EP Performance Verification (PV) Targets Recommendation Form

Submission Due Date: 27th October 2023

NOTE: Please do not change or delete the words marked in blue.

1. TITLE

Using galaxy cluster A1795 to verify energy response and background modelling of FXT

2. ABSTRACT *(< 250 words)*

(summarize the target properties, the EP capabilities to be verified, and justify why the proposed observations and targets should be considered for the PV phase)

A1795 is a nearby (z=0.06) massive (6 x 10^{14} $M_{\odot}$) galaxy cluster with a strong cool core. It shows a significant ellipticity but without known substructures. It has both Chandra (65ks) and XMM-Newton (66ks) observations in the central region. But their field of view (FoV) is too small to cover it (r_{500}=1.2 Mpc, corresponding to 17 arcmin). Although Chandra also have average 50ks observations on its outskirts, there are still gaps. Thus EP-FXT is an ideal equipment to explore its general physical properties and kinematic status.

Considering multiple surrounding faint sources in the ROSAT image of A1795, there are also chances to detect in-falling groups or even filaments in the outskirts.

We propose two observations: one is for A1795 and the other is for the background.

For the PV phase, XMM-Newton and Chandra observations provide ideal high resolution data for the verification and calibration of EP-FXT. With them, we could evaluate the data quality and detection limit of EP-FXT. While the spectra in the outskirts could be used to test the background modelling and subtraction method of FXT.

3. RECOMMENDERS' INFORMATION

Principal Recommender	
***Recommender' Name**	Yong Chen
***Recommender' Email Address**	ychen@ihep.ac.cn
***Recommender' Expertise**	Chen is the PI of FXT and is an expert of the observational study of galaxy clusters
***Recommender' STP(s)**	STP5
Co-Recommenders	

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***Recommenders' Names**	Weimin Yuan, Heng Yu, Shumei Jia, Chengkui Li, Xiaofan Zhao, Jingjing Xu
***Recommenders' Email Addresses**	wmy@nao.cas.cn, yuheng@bnu.edu.cn, jiasm@ihep.ac.cn, lick@ihep.ac.cn, zhaoxf@ihep.ac.cn, xujingjing@ihep.ac.cn.
***Recommenders' Expertise**	Yuan is the PI of EP. The recommenders are experts in cluster of galaxies and/or FXT data analysis.
***Recommenders' STP(s)**	STP4, STP5

4. TARGET FORM

- **TARGET 1** ***(mandatory)***

***Target Name**	A1795			
***Target Type**	Galaxy cluster			
***Target Coordinates**	***RA:**	13h48m53.0s	***DEC:**	+26d35m44s
***Expected Flux in 0.3-10 keV**	6.e-11 erg/cm^2/s			
***Primary Instrument**	FXT			
FXT Configuration ***(mandatory if the primary instrument is FXT, optional if the primary instrument is WXT)***	**FXT-A**	*full-frame* thin	**FXT-B**	*full-frame* thin
***Exposure Time**	10 ksec			
Suggest Joint Observation with	NO			

NOTE: Please do not change or delete the words marked in blue.

Other X-ray Telescopes	
Other remarks	(any other remarks)
*Note: * mandatory items*	

- **TARGET 2**
  (optional, if there are more than one target in this recommendation, copy the entire target form above to the empty space below; note that this is only for the case that one observing proposal includes multiple targets; for targets of a different proposal with distinct technical and scientific goals, please submit them in separate proposals.)

***Target Name**	Background to the west of A1795			
***Target Type**	Background			
***Target Coordinates**	***RA:**	13h45m20.0s	***DEC:**	+26d35m44s
***Expected Flux in 0.3-10 keV**	1.e-12 erg/cm^2/s			
***Primary Instrument**	FXT			
FXT Configuration ***(mandatory if the primary instrument is FXT, optional if the primary instrument is WXT)***	**FXT-A**	*full-frame* thin	**FXT-B**	*full-frame* thin
***Exposure Time**	40 ksec			
Suggest Joint Observation with	NO			

NOTE: Please do not change or delete the words marked in blue.

Other X-ray Telescopes	
Other remarks	(any other remarks)
*Note: * mandatory items*	

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5. SCIENTIFIC AND TECHNICAL JUSTIFICATION

(< 2 pages in total for this session, including figures, tables and references)

- **Scientific Motivations and Values**
  (briefly describe the properties of targets, scientific motivations and values, and explain why the proposed target and observation should be considered for a PV program rather than a regular observing program)

A1795 is a nearby (z=0.06) massive (6 x 10^{14} $M_{\odot}$) galaxy cluster with a strong cool core. It shows a significant ellipticity but without known substructures (Figure 1 left panel).

It has both Chandra (65ks) and XMM-Newton (66ks) observations in the central region. But their field of view (FoV) is too small to cover it (r_{500}=1.2 Mpc, corresponding to 17 arcmin). Although Chandra also has average 50ks observations on its outskirts [1], there are still gaps between pointing observations. Thus EP-FXT is an ideal equipment to explore its general physical properties and kinematic status.

For the PV phase, XMM-Newton and Chandra observations provide ideal high resolution data [2,3] for the verification and calibration of EP-FXT. With them, we could evaluate the energy response and the effective area of EP-FXT.

Chandra's observation found that A1795 showed a significant increase in surface brightness towards the west to A1775 [1]. Optical observations show that massive galaxies are distributed between these two clusters (Figure 1 right panel).

For this reason, in addition to observing A1795, we also selected an area on the west side of A1795 and applied for another observation. This has several purposes: first, to find whether there is clumpy gas outside the viral radius of A1795; Secondly, this data, after deducting point sources and possible clumpy gas and substructures, can be used as the background for application in data processing of galaxy cluster A1795. Finally, by comparing the differences between the CXB background in this region and that in other regions (such as Lockman Hole and other high galactic latitude blank sky regions), it may reveal whether there are additional CXB components in superclusters.

- **EP Capabilities to be Verified**
  (briefly describe the capabilities that can be verified by the recommended targets and observations. For example: this target can demonstrate WXT's imaging capability of large field-of-view and sensitivity)

There are many point and extended sources around A1795. They could be used to verify and demonstrate FXT's imaging capability. The central core of the cluster could be used to test the energy response. While the spectra in the outskirt could be used to test the background modelling and subtraction method. The proposed observations can be used to test the capability of FXT for diffuse sources with low surface brightness, such as the outskirts of galaxy clusters.

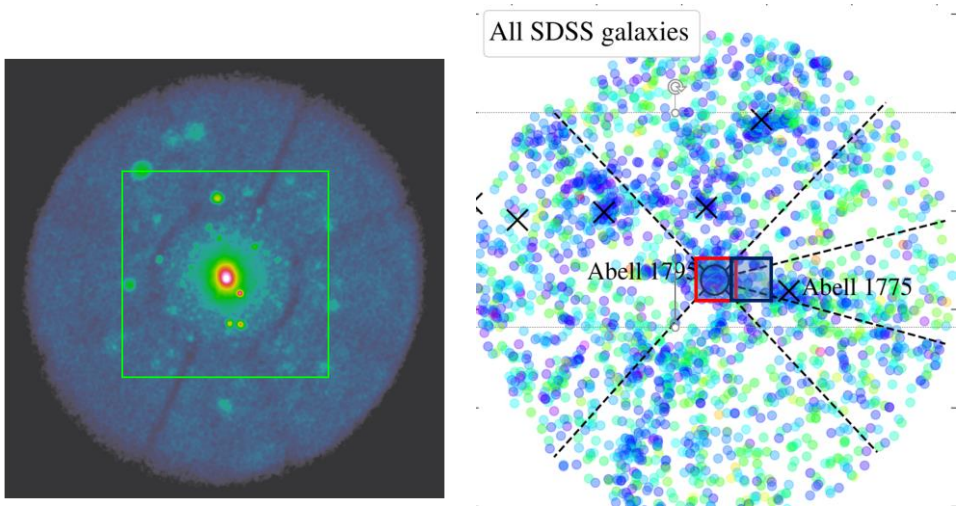

Figure 1. Left panel: The ROSAT observation of A1795 and the FXT FoV (green square region). Right panel: all SDSS galaxies [1] and the FOV of the two target observations (the red one is for A1795 and the black one is for background).

- **Immediate Objectives**
  (listed the main objectives of the recommended targets and observations)

  The main objectives of the A1795 observation are:
  1) Explore the general physical properties of the cluster, which is unclear since ROSAT satellite.
  2) Analyze the kinematical properties of the cluster. There is an optical substructure detected with the SDSS data.
  3) Searching for gas clumping beyond the viral radius of cluster.
- **Technical Justification (e.g. target visibility during the PV phase)**
  (briefly justify the technical feasibility of the recommended target and observation, such as the target visibility during the PV phase, brightness, variability, etc.)

A1795 is visible (>90 deg) between 2024-01-27 and 2024-7-30. Its flux is 6.e-11 erg/cm^2/s in the 0.1-2.4 keV band, which is very suitable for FXT full-frame mode.

- **References**
  (list relevant references for the recommended targets and observations)

1. Kovács OE, Zhu Z, Werner N, Simionescu A, Bogdán Á. Outskirts of Abell 1795: Probing gas clumping in the intracluster medium. Astronomy and Astrophysics. 2023;678:A91. doi:10.1051/0004-6361/202347201
2. Fabian AC, Sanders JS, Ettori S, et al. Chandra imaging of the X-ray core of Abell 1795. Monthly Notices of the Royal Astronomical Society. 2001;321:L33-L36. doi:10.1046/j.1365-8711.2001.04243.x
3. Gu L, Xu H, Gu J, et al. Two-phase ICM in the Central Region of the Rich Cluster of Galaxies A1795: A Joint Chandra, XMM-Newton, and Suzaku View. The Astrophysical Journal. 2012;749:186. doi:10.1088/0004-637X/749/2/186

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