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Estimating the flux distribution for a synchrotron X-ray beam using absolute ionisation-chamber measurements with various filters

It is shown that an extensive set of absolute ionisation-chamber (IC) measurements with a primary polychromatic synchrotron X-ray beam and various filter combinations/ thicknesses can be used to quite effectively estimate the flux distribution. The basic technique is simple but the “inversion” of the raw data to extract the flux distribution is fundamentally ill-posed. We demonstrate, using data collected at the Imaging & Medical Beamline (IMBL) of the Australian Synchrotron, that the absolute flux can be quickly and reliably estimated if a suitable choice of filters is made. Results are presented as a function of the magnetic field (from 1.40 to 4.00 T) in the superconducting multi-pole wiggler (SCMPW) insertion device installed at IMBL. A non-linear least squares refinement of the data is used to estimate the incident flux distribution and then comparison is made with calculations from the programs “SPECTRA” (Tanaka & Kitamura, 2001, 2007), “XOP” (Sánchez del Río & Dejus, 2011) and “spec.exe” (Stevenson et al., 2016).

The technique described is important not only in estimating flux itself, but also for a variety of other X-ray properties such beam quality, power density and absorbed-dose rate.

Keywords or phrases (comma separated)

Are you a student?

No

Do you wish to take part in the Student Poster Slam?

No

Are you an ECR? (<5 yrs since PhD/Masters)

No

What is your gender?

Male

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Track Classification : Technique Development