GEMS – German Engineering Materials Science Centre

- Beam time is allocated via a proposal procedure.
- The introduction to the instrument, the supervision during the experiment and help during the data analysis are provided by the instrument scientist.
- Requests for beam time can be submitted at http://gems.hzg.de
- Combined synchrotron and neutron proposals are possible
- Travel expenses are available to groups from universities and public research institutions
- Commercial service for industry:
  - Characterisation of structural and functional materials
  - Quality assessment, damage analysis, product optimisation
  - Test beamtime for industry supported by EU (projects SINE 2020 and Baltic TRAM)

About Helmholtz-Zentrum Geesthacht

A total of about 850 employees are involved in coastal and materials research at the Helmholtz-Zentrum Geesthacht. In line with the slogan "Science creates benefits", the employees are studying future storm surges and the coastal environment. The new materials and welding methods that the researchers create are making cars and planes lighter, and that in turn helps to save fuel and conserve the environment.

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The Helmholtz Centre Geesthacht has bundled its activities in the field of synchrotron radiation and neutrons at the „German Engineering Materials Science Centre“ GEMS. GEMS is part of the Materials Physics Division of the Institute of Materials Research. It is the user platform which provides external users with unique research instruments for their materials research with a strong focus on challenging in-situ experiments.

The instruments at GEMS are available for the use of research scientists and engineers from universities, research institutes and industry. The synchrotron radiation instruments are operated at the synchrotron ring PETRA III which is located at the HZG outstation at Deutsches Elektronen Synchrotron DESY in Hamburg.

The instruments using neutrons are located at the HZG outstation at the research reactor FRM II in Garching near Munich and are partially operated together with the Technical University Munich.

Instrumentation at the X-ray source PETRA III:

**HEMS**
The High Energy Materials Science Beamline HEMS uses its particularly high energy X-rays to penetrate deeply into materials. Due to the high photon flux in-situ experiments can be performed. Research scientists illuminate entire car engines with the HEMS instrument, for example. HEMS offers the possibility of tomography and diffraction (texture, strain).

**IBL**
The Imaging Beamline IBL takes particularly high resolution images which are very rich in detail. The resolution of the images goes right down to the nanometer level. However, the samples cannot be penetrated quite as deeply as with the HEMS-Beamline. For example, micro and nanotomography images can show medical doctors in fine detail how implants have become connected to tissue.

**Nanofocus Endstation**
The Nanofocus Endstation of the DESY beamline P03 (MINAXS) provides conditions for scanning X-ray nanodiffraction (SXND) for materials science, even in extended in situ sample environments, with a beam size of 250 nm and an energy in the range 8 - 23 keV. In addition control for pressure, E/B fields, temperature, fluid shear, tension or indentation force is available.

Instrumentation at the neutron source MLZ/FRM II:

**REFSANS**
The horizontal reflectometer REFSANS has been designed to enable specular reflectometry as well as grazing incidence neutron scattering studies of the interfaces of solids and liquids.

**SANS-1**
SANS-1 is dedicated to the small-angle scattering technique. Measurements with very high neutron flux are possible at this instrument e.g. of large or thick samples on the nanometer scale.

**STRESS-SPEC**
The STRESS-SPEC diffractometer measures the mechanical tensions and texture properties of materials - in particular in large steel components which cannot be penetrated by X-rays.