PN to MOS stability

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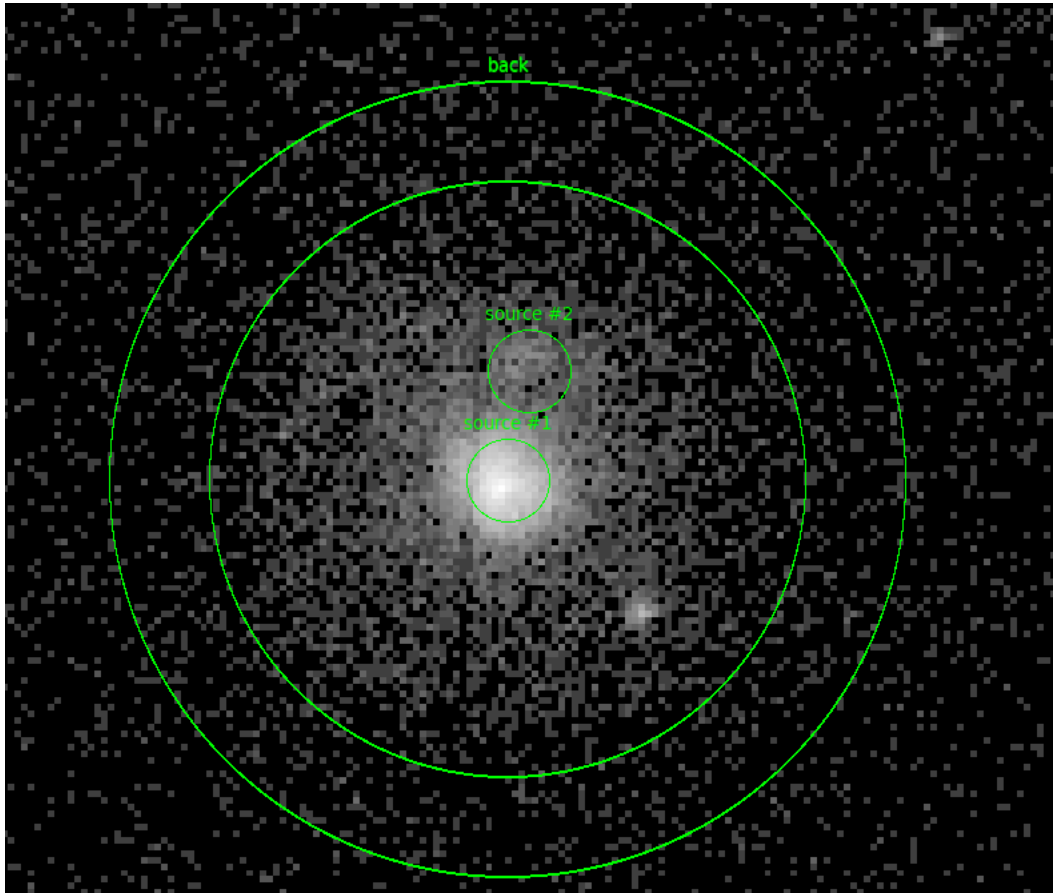
XMM-Newton EPIC CAL meeting, 27 Apr 2022

Investigating PN to MOS flux ratios as function of epoch

- Motivated by observations of SNR G21.5-09 in 2001 and 2021.
- All observations have the target centre at the boresight,
  - Were processed in an identical way
  - Source and background regions were the same (in sky coordinates)
- Fluxes derived using XSPEC per camera spectral fits, using recent models
- The ratios were normalised by the PN/MOS ratio from the most recent observation
- Targets in this study: SNR G21.5-09, Kepler SNR and Abell 0133 + 4XMM-DR11 sources

Source and background regions, MOS2

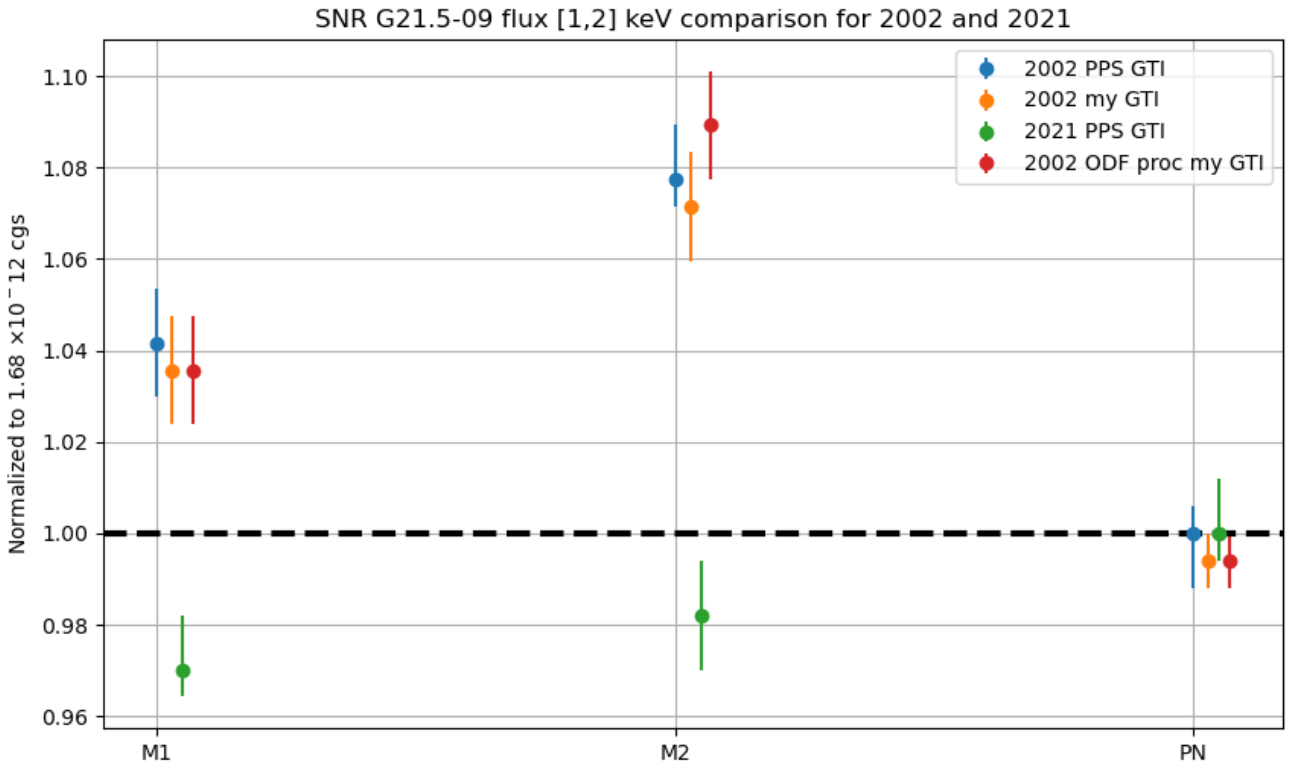


Fixed in RA, Dec

Source #1 at boresight
Source #2 at 1’ off

ARF generated for extended source

SNR G21.5-09, boresight



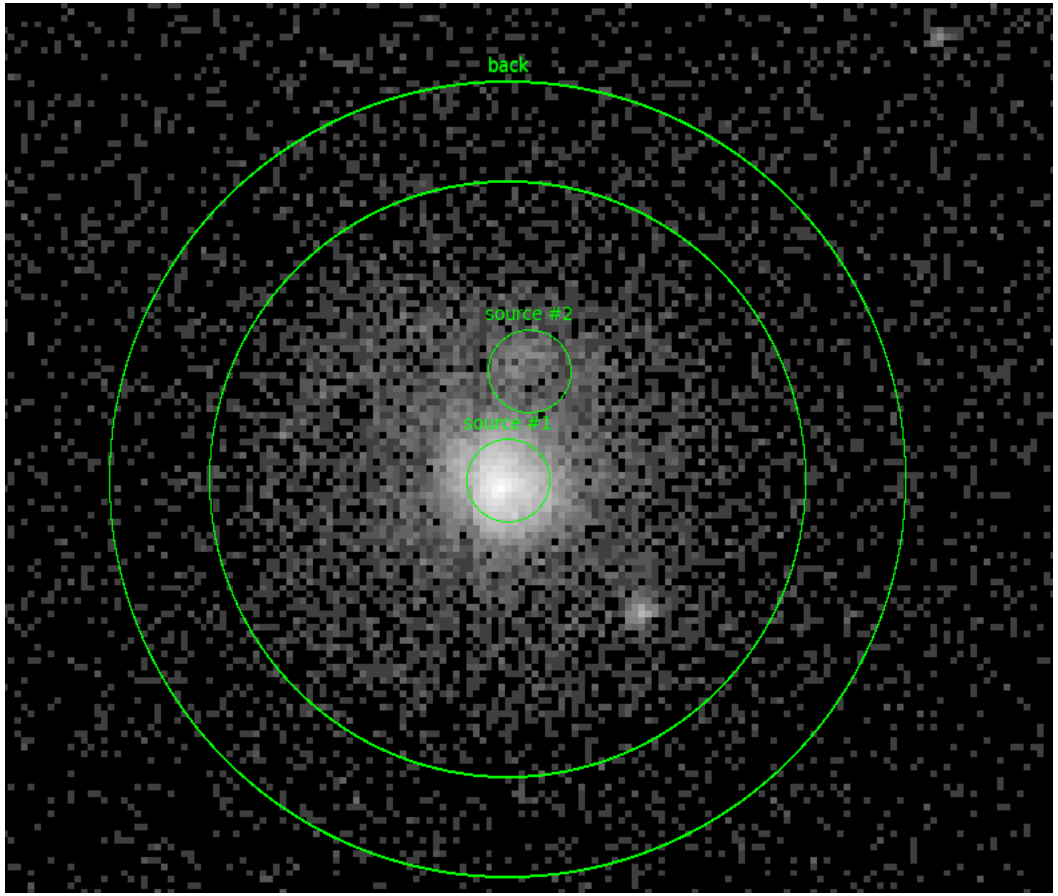
Comparing alternative processing options.

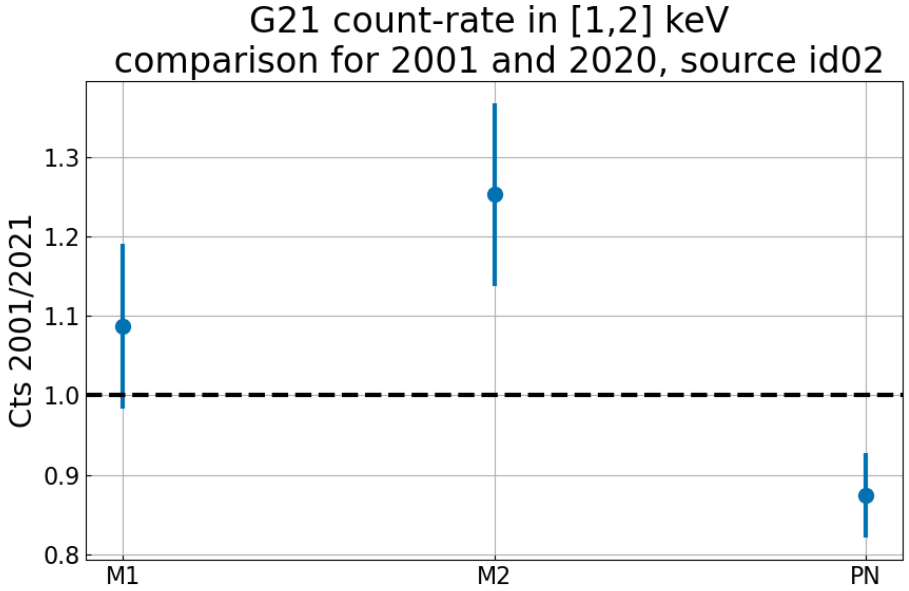
- PPS products and GTI
- My GTI and PPS products
- Starting from ODF

MOS2/PN ~ 8% higher for 2002

Note energy range in [1,2] keV

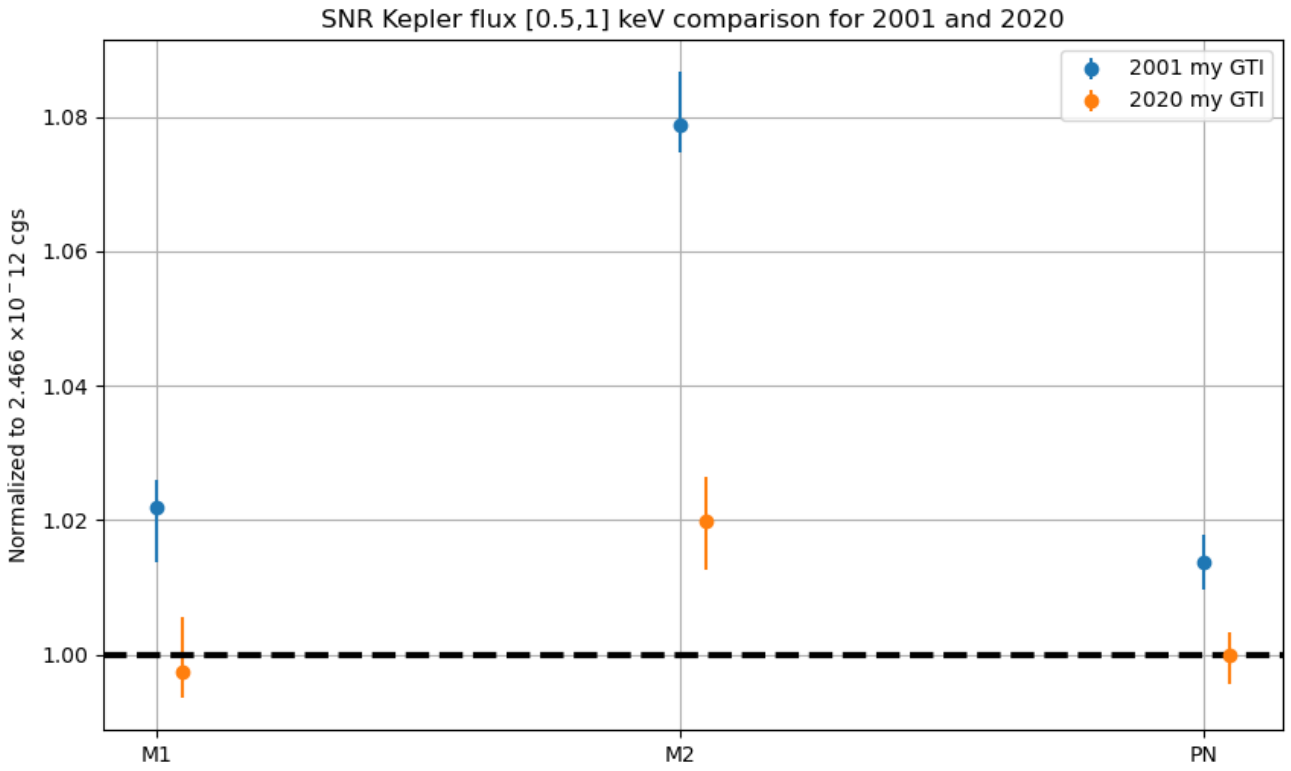
Off-axis region





Preliminary!

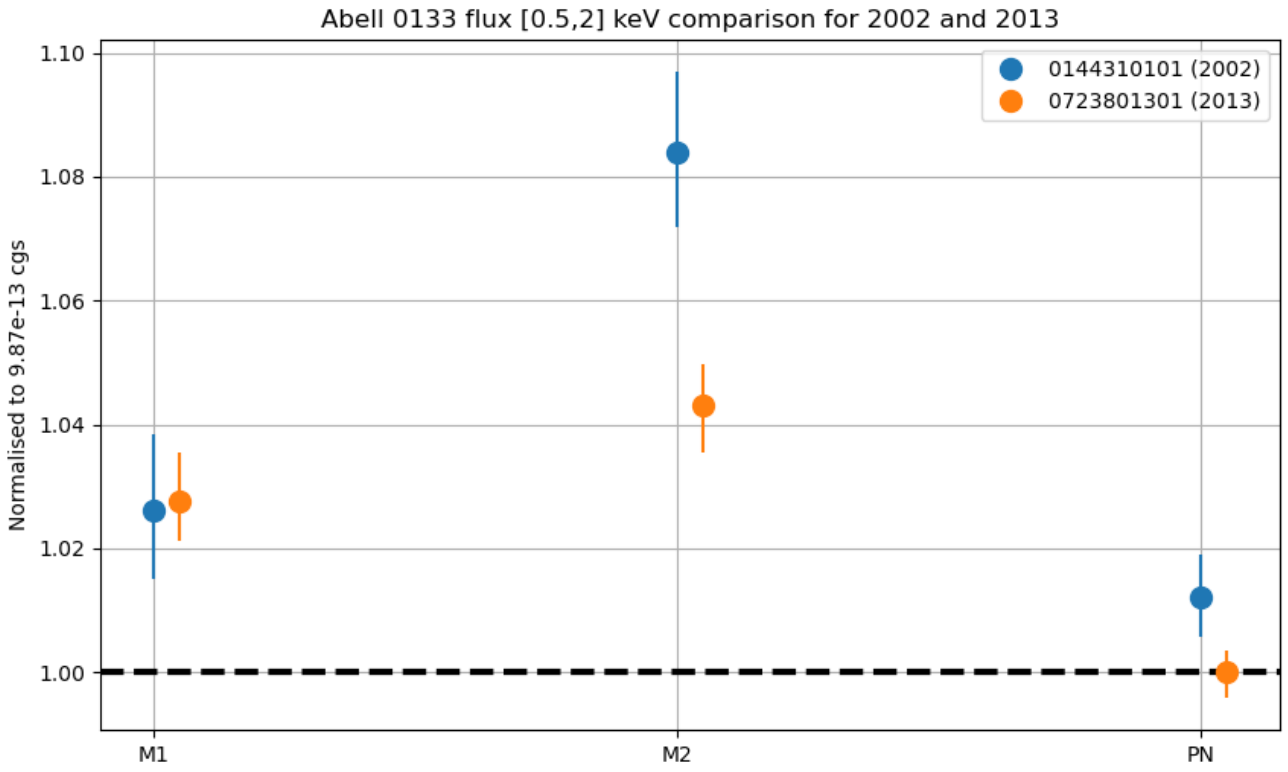
Kepler SNR, boresight



MOS2/PN ~8% higher for 2001

Note energy range in [0.5,1] keV

Abell 0133, boresight



MOS2/PN ~8% higher in 2002

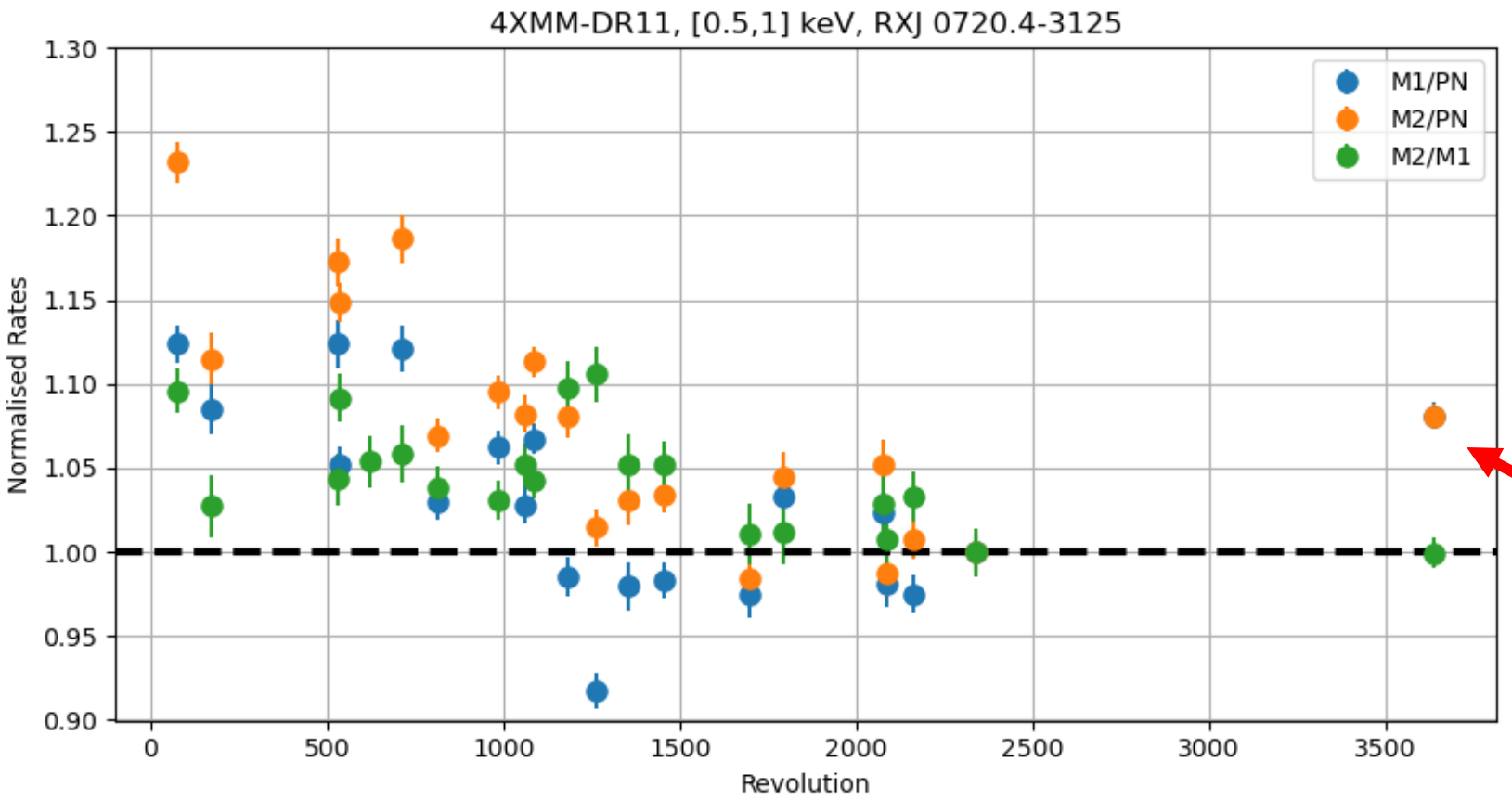
Note energy range in [0.5,2] keV

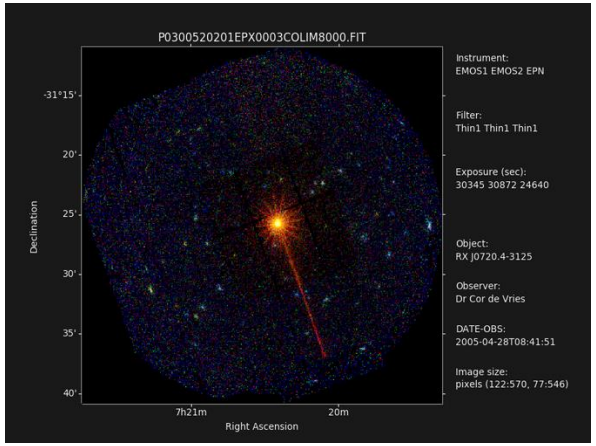
Check with 4XMM-DR11 sources

- Suggested by MSL
- Find targets on axis with repeated observations since 2001 (only FF and EFF modes, separate by FILTER)

- Relative count-rate ratio of MOS/PN per observation
  ➔ hence avoiding problems with variable sources!

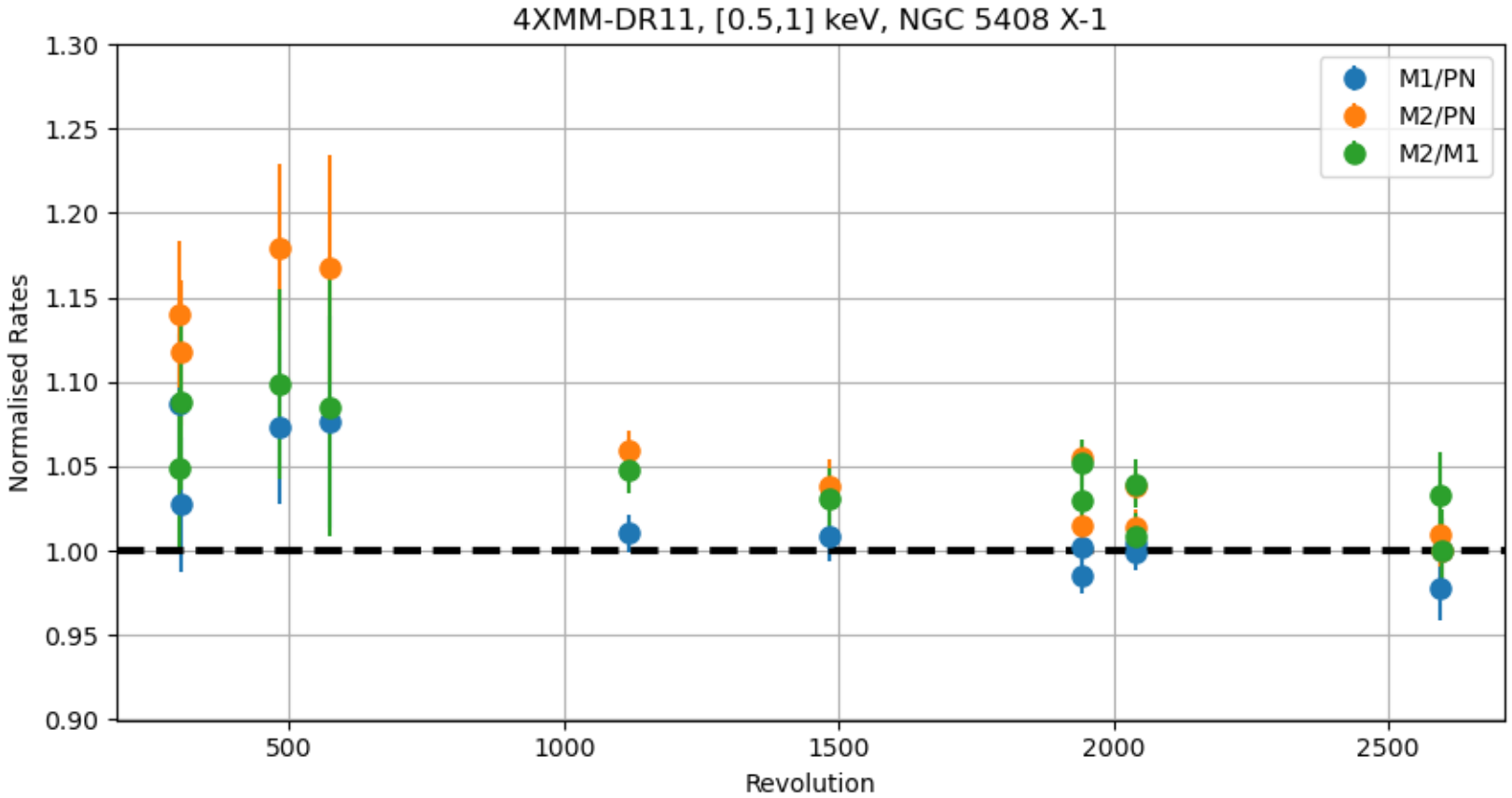
- Count-rates in band 2 ➔ [0.5,1.0] keV as in 4XMM-DR11.

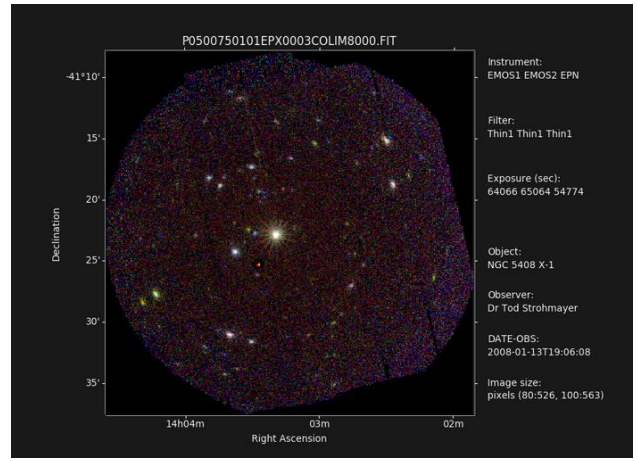


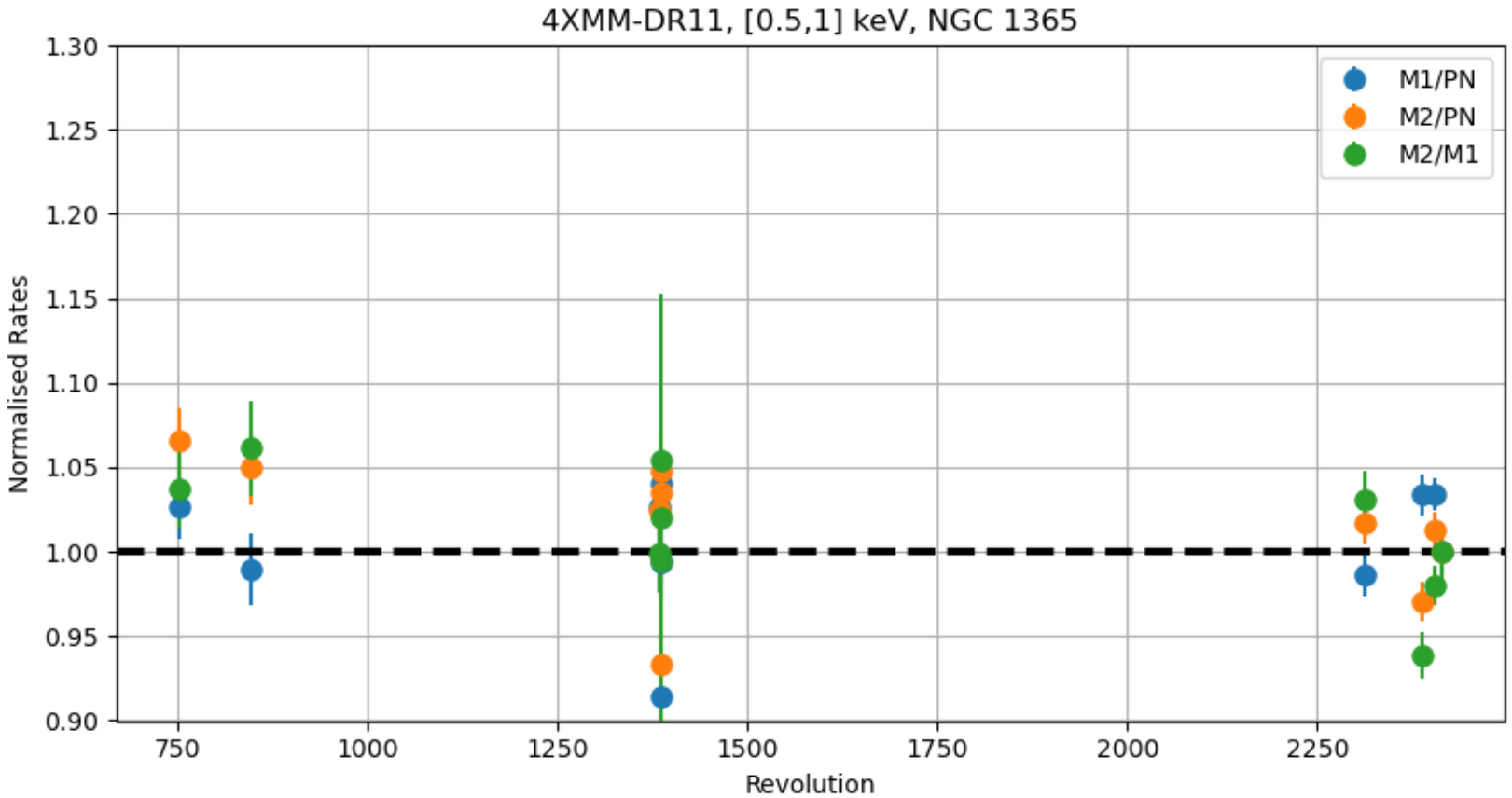


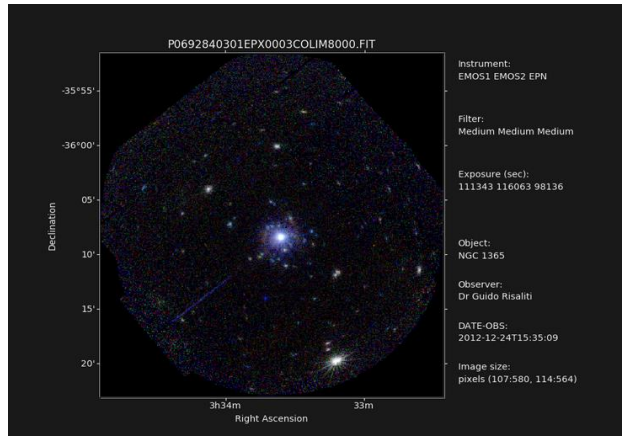
What?

Needs further check


4XMM-DR11, [0.5,1] keV, NGC 5408 X-1
Normalised Rates
Revolution
M1/PN
M2/PN
M2/M1
1.30
1.25
1.20
1.15
1.10
1.05
1.00
0.95
0.90
500
1000
1500
2000
2500


P0500750101EPX0003COLIM8000.FIT
Instrument:
EMOS1 EMOS2 EPN
Filter:
Thin1 Thin1 Thin1
Exposure (sec):
64066 65064 54774
Object:
NGC 5408 X-1
Observer:
Dr Tod Strohmayer
DATE-OBS:
2008-01-13T19:06:08
Image size:
pixels (80:526, 100:563)
Declination
Right Ascension
-41°10'
15'
20'
25'
30'
35'
14h04m
03m
02m


4XMM-DR11, [0.5,1] keV, NGC 1365
Normalised Rates
Revolution
M1/PN
M2/PN
M2/M1
1.30
1.25
1.20
1.15
1.10
1.05
1.00
0.95
0.90
750
1000
1250
1500
1750
2000
2250


P0692840301EPX0003COLIM8000.FIT
Instrument:
EMOS1 EMOS2 EPN
Filter:
Medium Medium Medium
Exposure (sec):
111343 116063 98136
Object:
NGC 1365
Observer:
Dr Guido Risaliti
DATE-OBS:
2012-12-24T15:35:09
Image size:
pixels (107:580, 114:564)
Declination
Right Ascension
-35°55'
-36°00'
05'
10'
15'
20'
3h34m
33m

Preliminary conclusions

- Full end-to-end analysis of 3 non-variable sources (SNR G21.5-09, Kepler SNR and Abell 0133) show systematic ~8% higher MOS2 flux for observations before rev. 1000 as compared to rev > 1000.

- With preliminary analysis of a small subset of 4XMM-DR11 sources the trend is confirmed and can be tracked as function of time:
  - Q: Is it a gradual decrease of the MOS2 flux or is it a jump at rev ~1200?
  - Need dedicated analysis of the sources to re-derive the count-rates with the same GTI for the three cameras.
- Michael Smith, using the CORRAREA sources: hint of a similar trend.
- Not looked at M1/M2 in details yet, but there are hints of some deviations too.