Update

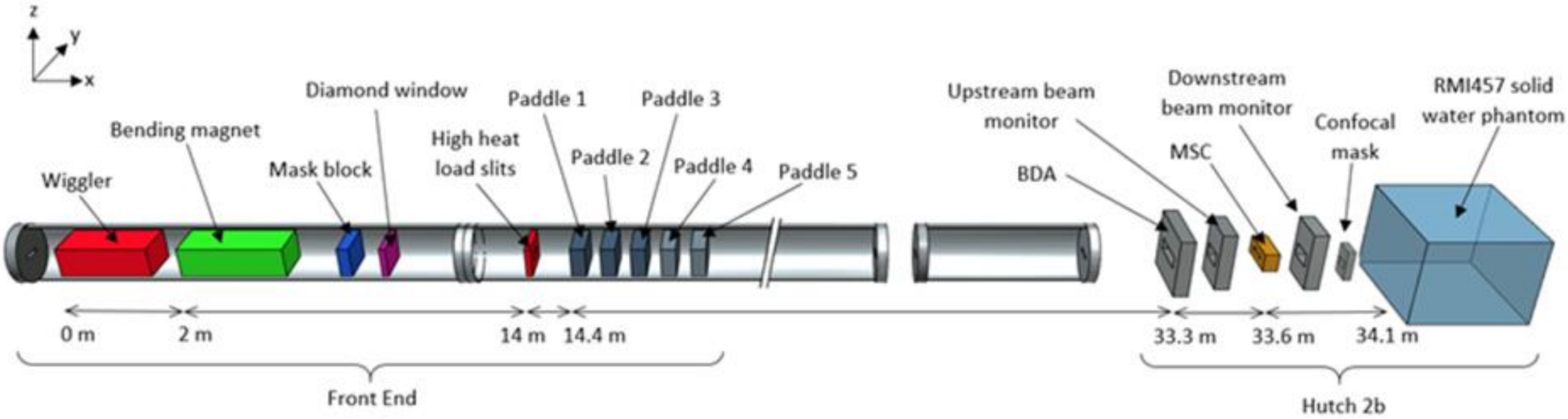
- G4MSBG: 18 tests running with geant-val at CERN, paper submitted to medical physics

- PIXE ANSTO cross sections to be included for the next public release of Geant4

Production of Synchrotron Radiation in a Wiggler

S. Guatelli, M. Cameron, A. Dipuglia, J. Davis, M. Lerch

G4Synchrotron (10.2patch02)



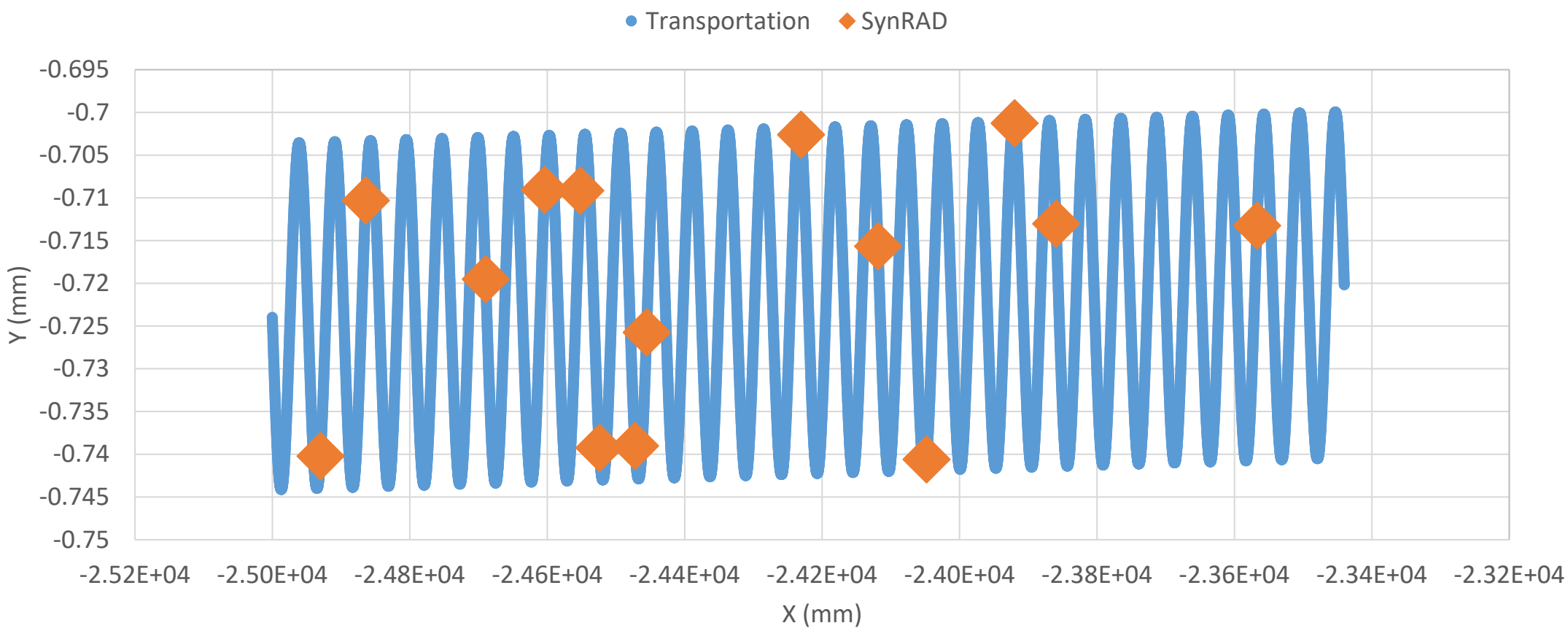
Simulation specifics

- 3T wiggler

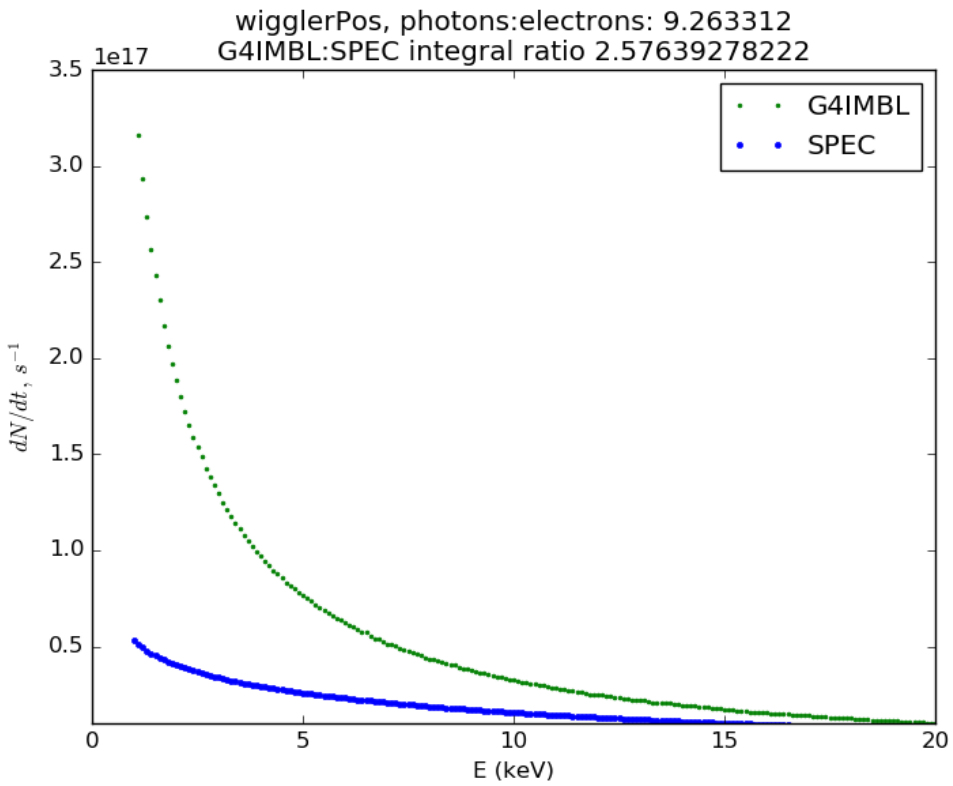
- Comparison with SPEC spectrum derived from first principles i.e. X-ray data booklet (*J. Synchrotron Rad.* (2017). **24**, 110-141 https://doi.org/10.1107/S1600577516015563)

- G4SynchrotronRadiation model is valid for “constant magnetic fields” (which insertion devices are not), but may be valid for regimes where magnetic field is “approximately constant” over formation length

Path through wiggler

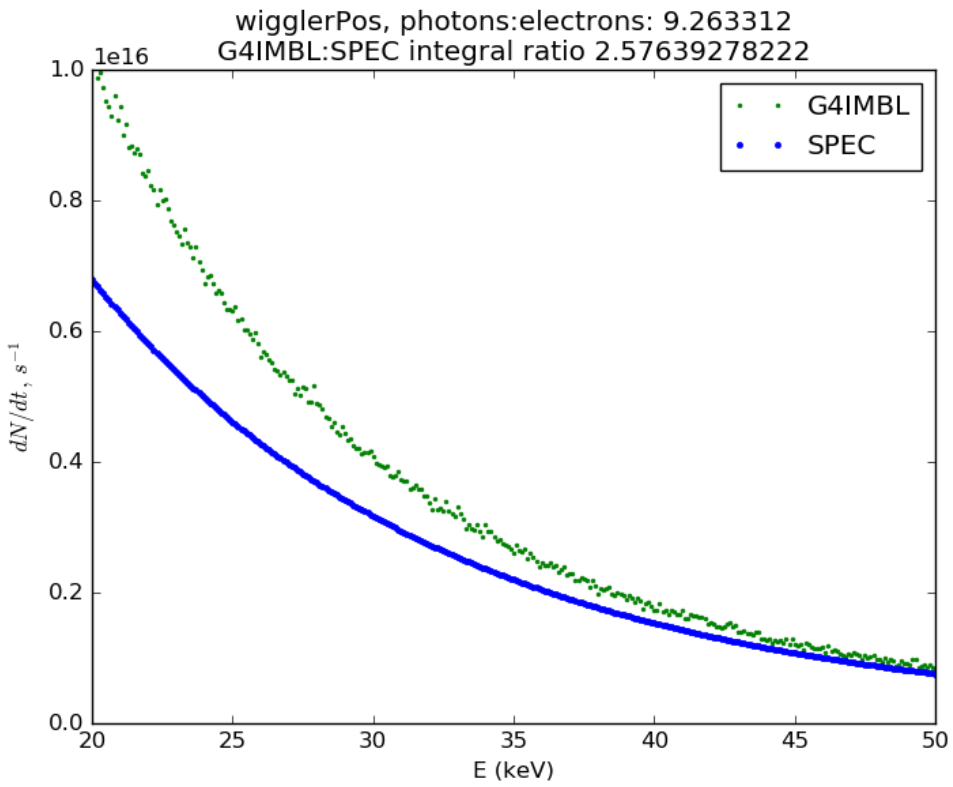


1—20 keV window



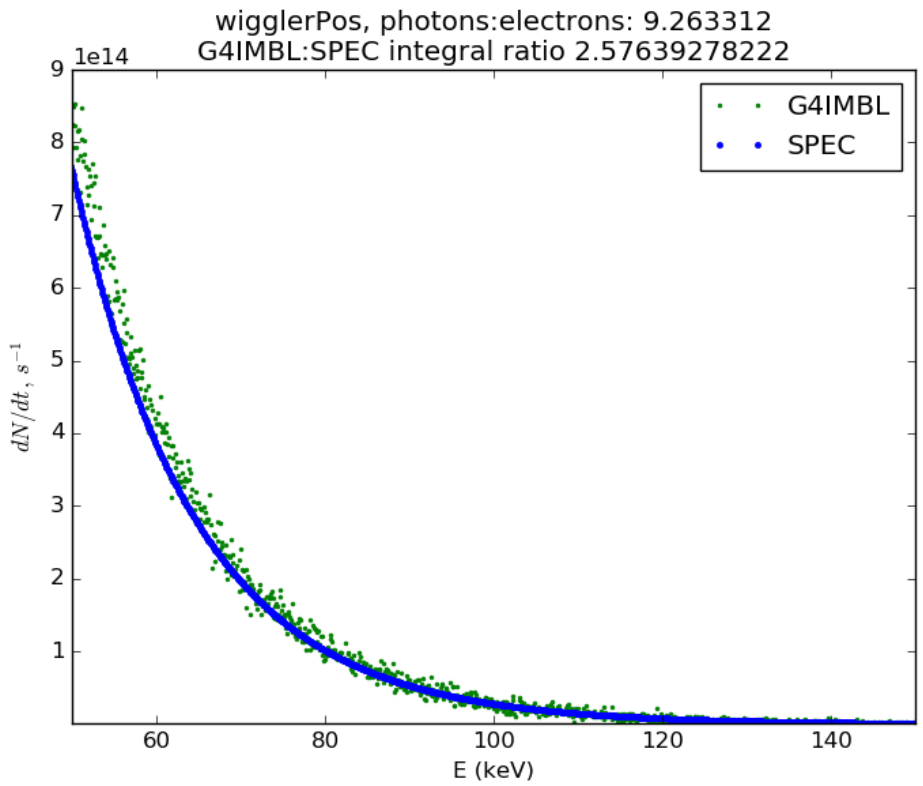
- G4:SPEC flux ratio = 2.922

20—50 keV window



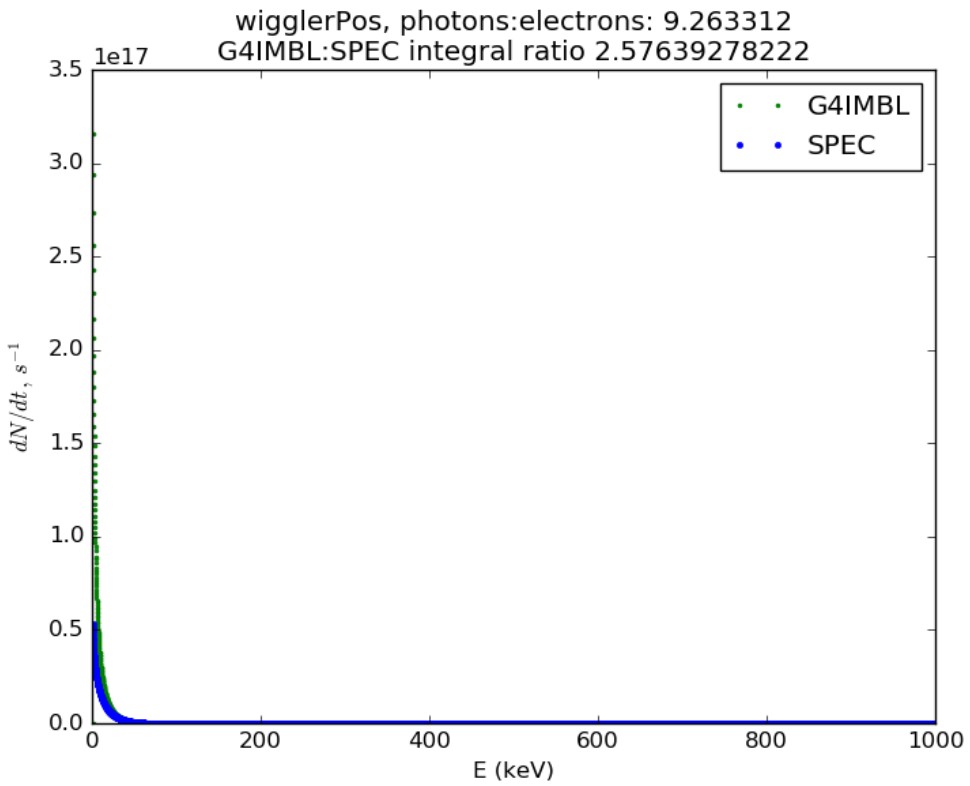
- G4:SPEC flux ratio = 1.299

50—150 keV window



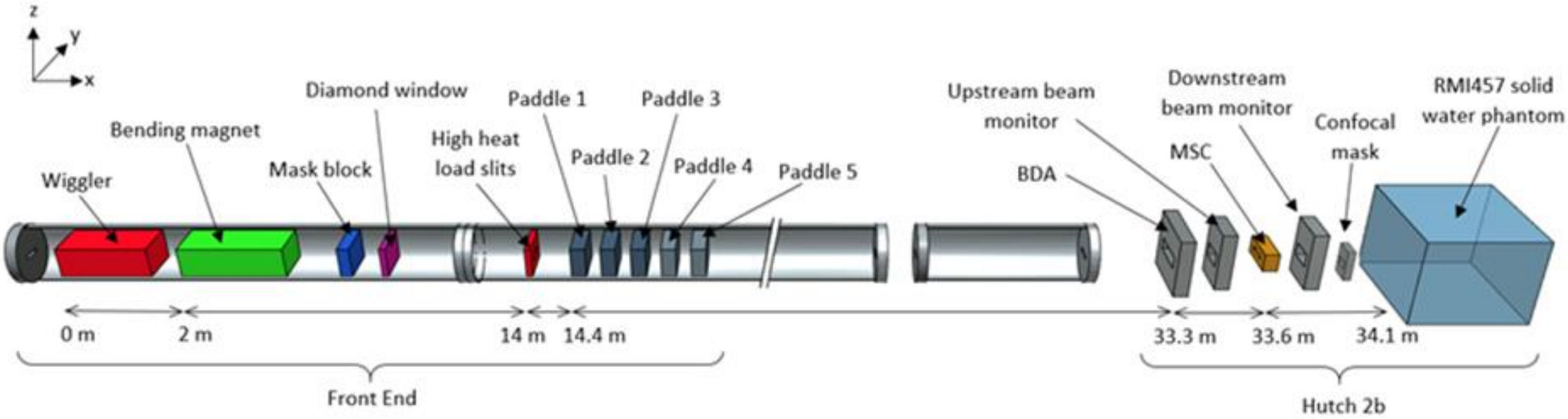
- G4IMBL: 097,007 photons in this window
- Corresponds to 1.212E17 per second
- SPEC: 1.13E17 per second in this window
- G4:SPEC flux ratio = 1.07

Full spectrum – no window (98% of spectrum < 150 keV)



- G4:SPEC flux ratio = 2.576

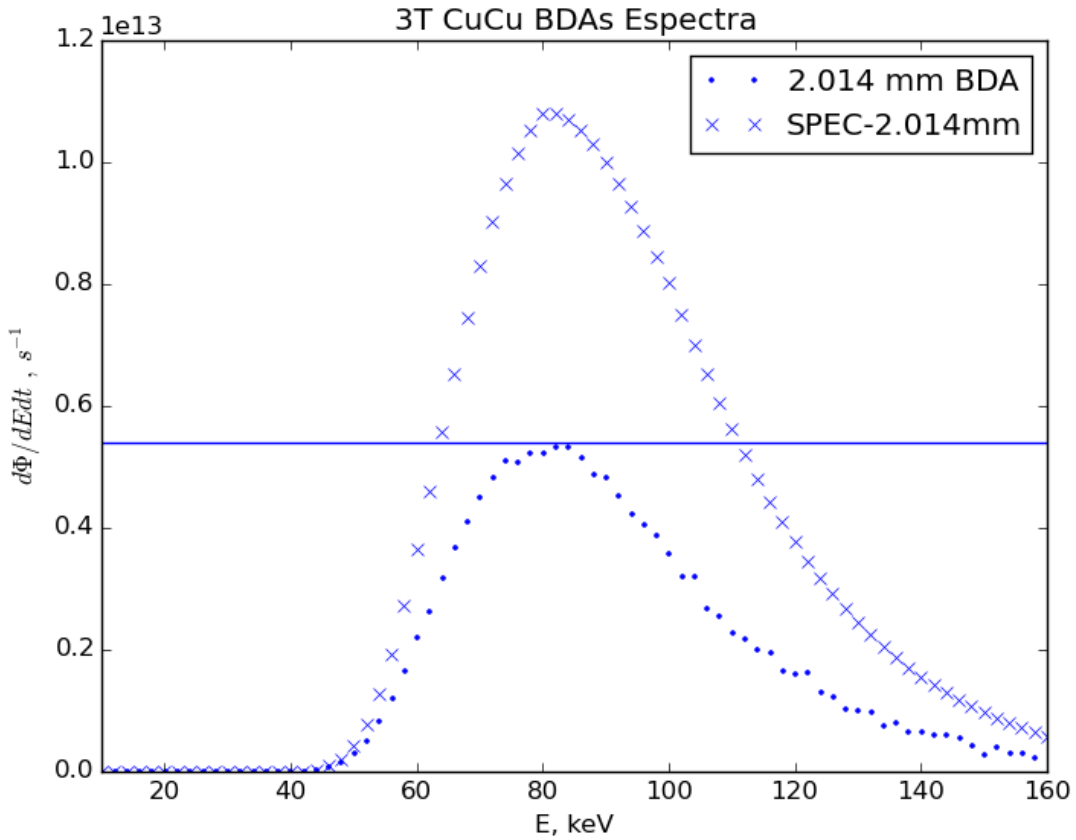
G4Synchrotron (10.2patch02)



Comparison of spectra to SPEC

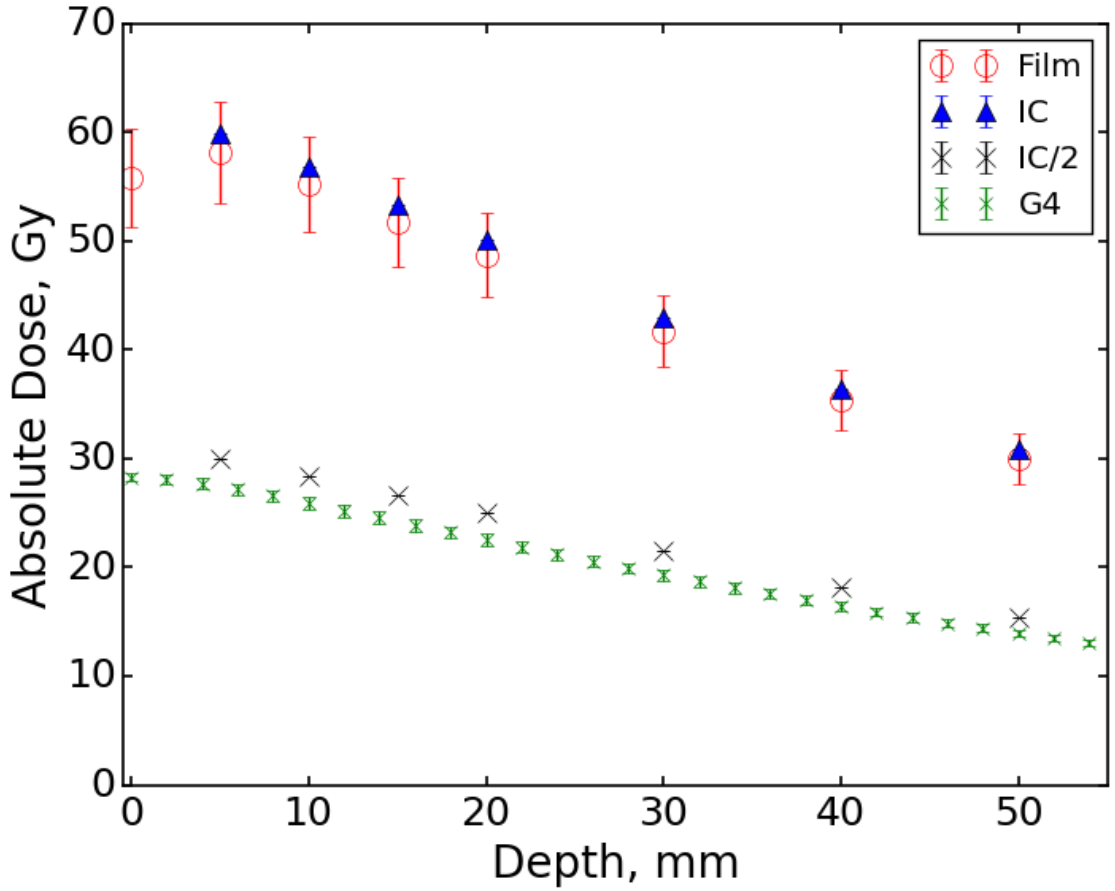
SPEC: Stevenson et al. 2017 J. Sync. Rad. **24**, pp. 110-141.

BDA is the height of the beam



Horizontal line represents 50% of max intensity of SPEC photon spectrum

3T-CuCu-2.014mmBDA Dose deposition RMI phantom (2x2x5mm³ voxels)



Summary of results

- Ratio of integral under the curve for all energies from G4:SPEC is equal to ~2.58
- Photon fluxes agree >50 keV but diverge at lower energies with G4Synchrotron overestimating flux compared to spec
- Therefore, distribution of photon energies is weighted to lower energy more than it should be
- Therefore, after transport through the beamline and filtration all energies lower than 50 keV have been absorbed, but remaining high-energy flux is less than it should be based off of number of electrons simulated