Segmented Adaptive Gap Undulator for Inelastic X-ray Scattering Beamlines

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Segmented Adaptive Gap Undulator (SAGU), in which different segments have different gaps and periods (see fig. 1), promises a considerable spectral performance gain over a conventional undulator with constant gap and period over its length. According to calculations (see fig. 2), this gain can be comparable to the gain due to the use of a superior undulator technology (e.g. a room-temperature in-vacuum hybrid SAGU would perform as a cryo-cooled hybrid in-vacuum undulator with uniform gap and period). SAGUs are particularly attractive for IXS beamlines, that typically don't require frequent changes of photon energy / undulator gaps in segments. Besides the calculation results, progress on construction of an SAGU prototype at NSLS-II will be reported.

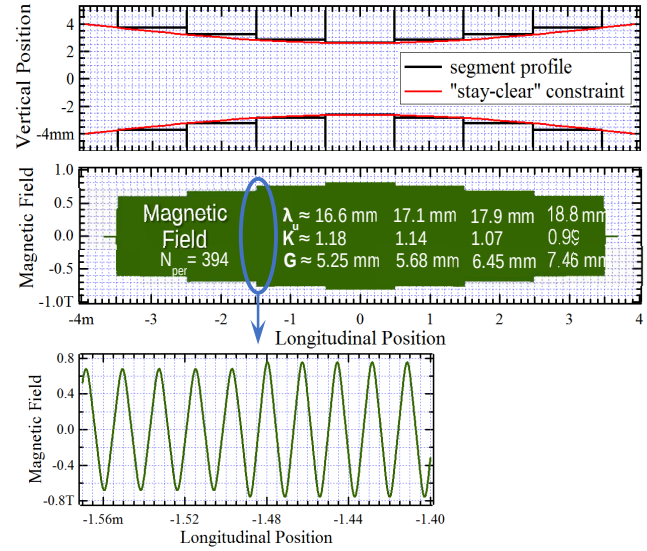

Figure 1: Electron beam vertical "stay-clear" constraint and the corresponding SAGU structure (upper and middle graphs), and the magnetic field in the region of a segment junction (bottom graph). Tentative parameters of a room-temperature hybrid permanent-magnet SAGU for IXS beamline are shown in the middle graph.

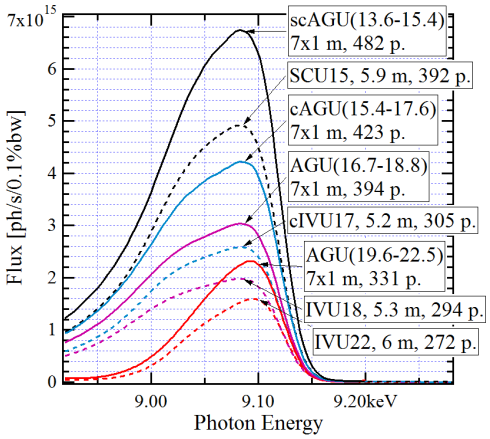

Figure 2: Calculated undulator radiation spectra in the vicinity of 9.1 keV photon energy, for constant-period undulators of different technologies (dashed curves): room-temperature hybrid (red and magenta), cryo-cooled (blue), and superconducting (black), optimized for producing maximal flux at that photon energy, and their corresponding SAGU versions (solid curves).