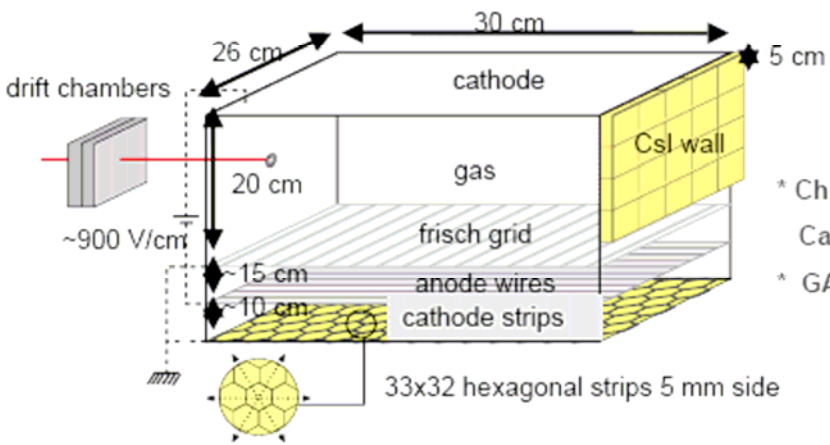
Active Target concept

- Gas detector where the gas constitutes both the target and the detection medium

  exotic HI on a light target ➔ inverse kinematics

- Working principle : Time projection chamber detector

MAYA: a successful first prototype



* Ch. E. Demonchy
  Caen University PhD (2003)
* GANIL SP 36/1999 (1999)

ACTAR Collaboration

GANIL

H. Savajols, W. Mittig, P.Roussel-Chomaz, A. Villari, F. de Oliveira, F. Rejmund, M. Rejmund, B. Jurado

DAPNIA

A. Drouart, L. Nalpas, V. Lapoux, A. Gillibert, E. Pollaco

CENBG

B. Blank, J. Giovinazzo, G. Canchel, C. Borcea, J.L. Pedroza, L. Hay, J. Pibernat

CLRC

R. Lemmon, D. Warner, I. Lazarus, P. Coleman-Smith, V. Pucknell, S. Letts

University of Liverpool

M. Chartier, R. Page, J. Thornhill, J. Cresswel, D. Sedon, C.E. Demonchy

University of Birmingham

M. Freer, N. Clarke, P. Jagpal

GSI

P. Egelhof, O. Kiselev

University of Santiago de Compostela

J. Benlliure, D. Cortina, I.Duran, M. Caamaño

Status of ACTAR

2 main questions:
Cubic or Cylindrical?
Magnetic field or not?

— Large dynamics needed: 0.2-20 MeV
— Either magnetic field or ancillary detectors (many)
— Energy resolution:

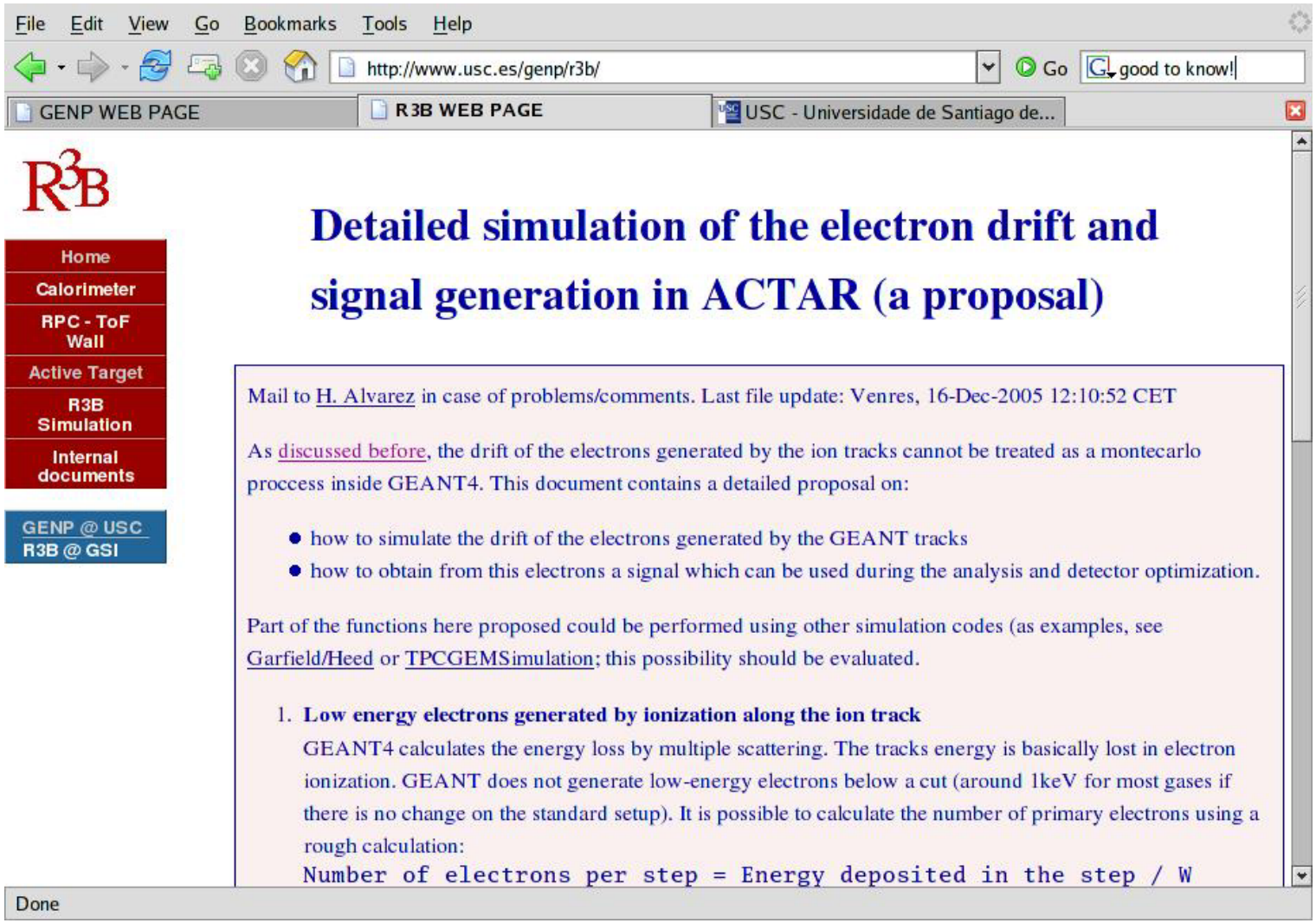
50 keV for Si detectors
=>10% at 0.5 MeV, 0.5% at 5 MeV
Position resolution 0.25mm
=>2.5% for 1cm, 0.25% for 10cm

—Cubic geometry :
Problem with deflection of the beam in with B
Solid angle reduced by factor 2(4)

—Cylindrical geometry:
Problem at small angles (ancillary detectors below 5°)
Varying rise times of the pulses

—Preliminary simultations in favor of cylindric geometry with longitudinal electric and magnetic field for reactions related to resonant elastic scattering, inelastic scattering (giant resonances) and transfer reactions.

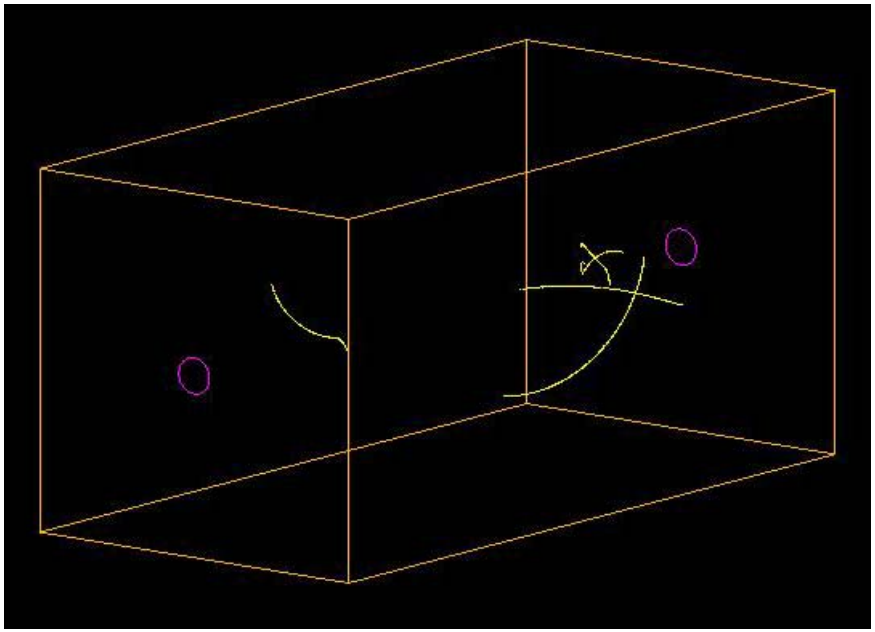
An overview of ActarSim



H. Alvarez Pol USC

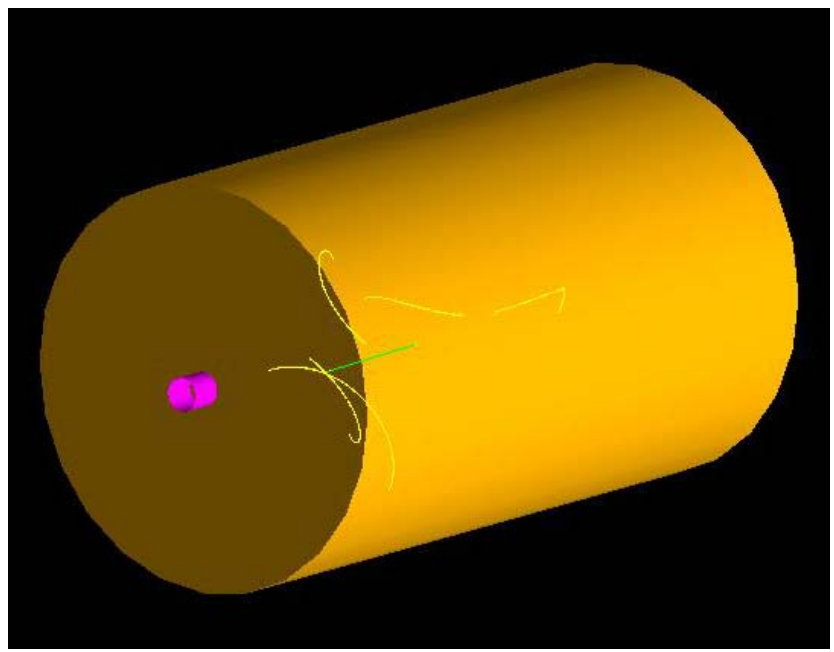
The (geant4) ActarSim: geometry

GEANT4 TRACKING | DRIFT AND DIGITIZATION | ANALYSIS AND RECONSTRUCTION



```
# BOX
/ActarSim/det/setDetectorGeometry box

/ActarSim/det/setXLengthGasBox 0.5 m
/ActarSim/det/setYLengthGasBox 0.5 m
/ActarSim/det/setZLengthGasBox 1 m
```

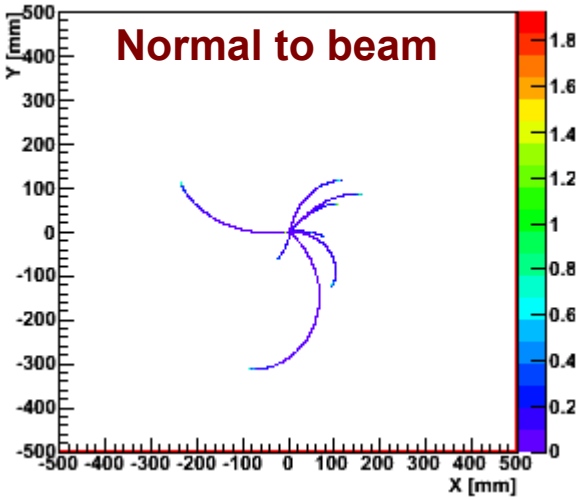
```
# TUBE
/ActarSim/det/setDetectorGeometry tube

/ActarSim/det/setRadiusGasTub 0.6 m
/ActarSim/det/setLengthGasTub 1 m
```

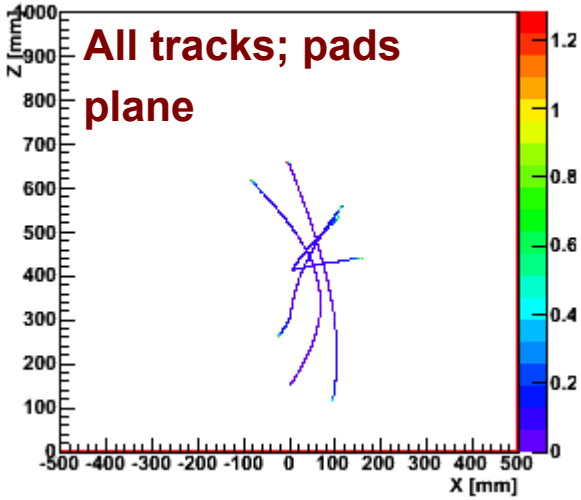


```
# BEAM SHIELDING
/ActarSim/det/setBeamShield tube
/ActarSim/det/setInnerRadiusBeamShieldTub 50 mm
/ActarSim/det/setRadiusBeamShieldTub 50.001 mm
/ActarSim/det/setLengthBeamShieldTub 1 m
# MATERIALS
/ActarSim/det/setGasMat isoC4H10STP
/ActarSim/det/setMediumMat Galactic
/ActarSim/det/setBeamShieldMat Iron
#ELECTRIC AND MAGNETIC FIELDS
/ActarSim/det/setEleField 0 0 0
/ActarSim/det/setMagField 0 0 0 T
# UPDATE (DO NOT FORGET!)
/ActarSim/det/update
```

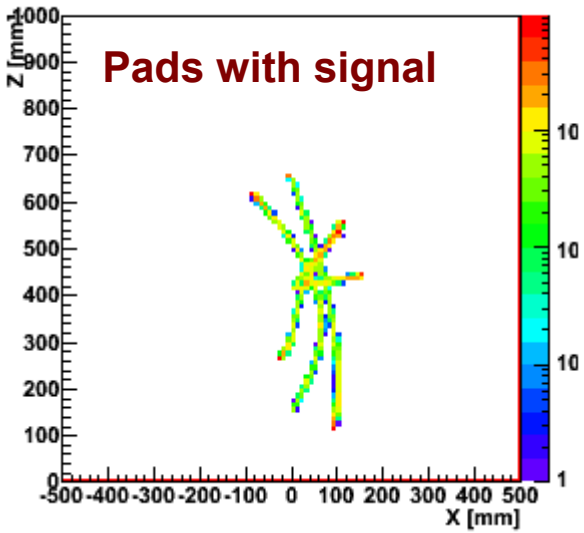
Digitization and visulatization macros

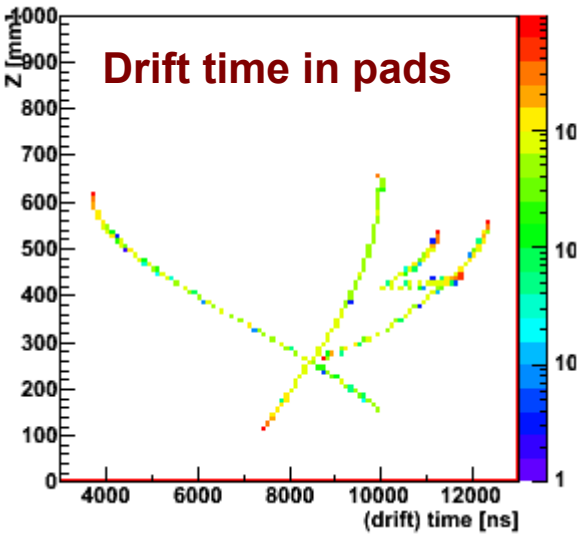
GEANT4 TRACKING | DRIFT AND DIGITIZATION | ANALYSIS AND RECONSTRUCTION



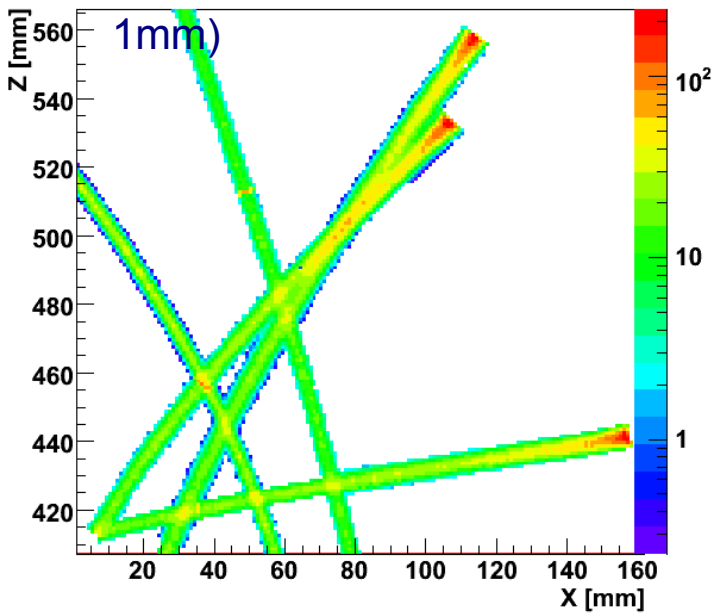


- Box-like geometry
- Square pads (side = 10mm)
- Drift velocity: 50 mm/μs
- Diffusion: 0.1 mm/√cm

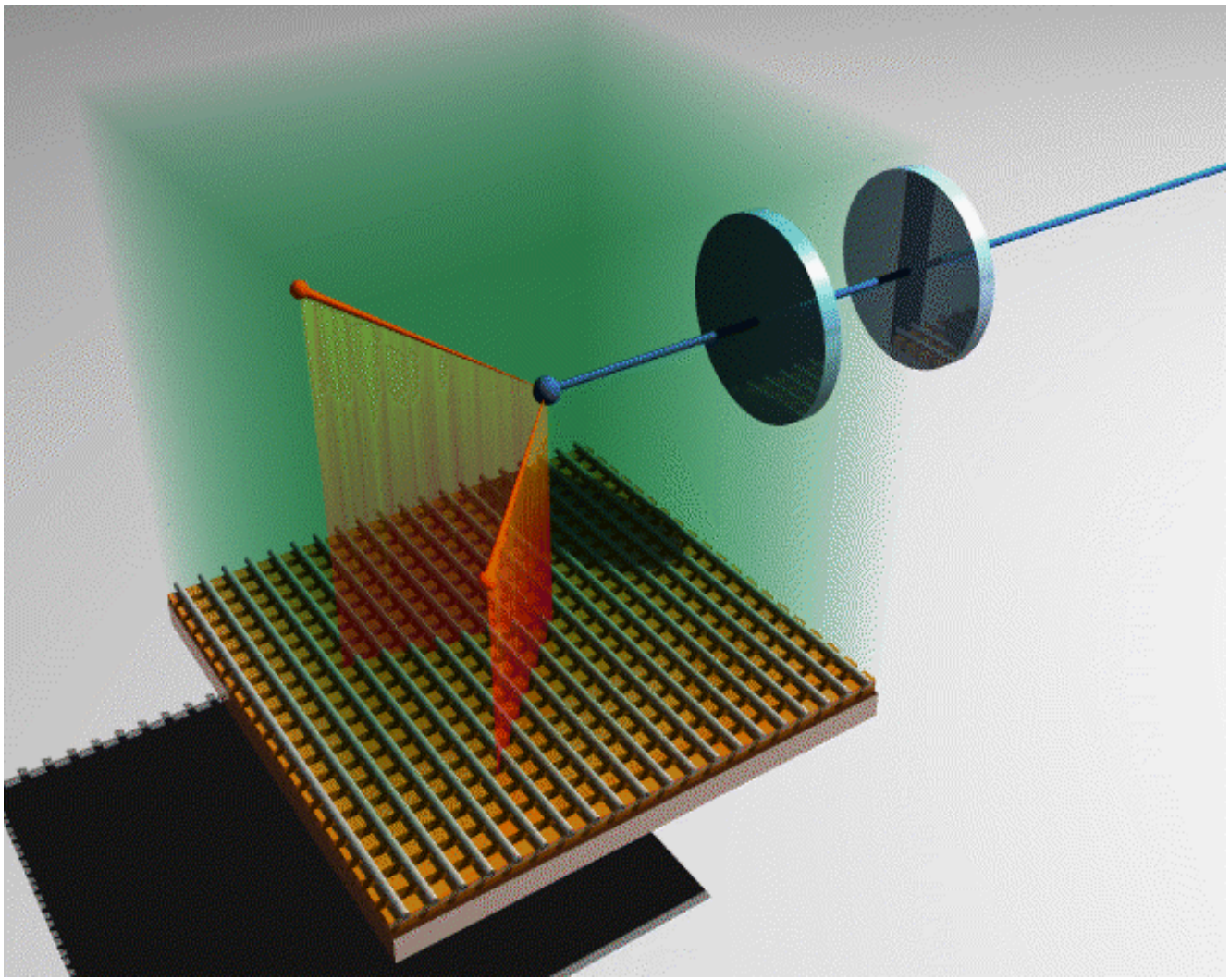




A high-res case with small square pads (side = 1mm)



TPC for 2p radioactivity studies

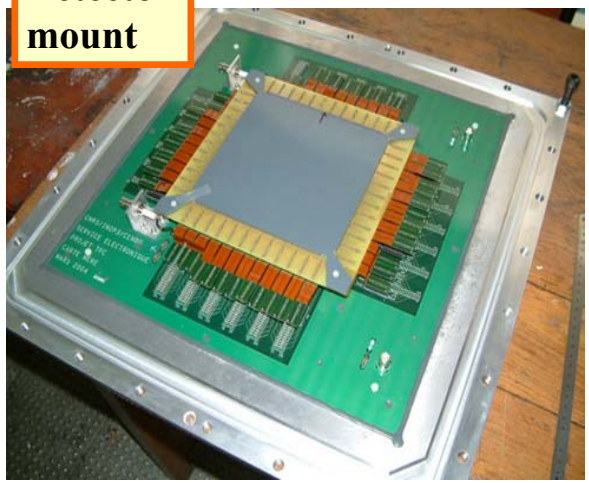


Bertram Blank, CENBG

time projection chamber

TPC chamber

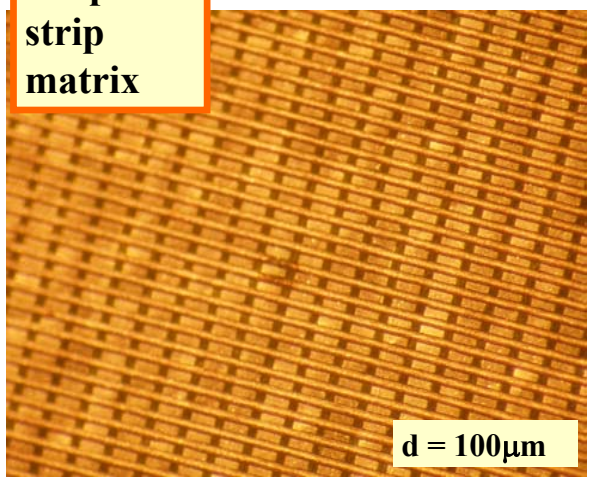
Detector mount



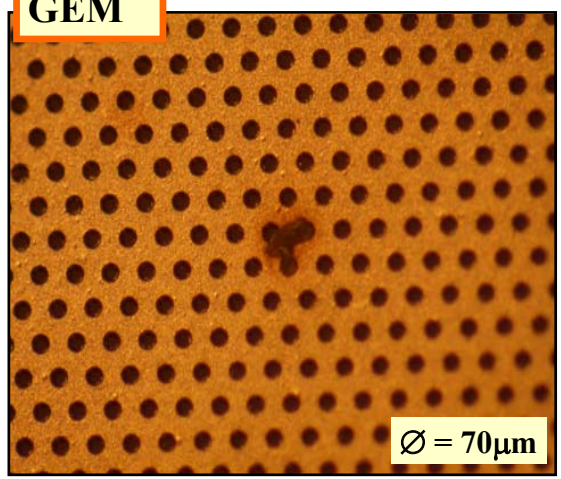
Detector mount

Electronics card

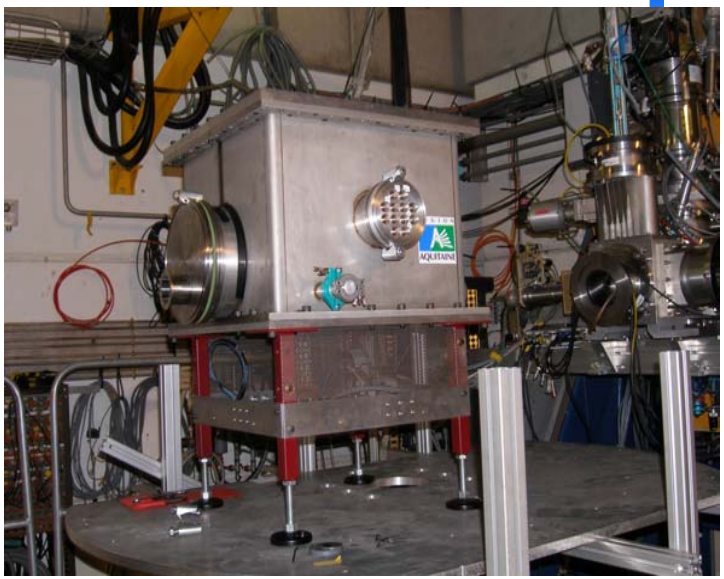
Strip-strip matrix

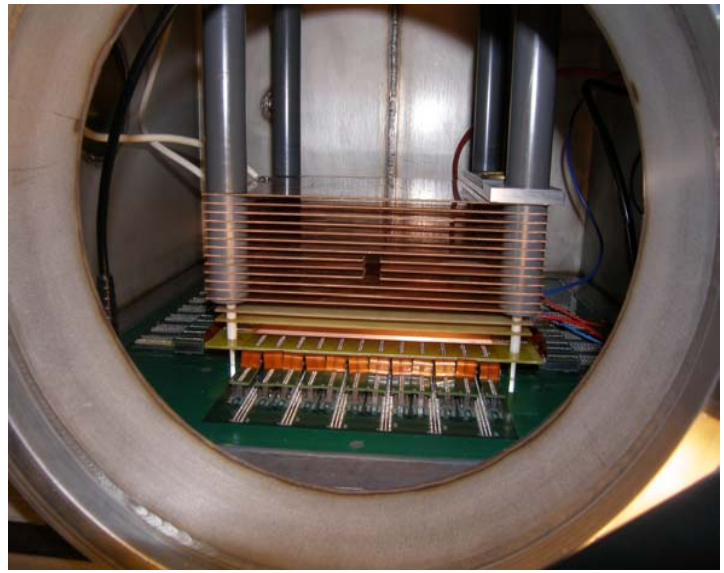


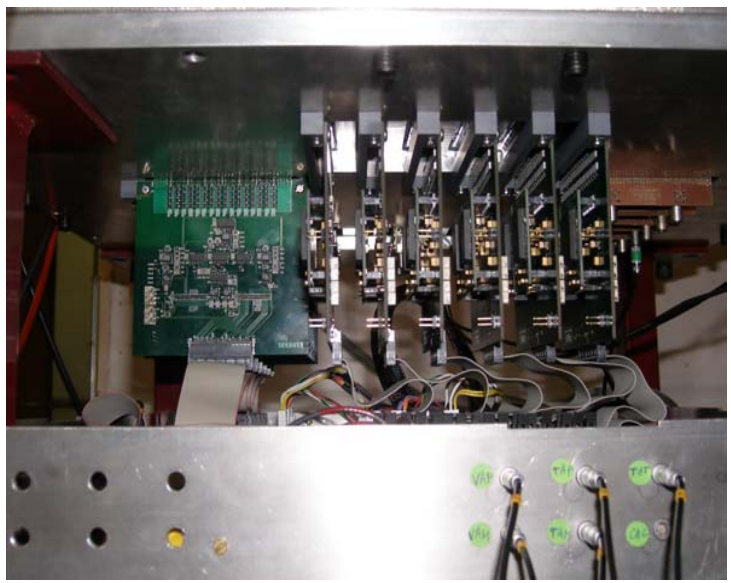
GEM



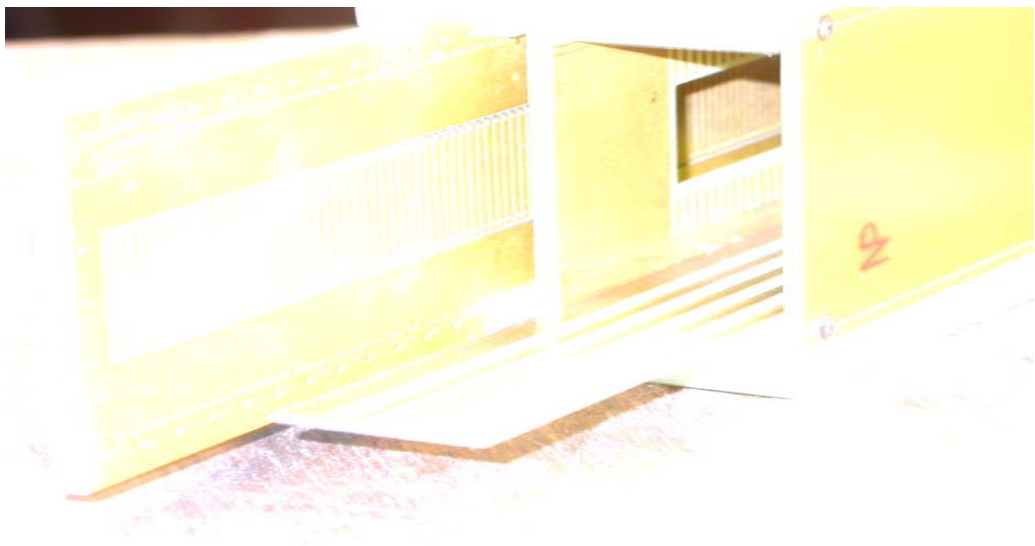
time projection chamber







MAYA-ITO test runs at GANIL



F. Rejmund et al.

MAYA-ITO test runs at GANIL

Beams used

^{13}C @ 3 - 4.35 - 11MeV/u

^{16}O @ 3.4 - 8.4 MeV/u

^{36}S @ 3.92 - 11.32 MeV/u

^{208}Pb @ 4.5 MeV/u

Gases:

H,D,He,Ne,Ar,Xe, Isobutane

MAYA-ITO test runs at GANIL: ^{13}C results

(a) Ion: ^{13}C 4.35 MeV/n (~ 56 MeV after the 1.5μm myler window)

Gas	ρ(STP) [mg/cm^3]	Pressure [mbar]	Inflexion point [mm] (Expt.)	Inflexion point [mm] (SRIM]	Inflexion Point [mm] (Expt)	Inflexion Point [mm] (SRIM)	Range [mm] (SRIM)
Ne	0.9	1500	120.9	115.6			123.2
Ne	0.9	1860	97.0	93.2	100.7	98.36	99.4
Ar	1.78	710	162.9	152.Õ			161.5
Ar	1.78	1005	114.1	107.7	114.9	112.6	114.1
Xe	5.85	500	108.6	123.9	110.0	107.8	124.8
Isobutane	2.59	500	81.6	73.4	81.6	73.65	75.2

(a1) Ion: ^{13}C 3.01 MeV/n (38.4~ MeV after the 1.5μm myler window)

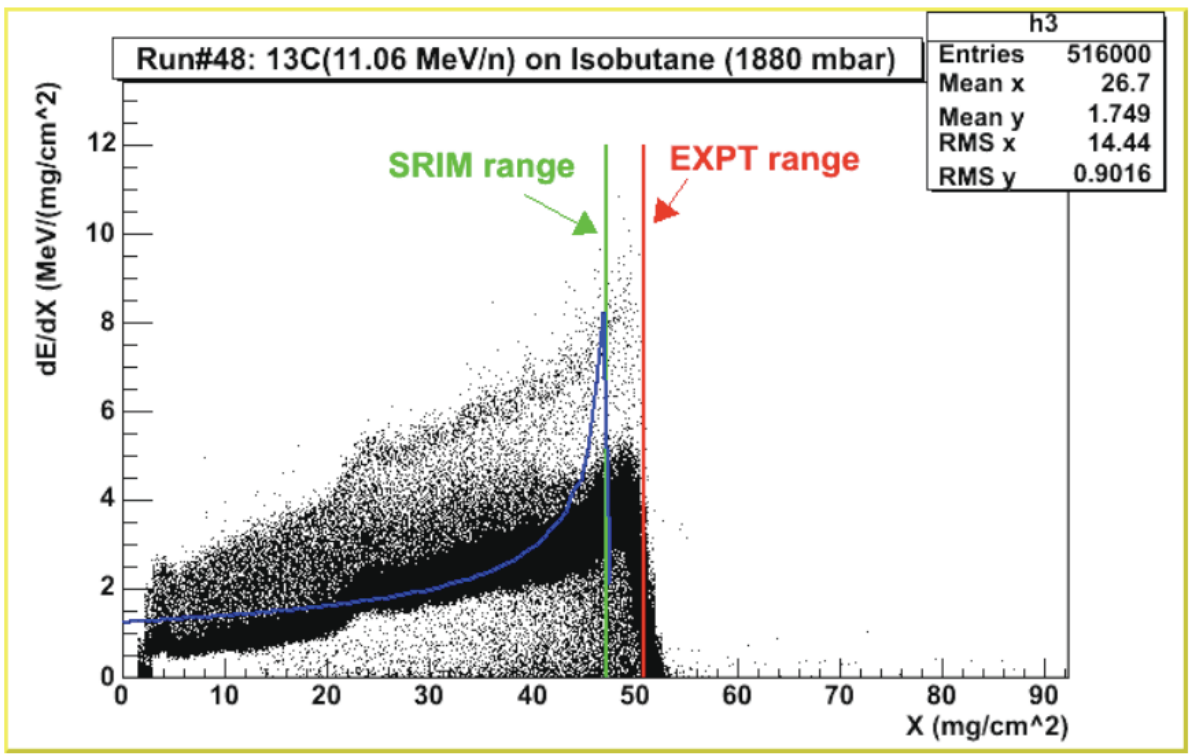
H_2	0.09	1800	148.95	141.9	150.9	162.8	152.8
D_2	0.18	1800	149.22	150.5			160.3
D_2	0.18	1950	137.6	138.9	138.8	146.7	148.0
He	0.18	1900	173.4	188.5	173.7	199.6	207.8

(a2) Range Straggling. Ion: ^{13}C 4.35 MeV/n

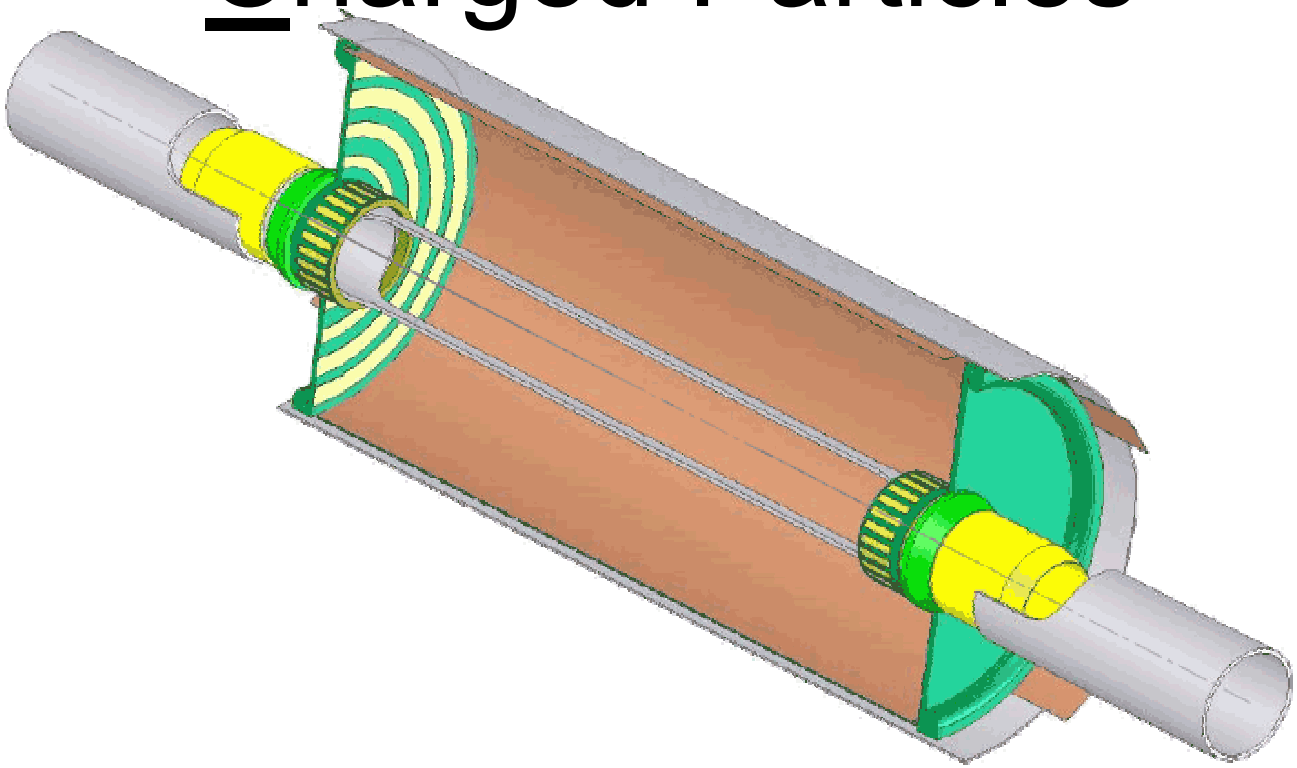
Gas	ρ	pressure	Straggling exp [mm]	Straggling SRIM [mm]
Ne	0.9	1860	5.3	6.5
Ar	1.78	1005	2.5	2.2
Xe	5.85	500	3.6	2.2
C4H10	2.59	500	4.1	1.38

MAYA-ITO test runs at GANIL: ^{13}C results

Gas	ρ(STP) [mg/cm^3]	Pressure [mbar]	Range [mm] (Expt.)	Range [mm] (SRIM)
Xe	5.85	1500	153.8	149.2
Isobutane	2.59	1880	105.7	98.2



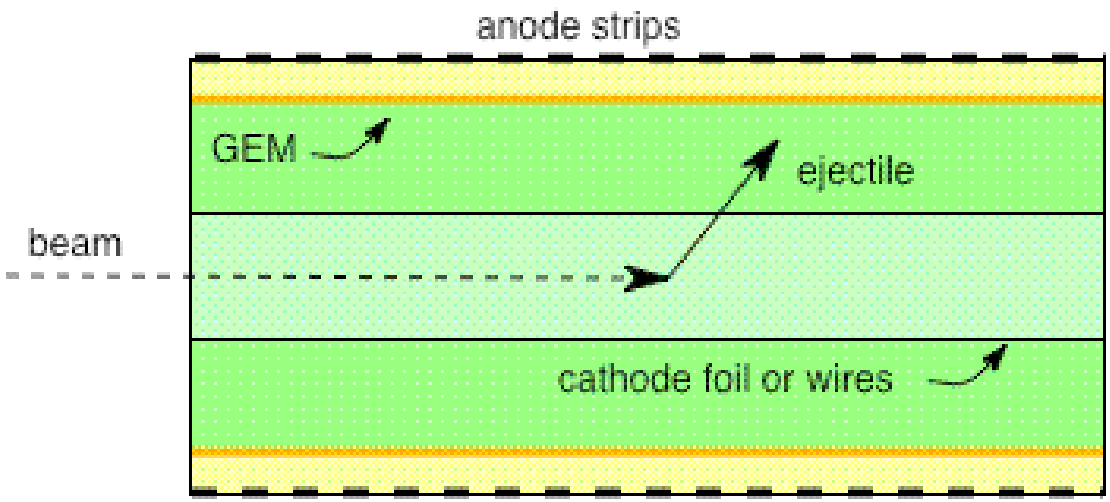
TRIUMF **A**nnular **C**hamber for the **T**racking and **I**dentification of **C**harged Particles

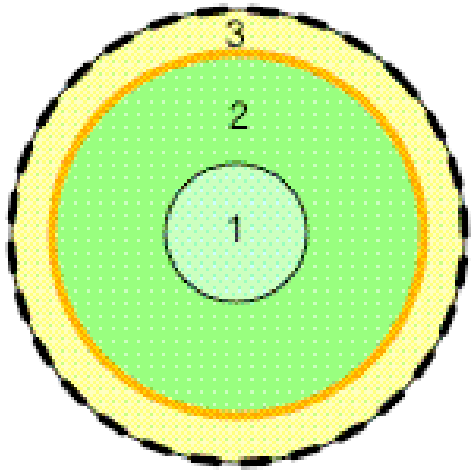


Original concept: L. Buchmann, TRIUMF

TACTIC: York-TRIUMF Collaboration

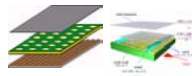
How is it going to work?





90% helium 10% CO_2 gas mixture
Pressure of a few hundred mbar
Drift voltage ~100V/cm

MWPC, GEM & Micromegas Performances

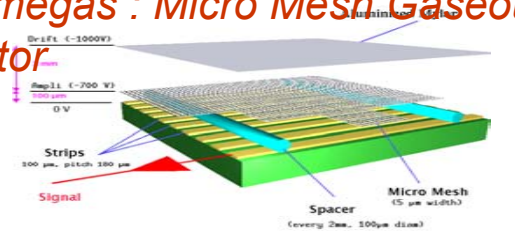


	MWPC	GEM	Micromegas
Rate capability	10^4Hz/mm^2	>5x10^5Hz/mm^2	10^6Hz/mm^2
Gain	High 10^6	low 10^3 (single) > 10^5 (multi GEM)	High > 10^5
Gain stability	Drops at 10^4Hz/mm^2	Stable over 5*10^5Hz/mm^2	Stable over 10^6Hz/mm^2
2D Readout ?	Not really	Yes and flexible	Yes, not flexible
Position resolution	> 200 μm (analog)	50 μm (analog)	Good < 80 μm
Time resolution	~ 100 μs	< 100 ns	< 100 ns
Magnetic Field effect	High	Low	Low
Cost	**Expensive, fragile**	**Cheap, robust**	**Cheap, robust**

L. Pollacco

TPC for T2K

Micromegas : Micro Mesh Gaseous Detector

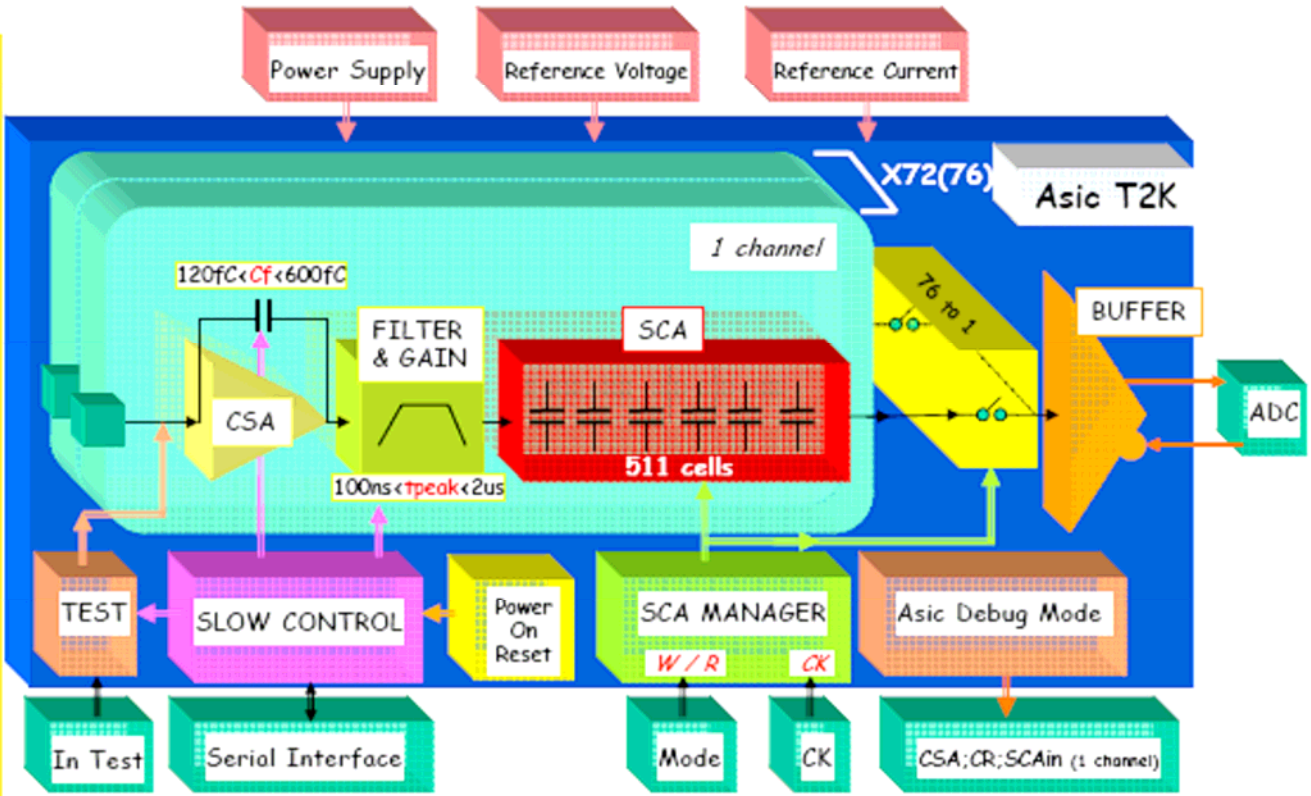


The T2K experiment will study oscillations of an off-axis muon neutrino beam between the JPARC accelerator complex and the Super-Kamiokande detector, with special emphasis on measuring the unknown mixing angle θ_{13} by observing the sub-dominant $\nu_\mu \rightarrow \nu_e$ oscillation. The neutrino en-

- Micromegas chosen as gas amplifier
  - 30x30 cm² ie 1400 of 0.8x0.8cm²
- Saclay is responsible for the FEE electronics. Namely ASIC + Front-end board+ADC
- ASIC T2K has 72 channels ie 20 chip/micomegas
- System slow 20Hz – needs trigger
- Gain options:n120,240,360,600 fC
- Shaping times:0.1…2 μs

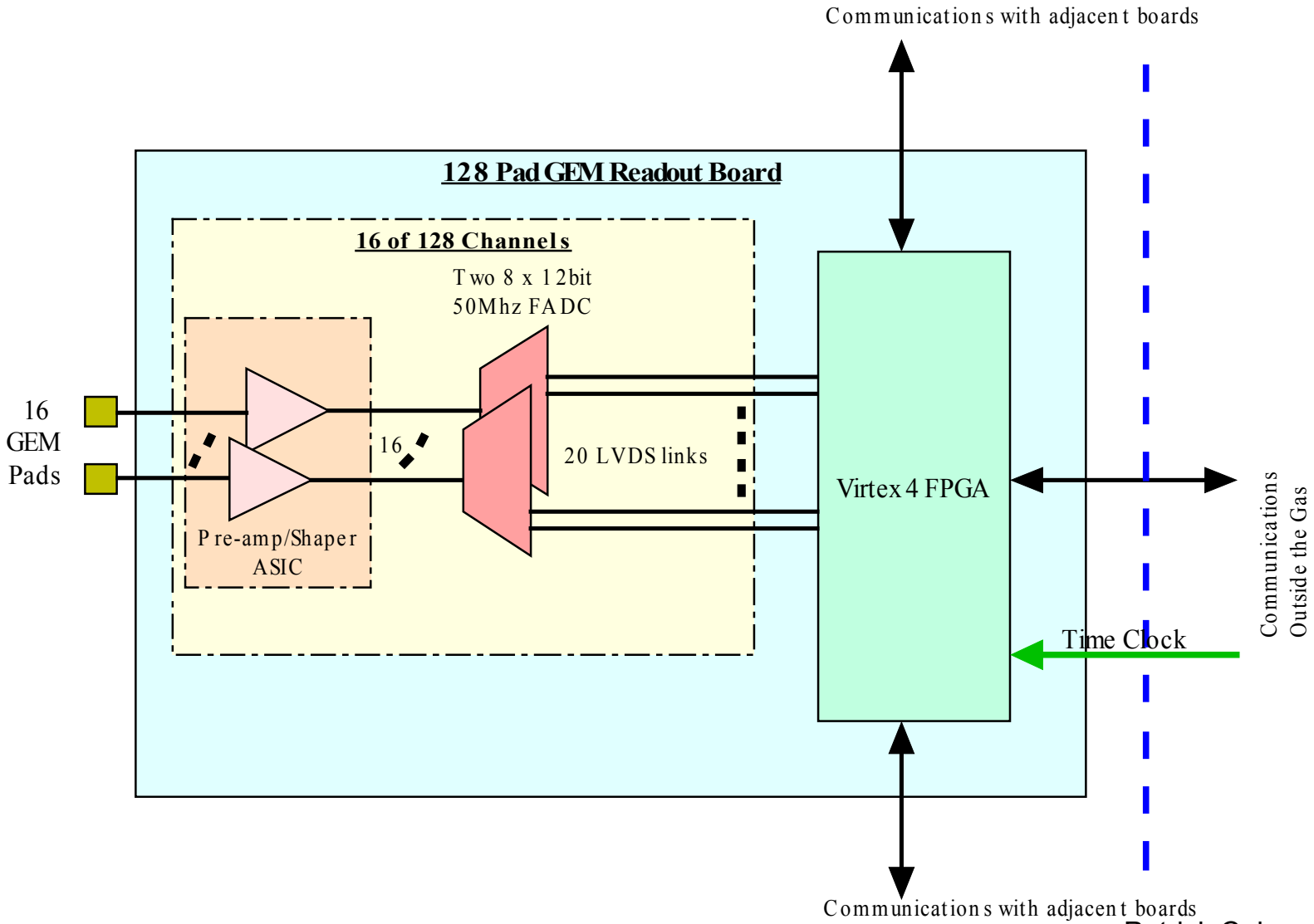
L. Pollacco

1. Présentation de l'asic

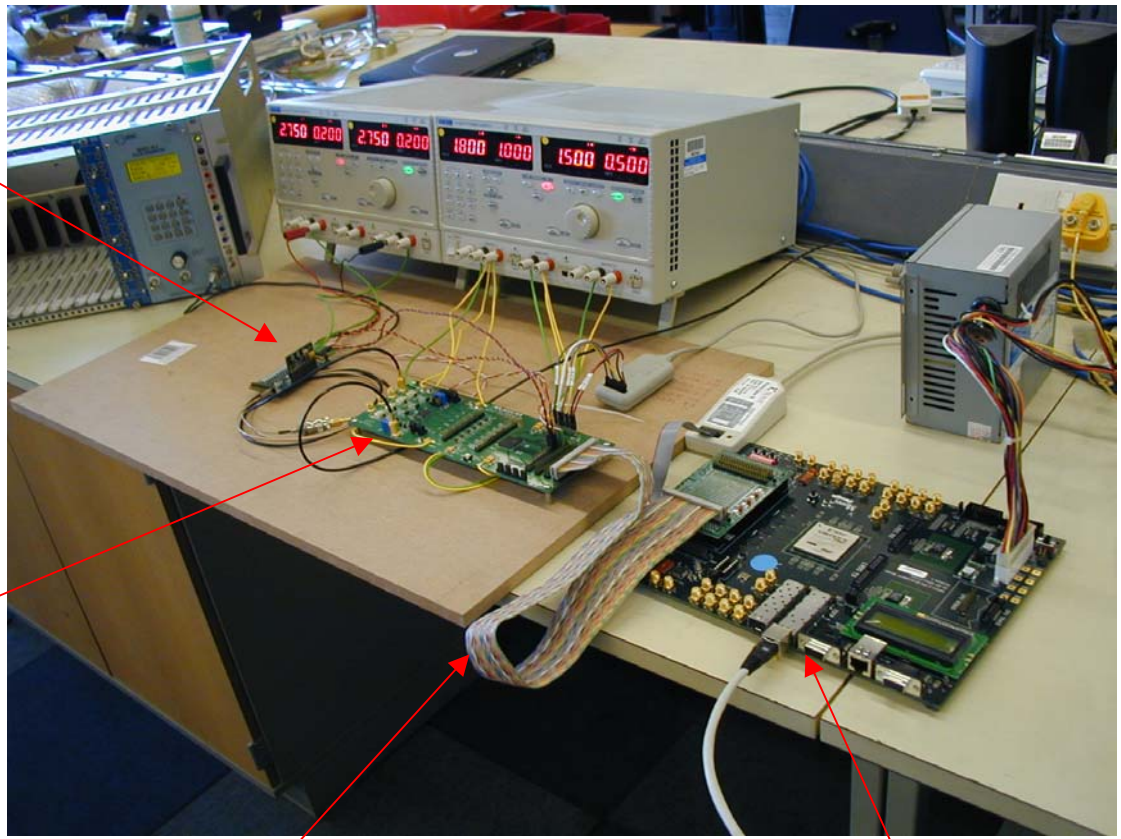


L.Pollacco

GEMs readout proposal with ASIC & ADC per pad.



Patrick Coleman-Smith
Daresbury Laboratory

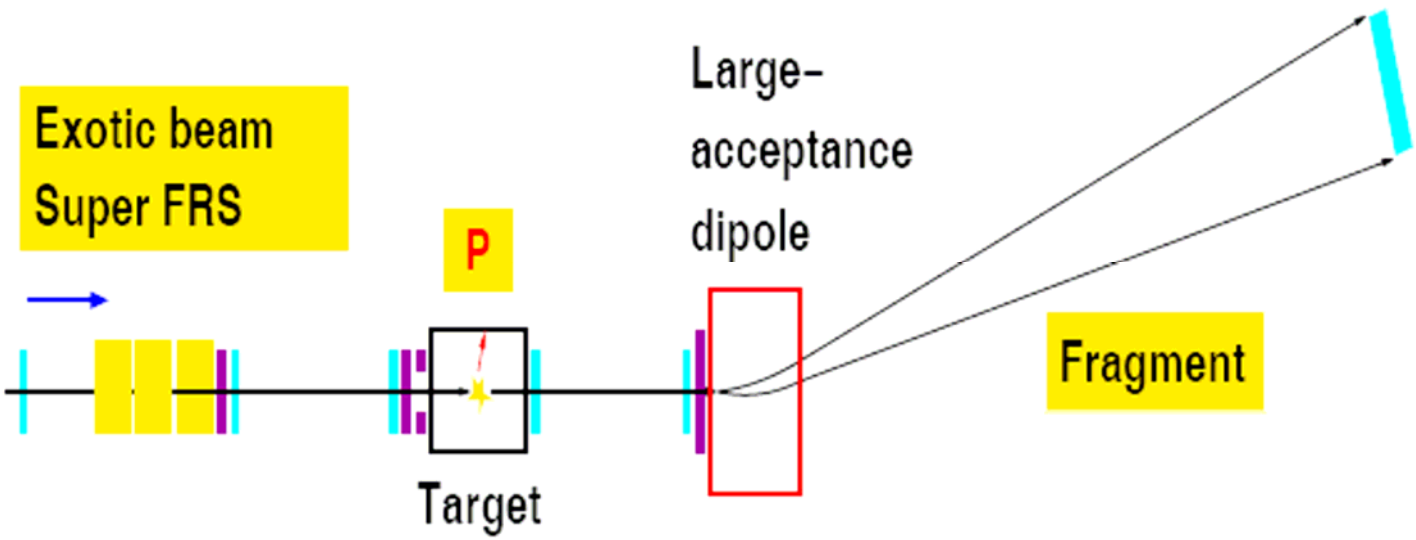


1. GASSIPLEX 32 channel board under test.
2. MAXIM Flash ADC evaluation board with Virtex2 FPGA for readout conversion, and GASSIPLEX control
3. Parallel connection between the two FPGAs
4. Virtex2Pro development board on loan from RAL with link to PC via Ethernet.

Current Test setup

Patrick Coleman-Smith
Daresbury Laboratory

ACTAR at R3B



Preliminary study of $^{132}Sn(p,p)^{132}Sn$ at 700 A.MeV

- report by F. Aksouh, GSI, September 2006

Needs for ACTAR

- Need to check the gain and dynamic range
- Shaping time – drift time of H2 might be too long for high pressure. Limitation approx 2μsec.
- Need to have a post doc for 12 to 18 months.
- ACTAR test set-up option ~October-November 2007
  - Order immediately?