VD-XA Photon Flux Simulation

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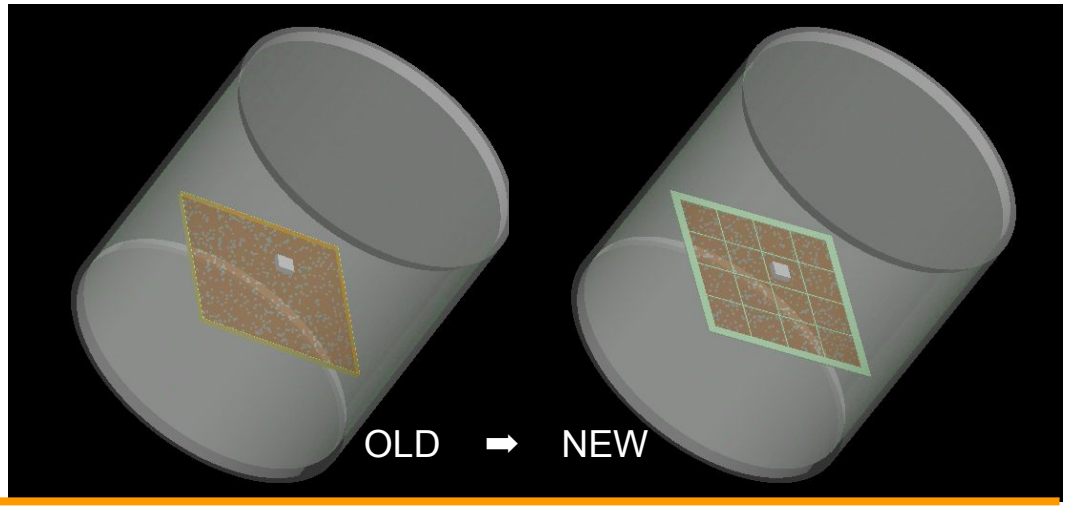
DEEP UNDERGROUND NEUTRINO EXPERIMENT

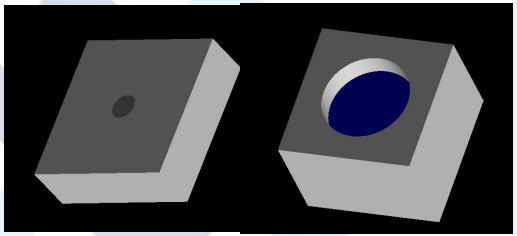
Simulation Summary

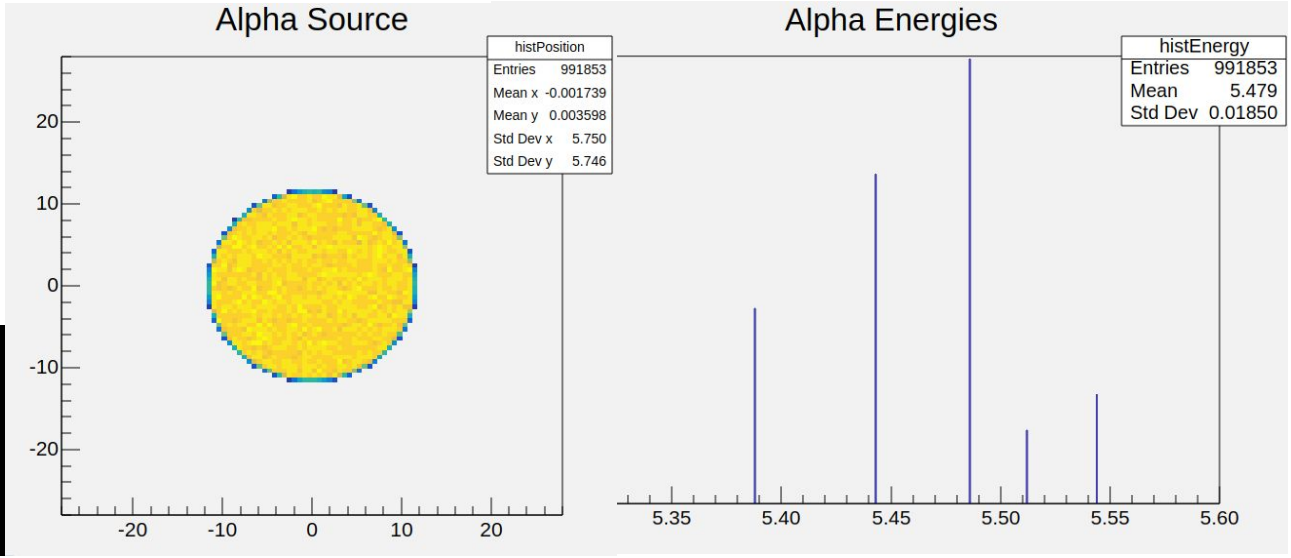
- Non-discriminatory photon counter, where the filters act as sensitive.
- Inherited from a previous work done by Vinicius Andreossi, modified to fit the Napoli setup:
  - Geometry of the top grid 🟢
  - 16 individual filters (acting as individual counters) 🟢
  - Cryostat inner walls lined with light-absorbent material 🟢
  - Alpha source support bracket 🟢



Alpha source

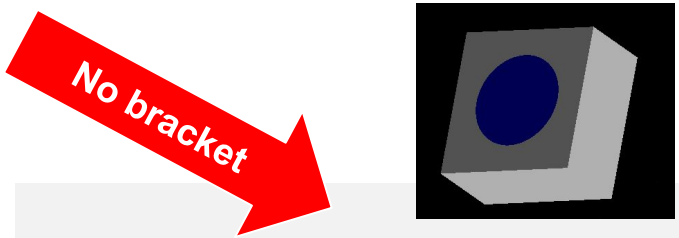
- Americium disc, ⌀ 2.3 cm (it was 1.0 cm), 140μm thick
- Five alpha lines (it was monochromatic @ 5.49 MeV), uniformly generated 0.5nm beneath the disc surface (it was 1.4nm).
- Implemented the support bracket, 6mm thick.

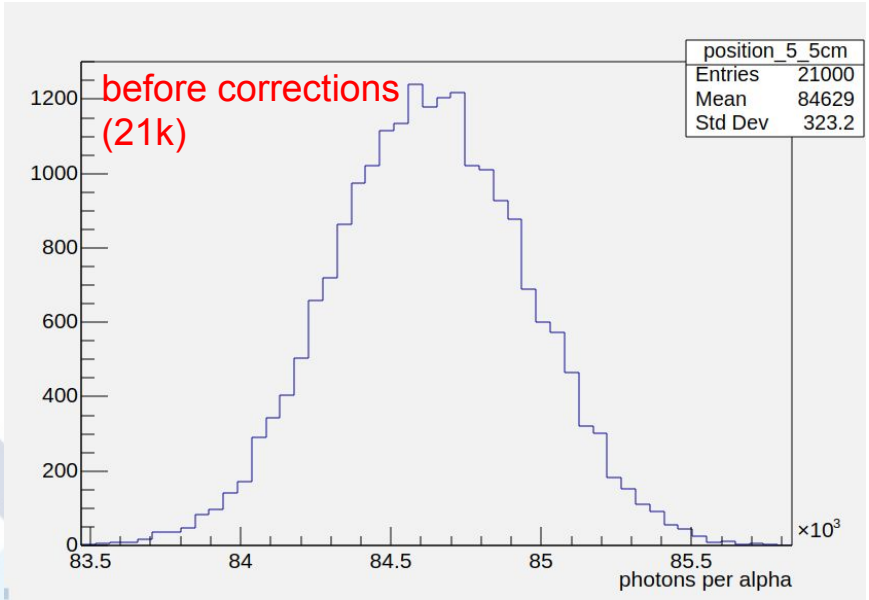


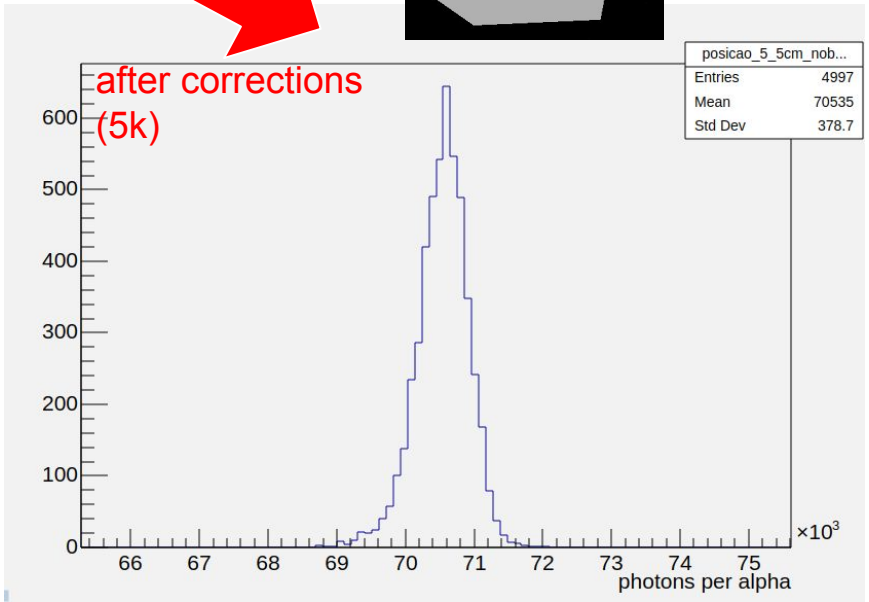


Full simulation

- Comparison before and after the corrections
- Position 5 @ 5cm







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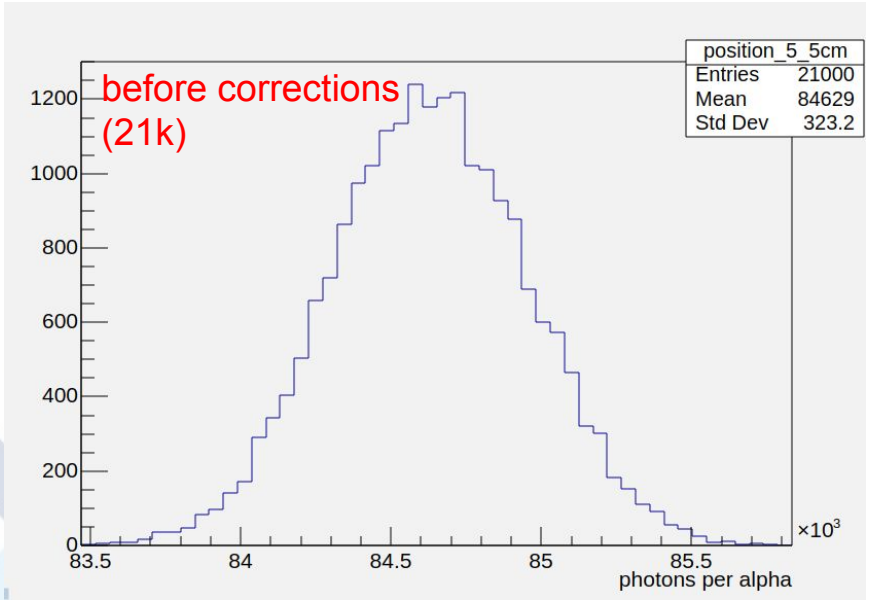
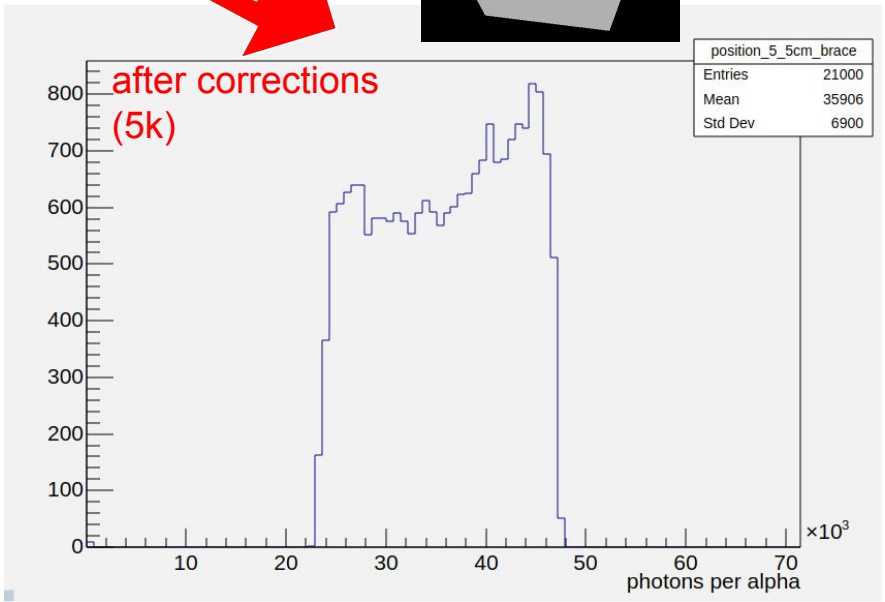
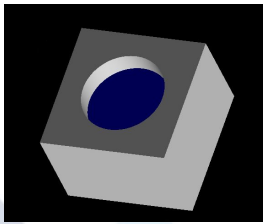
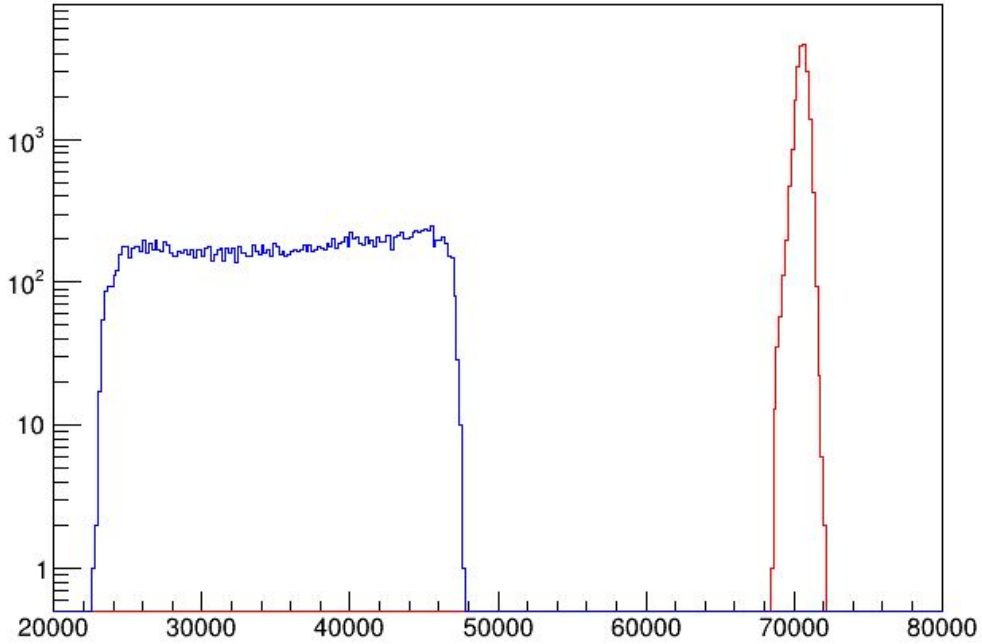


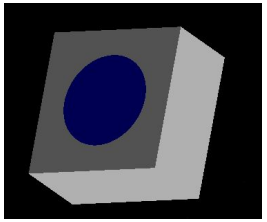


Comparison 1 - With and without the bracket

- Comparison before and after the corrections
- Position 5 @ 5cm

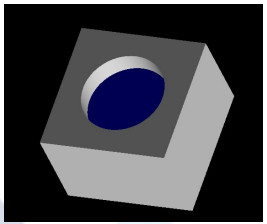


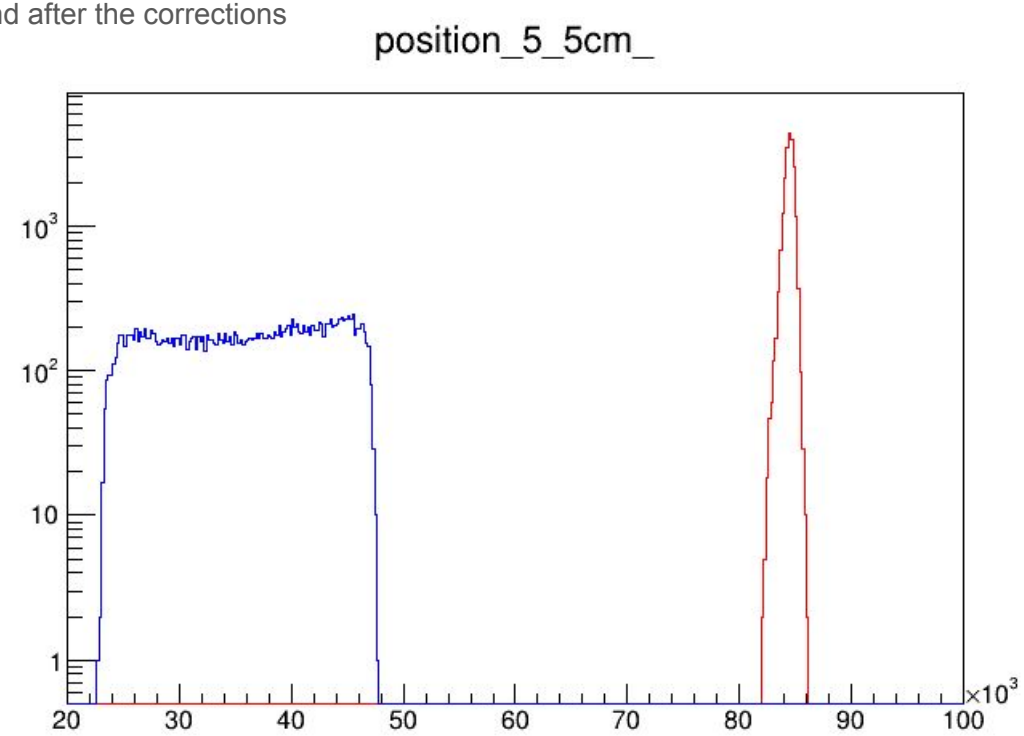


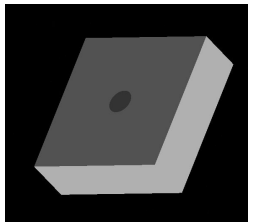


Comparison 2 - Corrected and Original (defective)

- Comparison before and after the corrections
- Position 5 @ 5cm

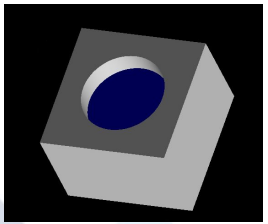


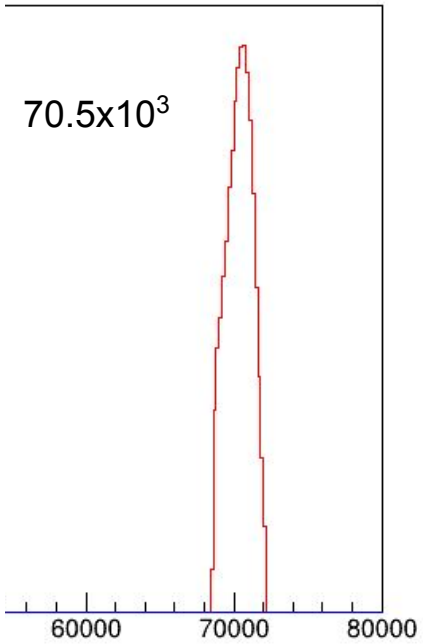


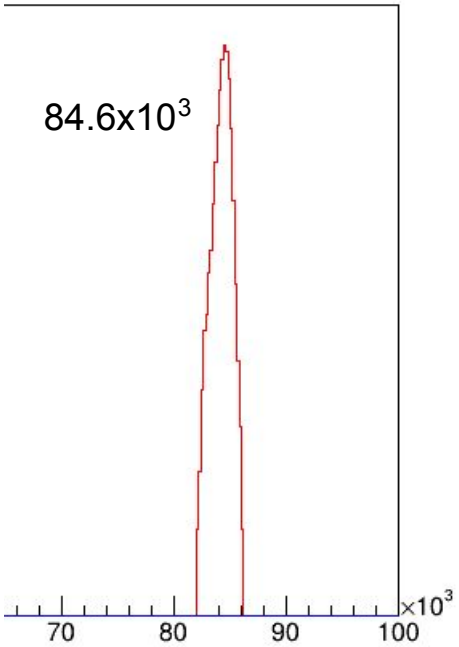


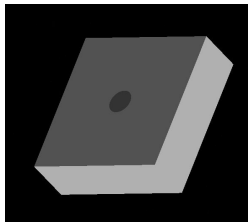
But Why?

- The original used a non-centralized system for parameter control that wasn't properly equating geometry and generator.
- The Z position of the source was closer than 5cm, which explains the reduction, even without the bracket.









In Conclusion

- The simulation borrowed from Vinicius was OK, just not meant to be easily tunable.
- By remaking most of the code, this new simulation predicted that we substimated the MegaCell efficiency by a factor of 1.8.