CAMP - A New Endstation for Simultaneous Detection of Photons and Charged Particles in Free Electron Lasers Experiments

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Synopsis We have designed a multi-purpose experimental chamber especially adapted to accommodate unique large-area, single-photon counting pnCCD detectors, developed by the Max Planck Institute Semiconductor Laboratory, together with advanced many-particle ion and electron imaging spectrometers (reaction microscope, REMI; velocity map imaging, VMI) for simultaneous detection of scattered and fluorescent photons and charged particles in experiments at Free Electron Lasers.

The CFEL-ASG Multi-Purpose (CAMP) endstation, designed by the Max Planck Advanced Study Group (ASG) at CFEL, is dedicated to explore the interaction of intense VUV and soft x-ray radiation from Free Electron Lasers (FELs) with various targets of increasing complexity and size, ranging from atoms and (laser-aligned) molecules to nano-particles such as clusters and biological targets. It is equipped with two large-area (78 x 74 mm^2), single-photon counting 1 Megapixel pnCCD detectors (75 x 75 μm^2 pixel size), which collect scattered or fluorescent photons with high quantum efficiency and an energy resolution of 40 to 200 eV between <100 eV and 25 keV at a frame read-out rate up to 200 Hz [1]. A variable-sized hole in the center of the first CCD allows the direct FEL beam to pass through the detector, while the small-angle scattering signal passing through the hole can be detected on the second CCD.

Specially-designed ion and electron spectrometers of the VMI [2] or REMI [3]-type detect ions and electrons with a large solid angle and allow measuring their kinetic energies and emission directions, while providing an unrestricted line of sight from the interaction region to the pnCCD detectors. This unique combination of large-area, single-photon counting pnCCD detectors and charged particle spectrometers thus allows measuring fluorescent or scattered photons in coincidence with ions and electrons.

First experiments planned at LCLS in Stanford in fall 2009 will briefly be presented.

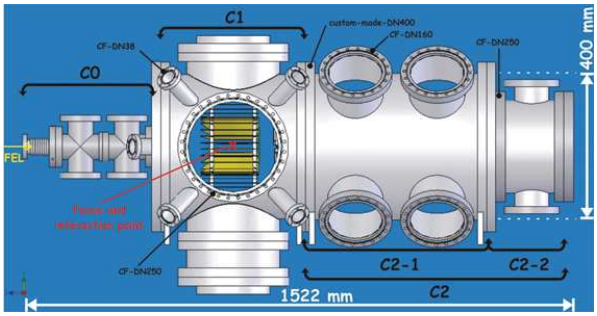

Fig. 1. Side-view of the CAMP chamber consisting of a differential pumping unit (C0), reaction chamber (C1), and pnCCD-detector chamber (C2).

References

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