Test of diamond detector at the FRS

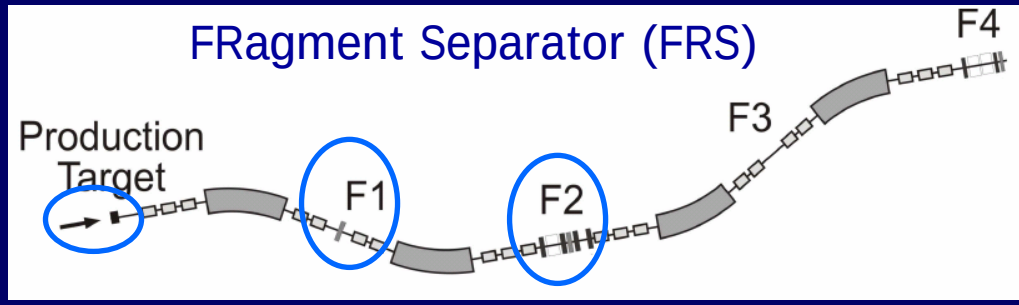
Chiara Nociforo

GSI, Darmstadt

Shoichiro Kawase

GSI summer student, Tokyo University

Test goals



1) **Tracking**

beam profile reconstruction with the **strip** diamond detector
→ F1 momentum tagging for PID F1-F2 (D_{TA-F1}= 2 cm /%)

2) **Time resolution test**

between **single** diamond detector and SCI21
→ ToF measurements (F1-F2)

3) **High intensity test** (only diamond in)

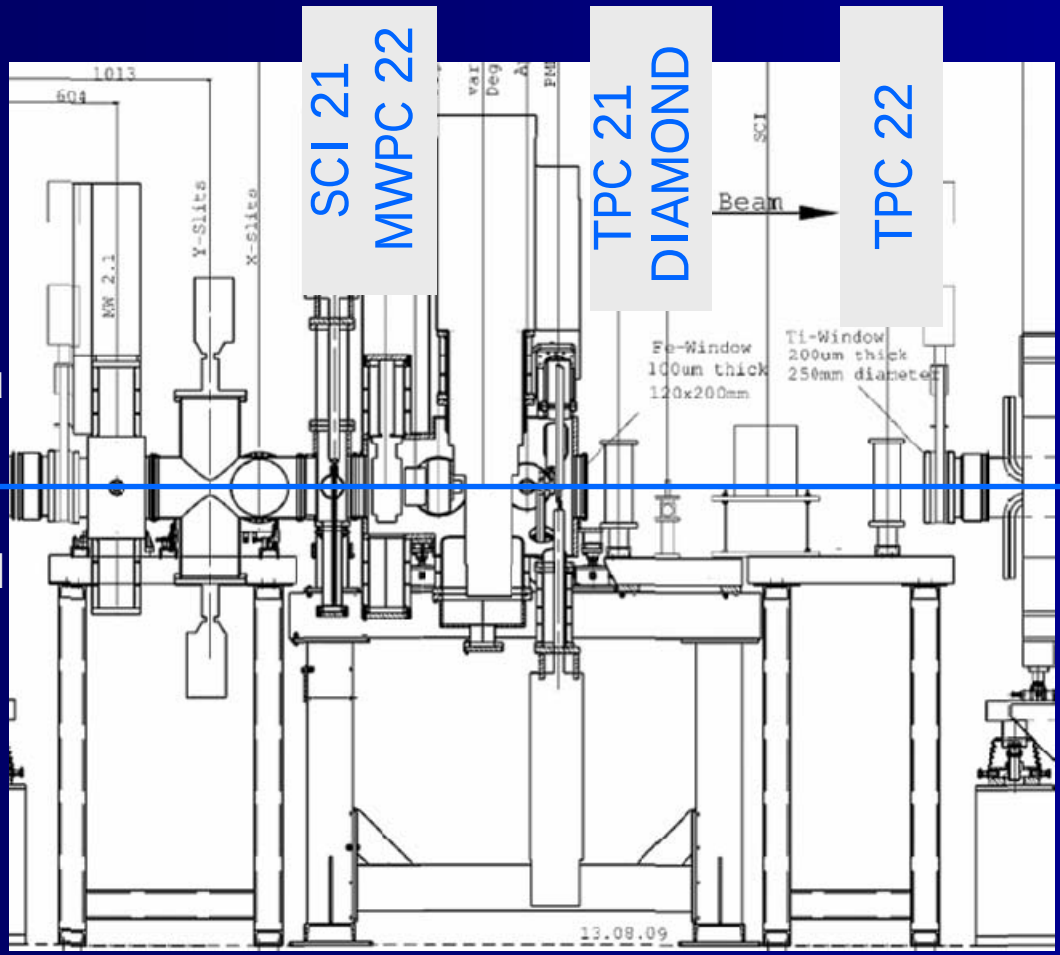
single signal sent to scope and counter only
→ at the entrance of the FRS (TA)

Experimental set up

No access at F1 imposes possible measurements only at F2

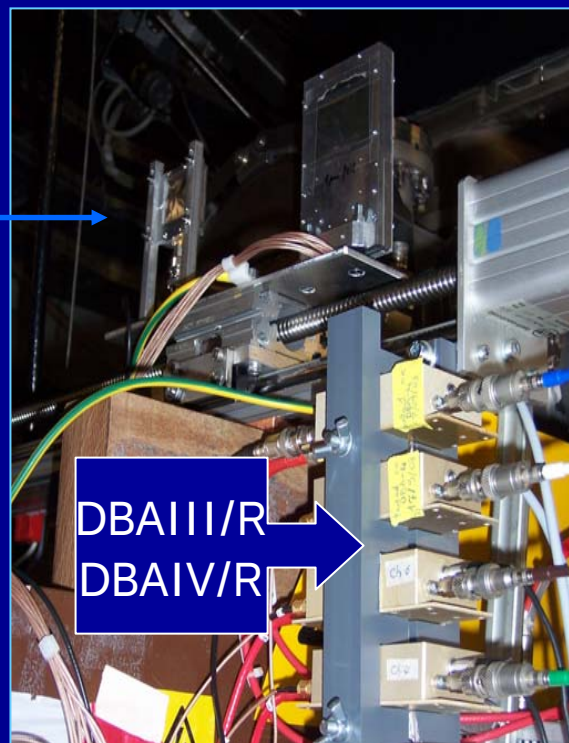
^{56}Fe
@350MeV/u
from SIS18

i=10^{2-8}/spill
(15Aug 09)



mid-focal plane

Diamond mounted
in air



Diamond detectors

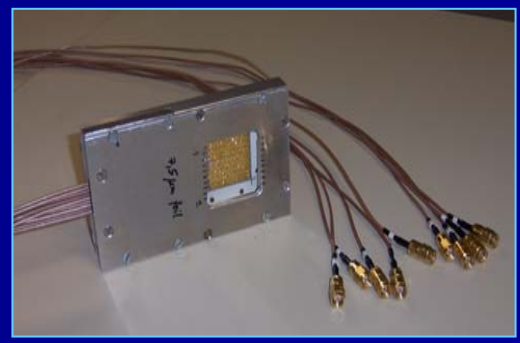
Diamond detectors borrowed from GSI detector lab

- ***9 strips PCVD detector***

  size (30x30) mm^2 , 360 μm thickness, 9 strips (3 mm each)

  V = -/+ 400 Volts

  C = 10 pF/strip



- ***single PCVD detector***

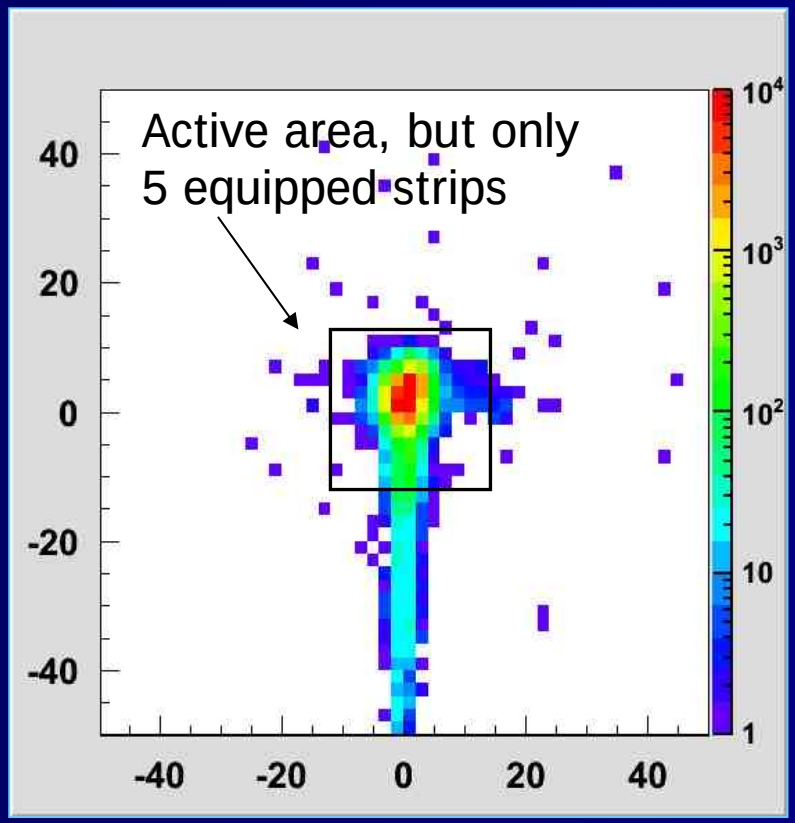
  size (10x10) mm^2 , 600 μm thickness

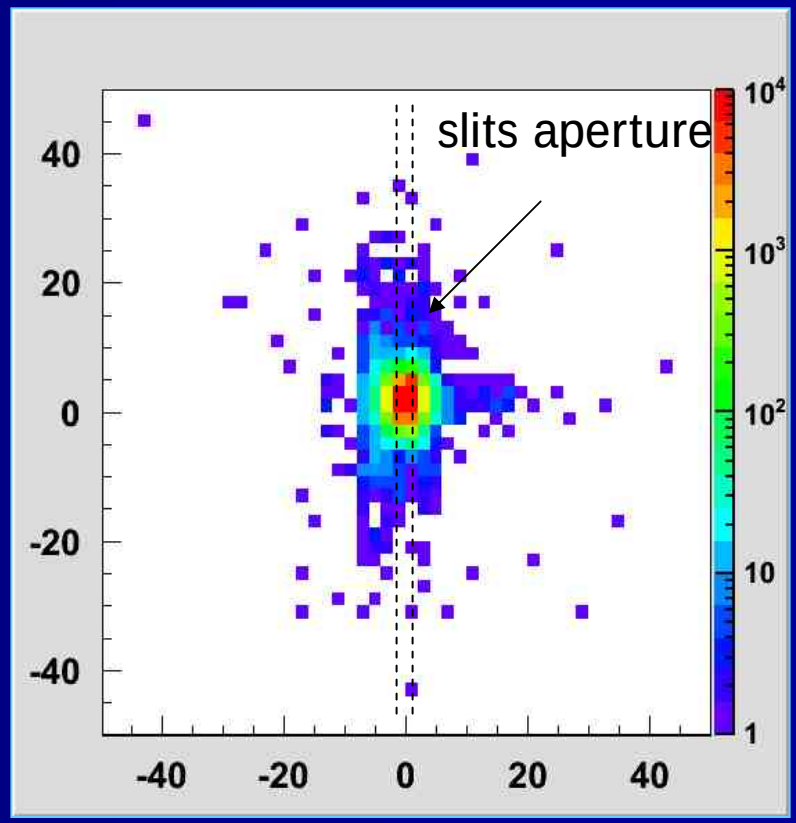
  V = -/+ 600 Volts

Beam size at F2

I_{beam} ~ 2.5 kHz

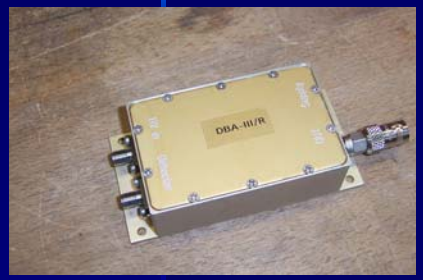
Beam spot reconstructed by MWPC 1.2 m upstream



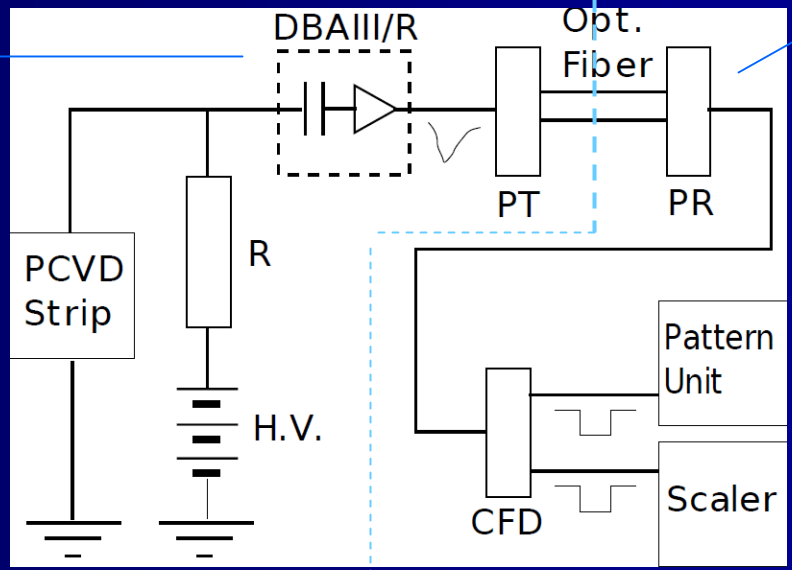


Electronic scheme

for the beam profile reconstruction



+42 dB
(2GHz)

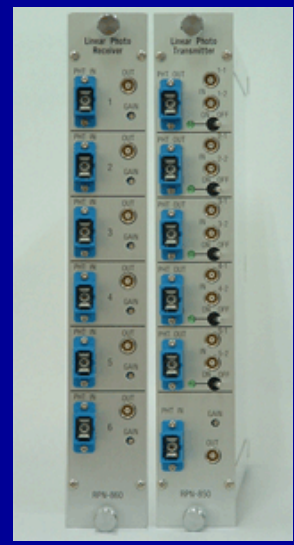


Caen V259

Caen V820

Phillips 730
(>100MHz)

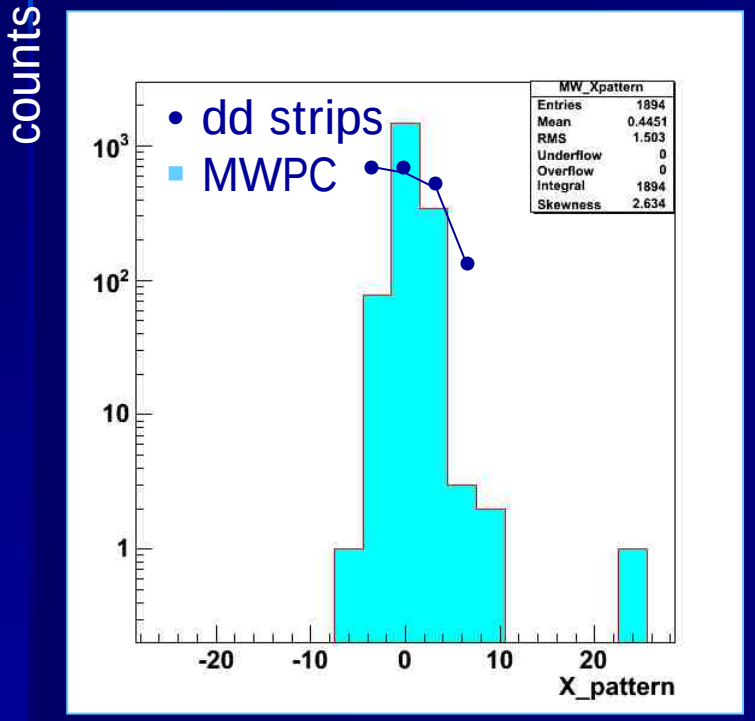
REPIC Linear
Photo
transmitter (PT)
/receiver (PR)
(100 MHz)



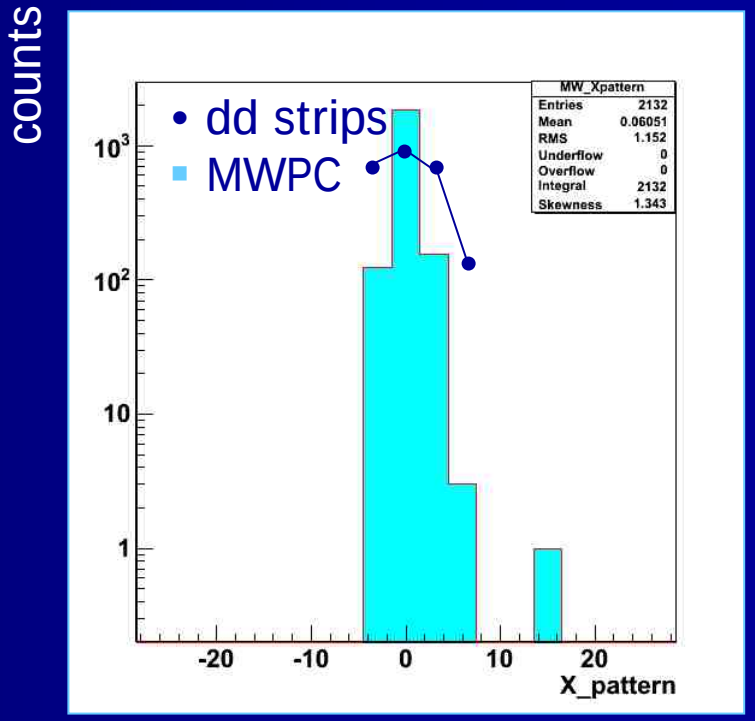
Beam profile

I_{beam} ~ 2.5 kHz

F2 slits: ± 20 mm



F2 slits: ± 1 mm

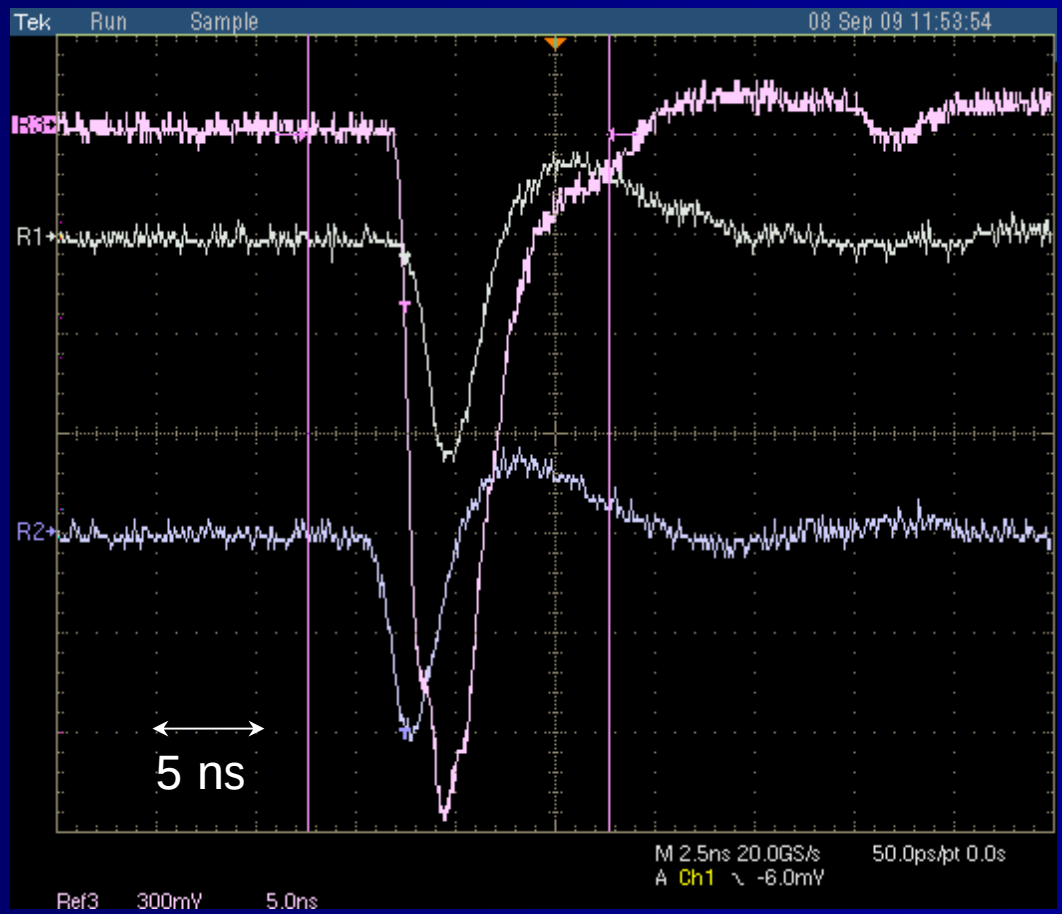


Test run Aug 09

^{56}Fe primary beam @350 MeV/u

dd single (> 2V, DBAIV/R)
SC21L (0.6 V)

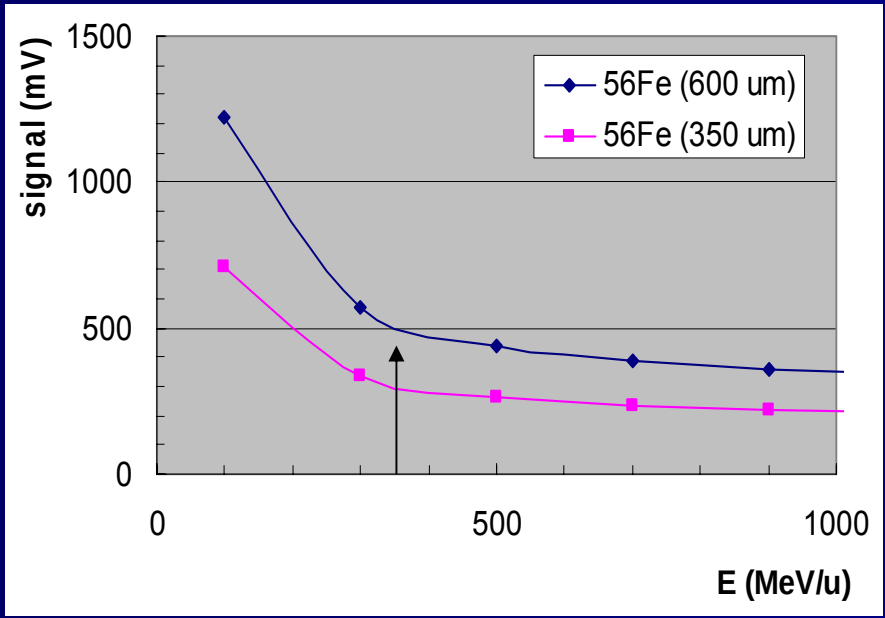
SC21R (0.6 V)



Tektronix TDS7404

Test run Aug 09

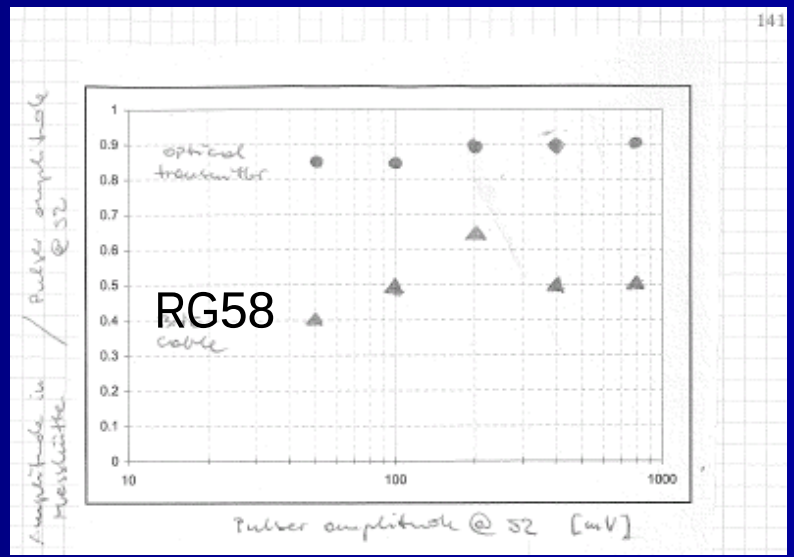
^{56}Fe primary beam @350 MeV/u



ρ = 3.54 g/cm^3 , 600 μm thick

Q_{gen} ~ 4 pC, Qcoll ~ 2 pC

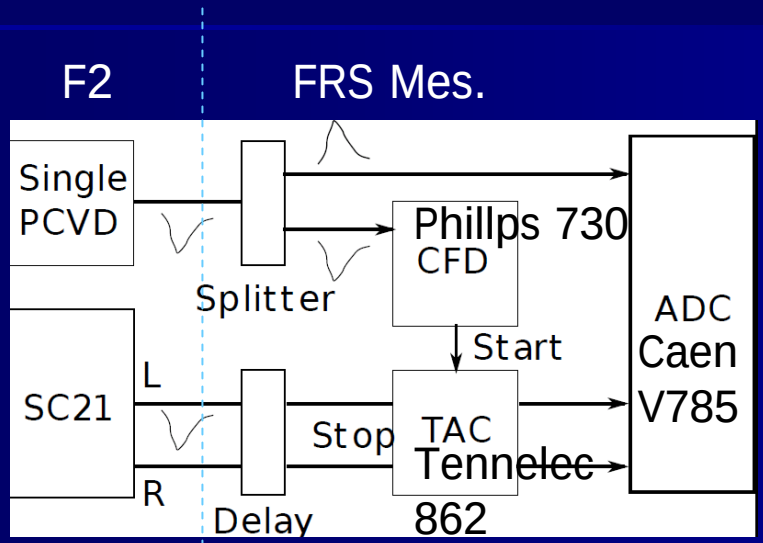
Cable attenuation



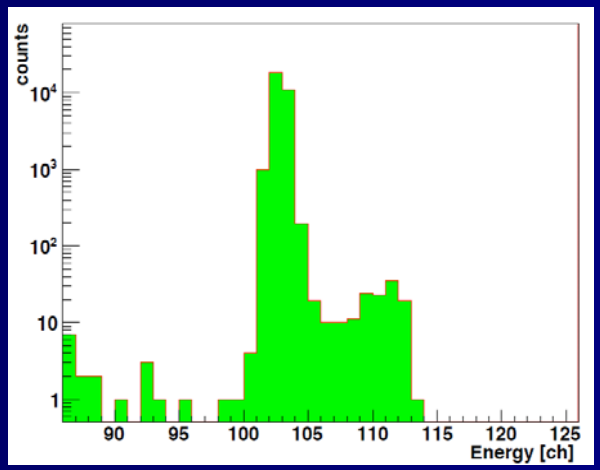
Electronic scheme & results

for ToF measurements

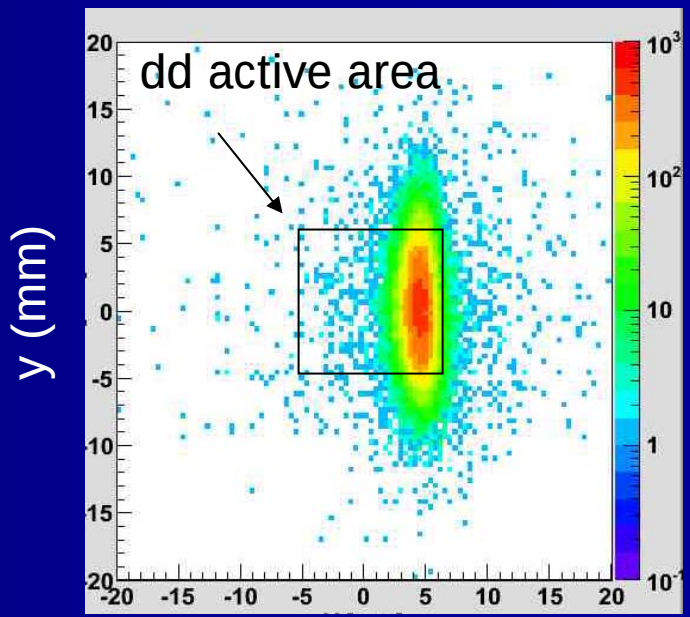
dd and SCI signals traveled via optical fibers (100 m)



dd energy spectrum



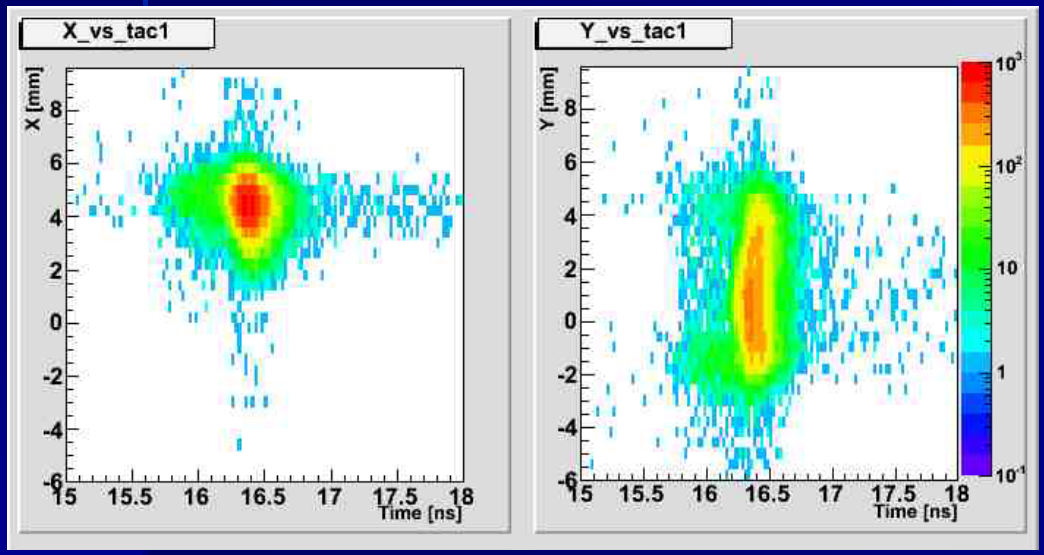
Beam spot reconstructed by TPC detectors



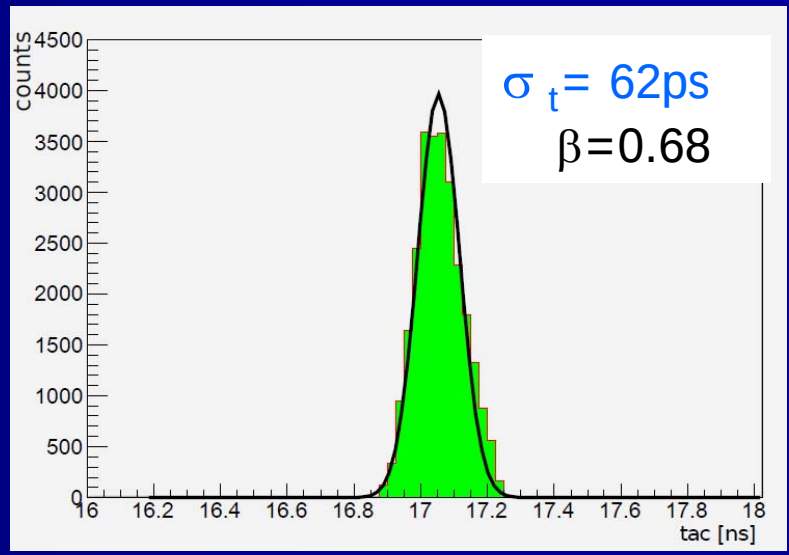
Results

I_{beam} ~ 2kHz

position vs ToF



Results comparable with the standard FRS ToF res.



Efficency : 70-60 % , constant up to 10^7/spill

At higher rate only few pulses have been characterized with a scope Tektronix TDS7404

Summary

- Momentum tagging by using strip dd (-400 V)

  → $Q_{coll} \sim Q_{gen} / 8$
  measured efficency detection <10%
  beam profile only qualitatively in agreement

- ToF measurement using SCI + single dd (+600 V)

  → $Q_{coll} \sim Q_{gen} / 2$, $\varepsilon \sim 70$ %
  $\sigma_t \sim 60$ ps
  rate capability tested up to 1 MHz

Higher rate test needs more work on electronic side (*after the amplifier*) and for operating at TA,F1 remote control is necessary.

Having ideal condition for a detector test (parassite) at the FRS is very difficult !

Acknowledgements

We are indebted to:

A. Brünle, K.-H. Behr, E. Berdermann, C. Karagiannis, J. Kurcewicz,

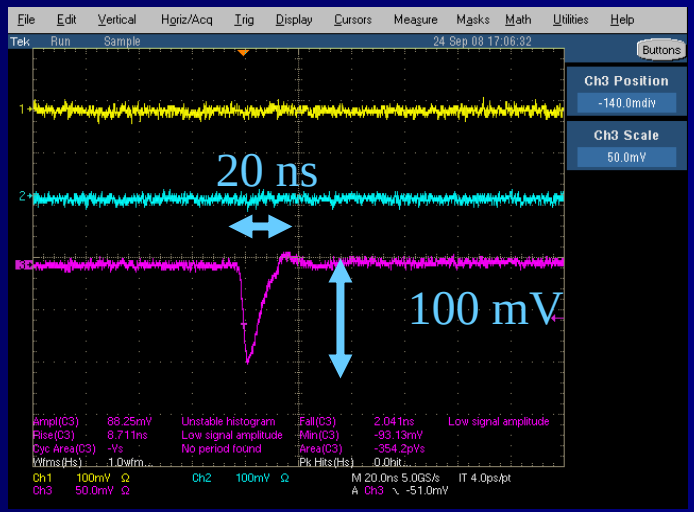
P. Moritz, S. Pietri, H. Weick and M. Winkler

"I regret being unable to be present. My sincere thanks to Ivan Mukha."

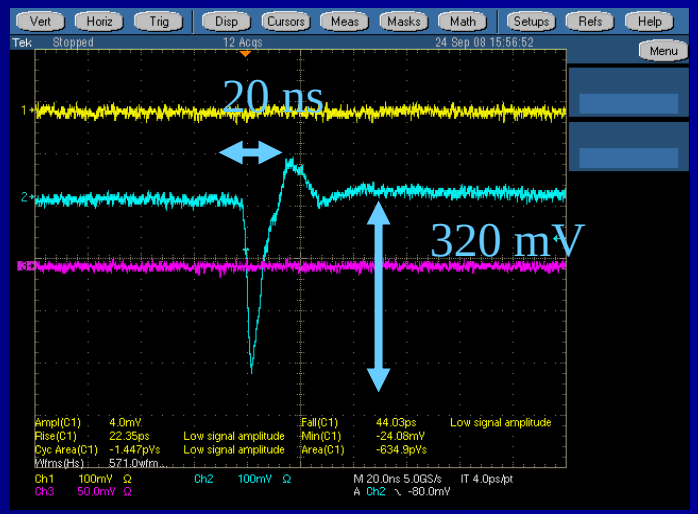
Test run Sep 08

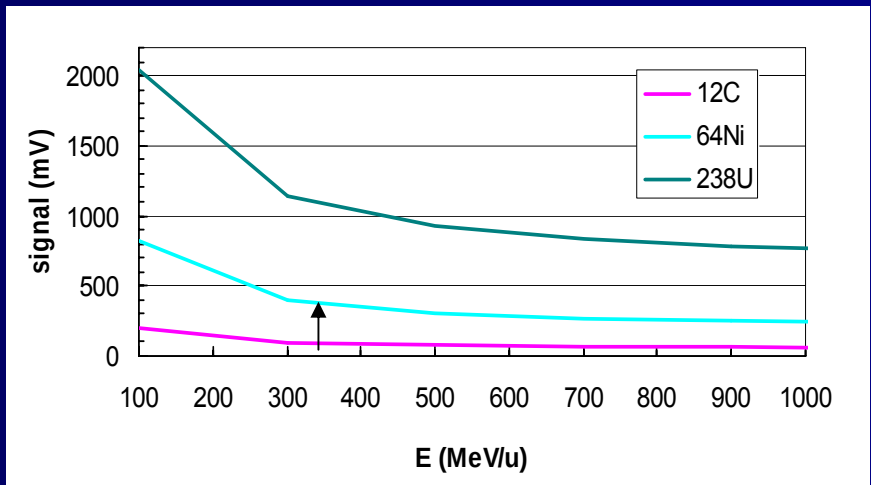
^{64}Ni primary beam @350 MeV/u

strip #6 (DBAIII/R)



strip #5 (DBAIV/R)



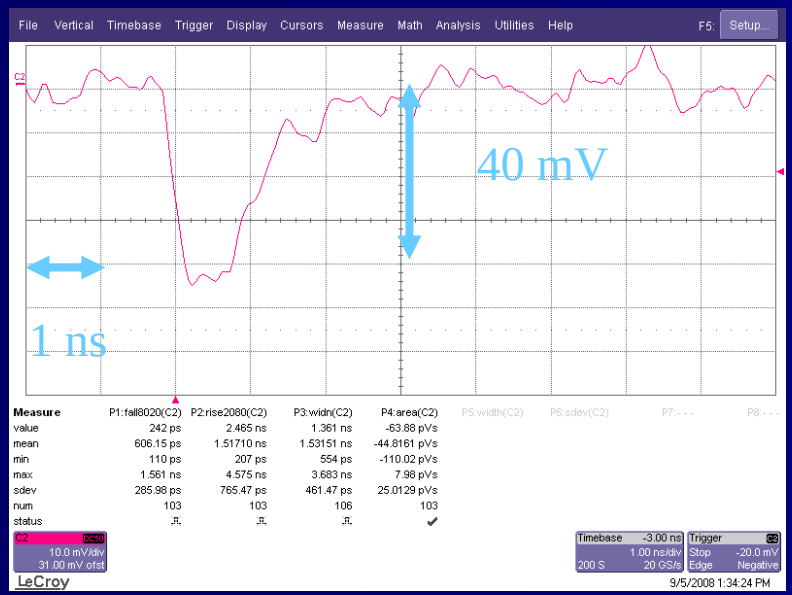


ρ = 3.54 g/cm^3 , 360 μm thick

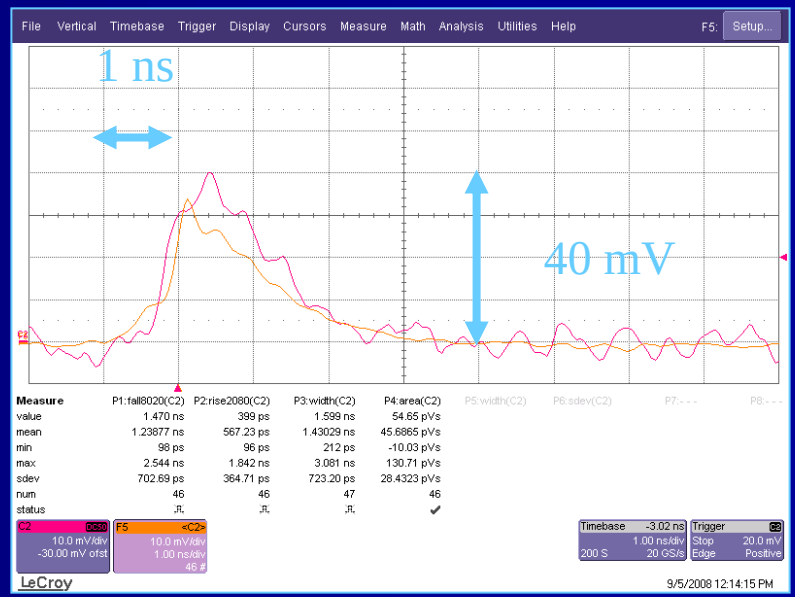
Q_{gen} ~ 3 pC

^{241}Am source pulse on air

strip #7 -400V

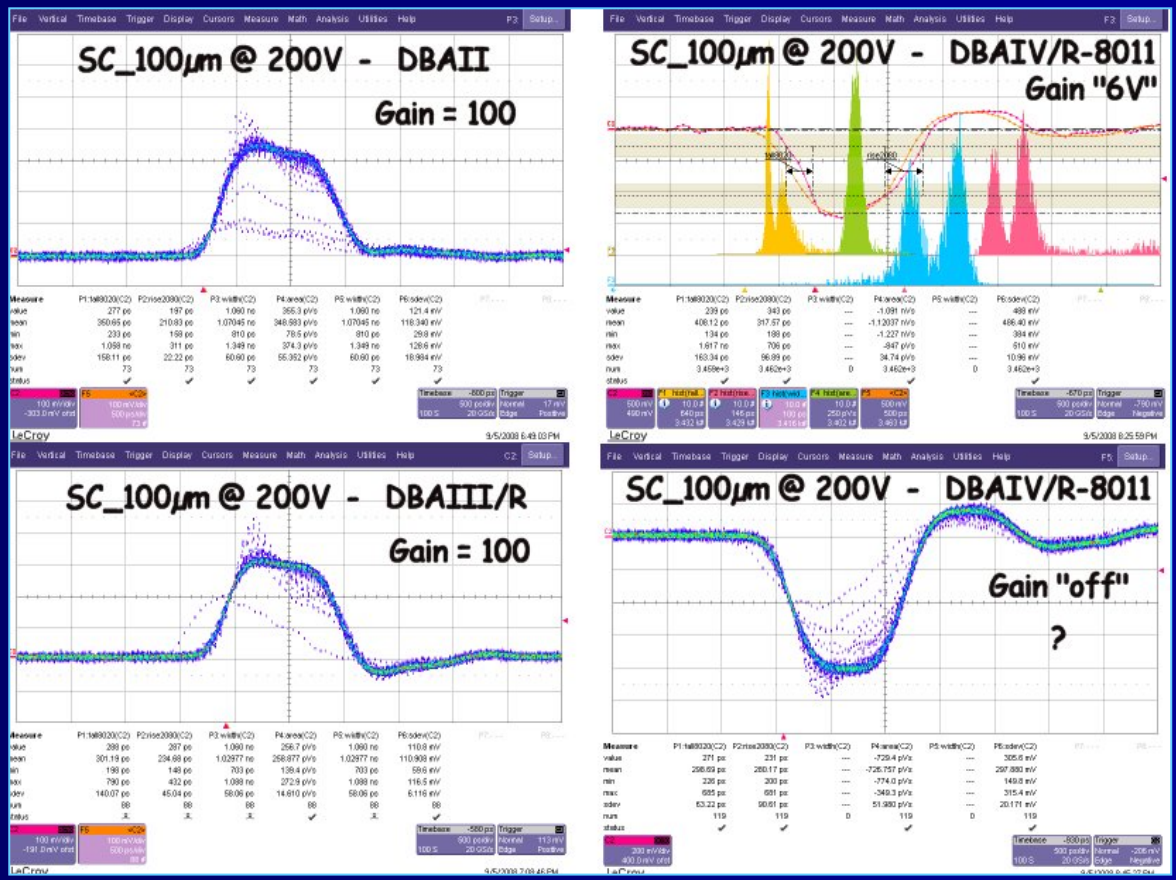


strip #6 +300V



E. Berdermann

α source pulse



E. Berdermann