



# BULLKID Digest

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# What we have

- Current shielding
  - 10 cm Cu
  - $\circ$  5 cm Pb
  - hat shield
- Background from the Pb estimated without considering internal shielding
  - Pb radiopurity from OPERA
- Waiting for gamma counting at Gran Sasso



#### Next: purity assessment for copper

- 10 cm Cu and 5 cm Pb
  - Cu mass: 4.72 T
  - Pb mass: 4.07 T
- Simulations on Copper shield considering the internal shielding
  - red Cu
  - yellow Pb



## Purity assessment for copper

- Data from SNOLAB Low Background Counting Facility
- Different copper samples were considered
- Radioisotopes simulated
  - o <sup>40</sup>K
  - ∘ <sup>60</sup>Co
  - o <sup>226</sup>Ra
  - o <sup>232</sup>Th
  - o <sup>234</sup>Th

## Purity assessment for copper

- For different purity values a fit on the histogram was performed
- The minimum value for the purity on Cu is determined for 10<sup>-2</sup> d.r.u.
  - output from the simulations





#### Purity assessment for copper

Isotope	Minimum purity [mBq/kg]
<sup>40</sup> K	0.57
<sup>60</sup> Co	0.04
<sup>226</sup> Ra	85.39
<sup>232</sup> Th	1811.21*
<sup>234</sup> Th	7.57

\*Value estimated from Poisson

#### Other results

- Discussions with Marco and Fabio (NUCLEUS) point to a possible GEANT4 cut impacting simulations
- Minimum "Cut value" on secondary tracks, set as default to 700 μm
- Modified the cut value of energy for  $e^-$ ,  $e^+$  and  $\gamma$ 
  - $\circ$  700  $\mu$ m (default value)
  - ο **7** μ**m**
  - ο 0.07 μm
- It does not seem to be a considerable difference between them
- Very likely be important for simulations of cosmogenics



# Summary

- Estimated purity for the copper shield has been done considering the external shielding design with a hat shield
  - o <sup>226</sup>Ra 85.39 mBq/kg
  - o <sup>234</sup>Th 7.57 mBq/kg
  - o <sup>40</sup>K 0.57 mBq/kg
  - o <sup>60</sup>Co 0.04 mBq/kg
  - <sup>232</sup>Th 1.81 Bq/kg (estimated from Poisson)
- Modifying the cut value of energy does not seem to bring a considerable difference for simulations of external, radiogenic gammas

#### Next steps

- Simulations to estimate the contribution of radiogenic and cosmogenic neutrons
- Tune the internal shielding (Cu +  $B_4C$  or other moderator)
- Check PIXE de-excitation model and its impact on simulations