Esperimento ALICE

Riunione CDS 14 luglio 2014

Attività 2013-2014 e richieste 2015

1. Principali risultati di fisica 2013-14
2. SPD
3. Tier2 PD-LNL
4. ITS-Upgrade

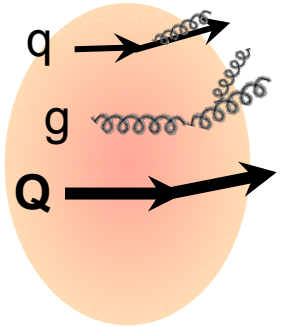
5. Anagrafe e richieste 2015

1. Principali risultati di fisica con importante contributo di Padova:

- produzione di charm in Pb-Pb: nuclear modification factor e elliptic flow (full statistics Run-1)
- produzione di mesoni D in p-Pb m.b.
- misura della D^0 a basso p_T in p-Pb
- studio di fattibilità della misura di jet prodotti da mesoni B

principali persone coinvolte: F. Antinori, D. Caffarri, A. Dainese, A. Festanti, C. Jena, R. Turrisi, M. Venaruzzo (LNL)

Intro: Parton energy loss and the nuclear modification factor



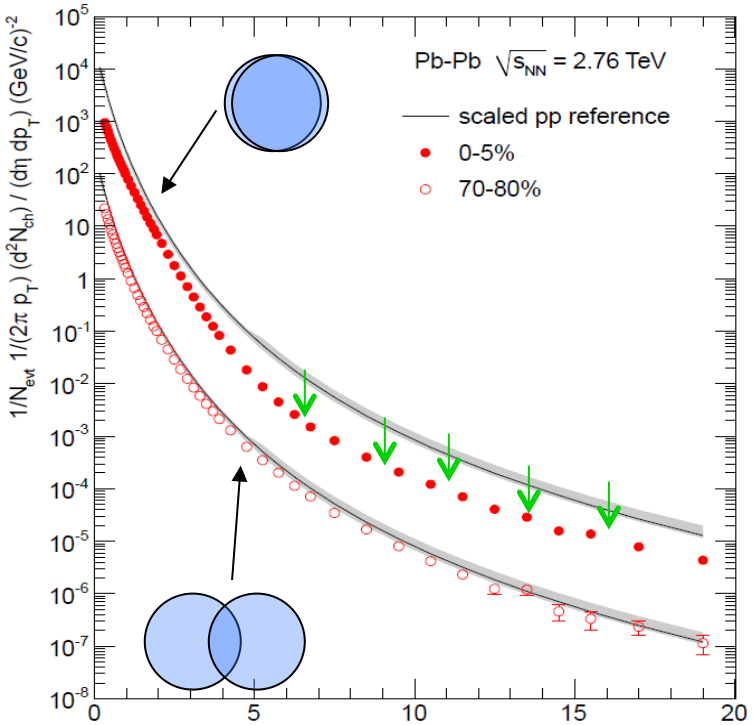
'QCD medium'

Parton Energy Loss by
- medium-induced gluon radiation
- collisions with medium gluons

$$p' = p - \Delta E(\varepsilon_{medium})$$

high-p_t suppression

$$dN_{AA} / dp_t < \langle N_{coll} \rangle dN_{pp} / dp_t$$



PLB 696, 30 (2011)

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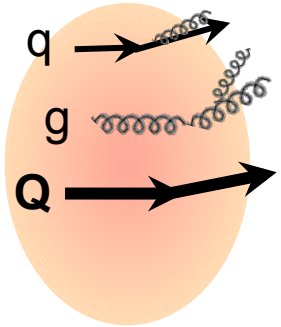

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$$dN_{AA}/dp_t < \langle N_{coll} \rangle dN_{pp}/dp_t$$

Nuclear Modification Factor

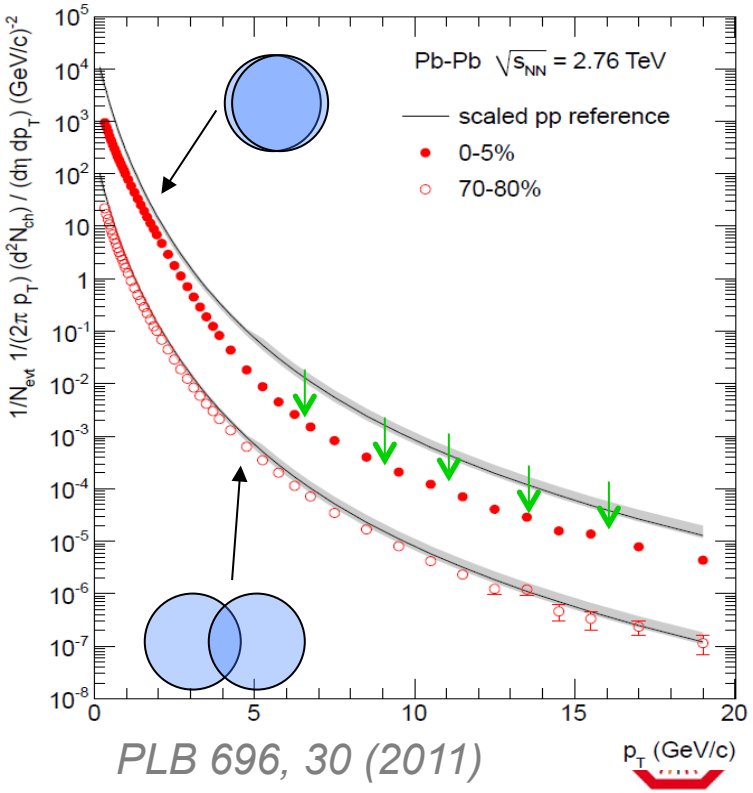
$$R_{AA}(p_t) = \frac{1}{\langle N_{coll} \rangle} \frac{dN_{AA}/dp_t}{dN_{pp}/dp_t} < 1$$

HEAVY QUARKS

pred: $\Delta E(\varepsilon_{medium}; C_R, m, L)$

HQ: $\Delta E_g > \Delta E_{c \approx q} > \Delta E_b$

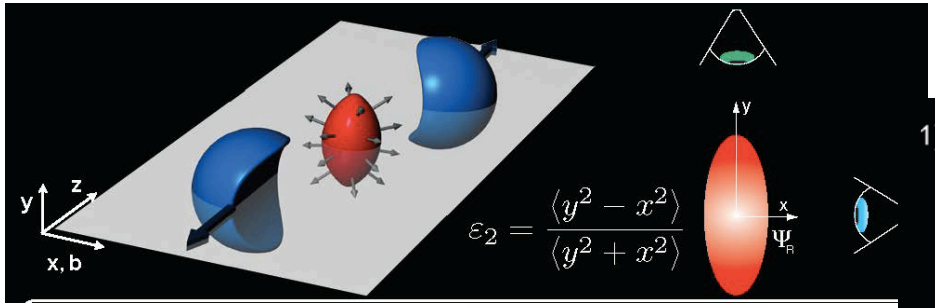
$$\rightarrow \quad R_{AA}^{\pi} < R_{AA}^{D} < R_{AA}^{B}$$



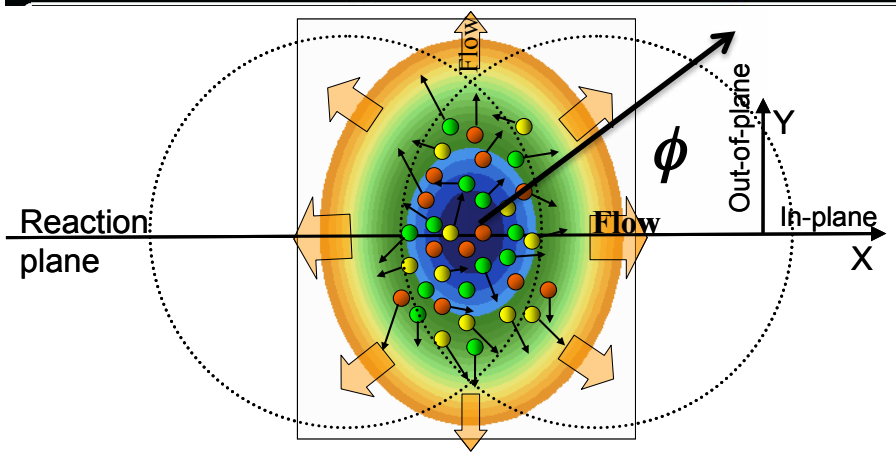
PLB 696, 30 (2011)

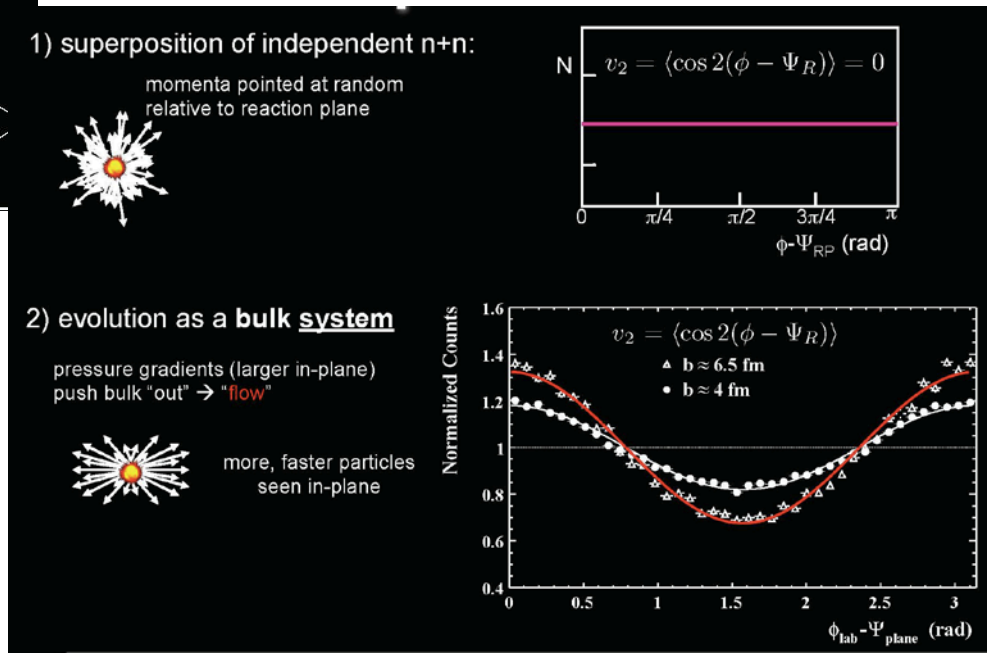
ALICE

Intro: Azimuthal anisotropy



$$\frac{dN}{Nd\phi} = 1 + 2v_2 \cos\left(2(\phi - \Psi_{RP})\right) + \ldots$$





- v_2 of "bulk" (low p_t) provides a measure of strength of collectivity (mean free path of outgoing partons)
  - Due to their large mass, **c and b quarks** should "feel" less the collective expansion

v_2 of Heavy Quarks?

→ need frequent interaction with large coupling to build their v_2

→ $v_2^{charm} < v_2^{light\ flavour}$??

ALICE Heavy Flavour Detection: D mesons, |y|<0.8

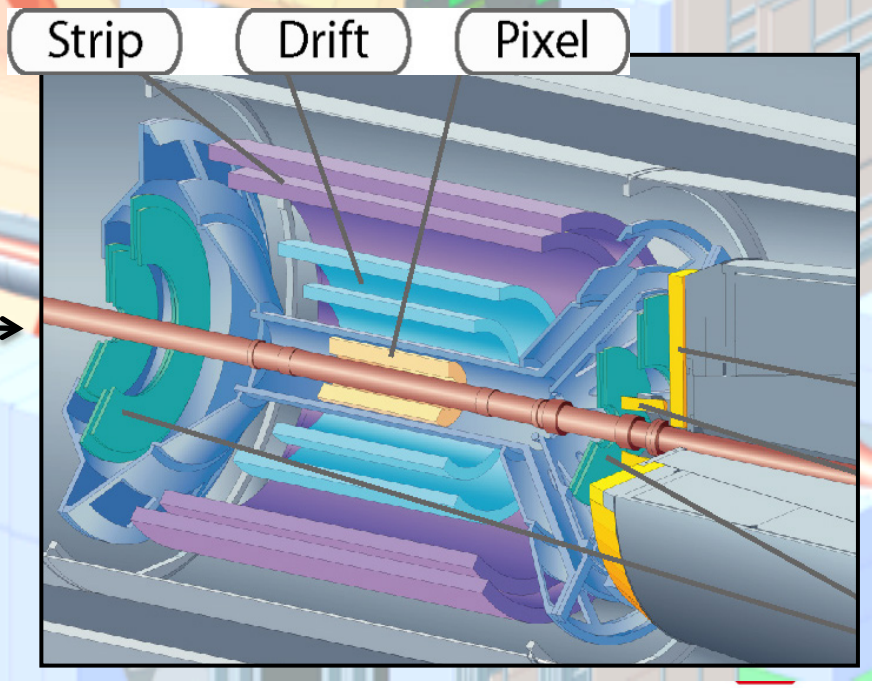
✓ $D^0 \rightarrow K\pi$ ($\pi\pi$)
$D^+ \rightarrow K\pi\pi$
$D_s \rightarrow KK\pi$
$D^* \rightarrow D^0\pi$
$D^0 \rightarrow K\pi\pi\pi$
$\Lambda_c \rightarrow pK\pi(K^0_S)$

TOF (π/K/p PID)

K π

TPC (tracking, π/K/p PID)

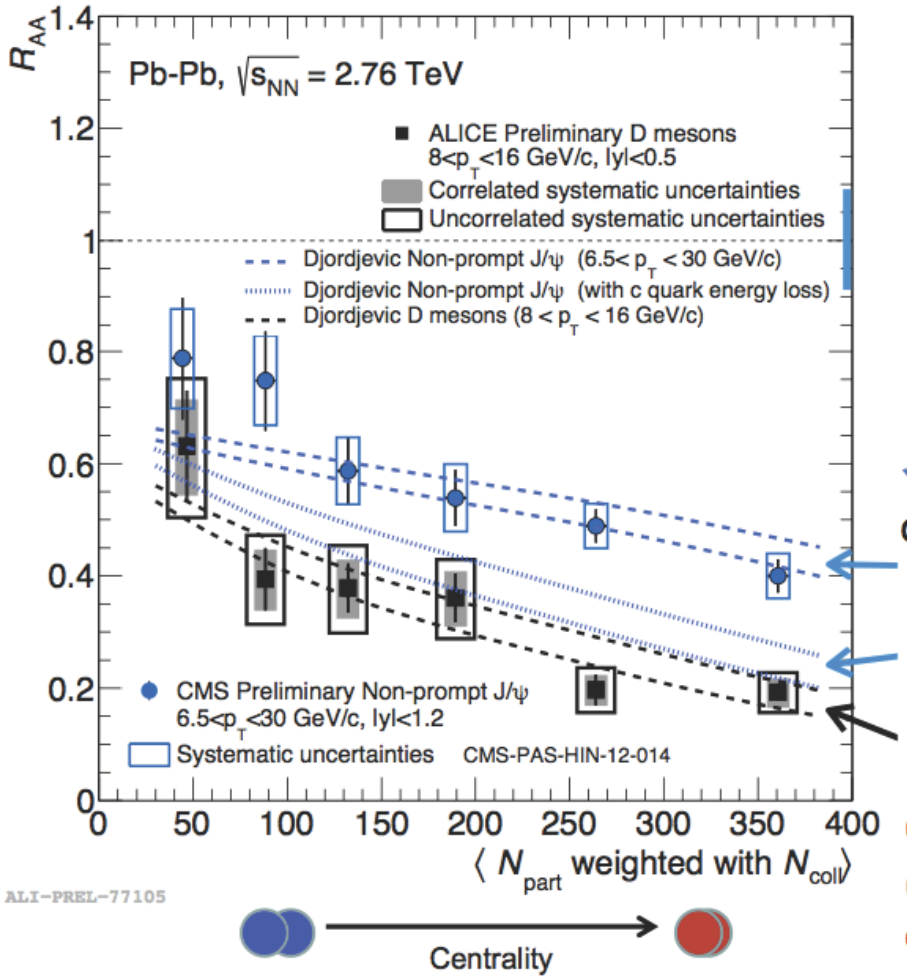
ITS (tracking & vertexing)



- **Crucial for HF:**
  - vertexing, tracking
  - hadron and lepton ID
- **Triggers:**
  - minimum-bias (MB)
    - or centrality, in Pb-Pb

D meson R_{AA} vs. centrality: mass dependence of parton energy loss

L'analisi dei mesoni D nel p_T-bin [8-16] GeV/c ha permesso il confronto diretto con i risultati di CMS



- ALICE prompt D mesons & CMS non-prompt J/ψ:
  - B and D mesons $\langle p_T \rangle \sim 10$ GeV/c
- **Clear indication of a dependence on quark mass : $R_{AA}^B > R_{AA}^D$**

✓ Djordjevic: non-prompt J/ψ R_{AA} considering for energy loss
- b quark mass
- c quarkmass

✓ Djordjevic: D meson R_{AA}

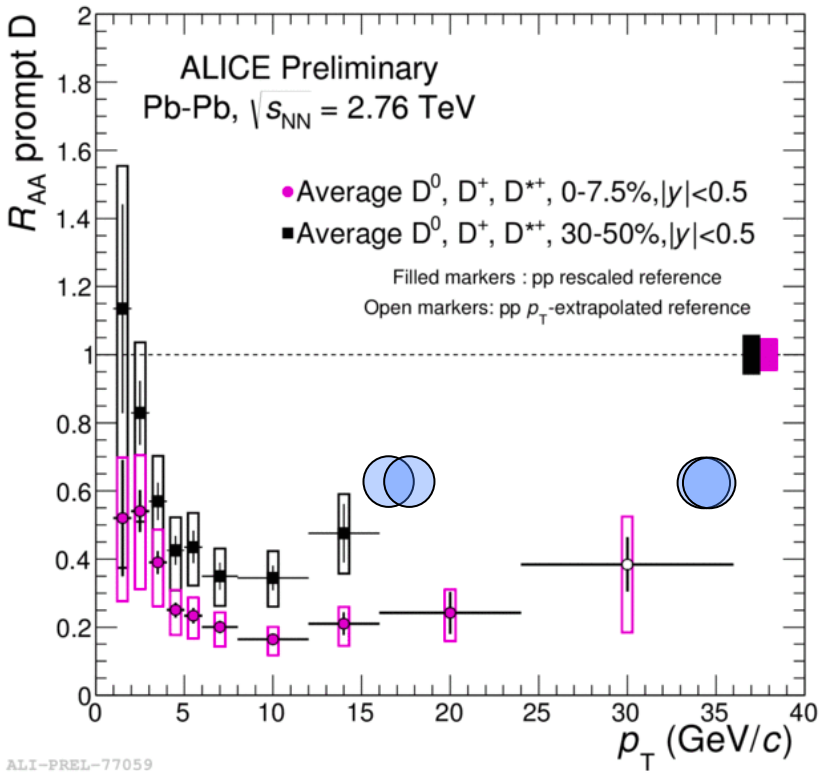
Calculation by M. Djordjevic (including mass-dependent rad+coll energy loss) predict a difference

by A. Dainese, D. Caffarri

Risultati nuovi presentati a HP2013 da D. Caffarri

D meson R_{AA} vs. p_t

R_{AA} dei mesoni D in funzione del momento trasverso per collisioni centrali (0-7.5%) e semi-periferiche (30-50%)



Less suppression in 30-50% than in 0-7.5%

by D. Caffarri, A. Festanti

Risultati nuovi presentati a QM2014 da A. Festanti

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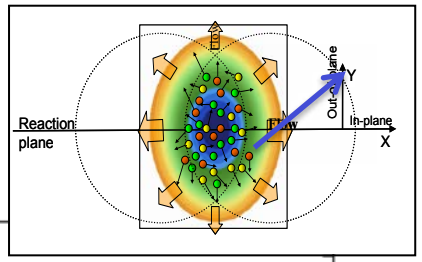

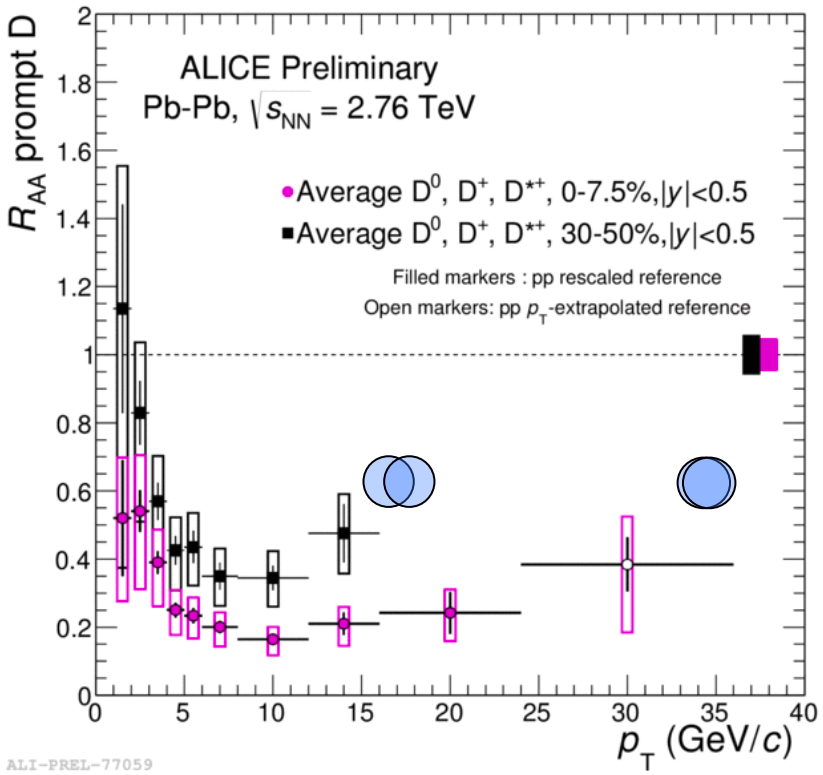

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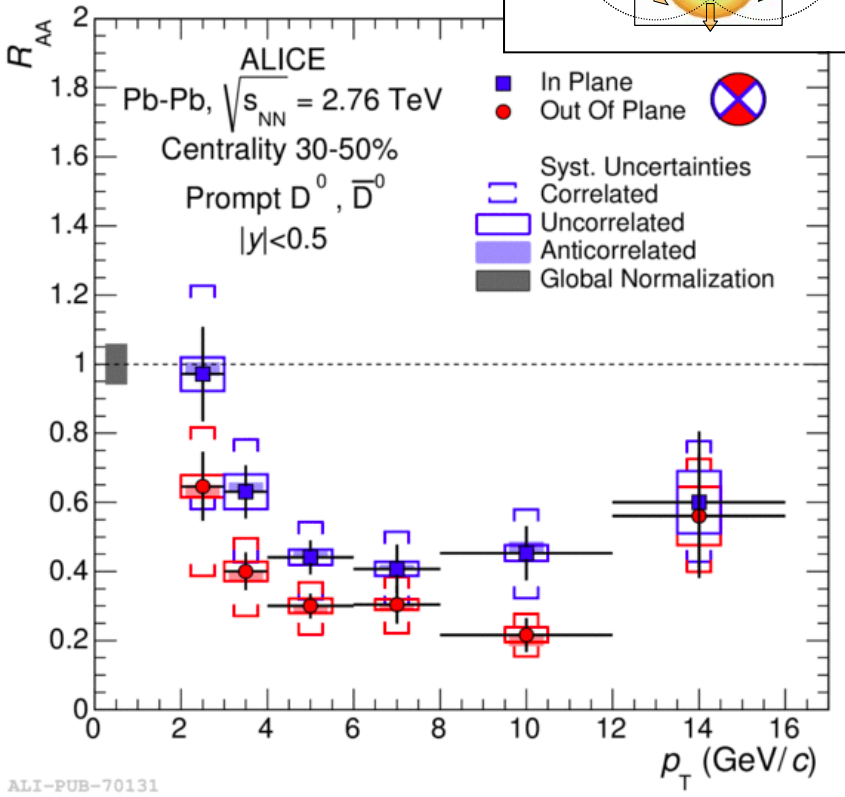


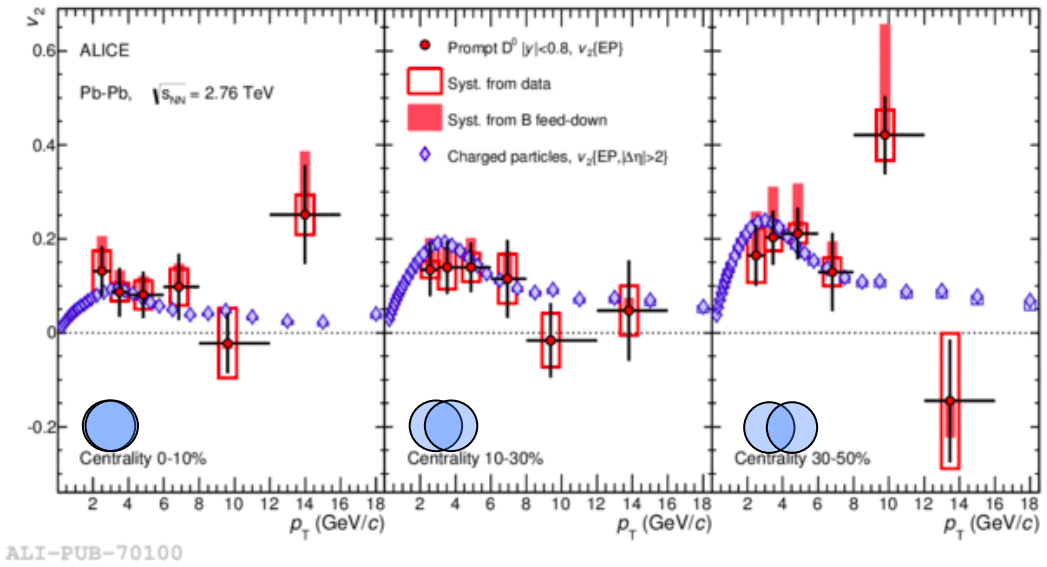
More suppression out-of-plane than in-plane => reflects elliptic flow and path length dependence of energy loss

by D. Caffarri, A. Festanti

Risultati nuovi presentati a QM2014 da A. Festanti

D meson elliptic flow v_2 vs. p_t

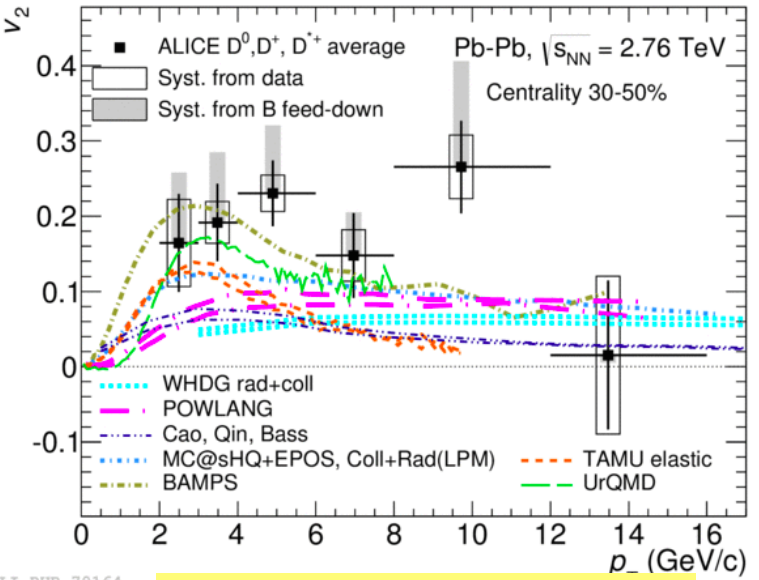
Flusso ellittico dei mesoni D misurato in tre classi di centralità (da centrale a semi-periferico e confronto con modelli teorici



ALI-PUB-70100

- Indication for elliptic flow increasing from central to (semi)peripheral collisions

- Data are best described by models that include mechanisms that transfer the collective expansion to c quarks (e.g. collisional energy loss).
- Some of these models also include a component of hadronization of c quarks via quark recombination.

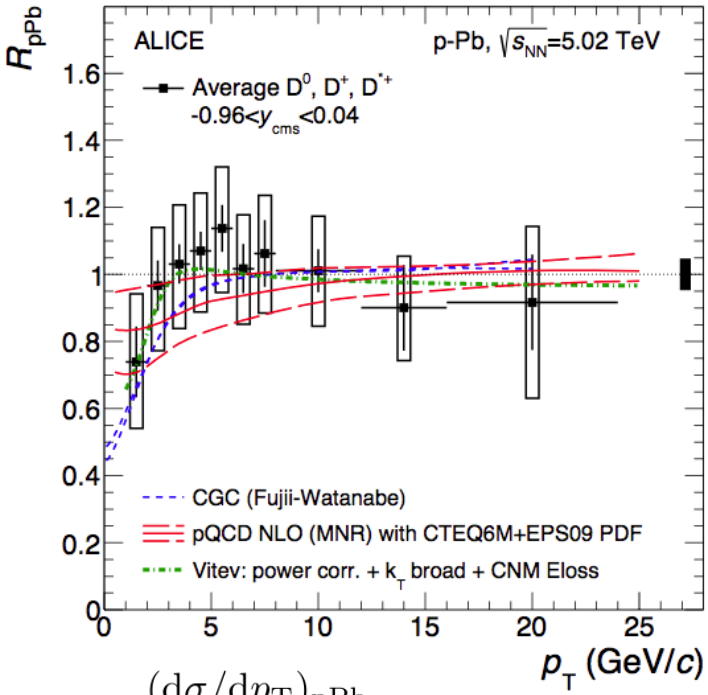


ALI-PUB-70164

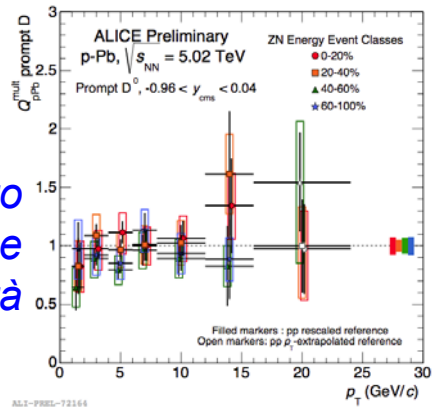
accepted Phys. Rev. C

D meson production in p-Pb min. bias

R_{pPb} dei mesoni D compatibile con l'unità entro le incertezze.



$$R_{\mathrm{pPb}} = \frac{(\mathrm{d}\sigma/\mathrm{d}p_{\mathrm{T}})_{\mathrm{pPb}}}{\mathrm{A}(\mathrm{d}\sigma/\mathrm{d}p_{\mathrm{T}})_{\mathrm{pp}}}$$



Trend confermato anche in diverse classi di centralità

submitted to Phys. Rev. Lett.

by A. Festanti

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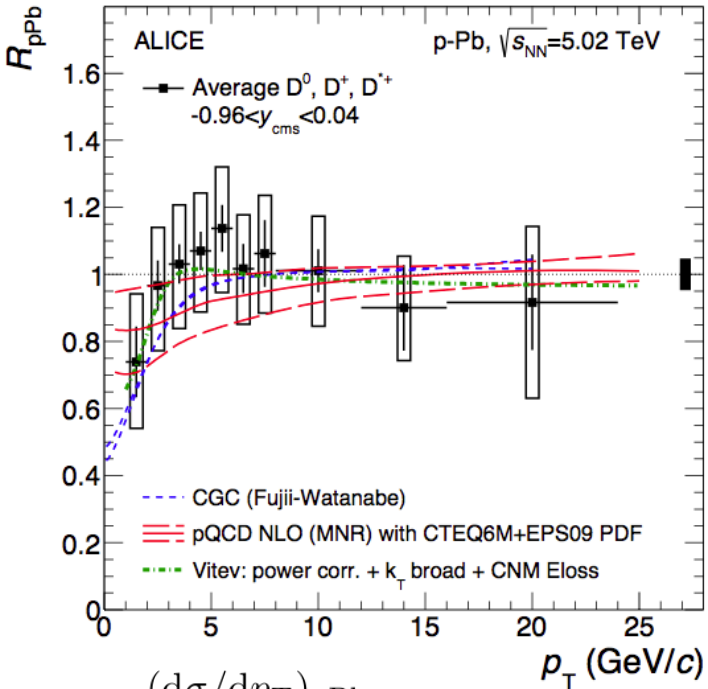
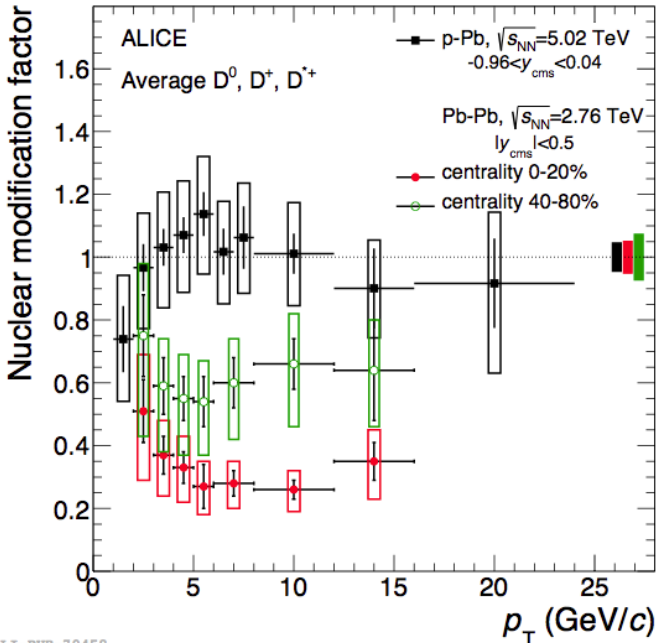


$$R_{\mathrm{pPb}} = \frac{(\mathrm{d}\sigma/\mathrm{d}p_{\mathrm{T}})_{\mathrm{pPb}}}{\mathrm{A}(\mathrm{d}\sigma/\mathrm{d}p_{\mathrm{T}})_{\mathrm{pp}}}$$

Conferma che la soppressione in eventi centrali Pb-Pb a p_T> 2 GeV/c è dovuta a effetti di stato finale (QGP)

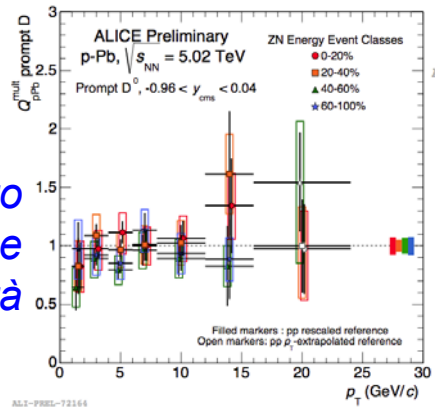


p-Pb min. bias

Pb-Pb 40-80%

Pb-Pb 0-20%

Trend confermato anche in diverse classi di centralità



submitted to Phys. Rev. Lett.

by A. Festanti

D^0 signal at low-p_T in p-p and p-Pb collisions

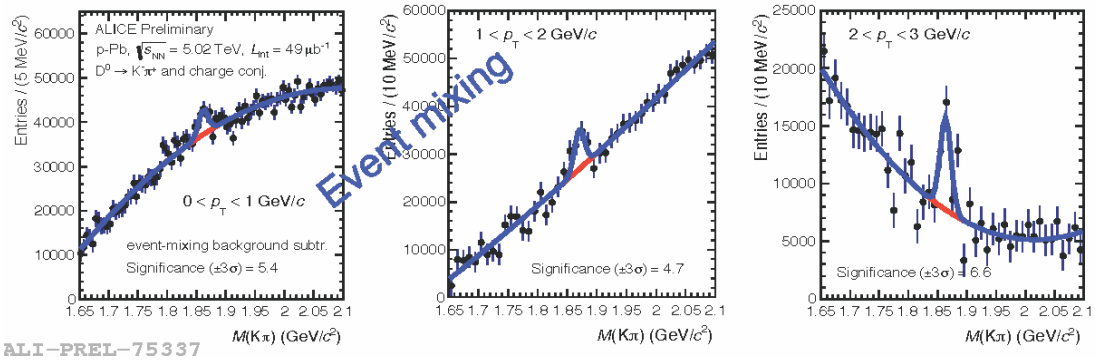
- Inclusive p_T-differential production cross section of D^0 meson has been measured in the p_T range 1 to 16 GeV/c in p-p collisions and 1 to 24 GeV/c in p-Pb collisions
- High interest in **extending the charm production measurement down to p_T=0** where standard analysis (based on impact-parameter cut) fails

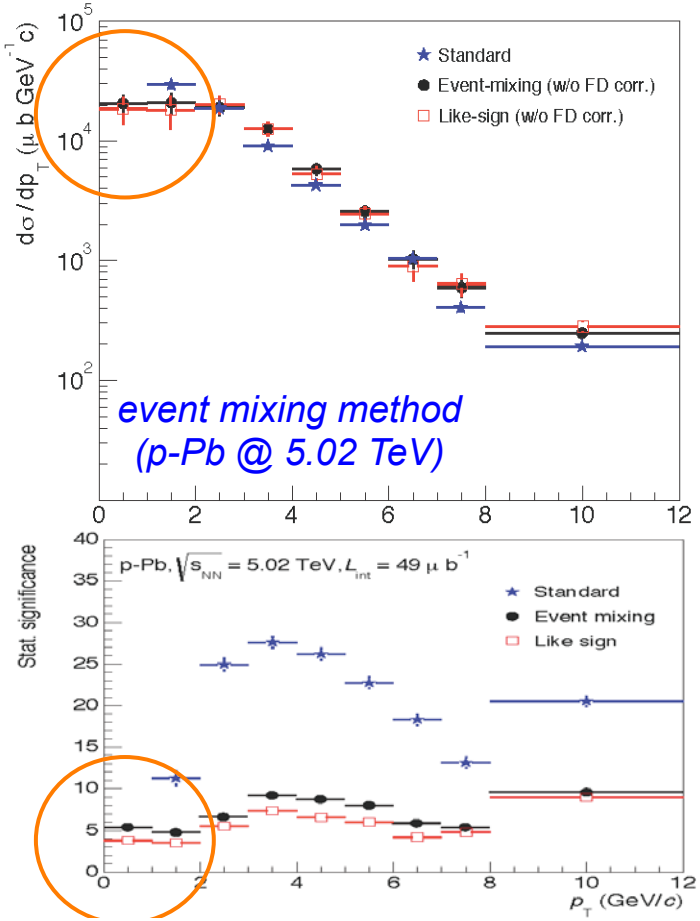
Event mixing method:

- Mix tracks from different events to break track to track correlation and increase the statistics.
- Mix events with similar characteristics.
- Normalize outside the D0 mass peak region.

Like sign method:

- Combine two positive or two negative tracks (like-sign pairs) instead of a negative and positive track in the same event.
- Normalization: $2\sqrt{(N++)x(N--)}$

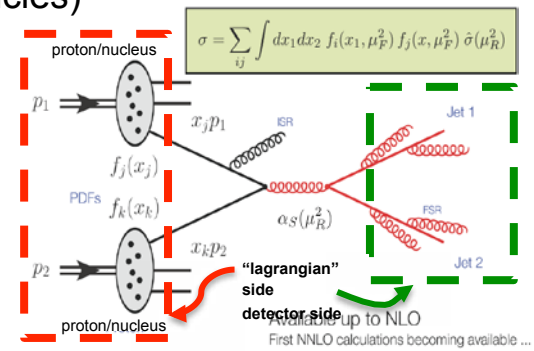




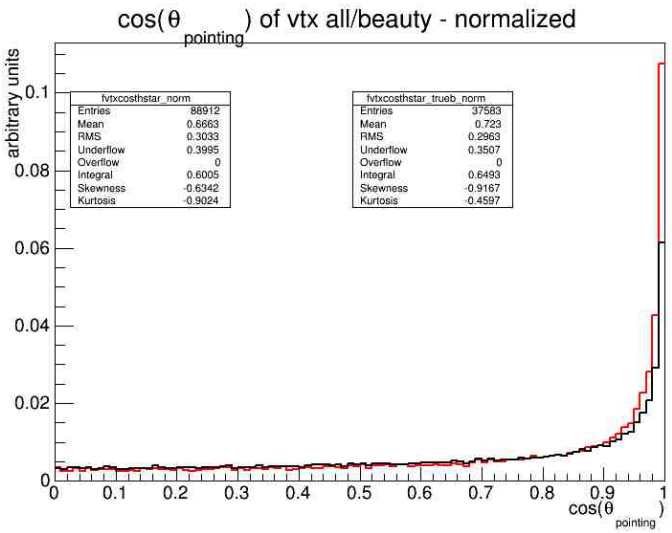
by C. Jena, M. Venaruzzo

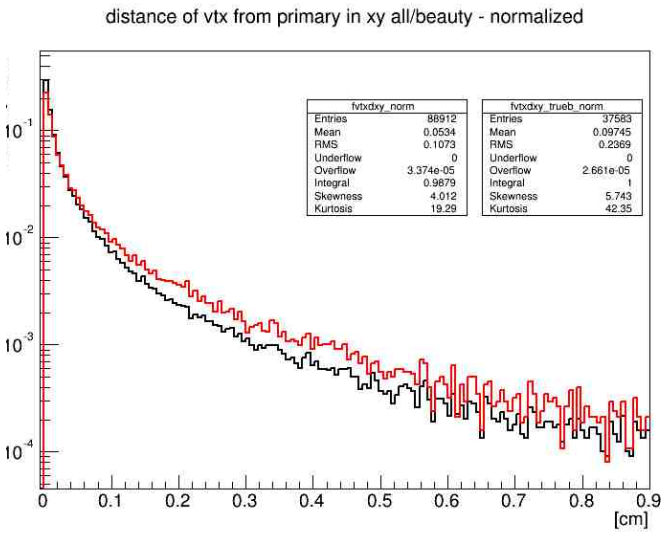
B-jet tagging by secondary vertex reconstruction

- Jets: unique link between lagrangian (partons) and data (detected particles)
- Key tool to study QCD properties
  - e.g. underlying event, fragmentation
- Specific to HI and HF jets:
  - study of energy loss → in-medium modification of fragmentation functions
  - hf production mechanisms, quark vs. gluon jets
  - low-p_T (of the parton) accessible via γ-jet correlations



- Study based on a CMS strategy (JHEP03-2011-136 and ref. therein)
- Topology of the vertices, impact parameter, kinematics to build up a method deploying ALICE skills, e.g.
  - pointing angle
  - vertex distance from primary in 3D





by R. Turrisi

Data analysis: outlook

- Short paper in preparation on D R_{AA} vs centrality, with focus on comparison with pions (ALICE) and with J/psi from B (CMS) – timescale: ~end of summer
- Long paper with all D meson results on spectra and $R_{AA}(p_T)$ – timescale: ~end of the year
- Look into very low p_T (with event-mixing) and high p_T (with EMCAL triggers, already started for pp 8 TeV)
- Finalization of pp and pPb mb signal extraction in $0<p_T<1$ GeV/c bin with systematics and B feed-down studies
- Run-2 (2015-2018): expect about 5x higher statistics (plus full SPD)
- B-jet tagging study

2. Silicon Pixel Detector

principali persone coinvolte: M. Caldogno, A. Francescon, S. Martini, R. Turrisi, Officina Meccanica

2. Silicon Pixel Detector (SPD)

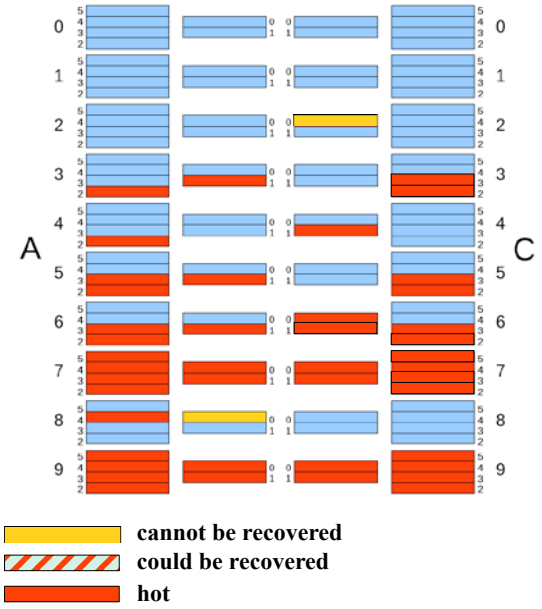
Completamento dell'intervento straordinario di recupero del sistema di raffreddamento e manutenzione in vista del recommissioning

Old SPD acceptance

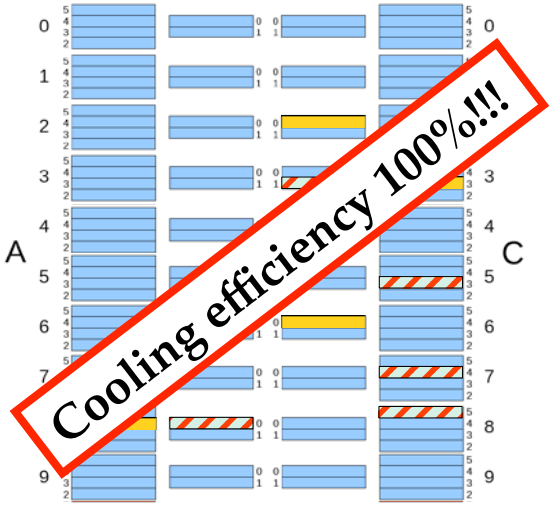
New SPD acceptance

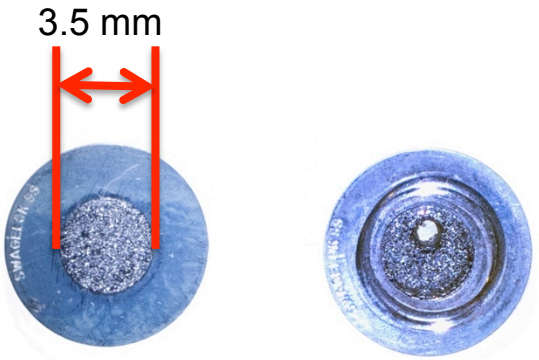
65/120 modules ''on" - 62.5%

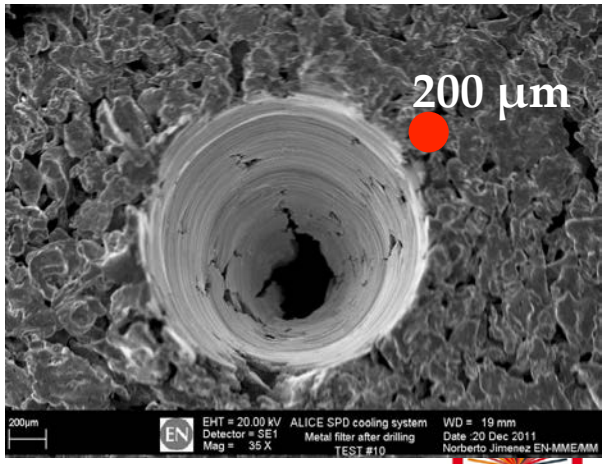
snapshot from November 10, 2011



111/120 modules ''on" - 92.5%
latest status 2013 before maintenance





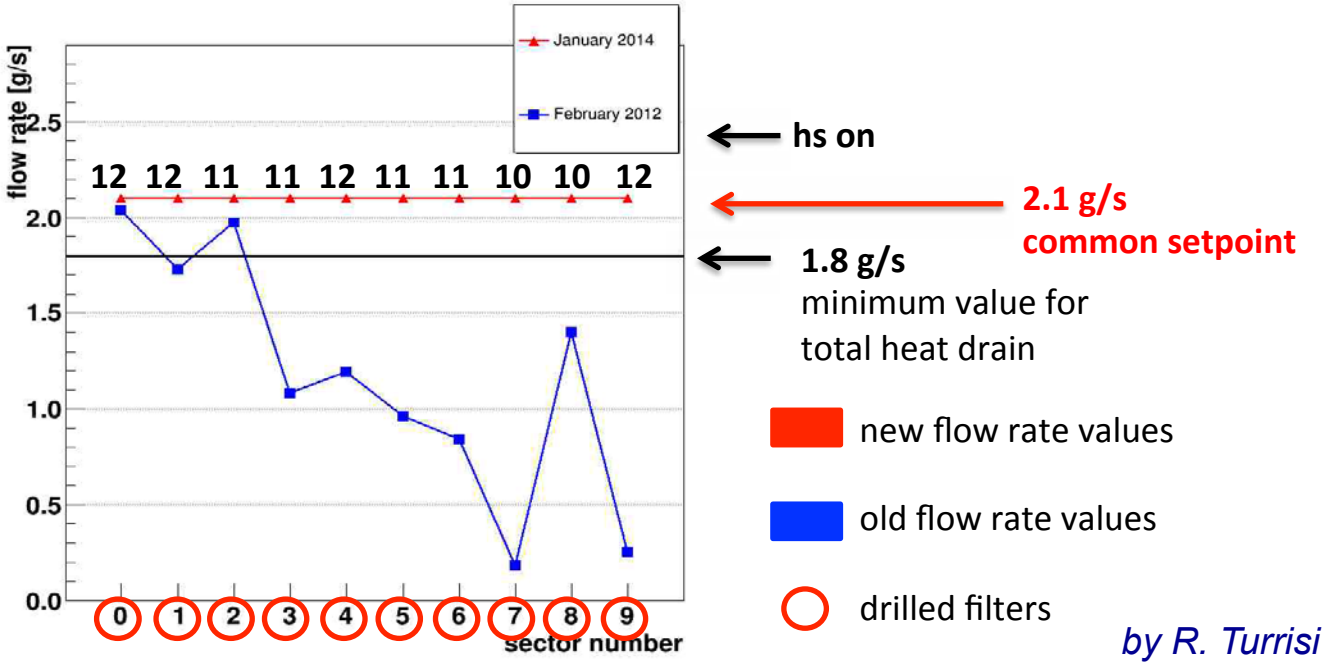


by R. Turrisi

C_4F_{10} flow story

- The ten filters have been drilled one per week, except last four
  - #9, #7 & #6 February & March 2012
  - #4 & #5 April 2012, #3 April 2013
  - #8 & #0 December 2013
  - #1 & #2 January 2014

- Comparison with February 2012, before the drilling started
- New values of freon flow set at 2.1, i.e. nominal value + contingency
- Still can push a factor 1.5 beyond nominal !!!



by R. Turrisi

What's next

- Check of all sensor calibrations (pressure, temperature)
- Long term pumps test (with SPD recommissioning)
- Removal of close-detector subcooling
- Rack consolidation

to happen this month…

Then ready for SPD recommissioning

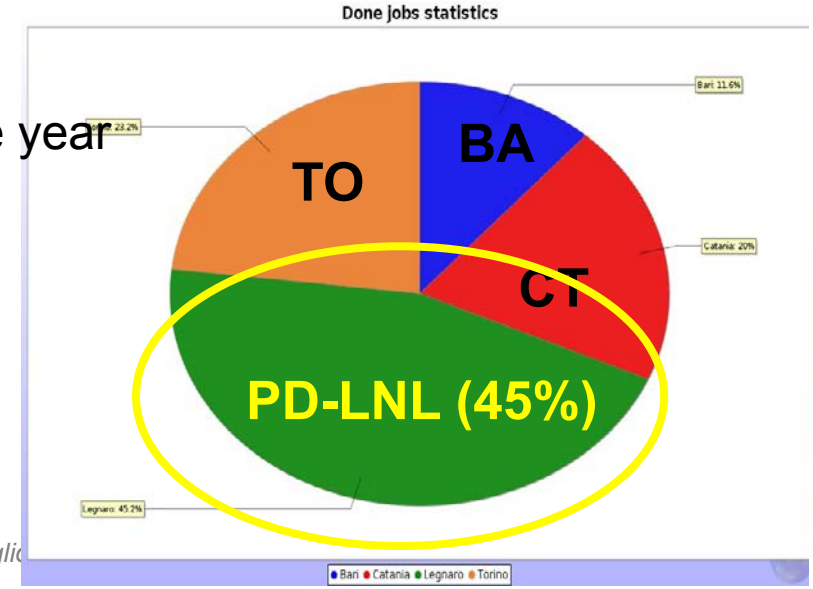
3. TIER2 PD-LNL

principali persone coinvolte: A. Dainese, A. Festanti, M. Sgaravatto, M. Venaruzzo

Tier-2 Padova-Legnaro

- Tier-2: one of the centres of the LHC worldwide computing Grid
  - provides CPU worker nodes and disk storage
  - in ALICE: used for simulations, centralized and end-user analysis
- Padova-Legnaro: Tier-2 for ALICE and CMS
  - CPU resources distributed between LNL and Padova
  - excellent technical support in both sites (thanks!)
- ALICE resources:
  - 386 TB storage + 400 TB by the end of the year
  - 64 WNs, 992cores, ~ 9000 HS06

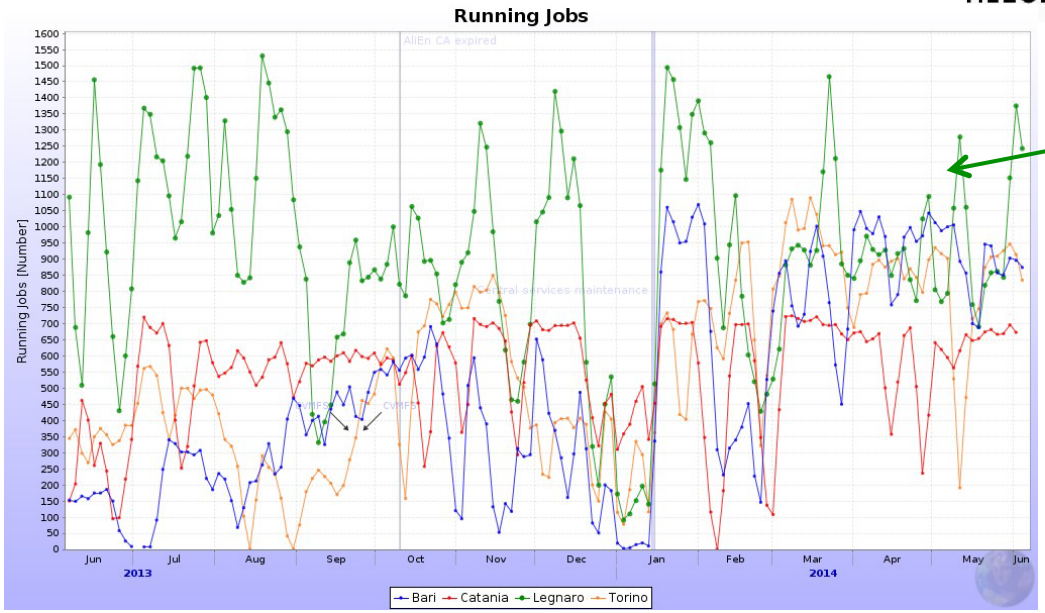
ALICE Jobs Tier-2 INFN (last year)



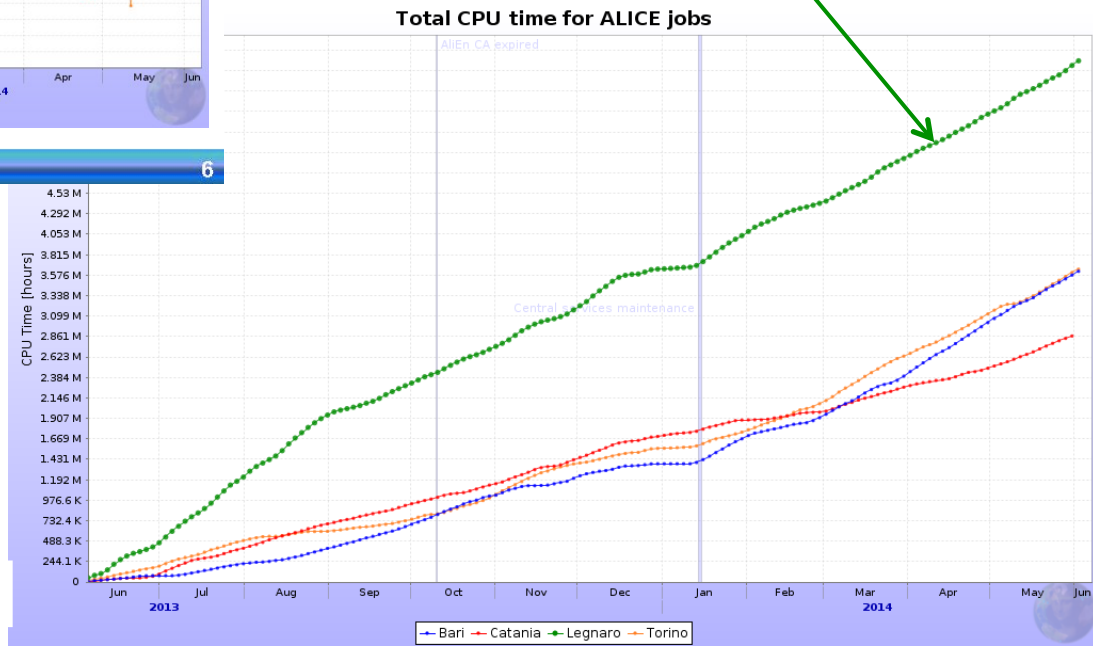
by A. Dainese and M. Sgaravatto

Computing Grid Tier-2 Padova-Legnaro

Running jobs in the Italian T2s



PD-LNL



Tier-2 Legnaro-Padova 6

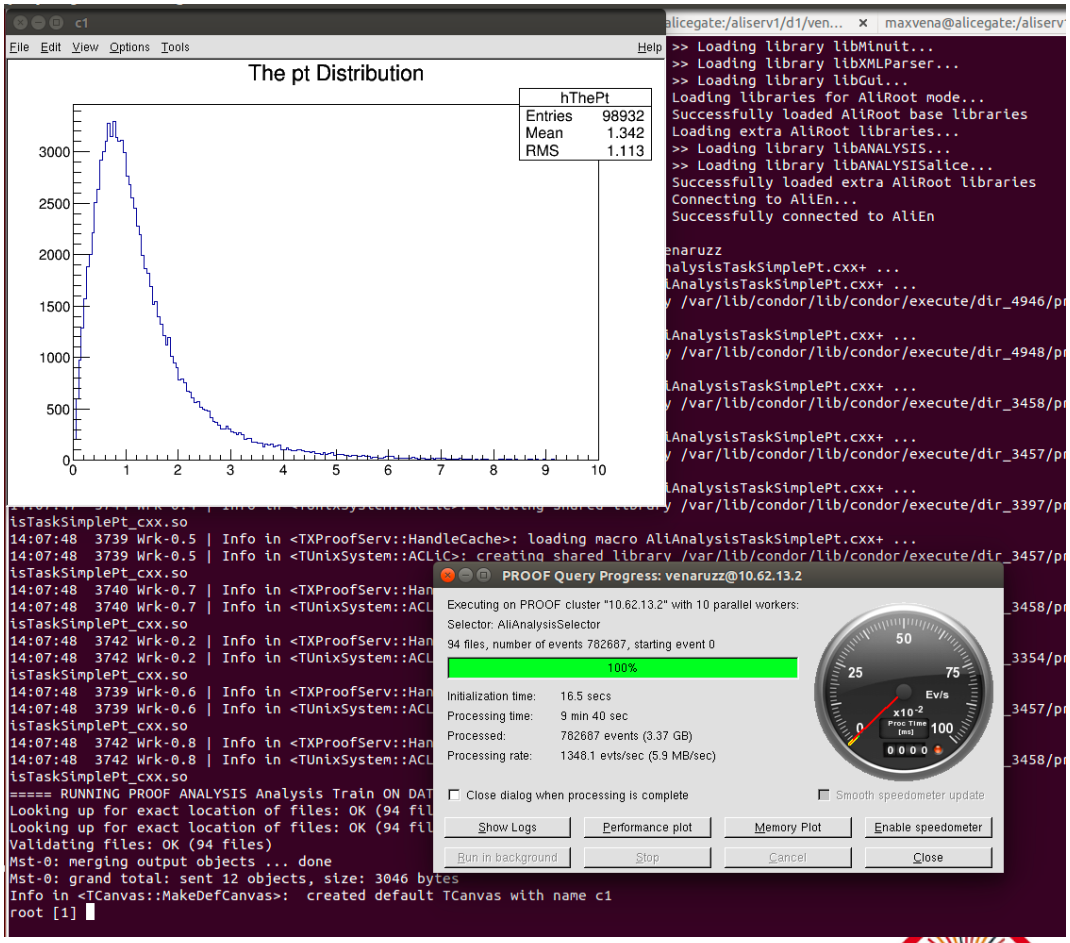
by A. Dainese and M. Sgaravatto

An use-case for the PD-LNL Cloud

A pre-production cloud available since may for pilot users. First pilot user: ALICE (Massimo V.)

First VAF use case on PD-LNL cloud: ALICE experiment

VAF application (performance evaluation): reconstruction of the charmed mesons D^0 at low p_T in pp @ 7 TeV, PbPb @ 2.76 TeV, pPb @ 5.02 TeV collisions



by M. Venaruzzo

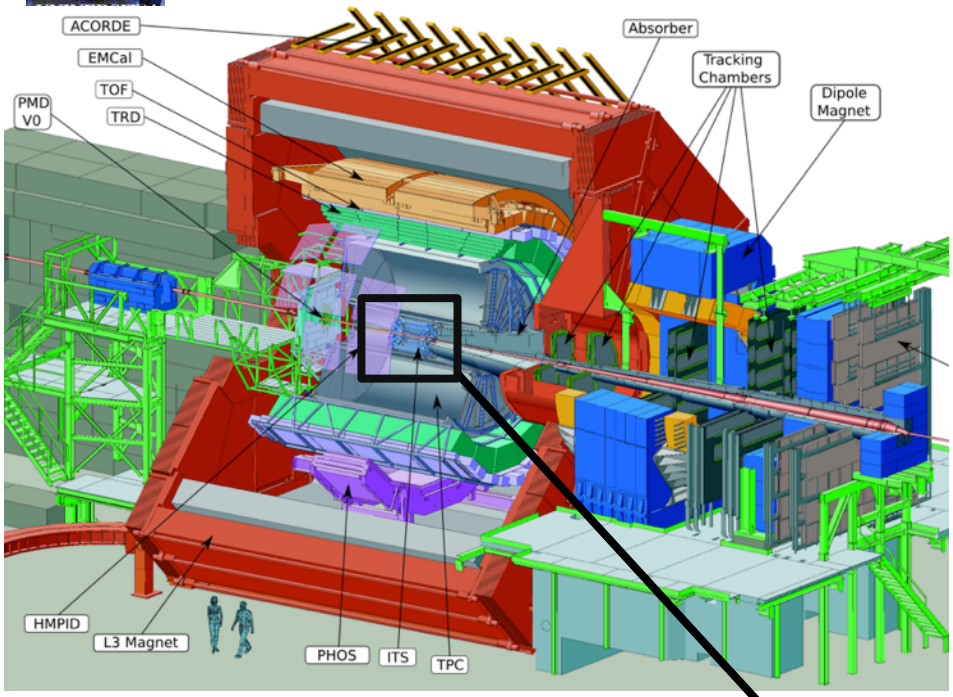
4. ITS Upgrade

- **Stato del progetto**
- **WP1: Studi di fisica e simulazioni delle performance del rivelatore**
- **WP5/WP10: R&D monolithic pixel chips, test system e read-out electronics**
- **WP8/WP9: R&D integrazione meccanica layers esterni; R&D raffreddamento con microcanali in Silicio**

ITS-Upgrade: stato del progetto

principali persone coinvolte: A. Dainese, P. Giubilato, M. Lunardon, S. Moretto

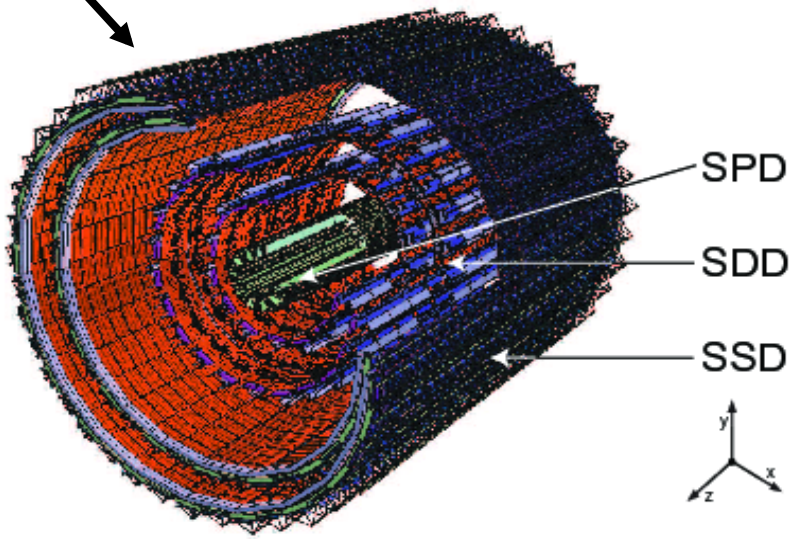
Present ITS



Present ITS layout:

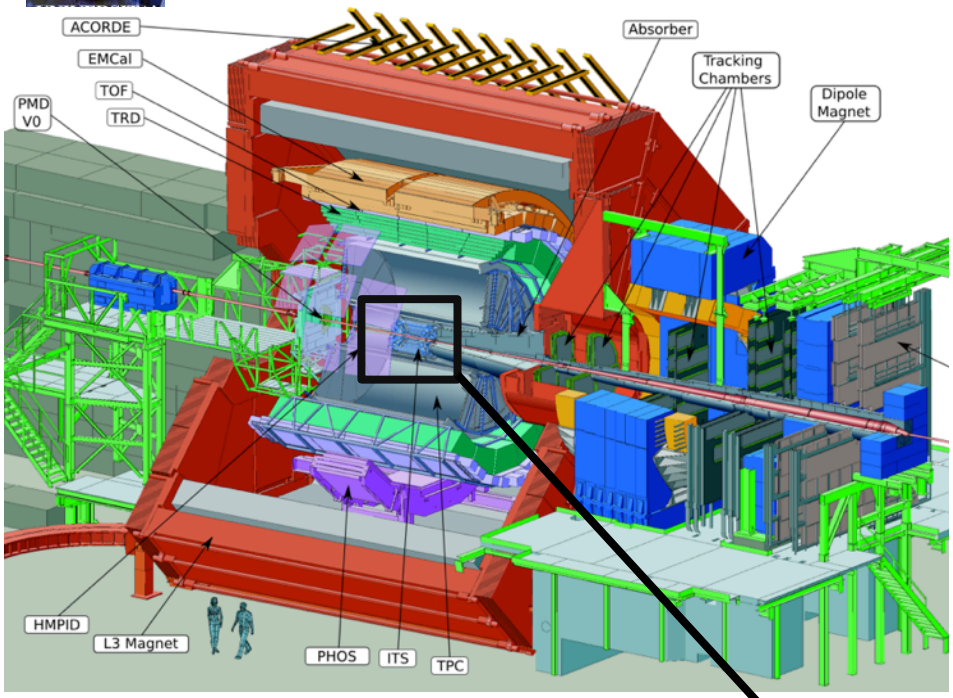
- **6-layer** barrel geometry
- 2 layers each of
  - Silicon Pixel Detector (SPD)
  - Silicon Drift Detector (SDD)
  - double sided Silicon microStrip Detector (SSD)

- **r coverage: 39 mm** to 440 mm



by V. Manzari

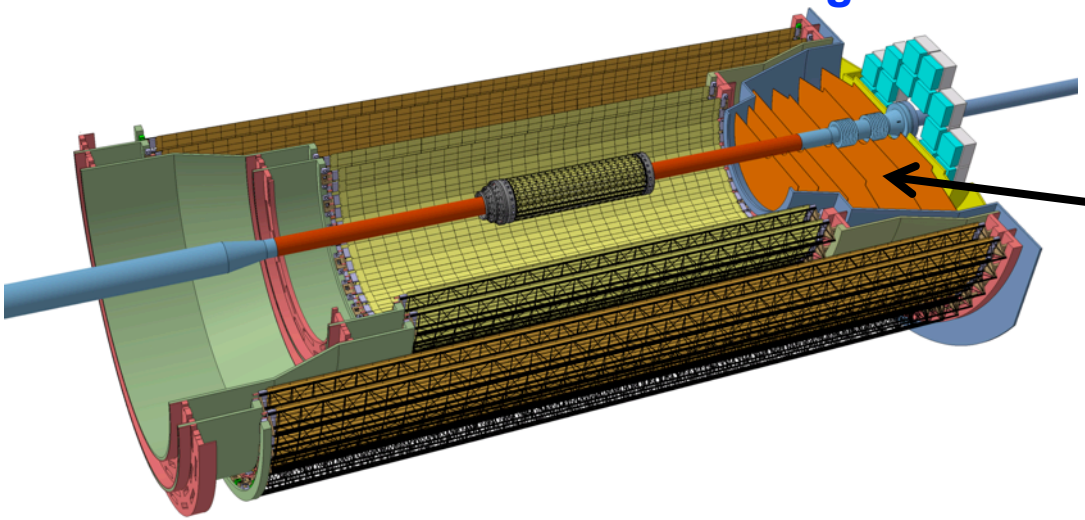
New ITS



New ITS layout

- **7-layer** barrel geometry of MAPS (Monolithic Active Pixel Sensors)
  - Inner Barrel → 3 layers
  - Outer Barrel→ 4 layers
- **25 G pixels**, ~10m^2
- Pseudorapidity coverage: |η| ≤ 1.22 for tracks from 90 % most luminous region
- **r coverage: 22 mm** to 400 mm

New ITS



by V. Manzari

ALICE Upgrade Physics Motivation

Two main physics topics that are uniquely accessible (among others) with the upgraded ALICE detector:

- **Heavy-flavour transport parameters in the QGP**
  - Heavy-quark diffusion coefficient (→ QGP equation of state, viscosity of the QGP fluid)
  - Heavy quark thermalization and hadronization in the QGP
  - Mass dependence of parton energy loss in QGP medium

item di interesse primario per Padova

- **Low-mass dielectrons: thermal photons and vector mesons from the QGP**
  - Photons from the QGP ($g \rightarrow e^+e^-$) → temperature of the system during its evolution
  - Modification of r spectral function ($\rho \rightarrow e^+e^-$) → chiral symmetry restoration

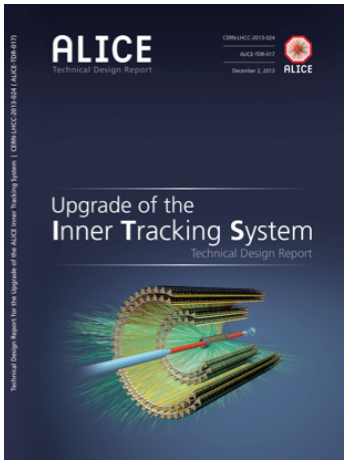
by A. Dainese

Status of the ITS Upgrade Project

LHCC Upgrade Cost Group review → 3 March 2014

Research Board approval → 12 March 2014

Memorandum of Understanding due to the RRB → Ott '14



by V. Manzari

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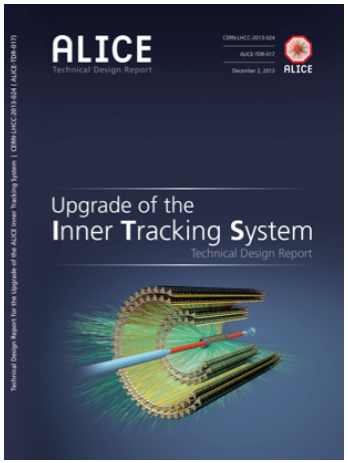
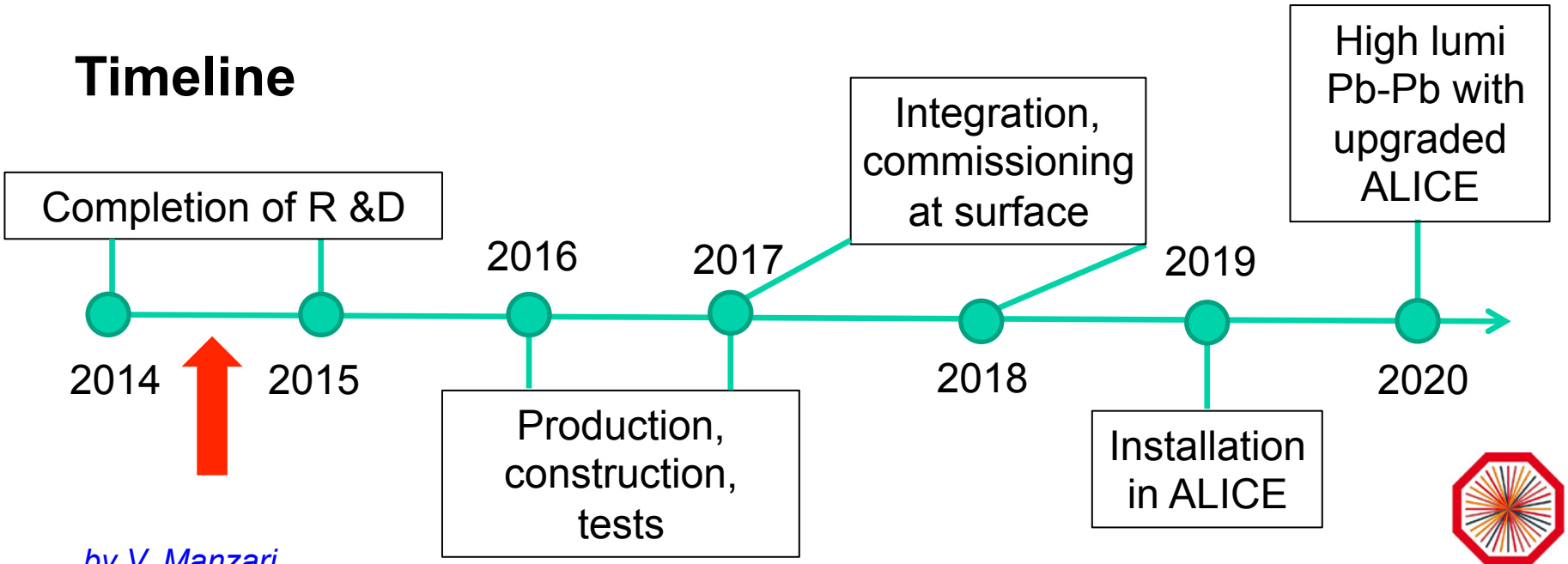


Timeline



by V. Manzari

Project Organization

Upgrade Work Packages	Convener(s)
1. Physics performance studies	**A. Dainese**
2. Simulation and reconstruction	I. Belikov, M. Masera
3. PIXEL Chip	L. Musa
4. Wafer post-processing and test	P. Riedler
5. Pixel chip characterization	M. Mager
6. Inner Layers	A. Di Mauro
7. Middle Layers	-
8. Outer Layers	P. Kuijer, V. Manzari
9. Mechanics, Cooling and Integration	C. Gargiulo
10. Readout Electronics	**P. Giubilato**

Contributi di Padova

Per il WP8 è stata costituita una struttura di coordinamento tra i gruppi delle Sezioni coinvolte (INFN-ITSupgrade) coordinata da V. Manzari. I rappresentanti per Padova sono S. Moretto e M. Lunardon

WP1
Studi di fisica e simulazioni delle performance del rivelatore

principali persone coinvolte: A. Dainese

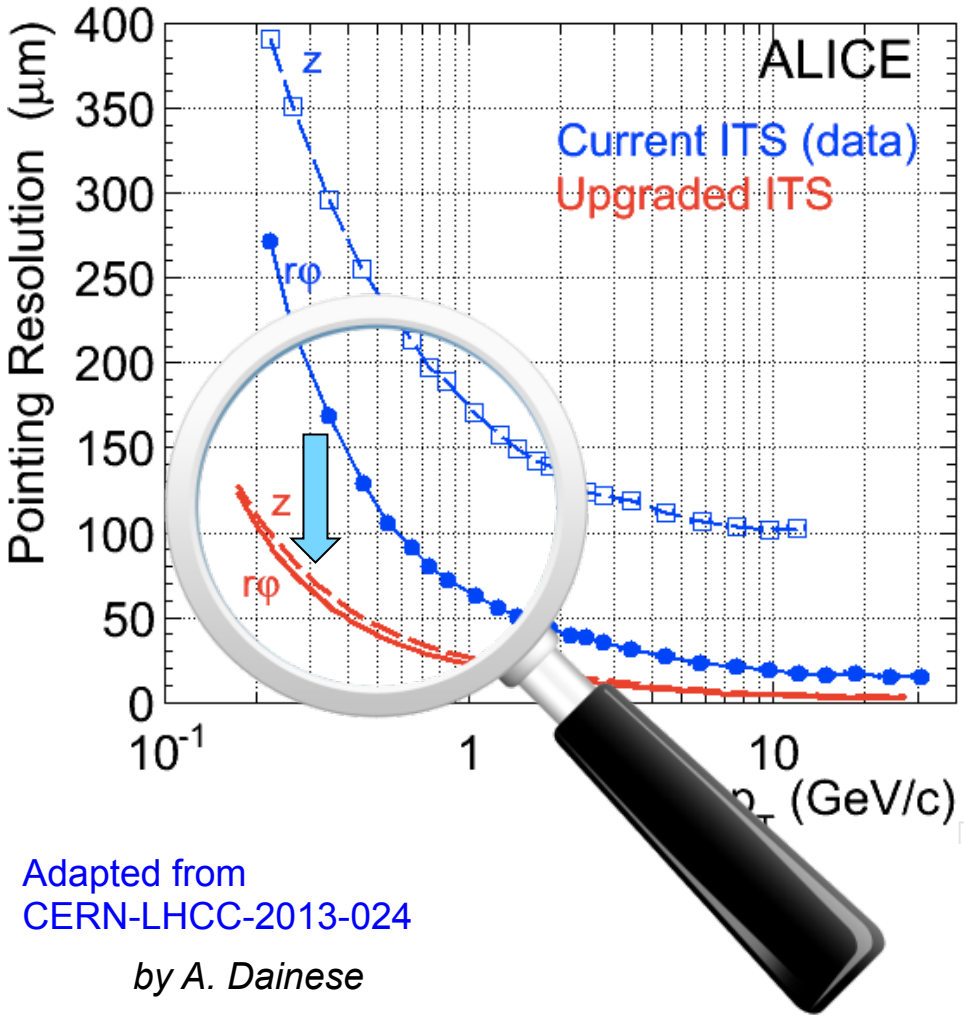
ITS WP1 activities overview

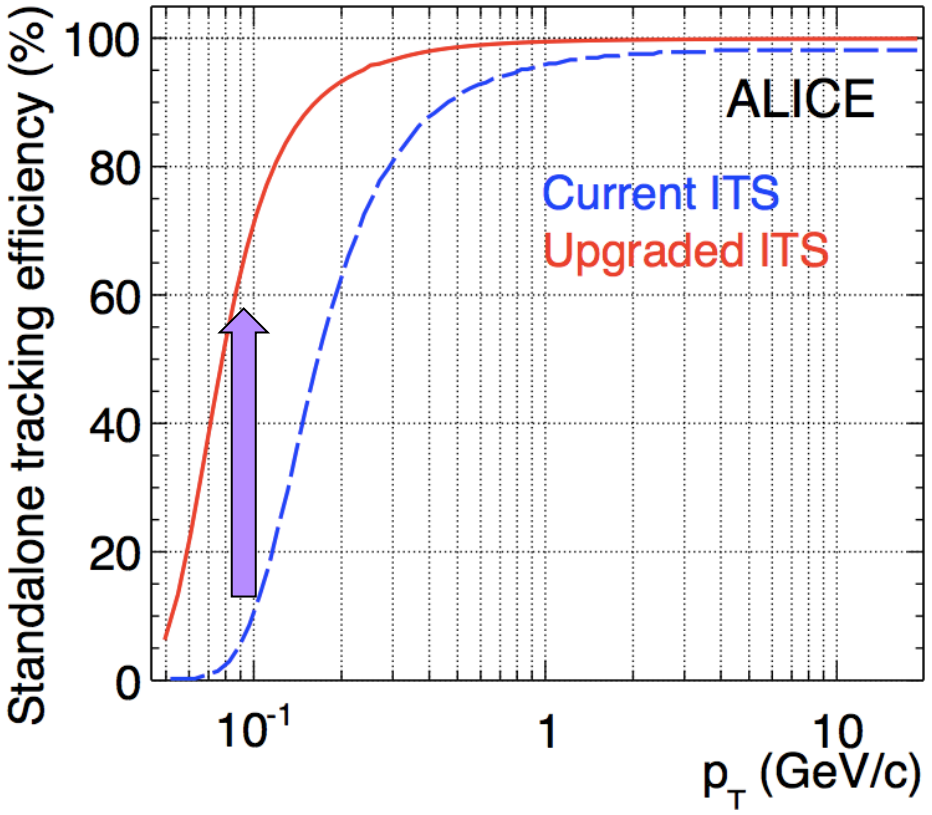
Not started	1)	Complete studies that were not mature enough for the TDR
Done	2)	Input to decision on beam pipe radius
Done	3)	Requirements for proton-proton running
Ongoing	4)	Performance with final detector specs and more realistic experimental conditions • New MC simulation (also with MFT): wait for software readiness
Ongoing	5)	Assess physics performance of ITS+TRD+TOF • First studies (Λ_c) started
Discussions started	6)	Trigger: do we need a ITS-based trigger for UPC? • Discussion with UPC group started
Discussions started	7)	Further explore the potential of extended acceptance • For correlations, also considering ITS+MFT
Ongoing	8)	Fast simulation tools to study reconstruction of rare signals • Advancing well

by A. Dainese

New ITS tracking performance

- Pointing resolution x3 better in transverse plane (x6 along beam)
- Tracking efficiency x10 better at low p_T



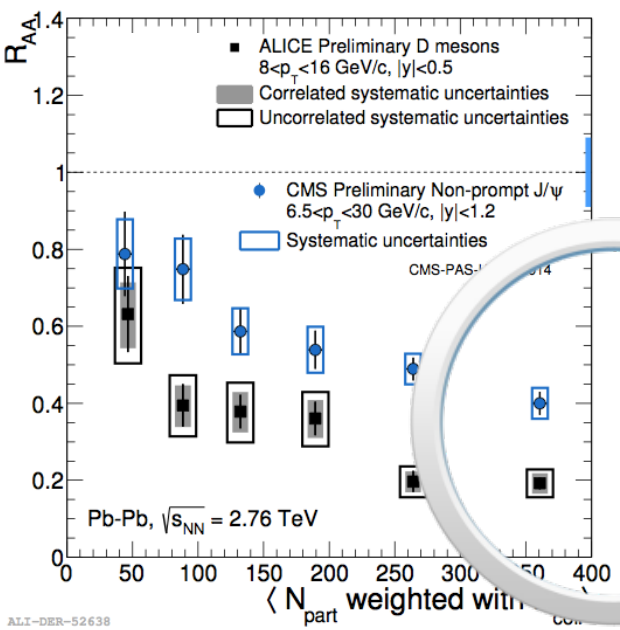


Adapted from
CERN-LHCC-2013-024

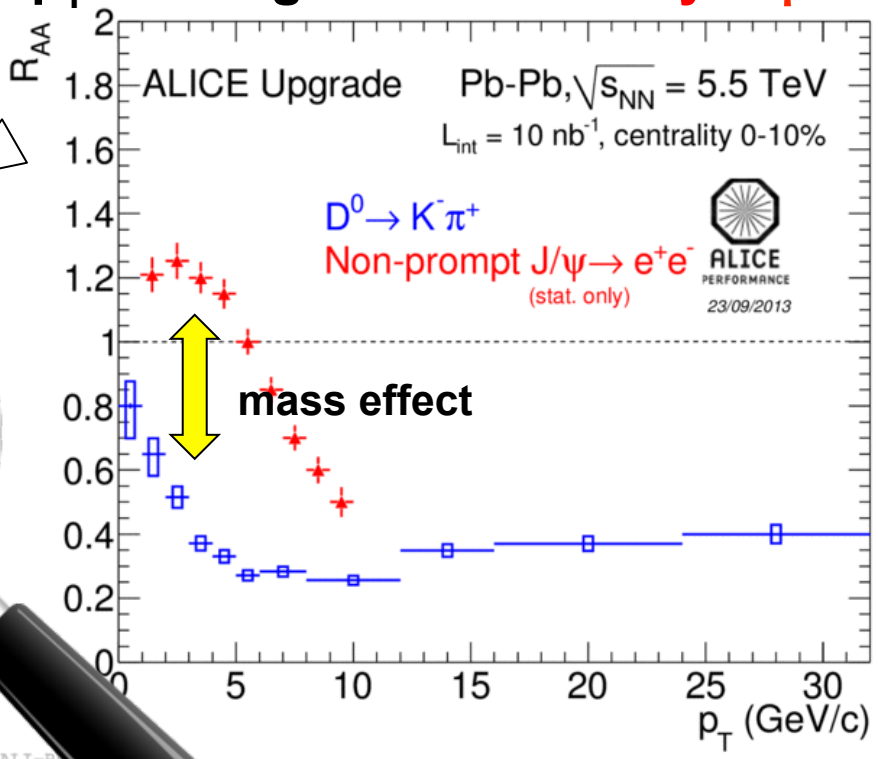
by A. Dainese

Heavy flavour R_{AA}: Upgrade

Present data at p_T~10 GeV



Upgrade: Charm and beauty R_{AA} down to p_T~0 using D^0 and B-decay J/ψ

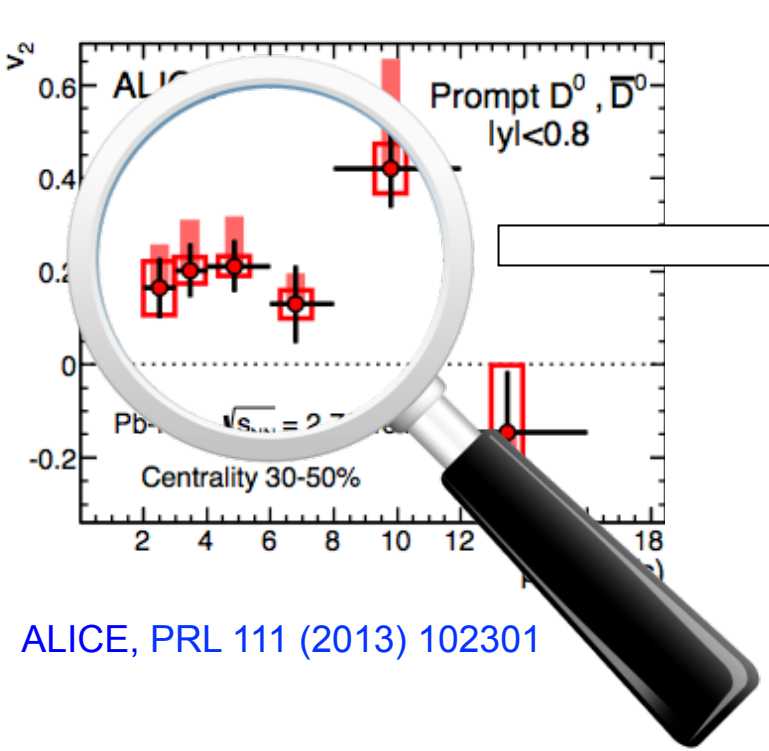


ALICE, CERN-LHCC-2013-024

by A. Dainese

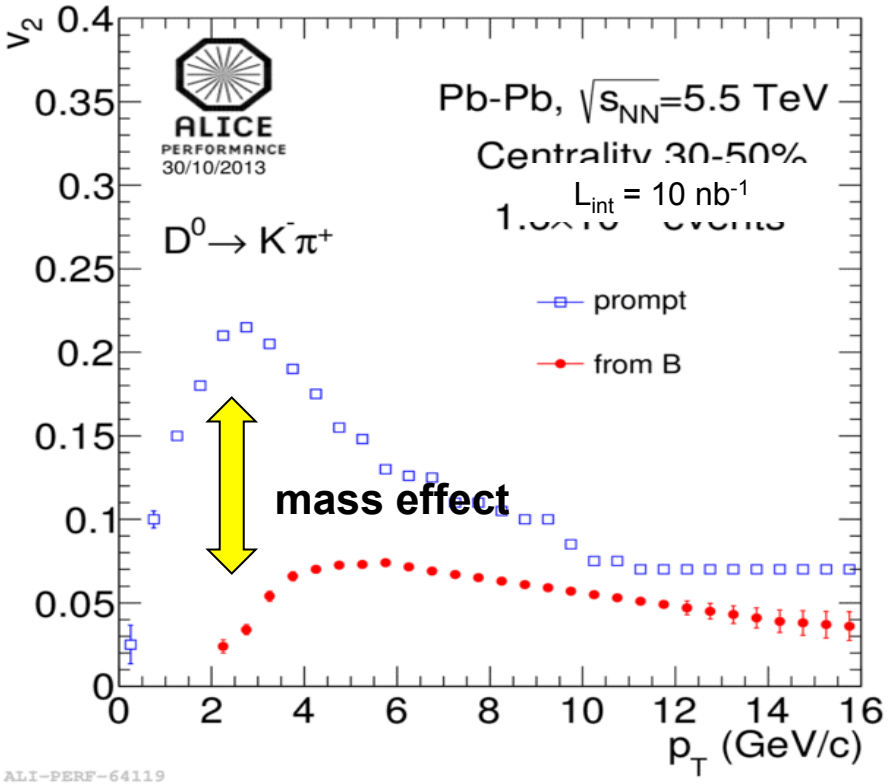
Heavy flavour flow: Upgrade

Present data on charm v_2



ALICE, PRL 111 (2013) 102301

Upgrade: Charm and beauty v_2 down to p_T~0 using prompt and B-decay D^0



ALICE, CERN-LHCC-2013-024

Input values from BAMPS model:
C. Greiner et al. arXiv:1205.4945

by A. Dainese

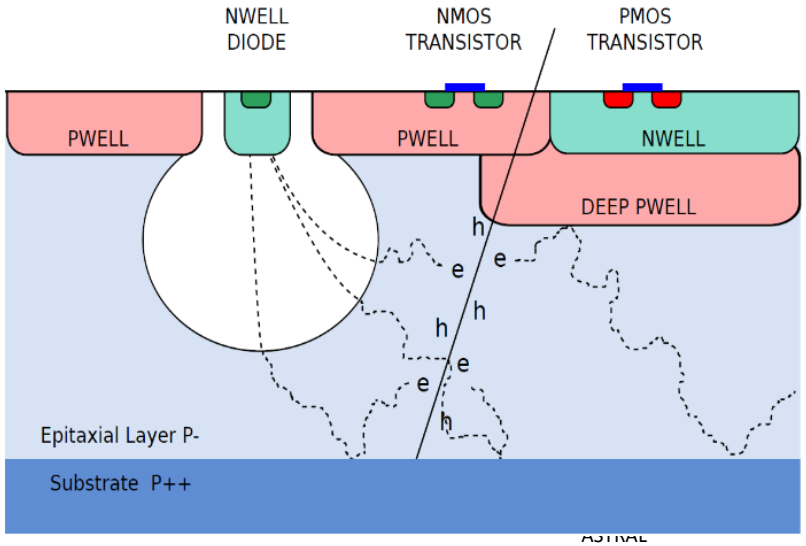
WP5/WP10
R&D monolithic pixel chips, test system and read-out electronics

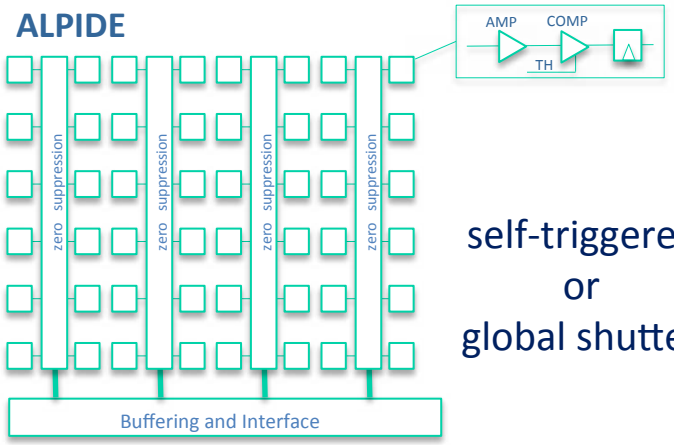
principali persone coinvolte: P. Giubilato, S. Mattiazzo, D. Pantano, Off. Elettronica

Pixel Chip Technology

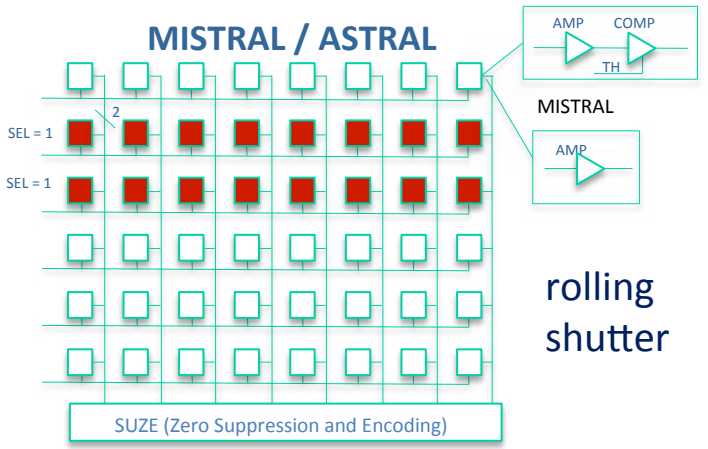
Monolithic Active Pixel Sensors (MAPS) using TowerJazz 0.18 µm technology

- Chip size: 15 mm x 30 mm
- Pixel pitch ~ 30 µm
- Si thickness: 50 µm
- Spatial resolution ~ 5 µm
- Power density < 100 mW/cm^2
- Integration time < 30 µs
- Supply pads over the pixel matrix





self-triggered
or
global shutter



rolling
shutter

pALPIDEfs
15 x 30 mm^2 – pixel 30x30 µm^2

?

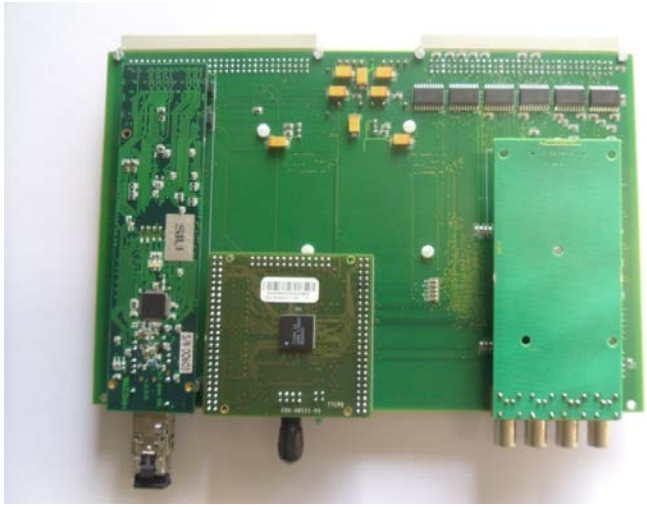
FSBB (Full Scale Building Blocks)
9.2 x 16.9 mm^2 (1/3) – pixel 22x33 µm^2

by V. Manzari

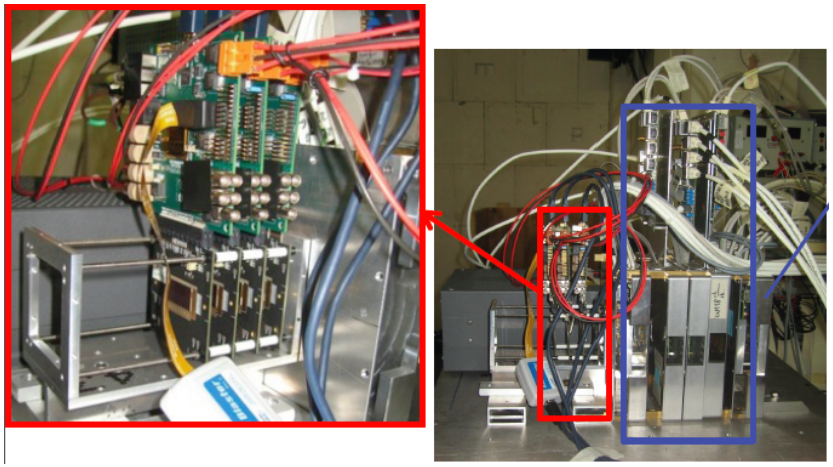
decisione entro fine anno .2014

Test system and beam tests

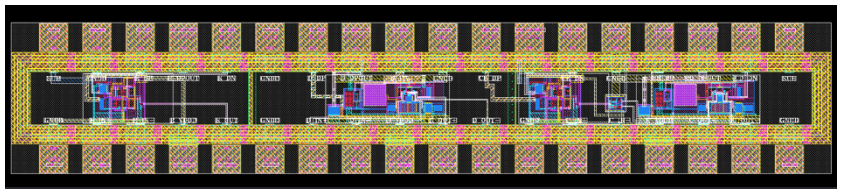
Advanced test systems

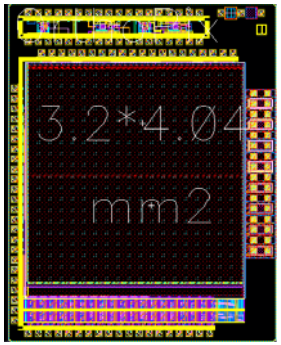


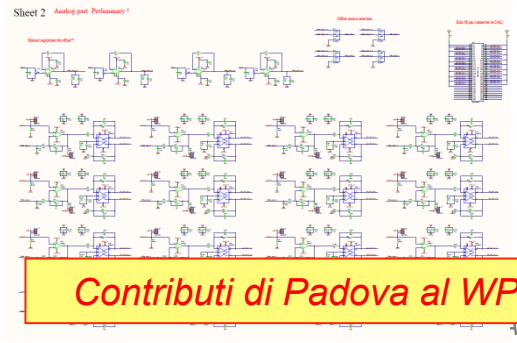
Test beams



Electronic design

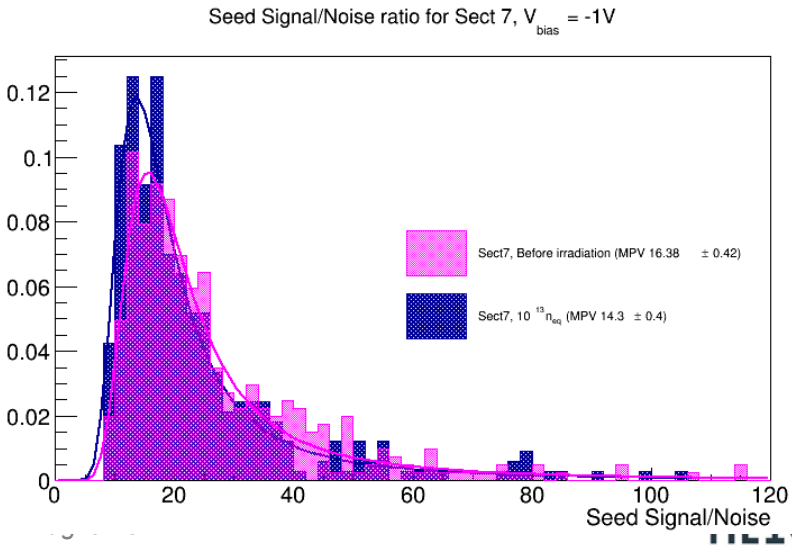






Contributi di Padova al WP5

Data analysis / characterization



Read-Out Electronics – WP10 coordination

Coordination of R&D for read-out electronics:

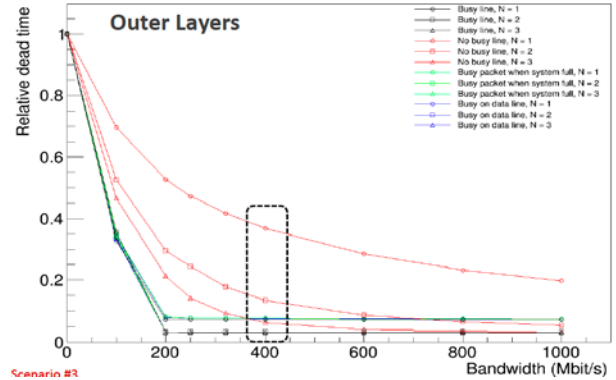
- Bandwidth requirements
- Logic signal transmission (trigger, strobe, busy, …)
- Power transmission
- Radiation hardness

Different issues for inner and outer barrels

Contributi di Padova al WP10

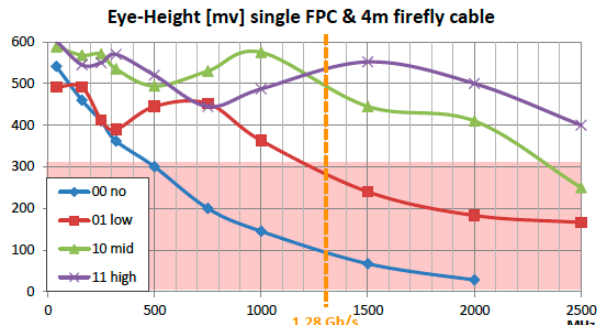
by P. Giubilato

Busy mechanism – busy transmitted through the high-speed data line



Bandwidth – 4m cable + single FPC (inner layers scenario)

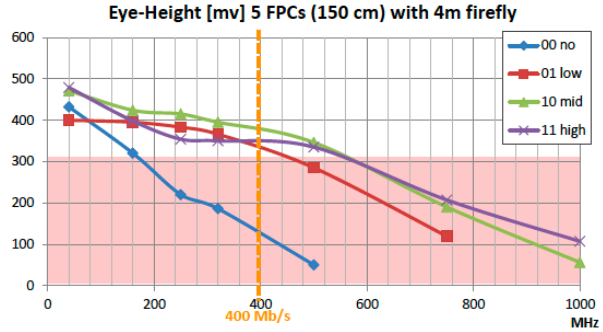
Eye-Height	pre-emphasis			
MHz	00 no	01 low	10 mid	11 high
40	541	492	588	602
160	460	491	568	545
250	410	413	571	550
320	362	390	535	570
500	300	445	494	520
750	200	452	530	445
1000	145	363	575	487
1500	67	240	445	552
2000	28	183	410	500
2500		166	250	400



Bandwidth – 4m cable + 5 FPC (150 cm) (outer layers scenario)

Eye-Height	pre-emphasis			
MHz	00 no	01 low	10 mid	11 high
40	432	400	471	479
160	320	395	424	398
250	220	383	415	354
320	186	366	395	350
500	50	285	346	335
750		119	190	207
1000			56	107
1500				
2000				
2500				

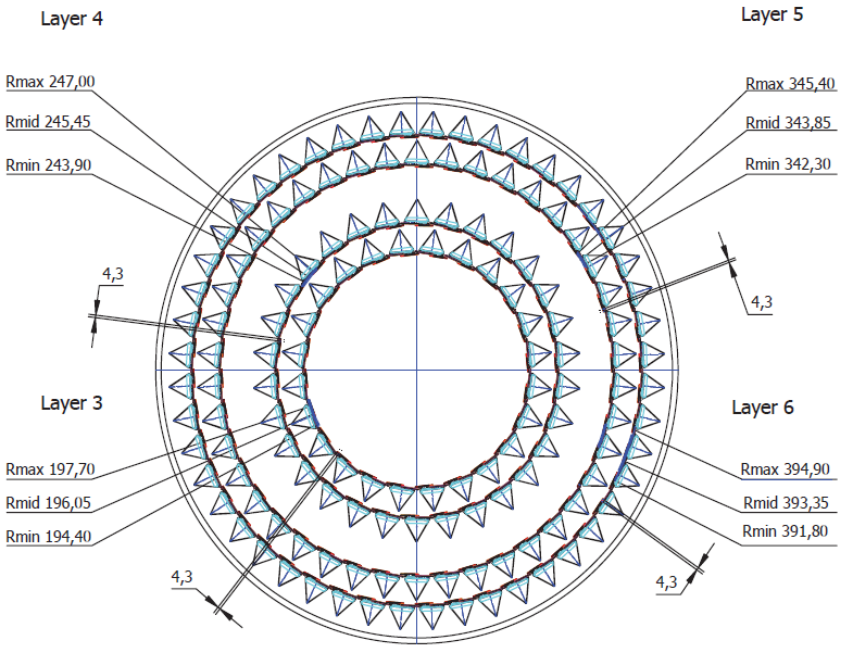
Q-factor	pre-emphasis			

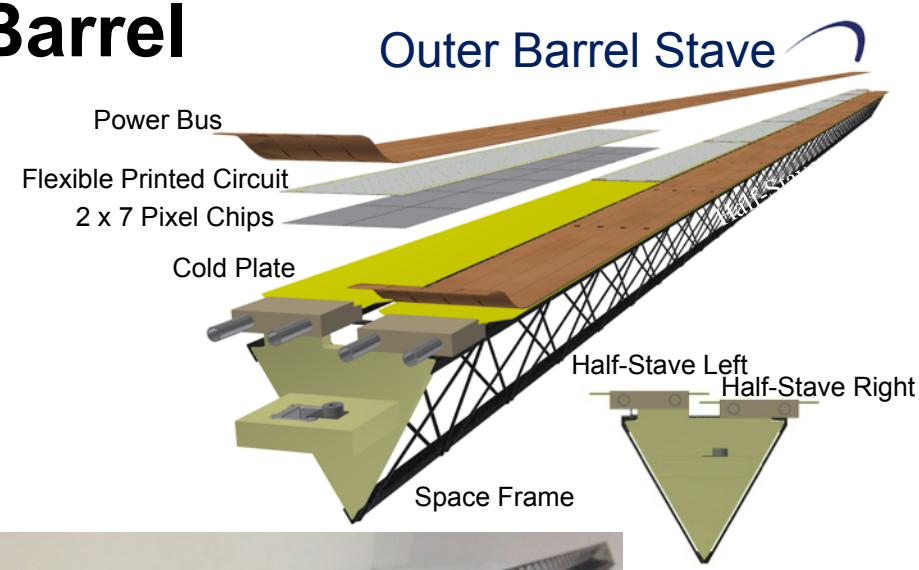


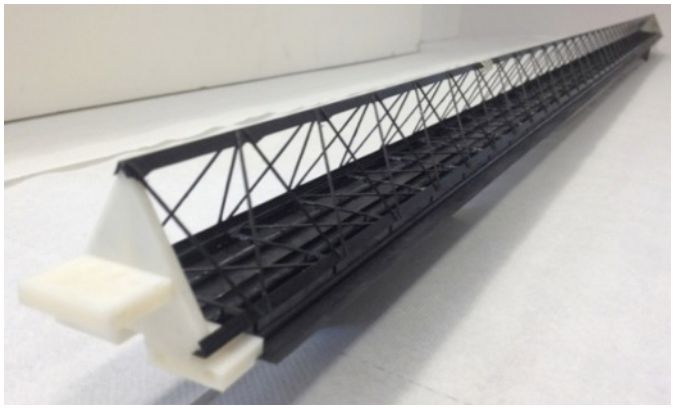
WP8/WP9
R&D integrazione meccanica dei layers esterni
R&D Si-microchannels cooling system per i layers interni

principali persone coinvolte: M. Benettoni, A. Pepato, D. Del Col, A. Francescon, L. Rossetto, F. Soramel, Uff. Progettazione Meccanica e Officina Meccanica

Outer Barrel







Outer Barrel (OB): 2 Middle + 2 Outer Layers

Radial position (mm): 194, 244, **342, 392**

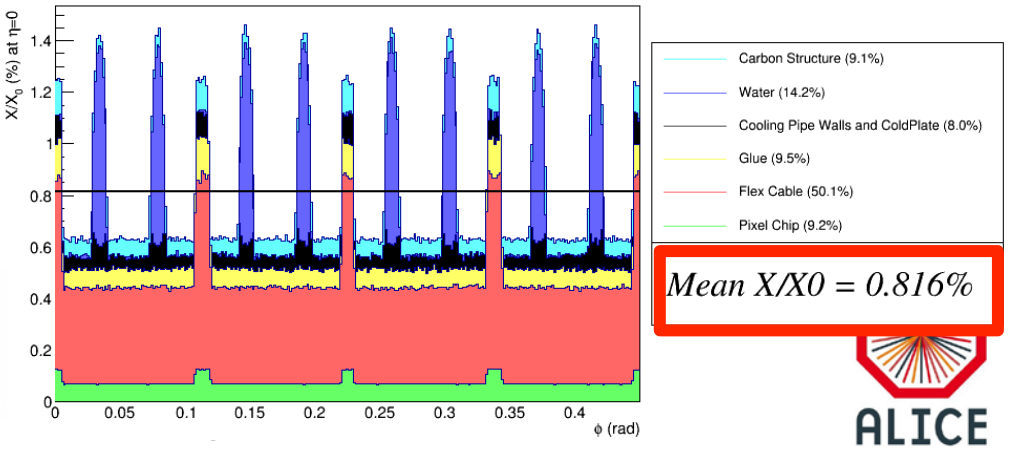
Length in z (mm): 843, **1475**

Nr. of staves: 24, 30, **42, 48**

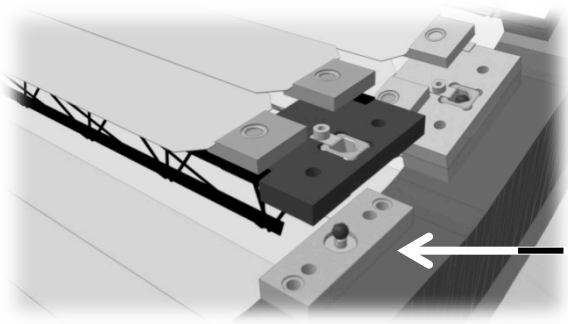
Nr. of chips/stave: 112, 112, **196, 196**

Nr. of chips/layer: 2688, 3360, **8232, 9408**

Material thickness: ~ 0.8% X_0 per layer

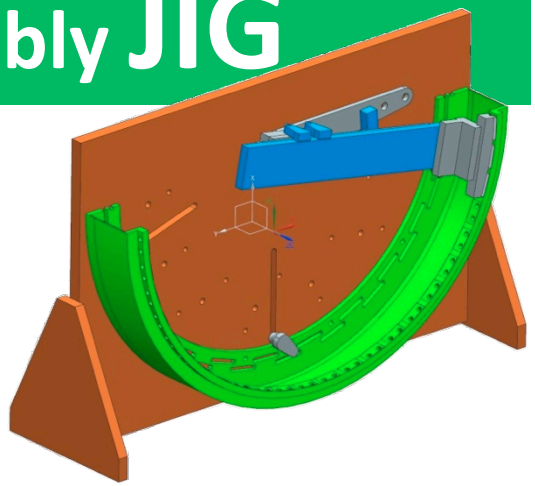


by V. Manzari

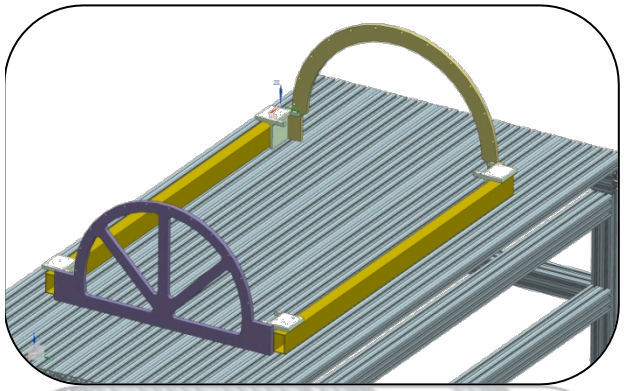


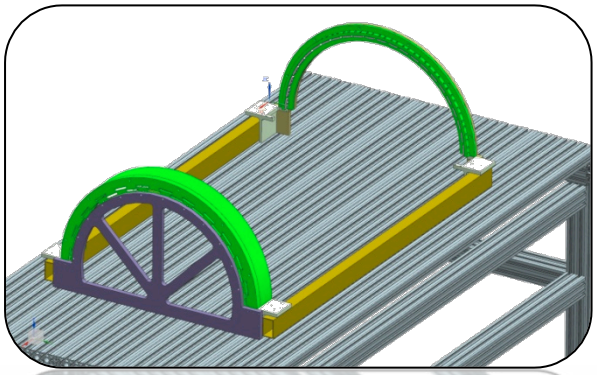
OB End-Wheels assembly JIG

- Stave ruby-pad gluing on E-W
- E-W relative positioning



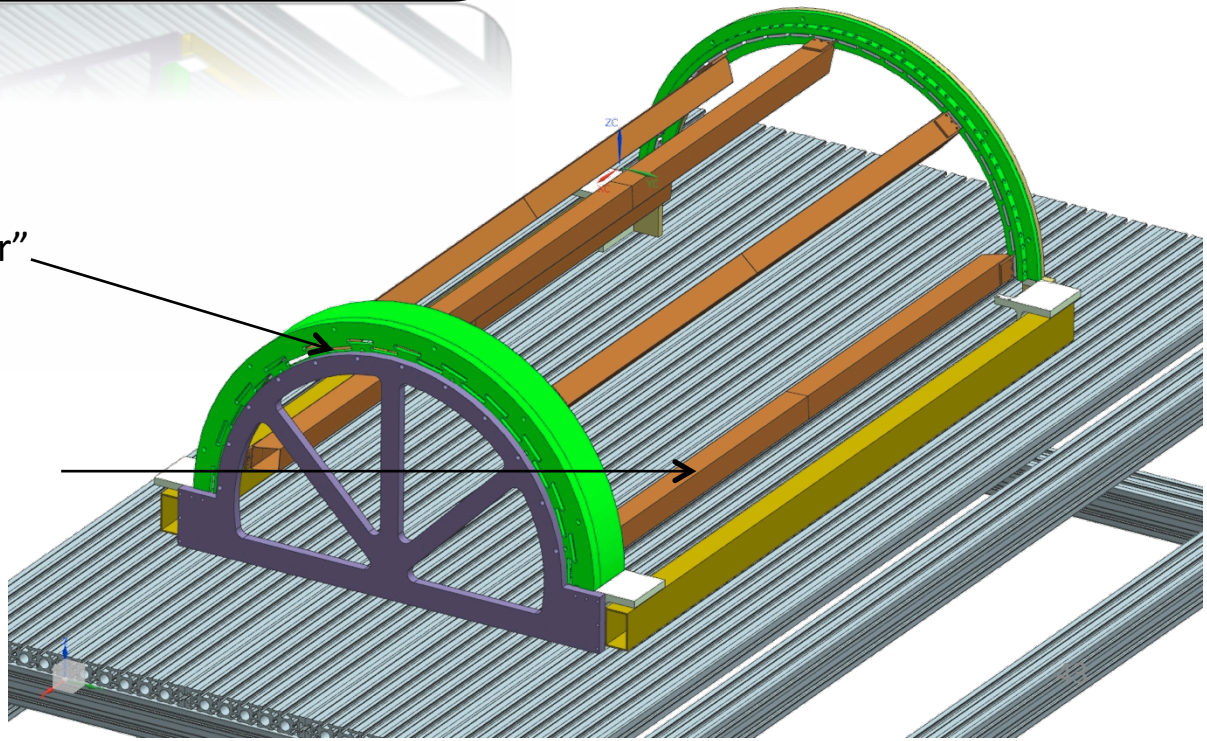
Ruby pads glued on the two E-W
-independently (pict. above)
-or using dummy staves





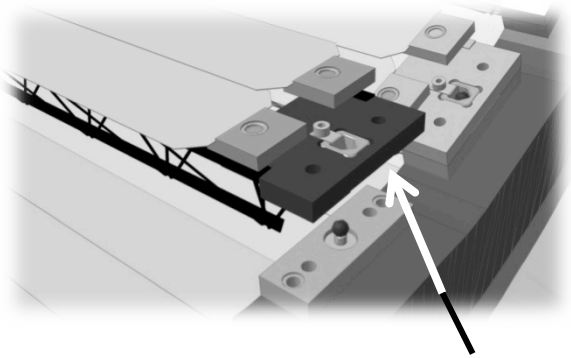
An array of holes on End-Wheels "outer" face, at precise relative position, matches the same array in wheels assembly Jig

A few dummy staves are installed between the End-Wheels

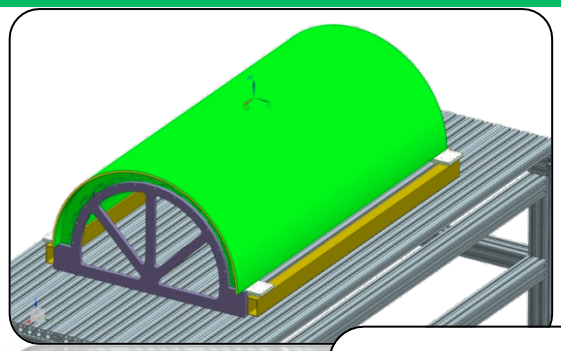


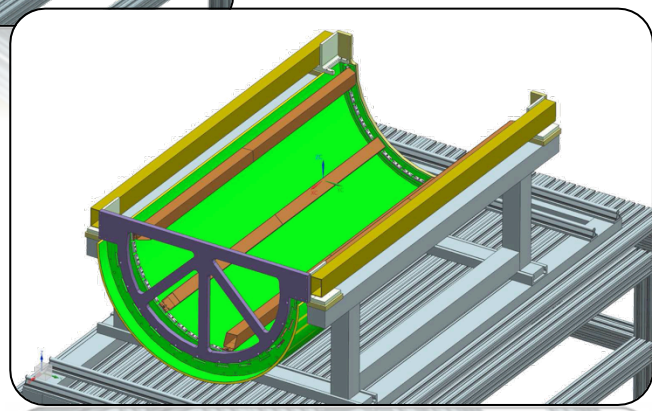
by M. Benettoni, M. Turcato

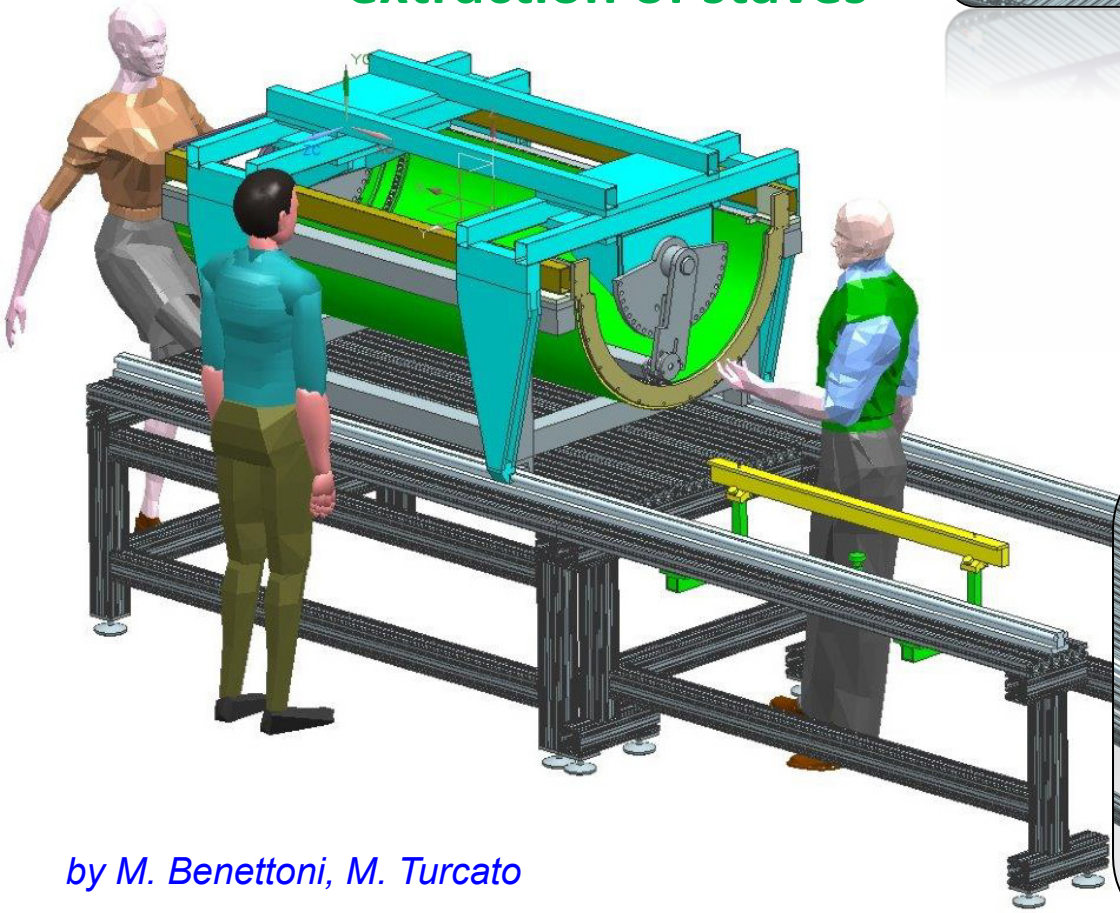
OB Stave Installation JIG

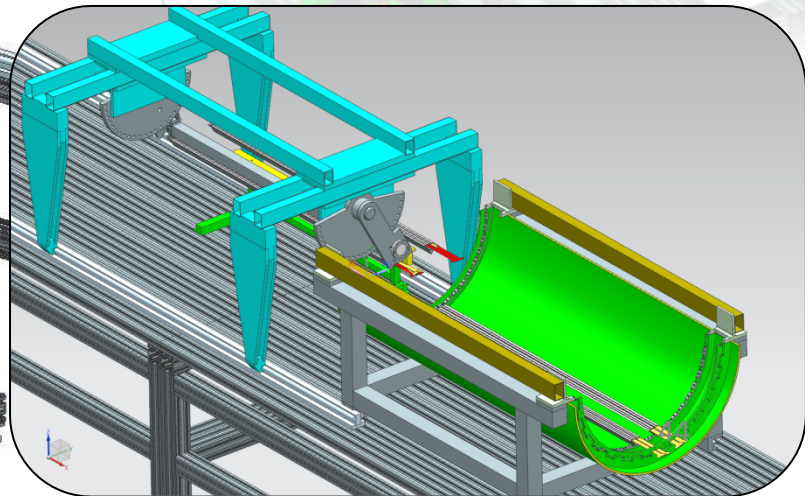


✓Jig to guide the insertion/ extraction of staves





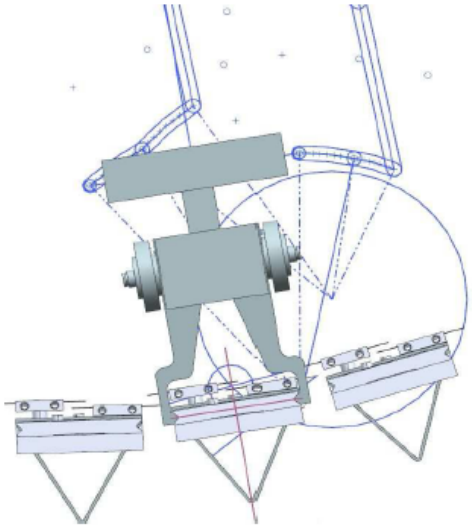


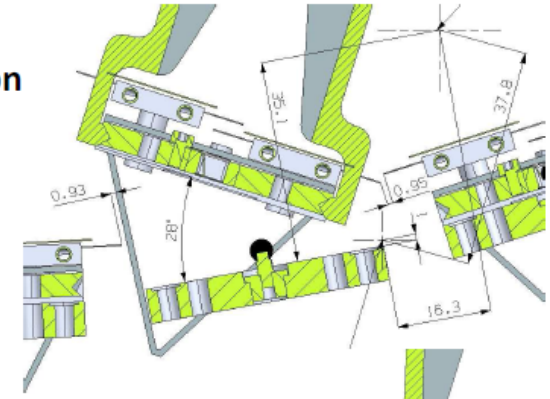


by M. Benettoni, M. Turcato

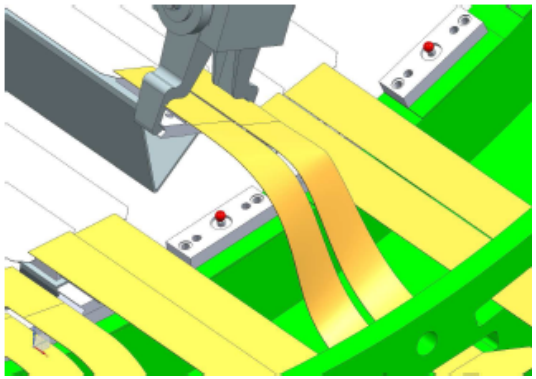
OB Stave Installation JIG

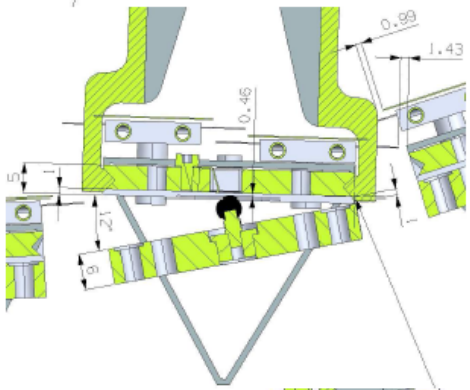
Stave insertion and extraction



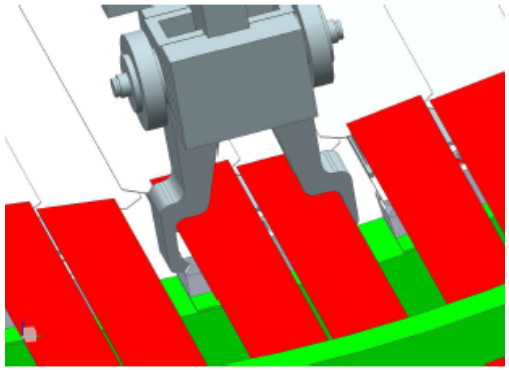


pos.1

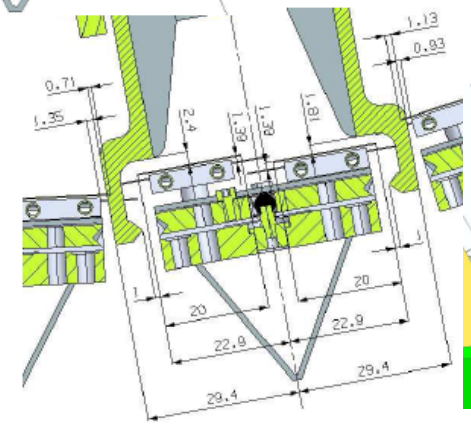


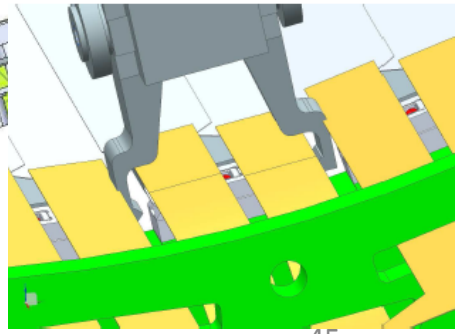


pos. 2



pos. 3





Movement steps to insert/extract:

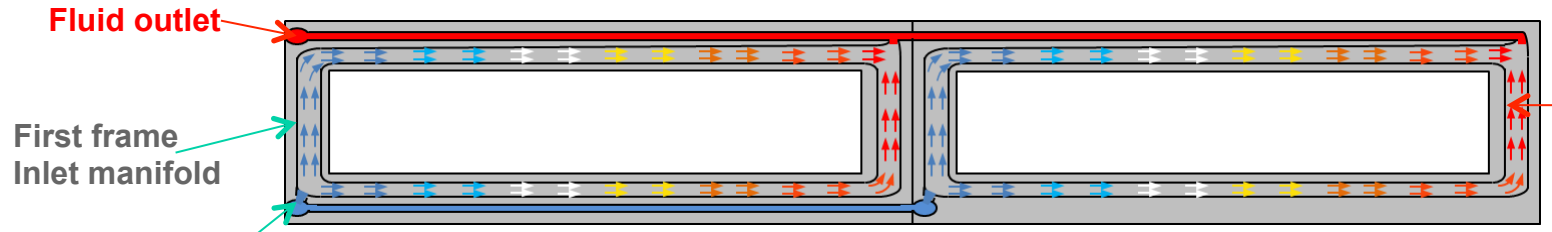
Radial (stave tilted ~28^ vs final position) up to position #1
Rotation from 28^ to ~12^ around side axis up to pos. #2
Rotation 12^ to position around axis near pad edge, pos #3.

Clearance always > 0.9 mm
(but interferences with bus as designed)

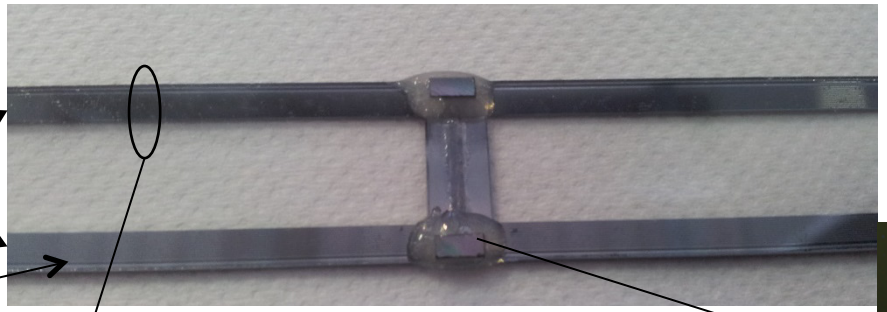
by M. Benettoni, M. Turcato

Si-µchannels and evaporative cooling

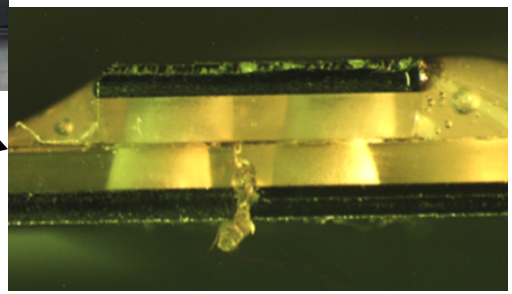
- New prototype fabricated at EPFL Centre of Micro and Nanotechnology (Cmi) with 2 interconnected frames (half barrel length)

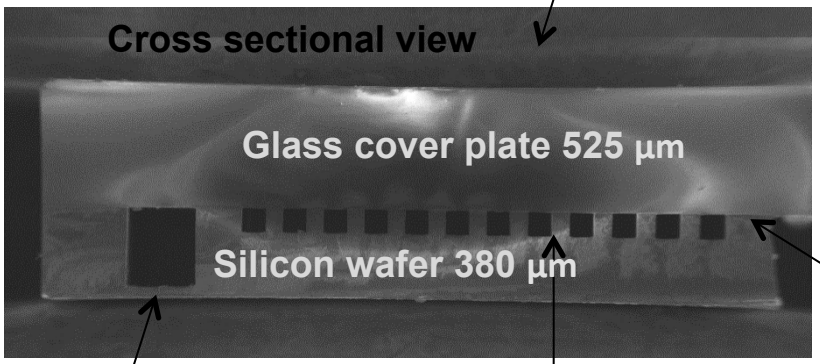


Fluid inlet



Bridge

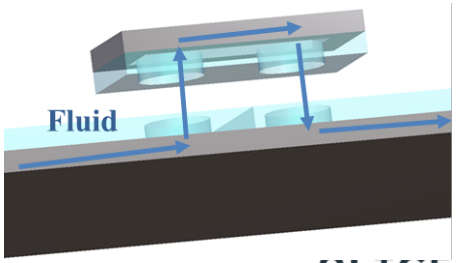




Bonding interface

Distribution line

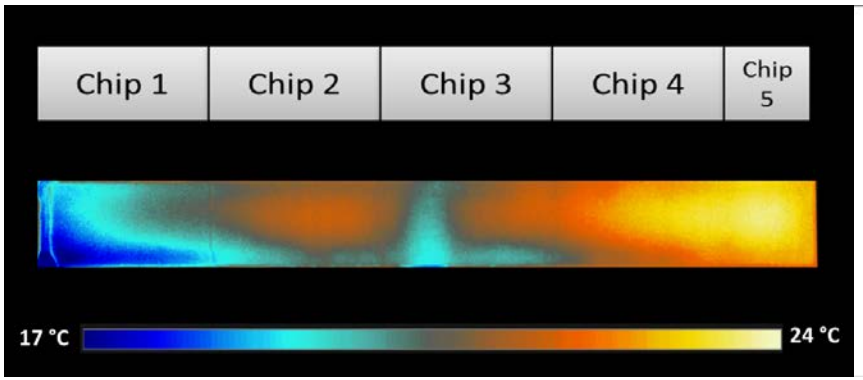
Microchannels

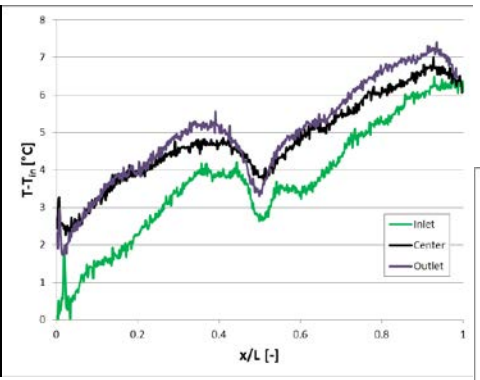


by A. Francescon

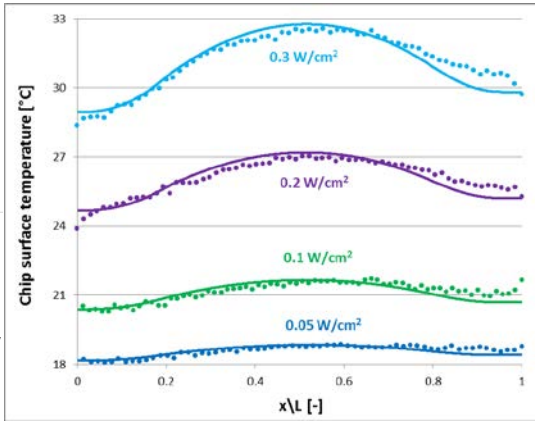
Si-µchannels and evaporative cooling

Single-phase and double-phase heat transfer test ongoing

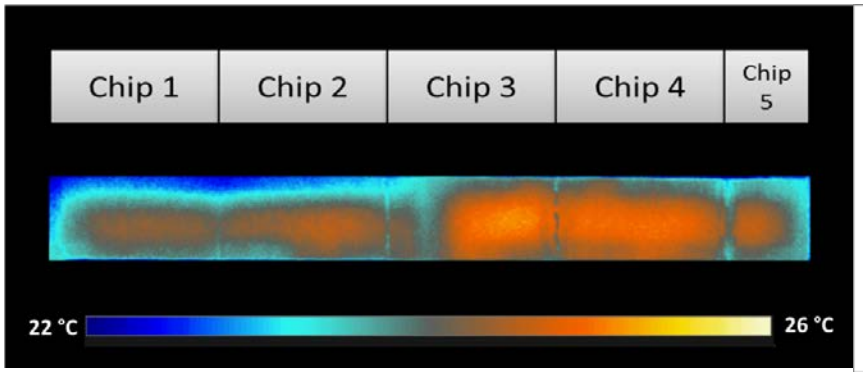


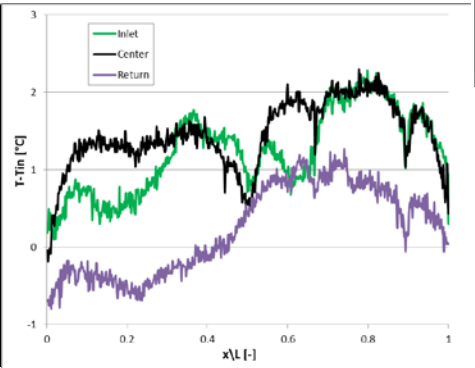


Test performed at q=0.1 W/cm2 and ṁ=0.4 g/s – Tin=17 C.



Radial temperature profile





Test performed at q=0.1 W/cm2 and ṁ=0.05 g/s – Tin=23 C

R&D prosegue anche nel 2015

by A. Francescon

5. Anagrafe gruppo e Richieste 2015

People 2014/2015

Anagrafe ALICE-PD

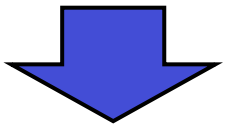
- **15 RICERCATORI (14 INFN + 1 *UNIPD*)** per un totale di **11.7* FTE**

  Federico Antinori, Andrea Dainese*, Daniela Fabris, Andrea Festanti, Piero Giubilato, Chitrasen Jena, Marcello Lunardon, *Serena Mattiazzo,* Maurizio Morando, Sandra Moretto, Fernando Scarlassara, Francesca Soramel, Cristina Terrevoli, Rosario Turrisi, Giuseppe Viesti.

  0.84 FTE/Ric.

- Numero **M&OA** per il 2015**: 13**

- Lo scorso anno: 15 ricercatori con 12.7 FTE e 14 M&OA



esce Davide Caffarri e Gianfranco Segato

entra Cristina Terrevoli

(*) Dainese: 90% ALICE + 10% PRIN LHC-STOA

People 2014/2015

- **6 TECNOLOGI** per un totale di **4.3 FTE**
  - Massimo Benettoni, Davide Del Col*, Andrea Francescon*, Adriano Pepato, Luisa Rossetto*, Massimo Sgaravatto

0.72 FTE/Tcng.

(*) Dip. Ing. Industriale

- **TECNICI**
  - Marco Caldogno, Devis Pantano e Sandro Martini
- come scorso anno

- **Responsabilità all'interno della Collaborazione**
  - Antinori: Management Board, Editorial Board, Physics Board (Coordinator), Collaboration Board
  - Dainese: Physics Board, ITS-Upgrade Convener (WP1), Upgrade Performace Coord., Editoriali Board
  - Giubilato: ITS-Upgrade Convener (WP10)
  - Lunardon: ITS Institute Board
  - Turrisi: SPD cooling

Richieste 2015

Richieste finanziarie

• Richieste **Missioni** secondo **schema generale ALICE-Italia** che tiene conto del **numero di FTE ricercatori+tecnologi** (**16.0**) per physics meetings, partecipazione a turni misura, manutenzione, etc... e responsabilità nella collaborazione (Physics/ Technical/Editorial/Computing/Collaboration Boards, PAGs), riunioni collaborazione italiana, partecipazione Convegno Nazionale Fisica di ALICE) e riunioni TIER2.

Estero: 0.7mu/FTE riunioni+ 0.2mu/FTE manutenzioni + Manutenzioni specifiche (SPD) + Responsabilità + 1.0mu/MOFA per presa dati 2015. Interno: 1.2k/FTE.

Upgrade: 25k per supporto WP10 + 3k per meeting generale INFN-ITS-Upgrade

• Richieste **Consumo** secondo schema generale ALICE-Italia. *Proposto 1.0k/FTE*

• Richieste R&D **ITS-Upgrade**:

- Electronics (board procurement for read-out tests: 8k)
- Mechanics (integration R&D and tooling production/procurement: 20k)

Richieste 2015

Riepilogo richieste finanziarie e confronto 2014 (in k€):

Capitolo	**Richieste 2015**	*Richieste 2014*	*Assegnaz. 2014*	*Impegni al 10/7*
Missioni (MI+ME)	***178*** *(30 ITSupg)*	*138 (3 ITSupg)*	*84.5 (11 a giugno)*	*62%*
Consumo/Trasporti/ Inventario	***48*** *(28 ITSupg)*	*111 (90 ITSupg)*	*27 (+20 Ba) (20+20 ITSupg)*	*87%*
TOTALE:	***226***	*249*	*111.5 (+20 Ba)*	

- *Rispetto allo scorso anno:*
  - ***aumento missioni per ripresa run misura e supporto ITS-Upgrade***
  - ***riduzione richieste per R&D ITS-Upgrade***

Richieste 2015

Richieste servizi

– **Ufficio Progettazione Meccanica**: **12 m.u.** per R&D integrazione meccanica layers esterni ITS-Upgrade

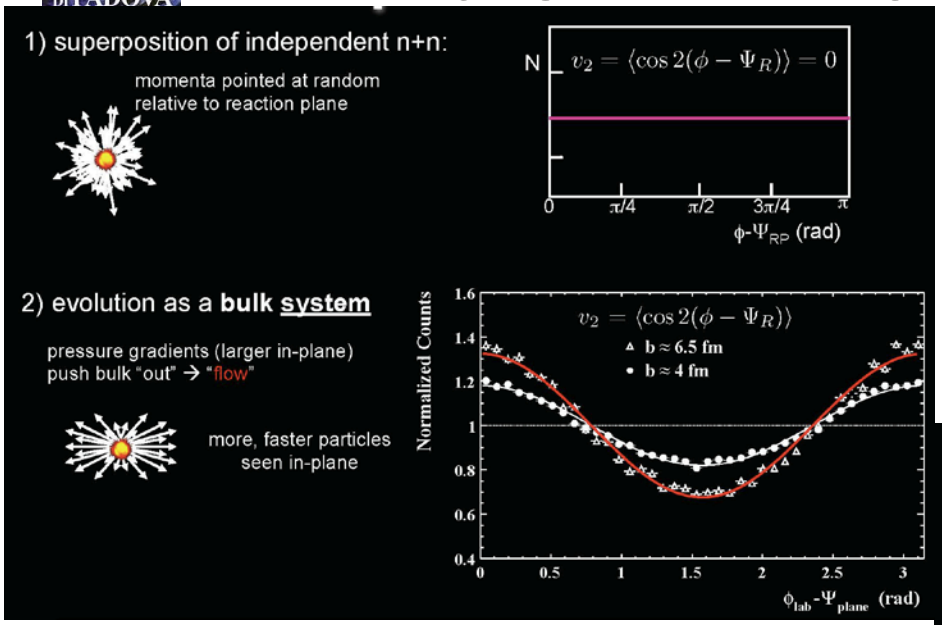
– **Officina Meccanica**: **1 m.u.** per manutenzione impianto raffreddamento SPD e **12 m.u.** per R&D integrazione meccanica layers esterni ITS-Upgrade

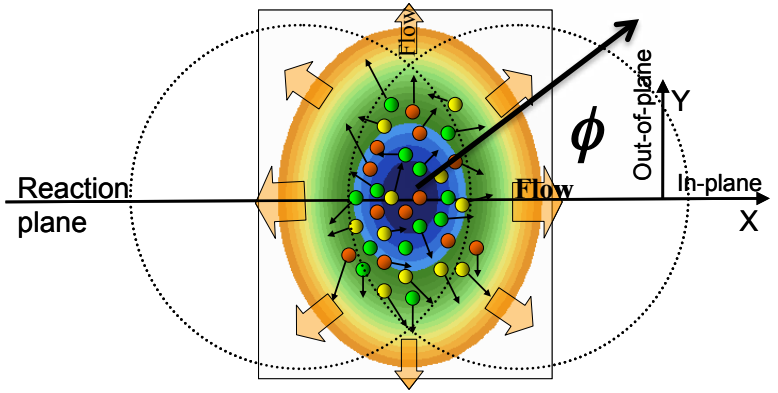
–**Servizio Calcolo**: **1 m.u.** per manutenzione/upgrade farm ALICE (non-GRID)

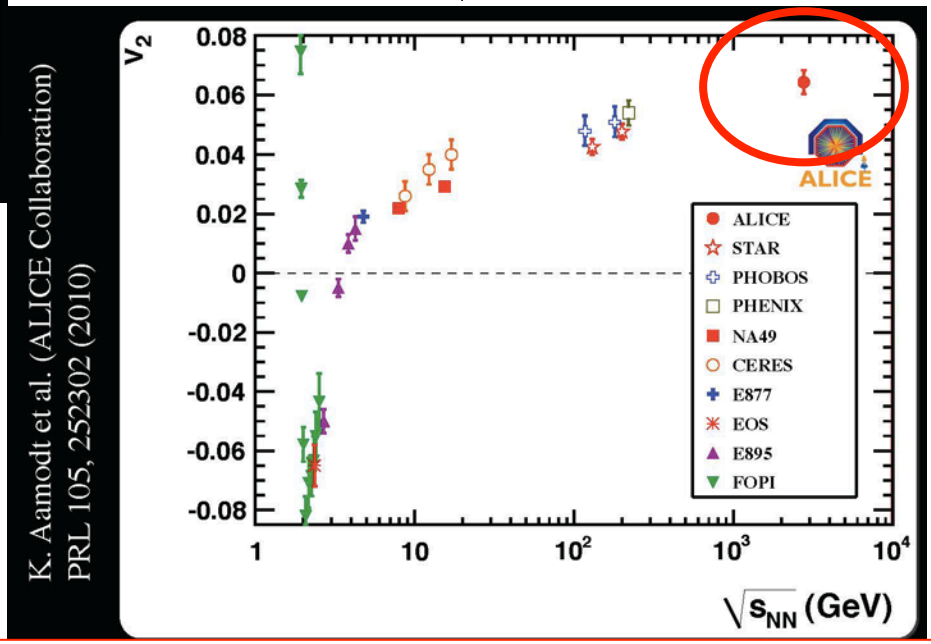
– **Servizio Elettronica**: **1 m.u.** per disegno e realizzazione schede per test dei rivelatori a pixel monolitici

BACKUP

Intro: Azimuthal anisotropy







- System geometry **asymmetric** in non-central collisions
- Collective expansion under azimuth-dep. pressure gradient results in **azimuth-dep. momentum distributions**
- Measured by the **elliptic flow parameter v_2** (p_t)

$$\frac{dN}{Nd\phi} = 1 + 2v_2 \cos\left(2(\phi - \Psi_{RP})\right) + \ldots$$

*The system produced at the LHC behaves like as a very low viscosity fluid (almost a **perfect fluid**) (2010)*

New ITS Design goals

1. Improve impact parameter resolution by a factor of ~3
- Get closer to IP (position of first layer): 39mm ➡22mm
- Reduce material budget: X/X_0 /layer: ~1.14% ➡ ~ 0.3% (for inner layers)
- Reduce pixel size
    - currently hybrid pixels 50mm x 425mm ➡ monolithic pixels O(30mm x 30mm)

2. Improve tracking efficiency and p_T resolution at low p_T
- Increase granularity: 6 layers ➡ 7 layers , reduce pixel size

BACKUP

3. Fast readout
- 50 kHz in Pb-Pb, 200 kHz in pp (currently limited at 1 kHz with full ITS)

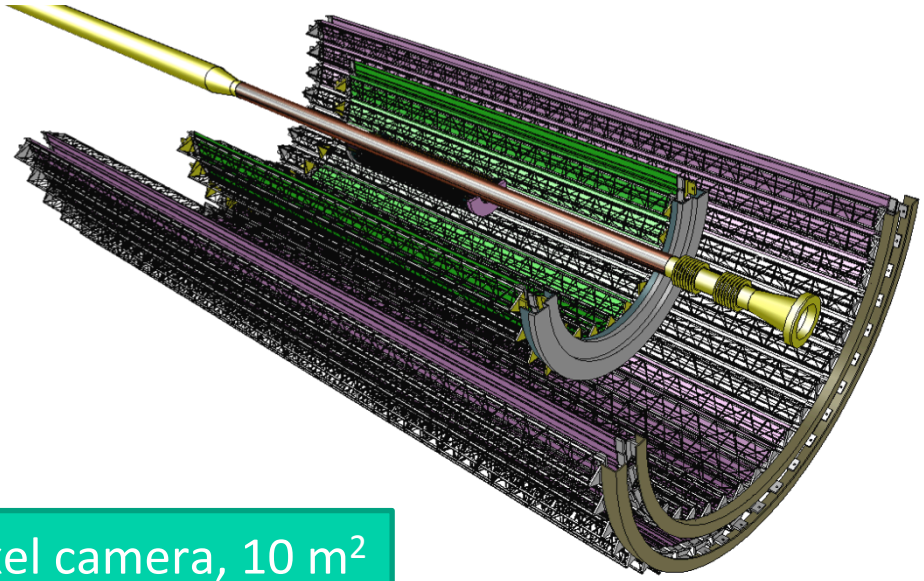
4. Fast insertion/removal for yearly maintenance
- possibility to replace non functioning detector modules during yearly shutdown

New ITS Baseline

- Inner Barrel: 3 layers of monolithic pixels
- Outer Barrel: 4 layers of monolithic pixels

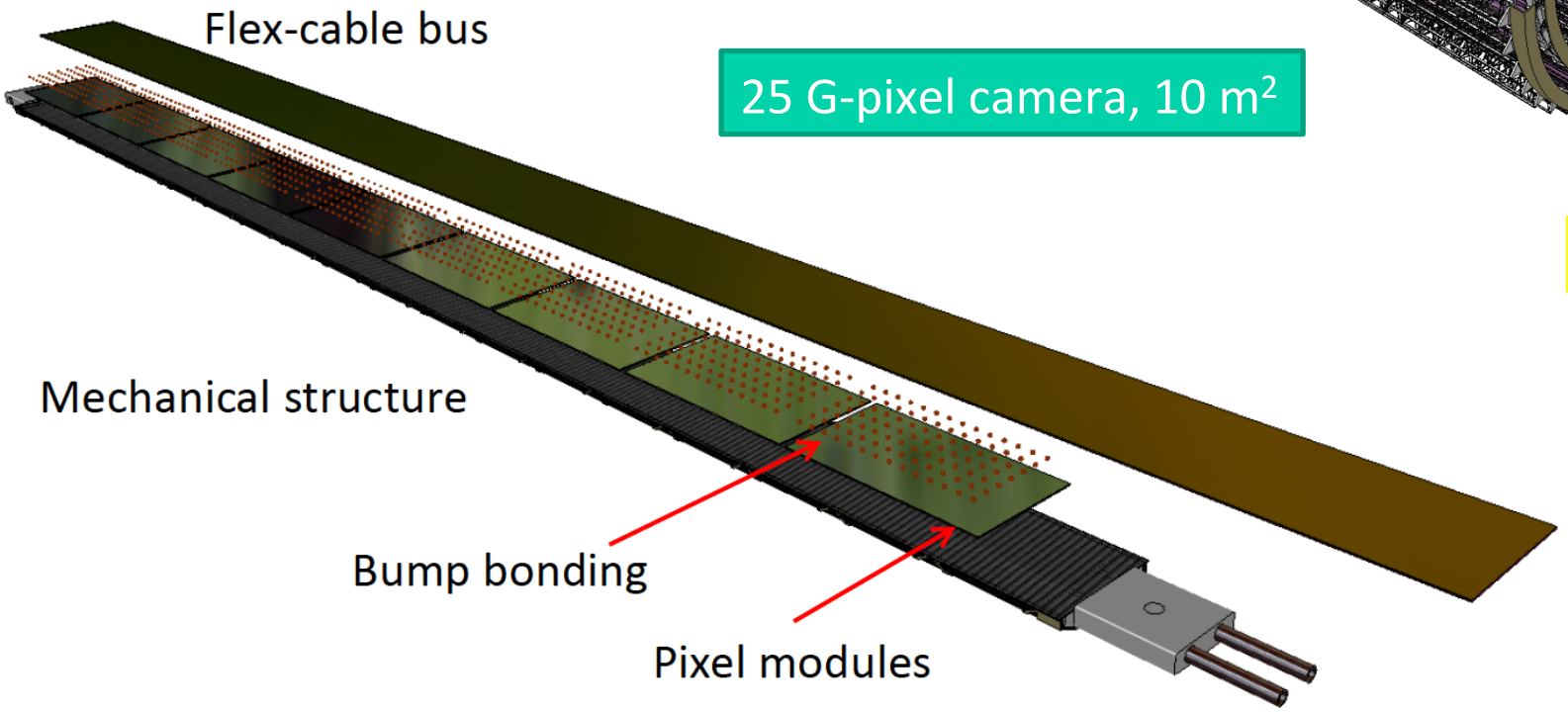
Detector module (Stave) consists of

- Carbon fibber support (space frame)
- Cooling unit
- Flexible Printed Circuit
- Pixel Chip (CMOS pixel sensors)



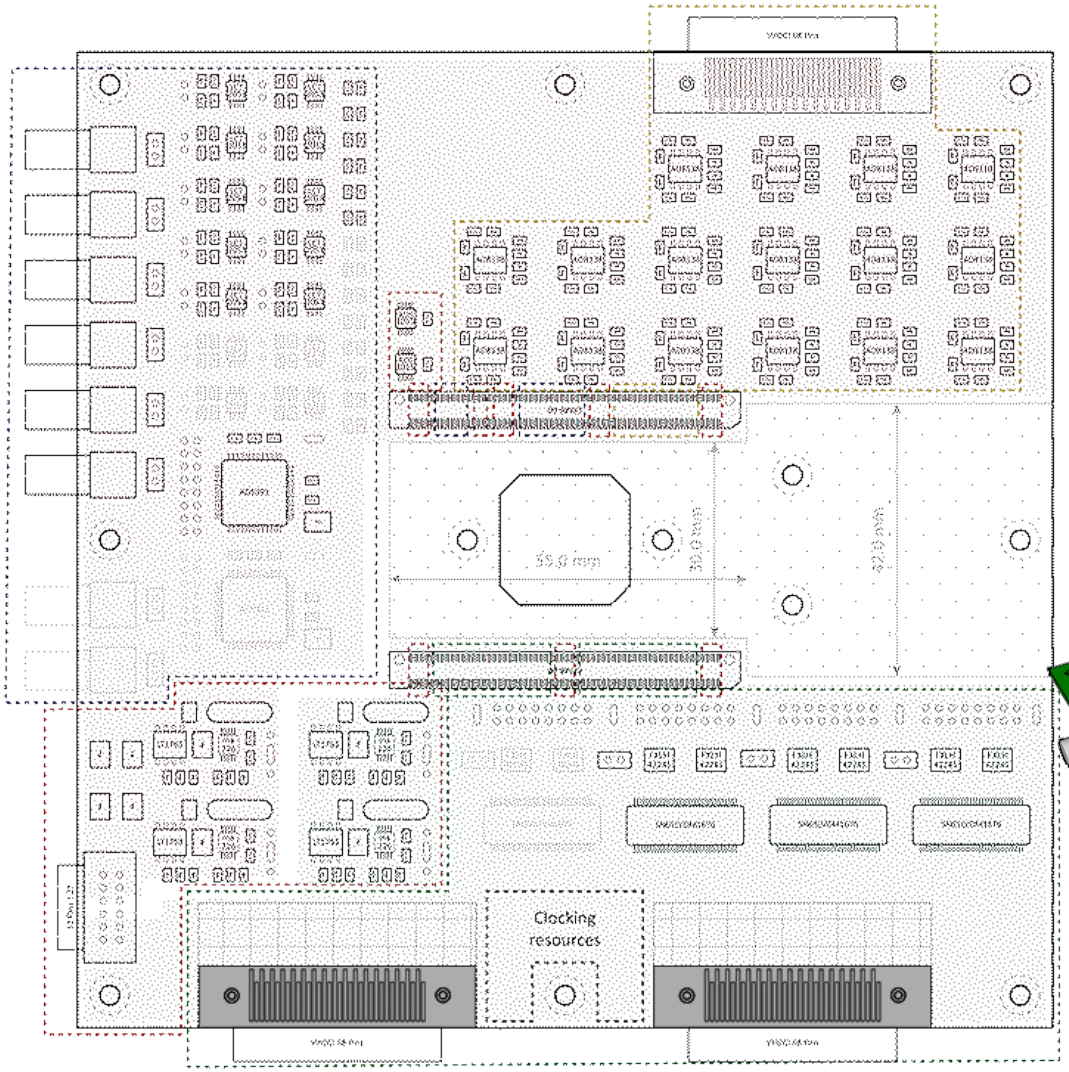
25 G-pixel camera, 10 m²

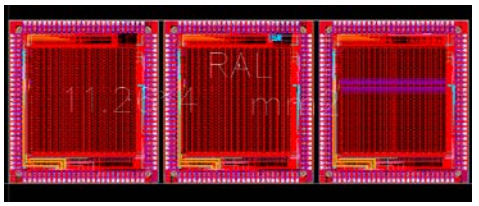
BACKUP



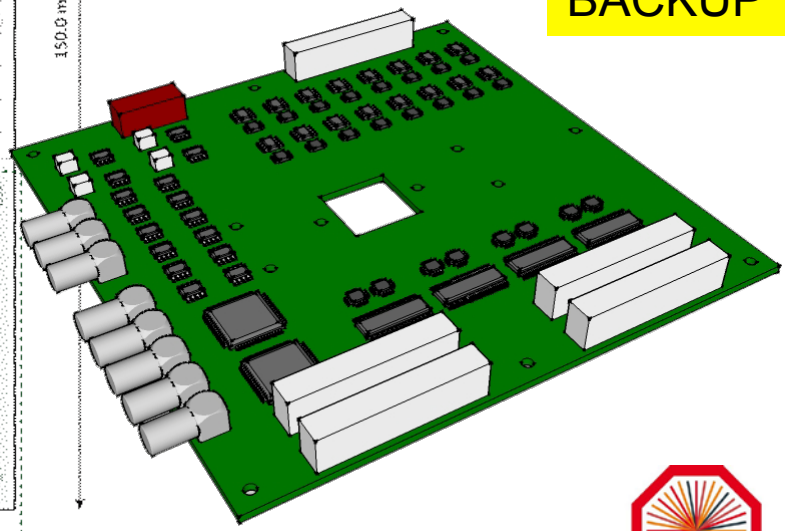
DAQ: boards, system and software for testing ALL the chip flavors

Layout phase already started for the Proximity board

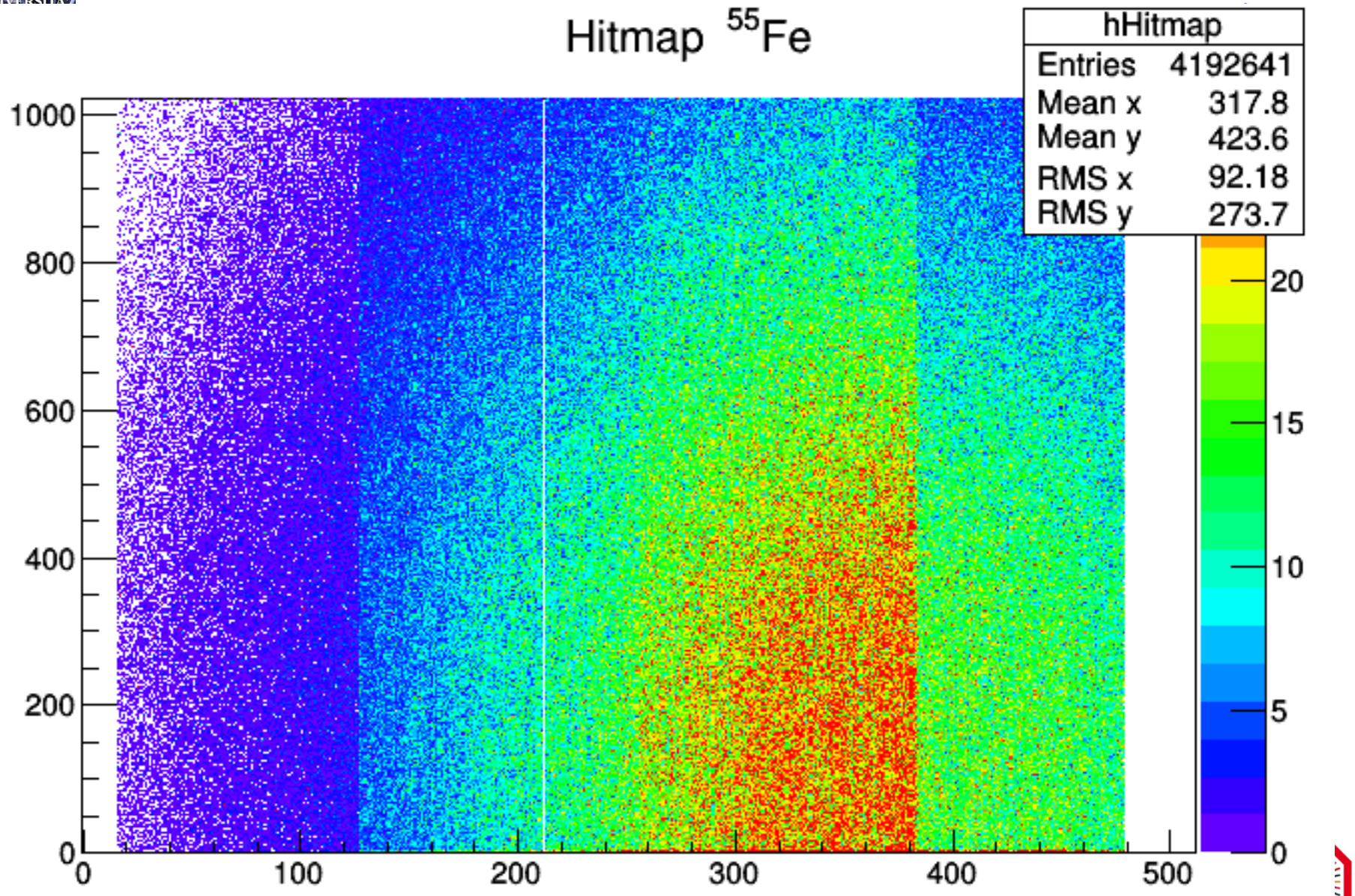




BACKUP



pALPIDE_FS hitmap



Beam pipe and IB radii: outcome

Potential gain
Potential loss

- Effects of a smaller beam pipe radius:
  1. Tracking resolution improves at low p_T → significant gain? **NO**
  2. The ITS IB could be placed closer (see below)
  3. OR: The ITS IB could be kept as is → easier installation **YES**
  4. The MFT could be placed closer → increased η acceptance? **NO**
  5. γ conversions closer to the primary vertex → bad for dielectrons? **NO**
- Effects of smaller ITS IB radii:
  1. Tracking resolution further improves at low p_T → significant gain? **NO**
  2. Increase of innermost layers occupancy → higher fake track rate? **YES**

(NO = not substantially; YES = substantially)

→ OK for reducing pipe by 1 mm and leaving IB as is

Approved by MB

by A. Dainese