

GFA & SwissFEL Accelerator Seminar

Recently research progress on Thomson scattering X-ray source at Tsinghua University

Tuesday, 4 October 2016 , 16.00 h, WBGB/019

Yingchao Du, Lixin Yan

Accelerator laboratory, Department of engineering physics, Tsinghua University, Beijing, China

Tsinghua Thomson Scattering X-ray Source (TTX) is the first-of-its-kind dedicated hard X-ray source in China based on the Thomson scattering between a Terawatt ultrashort laser and relativistic electron beams. Many improvements have been performed at the facility during the last three years since 2013, including developing a new separated Ti:Sapphire laser system for collision, 100-fs timing system, photocathode RF gun to produce better electron beams and many beam diagnostic methods. The measured photon yield at ~ 50 keV is $2 \cdot 10^7$ per pulse. The angular intensity, distribution and energy spectra of the scattered X-rays are measured by the silicon attenuators and Bragg diffraction in Highly Oriented Pyrolytic Graphite (HOPG) crystal. The results of the two methods both agree well with the theory predictions.

The scattered x-rays are partial coherent, due to the very small beam size (~ 5 μm , theoretical value), which meets the requirement of phase contrast imaging (PCI). A series of samples like shrimp, fish, and peanut are imaged using TTX, and both absorption image and phase contrast images at different imaging distances of the same sample are taken. The interfaces between different materials in the samples are enhanced as the imaging distance increases. Because of this characteristic the test of peanut, which can't be distinguished from cotyledon under its absorption image, can be seen clearly under its phase-contrast image, making interface diagnostics of low-Z materials possible. Besides, the tomography technique is also performed with the generated X-rays, and the 3-dimension structure of peanuts are reconstructed.

Contact Th. Schietinger, 3274

