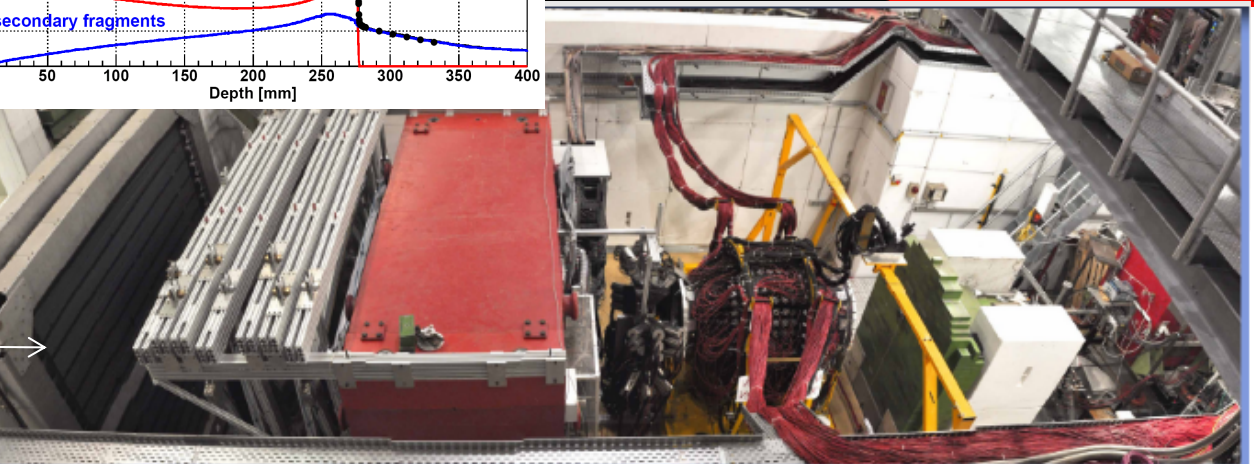
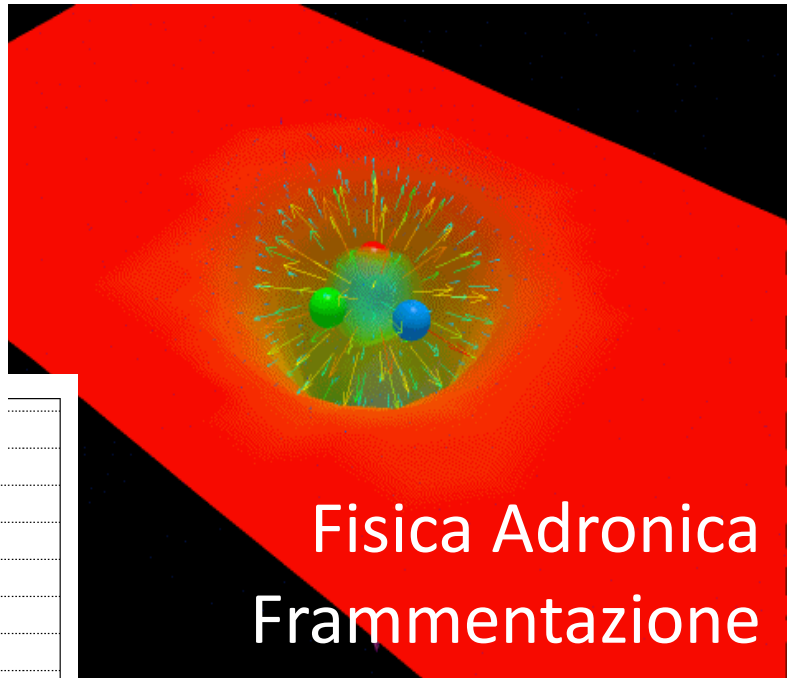
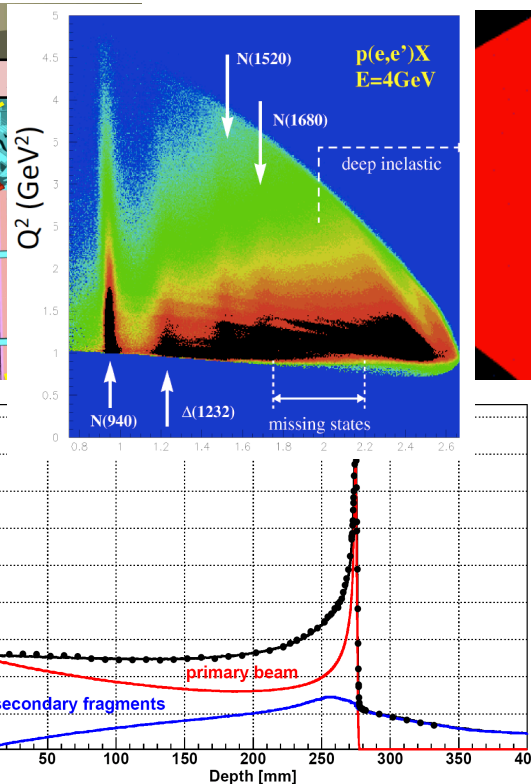
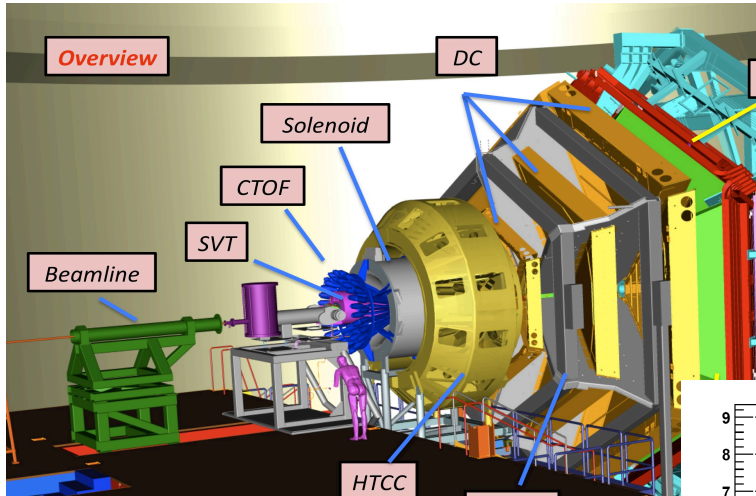


Gruppo III Roma Tor Vergata



Anagrafica GIII Roma Tor Vergata - Ricercatori

Nome	Età	Posizione	Qualifica	EIC_NET_DTZ	FOOT	JLAB12	MAMBO	UE-STRONG_2028	DOT3	CSM I	CSM II	CSM IV	CSM V	P.S.	CCR	Servizi	UE	POM	POR	FIRB	PRIN	ALTRO	PP	TT	C3H	Tot. M
1 D'Angelo Annalisa		Inc. Ric.	Prof. Associato	10		80								10												100
2 Di Salvo Rachele Anna		Dipendente	Ricercatore	10			90																			100
3 Fantini Alessia		Inc. Ric.	Ricercatore Universitario	20			80																			100
4 Messi Roberto		Inc. Ric.	Prof. Associato				0																			0
5 Morone Maria Cristina		Inc. Ric.	Prof. Associato		70								30													100
6 Narici Livio		Inc. Ric.	Prof. Associato		30					70																100
7 Romaniuk Mariia		Associato	Ricercatore straniero				100																			100
8 Lanza Lucilla		Assegn./Bors.	Assegnista	10		90																				100
				FTE Totali	0.5	1	1.7	2.7					Totale: 5.9 FTE													

Percentuale di partecipazione 5.9 FTE / 8 RIC (di cui uno in quiescenza)= 74%

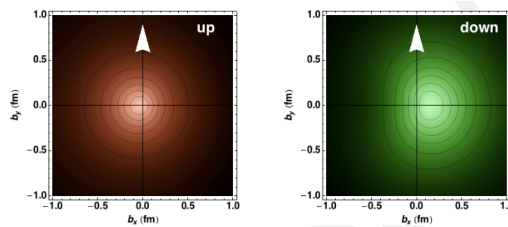
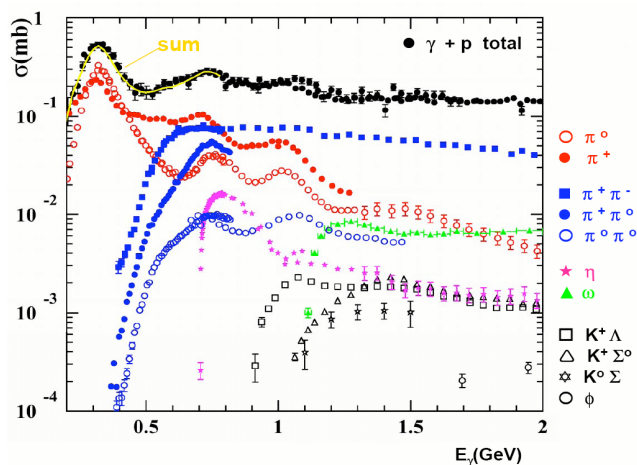
Anagrafica GIII Roma Tor Vergata - Tecnici

	Nome	Età	Posizione	Qualifica	Afferenza	EIC_NET + DTZ	FOOT	JLAB12	HAMBO
1	Iannilli Maurizio		Associato	Tecnico Categoria B	CSN III			20	30
2	Nobili Giovanni		Dipendente	C.T.E.R.	CSN III			50	40
3	Pecchi Daniele		Associato	Tecn.Cat.C	CSN III			30	40
4	Reali Enzo		Associato	Tecnico Categoria B	CSN II			30	
5	Tusi Enrico Maria		Associato	Tecnico Categoria B	CSN III			30	
6	Vitali Gianni		Associato	Tecn.Cat.C	CSN III				60
					FTE Totali			1.6	1.7

JLAB12 Jefferson Laboratory at 12 GeV

Motivation. Photo- and electro-production reactions on nucleons and nuclei with polarized beams and targets for:

- ✓ Hadron spectroscopy
- ✓ Nucleon Structure
- ✓ HPS – Heavy Photon Search

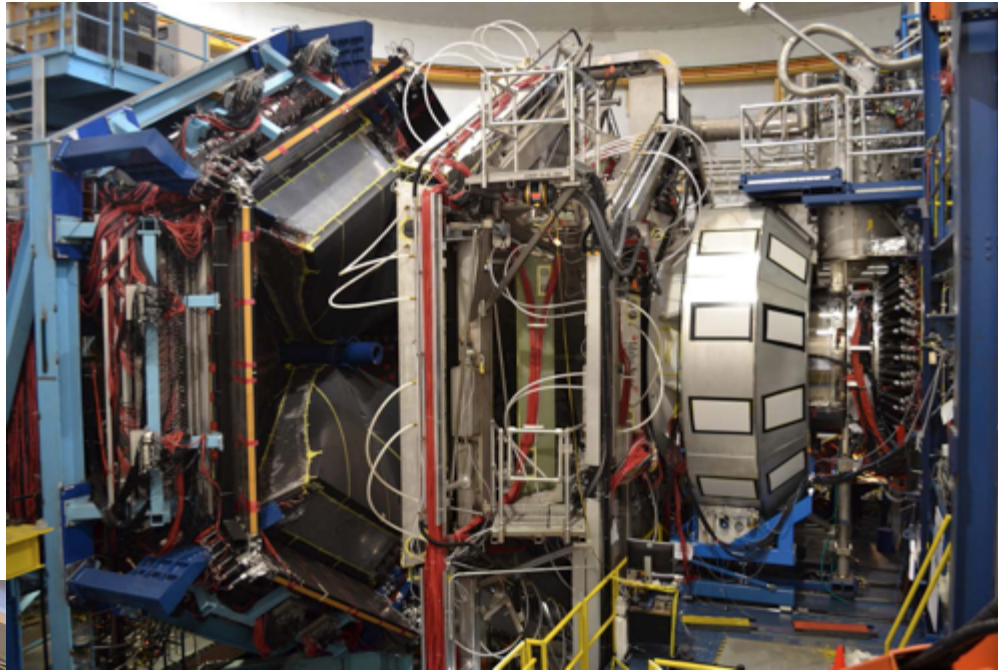


Bari, Brescia, Catania, Ferrara, Genova, LNF, LNS, Roma1, ISS, Roma Tor Vergata, Sassari, Torino, Padova, Pavia

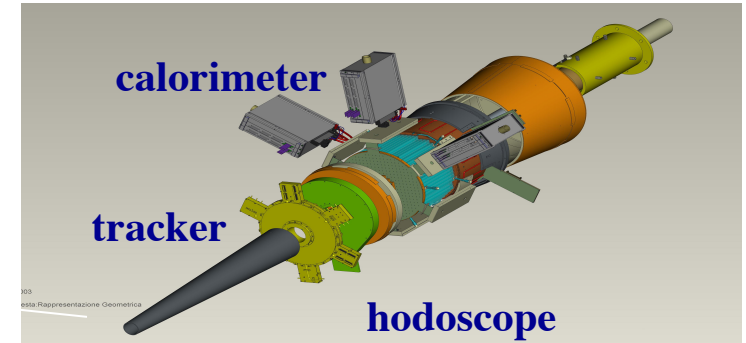
Thomas Jefferson National Accelerator Facility – Virginia, USA People: 72 researchers, 46 FTE

Data taking 2018-2027@ JLAB, Virginia

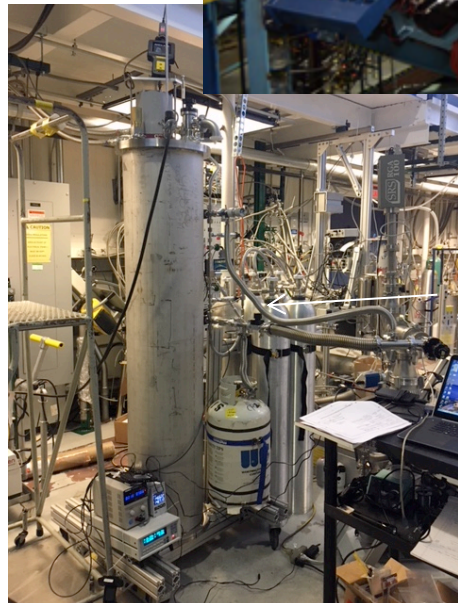
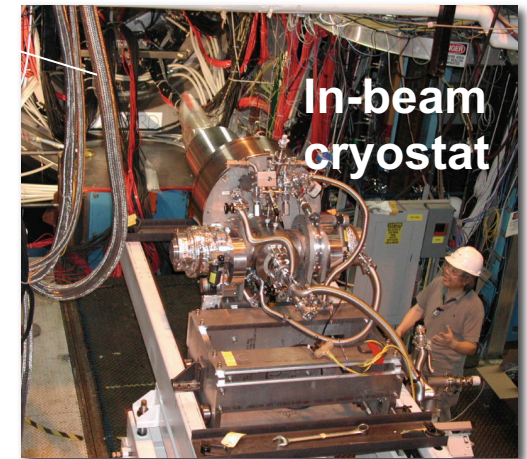
CLAS12



$\theta = 2.5^\circ \rightarrow 4.5^\circ$
Forwar Tagger

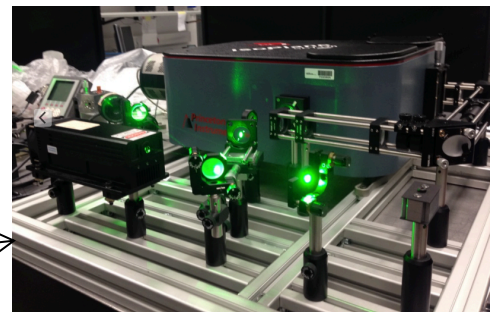


Polarized target



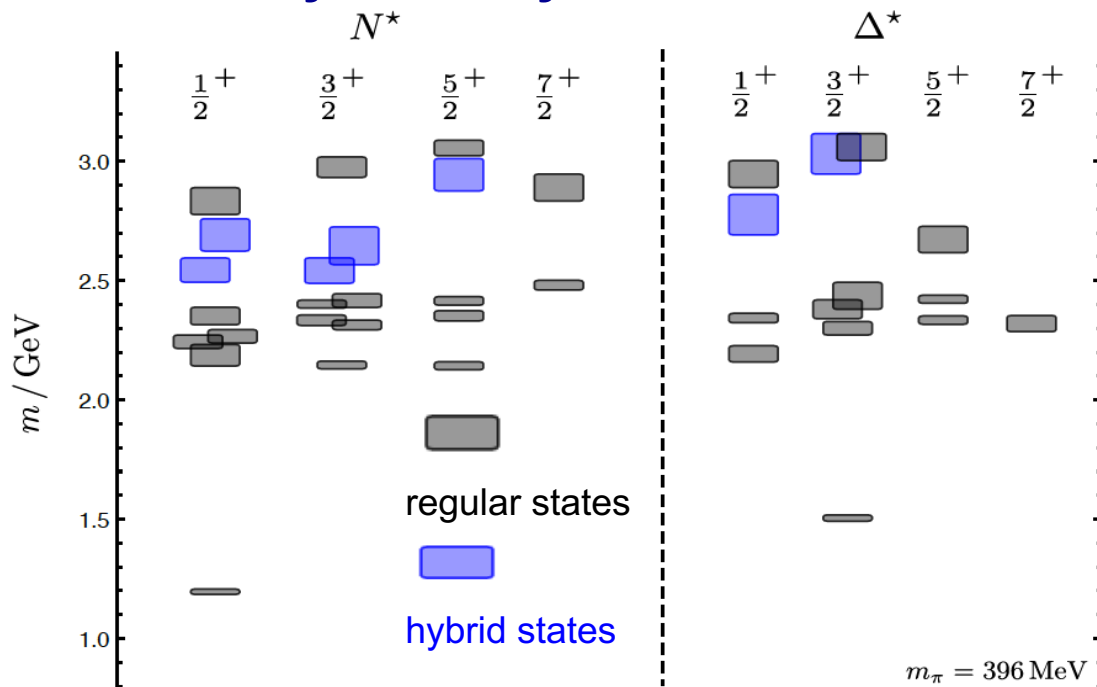
HD gas distiller

Portable Raman



Hadron Spectroscopy: search for hybrid baryons at CLAS12

Hybrid Baryons in LQCD



A Search for Hybrid Baryons in Hall B with CLAS12

Volker Burkert (*Spokesperson*), Daniel S. Carman (*Spokesperson*), Valery Kubarovsky, Victor Mokeev (*Spokesperson*), Maurizio Ungaro, Veronique Ziegler
 Thomas Jefferson National Accelerator Facility, Newport News, Virginia 23606, USA

Annalisa D'Angelo (*Contact Person, Spokesperson*), Lucilla Lanza, Alessandro Rizzo
 Università di Roma Tor Vergata and INFN Roma Tor Vergata, 00133 Rome, Italy

Gleb Fedotov, Evgeny Golovach (*Spokesperson*), Boris Ishkhanov, Evgeny Isupov, Igor T. Obukhovskiy[†]
 Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, 119991 Moscow, Russia

Ralf W. Gothe (*Spokesperson*), Iuliia Skorodumina
 University of South Carolina, Columbia, South Carolina 29208, USA

Vincent Mathieu[†], Vladyslav Pauk, Alessandro Pilloni, Adam Szczepaniak[†]
 Theory Center, Jefferson Laboratory, Newport News, Virginia 23606, USA
 ([†]Joint with Indiana University, Bloomington, Indiana 47405, USA)

Simon Capstick[‡], Volker Crede, Johnathan Gross[‡]
 Florida State University, Tallahassee, Florida 32306, USA

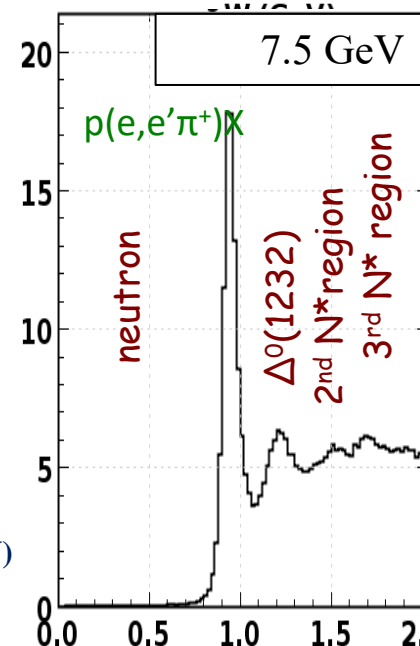
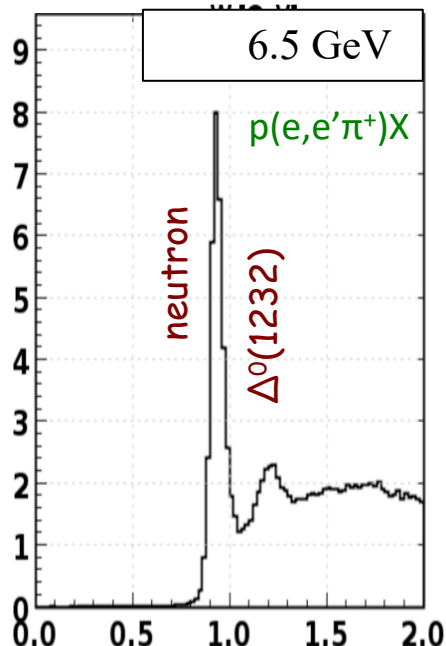
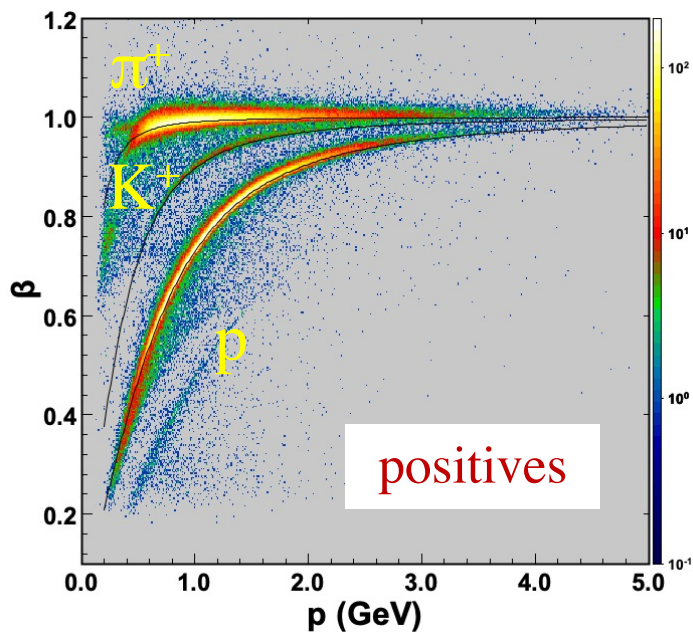
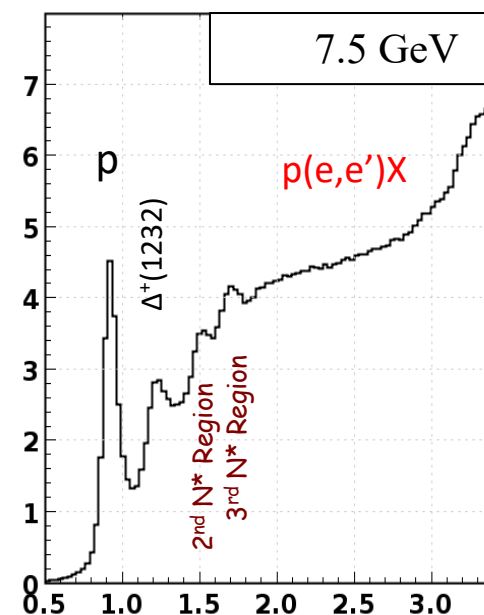
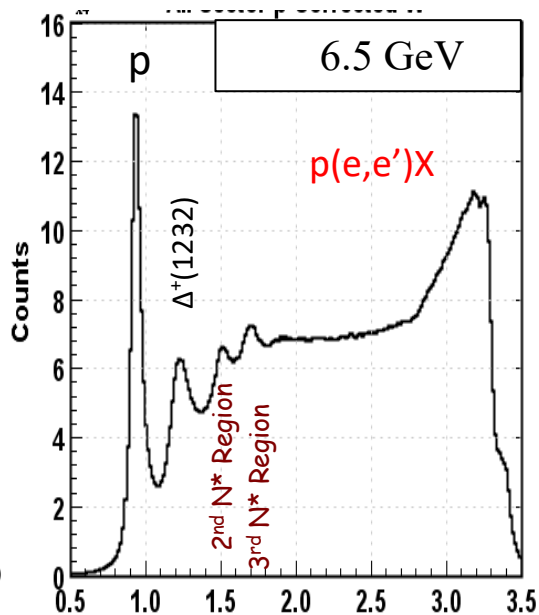
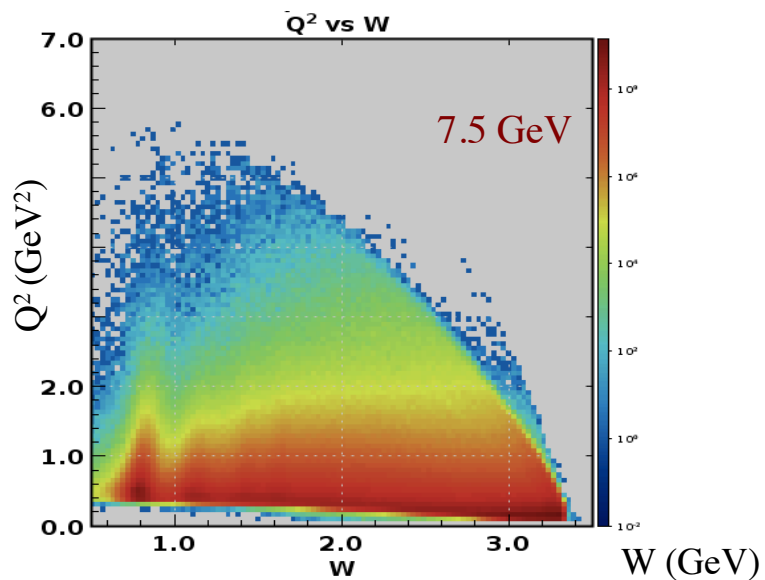
Approved experiment:
A⁻ rating + 100 PAC days beam time

Hybrid states have same J^P values as qqq baryons. How to identify them?

- Overpopulation of N $1/2^+$ and N $3/2^+$ states compared to QM projections.
- $A_{1/2}$ ($A_{3/2}$) and $S_{1/2}$ show different Q^2 evolution. Can we do it?

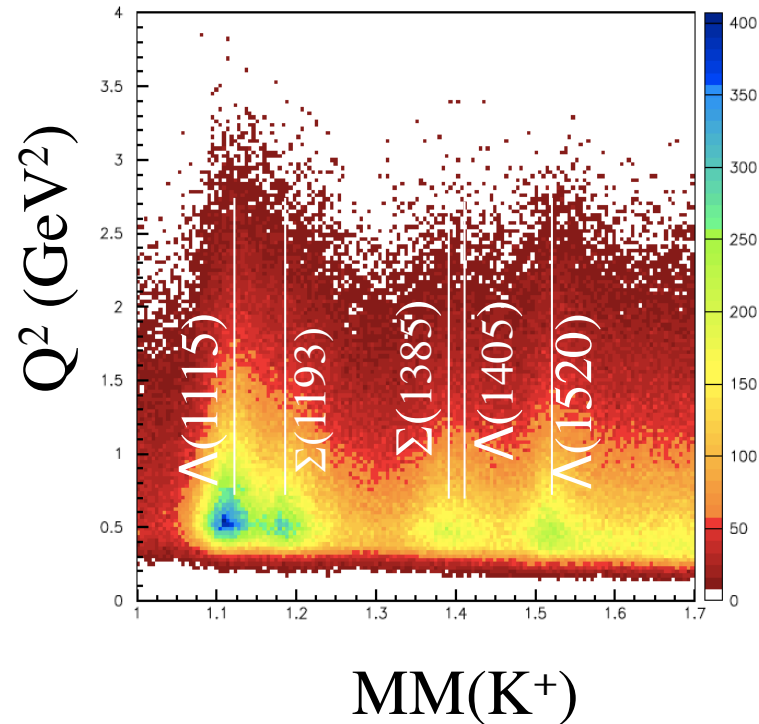
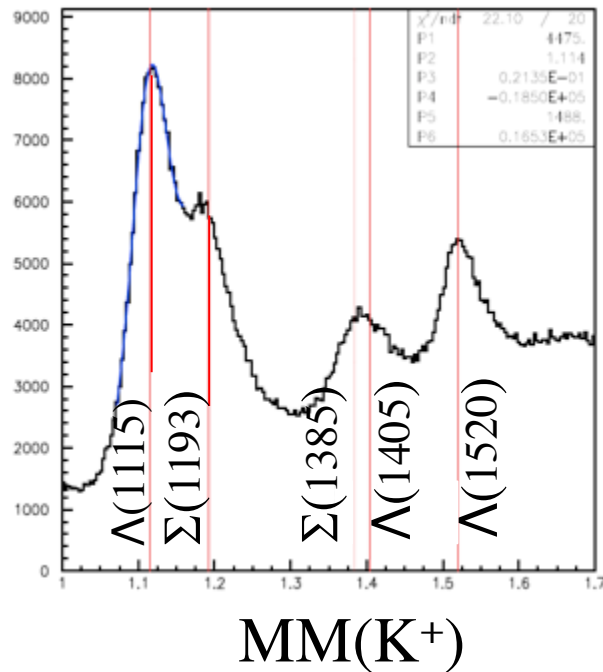
Study of Q^2 evolution of resonances electro-couplings from $K^+\Lambda$ electro production from the proton

18 days of data taking in 2018 (11 with 7.5 GeV and 7 with 6.5 GeV - A. D'Angelo run coordinator)



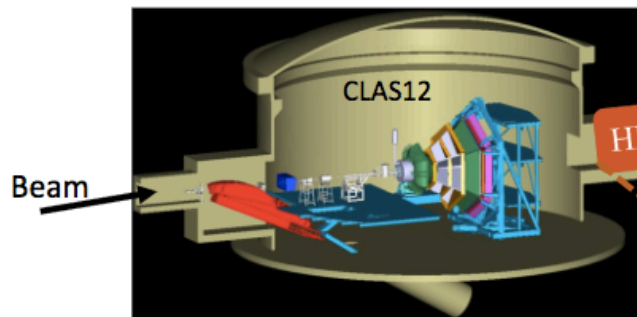
$p(e, e'K^+)$

80 000 $K\Lambda$ eventi da un set di 1G di trigger analizzati
 (80G di trigger acquisiti durante il run)





Hall B



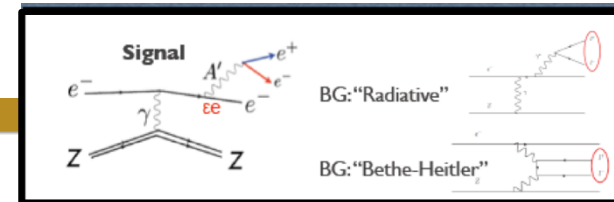
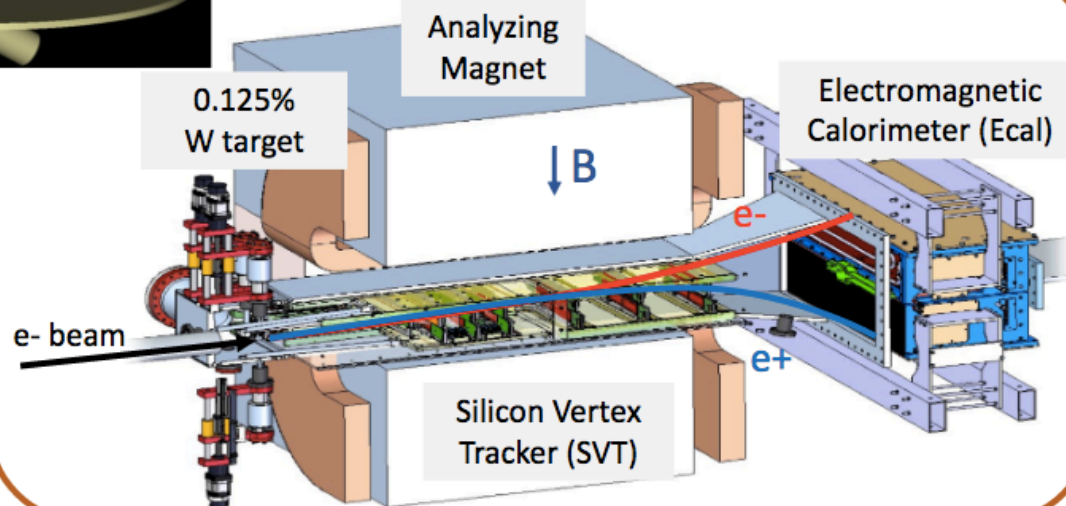
HPS

Silicon Vertex Tracker:

- Tracks particles
- Momentum and vertex reconstruction

EM Calorimeter:

- Triggers events
- Energy and timing



- Searches for A' with **prompt** and **displaced** vertices
- Downstream Hall B alcove
- 2015 Engineering Run, 1 GeV beam at 50 nA
- 2016 Physics Run, 2,3 GeV beam at 200 nA
- 2019 Physics Run **on-going**.

First Publication on PRD Editor's suggestion

(data of Engineering run 2015)

PHYSICAL REVIEW D **98**, 091101(R) (2018)

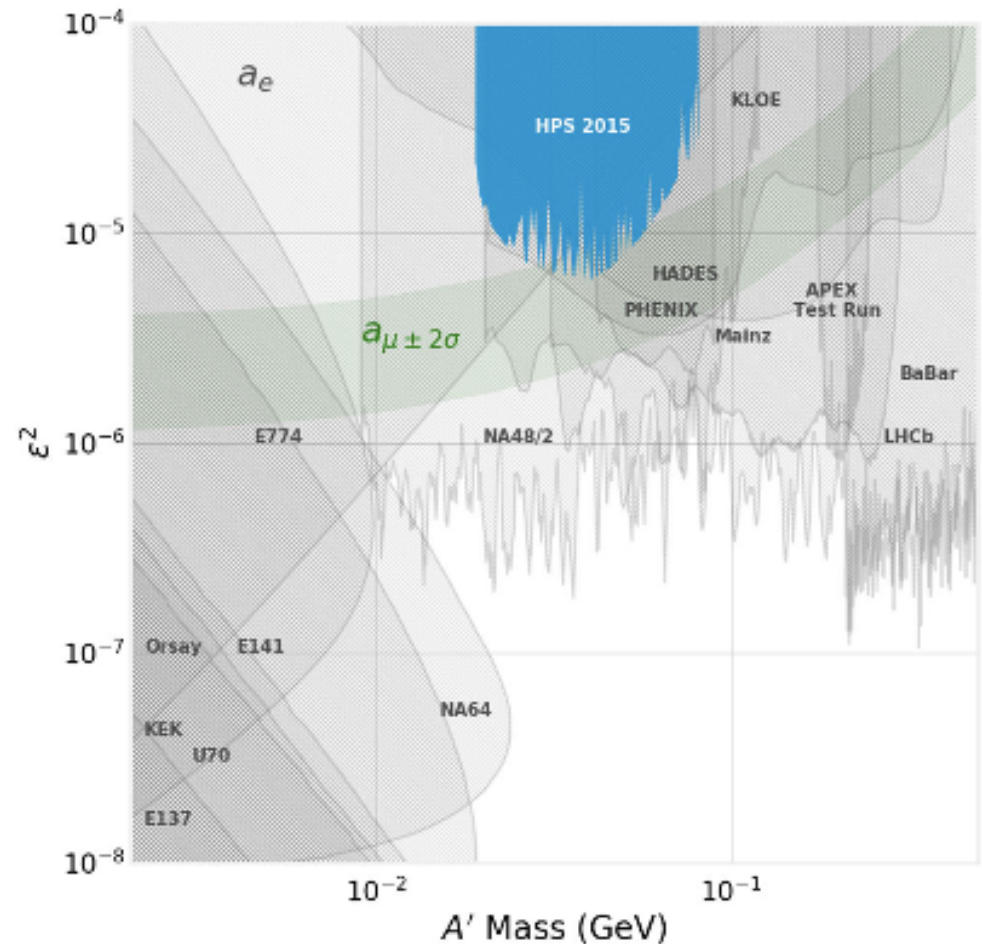
Rapid Communications

Editors' Suggestion

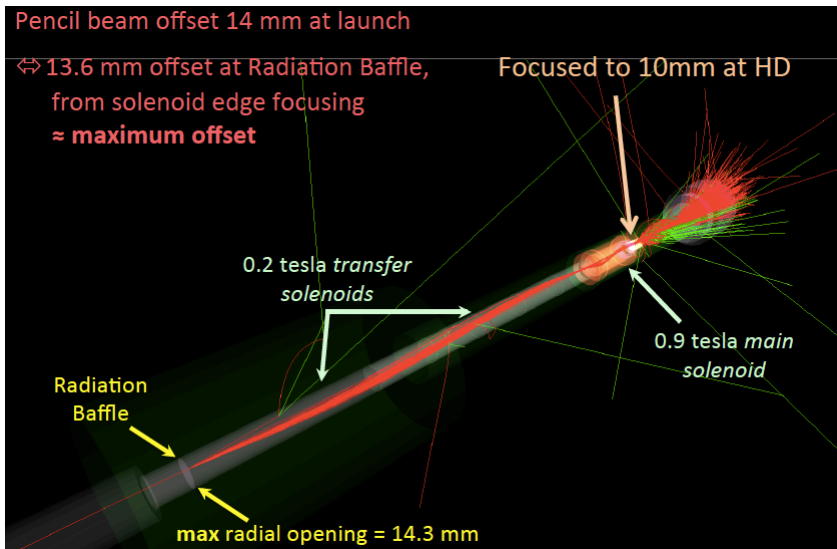
Search for a dark photon in electroproduced e^+e^- pairs with the Heavy Photon Search experiment at JLab

P. H. Adrian,¹ N. A. Baltzell,² M. Battaglieri,³ M. Bondi,⁴ S. Boyarinov,² S. Bueltmann,⁵ V. D. Burkert,² D. Calvo,⁶ M. Carpinelli,^{7,8} A. Celentano,³ G. Charles,⁹ L. Colaneri,^{10,11} W. Cooper,¹² C. Cuevas,² A. D'Angelo,^{10,11} N. Dashyan,¹³ M. De Napoli,⁴ R. De Vita,³ A. Deur,² R. Dupre,⁹ H. Egiyan,² L. Elouadrhiri,² R. Essig,¹⁴ V. Fadeyev,¹⁵ C. Field,¹ A. Filippi,⁶ A. Freyberger,² M. Garçon,¹⁶ N. Gevorgyan,¹³ F. X. Girod,² N. Graf,¹ M. Graham,¹ K. A. Griffioen,¹⁷ A. Grillo,¹⁵ M. Guidal,⁹ R. Herbst,¹⁸ M. Holtrop,¹⁸ J. Jaros,¹ G. Kalicy,⁵ M. Khandaker,¹⁹ V. Kubarovsky,² E. Leonora,⁴ K. Livingston,²⁰ T. Maruyama,¹ K. McCarty,¹⁸ J. McCormick,¹ B. McKinnon,²⁰ K. Moffeit,²⁰ O. Moreno,^{1,15,*} C. Munoz Camacho,⁹ T. Nelson,¹ S. Niccolai,⁹ A. Odian,¹ M. Oriunno,¹ M. Osipenko,³ R. Paremuzyan,¹⁸ S. Paul,¹⁷ N. Randazzo,⁴ B. Raydo,² B. Reese,¹ A. Rizzo,^{10,11} P. Schuster,^{1,21} Y. G. Sharabian,² G. Simi,^{22,23} A. Simonyan,⁹ V. Sipala,^{7,8} D. Sokhan,²⁰ M. Solt,¹ S. Stepanyan,² H. Szumila-Vance,^{2,5} N. Toro,^{1,21} S. Uemura,¹ M. Ungaro,² H. Voskanyan,¹³ L. B. Weinstein,⁵ B. Wojtsekhowski,² and B. Yale¹⁸

(Heavy Photon Search Collaboration)

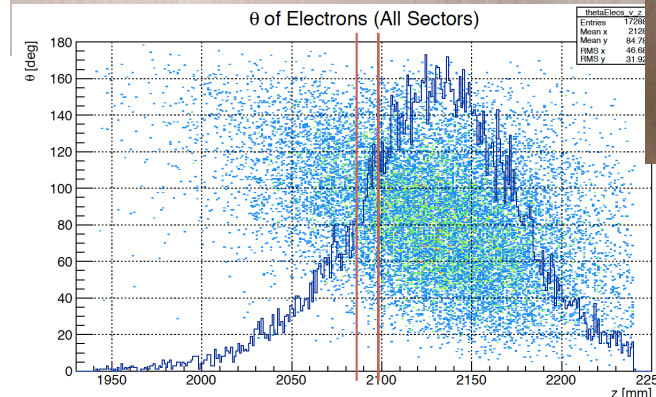
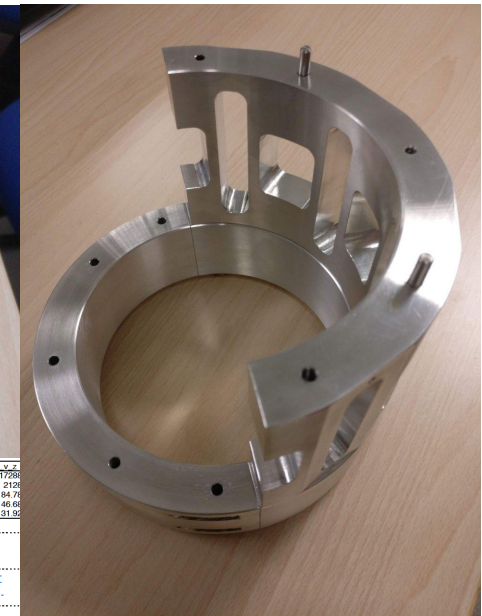
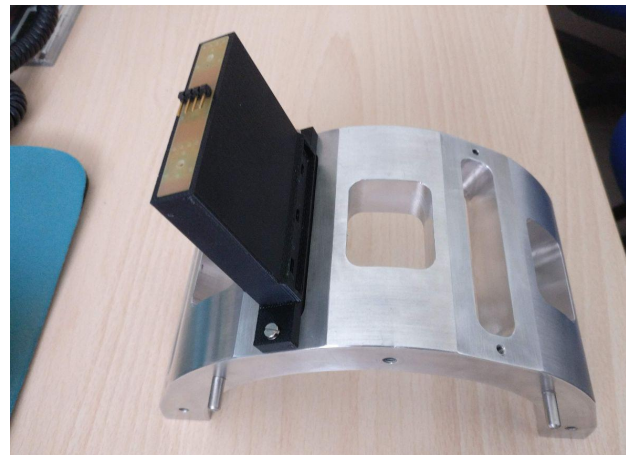
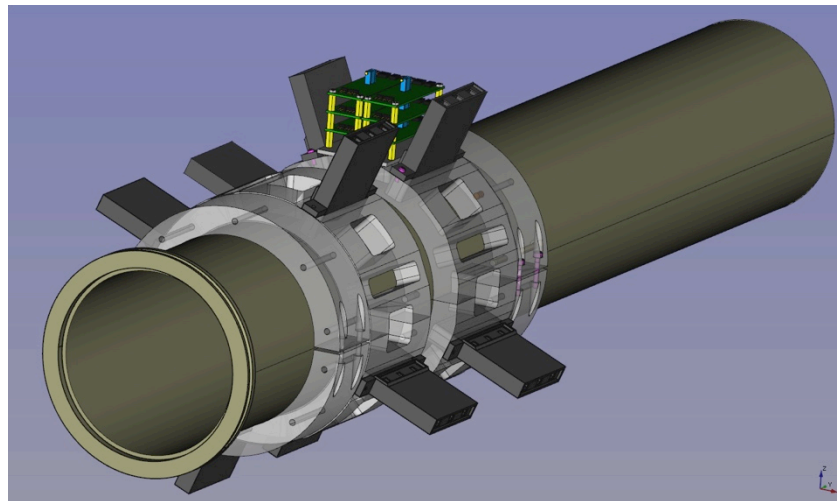


▪ Simulazione dell'interazione del fascio di elettroni da 10 MeV con l'IBC.



Costruzione di un Halo Counter in corso per monitorare il centraggio del fascio e validare le simulazioni:

16 scintillatori con PM resistenti al campo magnetico e relativa elettronica



Attività previste 2019-2020

HD-ice -> HD-e

- Test delle prestazioni eHD con fasci di elettroni (al JLAB)
- Distillazione del gas di HD ed analisi on-line del gas distillato con il nuovo sistema Raman (Roma - PP1)

Partecipazione a run di presa dati:

- CLAS (12 GeV)
- Test run per verificare la resistenza della polarizzazione dei bersagli al fascio di elettroni (10 MeV)

Le richieste maggiori sono relative al progetto PolTarg - Bersaglio polarizzato HD:

- manutenzione e funzionamento del sistema Raman
- funzionamento del sistema di distillazione del gas di HD a Roma
- test run

Missioni	
Turni di Misura CLAS12, Test Test e-HD, missioni Ge per collaborazione FT e analisi	25 K€
Consumo	
Ottica di ricambio sistema Raman, raccorderia da vuoto, manutenzione	15 K€
Altro Consumo	
Liquidi criogenici: LHe + LN	8 K€
Trasporti	
Spese di Trasporto e sdoganamento gas HD	5 K€
Apparati	
Componenti per Installazione Gas Cromatografo e HD Distiller	17 K€
Totale Richieste	70 K€

MAMBO (MAMi-BOnn)

La sigla MAMBO si articola su due attività:

BGO-OD a ELSA (Bonn)

□ Coinvolgimento della sezione TOV

- Fascio di fotoni di energia 0.3-3.2 GeV
- Polarizzazione lineare e circolare del fascio
- **Spokespersons: P. Levi Sandri e H. Schmieden**

A2@MAMI (Mainz)

- Fascio di fotoni polarizzati di energia fino a 1.6 GeV
- Polarizzazione lineare e circolare del fascio
- Bersaglio polarizzato
- **Spokespersons: P. Pedroni e A. Thomas**

Obiettivi di fisica:

- Studio delle proprietà delle risonanze nucleoniche attraverso la fotoproduzione di mesoni con e senza stranezza, pseudoscalari e vettoriali con fasci e/o bersagli polarizzati

Attività BGO-OD

- Periodo 2017-2020:
Finanziamento DFG (programma pluriennale per singole università) che vincola l'acceleratore ELSA a fornire all'esperimento BGO-OD un minimo di 1000 h fascio/anno (pari a circa 42 gg).
- **Prese dati 2018-2019:**
 - Presa dati di 3 settimane effettuata a giugno-luglio 2018 con bersaglio lungo di D_2 e picco di polarizzazione a 1300 MeV (prime 2 settimane) e a 1600 MeV
 - Presa dati di 3 settimane effettuata a dicembre 2018 con bersaglio lungo di H_2 e picco di polarizzazione a 1600 MeV
 - Le prese dati previste per giugno e settembre 2019 sono state annullate per problemi al Klystron di ELSA (che deve essere sostituito)
 - Prossima presa dati prevista tra novembre e dicembre 2019 (3-4 settimane)
- Rivelatore DAISY (**MRPC**): **vedi prossima slide**

DAISY TOF status

Attività 2019

Interventi sulla meccanica ed elettronica mirati alla riduzione del rumore indotto dal sistema di acquisizione e RF macchina

- a) isolato elettricamente tutti i petali del detector dalla massa del sistema BGOOD-macchina
- b) Nuova alimentazione di BT floating
- c) Sostituzione cavi segnali con shielded twisted cables
- d) modifica del sistema di massa e disaccoppiamento delle HV
- e) controllo completo del sistema gas

A giugno erano previsti 2 giorni di test prima della presa dati rimandati ad ottobre a causa del guasto dell' acceleratore

Caratteristiche test BTF (LNF) : risol.tof 40ps, 1Khz rate di acquisizione, tipo detector MRPC SF6+Tetra 10-90%

Analisi dati e risultati preliminari

- Continua l'analisi dati dei canali (di competenza di Roma "Tor Vergata"):

$\gamma + p \rightarrow \pi^0 + p$ → Asimmetrie

$\gamma + p \rightarrow \eta + p$ → Asimmetrie

$\gamma + p \rightarrow \eta' + p$ → Identificazione del canale

Continua l'analisi dati dei canali (gruppo di Bonn):

$\gamma + p \rightarrow K^+ \Sigma$ → Sez. Urto diff. Ad angoli extr. Forw.

$\gamma + p \rightarrow K^+ \Lambda^0$ → Sez. Urto diff. Ad angoli extr. Forw.

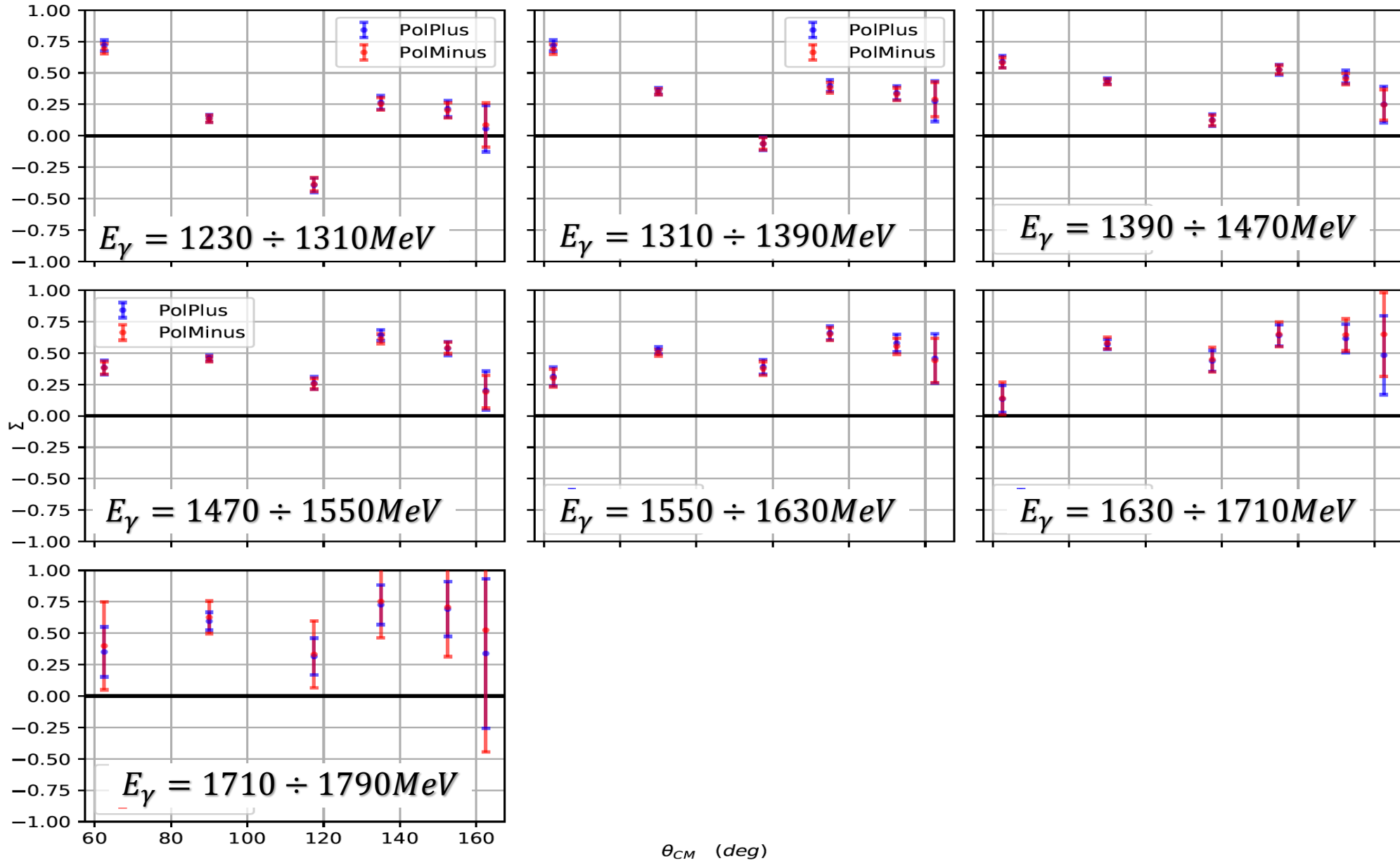
$\gamma + p \rightarrow K^+ \Lambda(1405) \rightarrow K^+ \pi^0 \Sigma^0$ Identif. Segnale e separazione dalla $\Lambda(1520)$

Pubblicazioni in uscita:

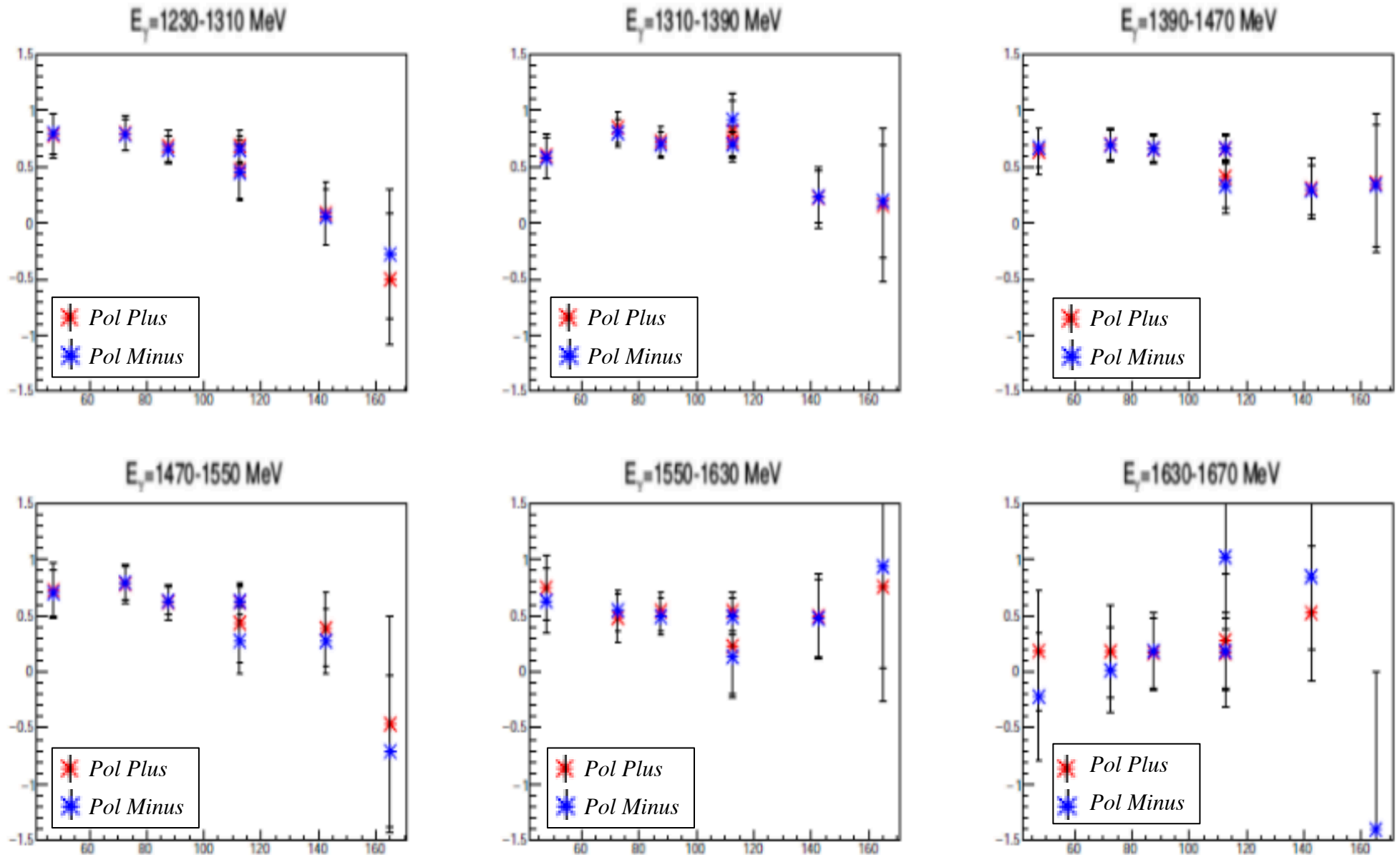
Si stanno finalizzando due articoli sulla $K\Lambda$ e sulla $K\Sigma$

Si sta finalizzando un Technical Paper sull'apparato sperimentale e le sue prestazioni

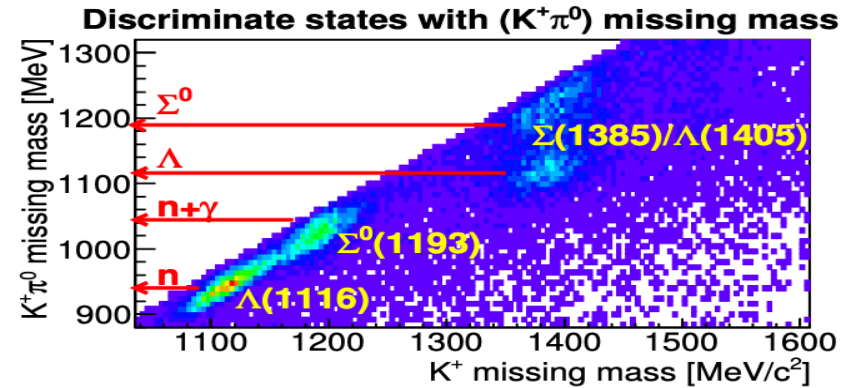
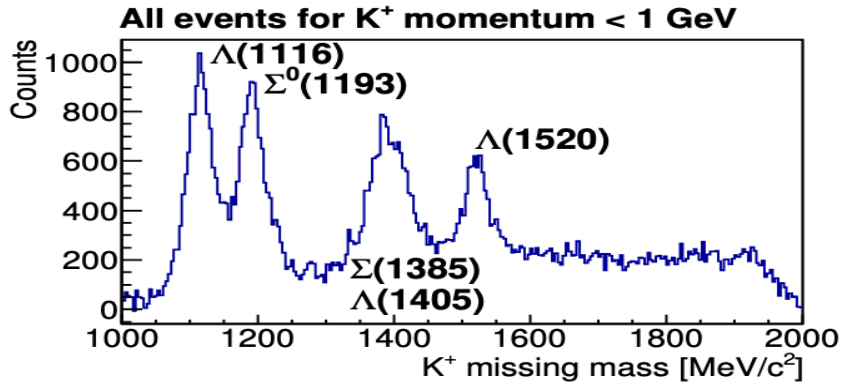
$\gamma + p \rightarrow \pi^0 + p$ – Beam Asymmetries



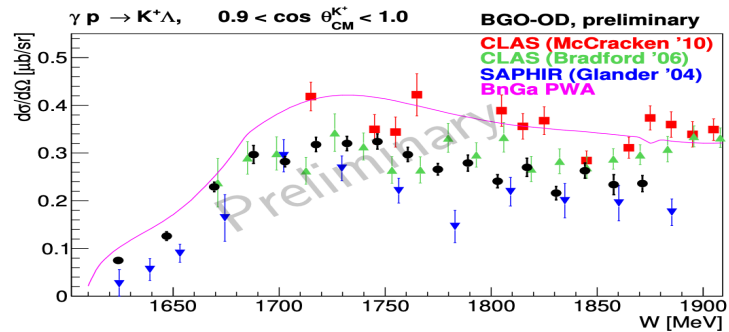
$\gamma + p \rightarrow \eta + p$ – Beam Asymmetries



Strangeness Photoproduction in Forward Angles



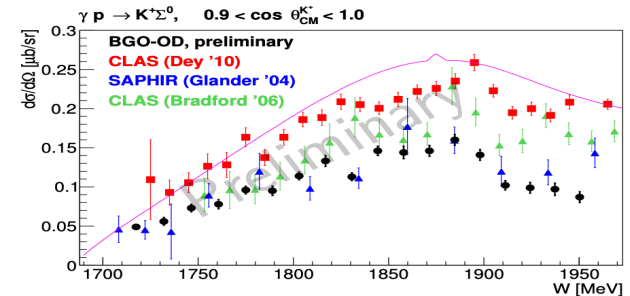
Forward $K^+\Lambda$ differential cross sections



R. Bradford et al., Phys. Rev. C73, 035202 (2006), M.E.McCracken et al., Phys.Rev. C81, 025201 (2010), K.H. Glander et al., Eur. Phys. J. A19, 251 (2004), Bonn-Gatchina PWA: Eur.Phys.J. A50 74 (2014) CLAS $0.85 < \cos \theta_{CM}^{K^+} < 0.95$.

Forward $K^+\Sigma^0$ differential cross sections

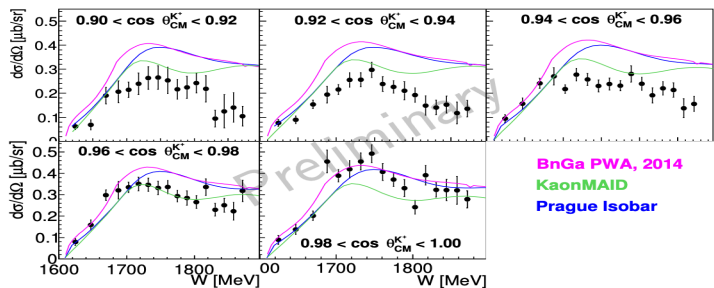
- “cusp” like structure at $W = 1900$ MeV? (maybe hints in previous data?)



R. Bradford et al., Phys. Rev. C73, 035202 (2006), B.Dey et al., Phys.Rev. C82, 025202 (2010), K.H. Glander et al., Eur. Phys. J. A19, 251 (2004), CLAS data in $\cos \theta_{CM}^{K^+}$ 0.85 to 0.95 interval

Forward $K^+\Lambda$ differential cross sections

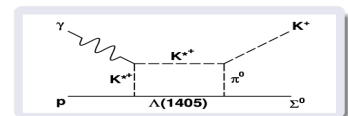
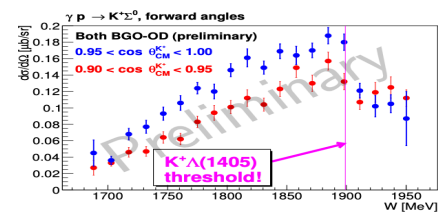
- Unprecedented angular resolution ~ 0.01 in $\cos \theta_{CM}^{K^+}$!



Prague Isobar model: D. Skoupil and P. Bydžovský Phys. Rev. C 97, 025202 (2018) Bonn-Gatchina PWA: Eur.Phys.J. A50 (2014) 74 KaonMAID: F.X. Lee, T. Mart, C. Bennhold, H. Haberzettl, L.E. Wright, Nucl. Phys. A695 (2001) 237

Forward $K^+\Sigma^0$ differential cross sections

- “Cusp” appears more pronounced at most forward angles!
- Sub-threshold $\Lambda(1405)$ production, pion rescattering to $K^+\Sigma^0$ final state?



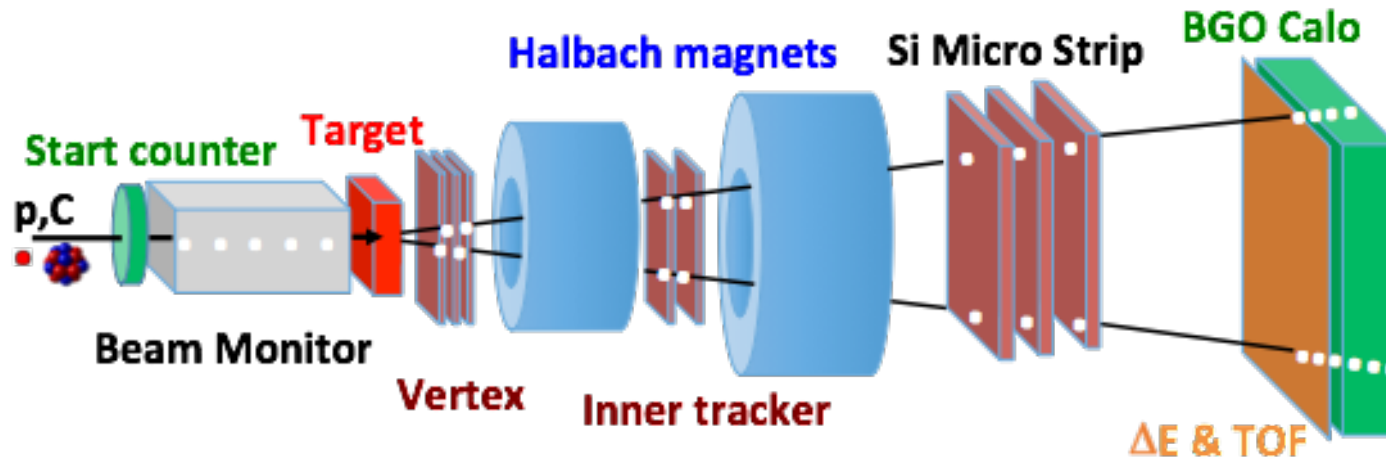
Attività 2019-2020

- Esperimento BGO-OD in corso
- Attività della sezione per il 2019-2020:
 - Finalizzazione analisi dati per asimmetrie nella fotoproduzione di π^0, η su bersaglio di idrogeno e deuterio
 - Continuazione analisi dati per asimmetrie nella fotoproduzione di η' su bersaglio di idrogeno

Esperimento MAMBO Richieste Roma Tor Vergata

Missioni	
Turni di Misura BGO-OD, manutenzione rivelatori e riunioni di collaborazione	22.5 K€
Altro Consumo	
Gas per MRPC	1.5 K€
Trasporti	
3 Trasporti Materiale da Roma a Bonn e viceversa (circa 0.5kE a trasporto)	1.5 K€
Manutenzione	
Riparazione schede	3 K€
Materiale inventariabile	
1 TDC per MRPC Mod. V1290A	7.5 K€
1 scheda HV spare	4.0 K€
Totale Richieste	40 kE

FOOT setup

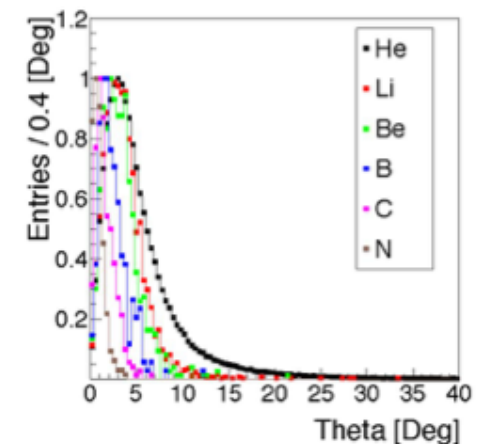


Needed detector performances

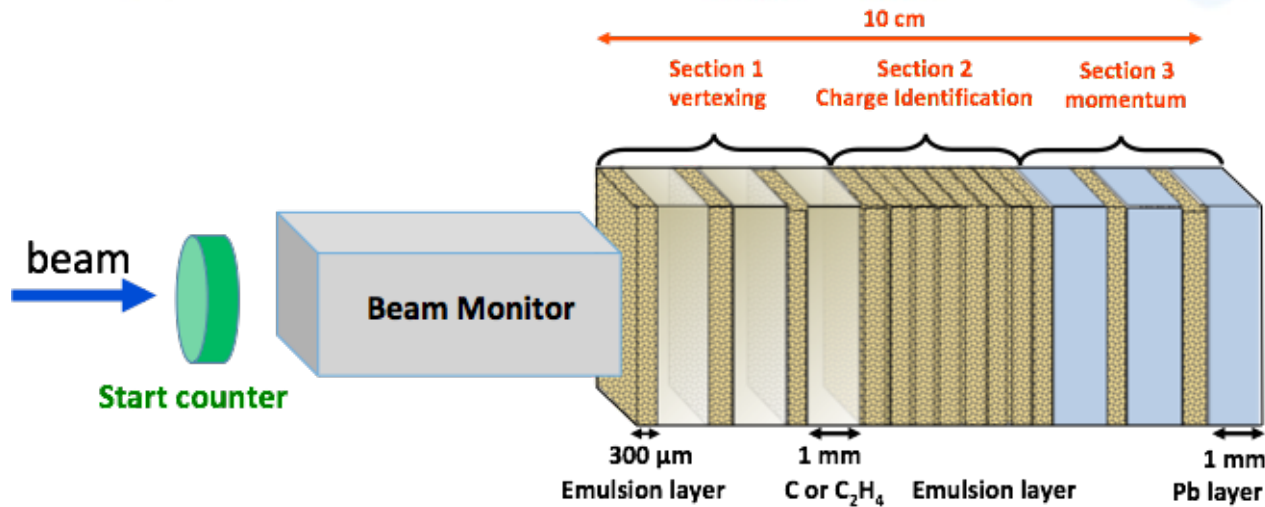
- $\Delta p/p \sim 5\%$
- TOF resolution $\sim 100\text{ps}$
- $\Delta E_{\text{kin}}/E_{\text{kin}} \sim 2\%$
- $\Delta(dE)/dE \sim 2\%$

Sub-detector	Main characteristics
Start counter	plastic scintillator 250 μm
Beam monitor	drift chamber (12 layers of wires)
Target	C+C ₂ H ₄ (2 mm)
Vertex	4 layers silicon pixel (20x20 μm)
Magnet	2 permanent dipoles (0.8 T)
Inner tracker	2 layers silicon pixel (20x20 μm)
Outer tracker	3 layers silicon strip (125 μm pitch)
Scintillator	2 layers of 20 bars (2x40x0.3 μm)
Calorimeter	360 BGO crystals (2x2x14 μm)

- optimised for heavy ($Z \geq 3$) fragments
- less than 2m: can be easily movable to fit the space limitations from experimental and treatment rooms
- angle setup: $\pm 10^\circ$



FOOT emulsion setup



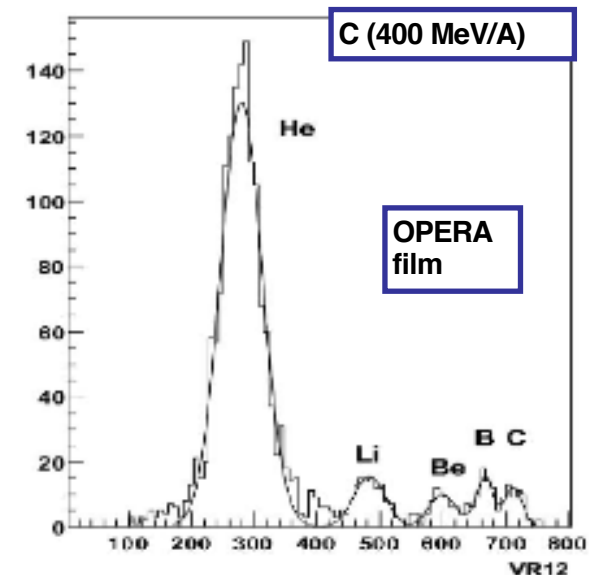
- optimised for light ($Z \leq 3$) fragments
- less than 1m: can be easily movable to fit the space limitations from experimental and treatment rooms
- angle setup: $\pm 75^\circ$

Two complementary setups

- main reason: required angular precision of few mrad hard to achieve with an apparatus of limited size
- lower mass fragments ($Z < 3$) can be emitted within a wider angular aperture wrt heavier nuclei

Main characteristics

- both target and detector integrated in a very compact setup
- accurate reconstruction of the interactions inside the target (sub-micrometric resolution)
- fragment charge assessed with an efficiency $> 99\%$
- automated scanning system technique: very fast and with wide angular acceptances



FOOT physics program: that's it?

- Using C, C₂H₄ → cross sections on C and H
- Using C, C₂H₄, PMMA → cross sections on C, O and H

Phys	Beam	Target	Energy (MeV/u)	Inv/direct
Target Frag. PT	¹² C	C, C ₂ H ₄	200	inv
Target Frag. PT	¹⁶ O	C, C ₂ H ₄	200	inv
Beam Frag. PT	¹² C	C, C ₂ H ₄ , PMMA	350	dir
Beam Frag. PT	¹⁶ O	C, C ₂ H ₄ , PMMA	400	dir
Beam Frag. PT	⁴ He	C, C ₂ H ₄ , PMMA	250	dir
Rad. Prot.space	⁴ He	C, C ₂ H ₄ , PMMA	700	dir
Rad. Prot.space	¹² C	C, C ₂ H ₄ , PMMA	700	dir
Rad. Prot.space	¹⁶ O	C, C ₂ H ₄ , PMMA	700	dir

PMMA is a combination of C,O,H.

There is possibility to enlarge the “core” physics program

Is possible to enlarge the energy range (150- 1000 MeV/u) and/or use different targets/beams combinations

April 2019 -Got first beam time : ESA@GSI

- ✓ Emulsions acquired production data with Oxygen beam (200 and 400 MeV/u) and C and CH₂ target.
- ✓ A skeleton of the electronic setup (SC+BM+Vertex + TW) took calibration run in the final DAQ

The data analysis has started

Attività prevista 2019-2020

- Analisi dei dati del test beam
- Sviluppo di tools per la ricostruzione
- Sviluppo delle simulazioni

FOOT@RM2: anagrafica & richieste finanziarie 2020

	Posizione	Percentuale (%)
M.C.Morone	PA	70
L.Narici	PA	30

Richieste finanziarie:

Missioni 4 kEuro



EIC-NET - Roma Tor Vergata

Attività e Preventivi

Light Baryon Spectroscopy at EIC? ECT* workshop

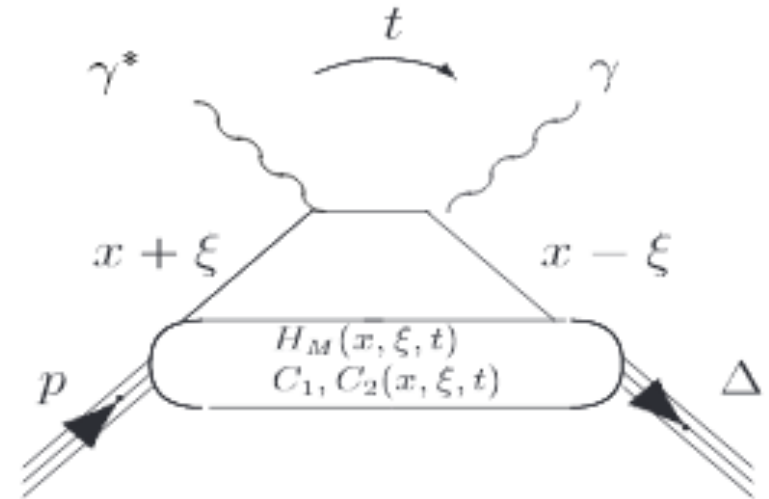
GENERALIZED PARTON DISTRIBUTIONS AND NUCLEON RESONANCES

M. GUIDAL, S. BOUCHIGNY, J.-P. DIDELEZ, C. HADJIDAKIS, E. HOURANY
Institut de Physique Nucléaire Orsay, F-91406 Orsay, France

M. VANDERHAEGHEN
Institut für Kernphysik, Johannes Gutenberg-Universität, D-55099 Mainz, Germany

arXiv:hep-ph/0304252

L. L. Frankfurt, M. V. Polyakov, M. Strikman, and M. Vanderhaeghen Phys. Rev. Lett. 84, 2589



“Transition” GPDs may be measured from hard exclusive electro-production of photons and mesons (π , ρ , ϕ , ω ..) and may give insight on the quark and gluon content of the excited states of the nucleon.

- “Transition” GPDs may be considered at EIC :
 - N^* longitudinal, transverse momentum and impact parameter partons distributions

ECT* (Trento)- December 20th 2018 - Annalisa D’Angelo

EIC-NET - Roma Tor Vergata

Attività prevista:

sviluppo di scintillatori per calorimetro EM

- PbWO

- streaming read-out

in collaborazione con INFN – Genova (nessuna richiesta economica)

Partecipanti: Annalisa D'Angelo 10% Rachele Di Salvo 10%

Alessia Fantini 20% Lucilla Lanza 10%

Richieste di Finanziamento: 5.5 K€ Missioni

Networking e sviluppo scintillatori

In linea con le richieste 2019

Dotazioni gruppo III: richieste finanziarie 2020

Metabolismo del gruppo come da algoritmo di commissione in base al numero di FTE

Missioni	5 K€
Consumo	3 K€
Seminari	0.5K€
Pubblicazioni	1 K€
Materiale inventariabile	8 K€
Totale Richieste	17.5 K€

Totale Richieste GIII Roma Tor Vergata

Sigla	A carico dell'I.N.F.N.												
	missioni	inviti	consumo	altri_cons	seminari	trasporti	pubblicazioni	manutenzione	inventario	apparati	licenze-SW	spservizi	TOTALI
EIC_NET.DTZ	5.50												5.50
FOOT	4.00												4.00
JLAB12	25.00		6.00	11.50		5.00		5.00		17.50			70.00
MAMBO	22.50			1.50		1.50		3.00	11.50				40.00
Tot.Sigle	57.00		6.00	13.00		6.50		8.00	11.50	17.50			119.50
Dotazioni di CSN III	5.00		3.00		0.50		1.00		8.00				17.50
Totale CSN III Roma II	62.00		9.00	13.00	0.50	6.50	1.00	8.00	19.50	17.50			137.00



Missioni