Status Report on the Alignment Efforts @ DESY

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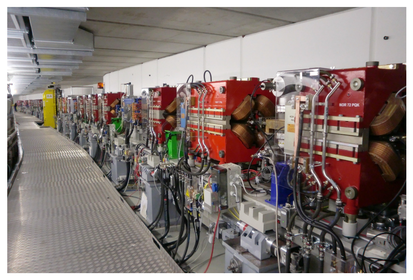
Upgrade to PETRA III finished

The new PETRA III experimental hall

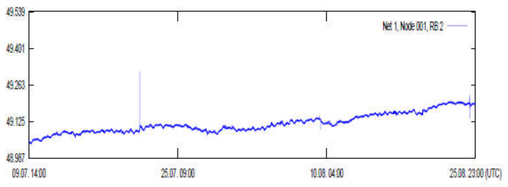


Different views of the tunnel-area in the PETRA III hall

After less than two years of shutdown the first positron beam was stored in the 2.3-kilometres long synchrotron source PETRA III on April 13th 2009. On July 17th the first monochromatic X-rays were observed in beamline P09. PETRA III has commenced user operation in October 2009 for selected beamlines. During this time we aligned 4085 machine components of PETRA III with an accuracy of 0.3mm about 100m.

HLS

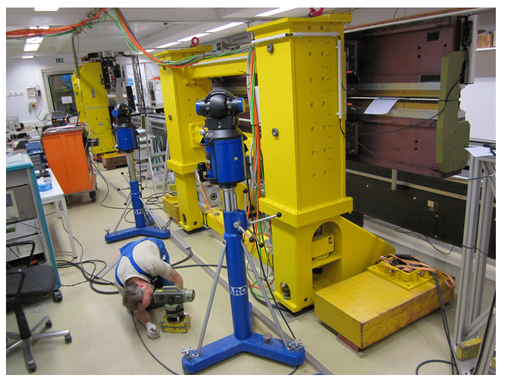
HLS system between two girders



Example data of one sensor

In the new PETRAIII hall a hydrostatic leveling system (HLS) for monitoring the vertical level of accelerator components was installed. 146 monitoring stations send data permanently. This information is available online. It works since summer 2010.

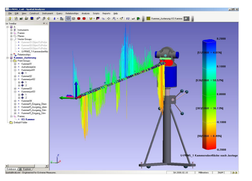
Undulators



Fiducialisation of an undulator

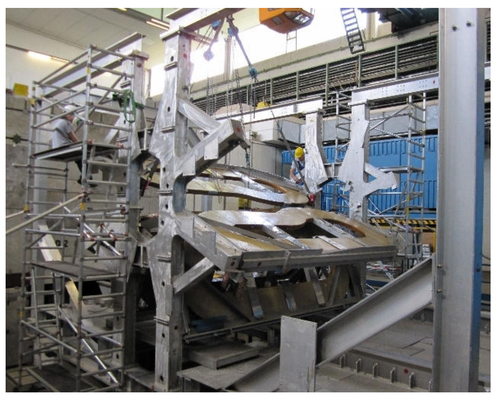
At this time there are 15 undulators assembled in FLASH and PETRA III. With XFEL it will become more then hundred.
Under operation conditions there is 0,2 mm distance between the magnets of an undulator and the vacuum camber, which has only 0,7 mm thickness in this area.
To ensure the required accuracy of 0,1mm, we will optimise the scanning of the undulator gap.

Slide for the gap



Camber adjustment

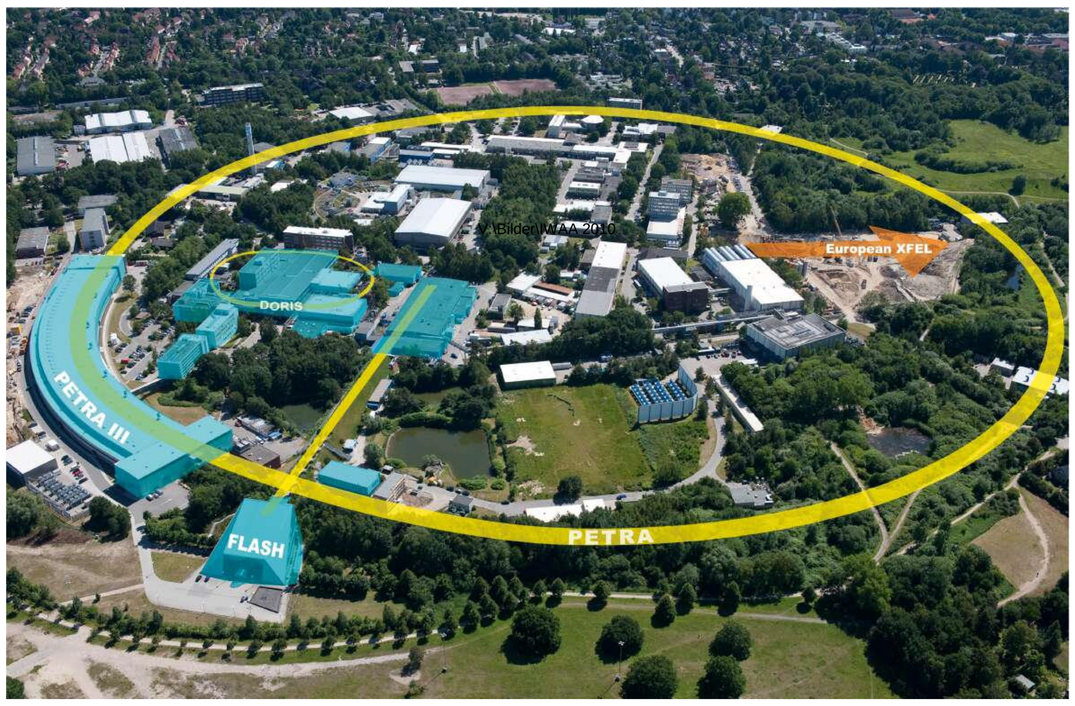
OLYMPUS a new Experiment at DORIS



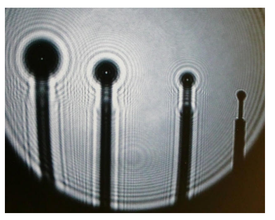
Current we align the components of the new OLYMPUS – experiment. OLYMPUS is an abbreviation of p**O**sitron-proton and e**L**ectron-proton elastic scattering to test the h**Y**pothesis of **M**ulti-**P**hoton exchange **U**sing **D**ORIS. It is not a new development but for the most part consists of the BLAST-detector, which was used in 2002 to 2005 at the Bates accelerator at MIT (Massachusetts Institute of Technology).

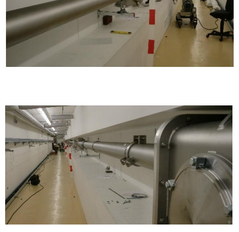
Accelerators at DESY

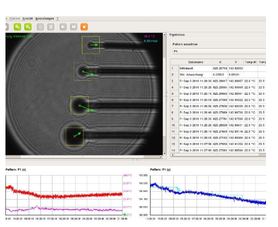
DORIS, FLASH, PETRA III and XFEL (from 2015)



Straight Line Reference System (SLRS)







Prototype

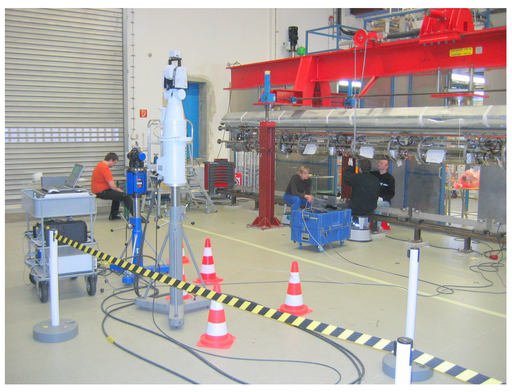
Software screenshot

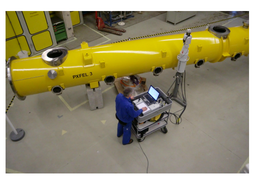
We built a prototype of the Straight Line Reference System (SLRS) at a length of 48 meters that is based on the Poisson alignment principle. In future the SLRS is a part of the alignment system of the XFEL. With this prototype different tests has been carried out. These included, inter alia, tests to sensibility, accuracy, stability and temperature dependency. In this context we developed a new analysis software.

FLASH

FLASH, the world's first X-ray free-electron laser is available to the photon science user community for experiments since 2005. Last winter, the facility underwent a major upgrade. The accelerator was equipped with a seventh superconducting accelerator modules to increase the maximum electron energy to 1.2 Giga-electronvolts (GeV). Moreover, a special 3.9-GHz module was installed to improve the quality of the accelerated electron bunches. We aligned 441 machine components in the 260-meter-long facility. We changed our FLASH-measurment-concept in this shutdown. Also we use the Lasertracker for our alignment in the FLASH-facility.

Modules

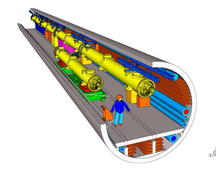




Intake controll and adjustment of the PXFEL-module parts

The two PXFEL prototypes from Spain and China were checked in detail. After the adjustment they work in position ACC6 and ACC7 of FLASH. The fiducialisation of the cavities was optimised.
The adustment and fiducialisation of the 3,9 GHz-modul for FLASH was made in cooperation with our colleagues from Fermilab. This module works well since May.

XFEL



The XFEL will generate extremely intense, ultra-short pulses of laser light in the X-ray range at wavelengths substantially shorter than even the radiation generated by the FLASH facility at DESY. The 3.4-kilometre-long facility, which is currently under construction, extends from DESY in Hamburg to the Schleswig-Holstein town of Schenefeld in the Pinneberg district. The start of commissioning is scheduled for 2014. Until now our work amounted to creating a survey network, several monitoring surveys, setting-out formworks, adjustments for the XFEL mock-up.

HELMHOLTZ ASSOCIATION