Simulation update

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CYGNO general meeting 26/03/20

Outline

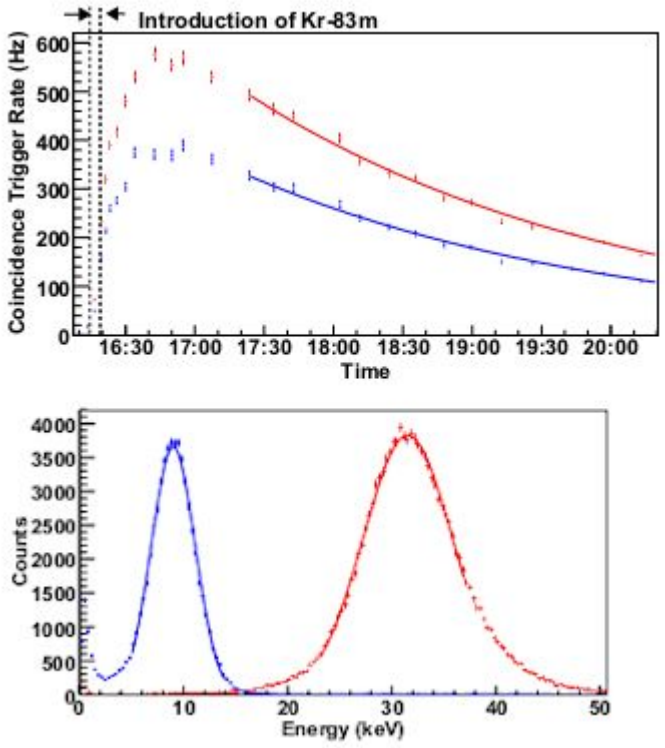
- Calibration sources for CYGNO (Flavio)
- Simulation of LIME (André)

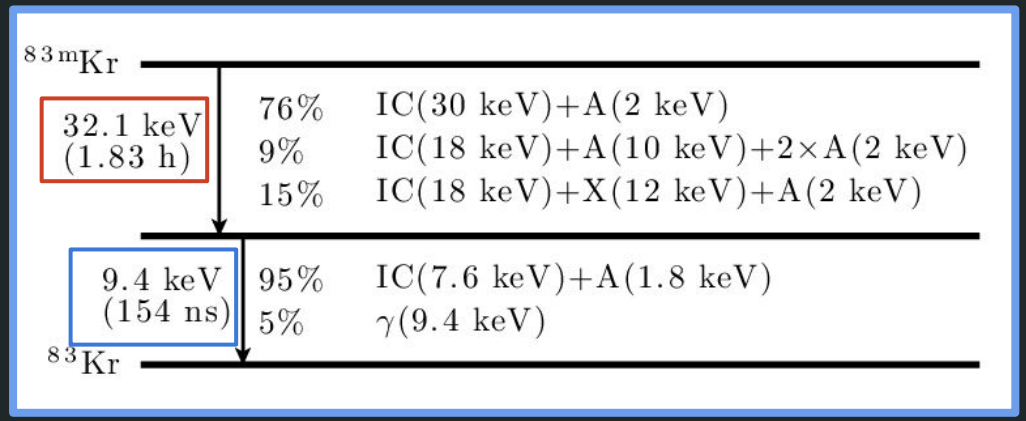
Other activities in progress (no updates for today):

- reconstruction & analysis of CYGNO MC data (Fabrizio, Giulia, Emanuele)
  ➜ study efficiencies and background rejection
- simulation of PMT (Francesco, Elisabetta)
- limits calculation, including background estimates (Giorgio)

Calibration for CYGNO

83m Krypton



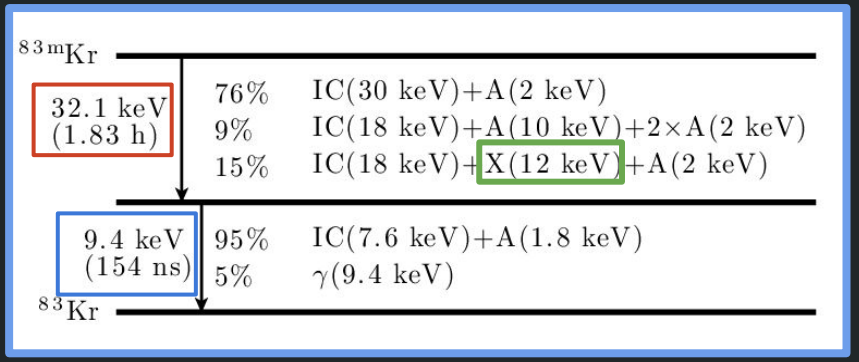


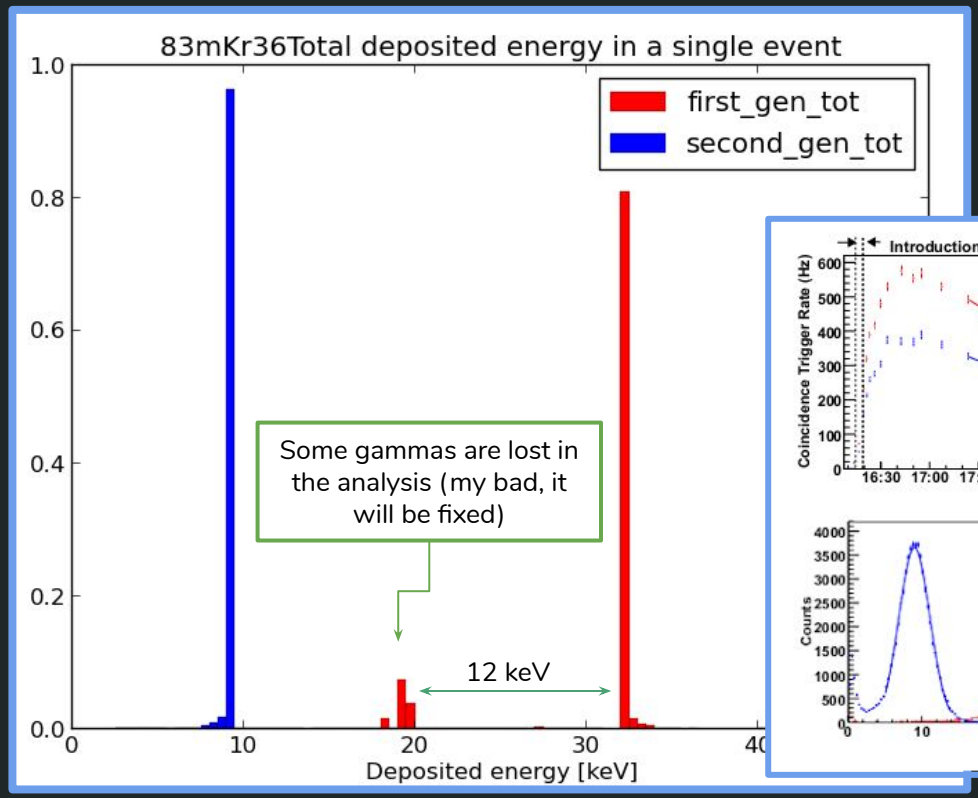
https://arxiv.org/abs/0905.1766v2

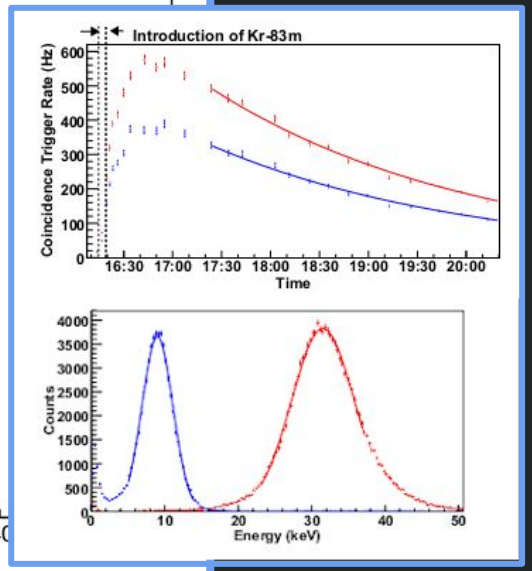
Calibration of a Liquid Xenon Detector with $^{83}Kr^{m}$

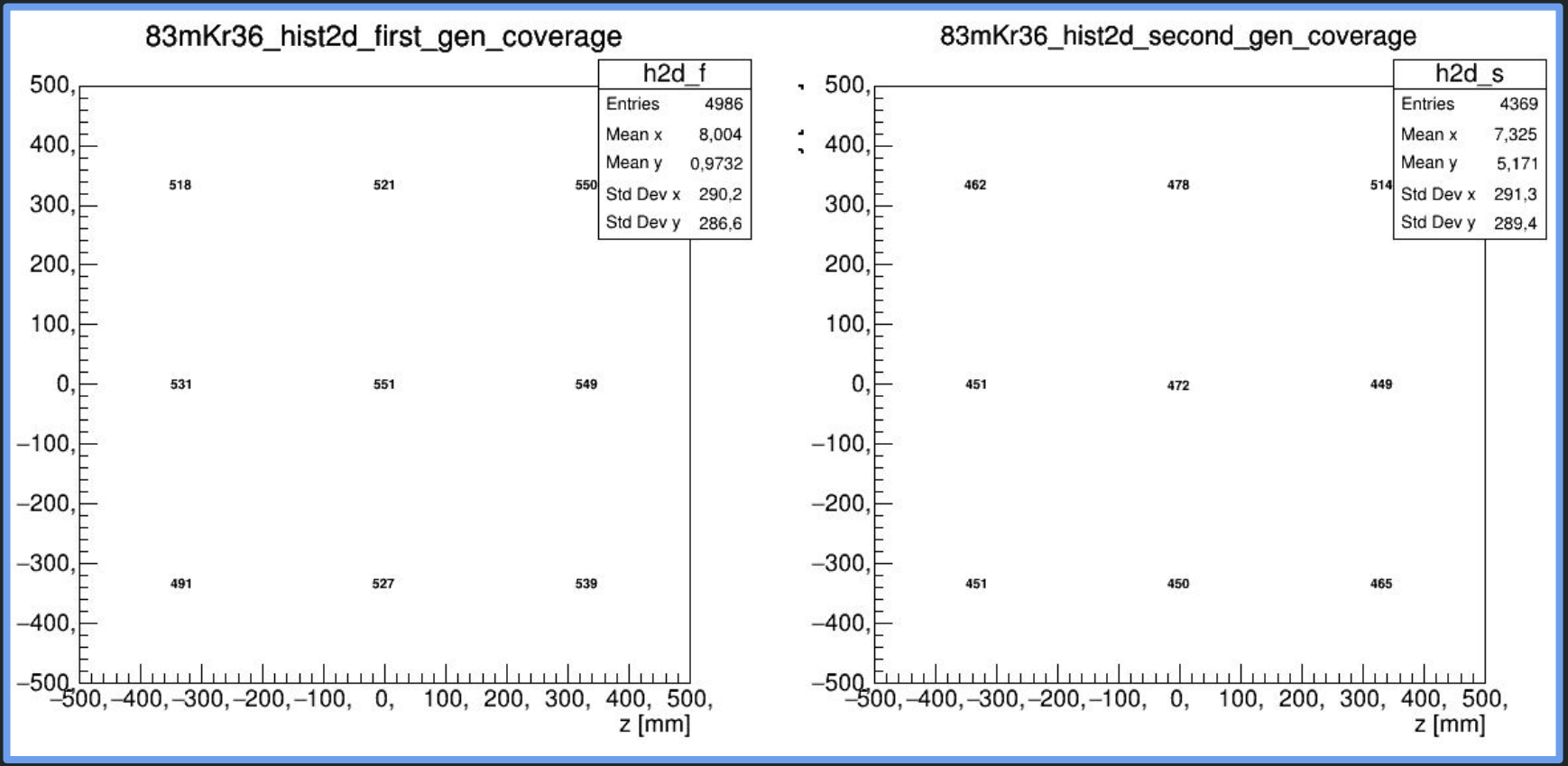
L. W. Kastens, S. B. Cahn, A. Manzur, and D. N. McKinsey
Department of Physics, Yale University, P.O. Box 208120, New Haven, CT 06520

The histogram is filled with the sum of the energies of all the particles resulting from the de-excitation of a single event (dividing the two steps)









We are working on 10^4 events. Events which are fully contained in a single camera represent ~40-50% of the sample. The source is in a gaseous form, thus it can evenly cover all the cameras. Each camera contains ~5% of the entire sample.

Conclusions

83mKr would be a great calibration source for CYGNO, but it needs to be produce in some way.

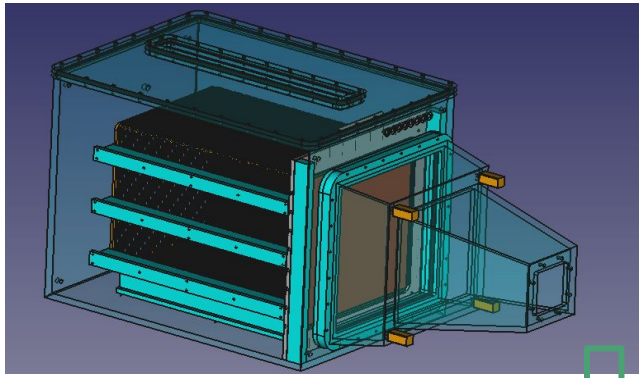
A gaseous source will perfectly satisfy the need for a uniform coverage.

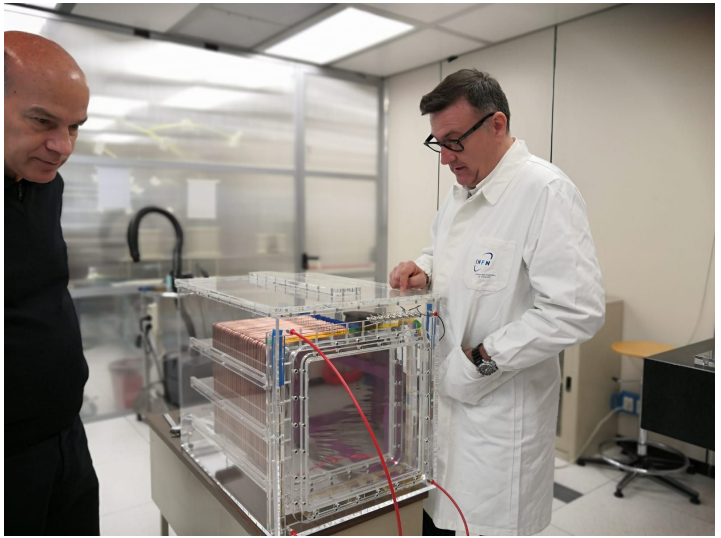
The 83mKr half-life is short enough to make the source easily removed from the sensitive region, but long enough to make a calibration run possible.

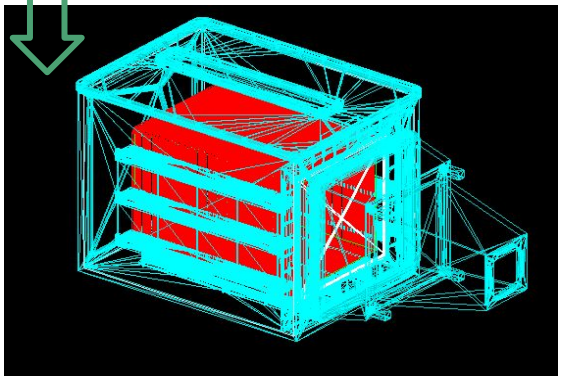
Also the energy spectrum has a well-resolved double peak at low energy.

LIME simulation

LIME prototype







Active volume:
50 cm (xx)
33 cm (yy)
33 cm (zz)

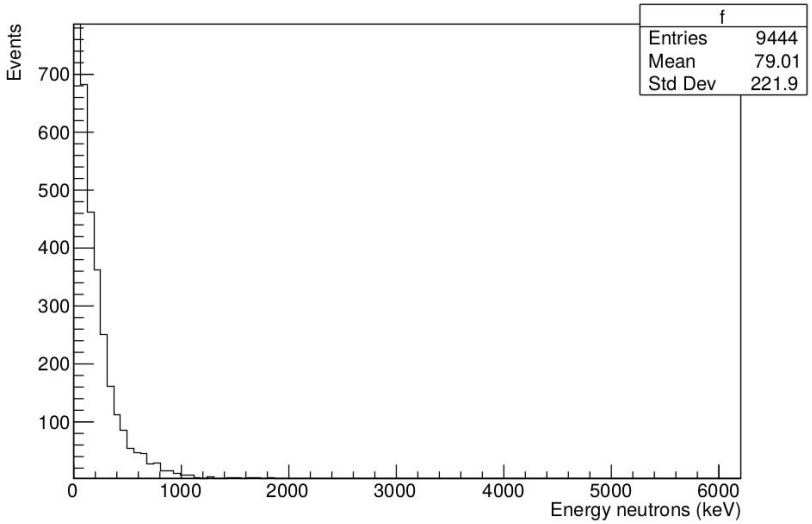
Materials:
PMMA
Cu
Field rings
GEMs

Camera not yet implemented but will be added

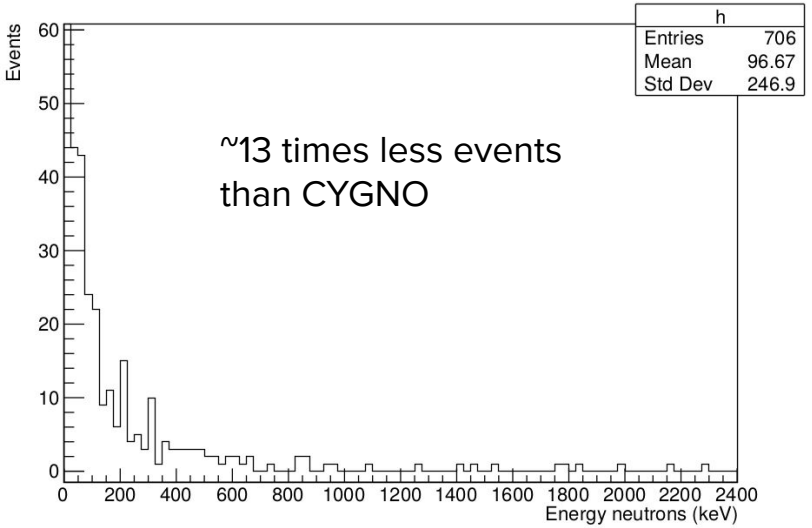
Neutron background

- First validation without shielding with 30M of events, CYGNO and LIME

Energy deposit in CYGNO



Energy deposit in LIME



Conclusions & to do

- LIME geometry is (almost completely) implemented in GEANT4
- To do: add the camera

Next steps:

- simulate external gammas and optimize the shielding (similar to what was done for CYGNO)
  ➜ constraint: effective space available for LIME underground
- study internal radioactivity background