

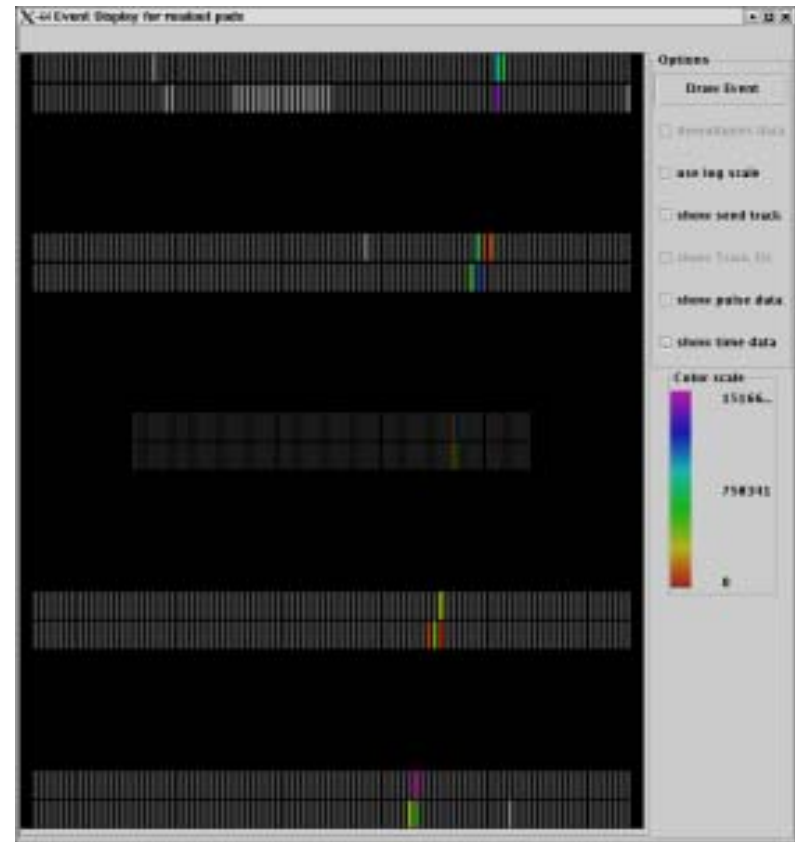


Results from a Micromegas TPC Cosmic Ray Test

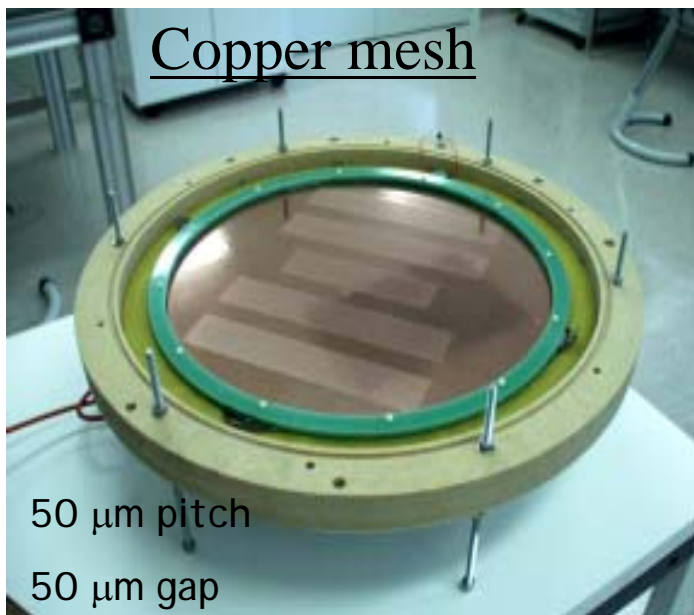
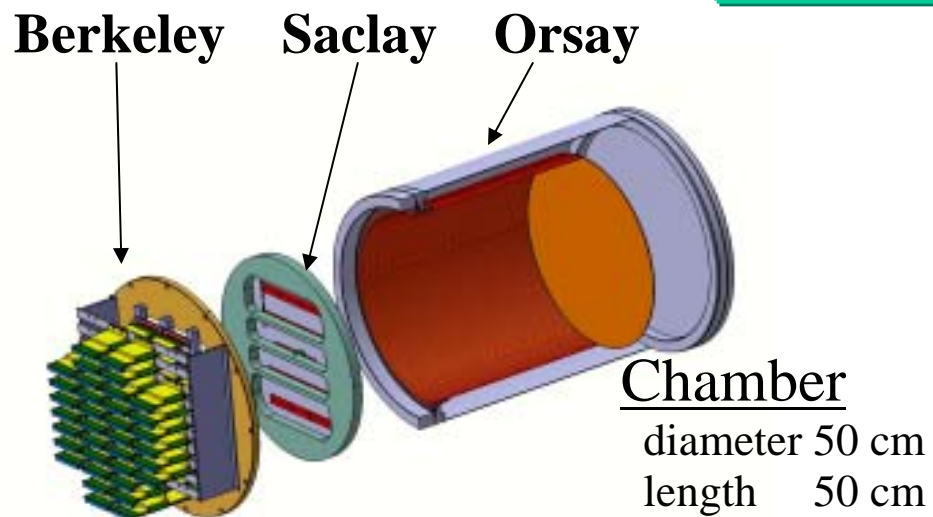
Berkeley-Orsay-Saclay Progress Report

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1) LBNL Berkeley, 2) Carleton Univ., 3) IPN Orsay, 4) LAL Orsay, 5) DAPNI A Saclay

- Reminder: the Berkeley-Orsay-Saclay cosmic setup
- News since the Paris LCWS04 : cosmic ray data taking
- Preliminary results
- First MC studies
- Future plans



The setup



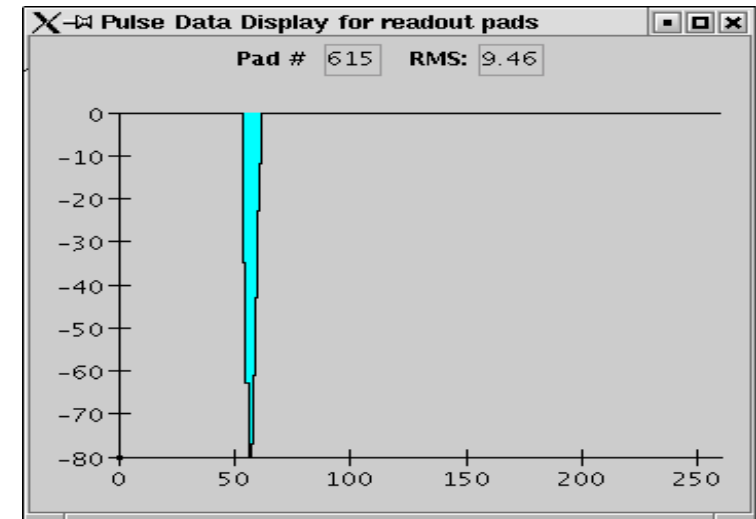
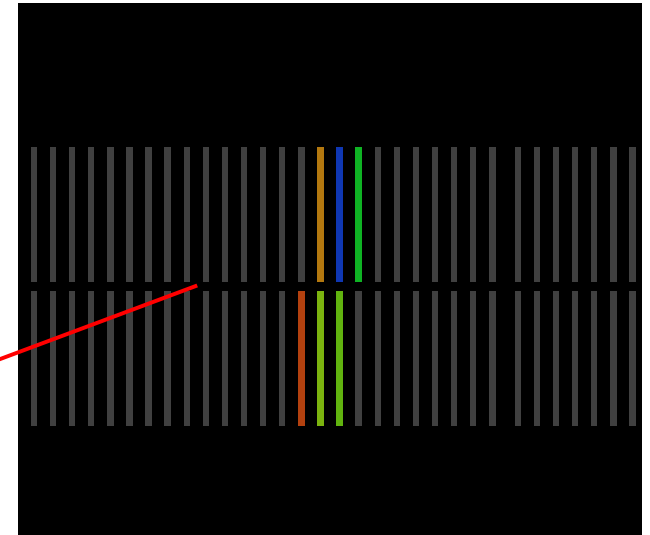
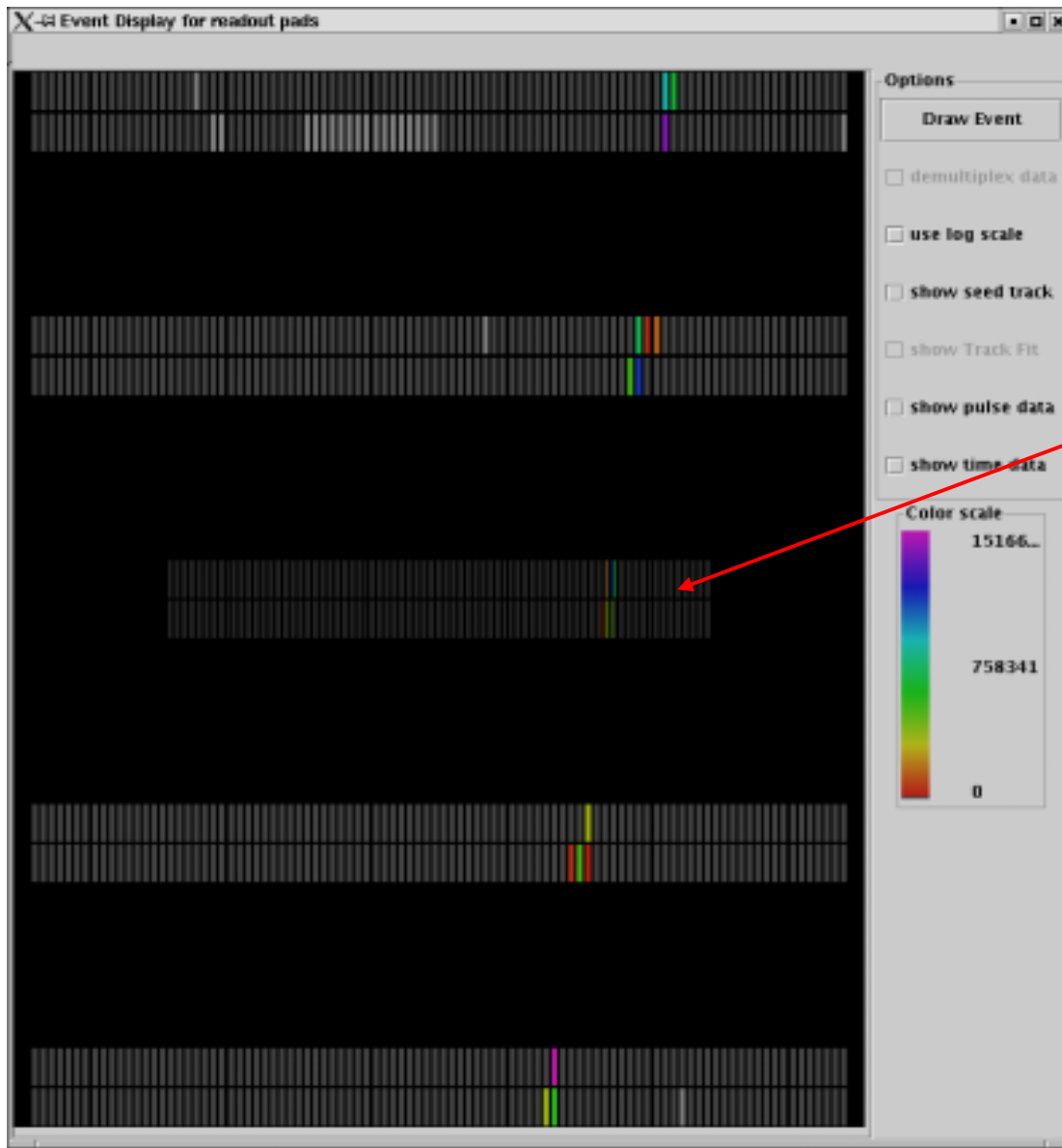
DAQ speeded up by a factor 20 in
May 2004

Trigger improved : 20/min 67% eff.

Online event display

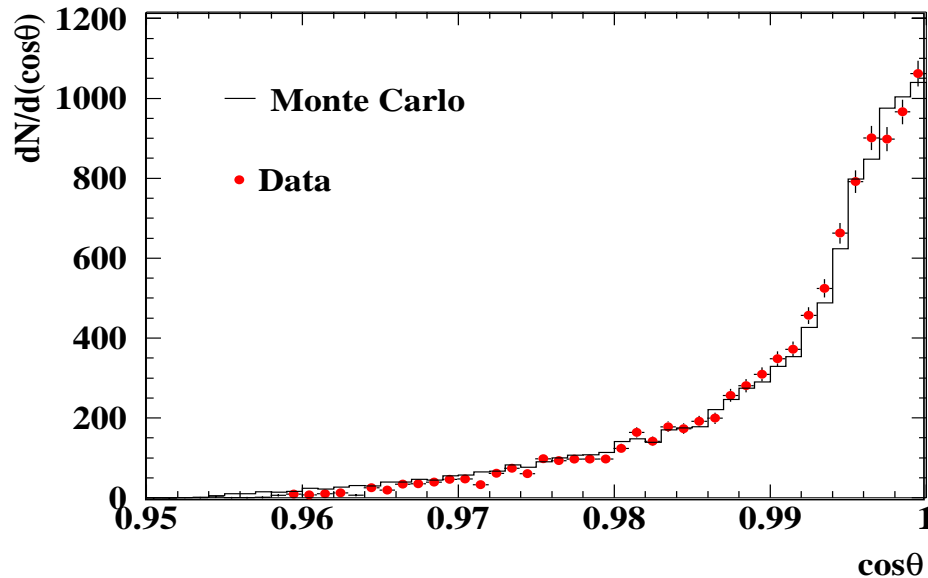
(software from D. Karlen, adapted by M. Ronan)

Rows 4 & 5

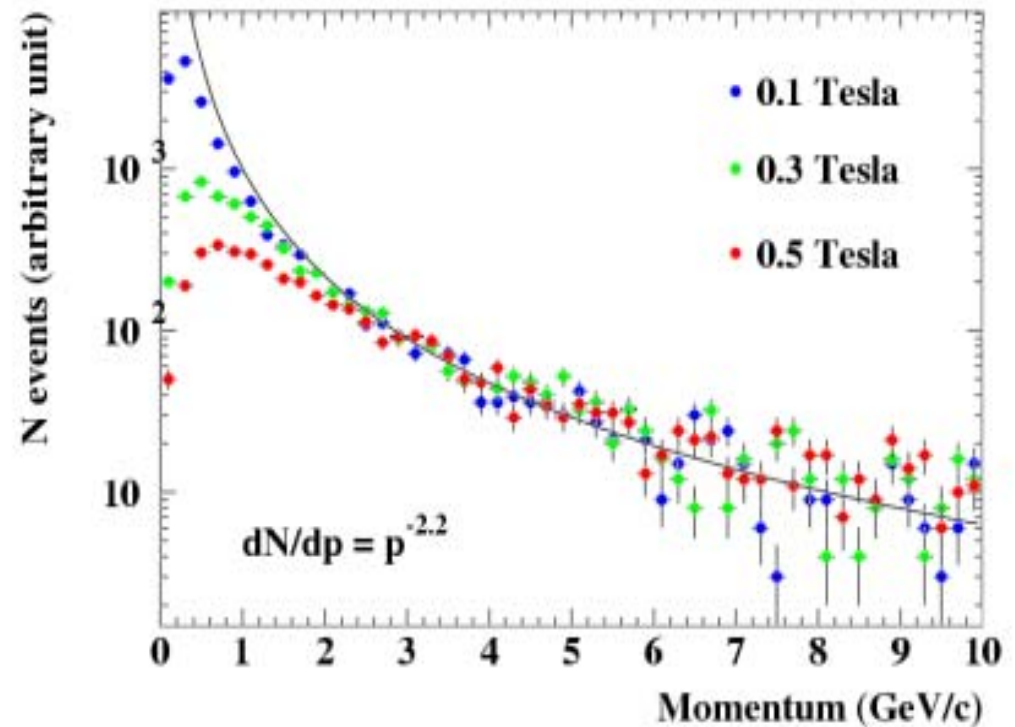


Data

150 000 cosmic tracks recorded
at magnetic fields of
0.1, 0.3, 0.5, 0.7, 1, 1.5 & 2 tesla
with
Ar-CF4:3%, Ar-CH4:10%(P10),
Ar-Isobutane:5% and some TDR
gas data.



Momentum distribution in Ar + 5% Iso data



Trigger simulation shows good understanding of angular distribution.

Track reconstruction

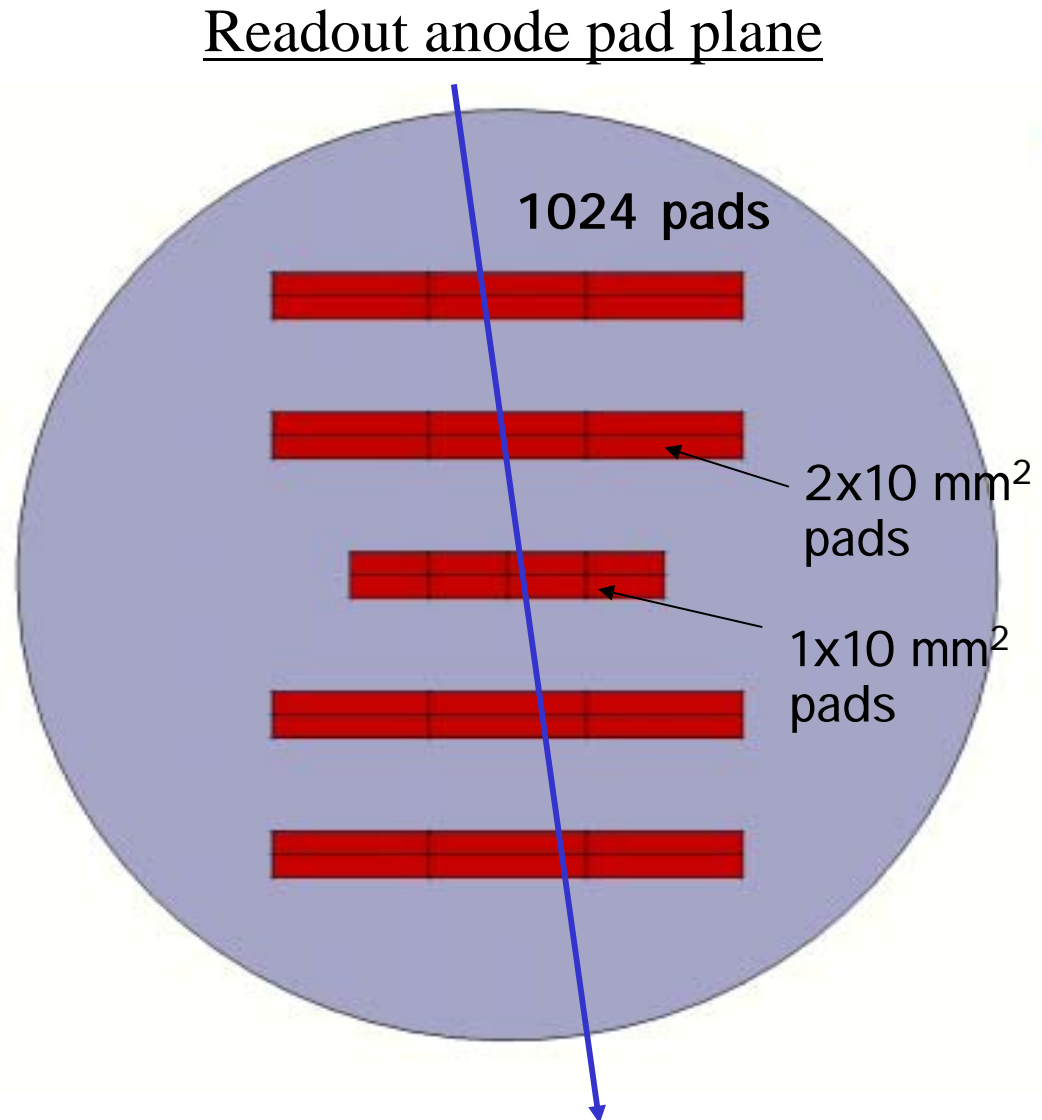
Subtract pedestals, using the first 15 time buckets + 15 after the chamber end

Max-likelihood fit the distribution of the number of electrons per pad with 4 parameters :

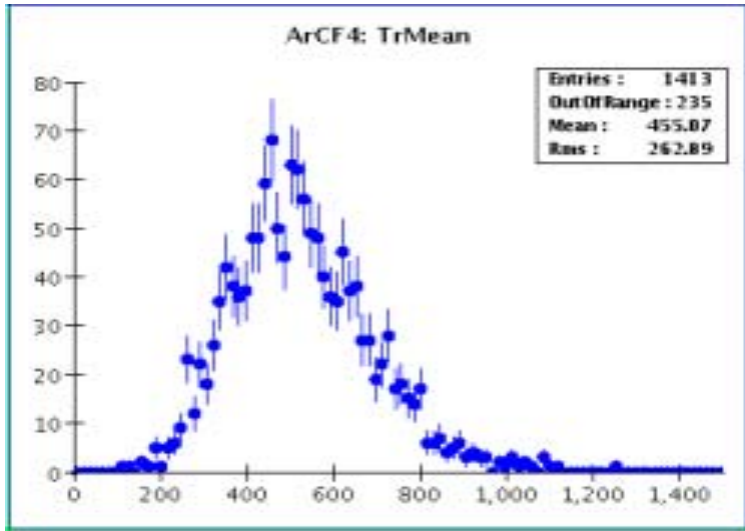
$(x_0, \phi, 1/R, \sigma)$

σ is the track width

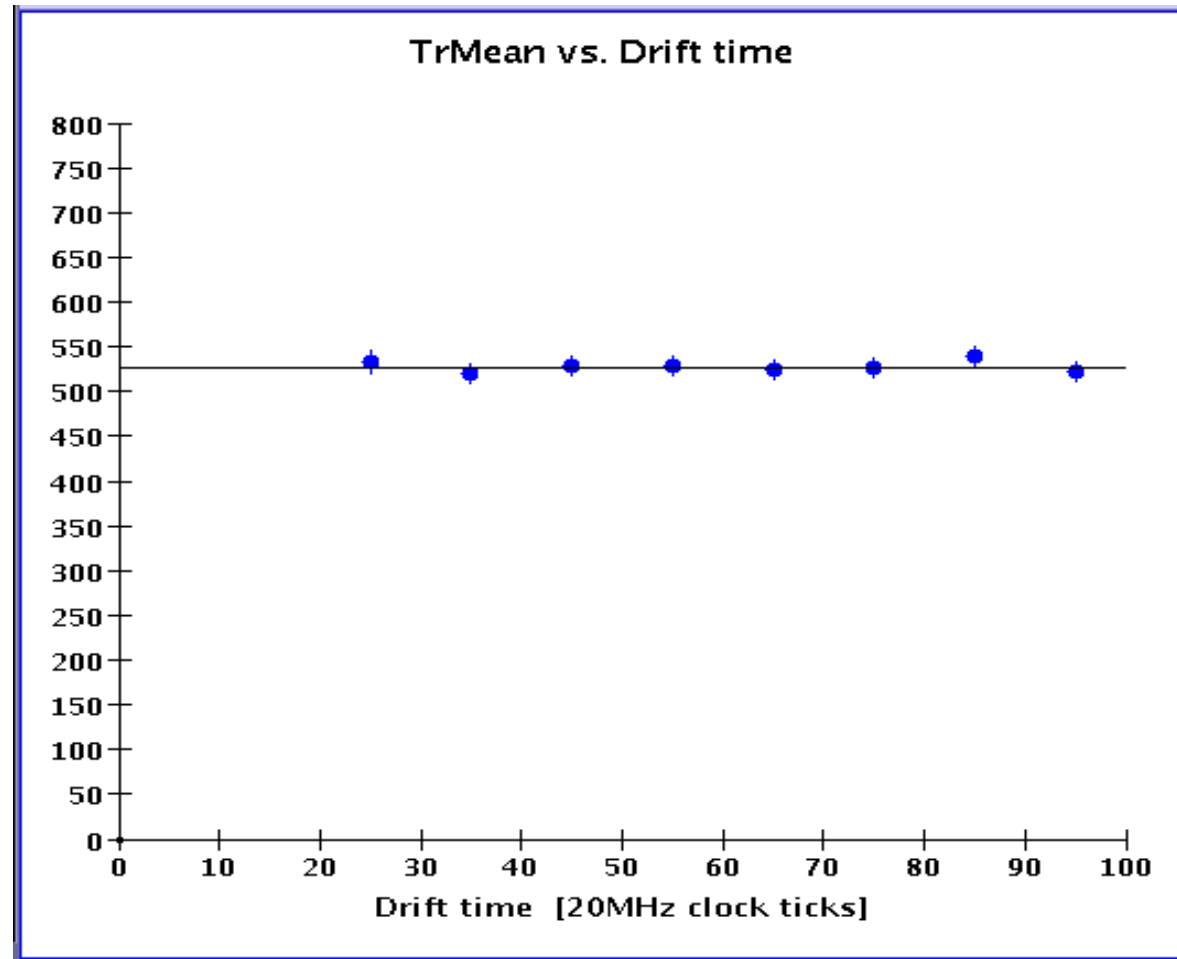
2 programs: one by D. Karlen, adapted by M. Ronan, in [Java](#), and one by K. Sachs in [F95](#), adapted by P.C. and T. Zerguerras.



Attenuation in Ar+3% CF₄



Plot truncated mean energy deposition vs drift distance, and fit an exp. dependence

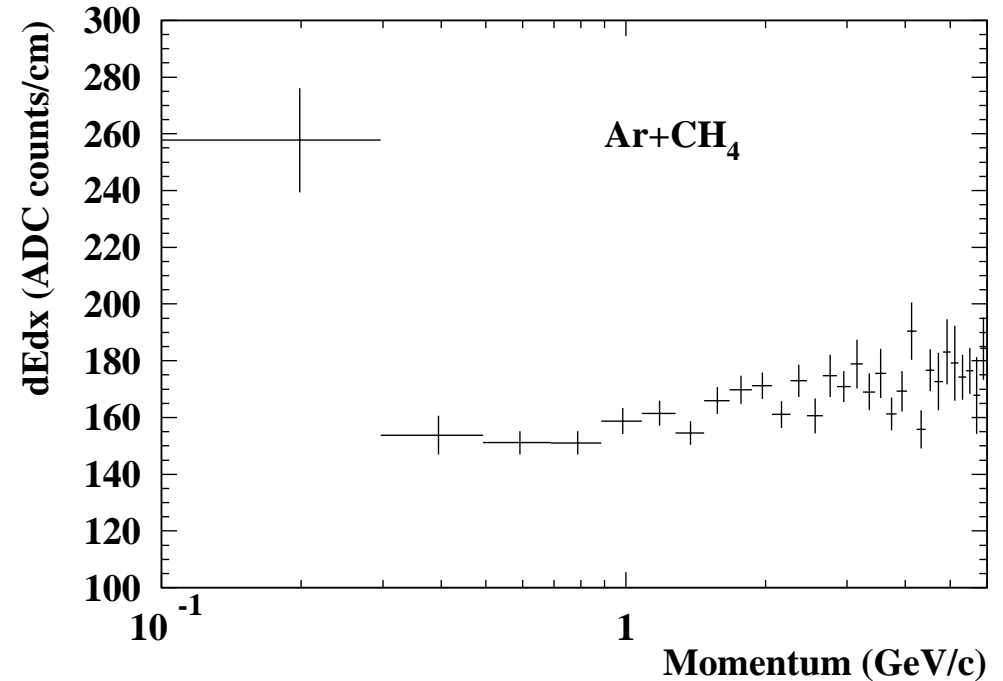


attenuation length in ArCF₄ > 440 cm at 90% C.L.

dE/dx measurement

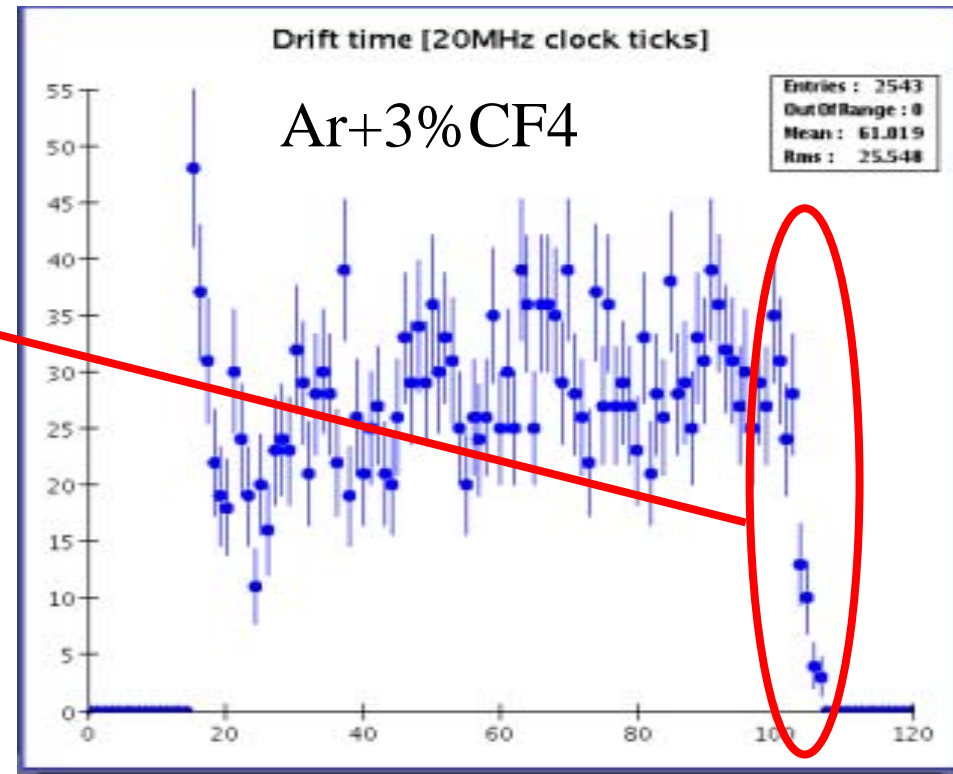
Plot average truncated mean vs momentum for our cosmic tracks:

Bethe-Bloch curve clearly visible, with the relativistic rise and the $1/\beta^2$ fall-off



Drift velocity measurements

Select tracks near the far end.
 Look at the time at which they exit the chamber. Add offset 200±100 ns (trigger delay)
 Divide by the length (47.9 cm)

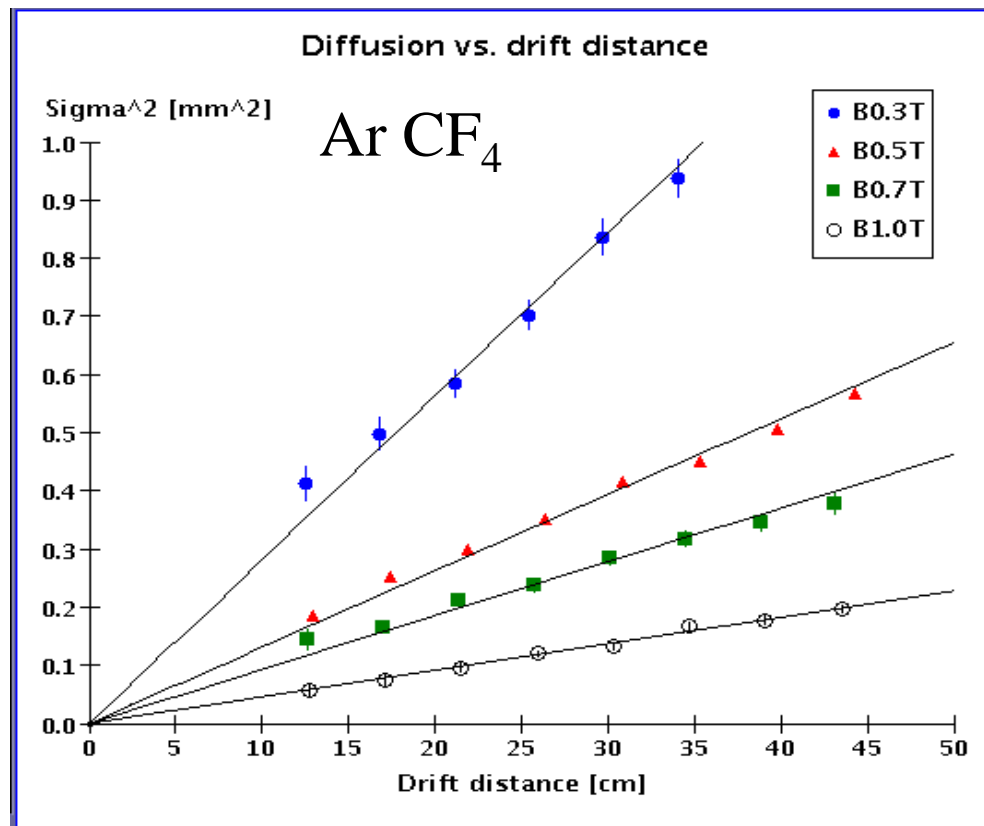
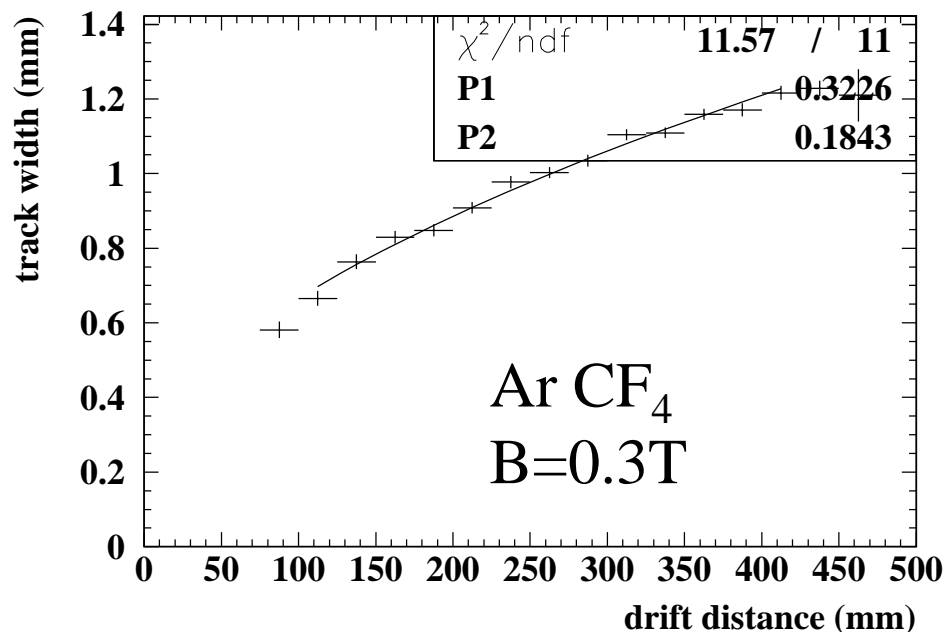


Excellent agreement
 with Magboltz
 (S. Biaggi, 2004)
 within 2% accuracy!

Gas mixture	E drift (V/cm)	V_{drift} (cm/ μs)	Magboltz
Ar+5%iso	210	4.24±0.08	4.17
P10	66	4.43±0.07	4.46
P10	150	5.61±0.09	5.50
Ar+3%CF ₄	200	8.8±0.2	8.51

Transverse diffusion measurements

$$\text{Fit } \sigma = \sqrt{(\sigma_0^2 + D_T^2 z)}$$

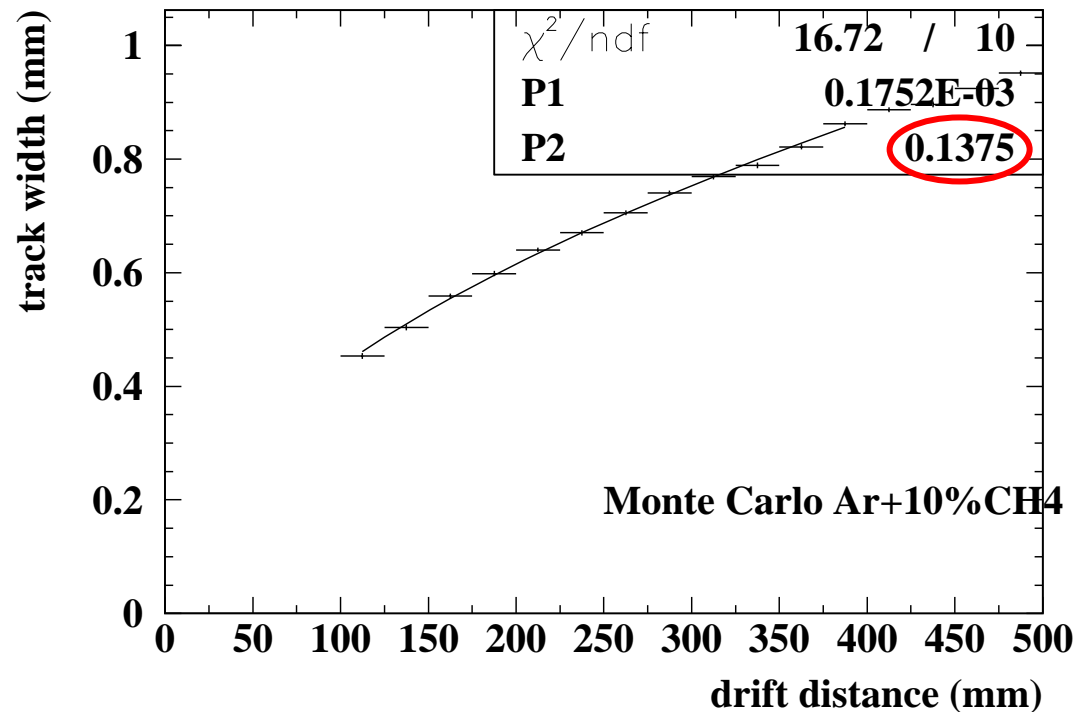


Transverse diffusion Monte Carlo

Check with MC:

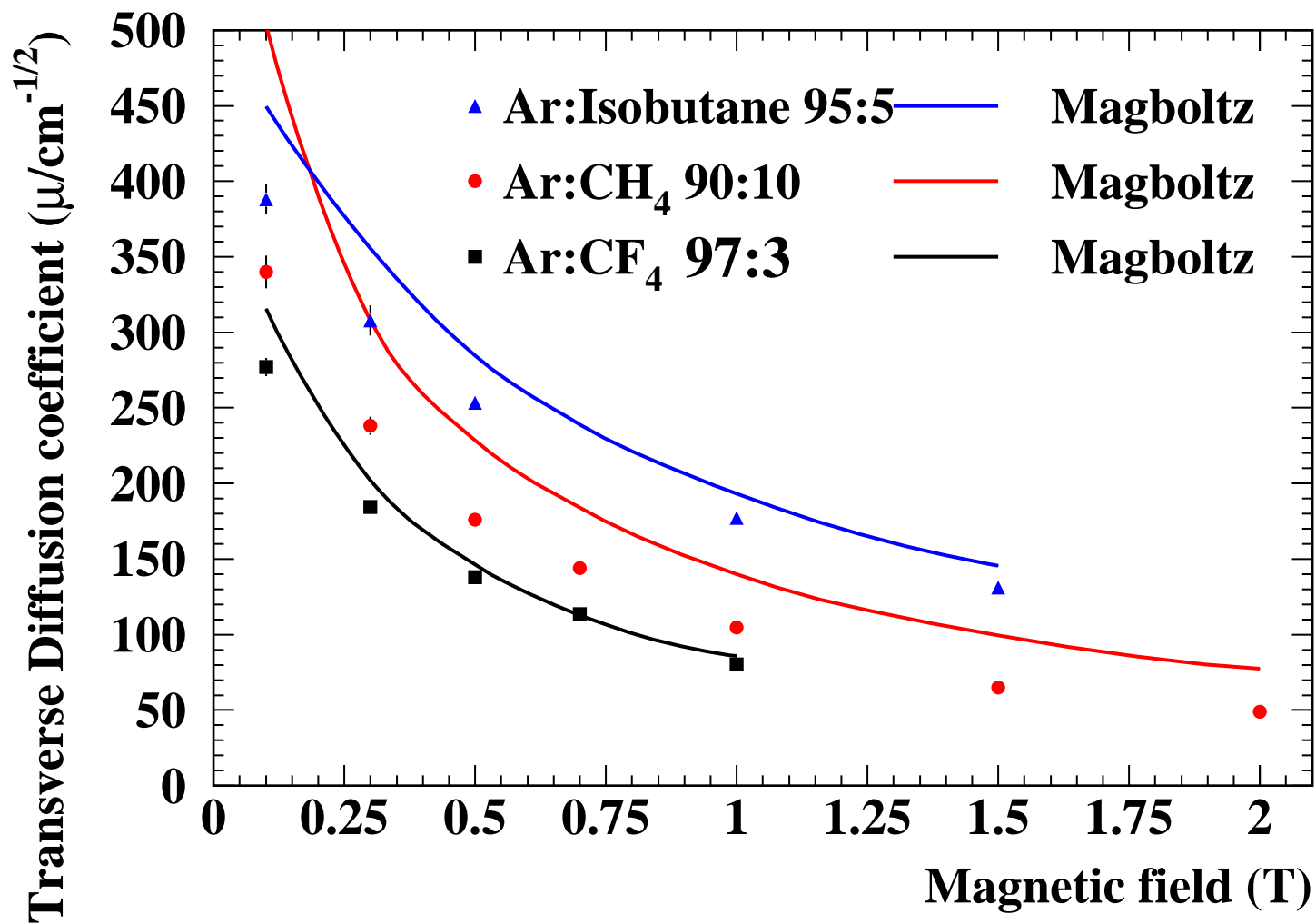
input $140 \mu\text{m}/\sqrt{\text{cm}}$

Fit $137.5 \pm 1.0 \mu\text{m}/\sqrt{\text{cm}}$



Transverse diffusion Results

PRELIMINARY



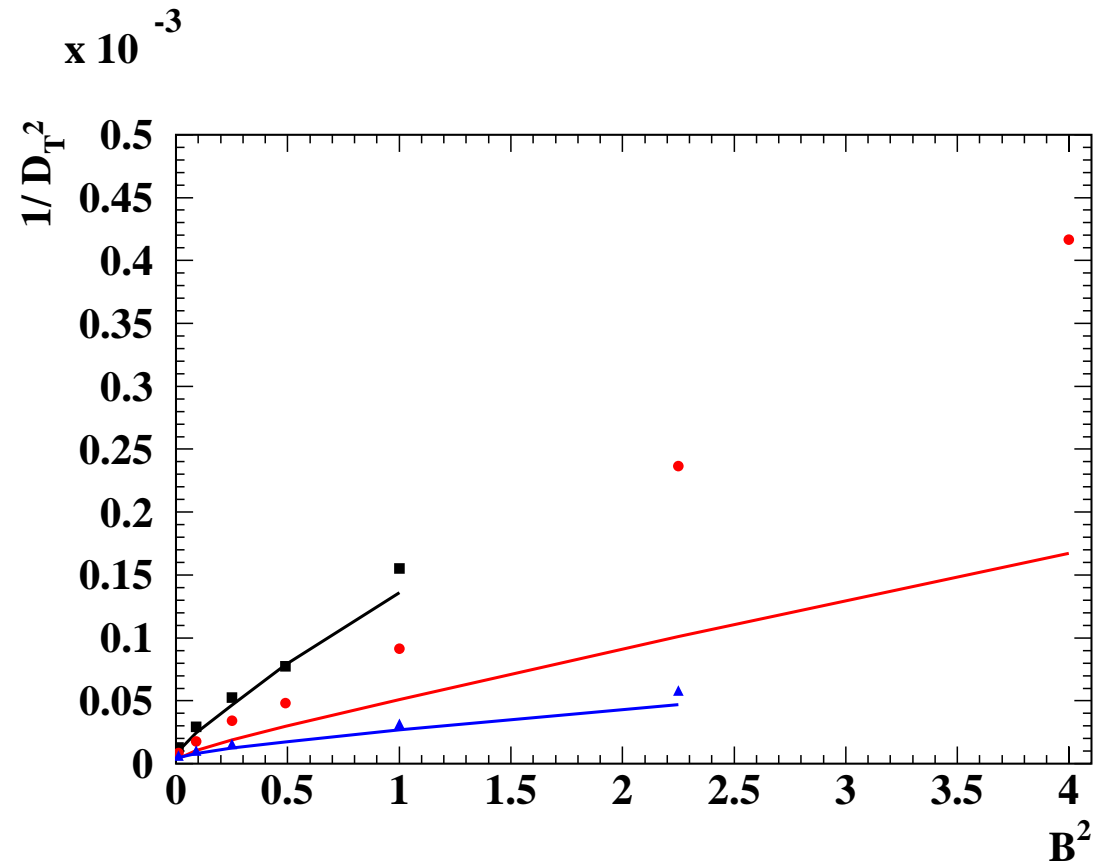
Transverse diffusion Results

Expect

$$D_T = D_T(B=0) / \sqrt{1 + \omega^2 \tau^2}$$

Plot $1/D_T^2$ vs B^2

Find good agreement
for ArI sobutane and
ArCF₄, but factor of 2
in $\omega^2 \tau^2 / B^2 D_T^2(0)$ for
P10.

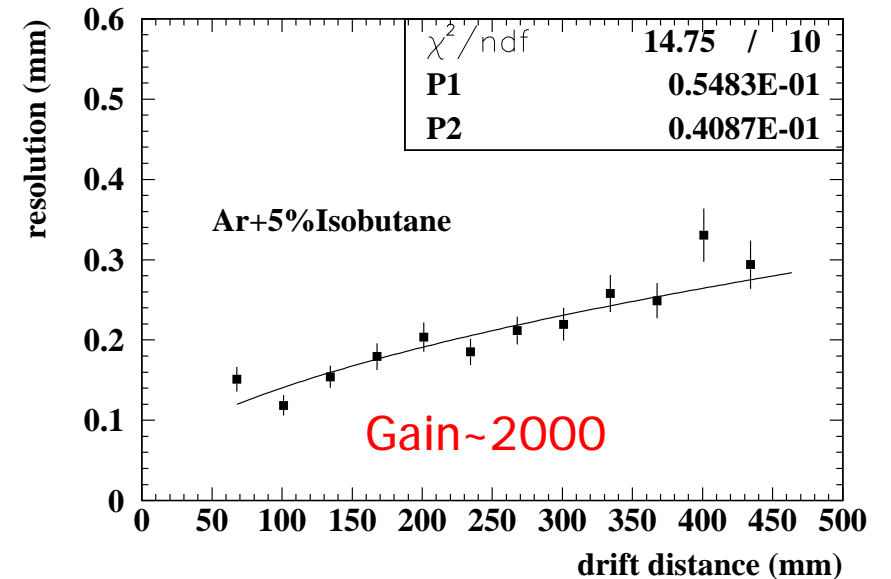
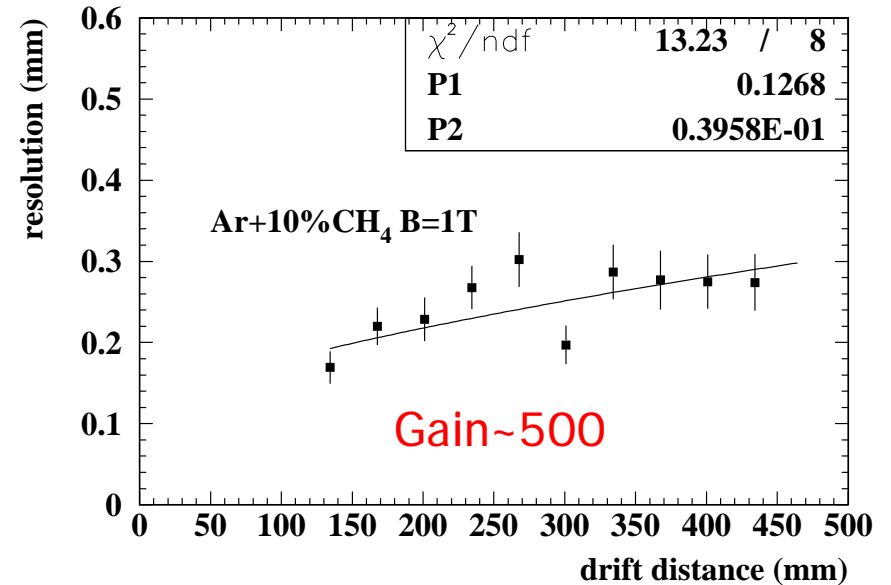


Resolution studies

Fit residuals distribution with all lines in the track fit, and with all except one. The point resolution is $\sigma_{\text{point}} = \sqrt{(\sigma_{\text{with}})^2 + (\sigma_{\text{wout}})^2}$.

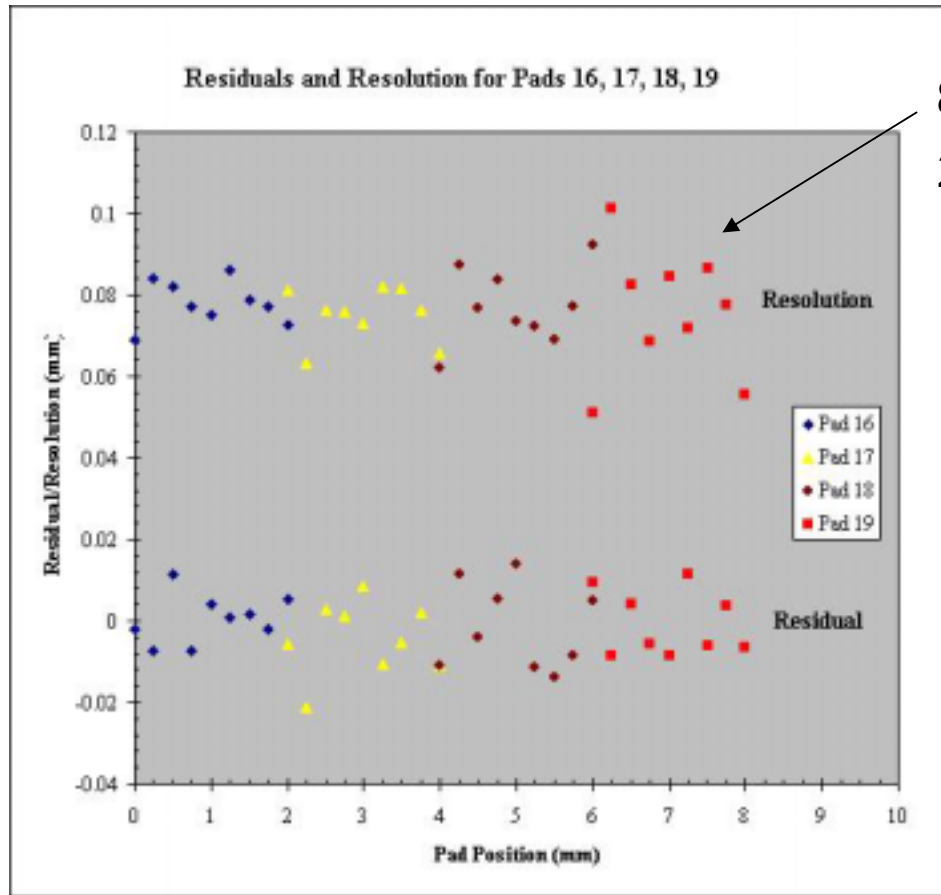
Plot σ_{point} vs z : observe resolutions about 100 μm and variation with z due to diffusion

Resistive foil probably needed to obtain the full resolution that Micromegas can yield.



Resolution studies

Results obtained at Carleton with M. Dixit et al. (see next talk) using 4.5 keV X-rays



80μ resol. with 2mm pads

Being reproduced with a photo-electron laser source at IPN Orsay



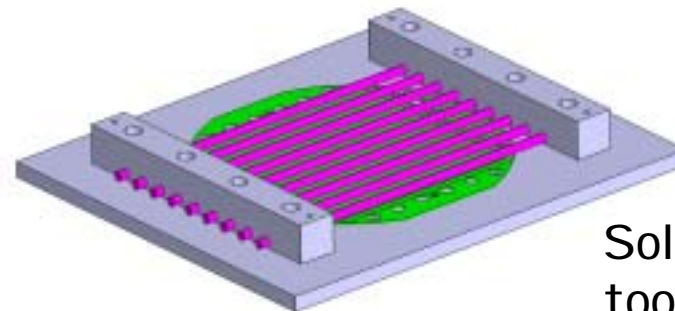
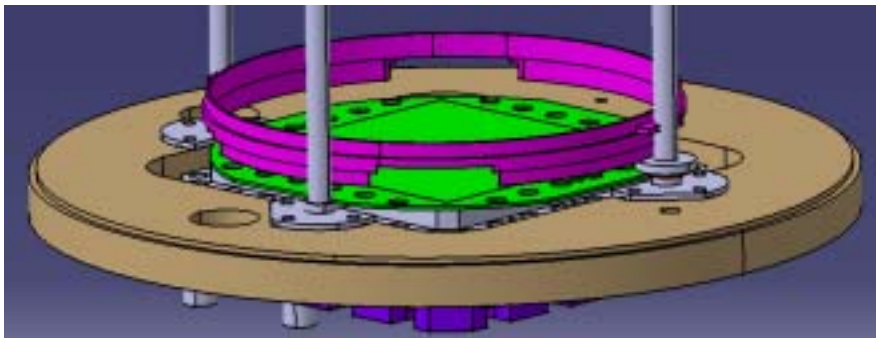
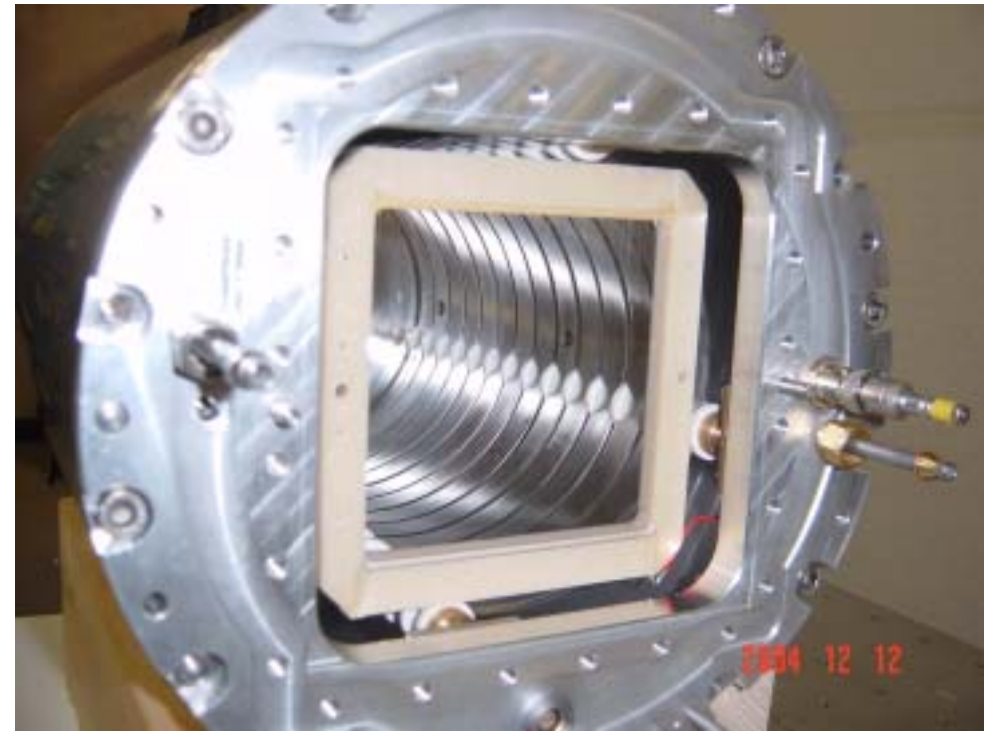
MPI -KEK beam test in preparation

Field cage

(With R. Settles, T. Matsuda, A. Sugiyama et al., M. Dixit et al., Ph. Rosier, ...)

Detector PCB, mechanical adapter and mesh ready.

Soldering of RO connections in progress (380 wires).



Soldering tool

Conclusions

The Berkeley-Orsay Saclay Micromegas TPC has taken good data and is performing interesting measurements.

Monte Carlo is now available for the diffusion and resolution studies.

Bulk Micromegas now produced daily at Saclay. A new method for cutting bulks is developed.

Future plans include:

Perform beam tests in the MPI setup at KEK

Intensify electronics R&D