

XSD/Detectors Group Strategy and FY2020 Goals

Strategy

The mission of the XSD Detectors Group is to deliver cutting-edge detectors to APS beamlines. Our mission is accomplished in two ways. First, we introduce new, cutting-edge commercial detectors to the APS community via the Detector Pool. We accelerate and facilitate early access to new detectors that come on the market. We also provide technical detector advisory services in a variety of ways (e.g., market research, design reviews, etc.) to assist beamlines with detector purchases and best detector practices. Second, we develop new, cutting-edge detectors which are unlikely to be commercially available. The group is engaged in a number of detector R&D projects to meet the future needs of the APS. These projects were chosen to align with the major scientific thrusts of the APS, take advantage of the source, leverage strategic partnerships with US domestic detector groups and leverage unique Argonne facilities. We focus our detector R&D efforts in three areas: pixel array detectors, high-energy sensors, and high-resolution emission detection. Currently, this includes the VIPIC detector for ultra-fast XPCS with BNL and FNAL and the MM-PAD detector with Cornell. For high-energy sensors, we are collaborating closely with the NSLS-2 detector group on the Germanium strip detector for high-energy spectroscopic applications. Finally, for emission detection, we are collaborating closely with NIST on transition edge sensors for high energy-resolution emission detection applications. At the APS, we are focused on developing application-specific TES sensors for hard X-ray applications. In particular, we are modelling, designing, fabricating and testing TES sensors optimized for XES, XRF, XAFS and Compton scattering experiments. Finally, we are exploring several new initiatives including refractive X-ray lenses using deep silicon etching, nano-calorimeters/bolometers for low temperature heat capacity sample measurements and X-ray detection and ASICs with on-chip compression.

Detector Pool Goals – FY2020

- Upgrade as many computers to RHEL 7 and Windows 10 as possible
- Deploy Jungfrau (PSI) and ePix10k (SALC) detectors
- Support detector/equipment loans from outside vendors (e.g., a-Se + CMOS imaging sensor SBIR project)
- Supporting cavity-based XFEL (CBXFEL) project with diagnostics detectors
- Supporting APS-U beamlines with detector advisory services

Detector R&D Goals – FY2020

- Superconducting Detectors
 - Commission and test 128-pixel TES array to 1-BM (LDRD-funded).
 - Continue to optimize new TES pixels for XRF, XES and XAFS applications
 - Continue to develop high-energy TES strip arrays for experiments up to 100 keV
- Germanium Strip Detector
 - Build the second high-energy GSD-192 system with radiation shield and getter

- MM-PAD v2.0
 - Complete development of the full-scale DAQ
 - Build the first complete detector system
- VIPIC
 - Assist with VIPIC pilot run chip testing
- New Initiatives
 - Continue to develop a prototype ASIC with on-chip compression with an aim to tapeout a chip in FY20
 - Continue development of refractive X-ray lenses using deep silicon etching
 - Explore the development of nano-calorimeters/bolometers for low temperature heat capacity sample measurements and X-ray detection