XMM-Newton

XMM-Newton Proposers Guide and Phase II Remote Proposal System Users Manual

Issue 24.0

Prepared by the
XMM-Newton Community Support Team
with contributions from the entire
XMM-Newton Science Operations Centre

08-Jan-2025

Revision history

Revision number	Date	Revision author	Comments
Issue 24.0	08-Jan-2025	I. de la Calle	Official release valid as of AO-24
Issue 23.0	15-Dec-2023	I. de la Calle	Official release for AO-23
Issue 22.0	12-Dec-2022	I. de la Calle	Official release for AO-22
Issue 21.0	10-Dec-2021	I. de la Calle	Official release for AO-21
Issue 20.0	01-Dec-2020	I. de la Calle	Official release for AO-20
Issue 19.0	20-Dec-2019	I. de la Calle	Official release for AO-19
Issue 18.0	14-Dec-2018	I. de la Calle	Official release for AO-18
Issue 17.0	15-Dec-2017	I. de la Calle	Official release for AO-17
Issue 16.0	12-Dec-2016	I. de la Calle	Official release for AO-16
Issue 15.0	10-Dec-2015	I. de la Calle	Official release for AO-15
Issue 14.0	01-Dec-2014	I. de la Calle	Official release for AO-14
Issue 13.0	27-Nov-2013	I. de la Calle	Official release for AO-13
Issue 12.0	15-Dec-2012	I. de la Calle	Official release for AO-12
Issue 11.0	22-Dec-2011	I. de la Calle	Official release for AO-11
Issue 10.0	20-Dec-2010	I. de la Calle	Official release for AO-10
Issue 9.0	15-Dec-2009	I. de la Calle	Official release for AO-9
Issue 8.0	15-Dec-2008	I. de la Calle	Official release for AO-8
Issue 7.0	17-Dec-2007	M.G. Breitfellner	Official release for AO-7
Issue 6.0	15-Dec-2006	M.G. Breitfellner	Official release for AO-6
Issue 5.0	16-Dec-2005	M.G. Breitfellner	Official release for AO-5
Issue 4.0	17-Dec-2004	M.G. Breitfellner	Official release for AO-4
Issue 3.0	01-Aug-2003	M. Ehle	Official release for AO-3
Issue 2.0	31-Aug-2001	M.G. Breitfellner	Official release for AO-2
Issue 1.0	18-Jan-1999	M. Dahlem	Official release for AO-1
Draft 1.0	02-Dec-1998	M. Dahlem	First draft

Citation: In publishing, refer to this document as:
"XMM-Newton Proposers Guide and Phase II Remote Proposal System Users Manual", Issue 24.0, 2025 (ESA: XMM-Newton SOC).

Contents

List of Figures

List of Tables

1 Glossary

For more information on frequently used technical terms, see also the *XMM-Newton* Glossary.

Acronym	Explanation
AO	Announcement of Opportunity
CCD	Charge Coupled Device
Co-I	Co-Investigator
DEC	Declination, δ(J2000)
EPIC	European Photon Imaging Camera
ESOC	European Space Operations Centre
FOV	Field Of View
FWHM	Full Width at Half Maximum
GO	Guest Observer
GUI	Graphical User Interface
HEASARC	(NASA) High Energy Astrophysics Science Archive Research Center
MOS	Metal Oxide Semi-conductor
OM	Optical Monitor
OTAC	Observatory Time Allocation Committee
QLA	Quick Look Analysis (software)
PI	Principal Investigator
PIMMS	Portable, Interactive Multi-Mission Simulator
PSF	Point-Spread Function
RA	Right Ascension, α(J2000)
RFC	RGS Focal Camera
RGS	Reflection Grating Spectrometer
SOC	*XMM-Newton* Science Operations Centre
TBC	To Be Confirmed
ToO	Target of Opportunity
UHB	*XMM-Newton* Users Handbook
UM	Users Manual
URL	Unique Resource Location
USG	*XMM-Newton* User Support Group
WWW	World Wide Web
XMM-Newton	X-ray Multi-Mirror Mission
XRPS	*XMM-Newton* Remote Proposal Submission software

2 Introduction

The *XMM-Newton* Remote Proposal Submission software (XRPS) has been developed for ESA (ESOC), under contract, by Logica UK Limited. It is an online proposal submission software package, which is accessible via the URL http://xmmrps.esac.esa.int/. The software is not downloadable and cannot be used off-line. All *XMM-Newton* proposals that have been awarded observing time by the Observatory Time Allocation Committee (OTAC) must be submitted remotely via XRPS. Details on the Call for *XMM-Newton* Proposals can be found in the SOC's AO documentation.

BEFORE submitting an *XMM-Newton* proposal, please read this document carefully and consult also the *XMM-Newton* Users Handbook (UHB). The *XMM-Newton* Users Handbook can be found via the URL, http://www.cosmos.esa.int/web/xmm-newton/documentation, where users can choose between HTML, PS and PDF versions of the document.

2.1 Scope of this document

This document is the aide to guide users through the *XMM-Newton* proposal submission process with XRPS. Users should follow the steps outlined here closely.

The XRPS Users Manual is available in three different formats:

HTML online at,
`http://xmm-tools.cosmos.esa.int/external/xmm_user_support/documentation/rpsman/`
PostScript (PS) & Portable Data Format (PDF) at,
`http://www.cosmos.esa.int/web/xmm-newton/documentation`

The *XMM-Newton* SOC advises users to use the online version whenever possible to take advantage of the hyperlinks in the text of this document to the appropriate sections of the *XMM-Newton* Users Handbook and also because it might be useful to have this Users' Manual available in one viewer while making the XRPS entries in a separate viewer session.

2.2 Document structure

This User Manual (UM) starts by providing general considerations to be taken into account when planning *XMM-Newton* science observations (§ 3). Then it provides general information on XRPS (§ 4). This is followed by a detailed, step-by-step, guide on how to submit an *XMM-Newton* proposal (§ 5). § 5 follows very tightly the order in which information should be introduced into the XRPS form sheets (the order, in particular at the level of individual OM exposures within an observation, can be important). § 6 describes the acknowledgement of receipt and provides a few guidelines in case the user does not receive it. § 7 is just a brief note on the implications of SOC proposal enhancement requests. § 8 outlines how to obtain information on *XMM-Newton* Targets of Opportunity. § 9 contains a caveat about the expected XRPS performance close to the deadline. Finally, § 10 lists XRPS-related documents and other information. Finally, Appendix A gives some examples.

Throughout the document, where users might need additional information about which decisions to make (for example from the *XMM-Newton* Users Handbook), hyperlinks are provided to the location of that information. Users can always use the "back" button of their viewer to return to this UM when finished reading the background information. This document is thereby embedded in the SOC web server.

2.3 XMM-Newton help and feedback

If lost, or in case of doubt, please collect information to describe your problem in detail and direct questions and requests for help on XRPS to the *XMM-Newton* HelpDesk. Feedback, i.e., suggestions and/or criticism, should also be sent to the *XMM-Newton* HelpDesk. For details on *XMM-Newton* HelpDesk services and mailing lists, please consult the *XMM-Newton* HelpDesk web page, at the URL:

`http://www.cosmos.esa.int/web/xmm-newton/xmm-newton-helpdesk`

3 Before entering XRPS

Before entering XRPS, users should first assess the technical feasibility of the intended observations, based on the available information (primarily the *XMM-Newton* Users Handbook) and tools from the SOC web server at the URL `http://www.cosmos.esa.int/web/xmm-newton/`.

Please, consult also the Policies and Procedures for the AO under,
`https://www.cosmos.esa.int/web/xmm-newton/documentation`

for details about proposal submission.

3.1 Planning an XMM-Newton observation

The Principal Investigator (PI) of an *XMM-Newton* proposal must be aware of those issues which irretrievably corrupt the data taken in-orbit and transmitted to ground and must plan and prepare their observations accordingly. Corruption of scientific results can, e.g., take the form of:

- confusion, or mixing, of the source photons with those from another source in, or near, the field of view,
- corruption of the reported energy data due to pile-up of more than one photon per pixel per CCD readout frame or due to excessive optical loading of the X-ray CCDs,
- loss of information due to saturation of telemetry rates,
- loss of calibration accuracy due to photons lost at CCD chip edges.

Generally, the observer needs to consider only the target of interest from the point of view of a simple matrix of properties, namely, whether the source is bright or faint, whether the interest is primarily in spatial, spectral or temporal information and/or whether the target is extended or point-like.
For each type of *XMM-Newton* instrument (EPIC, RGS, OM) the user must consider the optimal choice of instrument setup to maximise the scientific return of the observation. General preparatory steps to be taken are:

1. As a minimum, calculate the expected count rates using the information contained in the *XMM-Newton* Users Handbook or the PIMMS (Portable Interactive Multi-Mission Simulator) software from the Goddard Space Flight Center, at the URL: `http://heasarc.gsfc.nasa.gov/Tools/w3pimms.html`
2. Using optical source catalogues, determine the brightest optical object in the field of view; if any source beyond the OM brightness limit should be in its field of view (FOV), no OM exposures should be defined.
3. Using X-ray source catalogues, determine the presence of nearby X-ray bright objects which may cause straylight degradation.
4. Using the *XMM-Newton* Target Visibility Tool, determine the maximum duration of continuous visibility available in any orbit.

5. Use information from the XMM-Newton Serendipitous Source Catalogue or the *XMM-Newton* Science Archive XSA of previous observations of the target of interest if available.

We will now describe — in the form of checklists — which aspects of an *XMM-Newton* observation must be considered when planning an observation for different kinds of targets. Appendix A contains examples for the possible choices for some crucial input parameters, depending on the target properties. An example for how to prepare the XRPS form sheets based on such considerations and parameter choices is presented in § 3.2.

3.1.1 General considerations

1. Choice of prime instrument

   Users must first decide which is the main science goal and with which of the *XMM-Newton* science instruments this goal can be best achieved. We recall, that all *XMM-Newton* scientific instruments operate simultaneously.

2. Science mode of prime instrument

   Next, the best-suited instrument mode with which to conduct the observations, depending on the target properties, must be chosen. More on this will follow in § 3.1.2.

3. Integration time

   It must be decided how much integration time is needed for the prime instrument, operated in the selected mode, to achieve the science goals. Users must note that at this stage, the integration time has already been fixed by the OTAC and hence this is the time that should be used in the form.

4. Pointing direction

   For extended targets the optimal pointing direction (which might not coincide with the catalogued target coordinates) must be chosen. The pointing should be chosen in such a way that the target is optimally located on the detector of the prime instrument. Thus, if there is a certain region, e.g., in an extended target that is of particular interest, the coordinates of that particular point should be chosen as the boresight coordinates.

5. Avoidance of nearby sources

   XMM-Newton science data (both X-ray and optical/UV) can be contaminated by radiation from nearby sources. If such is the case and wants to be avoided, this might, e.g., lead to position angle constraints on the observations (for example in order to prevent spectral overlaps) which must be considered.

   Users must check for the presence of bright optical/UV sources in the OM FOV. In the case that a source violates the OM brightness limits, which are listed in the UHB Table 25, OM cannot be used for observing the target. This time will be used by the SOC for calibration observations with Filter = BLOCKED. Take notice that the OM brightness limit is filter depedent.

6. Observations and exposures

   An *XMM-Newton* proposal can consist of **up to 50** observations. An "observation" is defined as a pointing to one particular position on the sky, including all sub-units of the observations, which are called "exposures". For example, a second pointing towards a slightly offset position compared to the first observation (because, e.g., the target does not fit into the EPIC field of view) is a second, independent observation. Pointing towards a new target or position is, by definition, always a new observation since *XMM-Newton* has no capability to perform raster scans.

3.1.2 Instrument setup

3.1.2.1 For a faint extended source

7. Possible adjustment of optimal pointing position

   If it is important to ensure that any particular part of the extended object does not fall on a CCD gap, users must choose the pointing direction appropriately (see *XMM-Newton* Users Handbook sections on EPIC pn chip array, EPIC MOS chip array and position angle constraints).

8. Science mode of all instruments

   For both MOS and pn, when using the "Full Frame" imaging mode, it must be decided if any given part of the source is bright enough to give rise to local photon pile-up that would degrade the calibration and prevent the achievement of the scientific goals (see *XMM-Newton* Users Handbook section on EPIC pile-up). If not, the "Full Frame" mode should be used.

   RGS data of faint extended sources are compromised by low total count numbers and a reduced energy resolution. RGS should be used in the normal "Spectroscopy" mode (see *XMM-Newton* Users Handbook section on RGS modes).

   For a source that is faint and very extended also in the optical, the OM should be best operated in its "Full Frame Low Resolution" mode (see more about OM modes in § 5.2.4.5).

9. Observation duration

   If the observation is long compared to the visibility window (as reported by the online *XMM-Newton* Target Visibility Tool), the user must consider how best to split the observation, e.g., into multiple observations that fit into continuous visibility periods.

10. Selection of EPIC optical blocking filters

    Users must check the visible magnitude of in-field or nearby optical targets. If the soft X-ray response is important, one should choose the thinnest filter compatible with the brightest visible objects, as described in the *XMM-Newton* Users Handbook section on EPIC filters.

11. RGS readout sequence

    For standard "Spectroscopy" mode observations with RGS, a standard readout sequence is proposed which can be modified according to the needs of the user (see *XMM-Newton* Users Handbook section 3.4.5 on RGS modes).

12. Choice of OM filter sequence

    For OM, it must be decided if a specific filter coverage is necessary for the science, or if the recommended filter sequence is adequate (see *XMM-Newton* Users Handbook section on OM modes and OM optical elements).

13. Exposure duration

    While no limits are expected on the exposure duration for the X-ray instruments observing faint sources (except for visibility constraints and the duration of the observation), OM exposures are further constrained by telemetry and memory capacity limits (§ 5.2.4.5).

3.1.2.2 For a bright extended source

7. Possible adjustment of optimal pointing position

   If it is important to ensure that any particular part of the extended object does not fall on a CCD gap, users must choose the pointing direction appropriately (see *XMM-Newton* Users Handbook sections on EPIC pn chip array, EPIC MOS chip array and position angle constraints).

8. Science mode of all instruments

   For both MOS and pn, when using the "Full Frame" imaging mode, it must be decided if any given part of the source is bright enough to give rise to local photon pile-up that would degrade the calibration and prevent the achievement of the scientific goals (see *XMM-Newton* Users Handbook section on EPIC pile-up). In the case of a bright extended source, pile-up might be a concern, and if so, the user must decide whether "Full Frame" imaging with pile-up in the brightest parts should be performed, or to use partial frame imaging to avoid pile-up at the loss of imaging data over part of the extended object.

   Unless the target is extremely bright, it should be possible to leave RGS in the normal "Spectroscopy" mode (see *XMM-Newton* Users Handbook section 3.4.5 on RGS modes).

   The OM observing mode will depend on its optical characteristics. Please refer to section § 5.2.4.5.

9. Observation duration

   If the observation is long compared to the visibility window (as reported by the online *XMM-Newton* Target Visibility Tool), the user must consider how best to split the observation, e.g., into multiple observations that fit into continuous visibility periods.

10. Selection of EPIC optical blocking filters

    Users must check the visible magnitude of in-field or nearby optical targets. If the soft X-ray response is important, one should choose the thinnest filter compatible with the brightest visible objects, as described in the *XMM-Newton* Users Handbook section on EPIC filters.

11. RGS readout sequence

    For standard "Spectroscopy" mode observations with RGS, a standard readout sequence is proposed which can be modified according to the needs of the user. In case of particularly strong emission lines, observers might want to read out individual CCDs more often than others (see § 5.2.4.4).

12. Choice of OM filter sequence

    For OM, it must be decided if a specific filter coverage is necessary to achieve the science, or if the recommended filter sequence is adequate (see *XMM-Newton* Users Handbook section on OM modesand OM optical elements).

13. Exposure duration

    While no limits are expected on the exposure duration for the X-ray instruments observing bright extended sources (except for visibility constraints and the duration of the observation), OM exposures are further constrained by telemetry and memory capacity limits (§ 5.2.4.5).

3.1.2.3 For a bright point source

7. Science mode of all instruments

   For both MOS and pn, when using the "Full Frame" imaging mode, it must be decided if any given part of the source is bright enough to give rise to local photon pile-up that would degrade the calibration and prevent the achievement of the scientific goals (see *XMM-Newton* Users Handbook section on EPIC pile-up). In the case of a bright point source, pile-up is likely to be a concern. If so, the user should choose the partial window mode with the largest FOV that minimises pile-up or, for the very brightest sources, use the "Timing" or "Burst" modes.

   Pile-up in individual emission lines in RGS data of bright targets is possible and should be assessed. In the case where photon pile-up is not a problem, the RGS should be left in the normal "Spectroscopy" mode. If a high count rate is expected, the RGS "Small Window" mode should be used (see *XMM-Newton* Users Handbook section 3.4.5 on RGS modes).

   For an optically bright point source the user might consider using the "Science User Defined" mode with a large "Image mode" window plus a "Fast mode" window centered on the target, if high time-resolution photometry is required.

8. Observation duration

   If the observation is long compared with the visibility window (as reported by the online *XMM-Newton* Target Visibility Tool), the user must consider how best to split the observation, e.g., into multiple observations that fit into continuous visibility periods.

9. Selection of EPIC optical blocking filters

   Users must check the visible magnitude of in-field or nearby optical sources and the science target itself. If the soft X-ray response is important, one should choose the thinnest filter compatible with the brightest visible objects, as described in the *XMM-Newton* Users Handbook section on EPIC filters.

10. RGS readout sequence

    In case of observations of a target with particularly strong emission lines, observers might want to read out individual CCDs more often than others (see § 5.2.4.4).

11. Choice of OM filter sequence

    For OM, it must be decided if a specific filter coverage is necessary to achieve the science, or if the recommended filter sequence is adequate (see *XMM-Newton* Users Handbook section on OM modesand OM optical elements).

12. Exposure duration

    Telemetry and onboard memory limits place upper and lower boundaries on the duration of single OM exposures as listed in § 5.2.4.5.

3.1.2.4 For timing observations

7. Science mode of all instruments

   For EPIC, users must avoid contamination of the target data by checking that any neighbouring bright sources are not in the same CCD row/column as the desired object by selecting an appropriate position angle if necessary. The EPIC team recommends using MOS1 in imaging mode and MOS2 in timing mode in those cases where one needs to observe using one MOS in imaging and the other MOS in timing mode. Users are referred to the XMM-EPIC Status of Calibration and Data Analysis document XMM-SOC-CAL-TN-0018 (https://xmmweb.esac.esa.int/docs/documents/CAL-TN-0018.pdf) for more details.
   To collect time series of the central source with OM, the user can also consider using the "Science User Defined" mode with "Image" and "Fast" windows (see § 5.2.4.5).

8. Observation duration

   If the observation is long compared with the visibility window (as reported by the online *XMM-Newton* Target Visibility Tool), the user must consider how best to split the observation, e.g., into multiple observations that fit into continuous visibility periods.

9. Selection of EPIC optical blocking filters

   Users must check the visible magnitude of in-field or nearby optical sources and the science target itself. If the soft X-ray response is important, one should choose the thinnest filter compatible with the brightest visible objects, as described in the *XMM-Newton* Users Handbook section on EPIC filters.

10. RGS readout sequence

    If high time resolution is needed for RGS observations, it must be decided whether a reduced number of CCDs shall be read out (see *XMM-Newton* Users Handbook section 3.4.5 on RGS modes).

11. Choice of OM filter sequence

    For OM, it must be decided if a specific filter coverage is necessary for the science, or if the recommended filter sequence is adequate (see *XMM-Newton* Users Handbook section on OM modesand OM optical elements).

12. Exposure duration

    Telemetry and onboard memory limits place upper and lower boundaries on the duration of single OM exposures as listed in § 5.2.4.5.

3.1.2.5 For mosaic observations

Although the concept of Mosaic mode for *XMM-Newton* observations is simple (see section Mosaic mode of the *XMM-Newton* Users Handbook), its implementation on a system designed to deal with single pointing observations may be cumbersome. Since the only way to set a pointing direction in the system is to set the target coordinates of an observation, the adopted approach is to have as many individual observations as pointings or viewing directions required. Unfortunately, the same word "observation" is used to designate the whole and the part: a Mosaic "observation" approved by the OTAC is made up of a set of "observations" in the *XMM-Newton* proposal handling system.

During the second phase of proposal submission, users with approved Mosaic observations are requested to provide just pointing coordinates and EPIC filters. Thus, the users are expected to complete the XRPS proposal (5.2) and observation (5.2.3) details forms. **Changes in the default configuration for this type of observations are strongly discouraged and should be deferred to the enhancement process**.

7. Individual pointings

   Users must define the sequence of pointings that define a Mosaic observation entering the target coordinates of the individual observations in the XRPS. The angular distance between two consecutive pointing coordinates must be smaller than 1 degree.

8. Science mode of all instruments

   The setup of the X-ray instruments in a series of observations forming a Mosaic observation is determined by the configuration of the first observation in the series and there is no possibility to change modes and/or filters from pointing to pointing. Therefore, the first observation has to be treated differently than the rest of the observations in the XRPS.

   - In the first observation, the mode of EPIC-pn must be set to MOSAIC. In normal cases, the EPIC-MOS cameras should be set in Full Frame mode and the RGS spectrographs in "Spectroscopy" mode. Only under very special circumstances other modes would be preferred and, in such cases, the strategy needs to be agreed with the SOC. The filters of the three EPIC cameras for all the observations forming the Mosaic are selected in the first observation; therefore, they should be selected according to the presence of optically bright sources in *all* the fields to be observed (see the *XMM-Newton* Users Handbook section on EPIC filters). OM exposures can be included in this first observation as in the case of any other normal observation, as far as the time allocated permits and OM filters are allowed (see *XMM-Newton* Users Handbook section on OM modes and OM optical elements).
   - In the rest of the observations, **no** exposures of the X-rays instruments can be included. **Only** OM exposures are included; these are needed because the XRPS does not accept "empty" observations, i.e., observations with no exposures at all. The OM exposures are set so that they provide the total requested duration for the observation; this is achieved with a proper combination of the

duration of the actual exposures (including overheads) and the offset parameter. Users should **not** change/add/delete the OM exposures in these observations; for a scientific use of OM, users should contact the SOC during the enhancement process.

3.2 Preparing an XMM-Newton observation

As described above, the preparation of *XMM-Newton* observations starts with a technical feasibility calculation, using primarily the information provided in the *XMM-Newton* Users Handbook and the tools introduced there.

The scientific goal of the proposal determines the choice of prime science instrument and the total integration time required. Users must note that at this stage, the integration time has already been fixed by the OTAC. It is expected that in all cases either EPIC or RGS will be the most important instrument for the proposed science, i.e., the instrument driving the feasibility calculations. Having determined the total integration time needed for the primary instrument, one must consider in which mode this instrument should be operated and how many exposures (possibly in different modes) should be taken during the intended observation. Then, the use of the other instruments, which will be operated in parallel, is planned.

It should not be forgotten, that all instrument modes have the so-called "overhead" times associated. The overhead time has to be subtracted from the total observing time. It has to be kept in mind, that these overheads can take a considerable percentage of the total observing time, particularly for shorter observations, and can vary a lot depending on the instrument mode used. A summary of the different overhead times can be found in the following link:

`http://xmm-tools.cosmos.esa.int/external/xmm_user_support/documentation/rpsman/overheads_table.html`

For a detailed description of the different instrument modes see also § 5.2 and the *XMM-Newton* Users Handbook.

The time given by the OTAC to a specific proposal does include overhead times. This means, that a proposal with one granted observation of 10 000 s and e.g. RGS as prime instrument, will get effectively only 8 906 s of integration time using the "*Spectroscopy*" mode.

Note that the overhead times may change slightly throughout the mission if for some technical reason the activation and deactivation sequences for different instrument modes have to be adjusted.

One of the science goals of *XMM-Newton* is to conduct serendipitous surveys. To achieve this, all *XMM-Newton* science instruments should be active and defined whenever permitted by applicable constraints (such as, visibility constraints, target brightness, etc...). This implies that **exposures should be defined for each instrument for the entire duration of an observation**.

4 General XRPS instructions

The following general advice should be taken into account when using XRPS. It is recommended to read this chapter **before** starting-up XRPS and while using it.

4.1 Recommended browsers and caching setup

The web interface was designed such that most common browsers supporting Java and Javascript should work. However, for best results, the use of the latest versions of Mozilla / Firefox or Microsoft Edge is recommended.

If caching is enabled on a user's browser, it is possible that some pages are not updated correctly (for example the navigation tool or the results reported to the user when clicking "Check Proposal"). To avoid this, the size of both the **disk cache and the memory cache of the browser should be set to 0** while using XRPS.

For details about the best supported versions of browsers and Java, the correct browser settings and reported problems, please look also at the related link on the XRPS entry page.

4.2 Signing up as an XRPS user

Only users with proposals that passed the *Observatory Time Allocation Committee* (OTAC) successfully can use the XRPS.

Valid **User ID**s and **Passwords** for the current AO were distributed by email to the corresponding PIs. **To recover forgotten or lost User IDs and Passwords, please contact the XMM-Newton Users Support Group via** `xmmpi@sciops.esa.int`. Also use this account for all proposal related questions.

In the cover page of the XRPS system (see Fig. 1), at the URL `http://xmmrps.esac.esa.int/` you are asked to load your proposal.

This leads to the next page where you have to enter your user details (see Fig. 2).
Once this is done, press the "Commit" button at the bottom of the page to send your input to an intermediate memory area (more details on this will follow in § 4.3).

Some users might want to use more than one User ID (e.g., when preparing a proposal not only for themselves, but also for somebody else). In such a case, it is not possible to work on more than one proposal simultaneously during the same browser session. One can only work on different proposals sequentially, i.e., in order to start another XRPS session, the browser session must first be exited and a new one started. This is a safety procedure, where login information is stored in cookies which are only deleted once the browser session is closed.

4.3 The concept of an intermediate memory

All information that is entered into any of the XRPS web interfaces is, upon pressing the "commit" button, stored in a memory area. The commit button is always located at the bottom of the right frame of the web interface. From this memory area, entries can be loaded again, as sketched in Fig. 3. This implies that XRPS users have no access to the proposal database itself.

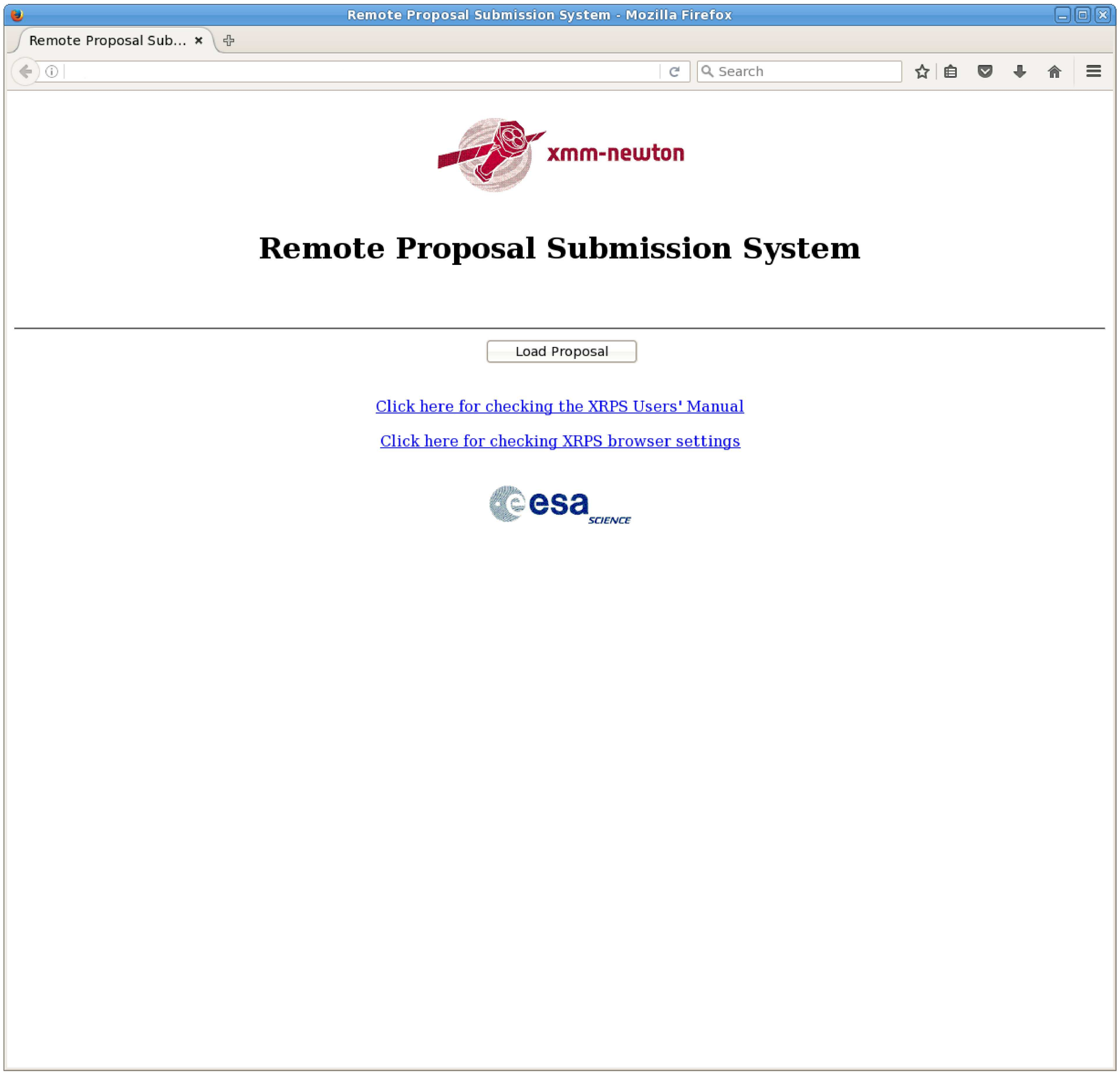


Figure 1: *Screen shot of the XRPS home page.*

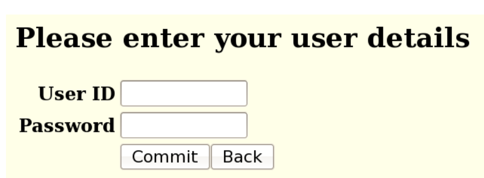


Figure 2: *Screen shot of the XRPS signup page.*

The submission procedure is described in § 5.7. A proposal can be submitted **only once** and will disappear from the working area. It will not be possible to edit again the proposal in a new browser session at a later time.

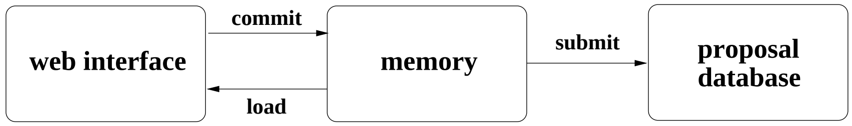


Figure 3: *Illustration of the concept of an intermediate memory area for proposal information storage that has not yet been submitted into the proposal database.*

Submission will only be acknowledged by email upon receipt of the submitted proposal in the proposal database.

If changes need to be made to the proposal after submission, the PI has to contact the SOC via `xmmpi@sciops.esa.int`. This email must list the proposal number in the Subject line.

4.3.1 Successful memory entries

Successful "committal" of the information contained in a page is acknowledged by a blue message at the top of the screen.

4.3.2 Errors upon committal of entries into memory

Formal input errors and missing mandatory entries will cause XRPS to report an error when trying to "commit" the contents of the page. Error messages are always highlighted in red at the top of the screen. When all entries have been entered correctly, a (blue) success message is returned to the user at the top of the screen.

4.3.3 Forgetting to press the commit button

When all entries are filled on one particular form sheet, users **must** press the "Commit" button – this will transfer the information to the working memory. **Failure to "Commit" information before exiting a page, or just resizing the viewer, will cause the loss of all the information entered.** If this is the case (at least) all mandatory fields (flagged with a red asterisk) must be filled in again. It is also recommended NOT to use the "Back" and "Forward" buttons of the browser to navigate to the different pages.

4.4 The frames of the XRPS web interface

XRPS uses frames to subdivide the viewer window. This frame environment is invoked as soon as a PI has successfully entered their personal information and is registered as a user. Once done, the "Proposal details" page is loaded and the PI can start introducing the details on the planned observations. As illustrated in Fig. 4, there are in total four frames.
The top frame just displays which software application is being used. The other frames are described briefly in the following subsections.

4.4.1 Right centre frame

The right frame of XRPS is the main frame where users type in all entries. This area is for displaying all the form sheets which must be filled in for any given observation. At the top of

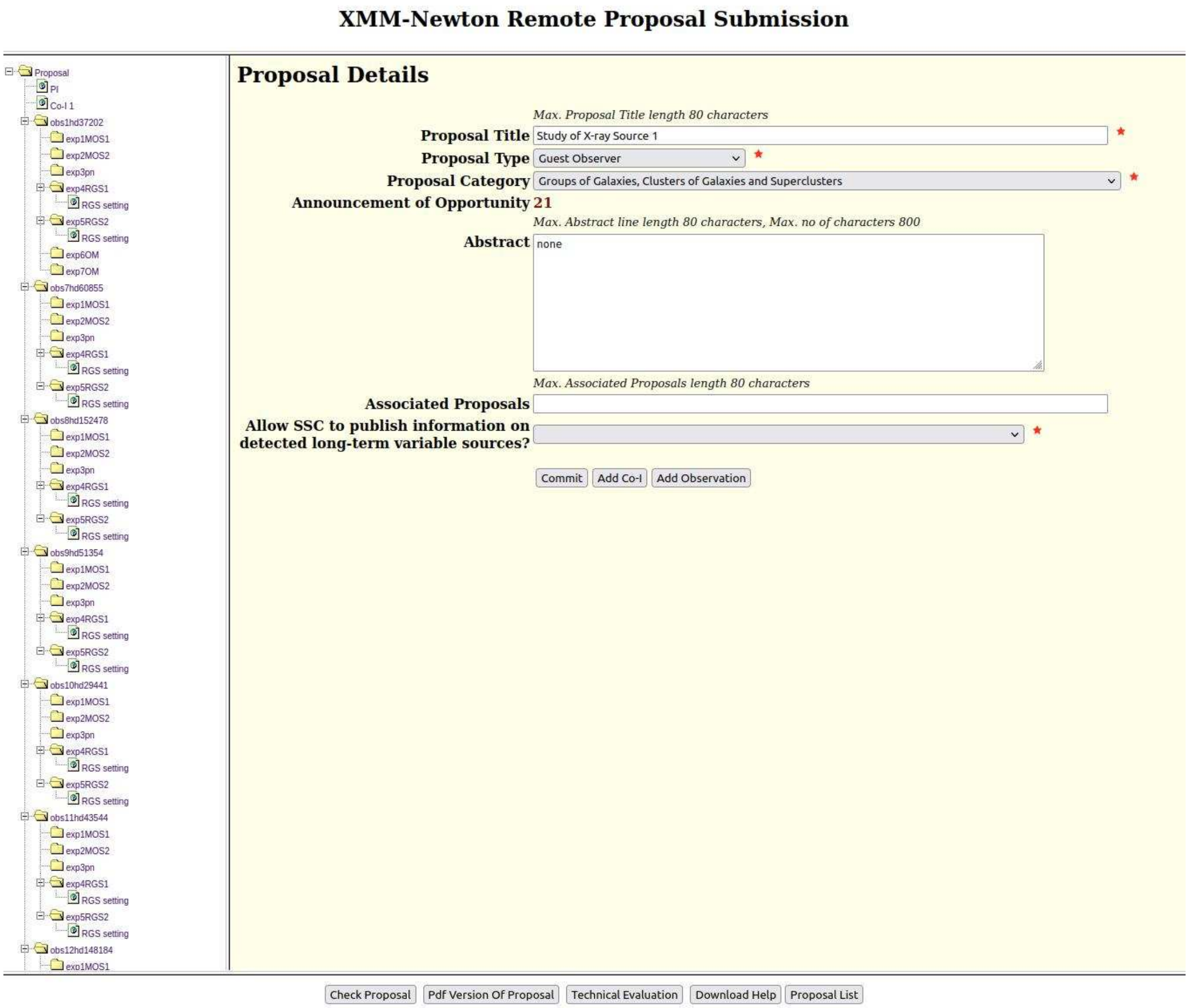


Figure 4: *Screen shot of the top-level page containing details about an observing programme: the so-called "Proposal Details" page. This is the first page displayed in the frames setup of the XRPS form.*

each page the title of the corresponding form sheet is provided for easy identification.

4.4.2 Left centre frame

The left frame of XRPS contains a navigation tool. This consists of a directory tree-like listing showing all filled in and committed entry forms, which are displayed either as files or directories (folder). The entries in the navigation tool are live hyperlinks, which can be clicked on to access the information on a certain form sheet. More information on navigation will follow in § 4.5.

4.4.3 Bottom frame

At the bottom frame, a number of click-on buttons are displayed which have the following functionality:

- "Check Proposal"
  This button can be used at any time to perform a formal check on the exposure times (including overhead and delay/offset times) for all instruments of all observations in the proposal draft stored in the intermediate memory. Proposals that are returned with formal errors must be corrected before they can be submitted. More details on this option are provided in § 5.3.

- "PDF Version of Proposal"
  This allows the user to create a PDF version of the proposal. More details on this option are provided in § 5.5.

- "Technical Evaluation"
  This allows the user to check the draft proposal for potential problems with the selected instrument configuration based on the provided source characteristics (e.g. forbidden OM filters because of exceeded brightness limits, pile-up, etc...). More details on this option are provided in § 5.6.

- "Download Help"
  The Download Help button offers a hyperlink to this document, the "XRPS Users Manual".

- "Proposal List"
  Hyperlink leading back up to the list of proposals of the PI. From there one can also go back up to the XRPS entry page.

4.5 Moving within XRPS

4.5.1 Moving down in XRPS

Movements down to the next lower level are always easy, because special function keys (buttons) are offered at the bottom of the higher-level page (web interface).

A PI can choose one of the proposal drafts from the list previously left in memory by clicking on the proposal title. At the next level, two buttons are offered, named "Add Co-I" and "Add Observation". The "Add Co-I" button is used to modify Co-I details e.g. in case of changes in their contact details. The "Add Observation" key leads the user to the level where information about the target of a proposed observation is entered.

One level lower, function keys are offered again to "Add EPIC MOS", "Add EPIC pn", "Add RGS" and "Add OM". These four allow the user to enter exposures for the different types of *XMM-Newton* science instruments. Note that **there are two EPIC MOS cameras and also two RGS detectors**, for each of which exposures must be defined. Below this first line, we find, "Add Standard Exposures" and "Adjust Exposure Time". The first is used to add standard exposures for all X-ray instruments. The later is used to adjust the exposure time of the X-ray instruments automatically based on the Total Observation Duration introduced. This is the level of input at which the schematic with the pre-planned sequence of exposures within an observation (§ 3.1) comes in handy.
In addition to the above function keys, three more are available at this level, namely "Copy Observation", "Add Time Details" and "Delete Observation". The names of the first and last are self-explanatory. The second, is used to enter time constraints, if any, and will only show up if the "Observation Type" is declared as "Fixed".

At the end of each exposure page one also finds the functional buttons to add exposures or to copy/delete the current one. These operations do not lead to a lower level, but create or remove entries at the same (i.e., the exposure) level.

4.5.2 Moving up in XRPS

There are no buttons on low-level pages leading the user back up to a level above. Instead, the entries in the navigation tree in the left-hand frame (Fig. 5) should be used. In the case where no changes are required on a page that has been opened, using the navigation tool on the left-hand side allows users to proceed to another XRPS page.

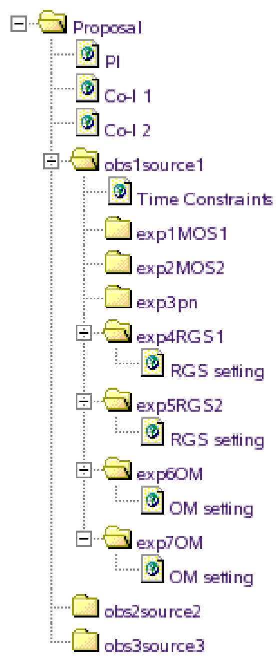


Figure 5: *Screen shot of the XRPS navigation tree. Observations are entered as directories carrying the first 8 characters of the object name. Each exposure is identified by a running index within the observation and the name of the instrument with which it is associated. If an exposure is deleted from the list, it will leave an empty slot. Exposures are not renumbered after a deletion.*

Normally, the "back" or "forward" buttons of the viewer should **not** be used to navigate, unless mentioned explicitly as an exception.

Note: Do not forget to "commit" all entries made on the current page before moving on to another!

By using the navigation tool in the left-hand frame, users can move as high up in the hierarchy as the proposal level. In order to return to any higher level (XRPS entry page or list of stored proposals), use the "Proposal List" button in the bottom frame, from where also the XRPS entry page can be reached again.

4.5.3 Arbitrary moves in XRPS

The navigation tool (Fig. 5) allows users to move anywhere, i.e., reload any page that had previously been committed to memory, up to the proposal level. Each entry in the directory tree carries a hyperlink leading to that particular page. To go back higher up, above the proposal level, see instructions in the previous section.

4.6 Recommended order of entries

Based on the schematic for an observation suggested in § 3.2 and on the navigation tools provided by XRPS, it is advantageous to insert a proposal by making entries in the following order:

1. Complete and update all details of PI and Co-Investigators.

2. Once completed, start working on the first observation by filling out the Observation page. Time constraints can also be provided at this point, but may also be added later.

3. On the Observation page, the above-mentioned (§ 4.5.1) buttons, are available to add exposures for the different *XMM-Newton* science instruments.

   The SOC **strongly** suggests to follow your observing schematic (§ 3.2) by rows, i.e., fill in first all exposures for one instrument (say, EPIC MOS-1), then the next (EPIC MOS-2 and EPIC pn), followed by those for RGS-1, RGS-2 and OM. For each of the six science instruments, the exposures should best be sorted chronologically. Exposure details, if any, can be added to exposures at any time. This order of making entries is favourable for various reasons:

   - Filling in exposures on a by-instrument basis, makes it easier to ensure that each instrument is used during the entire duration of the observation, thus maximising the efficiency of the instrument use.
   - Identifying exposures, when going back to make changes, is easiest when they are sorted first by instrument (Fig. 5).

   Note: It is also possible to add exposures for all the X-ray instruments by clicking "Add Standard Exposures", where the instrument's overhead time and exposure duration are calculated automatically (see § 5.2.4).

4. Only after one observation is completely finished, users should start making entries for the next. In case of similar observations (e.g., when observing a sample of objects with similar properties) it is then possible to copy the first observation and reuse the template created this way, just editing (changing) the entries to apply the required adjustments. Adding exposures (at the end of the list) is easy. Deleting unwanted exposures is also possible, using the "Delete Exposure" button.

Note: When deleting observations / exposures, XRPS does not automatically rename all others to fill the resulting gap in the numbering scheme. A new observation / exposure, even if it is meant to fill a gap produced by a deletion, will be appended at the end of the observations / exposure list of a proposal / observation, with a number 1 higher than that of the last observation / exposure in the existing list. Therefore, if an observation / exposure (or the detailed information associated with it) must be changed, it is much better to edit the entries accordingly instead of deleting and replacing it.

The actual order in which different exposures with the same instrument are performed can be controlled with the "Order" parameter (see e.g. § 5.2.4.1).

The following chapter (§ 5) is a step-by-step guide through XRPS; examples are provided in appendix A.

5 Filling in the form sheets – a step-by-step guide

Based on the above general advice the use of XRPS is now illustrated step by step, i.e., page by page and entry by entry.

5.1 XRPS entry page

After logging in with a *User ID* and *Password* each user gets access to their list of proposals that passed the *OTAC* successfully.

Clicking on the title of one of the proposals in the list brings up the proposal details page of that proposal (see Fig. 4). The form already contains some information given by the PI when applying for *XMM-Newton* observation time (e.g. address of PI and Co-Is, proposal title, type, category and abstract, . . .).

All fields marked with an asterisk are mandatory and have to be filled in. XRPS will accept the input when clicking on the ”commit” button. This will enter the information in the intermediate memory area described in § 4.3. In the case where an entry in a ”mandatory” field is missing, an error message will be displayed specifying which field does not contain a proper entry. In such a case, change it accordingly and try again to commit the information to memory.

It is strongly recommended to **fill in also the ”non-mandatory” fields** as detailed as possible. This information will be very helpful to the SOC during the *enhancement* phase of the proposal afterwards.

5.2 Proposal details page

The proposal details page is the first page to show the typical frames layout of the XRPS forms, as described in § 4.4 and displayed in Fig. 4.

Each proposal contains already some information given by the PI when applying for *XMM-Newton* observing time (e.g. target names, coordinates, total observation duration, proposal titles and abstracts, personal details of PI and Co-Is, . . .). **The user should verify that this information is correct but is not supposed to apply major changes to these parameters**, since this was the basis for the OTAC to distribute the *XMM-Newton* AO observing time.

The functional buttons at the bottom of this page have been described in § 4.4.3. Working on each proposal starts with the proposal details page, where the following information is required (notice again that items marked with asterisks are mandatory):

1. The proposal title

   The maximum allowed length of a title is 80 characters.

   The default is the title given by the PI.

2. Proposal type

   For the current AO the following proposal types are available:

   - **Guest Observer**
   - **Target of Opportunity (anticipated)**
   - **Fulfil**

For more details on proposal type, see the Policies and Procedures document.

The default is the proposal type given by the PI.

3. Proposal category

   XRPS offers a choice of proposal categories matching the composition of the *XMM-Newton* Observatory Time Allocation Committee (OTAC) panels. The available categories are:

   - **Life-cycle of Stars and Planets**
   - **Isolated and Binary Compact Objects and their Evolution**
   - **Galaxies, Groups of Galaxies, Clusters of Galaxies and Superclusters**
   - **Active Galactic Nuclei, Quasars, BL-Lac Objects and Tidal Disruption Events**
   - **Cosmology, Extragalactic Deep Fields and Large Extragalactic Areas**

   The default is the proposal category given by the PI.

4. Abstract

   Please enter the proposal abstract using the editor window provided (max. 10 lines with 80 ASCII characters per line).

   The default is the abstract given by the PI.

5. Associated proposals

   In those cases where one proposal depends heavily on the outcome of another, the other ("associated") proposal should be mentioned here. If you have received back an email acknowledging receipt of the associated proposal (including a proposal identification number), please provide first the number, followed by the proposal title (max. 80 characters altogether).

   It is also necessary to create "associated proposals" if your programme includes more than 50 observations. 50 is the maximum number of observations the XRPS can handle within one proposal.

6. Allow SSC to publish information on detected long-term variable sources ?

   Starting with AO24, PIs of accepted proposals are asked to grant permission to make the information on variable serendipitous sources in the field of view public shortly after the observations. To identify long-term variable sources, a new code developed at SSC (STONKS; Quintin+24) will be run within the Pipeline Processing System. Please note that this information only includes source position (RA, DEC), flux and variability; permission is not granted to make data public! The available options are:

   - Yes, for all the sources in the field of view,
   - Yes, but only for sources out of 2 arcmin-radius-circle centered at the target coordinates,
   - No.

The default is *empty*.

7. ToO Remarks

   Only if the *Proposal type* is marked as *Target of Opportunity (anticipated)*, when the Commit button is pressed an extra text panel becomes available at the bottom of the Proposal Details page. This text panel displays the trigger criteria, reaction time and observing strategy as given by the PI in phase I.

Still within the main input window of the page, the three functional buttons "Commit", "Add Co-I" and "Add Observation" are displayed, which offer the following functionality.

- Commit

  As before; commit the proposal details that were entered into the form to the working memory. If you do not commit your entries to memory before moving on, you will lose what you have typed in.

- Add Co-I

  Up to now only the PI personal information has been entered. All details about each Co-Investigator must be entered too. Fill in a separate page for each Co-I (see § 5.2.2).

- Add Observation

  After providing general proposal information, the proposer can now continue by entering details about the proposed science observations into an observation page (§ 5.2.3), by choosing the "Add Observation" option.

5.2.1 PI details page

This page is used to enter relevant information for the Principal Investigator (PI). To make easier for the *XMM-Newton* SOC to get in touch with the observer in case of need, this form should be filled in completely. **It is extremely important that the "email" address is correct and up-to-date**. An error message will be issued for incorrect, e.g. incomplete, email addresses. This is to make sure that the PIs receive the acknowledgement email after submission of their proposal. As all future interaction and communication between the PI and the SOC will be based on this email address, the use of an institutional email is strongly recommended. A warning message will be issued for obviously non-institutional email addresses, like e.g. gmail.

For some programs, if several PIs were introduced during Phase I of proposal submission, they will appear in the left frame of the XRPS navigation tool (Fig. 6; see Section 4.4.2). Only the first PI in this list has editing permissions and will be the recipient of the "Technical Evaluation" (see § 5.6) and Proposal Submission (see Section 5.7) confirmation emails.

"First Name" and "Surname" of the PI cannot be changed. A screen shot is shown in Fig. 7. The use of acronyms for the institute names (e.g., "ESAC" instead of "European Space Astronomy Centre") is permitted if necessary to save space.

Unlike for the Co-I where at the bottom of the details page there are two buttons, "Add Co-I" and "Delete Co-I Entry" from the list, for proposals with several PIs, these two actions are not permitted and only the PI details can be modified.

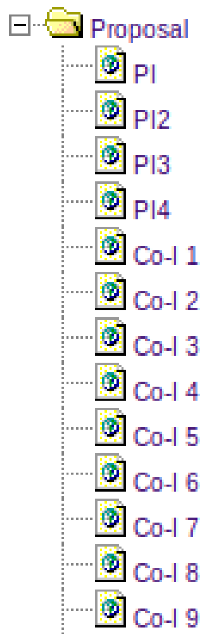


Figure 6: *Screen shot of the the XRPS navigation tree showing multiple PIs.*

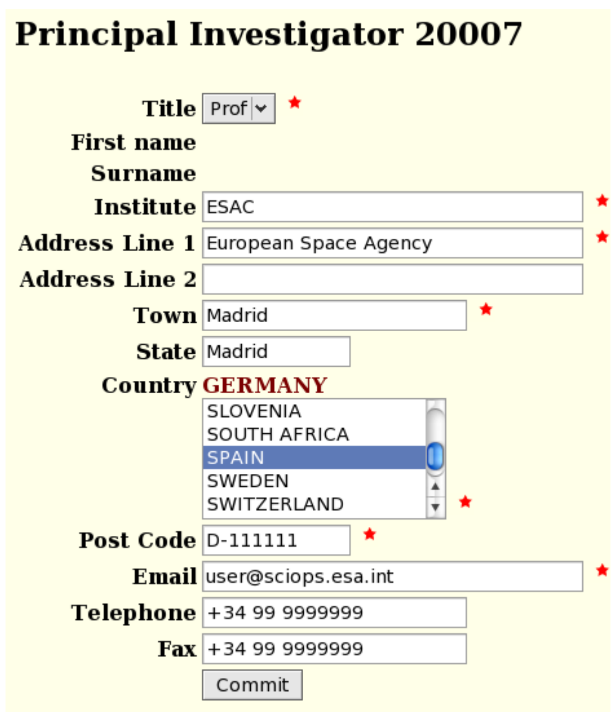


Figure 7: *Screen shot of the "PI personal information" page.*

5.2.2 Co-I details page

As for the Principal Investigator of the proposed project, the same information is required for each Co-Investigator, except for the user identification giving access to the proposals in the working memory. Use the commit button to commit the information to memory once the requested information has been completed.

At the bottom of each Co-I details page there are two buttons, "Add Co-I" and "Delete Co-I Entry" to add or remove a Co-I from the list of authors again.

Once done, and after committing all the information to memory, use the navigation tool to go back up by one level to the proposal level (§ 5.2). From there, either add more Co-Is if needed, or proceed to the first observation in the navigation tree and start entering observational details.

5.2.3 Observation details page

This is the top-level page for each observation within a proposal (i.e., in almost all cases, the top-level page for observations of one particular target, see Figs. 8 and 9).

When opening a proposal for the first time, it already contains the observations that the OTAC assigned to the successful PI. In the proposal details page only the first ten parameters are already defined with the information provided in Phase I. For technical reasons dummy values are given to the fields "Source Unabsorbed X-Ray Flux (ergs cm^{-2}s^{-1}): 9.000e+00" and "Hydrogen Column Density (atoms cm^{-2}): 1.0000e+30". These values have to be changed by the user to representative values to allow a successful "committing" of the page. At this level, the following information is required (all fields marked with an asterisk are mandatory).

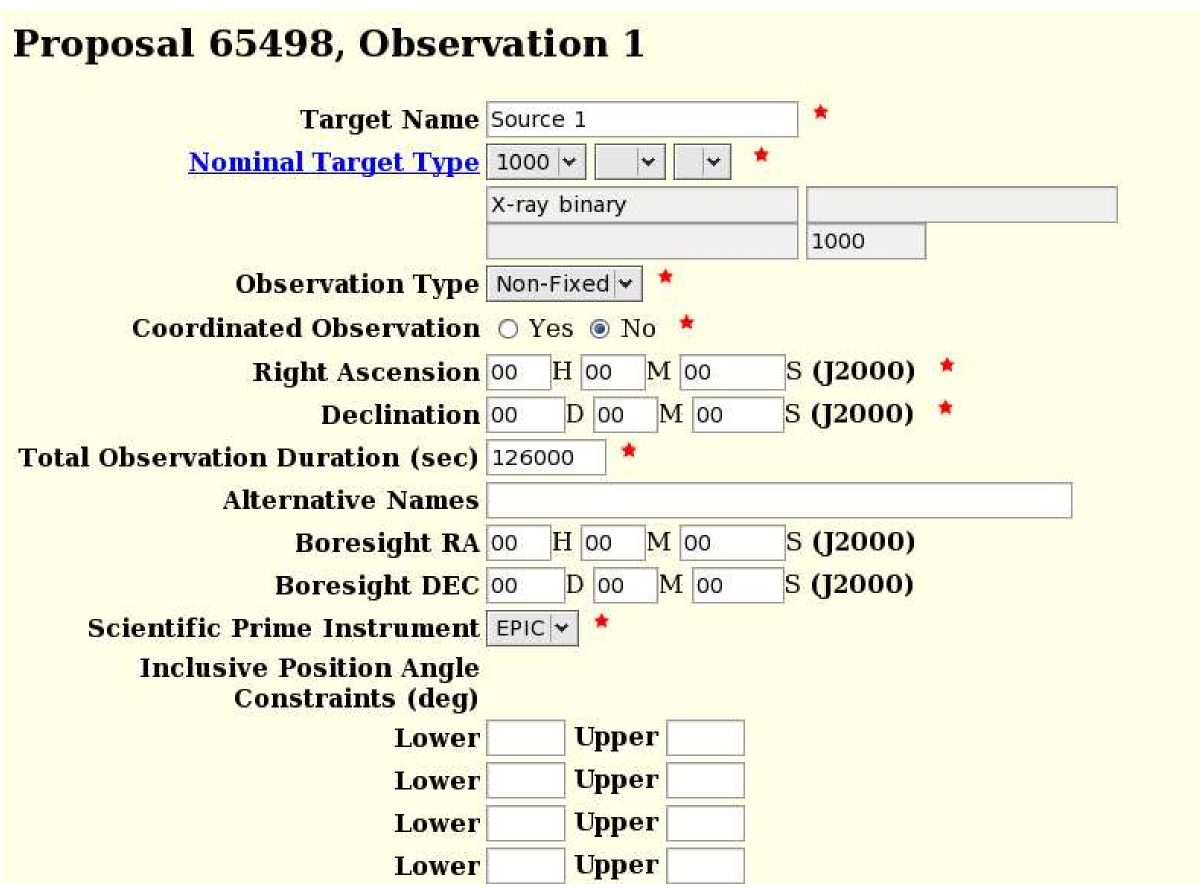


Figure 8: *Screen shot of an "Observation" page (top part).*

- Target Name

  Please use the most commonly used name of the target (max. 20 characters). The first eight characters will be used in the navigation tool (left frame) as the identifier of the observation.

- Nominal Target Type

  This "HEASARC Object Classification" parameter is used to select objects according to their classification. Clicking on the title "Nominal Target Type" in the form will open a separate window displaying the list of "Object Classes", also listed below.

  Each object is assigned a four digit numeric code to represent its object classification. The first digit describes the global classification (e.g., AGN or star). The following digits assign further classifications or properties, such as, spectral or AGN type. Each sub-class is chosen to contain a unique set of properties. For example, all normal (non-degenerate) stars have the first digit set to 2. The second digit for stars indicates the spectral type (O, B, etc.), the third digit the numerical sub-type, and the last digit the luminosity class; thus, a G5V star will have the class code of 2555. All stars later (cooler) than F0 have a "class" number between 2400 and 2999. As another example, all AGN have class codes that lie between 7000 and 7999; a search by class for AGN would thus be made by doing a search of the class parameter with the range set from 7000 to 7999.

  It should be emphasized that the class assignments of the same source found in different databases may not always be identical and, for any given database, the class codes may not always be present, correct, or complete: see the database help for the particular database in question to determine how the class codes were constructed. Always use the class codes with these caveats in mind !

```
Object Classes

1000 - X-ray binary
1100 - HMXRB                  10 - X-ray pulsar      1 - flares
1200 - HMXRB supergiant       20 - burster           2 - jets
1300 - HMXRB Be star          30 - black hole        3 - eclipsing
1400 - LMXRB                  40 - QPO               4 - ultra-soft transient
1500 - LMXRB Globular cluster 50 - QPO & black hole  5 - soft transient
                              60 - QPO & pulsar      6 - hard transient
                              70 - QPO & bursts      7 - eclipsing dipper
                              80 - QPO,pulsar,bursts 8 - eclipsing ADC
                              90 - pulsar & bursts   9 - dipper

1600 - CV                 10 - Classical Nova         1 - oscillations
                          20 - Recurrent Nova         2 - coherent osc.
                          30 - AM Her (polar)         3 - fast
                          40 - Intermediate polar     4 - slow
                          50 - Dwarf nova             5 - eclipsing
                          60 - Dwarf nova U Gem type  6 -
                          70 - Dwarf Nova Z Cam type  7 -
                          80 - Dwarf Nova SU Uma type 8 -
```

```
                          90 - Nova like              9 -

1700 - Gamma ray          00 - source                 1 - pulsar
                          10 - burst
                          20 - burst, soft repeater

1800 - Radio Pulsar
1810 - X-ray pulsator
1820 - Supersoft source
1830 - Isolated neutron star
1840 - Anomalous X-ray pulsar (AXP)
1850 - Extrasolar planet
1860 - Brown dwarf
1870 - Protostar of Type 0
1880 - Protostar of Type I
1890 - Luminous Blue Variable (LBV)

1900 - RS CVn star
1910 - Algol star
1920 - Beta Lyr star
1930 - W UMa star
1940 - Symbiotic star
1950 - Zeta Aurigae star
1960 - FK Comae star
1970 - UV Ceti type
1980 - T Tauri star       1 - (naked)
                          2 - (post)
1990 - Herbig Ae/Be star
1991 - Be star

2000 - Wolf Rayet     00 - unknown type     00 - spectral type unknown
                      10 - WN               10................ 1
                      20 - WC               20................ 2
                      30 - WO               30................ 3
                                            40................ 4
                                            50................ 5
                                            60................ 6
                                            70................ 7
                                            80................ 8
                                            90................ 9-11

                  00 - spectral type 0    0 .... luminosity class unknown
2100 - O          10................ 1    1 ..................... I or 0
2200 - B          20................ 2    2 ..................... II
2300 - A          30................ 3    3 ..................... III
2400 - F          40................ 4    4 ..................... IV
2500 - G          50................ 5    5 ..................... V
2600 - K          60................ 6    6 ..................... VI
```

```
2700 - M           70................ 7
2800 - Me          80................ 8
                   90................ 9

2900 - Star

                   10 - Luyten color class a
                   20 - Luyten color class a-f
                   30 - Luyten color class f
                   40 - Luyten color class f-g
                   50 - Luyten color class g
                   60 - Luyten color class g-k
                   70 - Luyten color class k
                   80 - Luyten color class k-m
                   90 - Luyten color class m


3000 - Extended galactic or extragalactic
3100 - SNR Crab-like                 10 - Shell              1 - Radio Pulsar
3200 - SNR                           20 - Filled-center      2 - Type I
3300 - Star forming region           30 - Composite          3 - Type II
3400 - Cloud                         40 - Dark
3500 - Nebula                        50 - Molecular
3600 - Open star cluster             60 - Planetary
3700 - OB association/HII region     70 - Reflection
3800 - Herbig-Haro object            80 - Globular Cluster
3900 - Diffuse X-ray emission

4000 - White dwarf                  00 -         0 -
4100 - White dwarf DA               10 - A       1 - PNN
4200 - White dwarf DB               20 - B       2 - PNN detached binary
4300 - White dwarf DC               30 - C       3 - detached binary
4400 - White dwarf DO               40 - O       4 - O
4500 - White dwarf DZ               50 - Z       5 - Z
4600 - White dwarf DQ               60 - Q       6 - Q
4700 - White dwarf DX               70 - X       7 - X
4800 - White dwarf sD               80 - V       8 - P
4900 - White dwarf PG1159-type      90 - P       9 - H


5000 - Cluster of galaxies          10 - Abell class <0     1 - Cooling Flow
                                    20 - Abell class 0
                                    30 - Abell class 1
                                    40 - Abell class 2
                                    50 - Abell class >2
                                    60 - non-Abell
5100 - Compact group of galaxies
5200 - Group of galaxies
```

```
5500 - X-ray background

6000 - Non-active galaxy
6100 - Dwarf Galaxy       10 - radio loud        1 - flat radio spectrum
6200 - Spiral galaxy      20 - HII region        2 - steep radio spectrum
6300 - Elliptical galaxy  30 - Multiple nuclei   3 - inverted radio spectrum
6400 - Starburst galaxy   40 - Barred
6500 - Interacting galaxy 50 - Unbarred
6600 - Irregular galaxy   60 - Mixed
6700 - Galaxy             70 - Nebulous region
6800 - Lenticular galaxy
6900 - Normal galaxy

7000 - AGN Unclassified
7100 - Seyfert        10 - radio loud           1 - flat radio spectrum
7200 - QSO            20 - radio loud/polarized 2 - steep radio spectrum
7300 - BL Lac         30 - radio quiet          3 - inverted radio spect
7400 - Liner          40 - radio loud/invert sp 4 - type 1
7500 - Radio Galaxy   50 - radio loud/flat sp   5 - type 1.5
7600 - IR Galaxy      60 - radio loud/steep sp  6 - type 2
7700 - OVV            70 - radio pol/invert sp
                      80 - radio pol/flat sp
                      90 - radio pol/steep sp
7800 - NEL (Narrow Emission-Line) galaxy
7900 - NLS1 (Narrow-Line Seyfert 1) galaxy

8000 - Solar system object
8100 - Planet         10 - Mercury
                      20 - Venus
                      30 - Earth
                      40 - Mars
                      50 - Jupiter
                      60 - Saturn
                      70 - Uranus
                      80 - Neptune
                      90 - Pluto
8200 - Solar Feature  10 - Quiet Sun
                      20 - Active Sun
                      30 - Sunspot
                      40 - Plage/Active Region
                      50 - North Pole
                      60 - South Pole
                      70 - Equatorial Region
                      80 - Mid-Latitude Region
                      90 - Flare
8300 - Asteroid       10 - Main Belt Object
                      20 - Centaur
```

```
                       30 - Kuiper Belt Object
                       40 - Near-Earth
8400 - Comet           10 - Periodic
                       20 - Non-Periodic
                       30 - Sun-Grazing
8500 - Moon

9000 - Unusual object
9100 - Supernova       10 - Type I
                       20 - Type II
9200 - Hypernova
9300 - Ultra-Luminous X-Ray Source (ULX)
9400 - Supermassive Black Hole

9999 - unidentified
```

- Observation Type

  Depending on the proposal type specified above, the type of observation intended must be filled in here. In case of a normal GO proposal, the choice is between "Fixed" or "Non-fixed", referring to the time of the planned observation. An observation is "Fixed" if it must be carried out (due to the object's properties or a certain required constellation) at a specific date and time, or at predefined intervals. More details on which entries are required for fixed observations follow in § 5.2.3.2. Observations without time constraints are "Non-fixed". Note, that the above refers only to scientific constraints, and **not** to the constraints imposed by the target visibility. Therefore, an observation of a target that is visible only during part of the AO observing period is NOT fixed.

- Coordinated Observation

  If your *XMM-Newton* observation should be coordinated with observations of other instruments (e.g. Chandra, NuSTAR, HST, VLT etc.) you should indicate this here by changing the flag from "No" to "Yes".

- Right Ascension and Declination (J2000)

  All coordinate entries MUST be made in the J2000 equinox, in the "hh mm ss.ss" format for right ascension hours, minutes and seconds (valid input range is from 00 00 00.00 to 23 59 59.99) and in the "[sign]dd mm ss.s" format for declination in degrees, minutes and seconds of arc (valid input range is from -89 59 59.9 to 89 59 59.9).

- Total Observation Duration (sec)

  The **total** proposed duration of the observation, including all exposures, in seconds. This time is the net science integration time plus the instrument overhead times and eventual offset times between exposures. These overhead times will be calculated when doing the "Check Proposal". The maximum allowed value for the observation duration is 127 000 s due to the characteristic of the *XMM-Newton* orbit. The minimum value for *XMM-Newton* observations, in order to keep the observatory efficiency high, is 6 500 s. In fact, the definition of the minimum is related to the effective net exposure time which should not be less than 5 000 s. Depending on the prime instrument chosen (EPIC or RGS) overhead times can vary a lot.

Users requiring a total integration time of more than 127 000 s (which is the approximate maximal continuous visibility for *XMM-Newton* of any point on the sky) for an observation are requested to split their programs into as many individual observations, of up to 127 000 s each, as needed to reach the required total integration time.

Users also have to check the visibility of their targets using the *XMM-Newton* Target Visibility Tool. Observations longer than the available maximum visibility will not pass the "Technical Evaluation". It might be necessary to split the observations in smaller pieces which can be accomodated in different revolutions.

It should also be taken into consideration that targets with limited visibility are normally visible only at the beginning or at the end of a revolution. This means that, depending on the conditions in the radiation belts, useful visibility might be shortened by up to 10 000 s.

XRPS will calculate the sum of all exposure, including overhead and offset times for all *XMM-Newton* instruments per observation of a given proposal (see § 5.2.4.1 for more details on "Exposure Offset" times). This time will be compared to the total observation duration. If the sum is higher than the observation duration, XRPS will raise an error. If the sum for the X-ray instruments is lower than 97% of the total observation duration, another error message is issued. In both cases the exposure times have to be corrected. For OM observations only the maximum limit gives an error, while exposure times lower than 97% of the total observation time just issue a warning message. The reason for this is that in those case where an optically bright source is present in the OM FOV, no OM exposure should be included. The SOC will use this time to perform OM calibrations with the Filter Wheel in the "Blocked" position.

- Alternative Names

  Other object names, if any (max. 80 characters).

- Boresight RA and DEC (J2000)

  The coordinates defining the direction in which *XMM-Newton* will actually be pointing. The requested boresight coordinates can differ from the target's centre coordinates, e.g., in case of extended targets if the observer wants to point to an off-centre position within the extended target (for which still the centre coordinates should be entered as indicated above under the Right Ascension and Declination (J2000) fields).

  The boresight coordinates input fields may be left empty. If so, the target coordinates will automatically be propagated when hitting the commit button. The format is the same as the one used for the target coordinates input in the fields above. Please note that when the target coordinates are changed again AFTER first committing them to memory, the boresight fields are also updated again.

  It should always be kept in mind that when pointing off-axis, the calibration of the RGS may not be optimal due to shifts in the wavelength scale as a function of source position. For off-axis angles of $\geq 2'$ (in the RGS's cross-dispersion direction) the spectrum of a source will not fall on the RGS chips. See also the comments below regarding the choice of prime instrument.

Note that also the OM standard configurations are optimised for on-axis targets.

- Prime Instrument

  The definition of the prime instrument serves to define the main scientific instrument of the proposal and to stablish whether the observation as a whole is considered as successful or flagged as failed. This last point is based on the total time of the exposures carried out with the prime instrument. The details about the success and failure criteria, and an eventual compensatory observing time for failed observations, are described in the Policies and Procedures document. See also the *XMM-Newton* Users Handbook chapter on instrument alignment for details.

  In the current AO users can select either EPIC or RGS as prime instrument. Users with a strong interest in RGS dispersive spectroscopy should declare RGS as the prime instrument. OM cannot be chosen as prime instrument.

- Inclusive Position Angle Constraint (deg)

  There are cases, like crowded fields or bright sources in the vicinity of the science target, where users will want to avoid other sources in the FOV, in particular during dispersive spectroscopic observations. Therefore, observers must make sure that nearby sources do not interfere with the science target's spectrum by being located along the dispersion direction of the RGS.

  Note: The *XMM-Newton* Target Visibility Tool can be used to determine the range of permitted position angles (PAs) for a given source and for each revolution. The user is allowed to specify up to four different PA ranges between 0 and 360 degrees.

The following entries are requested by the SOC to assist the *XMM-Newton* user support astronomers in conducting feasibility studies for the execution of the proposed programme.

- Source Extend (deg) of the X-ray emission as specified below

  Indicates the extent of the source's X-ray emission, if extended at all, in units of degrees; if the extension is not circular in shape, please enter a mean value. This is used to estimate count rates and to see whether an extended source will fit into the FOV. The allowed input range is from 0.0 to 20.0 degrees. **A value of 0 degrees must be entered for point-like sources**.

- Variable Source

  Knowing the variable status of the source will help during the technical feasibility studies, as well as to determine if observed varying count rates during data acquisition are due to the source or not. Allowed inputs: True / False

  Please specify Variable Source: "True", if the source flux in the *XMM-Newton* energy band (0.1–15.0 keV) is expected to vary by a factor of 2 or more (during the observation), on the basis of known source characteristics. If photon pile-up is a concern, users should orient their pile-up calculations for variable sources at the UPPER end of the expected flux range. If unsure about the source variability, leave the flag at its default value ("False").

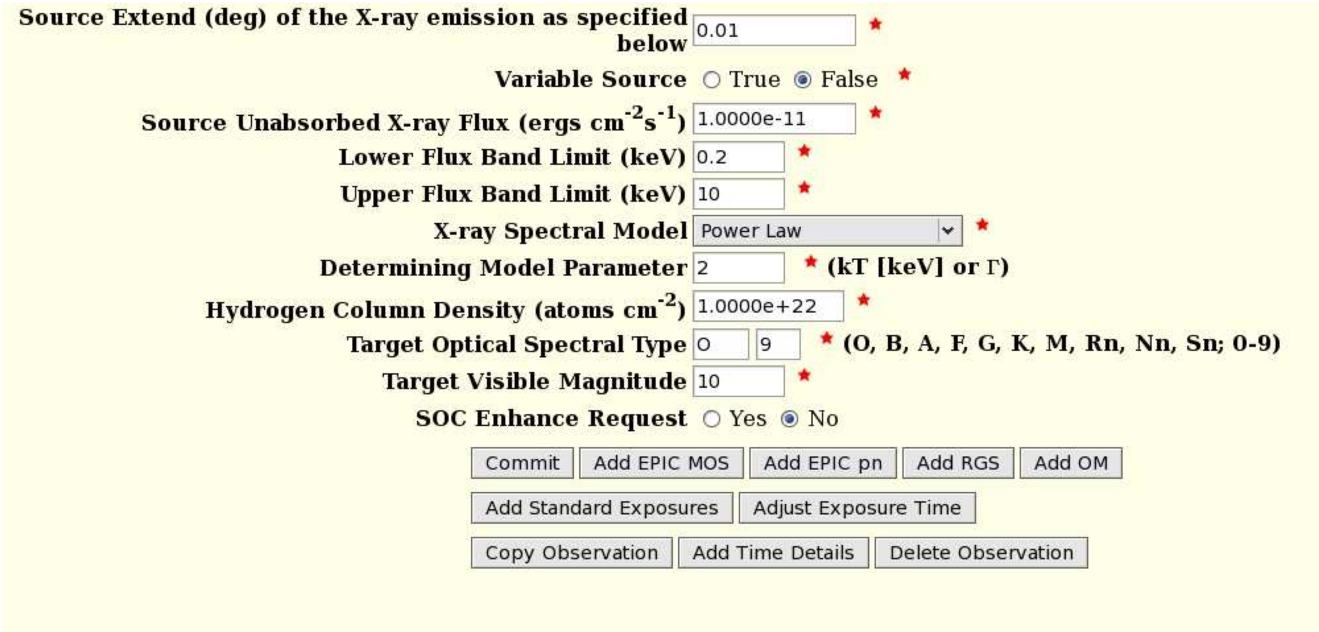


Figure 9: *Screen shot of an "Observation" page (bottom part).*

- Source Unabsorbed X-ray Flux (erg s^{-1} cm^{-2})

  In units of erg s^{-1} cm^{-2}, over the passband to be defined below. Entries can be made as $1.5e-13$ for 1.5×10^{-13} [erg s^{-1} cm^{-2}]. For count rate conversion from previous satellite missions and flux-to-count-rate conversions, the usage of the PIMMS software is recommended.

  If the source extent should exceed $30'$ (diameter), please provide the flux within a $30'$ region, centred on the boresight coordinates. The allowed input range is from 0.0 to 1.0×10^{-7} erg s^{-1} cm^{-2}.

- Lower Flux Band Limit (keV) and Upper Flux Band Limit (keV)

  Energy range over which the above X-ray source flux has been determined. The allowed input range for the "Lower Flux Band Limit" is from 0.1 to 10.0 keV and for the "Upper Flux Band Limit" is from 1.0 to 15.0 keV. Of course, the "Lower Flux Band Limit" must be smaller than the "Upper Flux Band Limit".

- X-ray Spectral Model

  X-ray spectral model approximating the source spectrum in the energy range from 0.1 to 15.0 keV (the *XMM-Newton* passband); the options are,

  - **Black Body**
  - **Power Law**
  - **Thermal Bremsstrahlung**
  - **Raymond-Smith**

  Even if you are not entirely happy with any of these models, choose one and set the parameters in such a way, that the resulting count rate equals approximately the count rate calculated with your model in the energy range you are most interested in.

- Determining Model Parameter (kT or Γ)

  Depending on the above X-ray spectral model, enter here the best-fitting value of the characteristic parameter, i.e.,

  - kT (keV) for "Black Body" allowed input range from 0.01 to 30.0 keV,
  - Γ photon index for power laws (following the convention $F_{\text{photon}} \propto E^{-\Gamma}$), allowed input range from -15.0 to 15.0
  - kT (keV) for "Thermal Bremsstrahlung" allowed input range from 0.05 to 30.0 keV,
  - kT (keV) for "Raymond-Smith" allowed input range from 0.1 to 28.0 keV.

- Hydrogen Column Density (atoms cm^{-2})

  Absorbing column density, in units of cm^{-2}; if known, please provide a fit result from existing X-ray data. For extragalactic sources with either negligible or highly inhomogeneous internal absorption, please provide the value for the Galactic foreground absorption. Exponential notation must be used, e.g.: $3.78e20$ for $3.78 \times 10^{20} cm^{-2}$. The allowed input range is from 0.0 to $1.0 \times 10^{25} cm^{-2}$.

- Target Optical Spectral Type (O, B, A, F, G, K, M, Rn, Nn, Sn; 0-9)

  Spectral type of the target. This information (together with the Target Visible Magnitude below) is used to estimate the optical loading in the EPIC cameras. In the case of extragalactic objects, the user must select the spectral type that best reproduces the optical spectrum of the target. The allowed spectral types are O, B, A, F, G, K, M, Rn, Nn, Sn with subclasses from 0 to 9.

- Target Visible Magnitude

  Johnson V magnitude of target, if known (or best guess of upper brightness limit). For extended targets, e.g. galaxies, please provide maximum surface brightness, in units of V magnitudes per square arcsec. The allowed input range is from 0.00 to 30.0 mag.

- SOC Enhance Request

  In case of doubt about the optimal observation setup, users can request SOC assistance for optimising an observing programme. However, **please read § 7** before filling in this field.

Finally, use the commit button to enter the information into memory.

By now, the navigation tool (§ 4.5) in the left hand window should show one file per Investigator, with the PI in first place, followed by a directory which has just been created for entries regarding the first observation of the proposal (cf. Fig. 5).

5.2.3.1 Functional buttons at the bottom of the observation details page

At the bottom of each observation page three rows of functional buttons can be found. Those in the two upper rows will be described in section 5.2.4. But before doing so, here is a brief description of the functions offered by the keys in the lower row. These are: "Copy Observation", "Add Time Details" and "Delete Observation". For Mosaic observations, users should not copy, delete or add time constraints to the observations; any change requiring these buttons should be checked first with the SOC, via `xmmpi@sciops.esa.int` email account, specifying the proposal ID in the subject.

- "Copy Observation"

  In many programmes which include more than one observation, the different observations are likely to be similar with respect to the observation details (such as, e.g., the number of exposures per observation, the prime instrument, the choice of filters, etc.). Thus, once all details of one observation (including all exposures, as described below) have been filled in, it can be used as a template for other, similar ones, to minimise the manual input and thus the amount of time spent filling out the proposal form sheets. Pressing the "Copy Observation" button, will allow to define the number of copies of the current observation that will be made, making easy, for example, to duplicate an observation a large number of times in one go, up to a maximum of 50 observations.

  In case it should be easier to just type in the details of different observations manually, instead of copying, please first commit all data to memory before clicking on the "Proposal" directory in the navigation tree on the left (Fig. 5). This will take you back up to the top-level "Proposal Details" page where you can use the "Add Observation" function key to proceed from there (§§ 5.2 and 5.2.3).

- "Delete Observation"

  Pressing this button, a whole observation, including all its exposures and associated time details (if any), is deleted. A verification request will appear before performing the deletion.

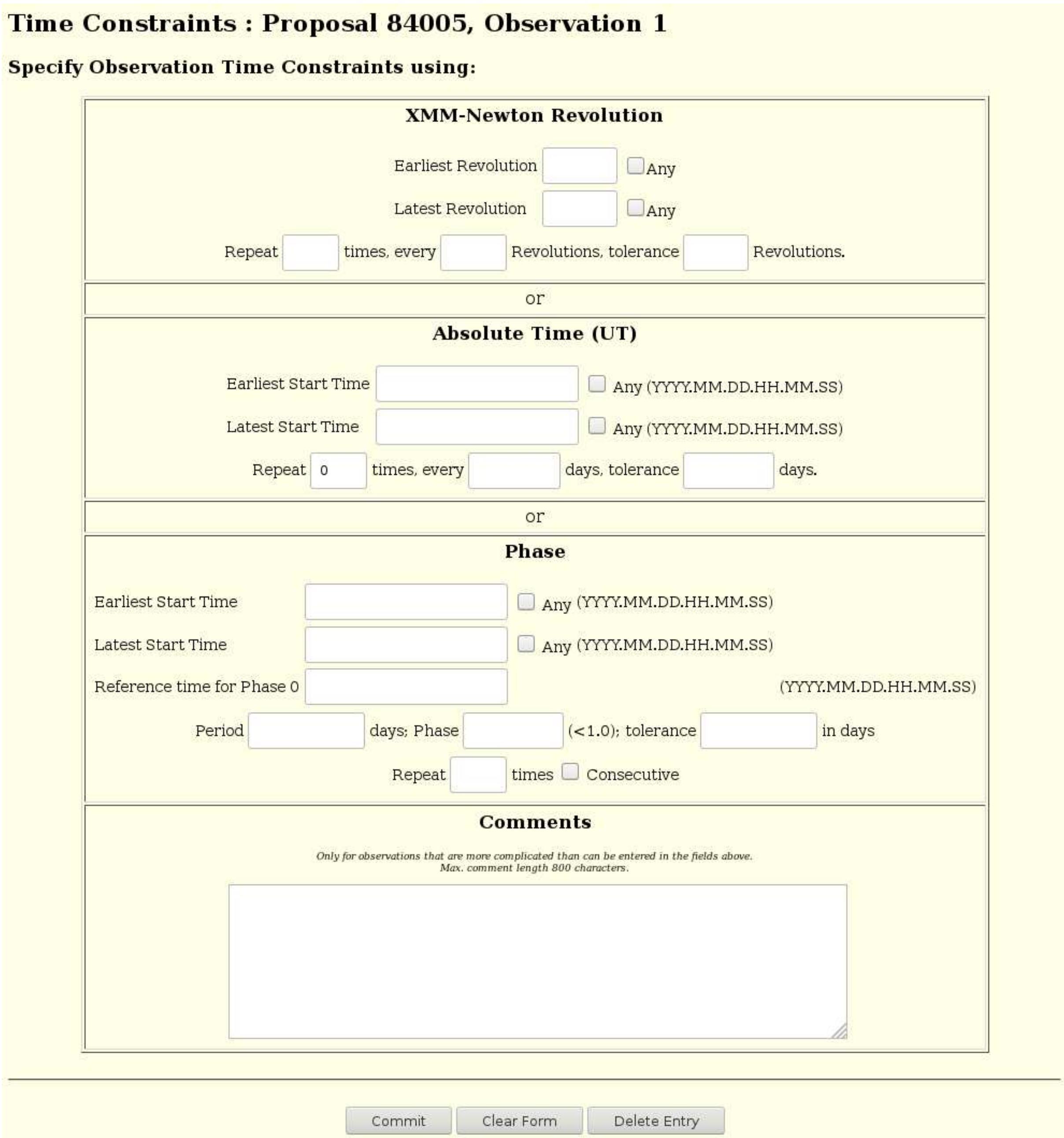
- "Add Time Details"

  This button is only visible if "Observation Type" is set to "Fixed". Time-critical observations need additional entries to specify when they must be conducted. These entries are made in a special time constraints page (§ 5.2.3.2).

5.2.3.2 Filling in time constraints

For each "Fixed" (i.e., fixed-time) observation, a special "Time Constraints" form must be filled in. Observations with Position Angle constraints should **NOT** be flagged as "Fixed" time observations. A screen shot of this page is displayed in Fig. 10.
The form offers four different sections, labeled as:

- "XMM-Newton Revolution"
- "Absolute Time (UT)"
- "Phase"



Time Constraints : Proposal 84005, Observation 1

Specify Observation Time Constraints using:

XMM-Newton Revolution

Earliest Revolution [ ] Any

Latest Revolution [ ] Any

Repeat [ ] times, every [ ] Revolutions, tolerance [ ] Revolutions.

or

Absolute Time (UT)

Earliest Start Time [ ] Any (YYYY.MM.DD.HH.MM.SS)

Latest Start Time [ ] Any (YYYY.MM.DD.HH.MM.SS)

Repeat [0] times, every [ ] days, tolerance [ ] days.

or

Phase

Earliest Start Time [ ] Any (YYYY.MM.DD.HH.MM.SS)

Latest Start Time [ ] Any (YYYY.MM.DD.HH.MM.SS)

Reference time for Phase 0 [ ] (YYYY.MM.DD.HH.MM.SS)

Period [ ] days; Phase [ ] (<1.0); tolerance [ ] in days

Repeat [ ] times [ ] Consecutive

Comments

Only for observations that are more complicated than can be entered in the fields above.
Max. comment length 800 characters.

Commit | Clear Form | Delete Entry

Figure 10: *Screen shot of the "Time Constraints" page in which entries for time-constrained observations must be made.*

- "Comments"

The first three sections are exclusive. This means that you can fill in only one section at a time depending on the kind of time constraint you want to use.

Inputs can be made either in the "Earliest Revolution" and "Latest Revolution" input fields (where relative times are required) or the "Earliest Start Time" and "Latest Start Time" input fields (where absolute times are required). The allowed input range for both is given in the

documentation for the current AO. Input values for "Latest Revolution" have to be equal or greater than "Earliest Revolution". Input values for "Latest Start Time" have to be equal or greater than values of "Earliest Start Time" **plus one hour**. A specified range can also be left open at the minimum or maximum side or both (to allow for non-fixed repetitions) using the "Any" button.
There is also the possibility of repeating an observation, specifying the number of repetitions "Repeat x times" (0-98), the period "every x orbits/days"(1-999 rev., 0.42-999.99 days) and the "tolerance" (1-998 rev., 0.04-period days).
For the special case of observations related to orbital phases the third section of the "Time Constraints" page offers additionally the possibility of specifying the "Reference time for Phase 0" in UT format YYYY.MM.DD.HH.MM.SS, the "Period" (0.4200-366) in days, the "Phase" requested, and finally the "tolerance" in days.

Example: To ask for repeated observations, spaced at certain time intervals, but at no particular time, enter an "Earliest Revolution / Start Time", a "Latest Revolution / Start Time" and specify how often the observation should be repeated. If, for example, two observations are needed, the "Repeat" parameter has to be set to 1 (repetition). Setting "Repeat" to 0 means that only one observation will be performed. The buttons at the bottom serve to either "Commit" your input, "Clear Form" or "Delete Entry" completely.

The *XMM-Newton* SOC will handle absolute (UT, orbital phase) and relative (*XMM-Newton* revolution) time entries into XRPS in the following way:

Observations which MUST be conducted at a fixed time.
For observations which MUST be conducted at a fixed time, e.g. an occultation experiment, absolute time entries must be entered into the proposal database via the "Time Constraints" page. The required format, as displayed on the form sheet, is YYYY.DDD.HH.MM.SS (i.e., four digits for the year, three digits for the day of the observations [the number of the day in that year] and two digits for hours, minutes and seconds in the 24 hours format). The separator is a dot, not a colon. Naturally, the requested time constraint has to be in agreement with the *XMM-Newton* visibility of the target. Therefore the user must perform a visibility check, using the *XMM-Newton* Target Visibility Tool. The absolute entry will be used by the SOC to check whether the target is visible. If so, the SOC will try to schedule the observations at the requested date and time.

Time-constrained observations that are not fixed to a particular date/time.
Complex repetition patterns should be described in the "Comments" section of the "Time Constraints" page. The SOC will then later on take care of the proper scheduling, interacting with the PI during the "enhancement" process of the observations within the proposal.

RGS Multipointing Mode.
For observations to be performed using the RGS Multipointing mode, any specific scheduling requirement must be specified as described above. If there is not any time constraint, the user must fill in the Time Details entering "Earliest Revolution" and "Latest Revolution" as "Any", four repetitions every 1 revolution, with tolerance zero. These are dummy values, and the scheduling details will be discussed during the Proposal Enhancement Phase. Also, please enter "RGS Multipointing Mode" in the "Comments" field.

Note: In the case of repeated observations, the science duration specified on the observation page applies to each observation. It is not the sum over all repeated observations (because each is, as the name suggests, handled as an individual observation).

5.2.4 Entering exposure details

Before entering exposure details, it is worth considering how XRPS will handle entries internally. Within an observation, a subdirectory is opened for each exposure. For each of the *XMM-Newton* science instruments at least one exposure must be specified. The suggested order (as mentioned already in § 4.6) is,

1. EPIC MOS-1
2. EPIC MOS-2
3. EPIC pn
4. RGS-1
5. RGS-2
6. OM

Thus, the recommended sequence of steps to fill out the exposure details for an observation, using the top row functional buttons at the bottom of the observation details page, is first to proceed to "Add EPIC MOS" and, once finished with EPIC MOS-1 and EPIC MOS-2 exposures, to "Add EPIC pn", before going on to "Add RGS" and "Add OM", as often as necessary to fill in all required exposures (see the following paragraphs).

Alternatively, a functional button at the bottom of each exposure page can be used to copy exposures. Also at the bottom of the page there is a button to delete exposures. Note that for Mosaic observations the required exposures of EPIC and RGS instruments are already in the system and, therefore, do not need to be created and should not be deleted; users should only set the EPIC filters. For any other change in Mosaic observations, users have to contact the SOC via `xmmpi@sciops.esa.int` email account.

A much **faster way** of doing this is to use the first button in the second row "Add Standard Exposures" which leads to a form (see Fig. 11) where "Instrument Mode" and "Filter Wheel" of the five *XMM-Newton* X-ray instruments can be defined in one go.
Pressing the Calculate "Exposure Times" button calculates automatically "Instrument Overhead" and "Exposure Duration" for each instrument and enables the button "Create Exposures" (see Fig. 12) to create all five exposures in one go.

The second button in the second row of the observation details page (Figure 9), "Adjust Exposure Time", will automatically calculate the exposure duration, ie., overheads subtracted, of all the X-ray instruments for the given Total Observation Duration input in the Observation page.
OM exposures have to be added manually because the times of multiple exposures can not be adjusted automatically. For maximum scientific yield, unless the user has specific requirements, it is recommended to make a series of exposures with filters "UVM2", "UVW1" and "U". The mode has to be chosen according to the target characteristics (see 5.2.4.5).

XRPS will count all exposures belonging to one observation consecutively. The name of the instrument for which an exposure has been defined will be part of the file name visible in the navigation tool.

Proposal 82002, Observation 1

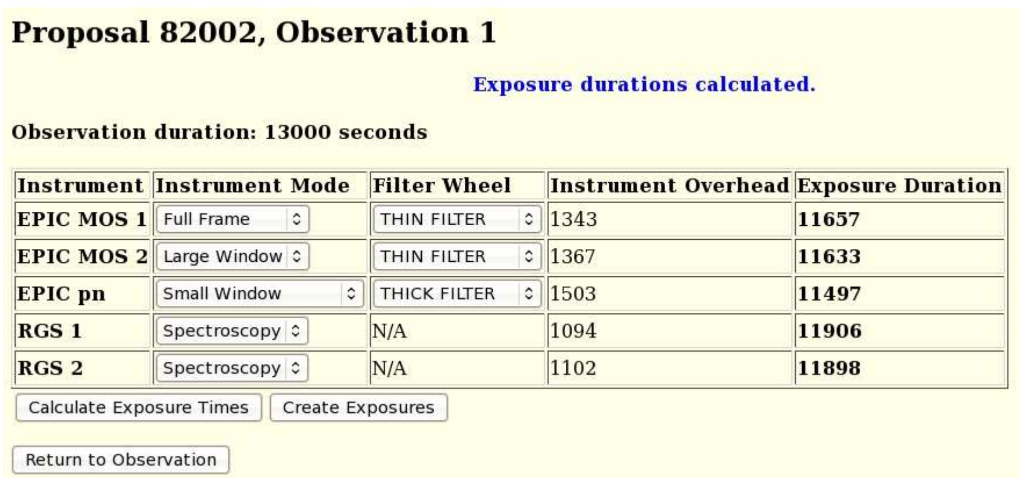
Observation duration: 13000 seconds

Instrument	Instrument Mode	Filter Wheel	Instrument Overhead	Exposure Duration
EPIC MOS 1	Full Frame	THIN FILTER	-	-
EPIC MOS 2	Large Window	THIN FILTER	-	-
EPIC pn	Small Window	THICK FILTER	-	-
RGS 1	Spectroscopy	N/A	-	-
RGS 2	Spectroscopy	N/A	-	-

Calculate Exposure Times

Return to Observation

Figure 11: *Form to create standard exposures of all five XMM-Newton X-ray instruments in one go before calculating the exposure times.*



Proposal 82002, Observation 1

Exposure durations calculated.

Observation duration: 13000 seconds

Instrument	Instrument Mode	Filter Wheel	Instrument Overhead	Exposure Duration
EPIC MOS 1	Full Frame	THIN FILTER	1343	**11657**
EPIC MOS 2	Large Window	THIN FILTER	1367	**11633**
EPIC pn	Small Window	THICK FILTER	1503	**11497**
RGS 1	Spectroscopy	N/A	1094	**11906**
RGS 2	Spectroscopy	N/A	1102	**11898**

Calculate Exposure Times Create Exposures

Return to Observation

Figure 12: *Form to create standard exposures of all five XMM-Newton X-ray instruments in one go after calculating the exposure times.*

5.2.4.1 Filling in EPIC MOS details

Fig. 13 displays a screen shot of an EPIC MOS exposure form sheet. The following (mandatory) entries must be made there.

"Filter Wheel", EPIC optical blocking filters The allowed choice of filters is presented in Table 1.

"Exposure Time (secs)" The valid range is between 0 and 127 000 s.

"Exposure Offset (secs)" The exposure offset should be left at its default value of 0 s to ensure continuous operation of the instrument. Only under special circumstances, under which one would **not** want the instrument to operate for a certain amount of time, should an offset with respect to the previous instrument exposure, if any, be defined here. The valid range is between 0 and 1 000 s.

Figure 13: *Screen shot of an EPIC MOS exposure form sheet for a "Full Frame" imaging exposure with a duration of 123034 s and an offset with respect to the previous exposure of 0 s. The "THIN FILTER" optical blocking filter was chosen.*

Table 1: *EPIC filters*

Filter[1]	**Description**
CLOSED	Blocked filter position
THIN FILTER	Thin aluminium
MEDIUM FILTER	Medium aluminium
THICK FILTER	Thick aluminium Polypropylene

Note to Table 1:
1) During the current AO only the highlighted filters are recommended for use.

"Instrument", MOS camera unit When first entering this page, the "Instrument" query will have the two options "EPIC MOS-1" and "EPIC MOS-2" from which users must choose one. EPIC MOS exposures are defined independently for both instruments. Once specified, and once all entries have been made and successfully committed to memory, this is not a selectable parameter anymore, but the fixed entry will appear on the form sheet, as displayed in Fig. 13. Therefore, it is not possible to change a MOS-1 exposure to a MOS-2 exposure without copying it.

"Instrument Mode", MOS modes of operation For a description of allowed EPIC modes see Table 2 below and consult the *XMM-Newton* Users Handbook for details.

Table 2: *EPIC MOS mode names*

EPIC MOS mode name
Full Frame
Large Window
Small Window
Timing

"Order (ins. based)" In this field one can define the sequence of exposures using the same instrument within an observation. If you do not specify this parameter explicitly, the exposures will be performed just in the order they were entered into XRPS.

5.2.4.2 Filling in EPIC pn details

In Fig. 14 a screen shot of an EPIC pn exposure form sheet is displayed.

Figure 14: *Screen shot of an EPIC pn exposure form sheet for a "Full Frame" imaging exposure with a duration of 123034 s and an offset with respect to the previous exposure of 0 s. The "THIN FILTER" optical blocking filter was chosen.*

The selectable parameters for the pn camera are again the EPIC filters, exposure time, exposure offset (which should normally be 0) and the EPIC modes.

"Filter Wheel", Optical blocking filters The choice of optical blocking filters is the same as for EPIC MOS (see Table 1, in § 5.2.4.1).

"Exposure Time (secs)" The valid range is between 0 and 127 000 s.

"Exposure Offset (secs)" This should be 0 again in order to avoid times during which the instrument is idle. The valid range is between 0 and 1 000 s.

"Instrument", pn camera unit There is only one EPIC pn camera, therefore the instrument unit is not a selectable parameter.

"Instrument Mode", pn modes of operation The allowed EPIC modes are summarized in Table 3 and are described in the *XMM-Newton* Users Handbook in detail.

The *XMM-Newton* modes "Timing" and "Burst" are two flavours of the EPIC fast mode, where the "Burst" mode has an extremely short duty cycle. Both modes operate on one CCD (the one on which the nominal on-axis boresight falls). These two modes can only be used in combination with the "Thick" filter.

"Order (ins. based)" In this field one can define the order of multiple exposures using the same instrument within an observation.

Table 3: *EPIC pn mode names*

EPIC pn mode name
Full Frame
Large Window
Small Window
Timing
Burst
Extended Full Frame
Mosaic Setup[1]

Notes to Table 3:
1) Although the system offers this mode, it is only valid for Mosaic observations and will not be added or removed by the users without SOC agreement.

5.2.4.3 Filling in RGS details

Similarly to the EPIC exposures, a few details must be defined for each RGS exposure. Fig. 15 provides an example for an RGS exposure form sheet.

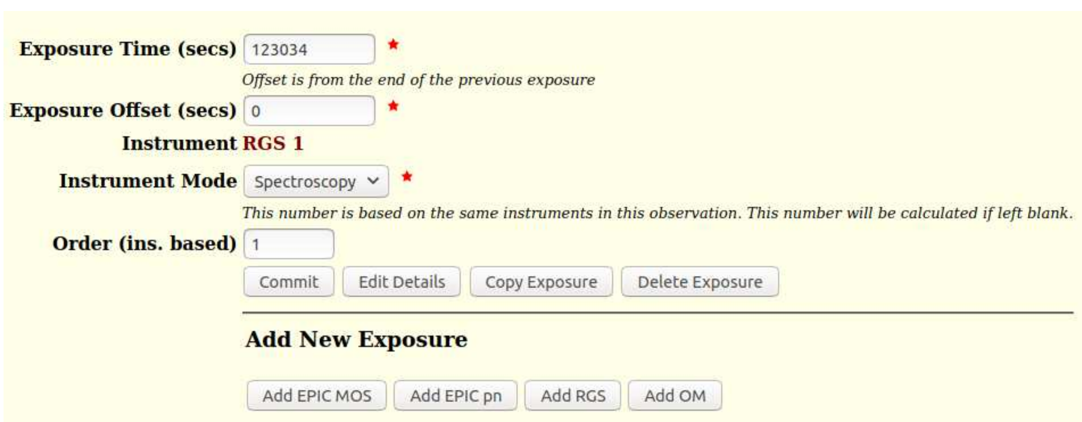


Figure 15: *Screen shot of an RGS exposure form sheet for a 123034 s exposure and an offset with respect to the previous exposure of 0 s of RGS1 in the recommended mode for standard "Spectroscopy".*

"Exposure Time (secs)" The valid range is between 0 and 127 000 s.

"Exposure Offset (secs)" The exposure offset should be left at its default value of 0 s to ensure continuous operation of the instrument. Only under special circumstances, in which one would **not** want the instrument to operate for a certain amount of time, should an offset with respect to the previous instrument exposure, if any, be defined here. The valid range is between 0 and 1 000 s.

"Instrument" When first entering this page, the "Instrument" query will have two options, "RGS 1" and "RGS 2". Users must choose one or the other since "RGS 1" and

”RGS 2” exposures are defined independently for each other. Once specified, and once all entries have been made and successfully committed to memory, this will not be a selectable parameter anymore, and the fixed entry will appear in red in the form sheet as displayed in Fig. 15. Therefore, it is not possible to change a RGS 1 exposure to a RGS 2 exposure without making a copy.

”Instrument Mode”, RGS modes of operation If photon pile-up is not a problem, the RGS should be left in the normal ”Spectroscopy” mode. If a high count rate is expected, the ”Small Window” mode should be used. For a more detailed description of allowed RGS modes see Table 4 and consult the *XMM-Newton* Users Handbook details.

Table 4: *RGS mode names*

RGS mode name
Spectroscopy
Small Window

”Order (ins. based)” In this field one can define the order of multiple exposures using the same instrument within an observation.

”Edit Details” Calls the RGS settings form to specify the RGS CCD readout sequence. This is only necessary if a non-standard readout sequence is required. Otherwise the following default sequences are used:

RGS 1 1,2,3,4,5,6,8,9

RGS 2 1,2,3,5,6,7,8,9

5.2.4.4 Filling in RGS exposure settings

Depending on the instrument mode in which observations are to be carried out, a few more options can be specified for RGS. These can be defined on a dedicated page which can be accessed by pressing the ”Edit Details” button at the bottom of the exposure page.

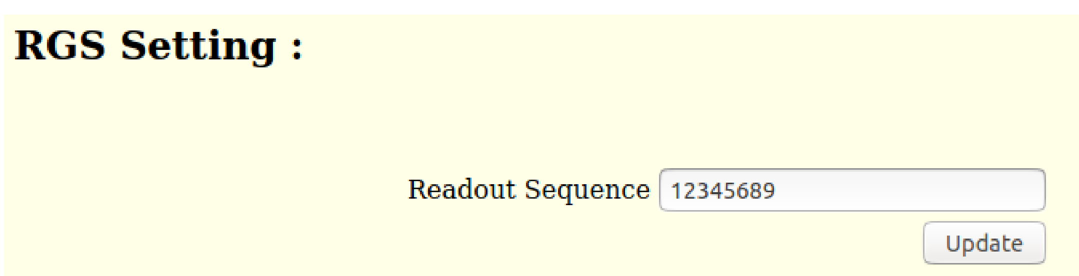


Figure 16: *Screen shot of an RGS-1 setting form. Note that CCD 7 is not available.*

In the ”RGS Settings” form sheet, the only user-selectable parameter is the RGS CCD readout sequence. For standard observations over the whole energy range this sequence should not be changed. Only if users want to perform spectroscopy over a part of the RGS bandpass or read out one or more chips faster than others, a different sequence should be chosen. Each RGS has 9 CCD chips, but is read out in a cycle with up to 12 readout slots. The energy ranges covered by the different RGS CCDs in different grating orders are described in the *XMM-Newton* Users Handbook section 3.4.2 RFC arrays. If a user is interested in a particularly strong and scientifically important line, falling for example in chip #3, and wants to read this chip more often than all others, a readout sequence of, e.g., [3 1 2 3 4 5 3 6 3 8 9] could be chosen. This readout sequence implies that chip #3 will be read out 4 times more often than the others. Note that for RGS-1 and RGS-2 CCD 7 and CCD 4 are not available respectively.

5.2.4.5 Filling in OM exposures settings

The OM offers imaging and fast modes which can be operated in parallel. An image will always have to be defined (by means of its central coordinates and size) while an additional fast mode is optional.

The image mode only produces brightness information for each pixel, from which a count rate/flux/magnitude for each source in the field can be derived. These values are averaged over the total exposure time. Higher time resolution can be obtained for one or two point sources in the field using the additional fast mode. The highest time resolution is achieved by utilising an event counting mode. This mode accumulates more data and is therefore only available for a small region of the detector, corresponding to $\sim 10 \times 10$ arcsec. The additional fast mode is therefore only feasible for point sources with well-known coordinates.

As described in more detail below, both readout modes can be used simultaneously for the same positions on the chip, thus an image and a light curve can be obtained at the same time.

An observation usually includes several OM exposures with different filters, or with the same filter. Users must choose one of the OM optical elements, the exposure time for that optical element, exposure offset (normally 0 s) and one of the available OM modes. Consult the *XMM-Newton* Users Handbook for a detailed description of the instrument and the available observing modes. Also take a look at § 3.2 for a description on how to prepare a sequence of different exposures. A screenshot of an OM exposure form sheet can be seen in Fig. 17.

"Filter Wheel" The user can choose one of the OM optical elements listed in Table 5. For maximum scientific yield, the following three filters are recommended:

1. UVM2 (first choice)
2. UVW1 (second choice)
3. U (third choice)

Since the **sequence of exposures using different optical elements must always have increasing filter wheel position numbers**[1], the three filters mentioned before have to be observed in the following order: U, UVW1 and UVM2.

[1]From AO-16 (announced in 2016) it is possible for programmes with specific approval by OTAC to perform several turns of the filter wheel. In other words it is possible to perform series of exposures in which a sequence of filters (ordered in increasing filter wheel position numbers) is repeated several times. A user without OTAC approval for additional filter wheel rotations will get an error message if the sequence of OM exposures does not have an increasing filter wheel position number.

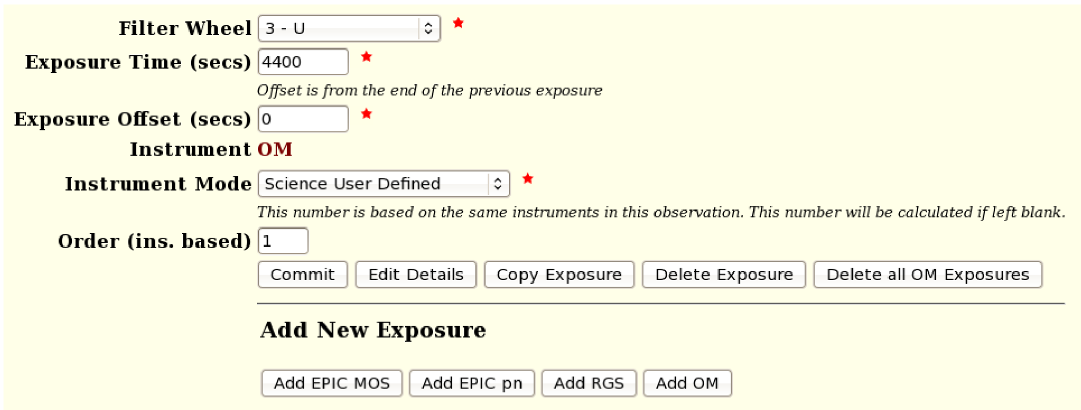


Figure 17: *Screen shot of an OM exposure form sheet for an exposure with the U filter (filter wheel position 3), in Science User Defined mode, with 4400 s exposure time. Read-out windows can be defined by clicking the button "Edit Details"; see § 5.2.4.6 for more details. In this case, an image and a fast mode are defined, so the exposure time can not be defined longer than 4400 s.*

Table 5: *OM optical elements*

Filter wheel position number[1]	**Filter name**
0	BLOCKED
1	V
3	U
4	B
5	WHITE
6	VISIBLE GRISM
7	UVW1
8	UVM2
9	UVW2
10	UV GRISM

Notes to Table 5:
1) Exposures using different optical elements must always have increasing filter wheel position numbers.

"Exposure Time (secs)" Due to internal memory capacity and telemetry bandwidth restrictions, OM science exposures have a limited range of exposure times. The allowed input ranges are listed in Table 6.

"Exposure Offset (secs)" The exposure offset should be left at its default value of 0 sec to ensure continuous operation of the instrument. Only under very special circumstances may one want the instrument not to operate for a certain amount of time. In that case an offset with respect to the previous instrument exposure has to be defined here. The valid range is between 0 and 1 000 sec.

"Instrument Mode" The instrument mode is chosen depending on the target characteristics (size, variability, etc.) and on the available total observation time. Table 7 shows

Table 6: *OM exposure time constraints*

Science window configuration	Minimum (s)	Maximum (s)
Science User Def.: Up to 5 Image windows[1,2]	1000	5000
Science User Def.: 1 Image + 1 Fast windows[3]	1200	4400
Science User Def.: 1 Image + 2 Fast windows[3]	1200	2200
Science User Def.: 1 to 4 Image + 1 Fast windows[3]	1200	4400
Science User Def.: 1 to 3 Image + 2 Fast windows[3]	1200	2200
Full Frame Low Resolution[1]	1000	5000
Full Frame High Resolution[4]	1000	5000
EPIC/RGS* Image Mode[1]	1000	5000

Notes to Table 6:
1) Minimum allowed exposure time is 800 seconds, but multiple observations of 800 seconds duration are strongly discouraged
2) The total number of allowed Science User Defined windows (IMAGE and/or FAST) is 5, with a maximum of 2 of them being FAST windows
3) When defining Science User Def., exposure times within the limits for Image mode are allowed. Additional fast modes can only be added if the exposure time is within the fast mode limits.
4) This mode is not recommended for use because of very large overhead and risk of data loss during downlink.
(*) "EPIC/RGS Image Mode" contains a default combination of 5 exposures in predefined windows.

an overview of possible OM modes. It should be noted that a FAST mode window in addition to an image mode window does not affect the integrity of the image.

Table 7: *OM mode names*

Mode Name	**Prime Instrument**
Science User Defined	Any
Full Frame Low Resolution	Any
Full Frame High Resolution[1]	Any
EPIC Image	EPIC
RGS Image	RGS
GO OFF[2]	Any

Note to Table 7:
1) This mode is not recommended for use because of very large overhead and risk of data loss during downlink.
2) This mode is related to Mosaic observations and should not be set for any other observation. Any change to exposures already created for this mode must first be agreed with the SOC.

All the possibilities are described in detail in the *XMM-Newton* Users Handbook, where also some examples are given in Sect. 3.5.9.6.

The user can choose between a user-defined setting and predefined defaults. The user-defined mode is strongly encouraged over the default modes and requires only one extra step to define the central coordinates and size of the read out windows. This is accessed via the "Add Details" button, and described in more detail in the next section § 5.2.4.6.

The default EPIC/RGS Image mode consists of five exposures in which two science windows are read out. A central 2' x 2' window with the boresight coordinates in the centre has a higher spatial resolution (0.5 x 0.5 arcsec). An additional lateral window is read out at 1 x 1 arcsec resolution. In all five exposures, the central window will always be around the target while the lateral windows will ultimately cover the entire chip. This is illustrated in Sect. 3.5.9.2 of the *XMM-Newton* Users Handbook.

Two full frame configurations are available, where the high-resolution mode is not recommended because of excessively large overhead and risk of data loss during downlink.

Important considerations for the choice of mode are, e.g., the source extent and expected variability of the source. If the target is not variable it could be of interest to obtain spectral information performing exposures in different filters. Variability on time scales shorter than 800 seconds, down to 0.5 seconds, can be followed with the FAST mode centred on the source. The FAST mode is offered by selecting the Science User Defined mode. In this mode, two FAST windows can be selected in addition to at least one IMAGE window. Data from IMAGE and FAST windows are acquired simultaneously without extra time consumption or telemetry expenses, and the source will be in the IMAGE **and** in the FAST window.

An important consideration is the required overhead times before each exposure. A smaller number of longer exposures requires less overhead than a large number of short exposures. A series of short exposures will not deliver a continuous stream of data because of the presence of overhead between exposures.

When selecting to observe with a Grism in Science User Defined Mode the IMAGE window is automatically defined for an optimal extraction of the spectrum of a target.

If V Grism or UV Grism observation of several targets in a field is desired, the "Full Frame Low Resolution" Mode has to be selected. Note: if the field is crowded it may not be possible to separate the spectra of the different objects.

XRPS will read the choice of prime instrument made by the user and will offer in the OM modes pull-down menu only those that are compatible with that prime instrument. Thus, the user will see only part of the configurations/modes from Table 7 listed in the pull-down menu on the screen. When reconsidering the choice of prime instrument AFTER having specified OM exposure details, one must go back and change these entries in compliance with the newly defined prime instrument. Otherwise the exposures are invalid (XRPS will flag an error condition). The use of non compatible filters and modes would give an error message, for instance V GRISM and UV GRISM filters are not compatible with "EPIC/RGS Image" modes.

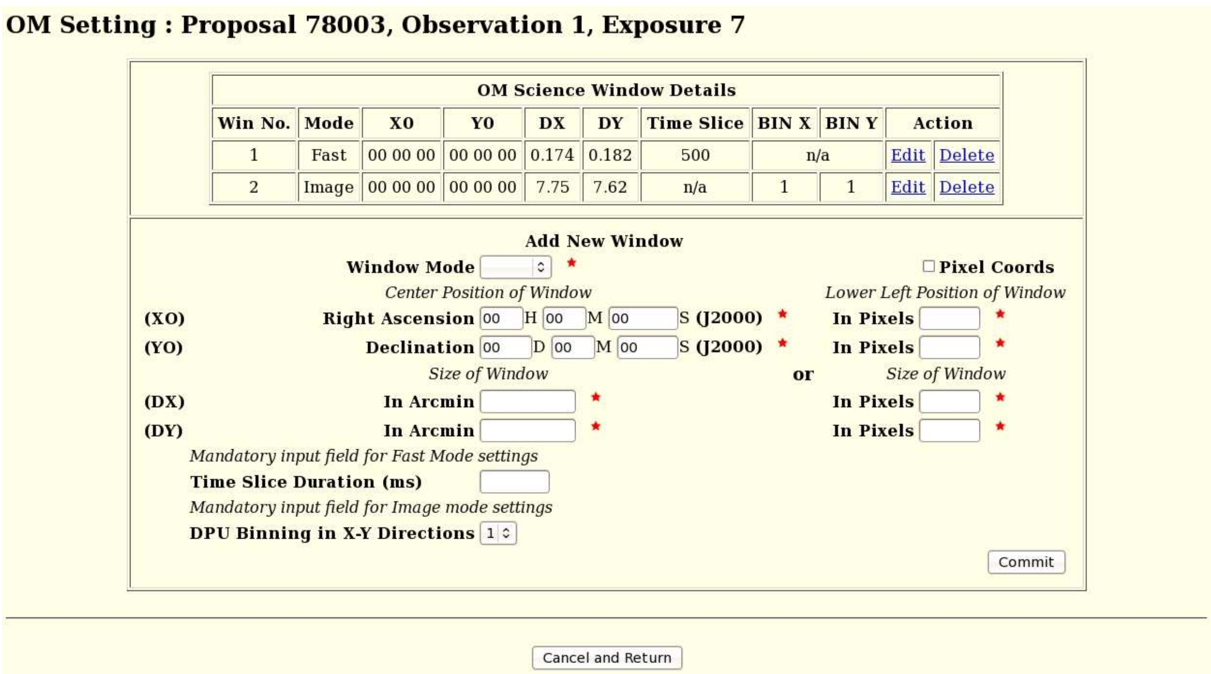
"Order (ins. based)" In this field you can define the order of multiple exposures using the same instrument and filter within an observation. This number is calculated automatically if left blank.

Note: If the user does not include OM exposures in the observation, then the SOC will consider one of the following approaches: i) to use the available time for OM calibrations, ii) to include

OM exposures suited for the particular target, iii) to introduce OM exposures in filters "UVM2", "UVW1" and "U" in "Full Frame Low Resolution" mode.

5.2.4.6 Filling in OM exposure details in "Science User Defined Mode"

For the OM "Science User Defined" mode a number of details has to be specified on a special page by pressing the "Add Details" button at the bottom of the exposure page. The appropriate form sheet is displayed in Fig. 18.



OM Setting : Proposal 78003, Observation 1, Exposure 7

OM Science Window Details

Win No.	Mode	X0	Y0	DX	DY	Time Slice	BIN X	BIN Y	Action	
1	Fast	00 00 00	00 00 00	0.174	0.182	500	n/a		Edit	Delete
2	Image	00 00 00	00 00 00	7.75	7.62	n/a	1	1	Edit	Delete

Add New Window

Window Mode * | Pixel Coords

Center Position of Window | *Lower Left Position of Window*

(XO) Right Ascension 00 H 00 M 00 S (J2000) * | In Pixels *

(YO) Declination 00 D 00 M 00 S (J2000) * | In Pixels *

Size of Window | or | *Size of Window*

(DX) In Arcmin * | In Pixels *

(DY) In Arcmin * | In Pixels *

Mandatory input field for Fast Mode settings

Time Slice Duration (ms)

Mandatory input field for Image mode settings

DPU Binning in X-Y Directions 1

Commit

Cancel and Return

Figure 18: *Screen shot of an OM exposure details page. Entries for one Image window and one Fast window have already been committed to memory. Below this table, it is possible to add details for further windows, either in Image or Fast mode. Committal of this information will add a third entry in the upper part of the form. Up to 5 windows can be defined.*

At the top of the form sheet you see a list of the defined readout windows with their characteristics. At the bottom are the fields used to define the new window to be added, to be exposed simultaneously.

Add new Window / Editing Win No. x When adding a new readout window (Image or Fast) there are two columns of input fields, only one of which must be filled in. The left column asks for the sky coordinates and the size of the window in angular units. The right column allows inputs in detector coordinates (pixels). The default coordinates for the centre of a new window are the boresight coordinates defined above at the observation level.

Once the window mode is selected, if the box labelled 'Pixel Coords' is ticked, default pixel values are entered that cover the boresight coordinates. The values can be modified but note that the orientation of the CCD chip depends on the position angle of the spacecraft and thus exact time of observation. Readout windows that do not cover the boresight have to be entered in sky units.

Window sizes have to be entered in the same units as the window position. The total number of pixels of all user defined windows must not exceed a certain value due to memory limitations. The default sizes take these limitations into account. The scale for unbinned pixels (BIN=0) is 0.476″/pix. For example, the maximum size (DX,DY) for a single square window is:

for BIN X=0 BIN Y=0: 5.20 x 5.20 arcmin or 656 x 656 pixels
for BIN X=1 BIN Y=1: 7.75 x 7.62 arcmin or 976 x 960 pixels, i.e. 488 x 480 pixels after binning in the final image.

Upon committal of a set of entries defining a science window, the top part of the form sheet in Fig. 18 is filled in automatically. Up to 5 science windows may be defined in total per exposure, of which up to 2 may be operated in the FAST mode. **A single FAST window is not allowed, always define at least one IMAGE window**.

The boundary conditions that apply to the definition of the science windows are described in the *XMM-Newton* Users Handbook. An OM tool that can help when defining the windows was developed at MSSL:

http://www.mssl.ucl.ac.uk/www_astro/xmm/om/om.html

Time Slice Duration (ms) For each FAST mode window the time slice duration (TSD) must be specified, i.e., the duration of individual readouts within an exposure. The allowed range is 500–20 000 ms. The recommended TSD is 500 ms.

DPU binning In the lower part of the OM exposure settings page the pixel binning in the Digital Processing Unit (DPU) must be specified for each image mode window. The choice is between values from 0 to 1. They stand for the power of 2. Value 0 represents $2^0 = 1$ pixels and $2^1 = 2$. Since only equal binning in both the X and Y directions makes sense, the choice is between binnings of 1×1 and 2×2 original 0.5” (DPU) pixels. Default binning is 2×2 pixels (i.e. bin=1).

More details on the required input for non-standard OM science windows are provided in the appropriate *XMM-Newton* Users Handbook chapter. The correct specification of OM science windows, which are constrained by various observation-dependent parameters, is the user's responsibility. Users proposing observations with non-standard OM science windows should ask for SOC enhancement support. However, note that the available SOC support to help users will be limited.

5.2.4.7 OM grism observations

There are two grisms on the OM filter wheel, named ”6-VISIBLE GRISM” and ”10-UV GRISM” covering the optical and the UV wavelength range, respectively (see *XMM-Newton* Users Handbook for details). The dispersion direction of both grisms is close to the detector Y-axis (+6 deg for the "UV GRISM" and -6 deg for the "VISIBLE GRISM"). The dispersed first-order spectra of both grisms are centred with their reference wavelength (260 nm and 420 nm, respectively) on the detector location that the target would have with a non-dispersive filter in place. Each grism has a zeroth- and a first-order image. The spectra of the two grisms differ in size (in both orders). GRISM observations are only compatible with the "Science User Defined Mode" mode with its corresponding default window (about 2' x 13' along the dispersion direction), or with a "FULL FRAME" mode (17' x 17' field). For a single target or a small region it is recommended to use the **"Science User Defined" mode** with its default window. The **FULL FRAME LOW RESOLUTION** mode is recommended for several targets in an extended field. In this case, if the field is crowded, the spectra and zeroth orders may overlap and its extraction may be difficult. In both modes, if the dispersion direction overlaps with a bright object, it may also be problematic for extracting the spectra.

5.3 Formal checks on a proposal

When all entries are made and all proposal pages have been successfully committed to memory, have XRPS go through all observations again to perform a few basic checks (essentially the observation and exposure times), by hitting the "Check Proposal" button.

If all entries are formally correct and no compulsory entries are missing, XRPS will report an "End of check - PASSED" status for each observation individually.
XRPS will calculate the sum of all exposures, overheads and eventual offset (delay between individual exposures) times for each of the *XMM-Newton* instruments per observation and compare this with the observation duration. If the sum is higher than the observation duration, XRPS will raise an error condition. If the sum for the X-ray instruments is lower than 97% of the total observation duration, another error message is issued. In both cases the exposure times have to be corrected. For OM observations only the maximum limit gives an error while exposure times less than 97% of the total observation time just issue a warning message.

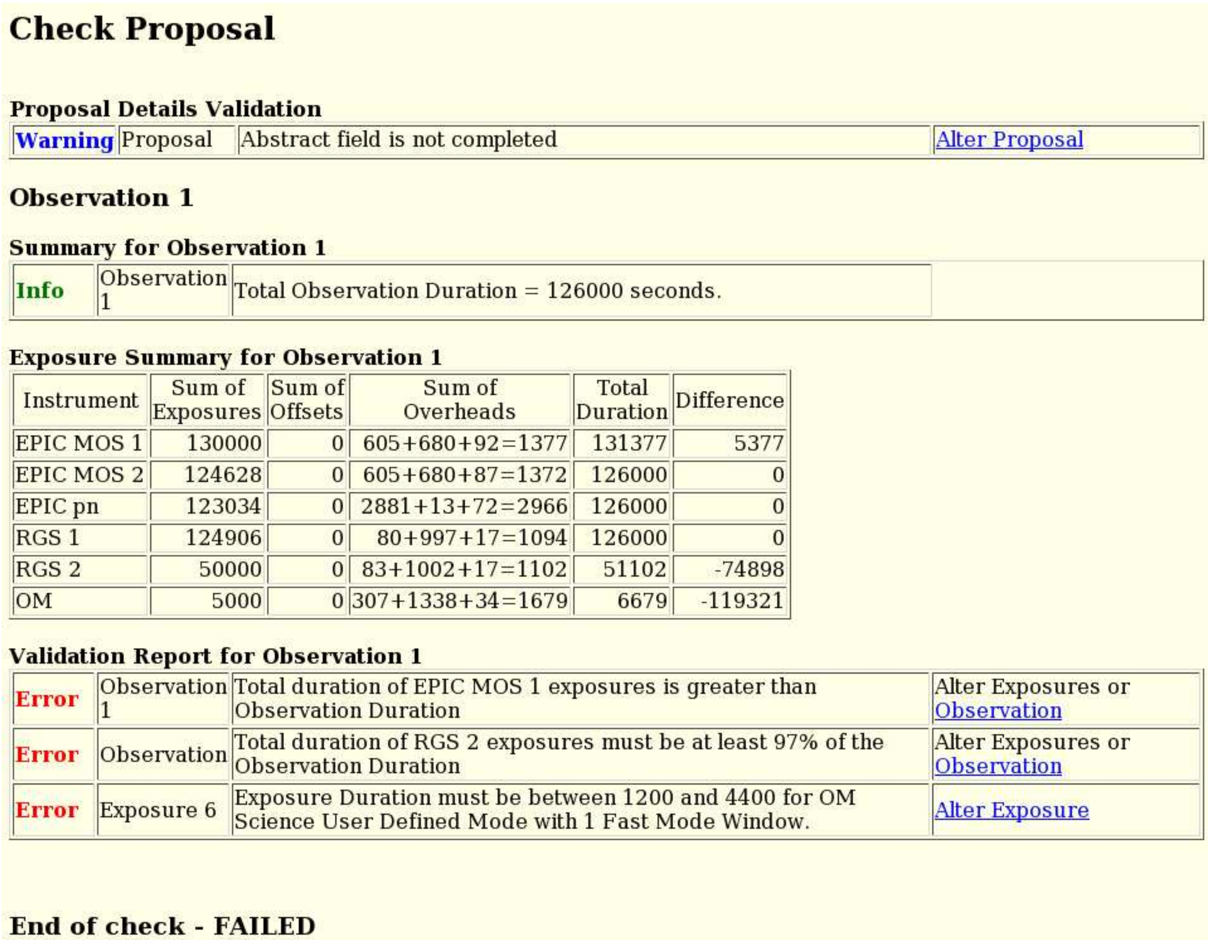
An example is displayed in Fig. 19. In this example the check failed and the user is warned that the EPIC MOS1 exposure time, including overhead times, exceeds the allowed observation time, and that one of the instruments is using less than 97% of the total observation time available.
In this case the user is asked to correct the appropriate entries. This procedure must be repeated by using the navigation tool in the left-hand frame to go back to the sheet forms and apply the necessary changes until the proposal passes all the checks.
For a more detailed check of the proposal's observational parameters use the "Technical Evaluation" button (see § 5.6).

5.3.1 Hitting the "Check Proposal" button accidentally

In case the "Check Proposal" button is hit accidentally, the recovery procedure is to use the "reload" function of the web browser to go back to the page that had been loaded. It is also possible to click on any entry in the left-hand frame of the navigation tool.

5.4 Modifying a proposal

Please note that **reloading proposals for subsequent editing is only possible from the intermediate memory! Once a proposal has been submitted to the proposal database, it cannot be retrieved from there again**.



Check Proposal

Proposal Details Validation

Warning	Proposal	Abstract field is not completed	Alter Proposal

Observation 1

Summary for Observation 1

Info	Observation 1	Total Observation Duration = 126000 seconds.	

Exposure Summary for Observation 1

Instrument	Sum of Exposures	Sum of Offsets	Sum of Overheads	Total Duration	Difference
EPIC MOS 1	130000	0	605+680+92=1377	131377	5377
EPIC MOS 2	124628	0	605+680+87=1372	126000	0
EPIC pn	123034	0	2881+13+72=2966	126000	0
RGS 1	124906	0	80+997+17=1094	126000	0
RGS 2	50000	0	83+1002+17=1102	51102	-74898
OM	5000	0	307+1338+34=1679	6679	-119321

Validation Report for Observation 1

Error	Observation 1	Total duration of EPIC MOS 1 exposures is greater than Observation Duration	Alter Exposures or Observation
Error	Observation	Total duration of RGS 2 exposures must be at least 97% of the Observation Duration	Alter Exposures or Observation
Error	Exposure 6	Exposure Duration must be between 1200 and 4400 for OM Science User Defined Mode with 1 Fast Mode Window.	Alter Exposure

End of check - FAILED

Figure 19: *Screen shot of a proposal that has not passed the formal XRPS check. Below the observation and the exposure summary, the error report appears. In this case the EPIC MOS 1 exposure is exceeding the allowed observation time of 1260 000 s by 5377 s. On the other hand the RGS 2 exposure is using less than 97% of the total observation time available. An error is issued as well because the exposure duration of an OM exposure is outside the allowed range. In all cases the user has to go back and change the exposure times. This can be done easily following the link at the end of the error report line. A warning is issued and displayed at the top because the Abstract field has not been completed.*

5.5 Producing a PDF version of the proposal

At this time (i.e., when all XRPS forms have been filled-in completely and correctly), it is also possible to create a PDF version of the proposal by pressing the "PDF Version of Proposal" button. This allows users to view/print or download to their home sites a PDF version of the proposal. Doing this serves two purposes:

1. The PDF output provides the user with a control printout for checking inputs once again.

   Provided the proposal has not yet been submitted, it is still posible to go back to any of the proposal pages to change, add or delete information. The new version of each page must be committed to memory again before proceeding to the next step.

2. The PDF file serves as the author's copy of the proposal. The final PDF version will also be e-mailed together with the acknowledgement of submission back to the PI.

Note that this PDF version of the proposal will contain only the XRPS forms, not the scientific justification.

5.6 Technical evaluation of the proposal

Pressing the "Technical Evaluation" button will produce an evaluation report summarizing possible instrument setup problems related to an optimal use of the instruments with respect to the scientific goals and eventual instrument safety issues. This is a preliminary check that should help to spot some of the most evident problems (e.g. pile-up, optical loading, etc.) of a proposal already at this stage.

The "Technical Evaluation" report is generated by pressing the "Technical Evaluation" button and sent to the email address specified in the personal details page of the PI.

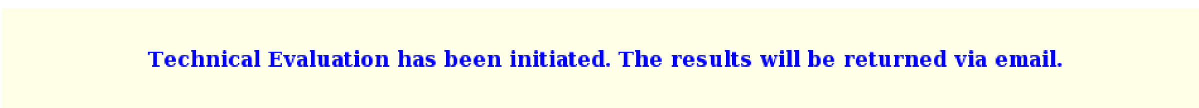


Figure 20: *Screen shot of the page generated with the "Technical Evaluation" button.*

Please, complete all forms of the proposal in detail before running the "Technical Evaluation" to avoid a lot of warnings in the "Technical Evaluation" report that were just generated because of missing information.

For every problem-type detected in the proposal a short problem description will be produced, together with guidelines as to how to solve the problem. It is also clearly stated there if the suggested changes are "MANDATORY", in order to not endanger the health of the instruments, or just "SUGGESTIONS" to optimize the data quality of the requested observations.

Although it is possible to submit a proposal containing "Technical Evaluation" problems even of the "MANDATORY" type, the SOC will NOT allow the requested observation to be performed without changes, and will come back to the PI with an alternative solution during the proposal enhancement process.

In all other cases it is the ultimate responsibility of the PI to check the impact of the suggested changes on the scientific goal of their proposal and to accept or reject the suggestions accordingly. However, during the process of "proposal enhancement" the SOC will propose to the PI an "optimal" instrument setup taking into account the latest calibration results from the instruments.

5.7 Submitting a proposal

To finally submit a proposal it has to be "checked" first pressing the "Check Proposal" button. At the bottom of that page, pressing the button "Continue" will lead to the "Final Proposal Submission Check" form (see Fig. 21).

This is the **last chance** to get back to edit your proposal pressing the "Back to Proposal" button. A proposal can be submitted **only once** and will disappear from the working area after

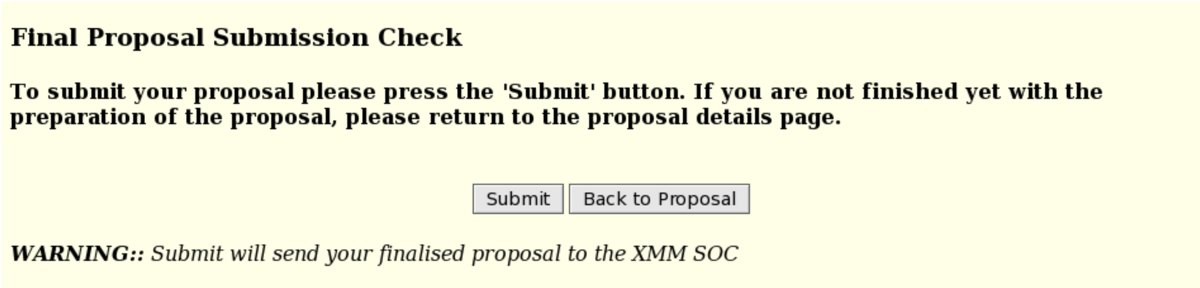


Figure 21: *Final form to submit a proposal.*

pressing "Submit", so that it will not be possible to edit it again in a new browser session at a later time.

Submission will only be acknowledged by email upon receipt of the submitted proposal in the primary database.

If changes need to be made to the proposal after submission, the PI has to contact the SOC via `xmmpi@sciops.esa.int` . This email must list the proposal number in the Subject line.

Note: Successful submission does not imply that all details of the proposal are formally correct or complete, because the formal checks performed by XRPS are not complete.

6 Acknowledgement of receipt

Upon successful submission of a proposal to the database, users will be notified via email (at peak times this might take a while). This email will contain the proposal number, title and as an attachment the pdf version of the submitted proposal.

Users who do not receive an email within 24 hours after submitting a proposal should,

- verify that there is no typo in the email address that was entered into XRPS and
- then try to verify that the mail server at your home institution was up and running.

If neither of these indicates a problem, please get in touch with the SOC via the `xmmpi@sciops.esa.int`, using the subject "Missing proposal submission verification" and identifying your proposal by PI name and full title.

7 SOC enhancement requests

XMM-Newton SOC user support will be provided by a small team of support astronomers. Therefore SOC enhancement requests and all other manual interactions with the proposal database must be limited to a minimum.

8 Submitting unanticipated ToO requests

Requests to observe unanticipated Target of Opportunity (ToO) are not submitted via XRPS, because the software will be taken offline after the closure of the second phase proposal submission. The process of ToO submission is described in the Policies and Procedures document and this route should be followed in all cases.

9 XRPS performance

The adoption of a two-phase proposal submission strategy ensures that during the AO Phase II Proposal Data Entry cycle, the full capabilities of the XRPS system will be focused on those users whose successful proposals have been awarded AO observing time by OTAC. It is only common sense and friendly advice that our users should avoid leaving the proposal submission until the last moment. We encourage PIs to benefit from the full extent of the time windows that have been made available to them for proposal data entry.

10 Related documents, tools and online services

Related documents, tools and other *XMM-Newton* online services can be found at the following addresses:

1. XRPS online
   `http://xmmrps.esac.esa.int/`
2. This document (XRPS Users Manual)
   `http://xmm-tools.cosmos.esa.int/external/xmm_user_support/documentation/rpsman/`

3. *XMM-Newton* Users Handbook
   `http://xmm-tools.cosmos.esa.int/external/xmm_user_support/documentation/uhb/`

4. AO documents
   `http://www.cosmos.esa.int/web/xmm-newton/aoannouncement`

5. Policies and Procedures
   `http://xmm-tools.cosmos.esa.int/external/xmm_user_support/documentation/AOpolicy/`

6. *XMM-Newton* Target Visibility Tool
   `http://www.cosmos.esa.int/web/xmm-newton/target-visibility-tool`

7. PIMMS (HEASARC) `http://heasarc.gsfc.nasa.gov/Tools/w3pimms.html`

8. *XMM-Newton* HelpDesk
   `http://www.cosmos.esa.int/web/xmm-newton/xmm-newton-helpdesk`

9. *XMM-Newton* Latest News
   `http://www.cosmos.esa.int/web/xmm-newton/latest-news`

10. XSA
    `http://www.cosmos.esa.int/web/xmm-newton/xsa`

11. XMM-Newton Serendipitous Source Catalogue
    `http://xmmssc.irap.omp.eu/cat.html`

Additional information on *XMM-Newton* can always be obtained from other locations under the SOC home page, at the URL `http://www.cosmos.esa.int/web/xmm-newton/`.

A Observation examples

In this chapter we provide a few examples that go through the crucial entries that must be made in the XRPS for *XMM-Newton* observations of selected generic targets. The examples follow the instructions presented above for planning *XMM-Newton* observations (§ 3.1).

A.1 Observation of a faint extended source

As an example for a faint extended X-ray source one might consider observing a cluster of galaxies, at relatively low redshift, z. The input of standard information (target name, catalogued position etc.) in XRPS is trivial. Other input parameters require some more thought:

Choice of prime instrument Chose the *XMM-Newton* prime instrument according to your main scientific goal. If moderate resolution spectroscopy is most important for the proposed science, the observer might want to select the EPIC pn camera. Alternatively, if high-resolution spectroscopy is intended, they may want to chose the RGS instrument.

Science mode of the prime instrument If the source is weak, all EPIC cameras can be assumed to have no problems with photon pile-up. In that case, they can all be used in the standard FULL FRAME imaging mode. RGS could be used in its standard SPECTROSCOPY mode.

X-ray properties of the source Based on PIMMS observers can convert *ROSAT*, *ASCA* or other known flux and band data into the *XMM-Newton* band (0.1–15 keV). These can be entered, together with an X-ray spectral model, e.g. Raymond-Smith, kT = 6 keV, N(H) = 3e20 cm^{-2} and the lower and upper limit of the energy band over which the X-ray flux was observed into XRPS.

Duration of observation vs. visibility constraints Users must check that the requested observation fits into a continuous visibility period of the *XMM-Newton* orbit by using the *XMM-Newton* Target Visibility Tool. In case that the required total integration time is longer than the longest possible visibility window, the observation must be split into an adequate number of individual observations.

Pointing coordinates Assuming that the cooling flow is located at the core of the cluster, no boresight coordinates need to be entered, and thus the target coordinates will automatically be propagated into the boresight fields. Otherwise, the boresight would be chosen to be directed towards the location of the brightest/most important X-ray feature to be observed. The best data quality will be achieved in the aim point of the prime instrument.

Avoidance of nearby bright sources Optical and X-ray catalogues should be searched for nearby bright sources which might lead to contamination of either the X-ray (e.g., RGS spectral overlaps) and/or optical/UV observations. Such sources must be avoided, which might require a Position Angle (PA) constraint.

Science modes of the other instruments The expected RGS count rates are lower than those for EPIC. There will thus be no need for fast readouts and RGS would be used in its standard SPECTROSCOPY mode.

Assuming that the cluster fits into the OM's 17′ FOV, the standard configuration would be chosen (”EPIC Image” or ”RGS Image”).

EPIC filters Since the source is assumed to be weak (both in X-rays and the optical/UV) the ”THIN” optical blocking filter can be used.

RGS readout sequence For the case of standard spectroscopy observations there is no need to change anything in the RGS readout sequence. CCDs will then be read out sequentially.

OM brightness limit Before planning the details of OM observations, users should check for the presence of bright optical/UV sources within the OM's FOV. There should be no source in the FOV that violates the brightness constraints tabulated in UHB Table 25. If such sources exist, no OM exposure should be included.

OM filters and modes OM filters and modes have to be chosen according to the optical characteristics of the target (see 5.2.4.5).

Duration of exposures All X-ray observations of faint sources can be obtained in a single exposure covering the entire duration of the observation.

The OM exposure times should be chosen according to the explanations in § 5.2.4.5 and the OM chapter of the *XMM-Newton* Users Handbook.

A.2 Observation of a bright extended source

Consider as an example for a bright extended X-ray source a relatively compact supernova remnant (SNR). The input of standard information (target name, catalogued position etc.) in XRPS is trivial. Other input parameters require some more thought:

Choice of prime instrument There might be a bright emission knot near the desired field centre. If moderate resolution spectroscopy is most important for the proposed science, the observer might want to select the EPIC pn camera. Alternatively, if high-resolution spectroscopy is intended, they may want to chose the RGS instruments (which is the unit with the highest energy resolution). Let us, for the time being, assume that RGS is prime.

Science mode of the prime instrument RGS can probably be used in its standard SPECTROSCOPY mode. In case of doubt, i.e., if the source has prominent emission lines, the user should check for potential pile-up problems.

X-ray properties of the source Based on PIMMS observers can convert *ROSAT*, *ASCA* or other known flux and band data (if known), and enter these, together with an X-ray spectral model, e.g. thermal bremsstrahlung, kT = 5 keV, N(H) = 1e20 cm^{-2} and the lower and upper limit of the energy band over which the X-ray flux was observed.

Duration of observation vs. visibility constraints Users must check that the requested observation fits into a continuous visibility period of the *XMM-Newton* orbit by using the *XMM-Newton* Target Visibility Tool. In case that the required total integration time is longer than the longest possible visibility window, the observation must be split into an adequate number of individual observations.

Pointing coordinates Assuming that the bright knot is not located at the centre of the SNR, its coordinates must be entered into the boresight fields. This is the position on which the prime instrument will be centred. The best data quality will be achieved in the aim point of the prime instrument.

Avoidance of nearby bright sources Optical and X-ray catalogues should be searched for nearby bright sources which might lead to contamination of either the X-ray (e.g., RGS spectral overlaps) and/or optical/UV observations. Such sources must be avoided, which might lead to a position angle constraint.

Science modes of the other instruments The science modes of the instruments will mostly be determined by the level of photon pile-up to be expected. As mentioned above (in § 5.2.3), EPIC pile-up calculations should be based on the brightest emission region's count rate. In the case of a bright knot in a known SNR, this could be done by estimating from (for example) *ROSAT* images the brightness within one *XMM-Newton* Point-Spread Function (PSF; see *XMM-Newton* Users Handbook section on *XMM-Newton* X-ray PSF). For the PSF a Full Width at Half Maximum (FWHM) of $6''$ can be assumed.

For the pn camera we compare the merits of two modes: Full Frame Mode could be used if the pile-up constraints are acceptable for the science goals. Large Window Mode can be used for sources up to $15'$ extent, and where exterior to this range there are no bright regions that would affect the desired image.

For MOS we compare the merits of two modes as well: Full Frame Mode could be used if the pile-up constraints are acceptable for science goals. The Large Window (300×300 pixels) can be used for sources up to $6'$ extent.

The expected RGS count rates are lower than those for EPIC. Therefore, RGS can in most cases be operated in its SPECTROSCOPY mode.

If no high time resolution is required for the OM observations, an imaging mode default configuration should be chosen (in this case, since RGS is prime instrument, "RGS Image"). The optical surface brightness of the brightest region of the target must be compared with the OM brightness limits (UHB Table 25).

EPIC filters Using the instructions provided in the *XMM-Newton* Users Handbook on EPIC filters, the user must decide which optical blocking filter suppresses optical loading in the soft part of the X-ray passband sufficiently and at the same time has minimal impact on the proposed science.

RGS readout sequence In the case of standard spectroscopy observations there is no need to change anything in the RGS readout sequence. The CCDs will then be read out sequentially. However, there might be strong emission lines, which the user wants to read out faster than the rest of the spectrum. One way of doing this would be to use the RGS SPECTROSCOPY mode and a readout sequence of e.g. [3 1 2 3 4 5 3 6 3 8 9], in which CCD #3 of RGS-1 is read out 4 times more often than all others (assuming that the bright line would be registered on chip 3; see the *XMM-Newton* Users Handbook section on RFC arrays).

OM brightness limit Before planning details of OM observations, users should check for the presence of bright optical/UV sources within the OM's FOV. There should be no source in the FOV that violates the brightness constraints tabulated in UHB Table 25. If such sources exist, no OM exposure should be included.

OM filters and modes OM filters and modes have to be chosen according to the optical characteristics of the target (see 5.2.4.5).

Duration of exposures The OM exposure times should be chosen according to the explanations in § 5.2.4.5 and the OM chapter of the *XMM-Newton* Users Handbook. For the OM imaging mode each exposure must have a duration of 800–5000 s.

A.3 Imaging observation of a point source

Users might be interested in observing a bright point source (like, e.g., an unresolved AGN, binary or stellar object). The input of standard information (target name, catalogued position etc.) in XRPS is trivial. Other input parameters require some more thought:

Choice of prime instrument The prime instrument is chosen according to the importance of data from either type of *XMM-Newton* instrument: either EPIC pn, if imaging with moderate resolution spectroscopy is crucial, or RGS, if the highest possible spectral resolution must be achieved. Let us, for the time being, assume that RGS is prime.

Science mode of the prime instrument RGS can be operated in its standard SPECTROSCOPY mode. In the case where the source has prominent emission lines, the user should be aware of, and check for, potential pile-up problems.

X-ray properties of the source Based on PIMMS observers can convert *ROSAT*, *ASCA* or other known flux and band data into the *XMM-Newton* band (0.1–15 keV). These can be entered, together with an X-ray spectral model, e.g. power law, $\Gamma = 0.7$, N(H) = 3e21 cm^{-2} and the lower and upper limit of the energy band over which the X-ray flux was observed.

Duration of observation vs. visibility constraints Users must check that the requested observation fits into a continuous visibility period of the *XMM-Newton* orbit, using the *XMM-Newton* Target Visibility Tool. In case that the required total integration time is longer than the longest possible visibility window, the observation must be split into an adequate number of individual observations.

Pointing coordinates No boresight coordinates need to be entered to centre the target on the prime instrument, because the target coordinates will be propagated automatically into the boresight fields, if no other values are provided. The best data quality will be achieved in the aim point of the prime instrument.

Avoidance of nearby bright sources Optical and X-ray catalogues should be searched for nearby bright sources which might lead to contamination of either the X-ray (e.g., RGS spectral overlaps) and/or optical/UV observations. Such sources must be avoided, which might lead to a position angle constraint.

Science modes of the other instruments The science modes of the instruments will mostly be determined by the level of photon pile-up to be expected, as mentioned above (in § 5.2.3).

For the pn camera we decide that the Small Window Mode is necessary to accommodate the source brightness without pile-up degradation (using the information provided in the *XMM-Newton* Users Handbook section on EPIC modes). This mode offers a total of $4'$ field coverage. We note the effect of significant dead time, which must be taken into account to obtain the correct exposure time (PIMMS and the plots provided in the *XMM-Newton* Users Handbook account for this).

For MOS we compare the merits of two modes: Small Window Mode (100×100 pixels) is able to accommodate the point source spatially. If the mode is not able to accommodate the expected flux without significant pile-up, then the Timing Mode must be considered.

If no high time resolution is required for the OM observations, an imaging mode default configuration should be chosen (in this case, since RGS is prime instrument, "RGS Image"). Becasue of the small size of the window it is very important to get the coordinates right.

EPIC filters Using the instructions provided in the *XMM-Newton* Users Handbook on EPIC filters, the user must decide which optical blocking filter suppresses optical loading in the soft part of the X-ray passband sufficiently and at the same time has minimal impact on the proposed science.

RGS readout sequence In the case of standard spectroscopy observations there is no need to change anything in the RGS readout sequence. CCDs will then be read out sequentially. However, there might be strong emission lines that the user wants read out faster than the rest of the spectrum. One way of doing this would be to use the RGS SPECTROSCOPY mode and a readout sequence of e.g. [3 1 2 3 4 5 3 6 3 8 9], in which CCD #3 of RGS-1 is read out 4 times more often than all others (assuming that the bright line would be registered on chip #3; see the *XMM-Newton* Users Handbook section on RFC arrays). If the mode is not able to accommodate the expected flux without significant pile-up, then the Small Window mode must be considered.

OM brightness limit Before planning details of OM observations, users should check for the presence of bright optical/UV sources within the OM's FOV. There should be no source in the FOV that violates the brightness constraints tabulated in UHB Table 25. If such sources should exist, no OM exposure should be included.

OM filters and modes OM filters and modes have to be chosen according to the optical characteristics of the target (see 5.2.4.5).

Duration of exposures Normally, the X-ray observations can be obtained in a single exposure covering the entire duration of the observation.

The OM exposure times should be chosen according to the explanations in § 5.2.4.5 and the OM chapter of the *XMM-Newton* Users Handbook.

A.4 Timing observation of a variable source

Consider observing a bright point source, as above (like, e.g., an unresolved AGN, binary or stellar object), but now with a special interest in high time resolution measurements. The input of standard information (target name, catalogued position etc.) in XRPS is trivial. Other input parameters require some more thought:

Choice of prime instrument The prime instrument is chosen according to the importance of data from either type of *XMM-Newton* instrument: either EPIC, if imaging with moderate resolution spectroscopy is crucial, or RGS, if the highest possible spectral resolution must be achieved. Let us, for the time being, assume that EPIC is prime.

Science mode of the prime instrument For high time-resolution observations the EPIC pn TIMING mode is a suitable choice.

X-ray properties of the source Based on PIMMS observers can convert *ROSAT*, *ASCA* or other known flux and band data (if known), and enter these, together with an X-ray spectral model, e.g. power law, $\Gamma = 0.7$, N(H) = 3e21 cm^{-2} and the lower and upper limit of the energy band over which the X-ray flux was observed.

Duration of observation vs. visibility constraints Users must check that the requested observation fits into a continuous visibility period of the *XMM-Newton* orbit, using the *XMM-Newton* Target Visibility Tool. In case that the required total integration time is longer than the longest possible visibility window, the observation must be split into an adequate number of individual observations.

Pointing coordinates No boresight coordinates need to be entered to centre the target on the prime instrument, because the target coordinates will be propagated automatically into the boresight fields, if no other values are provided. The best data quality will be achieved in the aim point of the prime instrument.

Science modes of the other instruments Based on the nature of the example, one can assume that all instruments will be operated in their fast modes. EPIC pn reaches a time resolution of 0.03 ms in its TIMING mode, MOS reaches a resolution of 1.5 ms. Note that the pn camera in its Small Window mode already reaches a time resolution of 6 ms, which would at the same time render possible imaging of the target. RGS would be operated in the SPECTROSCOPY mode and OM in the Science User Defined mode with Image and Fast windows.

Avoidance of nearby bright sources Optical and X-ray catalogues should be searched for nearby bright sources which might lead to contamination of either the X-ray (e.g., RGS spectral overlaps) and/or optical/UV observations. In particular, when the EPIC TIMING mode is used, one must ensure that nearby sources do not contaminate the target data. There must be no nearby source in the same column of the EPIC cameras as the science target. However, note that the two MOS cameras are mounted orthogonally to each other. For the RGS there must be no source along the dispersion direction of the target spectrum. Such sources must be avoided, which might lead to a position angle constraint.

EPIC filters Using the instructions provided in the *XMM-Newton* Users Handbook on EPIC filters, the user must decide which optical blocking filter suppresses optical loading in the soft part of the X-ray passband sufficiently and at the same time has minimal impact on the proposed science.

RGS readout sequence The user must determine whether one or several CCDs shall be read out. The whole spectral range (all 8 CCDs) can be read out in 5 s for RGS1 and 10 s for RGS2.

OM brightness limit Before planning details of OM observations, users should check for the presence of bright optical/UV sources within the OM's FOV. There should be no source in the FOV that violates the brightness constraints tabulated in UHB Table 25. If such source should exist, no OM exposure should be included.

OM filters and modes OM filters and modes have to be chosen according to the optical characteristics of the target (see 5.2.4.5).

Duration of exposures Normally, X-ray observations can be obtained in a single exposure covering the entire duration of the observation.

The OM exposure times should be chosen according to the explanations in § 5.2.4.5 and the OM chapter of the *XMM-Newton* Users Handbook.