

Comparison of brightness tuning curves of undulators at the APS and the NSLS-II storage rings

Rev. 4: Added Figure 2 with tuning curves for the U3.0-cm-period device.

Rev. 5: Added Figure 3 with APS tuning curves for 200 mA beam current.

Rev. 6: Changed y-axis labels from “On-Axis Brilliance” to “Brightness” for all figures and in the text. Added Figure 4 with APS tuning curves for 200 mA beam current and longer IDs ($L=4.8$ for permanent magnet devices, and $L=3.8$ m for SCU).

The brightness tuning curves for representative undulators at the APS and the NSLS-II are shown in Figs. 1 – 4. Please notice that brightness reductions due to magnetic field errors were applied (estimated from one undulator A at the APS). The same reduction factor was applied to each harmonic number, regardless of the device period length and type of device.

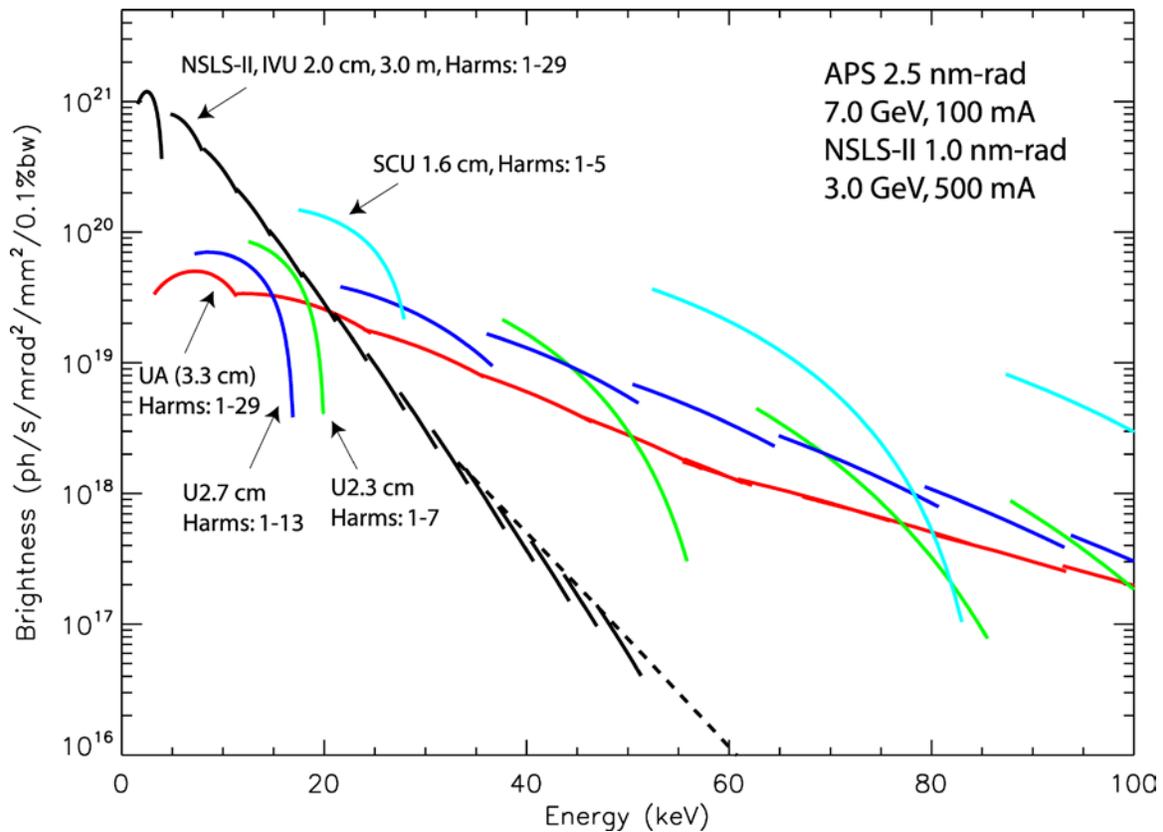


Fig. 1. Brightness tuning curves for odd harmonics for select planar permanent magnet hybrid undulators and one future superconducting undulator (SCU 1.6 cm) at the APS compared to the planned 2.0-cm-period in-vacuum undulator at the NSLS-II with a minimum gap of 5.0 mm. The APS undulators are 2.4 m long and the minimum gap is 11.0 mm for the regular devices. The gap for the SCU is fixed at 9.0 mm. The black dashed line shows extrapolation to high energies using a critical energy of 4.8 keV for the NSLS-II undulator. Brightness reductions due to magnetic field errors were applied to all tuning curves. The reductions were estimated from one measured undulator A (3.3 cm) at the APS.

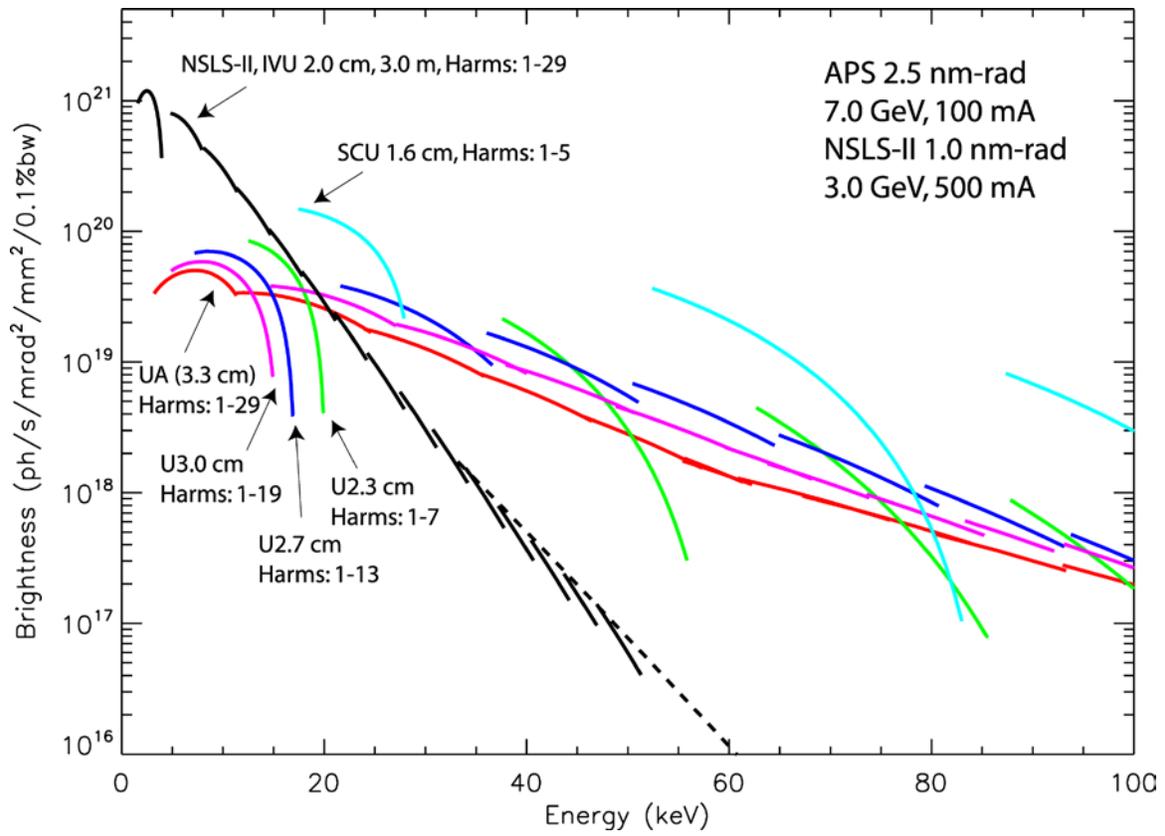


Fig. 2. Brightness tuning curves for select undulators at the APS with the APS U3.0 cm device added. All other conditions are the same as in Fig. 1.

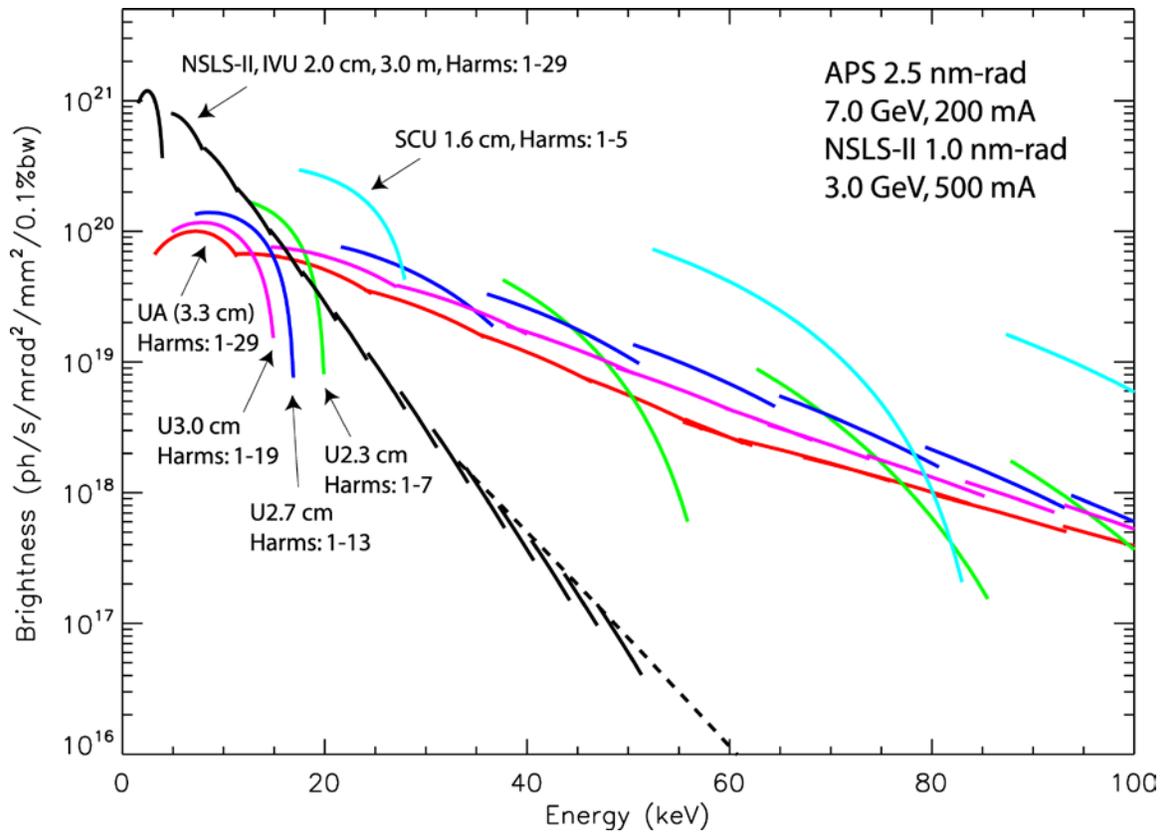


Fig. 3. Brightness tuning curves for select undulators at the APS with the APS beam current increased to 200 mA. All other conditions are the same as in Fig. 1.

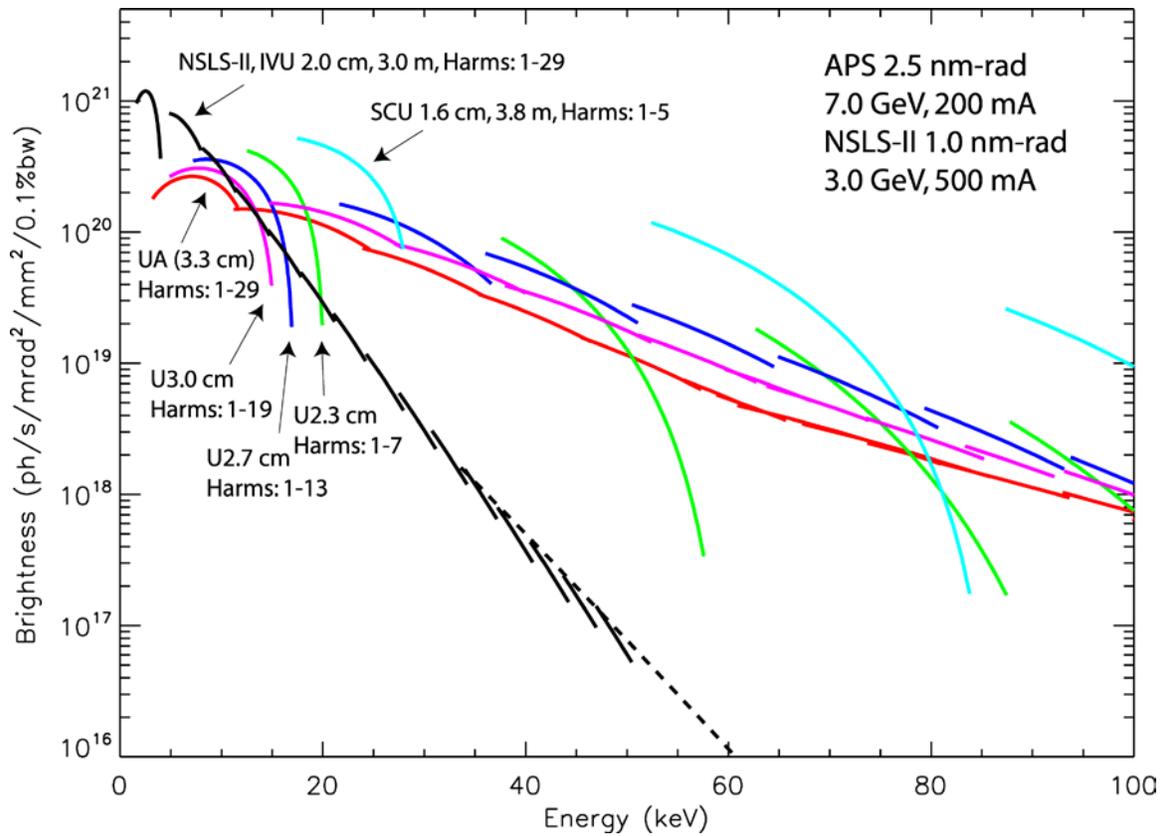


Fig. 4. Brightness tuning curves for select undulators at the APS with the APS beam current increased to 200 mA and the device lengths increased to 4.8 m for the permanent magnet undulators (UA 3.3 cm, U3.0 cm, U2.7 cm, and U2.3 cm) and to 3.8 m for the APS SCU 1.6 cm. The cross-over for equal brightness occurs at 9.7 keV and 10.9 keV for the U2.7 cm and U3.0 cm, respectively. All other conditions are the same as in Fig. 1.

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