

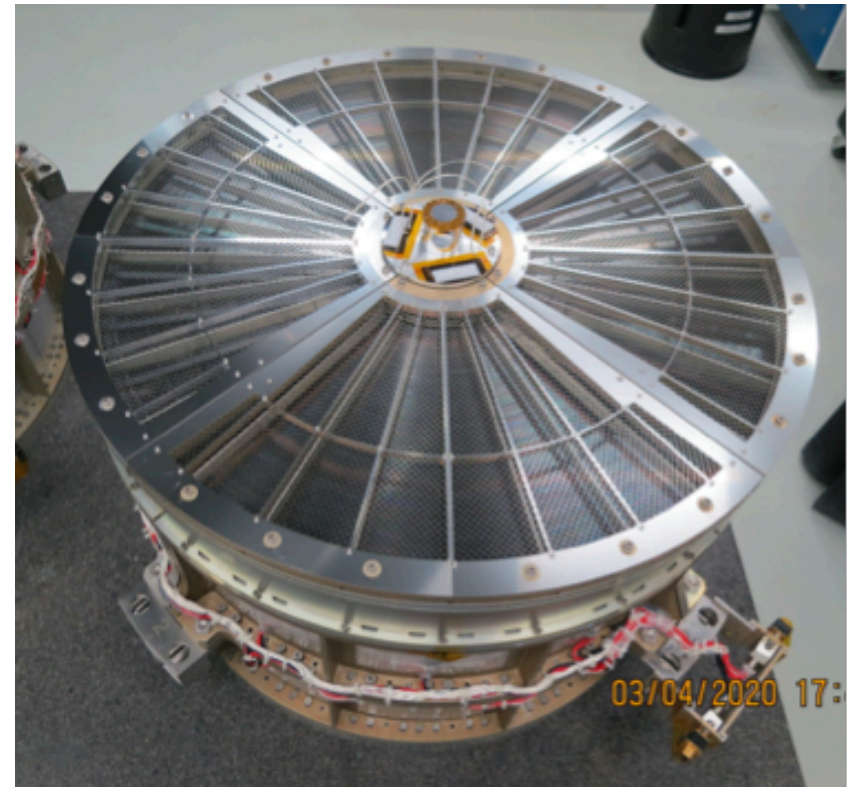
XRISM on-orbit PSF and optical axis calibration

16th IACHEC meeting

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on behalf of XMA team, XRISM IF-CP WG

- XMA
 - Resolve-XMA (Microcalorimeter)
 - Xtend-XMA (CCD Camera)
- Multi-nested thin foil optics
 - 5.6m focal length
 - 45cm diameter
 - Grazing angle 0.15 - 0.57 deg
 - 203 nested reflectors (Au surface)
 - Thickness of the reflectors
0.16mm, 0.24mm, 0.32mm
 - Precollimator (stray baffle)



Observations for XMA On-Orbit Calibration

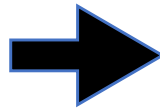
- Aim Point Search
 - Abell 2319 (rough)
 - LMC X-3, AO Psc, η -Car (fine)
- Point Spread Function (PSF)
 - NGC 4151 (Xtend 1/8 CCD mode)
 - 3C273 (Resolve)
- Effective Area ← Talked yesterday
 - 3C273
- Optical Axis Search
 - Abel 2029 (Xtend)
 - (GX3+1 (Resolve)) PROPOSED
- Off-Axis Point Spread Function (PSF)
 - Cyg X-2, PKS 2155
- Stray Light
 - Crab nebula (60' off)

Concentrate on PSF and optical axis search in this talk

Aim Point Search

Previous talk (Kanemaru-san)
for detail

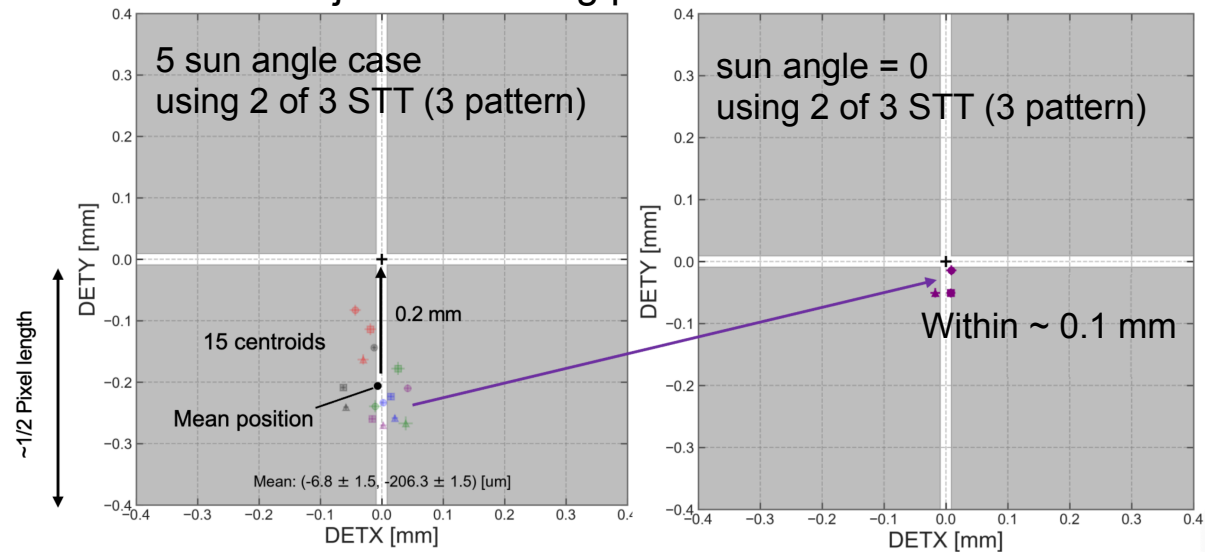
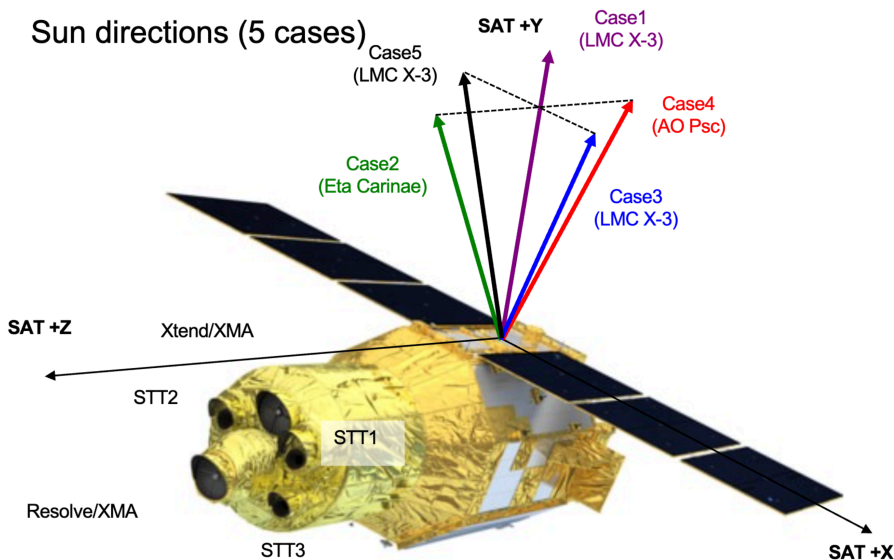
Rough alignment in 2023 Oct.
(Abell 2319)



Fine alignment in 2023 Nov.
(LMC X-3, AO Psc, η-Car)

Roughly adjusting the ACS
using the extended source

Precise adjustment using point sources



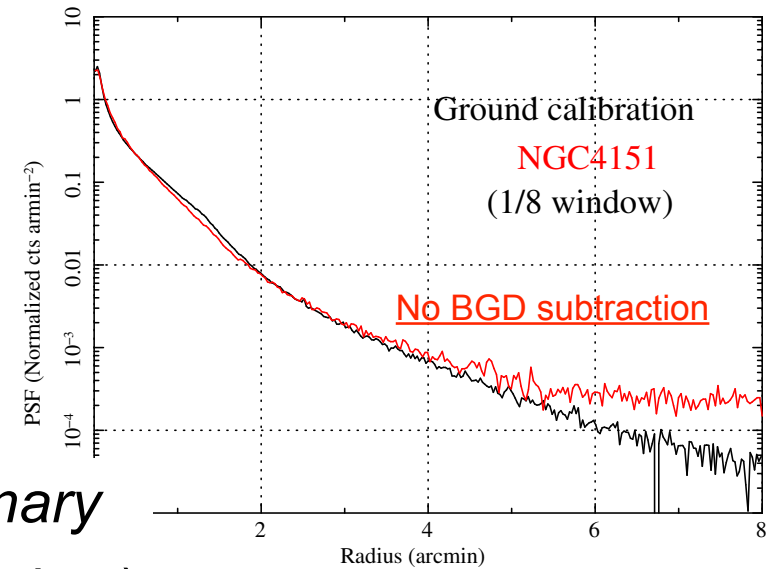
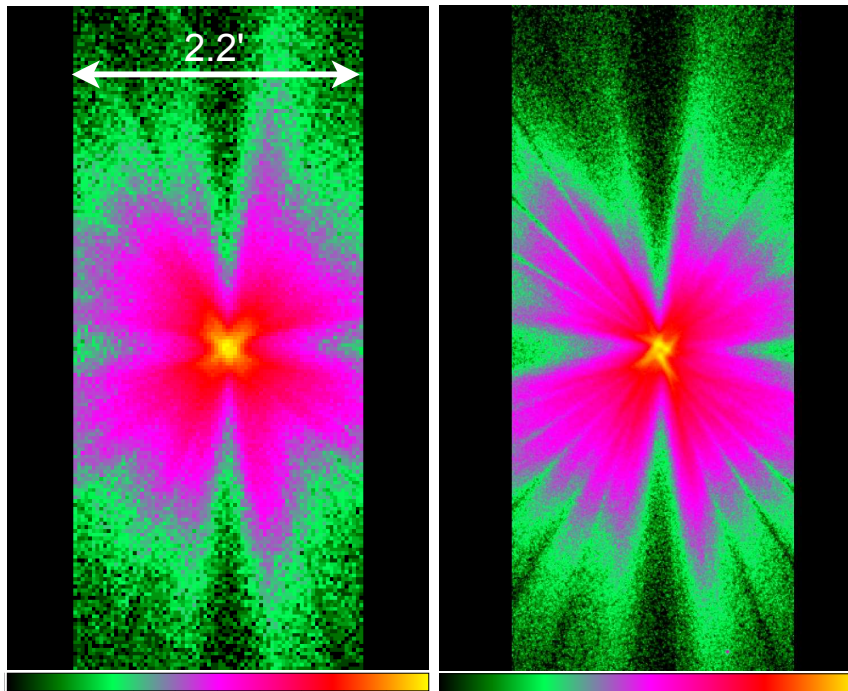
- Deviation from the center of Resolve FOV = 0.2mm (7.4") after rough alignment

After fine Adjustment ➡ <~ 0.1 mm ~ 5"
(During using STT)

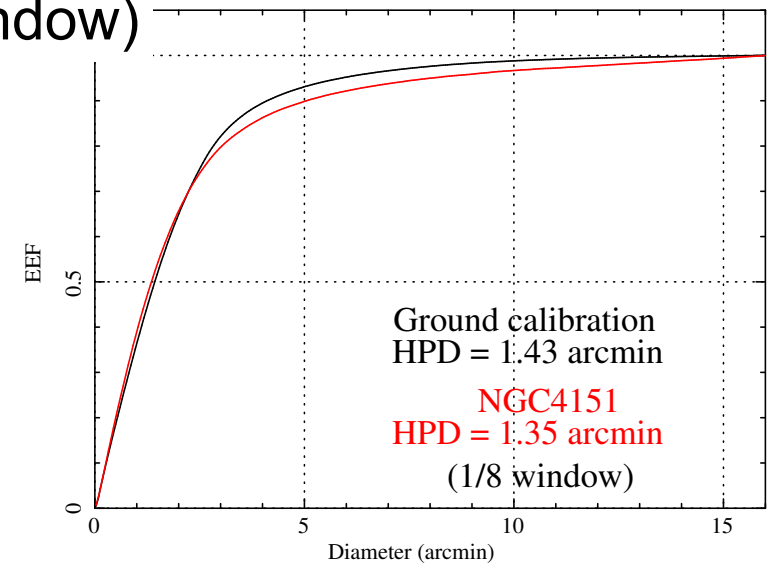
Point Spread Function (Xtend)

NGC 4151
(6-7keV)

Ground Calibration
(6.4 keV)



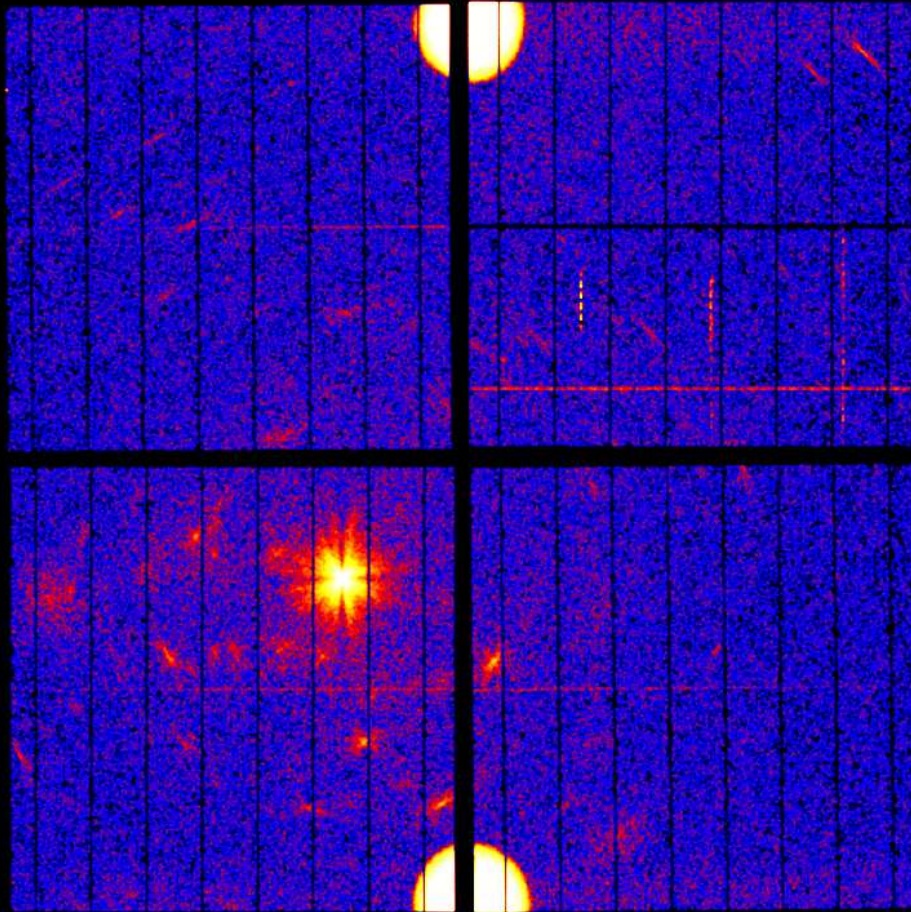
Preliminary
(1/8 window)



- No degradation in the Xtend-XMA imaging performance was observed in 1/8 Window mode
- Detailed calibration requires full CCD mode data

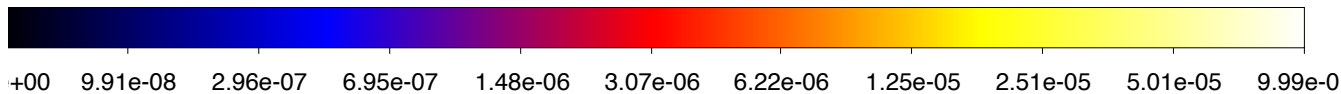
Off-axis PSF (Xtend)

PDS456 observation (1-6 keV)



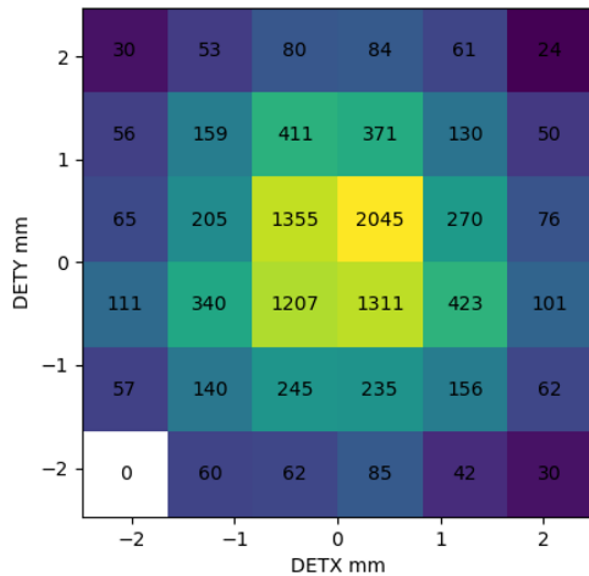
Dedicated observation is NOT performed or planned so far

- A lot of sources around the main target (Resolve FoV) in large FoV of Xtend
- To calibrate off-axis PSF & EA dedicated observations are needed

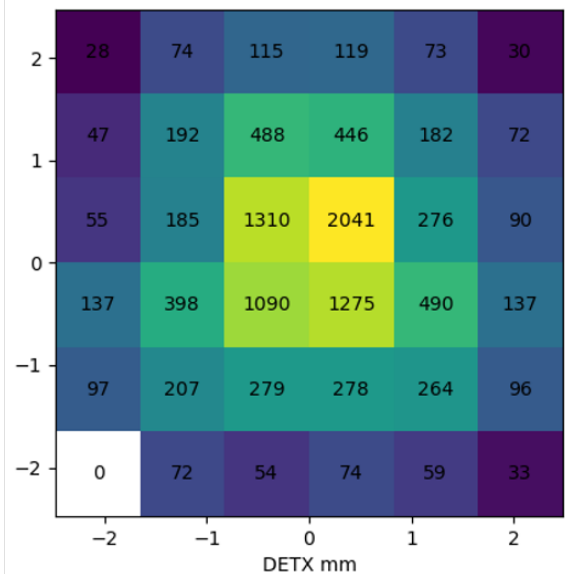


Point Spread Function (Resolve)

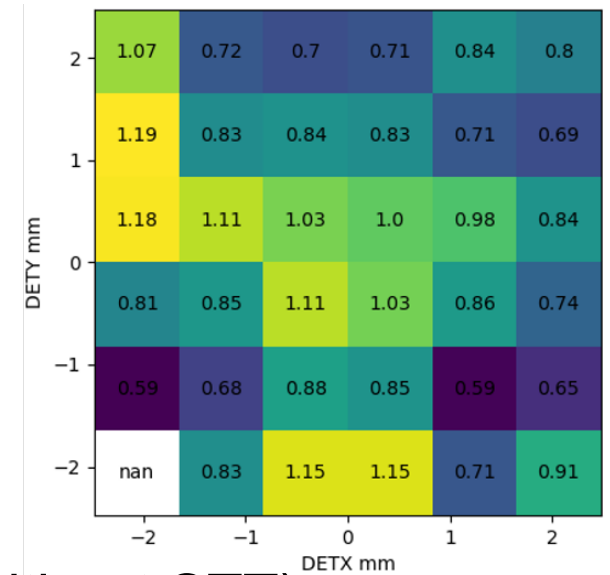
3C 273 on orbit
(6-7keV)



Calculation from the Ground
Calibration result
(6.4 keV)



Ratio (On orbit / Ground Cal.)
(6.4 keV)



Preliminary (including duration with/without STT)

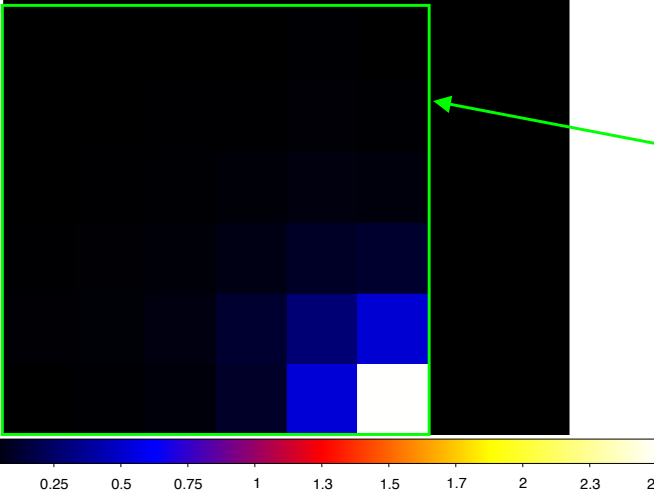
- There is no significant change in the imaging performance.
- Detailed calibration requires more statistics.

Off-axis PSF (Resolve)

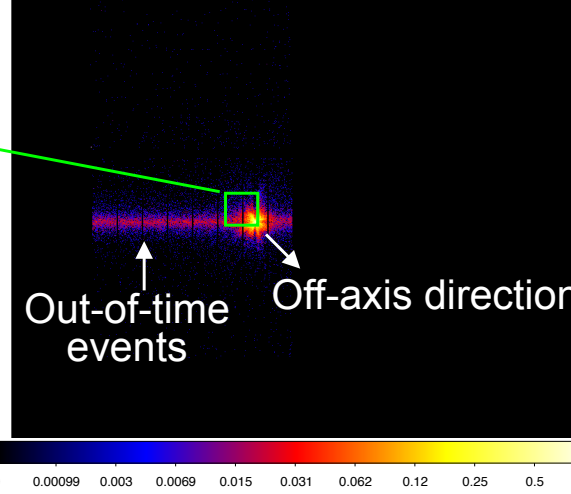
Cyg X-2 off-axis along QT center direction

Ground calibration

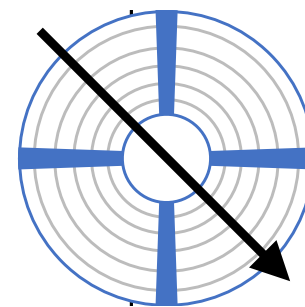
1.8' off (5-7 keV)



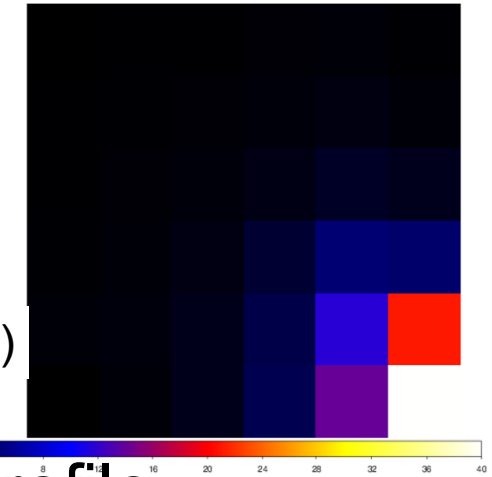
Xtend (reference)



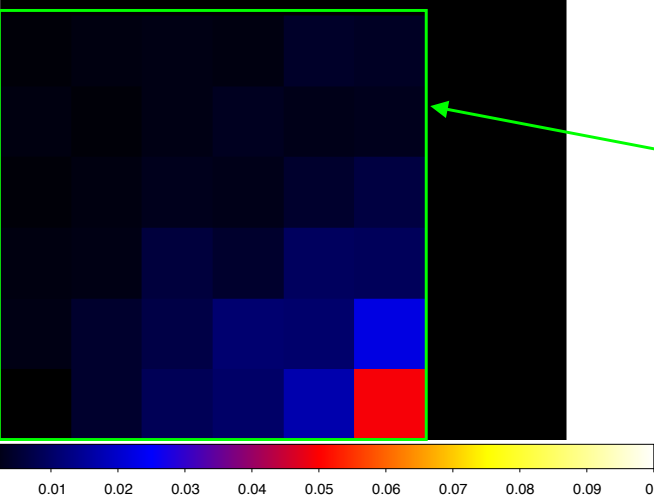
XMA aperture



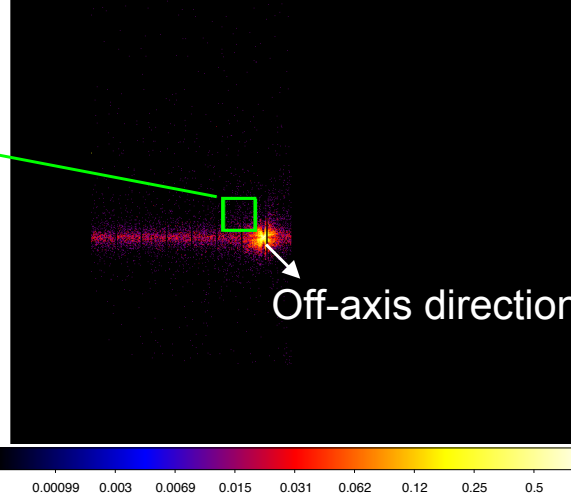
1.8' off (6.4 keV)



3.0' off (5-7 keV)

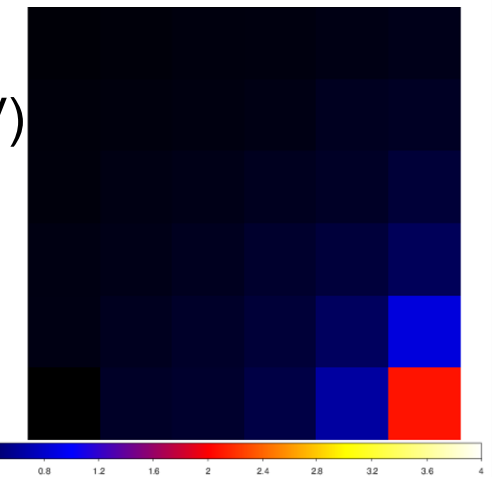


Xtend (reference)



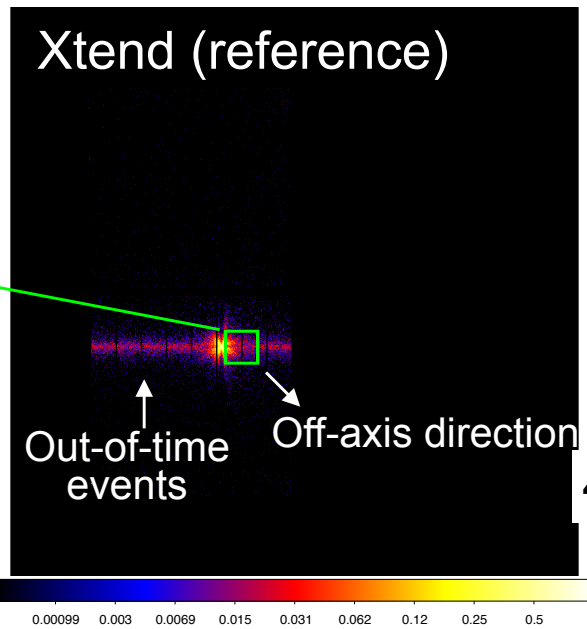
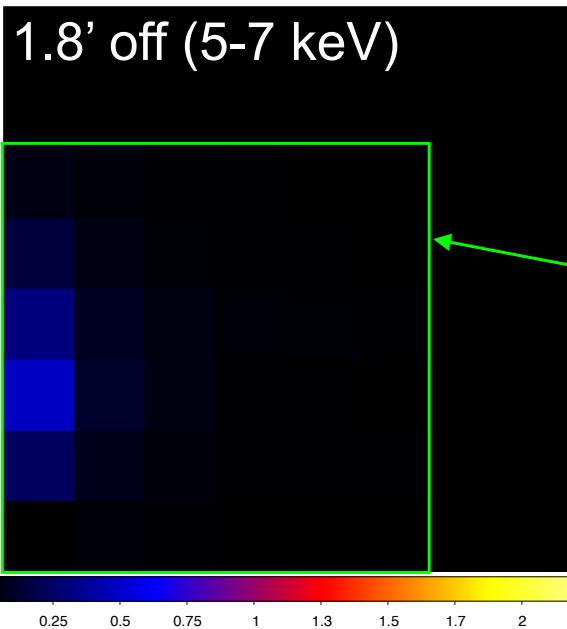
- Similar profile (quantitative comparisons are ongoing)

3' off (6.4 keV)

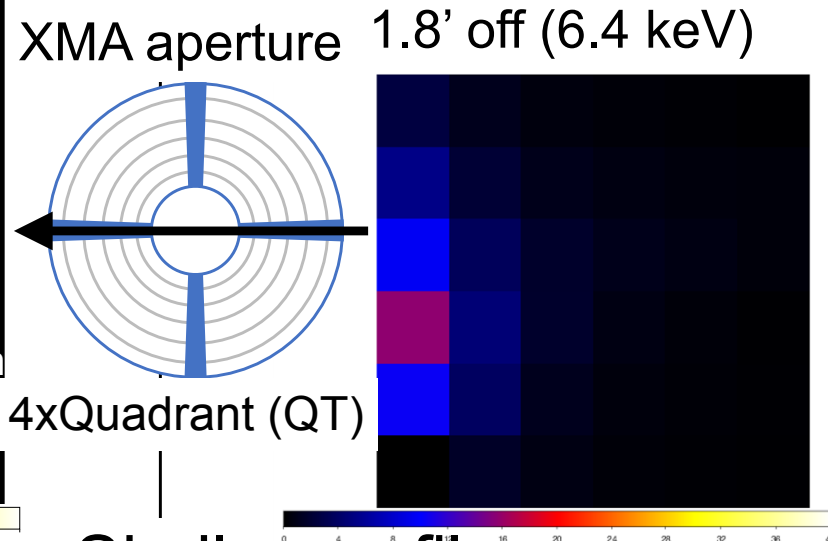


Off-axis PSF (Resolve)

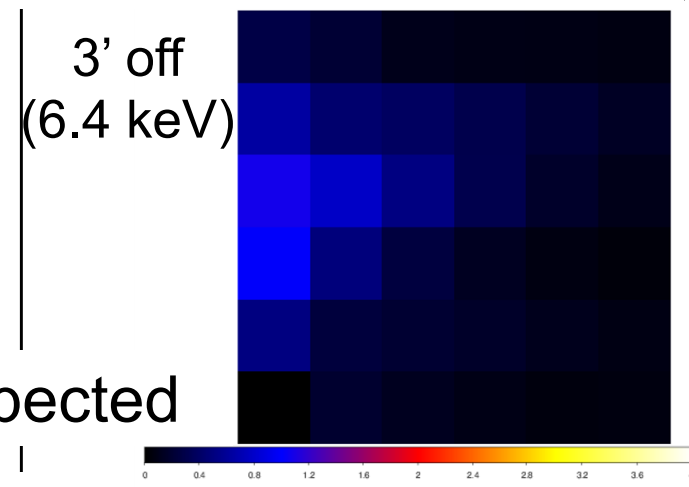
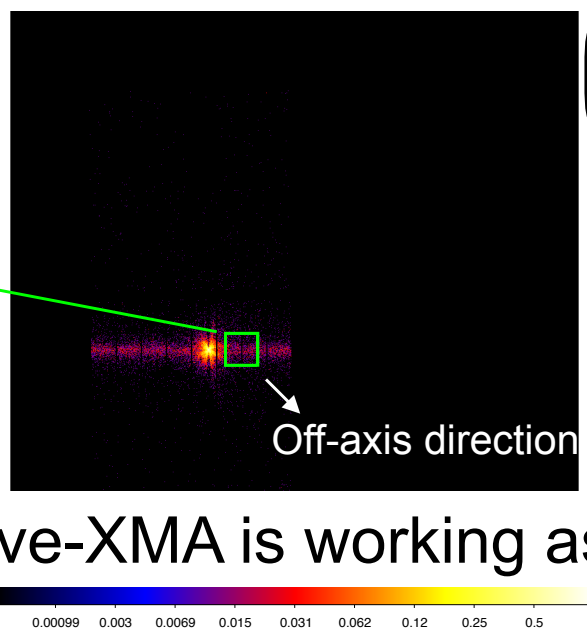
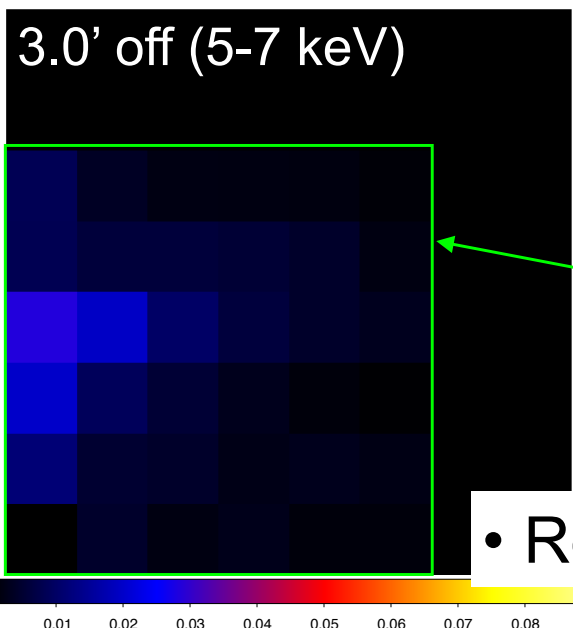
Cyg X-2 off-axis along QT boundary



Ground calibration



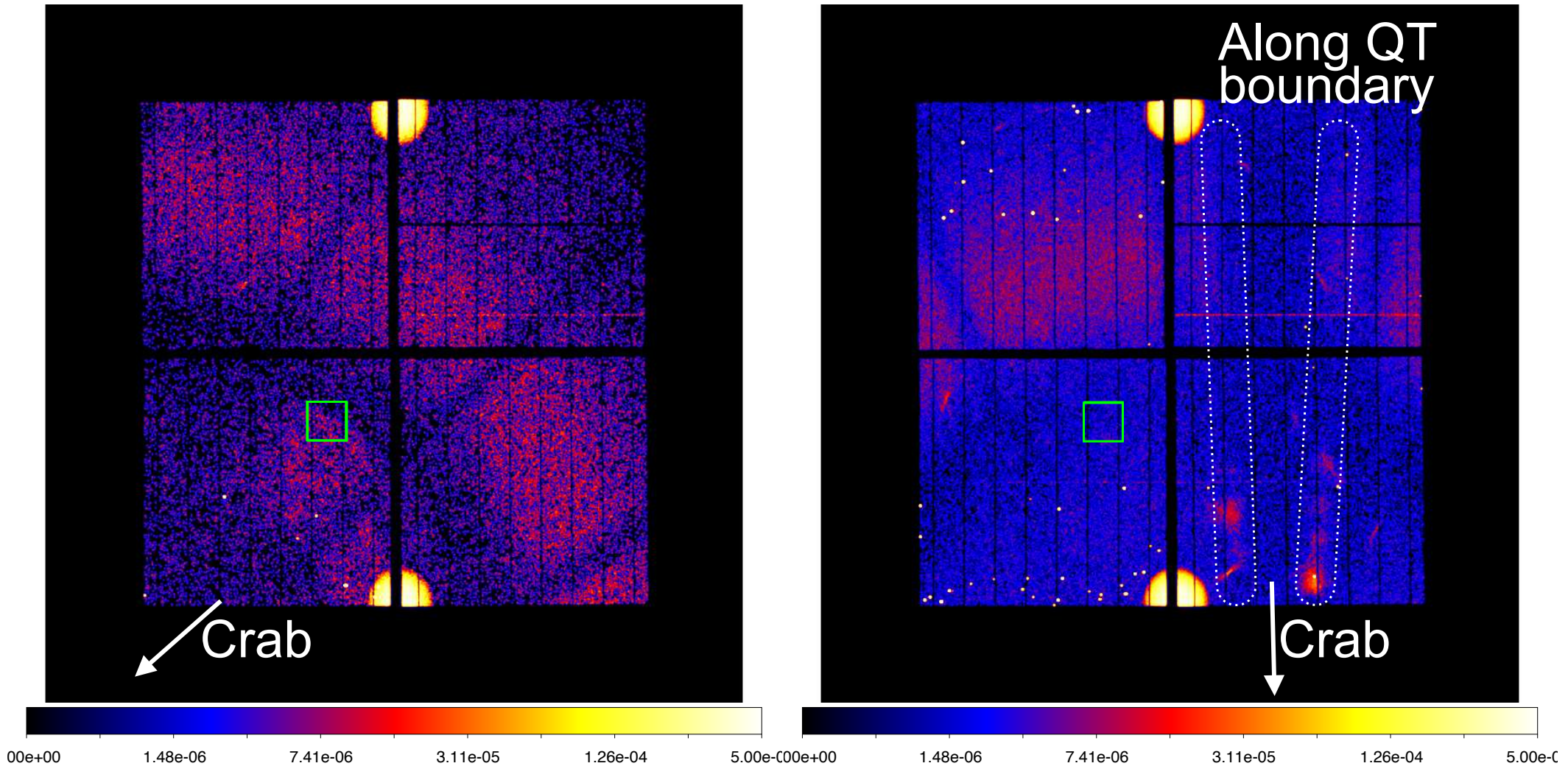
- Similar profile (quantitative comparisons are ongoing)



- Resolve-XMA is working as expected

Stray (Xtend)

Crab 60'-off in two azimuthal directions



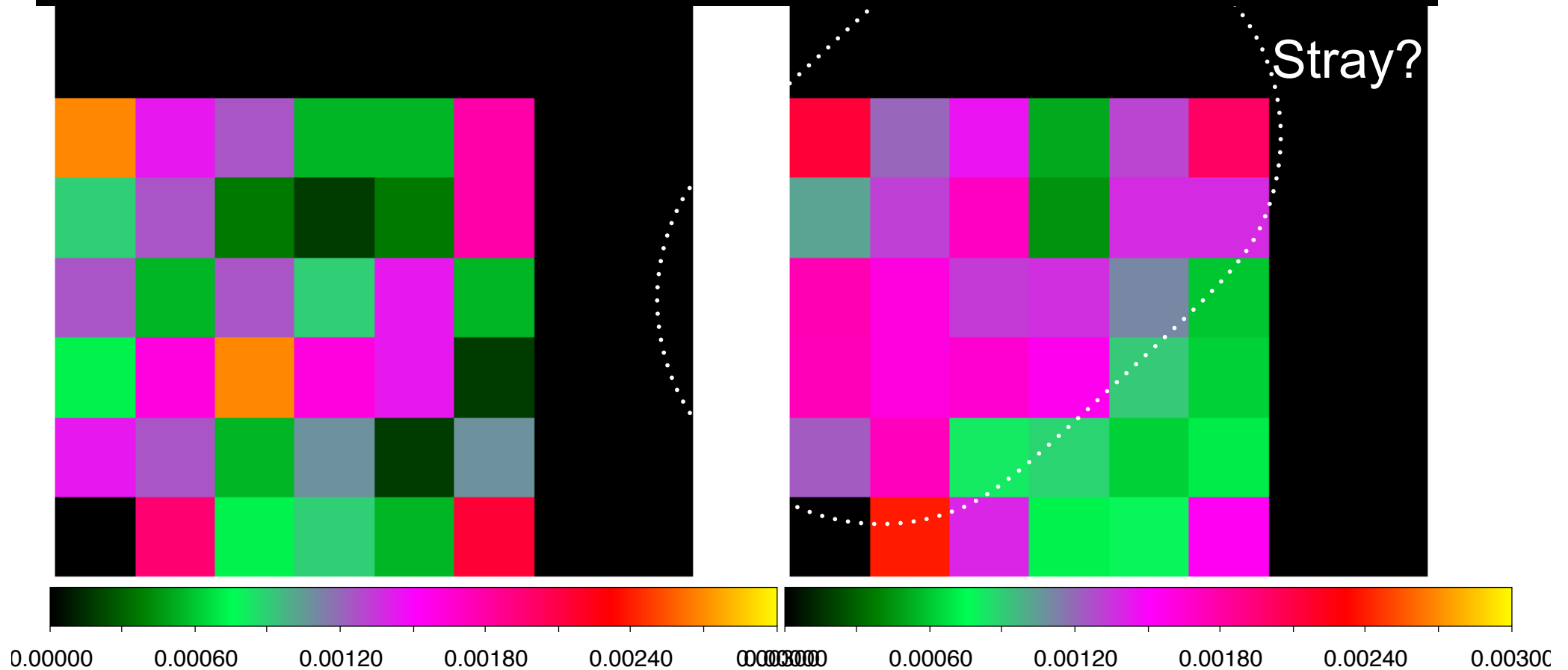
- Characteristic patterns
- Structure along QT boundary
- Comparisons with ground calibration are ongoing

Stray (Resolve)

Crab 60'-off in two azimuthal directions

(the same observations as the previous slide)

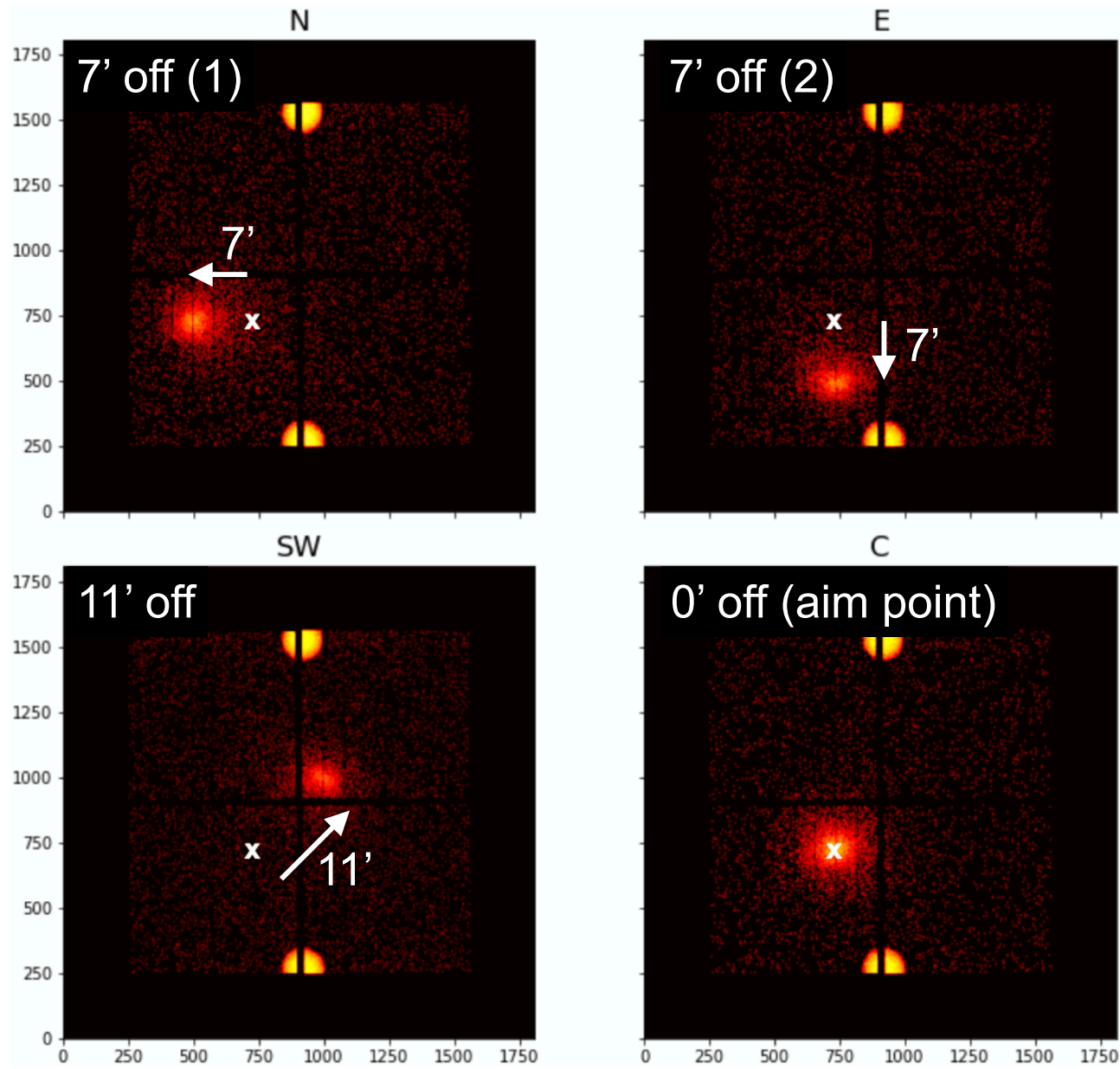
Note: Stray pattern can be different between Resolve and Xtend



- Hard to identify by the characteristic pattern because of Resolve's small FoV (3') and large pixel (0.5')
- Comparisons with ground calibration are ongoing

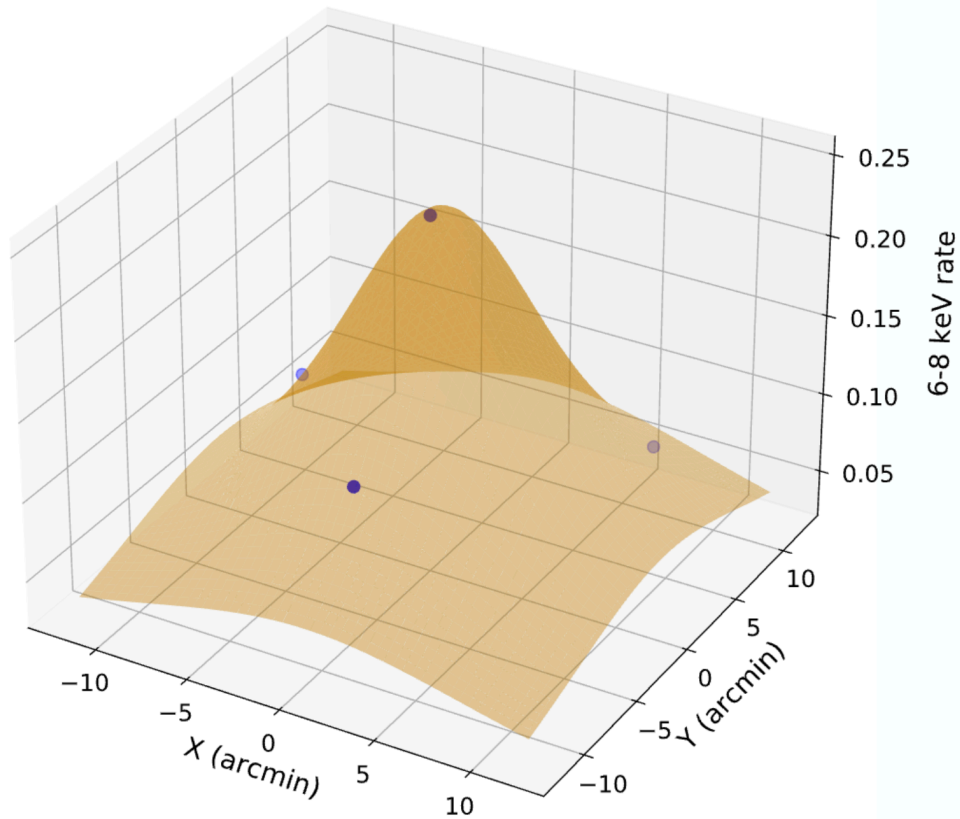
Optical Axis search (Xtend)

4 points observation of Abell 2029 (size ~30")
to measure the Xtend-XMA optical axis

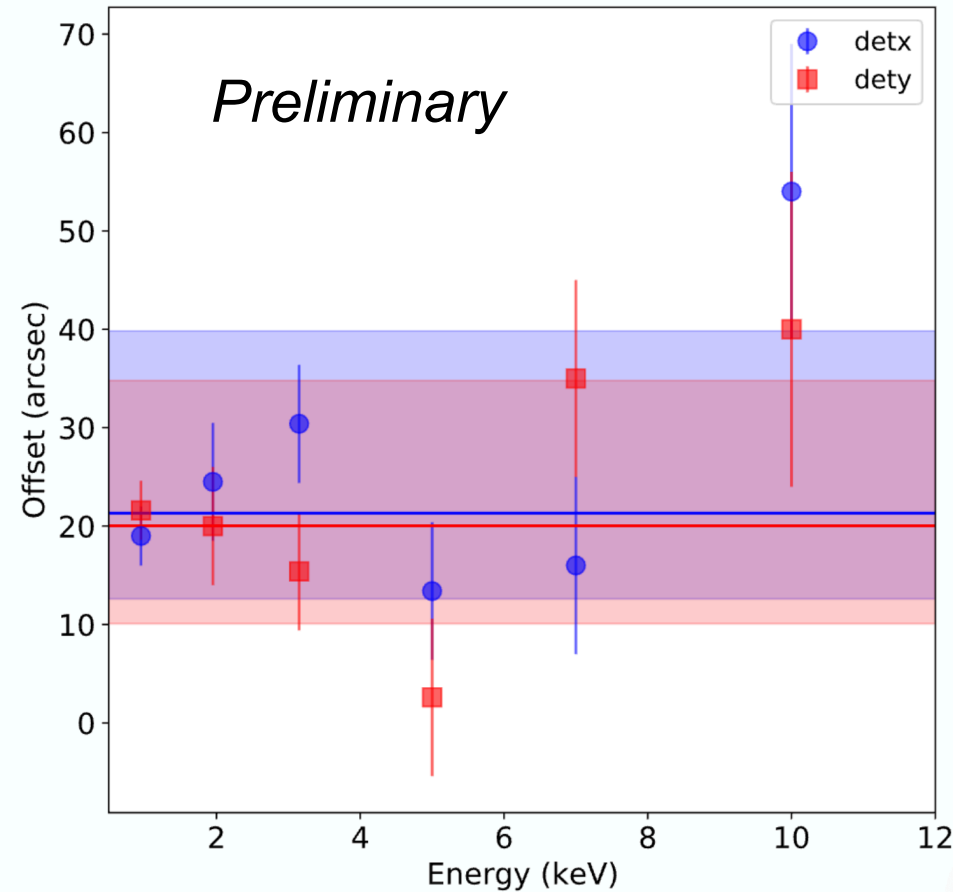


Optical Axis (Xtend)

The Xtend-XMA optical axis was calculated as peak in the EA at the 4 points



2D Lorentzian fit (amplitude, width, x_off, y_off all free parameters)



Caution: No background subtraction! Count rates estimated from 1.8' circle in SKY coordinates (based on Chandra centroid). Extended source, no raytracing (yet).

- Off-axis angle at the aim point is about 30" (Simionescu et al.)

- Aim Point Search
 - Adjusted to an accuracy 5 arcsec.
- Point Spread Function
 - Xtend: No degradation in the the imaging performance was observed in 1/8 Window mode.
 - Resolve : No performance degradation was observed
- Off-axis Point Spread Function
 - Resolve: Similar to ground calibration
 - Xtend: No observation is performed or planned so far
- Stray light measurements
 - Xtend: Obvious stray pattern was taken
 - Resolve: Sympton is seen
- Optical Axis Search
 - Xtend: Deviation of optical axis from Aim point is about 30" (preliminary)
 - Resolve: Measurement of GX 3+1 is proposed