# VA 1: Vacuum systems and monochromators at XFEL and PETRA

Time: Monday 10:00–12:00 Location: H 0106

**Invited Talk** VA 1.1 Mon 10:00 H 0106

**The vacuum systems for the European X-ray free electron laser project XFEL** — •Kirsten Zapfe — Deutsches Elektronen-Synchrotron DESY, Notkestrasse 85, D-22607 Hamburg

The European X-Ray Free Electron Laser XFEL, a new international research facility, will be build in close connection with DESY/Hamburg. The XFEL will generate extremely brilliant and ultra short pulses of X-rays with tunable wavelengths down to 0.1 nm, and exploit them for revolutionary scientific experiments at various disciplines. Therefore electron bunches are brought to high energy of about 20 GeV through a superconducting linear accelerator, and conveyed to up to 250 m long undulators where the X-ray pulses are generated by SASE (Self-Amplified Spontaneous Emission).

The beam vacuum system of the XFEL will operate at temperatures of a few K in the areas of the superconducting accelerating structures, thus requiring an insulating vacuum system. In addition to standard UHV requirements the vacuum system for this facility needs to preserve the cleanliness of the superconducting cavity surfaces, which are prepared with procedures similar to semiconductor industry. Thus the preparation of all vacuum components for the 1.6 km long main linac includes cleaning of the components in a clean room to remove particles, installation into the machine under local clean rooms and special procedures for pump down and venting. In the room temperature vacuum system the requirements to the aluminium vacuum chambers of the 700 m long undulators are challenging with respect to very low surface roughness and thickness of oxide layers.

VA 1.2 Mon 10:40 H 0106

**Simulations of the pressure profile in the Petra III frontends** — •Christian Amann, Ulrich Hahn, Mathias Hesse, and Horst Schulte-Schrepping — Deutsches Elektronen Synchrotron DESY, Hamburg, Germany

Petra III will be a high brilliance, small emittance, third generation synchrotron radiation source. The undulators will deliver photon beams with small cross sections and therefore the components in the frontend will be as compact as feasible. The resulting narrow cross sections of the vacuum system will yield a small conductivity in the whole beamline. The design of the frontends is now at an advanced state so that the initial design of the vacuum system has to be revised. The vacuum specification demands for a hydrocarbon and dust free vacuum system. To provide this, the beamline will be initially pumped down with a dry pumping station to a pressure of 10-6mbar. After reaching this pressure, the pumping station will be switched off and a set of ion getter pumps will pump the beamline continuously. To protect the ion getter pumps, it is necessary that during operation the pressure in the pumps will be below 10-6mbar. The simulation shows that especially at the high power slit systems and during the start of operation, a high amount of gas will be photodesorbed. To cope with this, additional pumps will be installed in the frontends as compared to the first design step. To control the pressure inside some beamline components an optional pressure control system is also introduced. The simulations of the pressure profileswere done with a Monte Carlo simulation program (Molflow developed by R. Kersevan / ESRF).

VA 1.3 Mon 11:00 H 0106

**The vacuum interlock system for the PETRA III beamlines** — •Markus Degenhardt, Ulrich Hahn, Mathias Hesse, and Horst Schulte-Schrepping — Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany

The storage ring PETRA at DESY in Hamburg is being reconstructed into the third generation source for synchrotron radiation, PETRA III. The up to 100 m long beamlines are large UHV-systems that guide the synchrotron radiation from the storage ring to the experiments. Each beamline will be equipped with a vacuum interlock system to ensure the safe operation of the vacuum components. In particular the task of the vacuum interlock is to prevent faulty operations that can cause a ventilation of the vacuum system or a damage of vacuum components by the high power synchrotron radiation beam.

The interlock system will be implemented as a PLC that is connected to a distributed input/output layer via a field bus system. As a specialty, the PLC will be realised as a soft-PLC running on a PC with a real time windows operating system. Another specialty is the visualisation and remote control of the vacuum interlock system by means of a website. At the beamline the interlock will be operated via a touch panel that displays the visualisation website. Additionally, the interlock can be remotely operated from any location by opening the visualisation website with a browser. The interlock is protected against unauthorised operation by a login page. All relevant interlock data will be fed into the existing network-based archive system.

VA 1.4 Mon 11:20 H 0106

**Tests on a prototype high heat load monochromator for PETRA III** — •Hans-Christian Wille[1,2], Jan Horbach[1], Ralf Roehlsberger[1], Ulrich Hahn[1], Horst Schulte-Schrepping[1], Carsten Detlefs[2], and Thomas Roth[2] — [1]Hamburger Synchrotronstrahlungslabor, D-22607 Hamburg, Germany — [2]European Synchrotron Radiation Facility, F-38043 Grenoble Cedex, France

We report on tests of a prototype high heat load monochromator for the PETRA III synchrotron radiation source under construction at the Hamburger Synchrotronstrahlungslabor (HASYLAB) which will be operational in 2009. The tests have been carried out at the European Synchrotron Radiation Facility (ESRF) on the beamline ID06 which is partly dedicated to tests of x-ray optical elements for 3rd generation synchroton radiation sources within the framework of a cooperation of HASYLAB and the ESRF. First tests started in October 2007 and focussed on the (mechanical) stability and the behaviour under high heat load of the monochromator.

VA 1.5 Mon 11:40 H 0106

**Design eines Large Offset Monochromators für PETRA III** — Markus Degenhardt, Ulrich Hahn, •Jan Horbach und Horst Schulte-Schrepping — Deutsches Elektronensynchrotron, Hamburg

Für die neue Synchrotronstrahlungsquelle PETRA III ist die Entwicklung verschiedener Monochromatoren mit spezifischen Eigenschaften notwendig. Um eine kompakte Anordnung der Strahlführungen in der Experimentehalle zu realisieren, wurde ein Large Offset Monochromator (LOM) konzipiert, der es erlaubt, den Synchrotronstrahl um 1,25 m in der Höhe zu versetzen. Hierdurch können zwei Experimente übereinander angeordnet werden. Auf Grund des großen vertikalen Versatzes des Strahls und einem angestrebten Energiebereich von 5 bis 29 keV sind für die Kristalle zwei getrennte Linearbewegungen über jeweils 1,5 m notwendig. Eine weitere Anforderung ist es, die Energie des Strahls in Schritten von etwa 10 meV variieren zu können und eine schmale Energiebreite des Bragg-Reflexes zu erreichen. Dies ist für hochauflösende Röntgenbeugungsexperimente notwendig. Die zur Realisierung notwendigen Komponenten und Konzepte werden in diesem Beitrag vorgestellt. Ein Stabilisierungssystem unter Verwendung von Piezoaktoren erlaubt es, die Ablage des Strahls am Experiment auf 10 $\mu$m genau festzulegen. Der LOM ist als Hochvakuumsystem ausgelegt. Eine möglichst geringe Konzentration von Kohlenwasserstoffen wird angestrebt, um eine Kontamination der optischen Flächen zu verhindern. Um den Synchrotronstrahl durch Positionsmonitore nicht unnötig abzuschwächen, kommt ein Lasersystem zum Einsatz, welches Lage- und Winkelabweichungen der Kristalle detektiert.