Panda Pavia 2008/09

Ricercatori:		%2009
Bendiscioli	PO	60
Rotondi	PO	60
Radici	1RIC	20
Boca	RU	30
Braghieri	RIC	50
Fontana	RIC	40
Montagna	RU	70
Salvini	RIC	20
Genova	ass.ric.	20
Lavezzi		0
Costanza	DOTT	100
Panzarasa	docente	(50)
Tot 2009		**4.7** FTE (5.2)

Assegnazioni 2008:

Miss.interne 6 k€ Miss.estere 17.5 k€

Consumo 3 k€ Inventariabile 3 k€

Situazione e aggiornamenti su:

FAIR
PANDA Collaborazione
PANDA Italia
PANDA Pavia:

- SW
  - simulazioni STT
  - track fitting STT/MVD
  - pattern recognition STT
- HW
  - test STT
  - studi HPGe in campo magn.

Tracking TDR – 2009→10

Tracciatore: opzione STT

- Primi studi e prototipo: Frascati (+Pavia)
- Nuova geometria (e realizzazione?): Julich
- Supporto meccanico: Frascati
- Simulazioni e test dE/dx: Pavia
- Ancora competizione con TPC…
- Technical Design Report per tutto il sistema di tracciamento

PANDA Tracking Group

Tracking Technical Design Report

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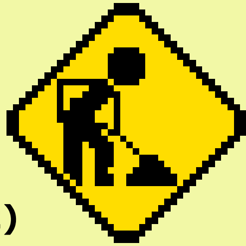

Software: contributo Pavia

STT: codice di simulazione e ricostruzione

- Simulazione singolo straw tube

  (Rotondi)

- Pattern Recognition

  (Boca)

- GEANE track follower e Kalman filter

  (Rotondi,Fontana, Genova, Lavezzi, Costanza)

  STT locale completato (2008) e superato in quanto inserito nel codice globale

STT+MVD: codice globale (GENFIT), test su STT

A Kalman filter has been developed in collaboration with the GSI and Munich groups: genfit, GENeric FITter, GEANE based.

- Studi di efficienza, risoluzione, valutazione parametri

  (Costanza, Lavezzi)

STT+MVD: Kalman filter

PANDA Report PV/01-09

Study of the Kalman filter performances with STT+MVD

S. Costanza and L. Lavezzi

A brief description of the code and the mathematics used in order to perform the fit procedure is described. A list of the results obtained so far from the application of this fitting procedure to the Straw Tube Tracker (STT) + Micro Vertex Detector (MVD) simulated points follows.

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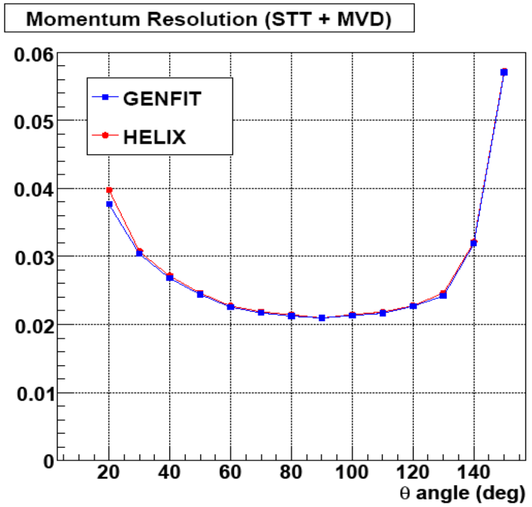
STT+MVD: Kalman filter

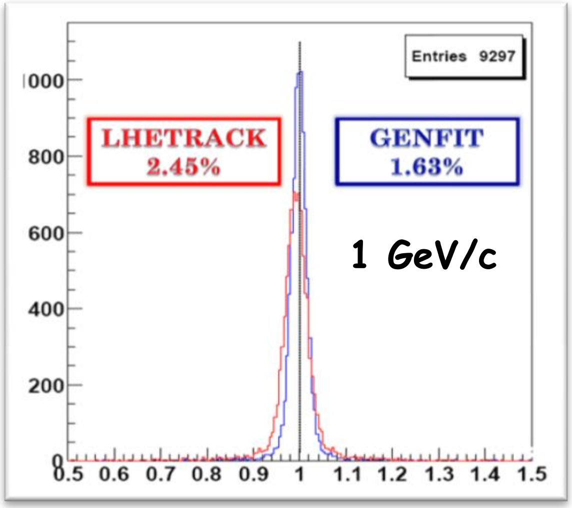


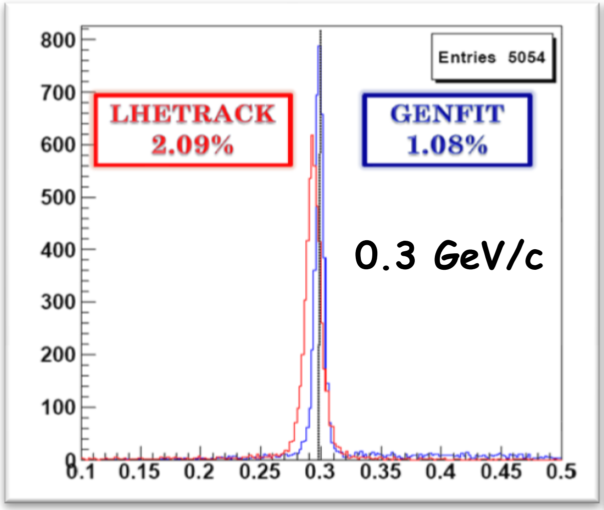
Tests performed in december 2008 showed no improvement with respect to by Kalman filter application to STT + MVD with respect to helix fit

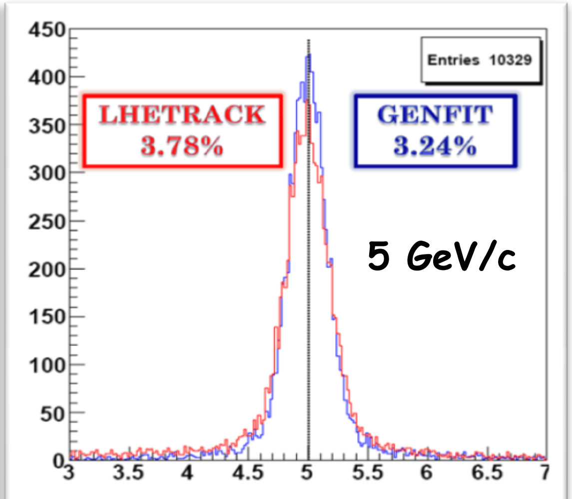
By changing:

- starting pos/mom errors;
- MVD and STT measured point coord. covariances
- Kalman filter planes orientation

we get these results:

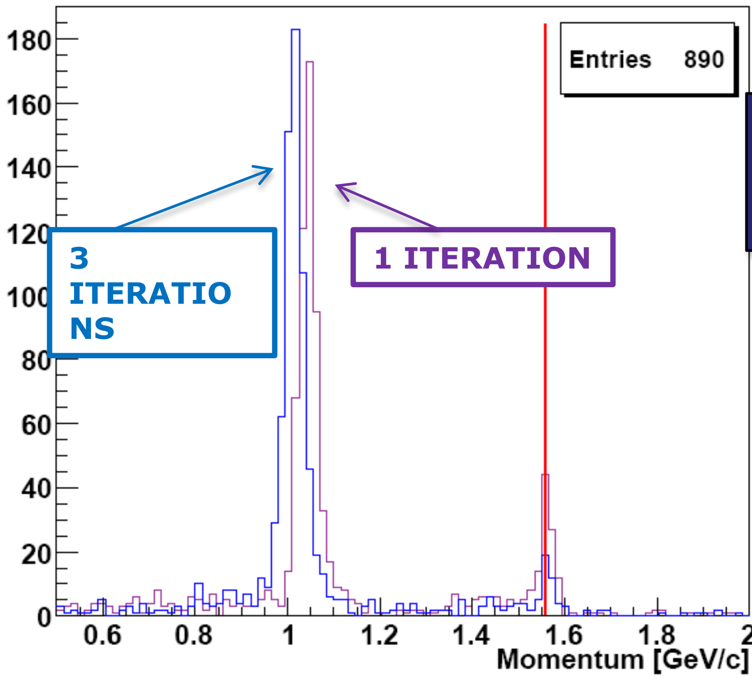






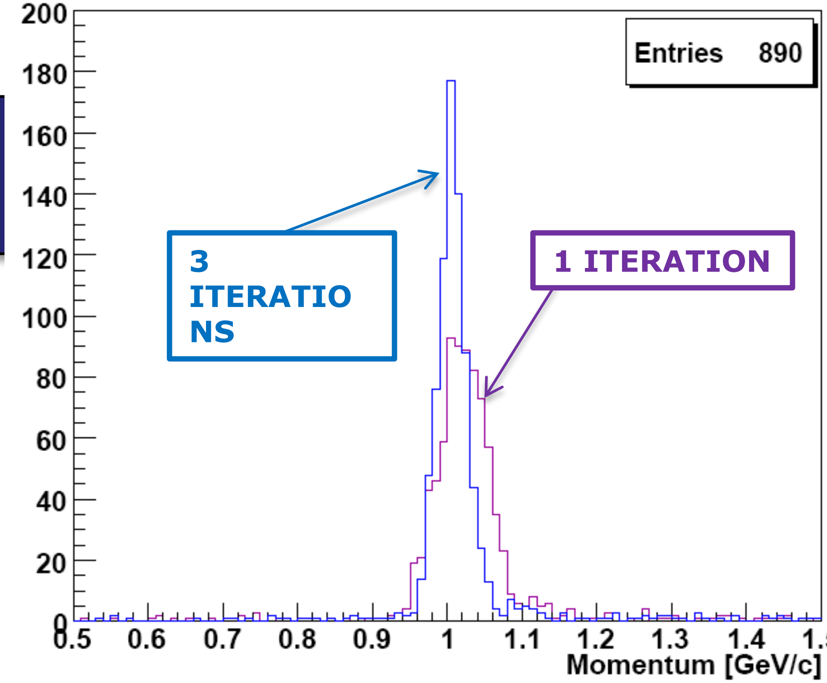
STT+MVD: Kalman filter

Even starting from a REALLY WRONG starting momentum, the Kalman procedure (after 1 and more after 3 iterations) finds the right one!



1000 μ^-

1 GeV/c



Kalman input 1:

(-0.9, -0.9, -0.9) GeV/c

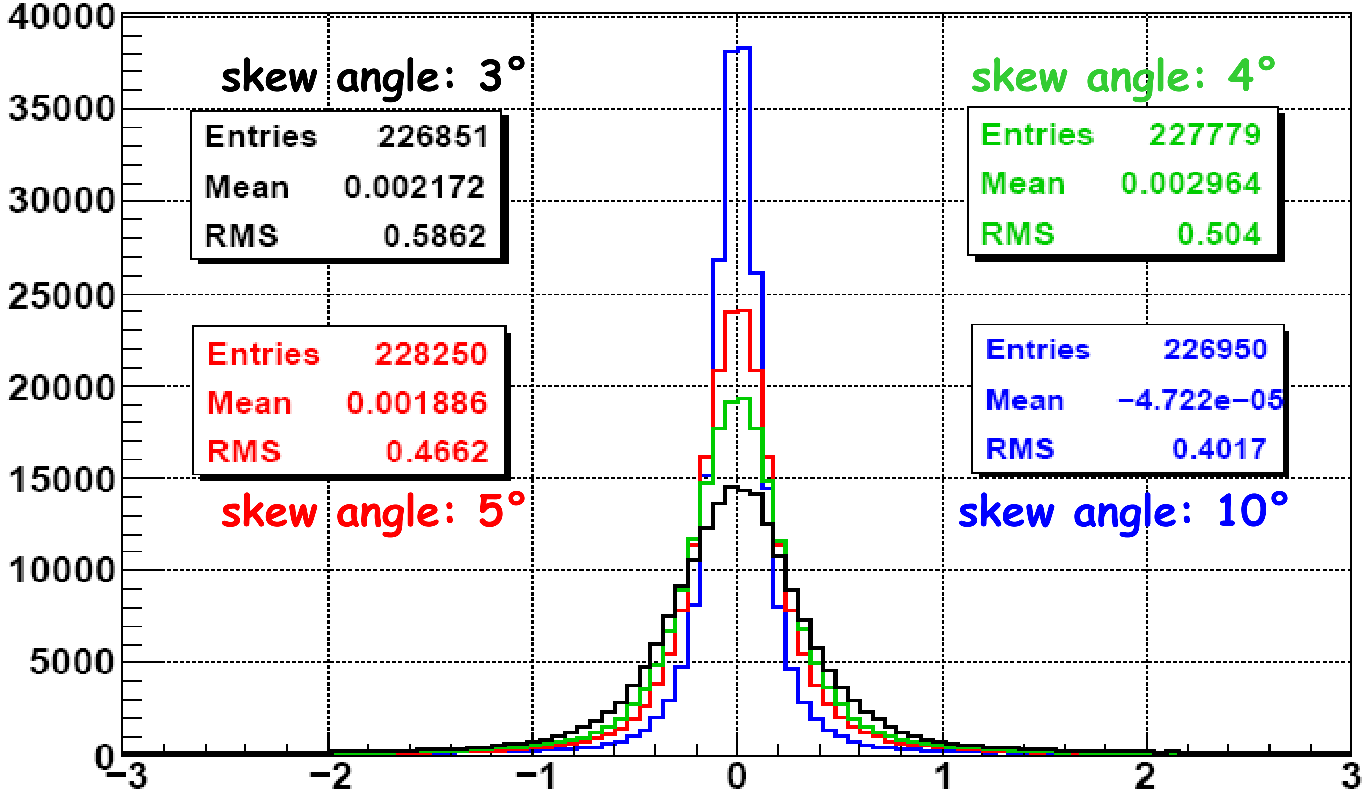
Kalman input 2:

MCmom + (0.4, 0.4, 0.4) GeV/c

STT test: skew angle

10000 μ^-, π^- @ 1 GeV/c,
generati uniformemente in ϕ (ϕ = [0°, 360°]) e *cos*θ (θ = [20°, 140°])
Geometry layout: skew angle = 3°, 4°, 5°, 10°

Residui della coordinata *z*



STT test: lunghezza dei tubi

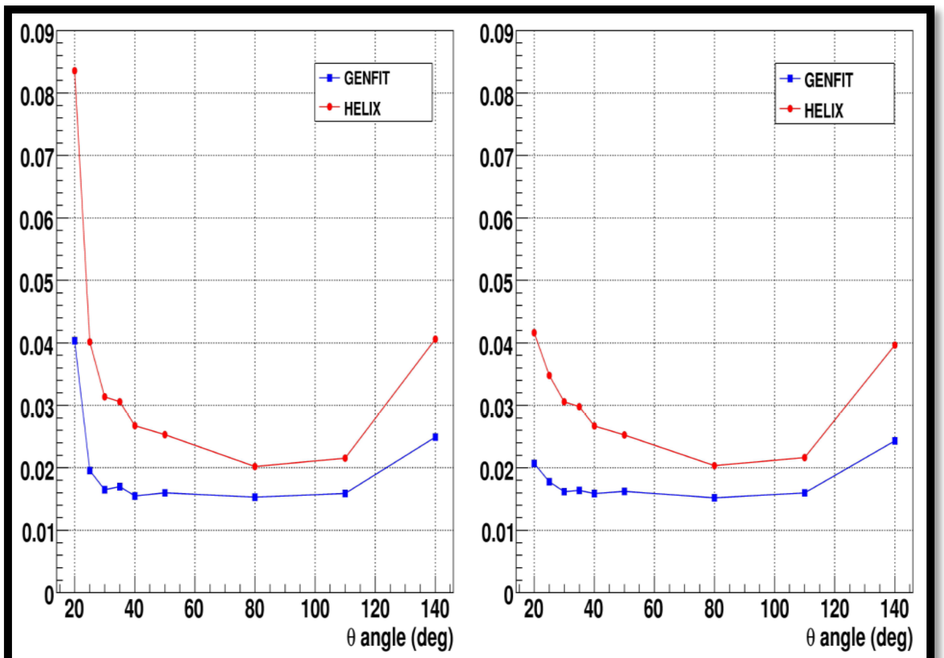
10000 μ^- @ 1 GeV/c

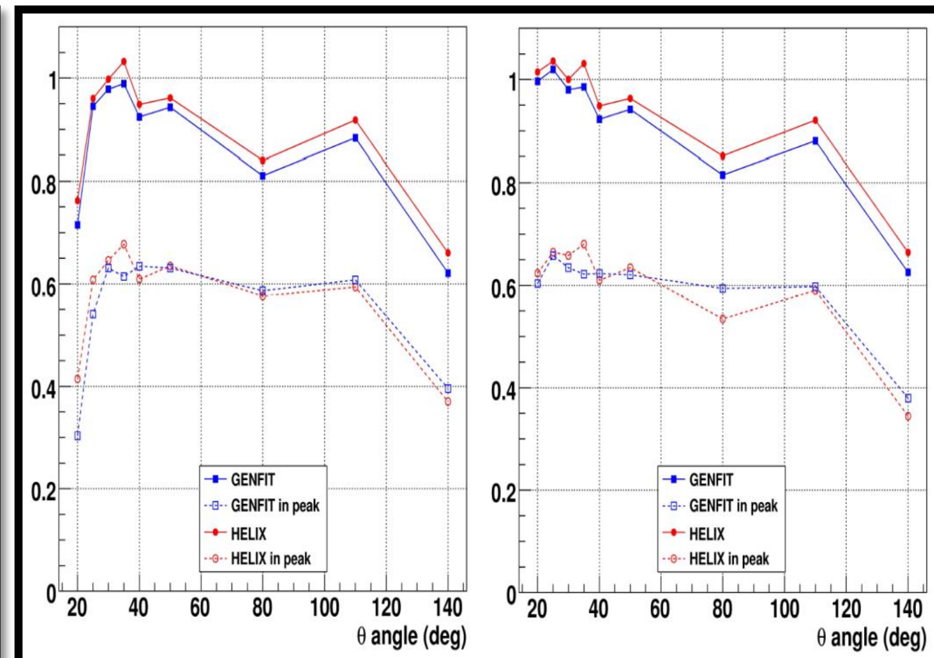
$\theta = \{20°, 25°, 30°, 35°, 40°\} \pm 2.5°$
$= \{50°, 80°, 110°, 140°\} \pm 5°$

Risoluzione in momento ($\sigma(p)/p$)

Efficienza

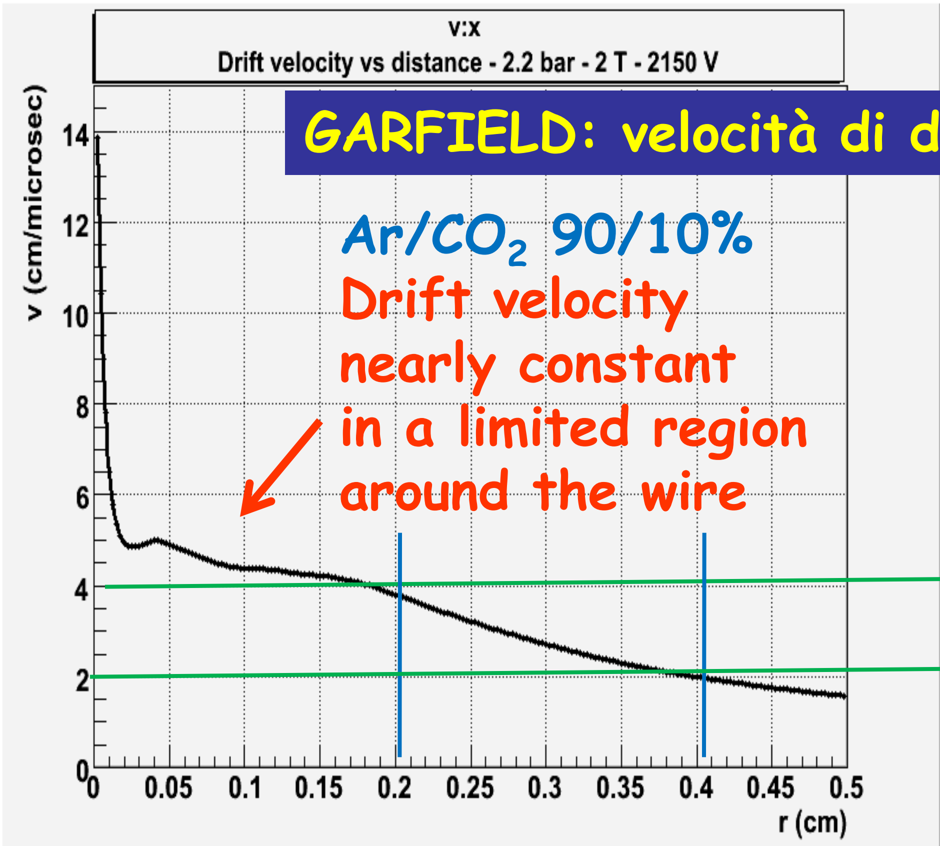
120 cm | 150 cm | 120 cm | 150 cm





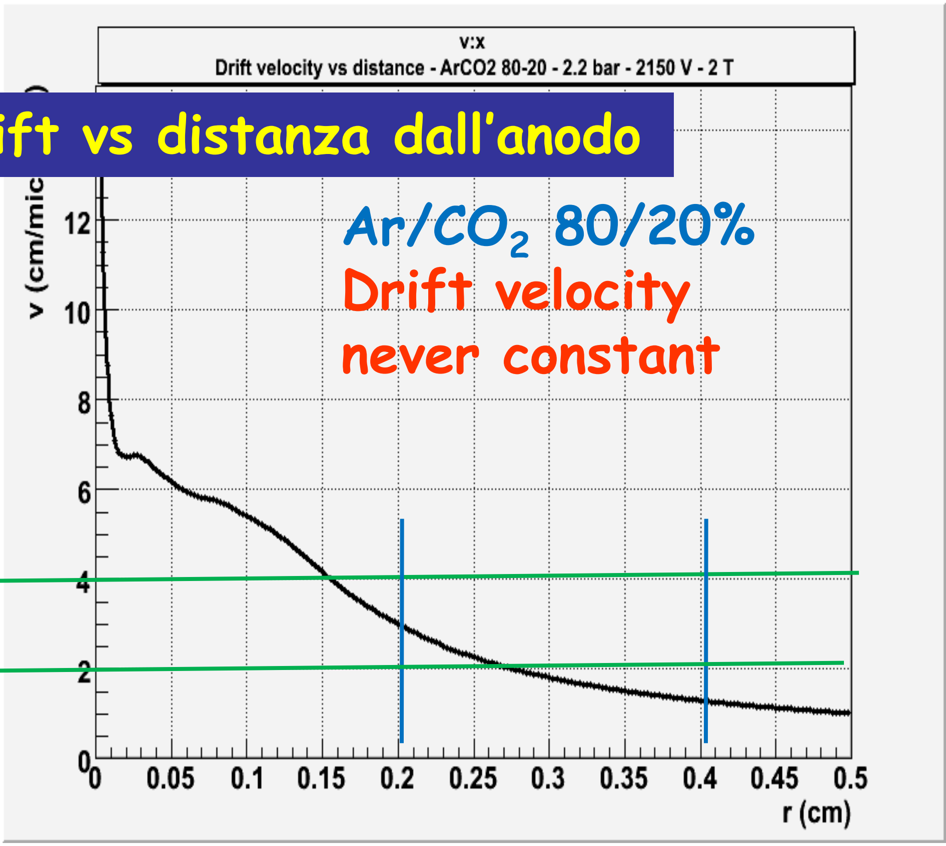
STT test: miscela di gas

GARFIELD: velocità di drift vs distanza dall'anodo



Ar/CO_2 90/10%

Drift velocity nearly constant in a limited region around the wire



Ar/CO_2 80/20%

Drift velocity never constant

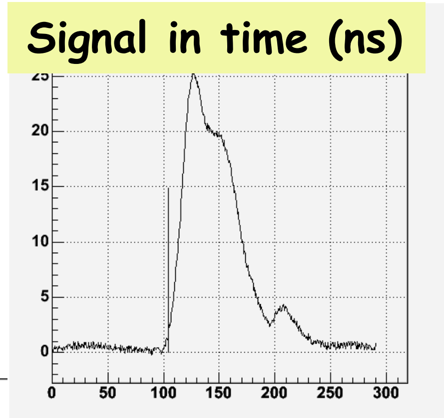
Both cases:

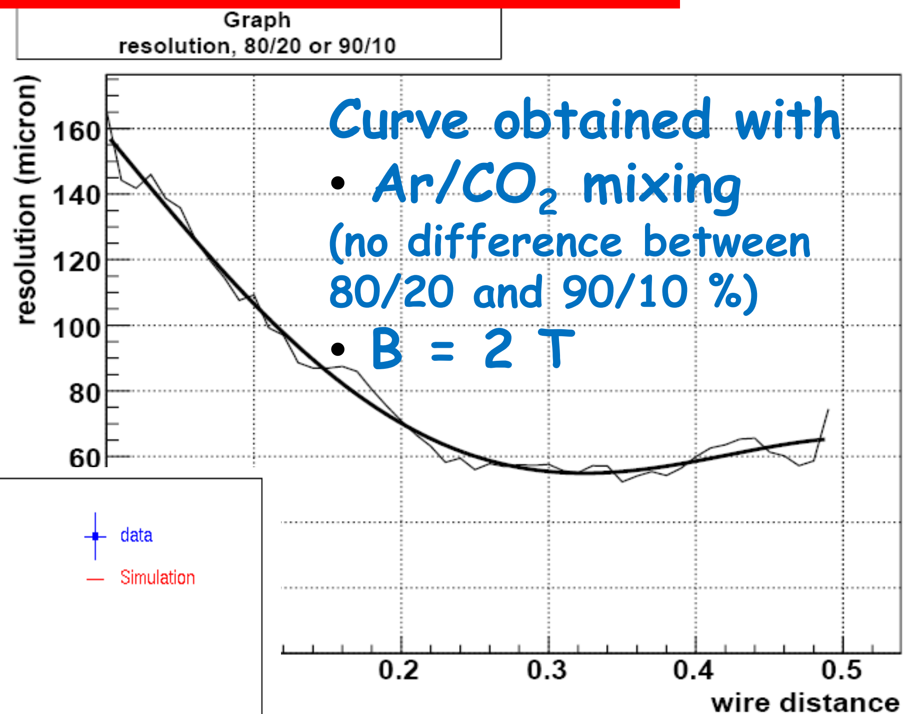
p = 2.2 bar ΔV = 2150 V B = 2 T

tube diameter = 1 cm anode diameter = 20 μm

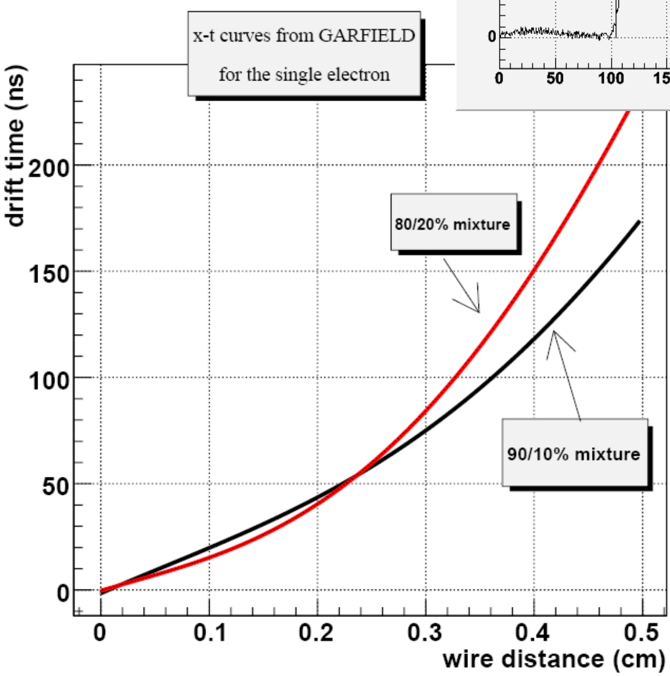
Simulazione singolo straw tube: curva di risoluzione spaziale

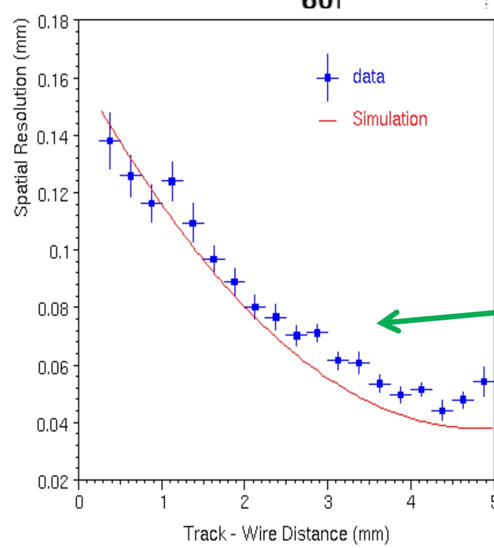
Drift faster in Ar/CO_2 90/10% mixture





Curve obtained with
- Ar/CO_2 mixing
(no difference between 80/20 and 90/10 %)
- B = 2 T

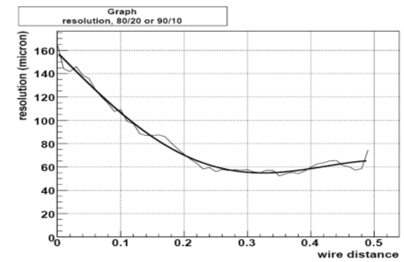




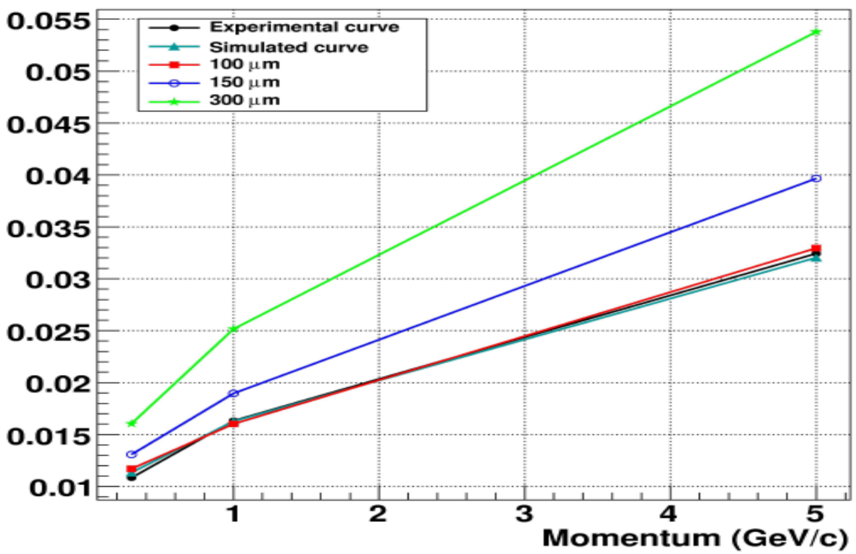
Experimental data (Juelich group, with B=0) well reproduced

STT+MVD test: dipendenza dalla curva di risoluzione spaziale

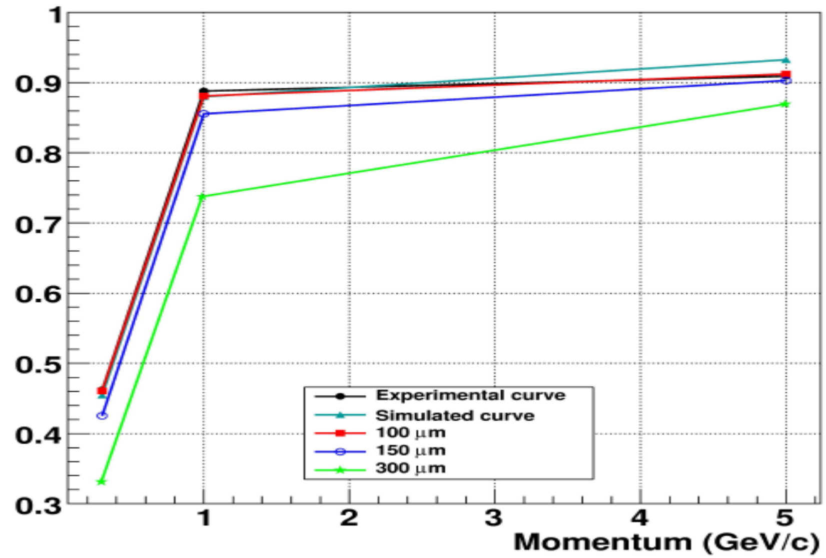
- Curva sperimentale di Juelich, senza campo magnetico
- Curva simulata con GARFIELD, con campo magnetico →
- Curva a risoluzione costante a 100 μm
- Curva a risoluzione costante a 150 μm
- Curva a risoluzione costante a 300 μm



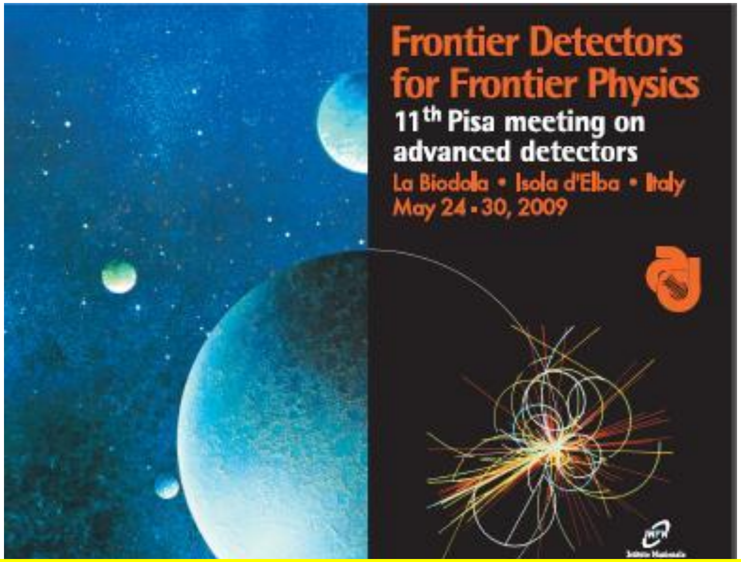
Risoluzione in momento



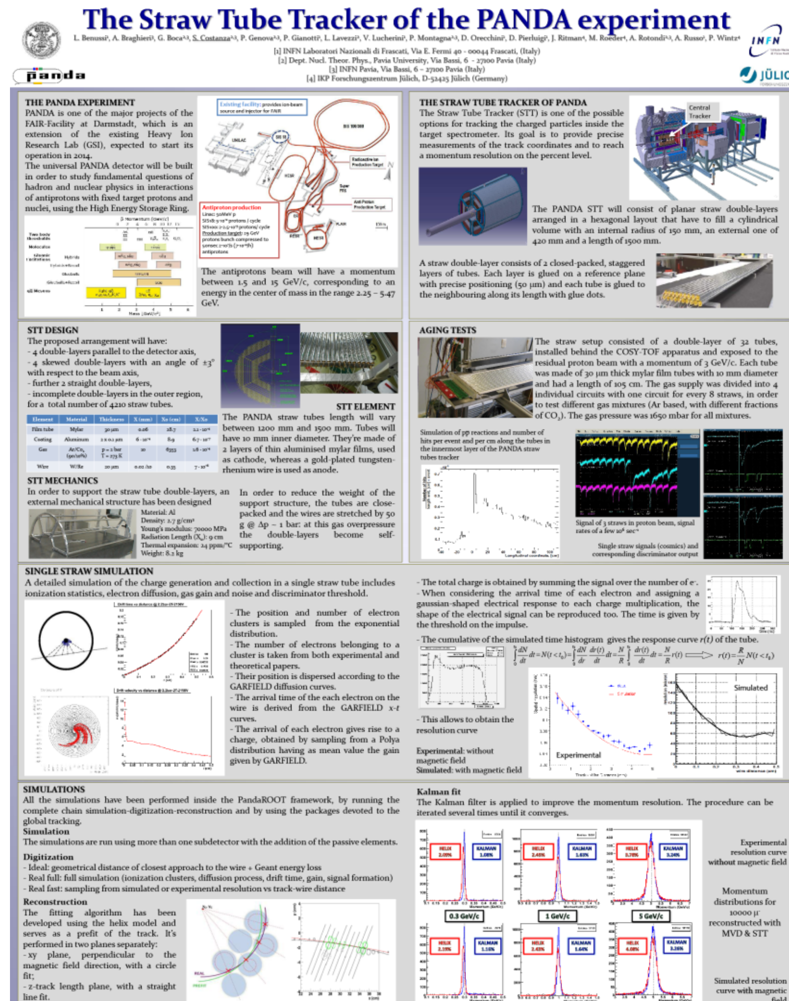
Efficienza



STT in sintesi

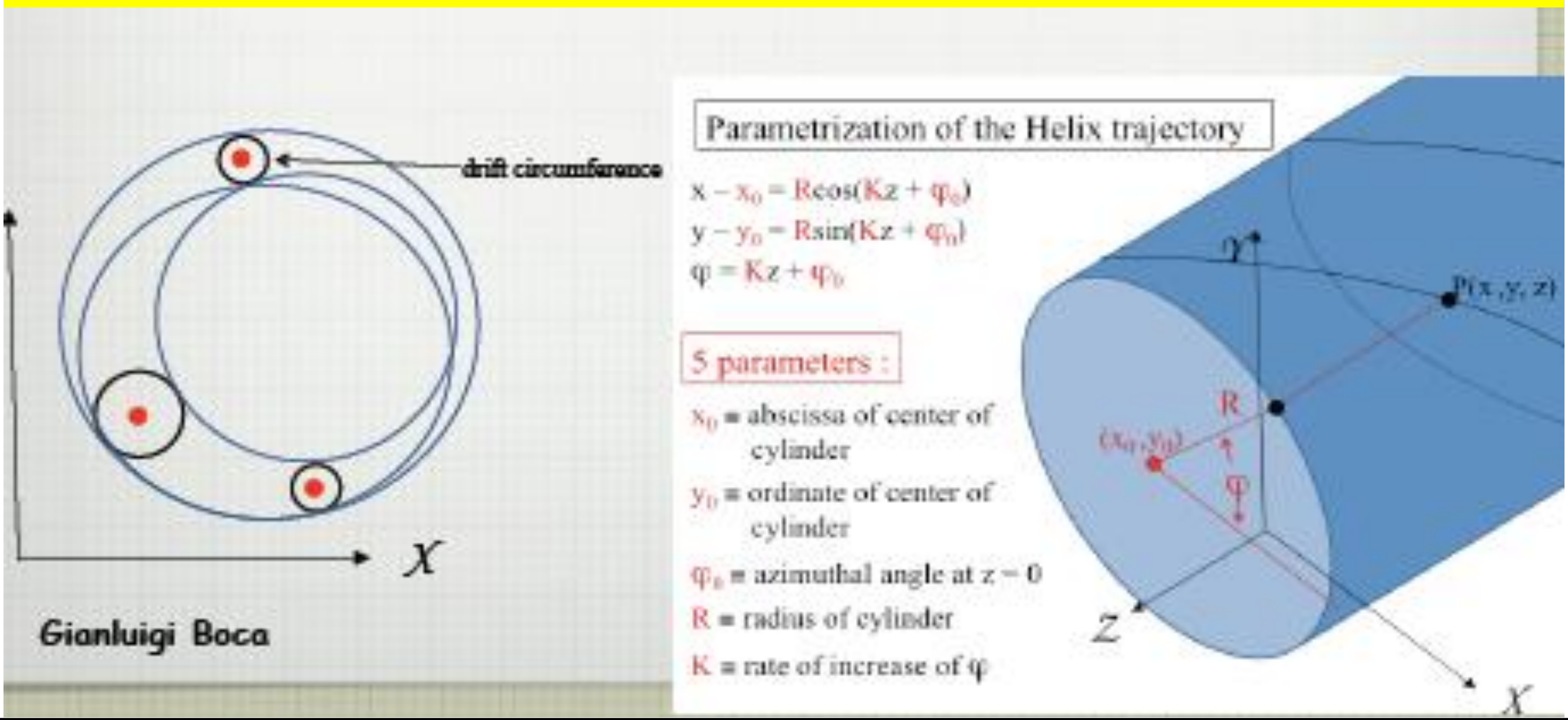


S.Costanza,
The Straw Tube Tracker
of the PANDA experiment,
Poster a
11° Pisa Meeting on advanced
detectors
Elba-LaBiodola, maggio 2009



STT – Pattern Recognition

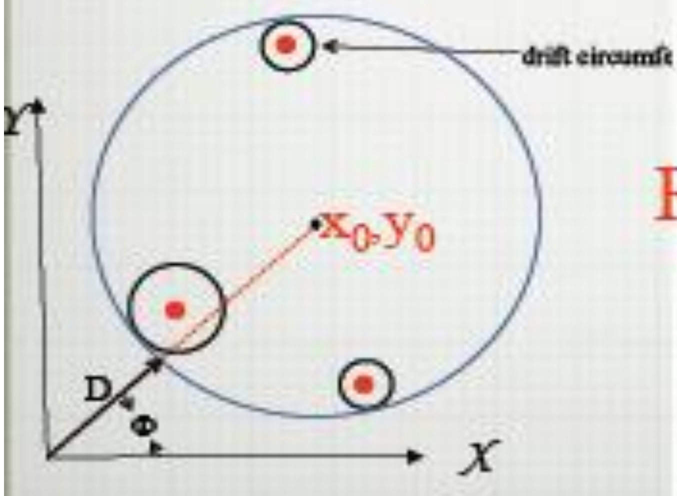
Pattern Recognition for STT
Based on Hough transformation of Helix trajectory
G.Boca, giugno 2009



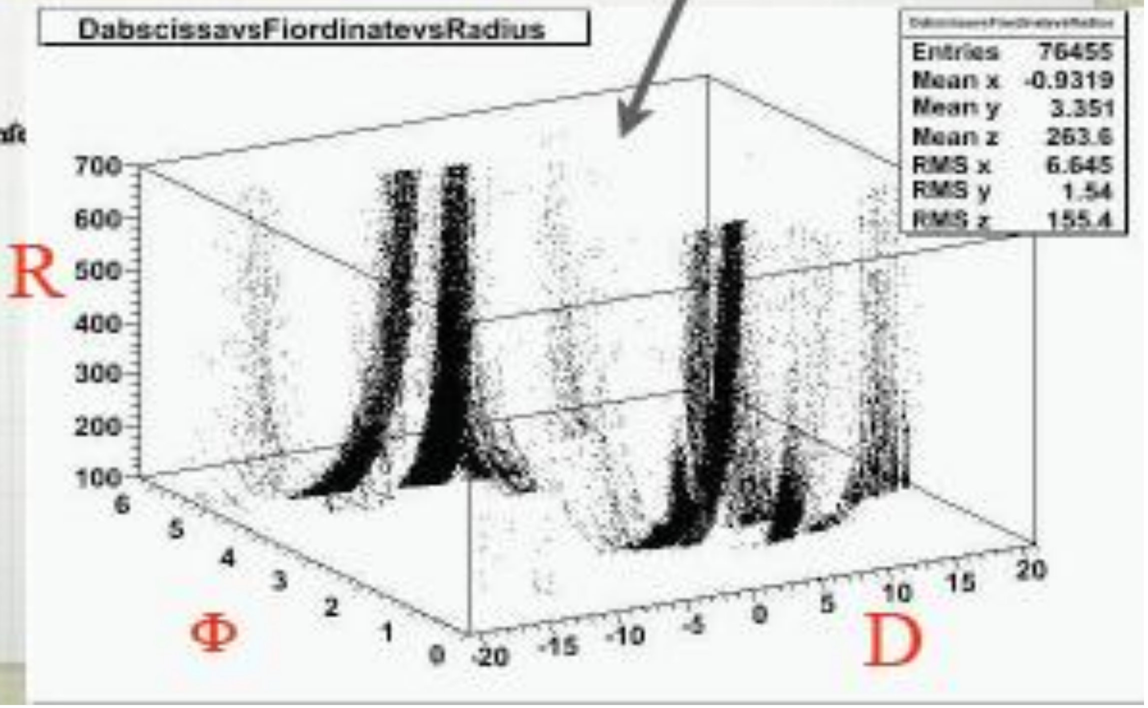
STT – Pattern Recognition

- Good news: speed of code OK (0.1-0.2 secs/event)
- Bad news: efficiency moderate (44-90%); problems to overcome for hit finding for skew straws

peak finding !!!



Gianluigi Boca

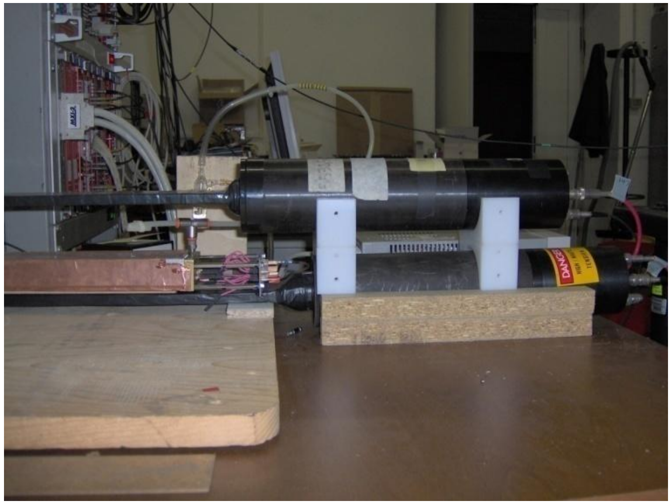


STT R&D: Test su prototipo

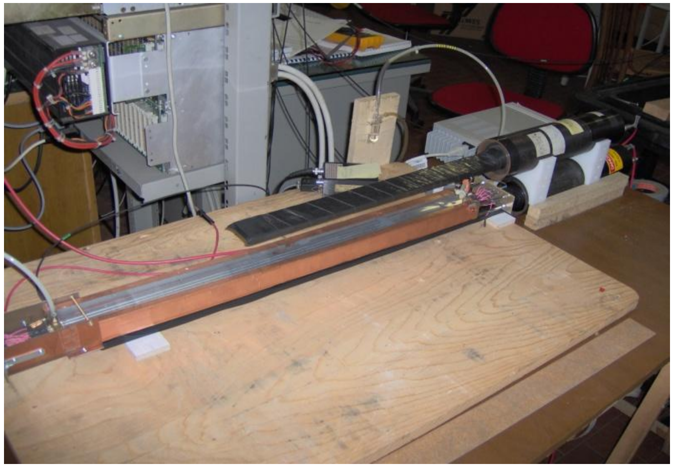
Risposta STT in regime proporzionale
Test con cosmici

Coincidenza tra due slabs di scintillatori plastici (45 x 7 x 0.5 cm) a distanza 10 cm

Rate basso: 1000 cosmici/ora
2% su singolo straw tube



Prototipo STT (by LNF):
12 tubi da 70 cm, Ø 6 mm
di kapton XC e alluminio (tot. 100 μm)
(prod. LAMINA, metodo LHCB)
3 strati incollati
Anodo: tungsteno-rhenio dorato, Ø 20 μm)
Gas: 93% Ar, 7% CO_2
d.d.p. 1300 Volt



STT R&D: Sviluppo elettronica

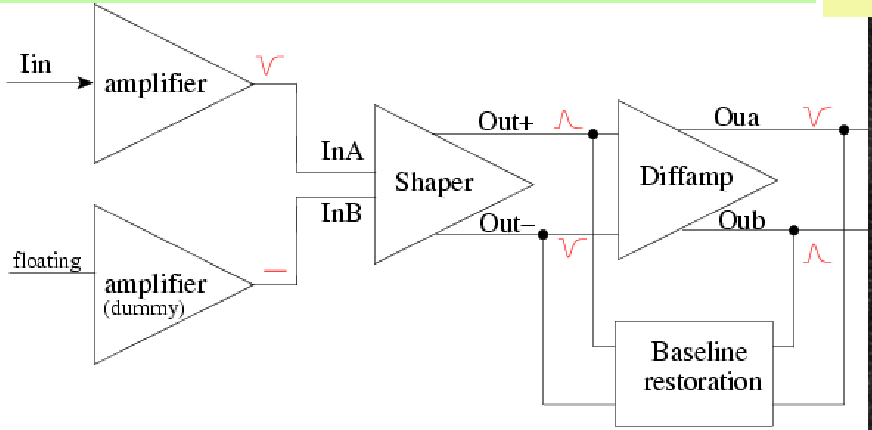
- Utilizzo di chips CMOS multicanale:

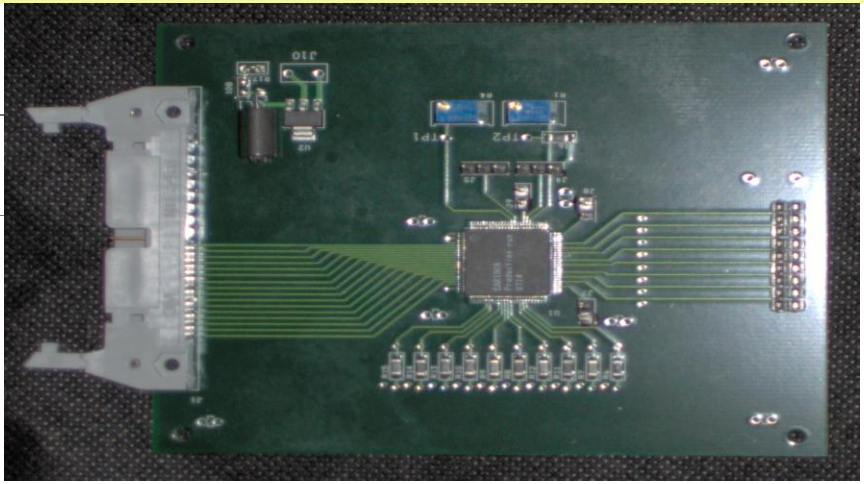
  Charge Preampl+filter+shaper

- Prime esperienze con "antiquato" chip GASSIPLEX 16

- Progettazione e realizzazione di una scheda basata su chip CARIOCA10 **(++ Supporto & ++ Performances)**: scheda di test ServEl PV

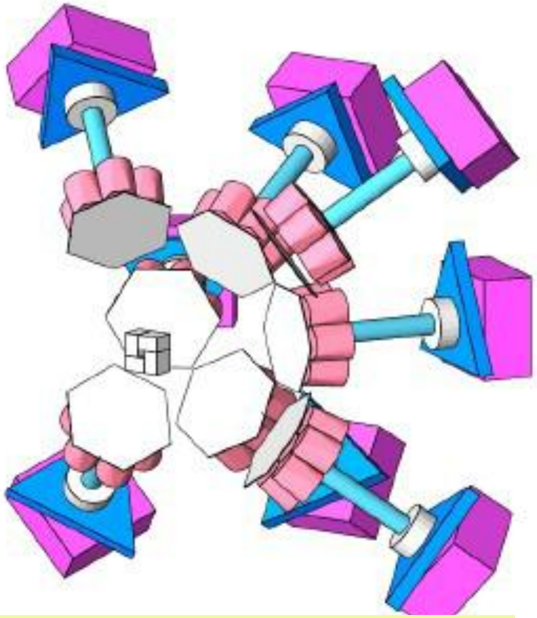
Attività di laboratorio: test di misura dell'ampiezza della carica rilasciata negli straw tubes, per l'identificazione di particelle cariche mediante dE/dx.
E' stata messa a punto e testata una scheda di Front End (FE) basata sul chip Gassiplex a tecnologia CMOS. Le prime misure hanno dato esito positivo, tuttavia si è ritenuto di cambiare tipo di chip in quanto il gassiplex non verrà supportato e prodotto a lungo ed inoltre è richiesta una seconda scheda FE per la misura del Drift Time (TDC). Dunque si è deciso di utilizzare un chip differente denominato CARIOCA che permette di misurare sia il drift time (mediante un TDC) sia l'ampiezza di carica mediante la tecnica del Time-Over-Threshold (TOT).





HPGe: obiettivo

Studio delle performances di un cristallo di Germanio ad alta purezza (HPGe) in campi magnetici elevati



Obiettivo: caratterizzazione di un cristallo di Germanio HPGe in campo magnetico di elevata intensità (fino a 2.5 T) con campo diretto lungo l' asse del cristallo.
Studio preliminare alla costruzione del rivelatore per spettroscopia gamma di ipernuclei di Panda.

PRIN 2005: Pavia, Torino, Bologna, Catania

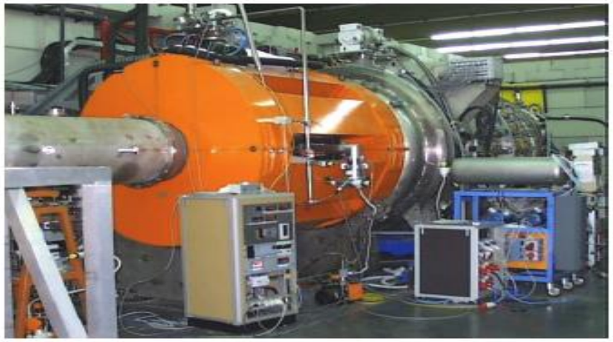
Misure effettuate ai LNS, nov.2007

Risultati presentati da A.Fontana a ANIMMA 2009, Marsiglia, mag.09
Advancements in Nuclear Instrumentation, Measurement Methods and their Applications

HPGe: experimental setup

Experimental setup @ INFN LNS Laboratory

Germanium detector: GX10P4-S-PLUS coaxial crystal manufactured by ORTEC.
High-purity, **n-type**, non-segmented, germanium cylindrical crystal (external diameter: 42 mm, length: 57 mm).
Nominal **energy resolution**: 1.8 keV at 1332.50 keV (for the γ-ray of the ^{60}Co)
Nominal **efficiency**: > 10% is guaranteed.
Cooling of the crystal: ORTEC electric cooler CFG-X-Cool-II-230, placed outside the magnet.



Magnetic field: superconducting SOLE magnet located at the Laboratori Nazionali del Sud (LNS) of the National Institute of Nuclear Physics (INFN).
Maximum value of the **magnetic field**: **2.5 T**
Uniformity: within 0.95% up to 15 cm from the coil axis.

Total free volume allows to place the HPGe detector with its symmetry axis along the field direction and to tilt the crystal up to a **maximum angle of 40°** with respect to the magnet axis.

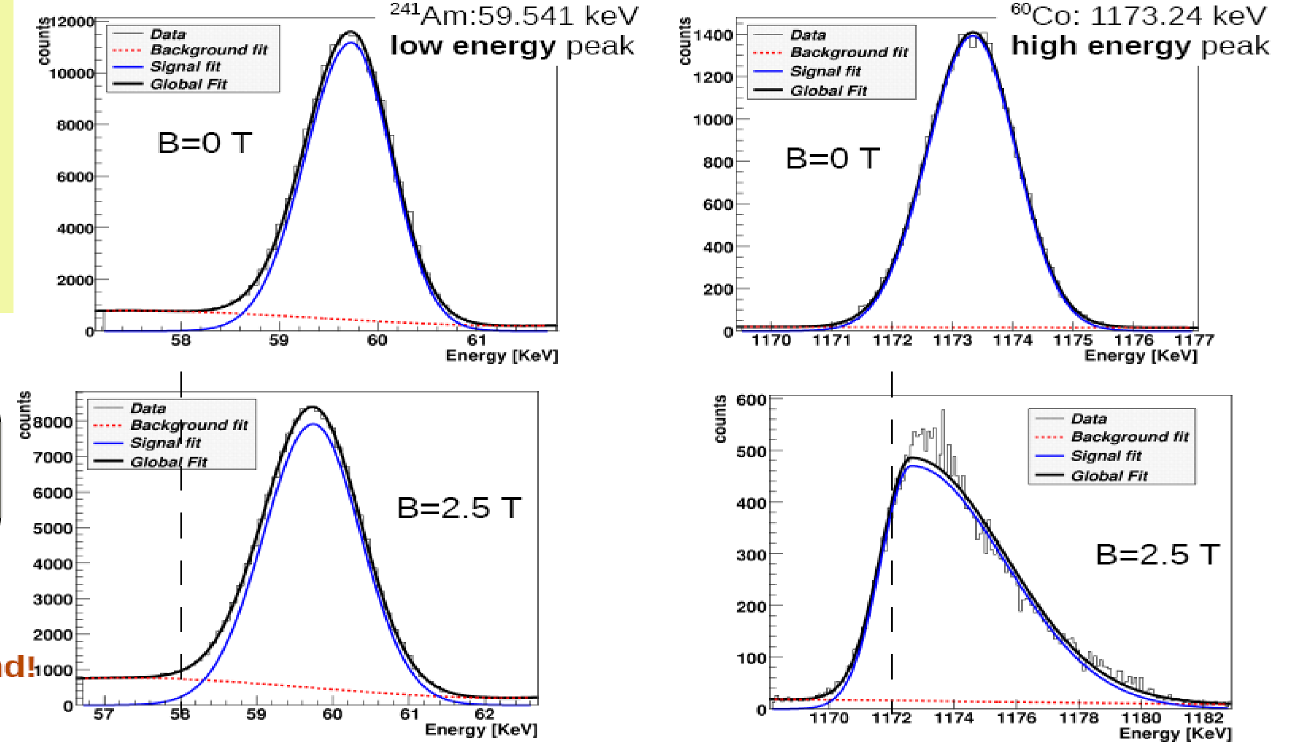
HPGE detectors in high magnetic fields – Conference ANIMMA 2009 – presented by Andrea Fontana, INFN Pavia

HPGe: effetti del campo magnetico sugli spettri gamma

Observed effects of magnetic field on γ spectra

Tre effetti attesi su picchi dello spettro:
- spostamento a sinistra del centroide
- aumento della FWHM
- perdita di efficienza

The effect varies as a **function of** the **γ energy** and of the B **field intensity**.



Note background!

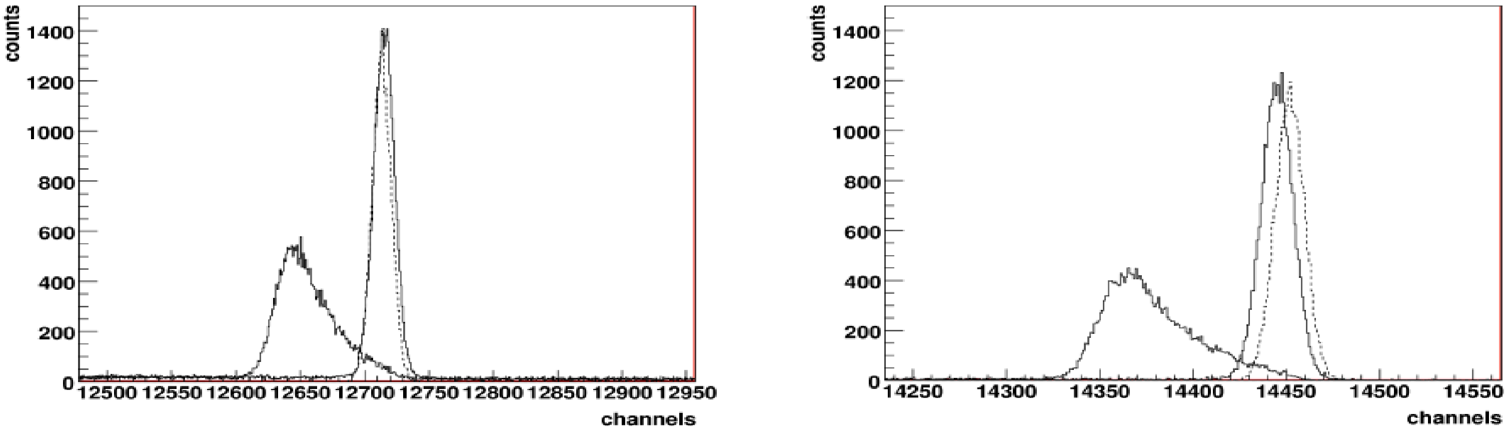
HPGE detectors in high magnetic fields – Conference ANIMMA 2009 – presented by Andrea Fontana, INFN Pavia

HPGe: metodo di correzione

Spectra recovery procedure

By using the interpolating functions for σ_1, σ_2 and for the centroid shift and the experimental values for the efficiency loss, it is possible to **correct the peak shape** measured in magnetic field by extrapolating the parameters to the zero field value.

1) the peak **centroid shift** is calculated and added to the measured centroid position;
2) the **ratios** $R_1 = \sigma_1(B=0)/\sigma_1(B\neq0)$ and $R_2 = \sigma_2(B=0)/\sigma_2(B\neq0)$ are calculated;
3) the experimental σ_1 and σ_2 obtained with $B\neq0$ are multiplied by R_1 and R_2 to obtain the **corrected σ**'s;
4) the efficiency loss is evaluated from the data and is used to **rescale** the number of entries of the measured spectrum.



HPGE detectors in high magnetic fields – Conference ANIMMA 2009 – presented by Andrea Fontana, INFN Pavia

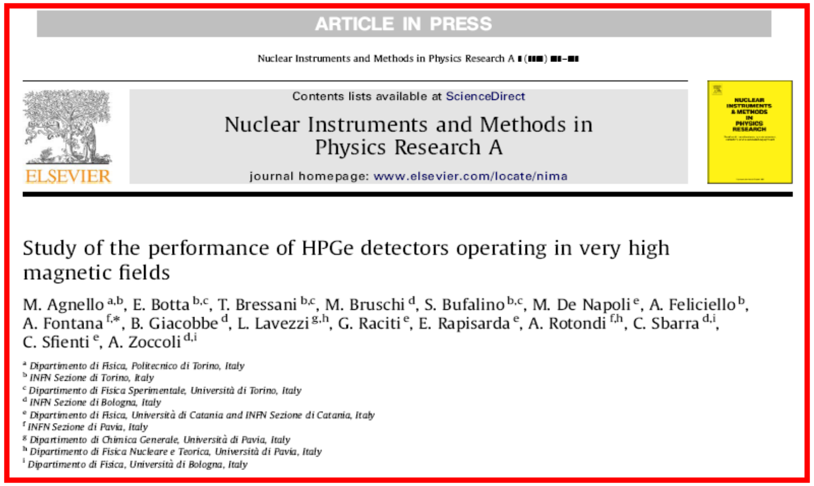
HPGe: risultati e conclusioni

Results and conclusions

- We have studied the performances of a **HPGe detector**, with commercial assembly, placed in the **highest magnetic field** ever tried for this type of detectors (**2.5 T**).
- The results show that the detector **works well** globally with **performances slowly worsening** with increasing energy of the γ-rays and field intensity.
- The peaks have been fitted with a **bi-gaussian function** whose parameters have been deduced as a **function of the energy and the field intensity**.
- We obtained an **almost full recovery of the detector resolution** and efficiency and we **demonstrated the possibility of using the HPGe's in very high magnetic fields**.

Our paper has been published (online) last week on **Nuclear Instruments and Methods A** with doi:10.1016/j.nima.2009.04.035 and is available at:

http://dx.doi.org/10.1016/j.nima.2009.04.035



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Nuclear Instruments and Methods in Physics Research A ∎ (∎∎∎∎) ∎∎∎–∎∎∎

Contents lists available at ScienceDirect

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Nuclear Instruments and Methods in Physics Research A

journal homepage: www.elsevier.com/locate/nima

Study of the performance of HPGe detectors operating in very high magnetic fields

M. Agnello [a,b], E. Botta [b,c], T. Bressani [b,c], M. Bruschi [d], S. Bufalino [b,c], M. De Napoli [e], A. Feliciello [b], A. Fontana [f,*], B. Giacobbe [d], L. Lavezzi [g,h], G. Raciti [e], E. Rapisarda [e], A. Rotondi [f,h], C. Sbarra [d,i], C. Sfienti [e], A. Zoccoli [d,i]

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[c] Dipartimento di Fisica Sperimentale, Università di Torino, Italy
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[h] Dipartimento di Fisica Nucleare e Teorica, Università di Pavia, Italy
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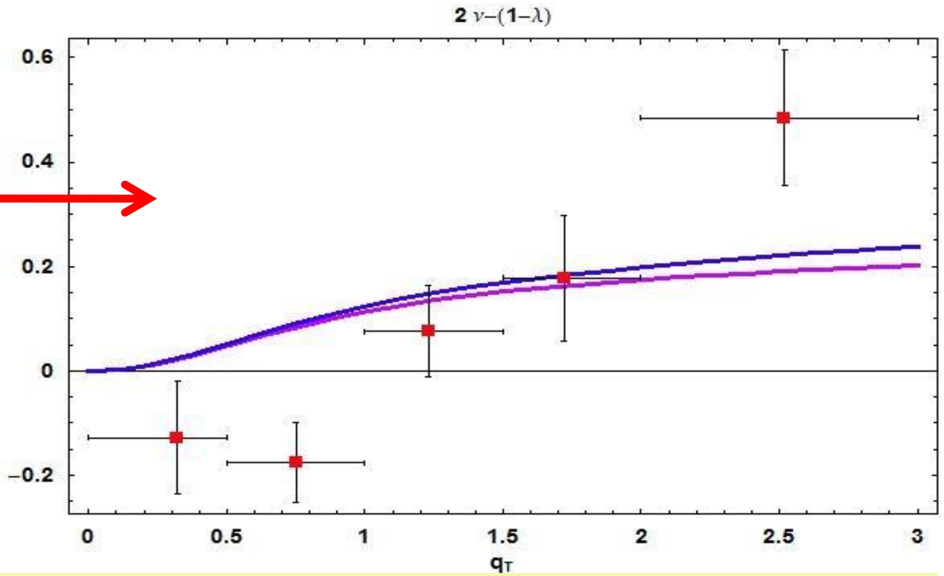
Contributo teorico

M.Radici

Studio della struttura partonica di spin del nucleone
attraverso simmetrie azimutali che coinvolgono distribuzioni partoniche "esotiche"
→ come costruire lo spin ½ dallo spin totale dei partoni costituenti
Studi di fattibilità con nuovo modello MC

Processo
Drell-Yan non polarizzato

Dati NA10, $\pi^- \, p \rightarrow \mu^+ \mu^- X$
con fasci di pione di 190 GeV



L'asimmetria azimutale dei dati potrebbe essere dovuta al moto trasverso dei partoni negli adroni, cioè al loro moto orbitale (che in QCD perturbativa si trascura sistematicamente)..

In PANDA reazione analoga: pbar p → $\mu^+ \mu^- X$

(annichilazione dominante in entrambi i casi ubar-u)

Miglior copertura angolare: grande riduzione delle barre di errore

Panda PV 2010: impegni e richieste

Situazione simile al 2009:

Ricercatori:		%2010	%09
Bendiscioli	PO sr	**100**	60
Rotondi	PO	**60**	60
Radici	1RIC	**20**	20
Boca	RU	**50**	30
Braghieri	RIC	**50**	50
Fontana	RIC	**30**	40
Montagna	RU	**70**	70
Salvini	RIC	**20**	20
Genova	ass.ric.	**20**	20
Lavezzi		**0**	0
Costanza	DOTT	**100**	100
Cattaneo C.	docente	**(20)**	(0)
Panzarasa	docente	**(50)**	(50)

Tot 2010 5.2 FTE (5.9)

(2009 4.7 FTE)

+ 100% ass.ric.biennale Hadron FP7 – nov.09?

PREVENTIVO DI SPESA 2010

Missioni interne: 9 K€

- 2 meeting Collab.italiana x 4 ric. x 2gg (2 k€)
- 4 meeting resp.locali e coordinatori (Montagna, Braghieri x 2gg Roma, 4 k€)
- contatti LNF per sviluppo STT (2 ric. x 5gg, 1.5 k€)
- contatti gruppi italiani SW (2 ric. x 5gg, 1.5 k€)

Missioni estere: 37 K€

- 4 meeting Collab. x 3 ric. x 5gg (18 k€)
- Mobilità rappr.Speakers Board e coord. SW-Tracking (Rotondi, 4x3gg, 5k€)
- 2 SW workshop x 2 ric. x 5gg (6 k€)
- Contatti con Julich per sviluppo STT (2x3gg, 3 k€)
- 2 meeting tracking x 2 ric. x 3gg (5 k€)

Consumo: 5 K€

- gas: argon, etano, freon, mix Ar-CO2 (3 k€)
- realizzazione stampati test carioca10 2° versione per time-over-threshold (1 k€)
- varie, piccola meccanica, comp.elettronica (1 k€)

Materiale inventariabile: 10 K€

- 4 HD 750 GB per upgrade server (1 k€)
- discriminatore VME constant fraction (3 k€)
- PC per catena test DAQ (2 k€)
- modulo sampling ADC Wiener test DAQ (4 k€)

TOTALE 2010 61 k€

2009	Rich.	Ass
Missioni interne	12	6
Missioni estere	39	17.5
Consumo	6	3
Materiale inventariabile	9	3
TOT '09	65	29.5