Accelerator Systems Division

Seminar Announcement

Title: Design and Testing of a Novel Pink Beam Stop for the Dynamic Compression Sector Beamline

Presenter: Jeff T. Collins, APS/AES

Date: Wednesday, January 14, 2015

Time: 11:00 a.m.

Location: Conf. Rm. A1100

Abstract

The Dynamic Compression Sector (DCS) beamline at the Advanced Photon Source (APS) will be capable of providing high power, highly focused pink beam to the user. This presents the significant engineering challenge of stopping continuous beam in all missteering cases in order to protect the downstream lead shielding as part of the personnel protection system (PSS). Under the worst-case condition, the device must stop pink beam in an area of 229 mm x 305 mm with a total power of 169 W and a peak heat flux of 105 kW/mm2. Although the total power is relatively low, the power density is high. In this case, the use of a conventional grazing-incidence Glidcop® beam stop is impractical without exceeding the maximum temperature requirement of 300°C, or increasing the length of the device to several meters. A simple, compact design is presented that utilizes an enclosed pressurized gas volume sealed with an O-ring and a normal-incidence 6.35 mm thick sacrificial copper beam-strike plate. Redundant pressure sensors detect beam presence by a slight rise in gas pressure, and a breach in the beam-strike plate is detected by a drop in gas pressure. An extensive testing program was conducted on a pink beam stop prototype using a 400 W laser with a focusing head to simulate the worst-case DCS beam condition. The results of the experiments show that under the conditions tested, the penetration depth of the beam is much less than the thickness of the 6.35 mm beam-strike plate. It was also determined that if a breach in the beam-strike plate were to occur, it could be positively identified, triggering the closing of the front end photon shutter. The device was reviewed and accepted by the APS beamline safety design review steering committee (BSDRSC), and four pink beam stop assemblies have been installed at the DCS beamline.