

Beam planning for test of Super-FRS detectors

Experiment S417 : Proposal for beam tests at the Fragment Separator FRS

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Beam time request for S417

The FRS due to its flexibility is the ideal site for developing optics modes, testing and commissioning equipments for the Super-FRS project.

Some tests already possible now are essential for developing the technical expertise and technology necessary for the Super-FRS.

Our request, in 2011-2012, was meant to have dedicated beam time as main user to test new components and prototypes needed for the future Super-FRS at FAIR

Approved shifts in 2011-2012 : 24 shifts (main) and 48 shifts (parasite)

Plan test in 2011-2012

- Ion optical measurements
- Test of high-rate capable detectors for the Super-FRS
 - tracking: [GEM-TPC](#) detectors (*in collab. with CUB & Helsinki*)
 - tracking & timing: diamond detectors ([PCCVD](#)) (*in collab. with GSI lab & TUM*)
 - beam profile monitors ([BPD](#)) (*in collab. with CUB*)
- Test of the Super-FRS target wheel
 - characterization, background measurements, irradiation test
- Developing readout, controls and *fail-safe* operations concepts
 - time-stamp synchronization ([BuTiS](#)) for the large scale

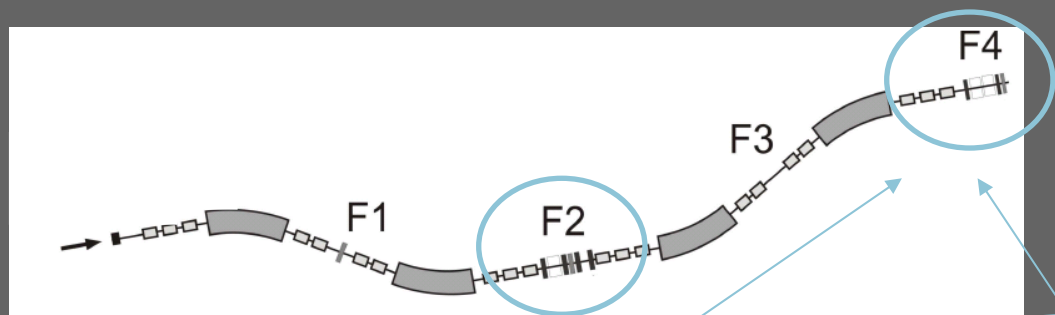
Beam time request I (S417)

We ask 2.5 days in April 2012 + 2.5 days in October 2012 + additional parasitic beam time

- GEM-TPC prototype + n-XYTER (*CUB, Helsinki, GSI*)
- Large area diamond detector prototype (*TU München, GSI*)

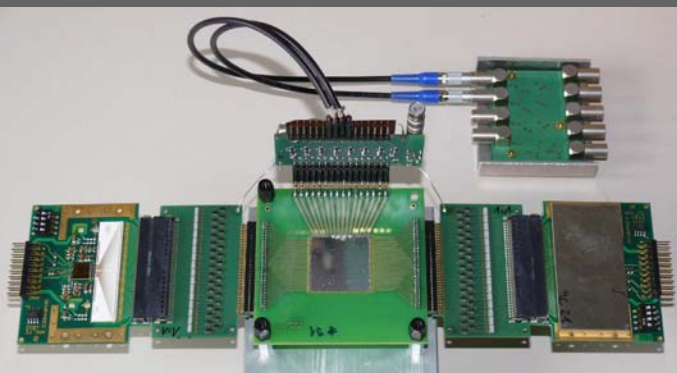
We are as flexible as in 2011: we can run sharing 1:1 with another experiment

$I_{\text{SIS}} < 10^7 / \text{spill}$
the higher Z,
the better



GEM-TPC (x, y, θ , ϕ)

Diamond (x, y, t)



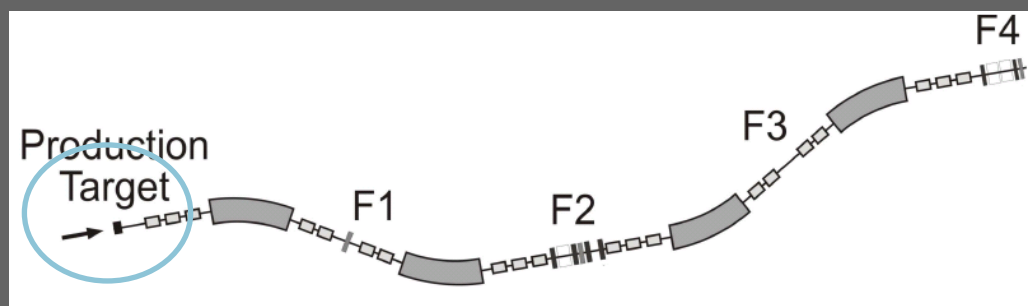
C. Nociforo, "FRS user meeting", Nov 28, 2011 – GSI, Darmstadt, Germany

Beam time request II (S417)

We ask 3 days of U beam (6 shifts, day time only), whenever the FRS target area can be set up and prepared for the Super-FRS target wheel + parasitic beam time

- Super-FRS target wheel: functionality and characterisation (absolute thickness, homogeneity), background measurements
- graphite samples

$$I_{\text{SIS}}: 2 \cdot 10^9 \text{ (} 10^{10} \text{) /s}$$



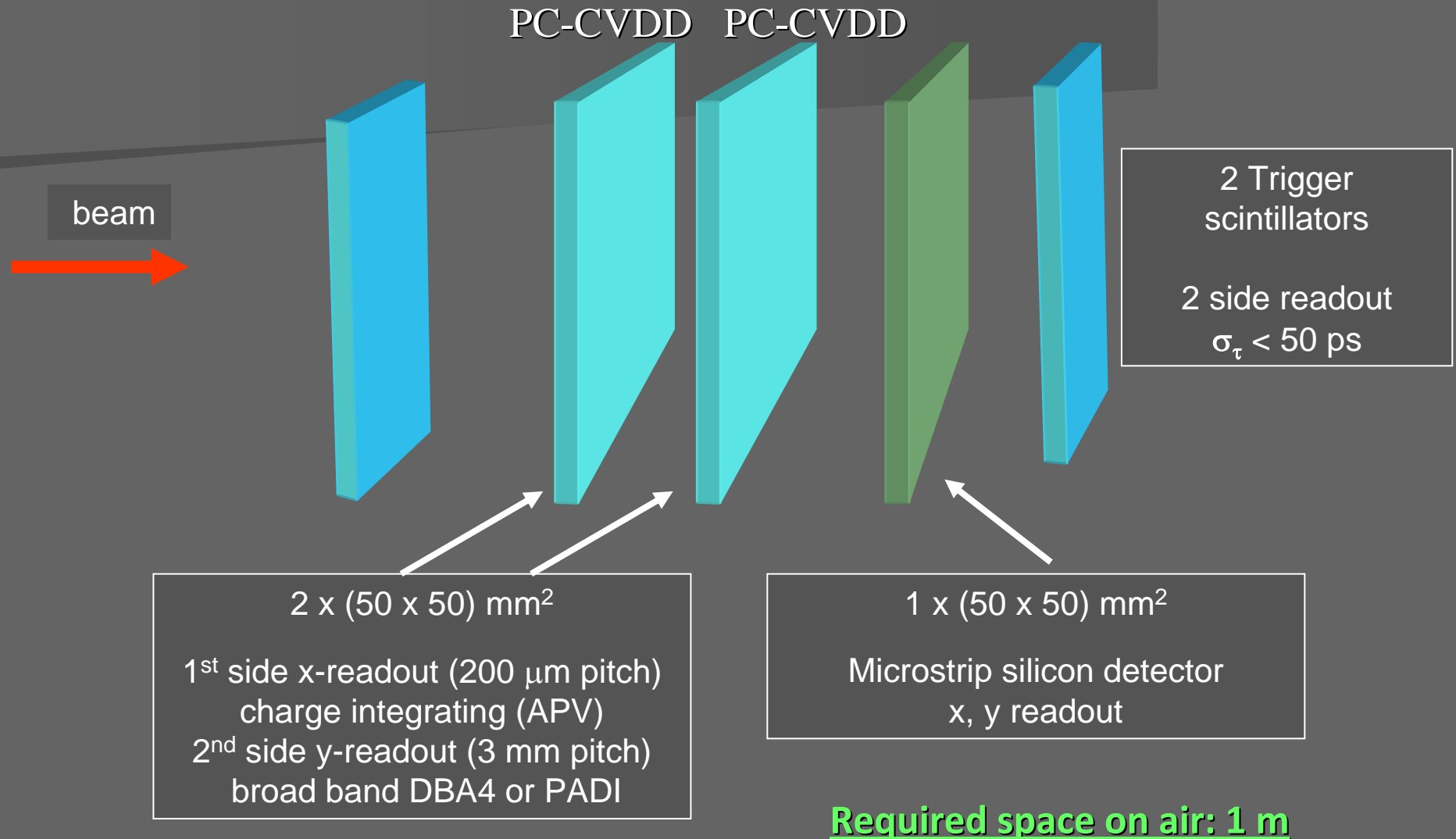
It requires $^{238}\text{U}^{73+}$ fast-extracted beam at $E_{\text{SIS}}=1 \text{ GeV/u}$ (share 30-50%).



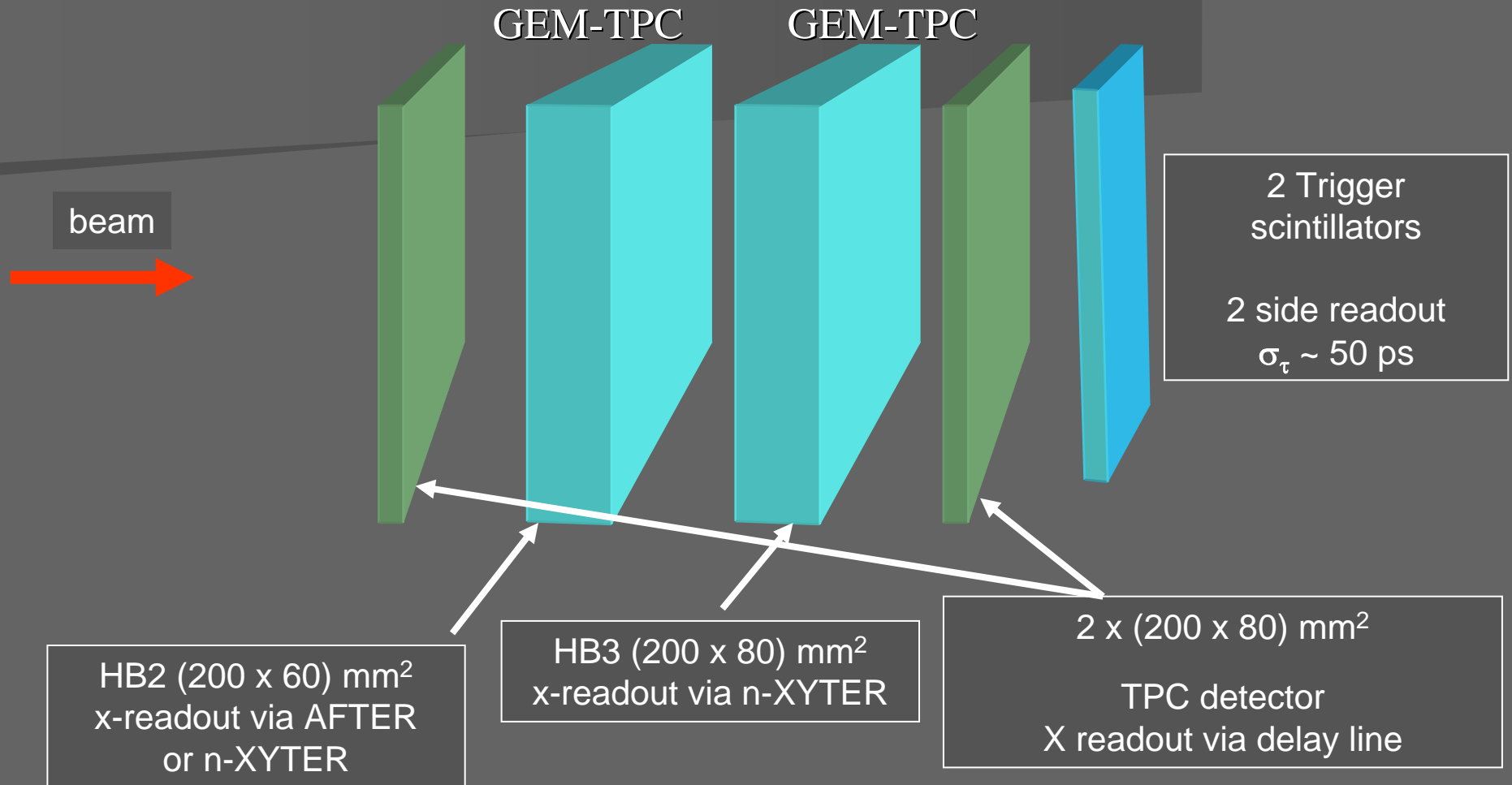
Ion optic tests are also required, crucial for running a succesful experimental program

C. Nociforo, "NUSTAR internal meeting", February 28, 2011 – GSI, Darmstadt, Germany

Full size diamond prototype test



Full size GEM-TPC prototype test



Required space on air : 1.5 m

Status report of FRS Expert Team

C. Nociforo on behalf of the Expert Team

GSI, Darmstadt

- **Activity in 2011**
 - **role in the experiments**
 - **technical developments**

Expert Team activity

All FRS group members, including PhD students, have been strongly involved (see <http://nustar-wiki.gsi.de/cgi-bin/view/FRS/ResponsiblePeople>)

Main duty in 2011 was preparation and running of FRS experiments

- No FRS000 dedicated beam time assigned

- No lab space available due to internal restructuring

- Restricted budget

Activity in 2011

(supporting GSI **experimental program**)

April-June

- S358 (FRS-Cave C)
- S377 (Prespec run)
- S395 (FRS-S4)

August-October

- S323/S410 (FRS-S4)
- S411 (FRS-S4)

Only one FRS-ESR experiment: **E082**.

In total: ~ 80 days

MUSIC detector status

- **The gas mixture P10 (4kV) was preferred to CF₄ (8kV)**
- **Larger number of MUSIC detectors is more often required (we have 3 available)**

$$\text{for } A = 205-208 \quad \left\{ \begin{array}{l} \Delta Z = 0.4 \quad (\text{TUM type}) \\ \Delta Z = 0.65 \quad (\text{old type}) \end{array} \right.$$

Munich is interesting in building a new detector (TUM type, 30 keuro)

- **Towards higher counting rate (pile-up discrimination)**
ongoing data analysis (S. Pietri)

J. Winfield
M. Takechi

TPC status

- **Detectors available**

- Four 200 x 60 mm² , on air
- One 200 x 80 mm² , on air
- Two 200 x 80 mm² in vacuum, not tested yet

All TPC modules have internal passive delays

- **Towards multi-hit data analysis (higher counting rate)**

One **Twin** (2-stacked)

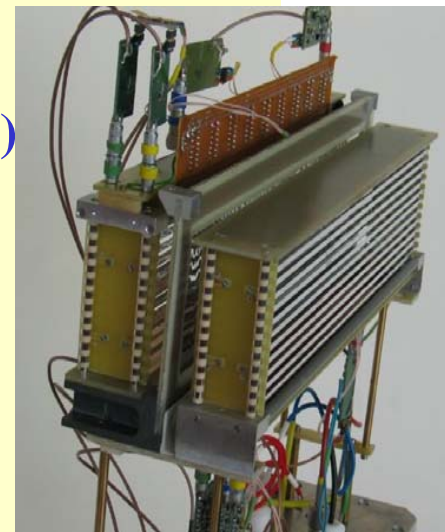
x and y control sums to distinguish multiple tracks

- Tested during S395, grounding problems,
new chamber under construction in Bratislava

- **Calibrations tested at different wire voltages**

- Offset and gain investigation

Xe : < 0.5 mm offset, $\Delta x/\Delta V=20\mu\text{m}/100\text{V}$ gain (@800 V)



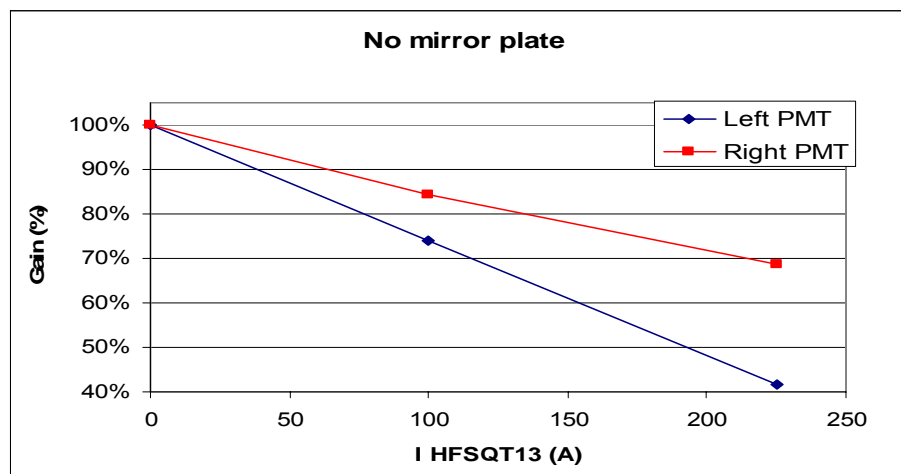
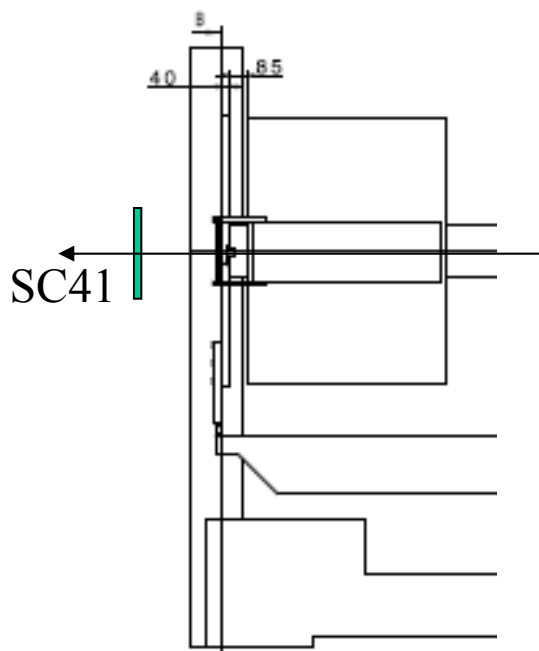
Plastic scintillator status

Goal: improve ΔA resolution

different configurations offline and online have been tested, different materials (EJ-232)

→ there was no difference when the electronics was installed directly in the cave, $\sigma_{\text{ToF}} = 30 \text{ ps}$ for ^{208}Bi primary beam

Due to space limitation and increasing number of detectors a mirror plate was installed at S4 to shield the fringing field of the last quadrupole

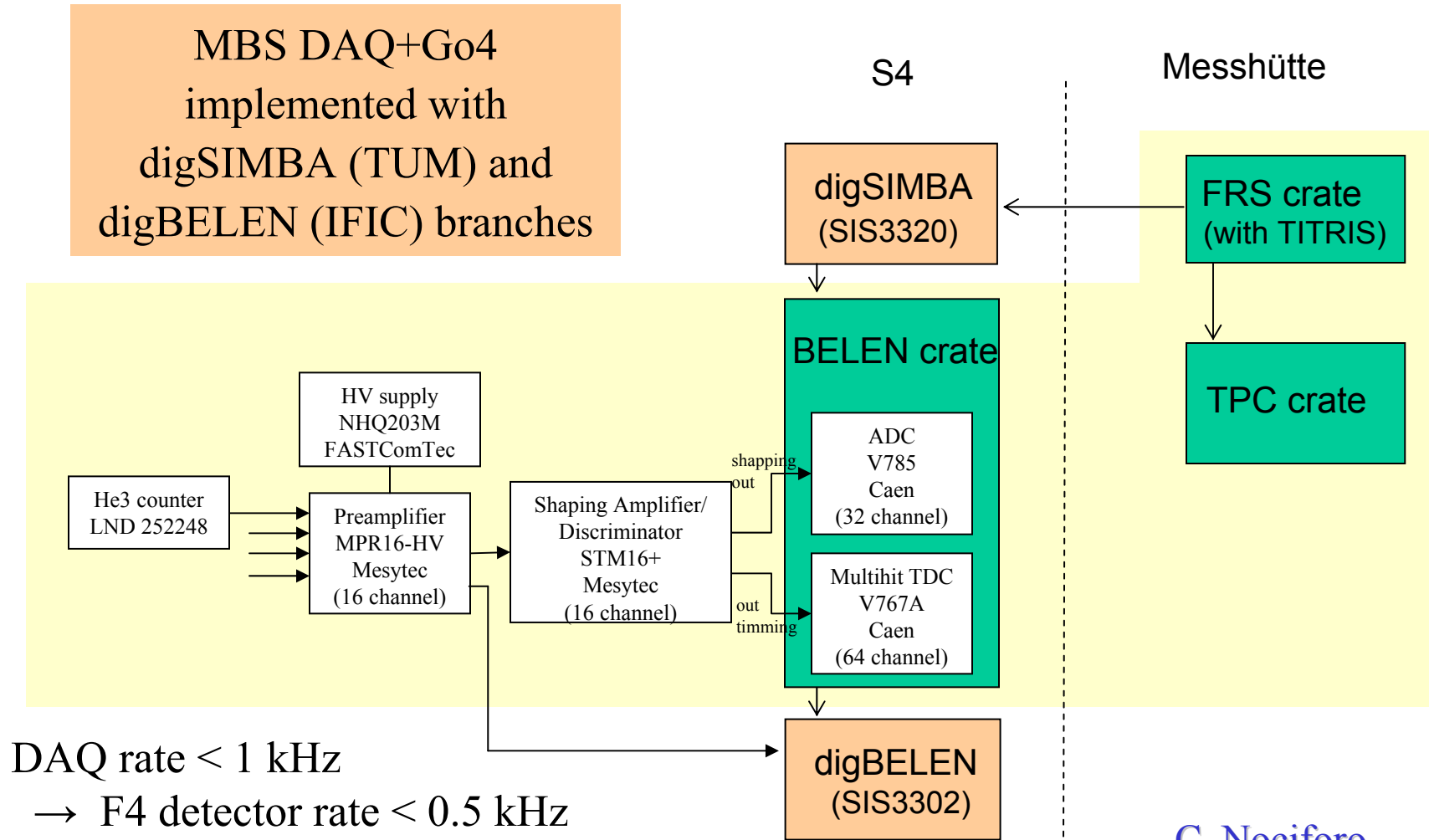


C. Nociforo, FRS User Meeting
28 Nov 2011

A. Estrade,
J. Kurcewicz

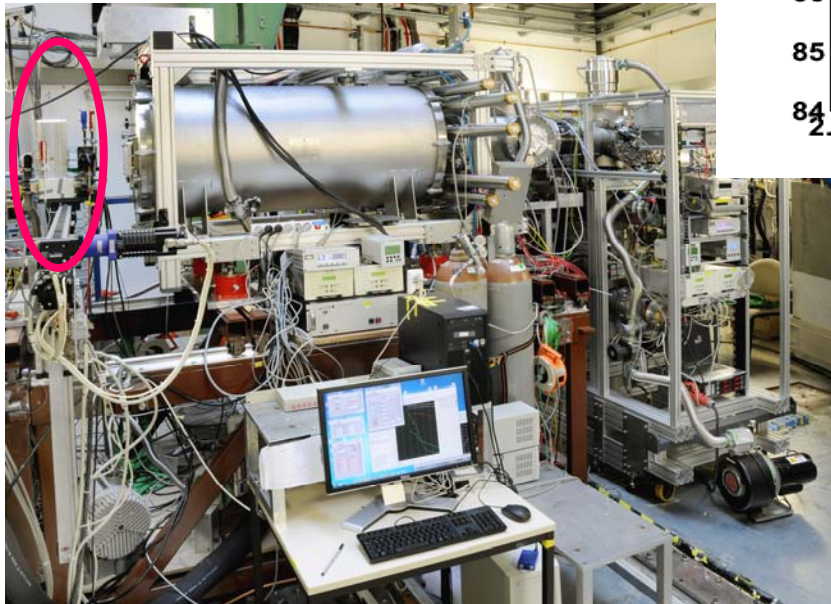
DAQ for S323/S410

MBS DAQ+Go4
implemented with
digSIMBA (TUM) and
digBELEN (IFIC) branches



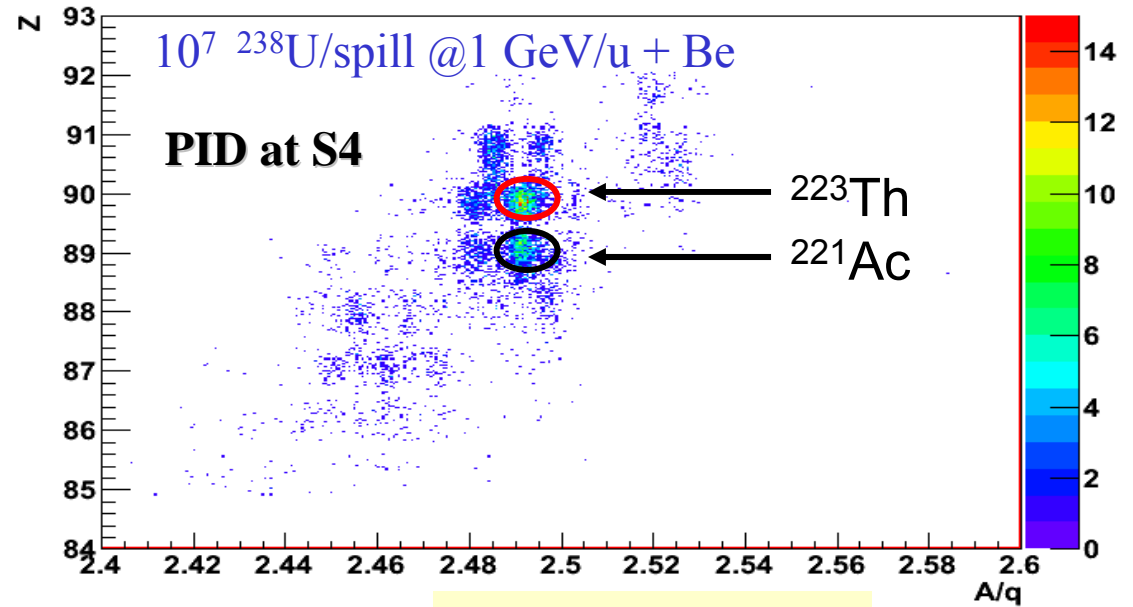
Isomer and α tagging

Si station:
1 DSSSD by Microns
16 x-strips, 16 y-strips
(50x50) mm², 1 mm thickness

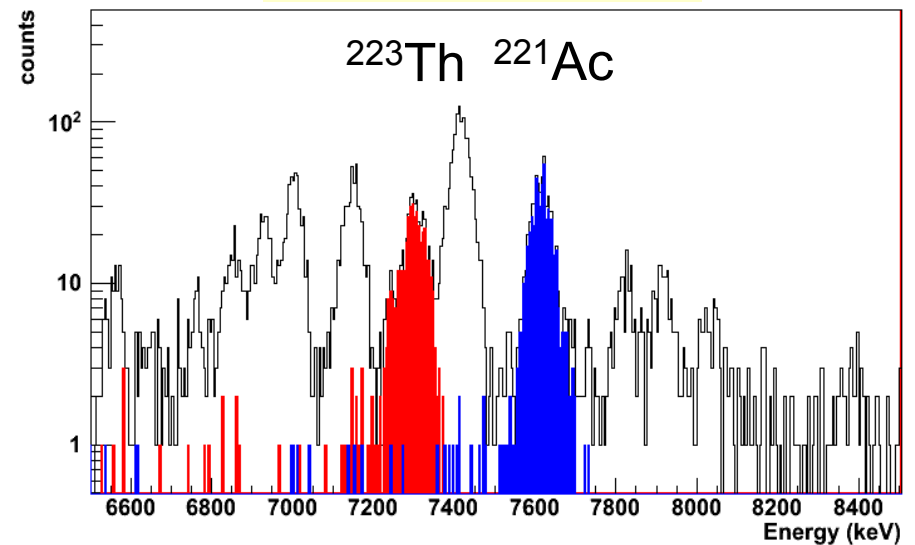


S. Pietri,
F. Farinon

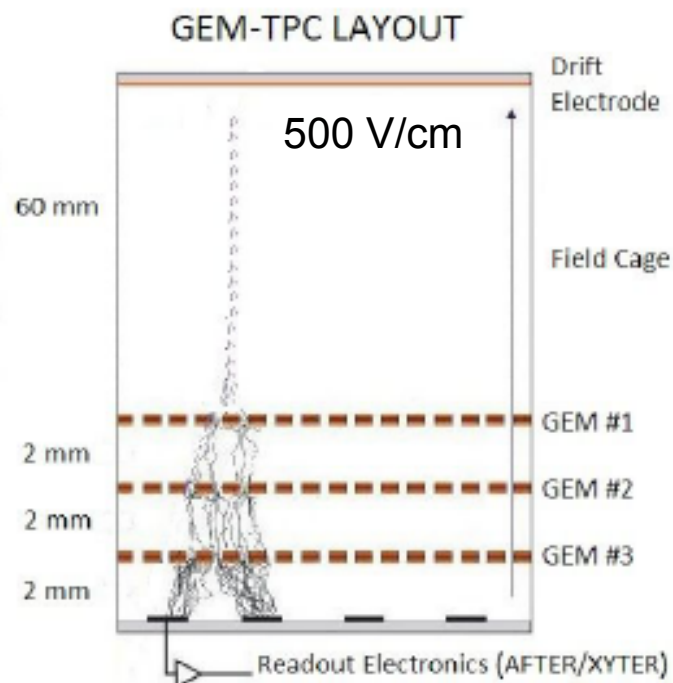
C. Nociforo, F.
28 Nc



Energy spectrum

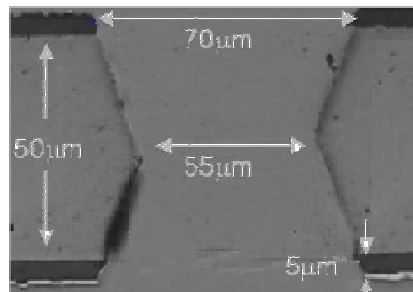
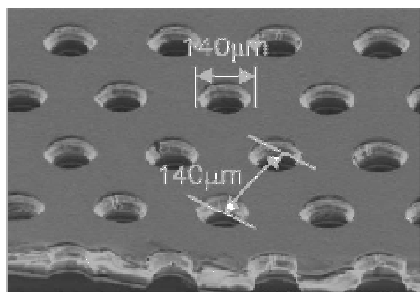


Other developments: GEM-TPC status

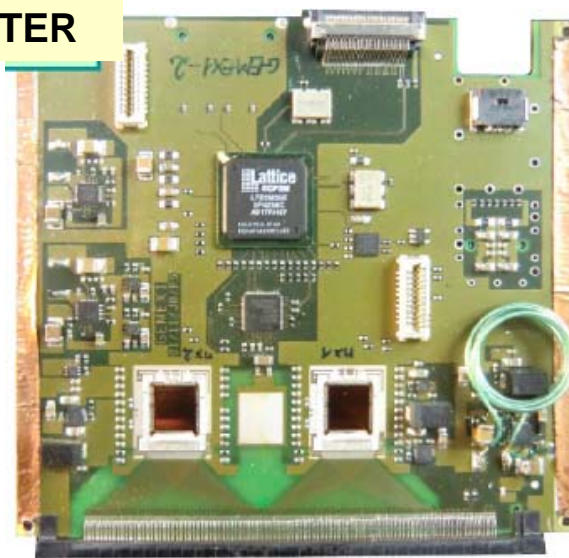


- Ongoing characterisation of the new electronics
- Integration of n-XYTER to GEM detector (CERN)
- Test of new GEM-TPC prototypes in April 2012

GEM foil



n-XYTER



Helsinki, CUB & GSI

Conclusion

Change of several setups and configuration would not have been possible without the help of the FRS technical staff

In particular a special thank to *Jan Kurcewicz*, for his collaboration, strong support to the group and help during the last 4 years (*see his talk today at 15:45*).

We enjoy a lot during the experiments and we regret that you are going to leave us.

We wish you all the best !



C. Nociforo, FRS User Meeting
28 Nov 2011