QUEEN'S UNIVERSITY BELFAST

EPSRC

Gamma-ray spectrometer for the LUXE experiment: status update

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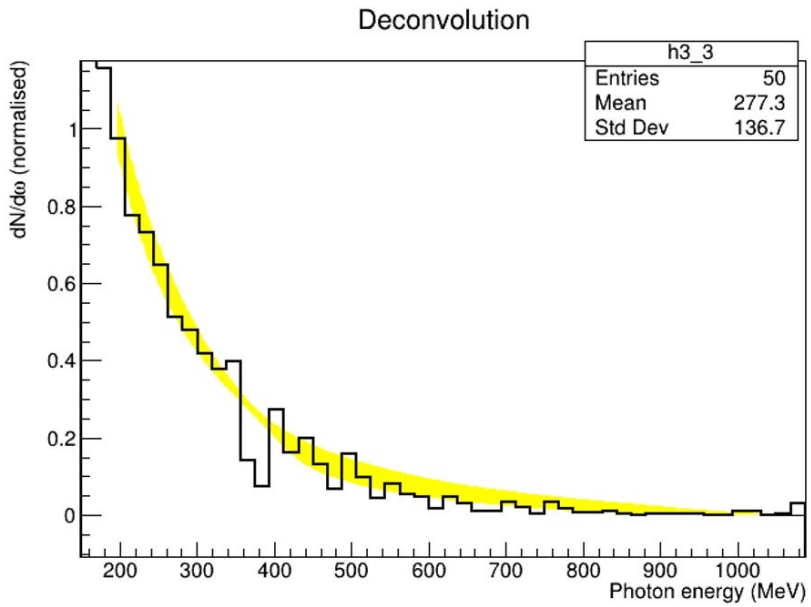
Progress since CDR

First experimental test of the spectrometer performed at RAL

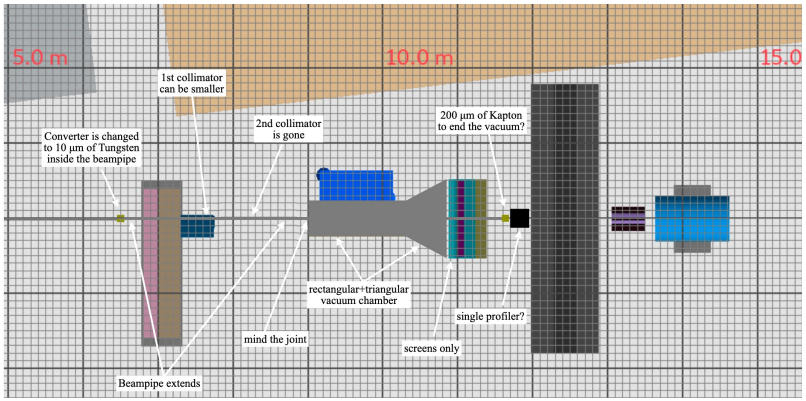


Expected bremsstrahlung spectrum from measured electron spectra (yellow) and deconvolved spectrum (black) from experimental data.

- Energy resolution: ~10% @ 200 MeV
  ~ 3% @ 600 MeV
- Minimum flux detectable: ~10^3 ph/MeV

Progress in numerical simulations and analysis techniques

- Updated deconvolution technique, which now includes the effects of potential data smoothing and more refined modelling of pair production in the converter.
- Finalised geometry of the detection area, with an extension of the vacuum region to avoid spurious signal coming from air



- Implementation of deconvolution techniques to extract energy-dependent angular distribution of the photon beam (ongoing)

Gianluca Sarri

To do list for TDR

- Update signal-to-noise simulations with a more realistic configuration (for instance, Compton-scattered photon beams from a linearly polarized laser pulse?).

- Finalise deconvolution routine to obtain a double-differential ($d^2N/dEd\theta$), to obtain information about the energy-dependent angular distribution of the photon beam.

- Study the possibility of having an on-shot diagnostic, instead of relying on passive detectors (current configuration).

- Perform experimental tests at higher energy (> GeV). Ideally, carry out tests with structured photon beams, to experimentally test the energy resolution of the system.

- Finalise the analysis of uncertainties and systematics both from the diagnostic and from the deconvolution algorithms.

Test experiments

- Additional tests currently ongoing at the Central Laser Facility (Rutherford Appleton Laboratory) using bremsstrahlung photon beams with a maximum energy ranging from 0.5 to 1 GeV.
- Possibility of running other tests at laser facilities.
- Necessity to test the system at higher energies (1 – 10 GeV), which are currently inaccessible in laser facilities. This will be more relevant to the LUXE experiment.
- Interest in running tests at the DESY test beam with bremsstrahlung radiation.