Methodology development for analysis of in-beam AGATA data

The 9th International Conference on Position Sensitive Detectors

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UNIVERSITY OF LIVERPOOL

Overview

- AGATA
- Experimental details
- NARVAL
- Linear polarisation method
- Future work

The AGATA project

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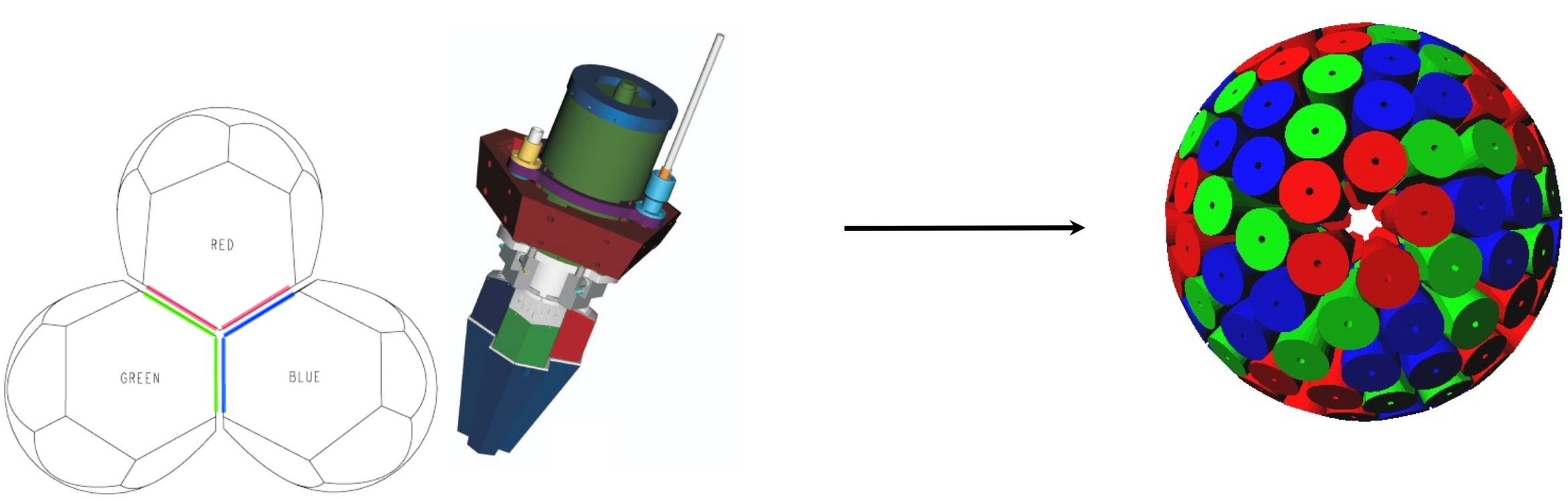
The Advance GAmma-ray Tracking Array

180 crystals will be mounted into 60 triple clusters

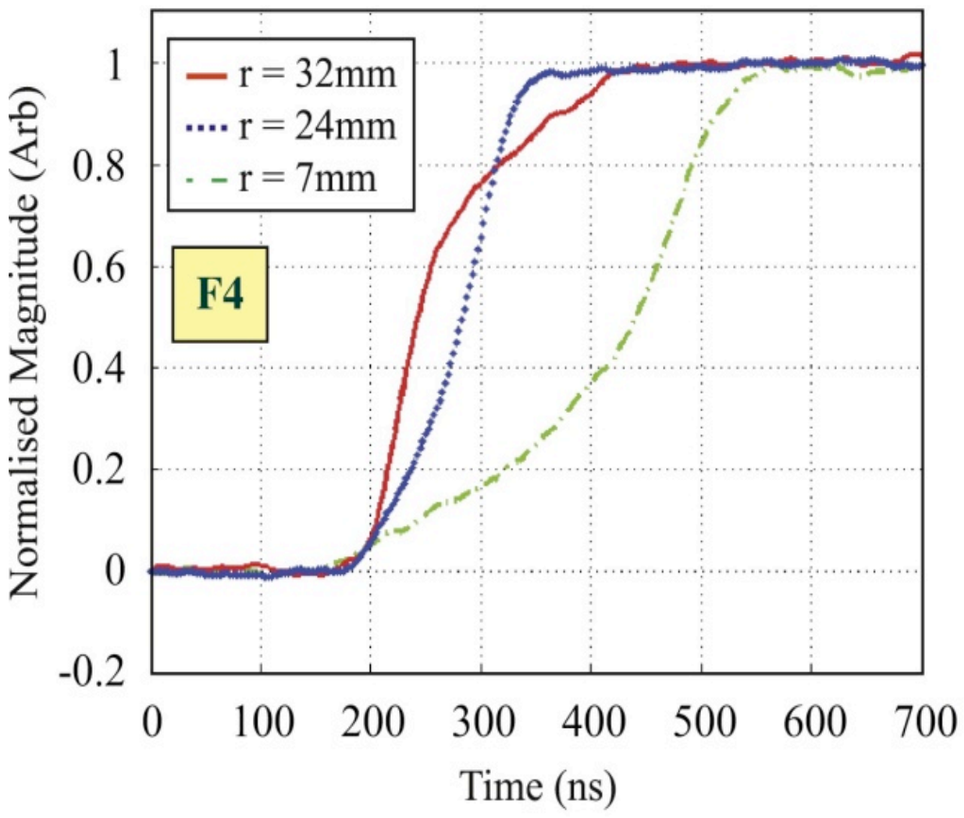
One of each of three crystal types

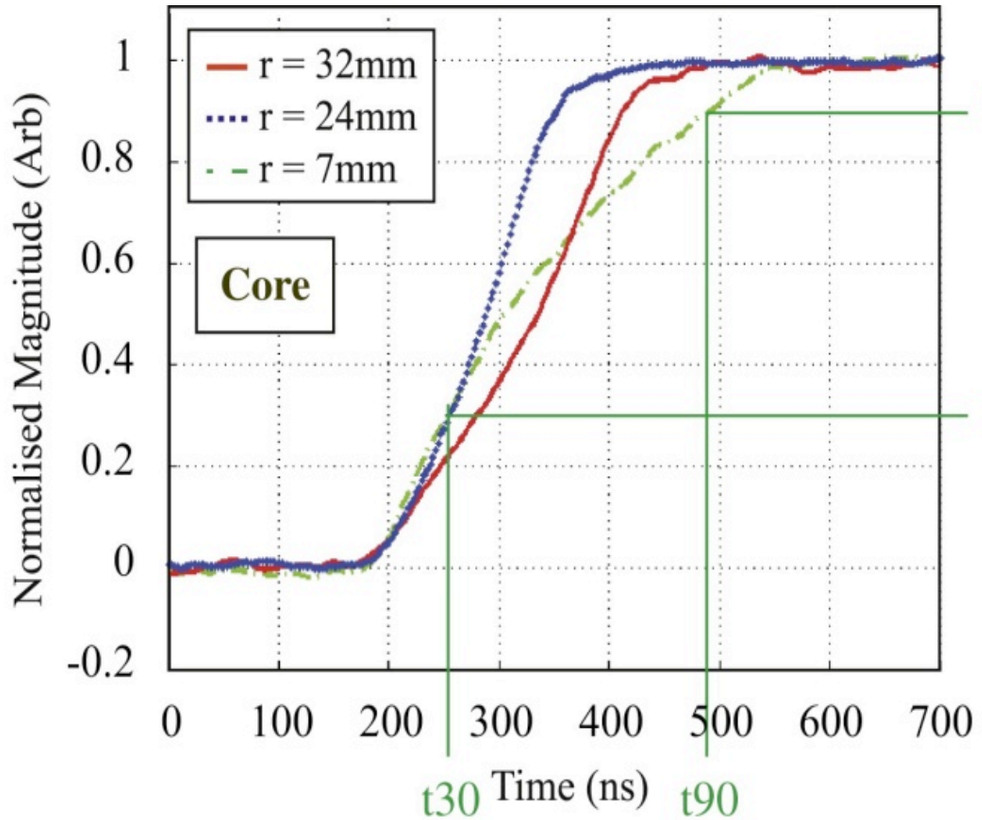
36 segments per detector + core = 37 channels

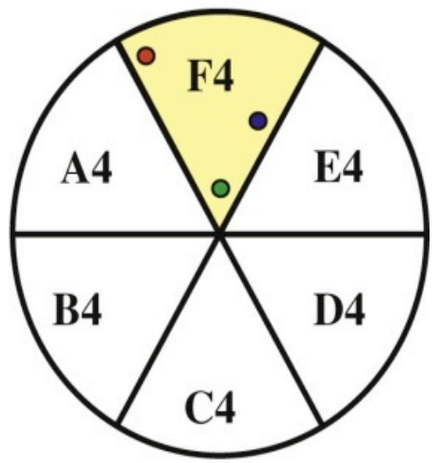


Pulse shape analysis and Gamma-ray tracking

Pulse shape analysis

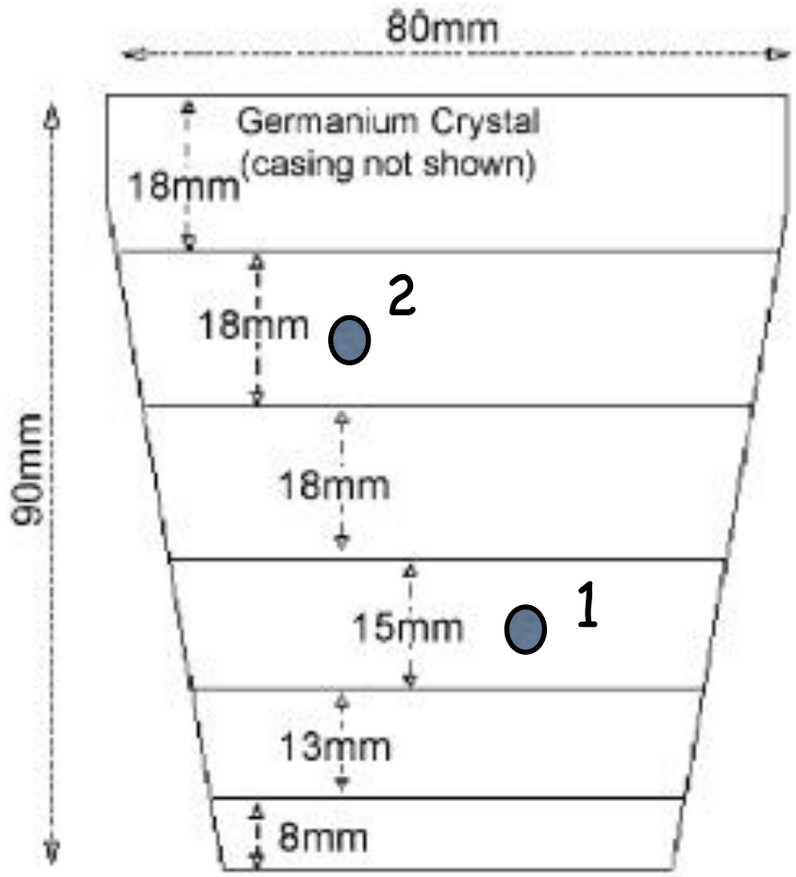


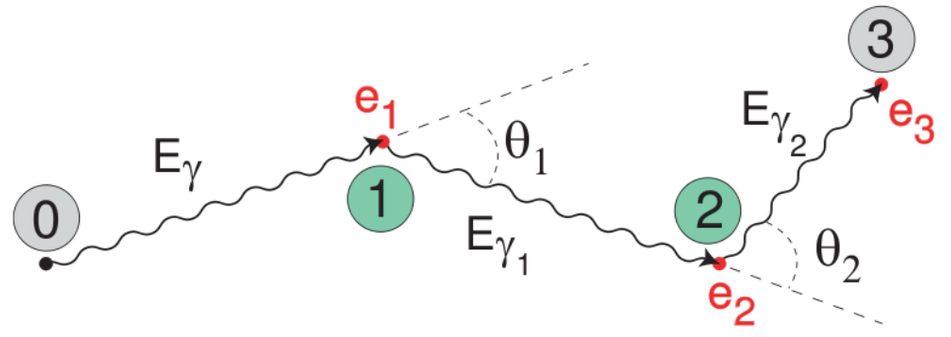




- Signals observed are dependent on the interaction point
- Pulse shape analysis makes use of the differences in signal shapes observed
- (x, y, z, E, t)

Gamma-ray tracking



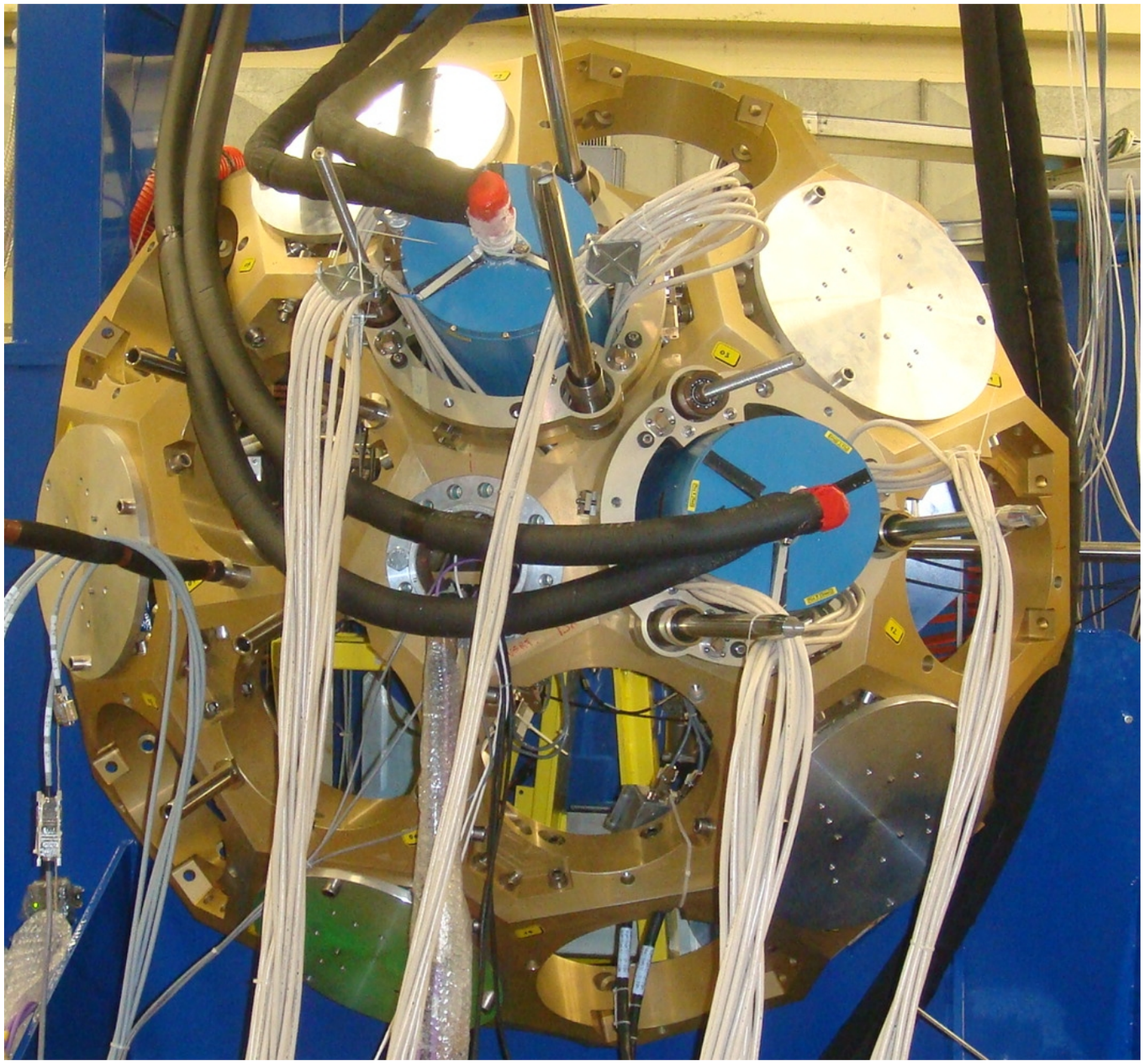


Reconstruct the path of the gamma-rays

Experimental details

- Commissioning experiment - October 2009
- 2 Triple clusters - 6 detectors
- ^{110}Pd (^{32}S,4n) ^{138}Sm @ 135MeV
- Calibrated with ^{133}Ba
- AGATA+$LaBr_3$+TRACE (no further analysis for ancillaries)
- Optimisation of the software, DAQ setup and testing of AGAVA digitisers

Experimental details



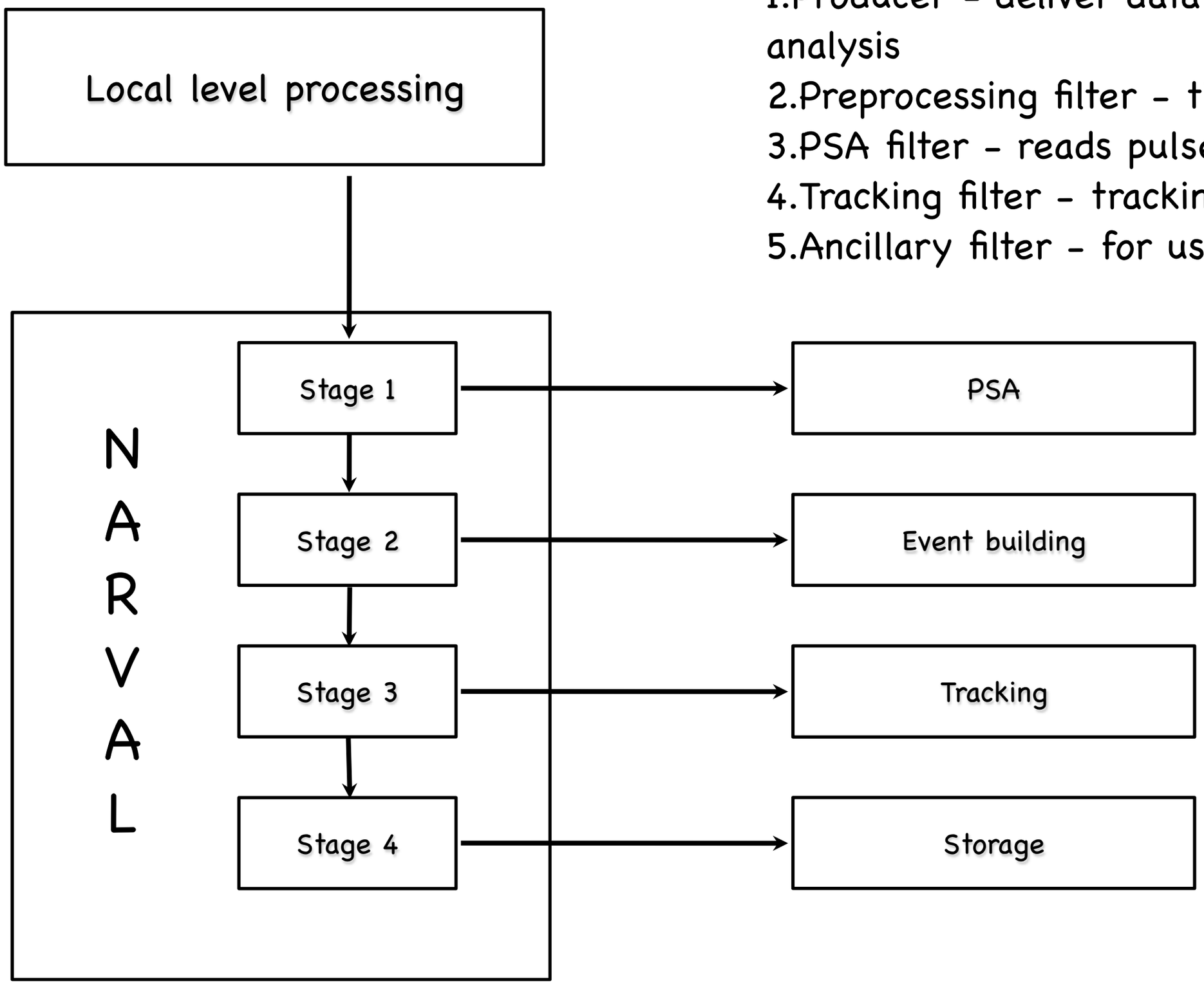
The AGATA frame holding

2ATCs

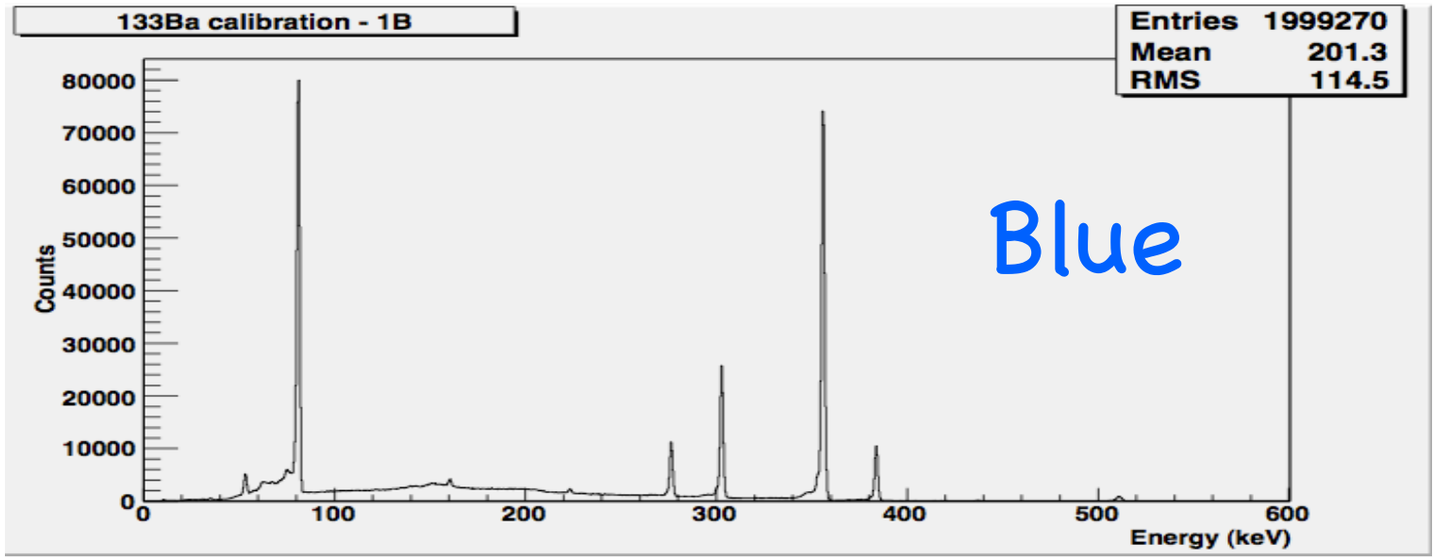
NARVAL

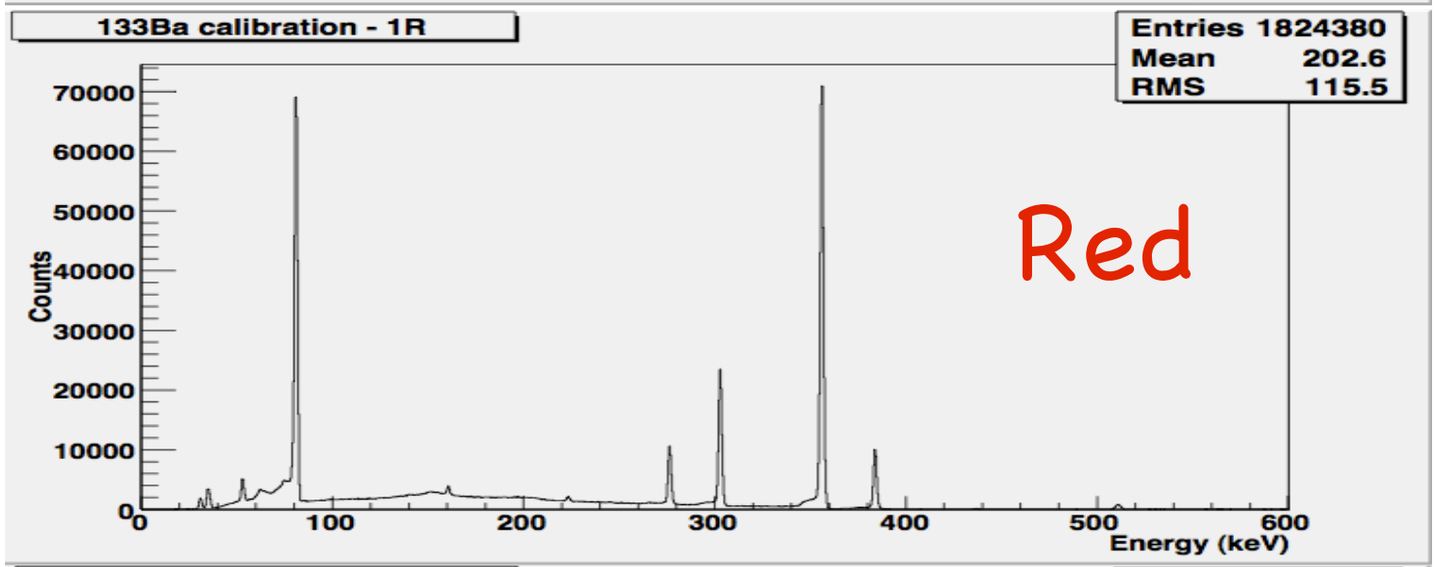
Narval - emulator

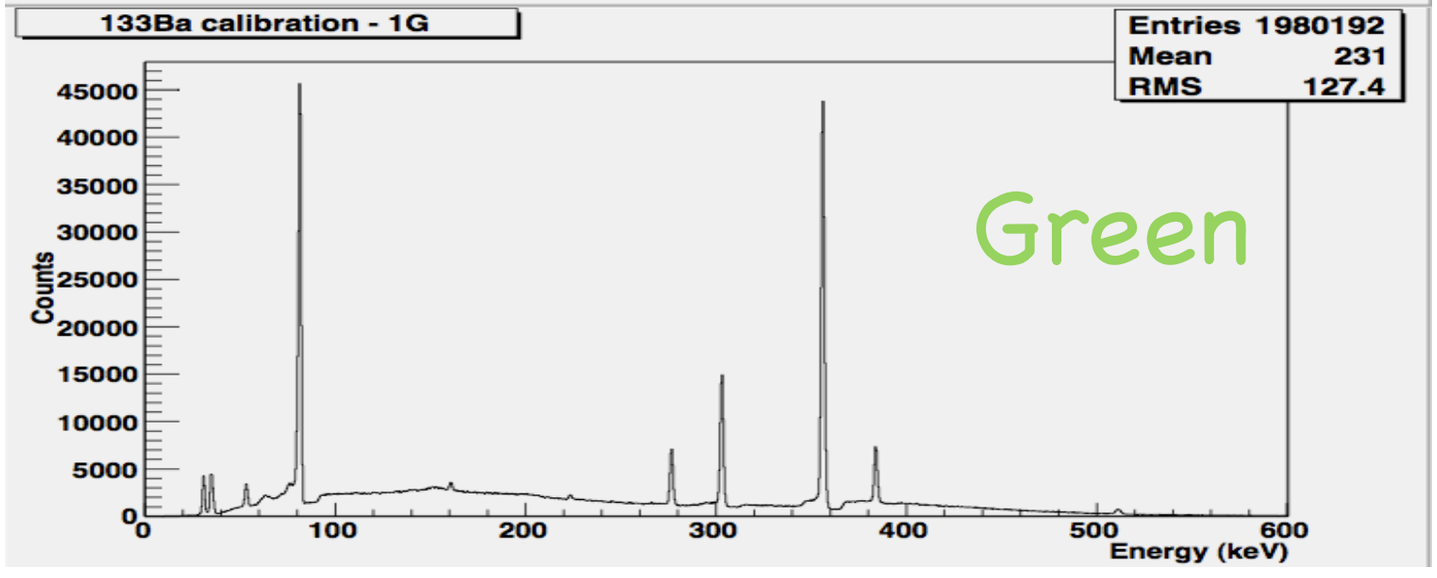
1.Producer - deliver data for pulse shape analysis
2.Preprocessing filter - times, gains.
3.PSA filter - reads pulse-shape data base
4.Tracking filter - tracking
5.Ancillary filter - for use with ancillaries



Calibration

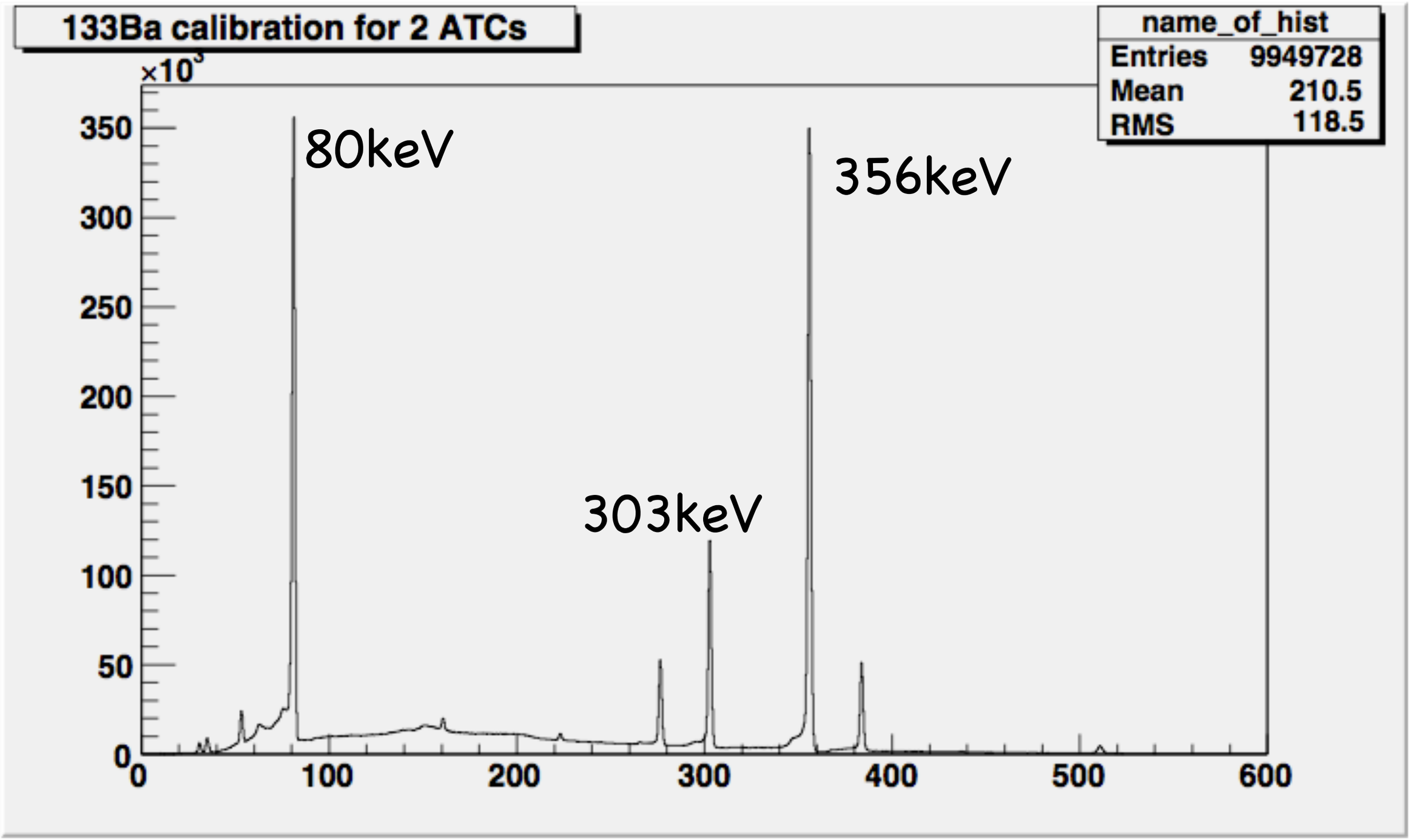




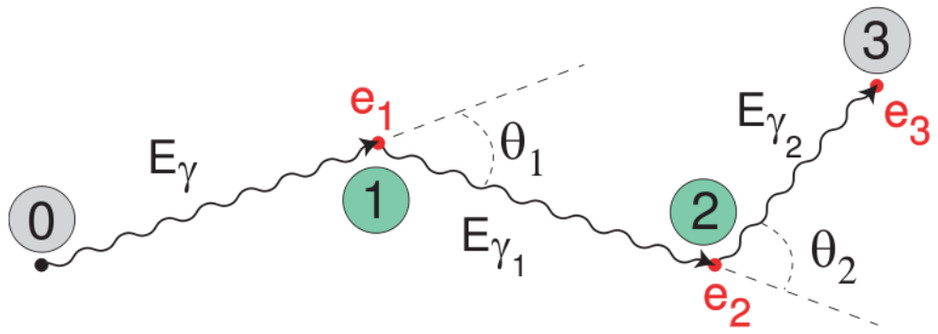


Consistent with ^{133}Ba

^{133}Ba spectrum for red, blue and green crystals



Linear polarisation



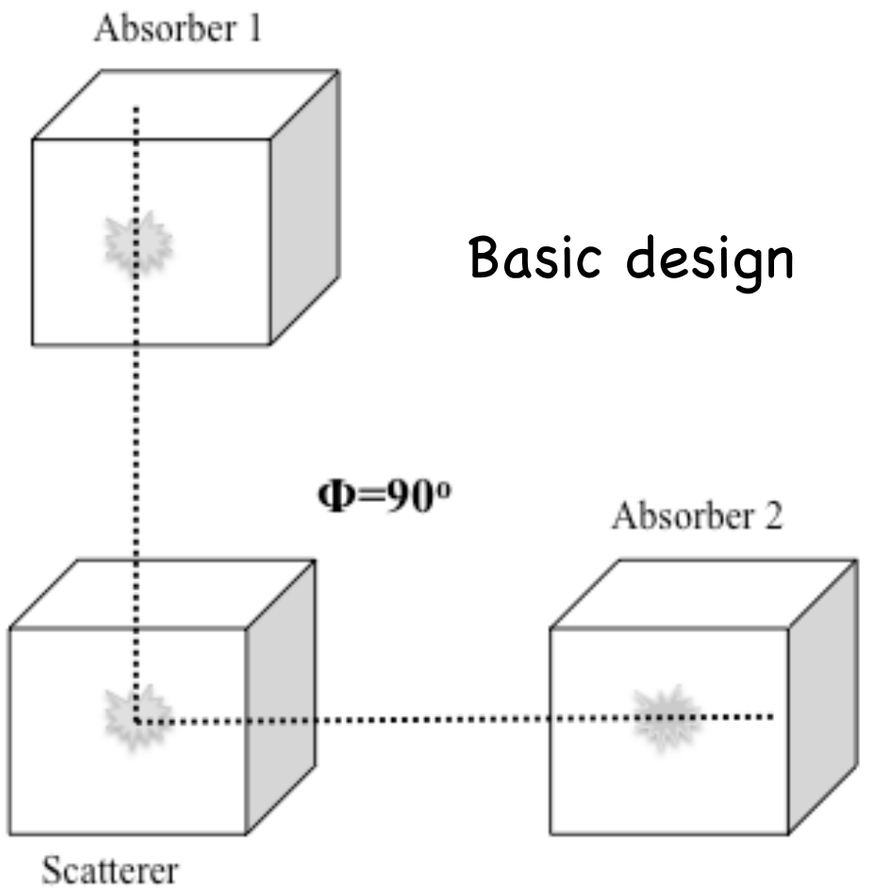
Compton scattering

Compton scatter in the direction perpendicular to electric field vector

Absorber detectors detects scattered gamma-rays

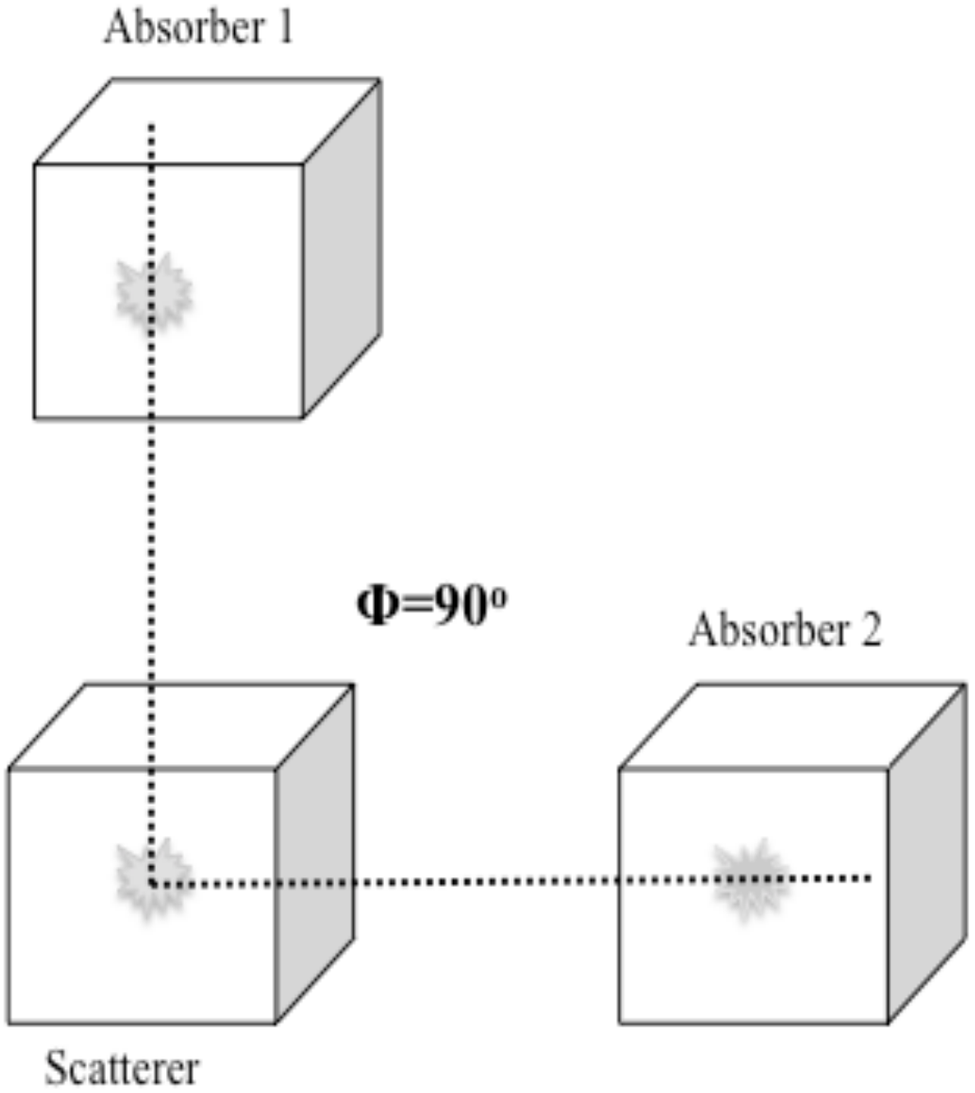
Propagational direction

Polarisation orientation



Basic design

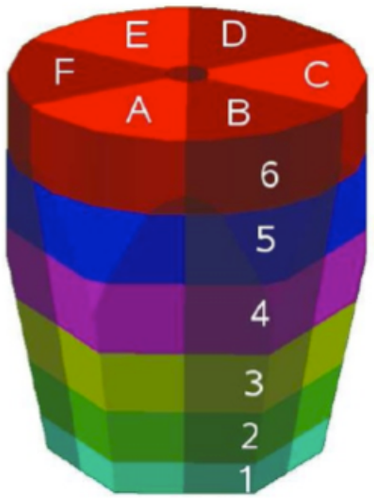
Linear polarisation



Electric or magnetic character

Degree of linear polarisation can be extracted from measuring the angular distribution of the scattered gamma-rays

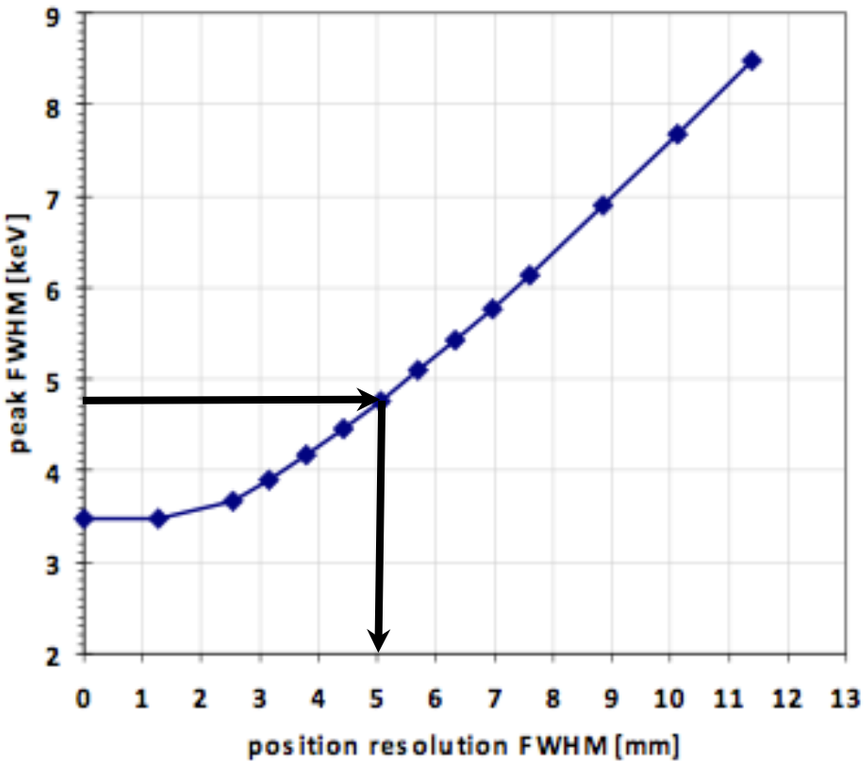
Measuring linear polarisation with AGATA



Scatterer and absorber

Pulse shape analysis

Position resolution = 5mm

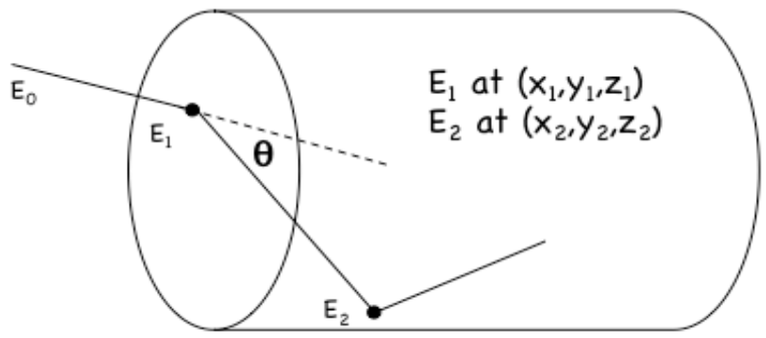


Increased linear polarisation sensitivity

Accurately locate the interaction points

F.Recchia et al, NIM A 604, 555 (2009)

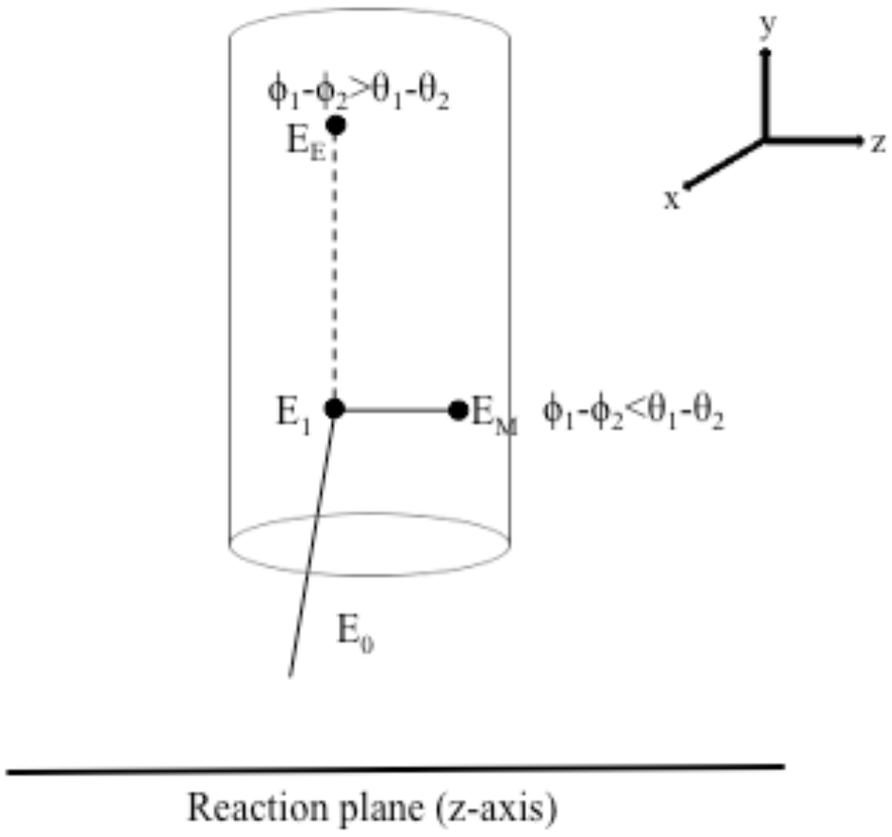
Linear polarisation sensitivity method



Fusion evaporation - 1 triple cluster

Coordinates (x,y,z) from NARVAL

Spherical coordinates (r,θ,ϕ)

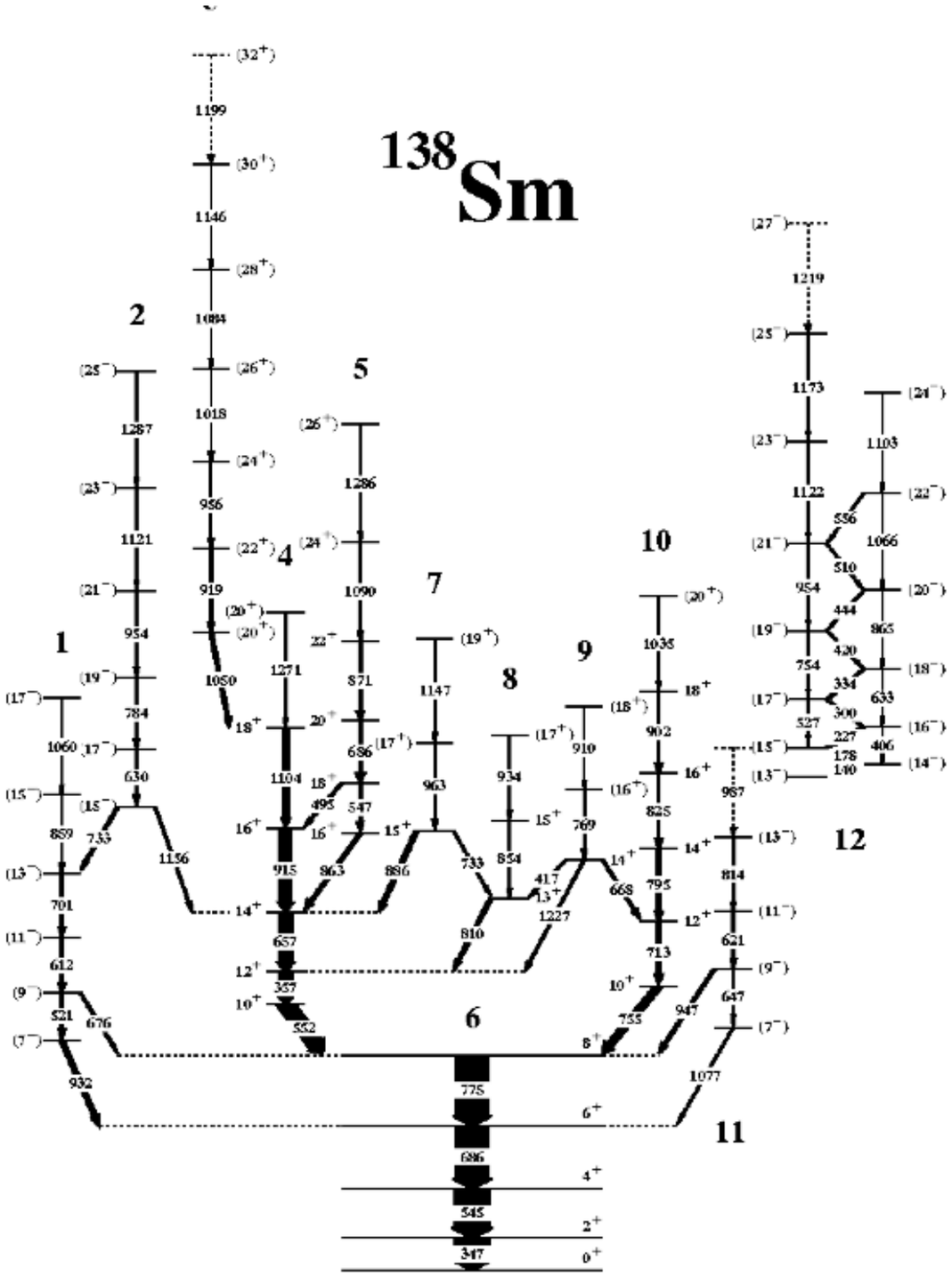


Determine θ and ϕ for every position from the (x,y,z) coordinates

Determine the direction of greater difference

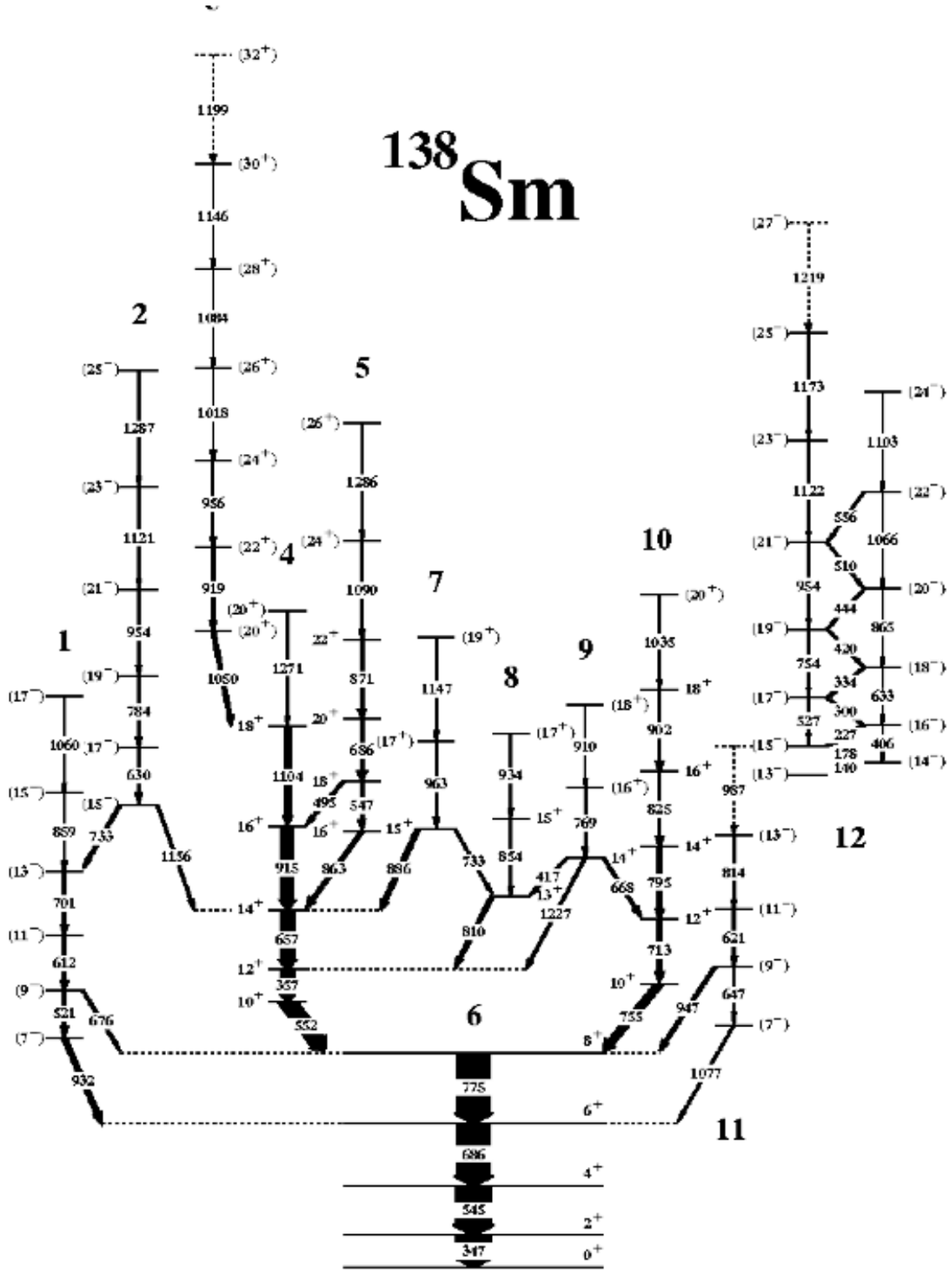
Assign E or M character

Linear polarisation sensitivity method



E.S. Paul et. al. J.Phys. G: Nucl. Part.Phys. 20 (1994) 1405 - 1421

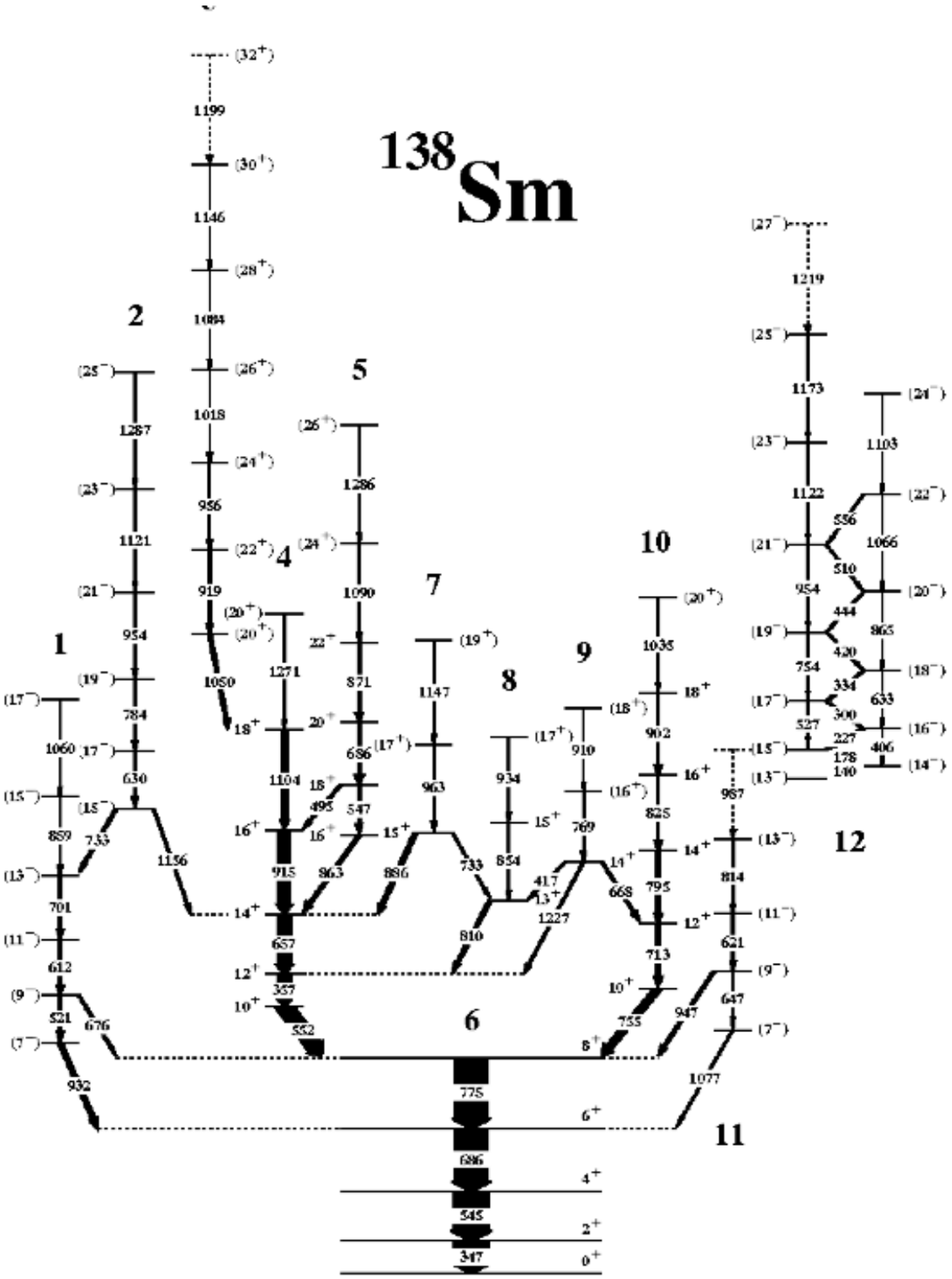
Linear polarisation sensitivity method

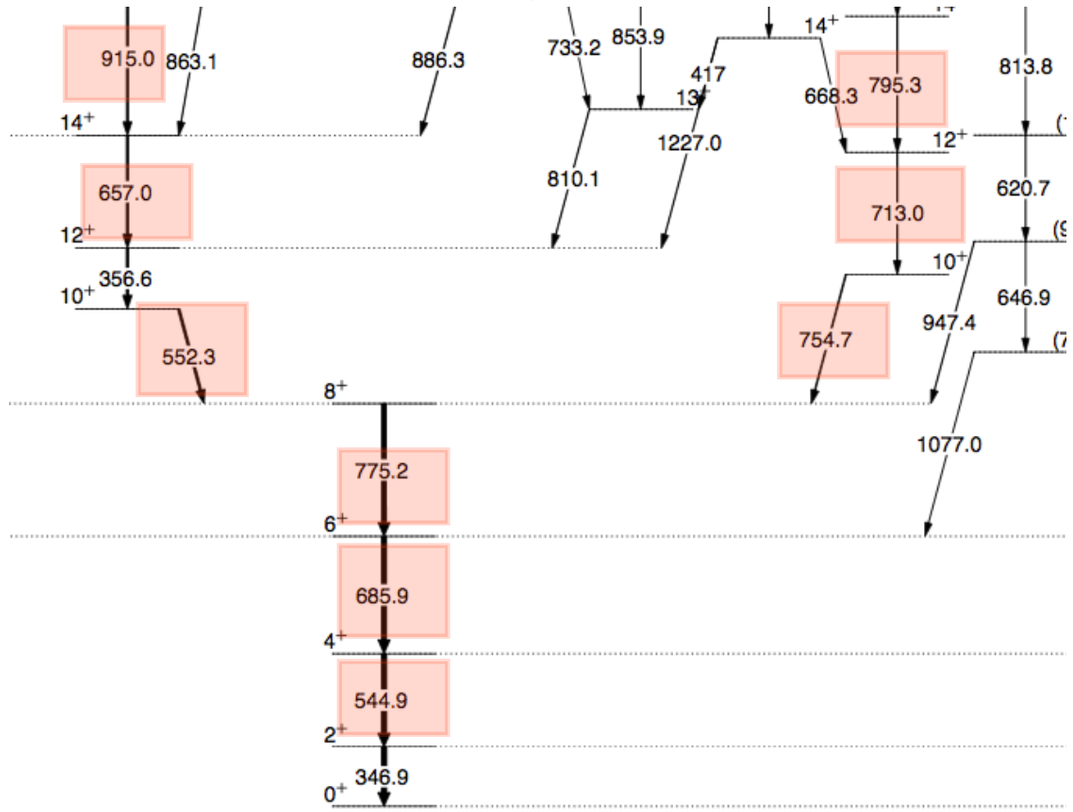


E.S. Paul et. al. J.Phys. G: Nucl. Part.Phys. 20 (1994) 1405 - 1421

Energy (keV)	Multipolarity	Exp. assigned
545	E2	E
552	E2	E
657	E2	E
686	E2	E
713	E2	E
755	E2	E
775	E2	E
795	E2	E
915	E2	E

Linear polarisation sensitivity method





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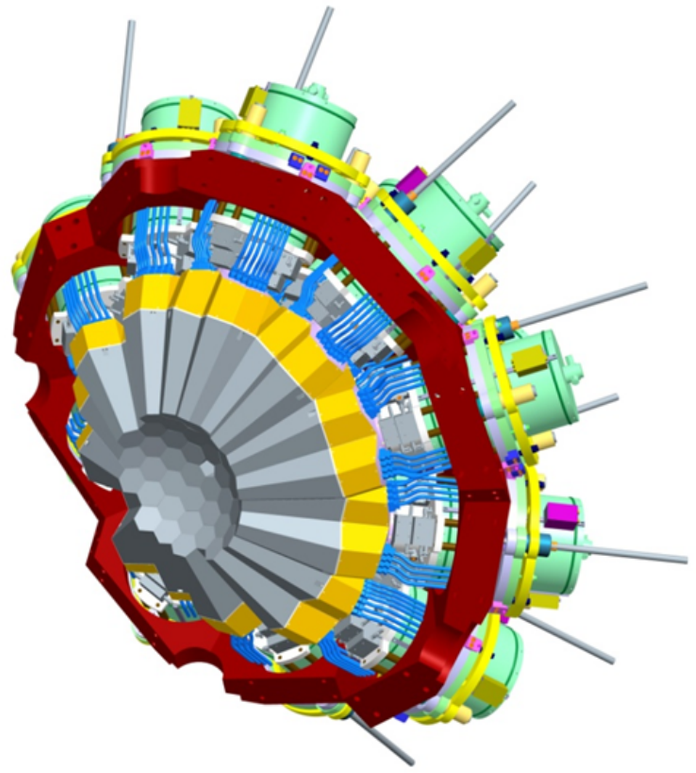
Future work

Continue investigating the polarisation sensitivity capability

Number of gamma-rays scattered perpendicular and parallel to the reaction plane from calibration data

Experimental linear polarisation value for each energy



Thank you

Collaborators

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