# Ancillary detector system: LaBr<sub>3</sub> array for fast timing measurements.

2016, 17th AGATA week, Orsay

Matthias Rudigier



6th October 2016

Ancillary detector system: LaBr<sub>3</sub> array for fast timing measurements.

**1** Frame and detector mounting

2 Shield against VAMOS magnetic field

**3** Data acquisition

Up-coming tests at GANIL

# Design



- 24 LaBr<sub>3</sub> detectors from FATIMA collaboration
- mounted on EXOGAM frame, placed between VAMOS and AGATA around target chamber
- detector faces 10.2cm distance to target
- Design: STFC Daresbury Labs, I. Burrows, A. Grant

# Mounting on EXOGAM frame

Tested 2015 with 3 detectors on EXOGAM frame.



Results: Some holes missing, mu-metal plates don't cover PMT.

# Detector mounting: Current status and next steps

#### Status

- Mounting structure designed (Daresbury)
- Test assembly with 3 detectors done in 2015
- All parts manufactured. Waiting in Surrey

## Next steps

- Ship to GANIL (Oct 2016)
- Installation on EXOGAM frame (Oct 2016)

# Magnetic field shielding



PMTs only shield against earth's magnetic field  $(\sim 10\mu T)$ When using VAMOS much higher field strength from quadrupole  $(\sim 10mT)$ Shielding is necessary. Three options:

- mu-metal plates
- individual shielding
- both

## mu-metal plates

Plates on EXOGAM frame between VAMOS and detectors



already exist, but extensions are needed. Extensions designed and already manufactured. Design had to take care of target chamber.

# Individual shielding

Shield each detector individually (similar to PARIS group approach)

Prototype:



Design: STFC Daresbury Labs, I. Burrows

# Detector shielding: Current status and next steps

## Status

- Extension of mu-metal plates ready for mounting and testing
- Test assembly for individual shielding designed and manufactured
- Prototype tested to fit FATIMA detector

#### Next steps

- Test mu-metal shield installation (Oct 2016)
- Test measurements with both options in place (EXOGAM frame) with VAMOS magnet on (Oct/Nov 2016)

# Data acquisition electronics



## **VME** electronics

- 5x V1751 digitizers (DPP firmware)
- 2x V1290 TDC
- 3x V812 CDF
- 1x V2818 controller
- 1x V1495 logic unit with CENTRUM plug



## Data acquisition - stand-alone mode

Combine V1751 (energy) and V1290 (time). Event based data acquistion system. V1495 logic unit controls flow (firmware: STFC, I Lazarus)



- Tested with sources
- Timing with TDC (25ps/chn)
- CFD timewalk compareable to Ortec 935 NIM CFD
- system ready for fast timing measurements in ps region
- currently high dead time (order 100µs after trigger) due to read-out

# Timing performance and measurement at ANL with Gammasphere

Standard sources:



<sup>100</sup>Zr from <sup>252</sup>Cf fission source with digital Gammasphere (preliminary!):



# Time walk for centroid shift method

## Standard sources:



# **Event based DAQ system, integration with CENTRUM**



Tested in 2015 Status after test:

- System runs successfully with 10MHz clock "long distance mode"
- V1495 gets:
  - eventnumber
  - timestamps
- Afterwards firmware changes on CENTRUM side were made to run with 40MHz clock (remains to be tested)

# DAQ: Current status and next steps

#### Status

- V1495 firmware and MIDAS ready for event based DAQ
- Working stand-alone system with V1751 and V1290
- First integration tests with V1495 and CENTRUM 2015 successful, but some questions remained.
- System using V1495 successfully used to integrate with Digital Gammasphere
- Dead-time problem

#### Next steps

- Test again the integration with CENTRUM at GANIL(Oct 2016)
- Try to improve read-out dead time (from Oct 2016)

# **Up-coming tests at GANIL**

## 17.10.2016-23.10.2016

- Mounting of the fast timing array fittings to the EXOGAM frame
- Setting up a test system with 4 detectors
- Set up the stand-alone mode
- Possibly test magnetic field shielding

## 24.10.2016-28.10.2016

- Test integration with CENTRUM
- More time in November if problems are encountered

## 14.11.2016-18.11.2016

- Test of system and magnetic field shielding with
- VAMOS on

## **Thank You!**

A.M. Bruce, I. Burrows, D.M. Cullen, A. Grant, S. Lalkovski, I.H. Lazarus, Zs. Podolyak, V.F.E. Pucknell, P.H. Regan, M. Rudigier, J. Simpson, J.F. Smiths E. Clement, B. Million, F. Saillant, Ch. Houarner, M. Gorska, P.R. John, W. Korten, M. Palacz, F. Recchia, P.A. Soderstrom, J. Valiente, M. Zielinska

and the whole FATIMA Collaboration