Construction of the UK DESPEC Array for Fast-Timing Measurements

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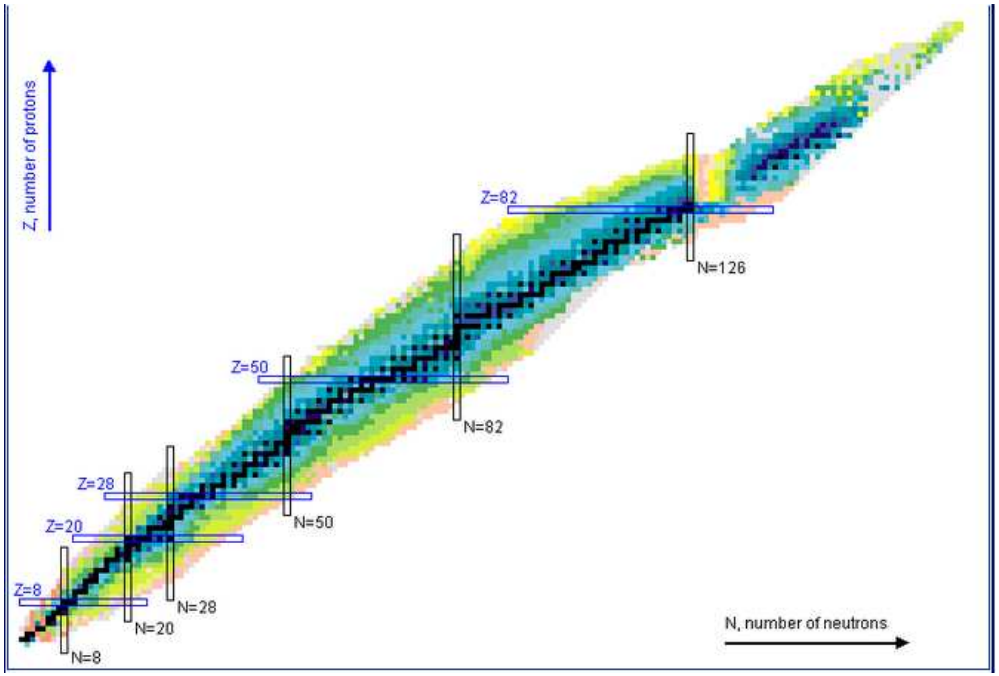
10 October 2015

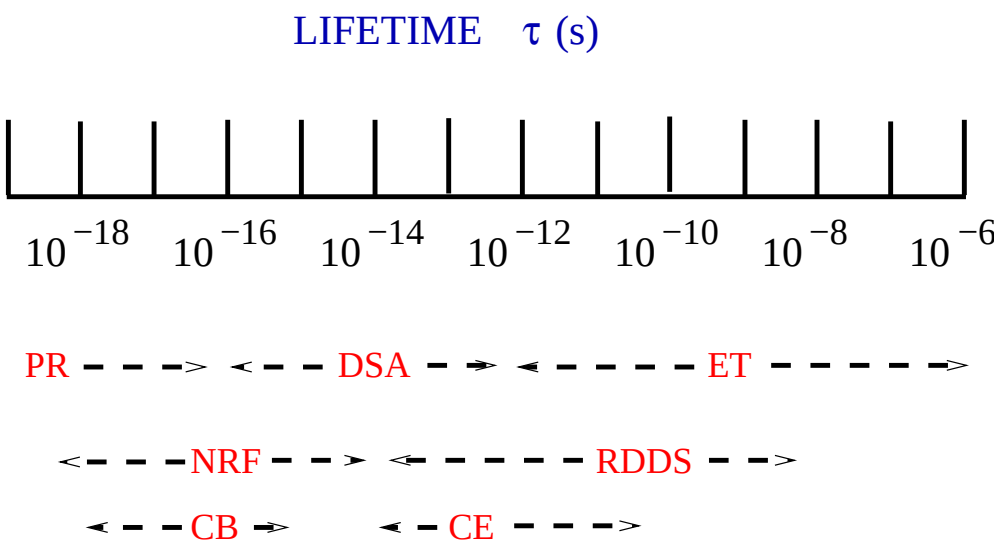
Agenda

Intro
Status of UK DESPEC WP
Spin off projects

Nuclear Landscape



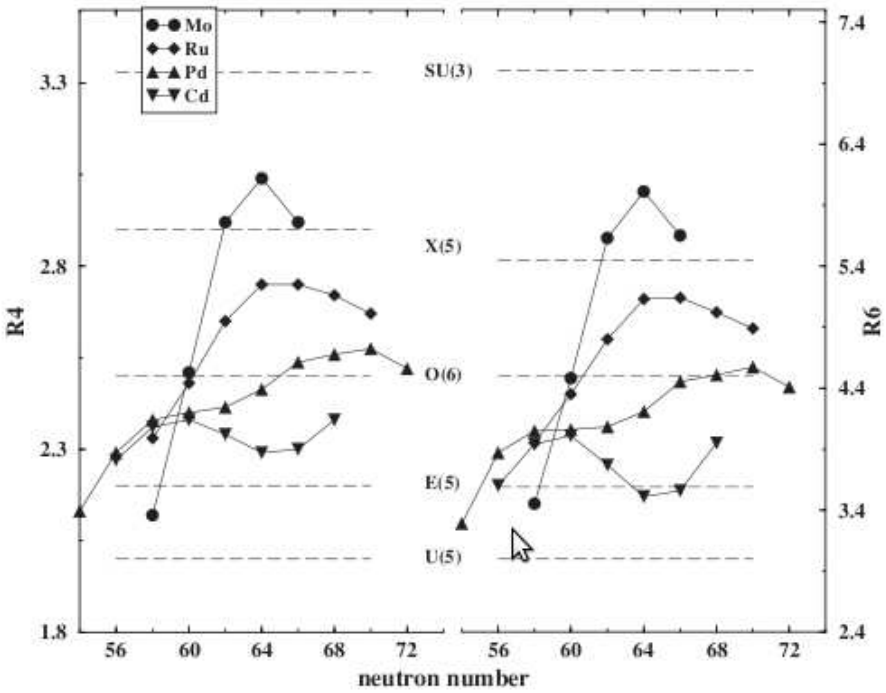
- **Typical time range:** 45 orders of magnitude;
  ^{50}V, EC, $T_{1/2} > 2.1 \times 10^{17}$ y.;
  ^{8}Be, ground state:
  $T_{1/2} = 1.4 \times 10^{-19}$ s;
  first excited state:
  $T_{1/2} = 7.1 \times 10^{-22}$ s.



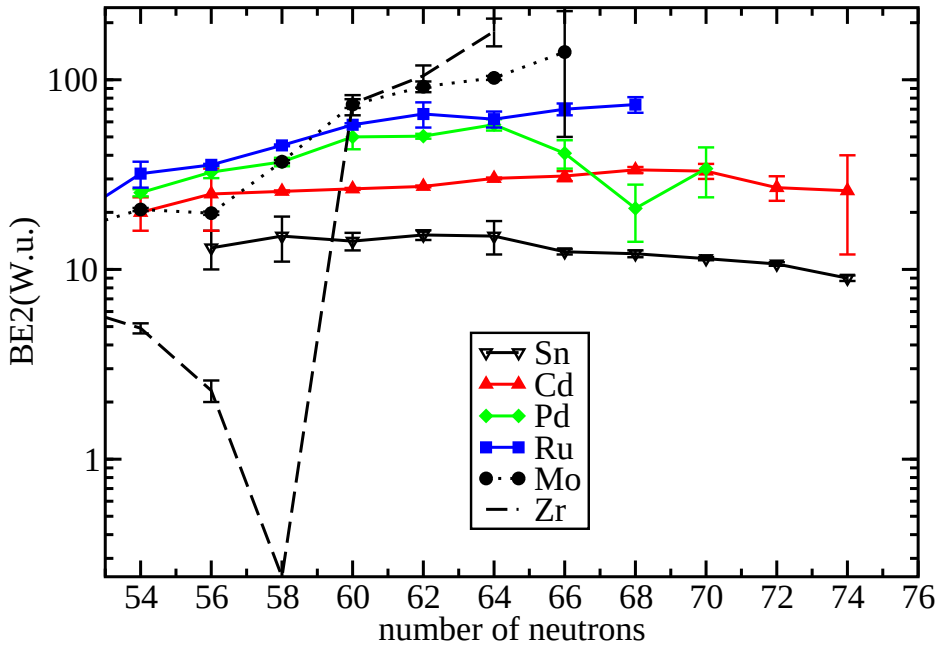
Methods

- **PR** Proton Resonances
- **DSA** Doppler Shift Attenuation
- **ET** Electronic timing
- **NRF** Nuclear Resonance Fluorescence
- **RDDS** Recoil Distance Doppler Shift
- **CB** Channel blocking
- **CE** Coulomb excitation

Evolution of collectivity in Zr-Cd region

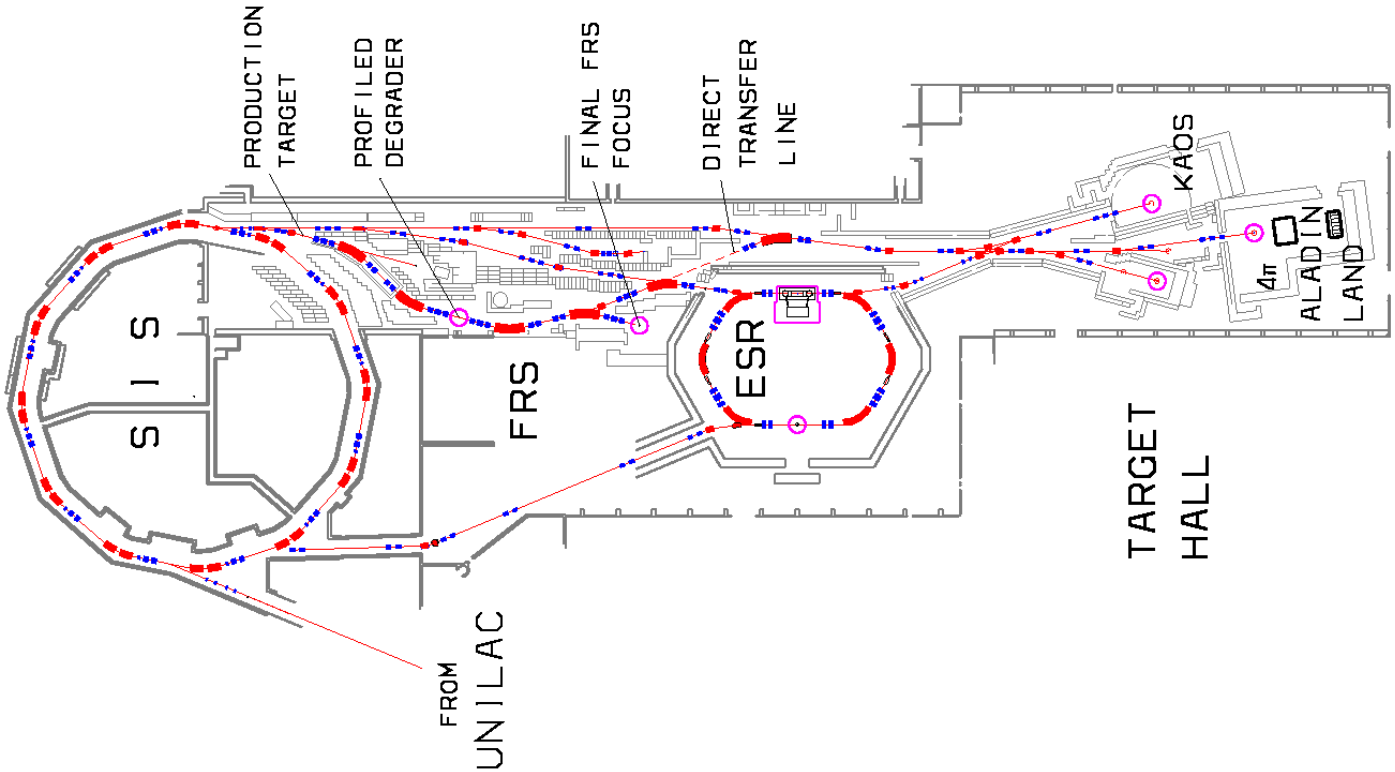


S.Lalkovski and N.Minkov, J.Phys.**G31** (2005) 427



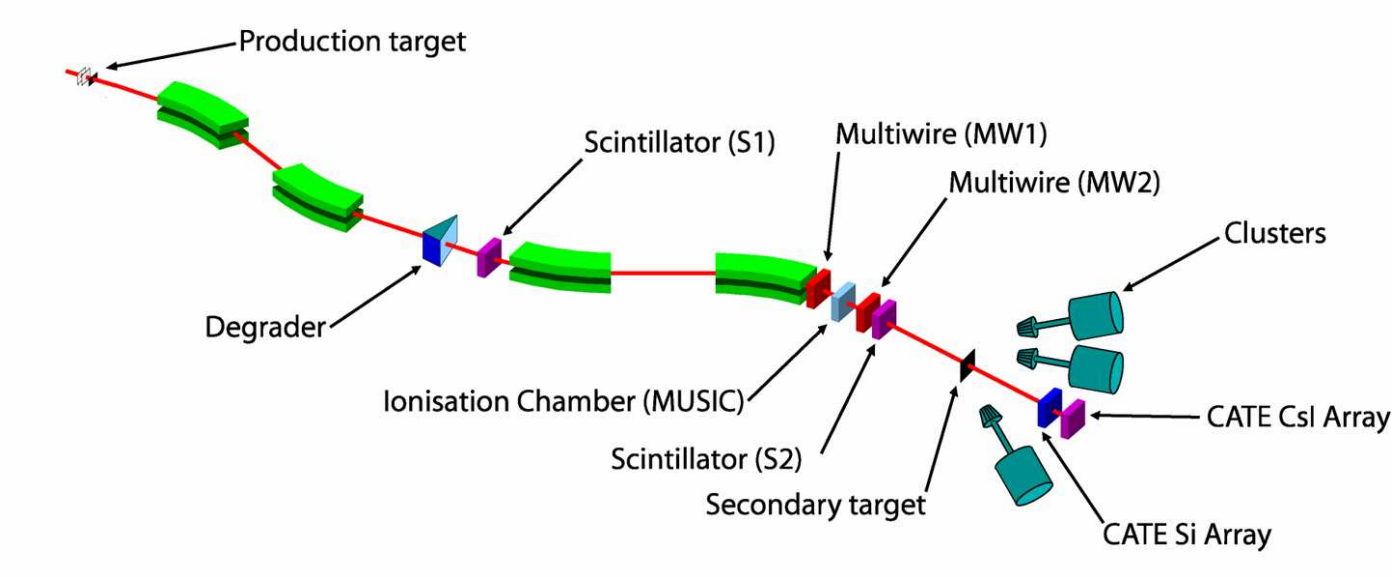
S.Kisyov *et al.*, Phys.Rev.**C84** (2011) 014324

GSI: Accelerators



Facility: LINAC SIS-18 synchrotron
Beams: ^{136}Xe and ^{238}U : to 11.4 MeV per nucleon in the LINAC and to 750 MeV per nucleon in the SIS; 10 s spils - different experiments at the same time
Target: 1-4 g/cm^2 Be

GSI: Fragment Separator



In-flight separation

$$A/q = \frac{e}{uc}\frac{B\rho_2}{\beta\gamma}\ , B\rho_2 = B\rho_1(1 - \frac{x_2 - V_2 x_1}{D2}) \qquad (1)$$

RISING Stopped beam campaign

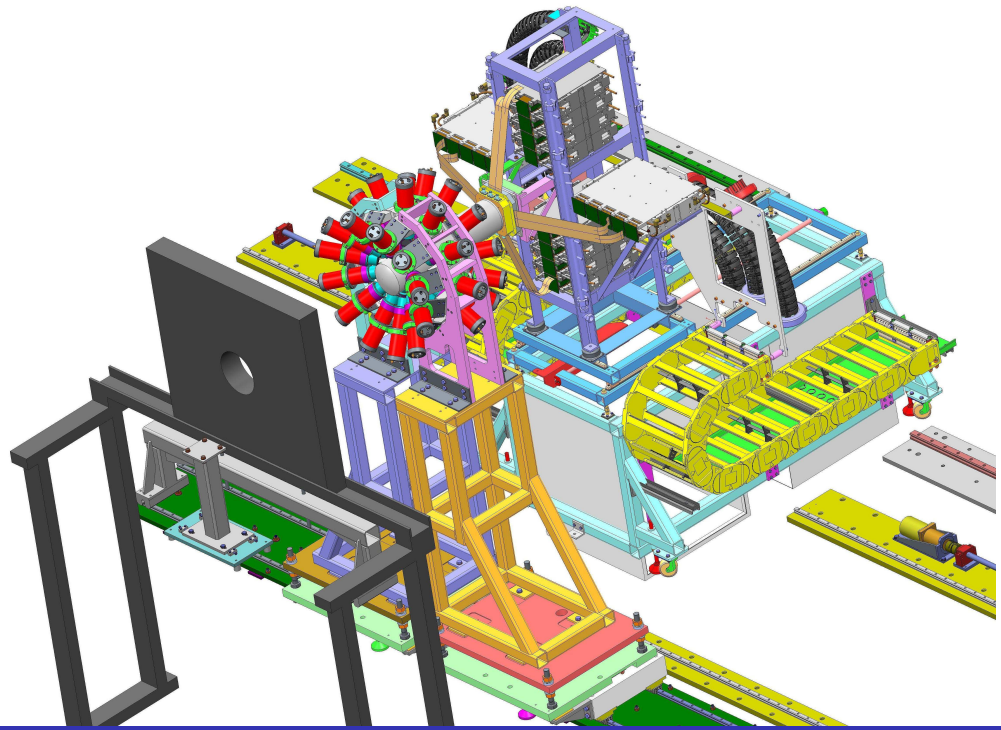
Detectors: Multiwire chamber (positions), Scintillators (TOF), Ionization chamber ($\Delta \boldsymbol{E}$), RISING (105 HPGe ex-EUROBALL detectors)

FRS focus: ^{126,130}Cd and ^{120}Rh

The UKNUSTAR Project - UK in FAIR

Work Packages

- **DESEPC:** FATIMA
- **HISPEC:** LYCCA Large Stop detector
- **R^{3}B:** Si tracker



Organization

PI: Prof. Zs. Podolyak
Management board 13 members

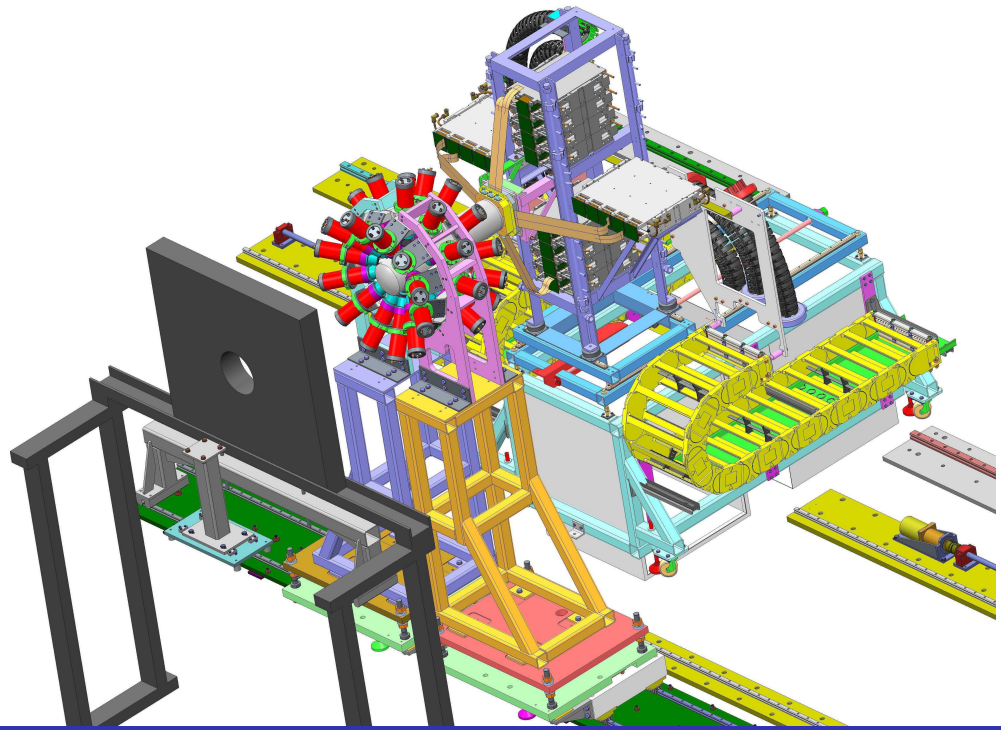
The UKNUSTAR Project - UK in FAIR

Project timescales

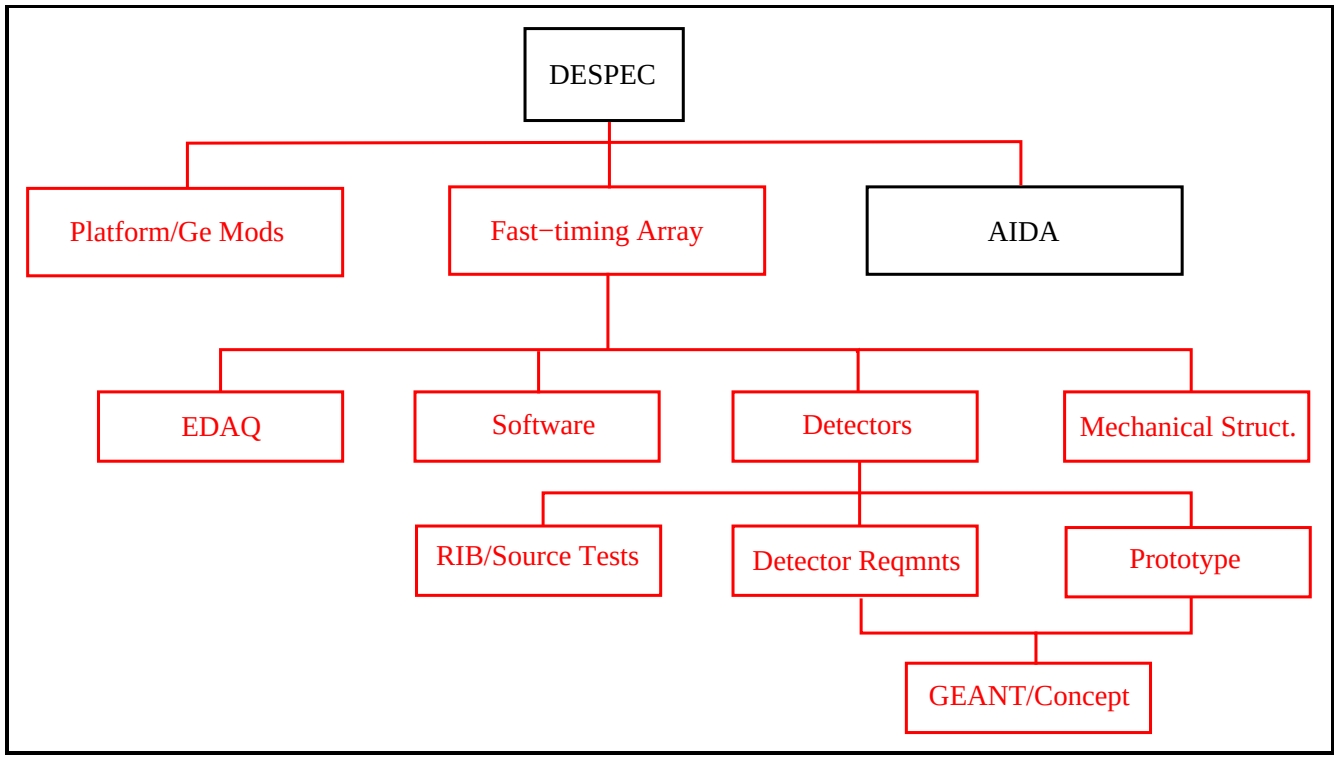
- **Start:** April 1st, 2010
- **End:** March 31st, 2016

Resources

- **Manpower:** 75.517 FTE
- **Budget:** £ 8.3M



UK DESPEC Technical Breakdown



Leader: Prof. P.H.Regan
Institutions: Brighton, Daresbury, Manchester, Surrey, UWS
Manpower: 11.947 FTE
Budget: 1.2M

Status: build
Commissioning: 2015/2016

UK FATIMA: Status

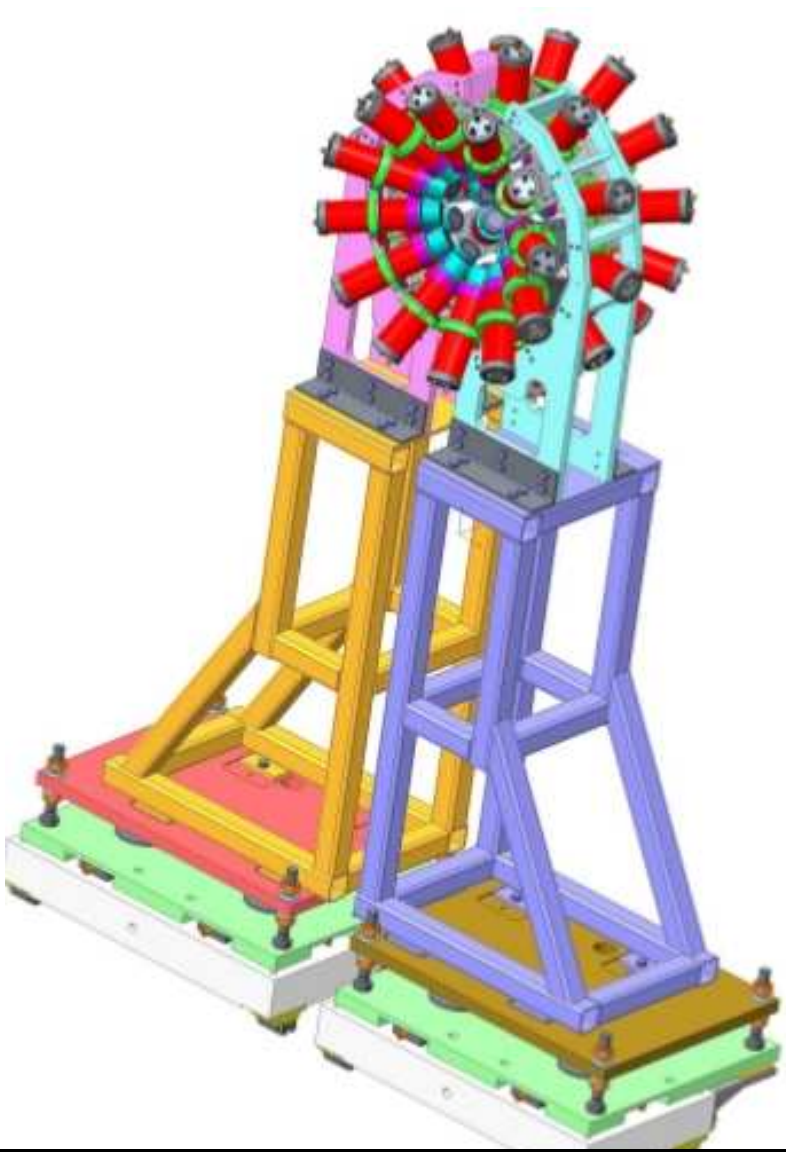
Equipment

- **Detectors:** 36x 1.5in x 2in $LaBr_3$:Ce+ H10570
- **EDAQ:** VME-based:
  Analogue timing: CFD (V812), TDC (V1290A)
  digital energy: digitizers + DPP-PSD (V1751C),
  VME-PSI optical bridge
- **Mechanical frame:** built in Daresbury; 378 kg;
  detectors arranged in three rings - one ring at 4° and two at ±44°
- **Use:** NIPNE, RIKEN, Grenoble, Birmingham, JYFL
- **to be used in:** ANL, GANIL

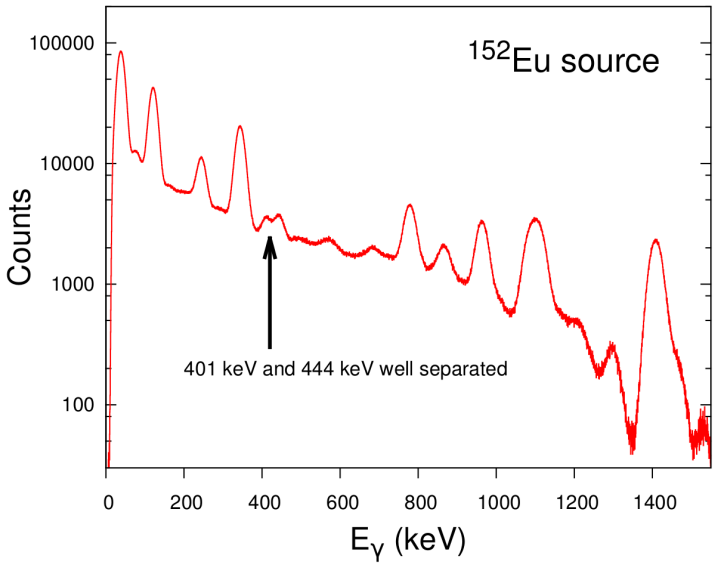
Part of

The International FATIMA collaboration
(Bulgaria, Germany, Poland, Romania, Spain, UK)
TDR: *Technical Report for the Design, Construction and Commissioning of the FATIMA - the FAst TIming Array*, L.M.Fraile *et al.*
Mechanics: Daresbury STFC

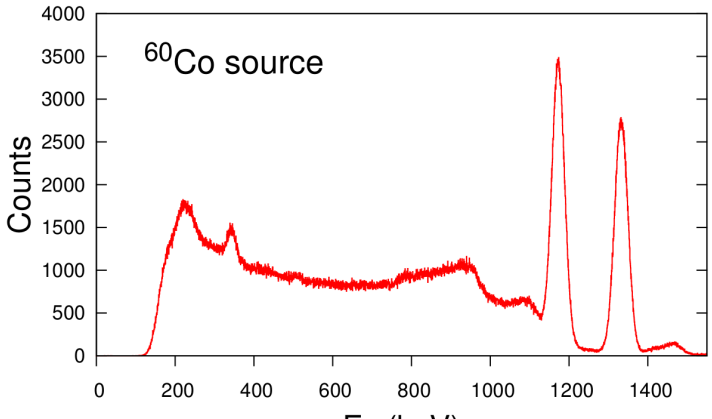
Mechanics

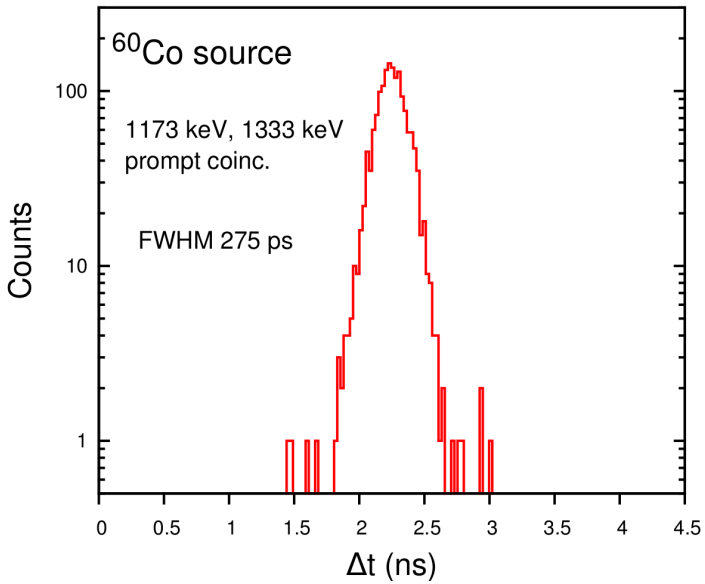


Performance



Energy resolution: 19% (121 keV); 8% (343 keV); 4% (779 keV);

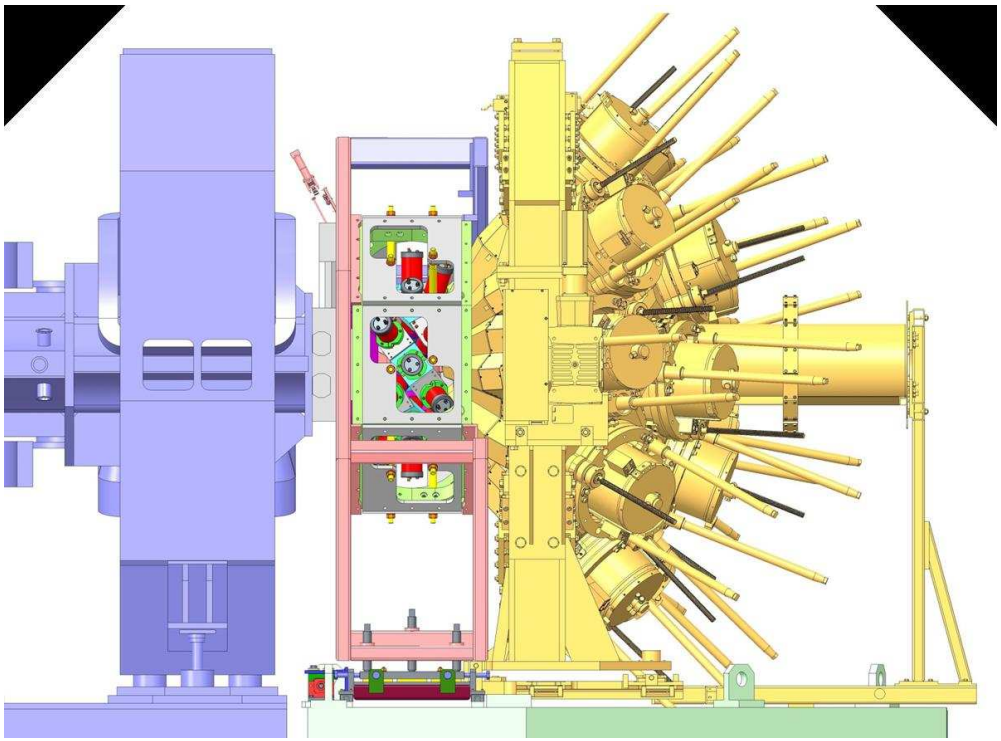




Time resolution: 272 ps
M.Rudigier

UK FT Array at GANIL: Mechanical Integration

FATIMA at GANIL



UK: A.Grant & I.Burrows

Experiments

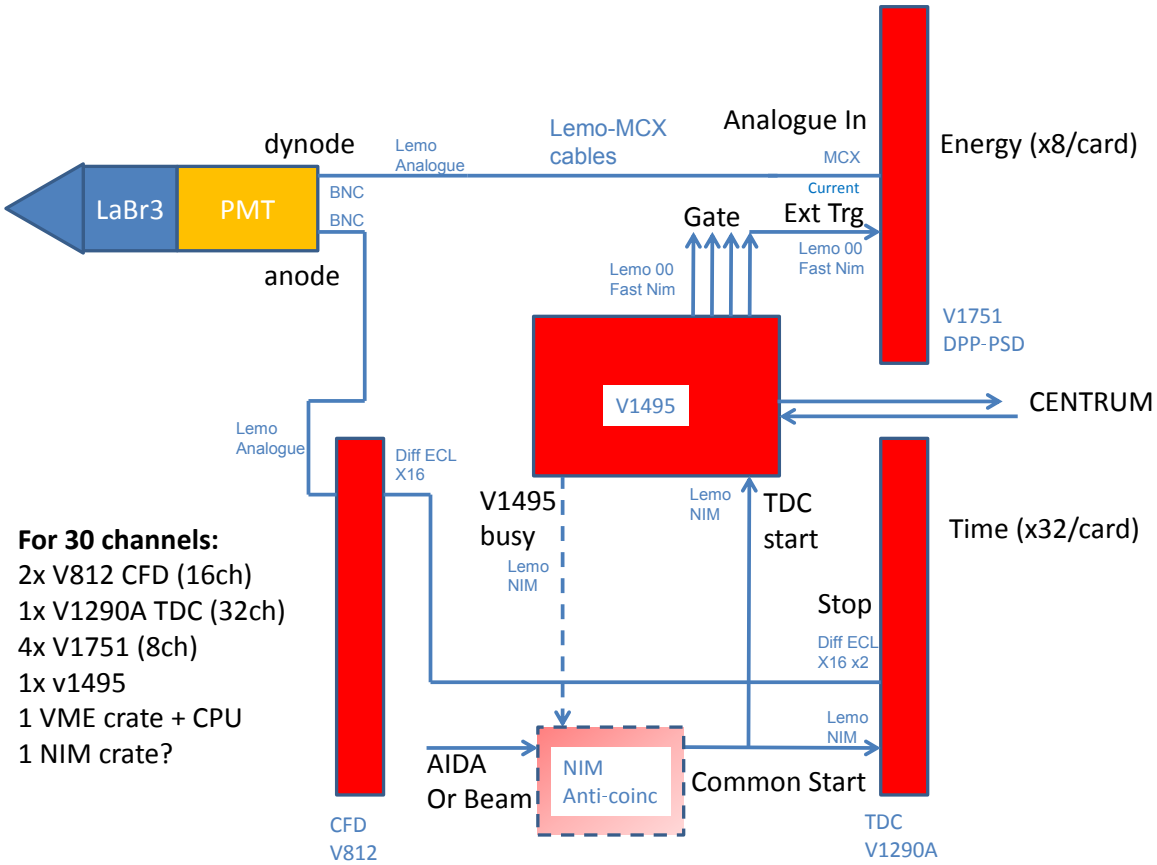
- Thick target experiments: P.Regan (Surrey)
- Thin target experiment: P.John (Padova), W.Korten (CEA)

Set up

- 22 $LaBr_3$:Ce 11.5 cm from the target
- $\approx$ 23 AGATA clusters
- VAMOS

Mechanics: Designed; A prototype tests at GANIL with EXOGAM structure - Feb 2015.; Now in production.
Concerns: Magnetic shielding (two scenarios - costly & less costly) - Needs more testing

UK FT Array at GANIL: EDAQ Integration



For 30 channels:
2x V812 CFD (16ch)
1x V1290A TDC (32ch)
4x V1751 (8ch)
1x v1495
1 VME crate + CPU
1 NIM crate?

Set Up

- 2x$LaBr_3$:Ce
- 2xV1751C
- 1xV812B
- 1xV1290A
- 1xV1495

Outcome

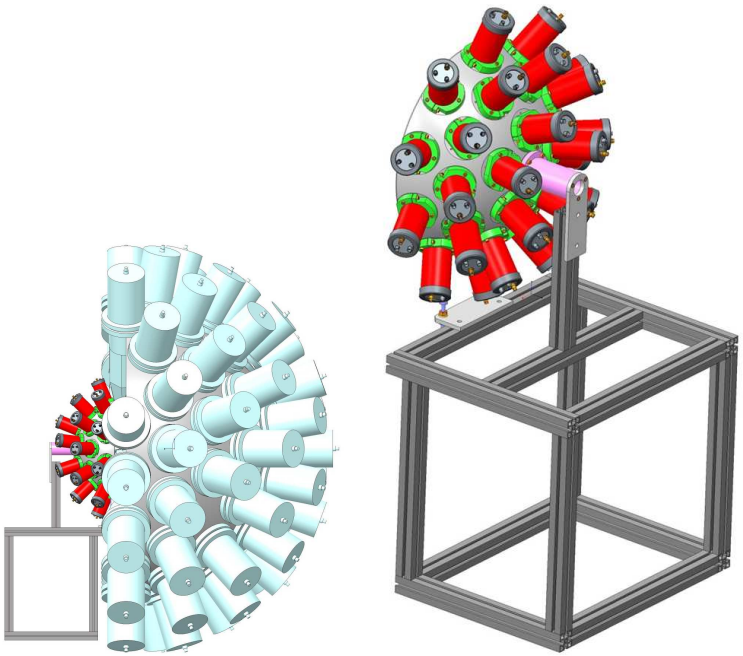
- $\gamma - \gamma$ coinc.
- $\gamma - t$

Data merging - to be done

UK: I.Lazarus & V.Pucknell & M.Rudigier
France: F.Saillant, Ch.Houarner

UK FT Array at ANL

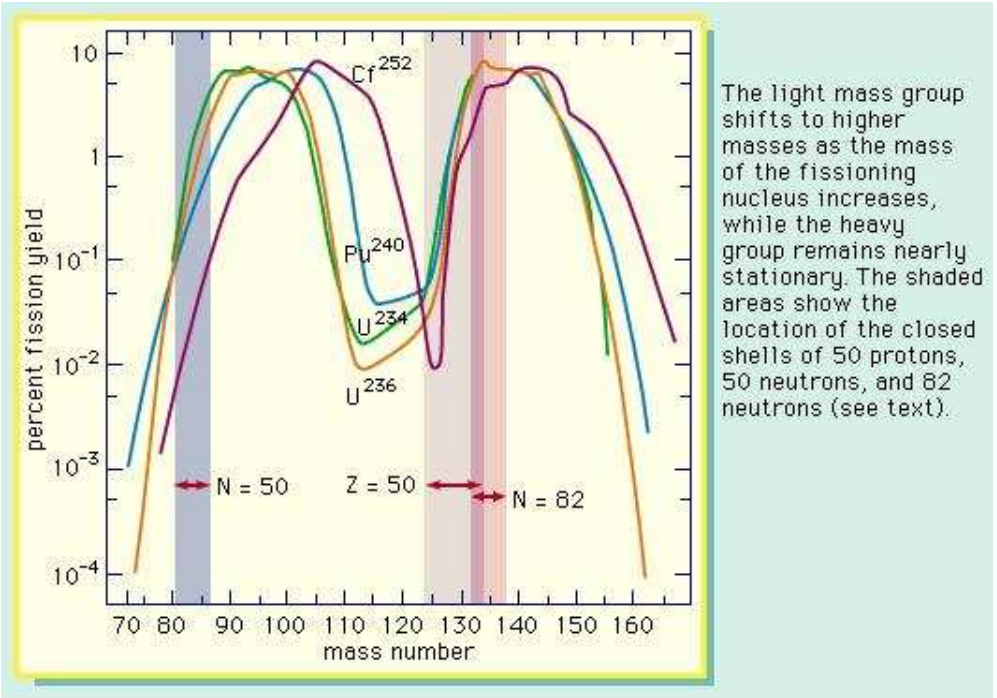
FATIMA at ANL



A.Grant & I.Burrows

Set Up

- ≈55 GS detectors
- 25 $LaBr_3$:Ce 13 cm



The Proposal

- **Source:** ≈ 40 μCi ^{252}Cf
- **Duration:** 30 days
- **Accepted** and planned for Dec/Jan 2015

Summary

- **Mechanics:** Designed, build and (partially) tested
- **EDAQ:** Designed, procured; to be commissioned.

Thank you!