

Bubble Chamber Simulation

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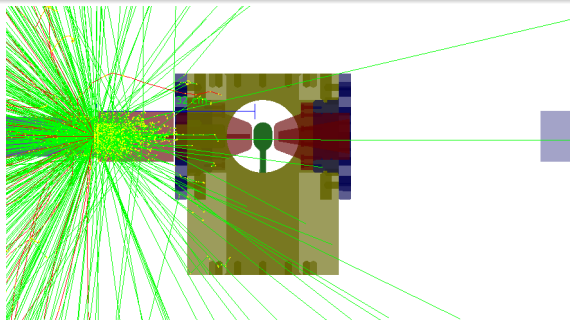
Argonne National Laboratory

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Introduction

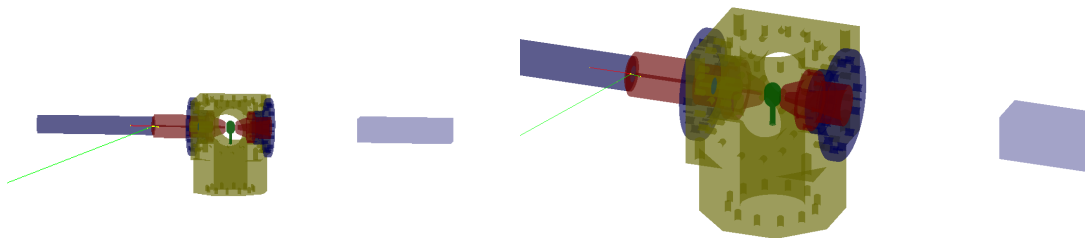
bubble_chamber

- https://github.com/whit2333/bubble_sim_doc : Farm documentation
- https://github.com/whit2333/bubble_chamber : Simulation code
- Straightforward Geant4 simulation
- Requires [CADMesh library](#)



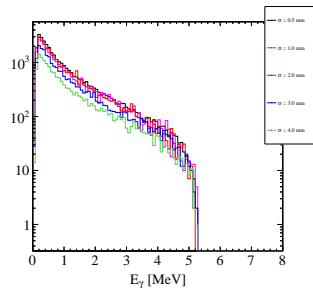
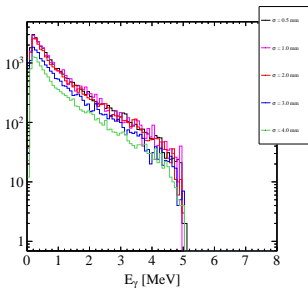
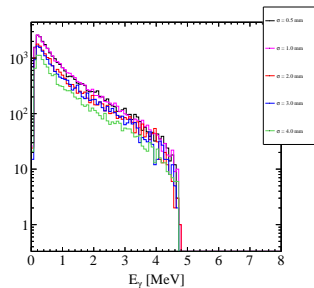
Simulation

- Easy to add cad geometries.
- Calculates the photon flux at arbitrary surfaces
- Outputs root file with histograms



Photon flux after port window

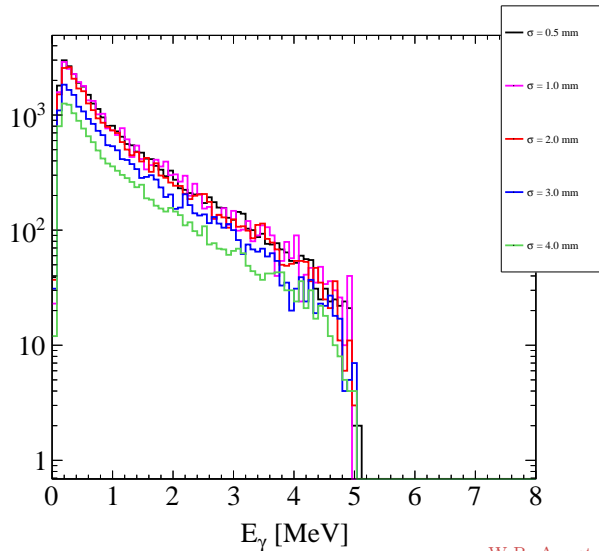
Position RMS Spread



- Notable change for larger offsets.
- Need to run more statistics!

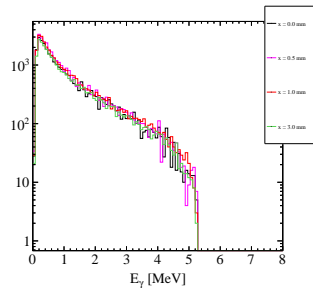
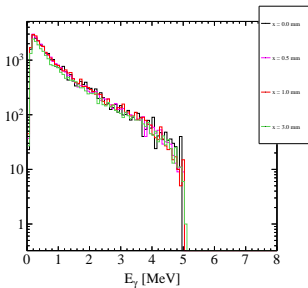
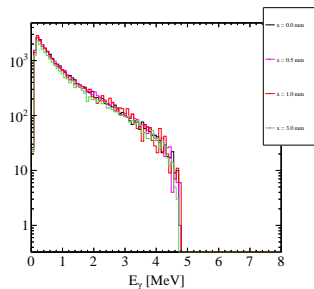
Photon flux after port window

Position RMS Spread



Photon flux after port window

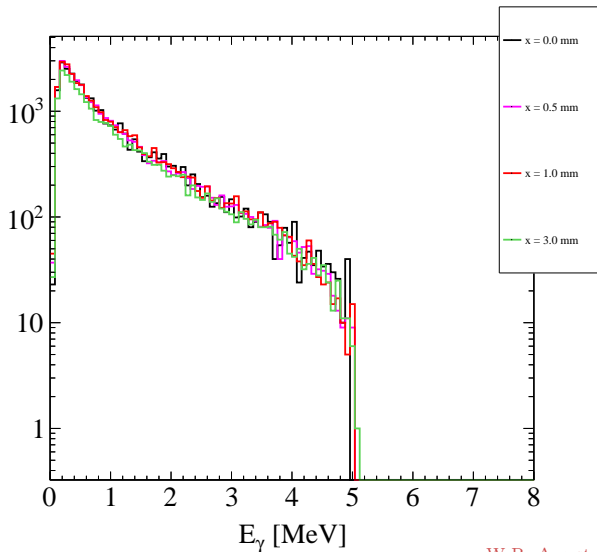
Position X offset



- Need to run more statistics!

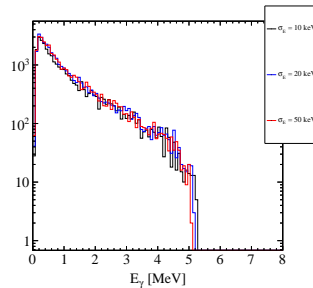
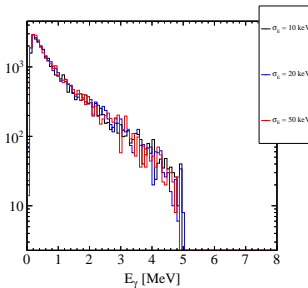
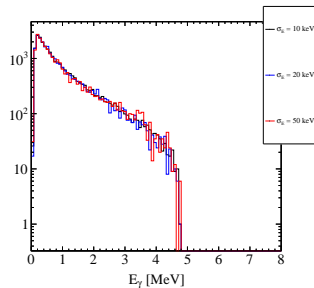
Photon flux after port window

Position X offset



Photon flux after port window

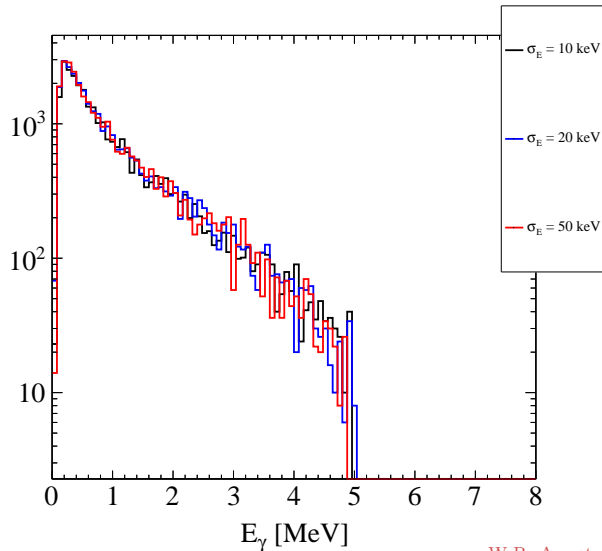
Energy RMS spread



Need to run more statistics!

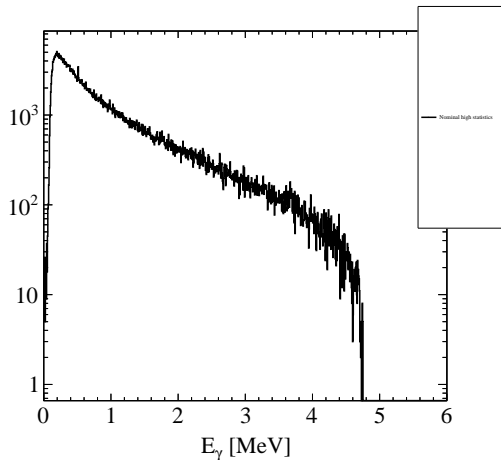
Photon flux after port window

Energy RMS spread



Photon flux after port window

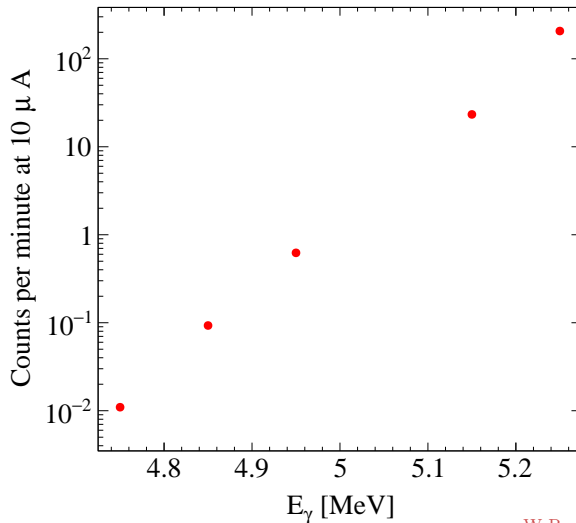
Nominal with higher statistics (2 billion)



- Need higher statistics to see endpoint effects
- Will fold with cross section to look at rate differences.

Counting rates at $10\ \mu\text{A}$

A cross check



Future work

- **More statistics!**
- More variations
- Looking at the photon flux just before the photon beam dump.
- Varying the various alignments:
 - ① Collimator relative to radiator
 - ② Collimator relative to chamber insert
 - ③ Do we have nominal parameters for these?
- Look at non-parallel incident electrons
- A mixture of position offsets, position spread, incident angle, and energy spread.
- Fold spectra with cross sections to compare rates (might amplify effects not seen in spectra alone)

Cross Section

