TASISpec

Heading Towards the First Experiment

TASISpec = TASCA in Small Image Mode Spectroscopy

- The TASISpec setup
- Commissioning experiments & results
- First experiment
- Future developments

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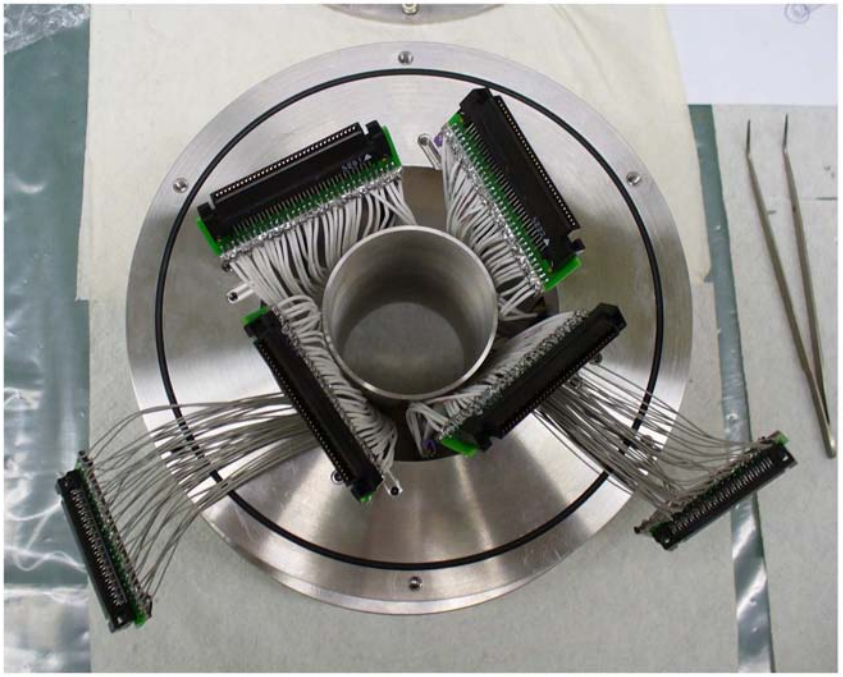
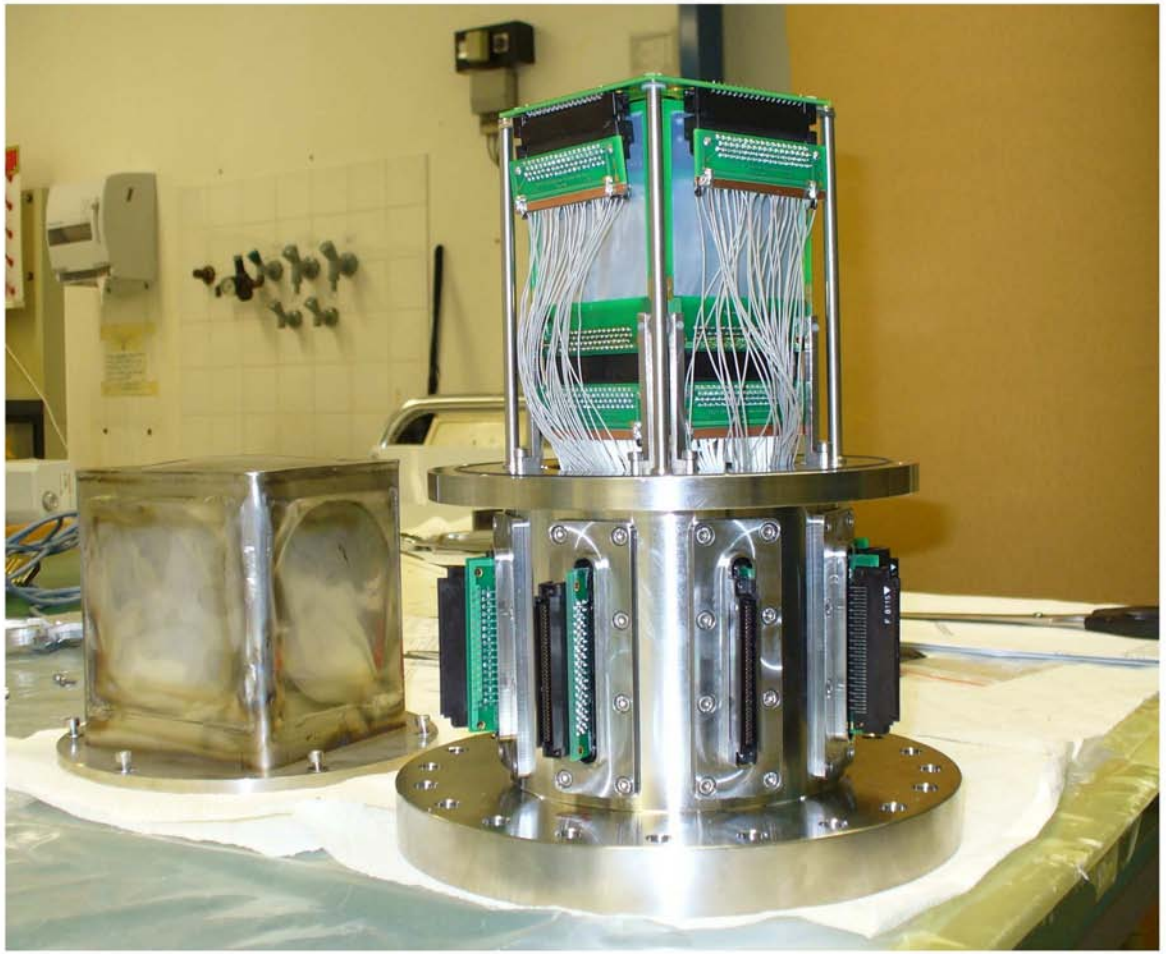
The Experimental Set−up

Details of the construction





- 4 SSSD (4*32 strips)
- 1 DSSSD (32+32 strips)
- 1 Ge cluster (7 crystals)
- 4 Ge clover (4*4 crystals)

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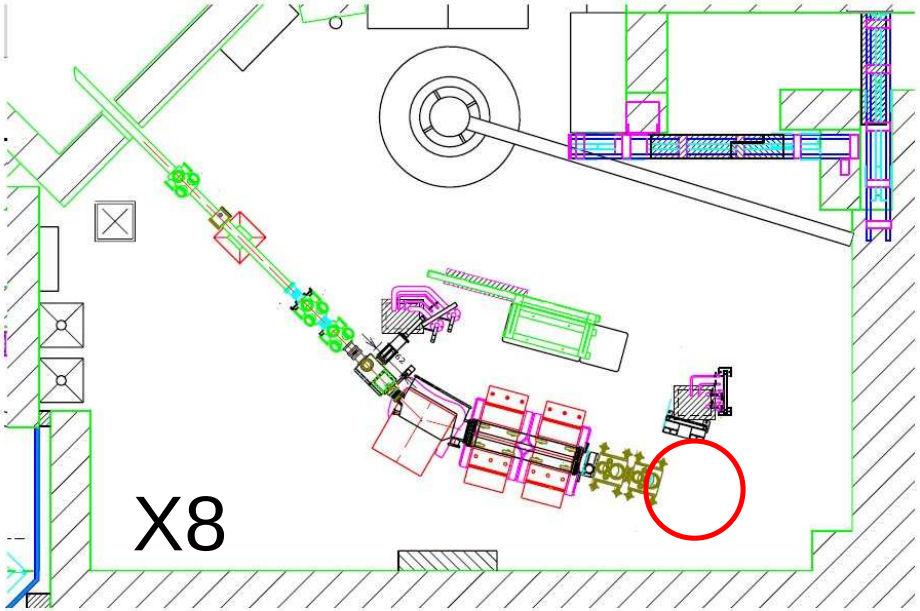
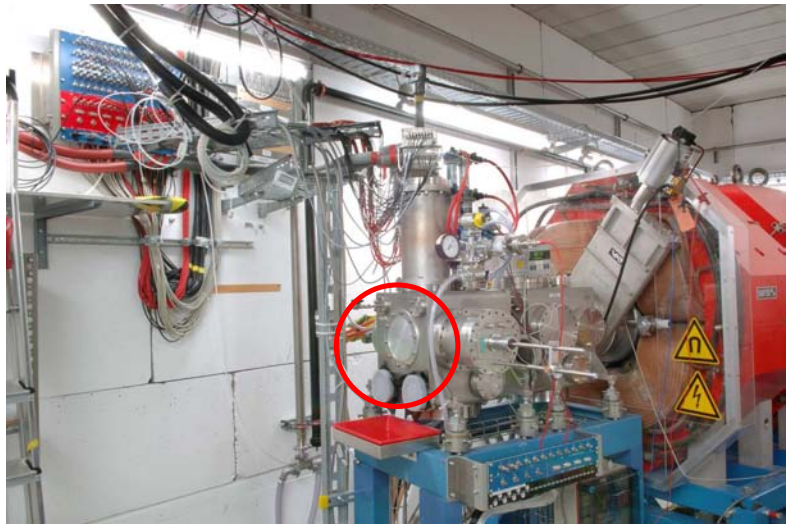
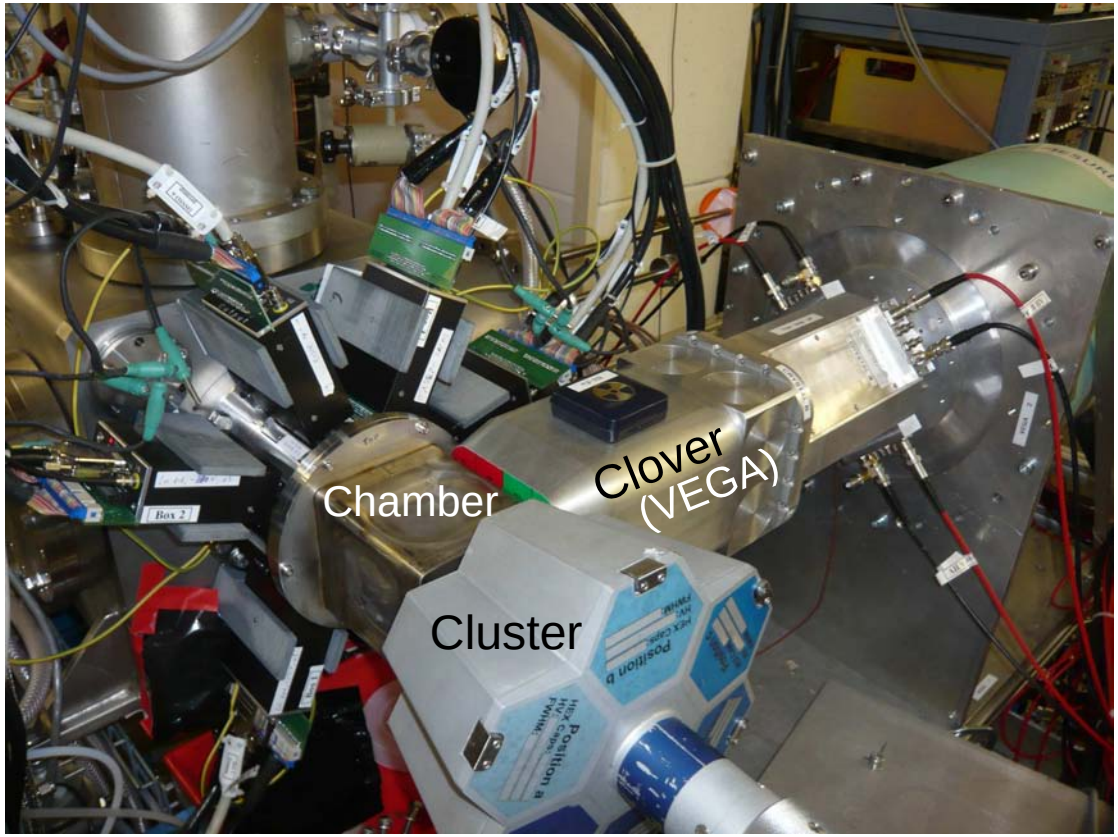
The Experimental Set−up

External structure, forming the "tail" of TASCA







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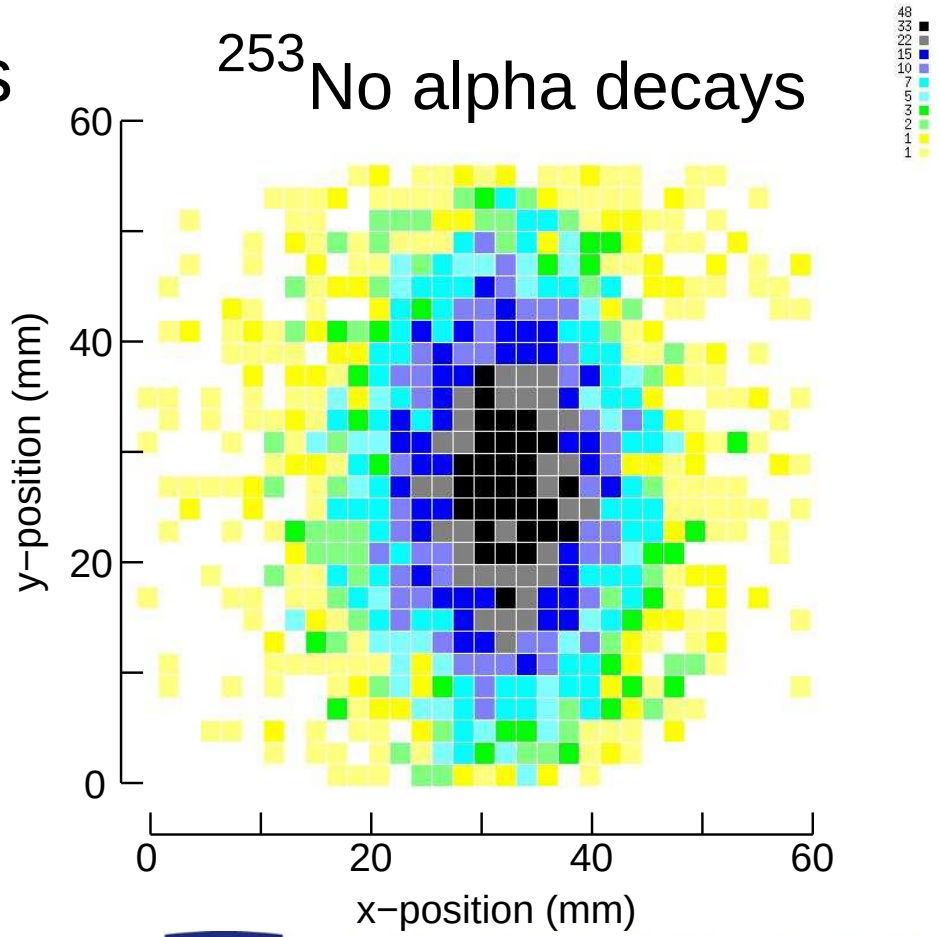
Why TASISpec?

A versatile SHE spectroscopy setup!

* Small−image mode => compact focal plane
* High segmentation => 192 Si strips
  α−efficiency ~80%
* 4+1 segmented Ge detectors
  γ−efficiency > 40% @ 250 keV
* Multi−coincidence capabilities



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A Selection of the Commissioning Experiments

August 2008, October 2008 and July 2009

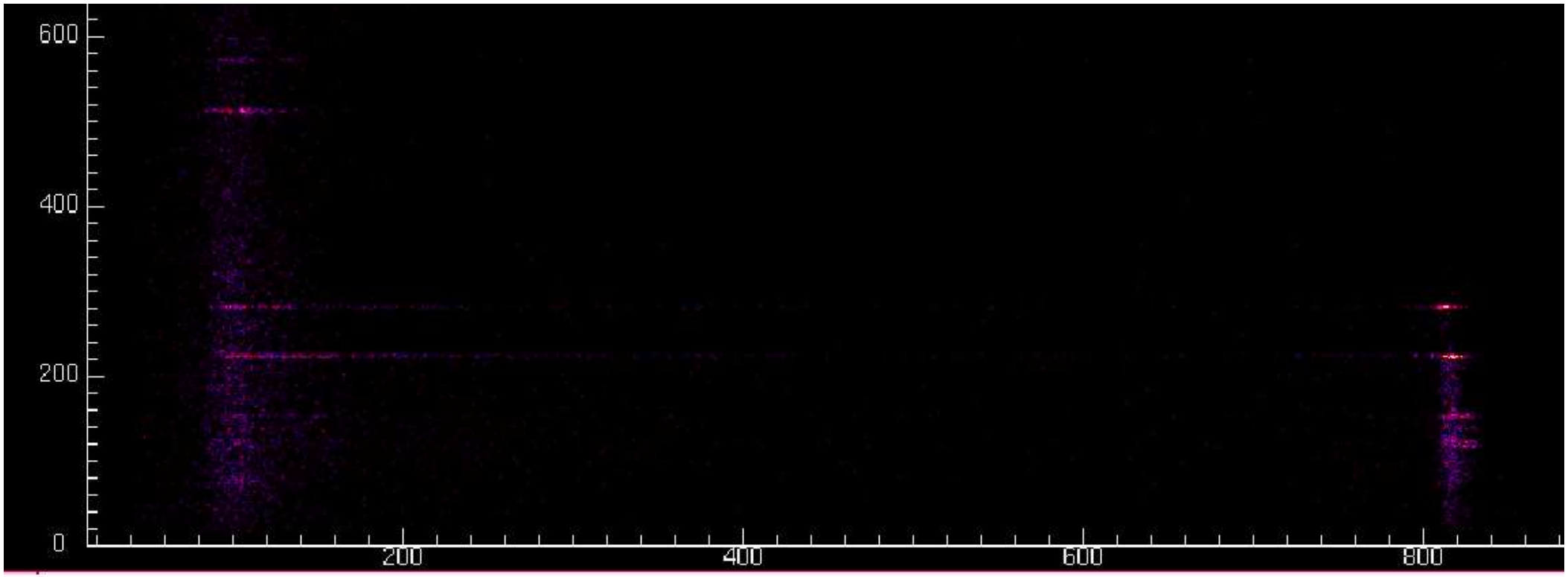
$^{207}Pb\ (^{48}Ca, 2n)^{253}No$	K−isomer test / $\alpha - \gamma(\gamma)$ test
$^{206}Pb\ (^{48}Ca, 2n)^{252}No$	Fission test
$^{208}Pb\ (^{48}Ca, 1n)^{255}No$	Pulse−shape electronics

$^{64}Ni + ^{150}Nd \rightarrow {}^{214}Ra^{*}$	Short−lived isomer tests
$^{64}Ni + ^{154}Sm \rightarrow {}^{218}Th^{*}$	$\alpha - \gamma(\gamma)$ tests
$^{64}Ni + ^{nat}Gd \rightarrow {}^{224}U^{*}$	Background tests
$^{64}Ni + ^{141}Pr \rightarrow {}^{205}Fr^{*}$	Reduced electronics noise

Results from Commissioning Experiments

$\alpha - \gamma$ coincidences

^{253}No decays with 8 MeV α + either 150, 222, 279 keV γ −ray



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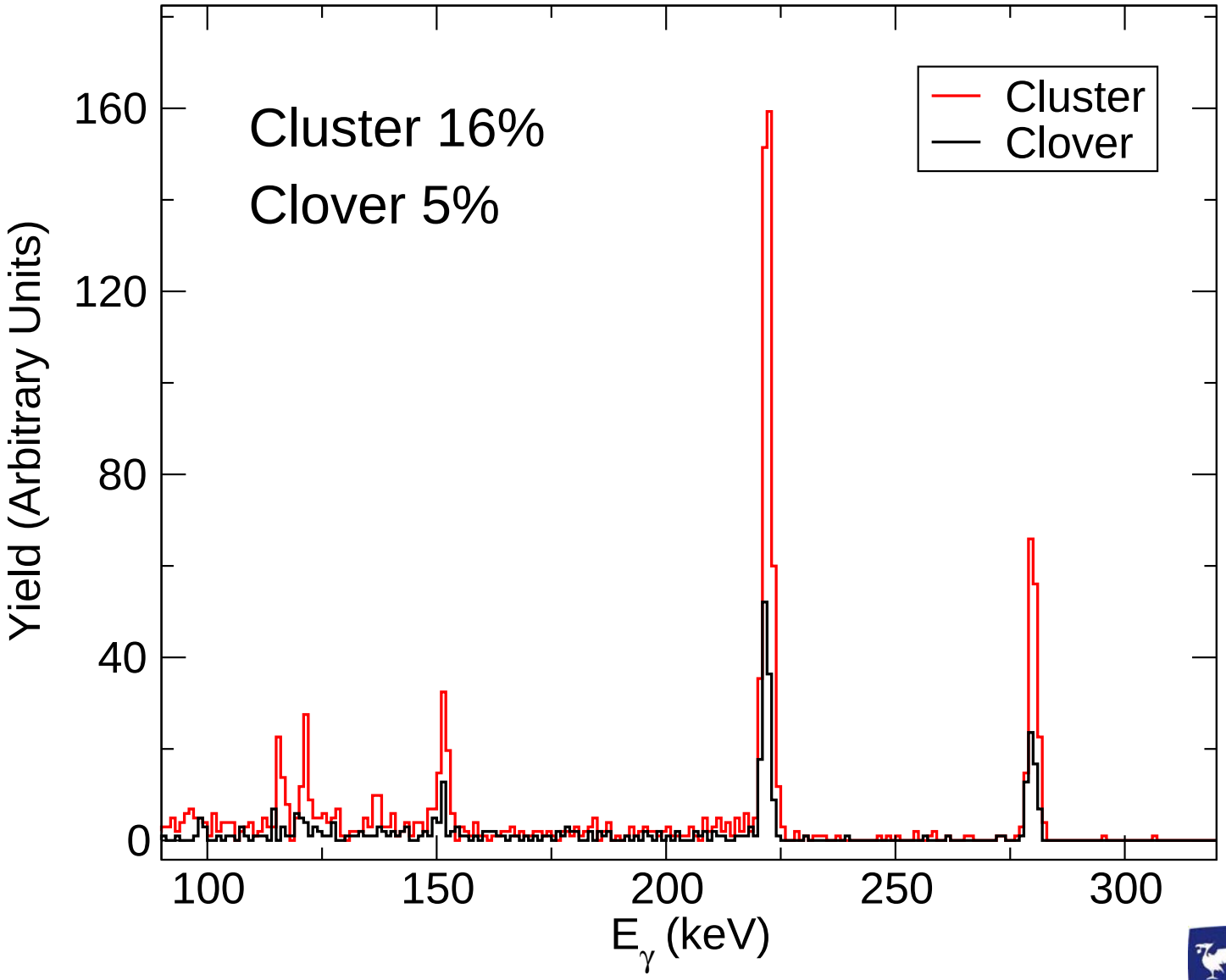
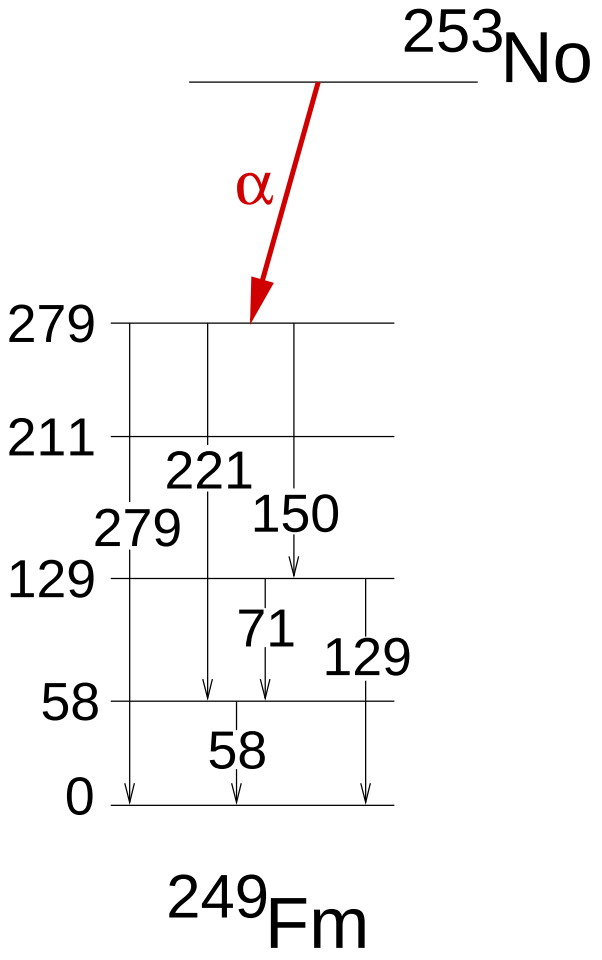
Results from Commissioning Experiments

$\alpha - \gamma$ coincidences and γ efficiencies





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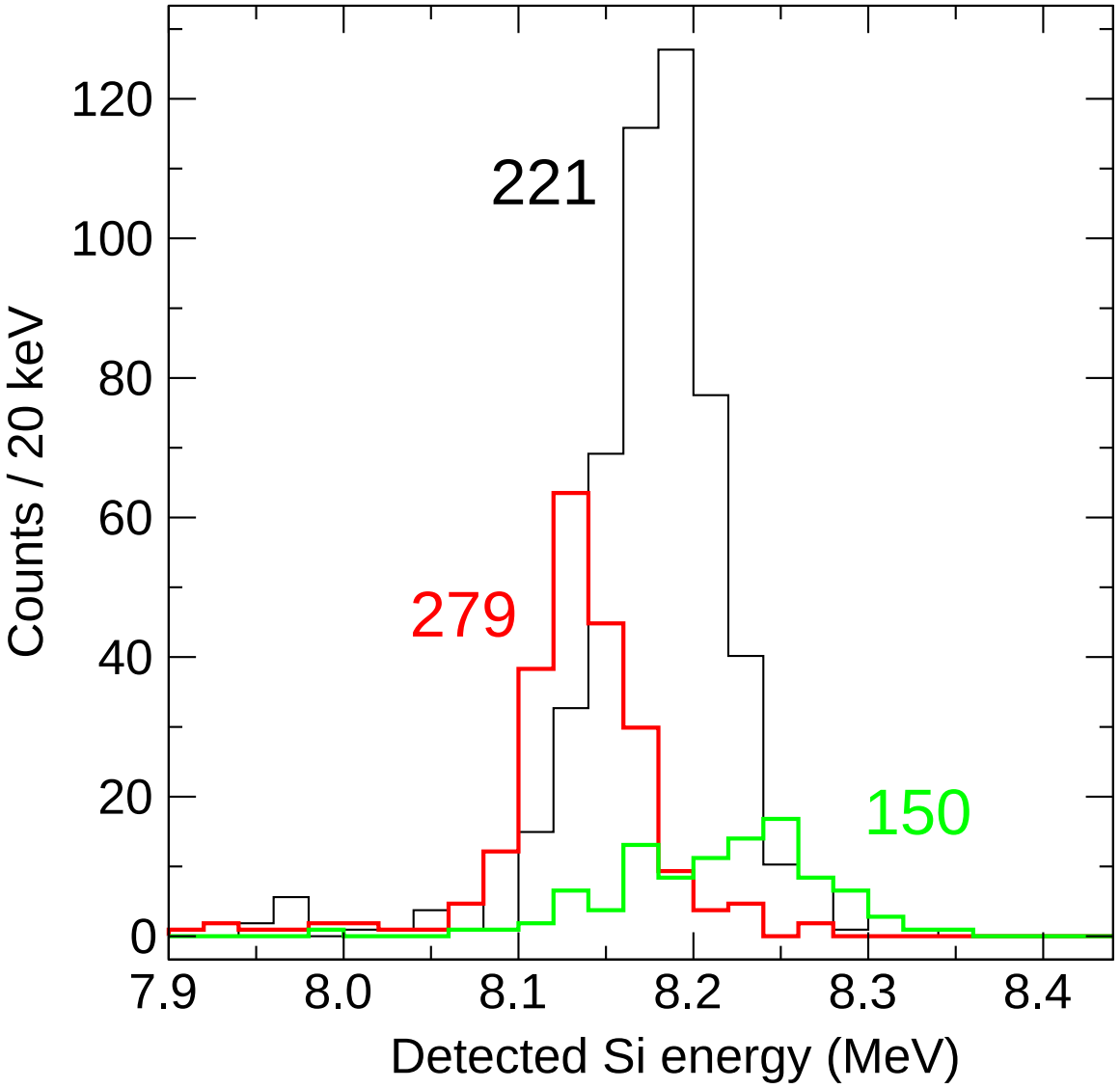
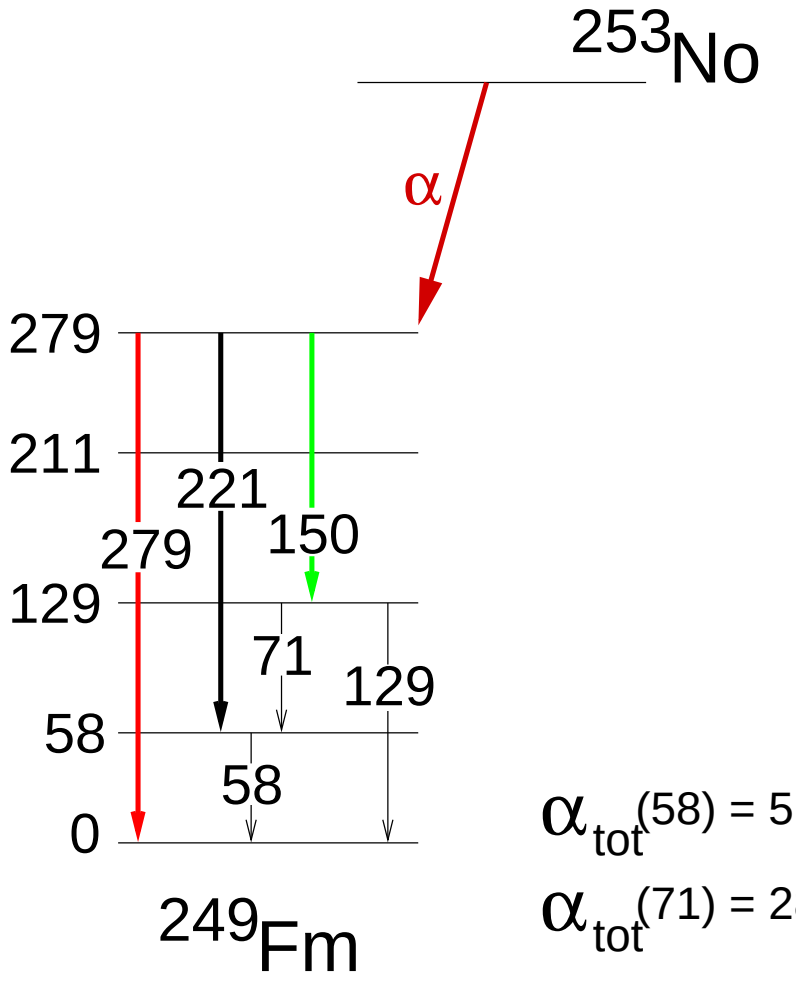
Results from Commissioning Experiments

Detection of α and IC decay





$\alpha_{tot}^{(58)} = 51.4$

$\alpha_{tot}^{(71)} = 28.4$

$\alpha_{tot}^{(129)} = 8.3$

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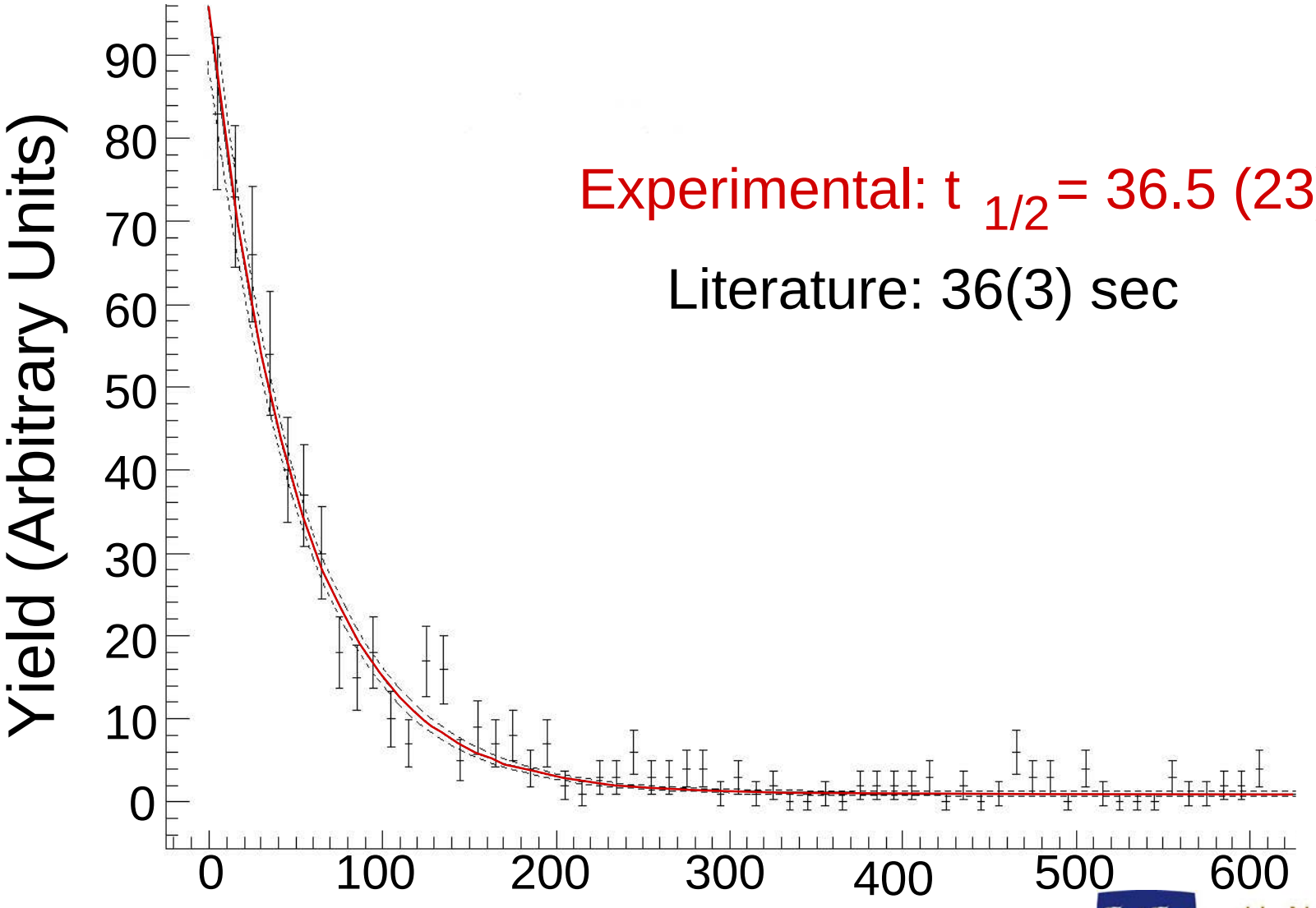
Results from Commissioning Experiments

Half life of ^{248}Fm



Experimental: $t_{1/2}$ = 36.5 (23) sec

Literature: 36(3) sec

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TASISpec

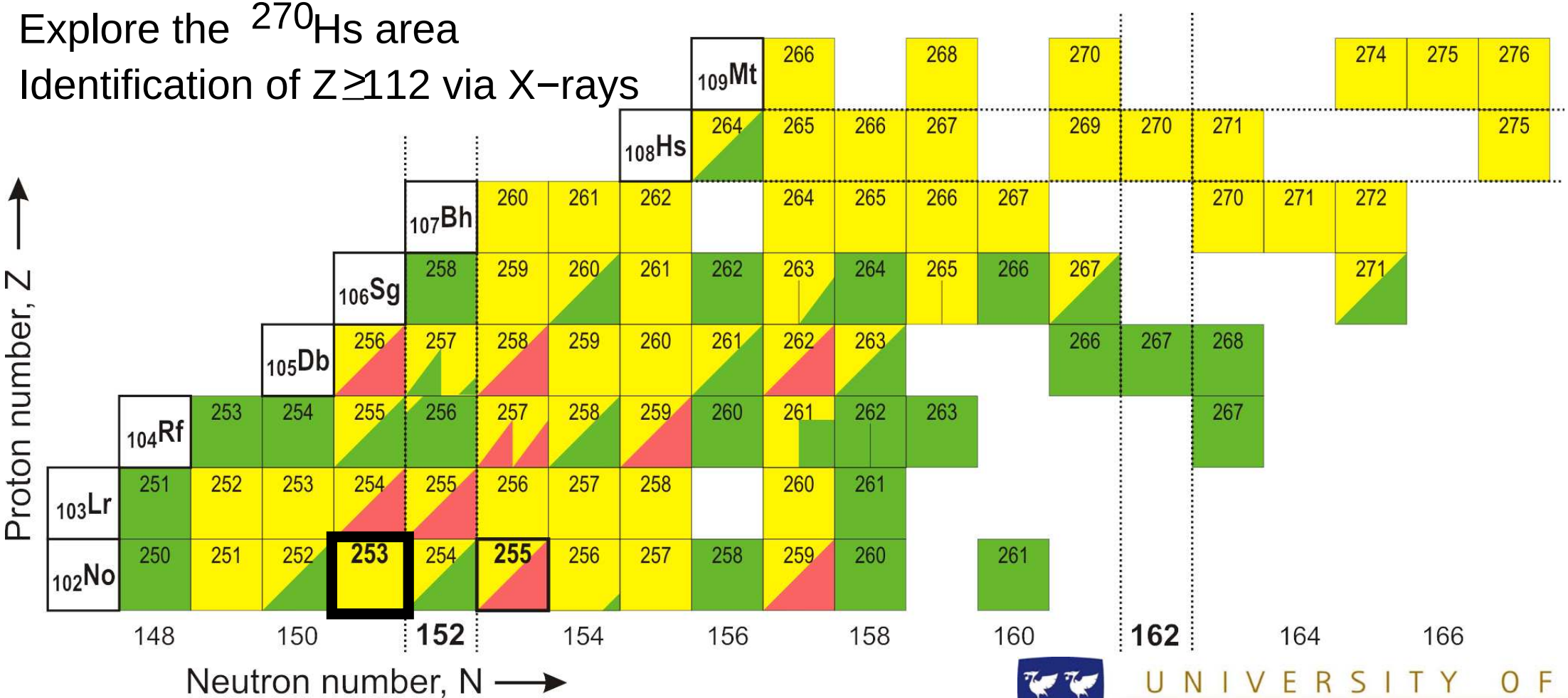
A new tool to explore superheavy elements

Shell structure of the heaviest elements via coincidence spectroscopy

Define the ^{254}No area (7 days of main beamtime granted)

Explore the ^{270}Hs area

Identification of Z≥112 via X−rays



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First Main Beam Experiment

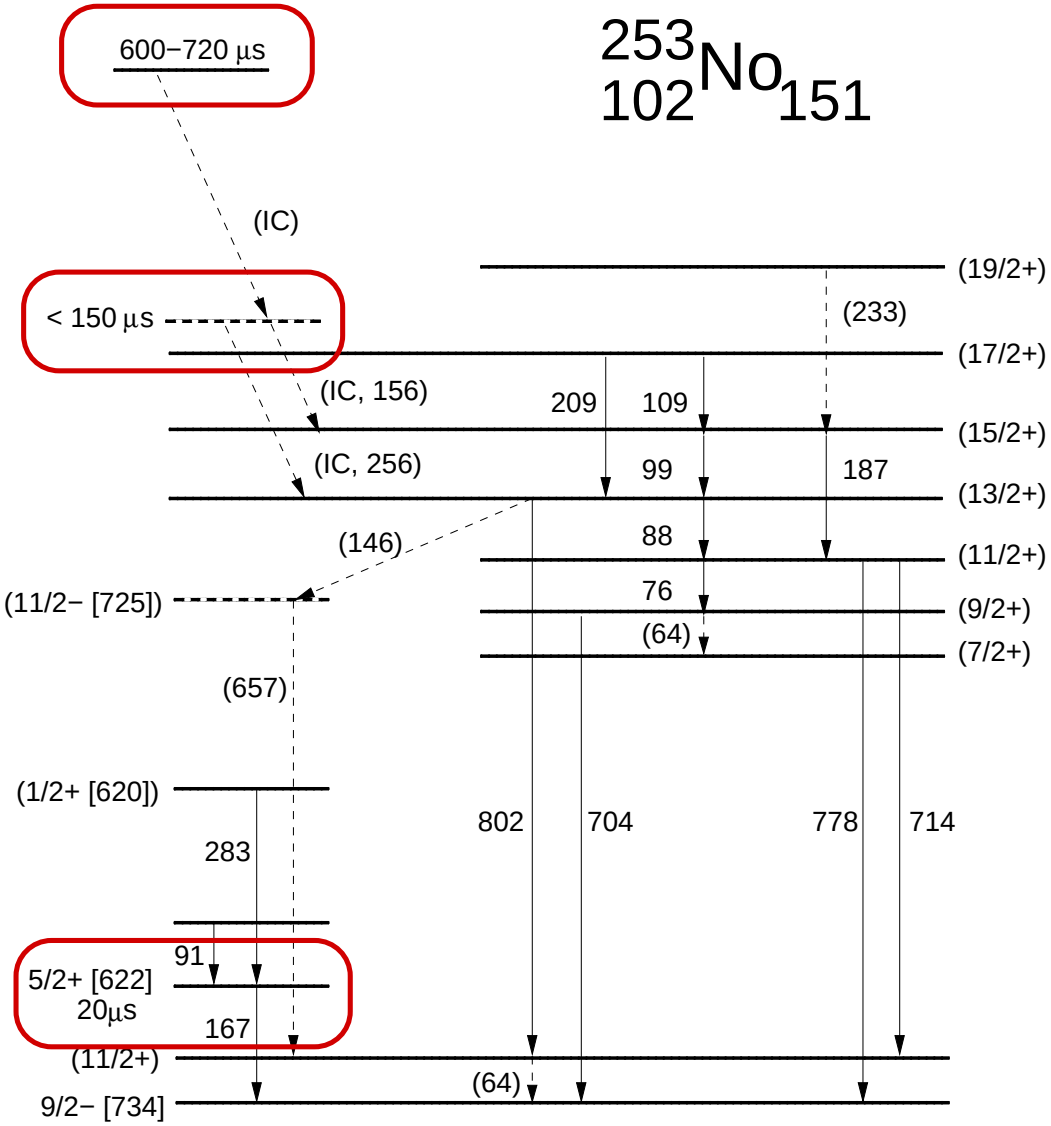
Define K−Isomers in ^{253}No

$$^{207}\mathrm{Pb}(^{48}\mathrm{Ca}, 2n)\,^{253}\mathrm{No}$$

* F.P. Hessberger; α–γ decay studies SHIP 2004
* F. P. Hessberger; isomeric γ and CE decays SHIP 2007
* A. Lopez−Martens; isomeric γ and CE decays Dubna 2007
* R.−D. Herzberg; in−beam studies JYFL 2002
* P. Reiter; in−beam studies ANL 2005

First Main Beam Experiment

Define K−Isomers in ^{253}No



$^{253}_{102}$No$_{151}$

"Sketch of a possible decay scheme"

Hessberger et al., Phys. of Atom. Nucl. 70, 1445 (2007).

AIM:

Establish reliable level scheme

Characterise K−isomers

Energy, spin, parity

=> define shell structure

NEEDED:

Multi−coincidence possibilities

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Experiments Using Parasitic Beam

Proposed studies

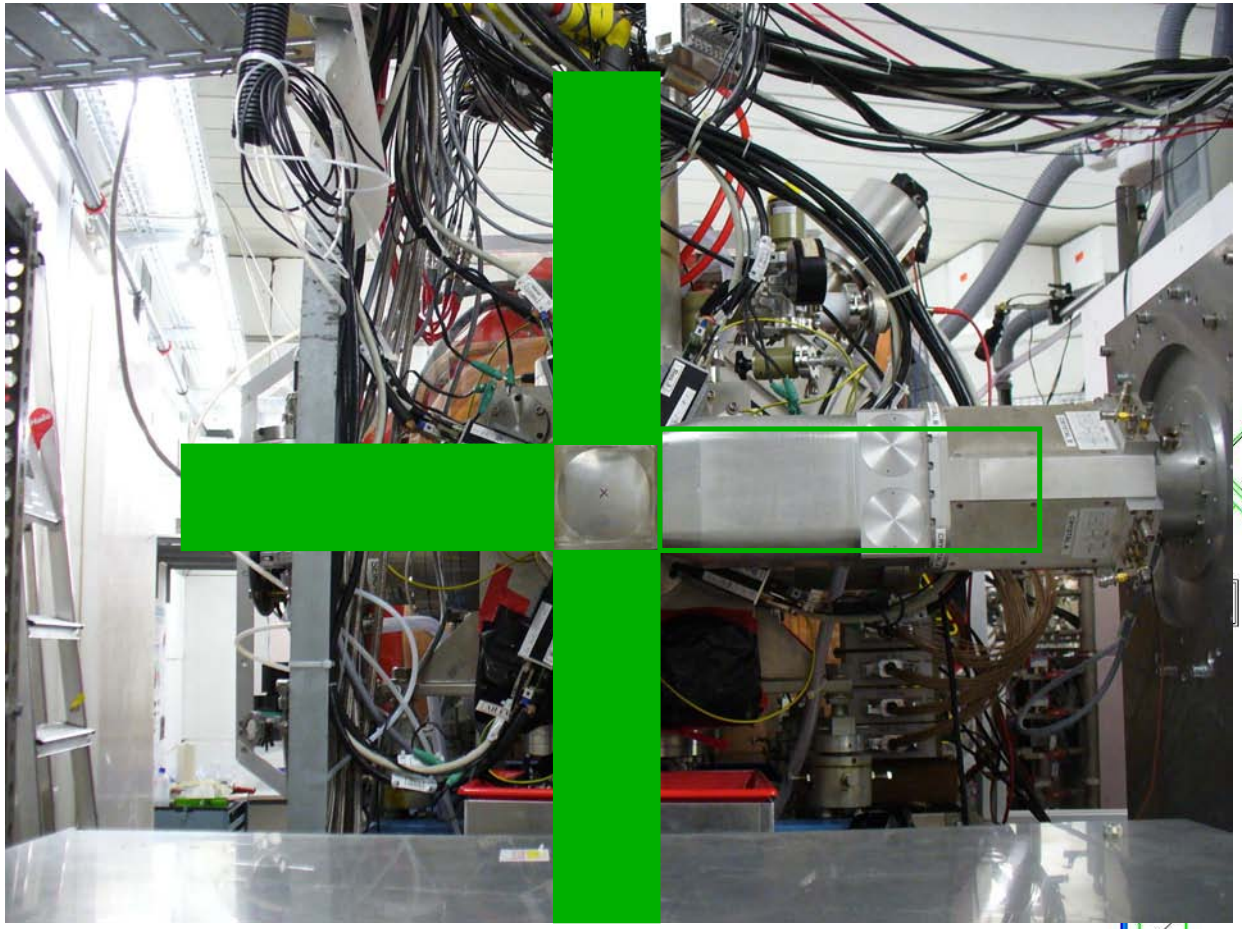
TASISpec granted 28 days of parasitic beam
to explore and optimise:

* TASISpec capabilities
* Different beam−target combinations
  e.g. ^{15}N, ^{18}O, ^{26}Mg, ^{30}Si, ^{34}S, ^{37}Cl, ^{50}Ti, ^{51}V beams
* TASCA optimisation : transmission
  gas mixture and preassure
  background

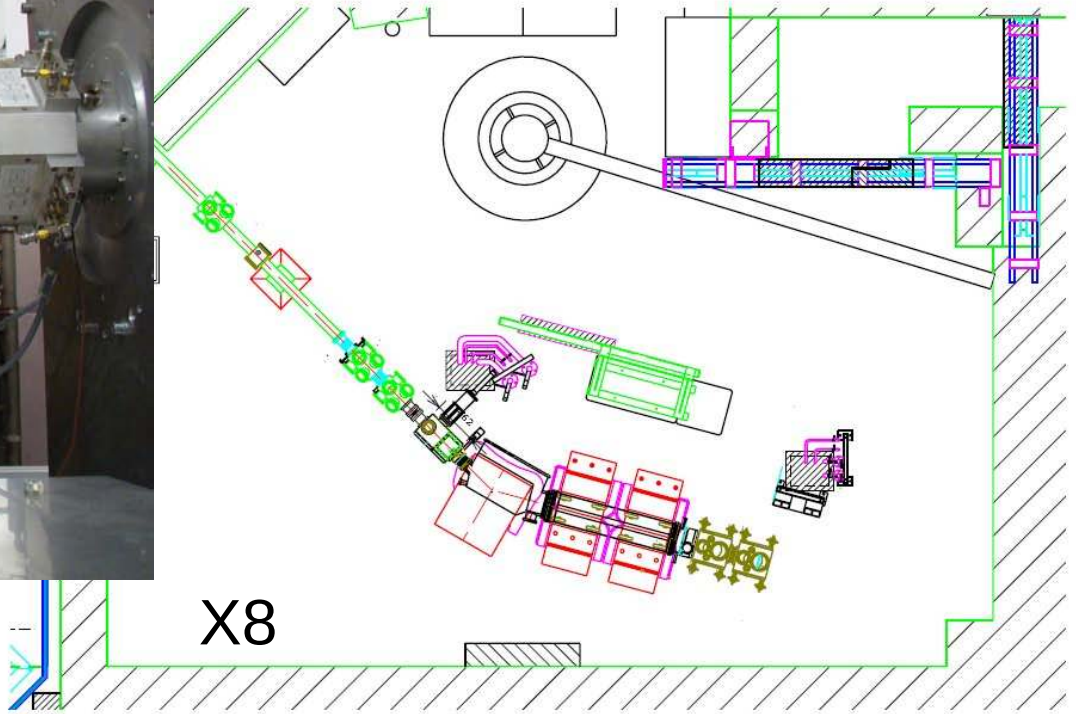
=> Stepwise approaching neutron−rich SHE

Necessary Preparations

Final steps towards a configuration for the first experiment



4 Ge Clover + 1 Cluster detectors in final configuration



Required: 4 Ge Clover holding structure at the TASCA focal plane!

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Possible or Desired Improvements

Final steps towards a configuration for the first experiment

* Thicker implantation detector (0.52 mm)
* 32−event block readout mode
* Pulse−shape electronics for DSSSD
* Larger target wheel ("SHIP size")
* Improved signal shielding

TASISpec

Heading towards the first experiment

TASCA @ GSI, DE

University of Liverpool, UK

Lund University, SWE

Technische Universität München, DE

Universität Mainz, DE