

Calibration of HPGe detector and usage of prompt γ rays to extend its efficiency curve in above 2 MeV range



D. Govekar, J. Peric, D. Kotnik, V. Radulović
 Reactor Physics Department, Jožef Stefan Institute, Ljubljana, Slovenia
domen.govekar@ijs.si



Motivation

- No decay calibration source with emission lines above 2 MeV available for energy and efficiency calibration.

Method

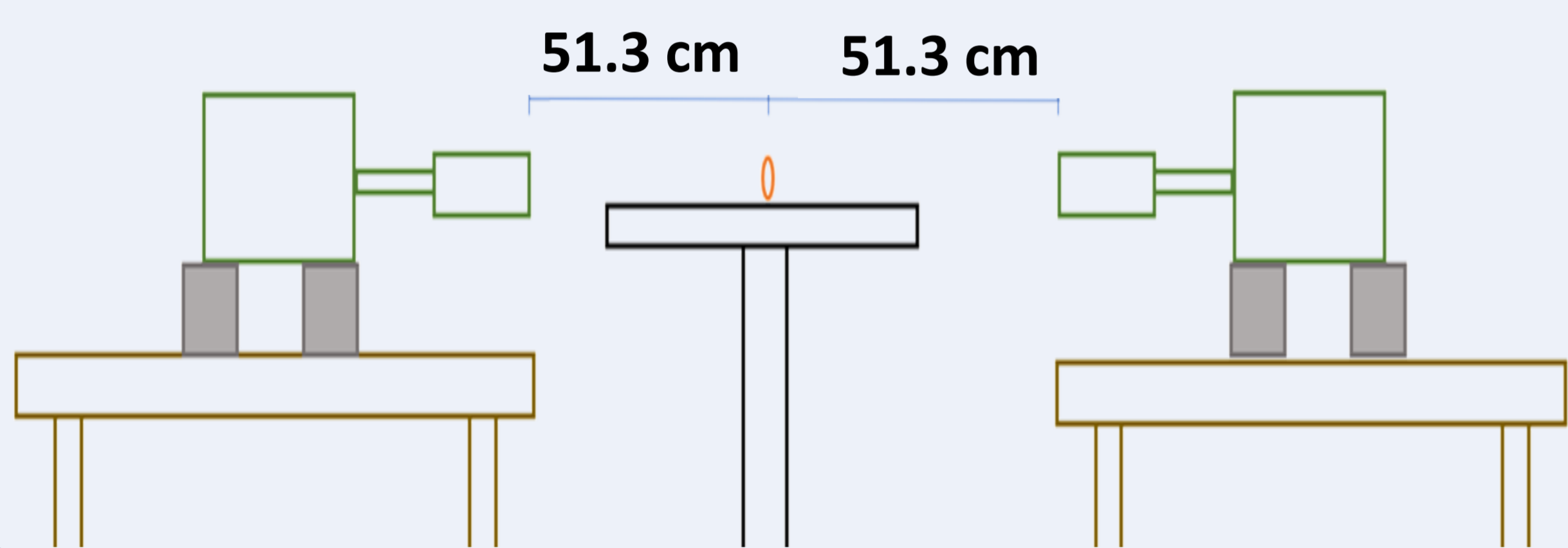
- 2 step approach:
- Calibration with decay sources
 - Neutron induced prompt γ rays for >2 MeV calibration.

Conclusion

- Valid method for extending the energy and efficiency calibration in the energy range >2 MeV.

Certified source calibration

Calibration Sources: europium-152, barium-133, cesium-137
Setup: The detectors were set up centrally at a distance of 50 cm from the calibration source.



Prompt γ experiment

Setup: An Am-Be neutron source induced prompt γ -rays in an Fe-56 target, with detectors 51.3 cm away and water as moderator to slow down the neutrons.



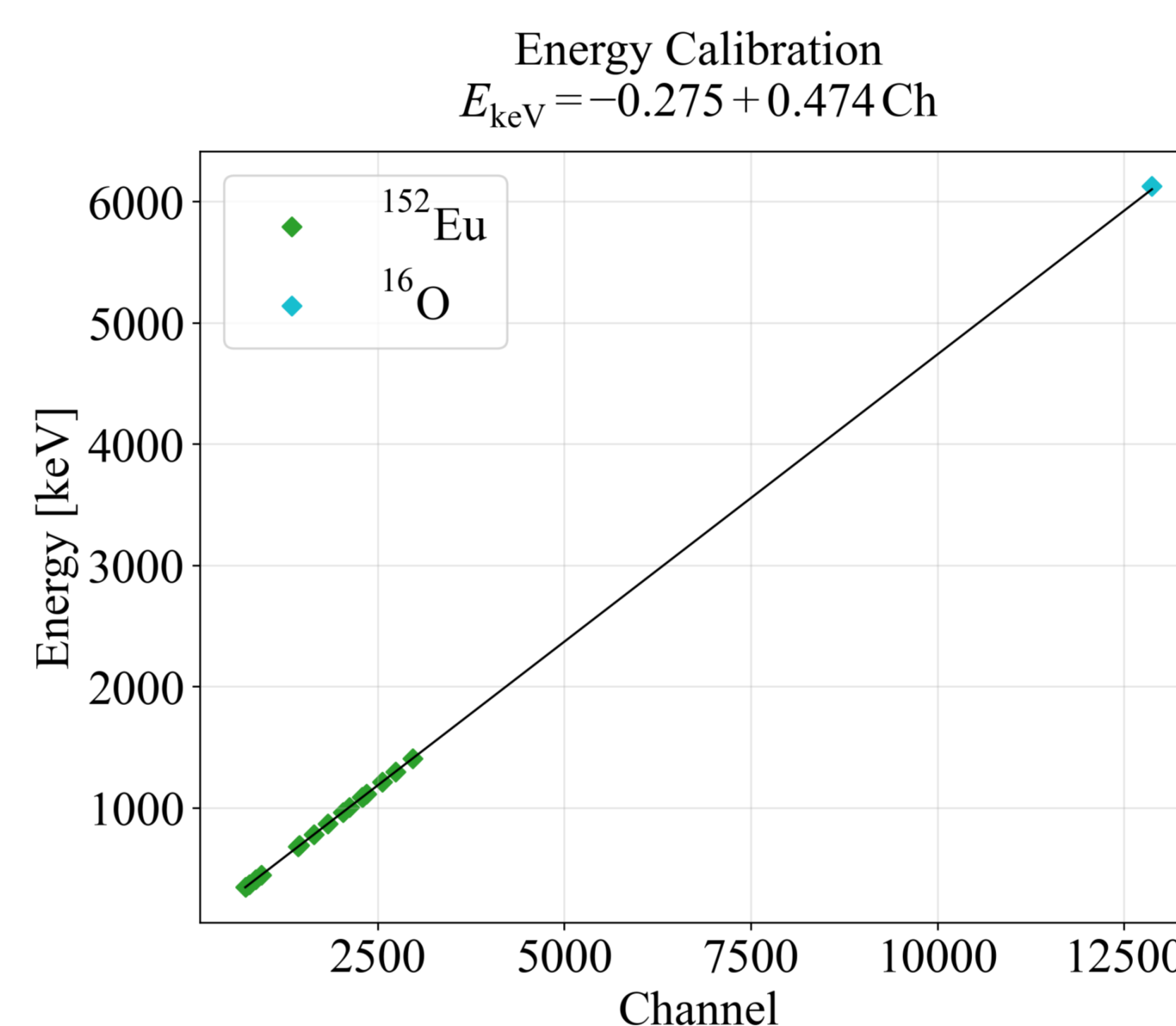
Calibration Points: A combination of low- and high-energy points was used to tie the high-energy prompt gamma calibration to the low-energy certified source reference

Conclusion

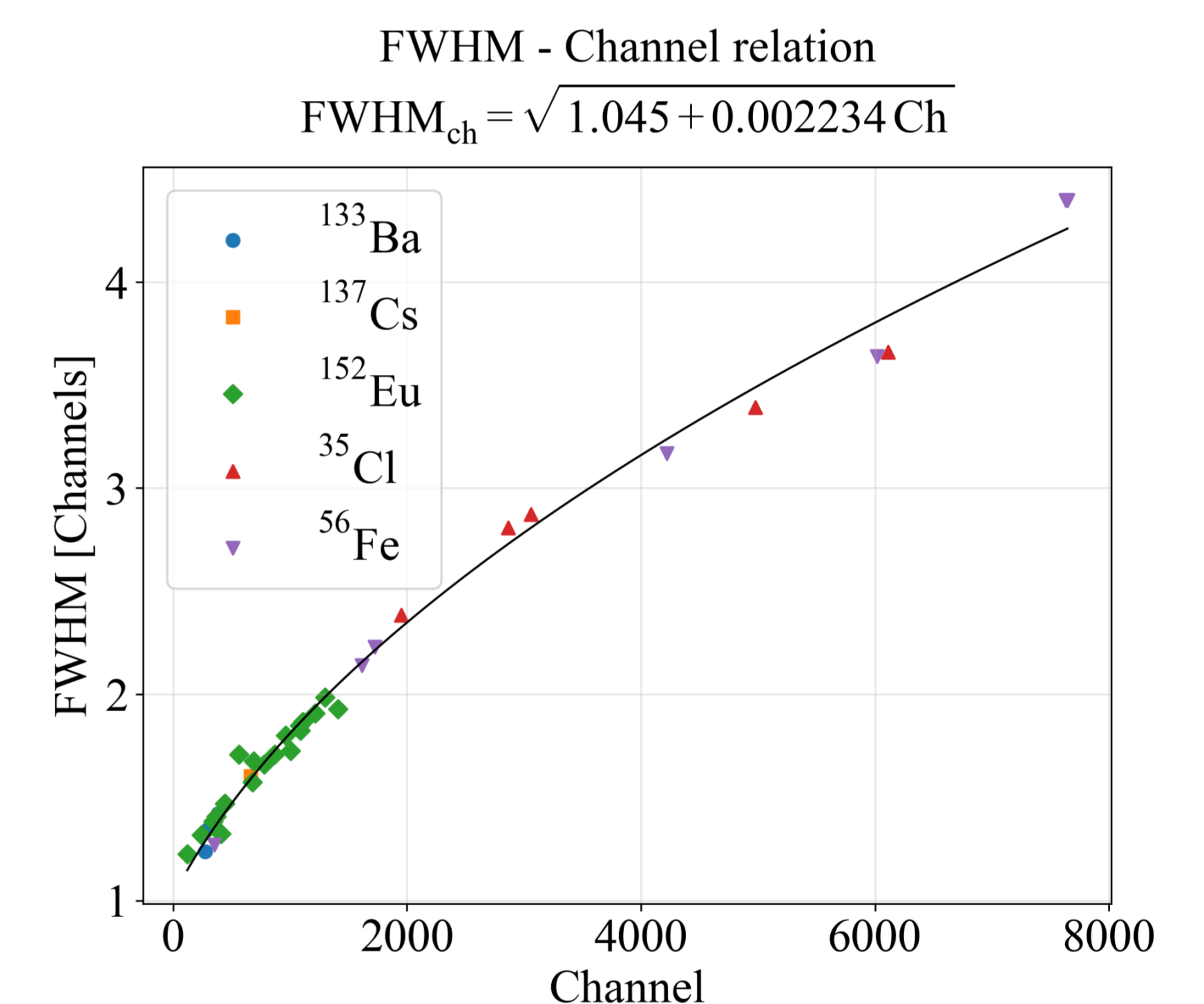
- Prompt γ measurements are a viable method to extend the efficiency calibration range of HPGe detectors.
- To increase the calibration accuracy at higher energies, further improvements to shielding of the experimental setup and longer measurement times are required.

Results

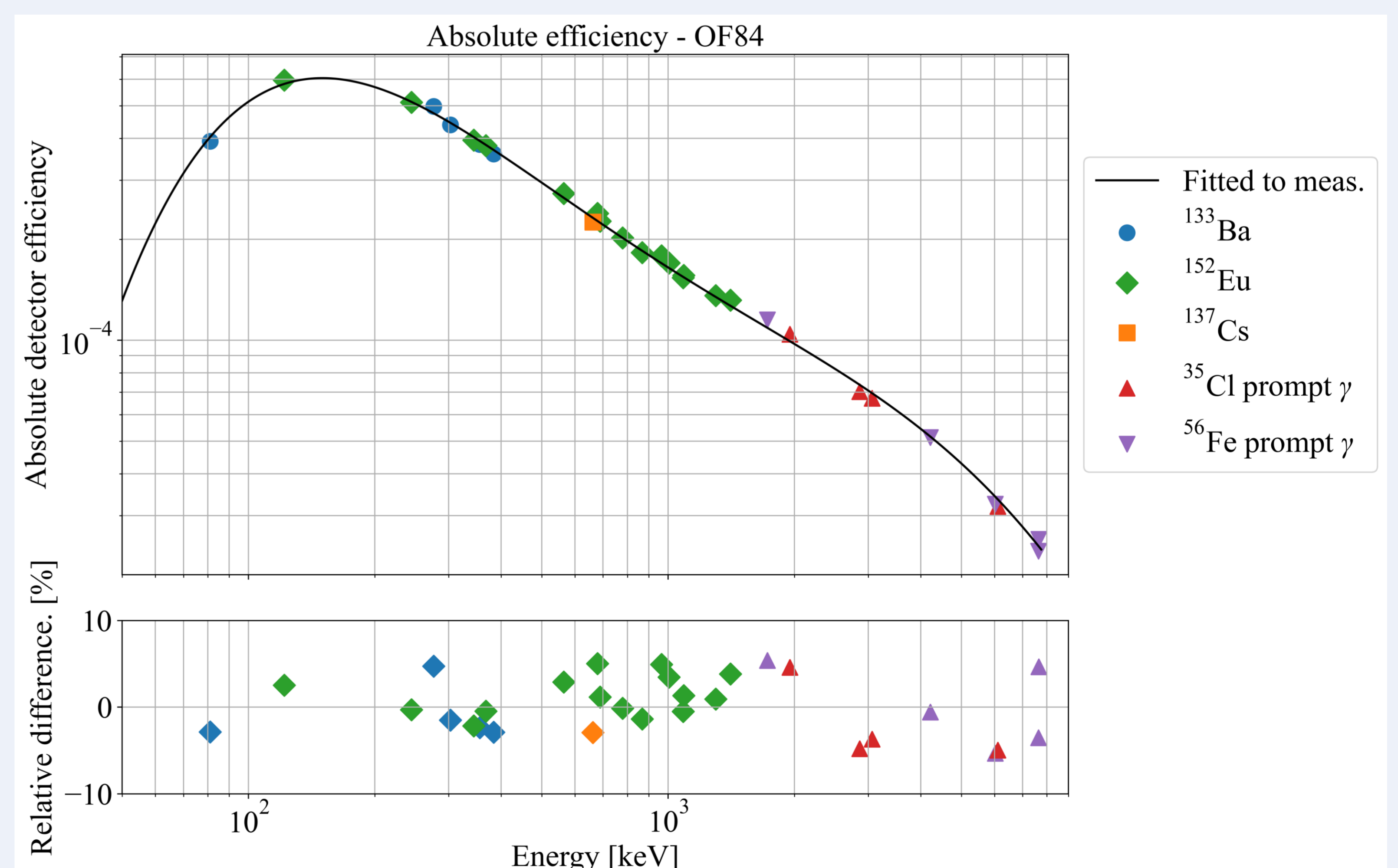
Energy Calibration: Achieved high linearity in energy determination across the γ spectrum.



Resolution Calibration: FWHM measurements showed minimal deviation from manufacturer specification.



Efficiency Calibration: Extended efficiency curve up to 7.65 MeV using a sixth-order polynomial model with good agreement (chi-squared = 0.946).



Acknowledgement

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