LIME background simulation

17/05/2021 CYGNO Simulation meeting

F. Di Giambattista

Background rates

- **40cm water + 10cm copper**

External gammas (0.56 cm^{-2} s^{-1})
  (ER): $(2.05\pm0.10)\times10^5$ events/yr (total)
   (ER): $(4.0\pm0.4)\times10^4$ events/yr (0-20 keV)

External neutrons (2.7×10^{-6} cm^{-2} s^{-1})
  (ER+NR): (23.6±0.6) events/yr (total)
   (ER+NR): (9.9±0.3) events/yr (0-20 keV)
  (Only NR): (4.7±0.1) events/yr (total)
   (Only NR): (3.2±0.1) events/yr (0-20 keV)

With Cu: 4.0×10^4 ER/yr (0-20keV)
With Pb: 4.5×10^4 ER/yr (0-20keV)
Internal background:
$0.5\text{-}1.0\times10^5$ ER/yr (0-20keV)

- **40cm water + 5cm lead + 5cm copper**

External gammas (0.56 cm^{-2} s^{-1})
  (ER): $(1.8\pm0.5)\times10^5$ events/yr (total)
   (ER): $(3.9\pm2.2)\times10^4$ events/yr (0-20 keV)

External neutrons (2.7×10^{-6} cm^{-2} s^{-1})
  (ER+NR): (30.1±0.3) events/yr (total)
   (ER+NR): (12.1±0.2) events/yr (0-20 keV)
  (Only NR): (4.38±0.09) events/yr (total)
   (Only NR): (2.66±0.07) events/yr (0-20 keV)

Radioactivity from 210Bi*:
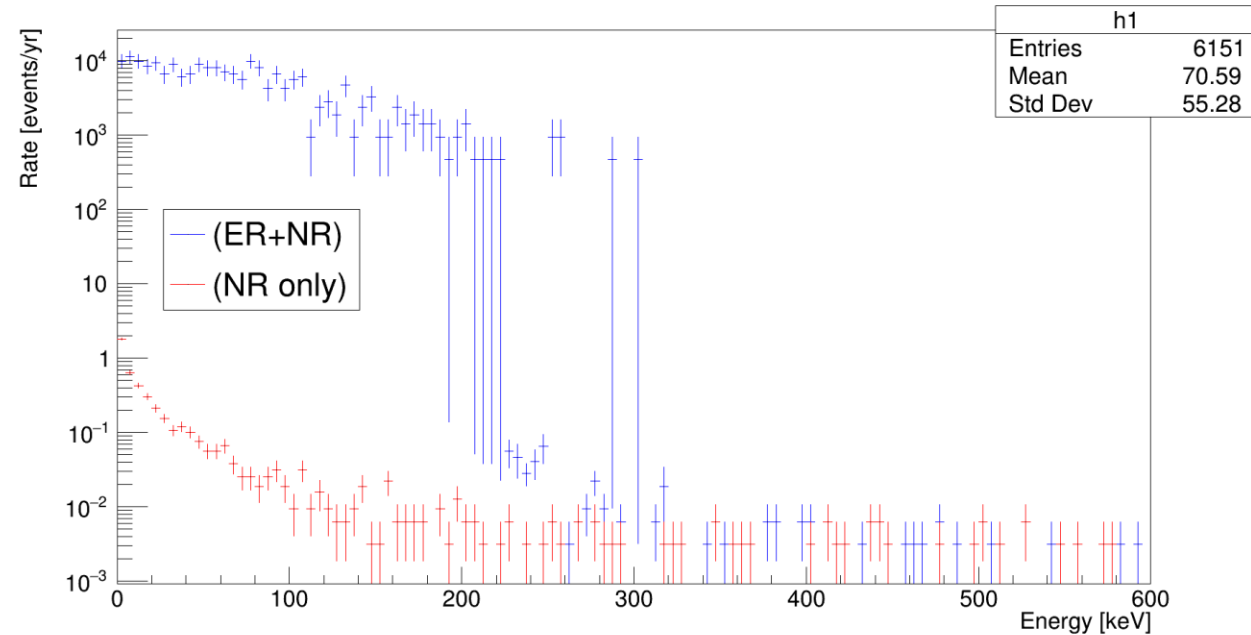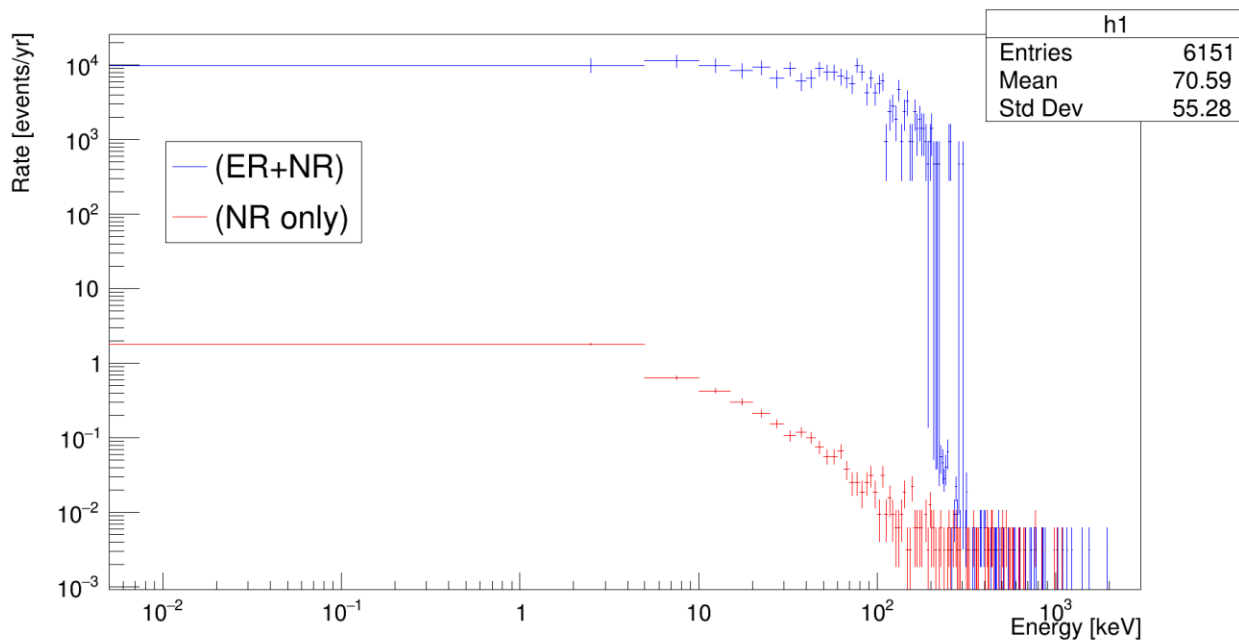 (ER): $(2.47\pm0.05)\times10^4$ events/yr (total)
   (ER): $(6.2\pm0.3)\times10^3$ events/yr (0-20 keV)
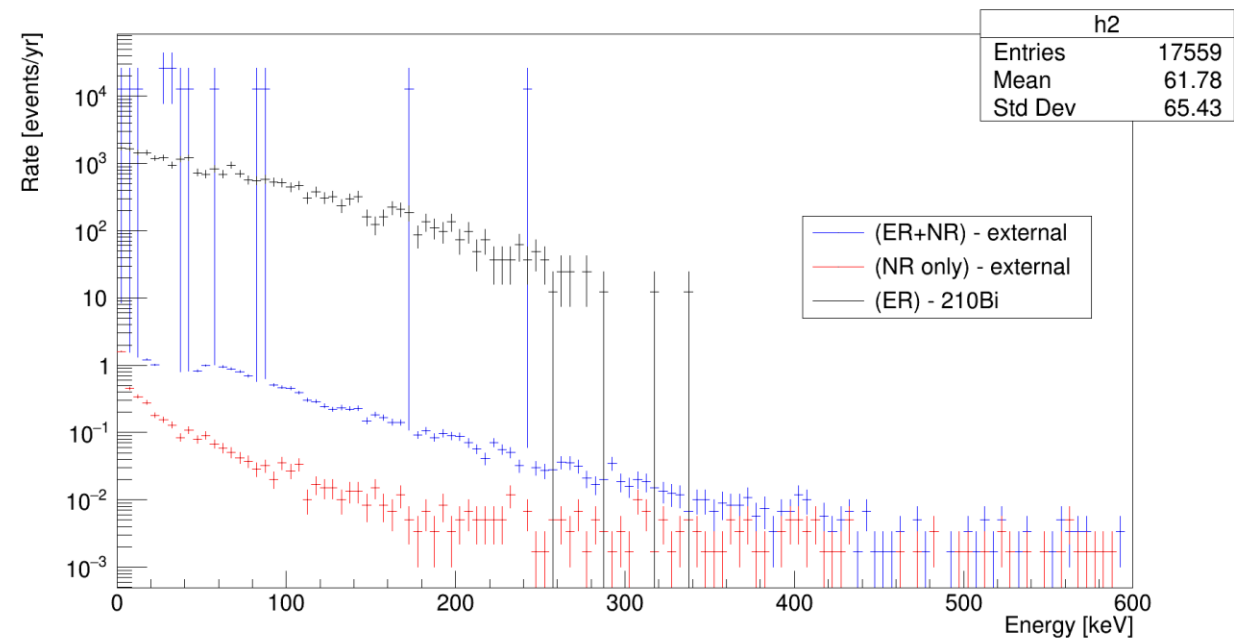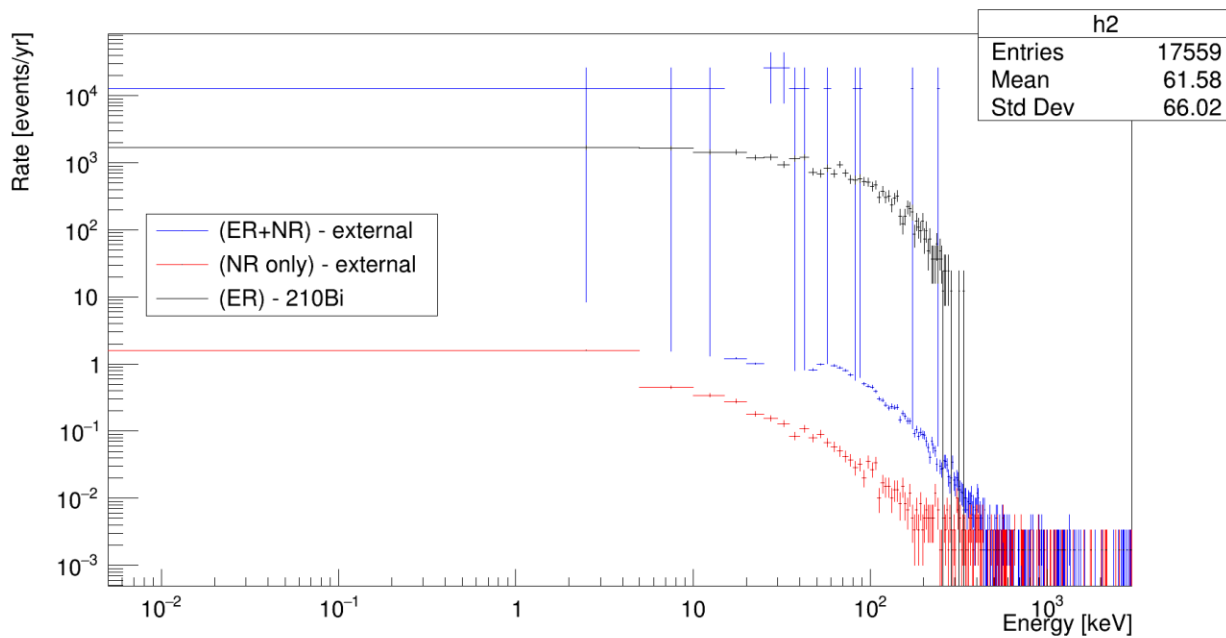
*(80Bq/kg×5658.7kg of lead = 452693 Bq)

Spectra – 40cm water + 10cm Cu

PRELIMINARY

Spectra – 40cm water + 5cm Cu + 5cm Pb

Conclusions

- There might be problems of self-consistency in the simulation – to be checked
- Still need to simulate the radioactivity of **resistors of the field cage**
- *If these results are correct*, difference in background rate between copper and lead configurations is small – using lead might be a good choice
  - Not necessarily true for both LIME and CYGNO: the volume of lead in CYGNO is much higher for same thickness