Minutes of the LCLS BLM Simulations Working Group
February 20, 2008
Attendees/Argonne: J. Dooling, W. Berg; /SLAC: A. Fasso, H.-D. Nuhn, M. Santana

HDN—Can one calculate dose and response; i.e. the signal at the PMT?

MS—FLUKA indicated a 1-2 percent sensitivity in downstream dose with analytical quadrupole field strength. One-half day of effort required to conduct radiation sensitivity calculations. Several days of effort requested. Also looked at the number of photons generated by a single electron (7-8 MeV) striking the radiator. Output plots from this simulation are presented below in Figure 1. Also requested was the response of the BLM PMTs (R7400U-04 or -06). A link to the R7400U data has been provided; the response function of this PMT family with wavelength is shown in Figure 2. Would like to have accurate model for quartz refractive index (presently using a fixed value of n=1.45). Wish to have 1st, 2nd, and 3rd derivatives; or equivalently a third-order polynomial of index with respect to wavelength. Indentified two types of quartz one with differing absorption especially on the short-wavelength side of the spectrum. Which type are we using?

These data along with geometrical (solid-angle) and optical (absorption, transmission, and reflection) properties need to be folded together to obtain an analytical estimate of the PMT output signal level.

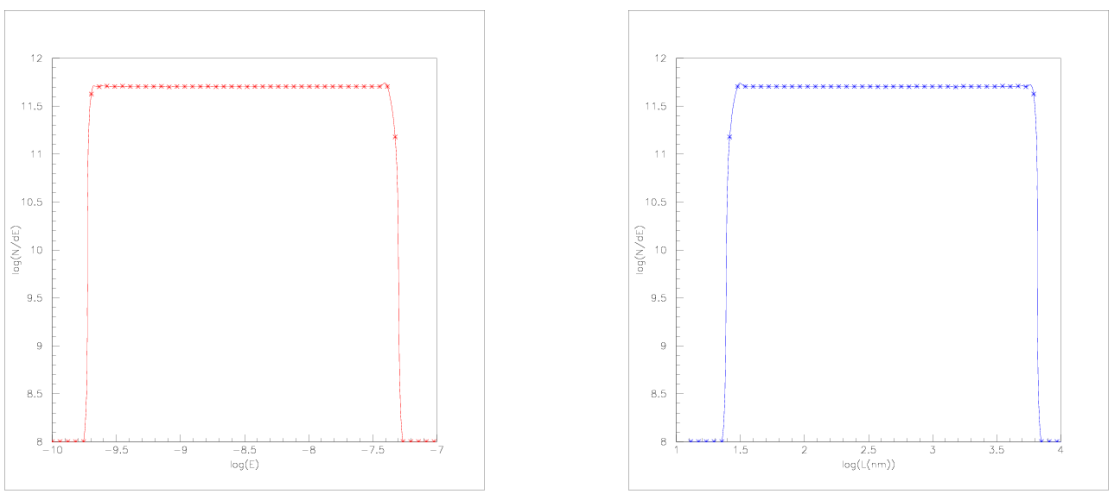

Figure 1: FLUKA simulation results showing the number of photons normalized by energy versus energy (GeV, left) or wavelength (nm, right)

JD—Script for writing full undulator geometry is now completed. Ran the first 3-set (1st 3 undulators, 2 short breaks and 1 long break) in MARS. Should have a complete MARS LCLS geometry ready for the next meeting; however, without magnetic fields. An algorithm to read in the quadrupole B-field data should be ready by mid-March.

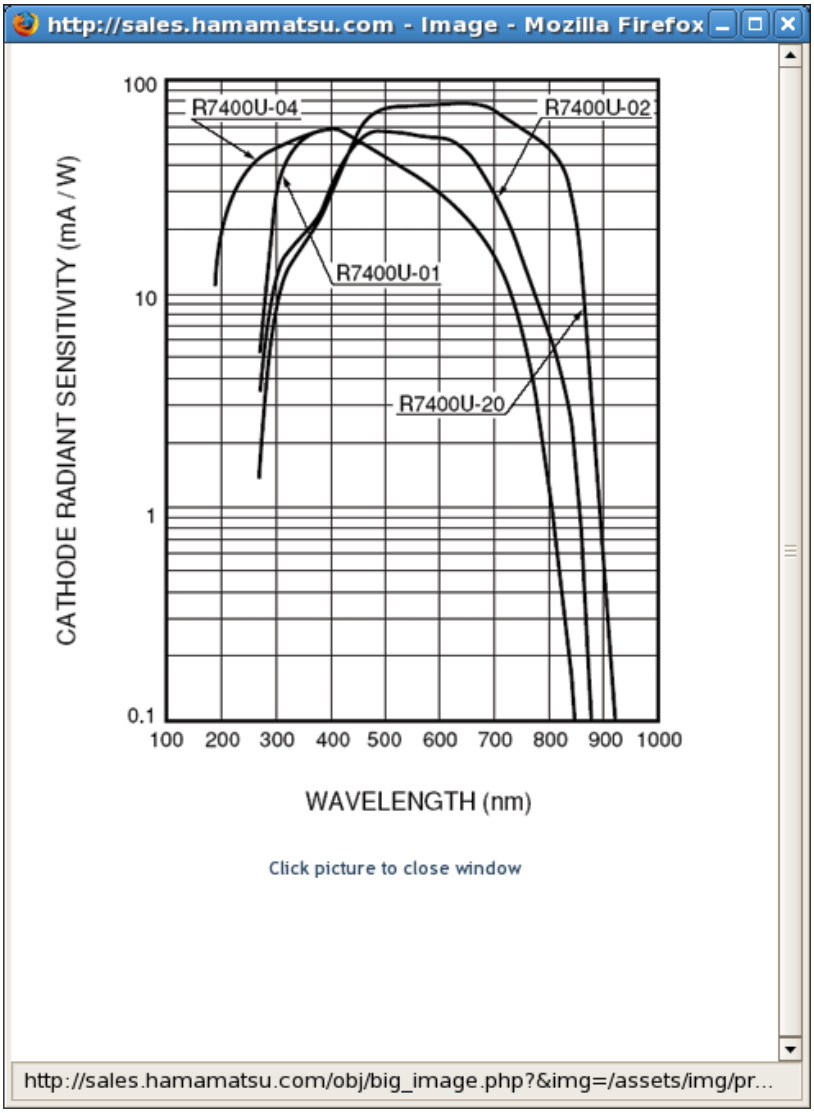

Figure 2: Response of the R7400U PMT family.

Electron spectra in the first LCLS BLM radiator have been simulated with MARS. Spectra are obtained assuming 1-nC of 13.64-GeV electrons strike a 1-μm Al foil 85-m upstream of the first undulator (in 1 sec). A W enhancer can be introduced just upstream of the quartz radiator. Unfortunately, the first sets of spectra were specified incorrectly by including the primary beam electrons in the radiator histogram volume. This error has been corrected in the MARS geometry file by defining two separate regions of equal

volume, one above and the other below the beamline. The volumes represent the upper and lower segments of the "tuning fork" radiator. Electron spectra from the first LCLS BLM top (solid) and bottom (dashed) radiator forks are overlaid in Figure 3. The combined spectrum is calculated with the W enhancer in place.

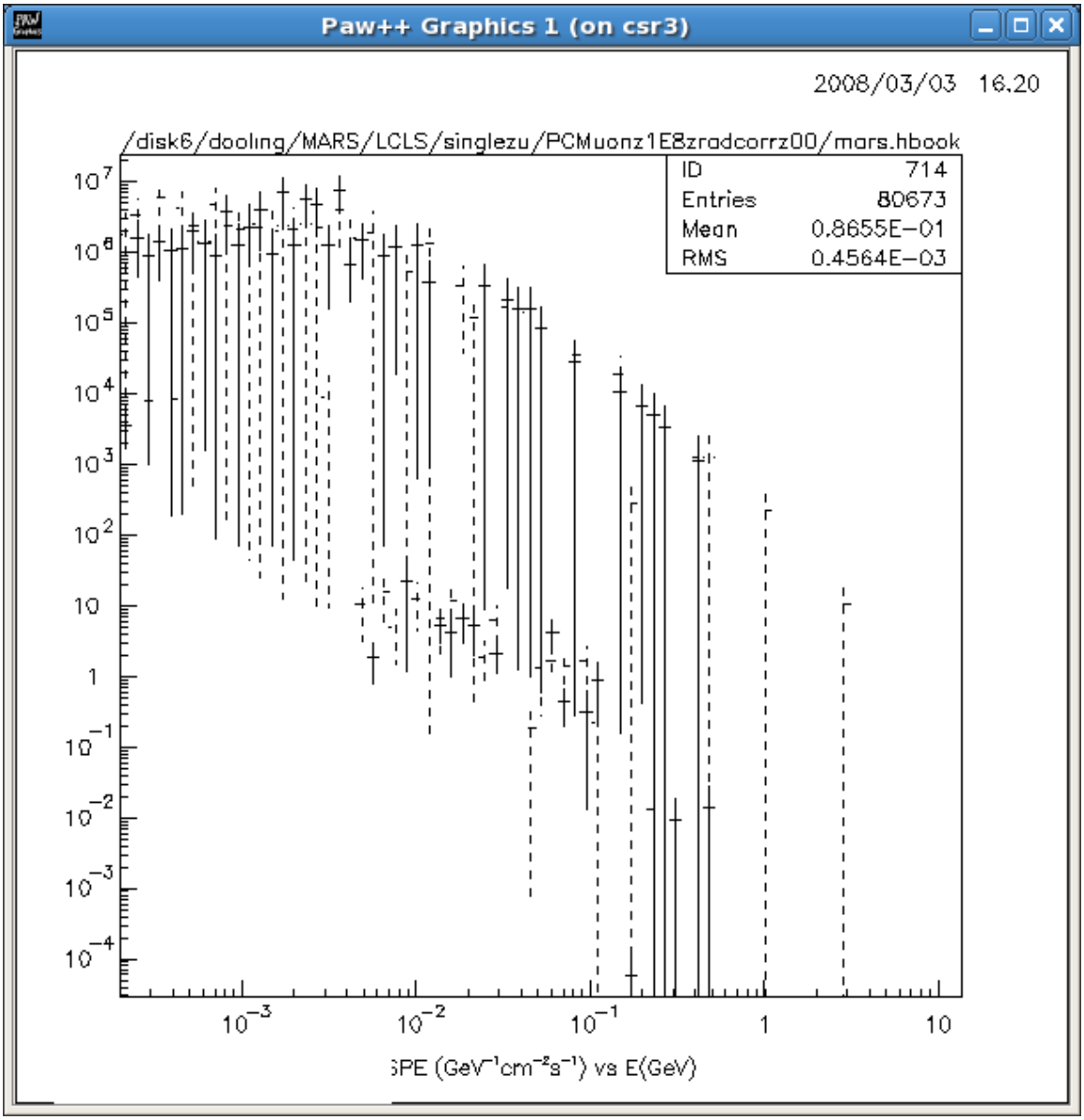

Figure 3: Electron spectra from top (solid) and bottom (dashed) BLM radiator volumes.

The working group meeting scheduled for Wednesday February 27, 2008 was cancelled. The next meeting will be held on Wednesday March 5, 2008 at 4:30 PM CST.

jcd