Relazione Coordinatore CSN3@LNF

Consiglio Laboratorio Aperto 1 Luglio 2014

Alessandra Fantoni

CERN	Fisica: QGP	10.8 FTE
Jlab	Fisica: adronica	9.0 FTE
Bonn/Mainz	Fisica: adronica	1.2 FTE
GSI	Fisica: adr./nucl.	1.9 FTE
LNF	Fisica: nucleare	11.6 FTE
LNGS	Fisica: nucleare	6.5 FTE

Totali: 41 FTE (Ric.+Tecnol.) + Tecnici

3 sigle (su 6) con Responsabilità Nazionali INFN: PANDA, SIDDHARTA, VIP
Numerose importanti responsabilità nazionali & internazionali

Nuclear Physics Exp. @ LNF in 2014

Funding 2014, SJ 2014 at the level of 1 kE

Exp	Res	Tec	FTE	MIS		CON		APP	INV	Other	
ALICE	9.3	1.5	10.8	70		6				6	TRA/OTH
JLAB12	9	0	9	46		8		170		3	TRA/OTH
KAONNIS	8.4	1.9	10.3	21		69	5		39	3	MAN
MAMBO	1.2	0	1.2	9		7					
PANDA	2.6	0.3	2.9	22		20			7	1	TRA
VIP	5.0	0.9	5.9	19	2	28			16	7	MAN
DTZ	**35.5**	**4.6**	**40.1**	**26**		**17**			**16**	**11**	**MAN / TRA / SEM ...**

LNF activities

12 researchers for 10.8 FTE
Average participation of 90%

1. N. Bianchi 0.8
2. L. Calero Diaz 1
3. **P. Di Nezza 1**
4. A. Fantoni 1
5. P. Gianotti 0.5
6. S. Liuti 1
7. A. Moregula 1
8. V. Muccifora 1
9. A.R. Reolon 1
10. F. Ronchetti 1
11. S. Sakai 1
12. E. Spiriti 0.5

Technicians:
A.Orlandi 0.5
A. Viticchié 0.5

Responsabilities:

- 2 Period Run Coordinators
- 1 System Run Coordinator (EMCAL)
- 1 HLT coordinator for EMCAL
- 1 calorimeter expert on call
- 1 calorimeters construction coordinator

Data taking & detectors

- 1 ITS WG chair
- 1 deputy spokesperson in calo MB

Management

- 1 member of the calo MB
- 1 Heavy Flavour Physics conv @ CERN
- 1 spokesperson Jet Physics HP3

Physics

F. Ronchetti:

- Adjoint Technical Coord. for LS1 consolidation in 2013-14
- Run Coordinator in 2015 data taking

The activity of the LNF group: analysis

LNF main contributor to physics@LHC

1. LNF paper contribution in 2014

- Hadron-jet and recoil jet spectrum *upcoming publication [LNF primary author]*
- QGP review paper (300 pages, arXiv:1404.3723) submitted to EPJC *[LNF co-primary author]*
- *Quenching by electron decay from Heavy Flavour quark, upcoming publication [LNF co-primary author]*

2. Phenomenological studies of jet quenching

and first interpretation of LHC data
Collaboration with Santiago de Compostela & LNF theory departments

3. Transverse Λ polarization in unpolarized pp scattering

Λ reconstruction globally and in jets => First polarization measurement on TeV scale
First link of GPDs and TMDs with LHC
Collaboration with Tufts University and University of Virginia

The activity of the LNF group: next data taking

Adjoint Technical Coordinator for LS1 Consolidation

1. Detector consolidation

- Water cooling
- Timing
- Implementation sor/eor
- Busy time
- FEE development
- Trigger update
- Configuration
- Gas system update
- …..

2. Online Systems

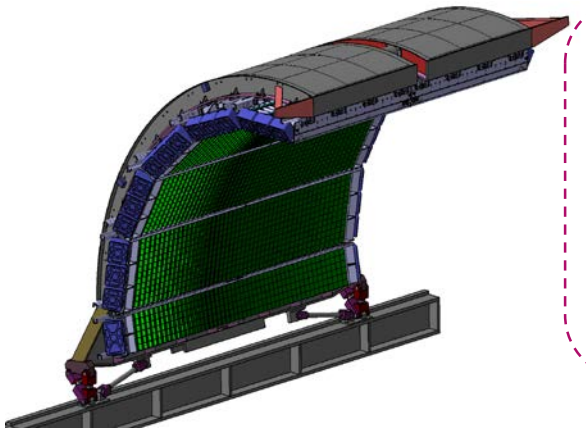
- DAQ & ARC operations
- New ECS Status Dislay
- LHC interface operations
- Central Trigger operations
- High Level Trigger
- Data Quality Monitor
- Event Display
- …..

3. Preparation for Data Taking

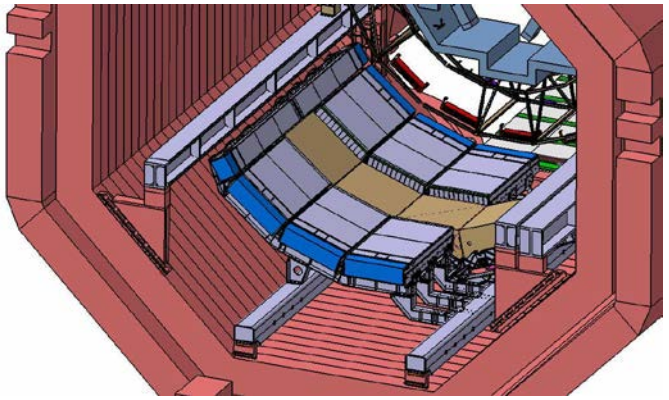
- Improving running efficiencies
- DCS
- Shift Management
- HI operations
- ……

See more on Ronchetti's talk at AW June 30°, 2014
https://indico.cern.ch/event/321366/session/9/contribution/16/material/slides/1.pdf

The activity of the LNF group: Calo



Lead-Scintillator
Sampling Calorimeters
Shashlik Geometry
APD Photosensor



EMCal 10 + 2 (1/3) super modules

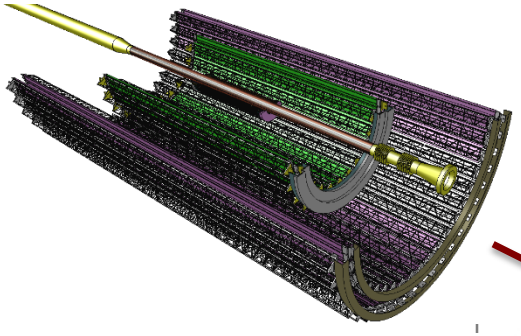
DCal 6 + 2 (1/3) super modules

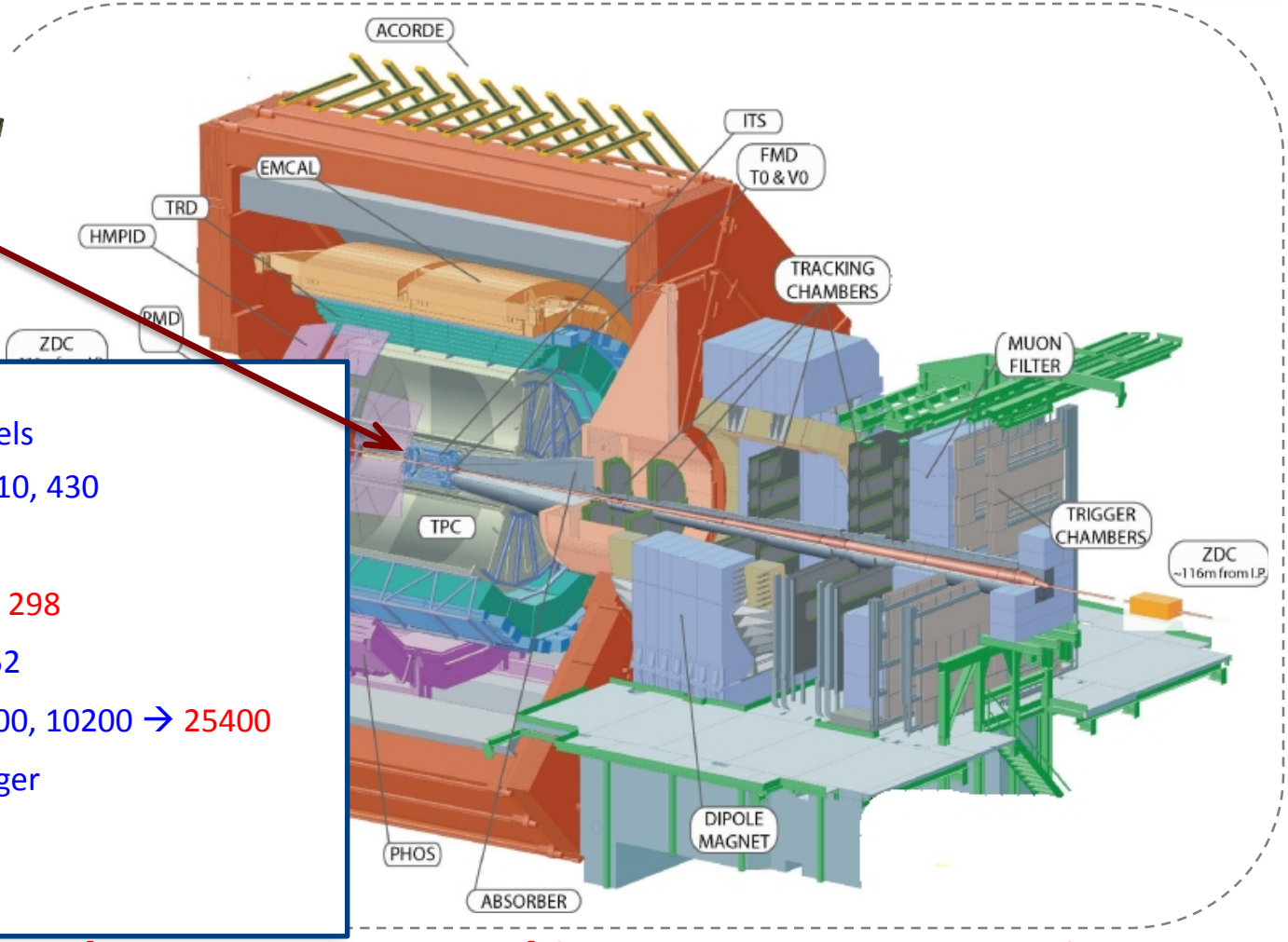
Installation completed in 2013

Installation to be completed in LS1

Construction of the e.m. calorimeters (modules & strips)
Sputtered fibers > 250k (at LNF)
Online monitoring
Offline codes
HLT
Commissioning ongoing for EMCal/Dcal/Phos
Development for common Dcal/Phos jet trigger

The activity of the LNF group: ITS





ALICE UPGRADE

ITS Outer Barrel (OB): 4 layers pixels

Radial position (mm): 200, 220, 410, 430

Length in z (mm): 843, 1475

Nr. of modules: 48, 52, 96, 102 → 298

Nr. of chips/module: 28, 28, 52, 52

Nr. of chips/layer: 2688, 2912, 9600, 10200 → 25400

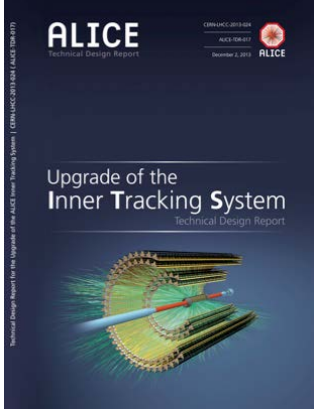
Pixel size: ~ 20 µm x 20 µm or bigger

Material thickness: ~ 0.3% X_0

Throughput: < 6 Mbit / sec·cm^2

Preparation for the new Inner Tracking System construction

LNF as national production center for all ALICE INFN groups



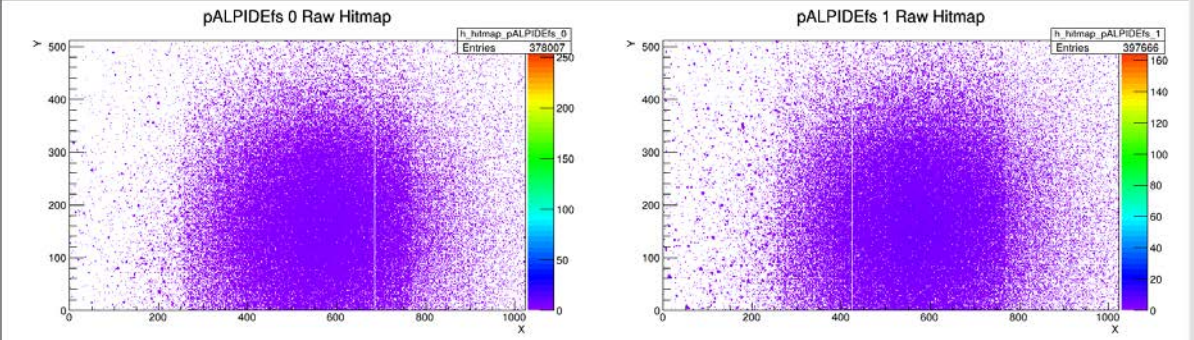
LHCC Upgrade Cost Group rev. 03/03/2014

Research Board approval 12/03/2014

MOU due to the RRB → Ott '14

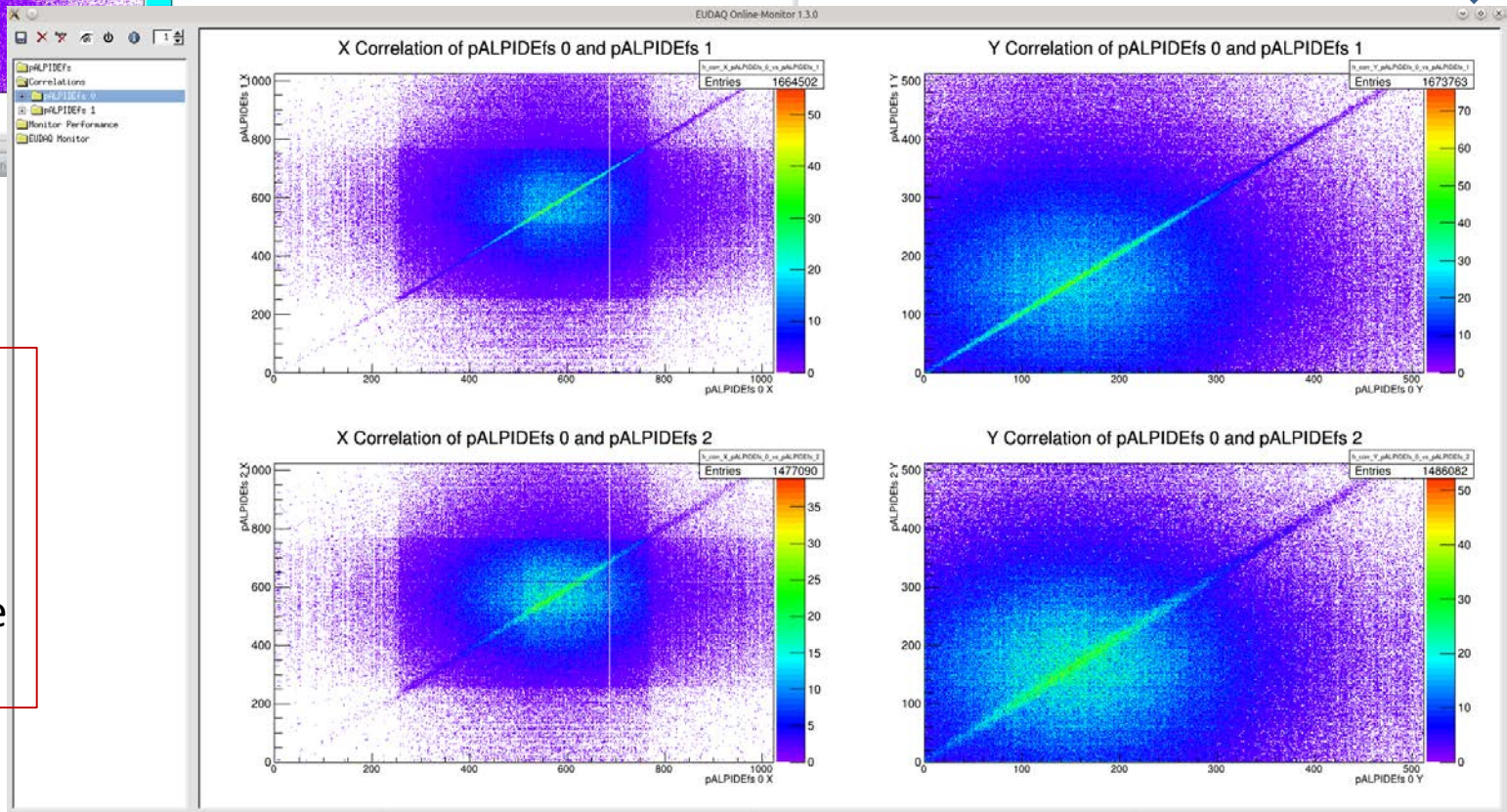
Contributo INFN	2013	2014	2015	2016	2017	2018	2019	Total
R&D (kEUR)	258	337+136	222					953
CORE (kEUR)			445	1040	935	400	80	2900

Institute	Responsibilities
Bari	• OB Module development and construction • R&D, Module 0, Production • Design of the End of Stave services • Module and Stave test system (*) • Power distribution and supply system (pro-tempore)
Cagliari	• Chip design and characterization • Chip characterization system (*)
LNF	• LNF Beam Test Facility • OB Stave production
Padua	• Outer Layers End-wheels and Half-layer Integration
Turin/Alessandria	• Chip design and characterization • OB FPC and PB • OB Stave development and construction • R&D, Stave 0



Testati i primi pixel ALPIDE prodotti con misure di efficienza e studio della diversa struttura di readout

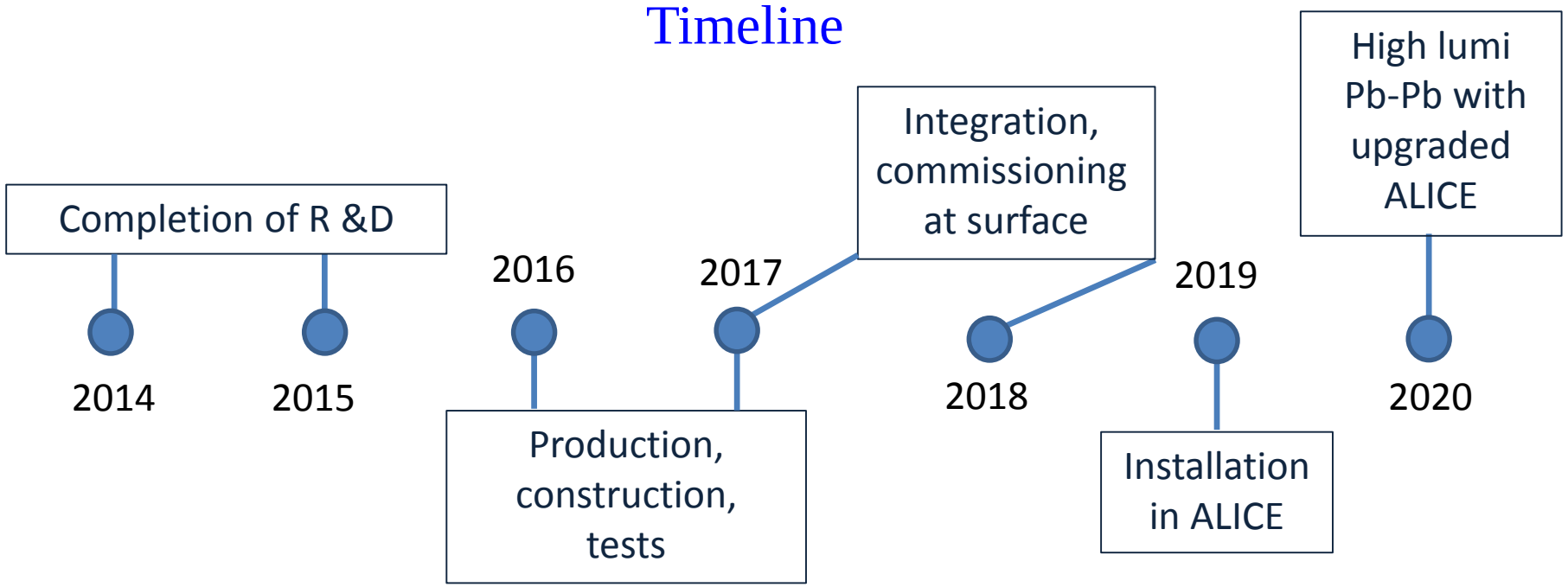
Correlazione tra i diversi piani dei sensori pixels MIMOSA

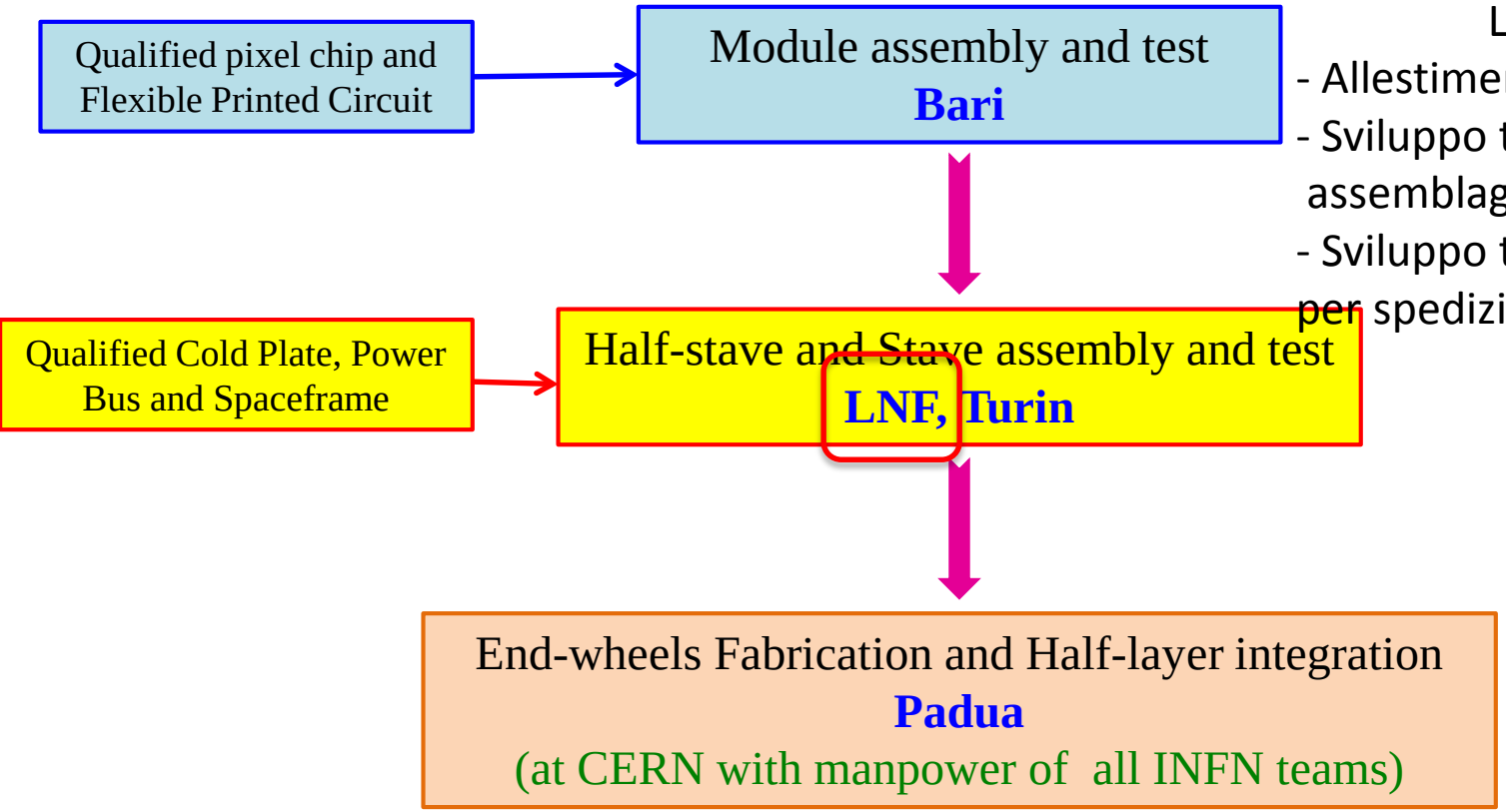


Giugno 2014
1 settimana BTF:
- Alta efficienza
- Stabilità fascio
- Caratterizzazione pixel chip

Activity	Contributing INFN teams
Chip test and characterization	Bari, Cagliari, Catania, LNF, Padova, Roma, Alessandria/Torino, Trieste
Mechanics for Stave Construction	Cagliari
Pixel chip, FPC and PB qualification and selection	Catania, Trieste
SpTAB (interconnect technique backup wrt laser soldering)	Trieste

Timeline





LNF:
- Allestimento Camera Pulita
- Sviluppo tools e tecniche di assemblaggio con Torino
- Sviluppo test elettronico finale per spedizione al CERN

Richieste

Richieste finanziarie

missioni	**88k**
inventario (rich. ITS-Italia)	**140k**
consumo (rich. ITS-Italia)	**60k**

Richieste ai servizi

supporto esperimenti	**12-18 mesi/u**
meccanica (tool ass. staves)	**8 mesi/u**
carpenteria (cam.pulita)	**2 mesi/u**
elettronica-automazione	**5 mesi/u**

> 1 ingegnere meccanico

1. G. Angelini - (laureando)
2. A. Biselli 1
3. A. Courtoy 1
4. E. De Sanctis -
5. D. Hasch 1
6. V. Lucherini 0.5
7. **M. Mirazita 1**
8. R. Montgomery 1
9. S. Pereira 1
10. J. Phillips 1
11. S. Pisano 1
12. P. Rossi 0.5

LNF activities

12 Physicists for 9 FTE
Average participation of 90%
1 FTE technicians

Technicians:
A. Orlandi 0.5
A. Viticchié 0.5

Research activity & Responsibilities

1. Physics Analysis => Study of parton distribution functions in exclusive and semi-inclusive reactions with 6 GeV electron data:

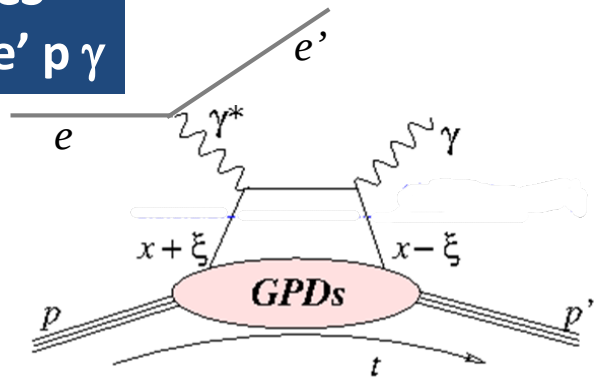
- Deeply Virtual Compton Scattering *S. Pisano*
- Two-hadron semi-inclusive production *S. Pisano & S. Pereira (data), A. Courtoy (theory)*
- Λ polarization in semi-inclusive production *J. Phillips (PhD thesis)*

2. Hardware for upgrade => Preparation for 12 GeV running:

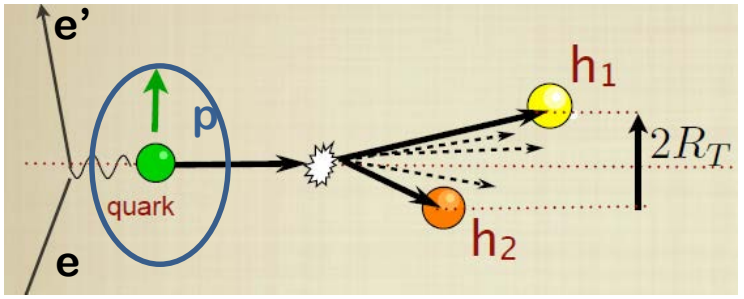
- RICH detector for the CLAS12 spectrometer in Hall-B
- Two proposals for new measurements submitted to PAC42:
  - Semi-inclusive Λ electroproduction in the Target Fragmentation Region (Spokeperson M. Mirazita)
  - Higher-twist collinear structure of the nucleon through di-hadron SIDIS on unpolarized hydrogen and deuterium (Spokesperson S. Pisano)

1. Physics analysis

DVCS
e p→e' p γ



Di-Hadron SIDIS
e p→e' π π X



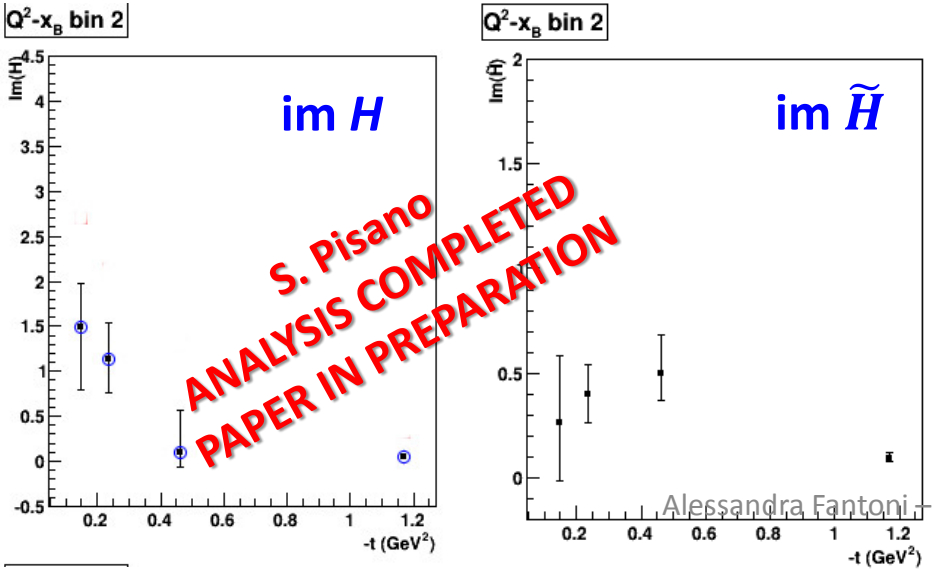
Generalized Parton Distribution (GPD) functions

- parton longitudinal momentum at a transverse position

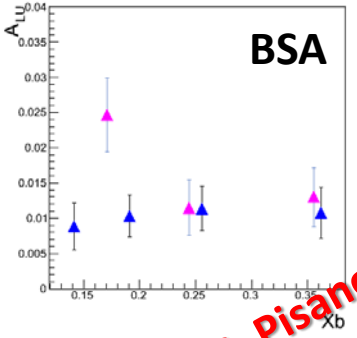
- polarized beam and polarized target
- extraction of CFF of GPDs

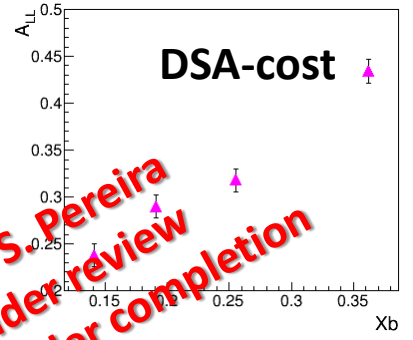
Access to Higher Twist PDFs

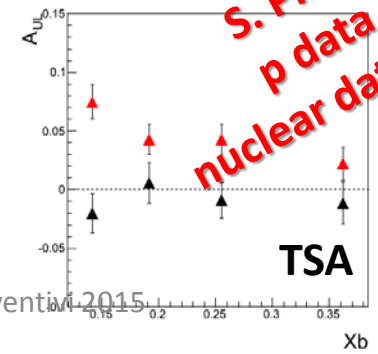
- simpler extraction of TMDs than in one hadron processes

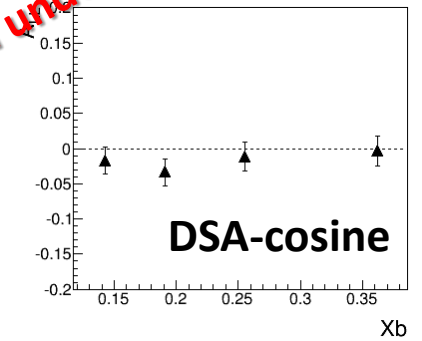


S. Pisano
ANALYSIS COMPLETED
PAPER IN PREPARATION









S. Pisano – S. Pereira
p data under review
nuclear data under completion

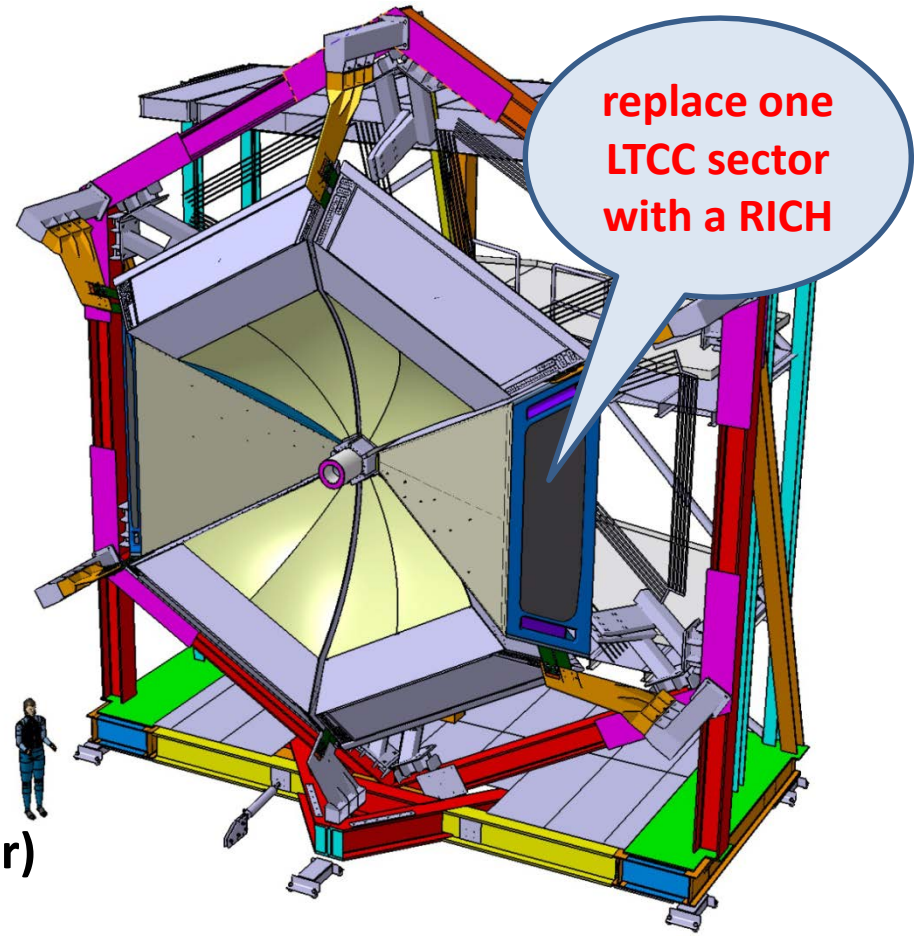
2. The RICH project for CLAS12

Improvement of PID needed to extend TMD measurements to kaons

Goal: ID of kaons vs π and p with momentum 3-8 GeV/c

TIME SCALE:

- **June-September 2013: the project for the first sector has been approved by DOE**
  - **JLab funds made available**
- **September 2013: PREMIALI CLAS-MED project approved**
  - **INFN funds for construction of the second sector**
- **End 2013 / Beginning 2014: start of construction phase**
  - **MAPMT (JLab)**
  - **Aerogel (LNF)**
- **June 2014: review of the mechanical external frame by JLab Committee**
- **October 2016: Start of RICH assembly**
- **June 2017: end of RICH project (first sector)**



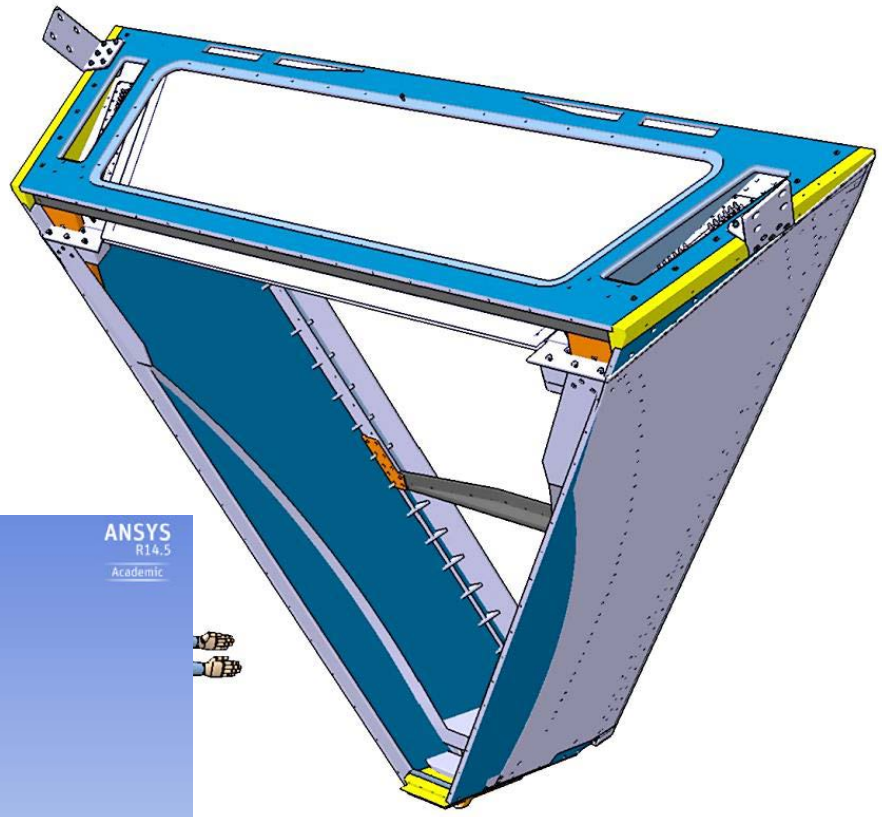
2a. The RICH design: external frame

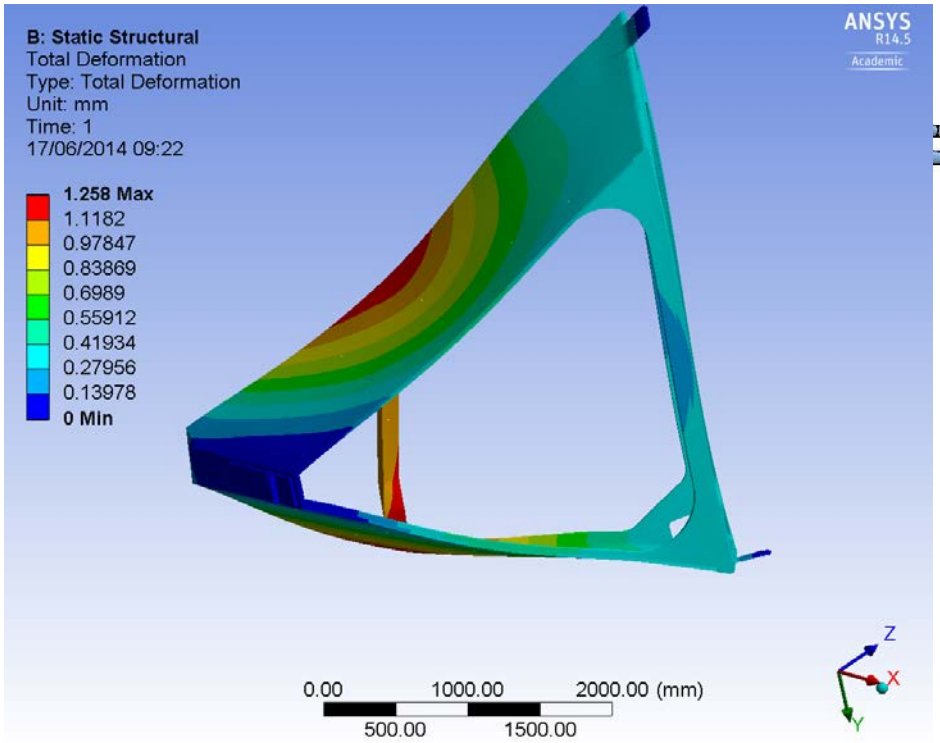
External structure in Al, closing panels in CFRP

- **Reviewed with JLab engineers committee on June, 20**

- **All elements have been defined, analysis of the weight deformation and of the load on the supporting carriage performed**
- **Technical drawings underway**

- **Ready to start construction**



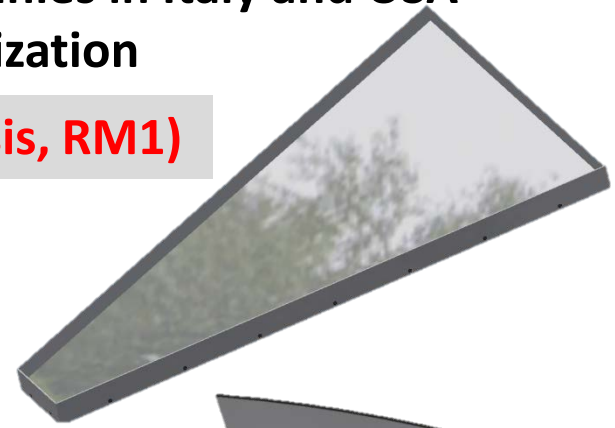


Under LNF responsibility
- D. Orecchini, S. Tomassini

2a. The RICH design: mirror

Manufacture Engineering Phase ongoing with companies in Italy and USA in contact with CERN laboratory for mirror characterization

S. Tomassini - G. Angelini (Thesis, RM1)



PLANAR GLASS MIRROR

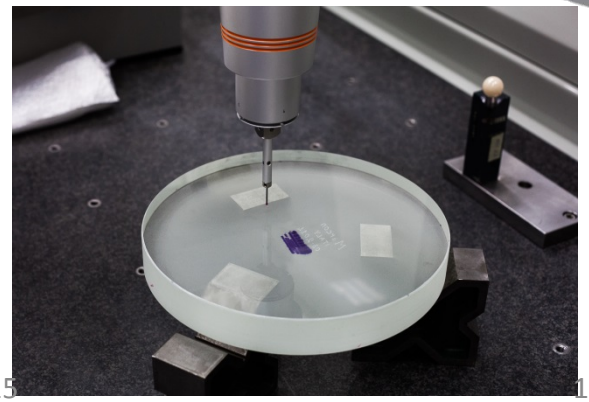
Planarity tolerance <= 0.1 mm
Surface accuracy: 5 µm RMS
Surface Quality: 3 nm RMS
Reflectivity > 90%

- **First prototype of the smaller submirror produced by MediaLario (Co) – optimization in progress**

SPHERICAL CFRP MIRROR

Radius tolerance <= 1%
Surface accuracy: 5 µm RMS
Surface Quality: 3 nm RMS
D0 < 5 mm
Reflectivity > 90%

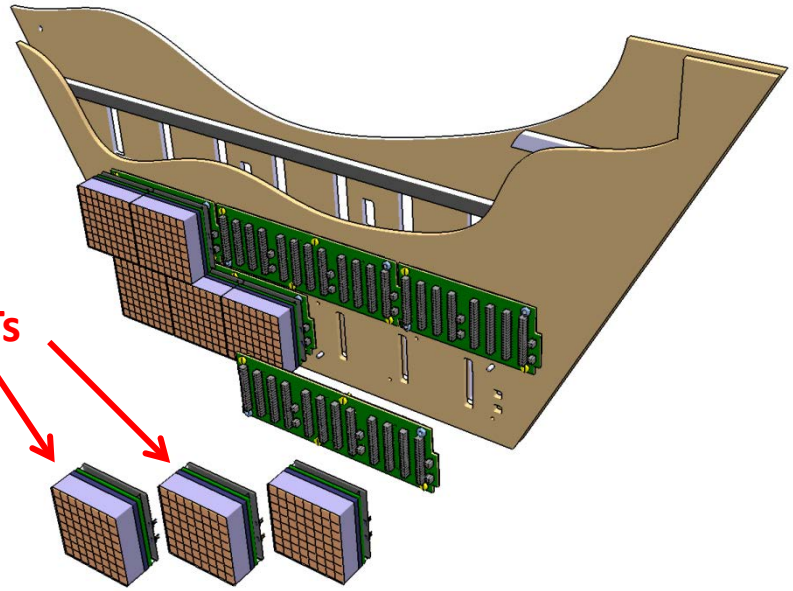
- **mandrel produced by Marcon Telescopes (Vi)**
- **small prototypes produced by CMA (USA) and RiBa Composites (Faenza) – optimization of production and surface coating in progress**



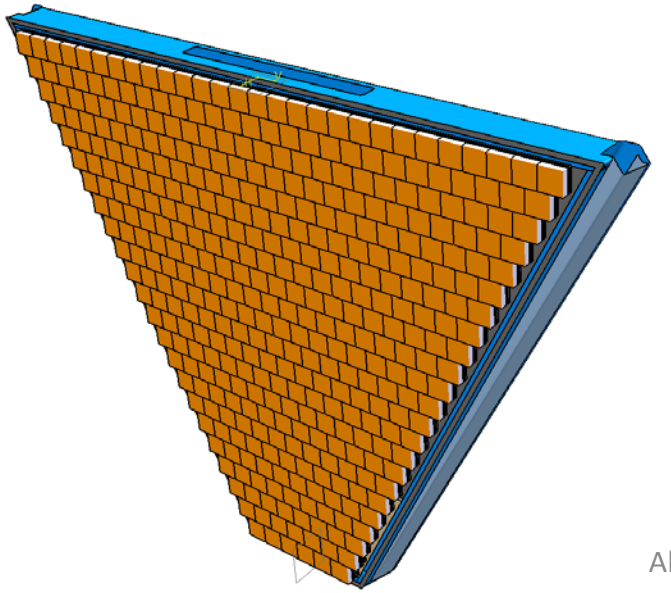
2a. The RICH design: FE electronics

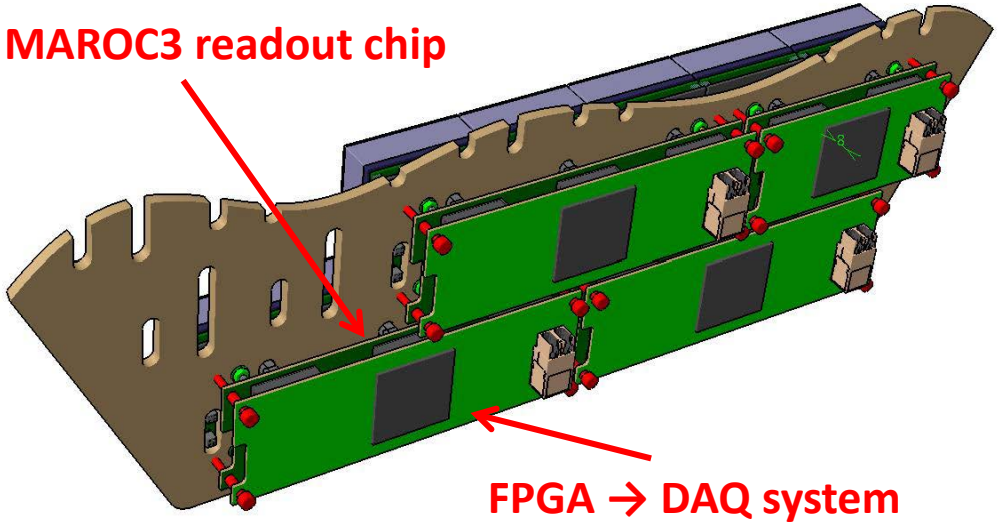
The MAPMTs and the FE electronics is housed in a 1m^2 panel

- **FE under INFN responsibility (Fe-Ge-ISS), readout developed by JLab**
- **Design of the components is almost done, first prototypes in production**



Mechanical design of the system under LNF responsibility (D. Orecchini, S. Tomassini)





Richieste e fondi esterni

Richieste finanziarie

apparati+consumo+inventario	240k
missioni	85k

Richieste ai servizi

officina meccanica	3 mesi/u
progettazione apparati	8 mesi/u

HORIZON 2020

- TMD-neXt: 3D structure of the nucleon in momentum space: opening the next stage
- NextDIS: Challenges for Next Generation DIS facilities
- ~~GPDology: Study of Generalized Parton Distributions~~

All proposals suffered strong cuts during the selection process

LNF activities

2 researchers for 1.2 FTE
Average participation of 60%
Total INFN ~14 FTE

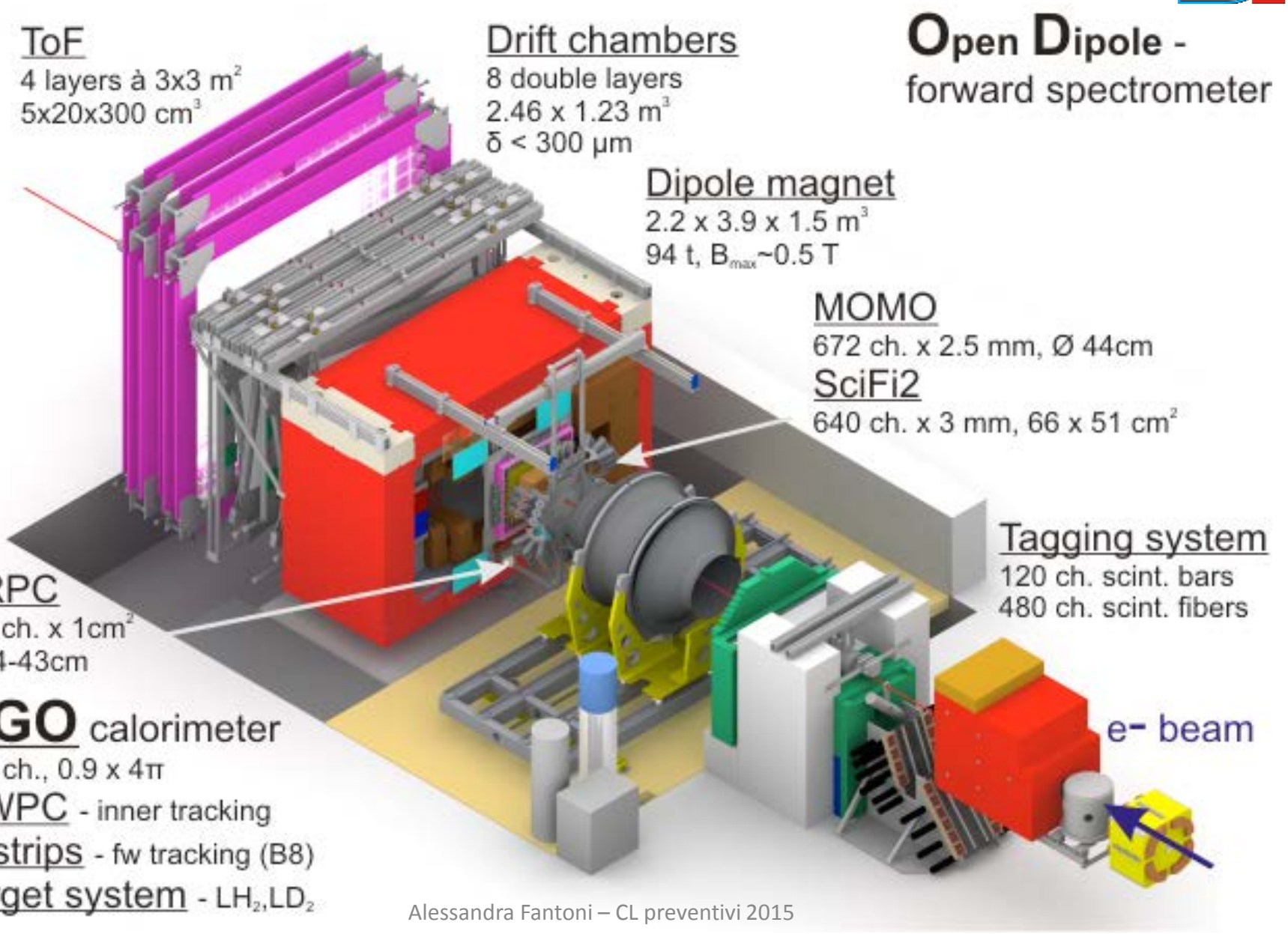
1. P. Levi Sandri	**0.8**
2. D. Pietreanu	0.4
A. Saputi (tech.)	0.1

- Nucleon excited states via meson photoproduction at MAMIc (Mainz) and ELSA (Bonn)
- Transition form factor
- International collaboration: Bonn PI, Bonn HISKP, Gießen, ISS, LNF, Messina, Pavia, Roma2, Torino, Glasgow, Basel, PNPI Gatchina, INR Mosca, IHENP Kharkov

Responsibilities:
- Co-spokesperson BGO-OD
- Analysis and MC coordinator

Activities:
Main interest in BGO-OD
- BGO (+ Roma2)
- Barrel (+ ISS)
- MRPC (+ Roma2)

Open Dipole + BGO calorimeter @ Bonn



ELSA (Bonn) beamline S - Status

Responsabilità INFN:

- Commissioning calorimetro, barrell e bersaglio (LNF/RM1/RM2/ME). Schermatura per campo magnetico costruita ed installata, necessaria agli angoli in avanti (LNF).
- Test beam @ BTF: ottima linearità e ottima risoluzione in energia. Calibrazione con sorgente trasportabile ad alta energia (RM2/ME).
- Camere cilindriche (PV) installate inizio 2014, in fase di commissioning.
- MRPC in costruzione, trovata soluzione separatori. Supporto meccanico installato. Installazione rivelatore prevista fine 2014, inizio 2015.
- MonteCarlo in continuo sviluppo, generatore di eventi (LNF/ME/RM2)
- Coordinamento del gruppo di simulazione/analisi (LNF).
- Co-spokesperson dell'esperimento BGO-OD (LNF).

Programma 2014-2015

- Completare installazione e commissioning rivelatori in installazione e costruzione:
  - MRPC (Roma2/LNF) in costruzione
  - MWPC (Pavia) in installazione
  - Čerenkov in installazione
  - TOF (Bonn-PI) installato
- Prima presa dati in configurazione ridotta con bersaglio H
  (9 settimane Settembre-Dicembre 2014)
- Run in configurazione completa (con MRPC+Č) nel 2015
  (12-20 settimane)

Richieste

Richieste finanziarie

missioni	**24k**
inventario	**8k**

Richieste ai servizi

costruzione/installazione MRPC 1 m.u.

LNF activities

6 researchers for 1.9 FTE
Average participation of 32%

1. N. Bianchi	0.2
2. M. Bragadireanu	0.2
3. **P. Gianotti**	**0.5**
4. V. Lucherini	0.5
5. E. Pace	0.3
6. D. Pietreanu	0.2

Responsibilities:

- INFN National Responsible
- Physics Coordinator
- Tracking System Coordinator

Activities:

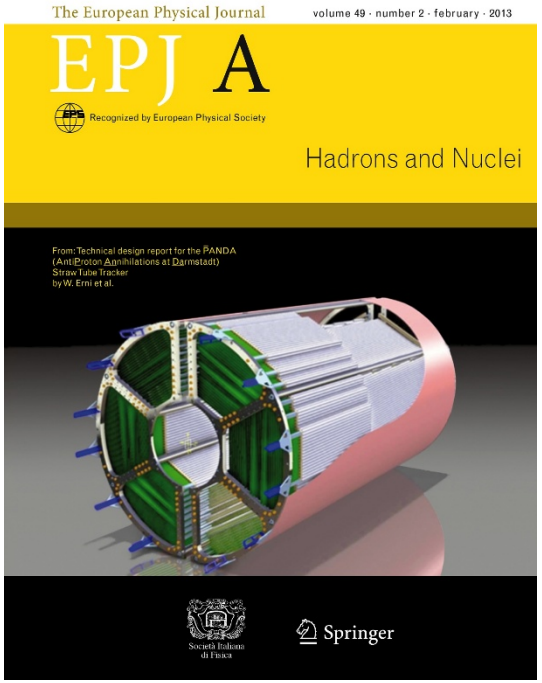
PANDA Central Tracking System

- Complete Straw Tubes characterizations

Gas mixture/overpressure/gain; HV working point; electronics

- Design of STT mechanical frame
- Prototype realization of CTM
- Services housing

electronics and gas distribution location, cabling

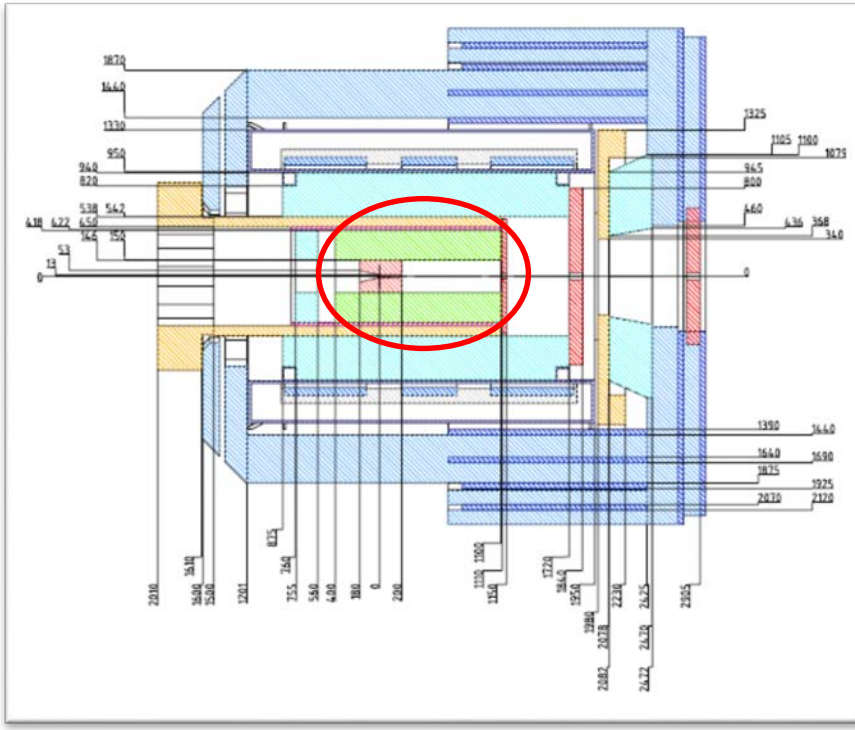


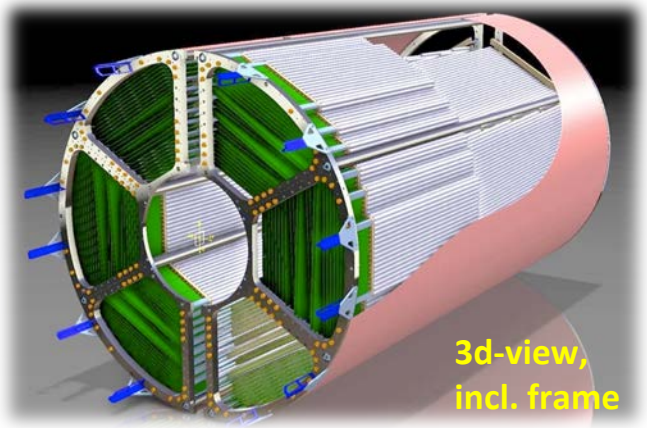
STT TDR in EPJA (2013) 49, 25
DOI: 10.1140/epja/i2013-13025-8

Straw Tube Tracker (STT) layout

PANDA central tracking detector has to fill a cylindrical volume with an internal radius of 150 mm, external one of 420 mm, and a length of 1500 mm.

- **4636 Straw tubes** in 2 semi-barrels
- **23-27 planar layers** in 6 hexagonal sectors
  - 15-19 axial layers in beam direction
  - 4 stereo double-layers with ±2.89° skew angle
- Time readout (isochrone radius)
- Amplitude readout (energy loss)
- **$\sigma_{r\Phi}$ ~ 150 (100) µm , σ_z ~ 3.0 (2.0) mm**
- **$\sigma_E / E < 8\%$** for π/K identification
- **σ_p / p ~ 1 - 2%** at B=2 Tesla
- **X/X_0 ~ 1.2%** ($^2/_3$ tube's wall + $^1/_3$ gas)





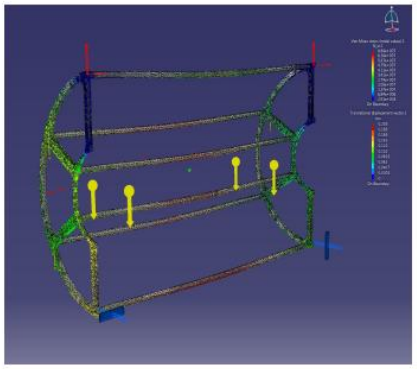
STT Mechanical Frame

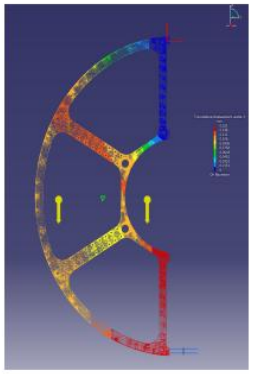
LNF is responsible for the design of the mechanics:

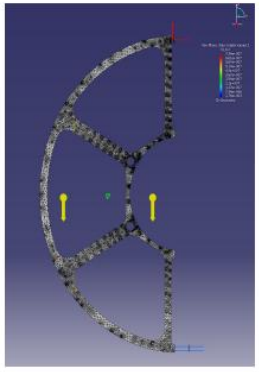
- 2 Separate **semi-barrels with end flanges**, connected by spacer bars
- Flanges have precise holes to fix straw modules
- FEM analysis: **0.03mm max. deflection**
- Inner & outer protection skins (~0.1% X/X_0 Kevlar)
- **Mechanical frame weight: 2× 9 kg**
- **11.6 kg Straw tubes (4636× 2.5 g)** with
  - strong wire stretching (230 kg equiv.)
  - strong tube stretching (3.6 t equiv.)

Semi-barrel components for	**FEM analys**
2 End flanges	60 N
6 Connecting bars (4 needed)	30 N
2300 Straw tubes	60 N
Straw grounding, boards	20 N
Electronics, gas supply	110 N
Total weight	**280 N**

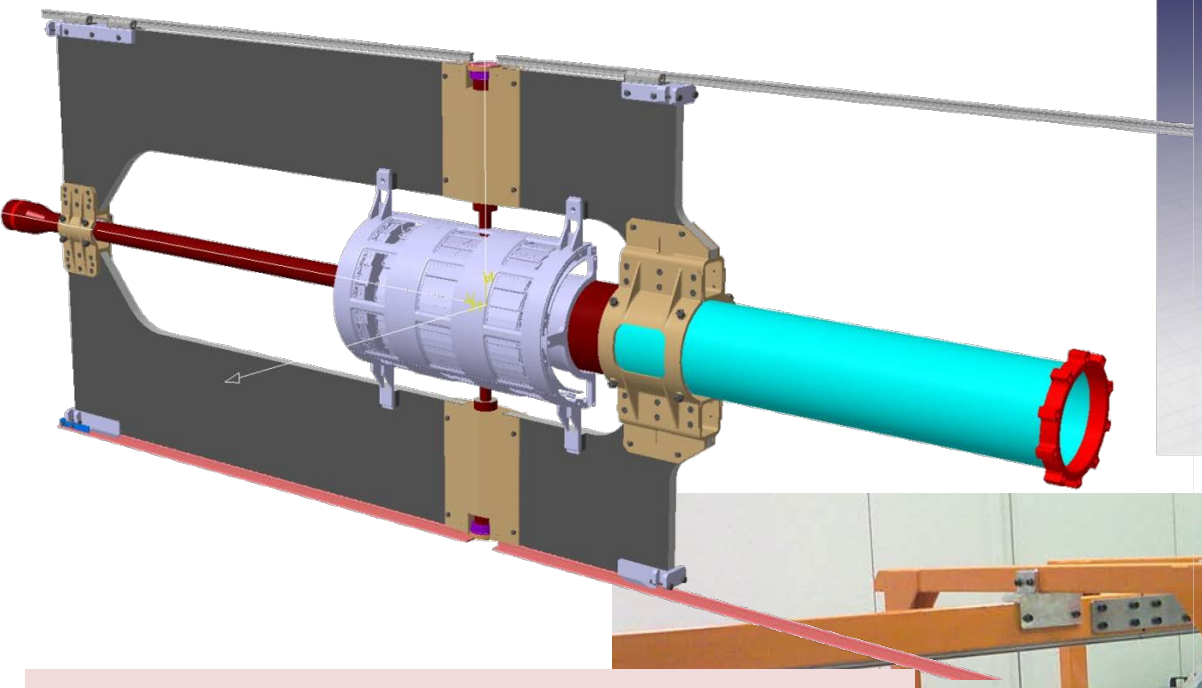
Material	**Aluminum**
Density	2.7 g/cm^3
Youngs modulus	70 GPa
Radiation length (X_0)	9 cm
Thermal expansion	24 ppm/°C

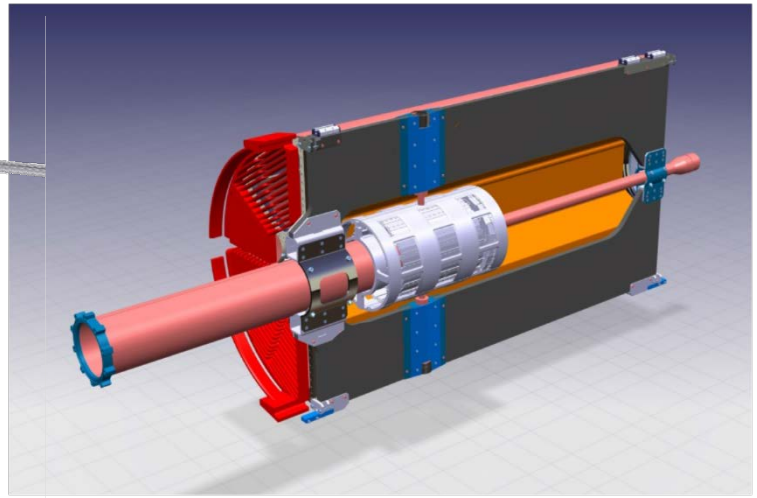






Central Tracker Mechanics





-The general design and the main dimensions are fixed;

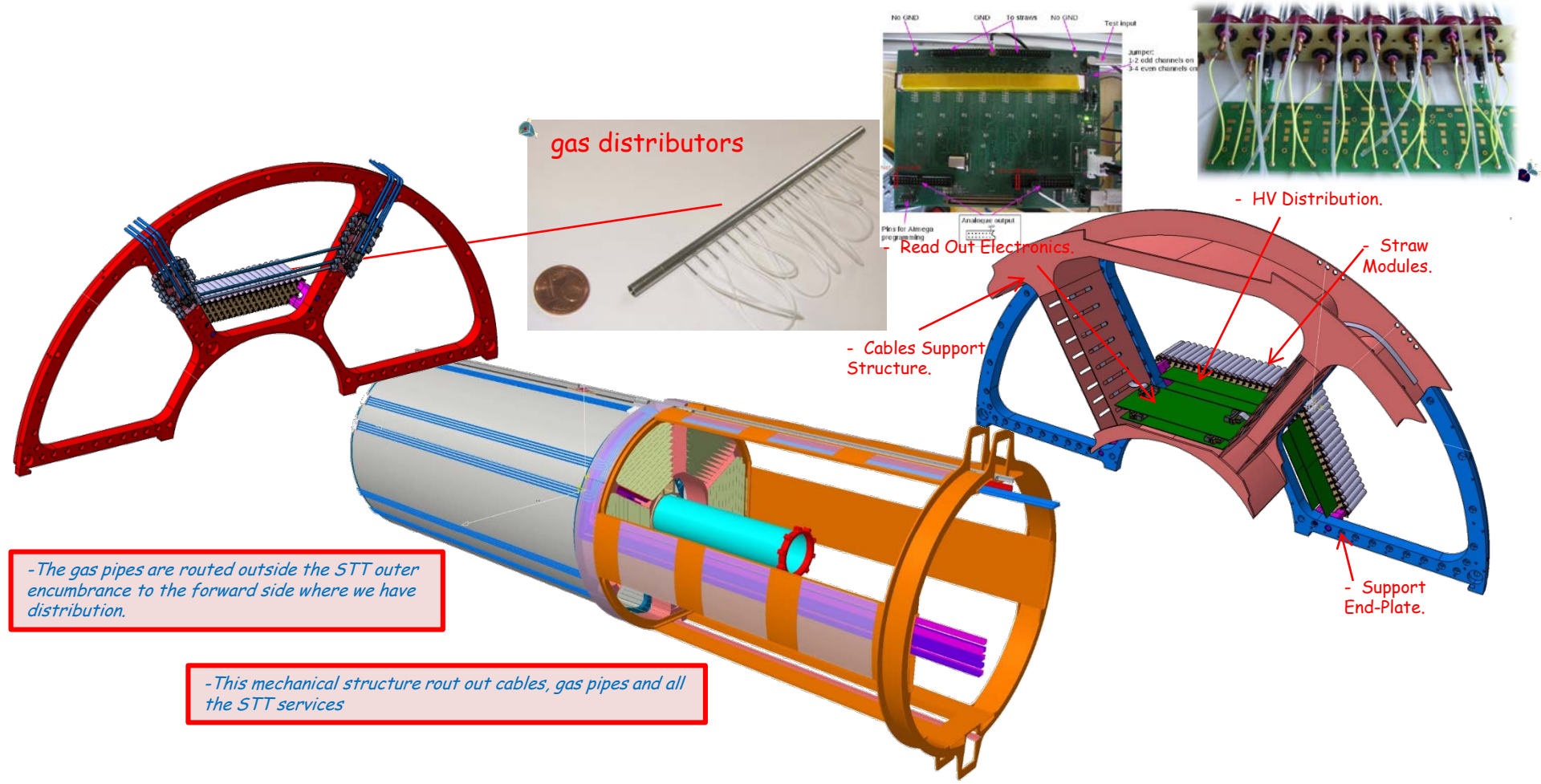
- Preliminary mechanical solutions to support the target-beam cross pipe have been developed;

-The preliminary structural calculations have been made with positive results;

- A full scale prototype has been realized in collaboration with Torino Group.

Present activity

presently working on services housing:
electronics and gas distribution location, cable routing



PANDA - Status

- FAIR è entrata a pieno titolo nella fase di costruzione
- PANDA Italia si appresta ad iniziare la fase di costruzione del tracker con Straw Tube, del rivelatore di vertice e il bersaglio primario ipernucleare
- Piano finanziario prevede un investimento di ~ 5000 k€ in un periodo di 5 anni
- MOU in preparazione: l'INFN sarà chiamato a firmarlo entro la fine del 2014
- LNF: responsabilità meccanica STT. Richiesta ~200 k€ (sj MoU) per inizio costruzione

Richieste

Richieste finanziarie

missioni	**30k**
costruzione apparati	**200k**
consumo	**10k**
trasporti	**2k**

Richieste ai servizi

supporto esperimenti	**12 mesi/u**
progettazione apparati	**4 mesi/u**

LNF activities

20 researchers for 11.6 FTE
Average participation of 58%
Total INFN ~14 FTE

1. M. Bazzi	0.8
2. C. Berucci	1
3. A. Bragadireanu	0.7
4. A. Clozza	0.3
5. C. Curceanu	**0.6**
6. A. D'Uffizi	0.6
7. C. Guaraldo	-
8. M. Iliescu	0.5
9. P. Levi Sandri	0.2
10. D. Pietreanu	0.3
11. K. Piscicchia	0.5
12. M. Poli Lener	1
14. E. Sbardella	0.6
15. A. Scordo	0.6
16. H. Shi	0.6
17. D. Sirghi	0.3
18. F. Sirghi	0.6
19. I. Tucakovic	1
20. O. Vazquez Doce	0.4
21. J. Zmeskal	1
F. Lucibello (tech)	0.5

- KAONNIS= Low energy kaons interaction studies at Daϕne
- Integrated initiative (SIDDHARTA + AMADEUS)
- Precise measurement of kaonic atoms X-ray transitions
- International collaboration: INFN; SMI-OAW (Austria); IFIN-HH (Romania); Politecnico MI; MPE, TUM, PNSensors (Germany); RIKEN, Tokyo U. (Japan); Victoria U. (Canada); Zagreb U. (Croatia)
- EU HP3 support

Spokesperson + ALL Responsabilities in LNF

Publications:

- **K^4He** first measurement ever in gaseous target

PLB 681 (2009) 310; NIM A628 (2011) 264; PLB 697 (2011); PhD

- **KH** 400pb^{-1}, most precise measurement PLB 704 (2011) 113, NP A881 (2012) 88; Ph D
- **K^3He** 10 pb^{-1}, first measurement in the world PLB 697 (2011) 199; Ph D
- **KD**: 100 pb^{-1}, exploratory first measurement ever NP A907 (2013) 69; Ph D
- **Widths and yields of K^3He and K^4He** PLB 714 (2012) 40; NPA 914 (2013) 305; EPJ A 50 (2014) 91
- **Yields of low-Z kaonic atoms transitions** NPA 916 (2013) 30

SIDDHARTA: important training for young researchers

KAONNIS (Integrated Initiative):

Low-energy QCD in strangeness sector – unprecedented results!

- SIDDHARTA data analyses and SIDDHARTA-2 experiment: kaonic atoms studies

- AMADEUS : kaon-nuclei interaction studies at low energies

- other collaborations related to strangeness physics (JPARC)

- support from European projects: HP3 (ongoing),

- ECT* Workshop 21-25 October 2013:

"Strangeness in the Universe? Theoretical and experimental progress and challenges"

-ECT* Workshop 27-31 October 2014:

"Achievements and perspectives in the low-energy QCD with strangeness"

SIDDHARTA2 strategy – phases

1) Kaonic deuterium measurement - 1st measurement and R&D for other measurements

2) Kaonic helium transitions to the 1s level – 2nd measurement, R&D

3) Other light kaonic atoms (KO, KC,…)

4) Heavier kaonic atoms measurement (Si, Pb…)

5) Kaon radiative capture – Λ(1405) study

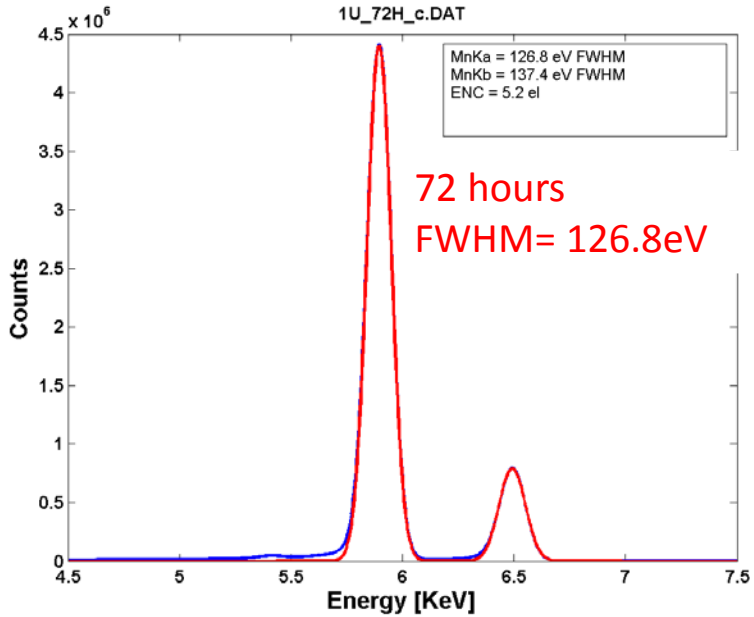
6) Investigate the possibility of the measurement of other types of hadronic exotic atoms (sigmonic hydrogen ?)

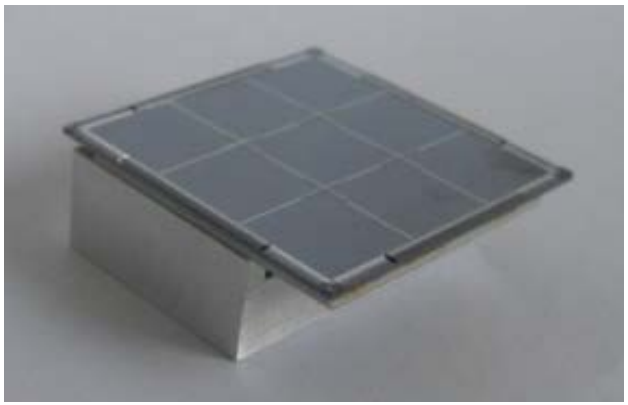
7) Kaon mass precision measurement at the level of <10 keV

SIDDHARTA2 setup (vs SIDDHARTA)

- new target final tests
- new SDD arrangement
- vacuum chamber final tests
- more cooling power
- improved trigger scheme
- shielding and anti-coincidence (veto)
- Assembly and tests

Use of new SDD detectors (FBK)





square SDD: 64 mm^2
meas. time: 72 hours
T= 100 K Rate: 1.1 kcps

Stategy for Kd measurement:

SIDDHARTA-2 setup is going to be ready in 2015 (compatible with financing)

We are confident that with an integrated luminosity of ***600 pb^{-1},*** SIDDHARTA-2 will be able to perform a first X-ray measurement of the strong interaction parameters - **the energy displacement and the width of the kaonic deuterium ground state, a fundamental measurement in low-energy strangeness QCD.**

Prepare for other measurements – SIDDHARTA-2 has a scientific program which could last about 2 years

A CLEAR DAΦNE TIME SCHEDULE IS MANDATORY !!!

Experimental program of AMADEUS

Unprecedented studies of the low-energy charged kaons interactions in nuclear matter:
solid and gaseous targets (d, He^3, He^4) in order to obtain unique quality information about:

AMADEUS collaboration:

119 scientists from 13 Countries and 34 Institutes

- Nature of the (elusive) $\Lambda(1405)$
- Possible existence of kaonic nuclei clusters (deeply bound kaonic nuclei states)
- Interaction of K^- with one and two nucleons
- Low-energy charged kaons cross sections for K momenta lower than 100 MeV/c (missing today)
- Many other processes of interest in the low-energy QCD in strangeness sector -> implications from particle and nuclear physics to astrophysics

AMADEUS status:

- analyses of the 2002-2005 KLOE data -> publications
- Step 0 : Pure Carbon Target inside KLOE data taking in 2012, under analyses -> publ.
- R&D for more refined setup: trigger and active target
- in 2014: collaboration AMADEUS+KLOE for KLOE2 data taking and studies of **future possible scenario and addings (hypernuclear…)**

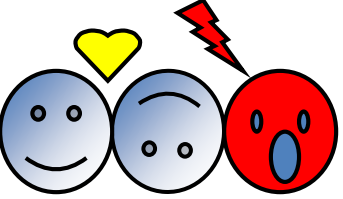
Richieste

Richieste finanziarie

missioni	**25k**
consumo	**125k**
inventario	**40k**
manutenzioni	**12k**

Richieste ai servizi

elettronica e automazione	**6 mesi/u**
progettazione apparati	**6 mesi/u**
costruzioni meccaniche	**8 mesi/u**



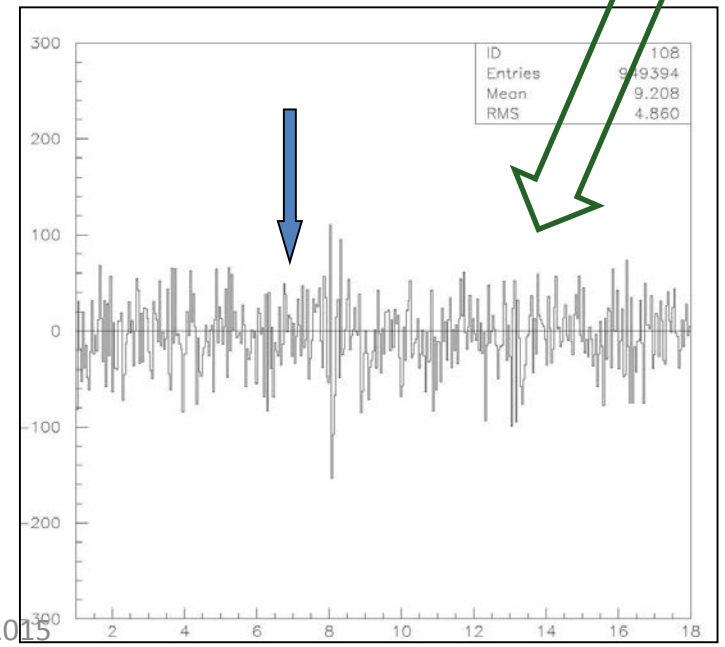
LNF activities

12 researchers for 6.5 FTE
Average participation of 54%
Total INFN 5.8 FTE

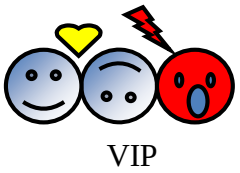
1. S. Bartalucci	0.4
2. A. Clozza	0.2
3. C. Curceanu	**0.4**
4. K. Piscicchia	0.5
5. E. Sbardella	0.4
6. D. Sirghi	0.4
7. F. Sirghi	0.2
8. H. Shi	0.4
9. L. Sperandio	1
10. O. Vazquez Doce	0.6
11. A. Pichler	1
12 J. Marton	1

- VIP=Violation Pauli Exclusion Principle (PEP)
- Perform experimental test of PEP for e^- with a clean method
- Located at LNGS to reduce X-ray background
- International collaboration: LNF, LNGS, Ts INFN; SMI-OAW (Austria); IFIN-HH (Romania); Neuchatel U. (Switzerland)
- VIP already established a probability of PEP violation $\beta^2/2<4\times10^{-29}$ previous limit $<1.7\times10^{-26}$ PLB 328 (1990) 438
- **VIP upgrade (CCD detectors replaced by SDD)**

ALL Responsabilities



Previous limit improved by 3 orders of magnitude
International Journal of Quantum Information 9 (2011) 145



Drawbacks of VIP:

- Reused an already done setup (DEAR experiment) – limitations in many aspects: signal and background
- No timing (trigger) capabilities
- Limited energy (efficiency) range (30 μm)
- .....

VIP-upgrade:

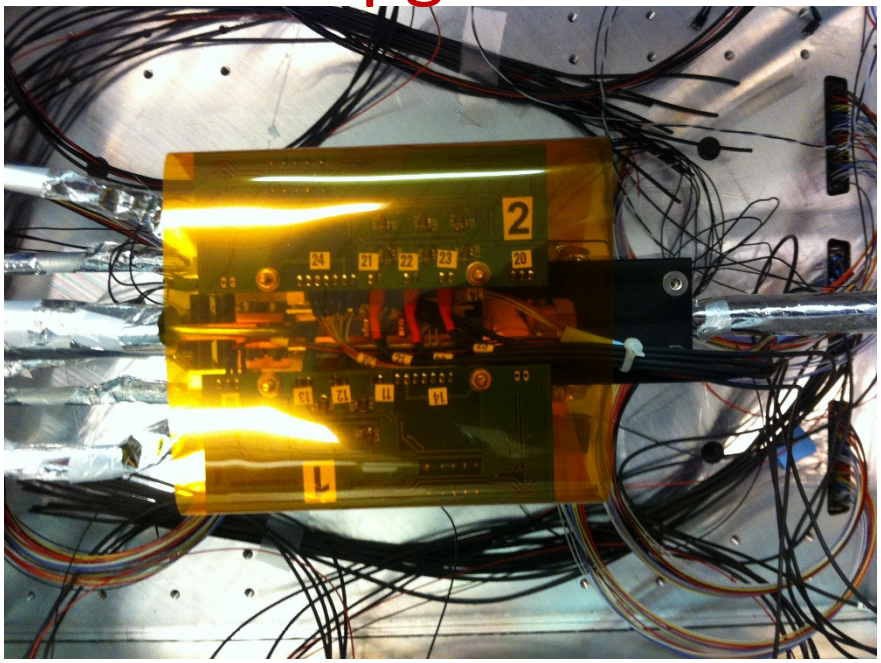
- Use new detectors – triggerable SDD
- 300 μm – more efficient in a broader energy range
- Design a new setup – much more compact; higher acceptance (present one 2.8%) and lower background

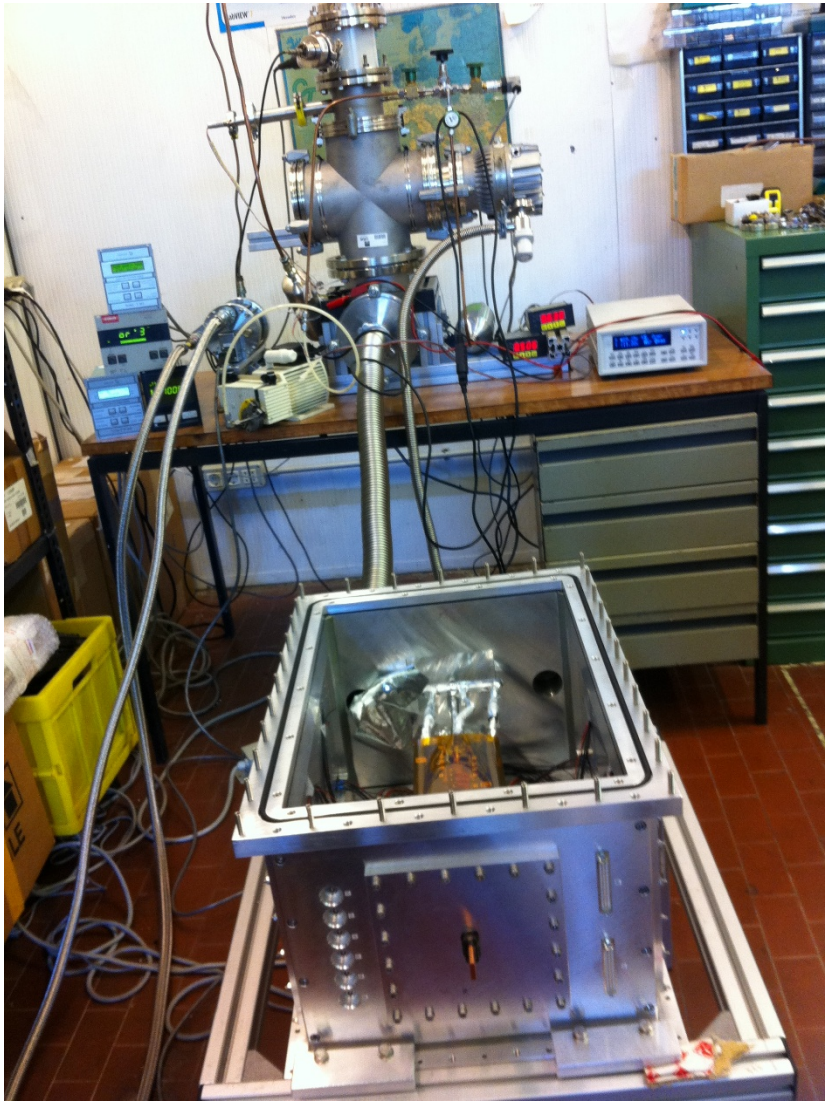
Goal to gain a factor 100

VIP upgrade ready to be moved to LNGS

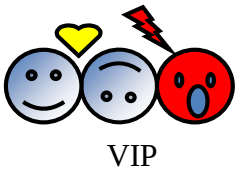
Upgraded VIP setup – tests at LNF

VIP





Upgraded VIP setup



- Detector ready to be moved to LNGS (problems with the impossibility to use sources for calibration, new rules....)
- Autumn 2014: start data taking with upgraded setup
- Expectation either to find a small violation or to be able to bound the probability that PEP is violated by electrons pushing it from about $4 \cdot 10^{-29}$ to 10^{-31}
- Expected period of data taking: 3-4 years

Explore other type of physics – q.m.(collapse mod.predictions)

Richieste

Richieste finanziarie

missioni	**20k**
consumo	**25k**
inventario	**12k**
trasporto	**2k**

Richieste ai servizi

elettronica-automazione	**2 mesi/u**
progettazione apparati	**2 mesi/u**
meccanica	**4 mesi/u**

Summary

- Nuclear physics group involved in 6 international collaborations, inside LNF and outside


- Big LNF contributions in all 6 collaborations
- Several national and/or international responsibilities
- LNF Support for design and construction
- Relevant contribution of LNF technicians for construction and for upgrades

4.1 46th SC Recommendations http://www.lnf.infn.it/committee/pdf/FindRec46.pdf

The SC is impressed by the strength of the LNF participation to CSN3 activities: the contribution of the LNF groups to the scientific production of the Nuclear Scientific Community is of primary importance. Each group went much over the threshold of the participation for a good visibility. The only concern is that there is a group waiting for PANDA.

Backup

ALICE Re-commissioning

2014/5	Critical Activity	System	Comment
Jan	LTU FW **support 100 classes**	CTP	**Deployed**
Feb	Local detector testing CDH v.3	ALL	Started
Mar	CDH v3 Aliroot	OFF	Gas pertubation
Apr	checklist for CDH v3 and FAST SOR/EOR mixed CHD v2 and V3 kit available LM board shipped end of month	ALL/JIRA DAQ/OFF CTP	Cooling Perturb.
May	Shuttle Standalone Tests Restarted **Online systems Operational** CTP 100 classes (old board) **Run-Control Center Operational**	**ALL**	**Cooling Perturb.**
June		DAQ/HLT/CTP	Standalone
July	New CTP LM board installed DCS/DAQ/CTP/HLT integration Global runs, Standalone runs (w/ global DAQ)	TPC,ALL	**First tests with new TPC gas mixture** **Mixed CDH**
August	Global runs / Shuttle tests	ALL	
September	Deploy LM logic in CTP	CTP	**Start shift Management**
October	Technical runs with TRD LM logic	TRD, V0, T0	
Nov (end of)	**Technical runs with TRD LM logic** **RCU2/partial install**	TPC ALICE	SECTOR TEST **GG potential scan**
Dec (mid of)	RCU2/1-2 Sectors test HLT/Mixed Mode	TPC, H:T	**B scan for ExB with comics and laser**
January 2015	RCU2/Partial Commissioning	TPC, TRD	Machine Checkout Krypton Run

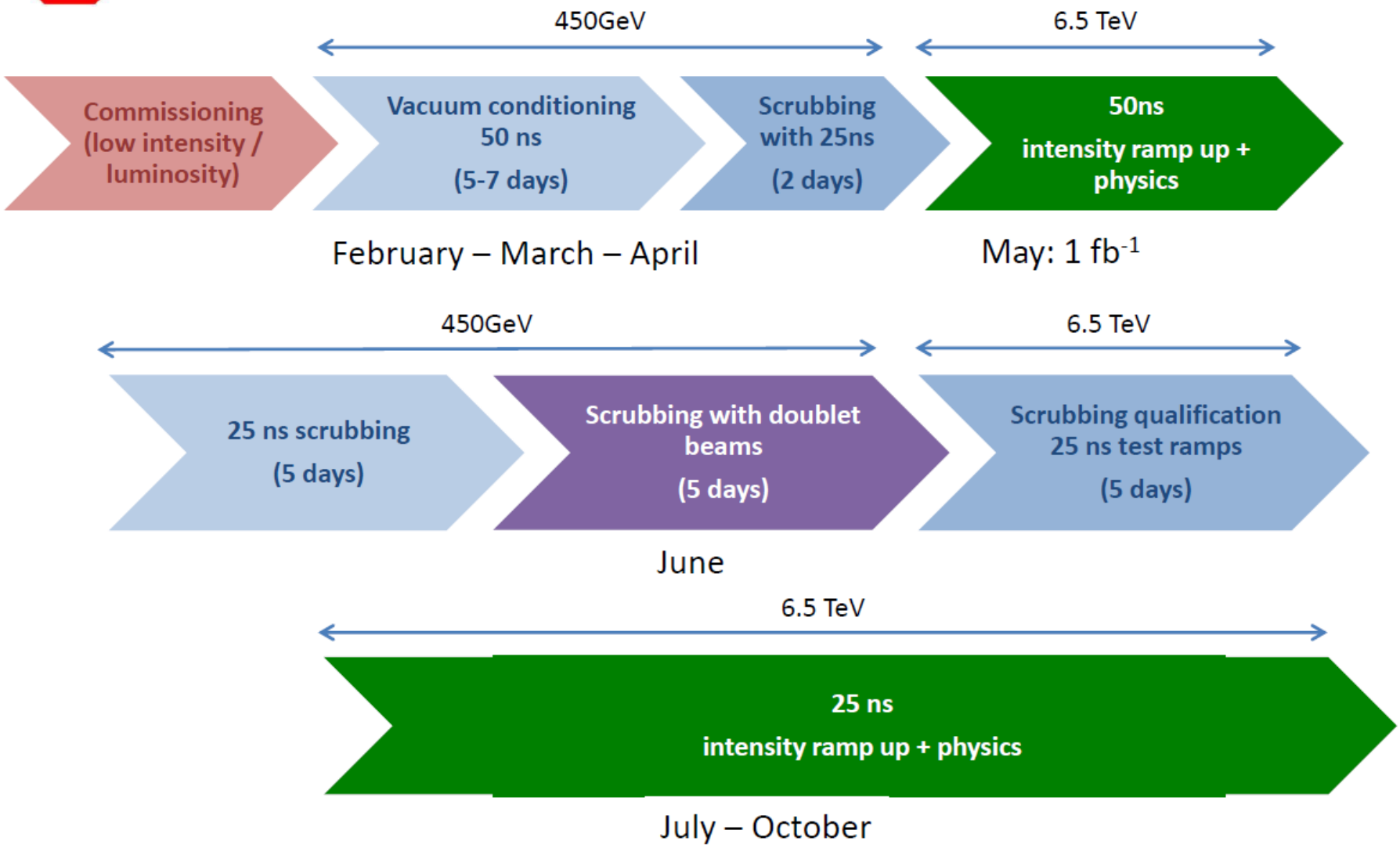
EXPERT

DET SHIFTS

GLOBAL RUNS

STABLE

2015 Restart and pp Operation



2015 pp Operation at 50 ns

3 weeks between April and May: **1 fb^{-1} delivered**

- ALICE requests main-main collisions (at least as much colliding bunches as in 2011)

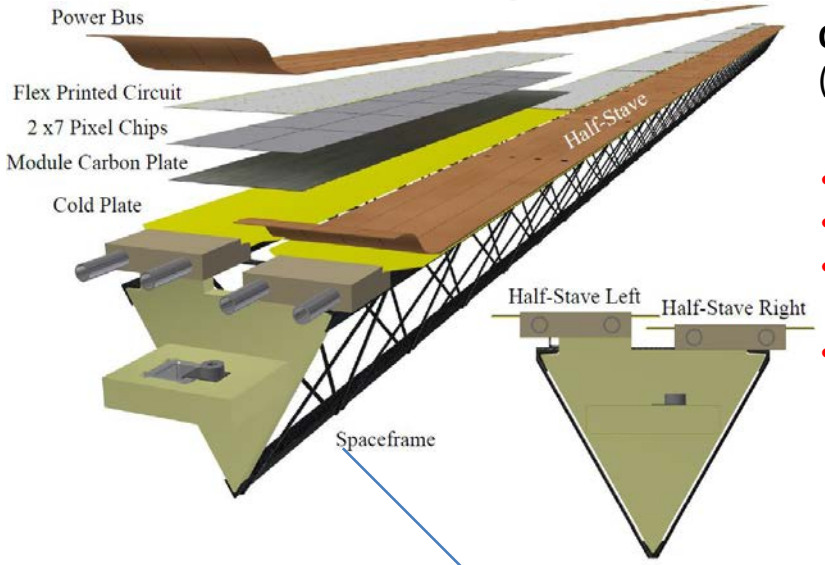
year	mode	$\sqrt{s_{NN}}$ (TeV)	β^* (m)	α_{int} (μrad)	α_{ext} (μrad)	colliding bunches
2011	pp	7	10	280	160	$\leq$ 39

L = 10^{29} – 10^{32} Hz/cm^2 → **10 – 600 kHz**

Trigger configuration(s) under study : MB + RARE +...

→ See Trigger Coordination presentation by Ken Oyama on Wednesday

4.2: Development of assembly technology for monolithic pixel super-modules



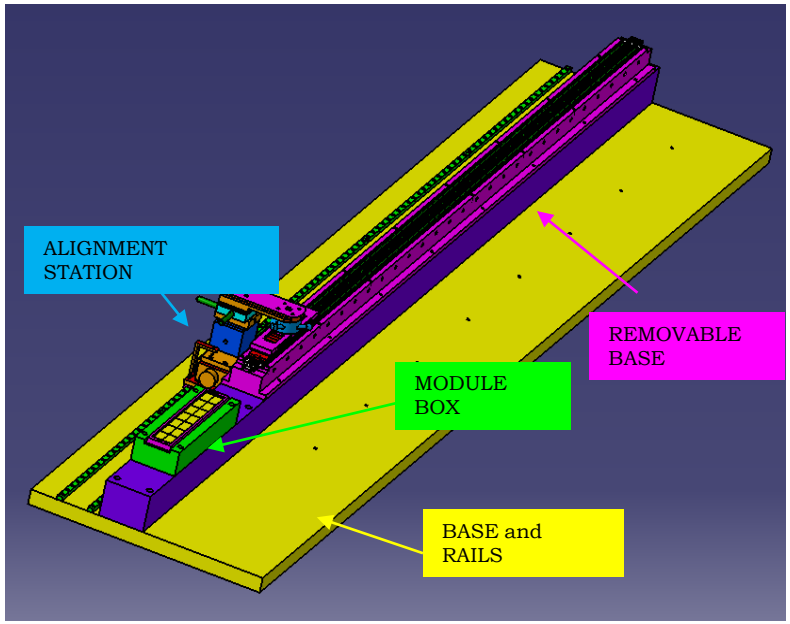
OUTER BARREL STAVES LAYOUT
(1500mm length, 80 gram weight)

- Material budget 0.8% X_0
- Large acceptance
- Cooling system and stave mechanics
- Data transmission

Carbon Fibre reinforced structure with embedded polyimide cooling pipes

4.2: Development of assembly technology for monolithic pixel super-modules

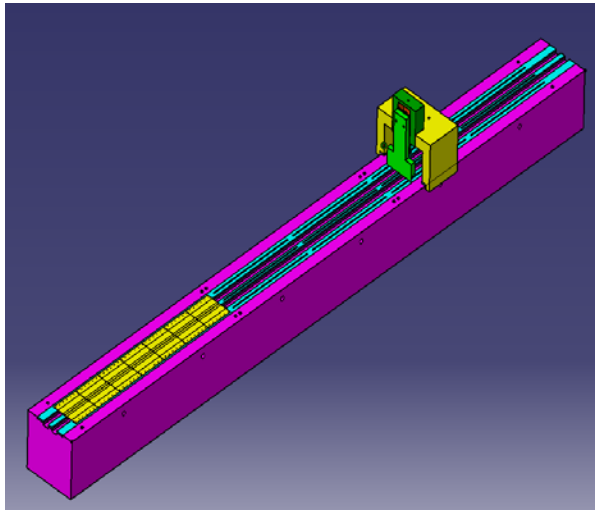
HALF STAVE ASSEMBLY JIG



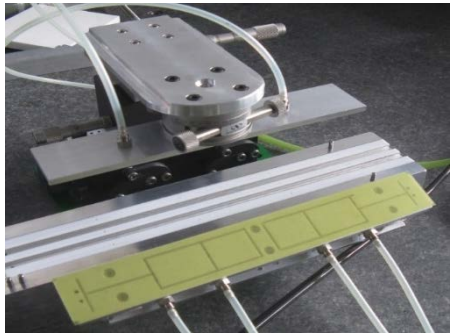
- Alignment precision (position accuracy of the modules <10μm in the horizontal plane)
- Good thermal coupling to the cooling system.
- Reliable interconnection techniques.

- The base and rails: to put the module in position
- The alignment station: to handling and aline the modules
- The module box: to store, carry and prealign the modules
- The removable base: to accomodate the cold plate, to interconnect the modules and to position the bus cable

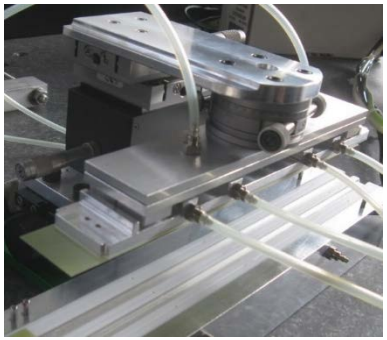
4.2: Development of assembly technology for monolithic pixel super-modules



- Tools for module gluing: test with glue and adhesive tape



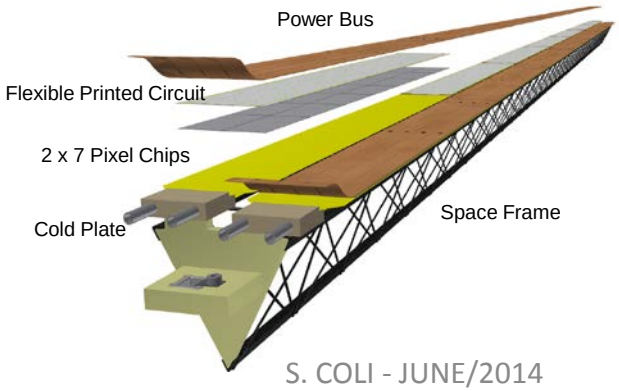
- First test on (dummy-dummy) module handling and alignment

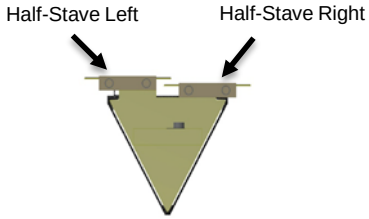


Stave Assembly - STATUS

STAVE ASSEMBLY PROCEDURE:

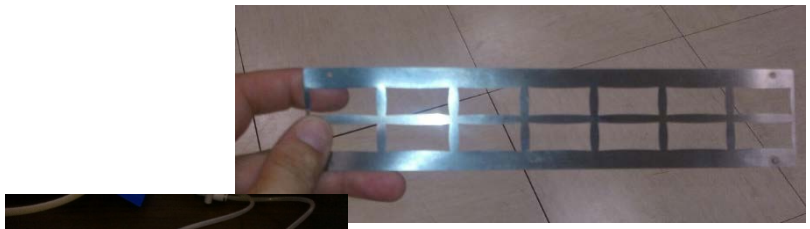
- ✖ First dummy half-stave in production:
  - + 7 modules aligned
  - + FPC-FPC connection under study
  - + BUS soldering under study
- ✖ stave
  - + Jigs design is almost finished,
  - + components procurement started
  - + ready by October

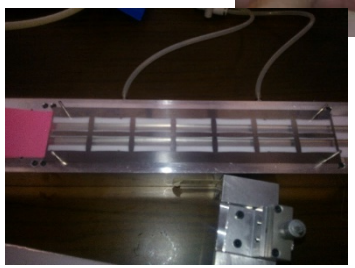


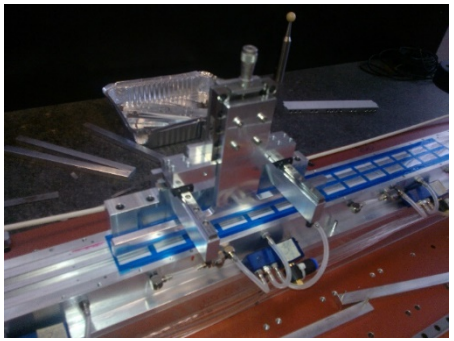


HALF STAVE ASSEMBLY PROCEDURE – NEW GLUING TOOL

- NEW GLUING TOOLS (test will follow)
- New metal masks
- New tool for the glue leveling

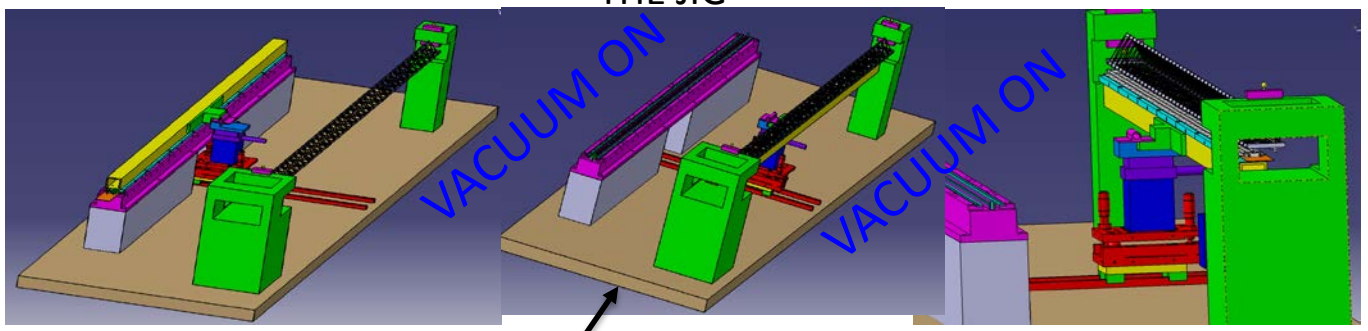




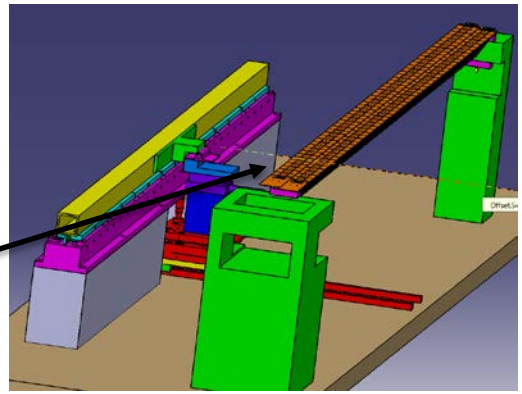


STAVE ASSEMBLY –

THE JIG



- Each half-stave will be
  - taken with a handling tool (yellow in the drawing) equipped with vacuum
  - rotated
  - placed under the space frame
  - aligned and fixed to the reference pins
  - Glued to the space frame through U-legs



- Each stave will be
  - MEASURED
  - Tested
  - Stored/shipped in dedicated boxes

JLab at 12 GeV

16-month installation
May 2012 - Sept 2013

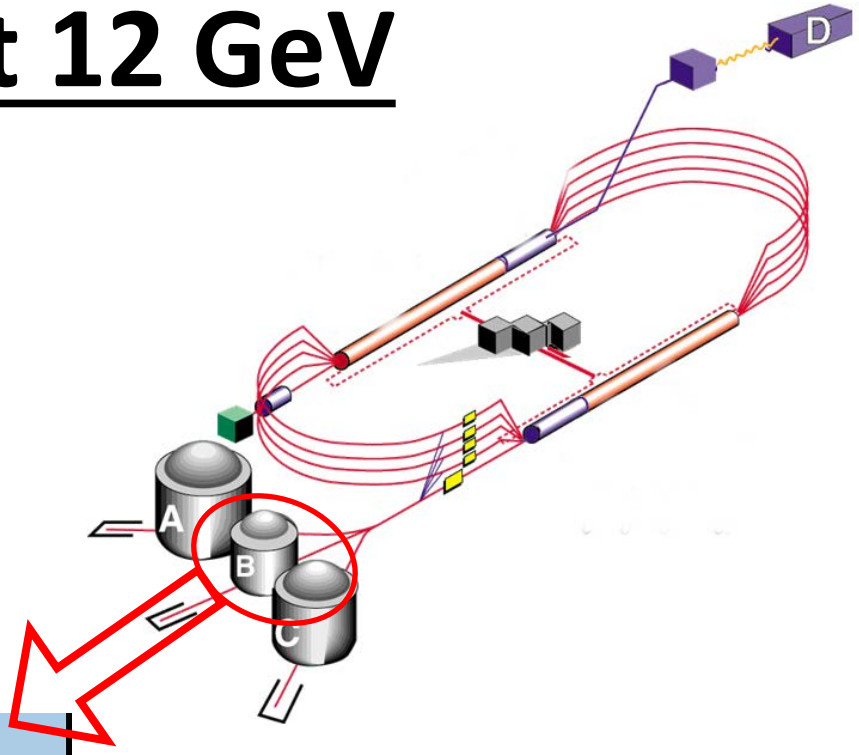
Accelerator commissioning start
Oct 2013

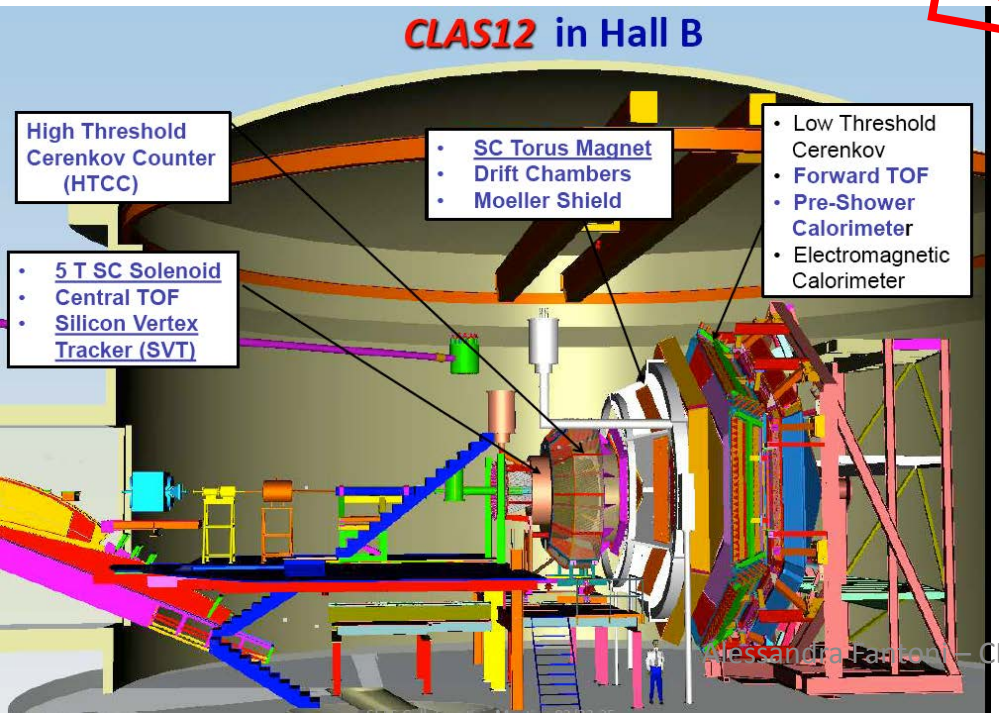
Hall A commissioning start
Feb 2014

Hall D commissioning start
Oct 2014

Halls B & C commissioning start
Jan/Feb 2016

Project Completion
March 2017





Physics program in Hall B

- TMD and GPD measurements
- meson spectroscopy
- hadronization
- physics beyond the SM

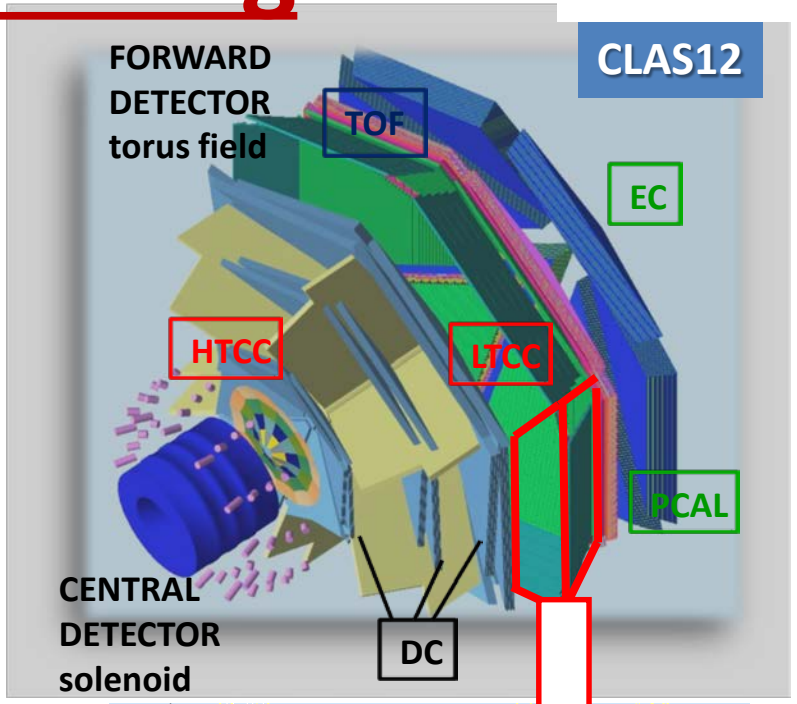
Improvement of PID needed to extend measurements to kaons

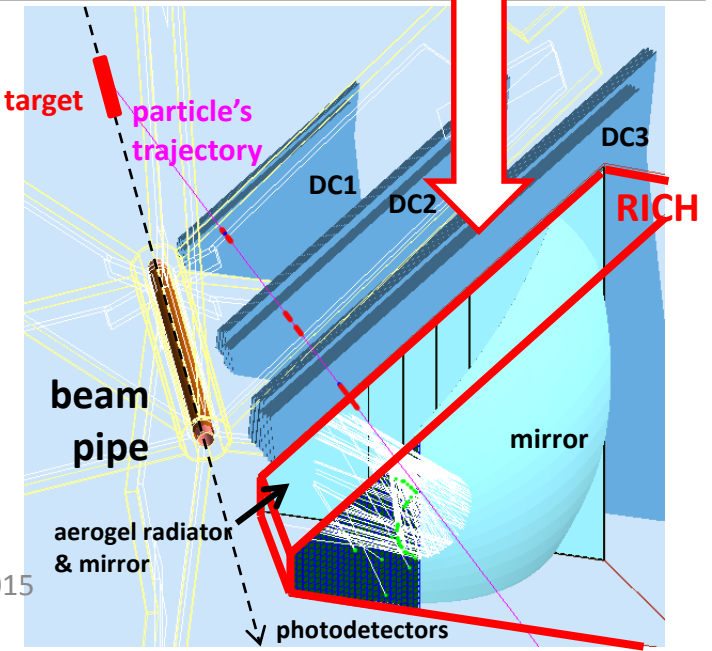
⇒ RICH

2. 12 GeV running

The JLab upgrade
- **increase of the beam energy from 6 to 12 GeV**
- **upgrade of the detectors in the 3 existing experimental Halls**
- **construction of the new experimental Hall D**

CLAS12 in Hall-B
- **Drift Chambers (DC) for momentum measurement**
- **Cerenkov (HTCC+LTCC) and calorimeters (PCAL+EC) for electron ID**
- **time-of-flight (TOF) measurement for pion and proton ID**

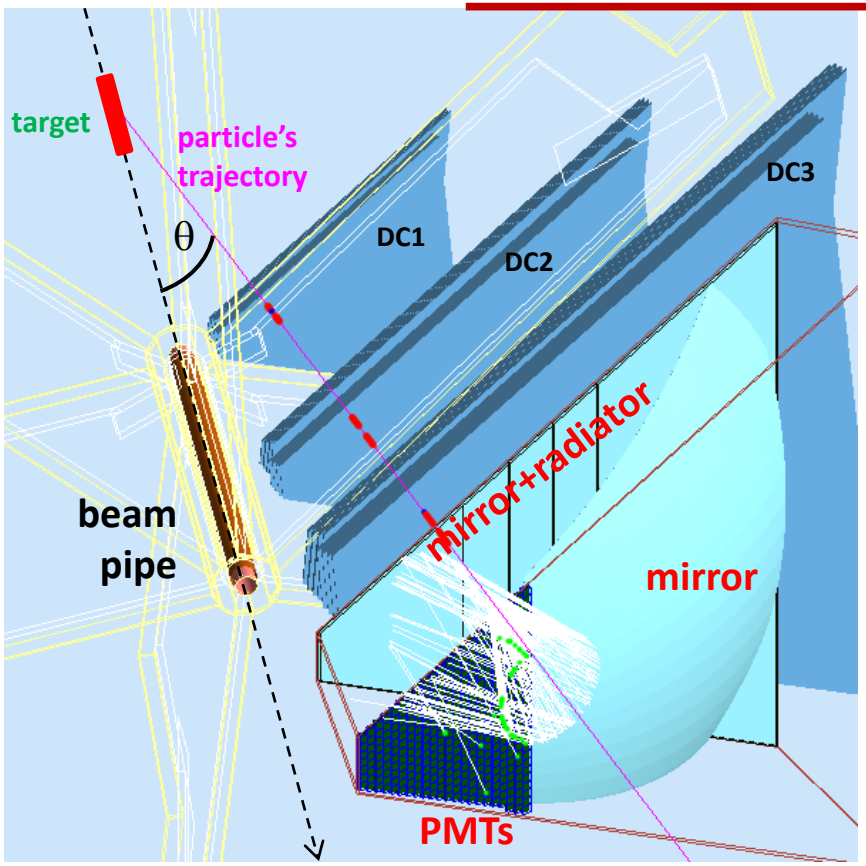


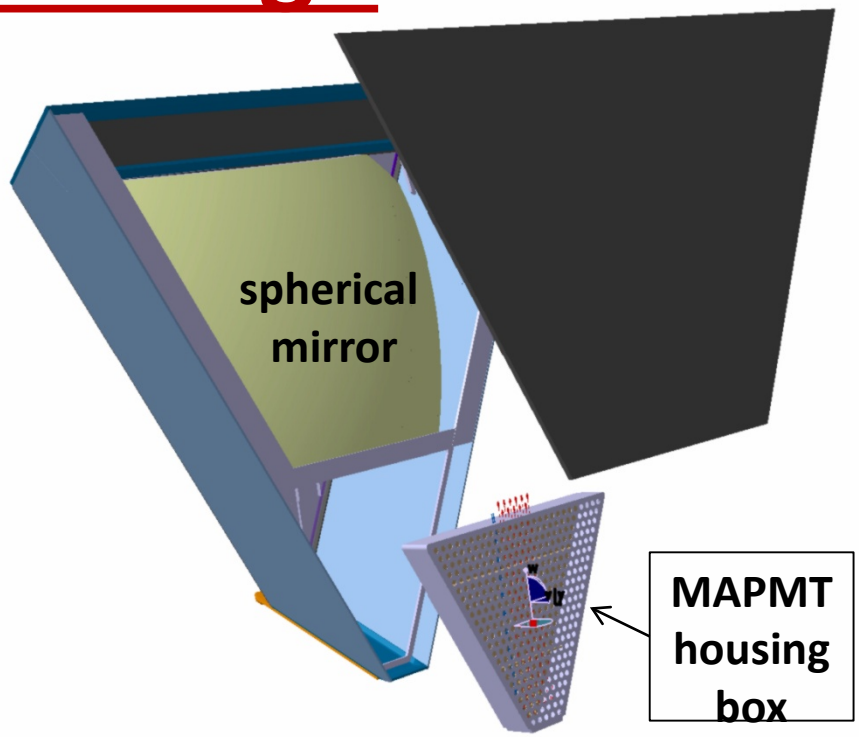


replace one LTCC sector with a RICH

PAC30 report (2006):
Measuring kaon asymmetries is likely to be as important as pions……
The present capabilities of the CLAS12 design are weak in this respect and should be strengthened

2a. The RICH design





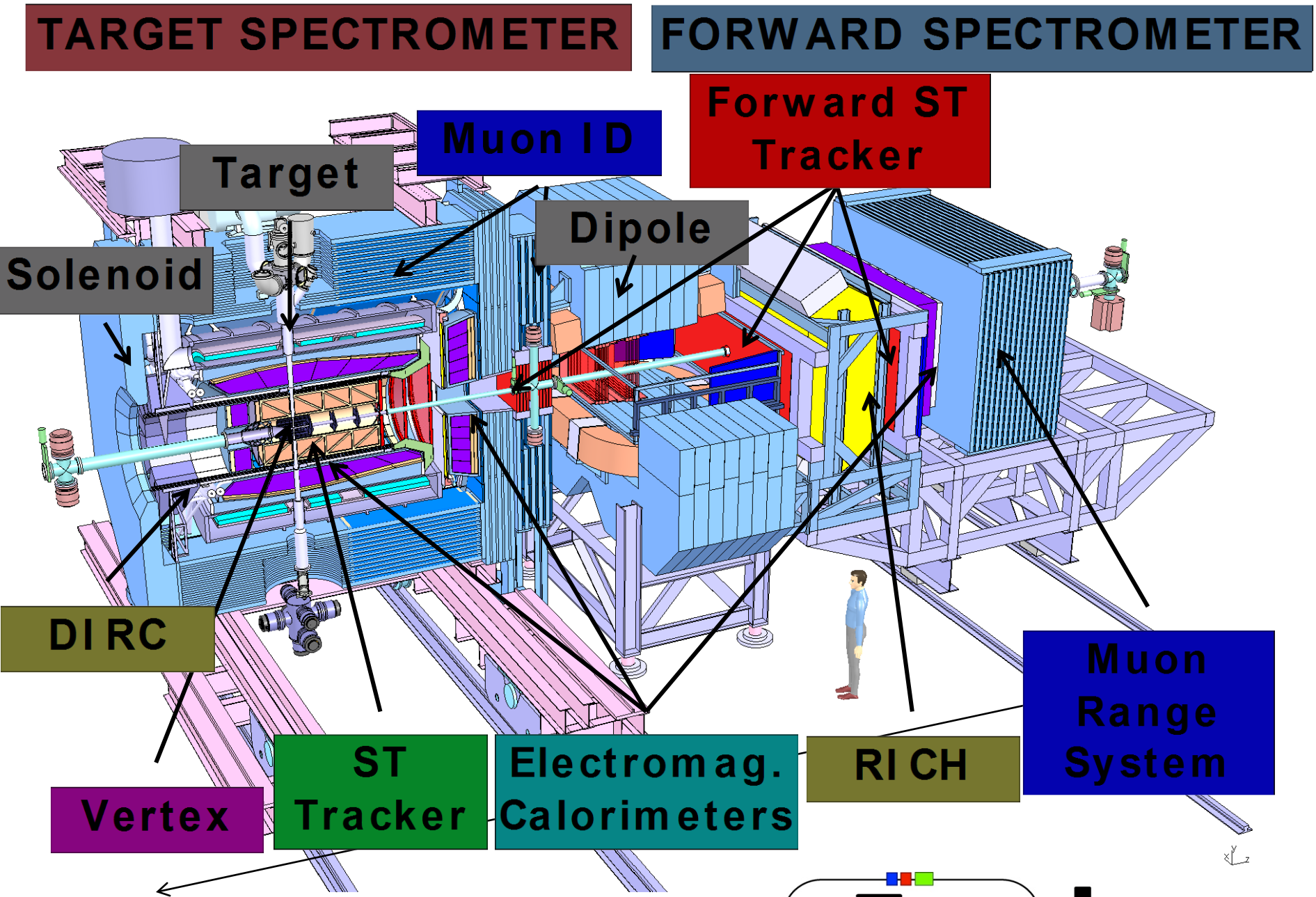
- **Design of the internal structure of the RICH under LNF responsibility**

  S. Tomassini, D. Orecchini

- **Collaboration with JLab and other INFN groups for the design of the Front End readout**

  G. Corradi

RICH components
- aerogel radiator
- MAPMTs for photon detection
- spherical and planar mirrors to reduce the area of MAPMTs
- integrated electronic readout


TARGET SPECTROMETER
FORWARD SPECTROMETER
Forward ST Tracker
Muon ID
Target
Dipole
Solenoid
DIRC
Muon Range System
RICH
ST Tracker
Electromag. Calorimeters
Vertex

Upgraded VIP setup