

This is a memo of the discussions and decisions about the Multi-Mission Study (MMS) taken place on Tuesday, 26 March 2013, in Session IV: Working Groups II - 09:00-12:30: Clusters of Galaxies II in IACHEC 2013 meeting in Theddingworth.

1) Multi-Mission Study (MMS)

A stack residual analysis of a few clusters observed with XMM-Newton/EPIC, Chandra/ACIS, Swift/XRT, Suzaku/XIS and ROSAT/PSPC.

1.1 The sample

The current sample consists of A1795, A2029, Coma and PKS0745-19. The sample is limited by the small number of cluster observations done with Swift. Andy B. will check the database to see if there are more clusters (**Task 1**).

We aim to extend the sample by new Swift observations of suitable clusters. We looked for the sample in our 2010 paper (Nevalainen et al.) and found that A2199 is well observed by the other missions. (*Andy B. passed the request to Dave Burroughs and he accepted the proposal, right? When will the observation (Task 2) be done?*) Andy B. will reduce the A2199 data (**Task 3**) and Jukka will add this data to the stack residual analysis (**Task 4**). If this proves successful, we try to get a few more clusters observed with Swift (**Task 5**).

1.2 Analysis details

1.2.1 Large scatter

Jukka will examine the apparently large scatter in the median \mp mean absolute deviation of the pn/MOS stack residuals of the 2010 paper sample, compared to that obtained for a few clusters in MMS project (**Task 6**).

1.2.2 Steep 1-2 keV feature

Jukka will examine the connection of the steep 1-2 keV band feature in pn v.s. others stack residuals and the steep feature in the pn effective area at these energies due to the gold (silicon?) edge (**Task 7**).

1.2.3 Include all instruments into analysis

Jukka will add Suzaku and ROSAT data into stack residual analysis (**Task 8**). *This requires that the SOURCE_REG parameter will be divided out from the Suzaku arf, and that the effect of the radially decreasing flux be corrected which is not included in the SOURCE_REG parameter (rather, an uniform flux is assumed). RIGHT?* Jukka will sort out the details with Eric, Naomi and Kimmo (**Task 9**). Jukka will figure out with Steve Snowden how to make ROSAT/PSPC data comparable, due to its special scaling (**Task 10**).

1.2.4 The reference instrument

At the moment we have used EPIC-pn as a reference instrument. Jukka will modify the code to use ACIS and/or Swift and MOS as a reference instrument to illustrate better the comparisons (**Task 11**).

1.2.5 The extraction region

At the moment we are using a 3-6 arcmin annulus for extracting the spectra to avoid a) the scatter from the cool core, dictated by the relatively large PSF of Suzaku and b) the complexity of the emission modeling due to multi-temperature structure. On the other hand, the last term in the stack residuals formula corrects for deviations between the data and model of the reference instrument. Using a central circle with a 6 arcmin radius might work: we would not waste data (which would improve the statistics of the data from badly flared observations), 2T modeling should be OK, and the Suzaku PSF scatter from this region would mainly end up in the 6 arcmin circle. This could be tested by PSF simulation for the sample (**Task 12**). Based on the fraction of the intrinsic Suzaku flux from a central $r=6$ arcmin circle to the final flux in the central $r=6$ arcmin circle, we can decide whether this is a good idea. Jukka will first examine how the XMM data from the central $r=6$ arcmin region performs in the stack residual analysis (**Task 13**). If this works, we will then extract and reduce the data using the central 6 arcmin region. Eric will do Suzaku (**Task 14**), Larry will do ACIS-I (**Task 15**), Andy B. will do Swift (**Task 16**), Steve Snowden will do ROSAT (**Task 17**). Jukka will do the stack residuals analysis to these data (**Task 18**).

1.2.6 Galactic absorption

We could test the accuracy of the calibration of the soft band effective area of different instruments by the consistence of a) N_{H} derived as a free parameter when fitting the X-ray spectra with b) the Galactic N_{H} values (Willingale et al., 2013, MNRAS). The Galactic values contain the atomic and molecular hydrogen and can be obtained using a dedicated web tool. If one of the instruments would yield systematically different N_{H} values from the Galactic value, while the other instruments yield consistence, this indicates that the instrument yielding discrepant values may have more problems with the low energy calibration.

This, unlike the stack residuals analysis, requires that we model the emission very accurately. Thus, this is better done with the 3-6 arcmin annulus data since there the emission is less complex due to exclusion of the cool core. Jukka will do this (**Task 19**). *We agreed to use the new model with **vern** cross-sections and **wilm** abundances, right?*

1.3 Consistence with Tsujimoto et al.

Jukka will compare the residuals with those obtained for G21... in Tsujimoto et al. with many instruments (**Task 20**)

1.4 A publication

Jukka will lead the efforts to publish the results in A&A instrumental section before the end of 2013 (**Task 21**).

1.5 Science project

Since A1795 has been observed frequently by Chandra for calibration purposes, there is ~200 ks of data, which could be used for Fe XXV/XXVI line ratio mapping analysis. The available data might yield adequate statistics for this in the narrow energy band covering the two lines. Jukka and Larry will work out the details later (**Task 22**).

2) Task list

Task_nr	Leader	Description	Deadline	Status
1	Andy B	Swift database search	April 2013	open
2	?	A2199 Swift observation	?	open
3	Andy B	A2199 Swift data reduction	After Task 2 completed	open
4	Jukka	A2199 to stack residuals analysis	After Task 2 completed	open
5	AB, AR, JN	More Swift observations	After Task 4 completed	open
6	Jukka	Large scatter	April 2013	open
7	Jukka	Steep 1-2 keV feature	May 2013	open
8	Jukka	Add Suzaku and ROSAT	May 2013	open
9	JN, EM, NO	Scaling of Suzaku spectra	May 2013	open
10	JN, SS	Scaling of ROSAT spectra	May 2013	open
11	Jukka	Reference instrument	June 2013	open
12	EM, NO	Suzaku PSF simulations	May 2013	open
13	Jukka	0-6 arcmin XMM data reduction	May 2013	open
14	Eric	0-6 arcmin Suzaku data reduction	May 2013	open
15	Larry	0-6 arcmin Chandra data reduction	May 2013	open
16	Andy B	0-6 arcmin Swift data reduction	May 2013	open
17	Steve	0-6 arcmin ROSAT data reduction	May 2013	open
18	Jukka	0-6 arcmin stack residuals	June 2013	open
19	Jukka	N_H	June 2013	open
20	Jukka	Consistence with Tsujimoto	June 2013	open
21	Jukka	Publication	Dec 2013	open
22	JN, LD	A1795 Fe XXV/XXVI mapping	?	open