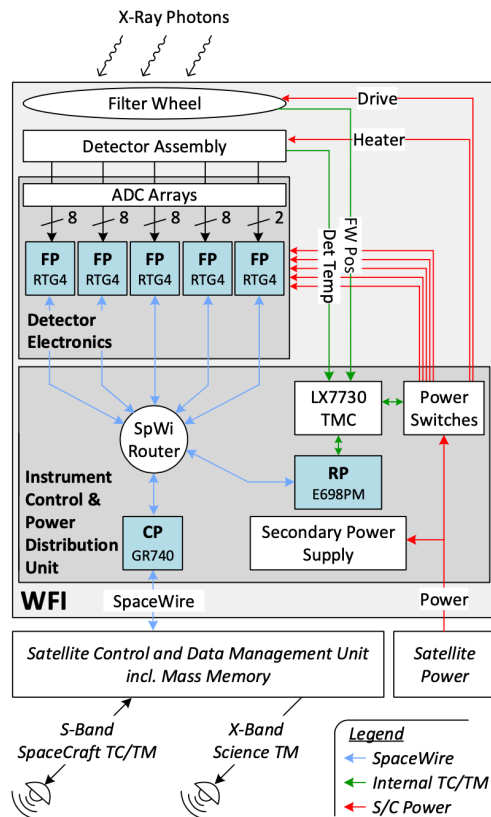# Distributed Control and Data Processing onboard *Athena* WFI

## Markus Plattner

([Max Planck Institute for extraterrestrial Physics](#)) on behalf of WFI electronics developers

*WFI instrument control and data processing architecture.*

The [Wide Field Imager (WFI)](#) is a camera with a detector based on five active pixel sensor matrices. Whenever one of these is hit by a ~0.2-15keV X-ray photon, an "event" is generated and energy, position and arrival time are assigned to it. In order to perform all the required data processing, the WFI utilizes a number of distributed processors in the two subsystems Detector Electronics (DE) and Instrument Control and Power Distribution Unit (ICPU).

Within the DE, the output data of the Detector Assembly is digitized with [Analog-to-Digital Converter (ADC)](#) arrays. This yields an overall data stream of up to 3.65 Gbit/s processed in parallel by five Frame Processors (FP) that are based on Microsemi RTG4 devices. These Flash-based FPGAs ([Field-Programmable Gate Arrays](#)) offer the resources high enough to process the entire data stream in real-time and are compliant to the L2 radiation environment. Pixel-wise data correction in the FP includes offset subtraction, common-mode correction and bad pixel flagging. The required correction values are stored in three 32 bit SSRAM memory components from Cobham, which are connected to each FPGA. Event detection and filtering is performed by the evaluation of energy thresholds and pattern recognition, including the identification of neighbouring events. Thereby, the data rates are reduced by three to four orders of magnitude, since only pixel values that contain event data are stored. The FP output is an event list, that includes all detected events together with their position (x and y pixel coordinate), measured photon energy and photon incidence time.

The functionality of the ICPU is divided into several modules. The [SpaceWire](#) Router combines the processed data streams and forwards the resulting data to the Central Processor (CP), a Cobham Gaisler GR740. A Remote Processor (RP), E698PM from OMC technology, combined with a [telemetry](#) controller LX7730 from Microsemi performs additional housekeeping and control tasks. Important tasks of the RP are detector temperature control, Filter Wheel positioning and DE power switching. The RP forwards all telemetry data to the CP. There, all science and telemetry data is combined, data compression is performed and all WFI data are forwarded to the satellite mass memory. Further, the ICPU connects WFI to the satellite power, generates all required bias voltages with its Secondary Power Supply, and receives and interprets all [tele-commands](#) from the Satellite Control and Data Management Unit.