The SAGE Spectrometer

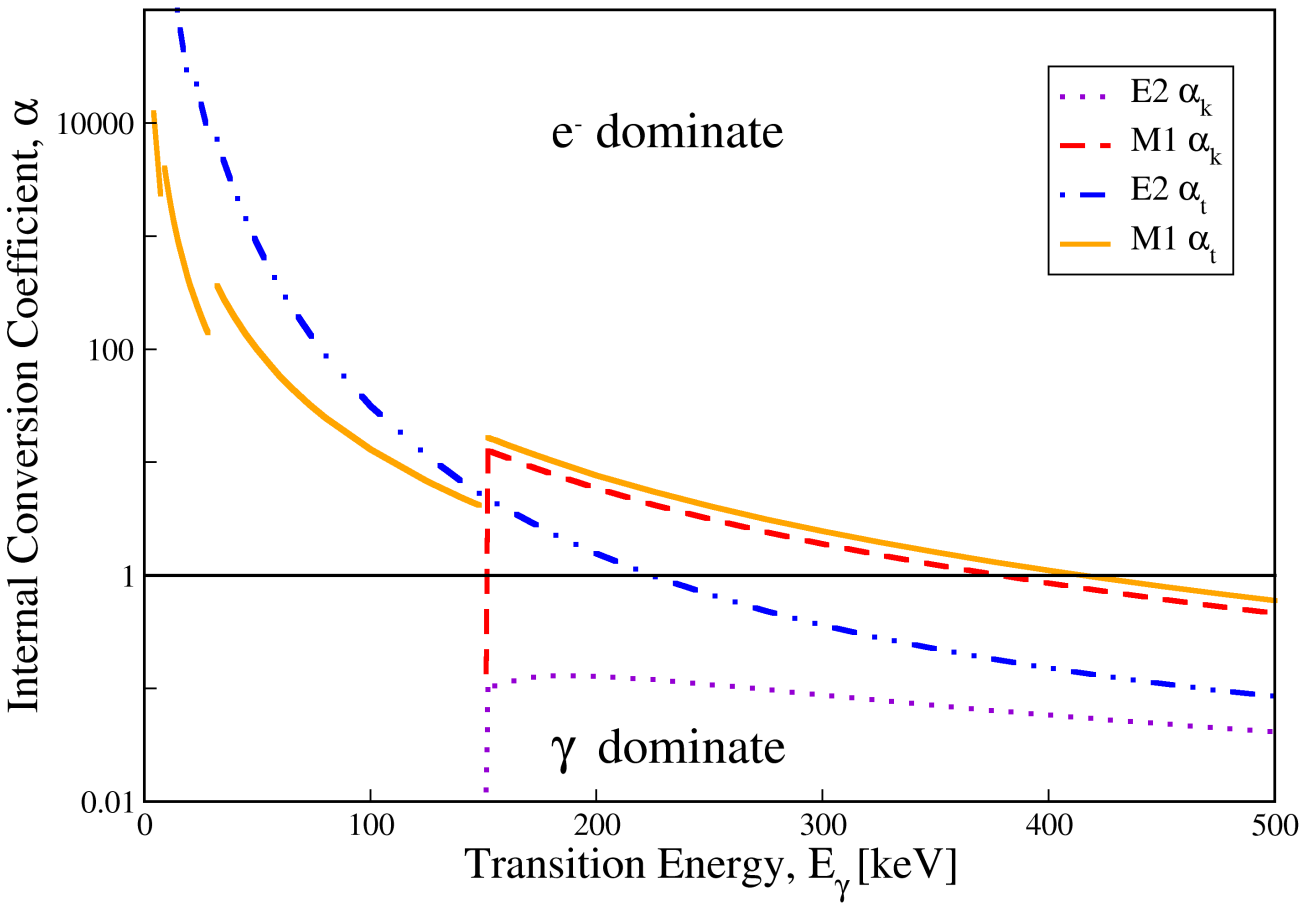
Status and first results

Philippos Papadakis

The University of Liverpool

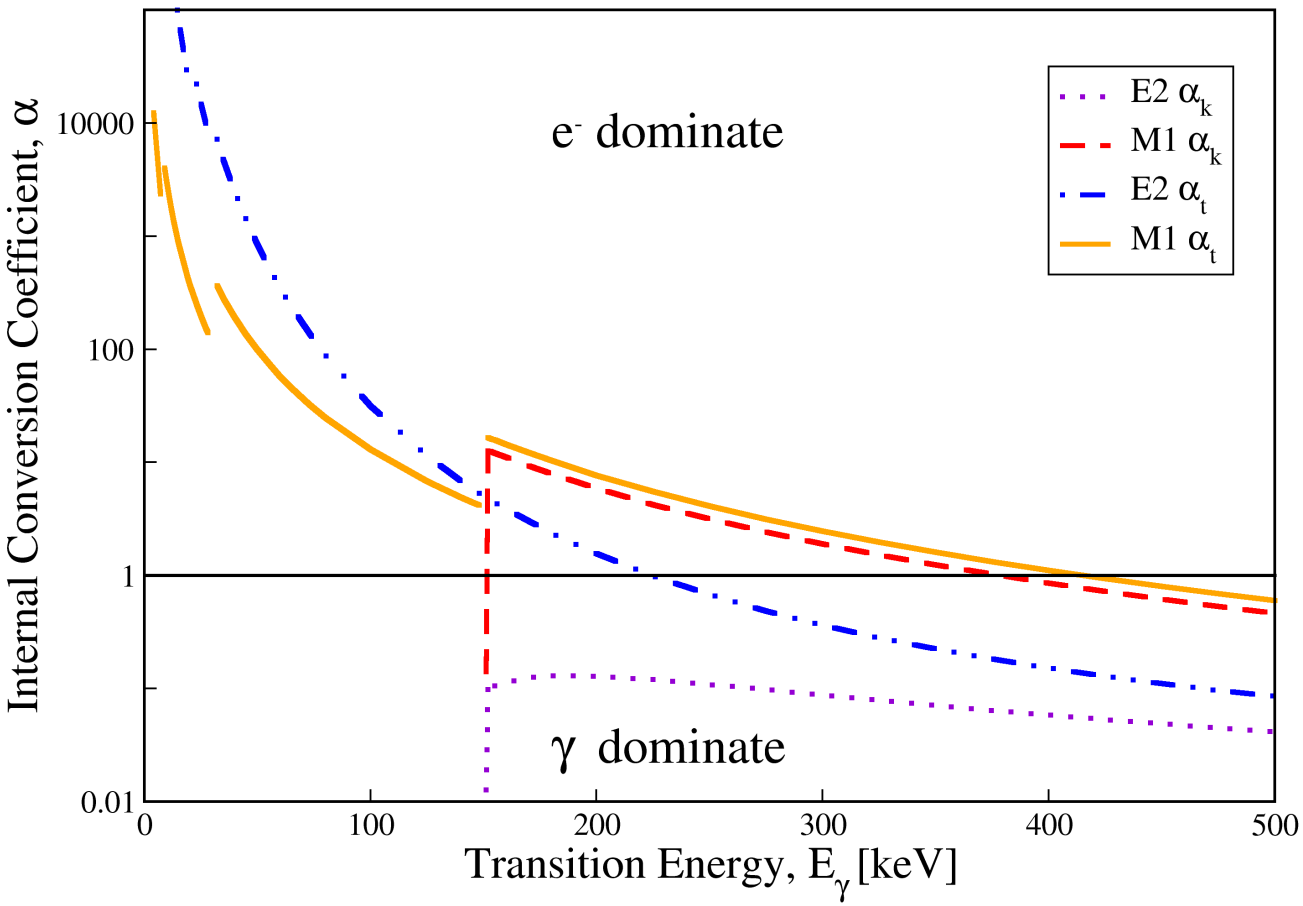
September 2011

UNIVERSITY OF LIVERPOOL



Dependence of internal conversion coefficients on transition energy (Eγ) for nobelium

Nucl. Instr. and Meth. A 589 (2008) 202-229



Dependence of internal conversion coefficients on transition energy (Eγ) for nobelium

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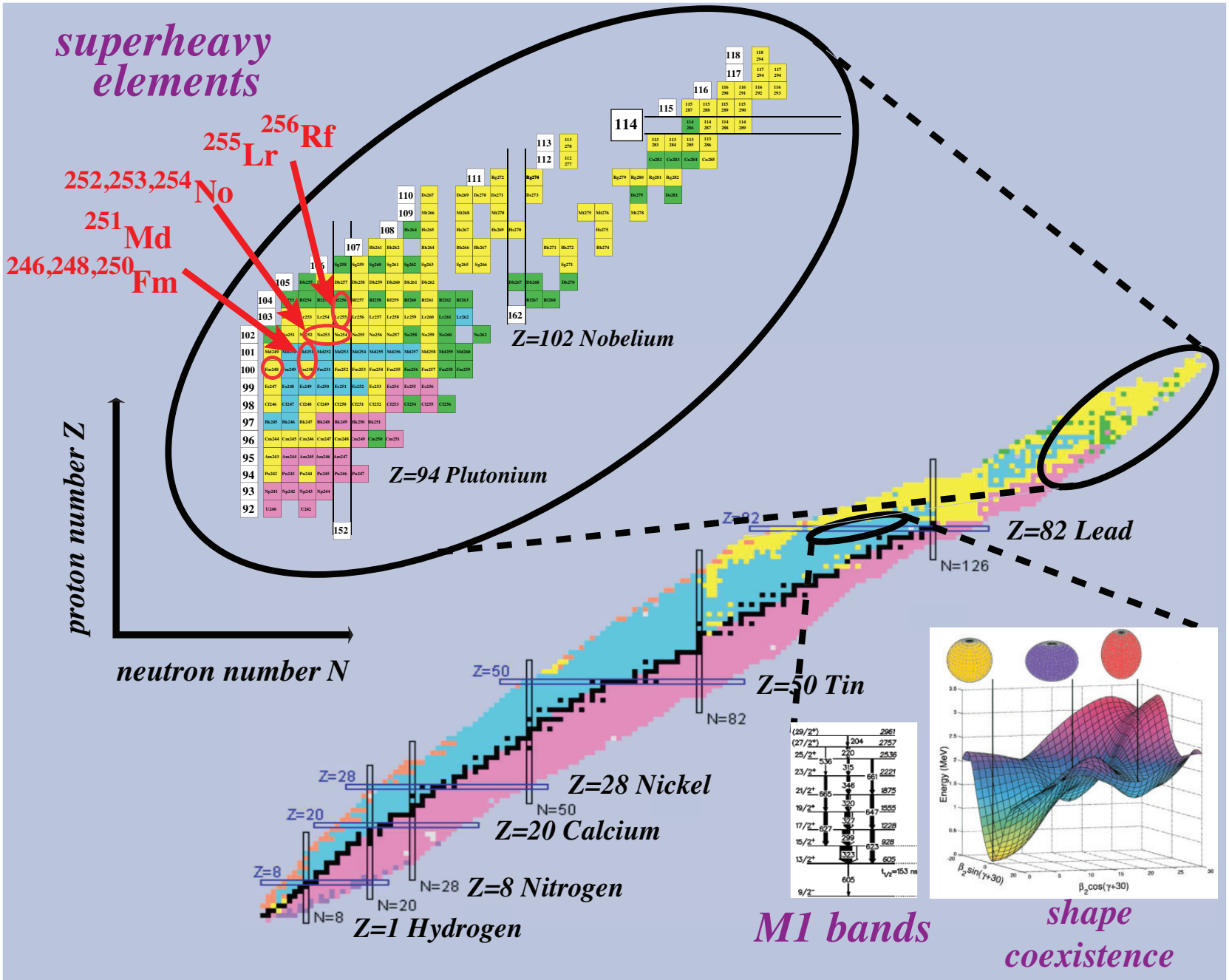
$\Rightarrow$ Simultaneous measurement of γ rays and conversion electrons


superheavy elements
^{256}Rf
^{255}Lr
^{252,253,254}No
^{251}Md
^{246,248,250}Fm
Z=102 Nobelium
Z=94 Plutonium
proton number Z
neutron number N
Z=82
Z=82 Lead
N=126
Z=50
Z=50 Tin
N=82
Z=28
Z=28 Nickel
N=50
Z=20
Z=20 Calcium
N=28
Z=8
Z=8 Nitrogen
N=20
N=8
Z=1 Hydrogen
M1 bands
shape coexistence
Energy (MeV)

1. SAGE
2. First Results
3. Optimisation
4. Geant4 Simulation
5. Summary

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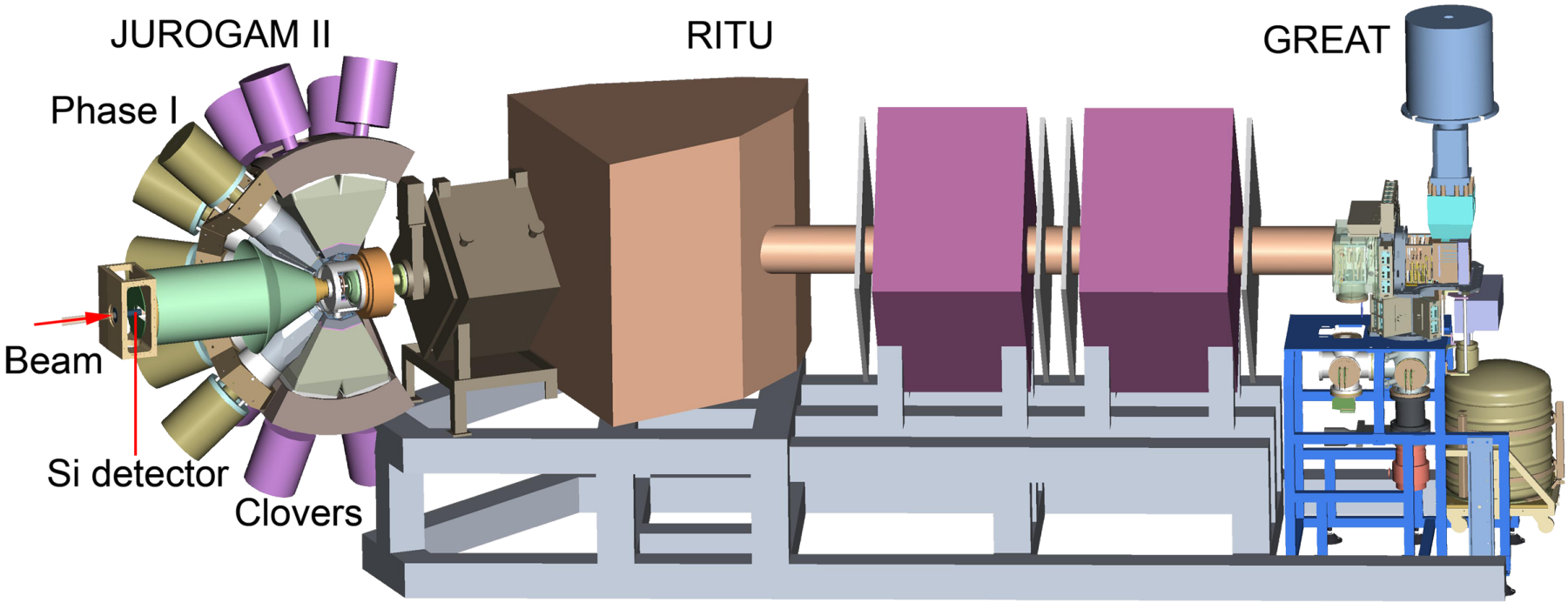
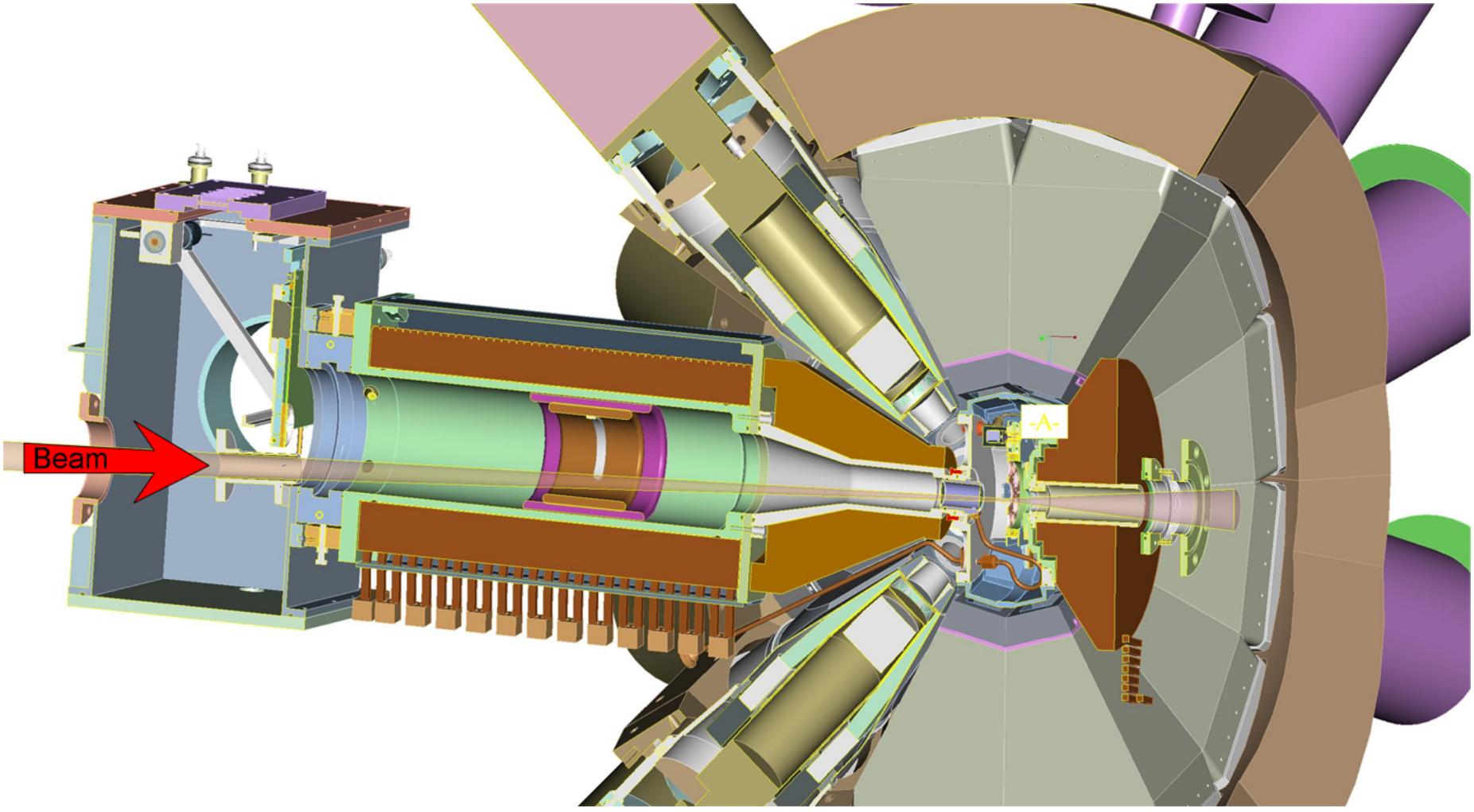
S(ilicon) A(nd) GE(rmanium) spectrometer



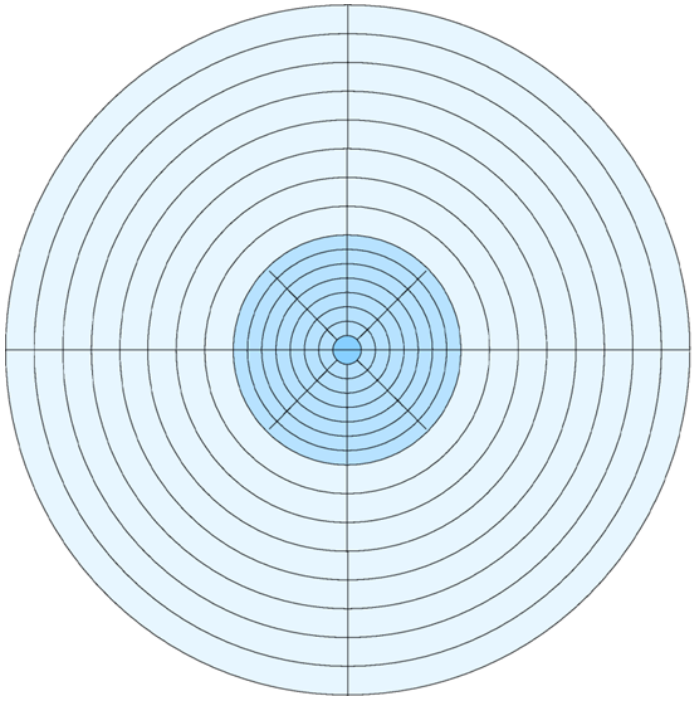
Employing **fully digital** front-end electronics

A closer look

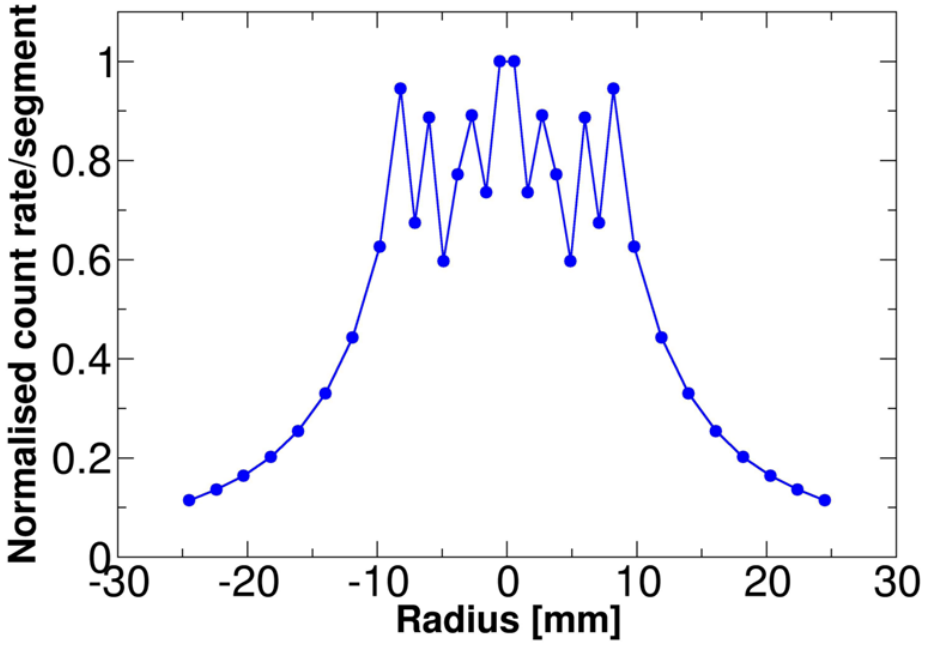


The Si detector

- 90 segments
- 50 mm diameter
- 1 mm thick



Simulated normalised count rate distribution using data from SACRED experiments



Detector geometry allowing higher count rates

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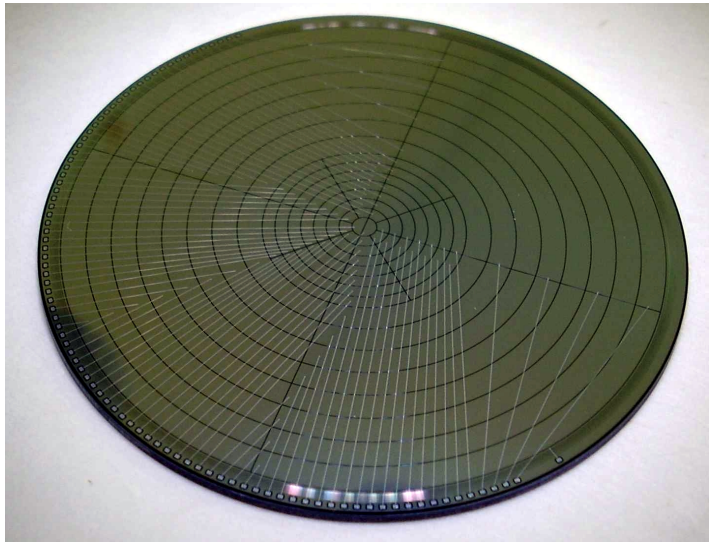

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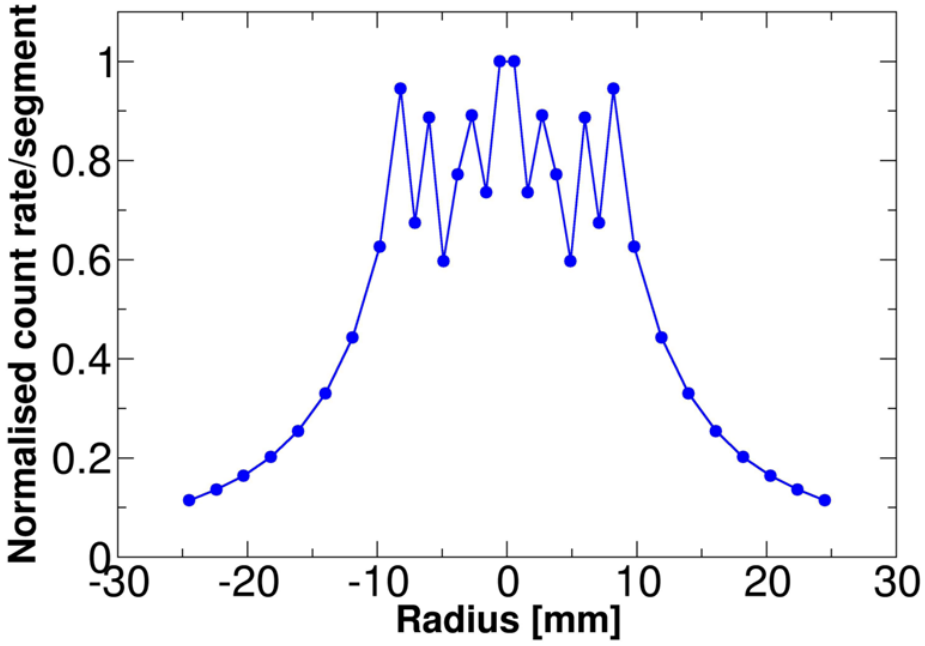
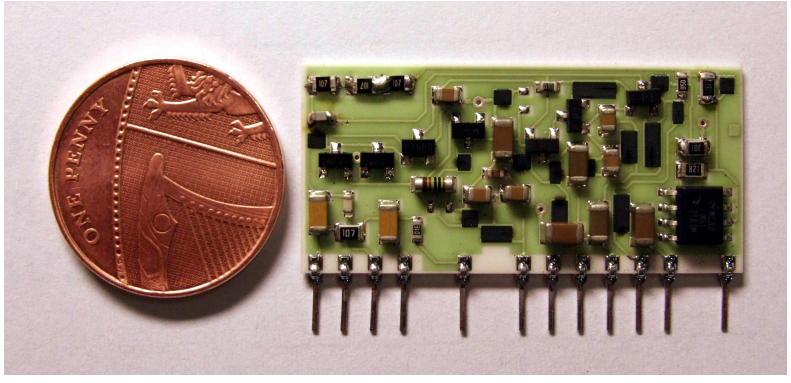


Detector geometry allowing higher count rates

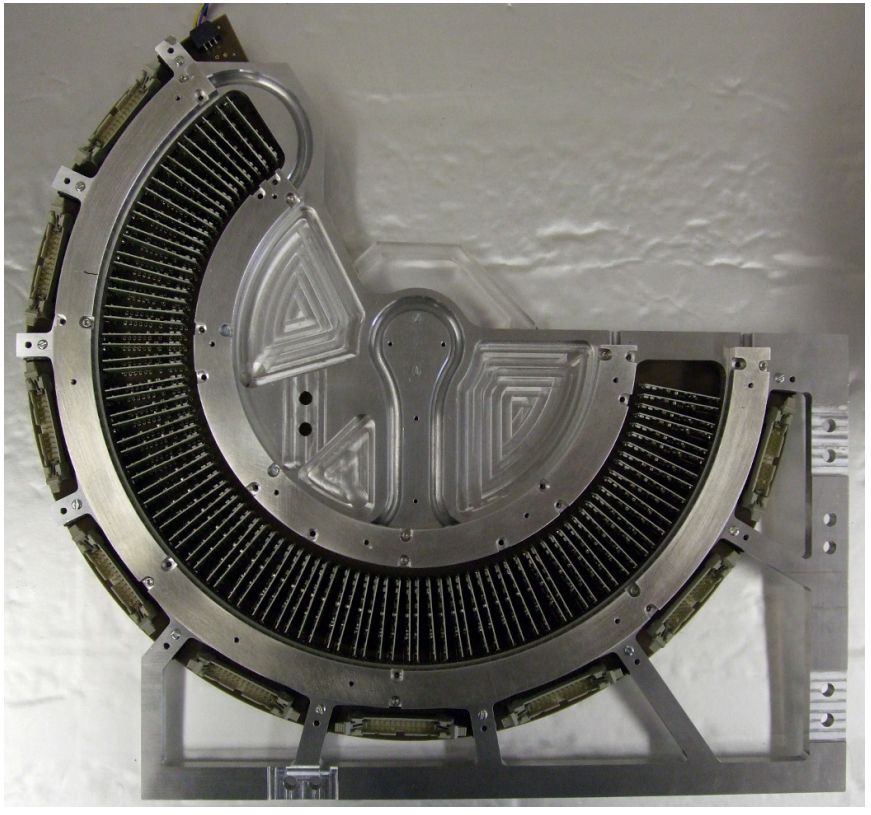
Preamplifiers

C.A.E.N. A1422 charge sensitive hybrid preamplifiers

- 400 mV/MeV
- Low noise



Detector PCB



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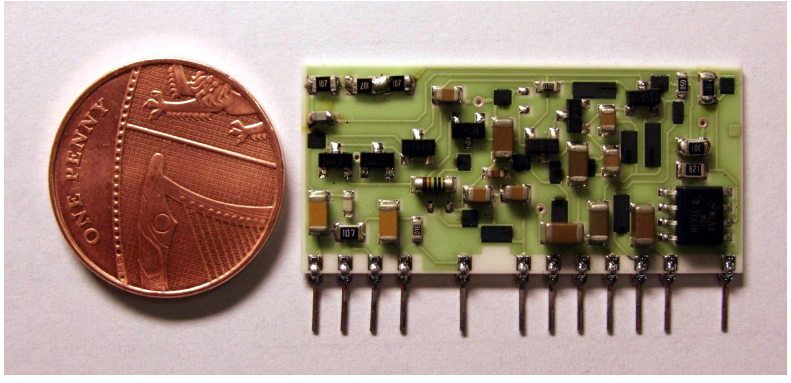

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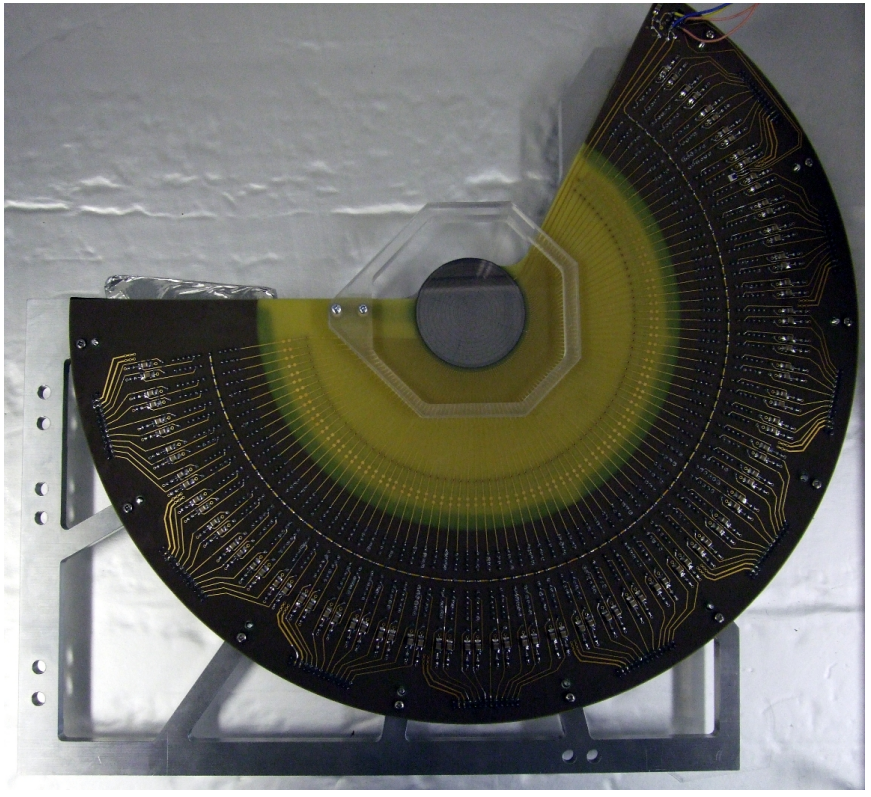
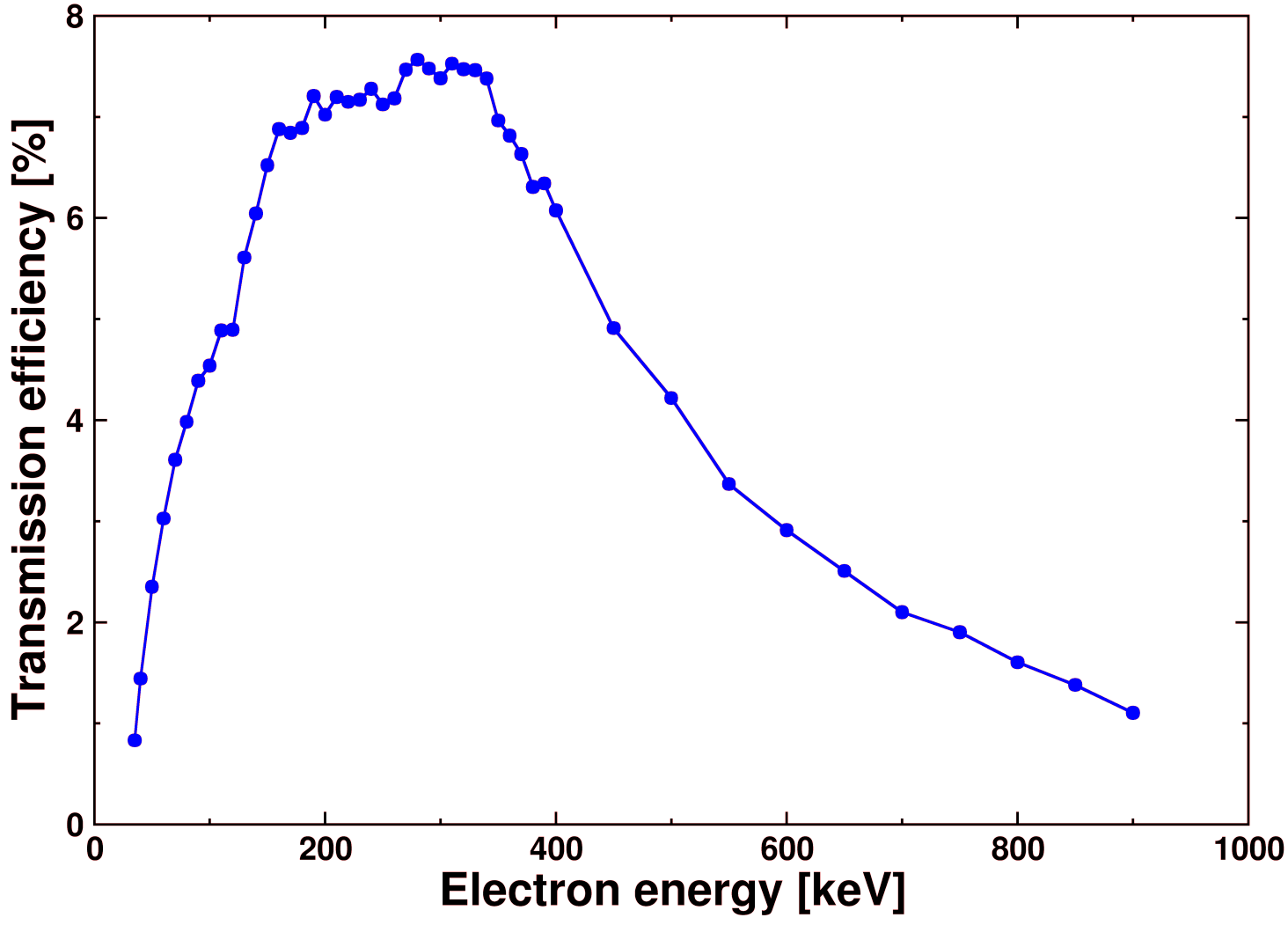
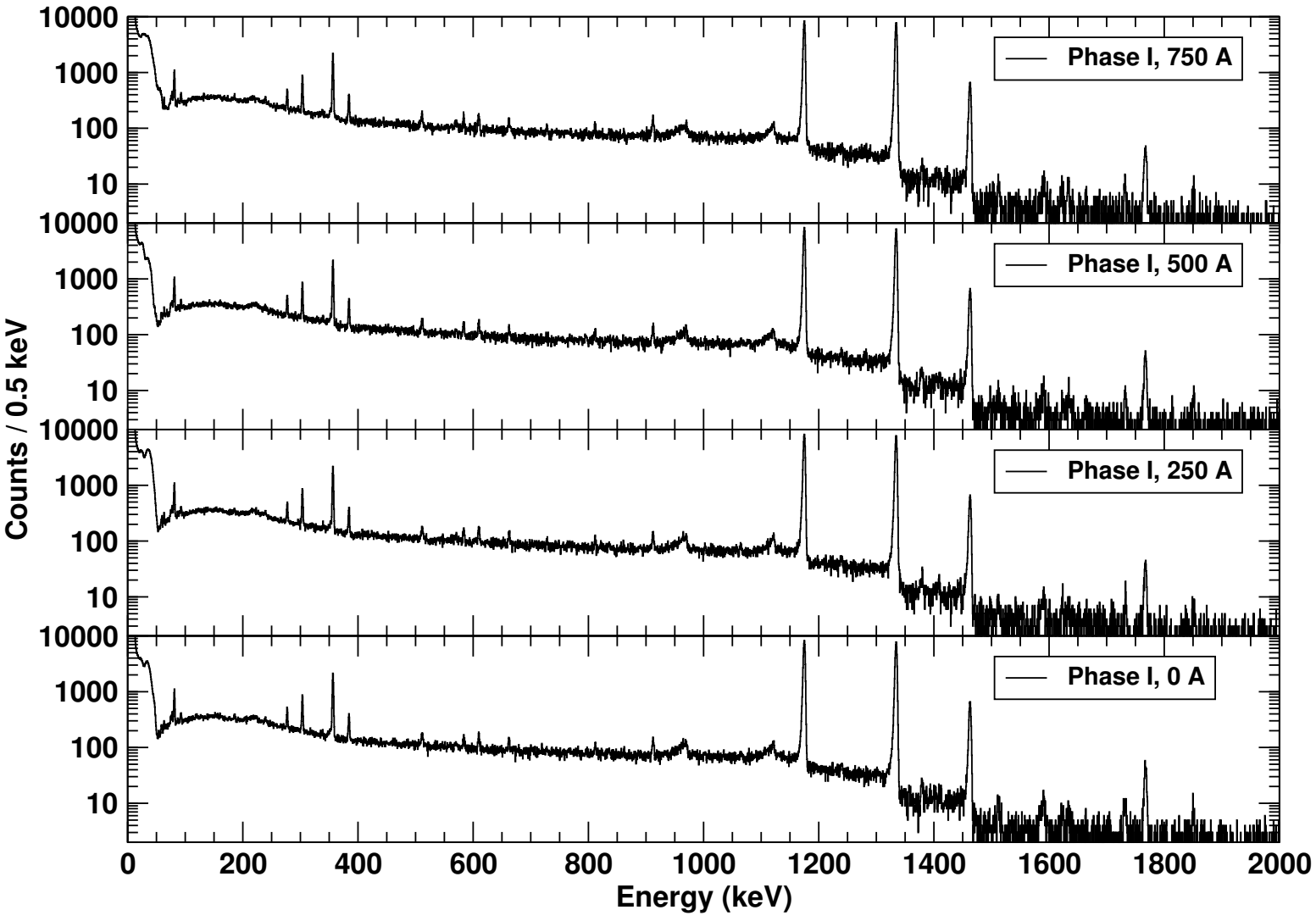


Simulated transmission efficiency



Peak-to-background of JUROGAM Phase I detectors



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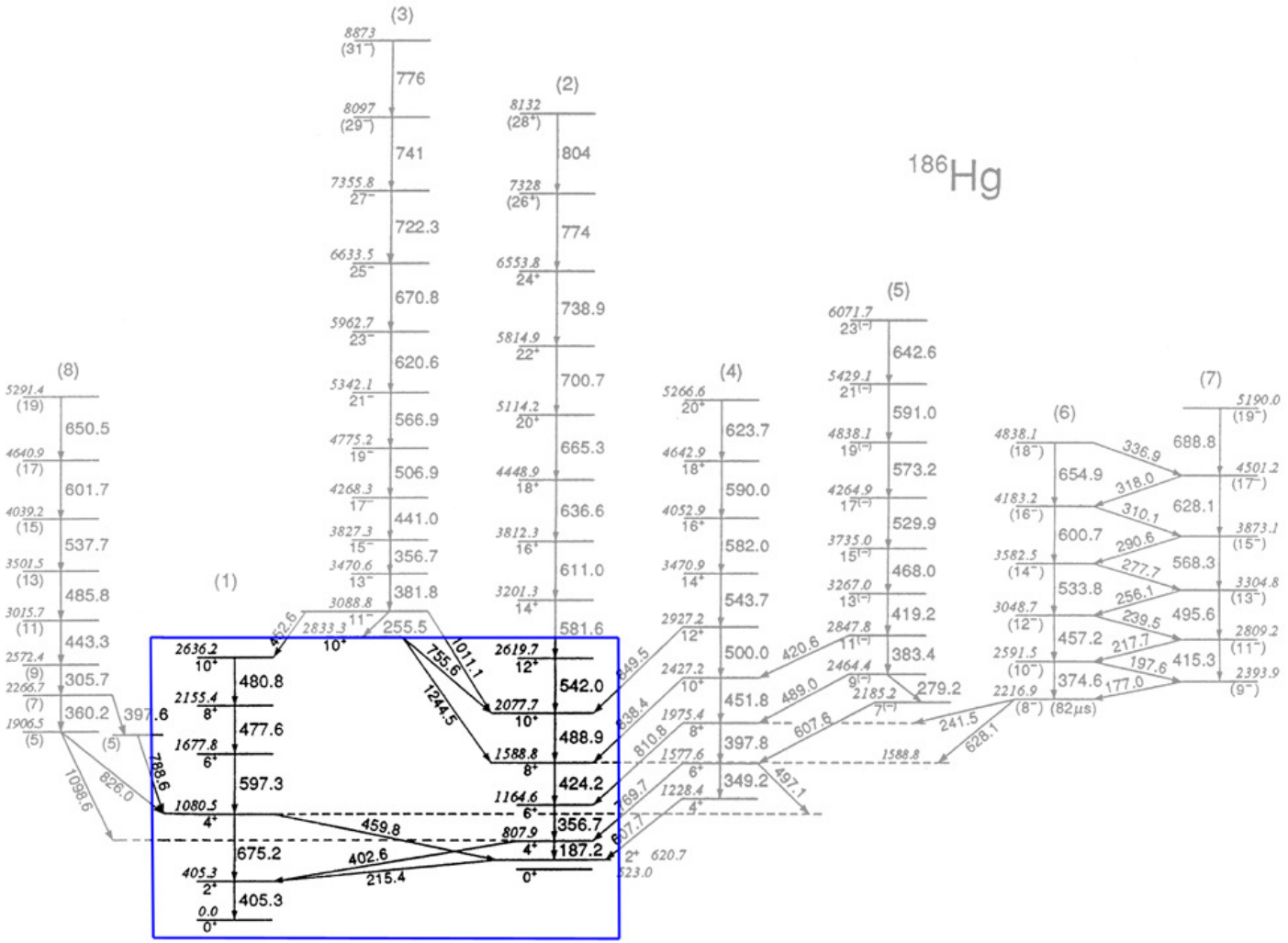
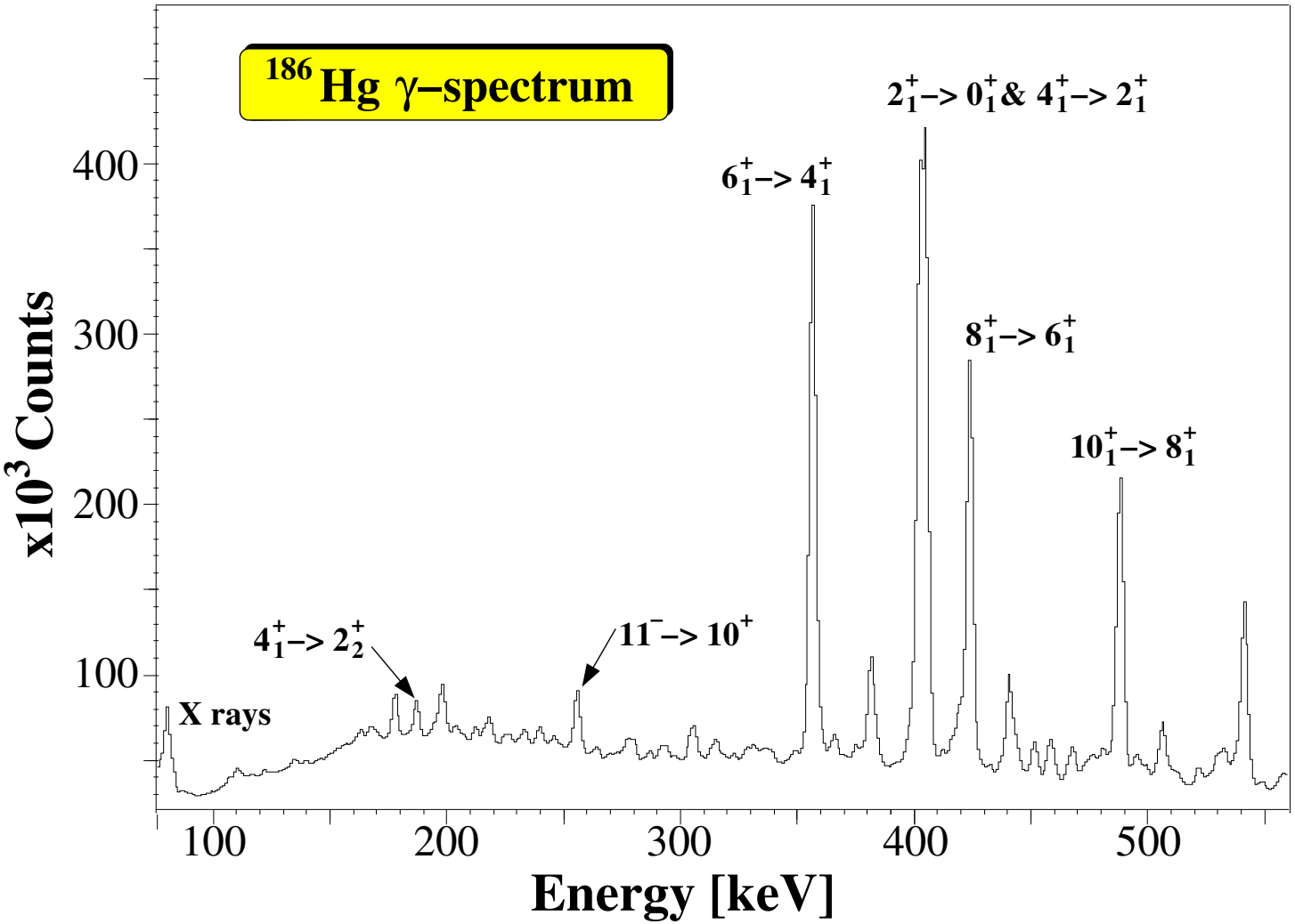
^{186}Hg SAGE experiment



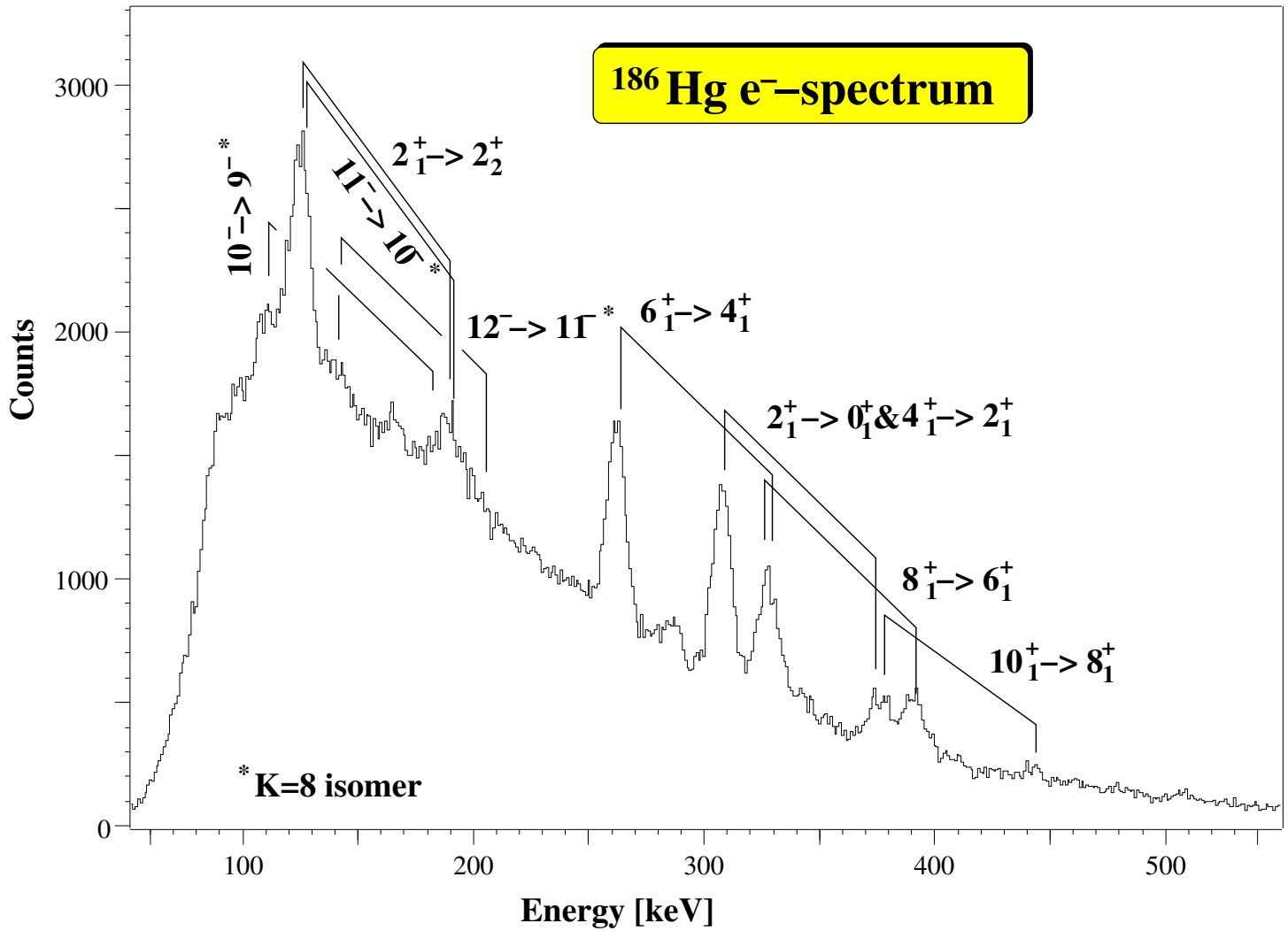
W.C. Ma *et al.*, Phys. Rev. C 47 (1993) 1

^{186}Hg - Raw γ-ray spectrum



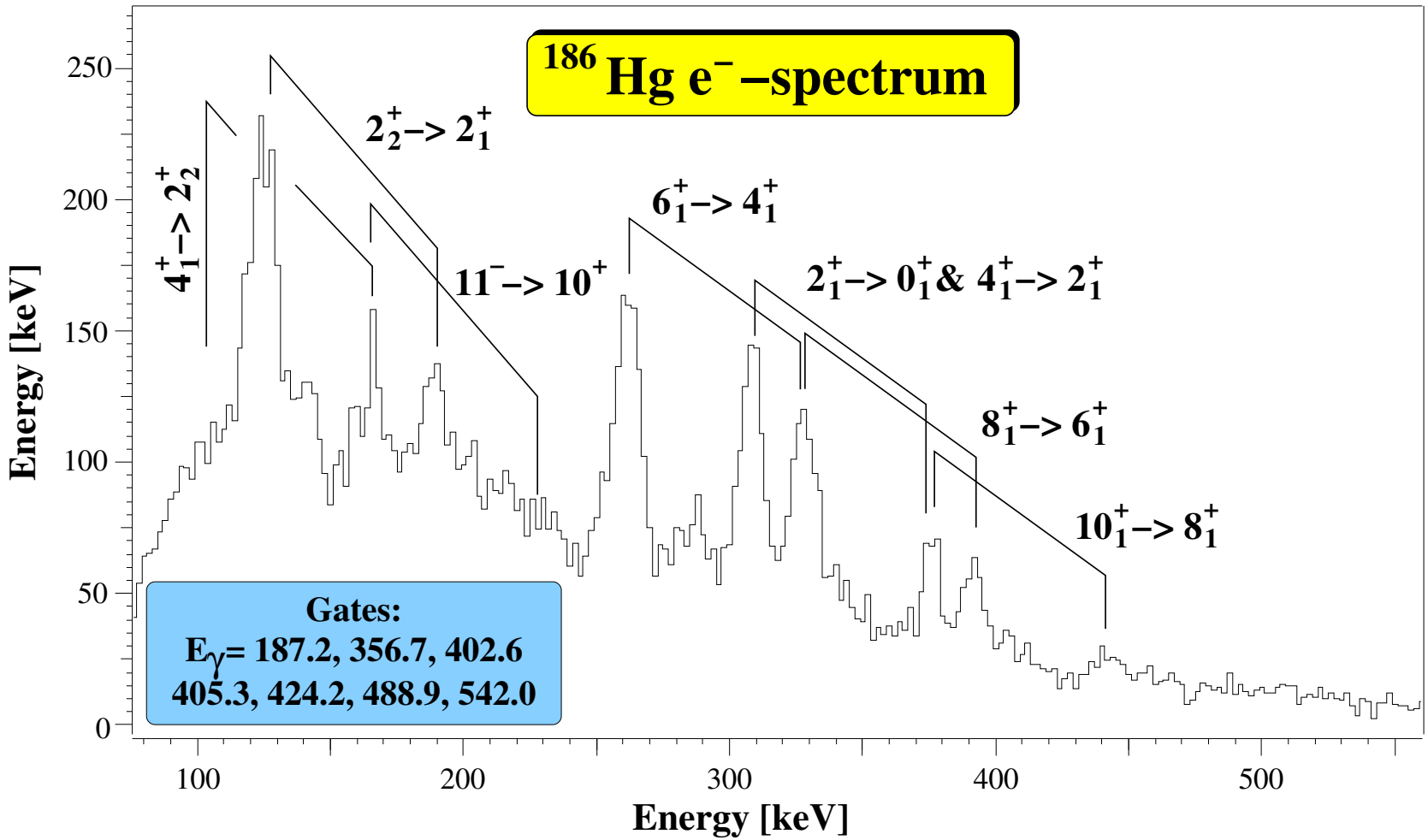
M. Scheck *et al.*, PRC **83**, 037303 (2011)

^{186}Hg - Raw electron spectrum



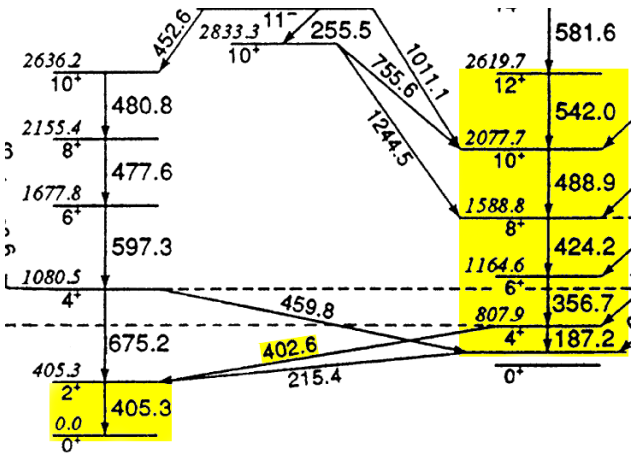
M. Scheck *et al.*, PRC **83**, 037303 (2011)

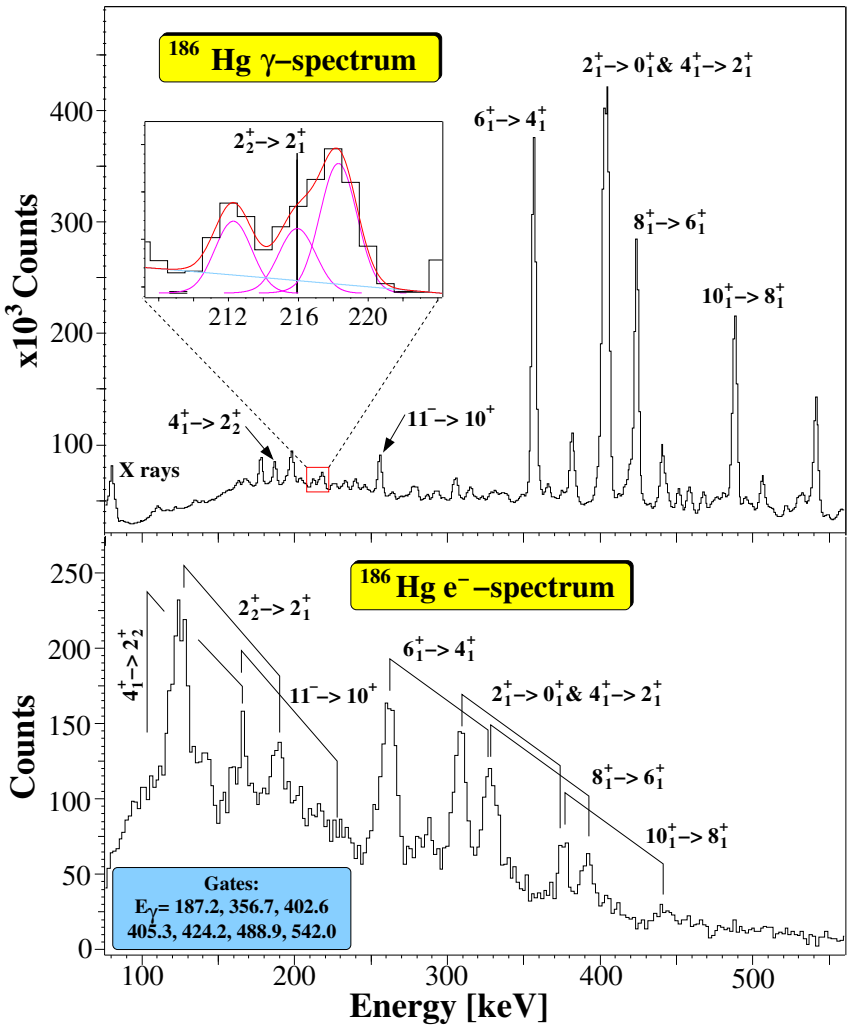
^{186}Hg - Gates on yrast transitions



M. Scheck *et al.*, PRC **83**, 037303 (2011)

^{186}Hg - E0 detection





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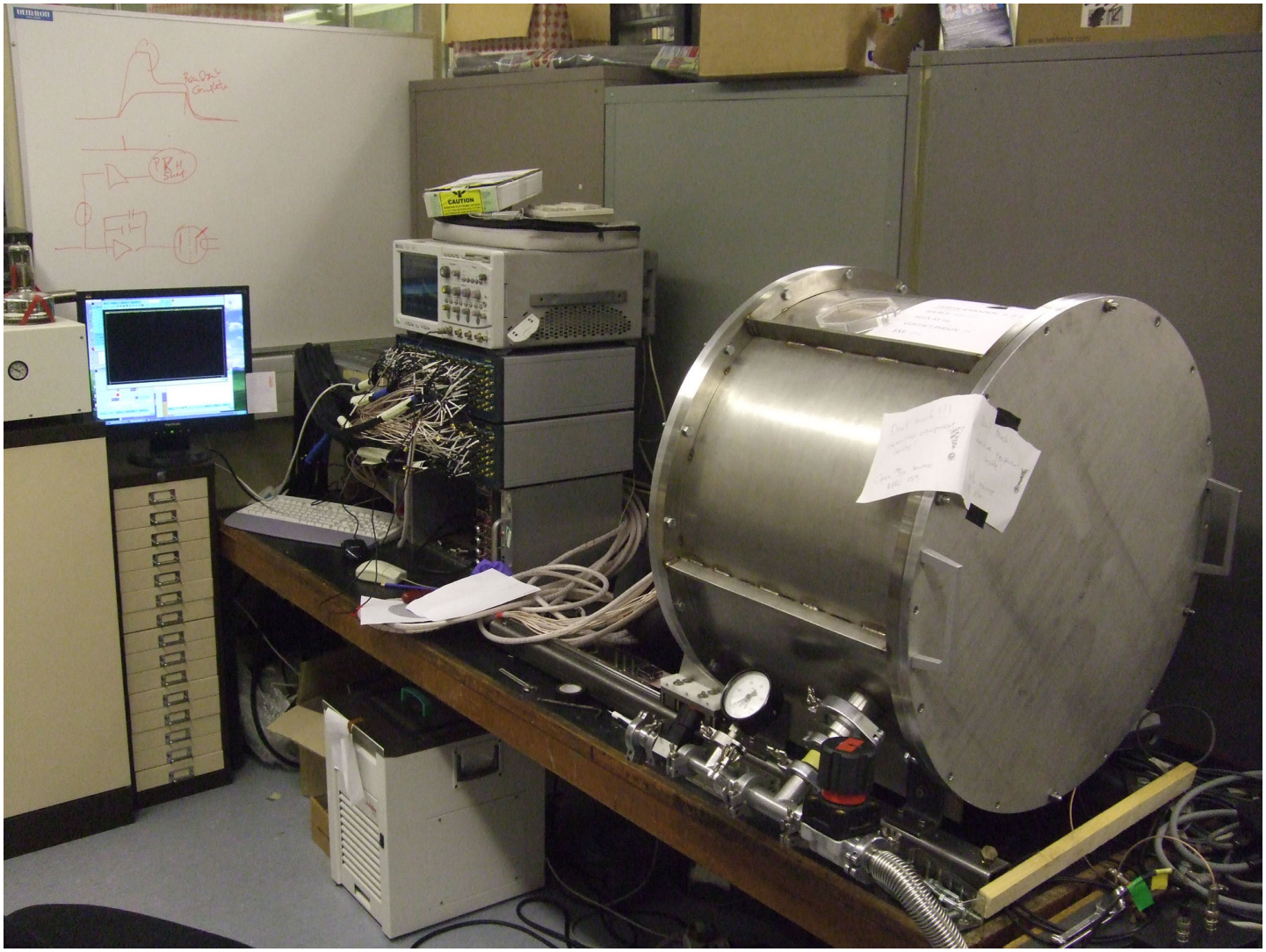
Test set-up in Liverpool



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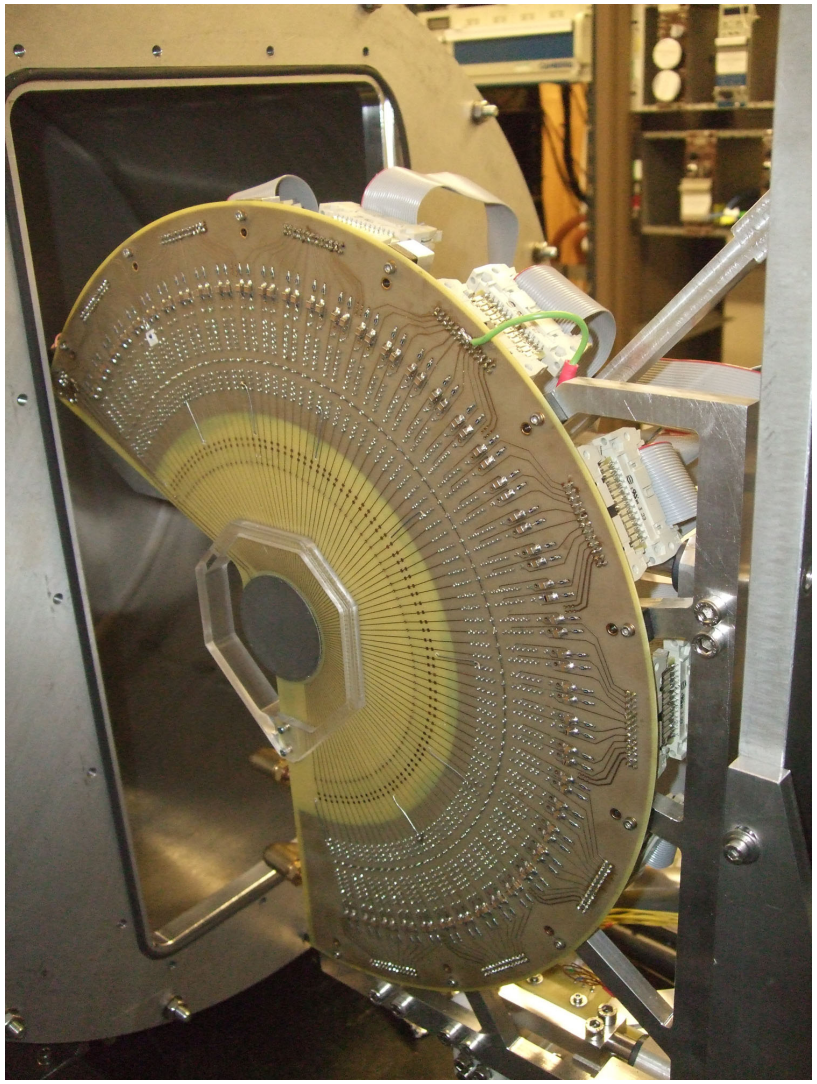

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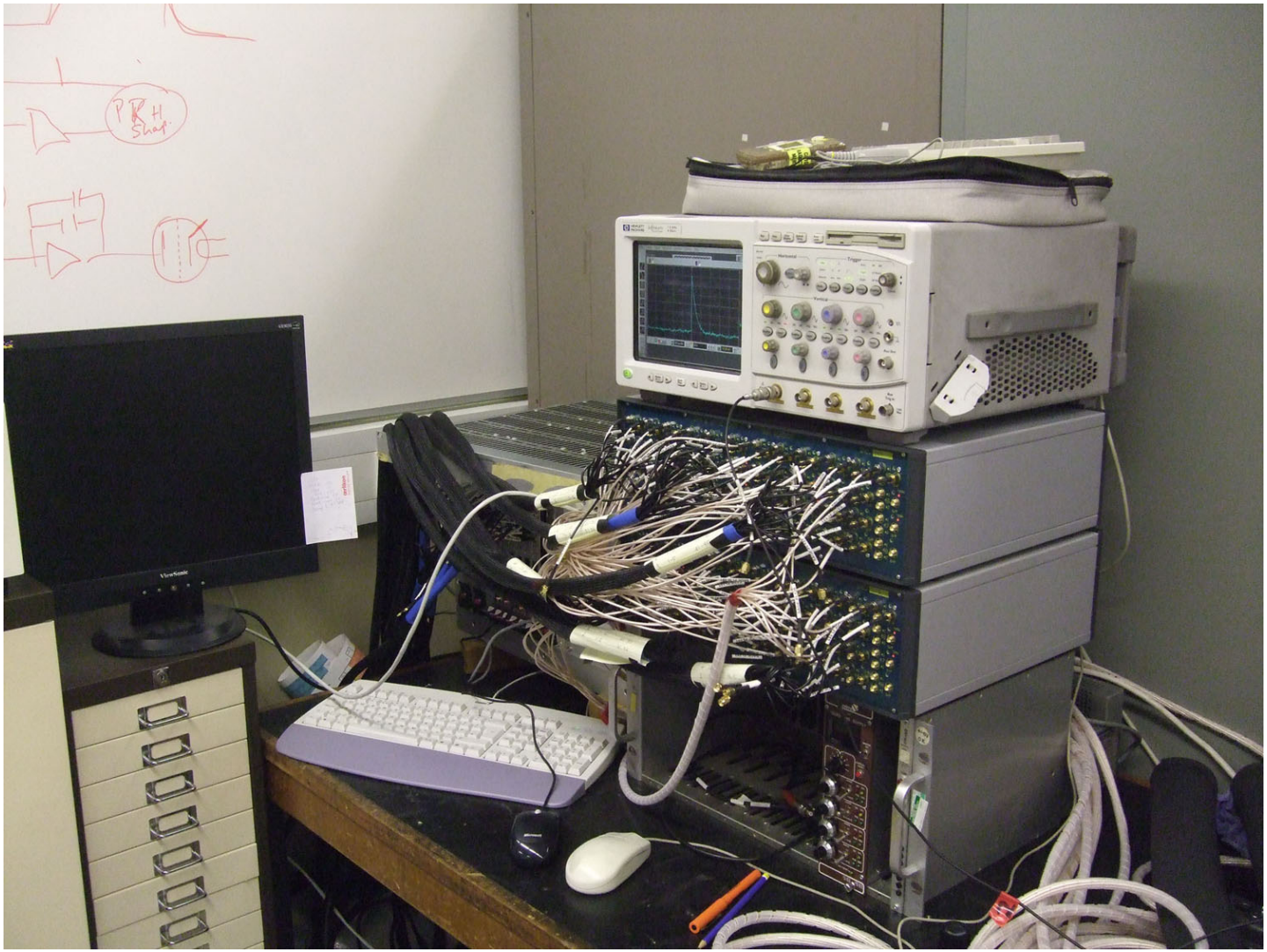
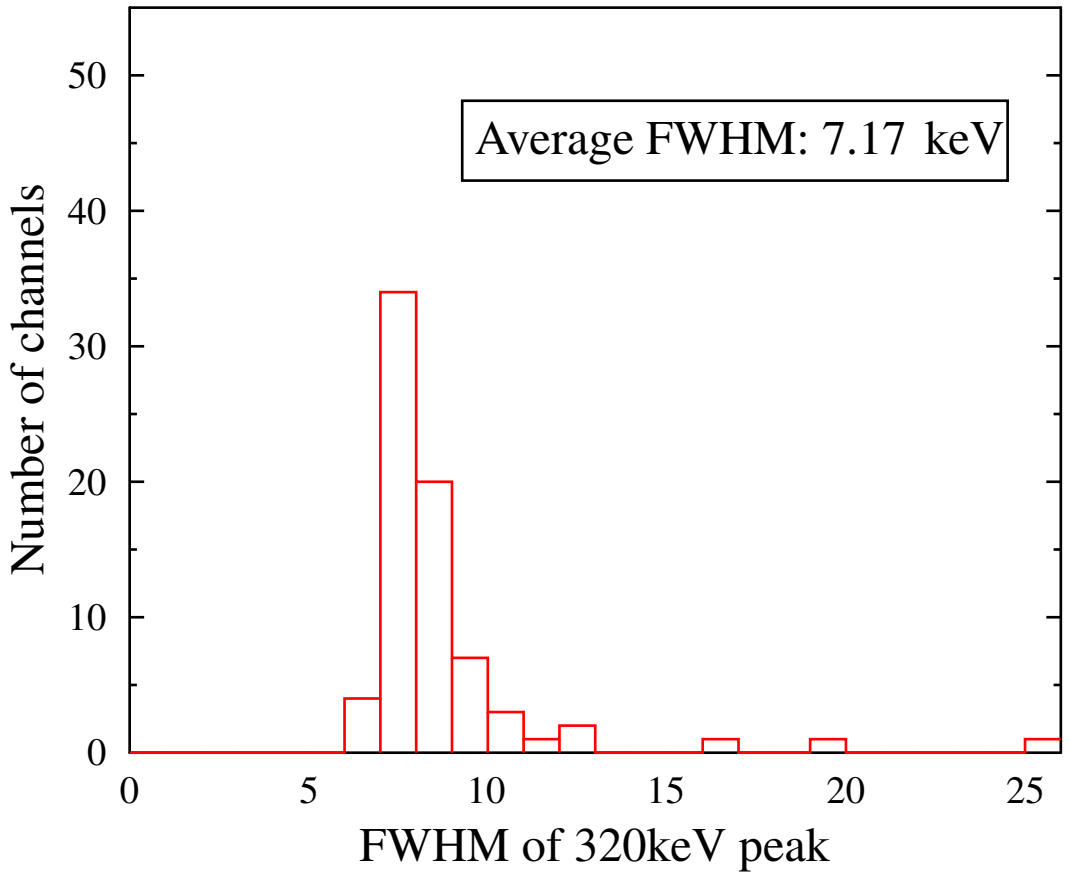
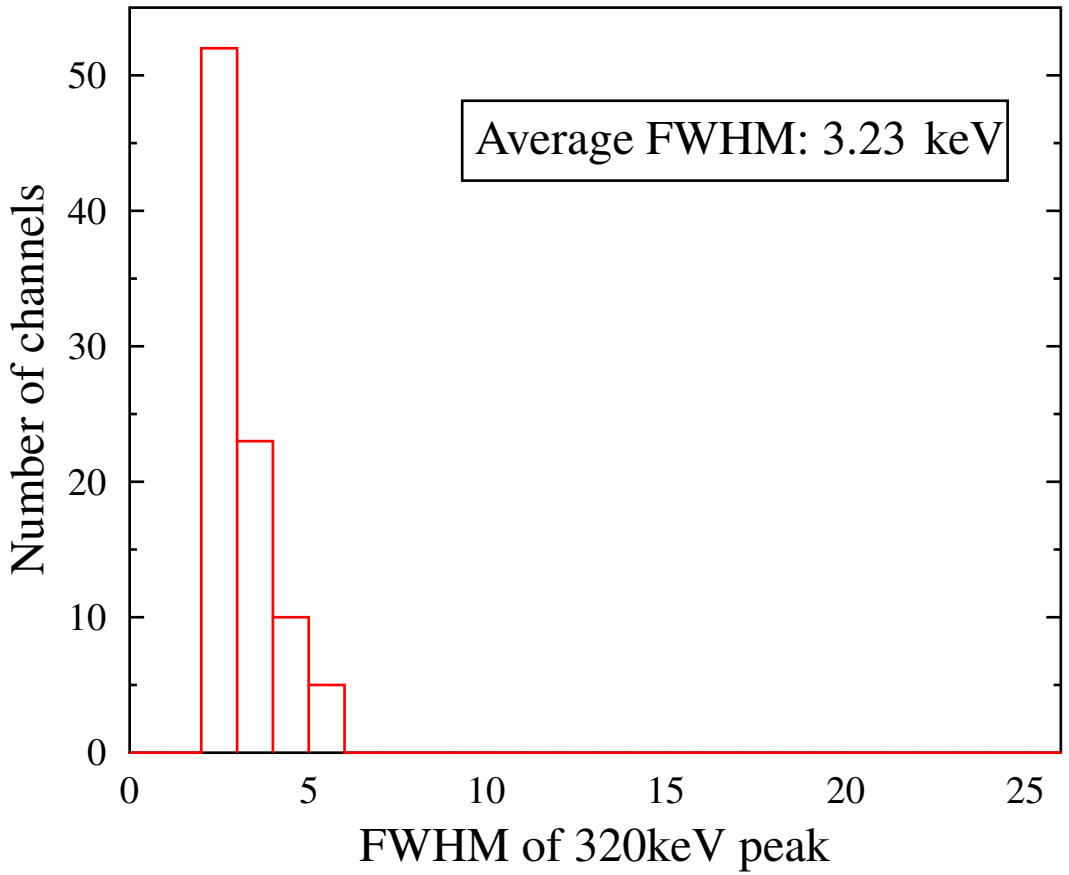


Status of detector during Hg run



After optimisation



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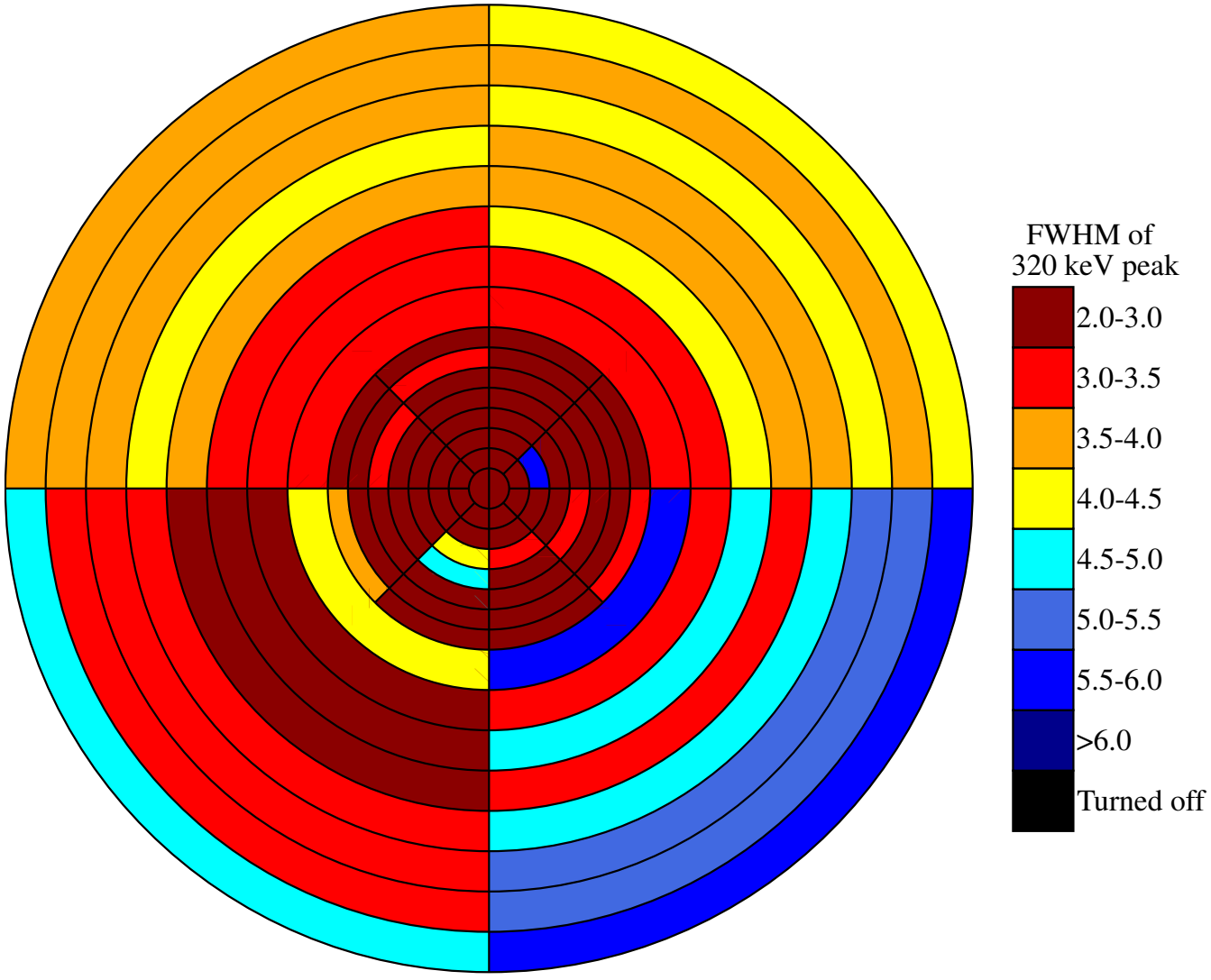
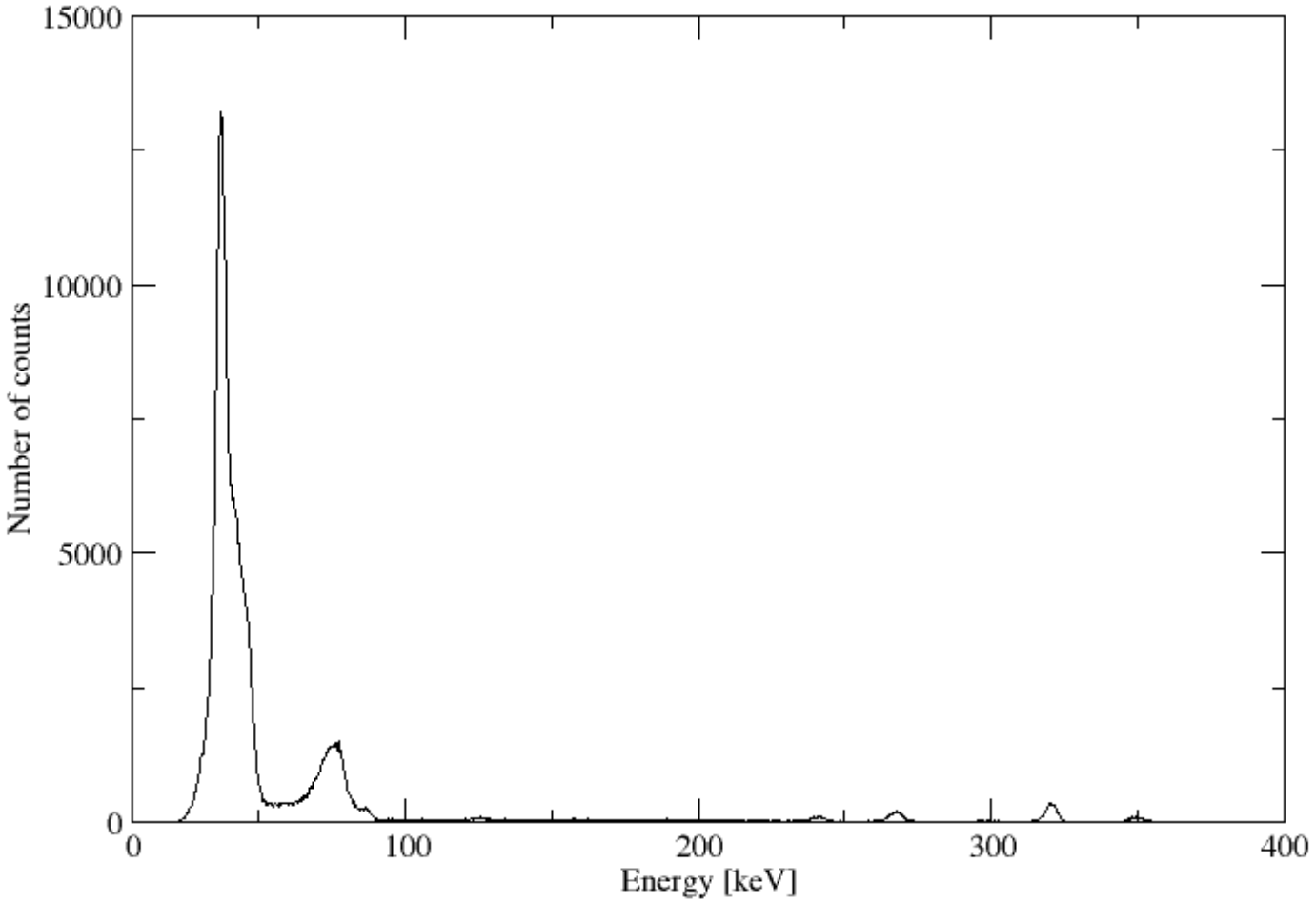


Example of a spectrum



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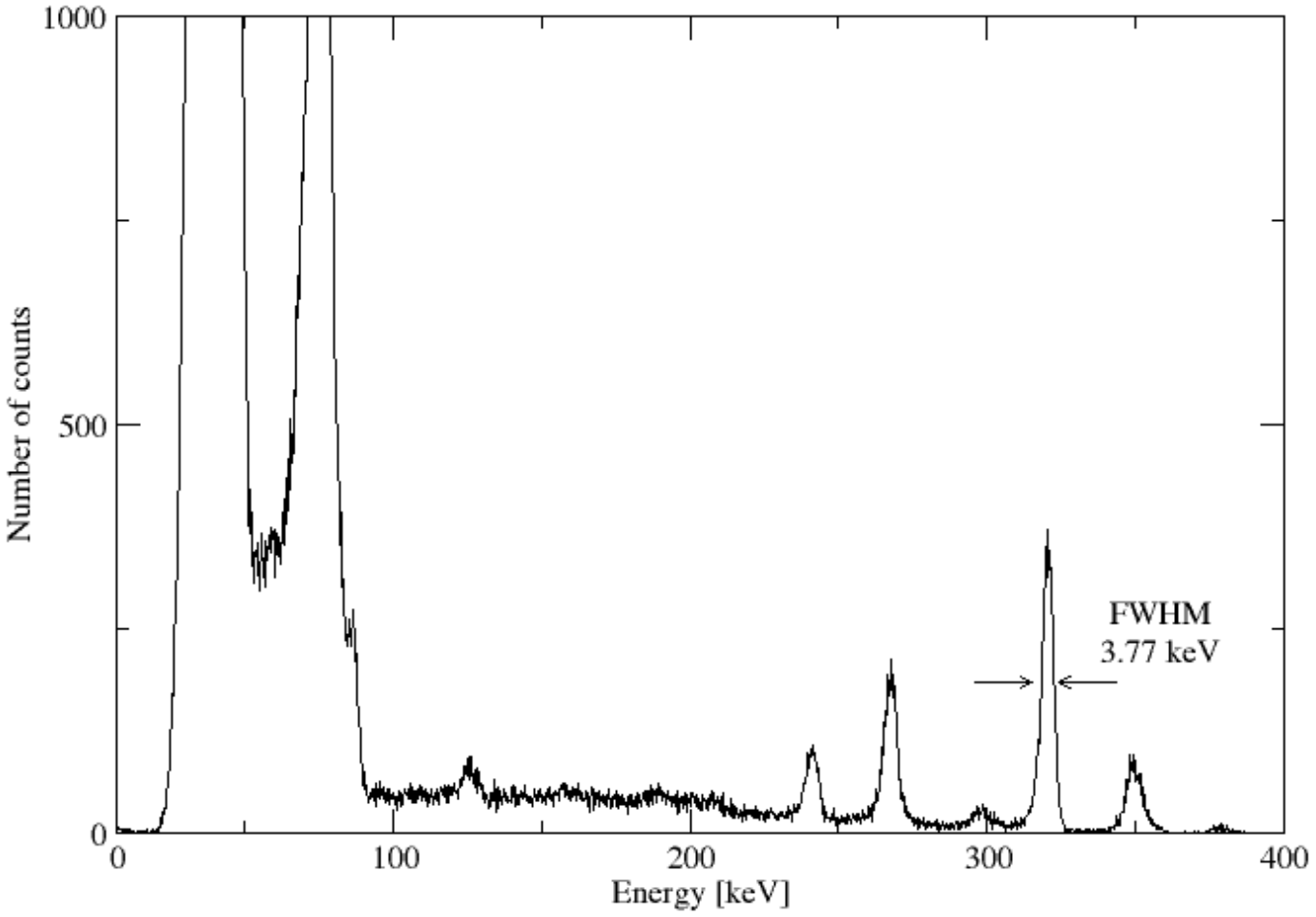

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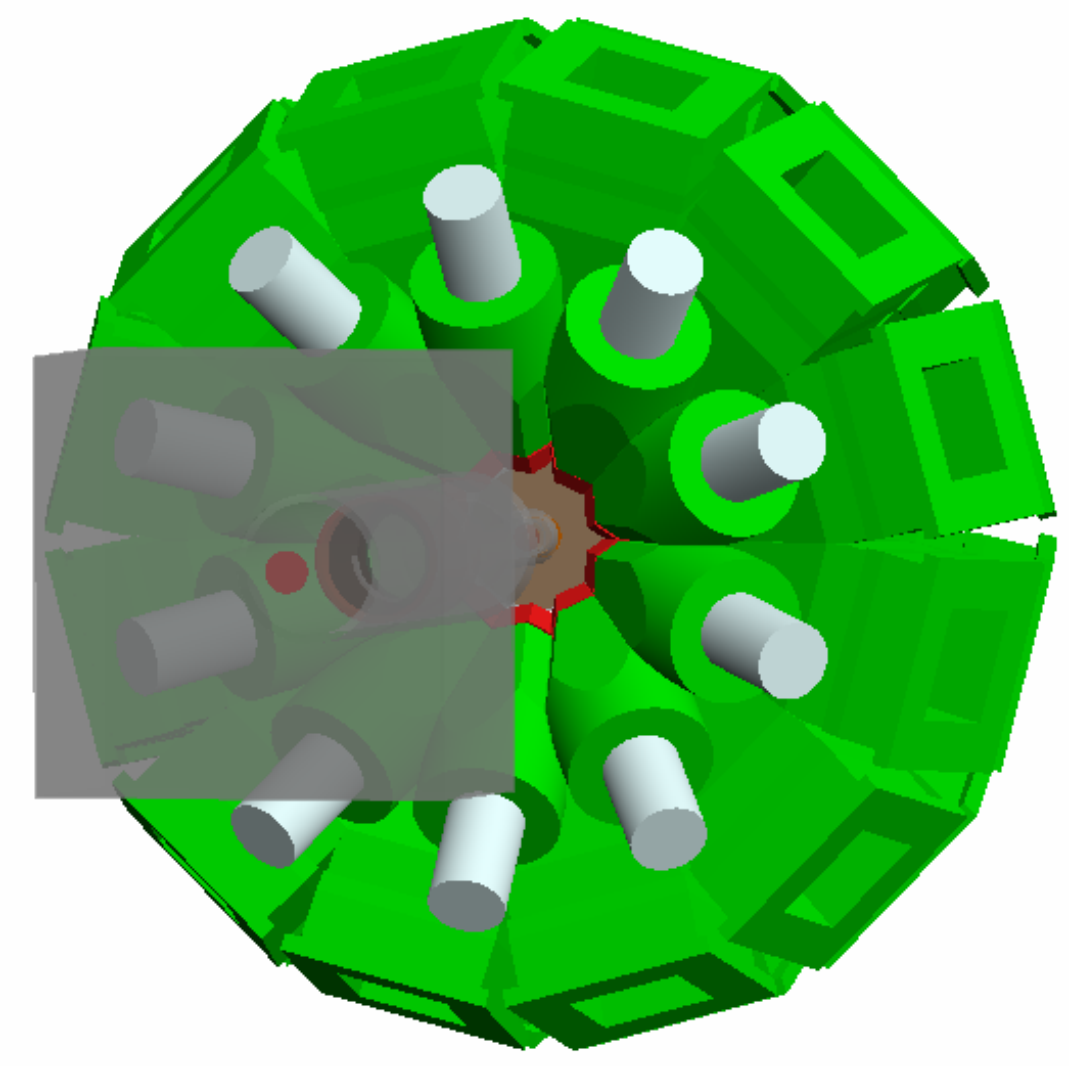
Geant4 simulation

Geant4 is a toolkit developed to simulate the passage of particles through matter.
Reasons for Simulation

- Deeper understanding of instrument
- Simulation beforehand to optimise set-up

Daniel Cox, Joonas Konki

Geant4 simulation



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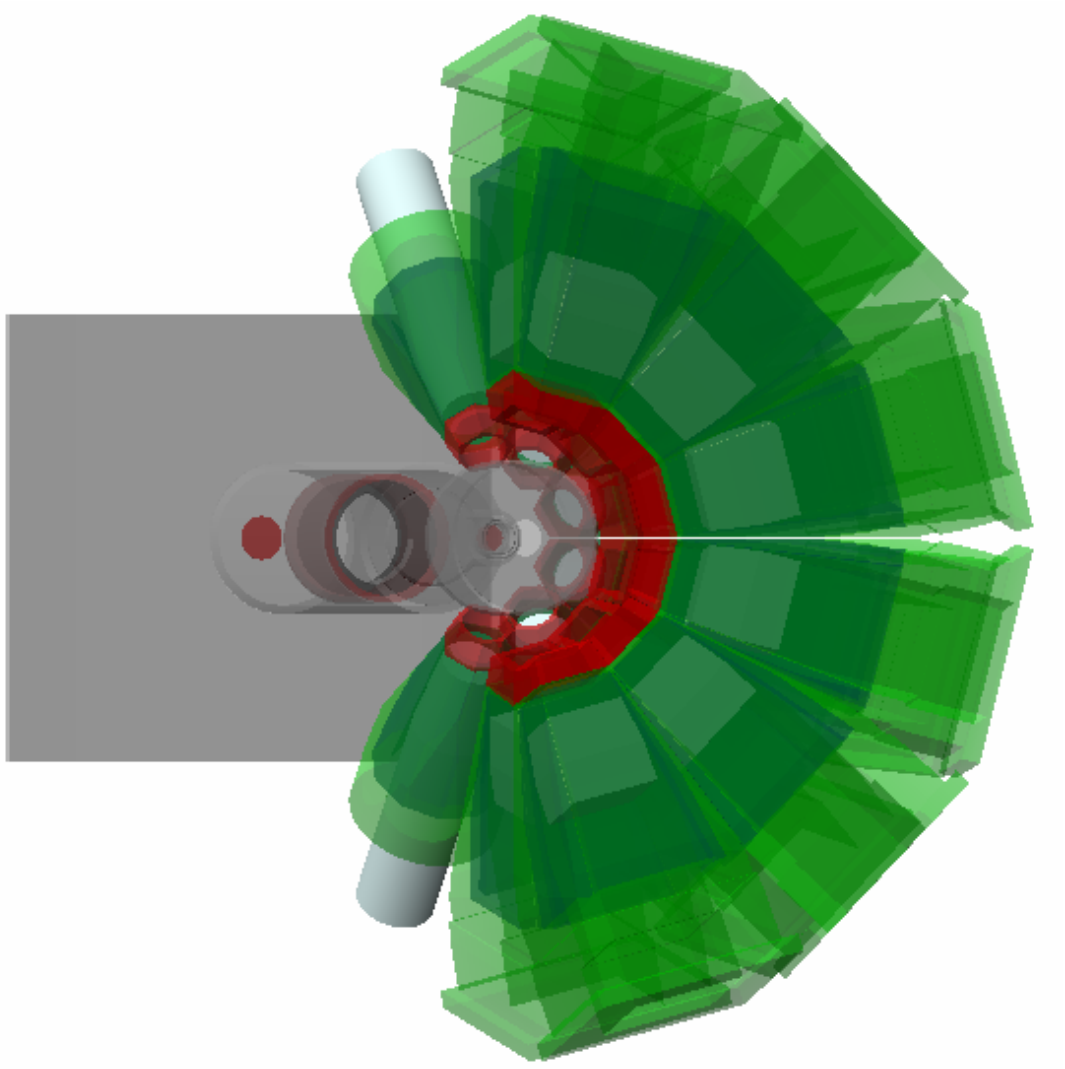

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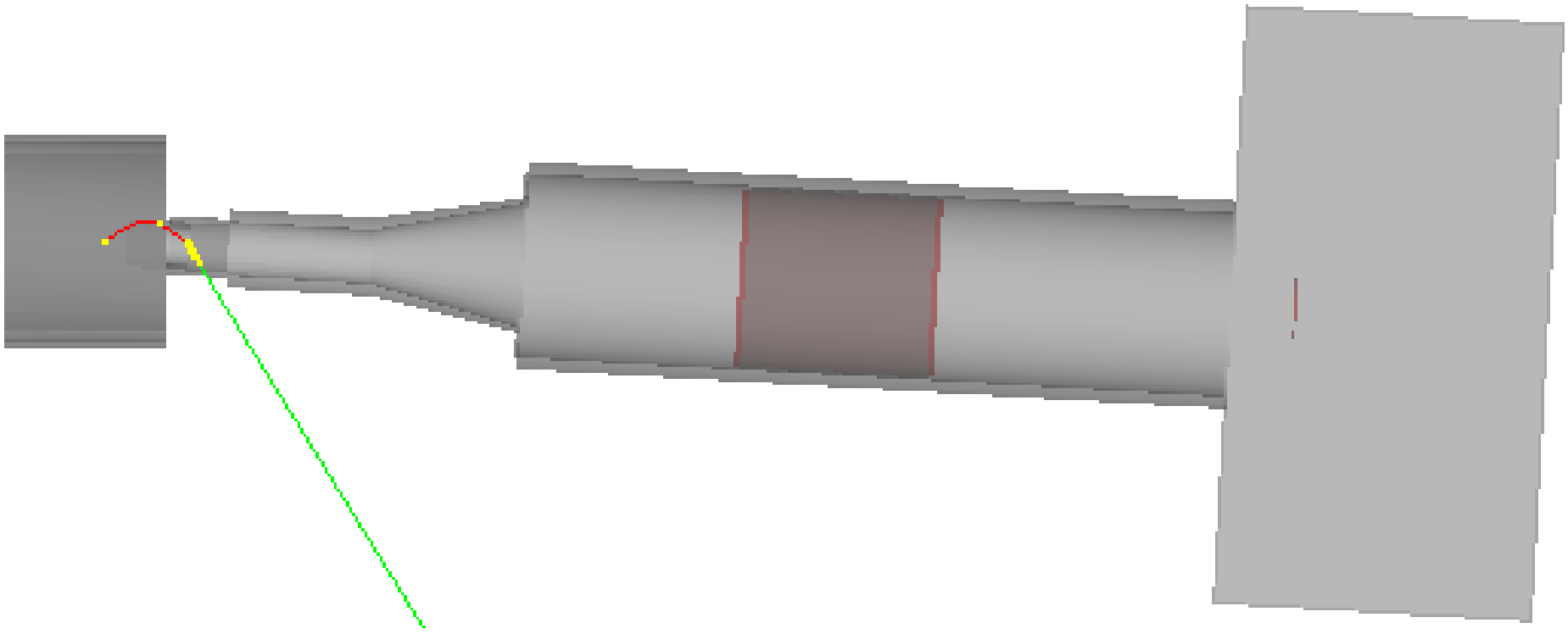

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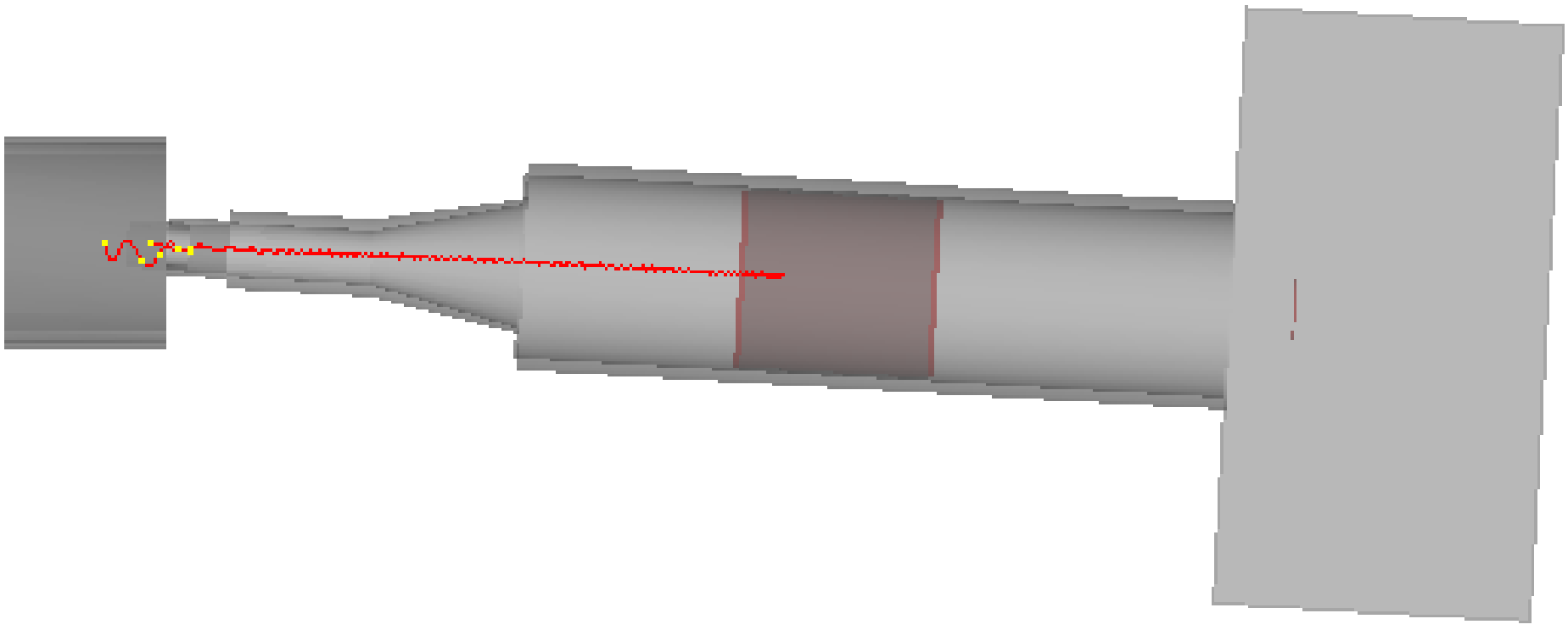

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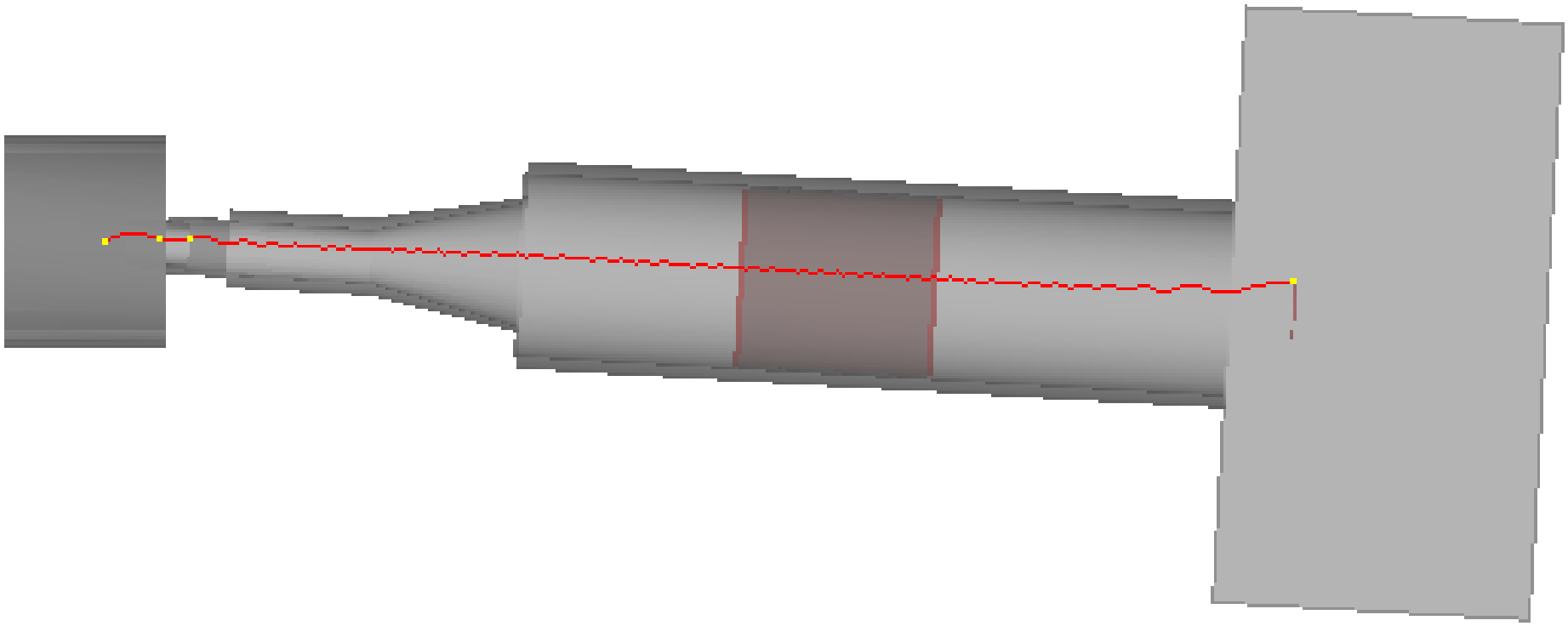

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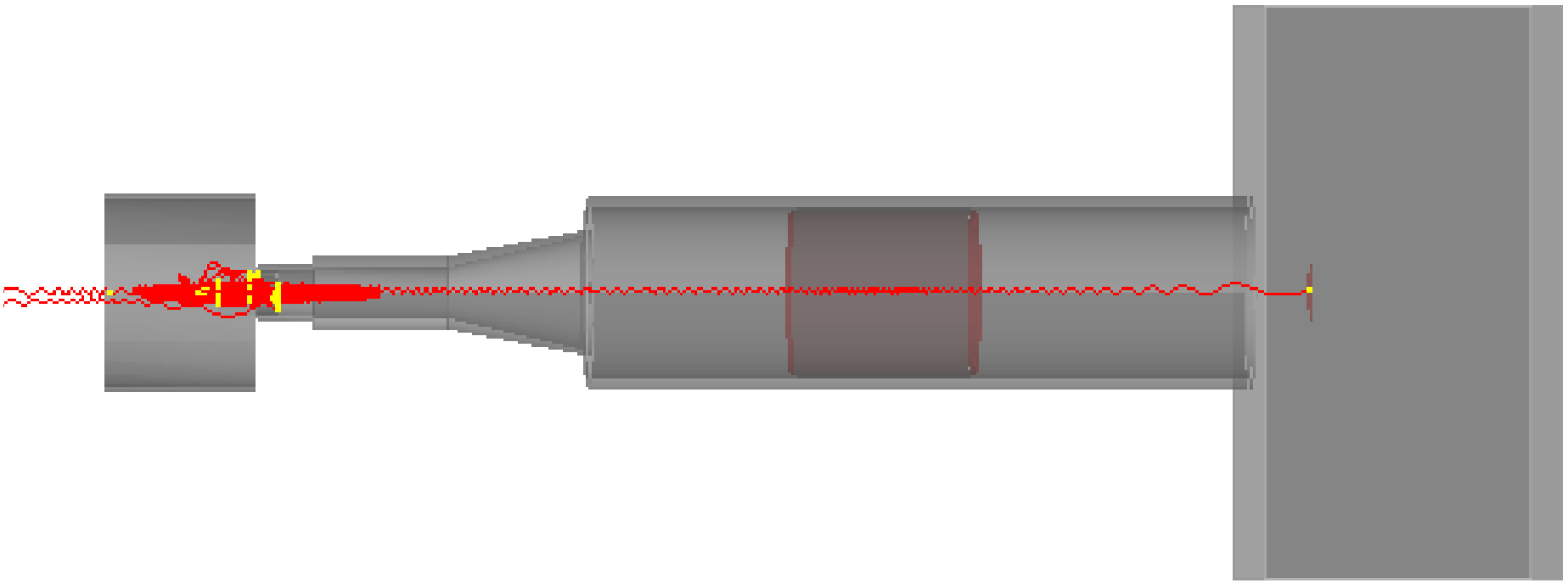

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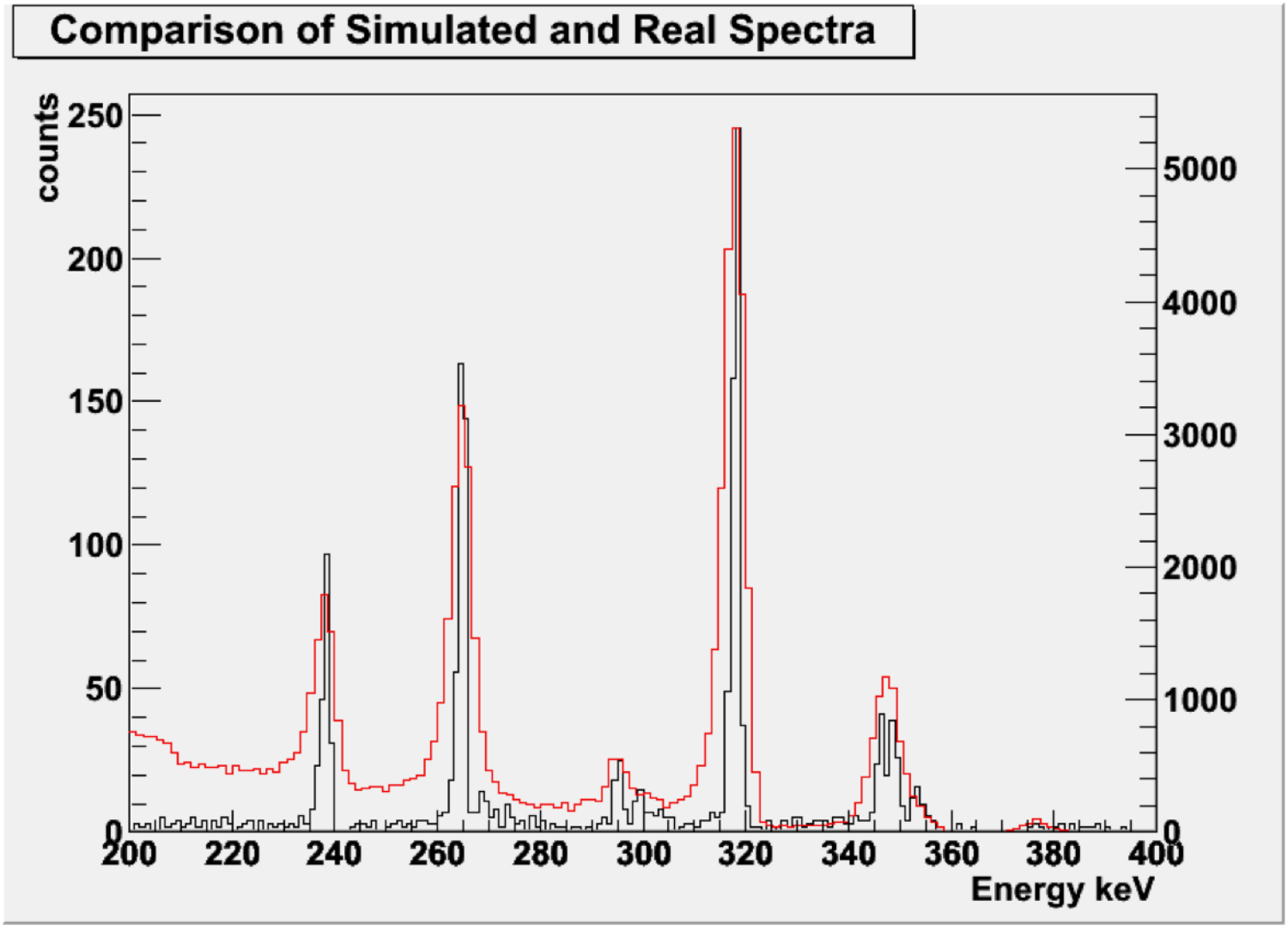

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  - Radon isotopes
- Experimental campaign scheduled for later on in the year

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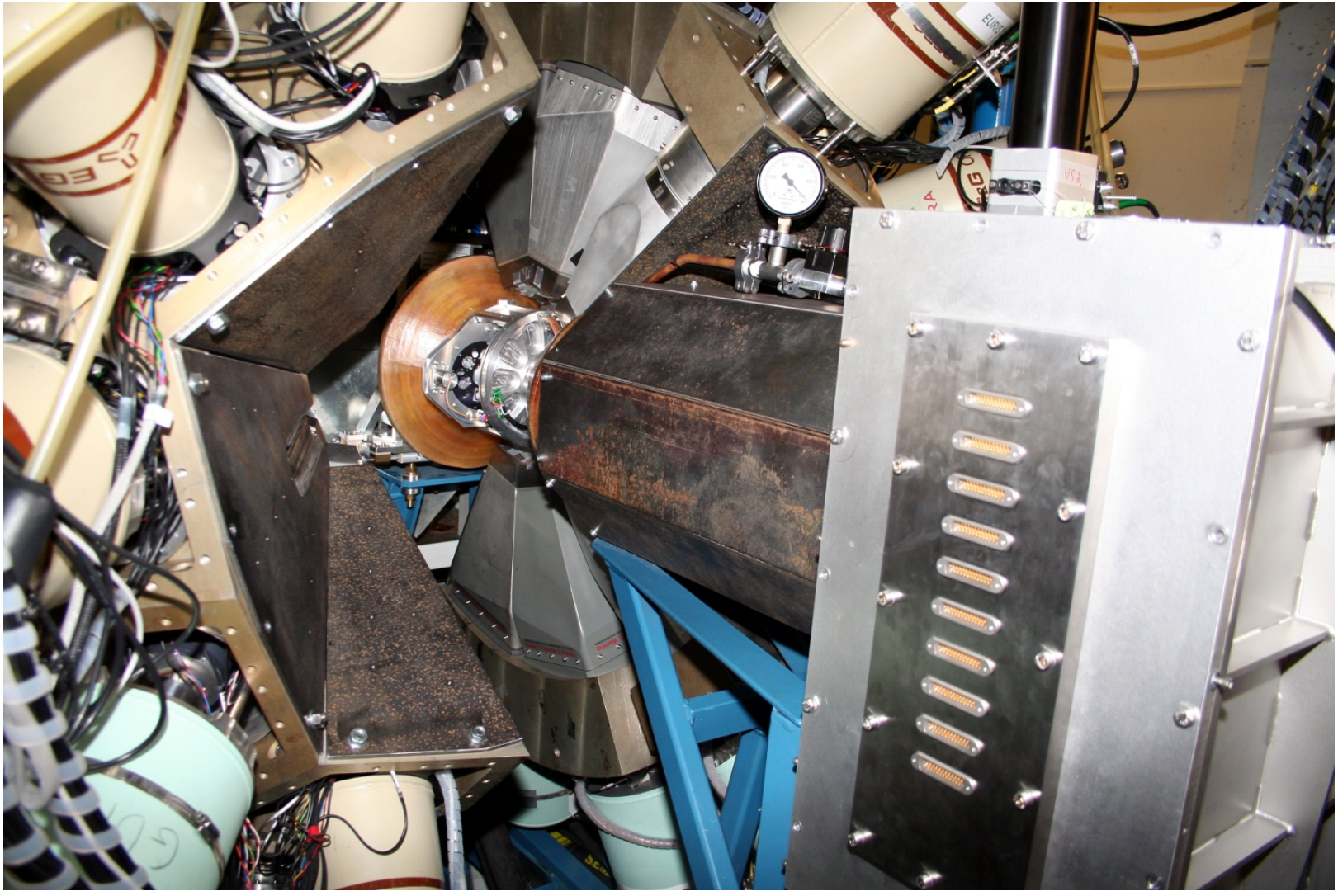

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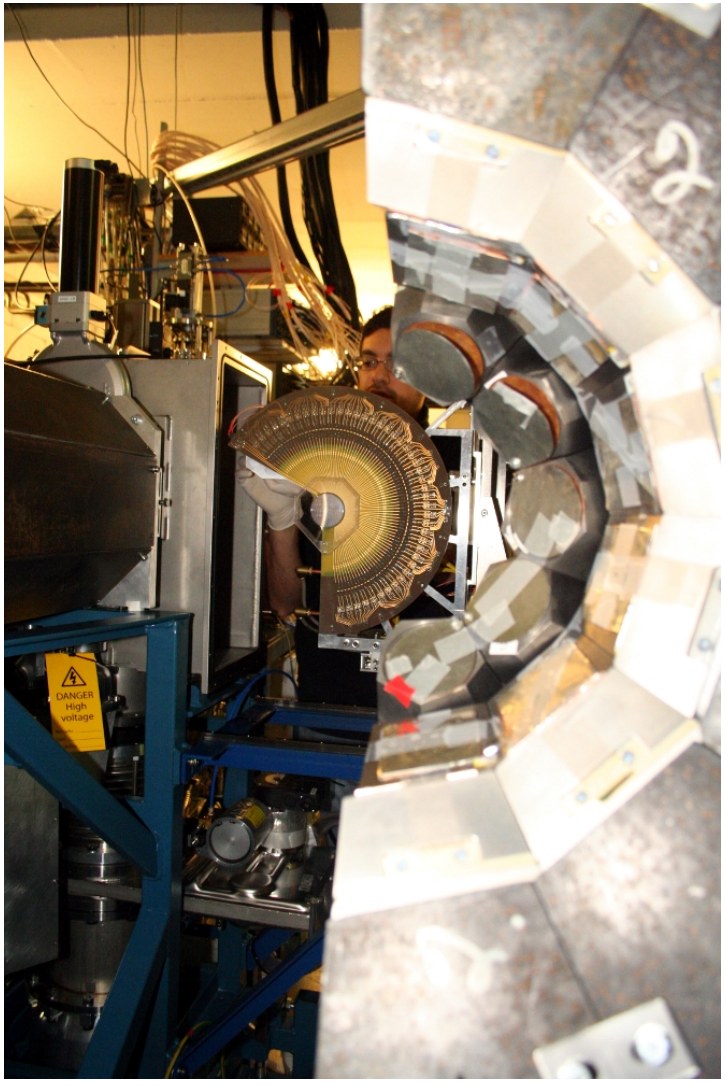

Collaboration

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R.-D. Herzberg, P. Papadakis,
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P. Jones, R. Julin, P. Peura,
P. Rahkila, M. Sandzelius

STFC Daresbury Laboratory, UK
J. Simpson, P.J. Coleman-Smith,
I.H. Lazarus, S.C. Letts, V.F.E. Pucknell

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