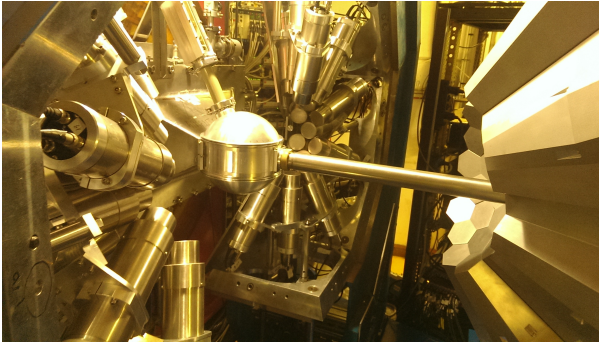# A LaBr array at GANIL with AGATA and VAMOS
AGATA week 2017, Milano

Speaker: Matthias Rudigier, University of Surrey

14. September 2017

Fast timing campaign at GANIL with AGATA and VAMOS

E705 (^{136}Xe @ 800 MeV on ^{170}Er) - Regan, Nyberg, Simpson

Understanding Nuclear Collectivity Approaching the π-ν Valence Maximum: Transition Quadrupole Moments in ^{166,168}Dy. 13 UT. Scheduled from Tues. 23rd May (06.00am) - Sat. 27th May (06.00am). **AGATA + FATIMA ONLY**.

E673 (^{136}Xe @ 900 MeV on ^{192}Os) - John, Söderström

Shape transition in the neutron-rich W isotopes. 25 UT. Scheduled from Sunday 29th May (10.00am) -Mon. 5th June (14.00) **AGATA + FATIMA ONLY**.
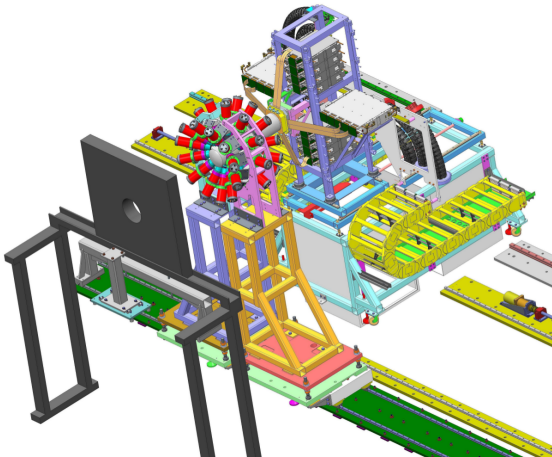
E706 (^{238}U @ 1475 MeV) – Korten, Görgen

31 UT. Scheduled from Sat 17th June (10.00am) - Tues. 27th June (18.00) - also included 1.5UT Buffer beam time to 02.00am Weds. 28th June. **AGATA + FATIMA + VAMOS + PLUNGER**
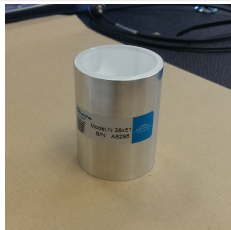
A LaBr array at GANIL with AGATA and VAMOS

FATIMA - DESPEC layout for FAIR

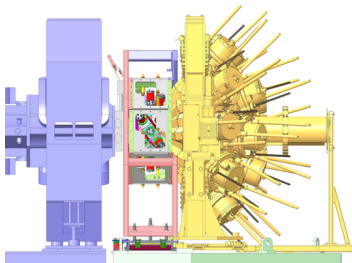### Fatima detectors
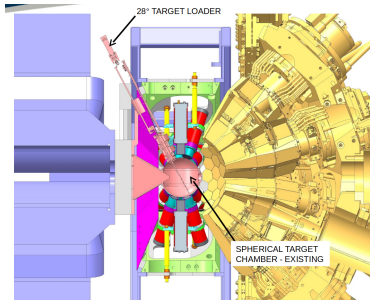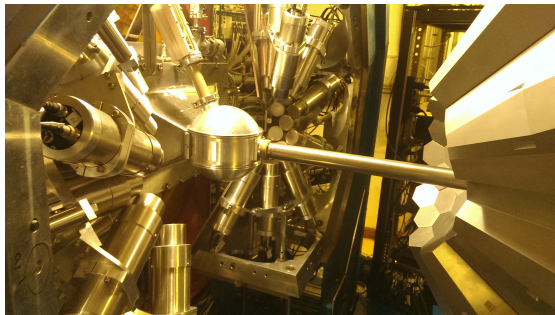
- 36 assembled detectors
- LaBr$_3$:Ce crystals (Saint Gobain)
- 1.5 inch x 2 inch cylindrical crystals
- R9779 Hamamatsu PMTs
- option for lead shield to suppress scattered γs between detectors

General setup

- 24 FATIMA detectors
- mounted on EXOGAM frame
- Three rings close to 90 degrees
- Distance to focus position 123 mm
- Mounting designed at Daresbury Labs (I. Burrows, A. Gran)

# PMTs in the fringe fields of the VAMOS quadrupole magnet

Photomultipliers of LaBr detectors only shielded against geomagnetic field ($\sim 10\mu$T)
Fringing fields from VAMOS quadrupole magnet up to a couple of 10 mT.

- field influences electron path
- affects gain/resolution
- affects timing
- shielding is necessary
- EXOGAM μ-Metal plates good up to VAMOS current of ~ 300 A
- individual shield cans
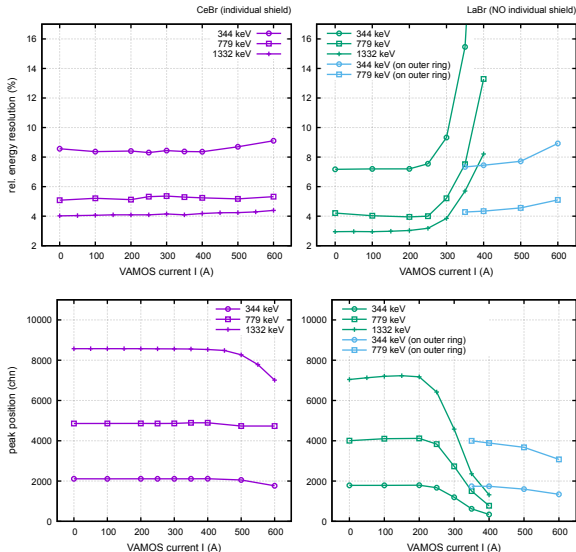
# PMTs in the fringe fields of the VAMOS quadrupole magnet

^{60}Co source, coinc. gate on 1332keV and compton continuum from 1173keV - both det. on inner ring.
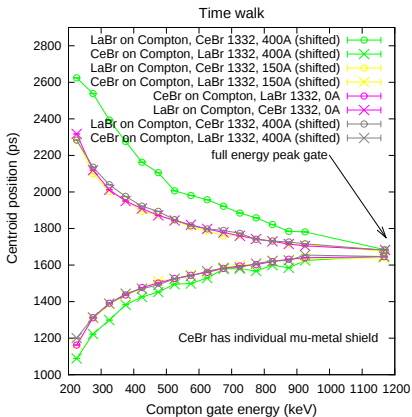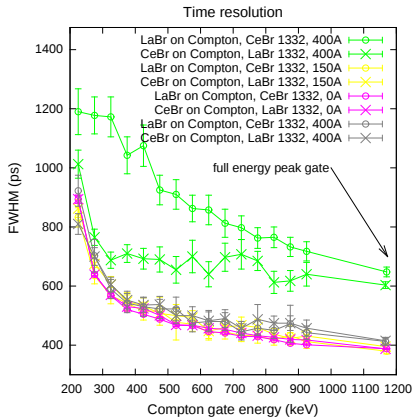
Unforseen additional magnets

To deflect δ-electrons two strong permanent magnets are placed after the target chamber when VAMOS is used.

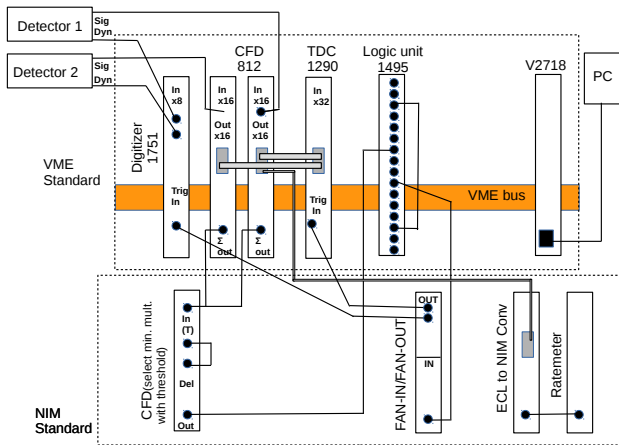The field was not negligible but the existing shielding was enough to ensure proper operation of the PMTs.
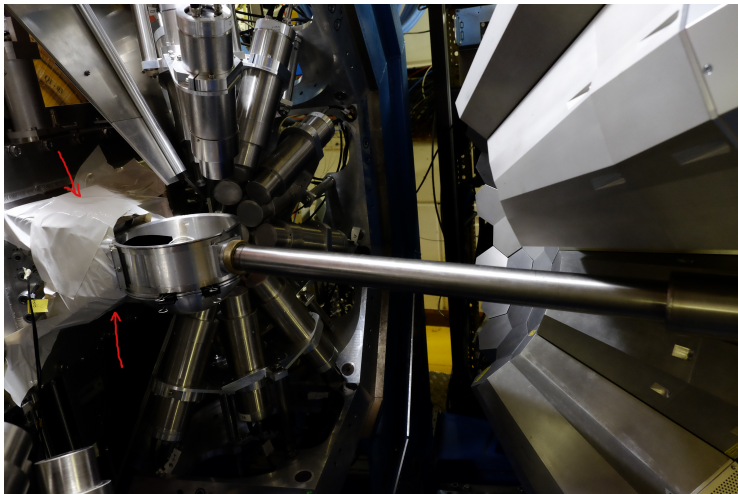
VME based data acquisition

| #	Module	
5	V1751	Digitizer (QDC)
		DPP-PSD firmware
3	V812	CFD
2	V1290A	TDC
1	V1495	Logic module
1	V2718	Controller

Correlating energy and time measurements
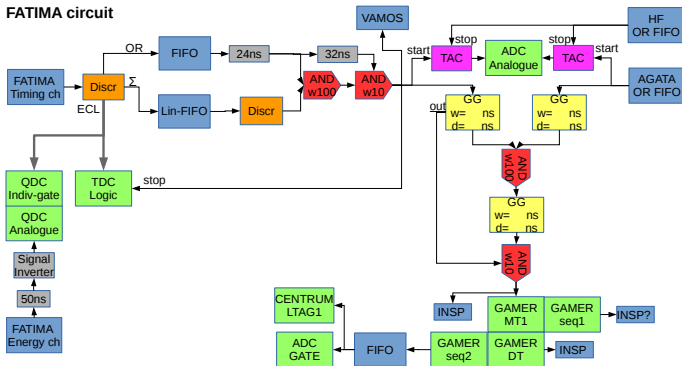
Event based data acquisition system

System's readout dead time leads to a maximal effective validated trigger rate.
With the number of modules in this setup and integration with CENTRUM, it is about
1.5 kHz for the current system.

Data acquisition integration
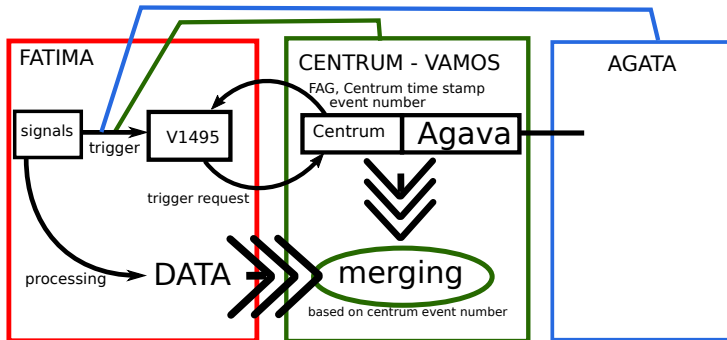
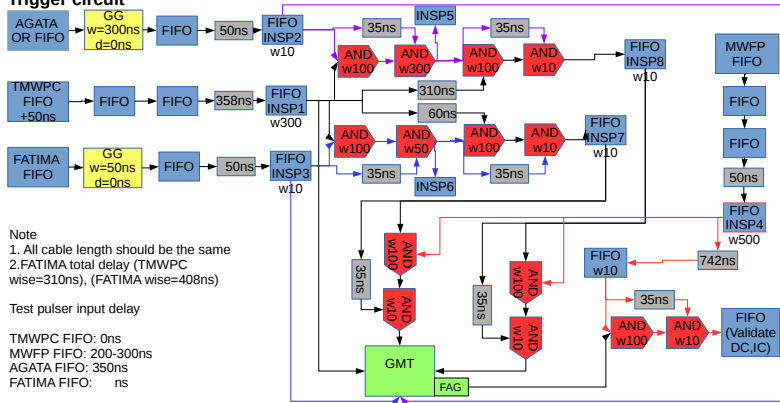offline merging with AGATA
using AGATA time stamp

VXI data acquisition system

FATIMA circuit

- TDC with common stop system
- also integrated with AGATA via VAMOS CENTRUM
- max. validated trigger rate $\sim$ 6 kHz
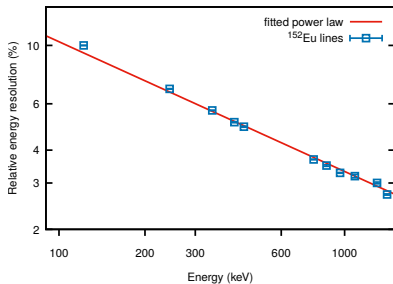
VXI data acquisition system

Thanks to Saba Ansari and Kim for these diagramms
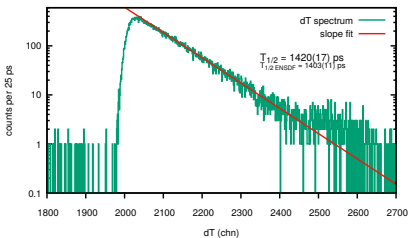
Tests with ^{152}Eu source (VME)

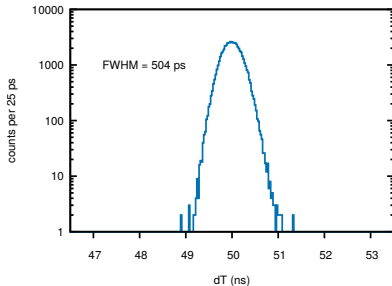FATIMA ^{152}Eu source E_γ total projection, 24 detectors
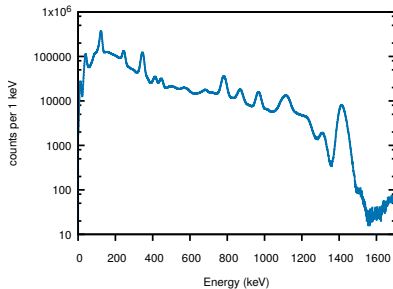
FATIMA energy resolution, 24 detectors
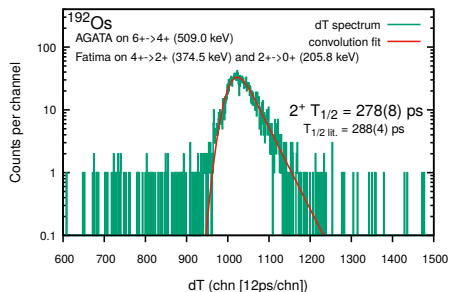
152Sm 2$^+$ half life (122 keV - 1408 keV)

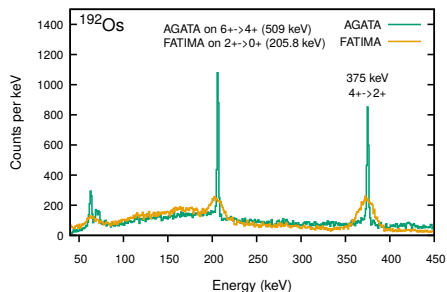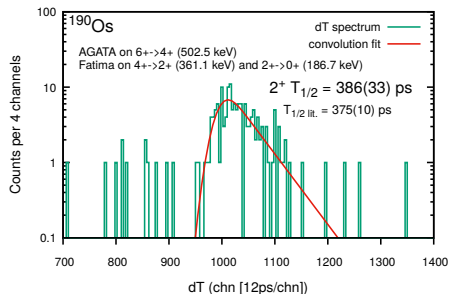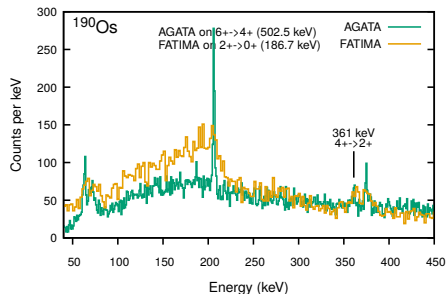FATIMA ^{152}Eu source 344 keV - 779 keV coincidence, 24 detectors

Tests and online analysis - online analysis of E673 data (VXI with VME CFD)
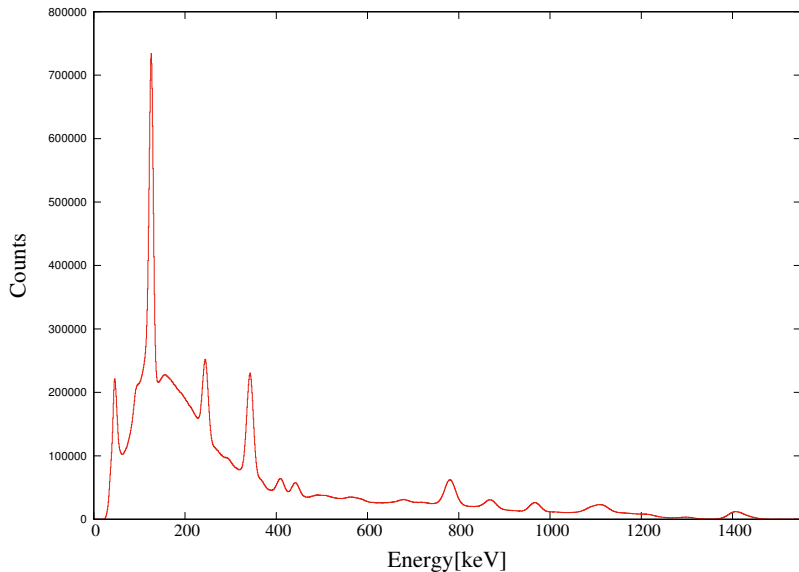
^{192}Os, target

Tests and online analysis - online analysis of E673 data (VXI with VME CFD)
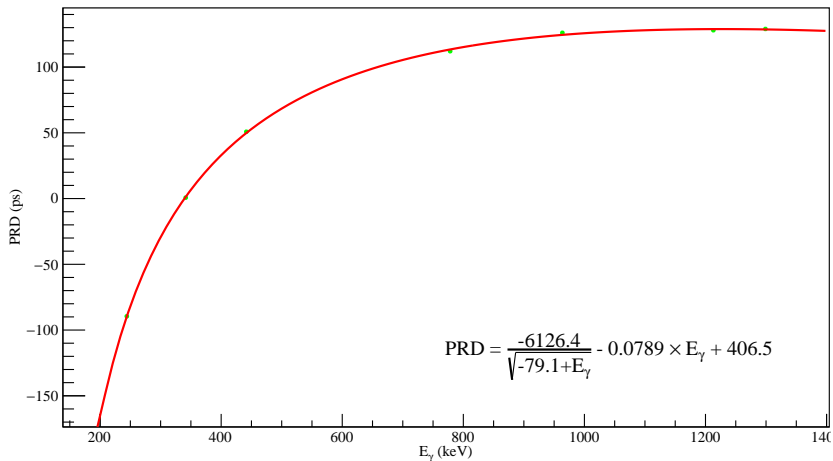
^{190}Os, two neutron transfer

3 days of data.

Tests and online analysis - E706 (VXI with Ortec CFD)

Tests and online analysis - E706 (VXI with Ortec CFD)

Prompt response difference curve for Ortec CFDs.

Thanks to Jeremie Dudouet for this plot.

Summary

- 24 LaBr detectors from the FATIMA collaboration were at GANIL for a fast-timing experiment campaign with AGATA and VAMOS
- VME DAQ in current state not suitable for trigger rates larger than ≈ 1 kHz
- in terms of spectroscopy and time resolution both DAQ systems worked well
- reproduced lit. values from in beam data in E673, but statistics for original goal most likely too small due to rate limitations
- E706 with VAMOS looks better due to better reaction product selection in the trigger