Possibilities of Fast Timing at Jyväskylä

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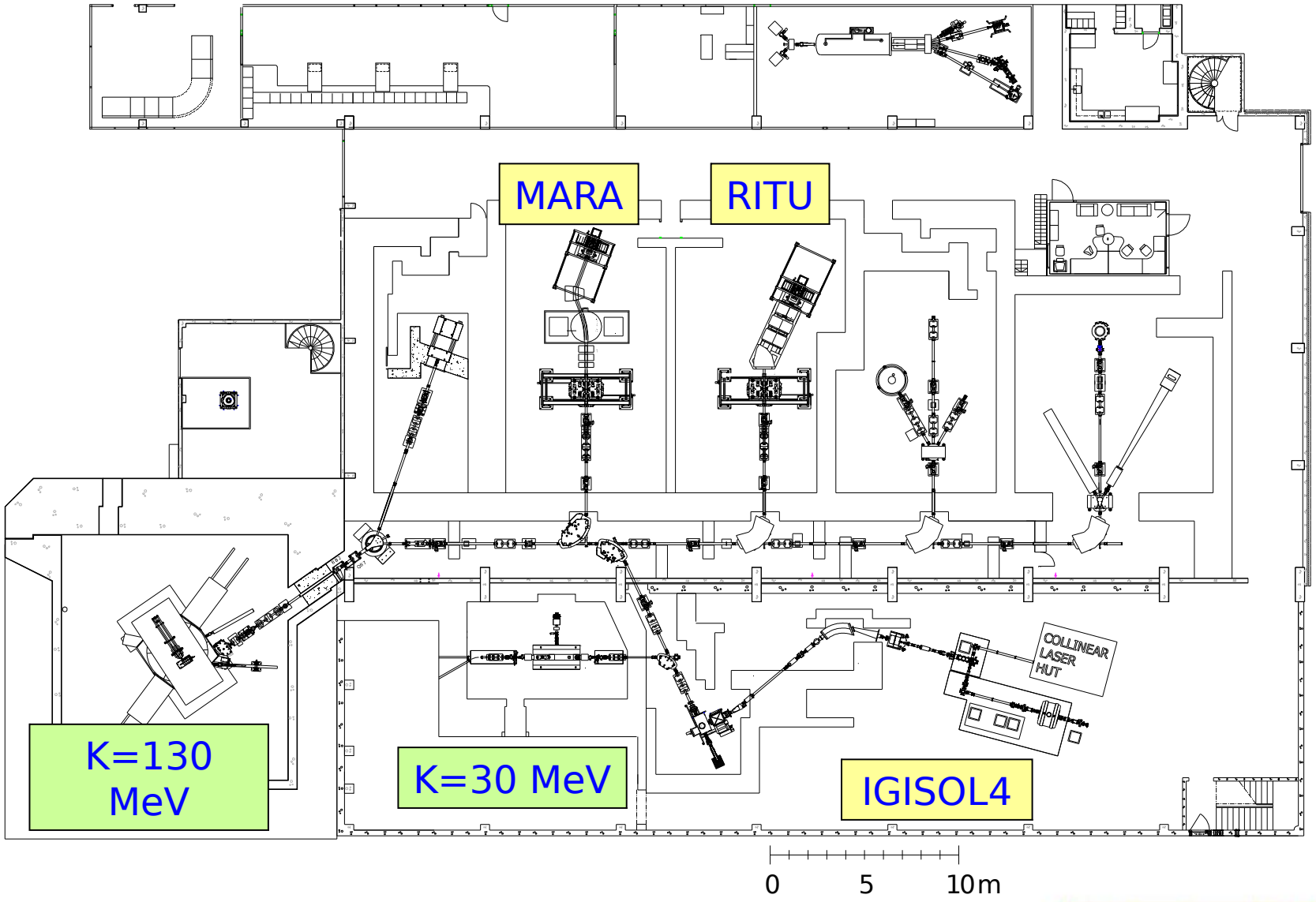
Workshop on Physics Opportunities Using Arrays of Fast-Timing Gamma-ray Detectors, NPL, Teddington, UK. 19th - 20th March 2015.

Cyclotrons and Separators

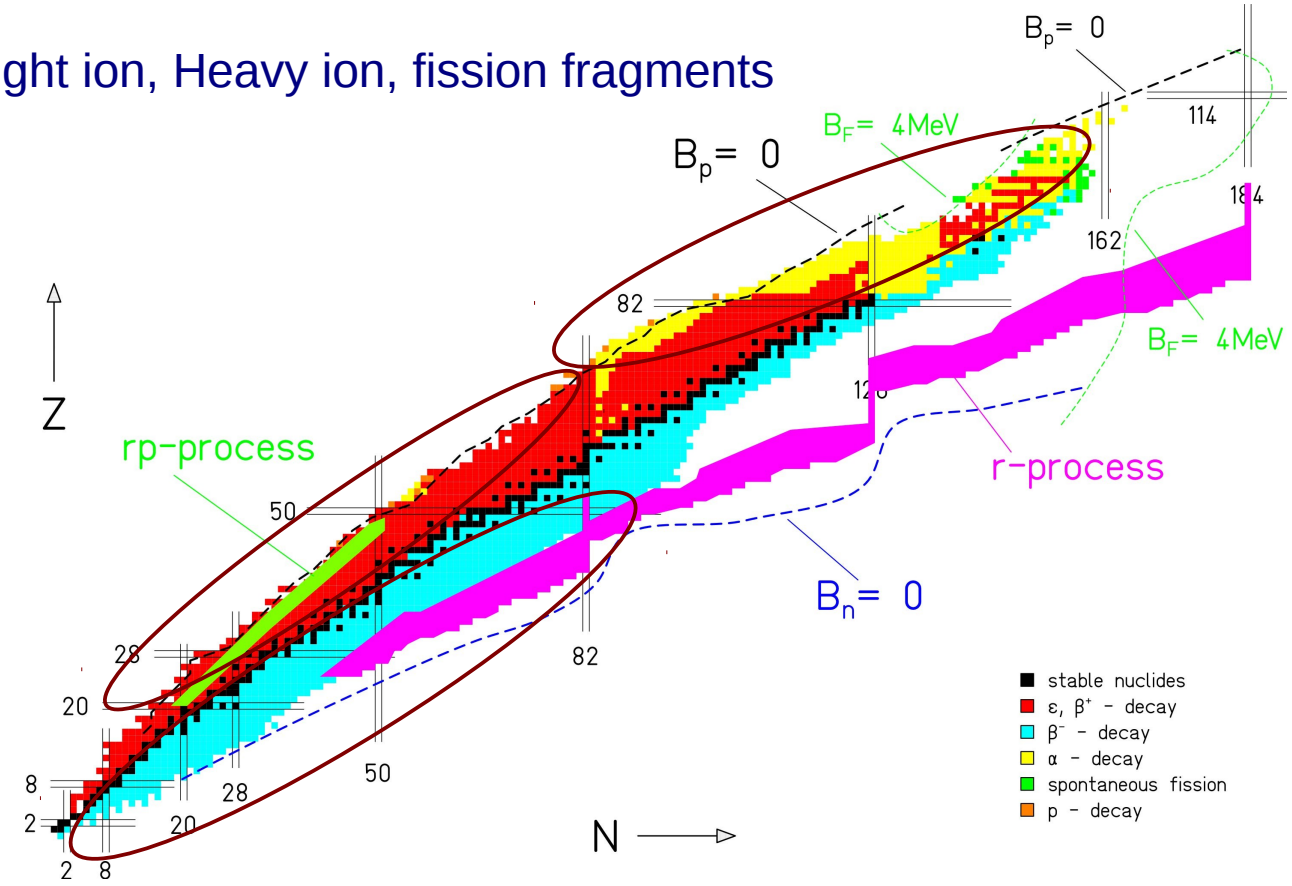


Which for what!?

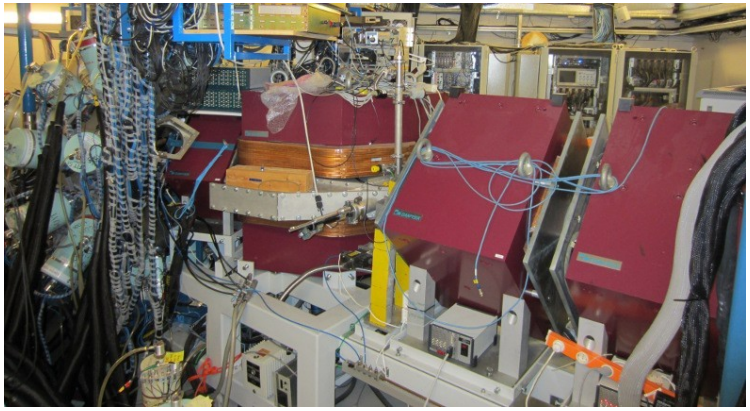
RITU : Heavy proton dripline and heavy elements

MARA: N~Z Proton dripline nuclei

IGISOL: Light ion, Heavy ion, fission fragments

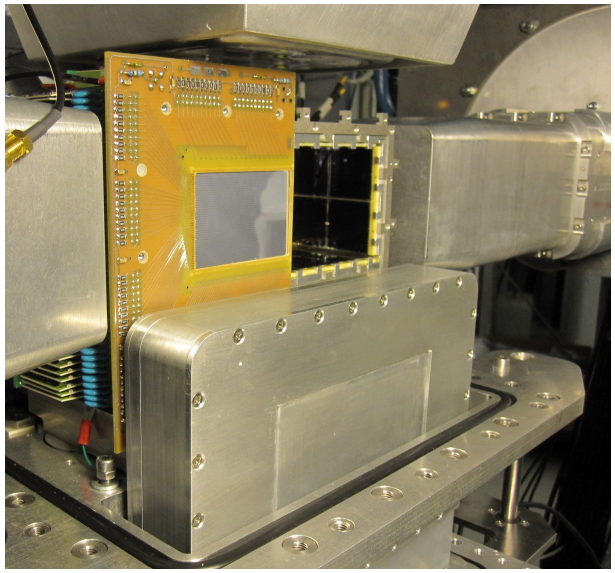


RITU (gas-filled separator)



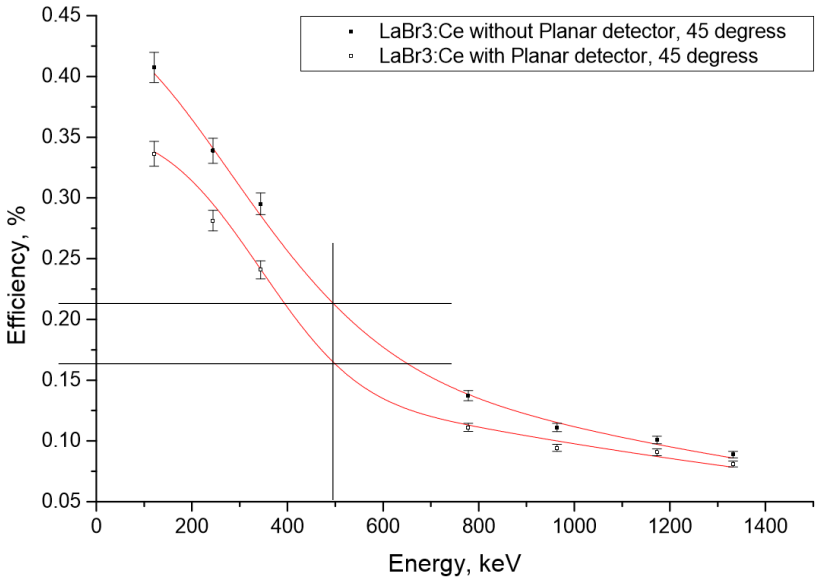
- Transmission typically 30% -60%
- Flight time ~0.5us.
- Focal plane image size ~120x30mm
- Fusion evaporation reactions thin targets v/c~2-4%
- Fast timing options: Target position or focal plane.
- Target position: LaBr detectors combined with JUROGAM II detectors (6% @ 1.3MeV).
- Focal Plane: LaBr detectors + GREAT

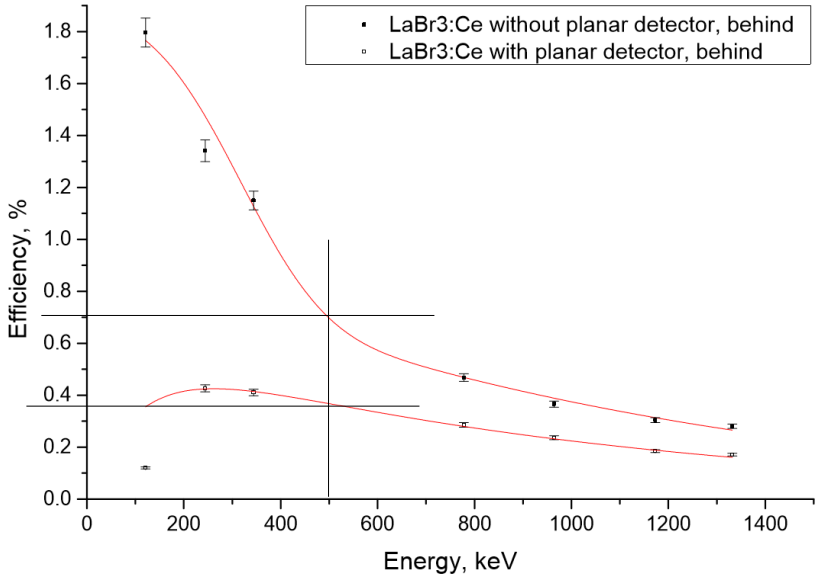
  Ge efficiency ~ 20% @ 100keV, ~ 5% @ 1.3MeV

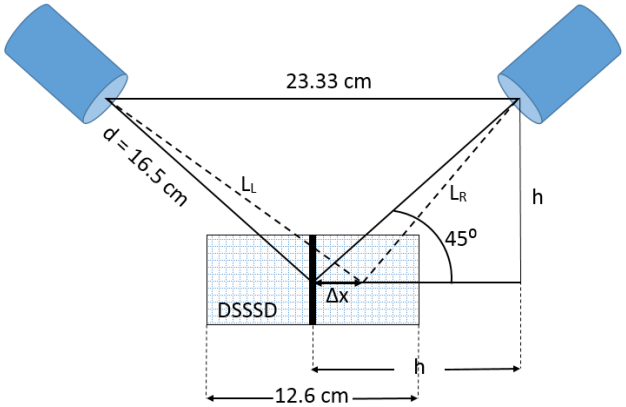


Gamma	Planar HPGe 60x120 mm area 150mm thick with 5mm strip pitch + Clover HPGe, 4 crystals each with 4-fold segmentation.
Recoil	Multi-wire-proprotional counter + 2 x DSSD 60x40mm, 1mm strip pitch = 4800 pixels
Electron	28 PIN-diodes 28 x 28mm 500 µm thickness.
Alpha	2 x DSSD 60x40mm, 100,300,700µm thickness, 1mm strip pitch = 4800 pixels
Timing	TDR, Total Data Readout acquisition system.

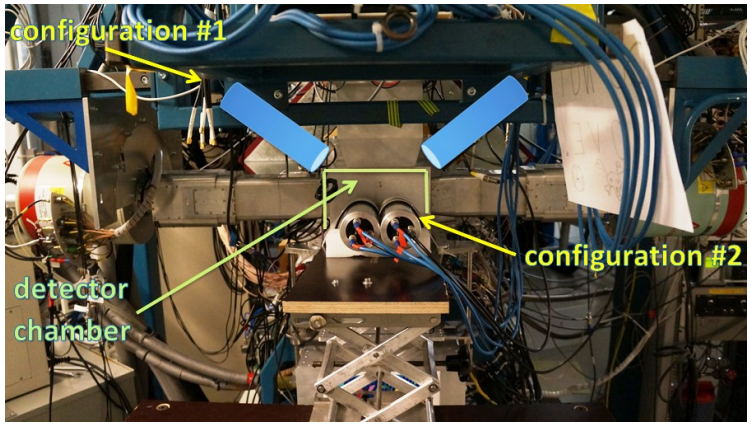
LaBr(Ce) @ RITU + Great



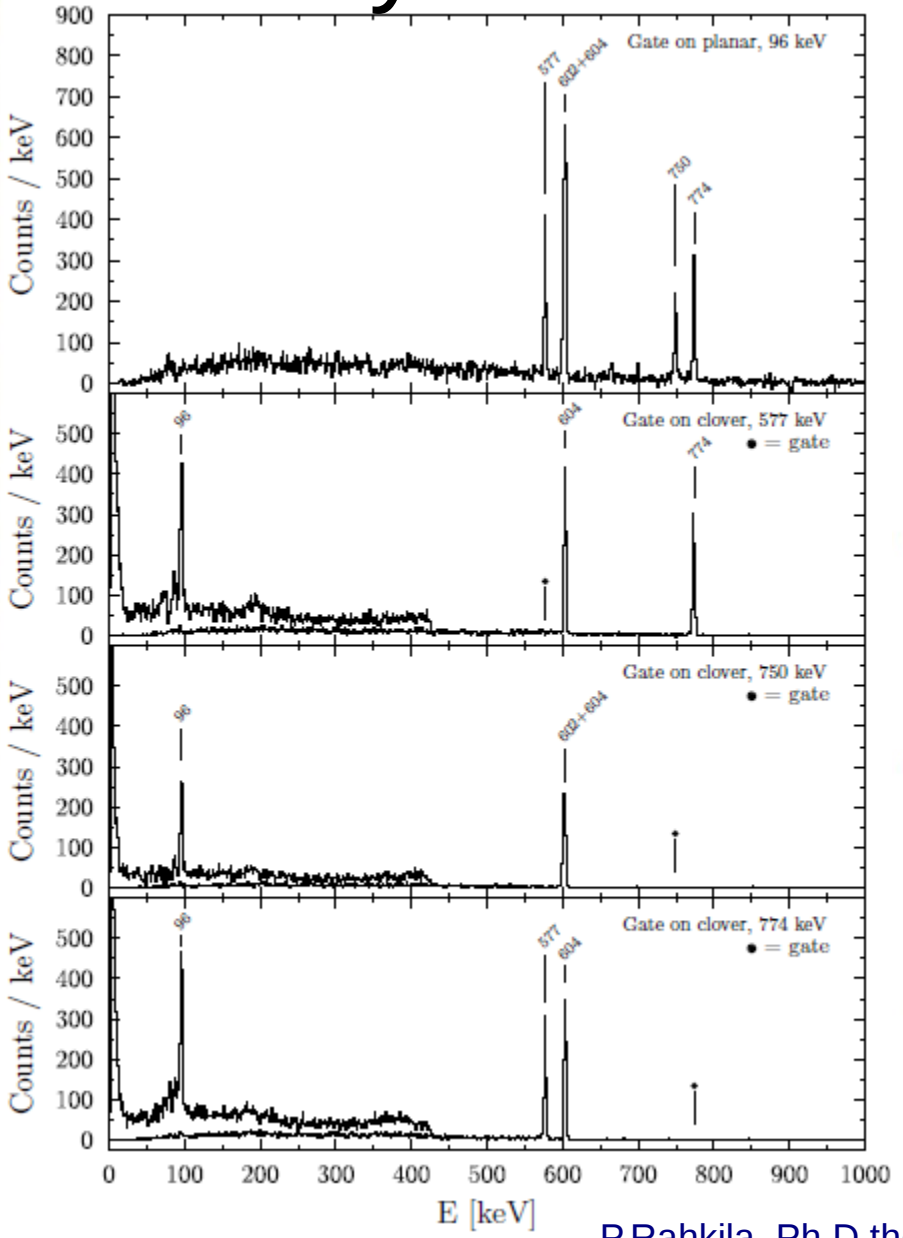




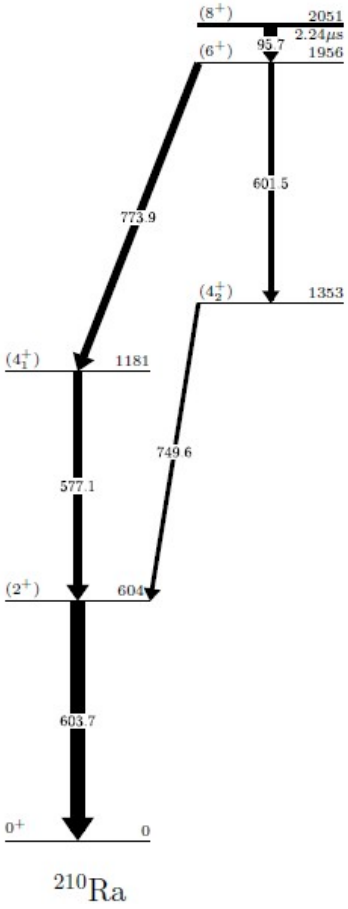
- Distance DSSD – LaBr ~ 6cm



Seniority above Pb: ^{210}Ra

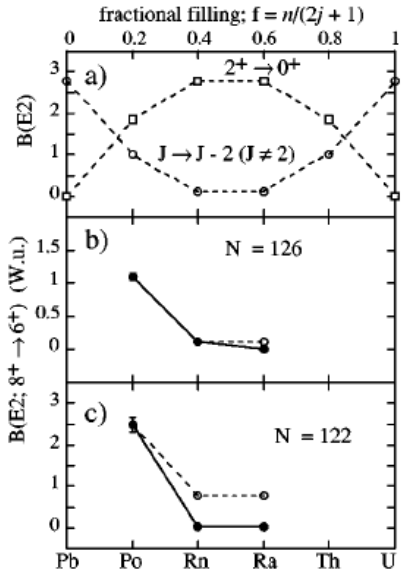


40Ar (183MeV) + 174Yb 1mg/cm2, 100pnA 30hrs



Directly measure
First 2+ and 4+ lifetimes

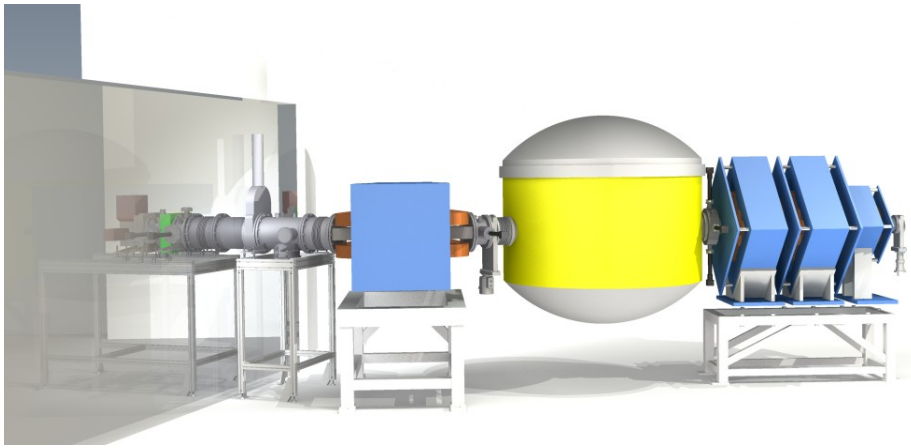
complements REX-ISOLDE coulex measurements

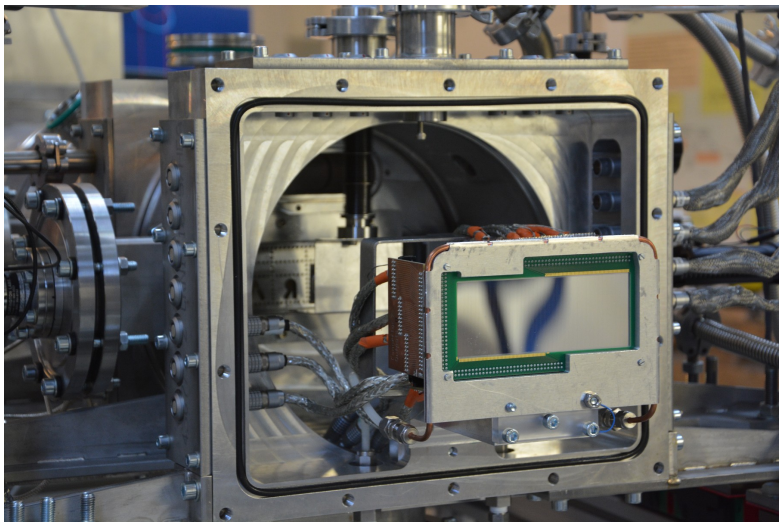


J.J Ressler et al., 69, 034331 (2004)

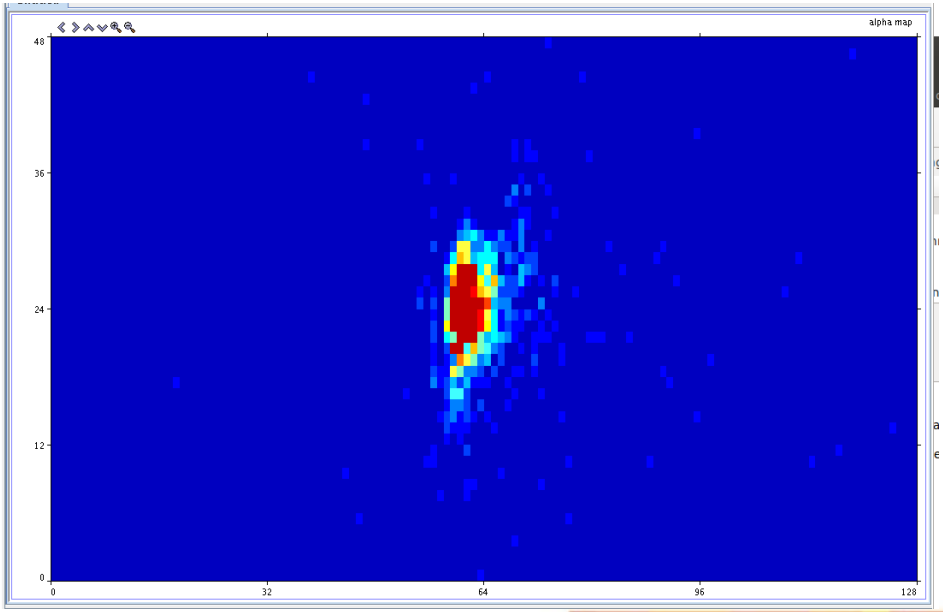
P.Rahkila, Ph.D thesis 2010

MARA (vacuum separator)





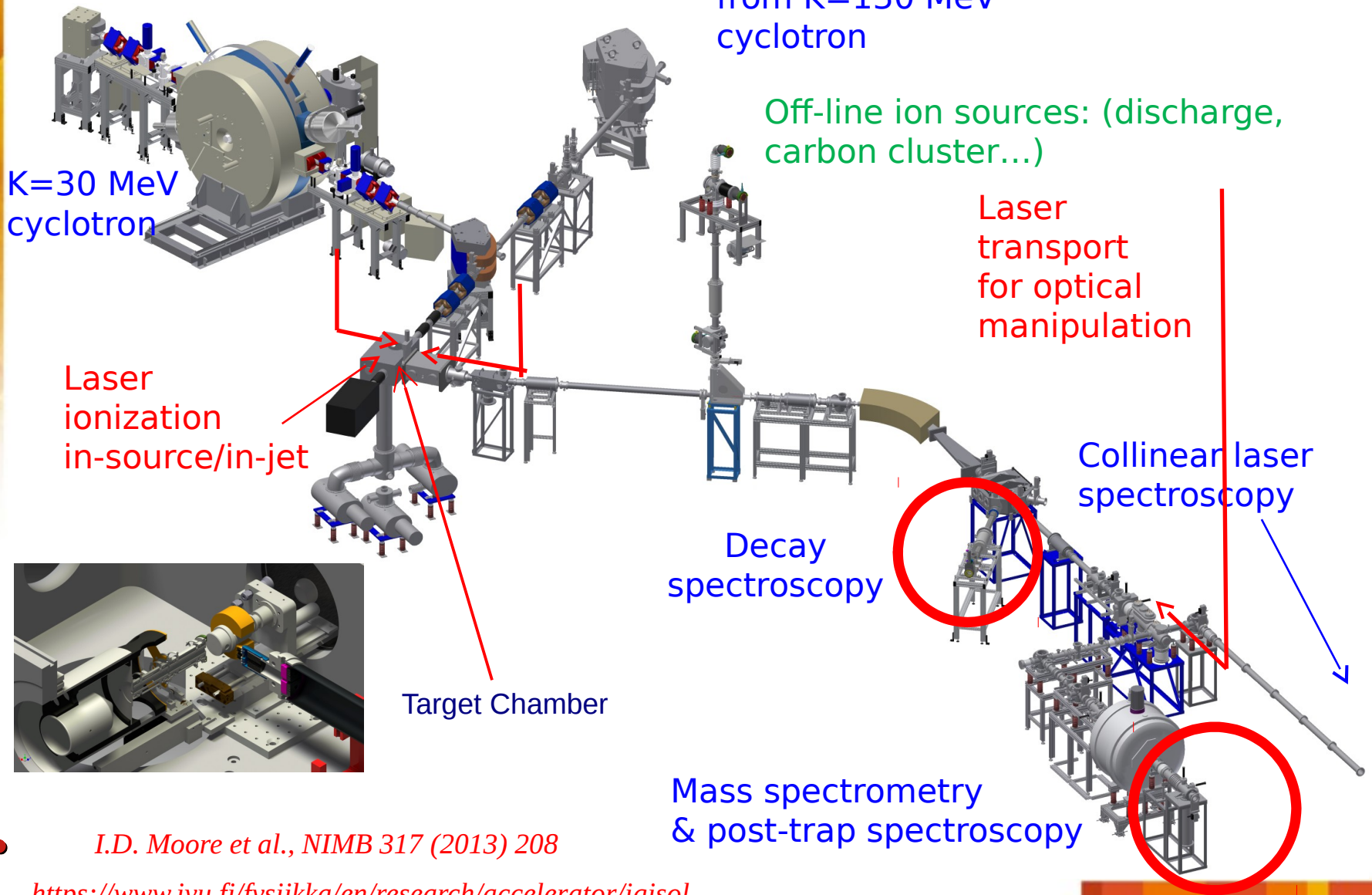
Mass resolving power of ~1/250
Magnets conditioned 225 kV
DSSD + MWPC tested
Alpha source tests ongoing



Si area 128x48mm
Image size of a single charge state ~3cm^2

Physics cases:
Seniority isomers around Sn
Mass A~140 K isomers
ideas welcome!

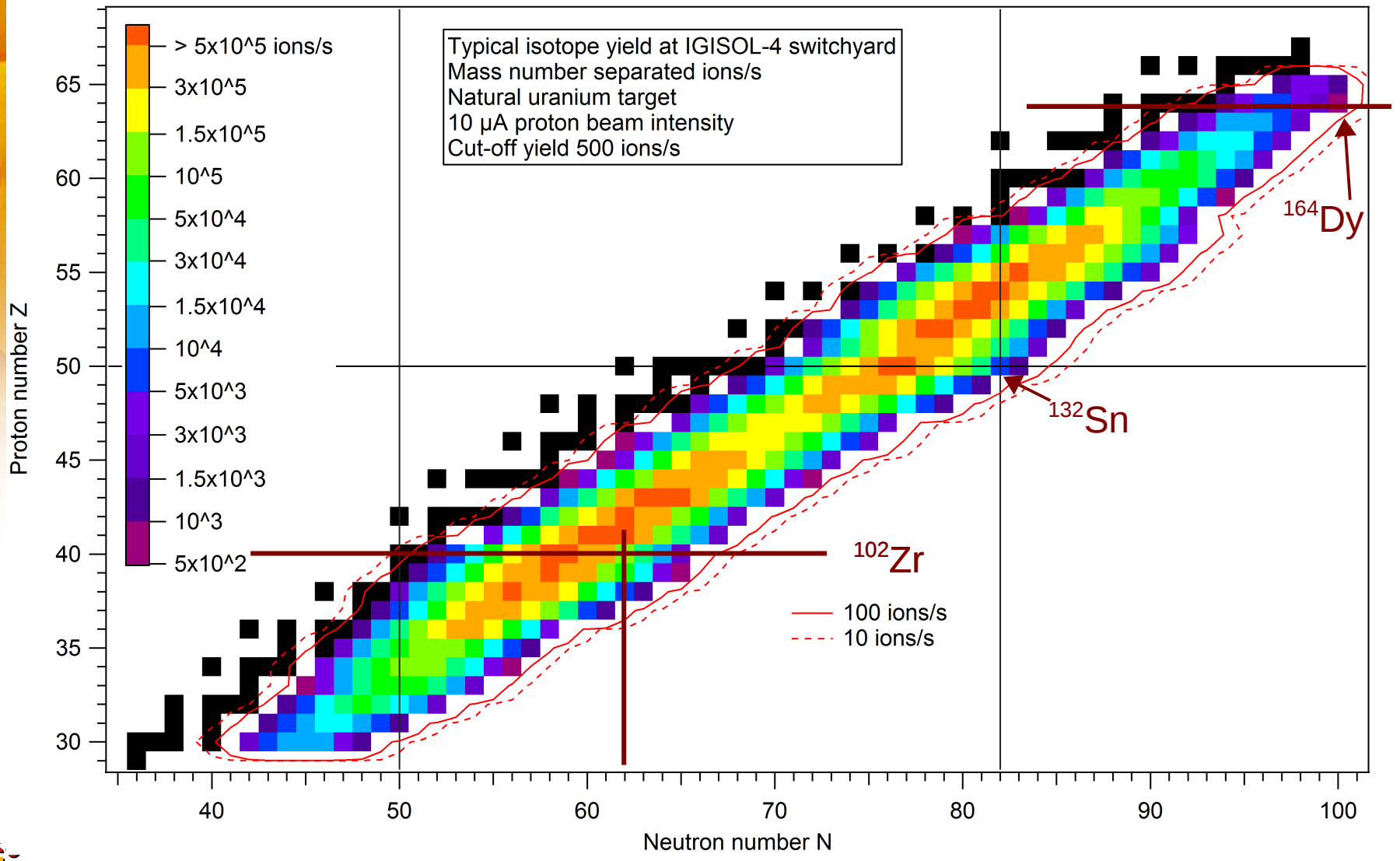
IGISOL-4 @JYFL



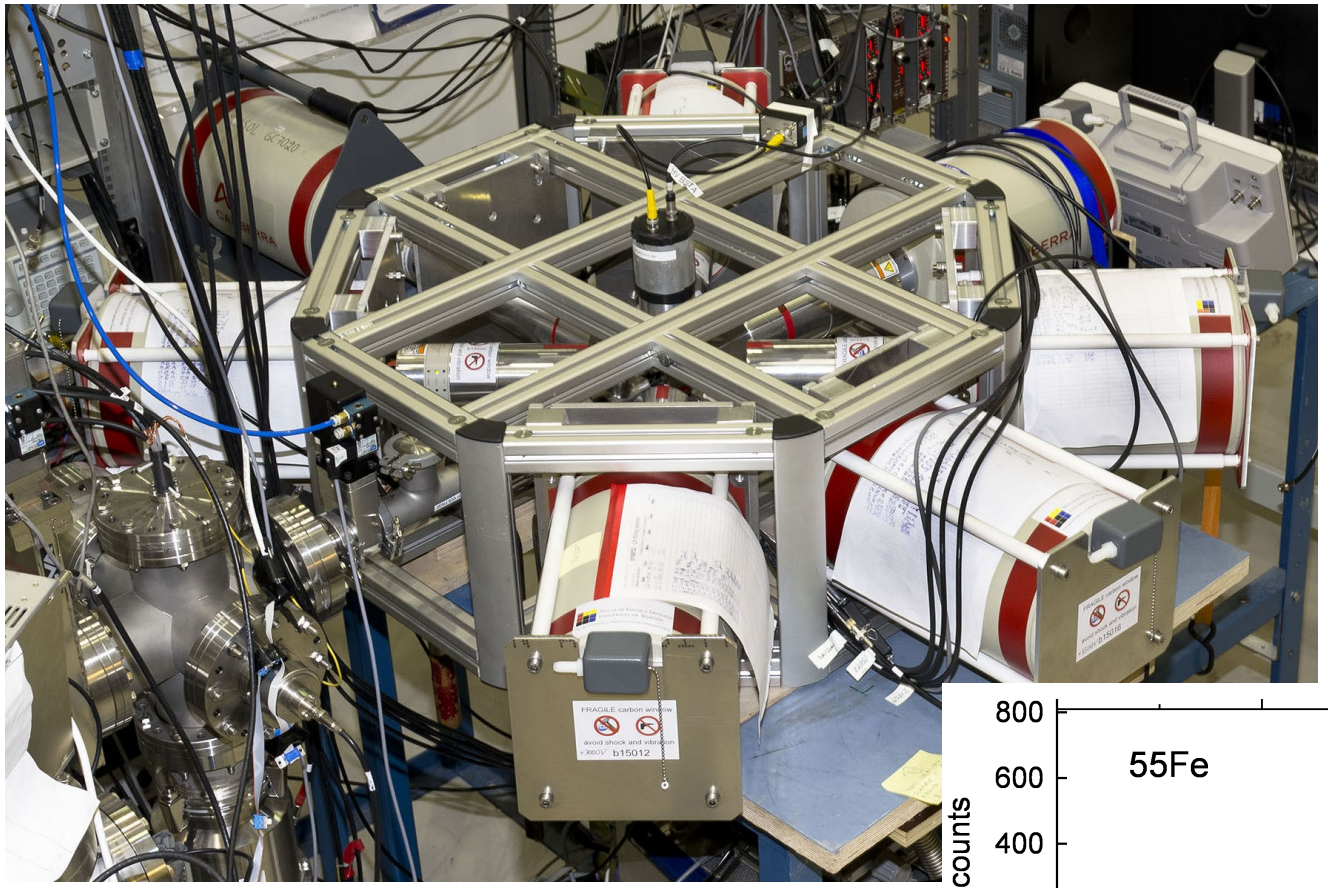
I.D. Moore et al., NIMB 317 (2013) 208

https://www.jyu.fi/fysiikka/en/research/accelerator/igisol

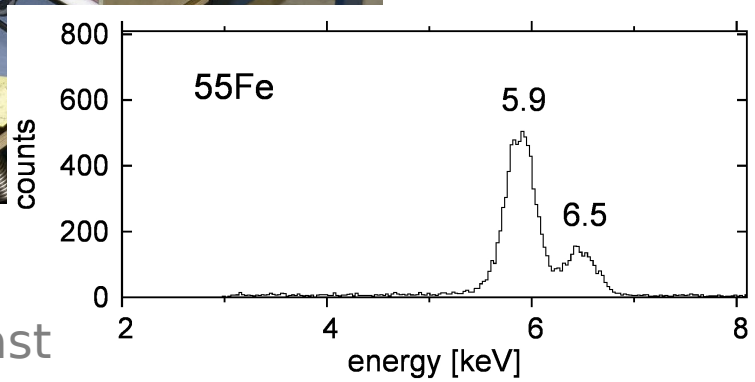
IGISOL IV: fission yields



February 2015 – new Ge array for decay studies of purified fission fragments



Canberra BEGe2825
Thickness = 25mm
Area 28cm$^{2.}$
Entrance window is composite carbon
efficient energy range from below 10keV



...and many other possible decay spectroscopy measurements including fast timing. Welcome!!

Summary: LaBr(Ce) detectors at JYFL

- 3 options of Separator:
  - RITU – around and above Pb.
  - MARA – Proton Dripline, in the near(ish) future.
  - IGISOL – Fission fragments and others.

- 2 LaBr detectors have been tested at the RITU focal plane
- 8 detector test will happen sometime soon (summer)
  – listen to Dave after coffee

WELCOME TO JYVÄSKYLÄ !!

Thanks for your attention.