



Calibration sources for SABRE PoP

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Calibration source

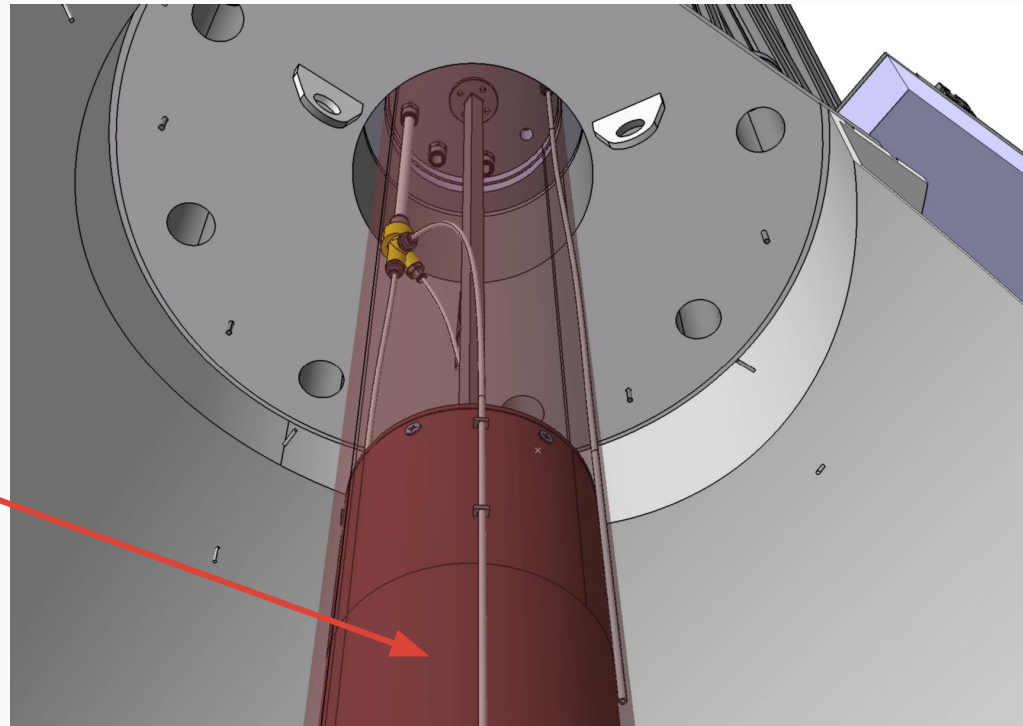
The most favourable positioning is at a height corresponding to the center of the crystal. Extra feedthrough should be added to the top flange with a teflon tube running between the CIS copper tube and the enclosure (space: 5 mm).

Possible sources:

- ^{241}Am - 13, 17, 20, 26, 59 keV x-rays/gamma
- ^{57}Co - 7, 14, 122 keV x-rays/gamma
- ^{109}Cd - 22, 24, 88 keV x-rays/gamma
- ^{228}Th - several high energy gammas

Source mounted on a wire that can be inserted in a teflon tube (connected to the top flange), the length of the wire will fix the position of the source

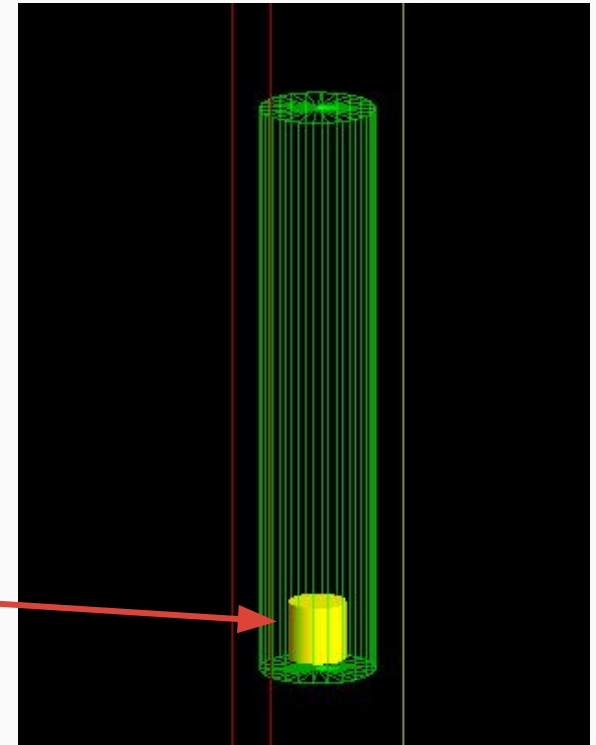
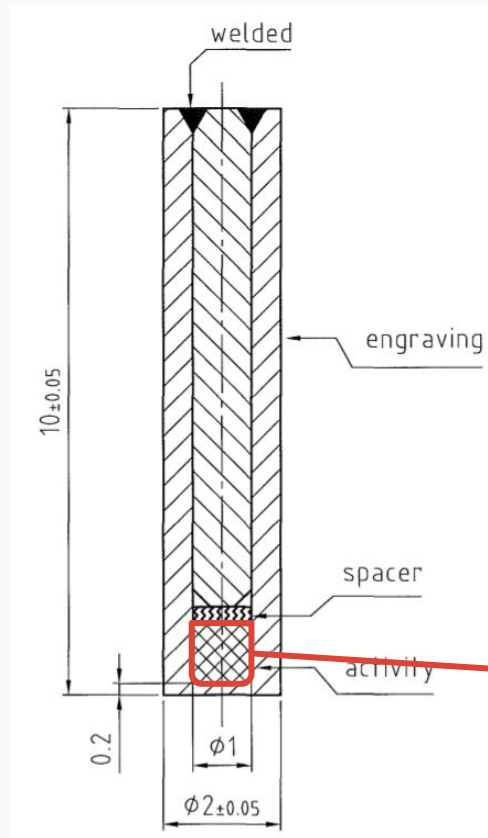
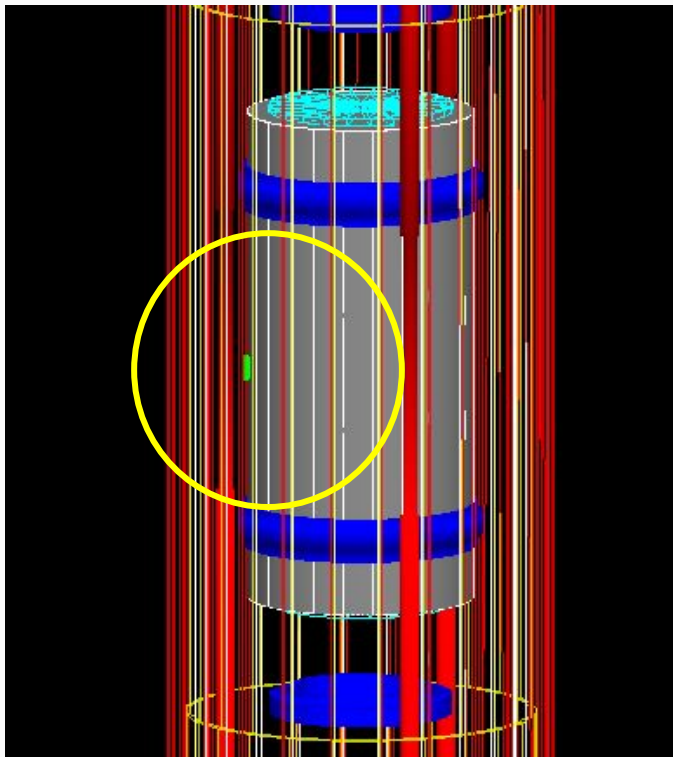
Maximum diameter of the source 2 mm



Source simulations

- Calibration source with realistic dimensions positioned outside the copper enclosure (not visible in the figure) between the enclosure and the copper CIS tube
- Central positioning wrt the crystal
- Study of the spectrum and evaluation of the required activity

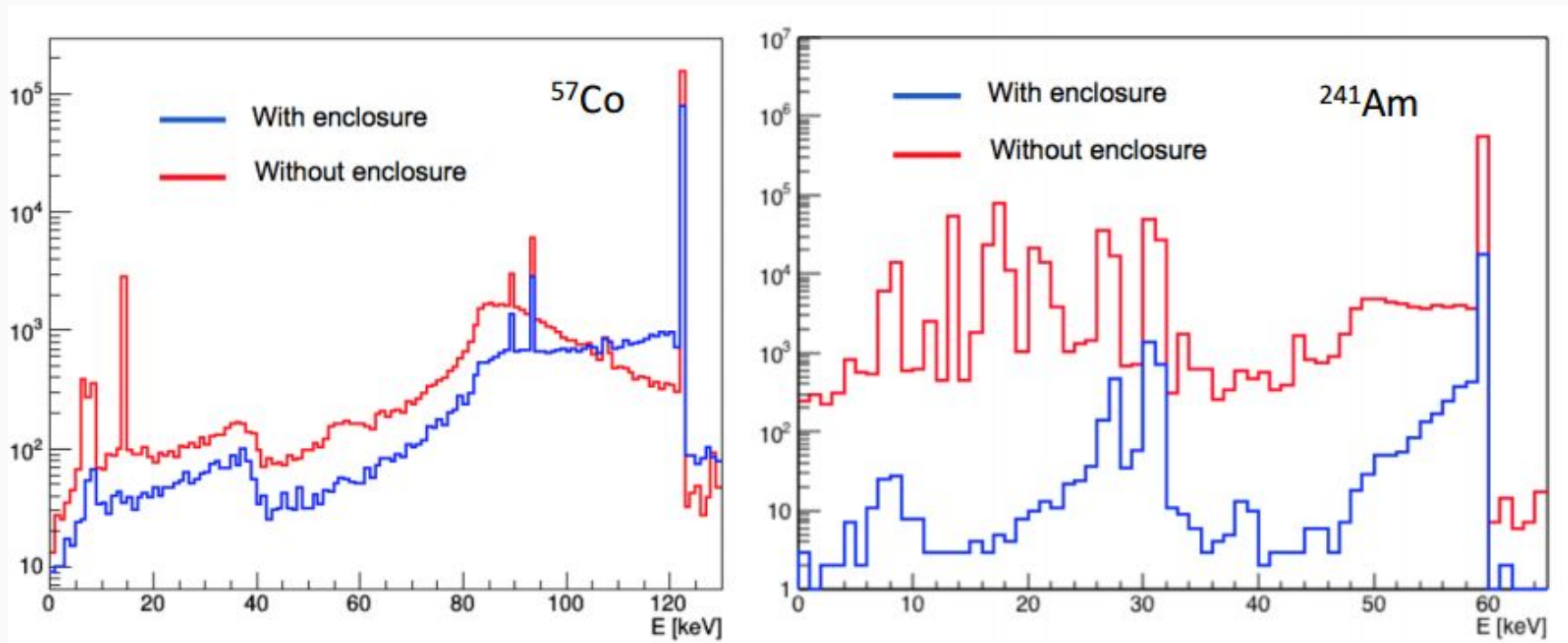
The activity is inside a stainless steel enclosure



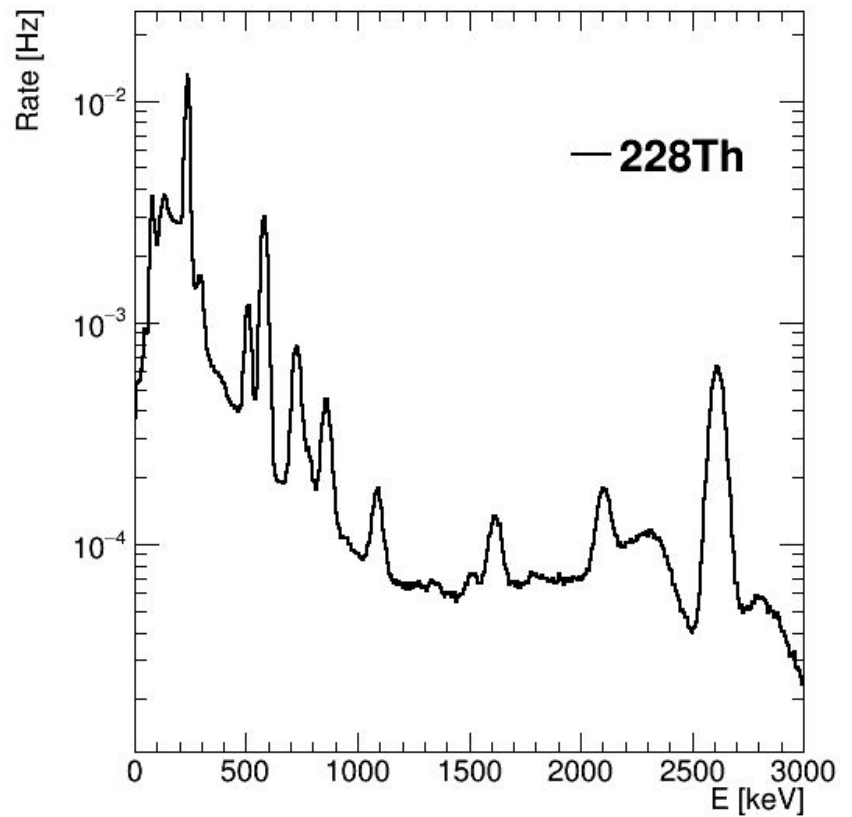
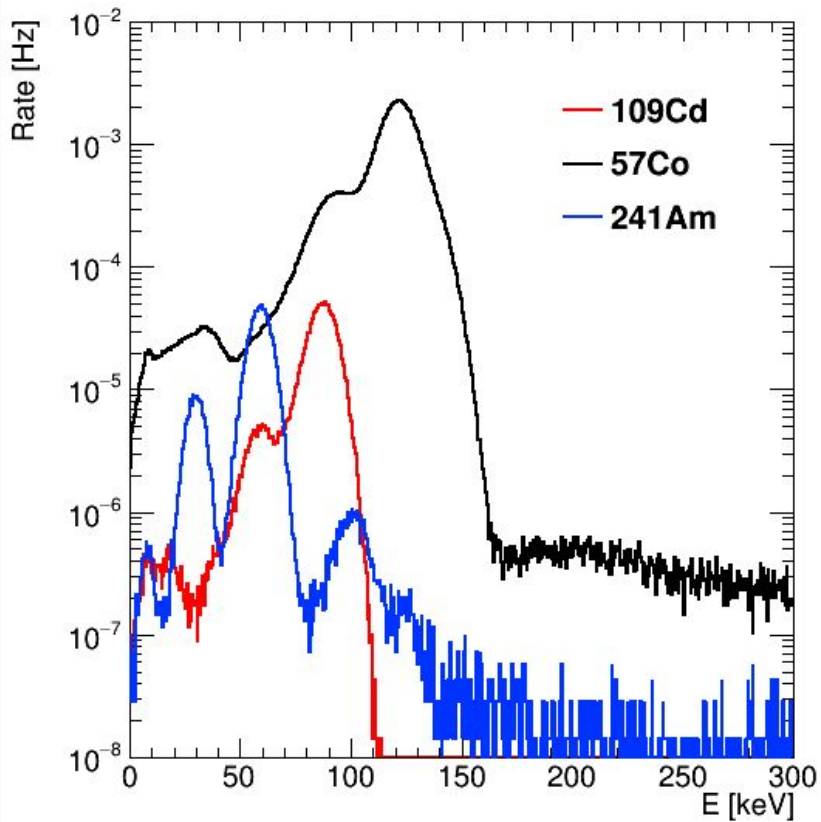
Effect of the enclosure

- The source stainless steel enclosure gives a negligible attenuation
- We have investigated the effect of the copper enclosure on the calibration source spectrum
- The copper enclosure absorbs X-rays/gammas below ~ 30 keV
 - No calibration at very low energies

^{241}Am : Copper enclosure absorbs the lines at 13, 17 and 20 keV

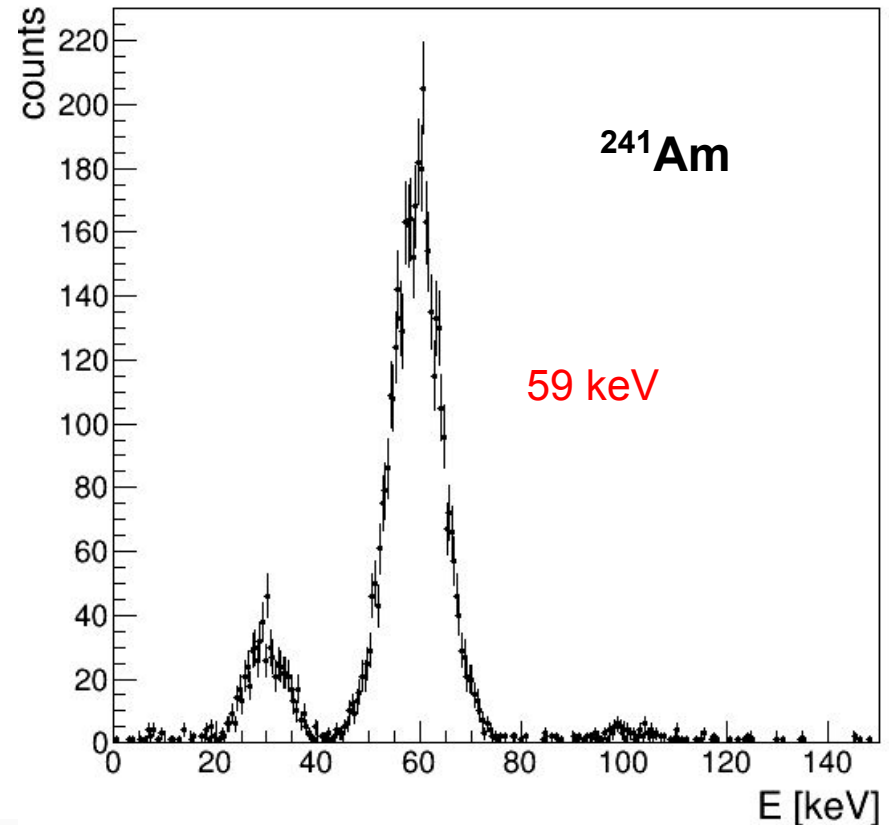
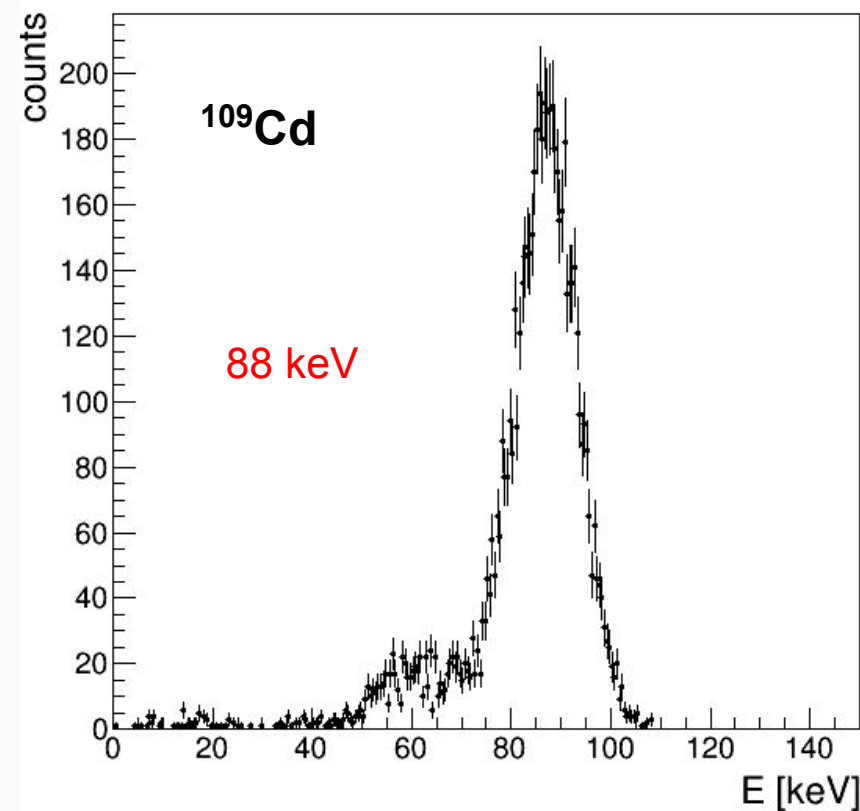


Source spectrum in the crystal



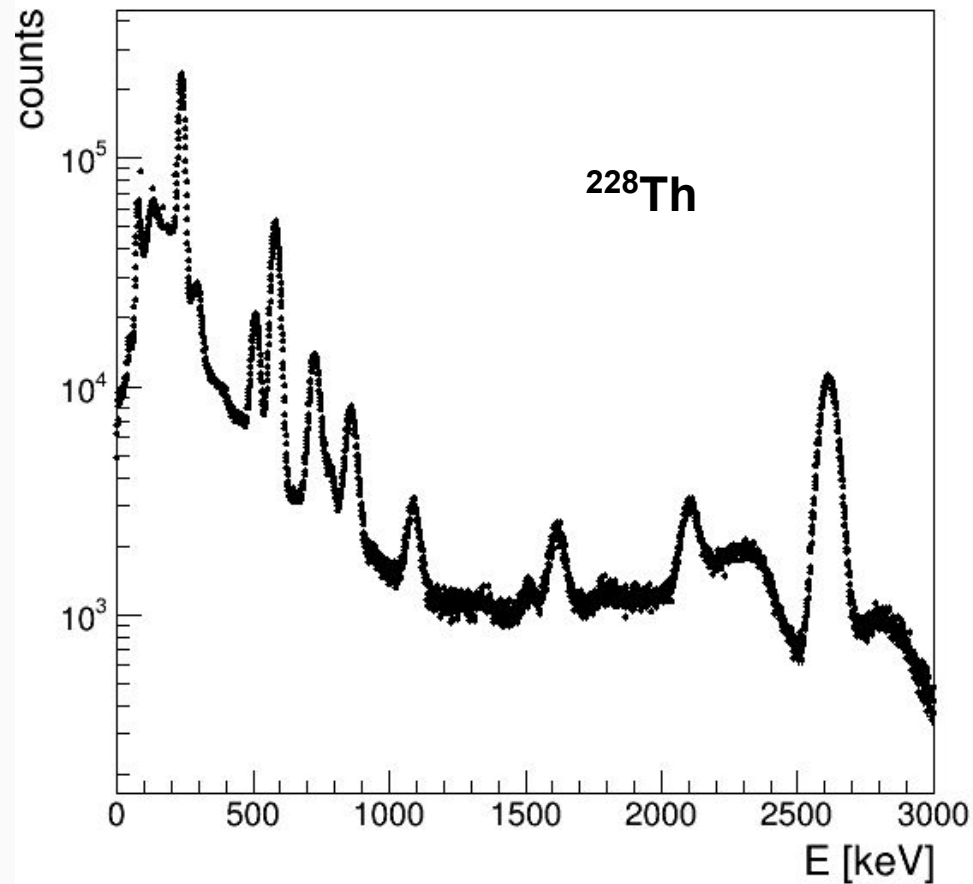
Low energy calibration

- 1 kBq source
- ~ 1 hour of data taking
- 2%/sqrt(E) energy resolution



High energy calibration

- 1 kBq source
- ~ 1 hour of data taking
- 2%/sqrt(E) energy resolution



Summary

- The CIS has been designed in order to insert a calibration source in the 5mm space between the enclosure and the copper tube
- Different radionuclides available: ^{57}Co , ^{241}Am , ^{109}Cd and ^{228}Th
- The copper enclosure absorbs all the x-rays/gamma below ~ 30 keV
- No calibration at very low energies (ok for PoP)
- Sources will be produced by Eckert & Ziegler
- INFN Roma has received an offer for 3 sources from the italian distributor
- Source production takes ~ 3 months
- With 1 kBq activity we can obtain enough statistics in a few hours