

The MPI Halbleiterlabor (semiconductor laboratory) is a joint research facility of the Max-Planck institutes for physics and for extraterrestrial physics. In an 800 m² clean room (Fig. 1) engineers and technicians produce silicon detectors for the research activities of the Max-Planck institutes, in particular for X-ray astronomy and high-energy physics. The MPI-scientists who develop and test those detectors have access to the latest measurement equipment within the same building.

The Halbleiterlabor is in the unique position to have a highly flexible production line, which can process ultra-pure, detector-grade silicon wafers on both surfaces. This technology – which has originally been developed for detectors in nuclear physics more than 20 years ago– is constantly being optimized and extended. These optimizations are aimed towards low noise performance (by minimizing leakage current and integrating electronics on-chip), low-energy response (by ultra-thin entrance windows) and large area devices (by introducing 6" technology, class 1 clean-room quality and extensive inspection-repair strategies). The various detector types produced with this technology are widely used, e.g.:

- onboard the X-ray satellite XMM-Newton (Fig. 2) and the solar observatory SOHO,
- in high energy physics experiments like the HERA-B experiment at DESY/Hamburg, ALEPH and the future ATLAS detector at CERN/Geneva (Fig. 3),
- in ultra-relativistic heavy ion physics experiment like CERES at the CERN SPS,
- for high-resolution high-rate spectroscopy at synchrotron light sources (ESRF/Grenoble, HASYLAB at DESY/Hamburg and the NSLS at Brookhaven National Laboratory, USA),
- for X-ray fluorescence analysis of works of art (Fig. 4, in cooperation with the Politecnico di Milano).

The activities of the MPI Halbleiterlabor also find interest in industry. In particular, commercial products based on silicon drift diodes have been successfully introduced as X-ray detectors for electron microprobe analysis in scanning electron microscopes.

Since the 1999 move to a new state-of-the-art clean room facility, the Halbleiterlabor focuses its activities on detectors for future space missions (ROSITA, XEUS) and high-energy experiments (TESLA). New (smaller pixel, faster readout) prototype CCDs for ROSITA have already been fabricated successfully. For XEUS and TESLA active pixel sensors are being developed (Fig. 5). High position resolution, radiation hardness, thinned material, fast readout and integrated amplification mechanisms are key items for this next detector generation.



Fig. 1: The Halbleiterlabor is located within the Siemens site in München-Neuperlach (Siemens Pressephoto).

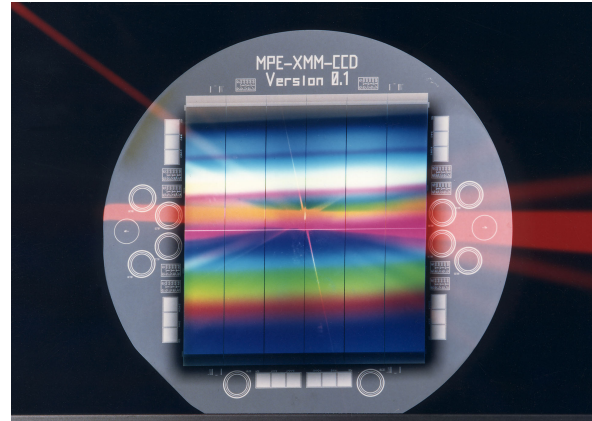


Fig. 2: CCD chip for the XMM-Newton X-ray camera.

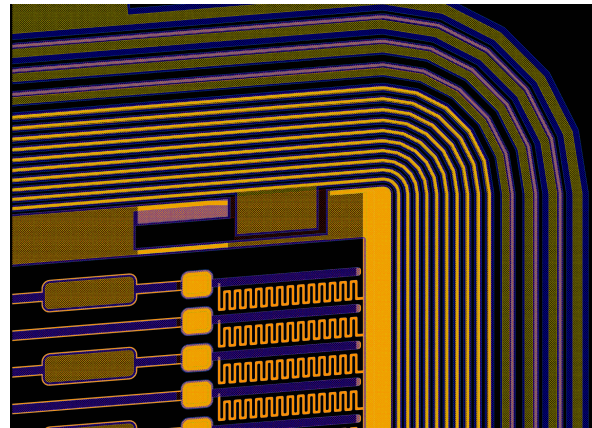


Fig. 3: Layout of an ATLAS strip etector.

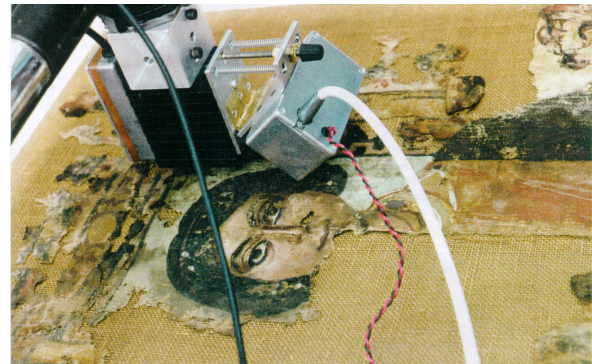


Fig. 4: XRF analysis of an old Egyptian shroud.

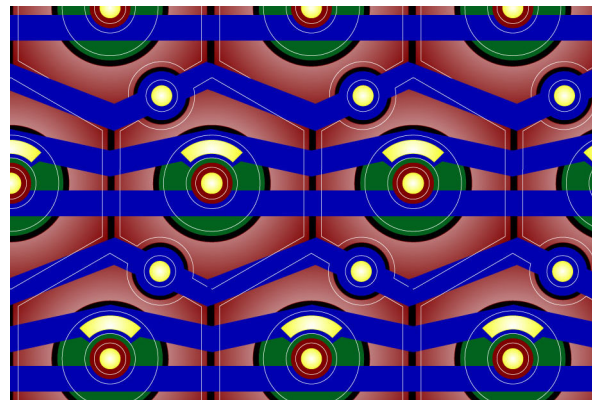


Fig. 5: Layout of a hexagonal active pixel matrix.