

THE NEW HIGH ENERGY MATERIALS SCIENCE BEAMLINE (HEMS) at PETRA III

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The future **High Energy Materials Science Beamline HEMS** at the new German high brilliance synchrotron radiation storage ring PETRA III will have a main energy around 100 keV, be fully tunable between 50 to 200 keV, and be optimized for sub-micrometer focusing with Compound Refractive Lenses and Kirkpatrick-Baez Multilayer mirrors. Design, construction, operation and main funding is the responsibility of the Research Center Geesthacht, GKSS. Approximately 70 p.c. of the beamtime will be dedicated to Materials Research, the rest reserved for general physics experiments covered by DESY, Hamburg.

The materials science activities will be threefold:

- Fundamental research will encompass metallurgy, physics and chemistry which are more and more merging. First experiments are planned for the investigation of the relation between macroscopic and micro-structural properties of polycrystalline materials, grain-grain-interactions, recrystallisation processes, and the development of new and smart materials or processes. For this purpose a dedicated 3D-microstructure-mapper will be designed.
- Applied research for manufacturing process optimization will benefit from the high flux in combination with ultra-fast detector systems allowing complex and highly dynamic *in-situ* studies of microstructural transformations, e.g. during welding processes (an *in-situ* friction stir welding device for measurements with synchrotron radiation has been designed at GKSS). The beamline infrastructure will allow accommodation of large user provided equipment.
- Experiments targeting the industrial user community will be based on well established techniques with standardised evaluation, allowing full service measurements. Environments for strain mapping on large structural components up to 1 t will be provided as well as automated investigations of large numbers of samples, e.g. for tomography and texture determination.

The current design for the beamline consists of a nearly five meter in-vacuum undulator source optimized for high energies, a general optics hutch, an in-house test facility and three independent experimental hutches working alternately, plus additional set-up and storage space for long-term experiments. HEMS should be operational in late spring 2009 as one of the first beamlines running at PETRA III.