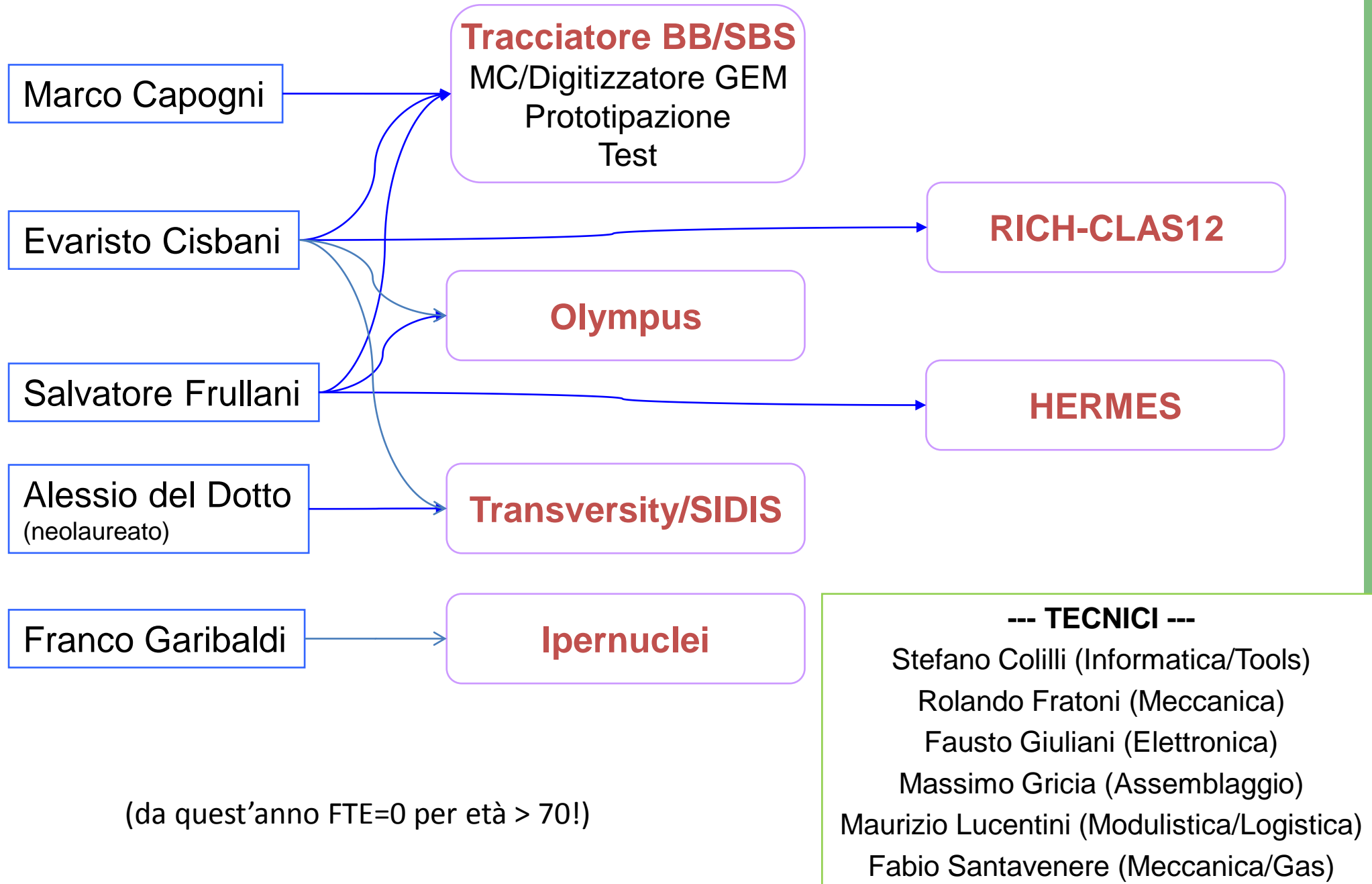


Gruppo JLab12/ISS vs Attività



(da quest'anno FTE=0 per età > 70!)

Attività in corso

- Analisi Esperimenti
 - **Ipernuclei**: completamento analisi Be (\Rightarrow Guido)
 - **Transversity @ 6GeV**: Short paper su SSA di π su n – in circolazione nella collaborazione di sala A per sottomissione a PRL
- Preparazione Esperimenti:
 - Esperimento su **Sezione d'urto Ipernucleare**
 - **GEP5**
- Proposta Esperimento: **SIDIS**
 - PAC37 – conditionally approved; verrà ripresentato in PAC38
- Apparati: **Tracker per SBS**:
 - Piani di silicio (\Rightarrow Franco Meddi)
 - Sviluppo Tracciatore GEM
 - Supporto ad Olympus
- Contributo a sviluppo **RICH-CLAS12**

Transversity @ 6 GeV

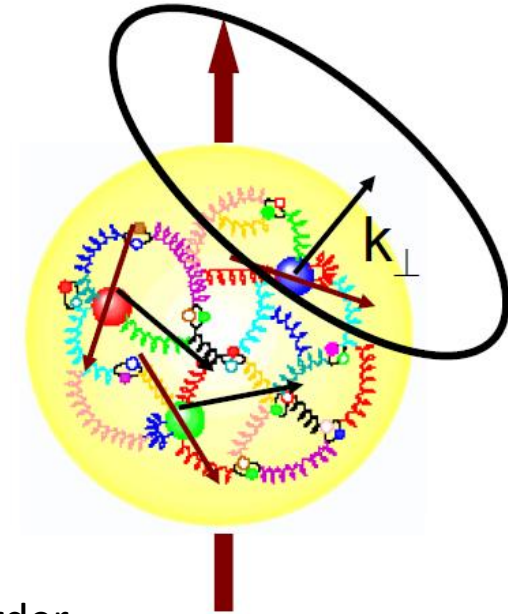
Structure of the Nucleon

$$S_3 = \frac{1}{2} = \underbrace{\frac{1}{2} \Delta\Sigma}_{\sim 0.15} + \underbrace{\Delta G}_{\sim 0} + \underbrace{L_q + L_G}_{?}$$

$\Delta\Sigma$: quark spin fraction

ΔG : gluon spin fraction

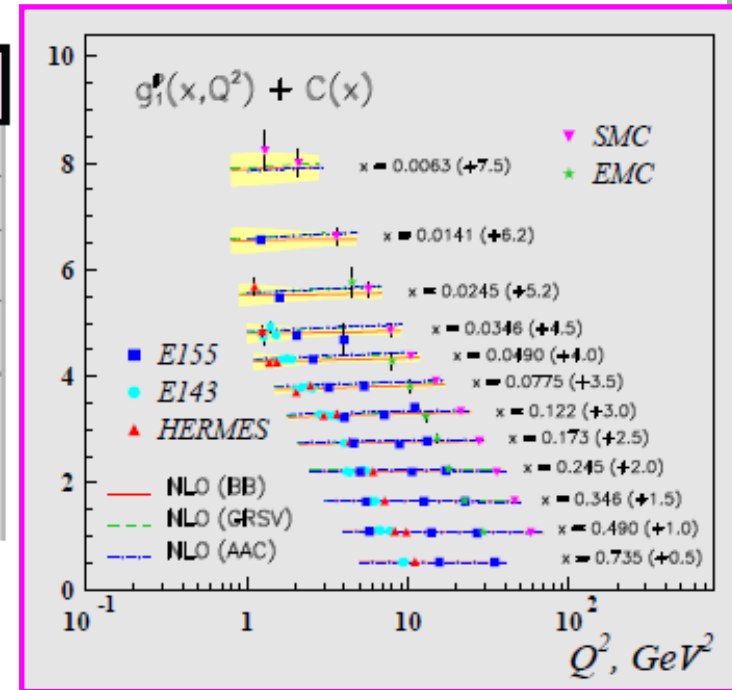
$L_q + L_G$: angular momentum



Description of the nucleon at leading order

		Distribution Functions (DF)		
		quark		
		U	L	T
nucleon	U	q		h_1^{\perp}
	L		g_{1L}	h_{1L}^{\perp}
	T	f_{1T}^{\perp}	g_{1T}^{\perp}	h_1 h_{1T}^{\perp}

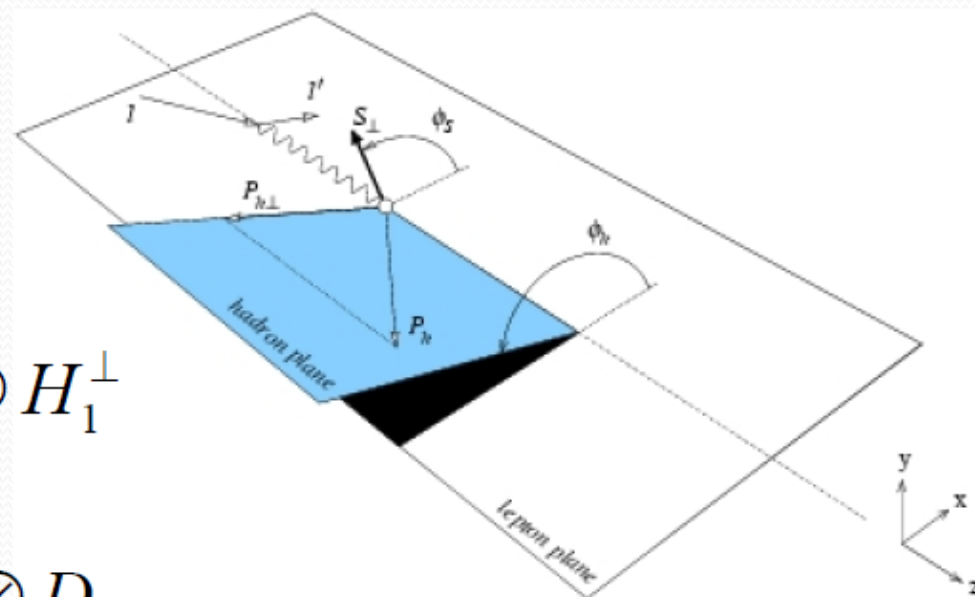
Transversity @ 6 GeV



Separation of TMDs

Separate different effects through angular dependence

$$A_{UT}(\phi_h^l, \phi_s^l) = \frac{N^\uparrow - N^\downarrow}{N^\uparrow + N^\downarrow}$$



- **Collins asymmetry:**

$$A_{UT}^{Collins} \propto \langle \sin(\varphi_h + \varphi_s) \rangle_{UT} \propto h_1 \otimes H_1^\perp$$

- **Sivers asymmetry:**

$$A_{UT}^{Sivers} \propto \langle \sin(\varphi_h - \varphi_s) \rangle_{UT} \propto f_{1T}^\perp \otimes D_1$$

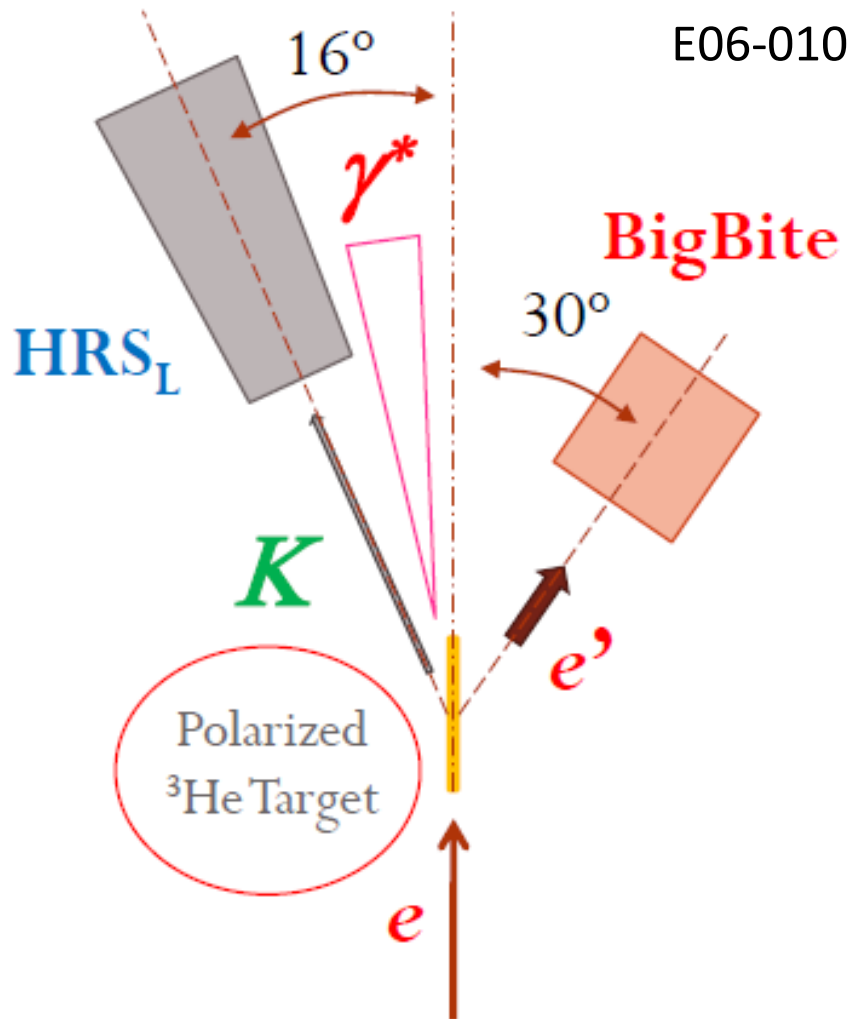
- **“Pretzelosity”:**

$$A_{UT}^{Pretzelosity} \propto \langle \sin(3\varphi_h - \varphi_s) \rangle_{UT} \propto h_{1T}^\perp \otimes H_1^\perp$$

- **Double-spin asymmetry:**

$$A_{LT}^{\cos(\varphi_h - \varphi_s)} \propto \langle \cos(\varphi_h - \varphi_s) \rangle_{LT} \propto g_{1T} \otimes D_1$$

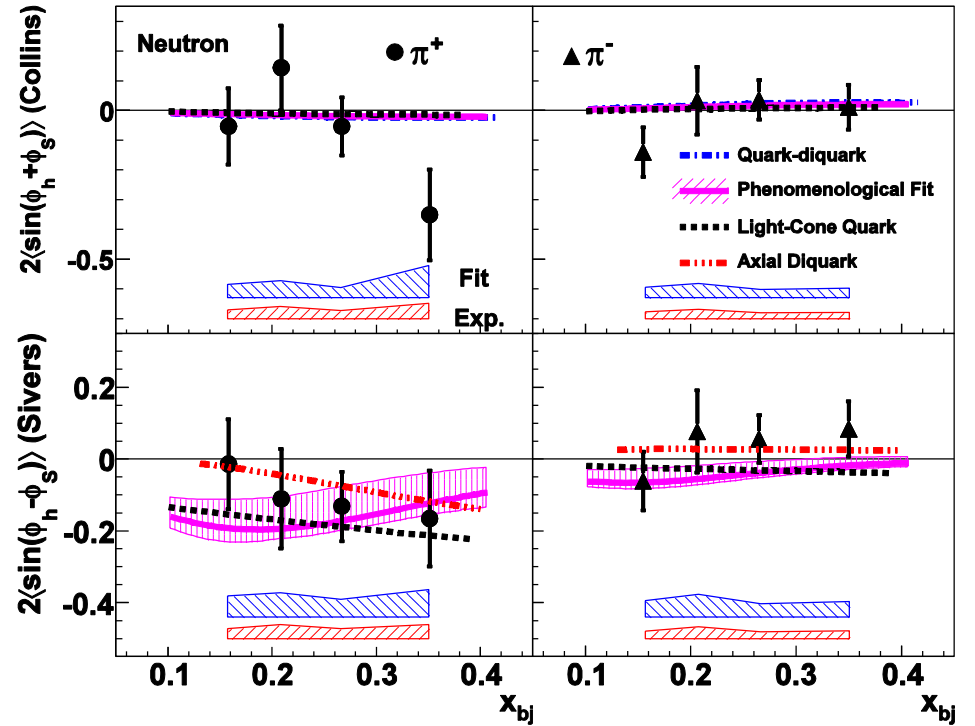
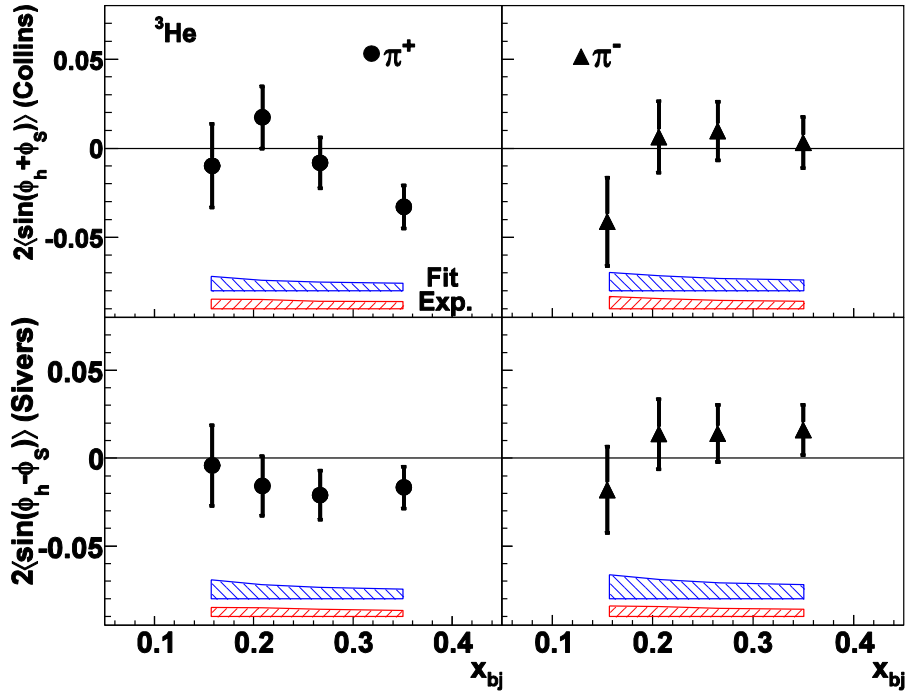
Transversity on neutron: Hall A experimental setup



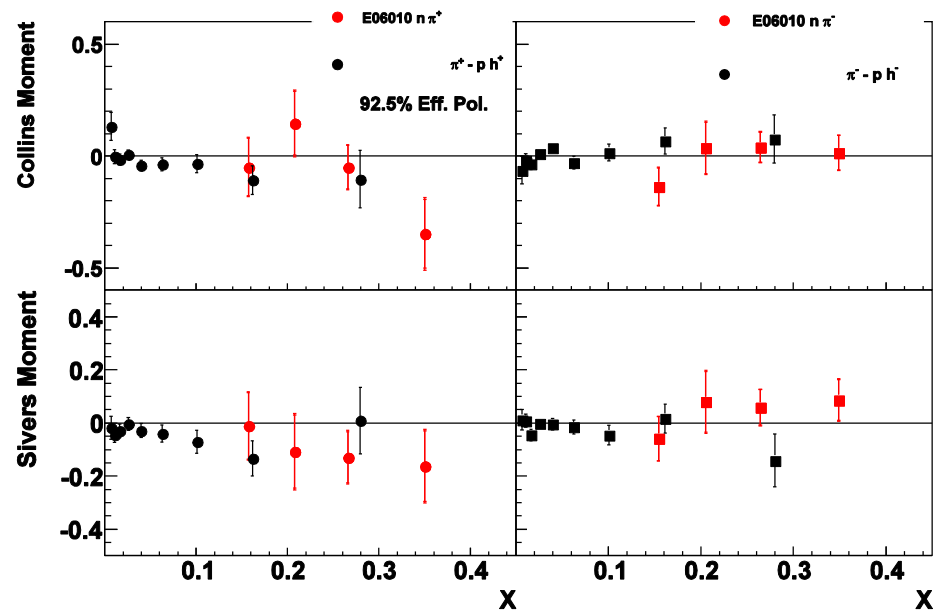
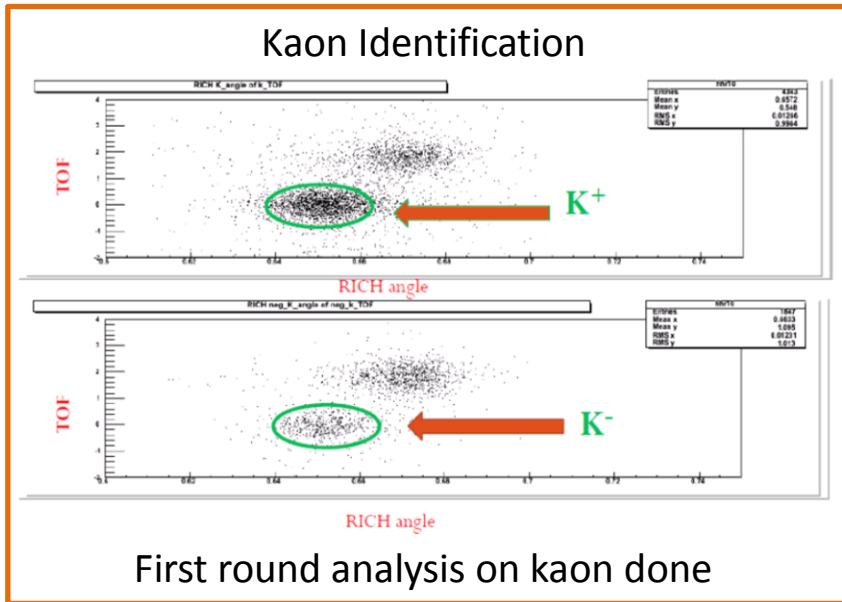
Data Taking:
Nov/08 – Feb/09
First Paper: S2/2011

- Beam e^- :
5.9 GeV, 15 mA
- Neutron Target:
High pressure polarized ${}^3\text{He}$
pol. 65%, 50 mg/cm² x 40 cm
- Luminosity: $10^{36}/\text{s}/\text{cm}^2$
- Electron Arm (BigBite):
 - $E' = 0.7 \div 2.2$ GeV,
 $\vartheta = 30^\circ$, $\Delta\Omega = 64$ msr
- Hadron Arm (HRS Left):
 $P_h = 2.35$ GeV/c \pm 5%,
 $\vartheta = 30^\circ$, $\Delta\Omega = 6$ msr, p/K ID
- Kinematic region:
 $\langle Q^2 \rangle \sim 2.2$ GeV²,
 $x \sim 0.13 \div 0.45$, $\langle z \rangle \sim 0.5$

Transversity 6 GeV / Results

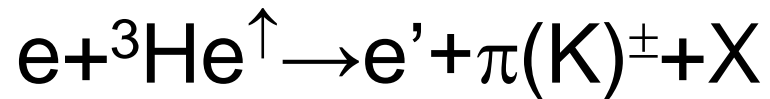


Collins small, largely compatible to 0
Sivers negative (?) for π^+ , zero for π^-

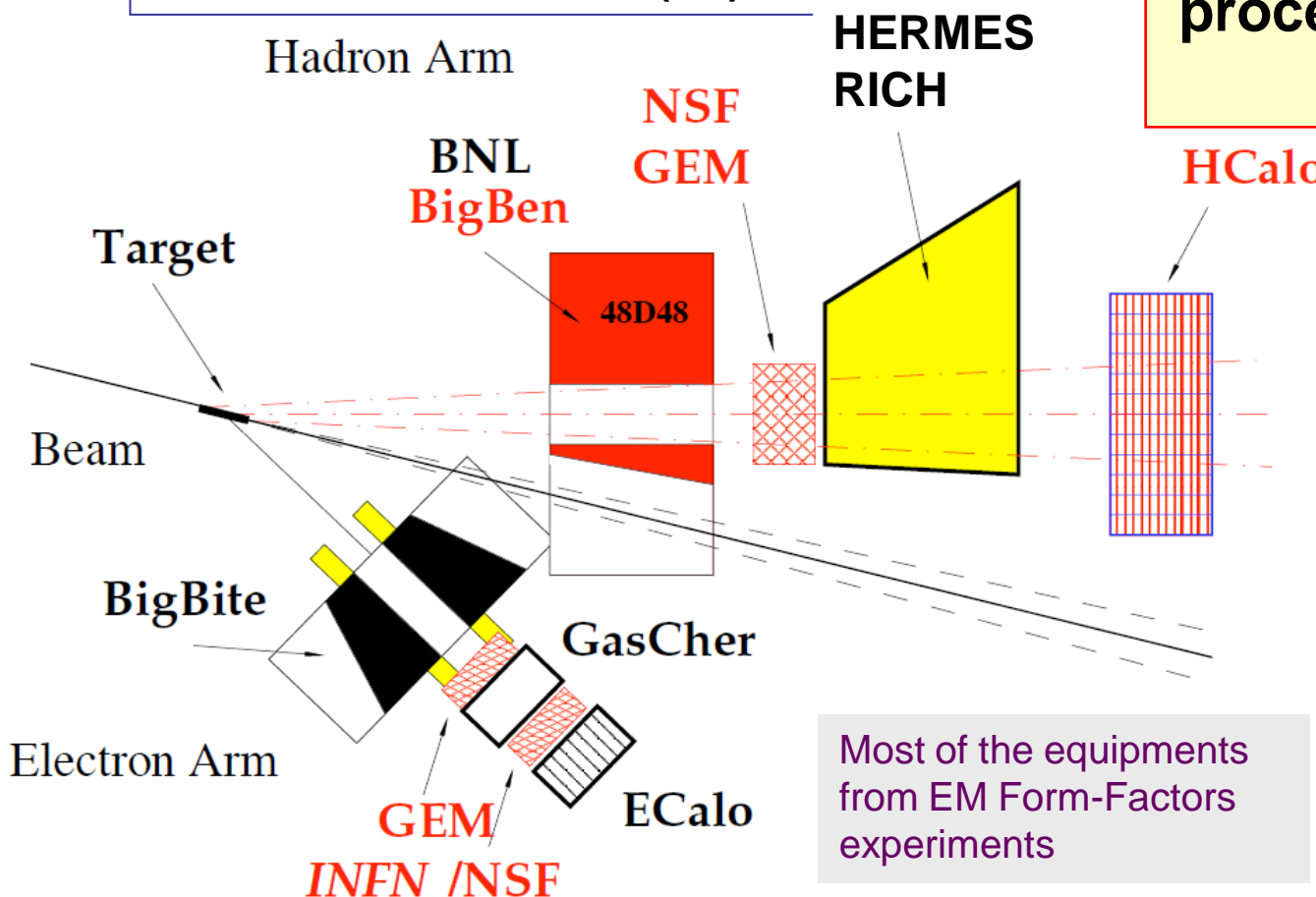


Transversity @ 8.8 e 11 GeV (proposal)

SIDIS: Experimental Setup



Measure the SSA of SIDIS processes $n^{\uparrow}(e, e' p^{\pm}) X$ and $n^{\uparrow}(e, e' K^{\pm}) X$



BB: e-arm at 30°
 $\Omega = 45 \text{ msr}$
 GEM Tracker
 Gas Cherenkov Shower

\leftarrow GMn/PR-09-019

SBS: h-arm at 14°
 $\Omega = 50 \text{ msr}$
 GEM tracker
 excellent PID / RICH
 Hadron CALO

Beam: $50 \mu\text{A}$, $E=8.8$ and 11 GeV (80% long. Pol.)
 Target: 65% polarized ${}^3\text{He}$ \leftarrow GEn(2)/PR-09-016
 \Rightarrow Luminosity: $1.4 \times 10^{37} \text{ cm}^{-2}\text{s}^{-1}$, 0.05 sr

Event rate: $\sim 10^4 \times \text{HERMES}$
 60 days of production expected
 stat. accuracy:
1/10 of proton HERMES

PAC34/PAC37 Conditionally Approved experiment

SIDIS proposal

- Estensione a 8.8 e 11 GeV dell'esperimento Transversity@6GeV con l'uso di SBS+BB
- Riproposta al PAC di Gennaio con varie migliorie:
 - Cross check stima accuratezze statistiche
 - Revisione modello Scopetta (in collaborazione con Scopetta, Salmé e Del Dotto \Rightarrow Tesi di laurea)
 - MC del RICH

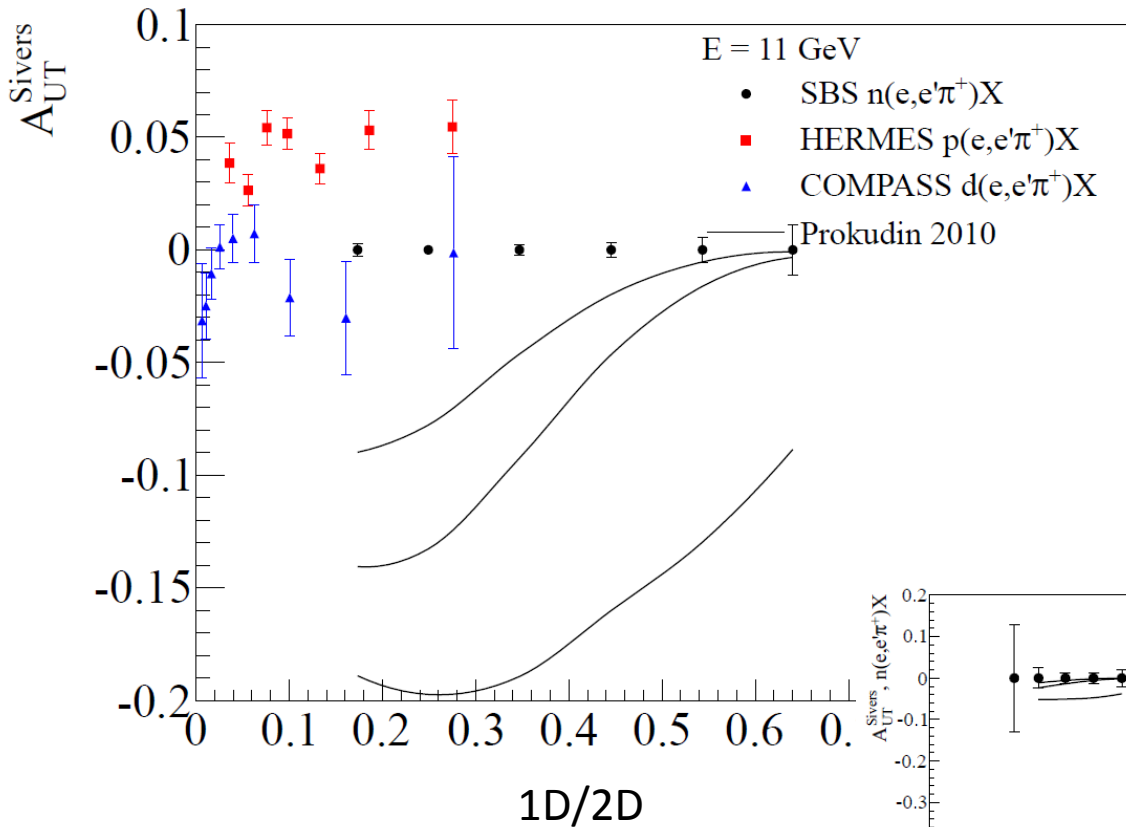
Approvata con condizione (?)

Verrà riproposta al nuovo PAC con modello SBS e BB più realistico, rianalisi delle accuratezze (MC usato per Transversity a 6 GeV) e nuovi plot di impatto.

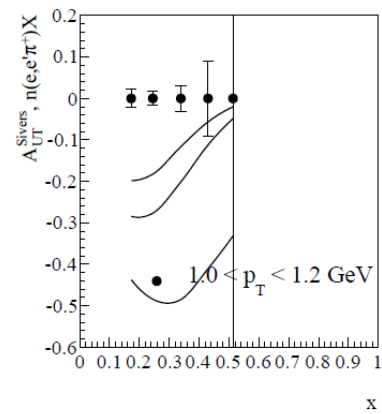
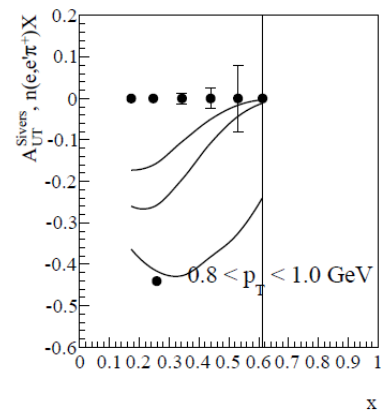
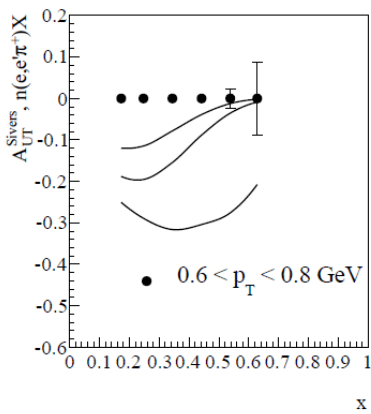
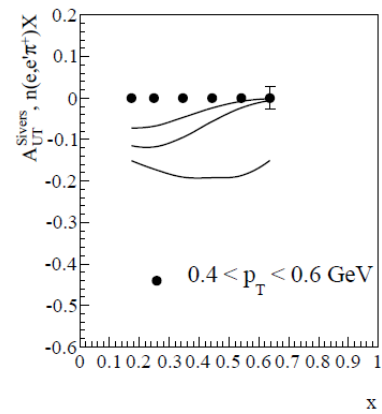
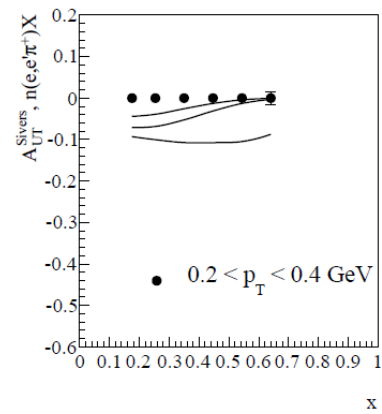
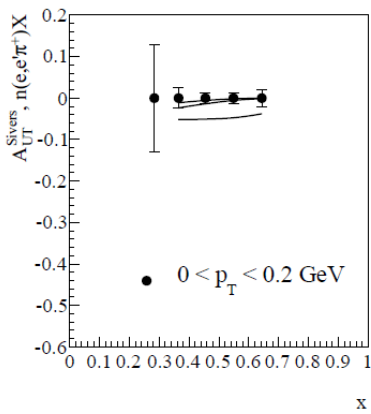
(Xiaodong Jiang supporta l'impresa)



Impact Plots for SIDIS Proposal @ PAC38



From A. Puckett
Theory from A. Prokudin

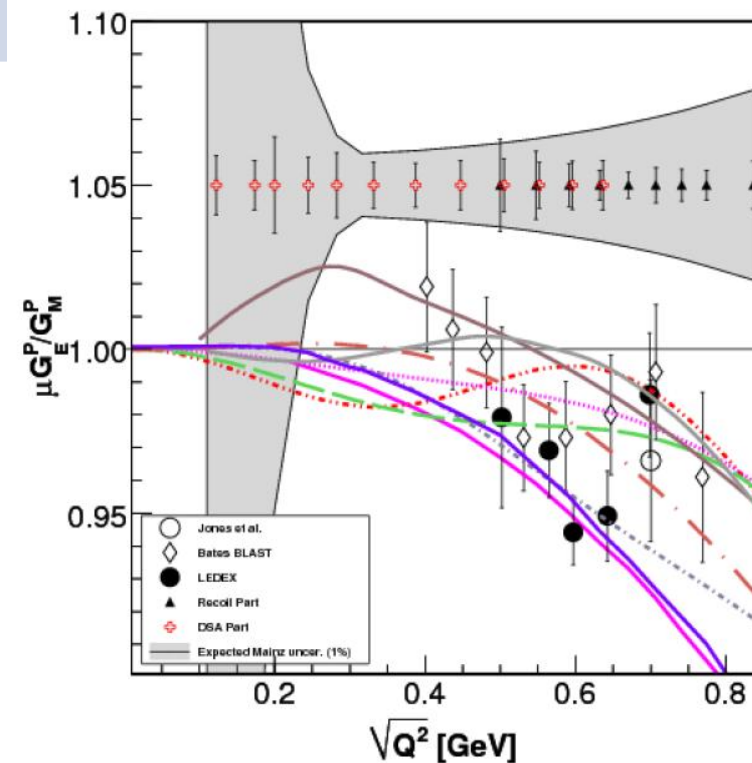
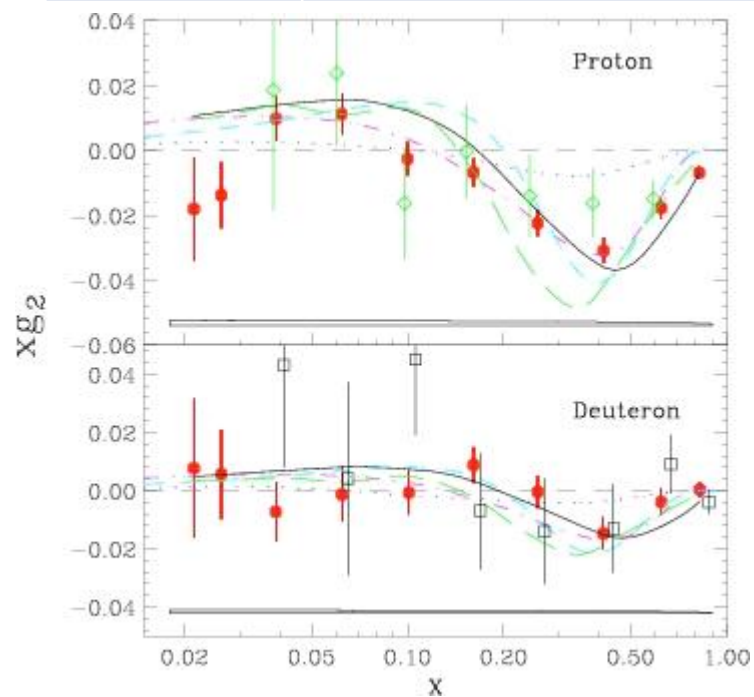


PRELIMINARY

2012

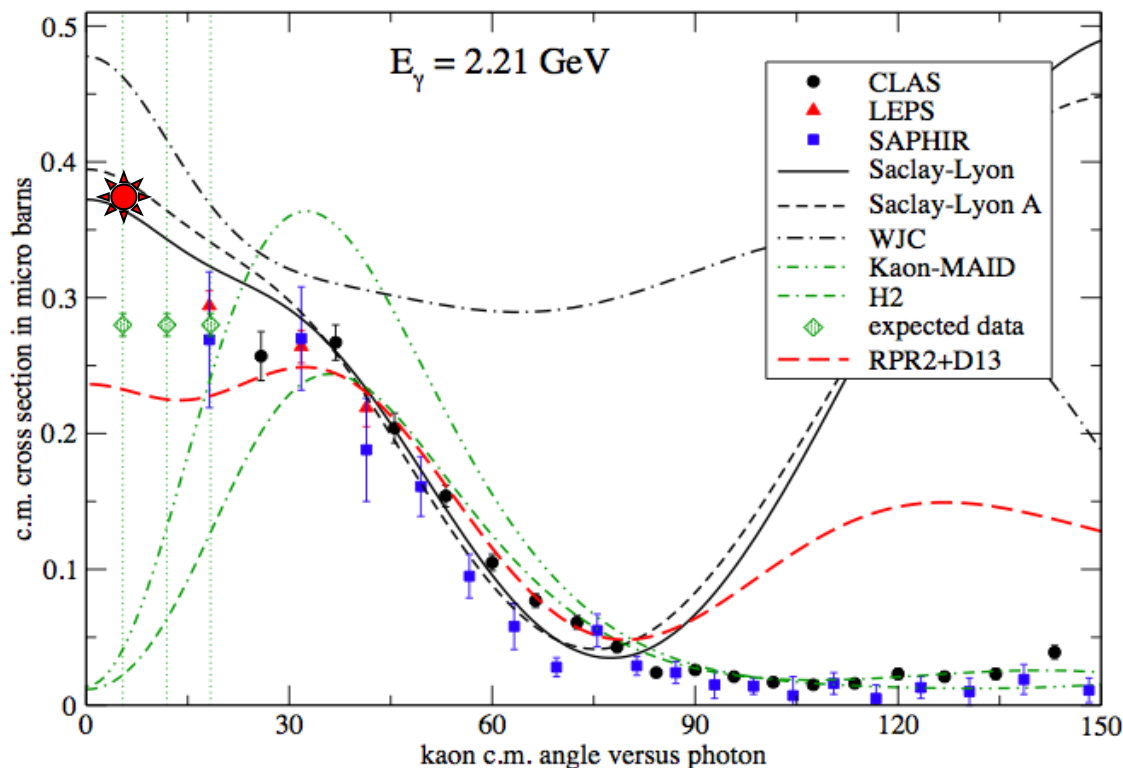
Last HallA Experiments @ 6 GeV

Exp.	Hypernuclei	Form Factors	Structure Function, PDF/TMD GPD	
g2p			$\vec{e} + \vec{P} \rightarrow e' + X$ (low $Q^2 < 1.3 \text{ GeV}^2$)	New septa
Proton FF: GE/GM		Pol. Trans + DSA at low $Q^2 < 0.7 \rightarrow G_{ep}/G_{Mp} \rightarrow$ Implication on DVCS and PVES		NH3 pol. target, New septa
Hypernuclei	On ^{16}O , cross section vs angle			



Ipernuclei
(esperimento previsto per fine 2012,
al momento cancellato)

E-07-012 - The Angular Dependence of $^{16}\text{O}(e,e'K)^{16}\text{N}_\Lambda$ and $^1\text{H}(e,e'K)\Lambda$



Region not covered by existing photo- and electroproduction data CLAS, SAPHIR, and LEPS

The ratio of the hypernuclear and elementary cross section measured at the same kinematics is almost model independent at very forward kaon scattering angles

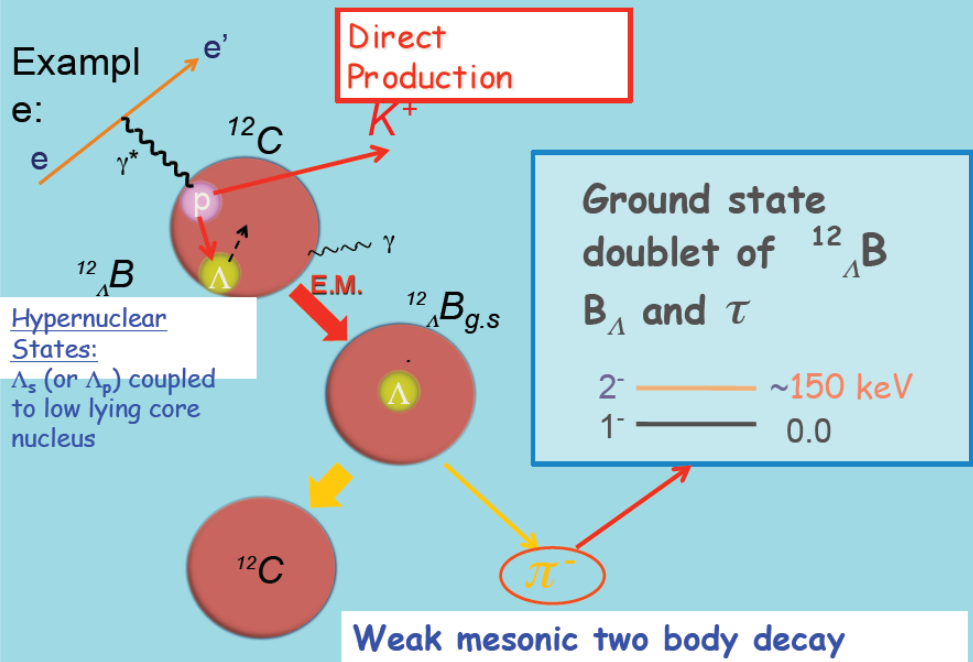
These data and, especially, the ratio of HN to the elementary cross section will give:

- new valuable information on hypernuclear structure (including spin assignment of produced hypernuclear states), and reaction mechanisms
- the modification of the dynamics of the $(e,e'K^+)$ process in the nuclear medium.

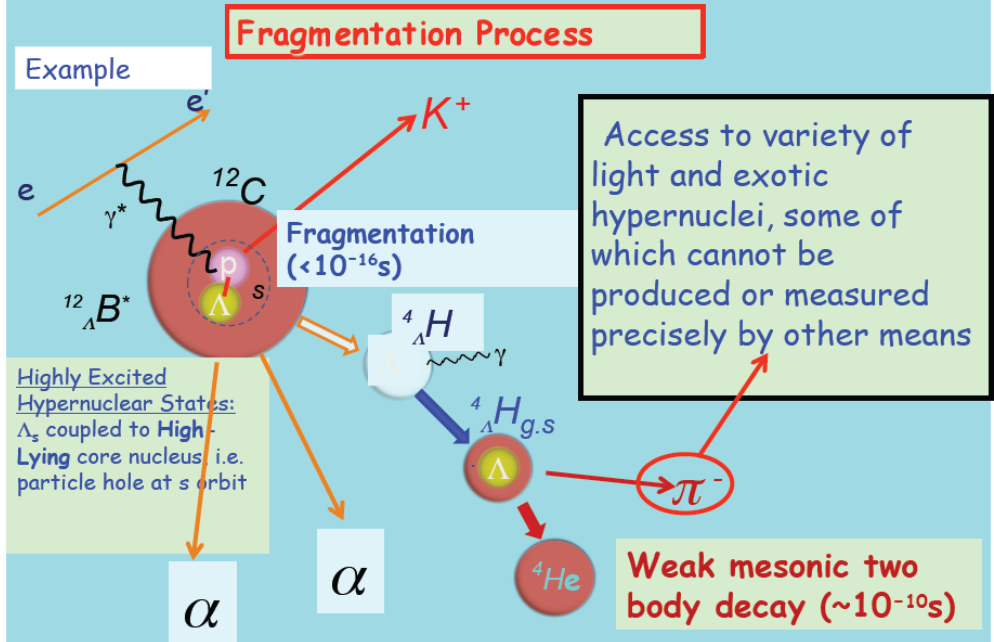
Parasitic test for E-08-012 Study of Light Hypernuclei by Spectroscopy of Two Body Weak Decay Pions **2-B:** $^A_\Lambda Z \rightarrow ^A(Z+1) + \pi^-$

2Body Pion Decay + Hypernuclear Exp.

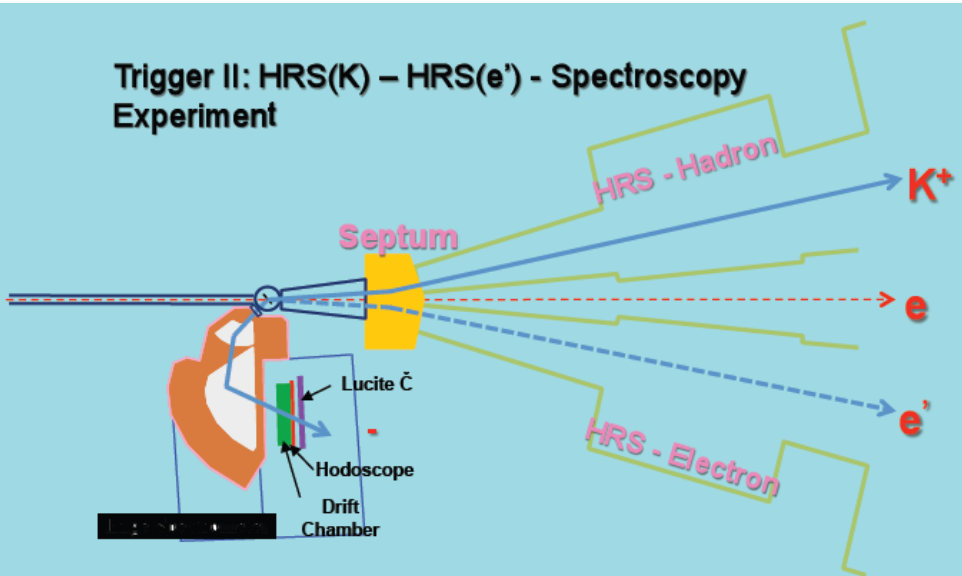
Decay Pion Spectroscopy to Study Λ -Hypernuclei



Decay Pion Spectroscopy for Light and Exotic-Hypernuclei



Trigger II: HRS(K) – HRS(e') - Spectroscopy Experiment



Trigger I: HRS(K) – Enge() - Decay Pion Experiment

Propedeutico per future proposte di esperimento in Hall A
 Che prevedono di sostituire Septum+HRS con Septum+HKS di Hall C

- Shorter path length ($\sim 9.0 \text{ m}$ vs. $\sim 24.2 \text{ m}$)
- Greater solid angle acceptance
- Greater momentum acceptance

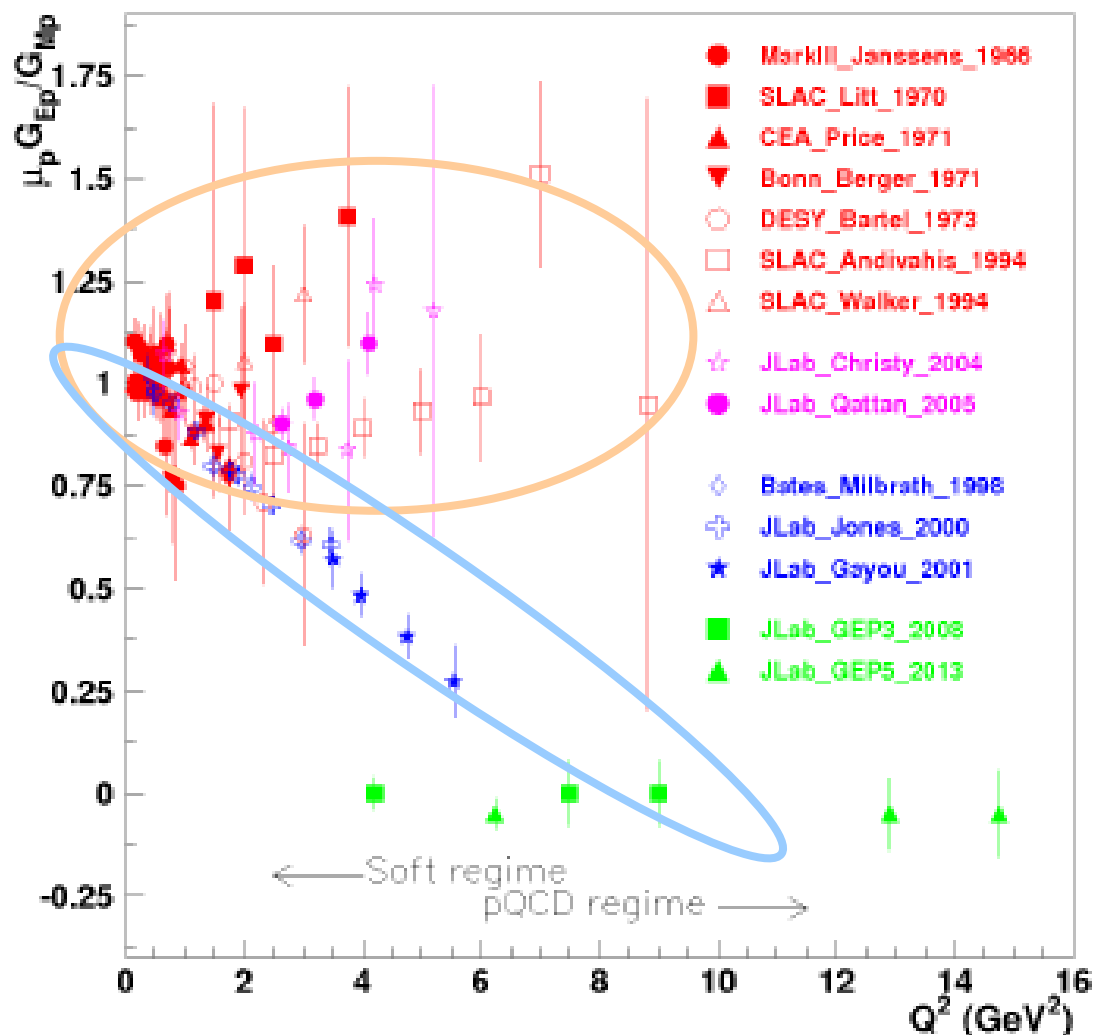
2013 ed oltre
(12 GeV era)

Halla Experiments @ 12 GeV

Exp.	Short Range Correlation	Form Factors	Structure Function, PDF/TMD GPD	PVES (beyond SM)	
Inclusive 3H, 3He	$\sigma(^3\text{He})-\sigma(^3\text{H})$ 2N, 3N Isospin dep.				HRS
GMP, GEP/GMP (GEP5), GMN		σ_{elastic} Pol transfer Double pol.			HRS, SBS&BB SBS&BB \supset GEM
Tritium			DIS off 3H 3He \rightarrow F2n/F2p		BB&HRS (maybe SBS)
A1n			DIS of 3He \rightarrow A1n $\sim (g1+\gamma g2)$		HRS&BB \supset GEM
SOLID-3He			SIDIS / π SSA on N (3D Sivers + Transversity)		Dedicated Solenoid
SIDIS			SIDIS / π + K SSA on N (2D Sivers + Transversity)		SBS&BB \supset GEM
DVCS			Exclusive reaction on H \rightarrow GPD		HRS & Dedicated detector
Moller				$\vec{e}^-e^- \rightarrow e^-e^- \Rightarrow \sin^2/(\vartheta_W)$ (0.1 %)	Dedicated Detector
SOLID-PVDIS				A_{PV} (0.5%), $\sin^2/(\vartheta_W)$ (0.6%)	Dedicated Solenoid

Fattori di Forma

Fattori di forma del protone



$$\frac{d\sigma}{d\Omega} \propto G_{Ep}^2 + \frac{\tau}{\varepsilon} G_{Mp}^2$$

Separazione Rosenbluth.

L'approssimazione di singolo fotone scambiato non sembra adeguata

$$\mu \frac{G_{Ep}}{G_{Mp}} = -\mu \frac{P_t}{P_l} \frac{(E_{beam} + E_e)}{2M_p} \tan \frac{\theta_e}{2}$$

Trasferimento di polarizzazione dalla sonda elettronica al protone diffuso elasticamente

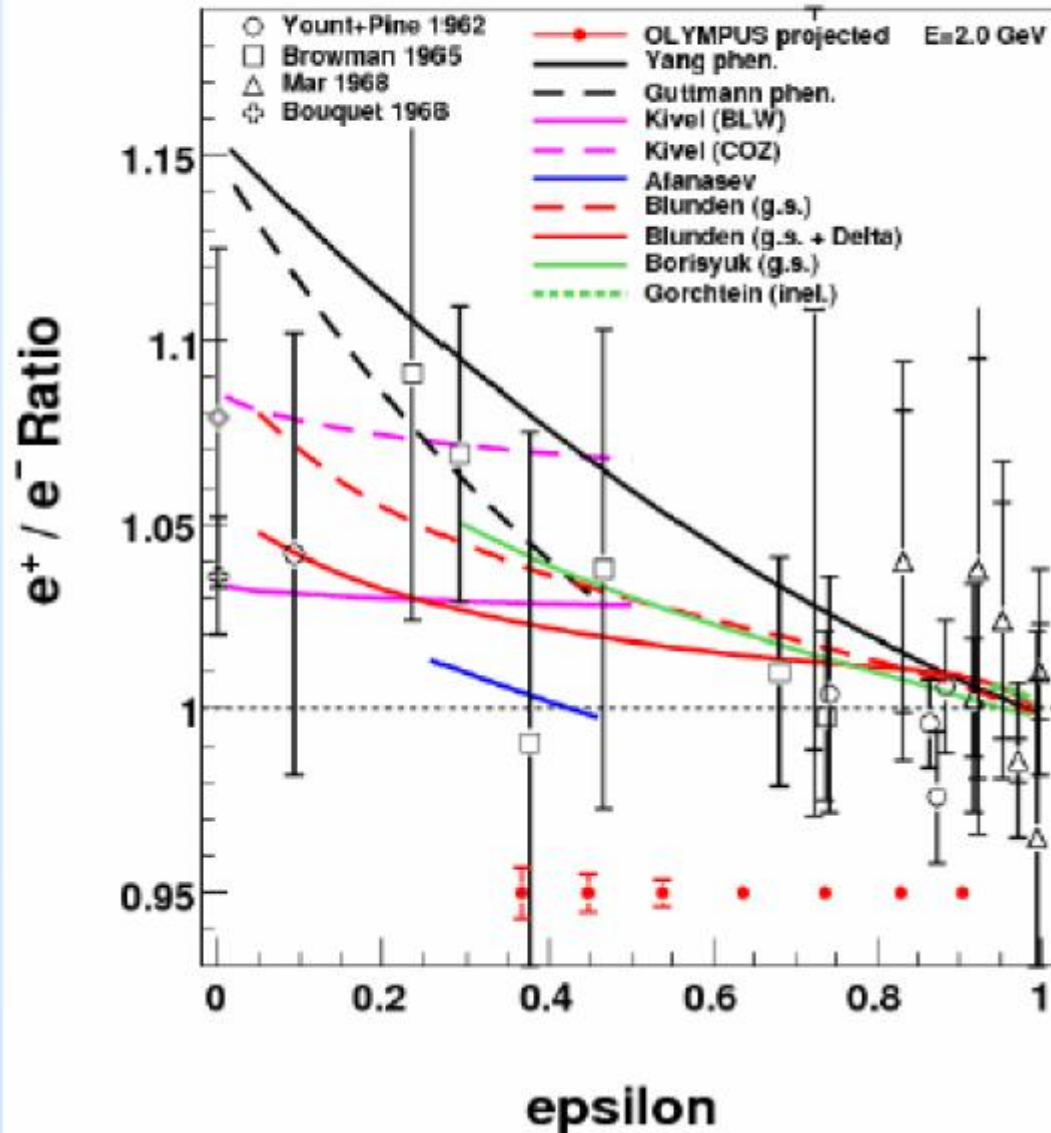
← Misure previste

Misura ad alto Q^2 (15 GeV^2) con tecnica del trasferimento di polarizzazione in diffusione elastica e+p.

Test per molti modelli fenomenologici.

Permette di studiare la regione di transizione tra la descrizione non- e perturbativa della QCD.

Projected Results for OLYMPUS



Data from 1960's

Many theoretical predictions with little constraint

OLYMPUS:

$E=2$ GeV

<1% projected uncertainties

500h @ 2×10^{33} / cm^2s

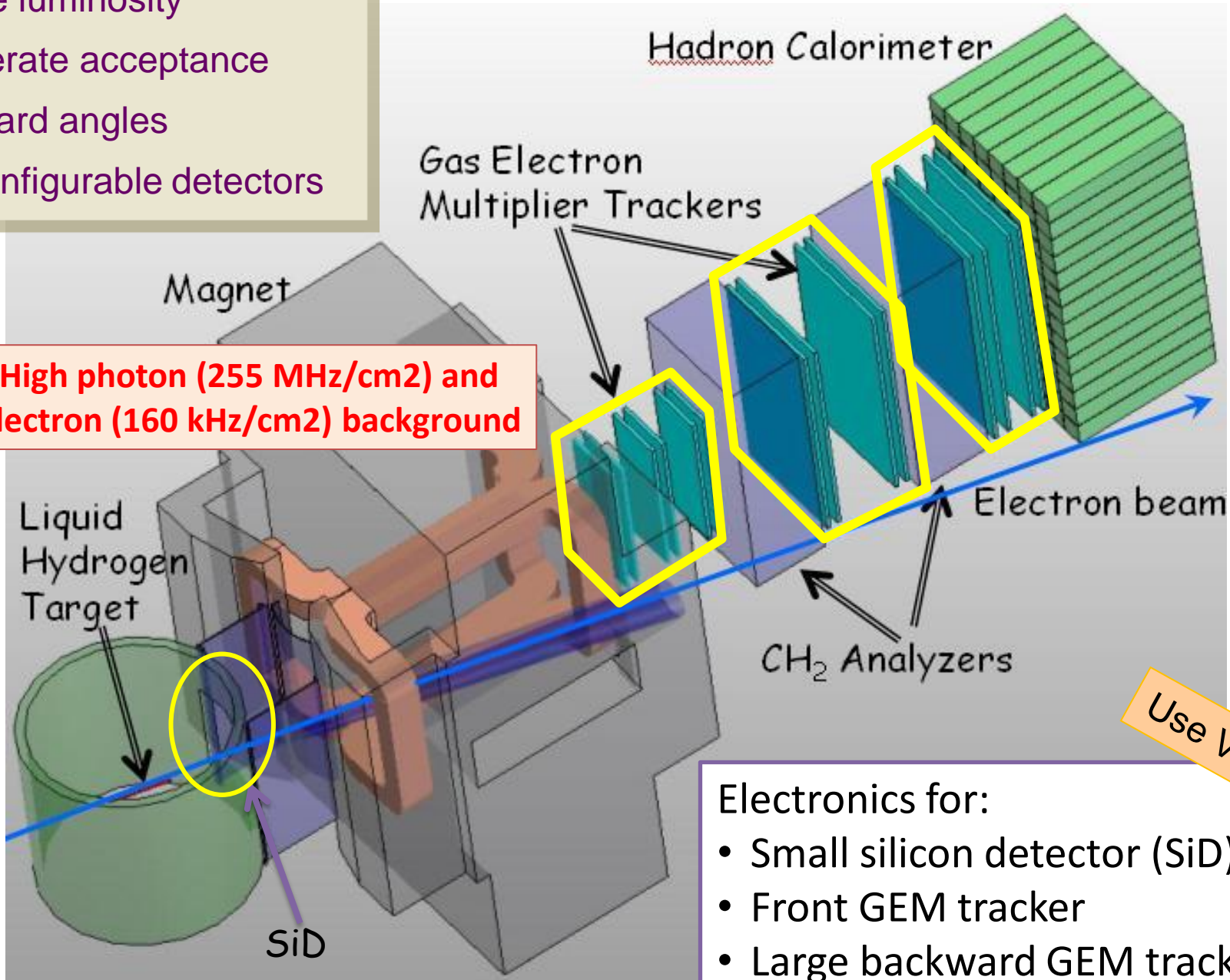
to be run in 2012

Apparati per i 12 GeV (Tracker per SBS)

SuperB_{igbite} Spectrometer in Hall A

- Large luminosity
- Moderate acceptance
- Forward angles
- Reconfigurable detectors

High photon (255 MHz/cm²) and electron (160 kHz/cm²) background



Use VME64x

- Electronics for:
- Small silicon detector (SiD)
 - Front GEM tracker
 - Large backward GEM trackers
- ⇒ >100k channels

Divisione dei compiti per GEM

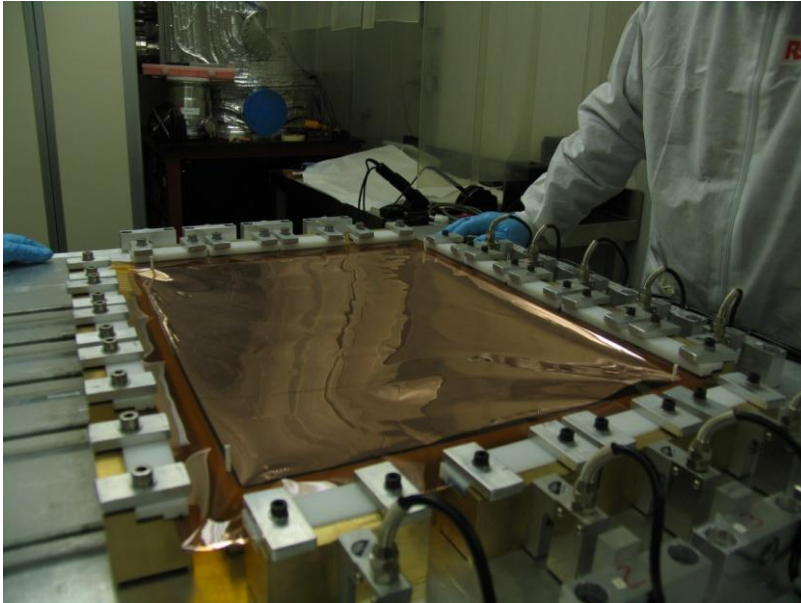
- Catania:
 - Design Meccanica + Analisi Elementi Finiti
 - Assemblaggio camere + Caratterizzazione
 - Analisi test
- Bari/Lecce
 - Sistema di gas + contributo MC
- Genova
 - Elettronica
- ISS
 - Coordinamento
 - Progettazione
 - Prototipazione
 - Supporto produzione + caratterizzazione
 - Monte Carlo Geant4

Tracciatore GEM, attività

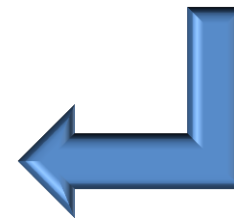
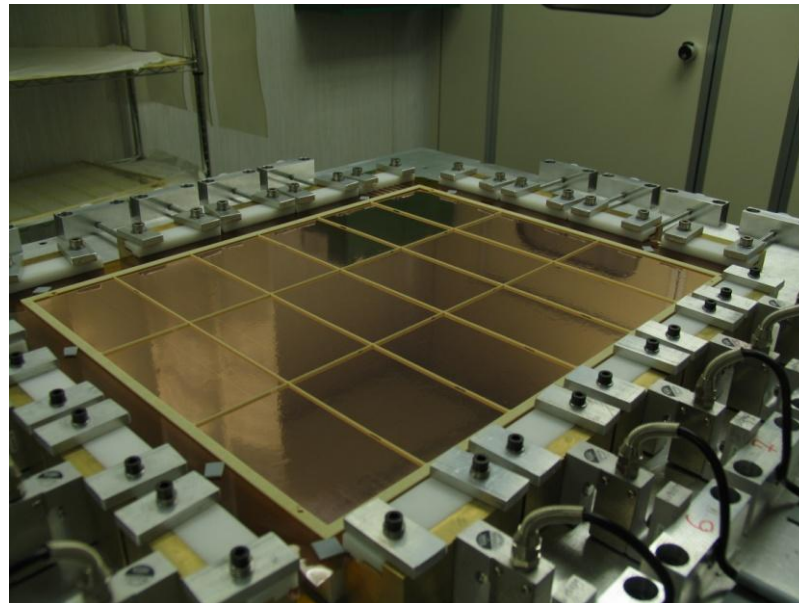
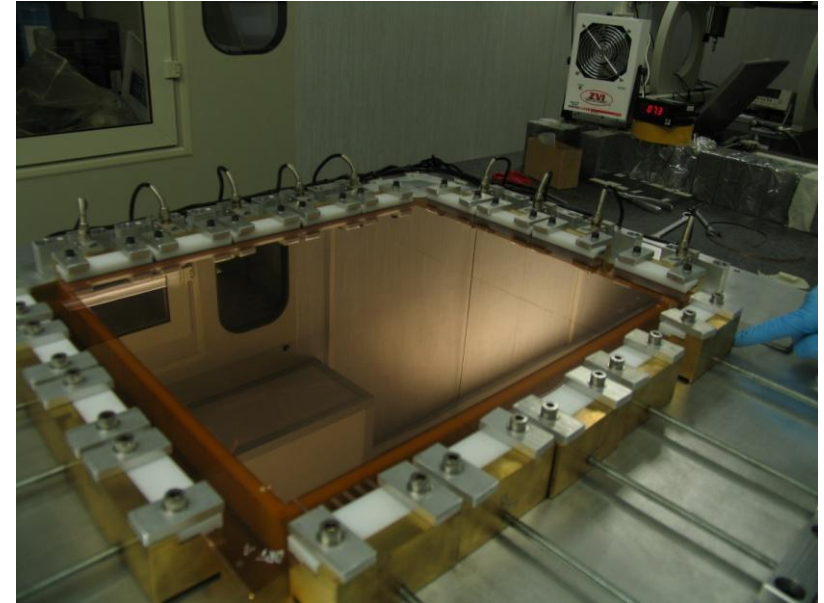
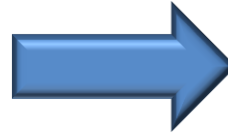
- Prototipo elettronica + firmware (GE/Paolo Musico)
- Test DESY/July 2010 (nuova elettronica)
- Primo prototipo 40x50 cm²
- Test DESY/Nov2010 (nuova elettronica + prototipo)
- Sviluppo Montecarlo e Simulatore GEM
- Finalizzazione design in corso (meccanica, gas, firmware)
- Supporto Olympus (installazione in corso)
- Test in campo magnetico (CERN/June 2011)
- Procurement Materiale 3 (4) camere GEM
- Realizzazione Camere (70%) / Caratterizzazione
- Caratterizzazione e Tuning Elettronica in Olympus

Verrà utilizzato nel primo esperimento a 12 GeV (A1n in the valence region) nello spettrometro BigBite

Assembling the first 40x50 cm² module



Stretching



Gluing the next
frame with
spacers

Electronics Components

GEM ⇒ FEC ⇒ MPD ⇒ DAQ

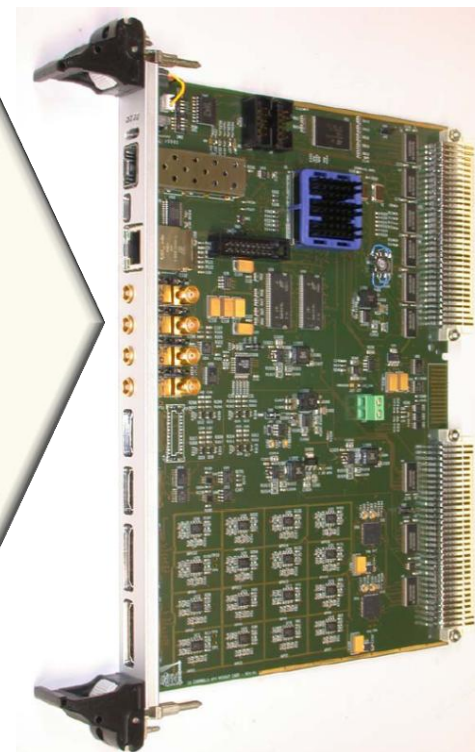
2D Readout

49.5 mm

75 mm

8 mm

Up to 10m
twisted,
shielded
copper cable
(HDMI)



Main features:

- Use analog readout APV25 chips
- 2 active components: Front-End card and VME64x custom module
- Copper cables between front-end and VME

Ri-utilizzata nelle GEM di Olympus

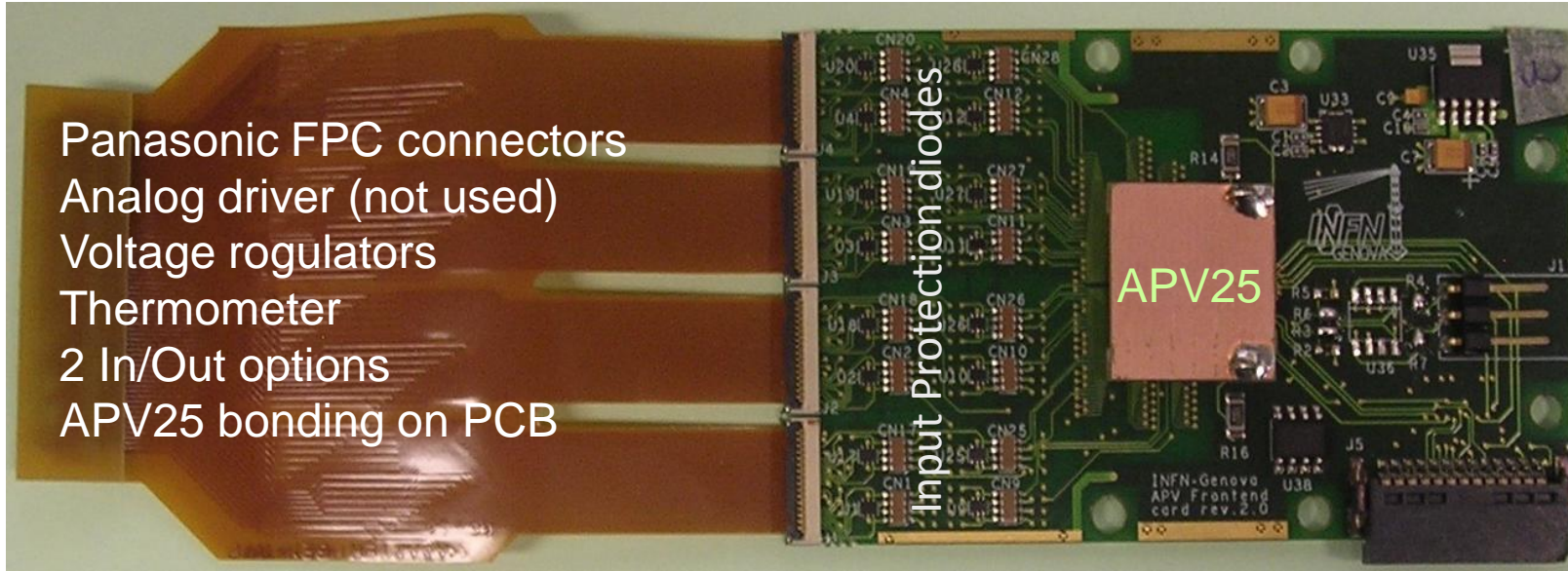
Utilizzata nei back tracker di SBS

Richiesta da 4 gruppi cinesi per sviluppi in SOLID (ed altro)

Paolo Musico/GE

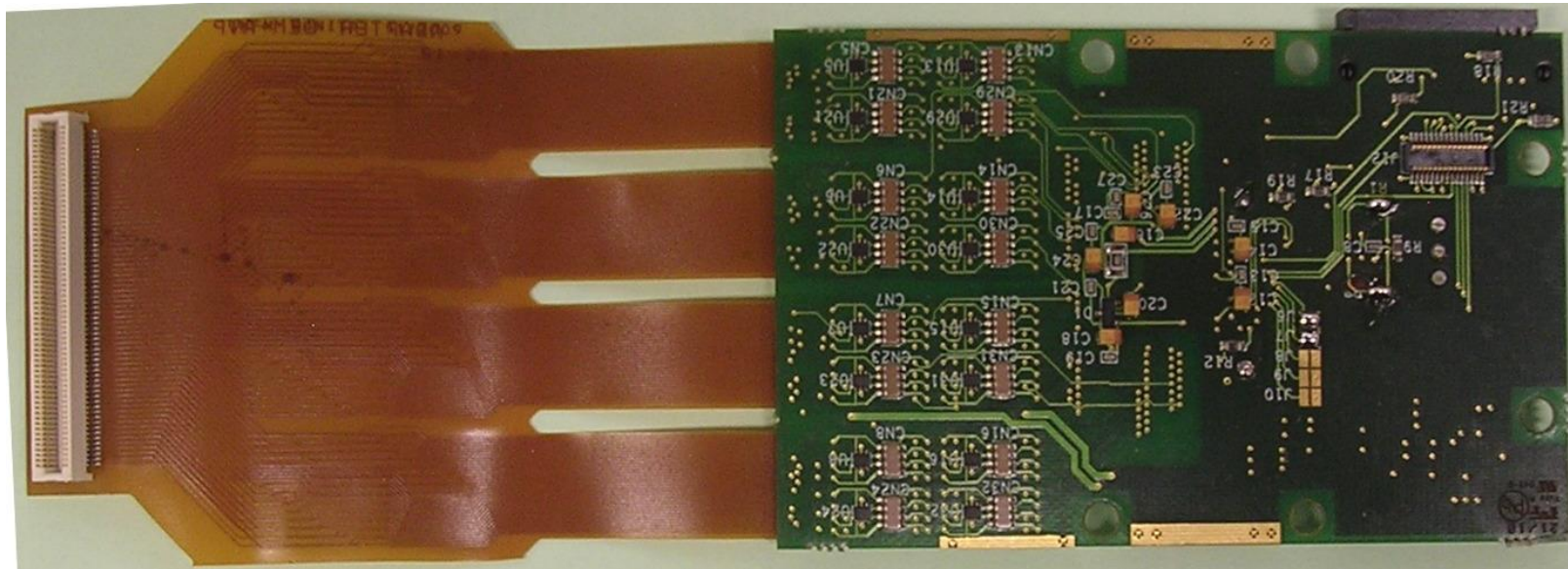
Front End Card (Proto 1 – basically final)

GEM ⇒ **FEC** ⇒ MPD ⇒ DAQ



Analog
Output

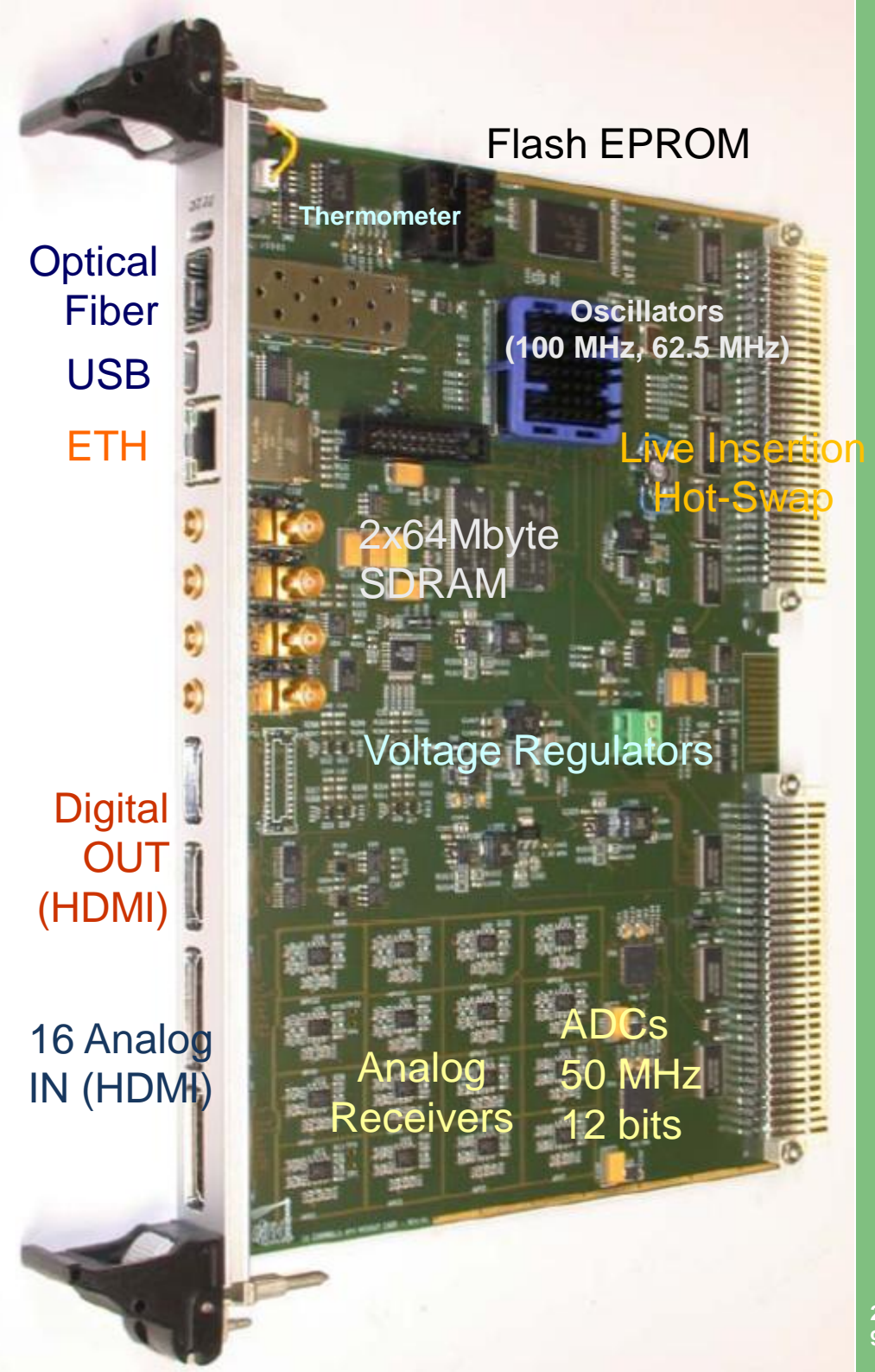
Digital Input +
Power supply



Analog out +
Digital Input +
Power supply

MultiPurposeDigitizer v1

- VME64x controller hosts the digitization of the analog signals coming from the front-end card.
- It handles all control signals required by the front end cards (up to 16 FE)
- Compliant to the JLab/12 VME64x VITA 41 (VXS) standard
- We intend to make it accessible by standard VME/32 as well
- 2 HDMI-type A: digital lines + 2 analog lines (compatible with SRS hybrids connector)
- 2 HDMI-type B: 16 analog lines
- Added delay line for clock-convert phase fine tuning (DELAY25 from CERN)

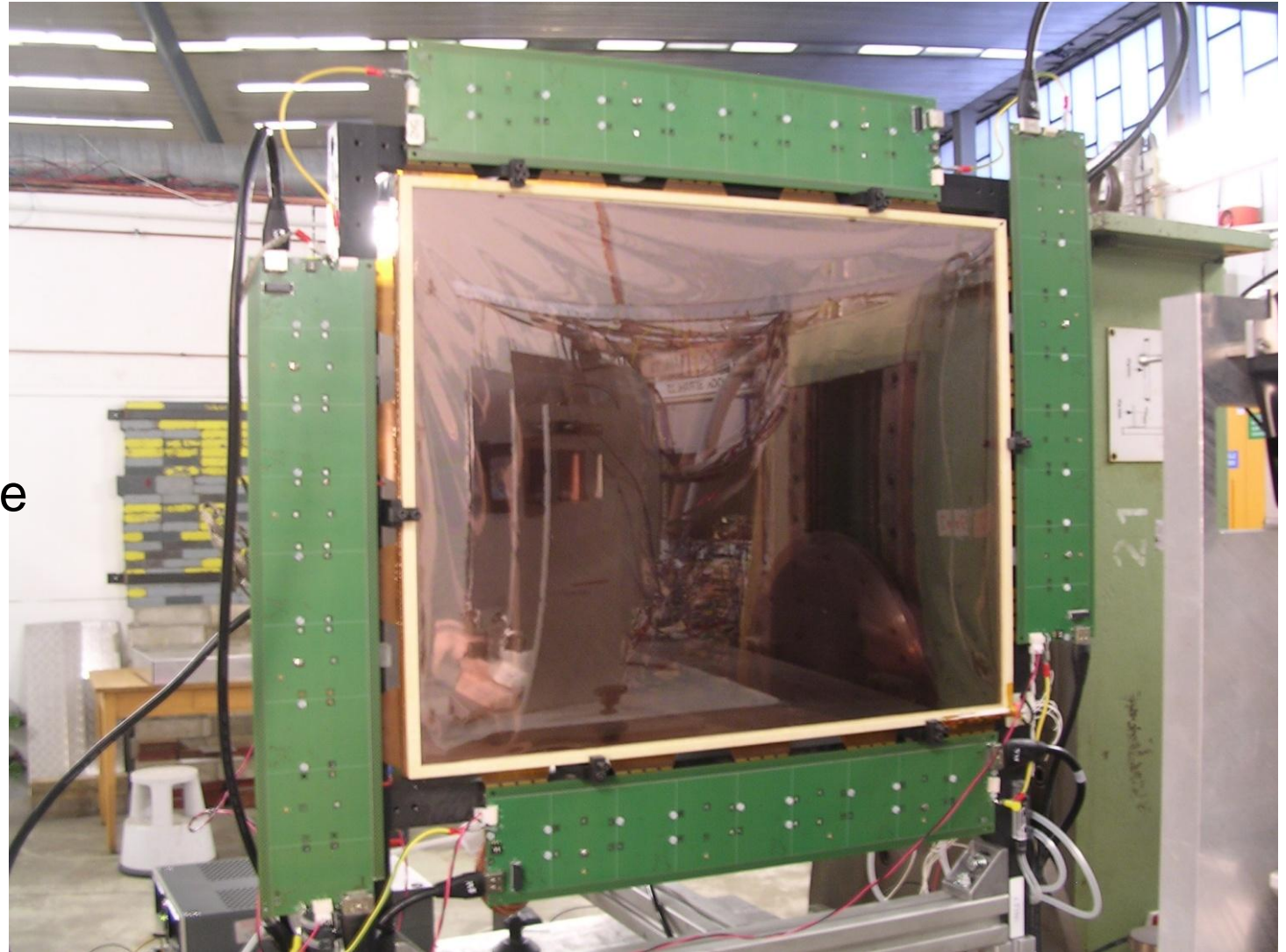


Beam test @ DESY (EUFDET support)



Beam test @ DESY (EUNET support)

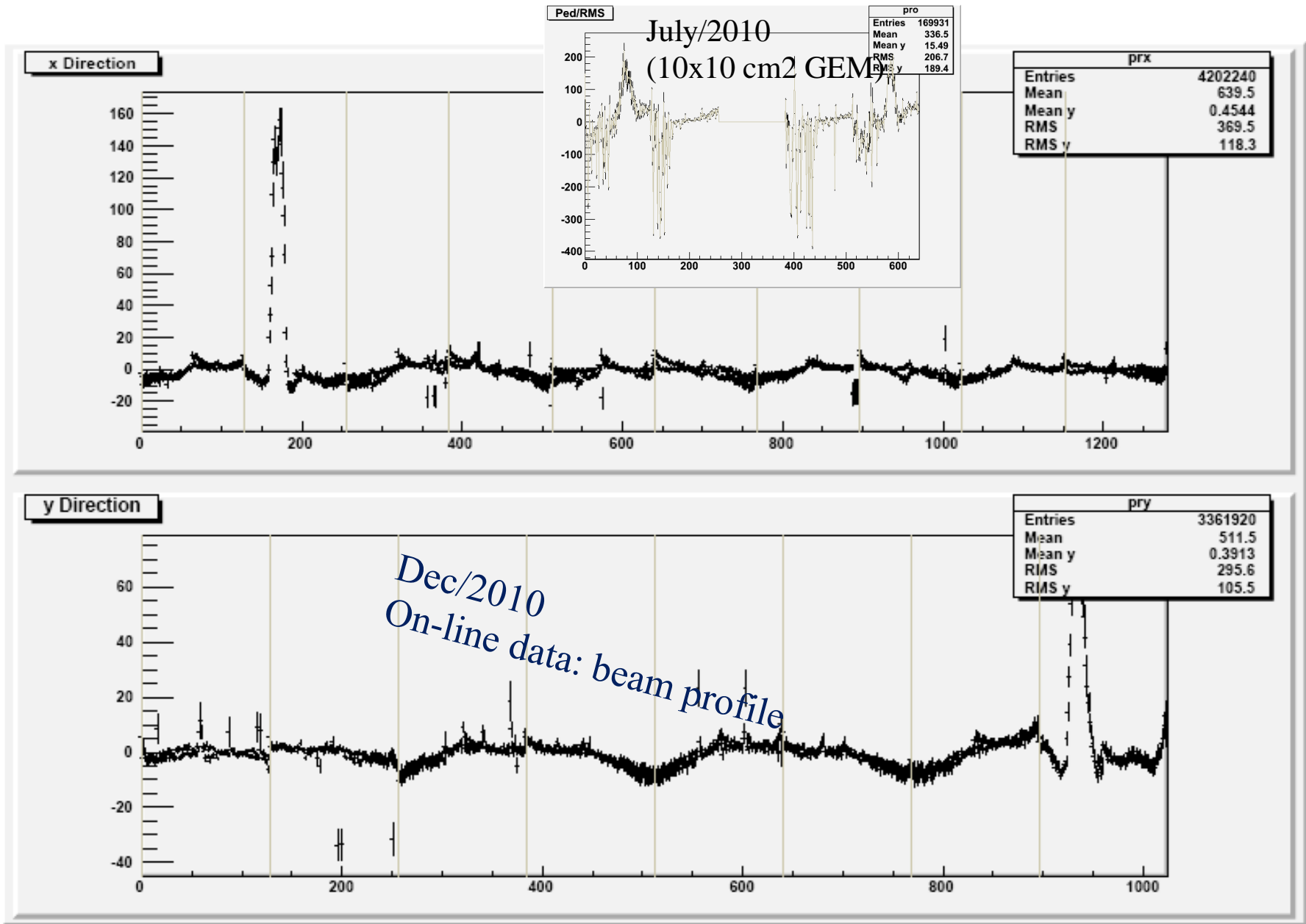
- Fully equipped GEM module
- 18 front-end cards
- 2304 channels
(front end cards on the other side)
- 7 independent HV levels



2-6 GeV low intensity electron beam / silicon tracker available

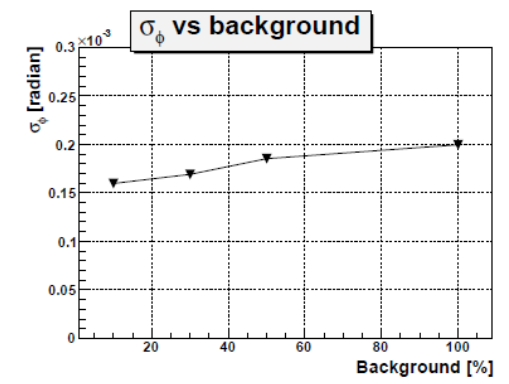
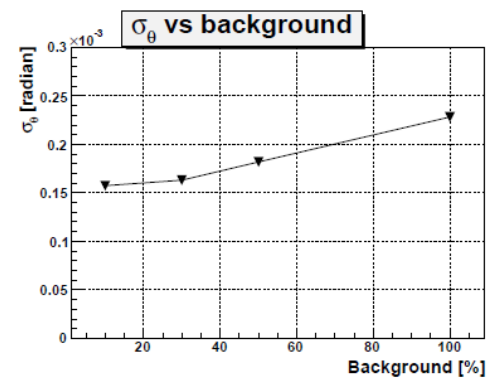
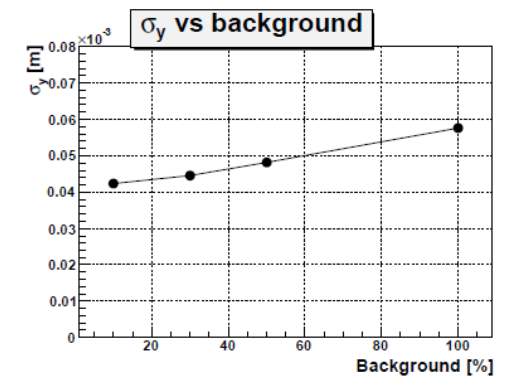
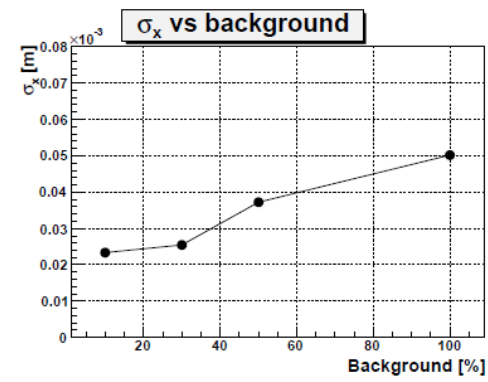
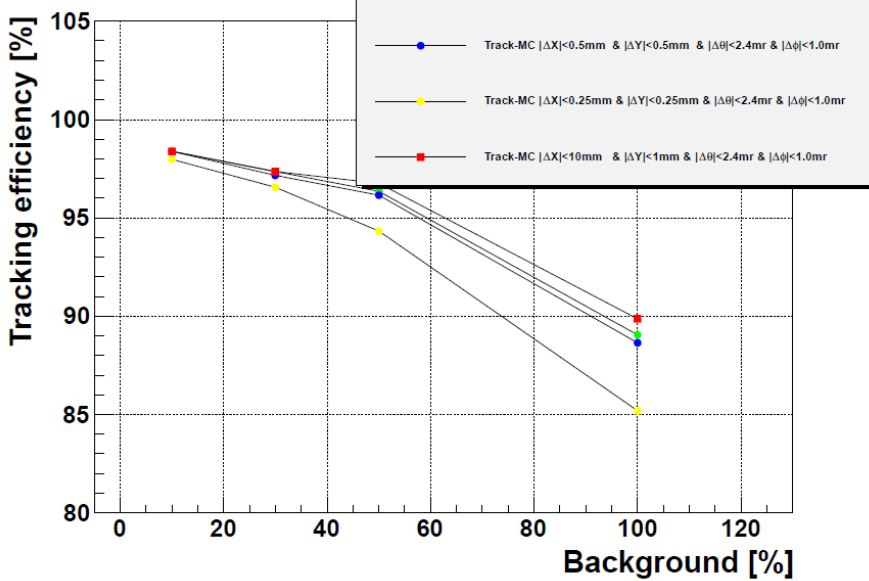
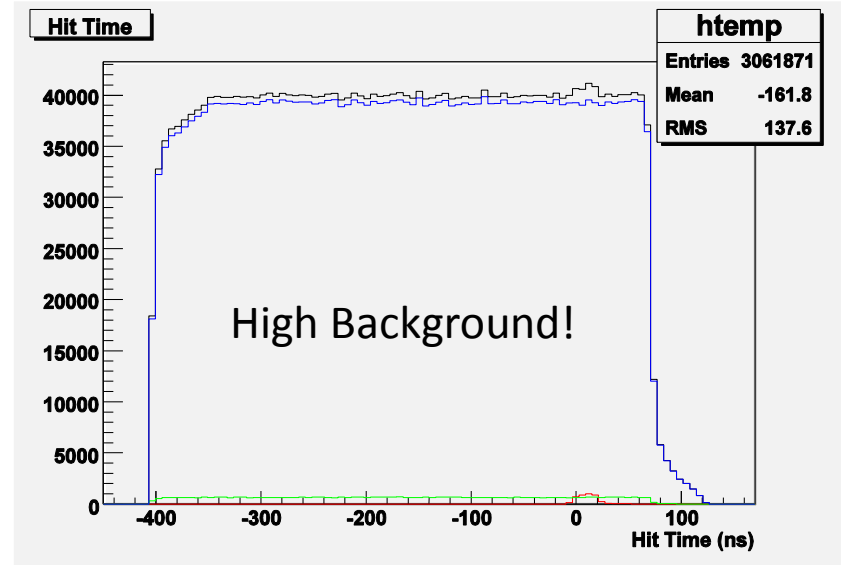
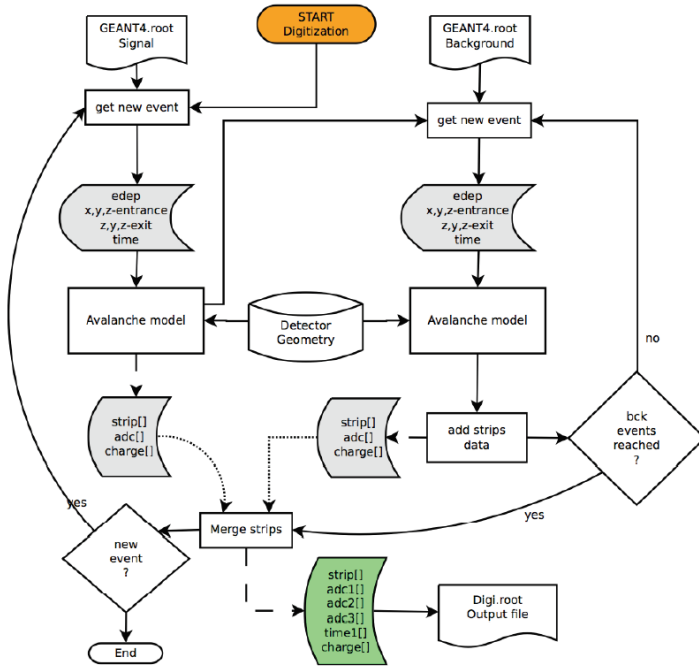
Data taking: 28/Nov-3/Dec 2010

Beam test @ DESY (EUFDET support)



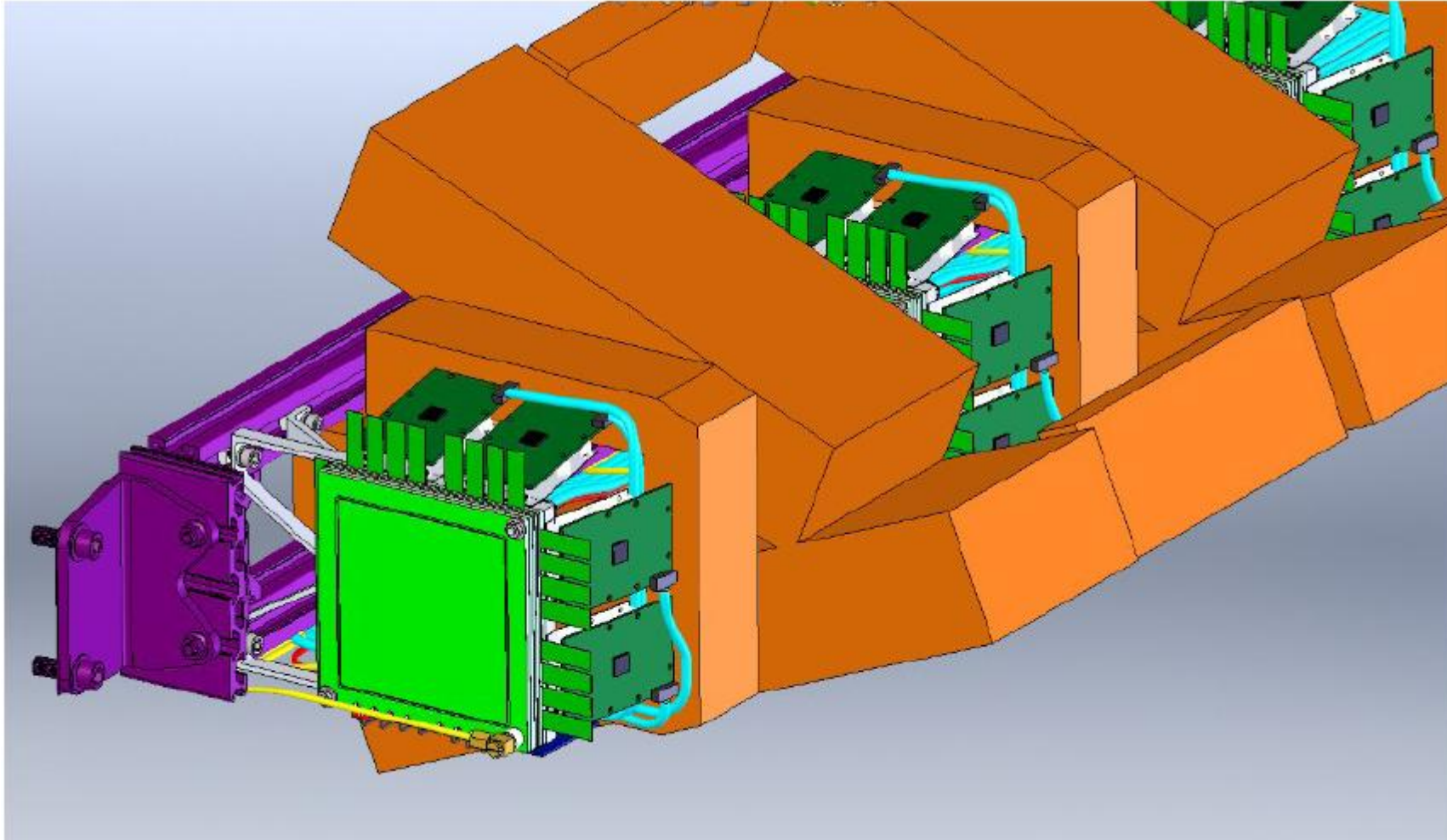
Large improvement from July/2010

MonteCarlo + Digitizzazione + Tracciamento



Flessibilità del progetto GEM

Implementazione in Olympus



Previsione attività 2012

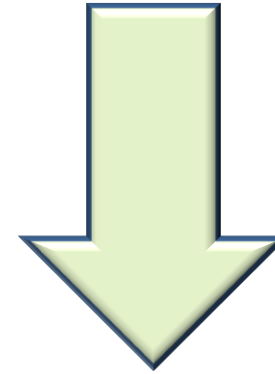
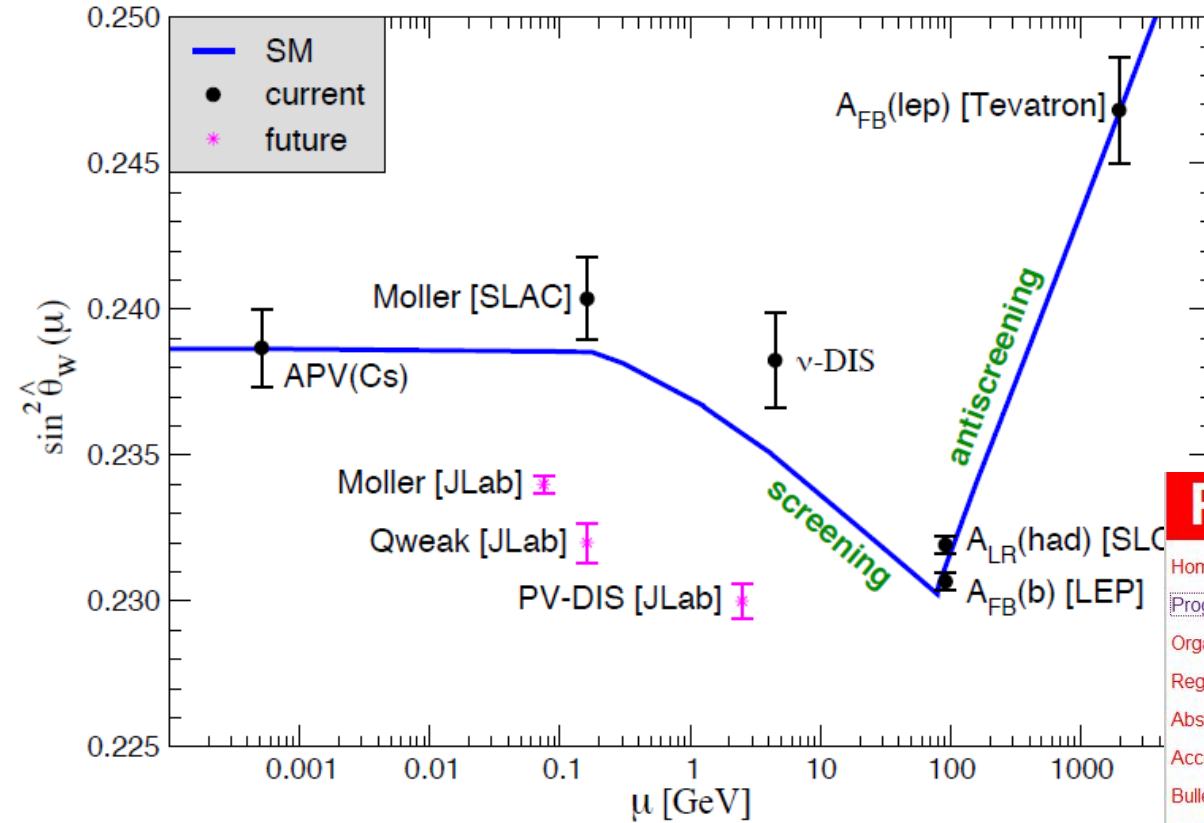
- Completamento Produzione GEM (30%)
- Supporto Prototipazione RICH CLAS12
- Ultimi esperimenti 6 GeV (ipernuclei ?)
- Presa dati Olympus (estate 2012),
 - Tra l'altro importante banco di prova per GEM electronics

Previsione Spesa 2012 / ISS

- Missioni Interne: 5-7 keuro
- Missioni Esterne: 25 keuro
- Consumabile: 5-10 keuro
- Costruzione Apparati (xGEM): 25-30 keuro

- Produzione GEM (tutte le sezioni):
 - ~ 120 keuro (30% camere GEM)

Standard Model Test and more



<http://www.roma1.infn.it/pavi11/>

PAVI11

Parity Violation to Hadronic Structure and more..

- Home
- Program
- Organization
- Registration
- Abstract submission
- Accommodation
- Bulletin
- Poster
- Proceedings
- Social events
- Local Info
- Links



PAVI11 - Rome, September, 5 - 9 2011

The 5th International Workshop "From Parity Violation to Hadronic Structure and more..." will be held from 5 through September 9, 2011 in Rome. This event is scheduled as the continuation of the previous four workshops, the first one having been held at the Institut fuer Kernphysik in Mainz, (Germany, 2002), the second one at the Laboratory for Subatomic Physics and Cosmology (LPSC) in Grenoble (France, 2004), the third at the Milos Conference Center (Milos, Greece, 2006) and the fourth at Atlantic College (Bar Harbor, Maine, USA, 2009).

The workshop represents a unique opportunity for scientists from all over the world to present and discuss their work in a variety of subjects from Parity Violation to Hadronic Structure Physics. It will be held at "Sapienza" University in Rome.



Helmholtz-Institut Mainz

E-mail: pavi11@roma1.infn.it Local contact: Guido Urciuoli +390649914087

Parity Violation Physics argomento centrale at JLab