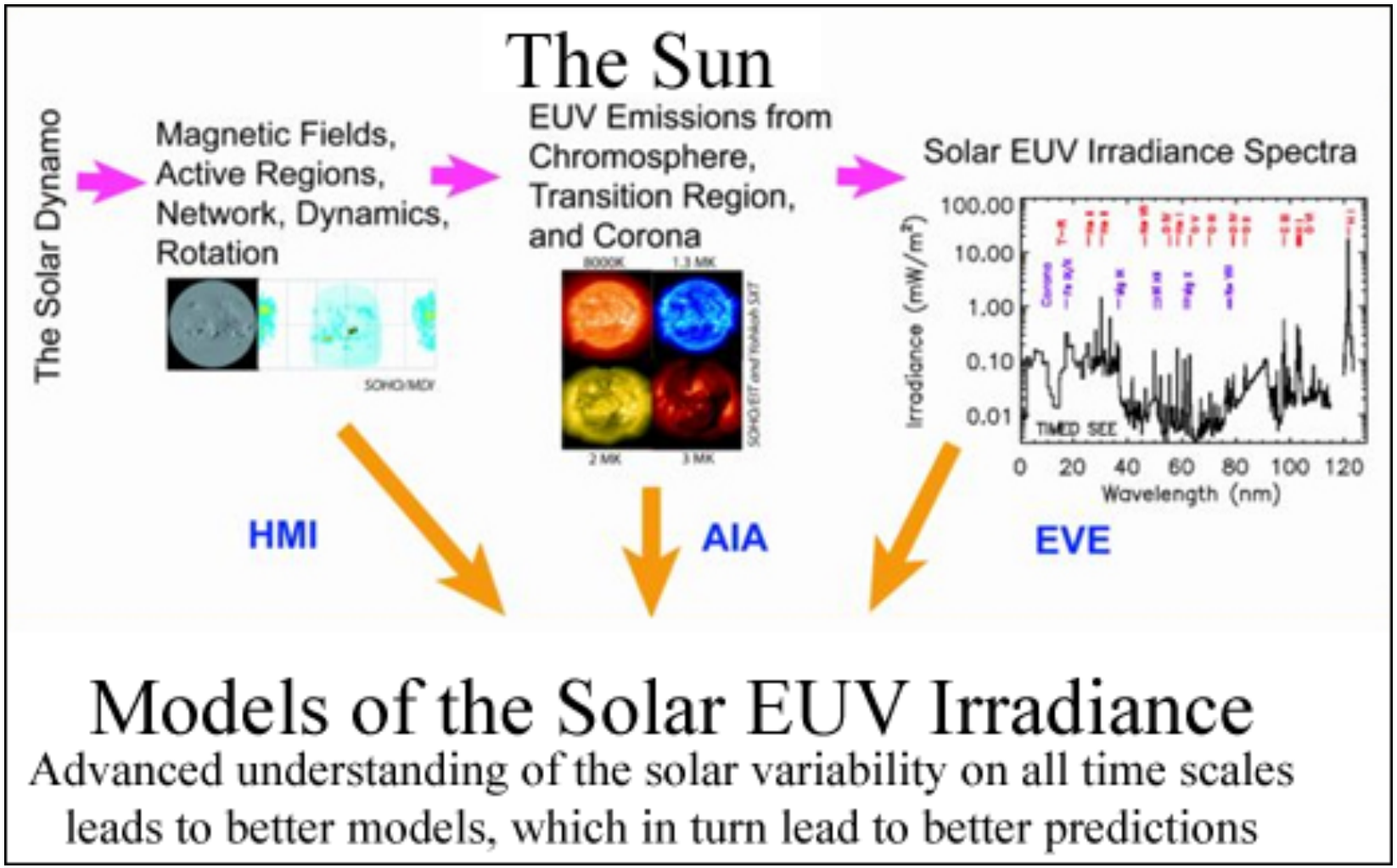
NASA 36.286 Flight Summary

SDO EVE Calibration Rocket flown on June 23, 2012
(only quicklook data are shown)

Tom Woods
LASP/University of Colorado
Email: tom.woods@lasp.colorado.edu

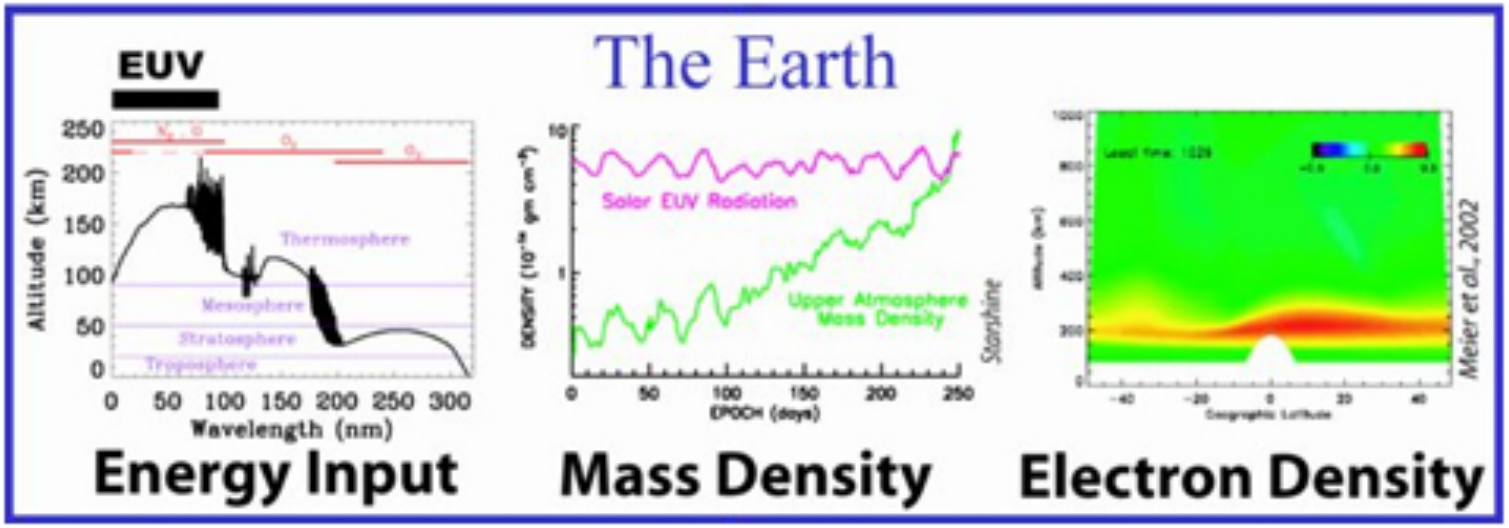
Comprehensive Success for this Mission

Solar Dynamics Observatory (SDO) EUV Variability Experiment (EVE) Studies the Solar EUV Irradiance



EVE Connects the Sun to the Earth

Solar EUV Irradiances



Societal Impacts

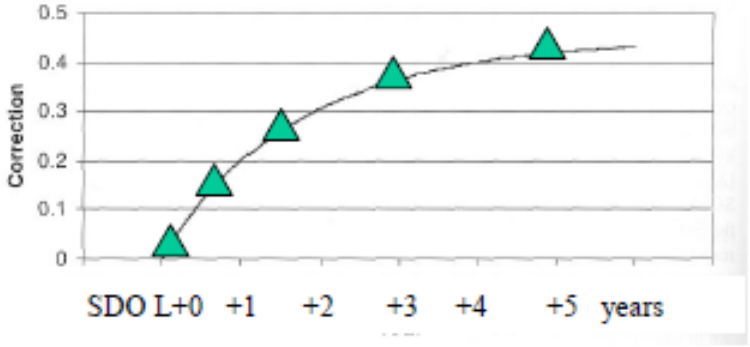
Solar-induced atmospheric variability include spacecraft drag drag and communication / navigation disruption

Underflight Calibrations → Sounding Rockets

- **EVE requires an in-flight channel with < 17% degradation between underflight (rocket) calibrations in order to meet the SDO 25% accuracy requirement for the solar EUV irradiance**
  - ESP and MEGS-P are these in-flight channels for MEGS
  - 5 calibration rocket flights are planned to meet SDO accuracy requirement
  - SOHO SEM degradation is good model for estimating frequency of flights

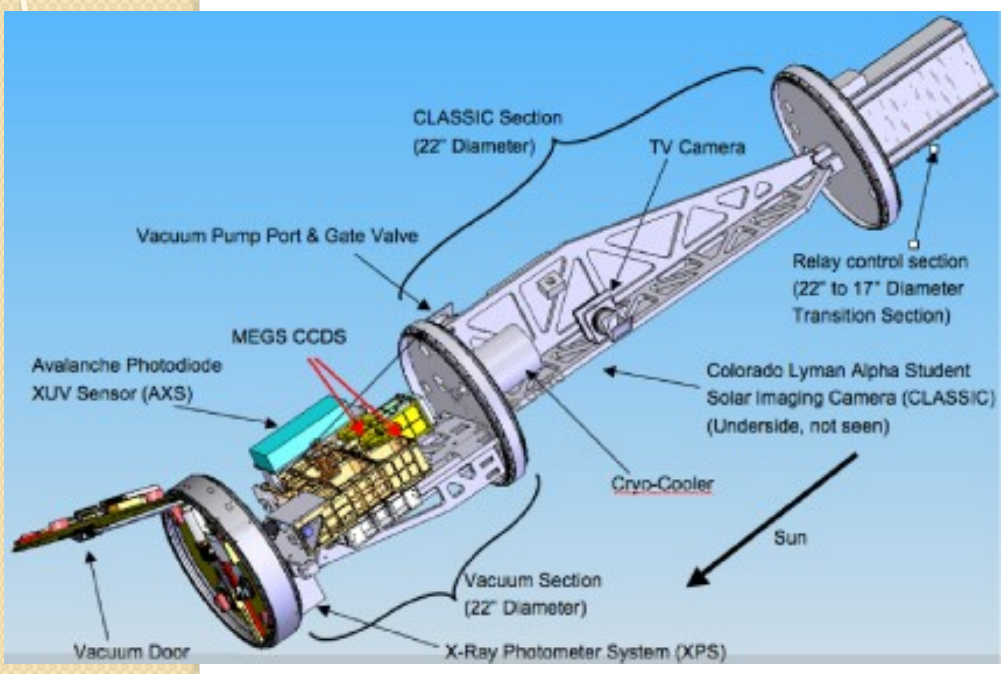
- 1st cal rocket: L+1 month: ASAP after SDO EVE begins solar observations in order to track degradation from last SURF calibration to post SDO launch
- 2nd cal rocket: L+7 months: degradation strongest during early mission
- 3rd cal rocket: L+18 months: decrease launch frequency as degradation rate slows down
- 4th cal rocket: L+3 years
- 5th cal rocket: L+5 y

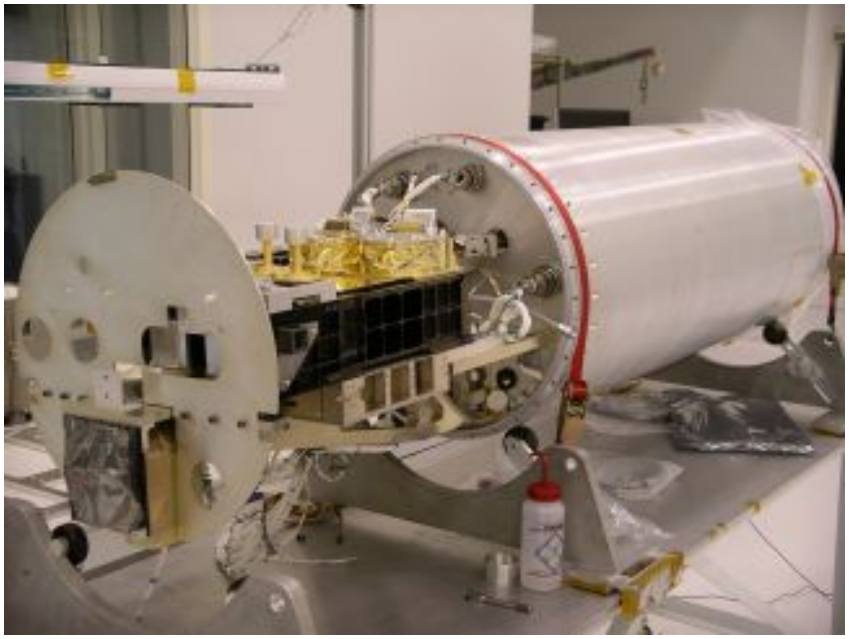
SOHO SEM Degradation Correction



Projected EVE Cal Rocket Flights

Rocket Experiment





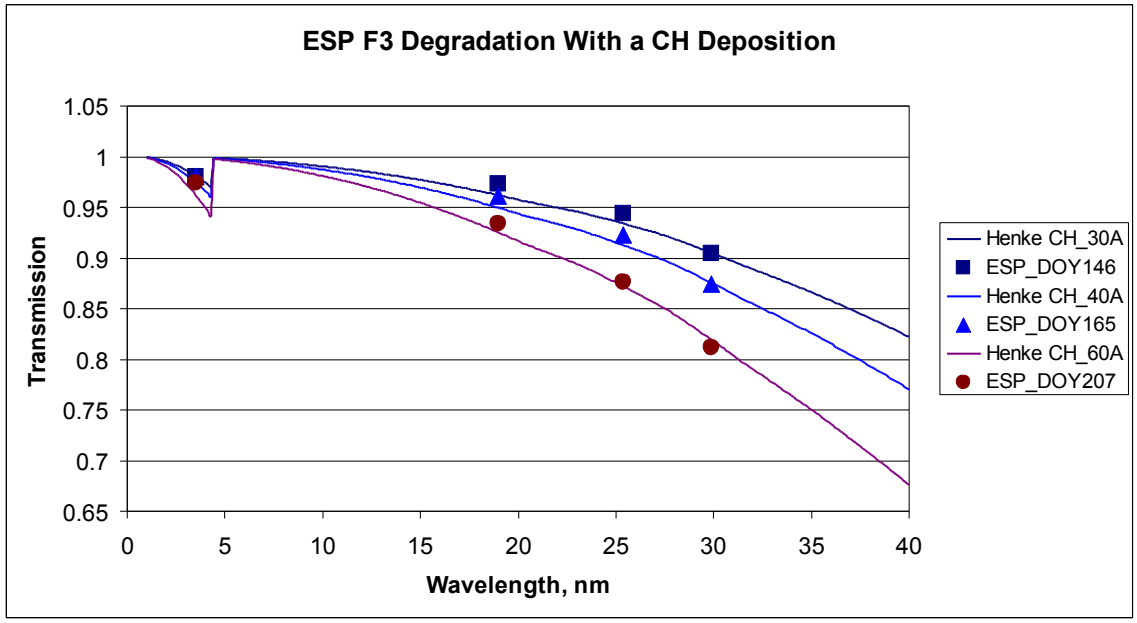
The payload, built in 2006, includes protoflight SDO EVE MEGS and ESP channels.

The payload was further updated with additional channels to measure the soft X-ray spectrum. These channels includes prototype GOES-R XRS (0.05-0.8 nm, 2 bands), modified EVE-SAM (0.5-5 nm with 0.1 nm resolution), and Amptek X123 (0.05-3 nm, < 0.5 nm resolution). These last two are new for the June 2012 launch to better calibrate the EVE broad band at 0.1-7 nm.

Understanding EVE Instrument Degradation

The underflight calibration rockets provide the required measurements to accurately understand the amount of instrument degradation and thus provide improved solar EUV irradiance results from the satellite version of the SDO EVE instrument.

The reference EUV spectra from this rocket are useful for the calibration of several other satellite instruments: SDO/AIA, TIMED/SEE, SORCE/XPS, SOHO/SEM, SOHO/EIT, SOHO/CDS, Hinode/EIS, Hinode/XRT, STEREO/EUVI, GOES/XRS, GOES/EUVS, GOES/SXI, ISS SOLAR/SOLACES, Proba-2/LYRA, and Proba-2/SWAP

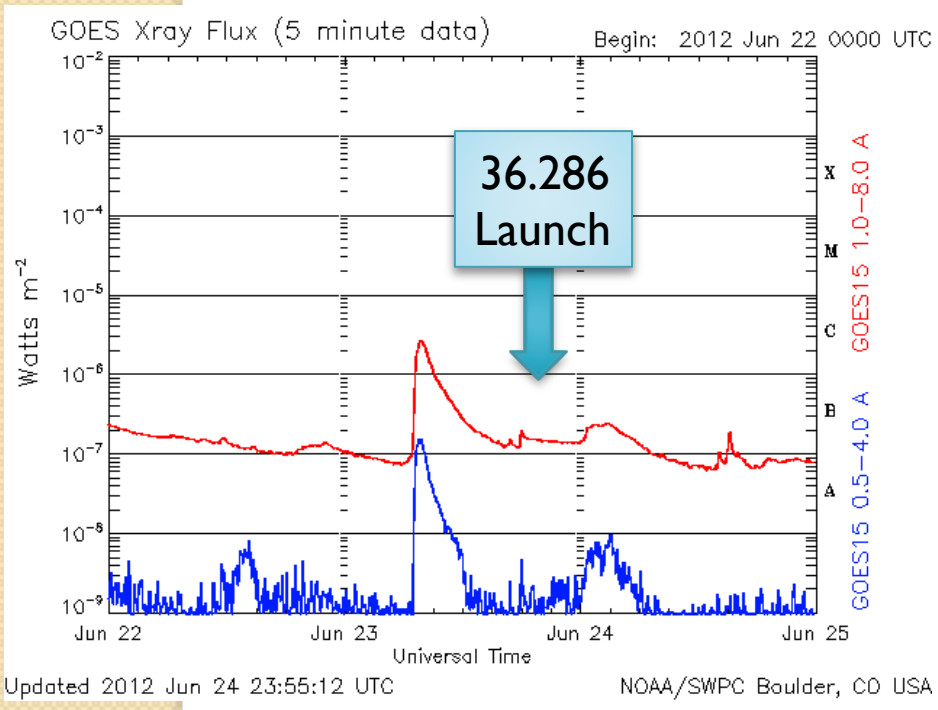


Filter degradation of about 10%/year is due to hydrocarbon contaminates.

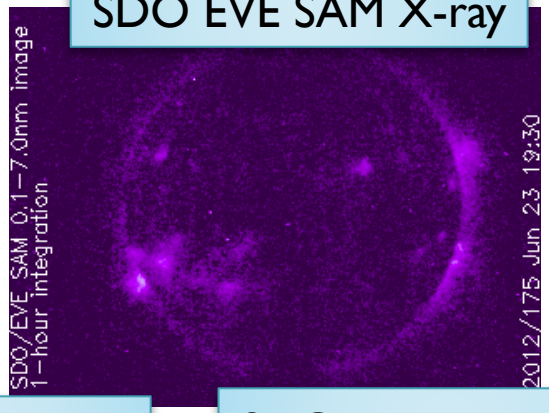
Understanding the wavelength dependent degradation requires accurate underflight calibration rockets

Summary of NASA 36.286 Results

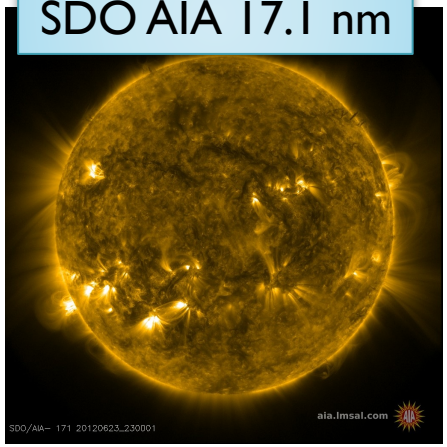
- All instruments worked well, attitude control was excellent, and good solar measurements were obtained.
- This was on day with very low solar activity; consequently, a few channels have weak signals.
  - SAM (modified with grating) X-ray spectra are not clearly detectable
  - GOES XRS-A channels have weak signals



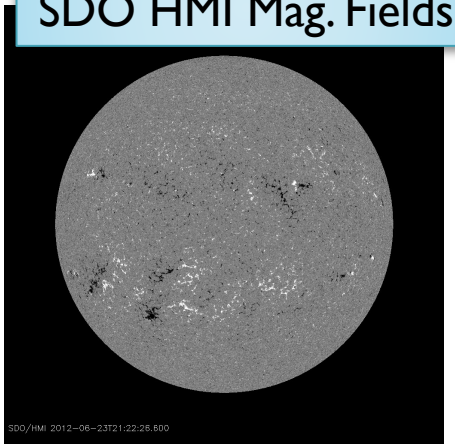
SDO EVE SAM X-ray



SDO AIA 17.1 nm

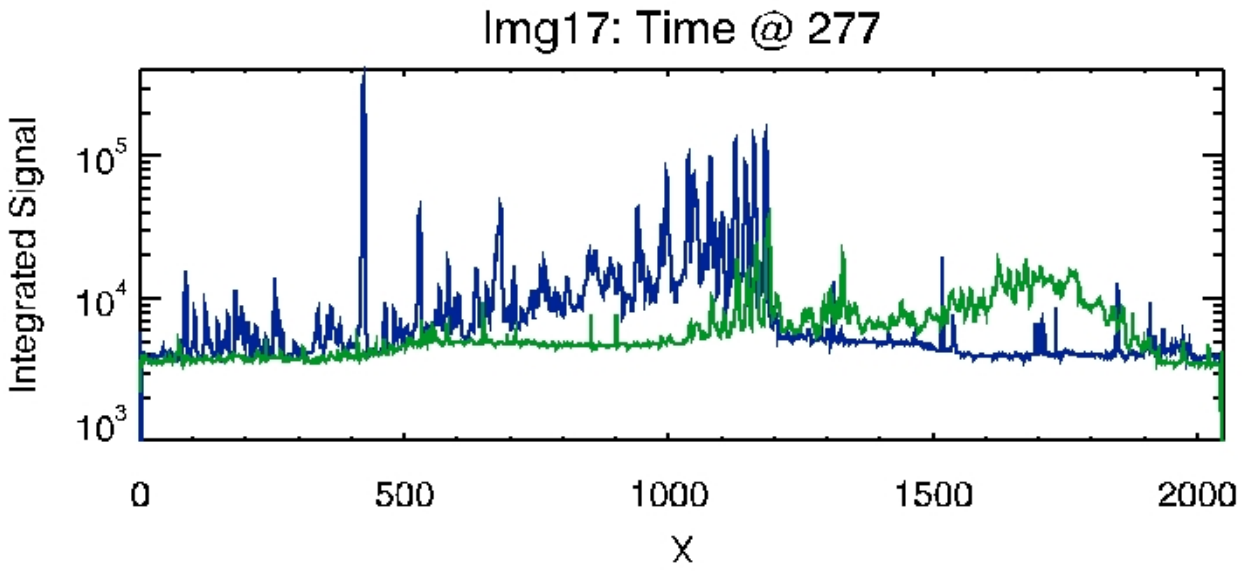


SDO HMI Mag. Fields



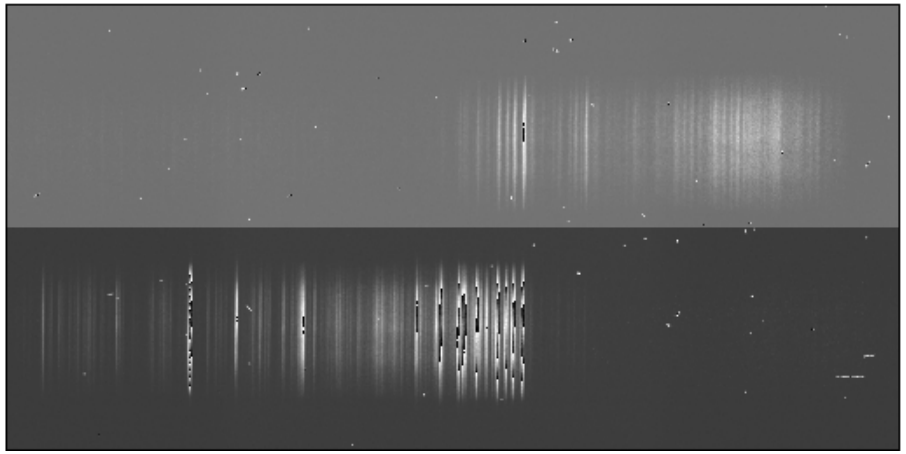
NASA 36.286: MEGS-A (5-37 nm)

- MEGS-A has dual slit/filter pairs – so two spectra obtained.
  - There is no obvious detection of SAM image. Need larger pinhole…



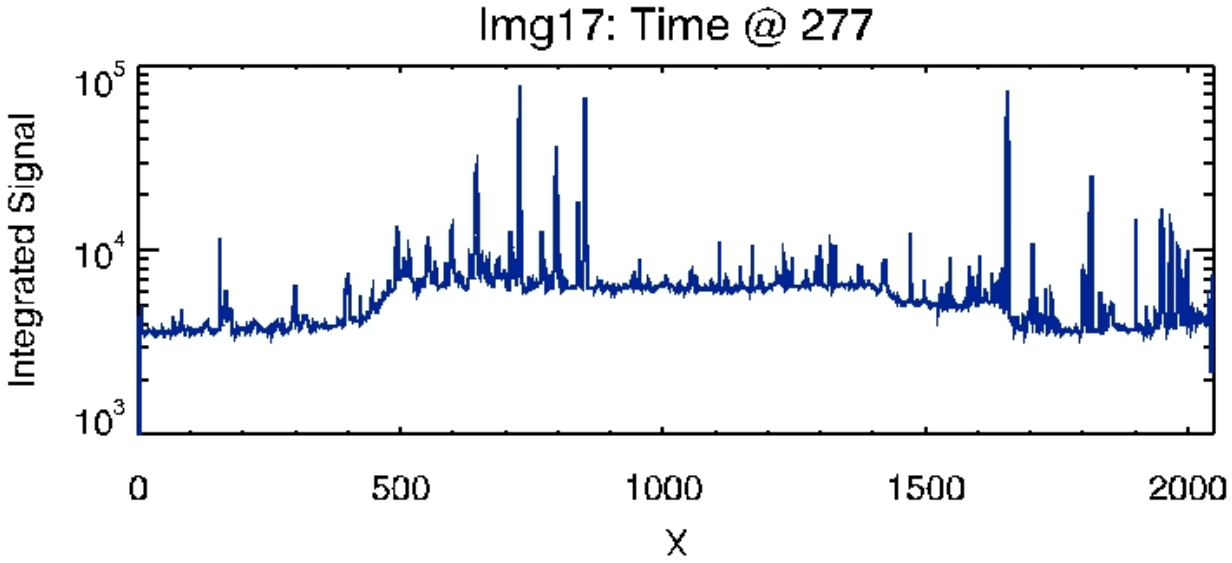
MEGS-A1

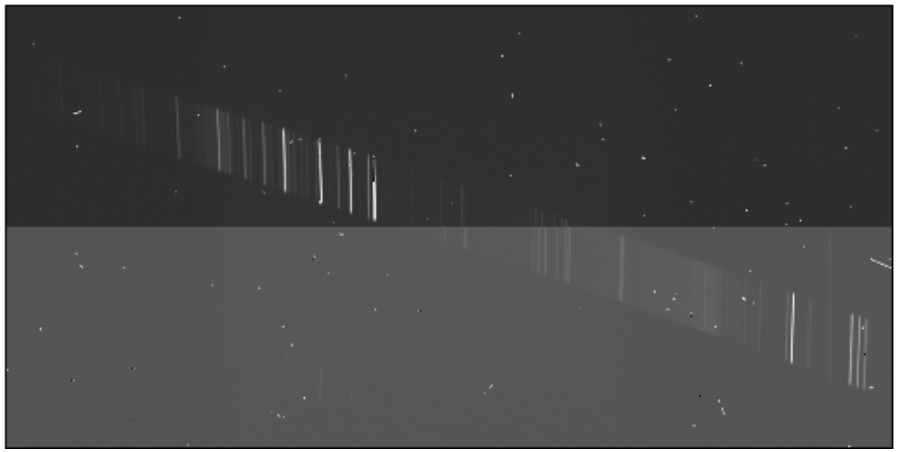
MEGS-A2 + SAM



NASA 36.286: MEGS-B (35-105nm)

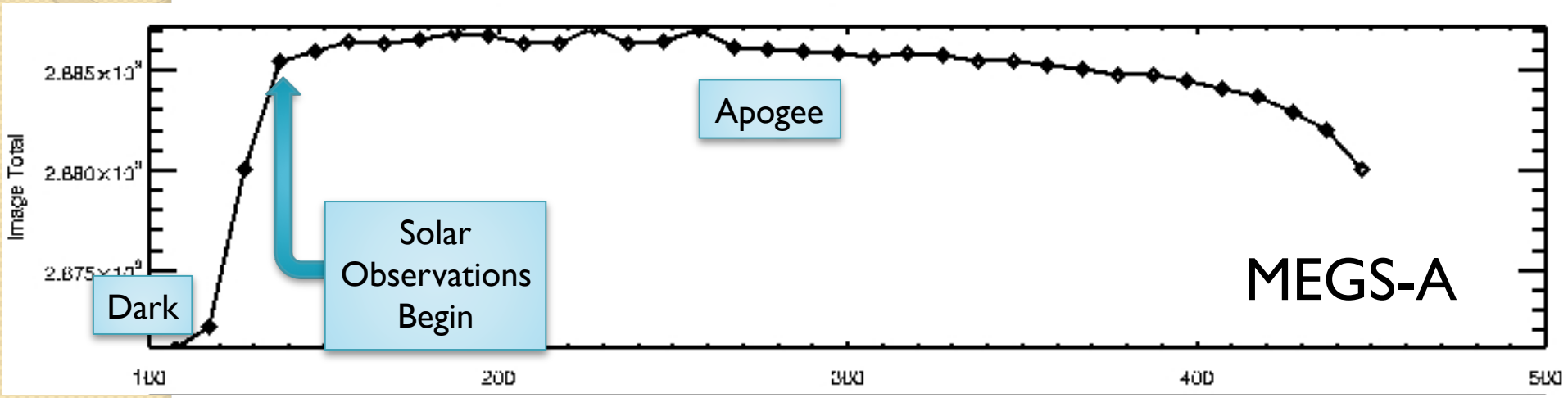
- MEGS-B has two gratings with cross dispersion, so the spectrum goes across the CCD diagonal.

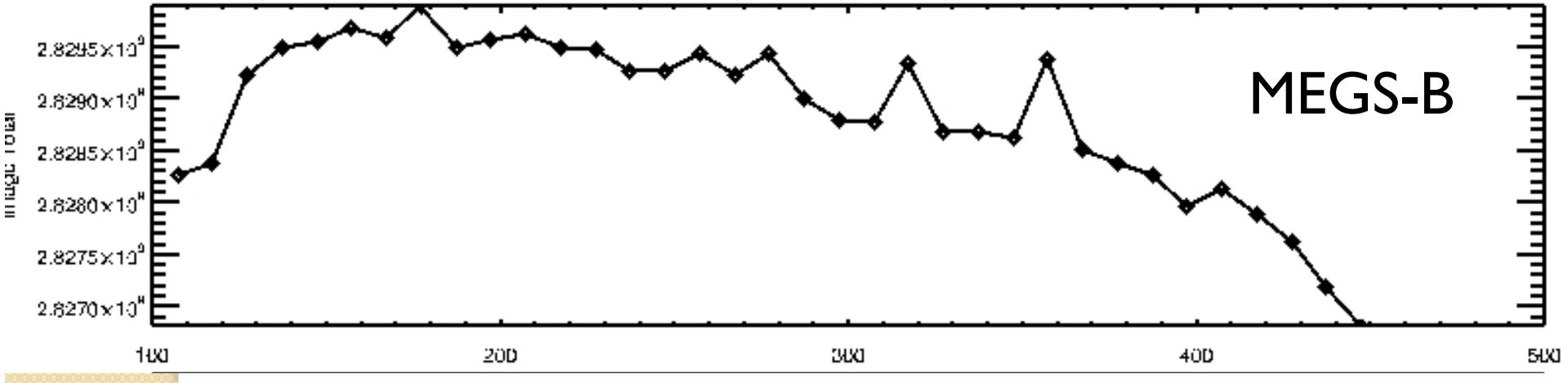




NASA 36.286: MEGS Total Signals

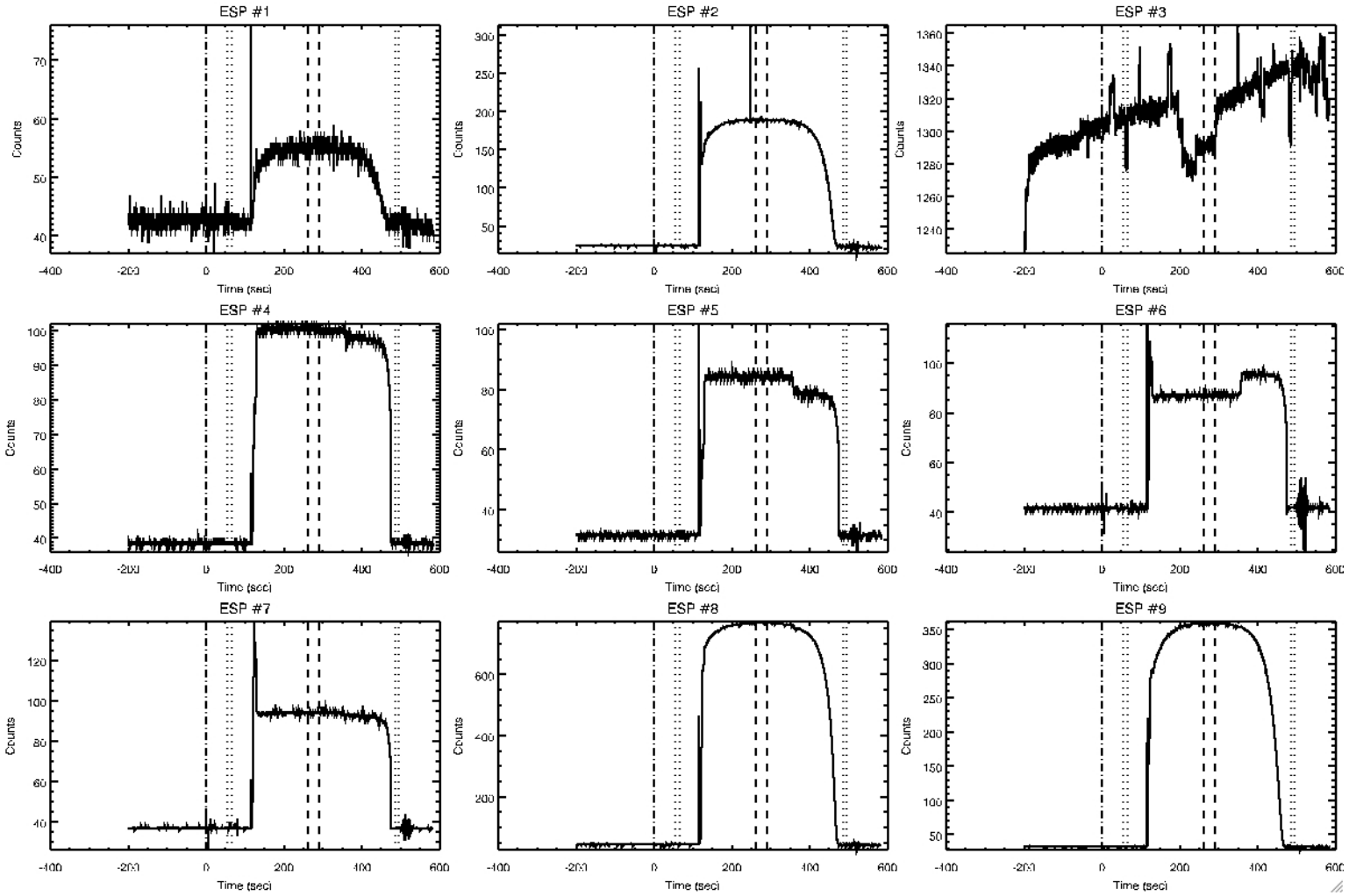
- MEGS-B dark is changing with time. MEGS-A dark is steady.
- Roll off after apogee is due to atmospheric absorption.





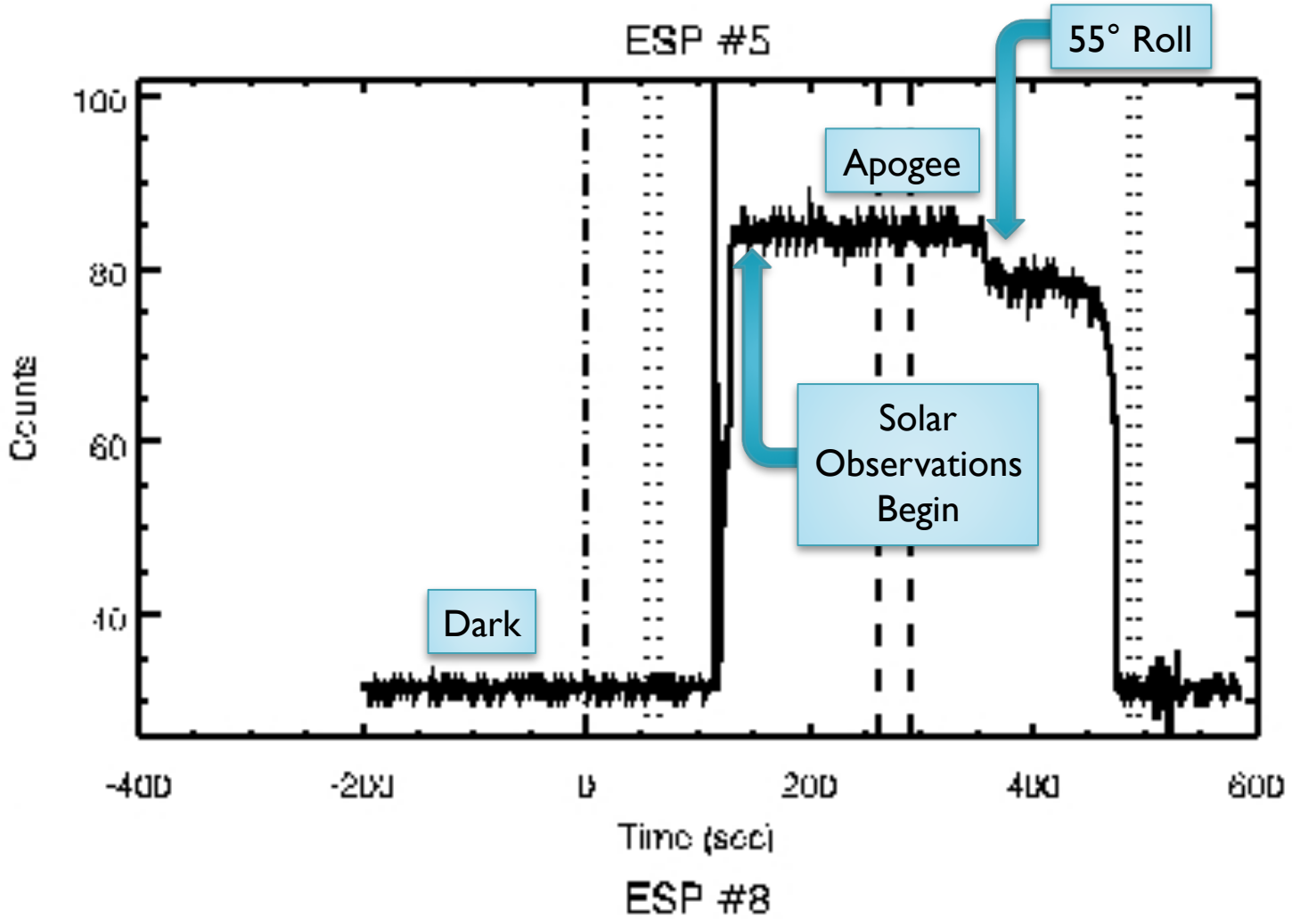
NASA 36.286: ESP

- ESP has 9 channels. ESP#3 is dark channel (but has bad diode)
- ESP#4-7 is Quad Diode. ΔX=-1.2 arc-min, ΔY=-6.9 arc-min



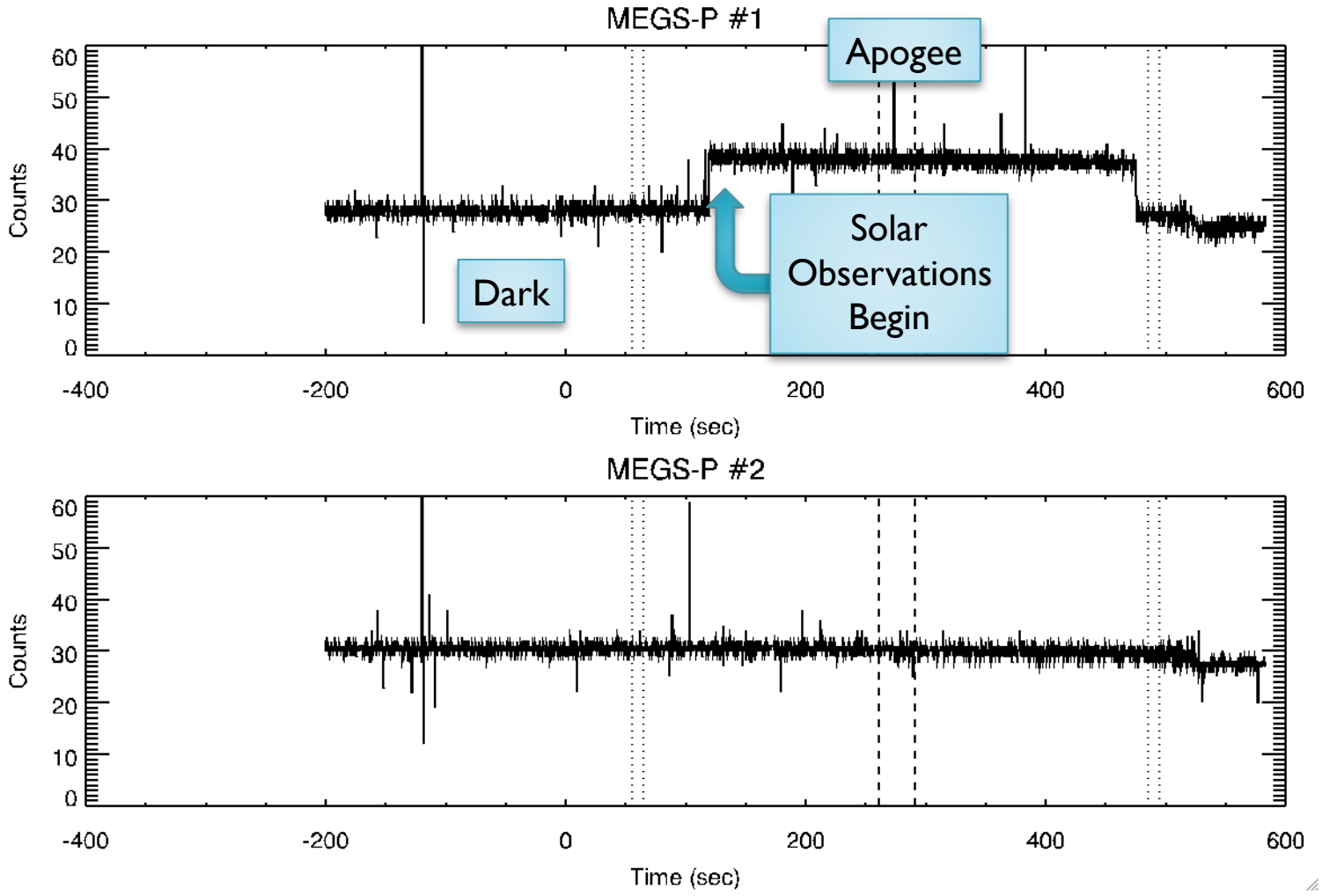
NASA 36.286: ESP QD sees Roll

- 55° roll made at T+350sec for SAM calibration



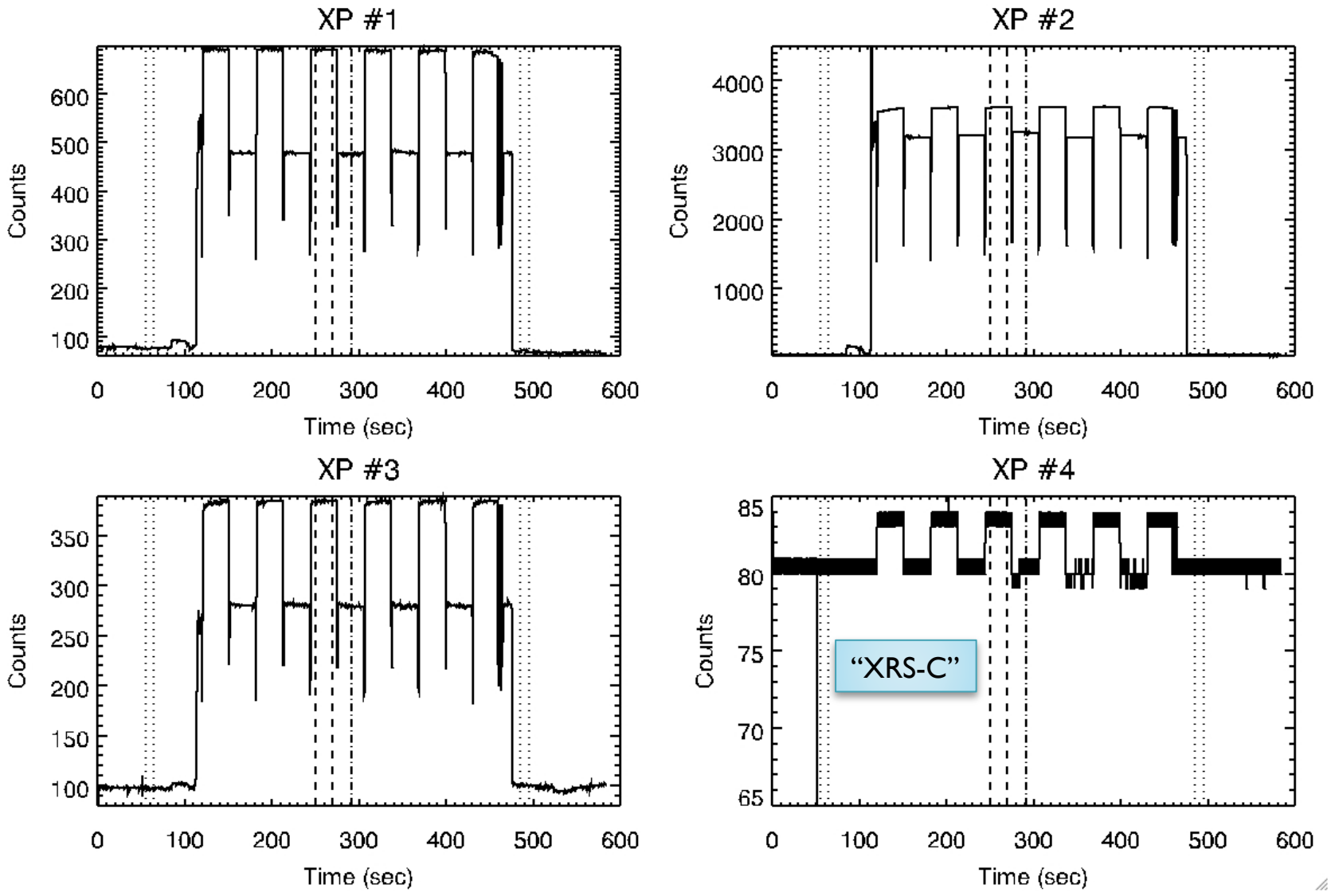
NASA 36.286: MEGS-P (H I Ly-α)

- MEGS-P has 2 channels with #2 being a dark diode



NASA 36.286: XPS (TIMED SEE)

- XPS has 12 channels (4 shown per slide)



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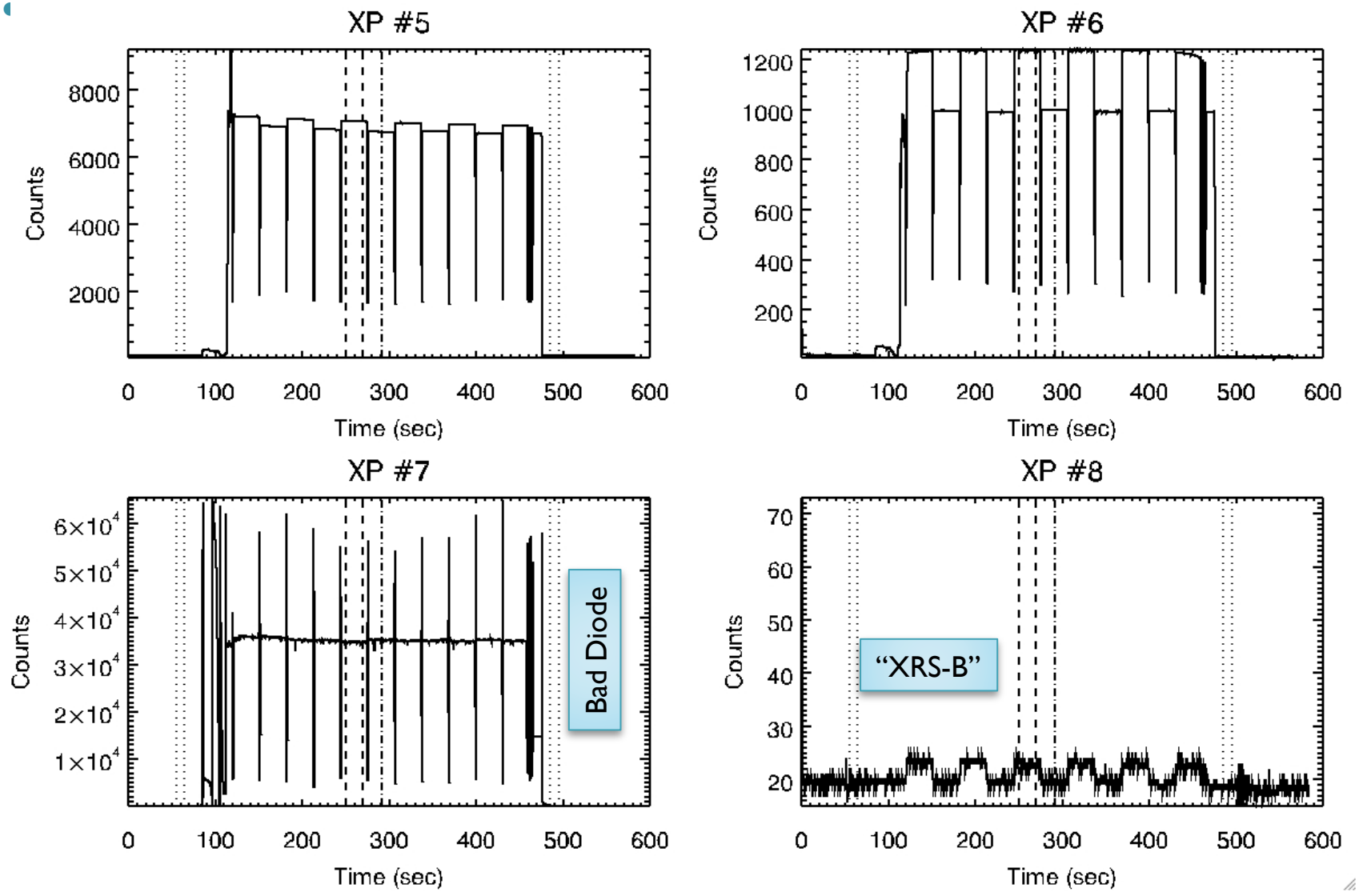

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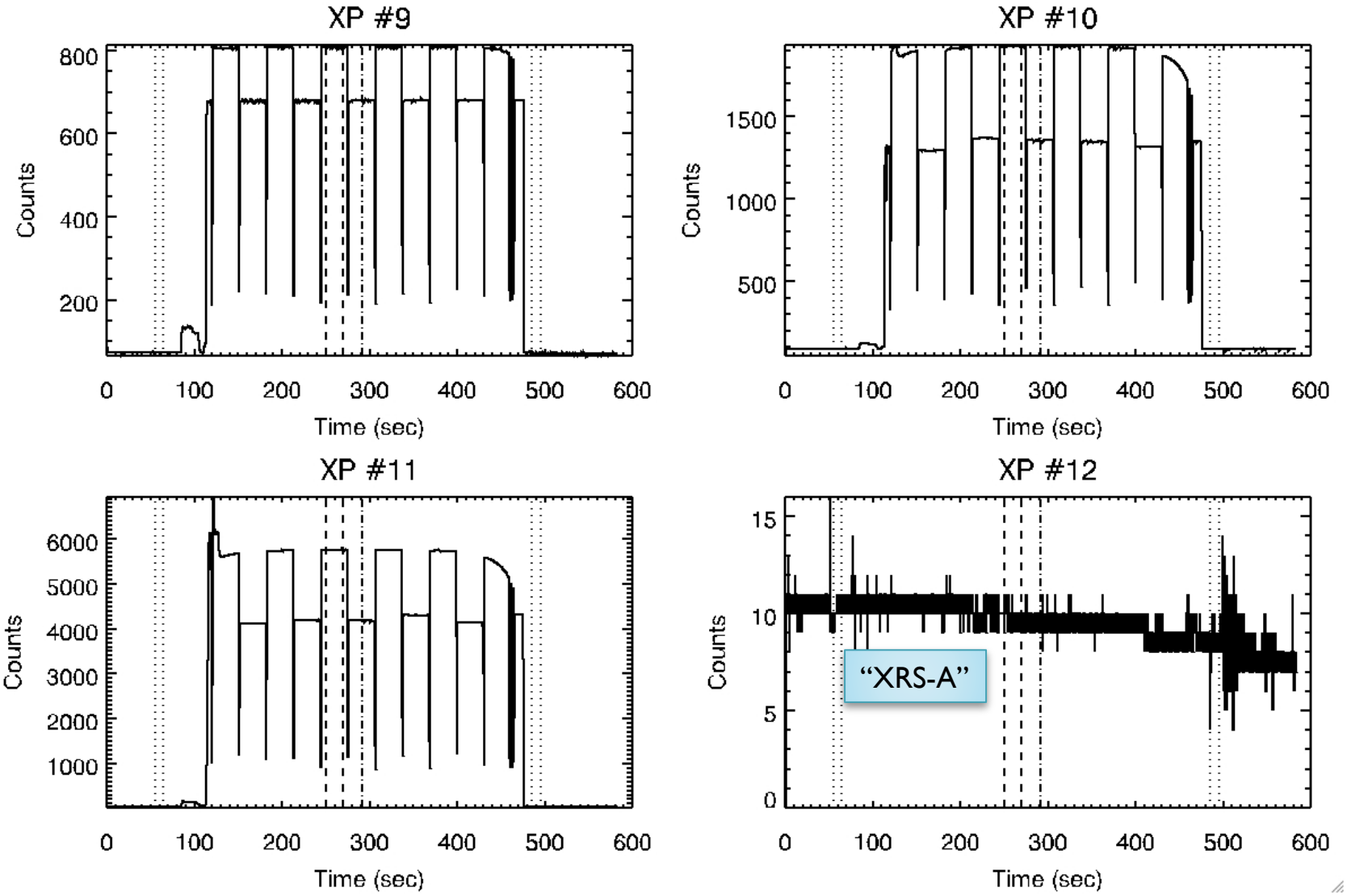
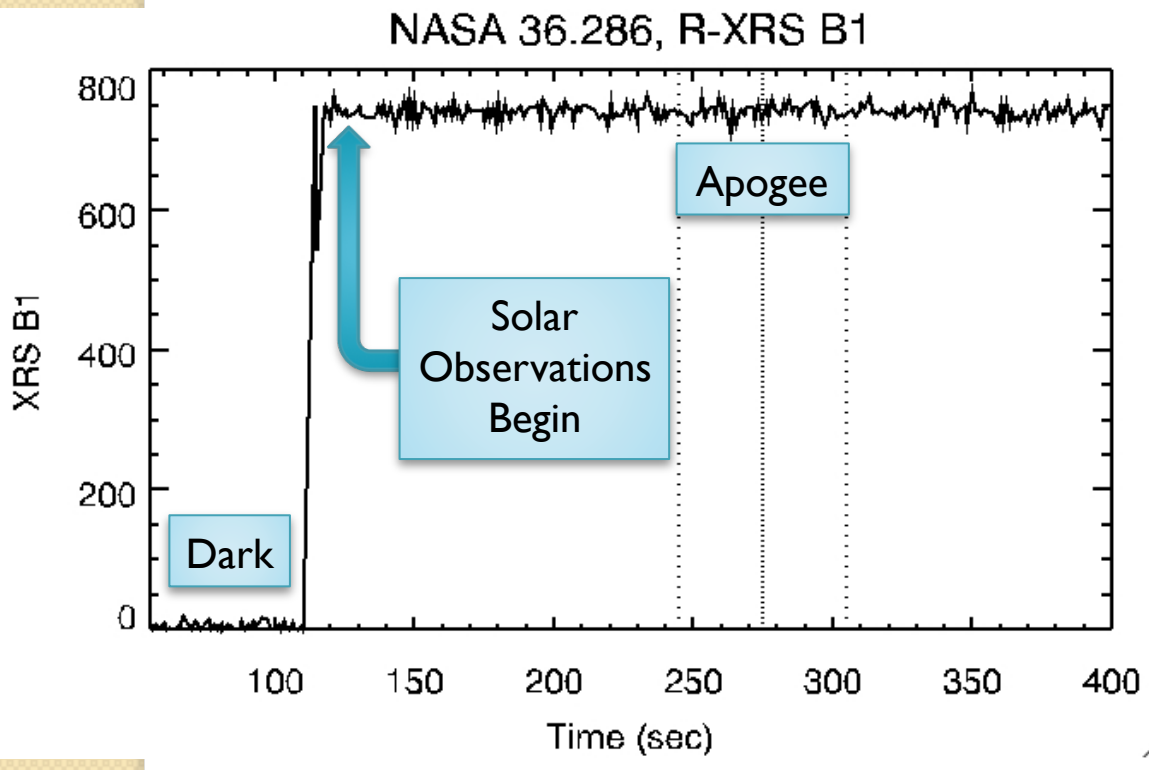
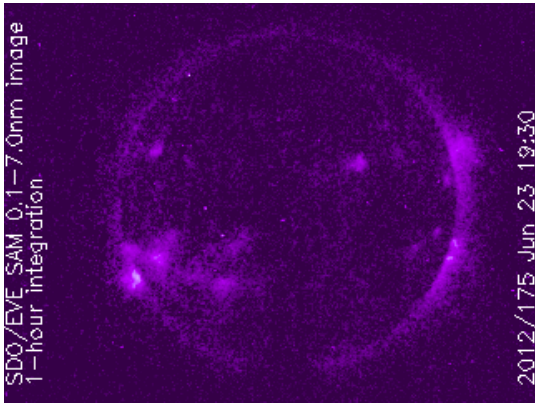


NASA 36.286: GOES-R XRS

- This was on day with very low solar activity, so signal is very low for XRS-A channels. XRS-B1 data are shown below.
- With X123 heating effect on XRS, there is need for correction of background signal with temperature (time)



This level is x2 more than 2010 but is x4 less than 2011



SDO SAM X-ray image indicates no major active region on June 23