



Absolute On-Orbit Aspect Requirements

NB: On-Ground requirements may differ

Example: IXO, but generally applicable

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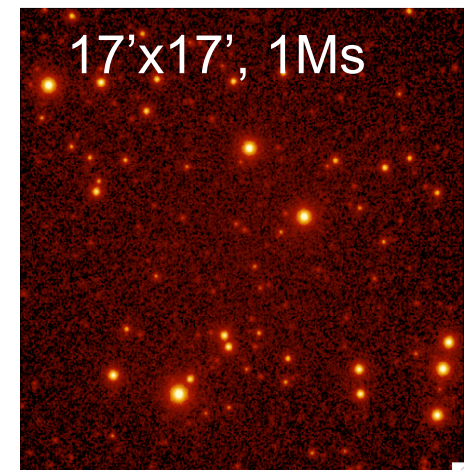
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Question:

- **What is absolute aspect requirement, both on-orbit and on-ground?**
- **Driving Science Topic: IDs for deep ($<10^{-17}$) fields, mainly AGN and galaxies, requires final x-ray positions $<1''$**
- **Difference from previous missions: deep all-sky x-ray survey (ala eROSITA) likely in not-too-distant future (late 2012)**

IXO WFI

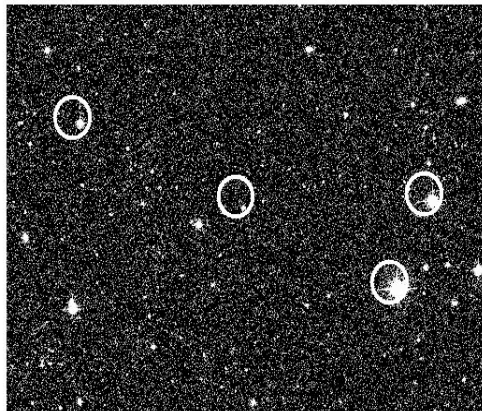


Background

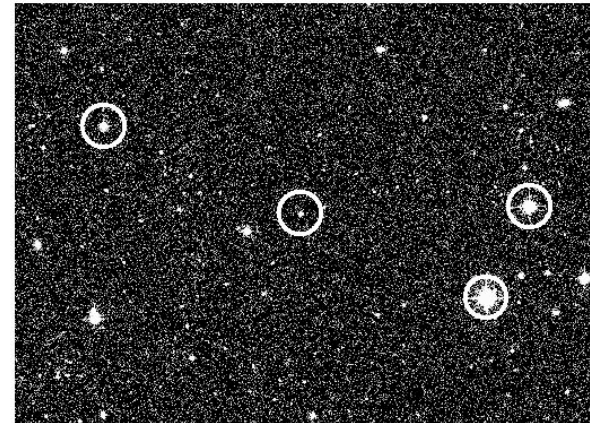
- CXO on-orbit astrometry $<1''$, but registration allows $<0.2''$ positions in **selected, well studied** fields (M31, Orion)
- eROSITA will find $\sim 10^6$ AGN with $F_x > 1.5 \times 10^{-14}$ (0.5-2.0 keV) covering $\sim 20,000$ square degrees (expect optical/IR IDs, $<1''$ positions for \sim all based on XMM-COSMOS $>99\%$ ID rate, Brusa et al 2010)
- Can we use these AGN to register future (deeper) pointings, therefore relaxing on-orbit absolute astrometry requirements?

On-Ground Registration

- How many x-ray/optical matches are required, and what positional accuracy is needed, in order to boot-strap from R'' to better than $1''$?
- Experience says $\sim 4+$ matches are needed. One 'outlier' to the registration can be tolerated, but two cannot.



X-ray
Error
Circles,
Radius R''



Surface Densities (X-ray, Opt)

- 10^6 eROSITA AGN/20,000 sq-deg (=wide, high latitude survey) means $\langle 4 \rangle$ AGN in every WFI/FOV at $17' \times 17'$ (**2 or more 91%**, 1 or more 98%)
- From ChaMP: $\langle r \rangle = 20.0$ for 1.5×10^{-14} AGN, one sigma limit $r < 21.1$
- From NOAO 4m MOSAIC fields for ChaMP: Density of **ANY** object at $r < 21.1$ is 1.24/sq-arcmin

Error Circle Size?

- **Assume a 5'' on-orbit error circle. Density of $r < 21$ objects yields 0.11 random objects in 4 circles.**
- **Poisson probability of 0 or 1 random match (=success!) is 99.5%. Random match= many σ outliers in registration. [15'' circle gives 25% failure rate]**
- **Random matches (interlopers) rare even with 5'' absolute aspect. Surface density of BG (eROSITA) AGN limiting factor, at 2 or more 91% of time.**

Conclusion

- **Ground processing (registration) can reduce absolute position errors to $<1''$, which will be required for ID of fainter ($F_x < 10^{-14}$, $r > 21$) AGN**
- **On-orbit absolute positions of $5''$ are sufficient. There will be 2 or more eROSITA BG AGN 91% of the time (at high latitude).**
- **Similar approach studied in design of WFXT deep surveys, ie, Brusa et al 2010**