



# STIX BKG detector: Analysis of the 500 strongest flares

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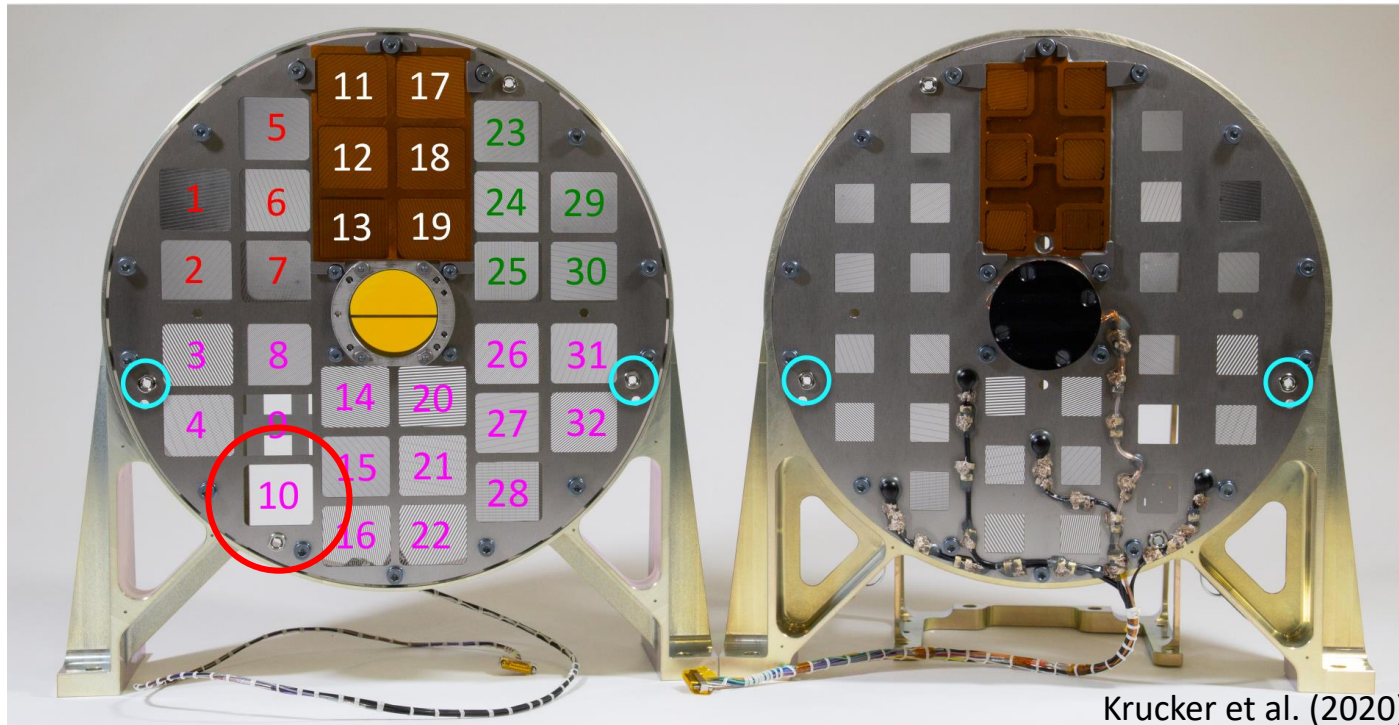
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# Introduction to the Background Detector

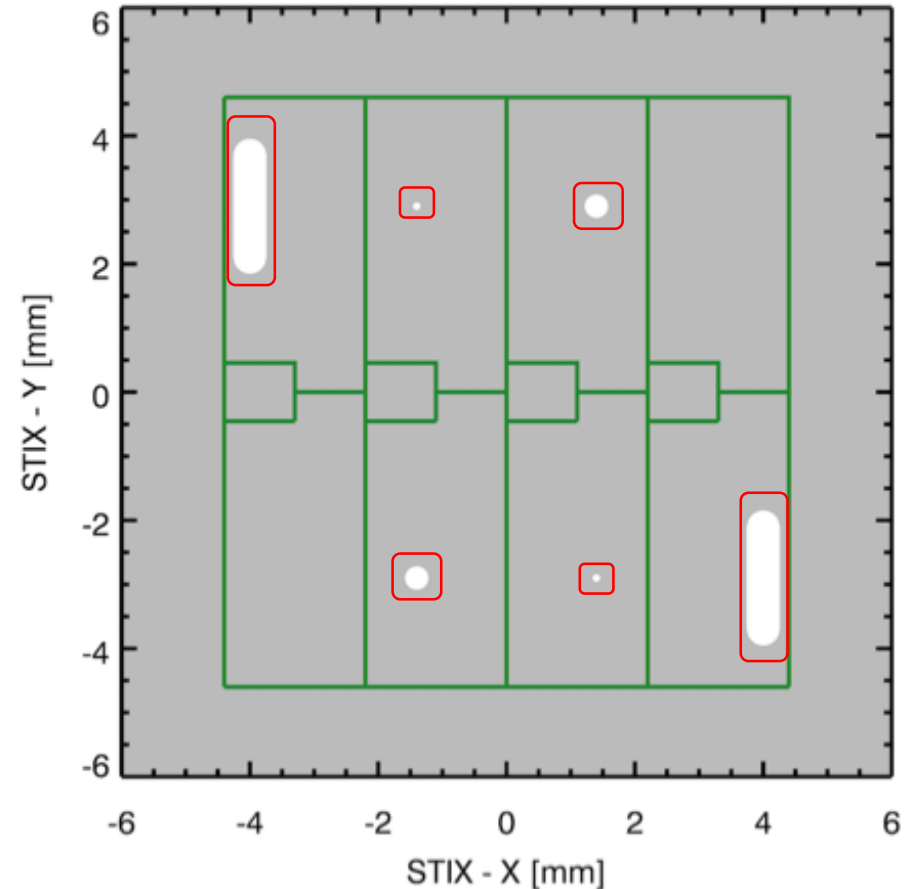
Two main purposes of the Background Detector:

- Measurement of the background
- Measure flux of low energy photons during high flux levels (attenuator inserted)



# Properties of the Background Detector

- Not covered by attenuator
- Front grid: completely open
- Rear grid: apertures of different sizes
- Two large sized apertures:  $1.0 \text{ mm}^2$
- Two medium sized apertures:  $0.1 \text{ mm}^2$
- Two small sized apertures:  $0.01 \text{ mm}^2$
- Two dark pixels

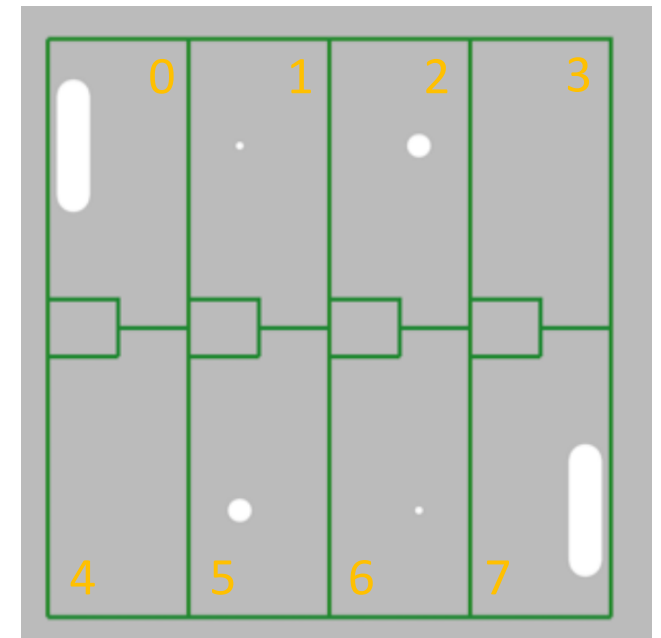


# Goal

- Analysis of the performance of the STIX background detector
- Measure of the relative size difference between the apertures -> Comparison Matej measurement
- GOES-class estimate for flares using Background Detector

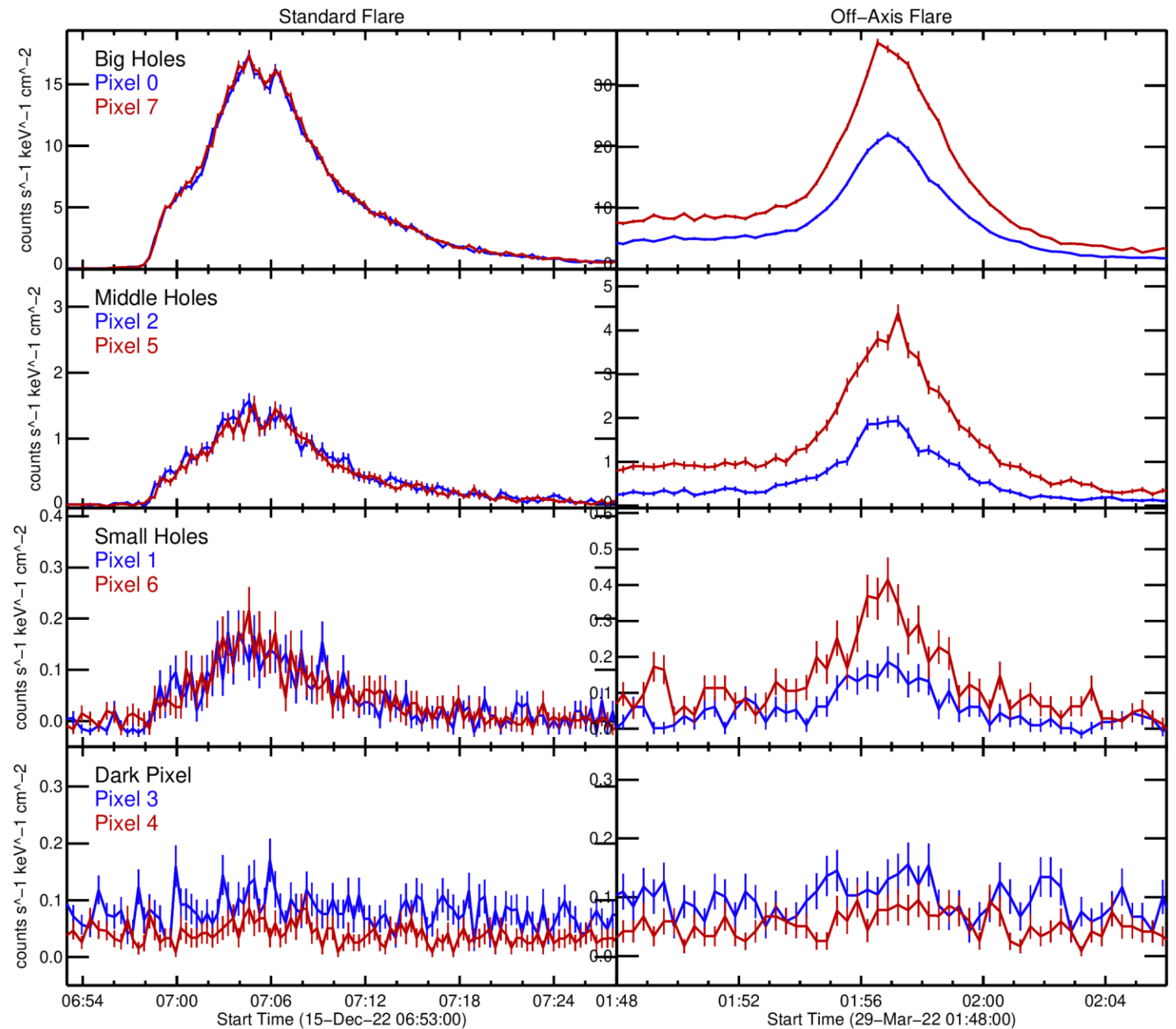
# Preparation

- STIX flare list<sup>1</sup>: flares from Feb. 2021 – April 2023
  - Filter for flares visible from Earth
  - Sort by size (quicklook: first 4-10 keV, second 10-15 keV) -> take 500 largest flares
- stx\_science\_data\_lightcurve for 4-10 keV
  - Each Pixel individually
  - bkd subtraction for all except for the dark pixel (3&4)
  - No elut corrections (expected change max. 0.5%)
- Analysis over peak of flare (automatic procedure): 1-5 min



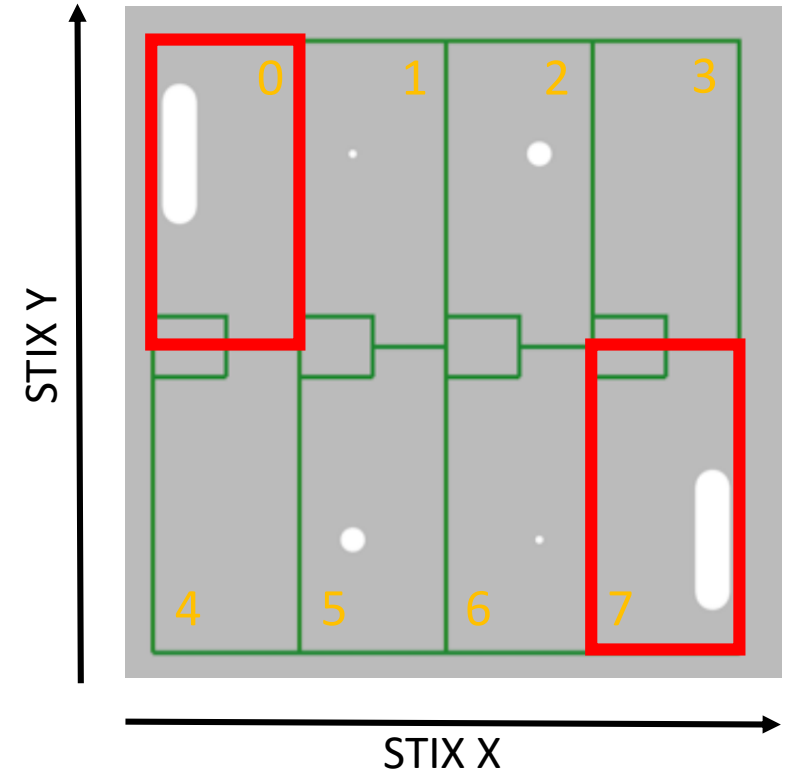
<sup>1</sup> [https://github.com/hayesla/stix\\_flarelist\\_science/tree/main](https://github.com/hayesla/stix_flarelist_science/tree/main)

# Examples



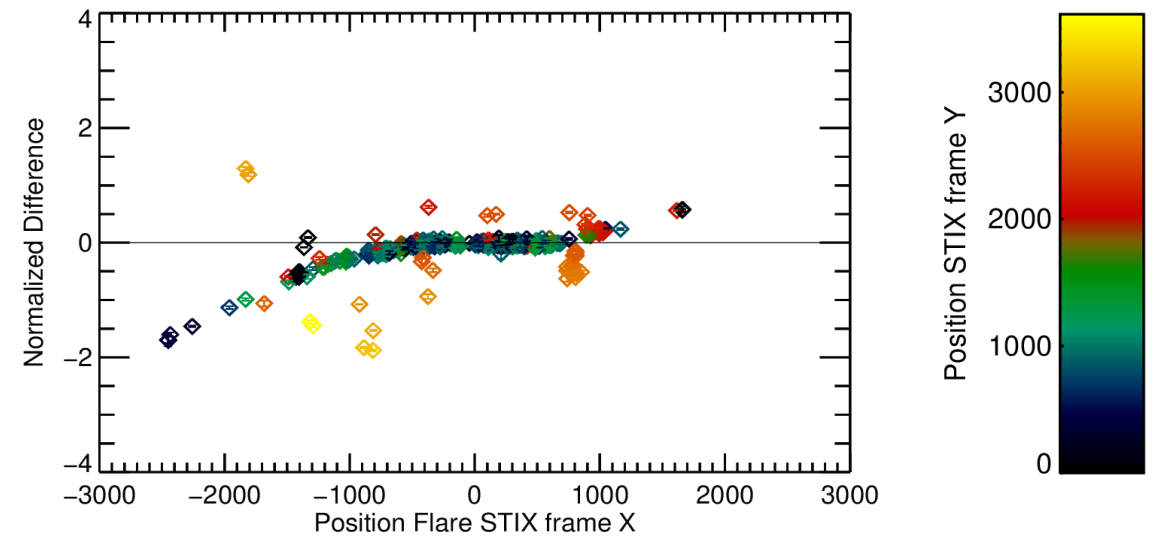
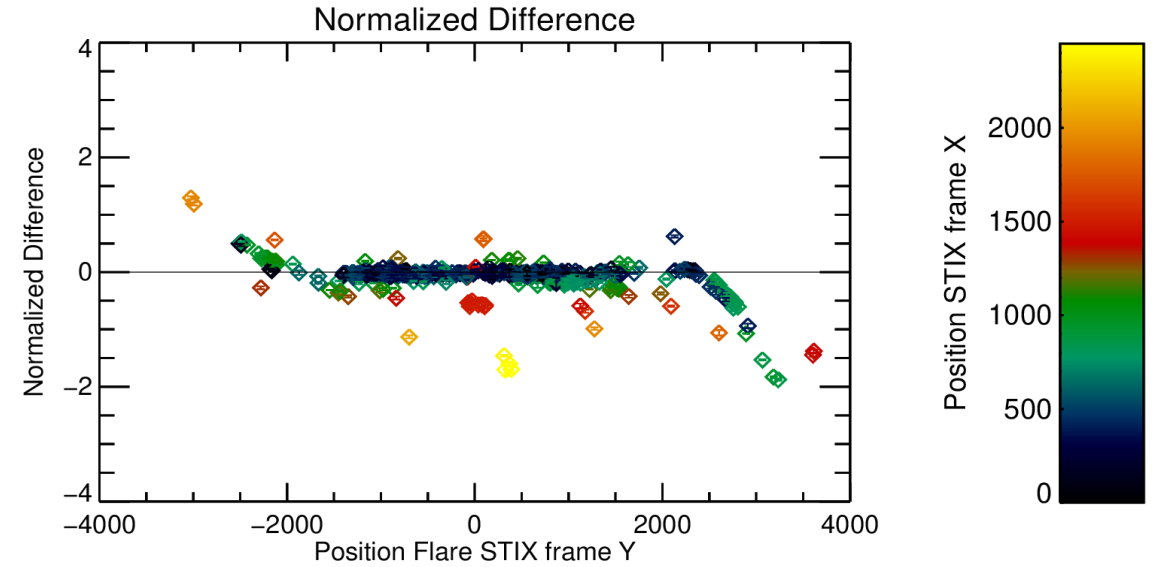
# Analysis

- Comparison among big, middle, small apertures and dark pixel
  - Normalized Difference: 
$$\frac{P_0 - P_7}{(P_0 + P_7)/2}$$
  - Ratio: 
$$\frac{P_0}{P_7}$$
- Plot results vs. location of flare in STIX X and Y coordinates

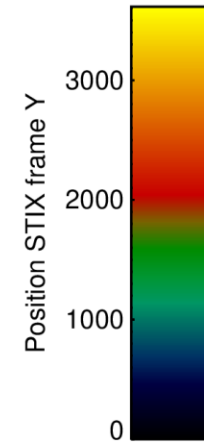
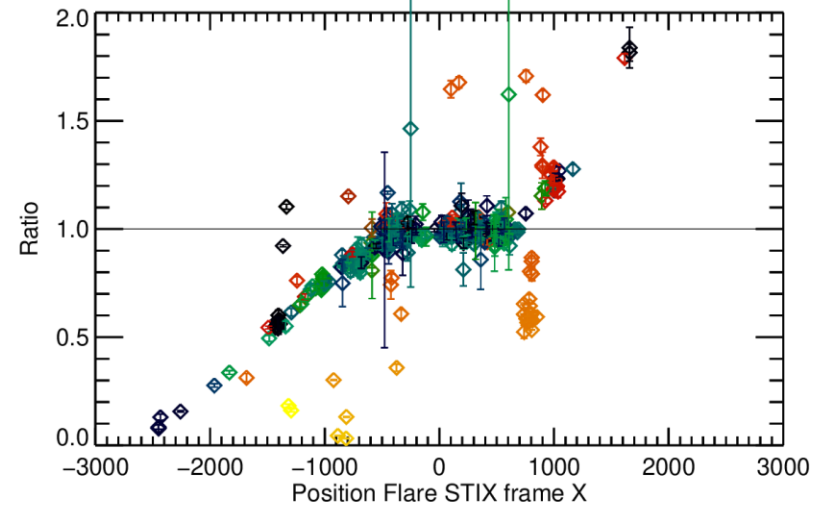
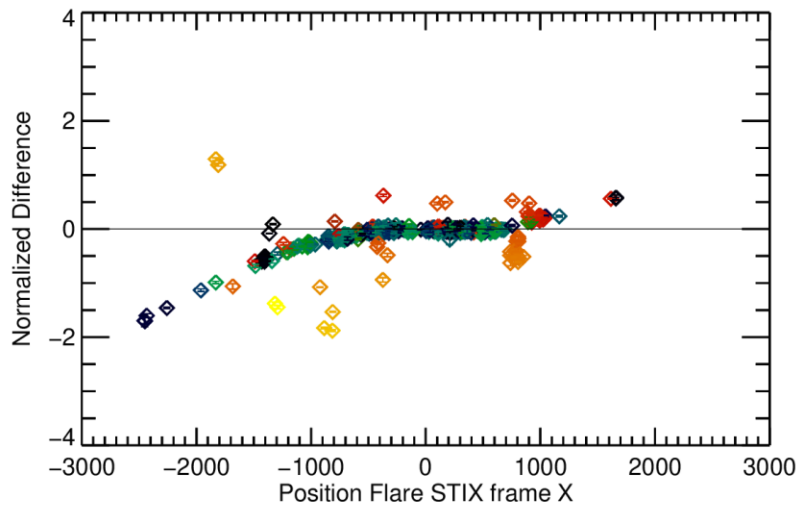
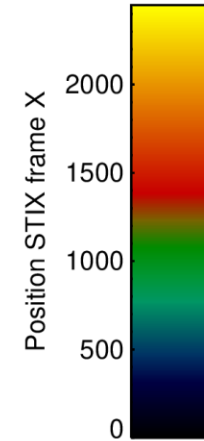
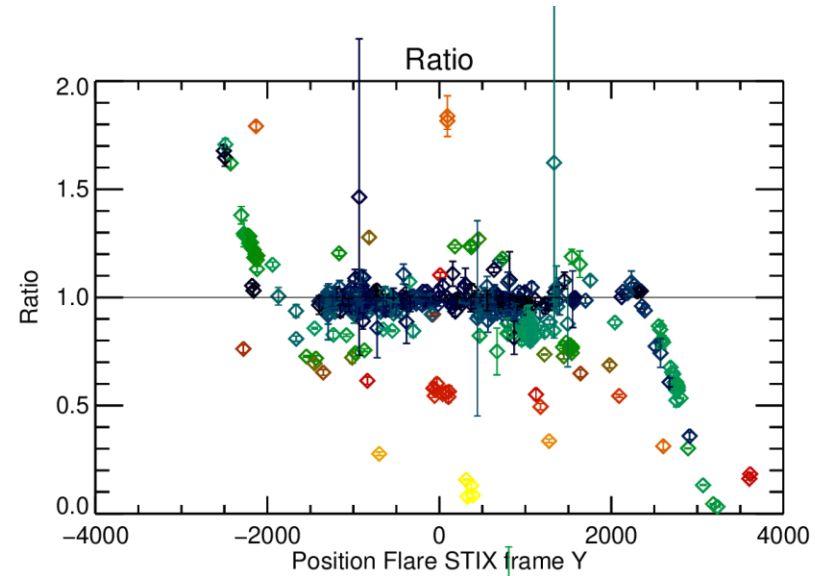
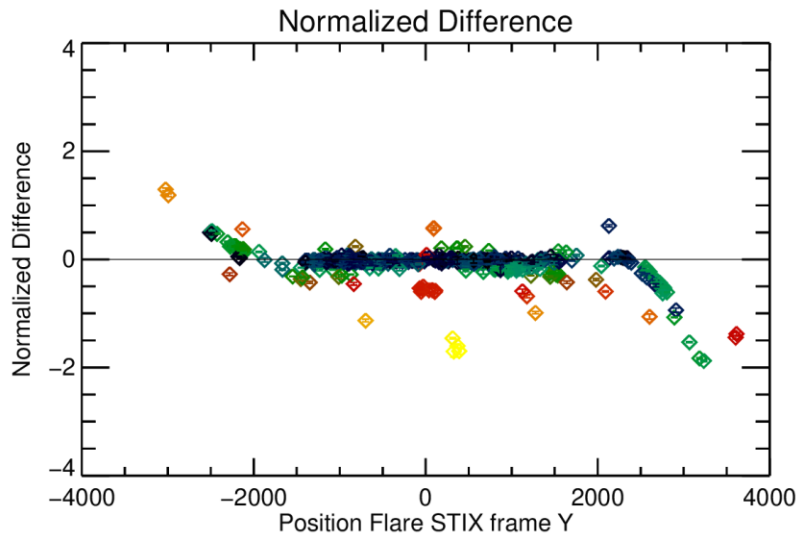




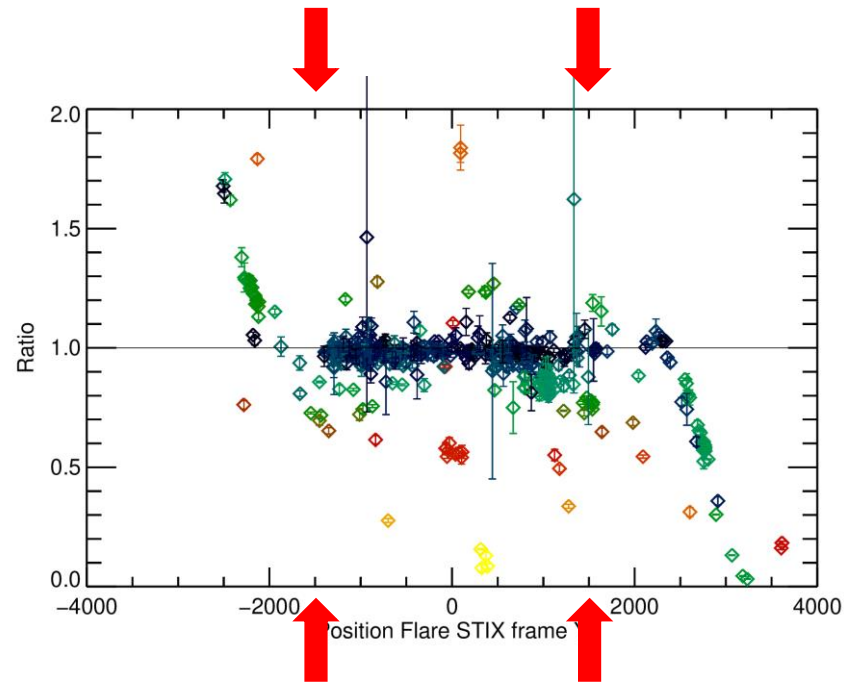
# Analysis – All Flares



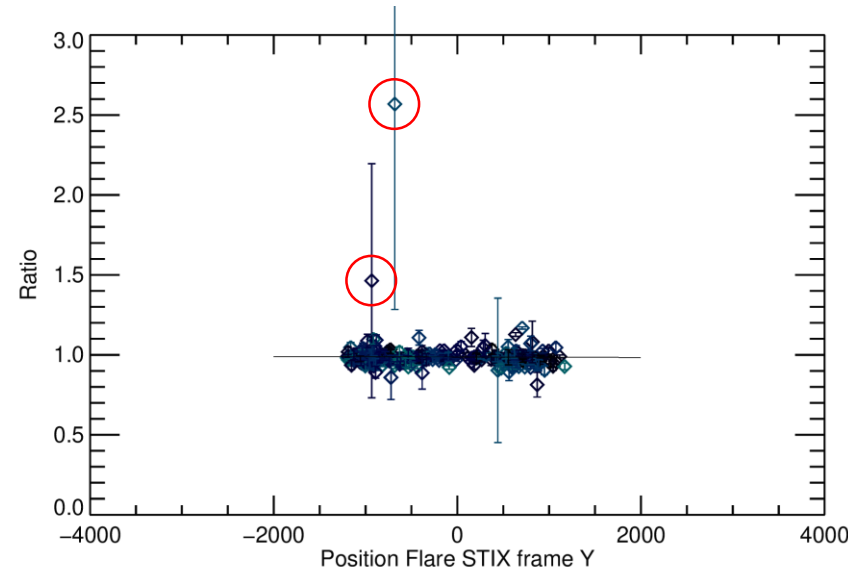
# Analysis – All Flares



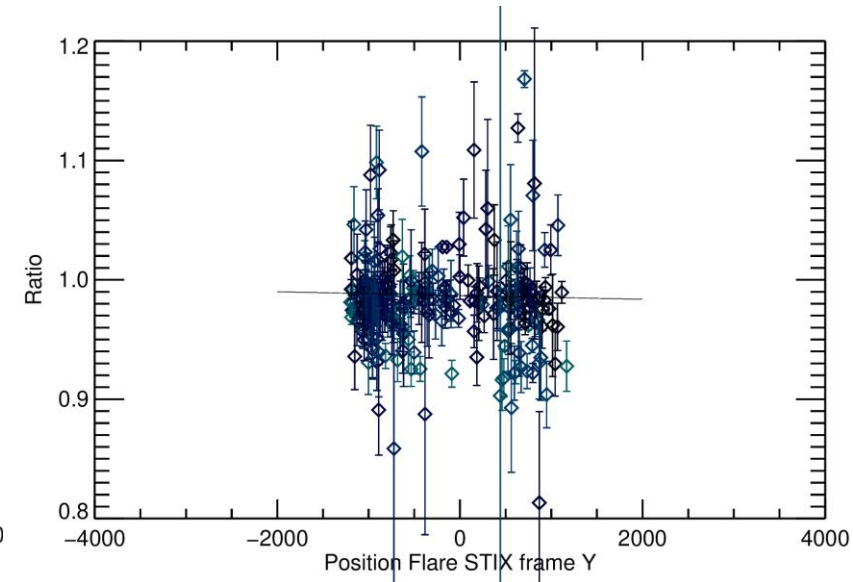
# Analysis – Towards the relative size difference



Filter out flares which are off-axis



Filter out flares with ratio  $> \text{mean} \pm 2 \cdot \text{std}$

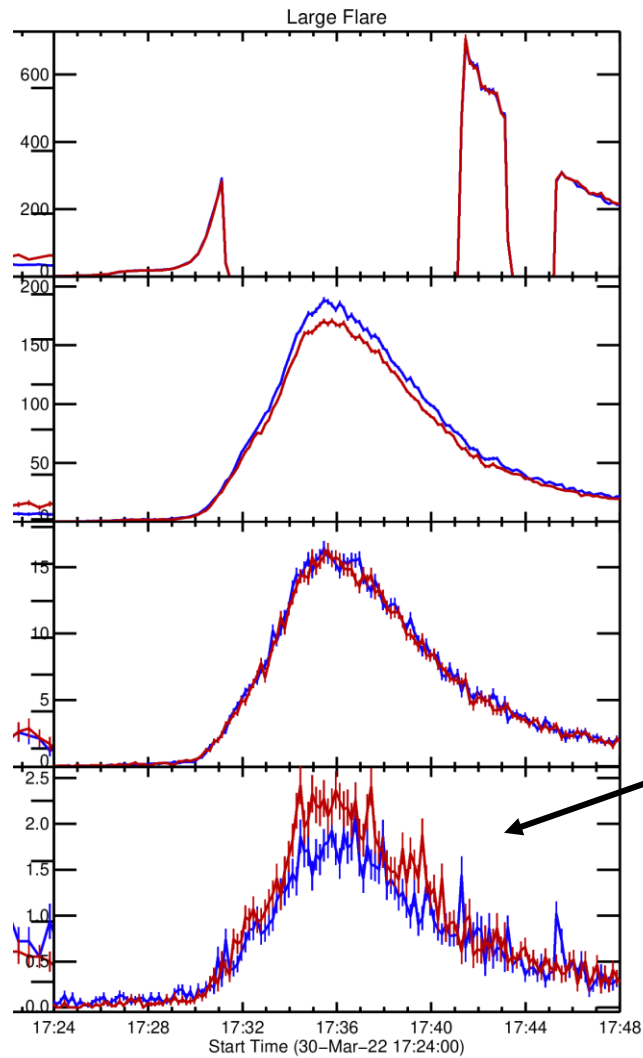


Linear fit

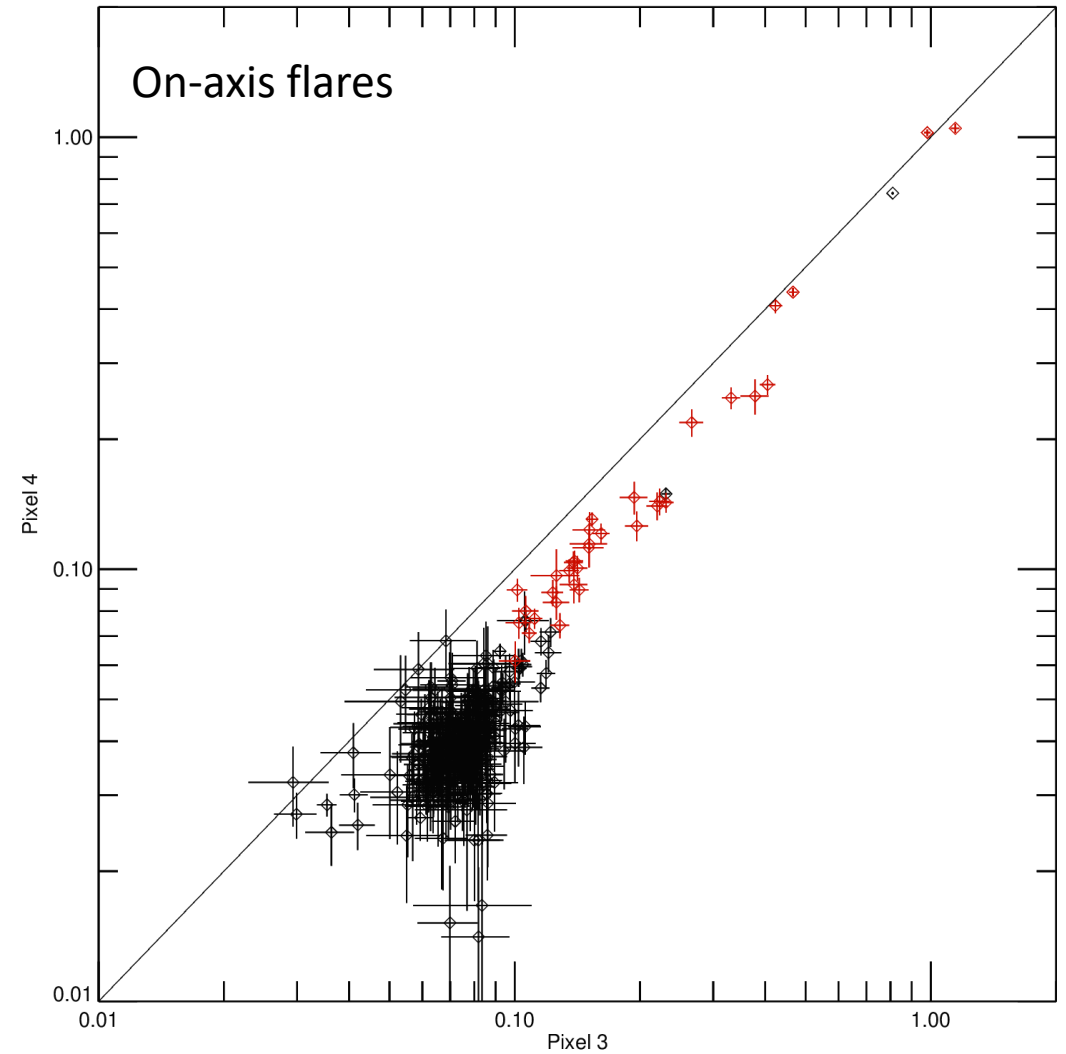
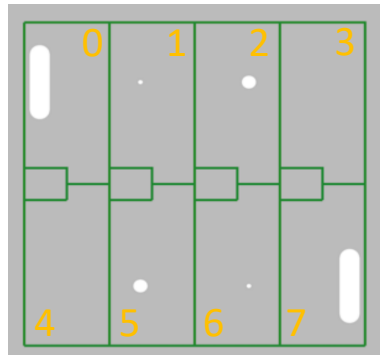
# Results – Relative size difference

Size_A/Size_B	Big Aperture	Middle Aperture	Small Aperture
Optical Measurement (Matej)	0.961788	1.01747	1.02701
Results X	$0.9869 \pm 0.0006$	$1.0350 \pm 0.0012$	$0.9751 \pm 0.0042$
Results Y	$0.9869 \pm 0.0006$	$1.0351 \pm 0.0011$	$0.9755 \pm 0.0039$

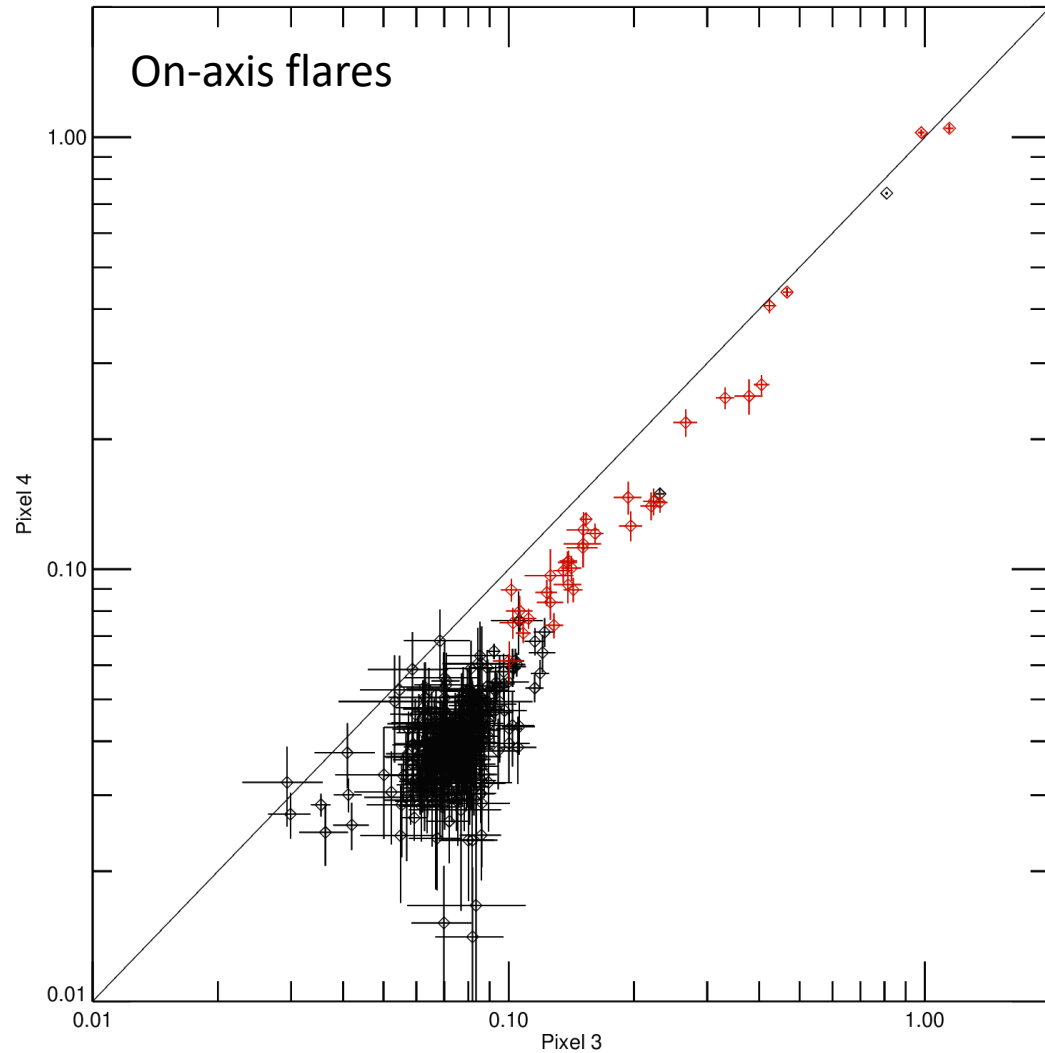
# Results – The Dark Pixels



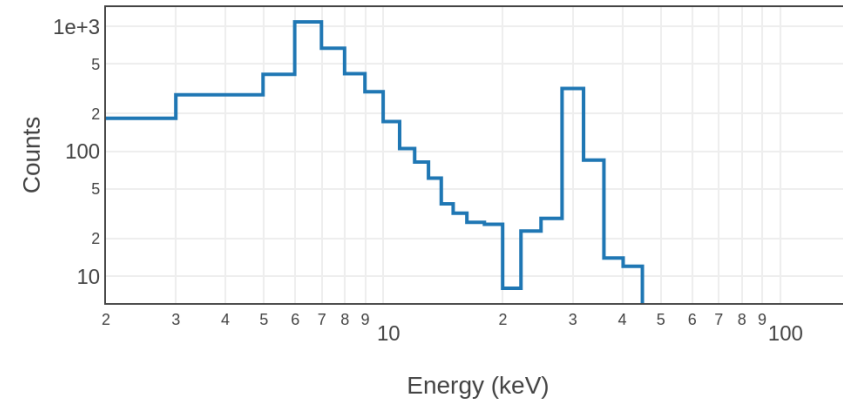
Dark Pixels "see" the flare



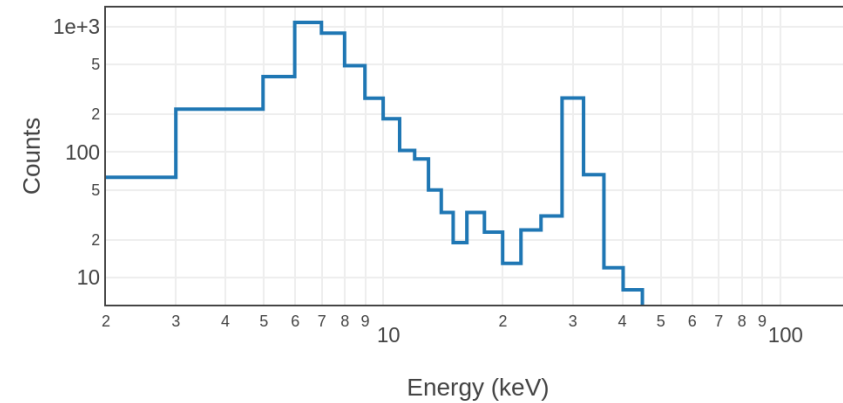
# What do the dark pixel see?



Spectrum of D#10/Pix#3(W/o BKG sub.)



Spectrum of D#10/Pix#4(W/o BKG sub.)



# Conclusions and Outlook

- Comparison measurement Matej: plus/minus a few percentage
- Dark pixels see flare counts for the largest flares
- Relation big/mid and mid/small
- Expand to flares not seen by Earth for small apertures -> better statistics
- Understand the dark pixel
- Database with time profiles of thermal emission when attenuator is in?
- Compare flux measured by bkg detector with GOES

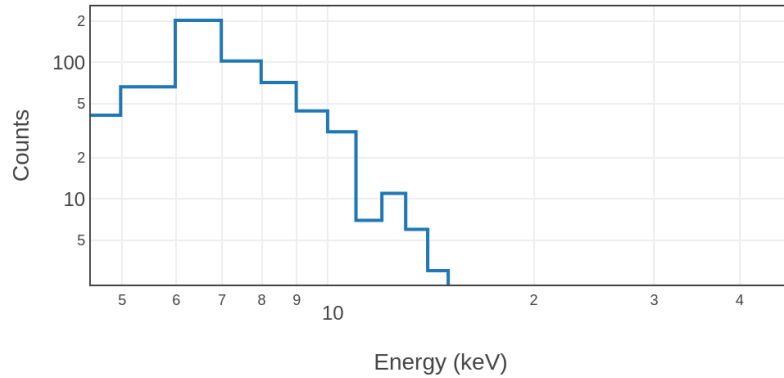
Questions?



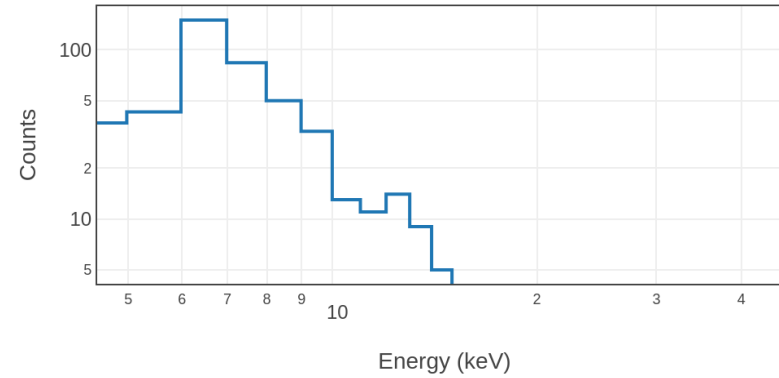


# Spectra for small pixel

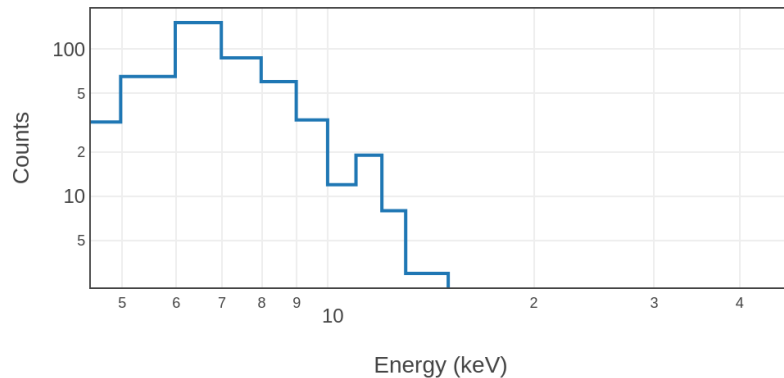
Spectrum of D#10/Pix#8(W/o BKG sub.)



Spectrum of D#10/Pix#9(W/o BKG sub.)



Spectrum of D#10/Pix#10(W/o BKG sub.)



Spectrum of D#10/Pix#11(W/o BKG sub.)

