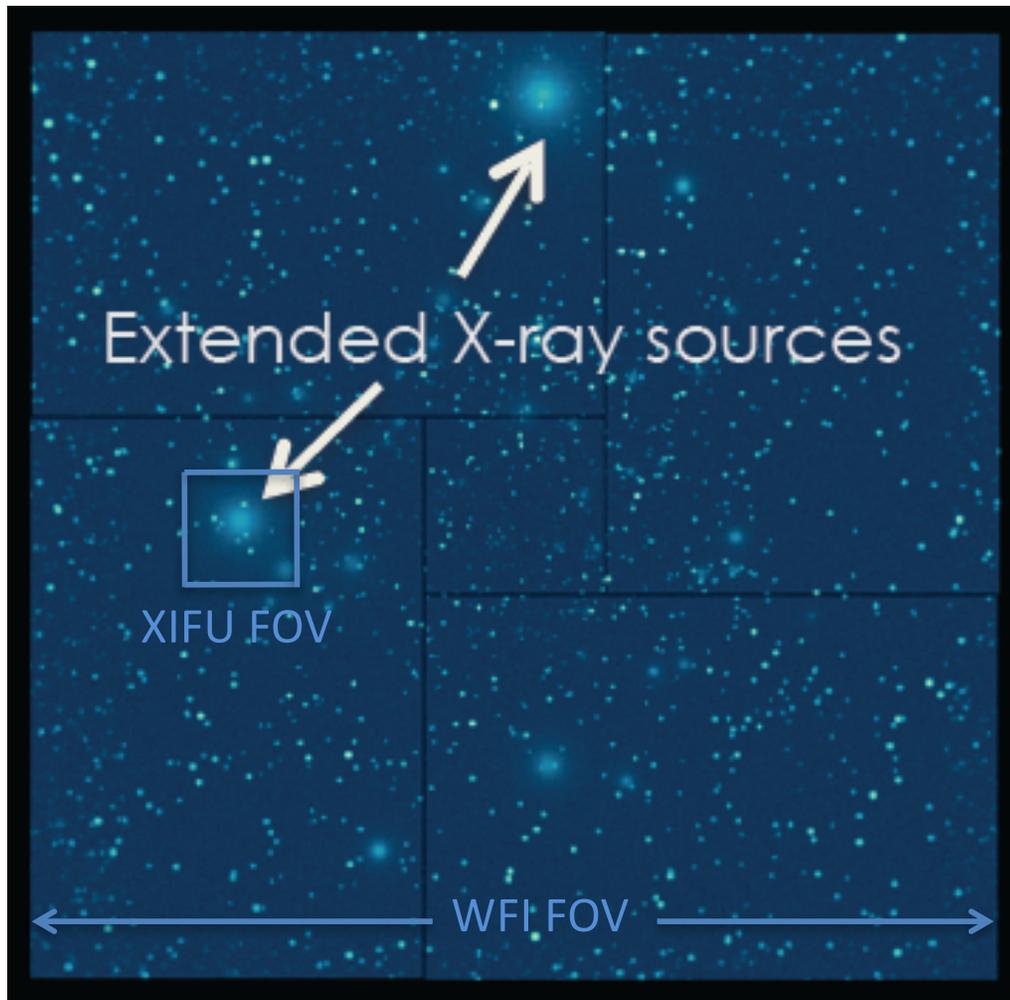# ATHENA WFI US Contributions

US SWG Co-Chairs meeting
January 5, 2017

PSU, MIT, SAO, Stanford/SLAC

WFI has unprecedented sensitivity to extended sources

- ATHENA will have ~30x Chandra's area and thus much better point source and surface-brightness sensitivity

- Very large FOV (40' x 40'), CCD-like energy resolution

- Probability of serendipitous detection of transient sources is not negligible

- Low and well-understood background is required to exploit this capability

US Contributions: Enhance science in 3 areas

1) Transient sources
    a) Analyze observing target for variability, provide feedback to instrument on whether the selecting observing mode is appropriate
    b) Search for serendipitous sources brighter than catalog fluxes
2) Clusters and other extended sources:
    a) Improve background determination through on-board analysis of all events.
        i. On-board event recognition rejects > 99.5% of background events, which are not telemetered to the ground
        ii. On-board background determination can improve knowledge of background level and variability
3) Provide critical mechanical and electronic support required for successful instrument design

US Contributions: 3-pronged approach

1) Science Products Module (SPM)
   a) Space-qualified processor board to perform ancillary analysis on on-board science data stream (PSU)   [TBD: Go/No Go decision will be made in 2019]
   b) SPM software
      i. Transient Analysis Module (PSU)
      ii. Background Analysis Module (MIT+SAO)
2) Front-end electronics ASIC design (Stanford/SLAC)
3) Primary WFI Mechanical Structure
   a) Interfaces being monitored by GSFC, design/fabrication TBD

WFI Block Diagram
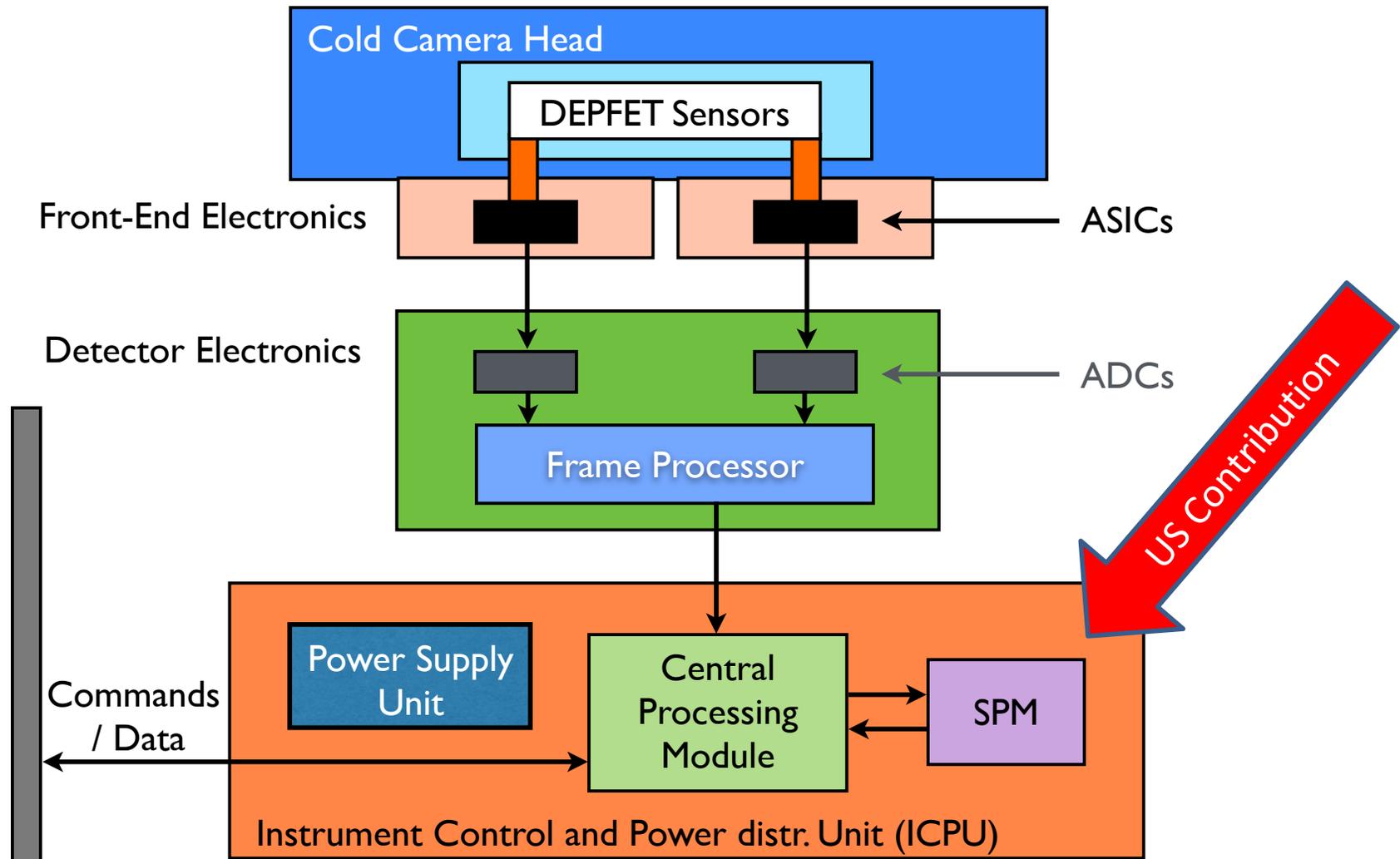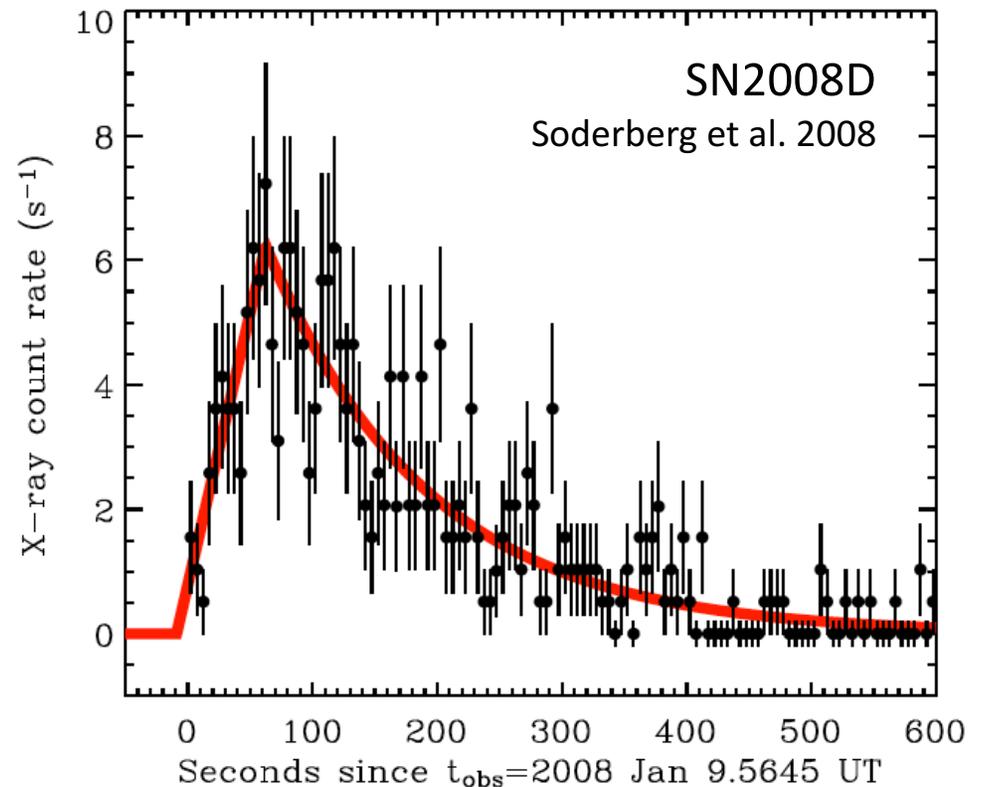
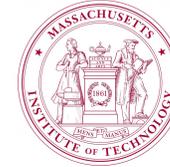# 1) Science Products Module Software

Transient Analysis Module

- Monitors central source for variability and pileup

- Searches for transient objects by comparing images to catalogs

- Will be able to find shock breakout events (like SN2008D), Tidal Disruption Events, and new LMXBs and HMXBs in Milky Way and nearby galaxies

- Info on transients will be sent to ground via HK telemetry for rapid processing


SN2008D
Soderberg et al. 2008

1) Science Products Module Software

Background Analysis Module

- Processes full data stream from detectors to measure instrument background on-orbit

- Onboard analysis has access to ~10x more raw background data than is telemetered to ground

- Produces high-level products including background spectra and spatial background maps

- Data products telemetered with normal science telemetry (not time-critical)
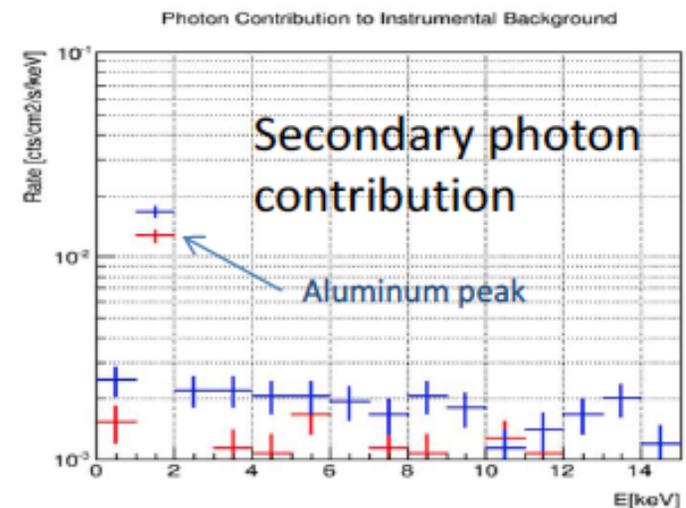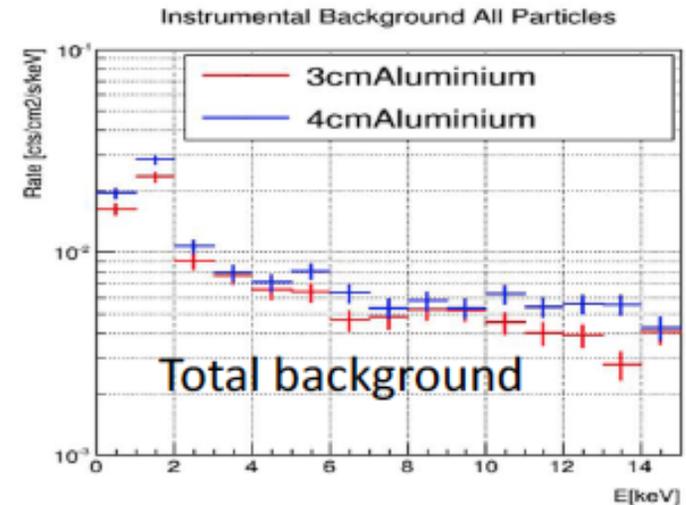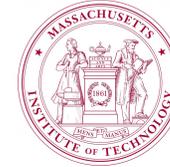
2) ASIC Design

- WFI requires extremely high speed readout at extremely low noise to enable black hole science goals
  - Performance of WFI depends critically on the ASICs that read it out
  - Noise levels must be < few electrons RMS
- MPE has requested support from SLAC to debug and refine the ASIC design