

AIDA 8.5.3: GIF++ User Infrastructure

Introduction and beam tracker implementation

D.Boscherini, G.Mikenberg



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GLF++ Specifications

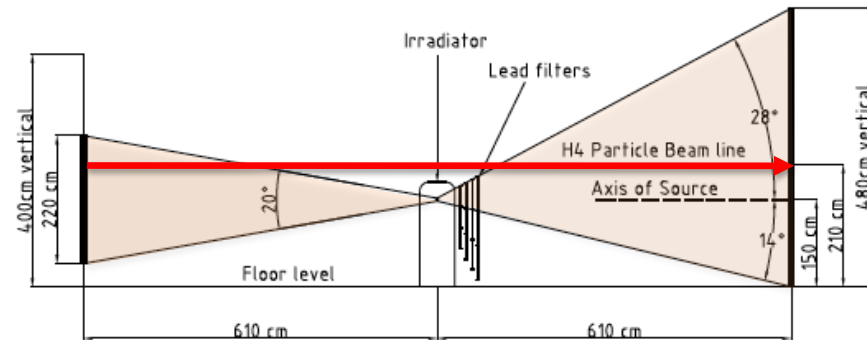
- **Source**

- ^{137}Cs , ~7-10 TBq
- Up to ~2 Gy/h at a distance of 50 cm
- 662 keV photons
- 30 y isotope half-life

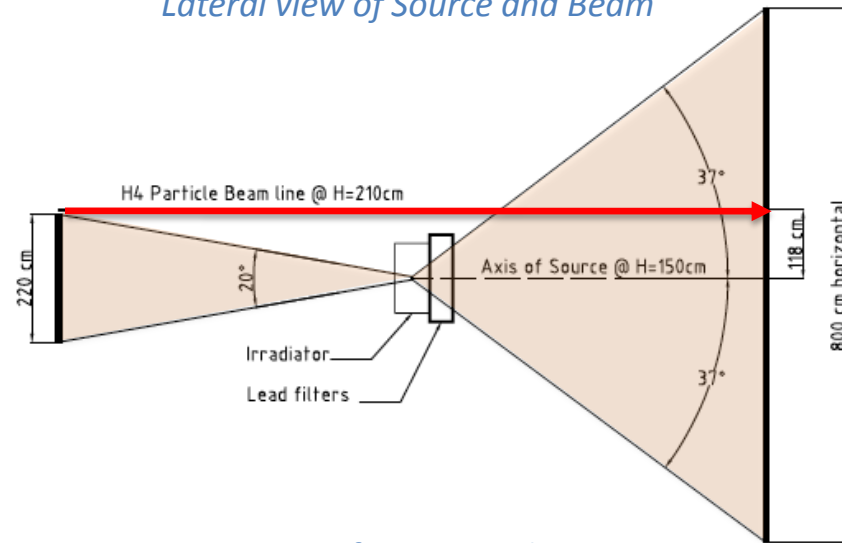
Max. expected doses at sLHC	Equivalent time at GIF++ (~ 50 cm from source)
Si-trackers: ~ MGy/y	>> years
Calorimeters: ~ 20 kGy/y	< 1 year
Muon systems: ~ 0.1 Gy/y	~ minutes

- **Particle Beam**

- EHN1 location in the SPS H4 beam
- 100 GeV muons
- 10^4 particles per spill traversing 10×10 cm²
- available ~6-8 weeks/y (in 2-week periods)



Lateral view of Source and Beam



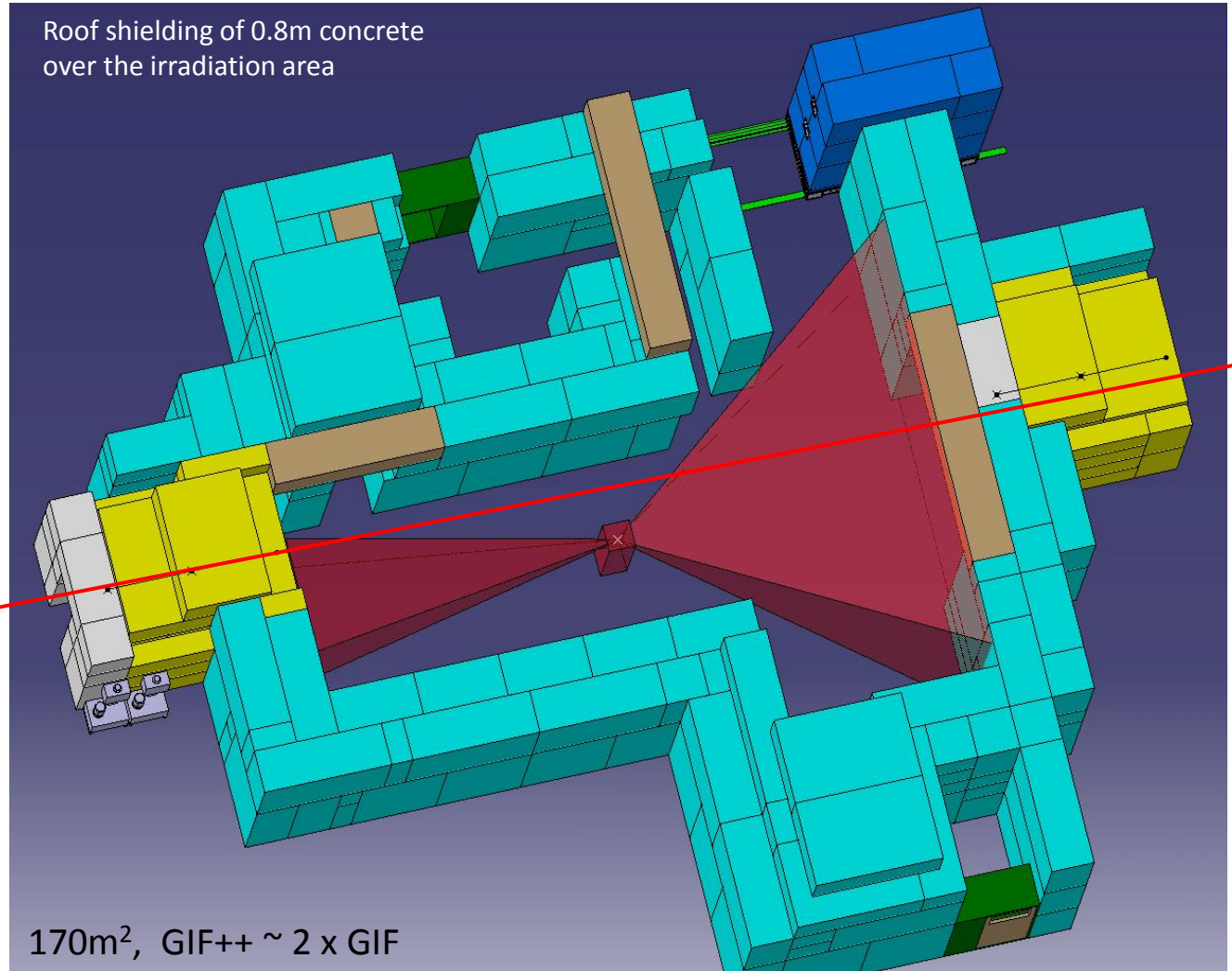
Top view of Source and Beam

GIF++ Bunker

Roof shielding of 0.8m concrete
over the irradiation area

100 GeV Muon beam
 10^4 /spill in $10 \times 10 \text{ cm}^2$

170 m^2 , GIF++ $\sim 2 \times$ GIF



Project items

- ☐ Precise muon tracking set-up
- ☐ Large area cosmic ray set-up
- ☐ Detector Control System
- ☐ DAQ
- ☐ System for active gamma dose measurements
- ☐ System of environmental sensors

Involved institutes

- *Bulgaria:* INRNE
- *Greece:* NTUA, AUTH, Demokritos, NCUA
- *Israel:* Weizmann, Technion
- *Italy:* INFN-Bari, -Bologna, -LNF, -Naples, -Rome2

AIDA 8.5.3	Item	Sub-item	Institute in charge	Responsible	Comment
	Cosmic ray set-up	Detector	INFN-BO INFN-RM2	G.Aielli	
		Front-end electronics	INFN-RM2	R.Cardarelli	
		Power-supplies + cables	INFN-NA INRNE	S.Buontempo	LV -> INFN-NA HV -> INRNE
		Gas system	INFN-BA INFN-LNF	S.Bianco	
		DCS	INFN-BO INFN-RM2	A.Polini	
		Readout electronics / DAQ	?	?	MPI contacted
	Beam monitor set-up	Detector + mechanics + cables	Weizmann	G.Mikenberg	
		Front-end electronics	Technion Weizmann	S.Tarem	
		Gas system	Technion Weizmann	G.Mikenberg	
		DCS	Technion	S.Tarem	
		Readout electronics / DAQ	Technion weizmann	?	Tel-Aviv to be contacted
DCS			INFN-BO INFN-RM2 NTUA	A.Polini	
DAQ			NTUA + ?	?	Need manpower!
Environmental sensors			INFN-LNF INFN-NA	S.Bianco	
Radiation sensors			INFN-BA INRNE	P.laydjiev	

Project deadlines

1 milestone (M8.5.3):

Design of GIF++ infrastructure

via Activity Report

18 months -> end of July 2012

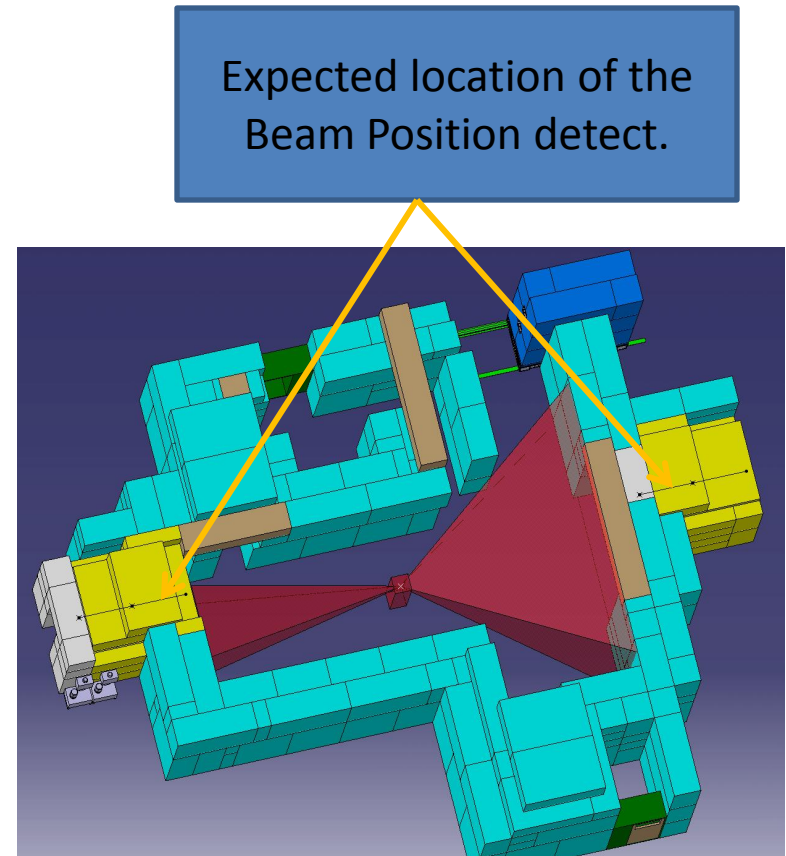
1 deliverable (D8.5.3):

GIF++ Infrastructure commissioning and utilization

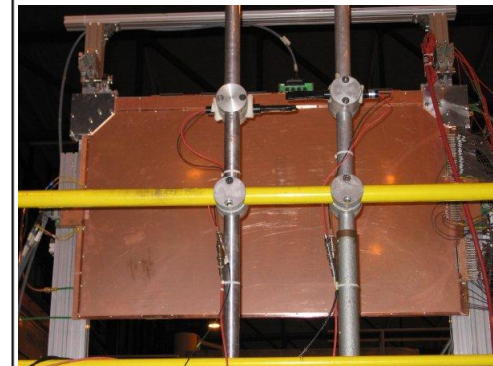
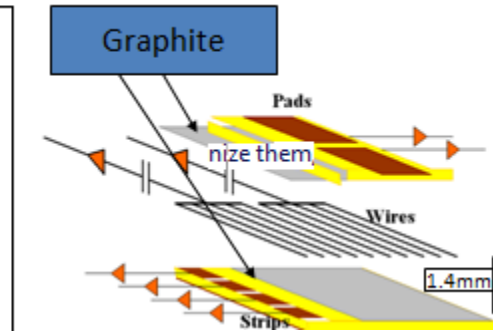
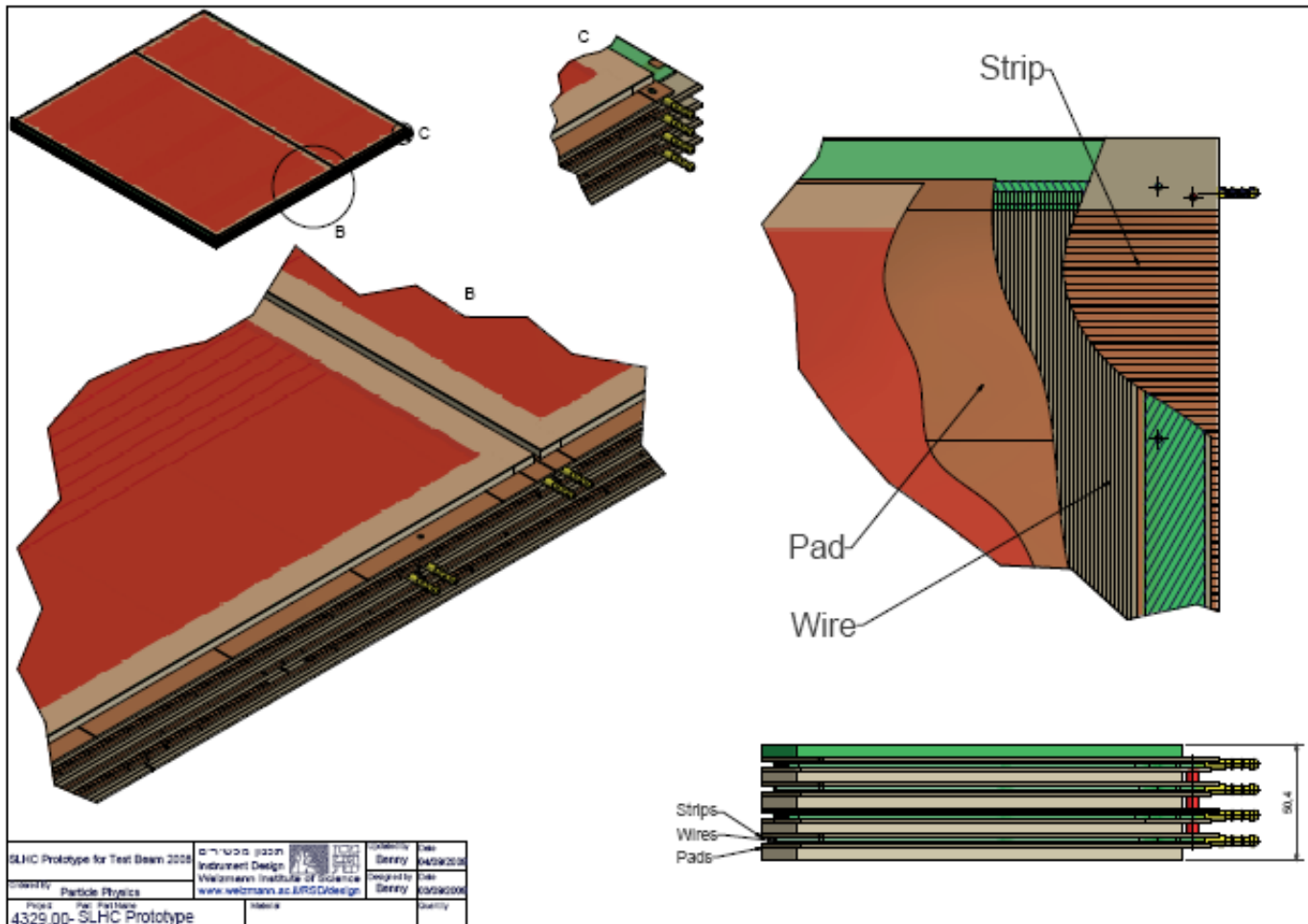
44 months

Beam Tracker detectors for GIF++

- 2 Quadruplets were constructed
- They were tested in H8
- Their position and angular resolution were determined by comparing with a small tube MDT
- Achieved resolutions.
- Conclusions.



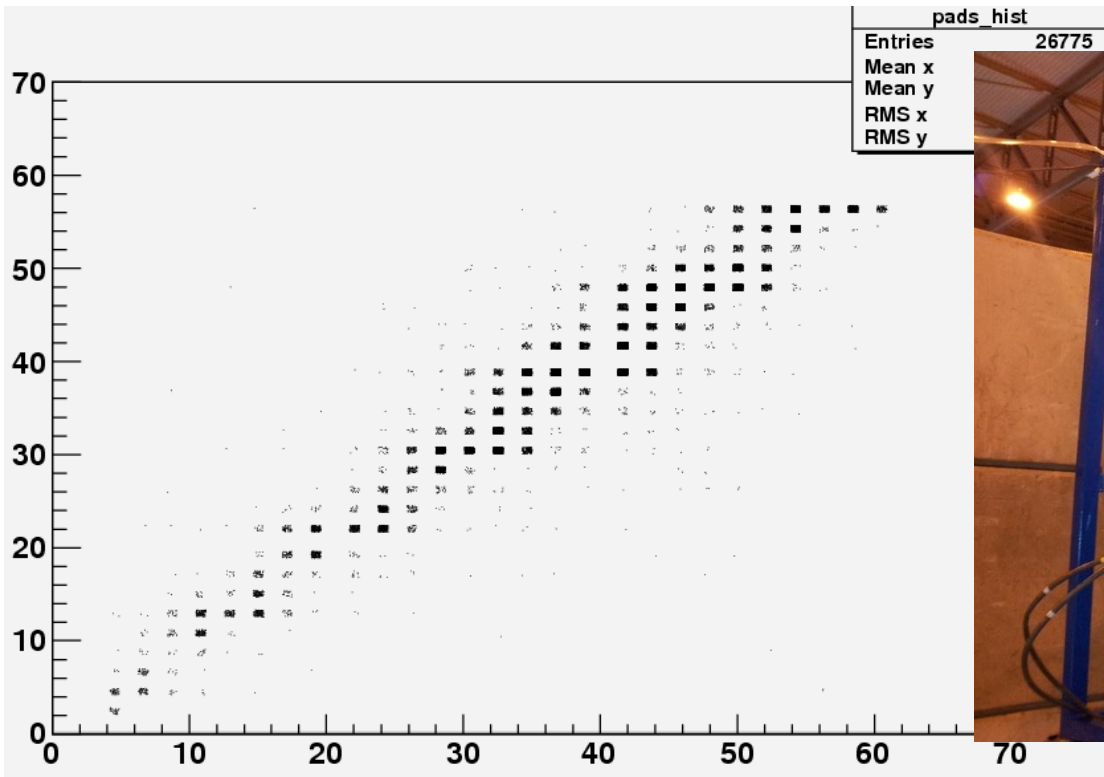
2 Quadruplets were constructed ($60 \times 40 \text{ cm}^2$) with strip, wires and pads in each gap



Combined pad with digital info from strip for trigger

- Proposed arrangement of individual gaps, showing the strips, wires and pads, as well as the staggering of layers.
- One multilayer of 4 gas gaps fits into 50mm.

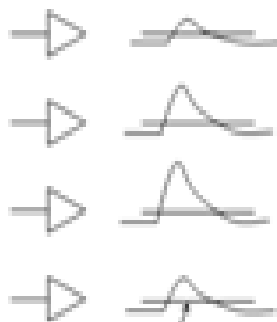
August 2011 Test beam with sMDT sandwiched with 2 sTGC packages



- Pads are very nicely correlated as a position measurement device.

Signal from strips

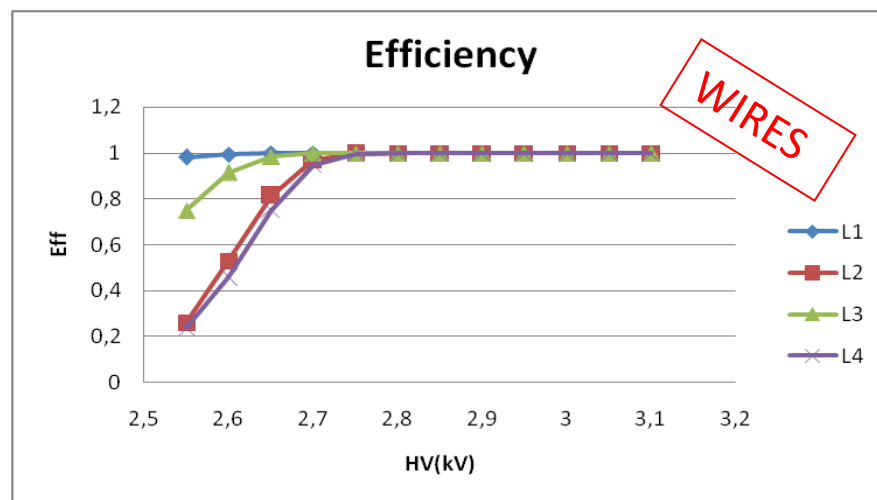
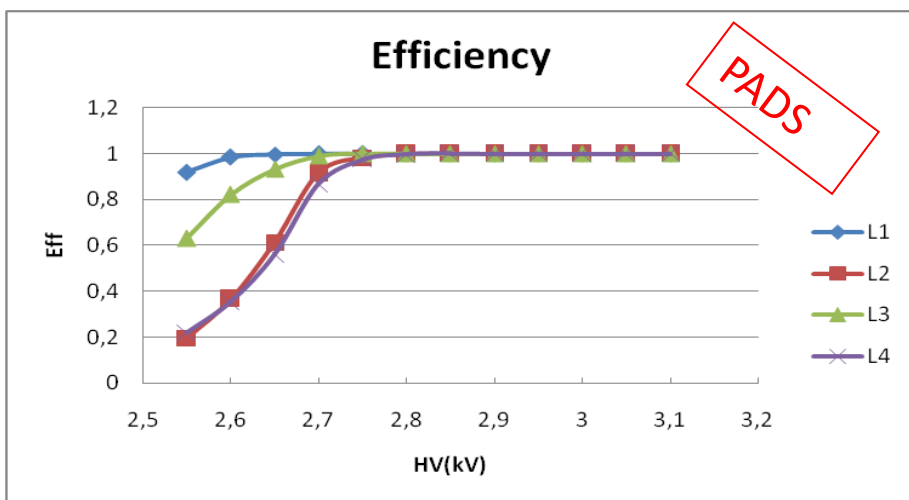
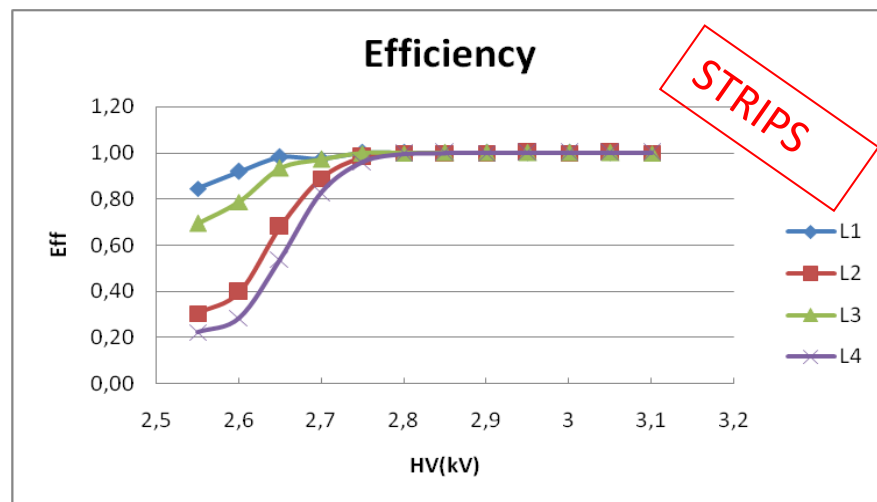
Analog



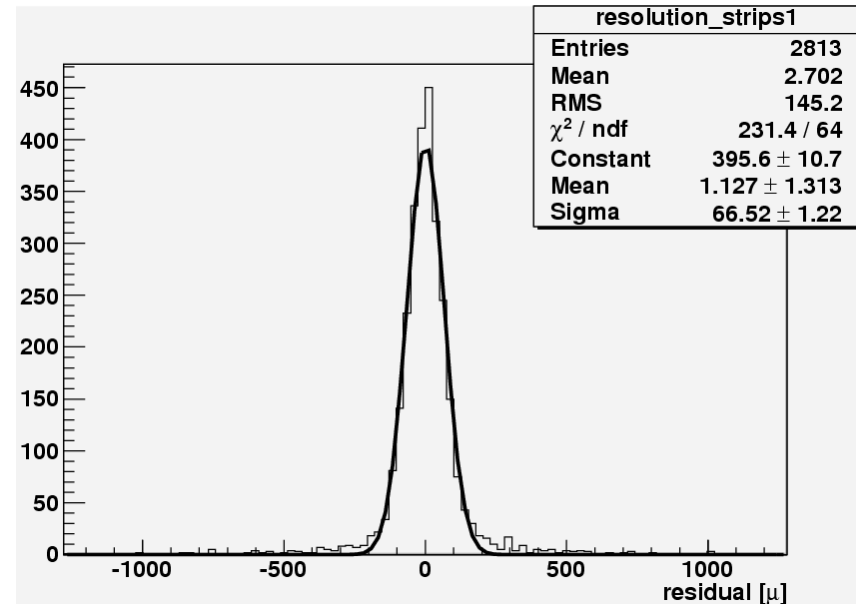
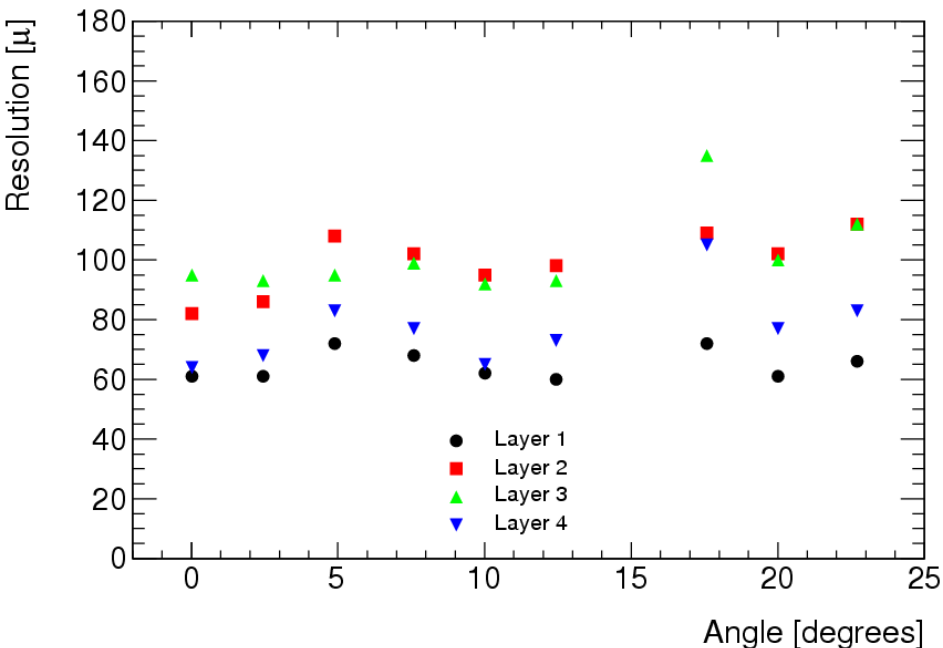
Threshold

Improve strip capacitance to allow for the use of Time-Over-Threshold measurement of charge

For each layer we select good triggers: demand that all other layers work well in proper start-stop window and have exactly one cluster. Then we look if we see anything in the tested layer

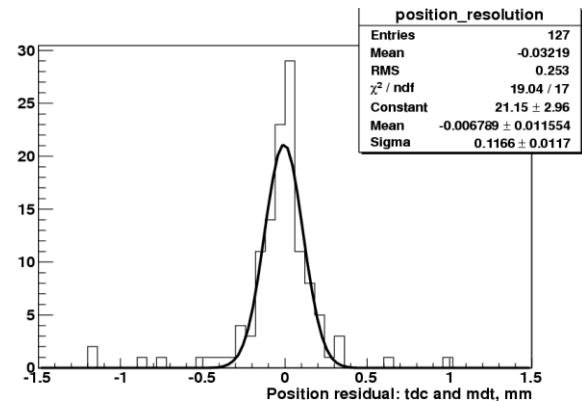
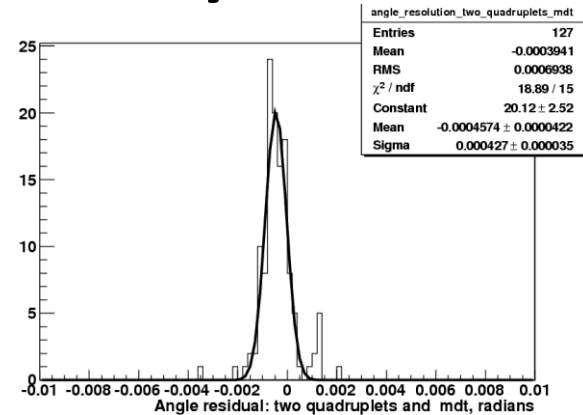
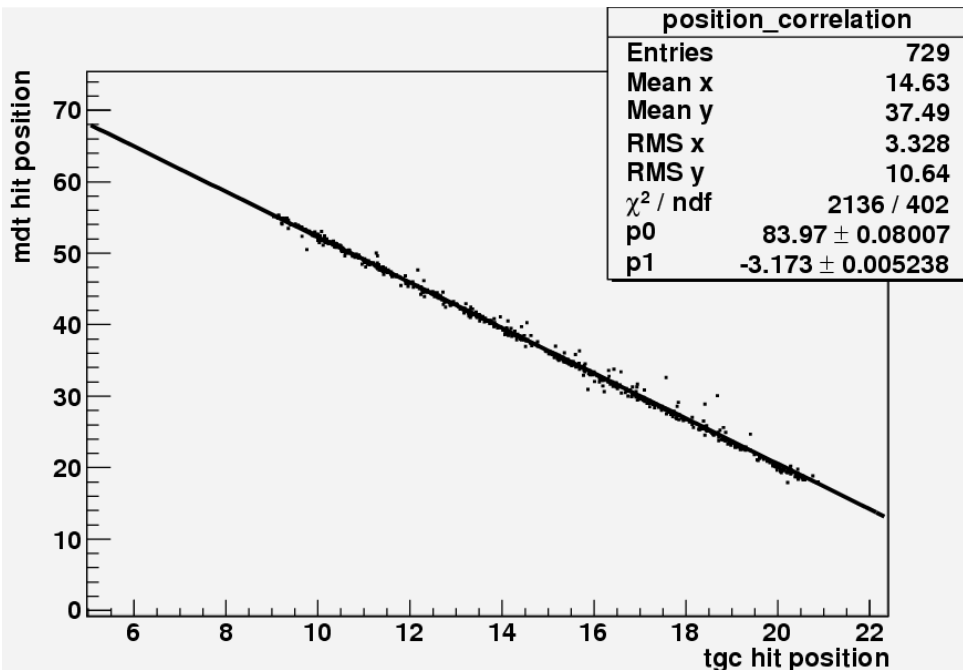


Very small resolution dependence on angle



- Measurement based on taking 3 layers to calculate the position of the 4th.

August 2011 Preliminary results



- Angular resolution $0.43/\sqrt{2}=0.3\text{mRad}$
- Position resolution $0.117/\sqrt{2}=0.082\text{mm}$

Conclusions

- The detectors to be used as a position monitor system for GIF++ have been constructed.
- Their expected angular and position resolution has been confirmed in test beam.
- The electronics to equipped the full detectors are being developed.

Beam tracker