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# MEETING

**Meeting Date** 10-11 April 2014

**Ref** MoMUG#15

**Meeting Place** ESAC/XMM-Newton SOC B5/B65

**Chairperson** Xavier Barcons

**Minute's Date** 15 April 2014

**Participants**

**Members:** Xavier Barcons (Chair), Hans Böhringer, Anne Decourchelle, Christine Done, Manuel Güdel, Mariano Mendez, Richard Mushotzky, Craig Sarazin, Beate Stelzer; Marco Salvati (OTAC Chair)

Norbert Schartel (Project Scientist), Fred Jansen (Mission Manager), Maria Santos-Lleó (Science Support Manager), Matthias Ehle (UG secretary);

**Invitees:** Jelle Kaastra (RGS PI), Mike Watson (Survey Scientist); Martin Ward (future UG Chair);

Presenters and interested staff from the XMM-Newton Science Operations Centre.

Absent: Invitees Steve Sembay (EPIC PI) and Mat Page (OM acting PI) had excused themselves.

**Subject**

Minutes of XMM-Newton Users Group Meeting 15

**Copy**

Description	Action	Due Date
Edited by Matthias Ehle. Approved by UG members on 12 May 2014		



## WELCOME:

X. Barcons (Chair) and N. Schartel (Project Scientist) opened the meeting on April 10<sup>th</sup> at 10:00. The future XMM-Newton Users Group (UG) Chair, Prof Martin Ward, was welcomed and all panel members introduced themselves. X. Barcons explained the format of the meeting, with an open meeting on the 1<sup>st</sup> day, and an open discussion session in the morning of the 2<sup>nd</sup> day followed by a UG member-only executive session in the afternoon.

## ADOPTION OF THE AGENDA:

The agenda of the meeting was presented and adopted by the participants.

## PRESENTATIONS:

The following presentations were given on April 10<sup>th</sup>:

Overall Mission Status	(F. Jansen; 10:10-10:30)
Instrument Operations	(R. Muñoz; 10:40-11:10)
Report of the Project Scientist	(N. Schartel; 11:15-11:25)
User Support and Mission Planning	(M. Ehle; 11:45-12:05)
SSC Status	(M. Watson; 12:15-12:30)
Calibration	(M. Guainazzi; 13:45-14:35)
SAS Developments and Future Plans	(C. Gabriel; 15:00-15:30)
Mission Extension	(N. Schartel; 16:00-16:05)
Requirements for Calibration & Post-operation	(N. Schartel; 16:10-17:35)
Input for Discussion: anticipated & unanticipated TOOs, and Gravitational wave follow-up	(N. Schartel; 17:40-18:20)

The view-graphs of the presentations are available on the XMM-Newton public web site, under “General User Support” → “Users Group”.

## DISCUSSIONS:

During the presentations, several questions were raised and discussions took place:

After the presentation on the Overall Mission Status, R. Mushotzky asked about the manpower evolution of the XMM-Newton project and was informed that the SOC, having had ~75 FTEs one year after launch is now down to 30 FTEs; the instrument team approximately reduced to 25% and MOC down from more than 40 to about 20 FTEs. X. Barcons expressed the opinion that no further reductions are possible without significant impact on the science return of XMM-Newton (see **Resolution 2014-04-11/06**).

X. Barcons congratulated the project on the 4 reaction Wheel drive implementation (see **Resolution 2014-04-11/02**). R. Mushotzky asked for more details about the future pro-active ideas presented with respect to possible life time extension for the XMM-Newton spacecraft. Studies on science with 2-reaction-wheel-only drive have started. Needed fuel migration between different tanks is also under preparation (tests on tank temperature control are already on-going, again with strong involvement of industries).

After the presentation on Instrument Operations & Data Generation, H. Böhringer asked if no automatic control of the instruments is possible during the ground station gaps. This is nearly impossible as XMM-Newton has no on-board command stacks; a CDMU patch for thermal control will soon be implemented but during eclipses the power available is strongly reduced and only one heater is left to control the three EPIC cameras and another one for the two RGS cameras. Asked about the impact of a lower than expected number



of big solar flares, together with other factors that resulted in more time available for science during AO-12, N. Schartel explained that an increase in performed C-observations has been seen, that is expected to be reduced again already in AO-13 as more time to A+B-targets has been allocated.

The Report of the Project Scientist led UG to discuss the joint programmes; X. Barcons explained that existing joint programmes were reviewed by UG some years ago and input from the community on such programmes is welcome. With respect to a possible joint programme with Astro-H, the UG issued **Recommendation 2014-04-11/02**. The XMM-Newton and Astro-H operation teams are in contact with respect to possible joint calibration campaigns.

The presentation on User Support and Mission Planning was followed by a statement of UG members confirming that the re-engineered XMM-Newton Science Archive is indeed fast and user friendly (see **Resolution 2014-04-11/03**); H. Böhringer further acknowledged that his request to update the filter-wheel-closed data repository at the SOC had been closed. With respect to SOC organising, with external help for the biggest events, science conferences and SAS workshops, UG formulated **Recommendation 2014-04-11/04**.

After the presentation on Calibration, UG acknowledged the work of the calibration team (see **Resolution 2014-04-11/04**) and decided to discuss and propose priorities for future calibration activities as formulated in **Recommendation 2014-04-11/01**.

After the presentation on the SAS Developments and Future Plans, UG expressed their opinion that SAS has evolved into a highly-performing and user-friendly tool (see **Resolution 2014-04-11/05**). UG reminded that dropping the 32-bit versions will need to be communicated early (i.e. 3-4 years in advance) as problems are expected with installations at institutes (less with user laptops). M. Santos reminded that a related Newsletter has already been sent in December 2013.

M. Watson presented the status of the Survey Science Centre, highlighting especially SSC restructuring (with Natalie Webb, IRAP, Toulouse, being the new SSC Project Manager), SSC activities and future plans (3XMMi now being in production), followed by a brief report on linked ventures, i.e. 3XMM spin-off projects. UG found it encouraging seeing such projects already on their way making efficient use of XMM-Newton data.

N. Schartel informed the UG on the coming mission extension consideration for which he will contact UG members asking them for recent highlights in their individual areas of research as well as about envisaged future science. UG took note and already formulated the related **Resolution 2014-04-11/06**. Discussing the draft of the Post-operation Requirement Document presented by N. Schartel, UG discussed possible additions and amendments, resulting in **Action-Item 2014-04-11/02**.

On the draft of the Calibration Requirement Document also presented by N. Schartel, UG noticed that the list of calibration parameters seems to be complete; several of them having reached already physical limits, some being close to it, and a few that probably will need to be finalized. F. Jansen underlined that the document is supposed to show what has been reached and what needs to be maintained for science; it is anyway a “working document” based on science drivers that can evolve with time if new science goals are identified, it has to identify where limits are already reached, also in order to define calibration objectives and to scope efforts required. In summary, UG issued **Action-Item 2014-04-11/03**.

As inputs for discussion, N. Schartel presented two issues, 1) the experienced conflict between concurrent Target of Opportunities (ToOs) and 2) the presentation of a possible gravitational wave follow-up by XMM-Newton. For the ToOs, N. Schartel explained that since the introduction of a new policy, i.e. having expiry periods for ToOs (lasting 1 or 3 AOs), open observations aiming at similar science have accumulated (see [http://xmm.esac.esa.int/external/xmm\\_sched/too/](http://xmm.esac.esa.int/external/xmm_sched/too/)). This is e.g. because OTAC may, on purpose, approve a new proposal if an old one is due to expire soon, or OTAC may decide to approve the same target twice if trigger criteria differ in two proposals. In order to ensure the best science return and OTAC-



recommendation-driven decisions about conflicting triggers when fast reactions are needed, all PIs of open ToO proposals have been requested by the SOC to inform as soon as possible about a possible trigger, even before the final decision about its execution as an XMM-Newton observation. The UG decided to further elaborate on this issue and finally issued **Recommendation 2014-04-11/03**.

Having been presented with the idea of a possible gravitational wave follow-up by XMM-Newton, UG asked for further details also on the planned Memorandum of Understanding and decided to issue **Recommendation 2014-04-11/06**, see section “On Gravitational Wave Events Follow-up” below.

## INPUT FROM THE COMMUNITY

J. Kaastra informed about input received, claiming that an emission line reported in a paper might not be significant but related to the energy scale. The data was obtained in EPIC-pn burst mode. Re-calibration of this mode is currently on-going.

C. Sarazin informed about input received related to the possibly negative effect of straylight on projects studying e.g. the outskirts of clusters of galaxies in which the emission of the core of the clusters might be impacting the off-axis emission stronger than thought. The currently ground-based-only calibration of the straylight seems to be insufficient as it might not well describe the alignment of the baffles, suggested by existing Sco X-1 offset and Crab observations. Additional in-orbit calibrations may be necessary to measure the exact geometry. M. Guainazzi explained that a non-routine calibration observation request is currently under preparation. SOC counts on external (D. Lumb) support for the analysis; if not possible, the analysis will need to be deferred until higher priority issues (as per UG recommendations) may be closed. UG supports these planned activities according to item 2 of **Recommendation 2014-04-11/01**.

N. Schartel, on behalf of the XMM-Newton project, expressed deepest recognition and warmest thanks to Prof. Xavier Barcons for all his efforts and support to XMM-Newton over the last years as chairperson of the Users Group.

The meeting finished, without any further AOB, on the 1<sup>st</sup> day at 18:45.

## DEDICATED DISCUSSION:

Discussions continued on April 11<sup>th</sup> starting at 10:00; UG discussed and finalized resolutions, recommendations and action items, based on a draft prepared by X. Barcons, summarizing items that came up for discussion of presentations received on the 1<sup>st</sup> day of the meeting.

## RECOMMENDATIONS FROM PREVIOUS MEETINGS

In the UG's executive session that started at 13:50, M. Ehle presented, and UG revised, the status of recommendations formulated in previous meetings. Their disposition grouped by topic is as follows:

### ***Resolution on Calibration (from UG meeting in May 2013):***

Priorities in this area should be:

1. MOS-pn EPIC cross-calibration has to be the highest priority, including the time dependence of the cross-calibration. This is to guarantee that the full EPIC effective area can be reliably exploited.
2. Closely linked to the above, continue working in the improvement of the cross-calibration of XMM-Newton's instruments with other missions, in particular with Chandra, Suzaku and NuSTAR,



provided these other teams also deploy the necessary matching resources for this very necessary joint effort.

3. Work towards completing the EPIC timing mode calibration, including characterisation of the PSF at higher energies. **Closed.**
4. Burst mode calibration.

Continuous monitoring of the EPIC-pn long-term stability including the energy scale, effects of contamination, RGS and OM characterisation etc., should be part of the normal house-keeping procedures with the highest priority. **Status as reported by M. Guainazzi. Superseded by Resolution 2014-04-11/03 & Recommendation 2014-04-11/02.**

### ***Related to RGS and forthcoming calls for observing proposals:***

**Recommendation 2011-05-19/02:** The XMM-Newton Project should prepare a list of clear strategies for RGS observations that can help to exclude any negative effects from the existing warm pixels in the RGS CCDs on the observations. **Closed: Technical Note XMM-SOC-CAL-TN-0192 published.**

### ***On Future Calibration Goals:***

**Action Item 2013-05-17/01:** In order to review calibration requirements formulated before the launch of XMM-Newton, a working group is to be appointed by the Project Scientist with the task of updating the original mission calibration requirements, taking into account the current science goals of the mission as well as a realistic estimate of the progress that can be achieved in meeting such calibration specifications in the future. The working group shall have members with a broad view and expertise in data reduction covering all XMM-Newton instruments, e.g. members from different OTAC panels and from the calibration team. UG members are asked to send their inputs and suggestions for memberships to the Project Scientist. Results from the working group shall be available and agreed upon well before the next UG meeting.

**Status as reported by N. Schartel: On-going, see Action-Item 2014-04-11/03.**

### ***On the 4 Reaction Wheel Study:***

**Recommendation 2012-04-20/02:** The UG strongly recommends that in order to guarantee the correct operation of the mission, the 4 Reaction Wheel Drive option for the XMM-Newton spacecraft is implemented as soon as technically feasible. **Closed: cf. presentations by F. Jansen & R. Muñoz and Resolution 2014-04-11/01.**

### ***On Large (LP) and Very Large (VLP) proposals:***

**Recommendation 2013-05-17/01:** In order to guarantee the large slate of proposals, panels should be asked to promote for discussion in the OTAC Chairs meeting a pre-allocated number of VLP+LP proposals, without distinction among them. The UG is willing to review the effect of implementing this change at its next meeting. **Closed.**

### ***On Priority C targets:***

**Recommendation 2013-05-17/02:** Given that about 40-50% of the priority C target observations are being executed at the moment, it is recommended that the time allocated to A+B proposals be increased to maximize the science output. The amount by which A+B time could be increased is to be explored by the project, given visibility constraints. The total time allocated to Priority-C targets should remain the same, but with a smaller fraction of them being actually executed. **Closed.**

### ***On HST Frontier Fields:***

**Recommendation 2013-05-17/03:** XMM-Newton would welcome receiving proposals through the OTAC to further exploit the HST frontier fields project, where XMM-Newton can be of real added value. **Closed.**



### ***On the Source Catalogue:***

**Recommendation 2012-04-20/06:** The UG strongly encourages the SSC to continue working for the XMM-Newton source catalogue and recommends that close contact between SSC and SOC is maintained to secure a successful outcome of this joint venture. **Closed.**

### ***Resolution on SAS & User Support: (Status as reported by M. Ehle & C. Gabriel)***

Priorities in this area should be:

1. Maintaining the SAS threads to follow all updates in extraction procedures. These threads are the main guiding tools for users to analyze XMM-Newton data. In particular when there are new SAS version releases, clear indications should be made to the users of the new functionalities and the impact of these compared to previously extracted data. **Closed: routine activity.**
2. Selecting only a few of the most commonly used platforms/operating systems for SAS support, so that the effort can be concentrated where it is most required. **Closed.**
3. SAS workshops are important to train newcomers to the XMM-Newton users community, and it would be very helpful to continue them. Before discontinuing them totally, the possibility of reducing their frequency should be explored. **Closed: SAS Workshop planned for 2014, see also Recommendation 2014-04-11/05.**
4. The publication of the public long-term plan, although it is useful for the users, does not appear to be as critical as other tasks. **Closed, de-scoped as of AO-13.**
5. Bibliographic studies are good to have and provide a useful handle to support mission extensions. This activity is also of lower priority with respect to others. **Closed & routine task, at reduced level.**

### ***On SAS and Pipeline development:***

**Recommendation 2012-04-20/07:** The UG recommends the MPE EPIC-pn and Saclay MOS teams to work with SAS and pipeline teams to assess the possibilities of implementing one of the procedures and tools, previously established by those teams, to create exposure corrected flat-fielded images into the pipeline system. **Closed; planned for SASv14.**

### ***On Scientific Goals for the Post-operational Phase:***

**Action-Item 2013-05-17/02:** In order to re-consider the XMM-Newton Post-operational Phase in the Cost at Completion, the Project Scientist agreed to draft requirements that he will distribute to UG members by the end of January 2014. UG members are invited to comment them. The aim is to have them ready for endorsement for the next UG meeting. **Status as reported by N. Schartel; see Action-Item 2014-04-11/02.**

### ***On Candidates for UG Chairperson:***

**Action-Item 2013-05-17/03:** On UG members to send suggestions for the next chairperson of the XMM-Newton Users Group to the Project Scientist. Input should be provided before June 30th 2013, if possible. **Closed. Prof. Martin Ward will officially take over after the mission extension proposal (expected in Oct-Nov 2014).**

## **RESOLUTIONS, RECOMMENDATIONS AND ACTION ITEMS**

The UG formulated the following new resolutions, recommendations and action items:

### ***On Project Aging and Replacement of Key Personnel:***

**Resolution 2014-04-11/01:** After almost 15 years of very successful operations and delivering extraordinary science results, it is to be expected that project staff that have been working on XMM-Newton



for a long time and treasure most of the essential expertise continues leaving the project. The UG strongly recommends ESA management to deal with such staff turnover in a very careful way, by making sure that the accumulated expertise is successfully transferred to people joining the project. This is crucial to keep the mission safe and scientifically productive.

### ***On 4 Reaction Wheel Drive Implementation:***

**Resolution 2014-04-11/02:** The UG commends the XMM-Newton project, and especially the MOC, for having successfully implemented the 4 Reaction Wheel Drive mode in a safe and smooth way. This will secure safer operations as well as a potentially longer mission lifetime.

### ***On the new Archive Interface:***

**Resolution 2014-04-11/03:** In noting the new XMM-Newton archive interface, the UG wants to commend the SOC and the Science Archive Team for their efforts in providing such a user-friendly and easy to use access tool to the science archive. The UG looks forward to further progress and continuous improvements on this important tool.

**Action-Item 2014-04-11/01:** While recognising that this might take significant effort, the UG suggests that a useful addition to the EPIC X-ray source archive would be that OM data products would be made easily accessible for every X-ray source. This would probably enhance the use of OM-related data products in the science derived from XMM-Newton data. Both the SOC and the SSC agreed to look into options.

### ***On Calibration:***

**Resolution 2014-04-11/04:** The UG noted with satisfaction the enormous progress in the calibration areas that were identified in 2013 as highest priorities, in particular

- a. The on-going EPIC MOS-pn cross-calibration and multi-mission effective area calibration
- b. The Timing Mode energy scale calibration which is now accurate to ~20 eV
- c. The start of the Burst Mode calibration activities
- d. The updated PSF calibration based on EPIC-pn Timing Mode data
- e. The RGS absolute wavelength calibration scale, now accurate to 5-7 milli-Angstroms

The UG expresses its deepest recognition and warmest thanks to Dr. Matteo Guainazzi for his continued dedication to XMM-Newton as calibration scientist, and wishes him all the best in his new role on Astro-H.

**Recommendation 2014-04-11/01:** The UG establishes the following priorities for the calibration activities:

1. Continue progress on non-finished issues should be the top priority:
  - a. Finalise cross-calibration among EPIC cameras, with a proper scientific validation, within the next months and continue monitoring EPIC-RGS cross-calibration.
  - b. EPIC-pn issues to be fixed within SAS 14: fix the different calibration between single and double events, re-engineering of the long-term CTI and correct for the time-evolution of energy resolution.
  - c. Continue the Burst Mode calibration activity, leading to a new calibration in ~1 year timeframe.
2. Understanding the background for low-surface brightness observations
  - a. Recognise Dr. David Lumb's contributions and encourage him to continue with the on-going progress on stray-light in-orbit calibration activities.



- b. Make progress on the characterisation of the particle-generated background (either through protons or reflected X-rays) in the EPIC cameras.

### ***On the Science Analysis System (SAS):***

**Resolution 2014-04-11/05:** In recognising that the SAS has evolved into a highly-performing and user-friendly tool to analyse XMM-Newton data, the UG commends the SAS team, both at the SOC and in the community (the SSC and the instrument teams) for that success. The UG is of the opinion that having this high-quality tool has been instrumental in the high productivity of XMM-Newton.

### ***On the Mission Extension:***

**Resolution 2014-04-11/06:** In view of the upcoming decision on the possible extension of XMM-Newton to 2015-16 and preliminary decision to extend it to 2017-18, the UG expresses its strong support to these extensions based on the following facts:

- XMM-Newton is ESA's flagship observatory, producing over 300 scientific papers per year, with outstanding impact across all astronomical themes (Ness et al., AN 335, 210, 2014). There are no signs of aging in the scientific output of the mission, which is continuously opening new scientific avenues with the use of X-ray observations.
- There are new potential scientific opportunities driven by synergies with other missions and/or facilities in next years that XMM-Newton cannot miss. Examples include those triggered by NuSTAR, ALMA, LOFAR, GAIA (which will find many transient sources), Pan-STARRs and other panoramic telescopes/experiments. In the future, when ASTRO-H comes on line, XMM-Newton will be critical in complementing Astro-H observations thanks to XMM-Newton's much better imaging capability.
- There are new physical phenomena being unveiled by XMM-Newton itself, thanks to highest Signal to Noise observations being conducted over long time baselines and improved calibration (e.g., the detection of an unidentified line in stacked cluster spectra).
- Now that ESA has decided that the Horizon 2015-2035 L2 mission will be a large X-ray observatory, due for launch in 2028, XMM-Newton has the responsibility of building a legacy and ensuring continuity for that future mission. The vibrant community of European astronomers requires continued use of XMM-Newton to prepare for a successful L2 mission exploitation.

The UG notes that severe budget reductions to the mission operation costs have been implemented in recent times, putting the scientific remit of the mission at risk. XMM-Newton is currently running with the absolute minimum - if not below - the level of resources needed to keep it as what it is: ESA's astronomical flagship observatory. Further reductions in the operations budget would certainly result in a very significant loss of science output of XMM-Newton.

### ***On the 2 Reaction Wheel Drive Operations:***

**Resolution 2014-04-11/07:** Noting that ESA is considering scenarios in which XMM-Newton might eventually have to be operated with less than 3 Reaction Wheel Drives due to aging of the S/C systems, the UG is willing to be involved in the definition of the science that could be done under such conditions, once such scenarios are better defined.

### ***On Interactions with Astro-H:***

**Recommendation 2014-04-11/02:** The UG applauds discussions between the XMM-Newton and Astro-H operations teams to engage in coordinated calibration plans, and encourages the SOC to continue with such plans.





It also notes and supports the offer of the XMM-Newton Project Scientist to Astro-H to consider joint science observation programmes, and looks forward to a response in due course.

### ***On Target-of-Opportunity (ToO) Policies:***

**Recommendation 2014-04-11/03:** The UG recommends that a realistic and sufficient amount of observing time is allocated at every AO to anticipated ToO observations. This amount of observing time should be estimated using the real number of ToOs executed in previous AOs, among other factors. The OTAC should allocate up to that amount of observing time by carefully ranking the ToO proposals.

In that scenario the UG recommends that there are no changes in the rules for ToO triggers, and expects that this will decrease the amount of executed normal Priority C observations. The situation regarding the latter point will be reviewed in 2 years time.

### ***On Community Support Activities:***

**Recommendation 2014-04-11/04:** As in previous meetings, the UG considers that SAS workshops are important to get the community - especially young PhD students, postdocs and researchers with little previous expertise in dealing with X-ray observations - engaged with XMM-Newton. Such SAS workshops should be kept at a reasonable frequency.

The X-ray symposia that XMM-Newton organises every three years are extremely important to foster interactions among the research community around XMM-Newton data, and to showcase to all astronomers the importance of X-ray observations for astronomy at large. The UG strongly encourages that these symposia continue into the future with the support of the XMM-Newton SOC. The yearly thematic Workshops, which are hosted by ESAC in a very cost-effective fashion, are also vital to support the scientific health of the mission and they should also continue under a similar scheme.

### ***On the Pipeline:***

**Recommendation 2014-04-11/05:** With regard to the new pipeline products, the UG notes the addition of EPIC images binned to 1"x1", but strongly suggests to keep the existing 4"x4" format as well.

### ***On the OM Source Catalogue:***

**Resolution 2014-04-11/08:** The UG noted with satisfaction the recent release of the OM source catalogue, and thanked MSSL **and all other contributors** to this resource for this very valuable addition to the XMM-Newton science archive.

### ***On the Post-operational Requirements Document:***

**Action-Item 2014-04-11/02:** The UG was content with the draft version of the Post-Operational Requirements as prepared by the Project Scientist, with the following comments:

- The document should emphasize that data products should be VO-compliant and easy to use by non-X-ray astronomers. The format for such goal will have to be defined at the epoch when this final archive is constructed.
- At the time of production, archival data should have links to all scientific publications that used every data sample.
- An additional data product should be added to facilitate preliminary analysis of extended sources: A Hardness Ratio background-subtracted and exposure-corrected image.

The UG expects to receive a final version of this document for endorsement by 30.04.2014.



### ***On the Calibration Requirements Document:***

**Action-Item 2014-04-11/03:** The UG received an early draft of the Calibration Requirements Document, from the Project Scientist, and asked him to distribute the table on which he based the presentation. The UG agreed to send any feedback to the PS, especially on the science drivers for the various parameters, before 15.05.2014. The PS will then circulate a further draft for discussion by 15.06.2014, with the goal of having converged on it by the end of 2014.

### ***On Gravitational Wave Events Follow-up:***

The UG was enthusiastically supportive of the XMM-Newton involvement in any reliable Gravitational Wave (GW) potential trigger from the LIGO/VIRGO collaborations and formulated

**Recommendation 2014-04-11/06:** With regard to the proposed signature of a Memorandum of understanding (MoU) between the GW collaborations and XMM-Newton, the UG requested to have the draft MoU and to provide feedback to the Project Scientist before 30.04.2014.

An observational strategy had been suggested as input item from the community, proposing follow up of GW triggers slewing through large areas of the sky. The scientific requirements and detailed needs are not clear, however, but overall the strategy was deemed to have very serious feasibility issues by the SOC, rendering such option virtually impossible.

The executive session ended on April 11<sup>th</sup> at 14:45.

**Date of next meeting:** May 21<sup>st</sup> (Thursday) and 22<sup>nd</sup> 2015, starting at 10 am at ESAC.