ALICE Status

F Antinori

47th ALICE RRB, 30 October 2019

Contents

- Collaboration news
- Computing update
- Physics update
- LS2 upgrades update
- ITS3 upgrade
- Conclusions

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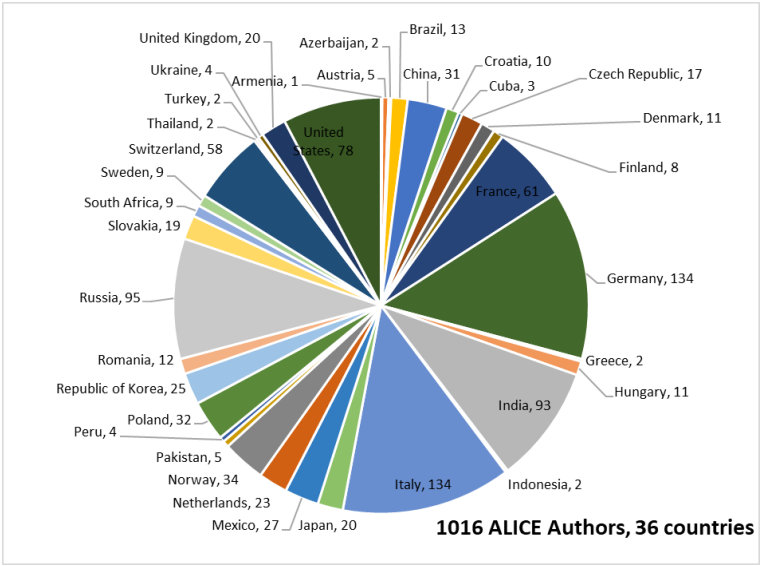
Participating Institutes
176 INSTITUTES – 40 COUNTRIES



- new Full Member Institute: Chungbuk National University (CBNU), Rep. of Korea
  - joins PDP project
- ongoing discussions with groups in Bolivia, Pakistan, Russia, …

Source: Alice Collaboration data base, 21 October 2019

New appointments

- Collaboration Board Chair
  - Silvia Masciocchi (GSI)
  - elected by CB on 28/8
  - took office on 1/10

- Run Coordination
  - Taku Gunji (Tokyo)
  - Federico Ronchetti (Frascati), Deputy

- Computing Resources Coordinator
  - Stefano Piano (Trieste)

- Physics Working Group Conveners
  - Dileptons, Quarkonia — Michael Weber (Vienna), Michael Winn (Saclay)
  - Heavy Flavours — Andrea Dubla (GSI)
  - Jets — Filip Krizek (Prague CTU)
  - Ultraperiph., Diffraction — Michal Broz (Prague CTU)

- Juniors' Representative
  - Fernando Flor (Houston)

Taking office on 1 January 2020

(already endorsed)

- Spokesperson
  - Luciano Musa (CERN)
  - elected by CB on 27/3
- Deputy Spokespersons
  - Barbara Erazmus (Nantes)
  - Mateusz Ploskon (Berkeley)
- Conference Committee Chairs
  - Roberta Arnaldi (Torino)
  - Dariusz Miskowiec (GSI)
- Physics Coordinator
  - Andrea Dainese (Padova)
- Deputy Physics Coordinators
  - Cvetan Cheshkov (Lyon)
  - Leticia Cunqueiro (Oak Ridge)
- Upgrade Coordinators
  - Jochen Klein (Torino)
  - Marco van Leeuwen (Nikhef)

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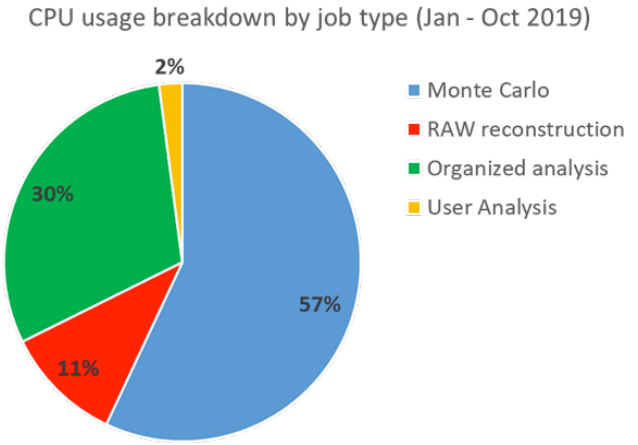
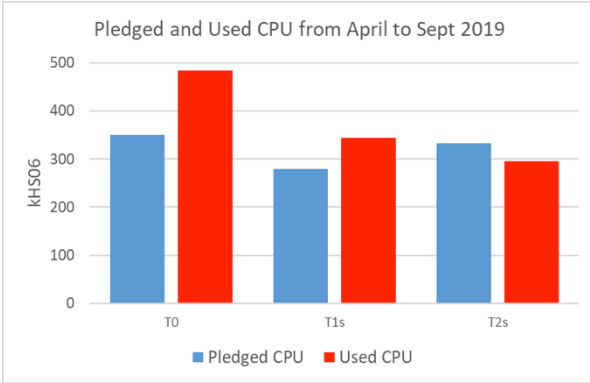
Resource usage

- increase in the fraction of CPU used for analysis
  - 20% in 2018 → 30 % in 2019
  - important effort for analysis of 2018 sample
- preparing for second pass through 2018 data
  - to be started before end of the year
- stable resource delivery from all tiers
- full utilisation of available CPU: 130 k jobs on average
- available disk capacity is sufficient
- unpopular data ~ 2% of total used space





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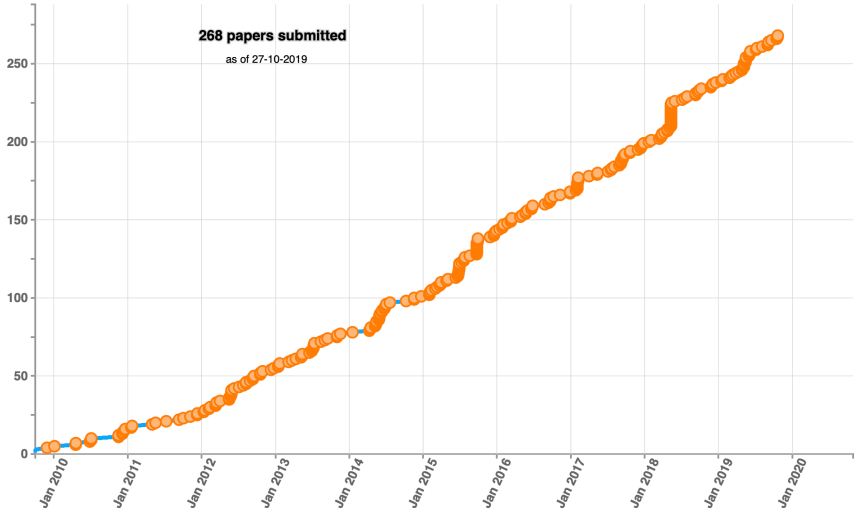
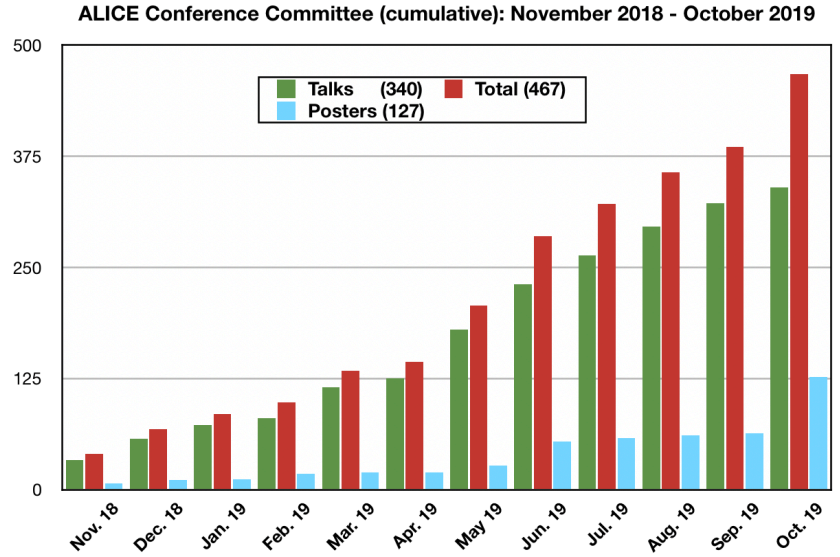
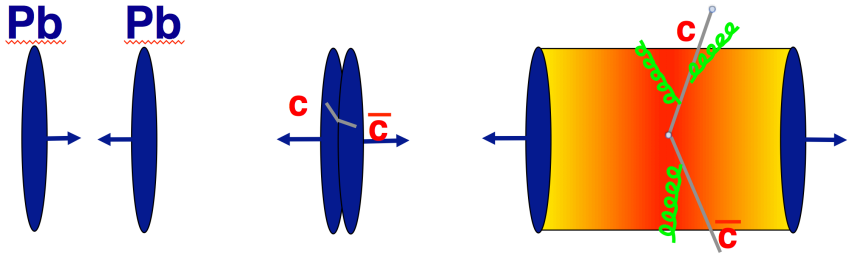
Physics output

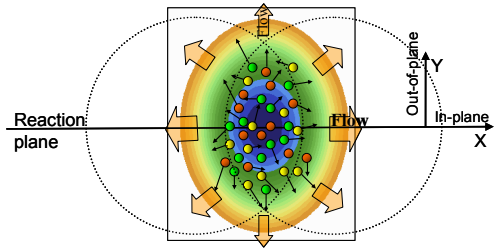
- going strong!
  - 268 papers on arXiv (average of 52 citations per paper, excluding self-cites)
  - several hundred conference presentations each year





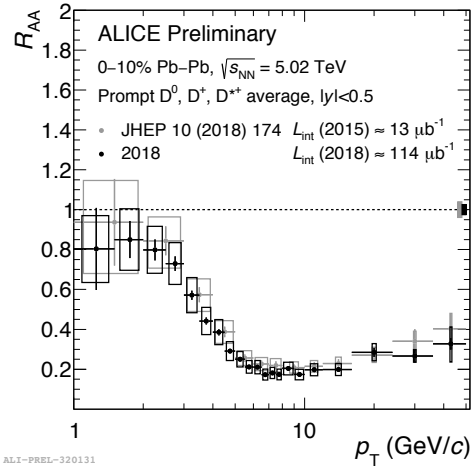
Probing the medium with heavy quarks

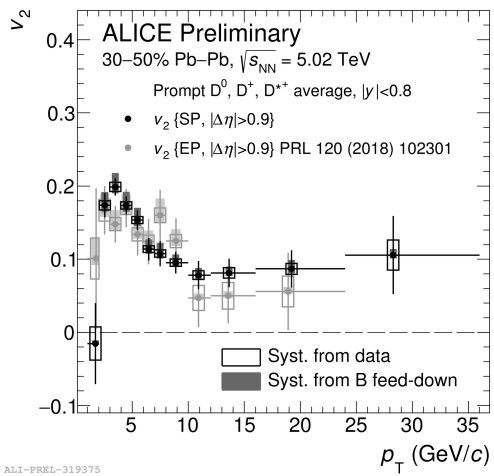




$$R_{AA} = \frac{(dN/dp_T)_{AA}}{\langle N_{coll} \rangle (dN/dp_T)_{pp}}$$

$$\frac{dN(p_T,\varphi)}{d\varphi} \propto 1 + 2v_1\cos(\varphi - \psi_1) + 2v_2\cos(2[\varphi - \psi_2]) + \ldots$$

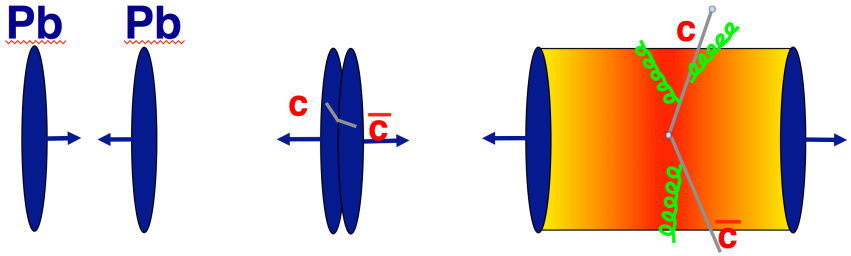


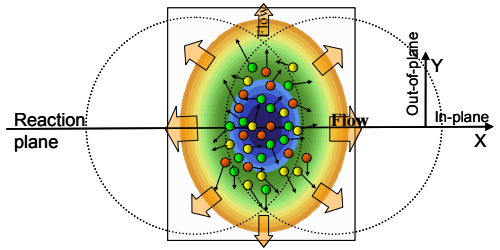


2015 data sample

2018 data sample

Probing the medium with heavy quarks





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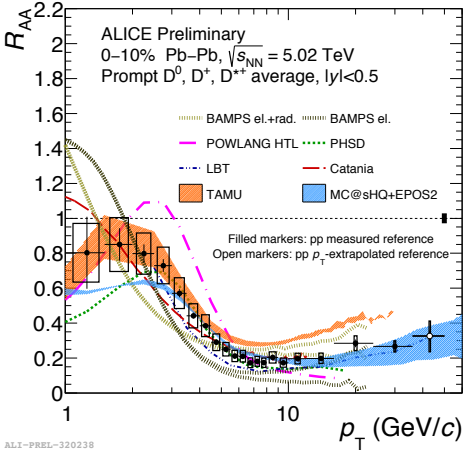
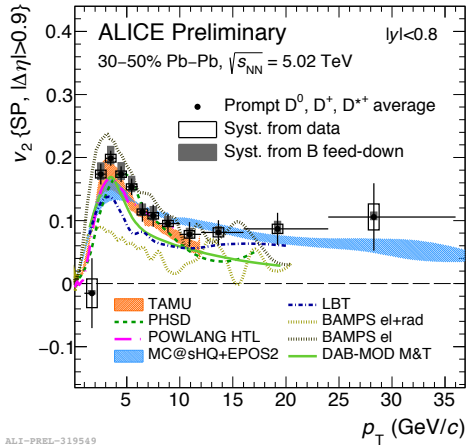
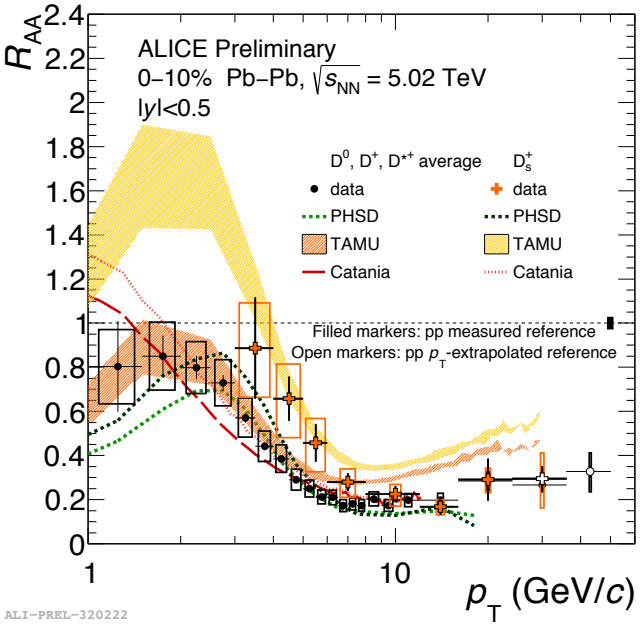


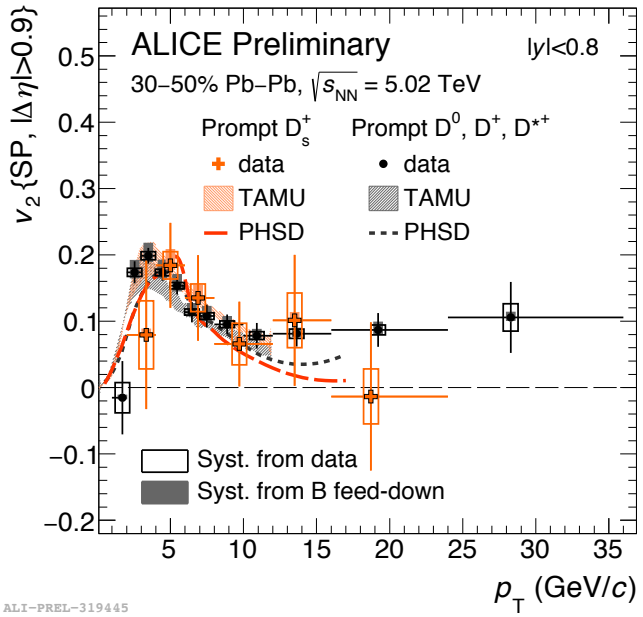


- simultaneous constraints from R_{AA}, v_2
- study interplay of effects
  - shadowing
  - collisional energy loss
  - radiative energy loss
  - coalescence
  - medium evolution

D_s

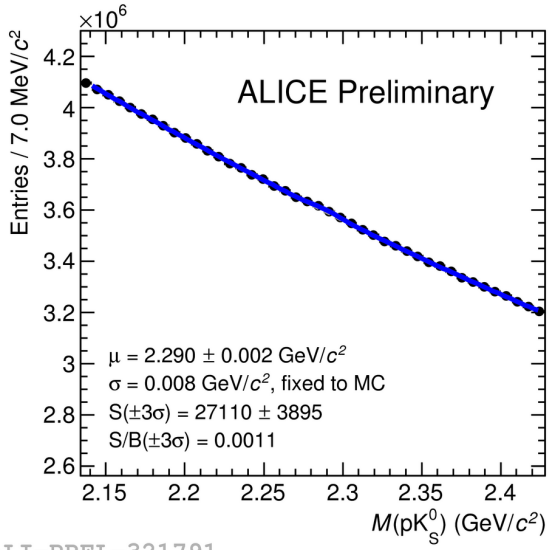
- very sensitive to coalescence contribution



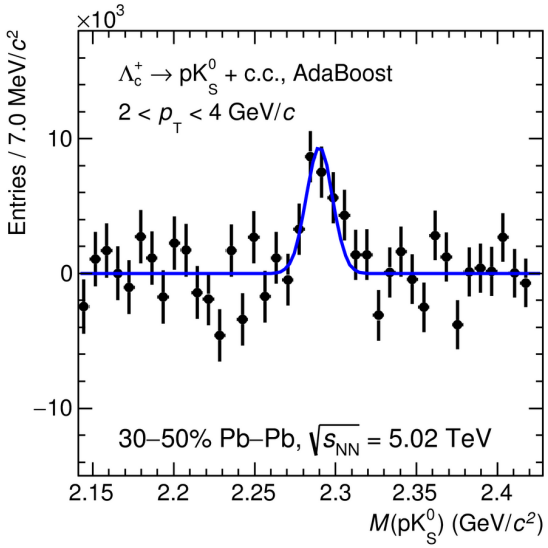


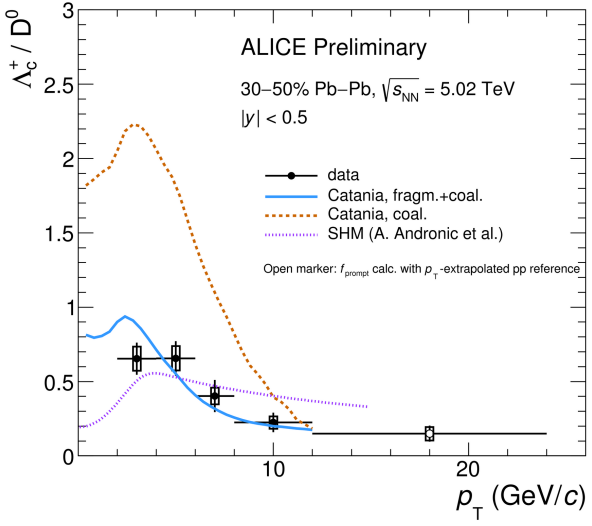
Λ_c

- 2018 data + Machine Learning (BDT)



ALI-PREL-321791





ALI-PREL-321686

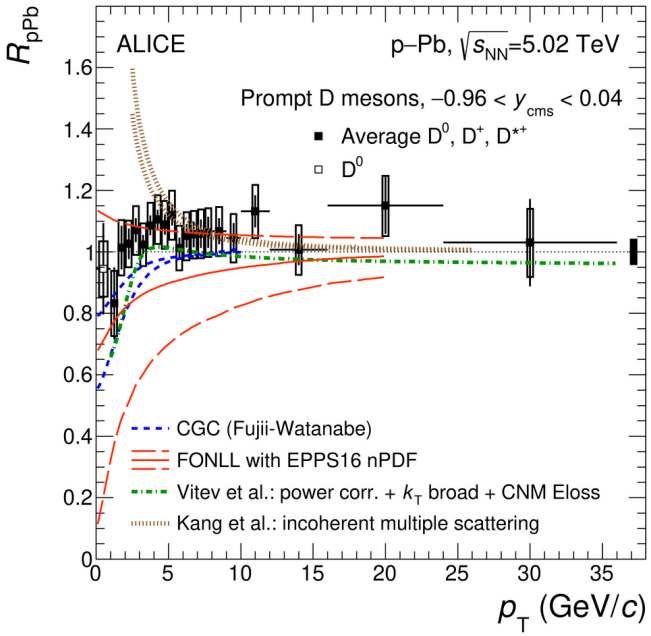
→ important input for hadronisation models

Charm production in p-Pb collisions (i)

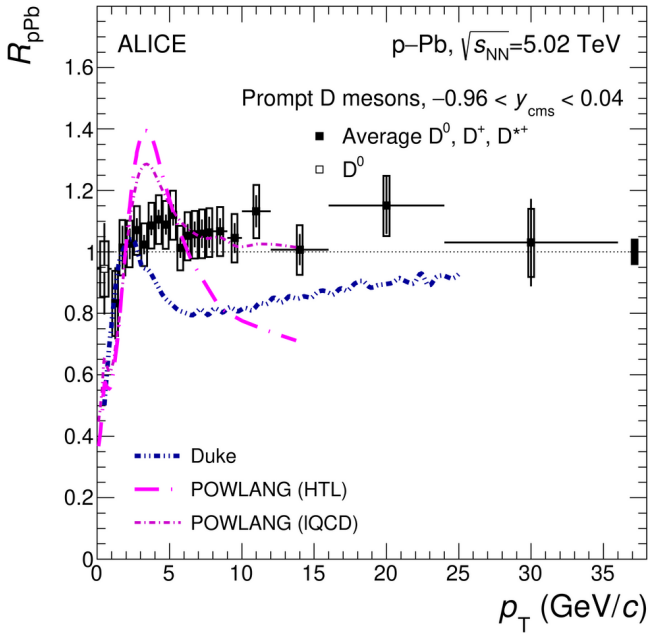
- weak nuclear modification wrt pp

arXiv:1906.03425

models with initial-state modification

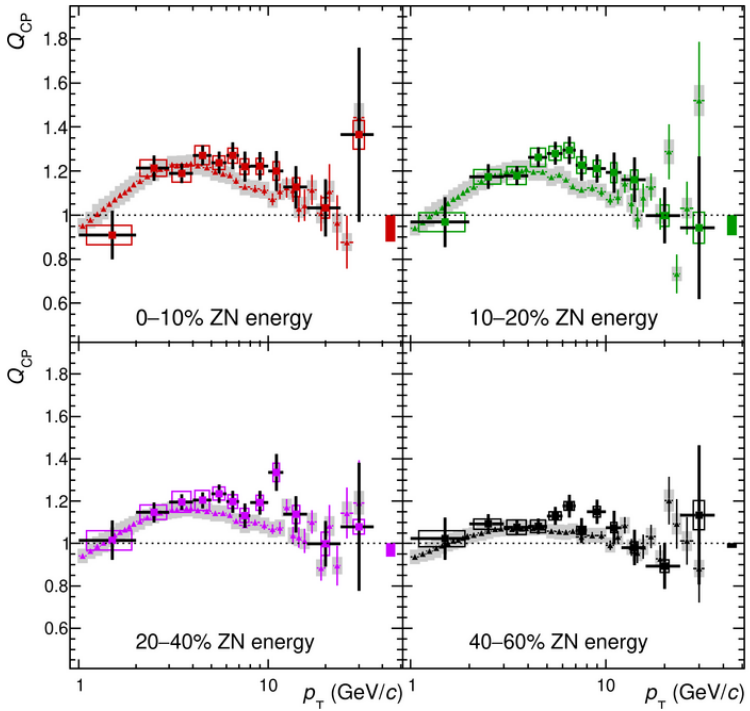


models with final-state modification



Charm production in p-Pb collisions (ii)

- central-to-peripheral



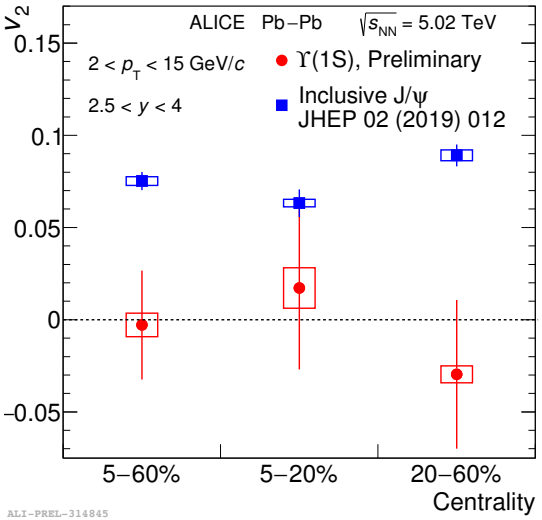
→ radial flow build-up
  – increases for more central collisions

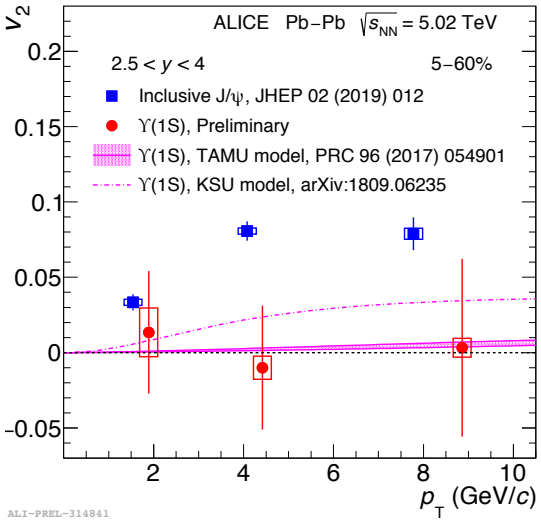
→ similar effect as for h±

arXiv:1906.03425

Y(1S) azimuthal asymmetry in Pb-Pb

- first measurement of bottomonium v_2!





- ... the one that doesn't flow?

- if our understanding of J/ψ correct

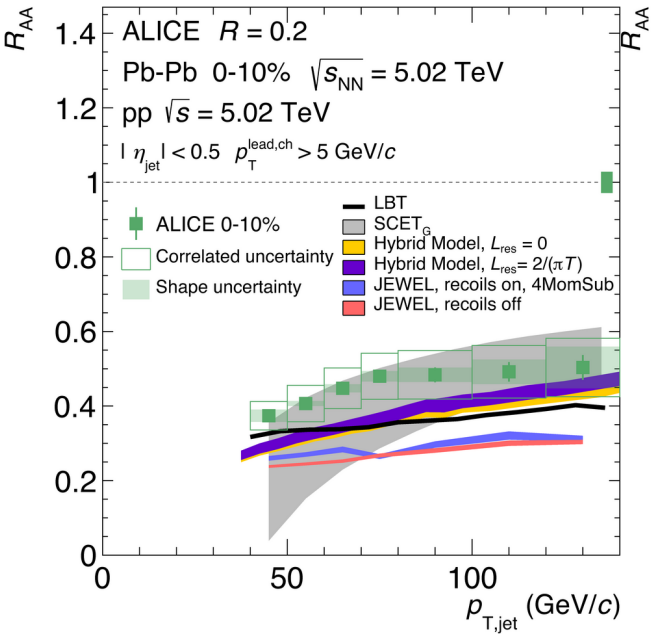
→ expect much less v_2 for Υ
  - higher dissociation T
  - negligible recombination

- this seems to be what we see…

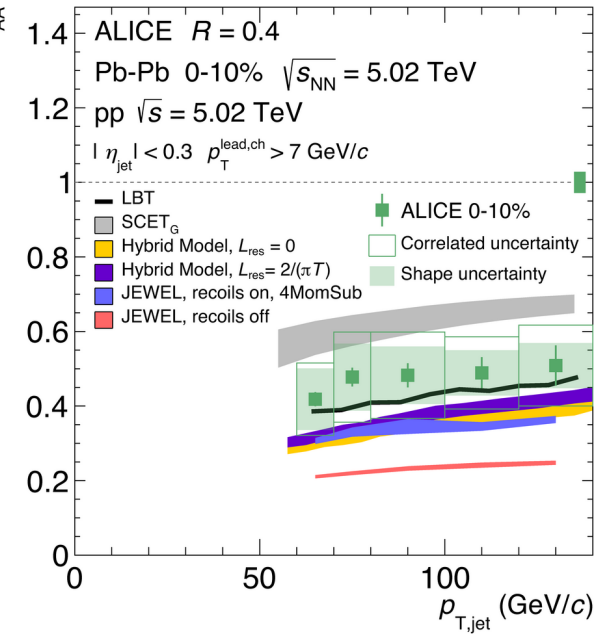
Nuclear modification of jet production

- measurement of nuclear modification at different jet radii

R = 0.2



R = 0.4

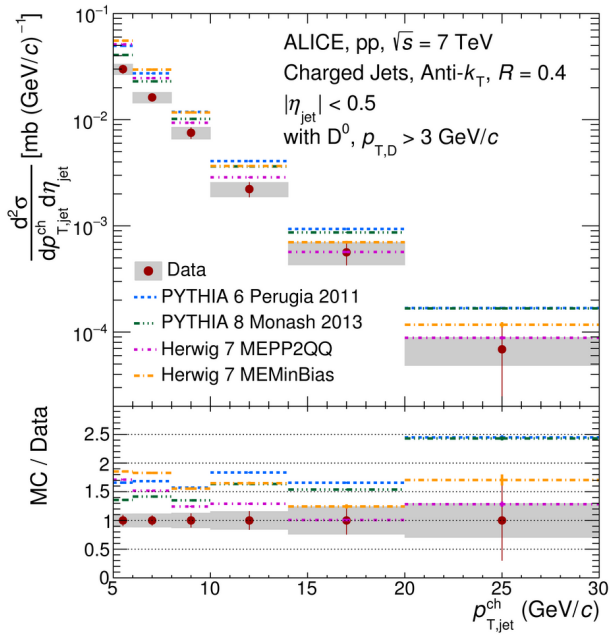


- energy loss
- angular redistribution

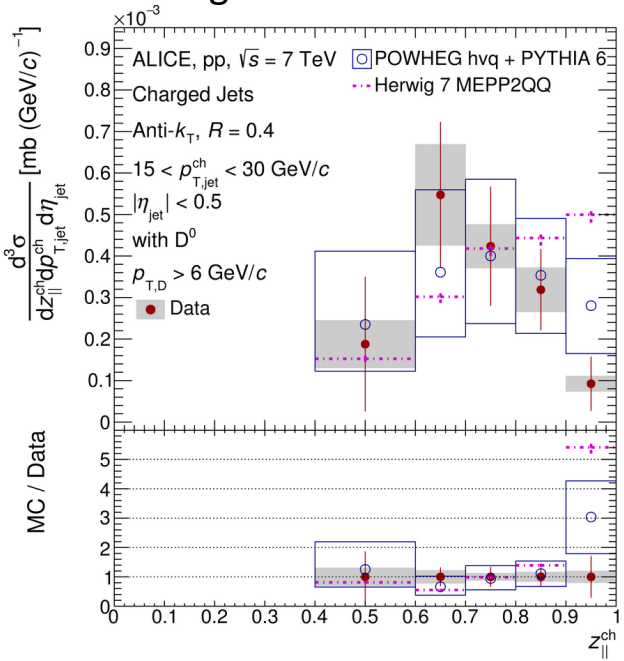
arXiv:1909.09718

Charm jets in pp

p_T spectrum



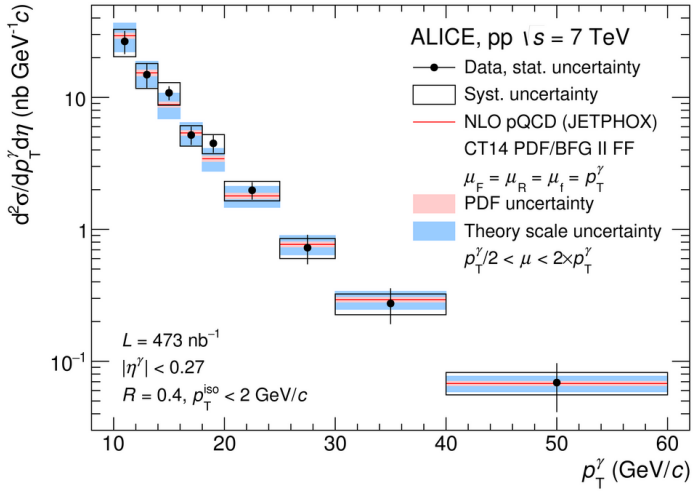
fragmentation function

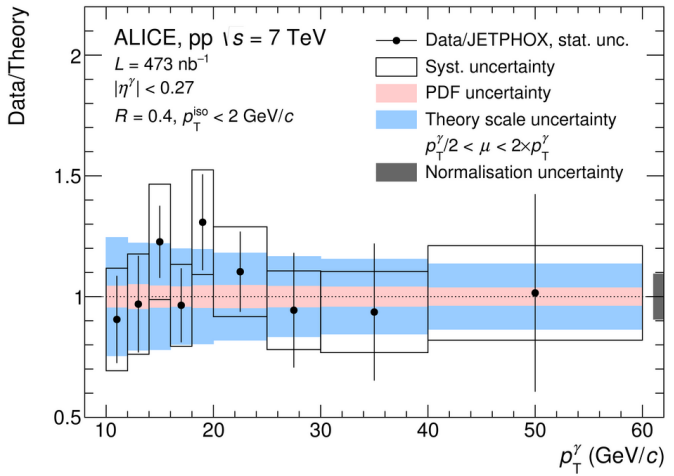


- important reference process
- sensitive to production mechanism (e.g. amount of g splitting to cc)

Isolated direct photon production in pp sqrts=7 TeV

ALICE, arXiv:1906.01371



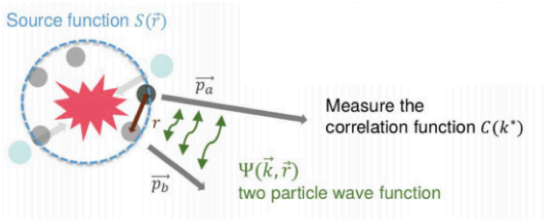


Isolated direct photon production: important reference process in QED/QCD

Challenging measurement; results agree with theoretical expectations

Λ-Λ interaction

- two-particle correlation “femtoscopy”
- sensitive tool
  - source size/distribution
  - interaction potential



Experimental definition ***Theoretical definition***

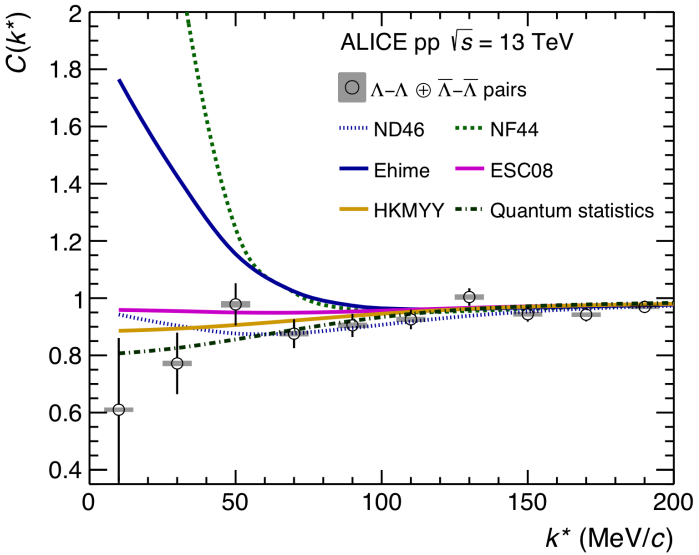
$$C(k^*) = \mathcal{N}\frac{N_{\text{Same}}(k^*)}{N_{\text{Mixed}}(k^*)} = \int S(\vec{r})\left|\Psi(\vec{k}^*,\vec{r})\right|^2 \mathrm{d}^3\vec{r} \xrightarrow{k^*\to\infty} 1$$

>1 : **Attractive** Interaction

<1: **Repulsive** Interaction

Relative distance / reduced momentum in the rest frame of the pair

arXiv:1905.07209

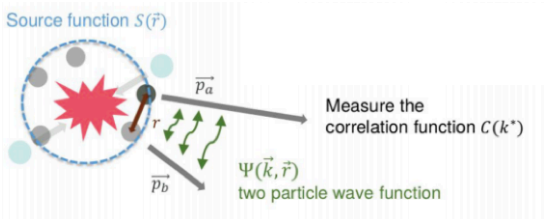


- compatible with shallow attractive potential
- possibly bound state

  → $B_{\Lambda\Lambda}$ = 3.2 +1.6/–2.4 (stat) +1.8/–1.0 (sys) MeV

p-Ω interaction

- two-particle correlation “femtoscopy”
- sensitive tool
  - source size/distribution
  - interaction potential



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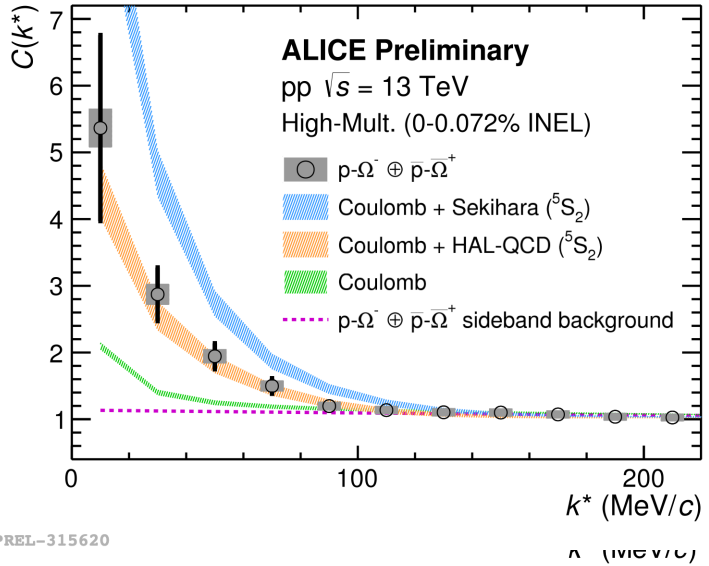

ALI-PREL-315620

- very good agreement with HAL-QCD
- important input for nuclear astrophysics

Quark Matter 2019

- the most important series in our field

- major operation underway
  - 27 talks
  - 90 posters
  - 57 new analyses under approval
  - 18 papers being submitted

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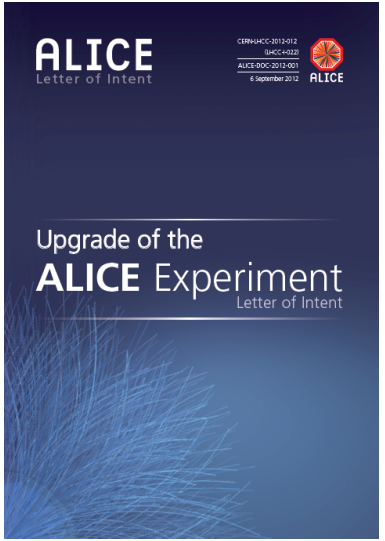
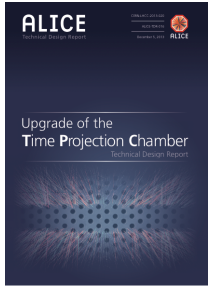
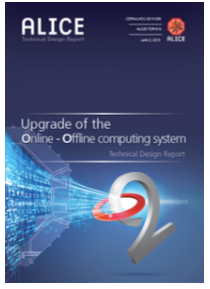
ALICE LS2 upgrades

Main physics goals

- study heavy quark interaction in QCD medium
  → heavy flavour dynamics and hadronisation at low p_T
- study charmonium regeneration in QGP
  → charmonium down to zero p_T
- chiral symmetry restoration and QGP radiation
  → vector mesons and virtual thermal photons (di-leptons)
- production of nuclei in QGP
  → high-precision measurement



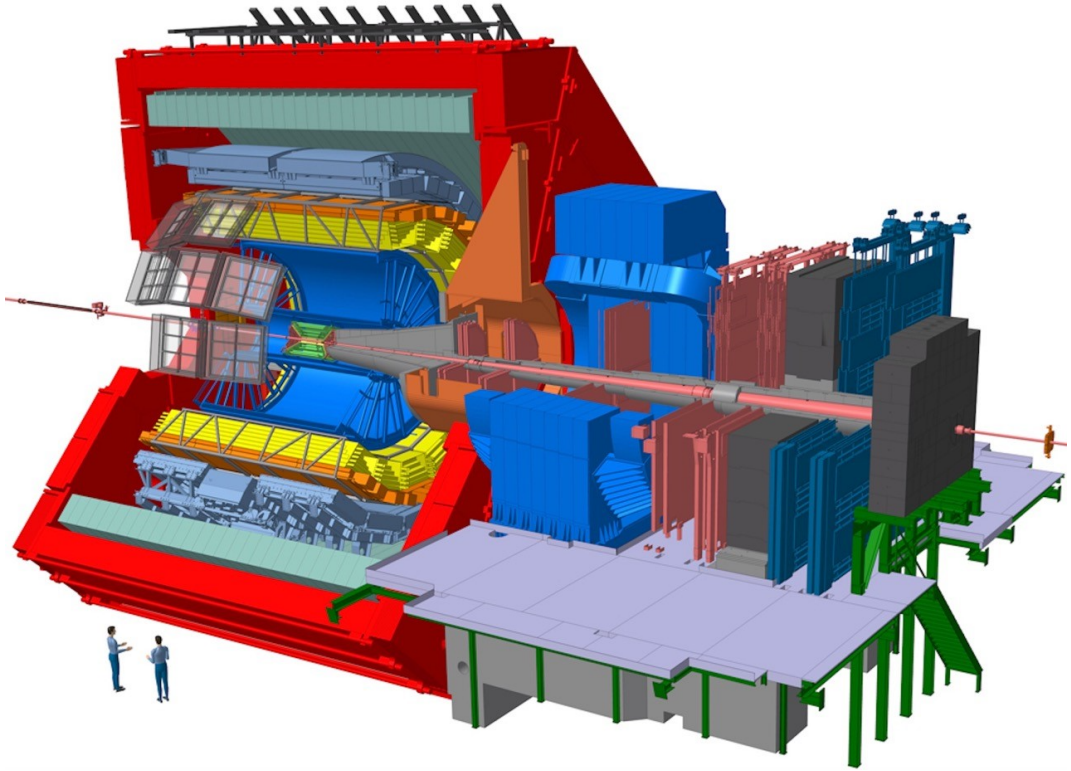




ALICE LS2 upgrades

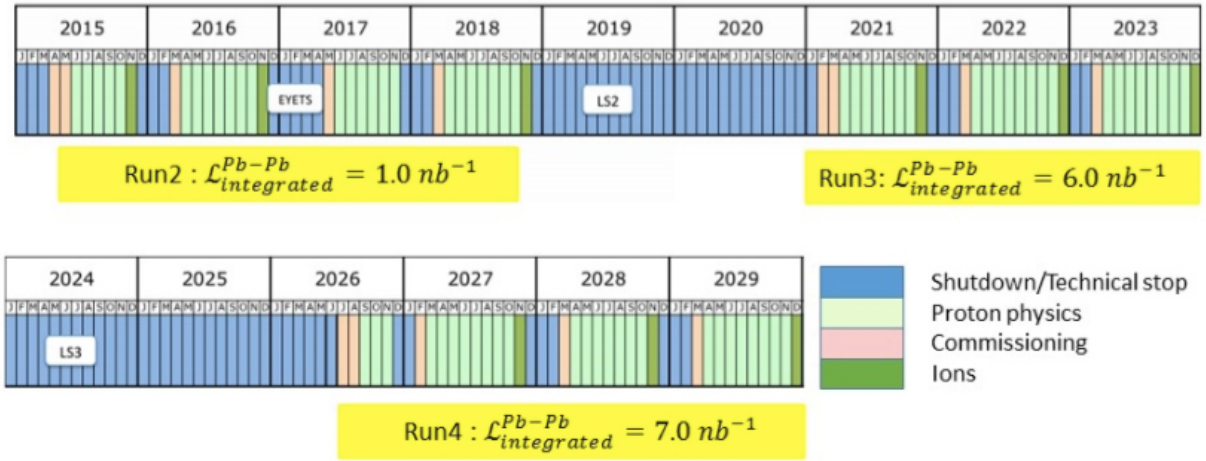
Layout

- New Inner Tracking System (ITS)
  - MAPS: improved resolution, less material, faster readout
- New Muon Forward Tracker (MFT)
  - vertex tracker at forward rapidity
- New TPC Readout Chambers
  - 4-GEM detectors → continuous r/o
- New forward trigger detectors (FIT)
  - centrality, event plane
- Upgraded read-out for TOF, TRD, MUON, ZDC, EMCal, PHOS, new Online-Offline system (O^2)
  - record minimum-bias Pb-Pb data at 50 kHz (currently <1 kHz)



ALICE LS2 upgrades

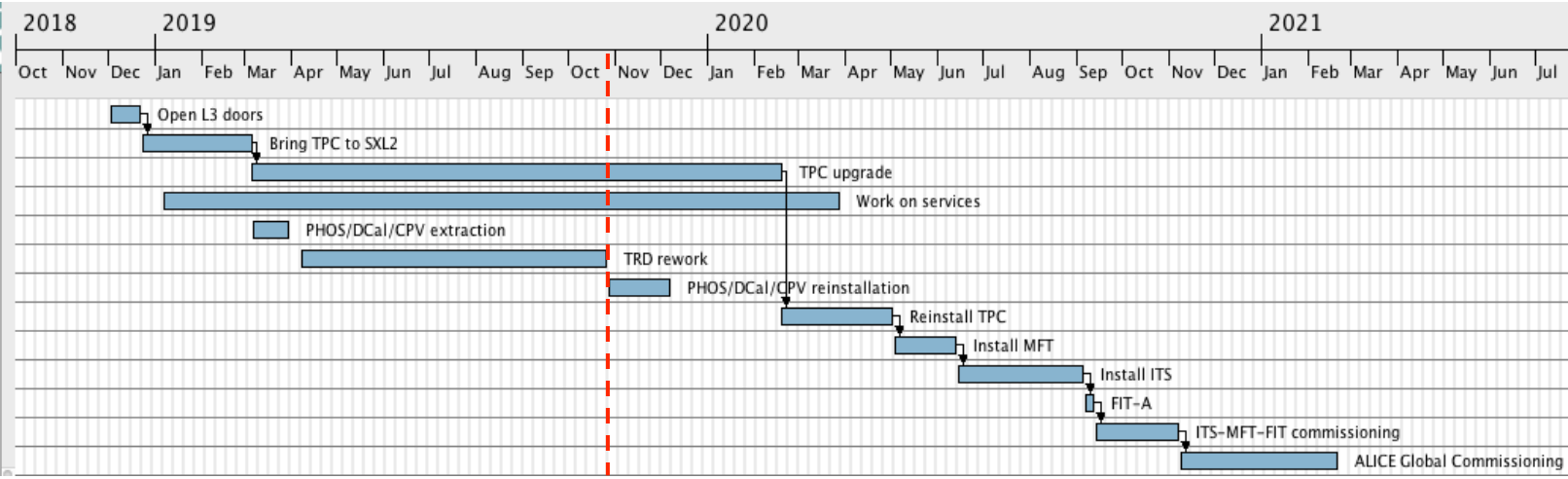
Timeline



- LS2:
  - LHC injector upgrades, Pb-Pb rate → 50 kHz (now ~10 kHz)
  - ALICE upgrades
- Run 3 + Run 4:
  - experiments request > 10/nb (ALICE: 10/nb + 3/nb at 0.2 T)
  - in line with projections from machine group

LS2 masterplan

Begin date	End date	Dur...
3/12/18	21/12/18	15
24/12/18	5/3/19	52
6/3/19	18/2/20	250
7/1/19	27/3/20	320
7/3/19	29/3/19	17
8/4/19	25/10/19	145
28/10/19	6/12/19	30
19/2/20	1/5/20	53
4/5/20	12/6/20	30
15/6/20	4/9/20	60
7/9/20	11/9/20	5
14/9/20	6/11/20	40
9/11/20	19/2/21	75



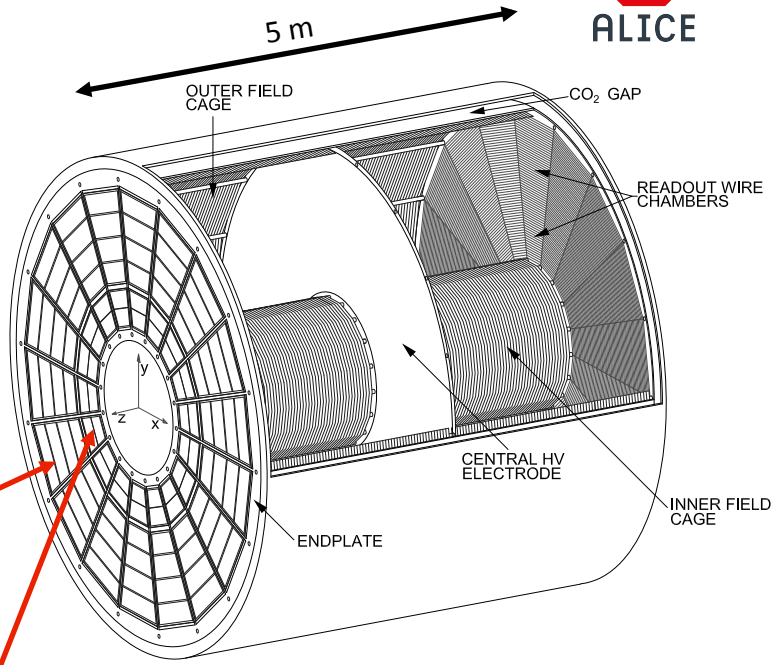
2019: Detector upgrades and Services, 2020: Sequence of detector installation

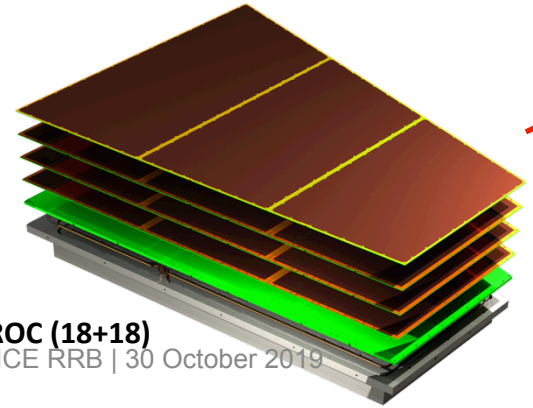
TPC installation:	Feb. 2020
ITS Installation:	Jun. 2020
Global Commissioning start:	Oct. 2020
End of LS2:	22 Feb. 2021

TPC RO chambers upgrade

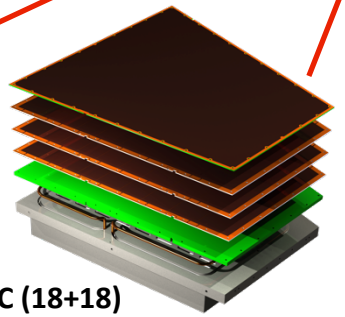
- Goal: replace existing MWPC-based Readout Chambers and Front-End Electronics in LS2 to allow **continuous readout** of Pb-Pb collisions at 50 kHz in RUN3 and 4

- Technical solution: **4-layer GEM** detectors

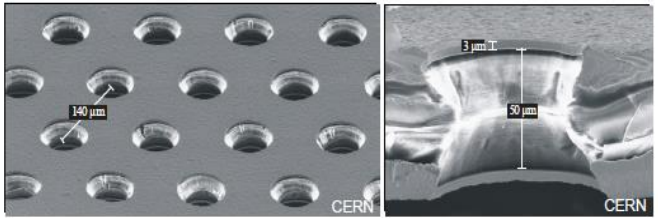




OROC (18+18)



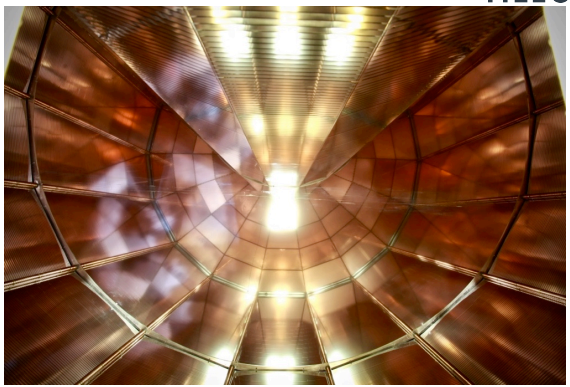
IROC (18+18)

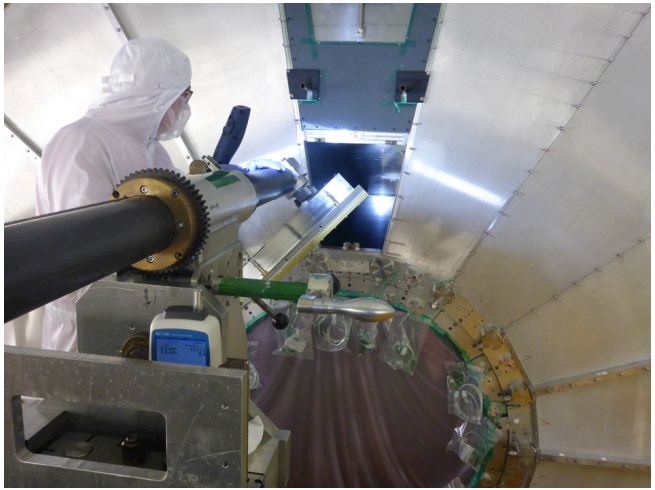


Electron microscope photograph of a GEM foil

GEM Chambers installation

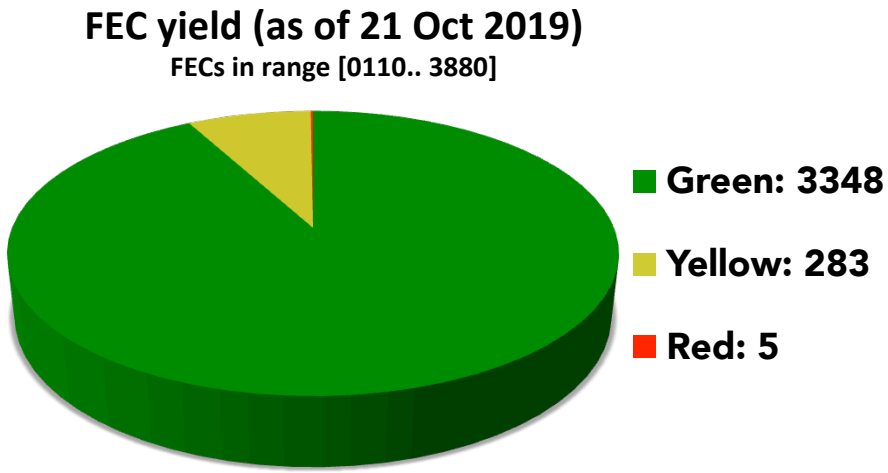
- MWPC decommissioning and GEM installation done
  - completed on 12 September
- survey, shimming, sealing done
- Service Support Wheel installed
- laser and HV systems ready for pre-commissioning





TPC front-end electronics

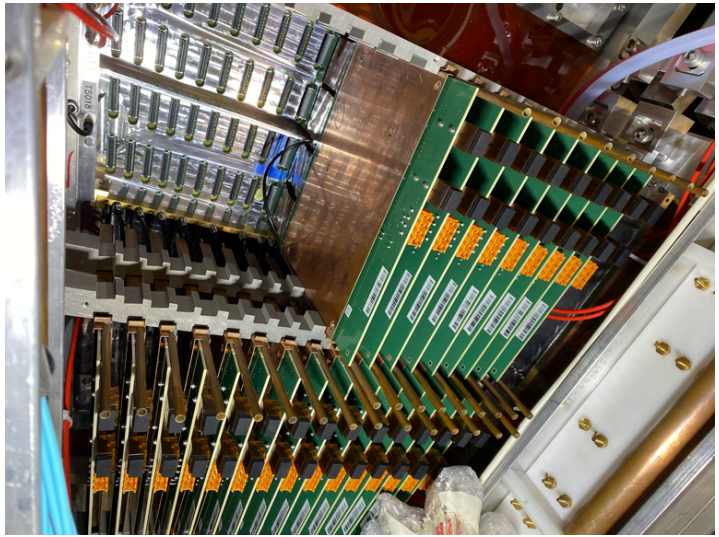
- all FECs received at CERN, prepared for installation



- excellent testing yield: 99.9 % good FECs
  - green + yellow
  - yellow FECs have one non-perfect (fully functional) channel
  - some FECs still to be retested

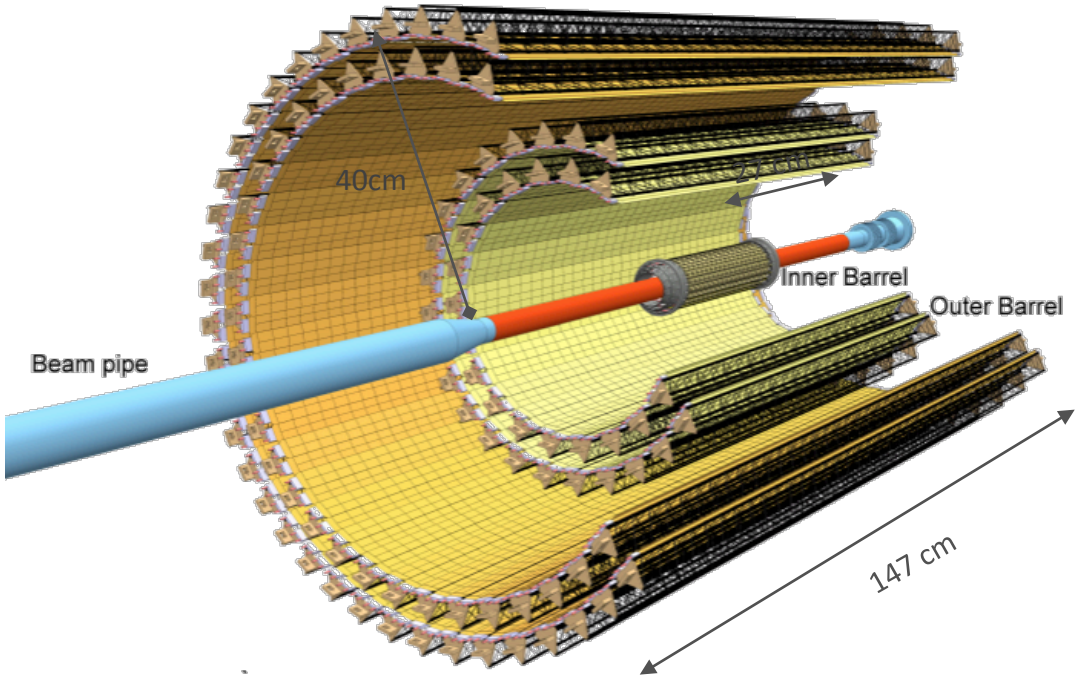
FEC installation

- ongoing according to plan (~ 3 sectors/day)
- completion expected by 15 November



- then pre-commissioning
  - cosmics, laser, pulser, X-ray

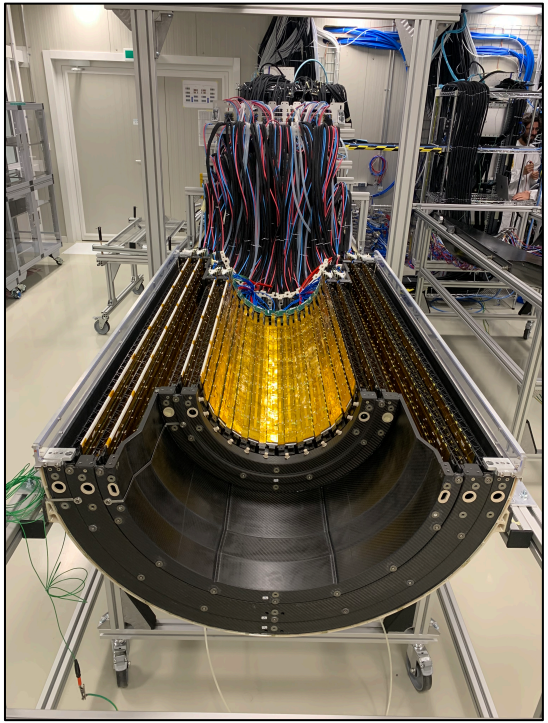
ITS Upgrade

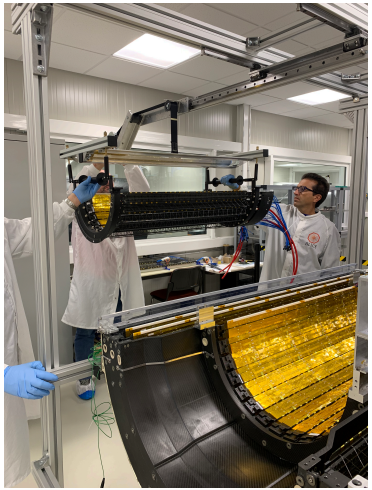


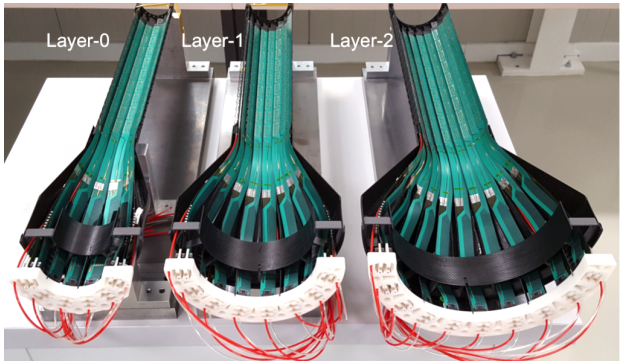
Based on MAPS

- 7-layer geometry (23 – 400mm), $|\eta| \leq 1.5$)
- 10 m^2 active silicon area (12.5 G-pixels)
- Pixel pitch 28 x 28 μm^2
- Spatial resolution ~5μm
- Power density < 40mW / cm^2
- Material thickness: ~0.3% X_0/ layer (IB)
- Max particle rate: 100 MHz / cm^2

Half-layer and half-barrel assembly



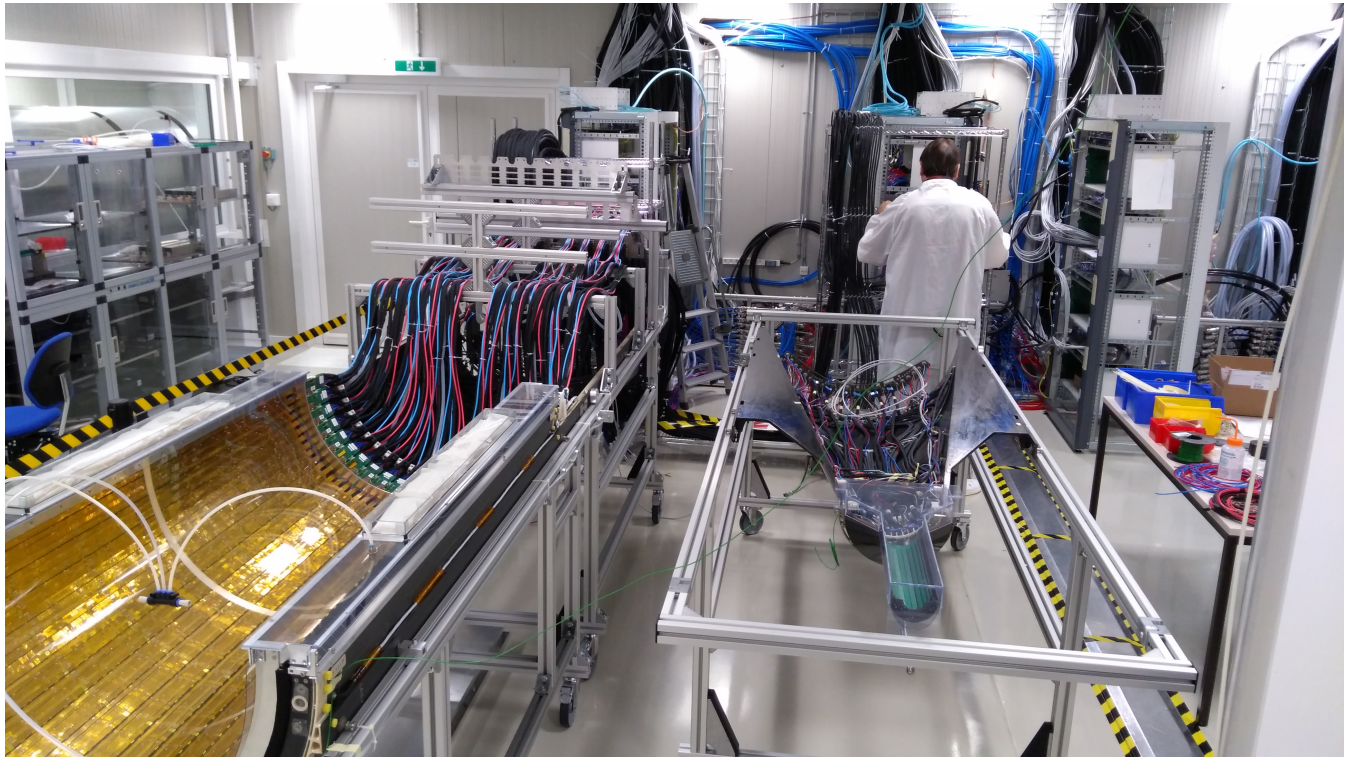




		Inner Barrel			Outer Barrel			
		Layer 0	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6
1st Half-Barrel (Top)	Half-layer assembly	Done	Done	Done	Done	Done	Done	Done
	Half-barrel assembly	Done	Done	Done	Done	Done	Done	Done
2nd Half-Barrel (Bottom)	Half-layer assembly	Done	Done	Done	Done	Done	Done	Done
	Half-barrel assembly	Done	Done	Done	Week 48	Week 46	Done	Done

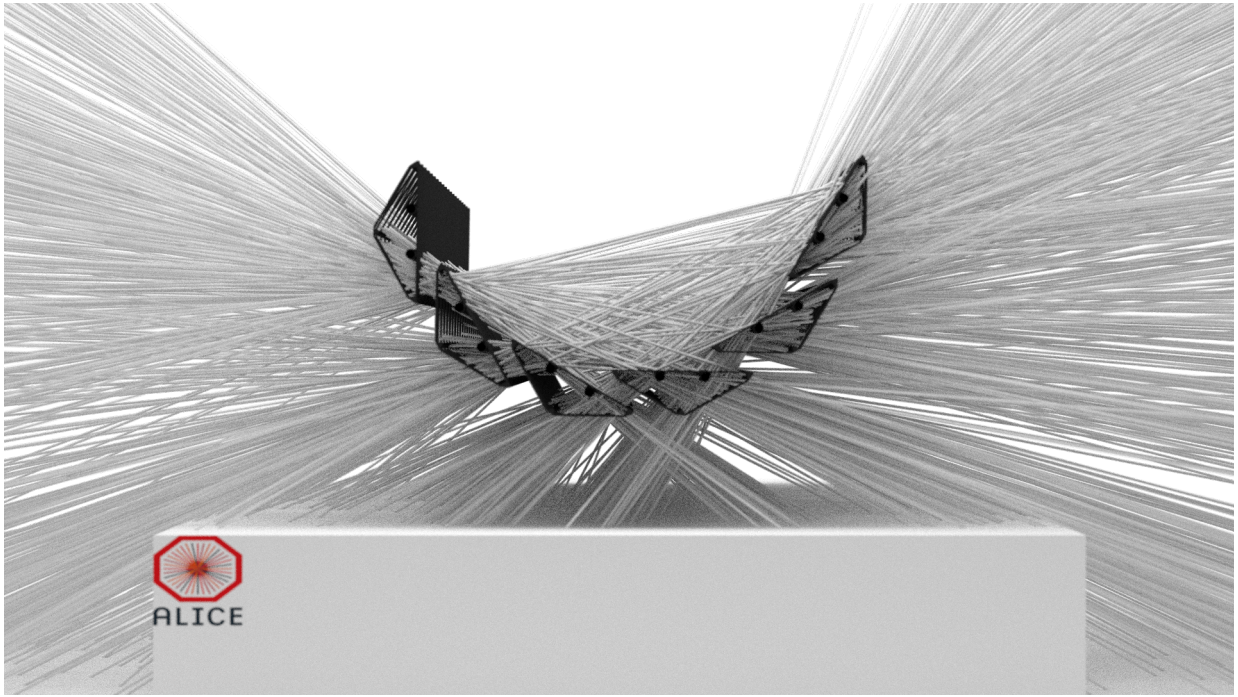
Integration and commissioning

- ongoing, 24/7 shifts since May, large effort by all participating institutes

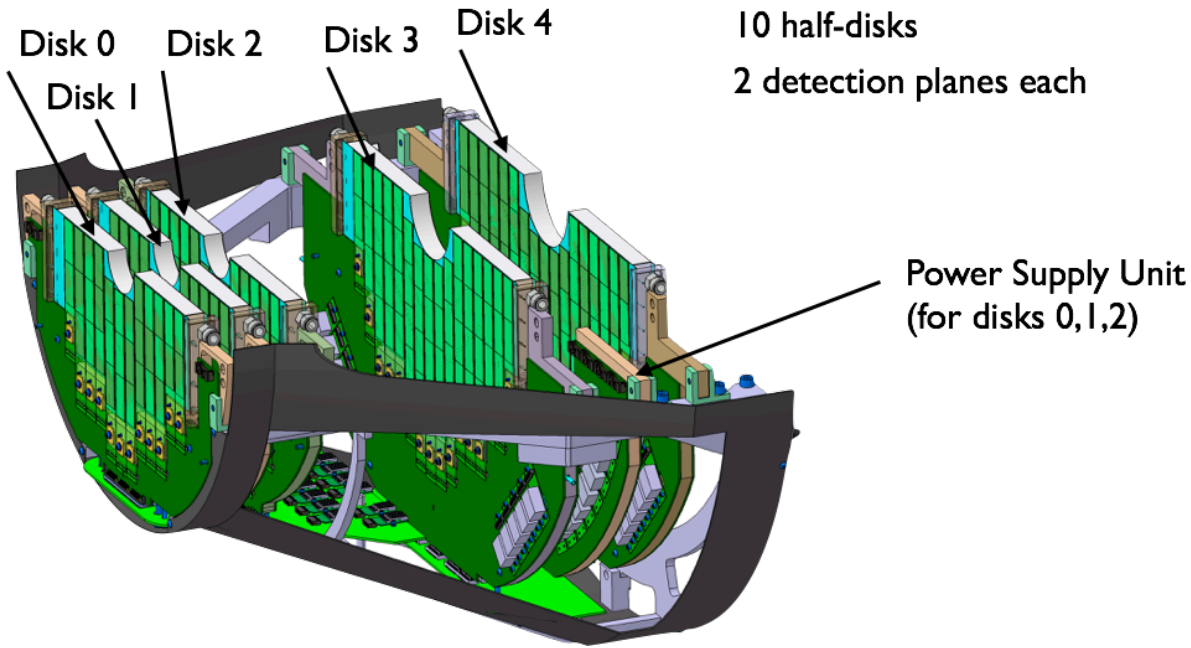


Cosmics!

- ~ 10 hours of data taking

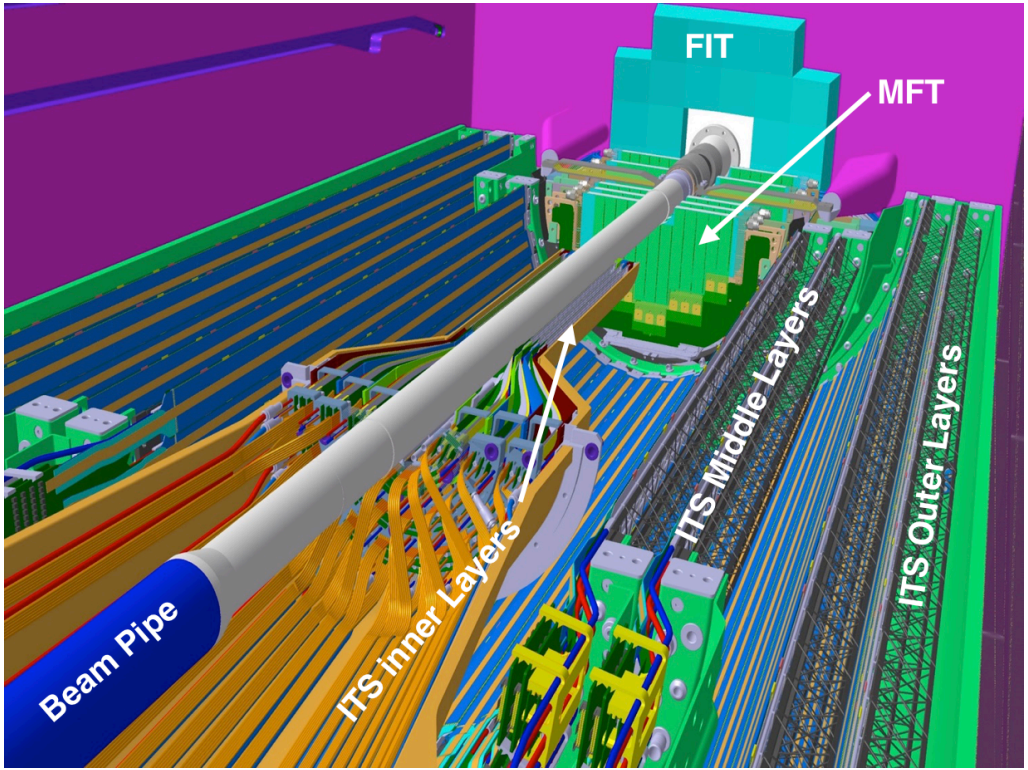


New Muon Forward Tracker

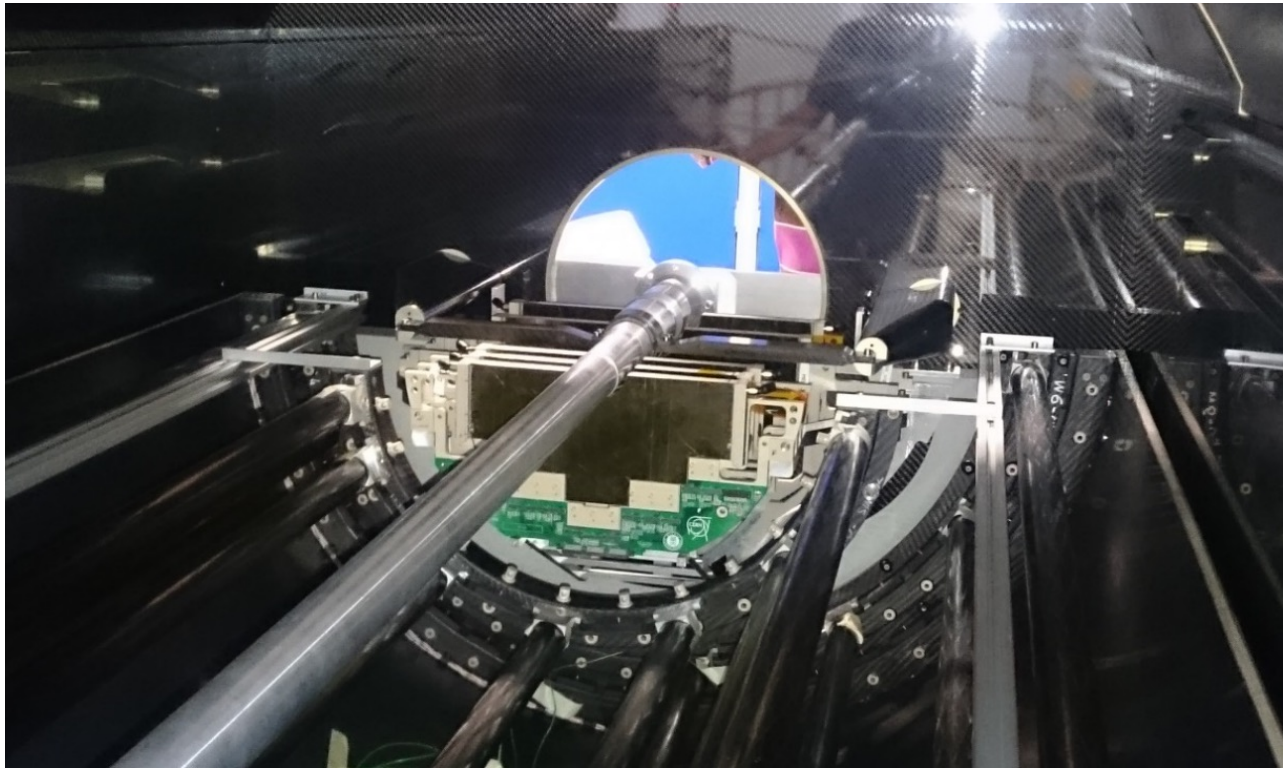


- new Si pixel tracker
  - same technology as ITS
- in front of muon absorber
  - $2.45 < \eta < 3.6$
- 0.7% X_0 per disk
- 280 ladders
  - 2 to 5 sensors each
- 928 pixel sensors (0.4 m^2)
  - ~ 5% of ITS surface

MFT: from design…

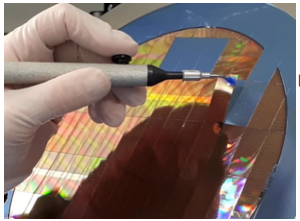


MFT: from design… to the real object

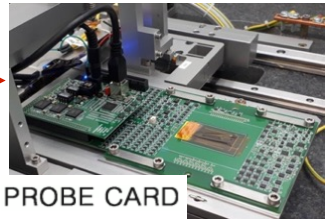


MFT disk production in a nutshell

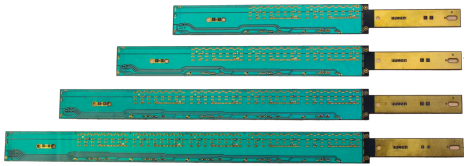
Chip Picking



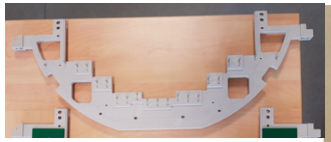
Chip testing



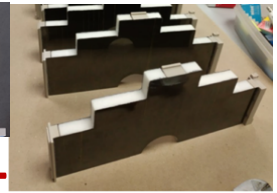
Flexible Printed Circuits



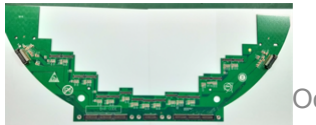
Disk support



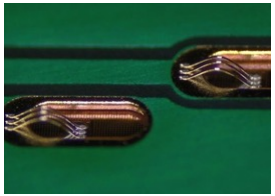
Heat Exchanger



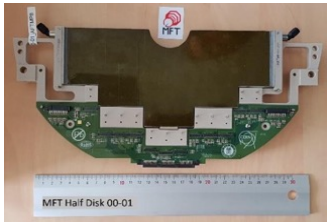
Disk PCB



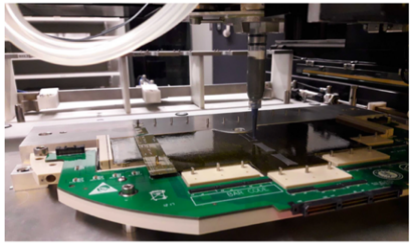
Wire Bonding

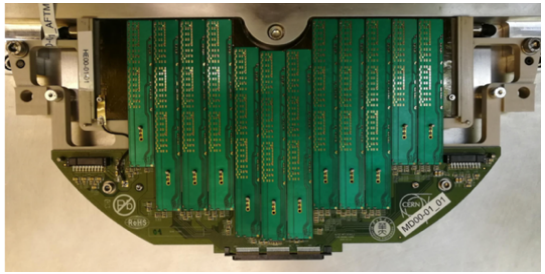


Mechanical disk



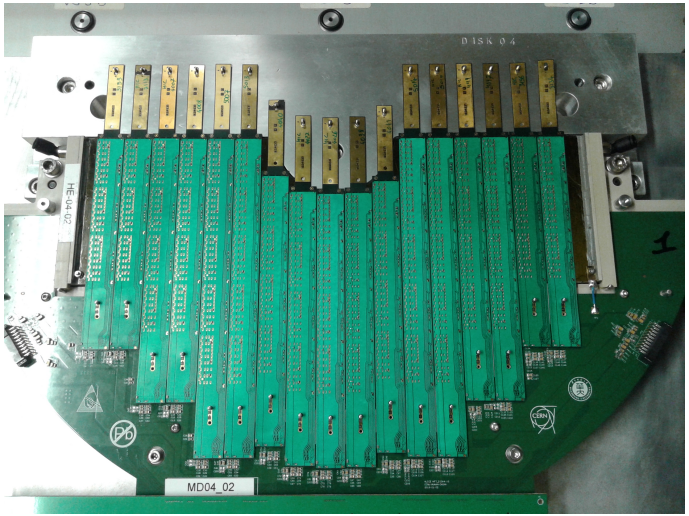
Ladder glueing on the disk

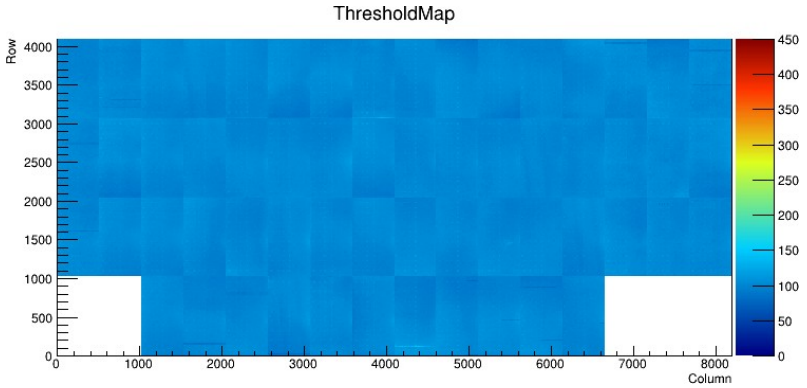




MFT production status

- Ladder production: 76%
  - ~ 10 ladders per week
  - ~ 90% yield
  - to be completed by December
- Disk production: 6 out of 10
  - to be completed by December
- commissioning
  - ongoing at CERN
  - very low noise (< 5 e^-)
  - good threshold uniformity
  - first integration test with FIT OK

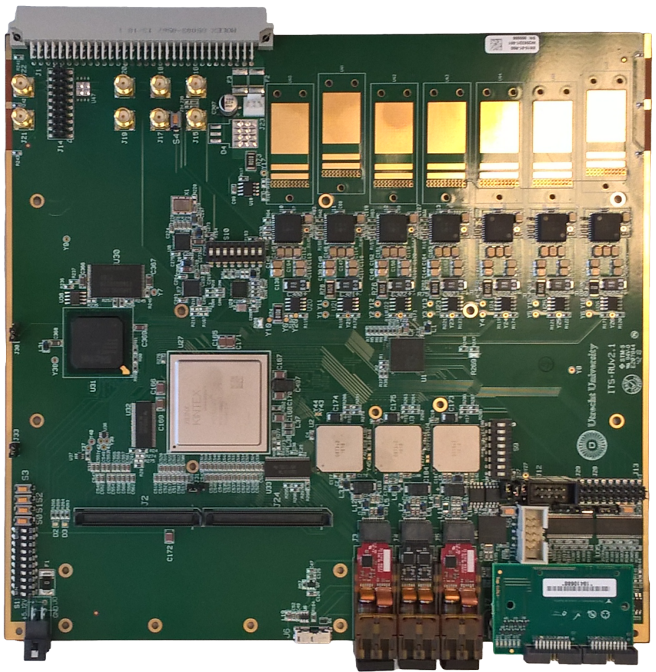


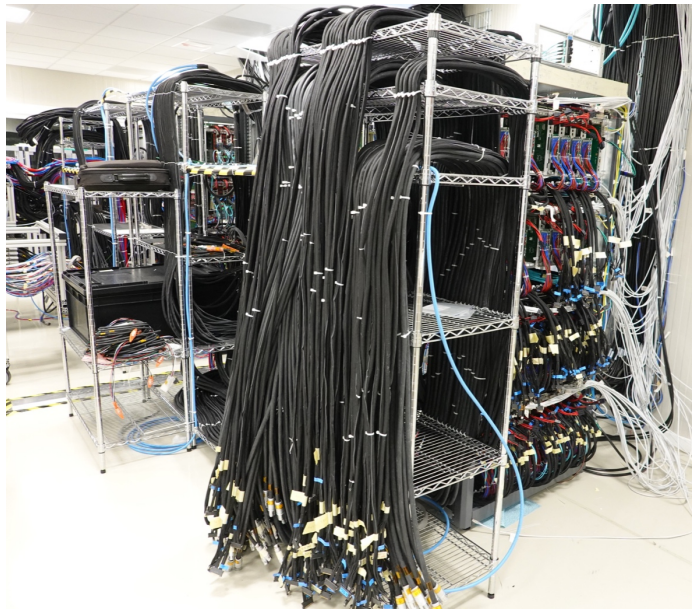


ITS/MFT readout electronics

All 288 ITS/MFT read-out units RU2 have been produced and tested at Nikhef

Full chain surface tests including front-end, 16 CRUs, 8 FLPs and CTP/LTU



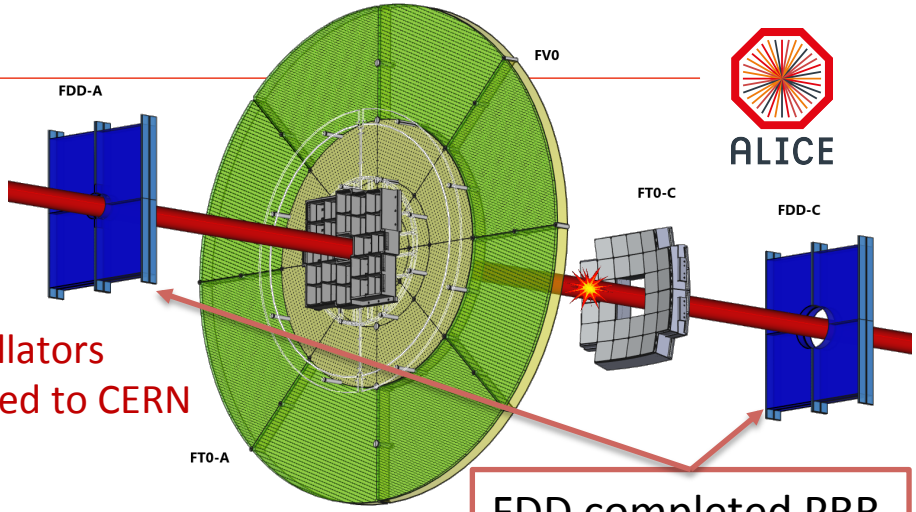


Fast Interaction Trigger

FIT consists of: FT0, FV0 and FDD

← FV0 frame ready

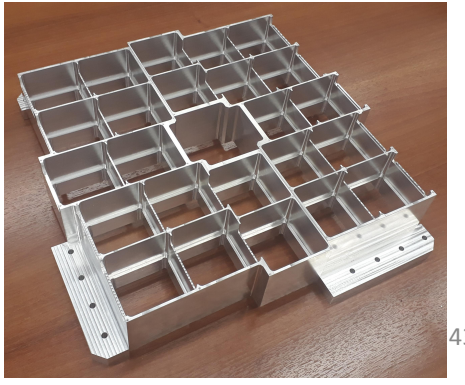
← scintillators shipped to CERN



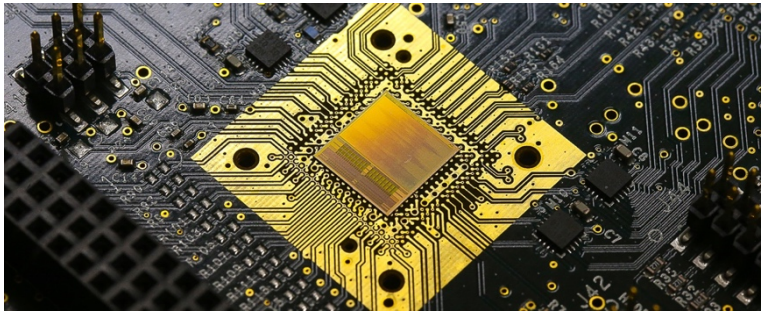
FDD completed PRR on 16 Oct 2019

← FT0-C on MFT support

FT0-A frame ready for assembly →

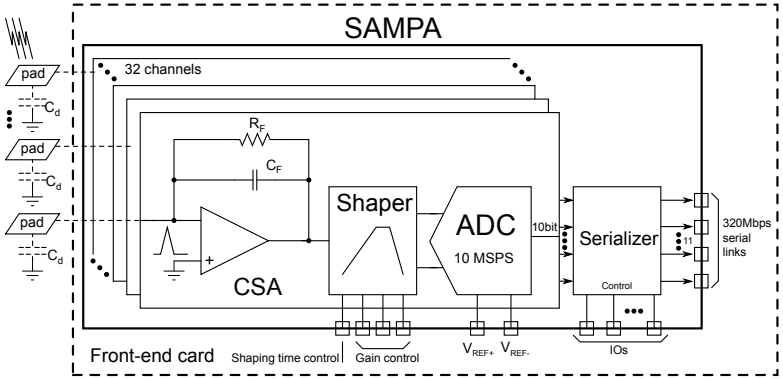


SAMPA – TPC/MCH front-end ASIC

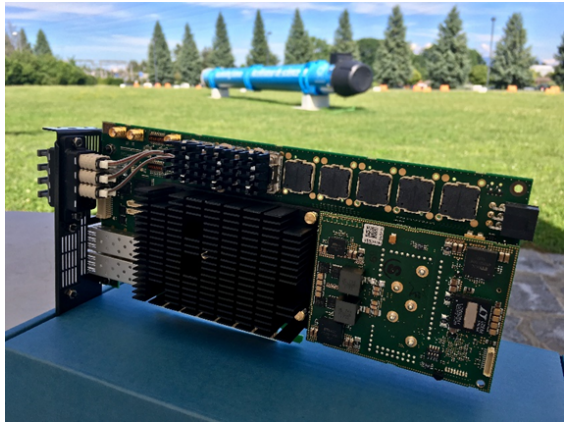


Production of 80000 ASICs finalized

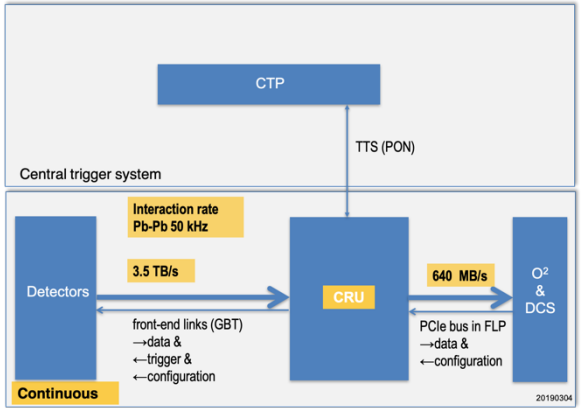
- Fully automatic test system, >75% yield
- Implemented in 3500 TPC front-end cards (all tested)
- Implemented in 19000 MCH front-end cards (pre-series produced and tested)
- Excellent performance
  - Will also be used by STAR, sPhenix, NICA

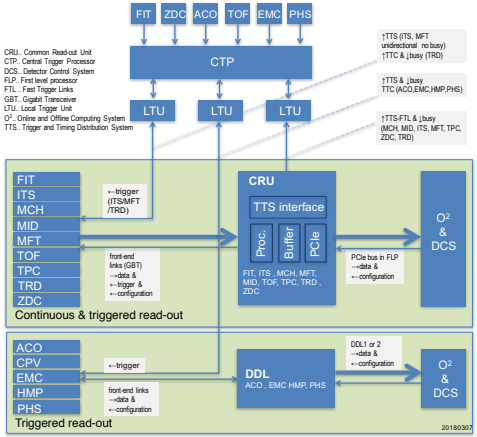


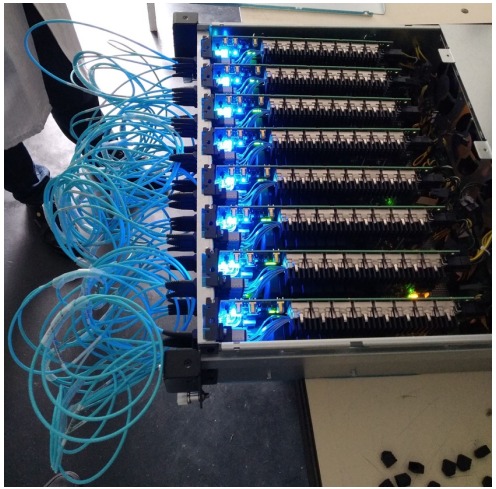
Common read-out unit (CRU)



- 232 CRUs (out of 540) already produced and tested
  - Yield > 99%
- Full system integration of CRU: FE– CRU – FLP – CTP/LTU
  - ITS, MCH, MFT, MID, TOF, TRD, TPC







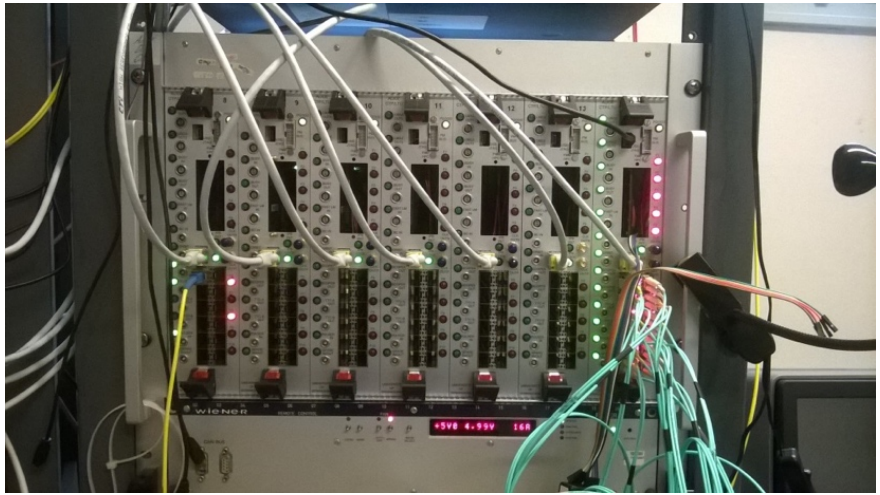
TPC CRU procurement

- CRU developed in collaboration between ALICE (CERN, Hungary, India) and LHCb
  - 540 cards needed for ALICE, 700 for LHCb
- the procurement of 390 CRUs for the TPC is part of the Indian contribution to ALICE
  - Addendum 41 to the ALICE MoU, CERN-RRB-2016-002
- original plan: issue production order for the TPC part to an Indian company
  - attempted a few times, but never converged, mostly for administrative reasons
- to ease time pressure on Indian order, which had already been delayed, in agreement with Indian authorities, in March 2018 a partial order for 100 TPC CRUs was put forward to the French company producing the rest of the CRUs
- the last attempt to issue a production order in India for the remaining 290 TPC CRUs failed in July
- in August, we requested the Indian authorities to transfer to an ALICE account at CERN the funds to issue the rest of the order to the French company
- requests to the same end were reiterated by the CERN management

TPC CRU procurement

- the latest moment to place the production order to the French company in time not to delay the ALICE commissioning was mid-October
- by the second week of October, not having yet received a commitment to the transfer of funds from the Indian authorities, we asked the CERN management for the authorisation to move ahead with the production order anyway
- we count on the Indian authorities to honour their MoU commitment
  - in case of failure, the ALICE CB would have to seriously consider the position of individual institutions
- as an extreme risk-management measure, we proposed a scheme in which we would cover the purchase of the TPC CRU making partial use of the funds that are being accumulated for the replacement of online computers
  - this would imply that in 2026 we would only be able to replace about 3/4 of the computers

Central Trigger Processor (CTP)

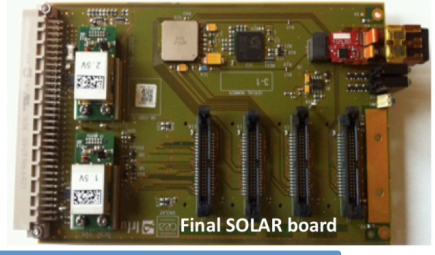


Production started

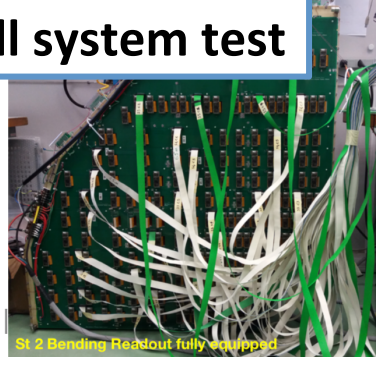
- Batch I (28 units) delivered and in operation
- Batch II (31 units) production Q4/2019
- CTP/LTU HW/FW/SW in full system qualification tests with largest detectors
  - Front-end – CRU – FLP – CTP/LTU
  - ITS, MCH, MFT, MID, TOF, TRD, TPC

Muon chambers (MCH)

FLEX+DualSAMPA



Full system test



Front-end card – DualSampa (19000 x)

- 1700 cards produced and tested
  - sufficient to equip first installed chambers
  - mass production started 07/19
  - 1st batch of 800 end 10/19, then each week 800 until 03/20

Read-out card – SOLAR (624 x)

pre-series (25) produced and validated 06/19

mass production launched 06/19,

first 150 received 07-09/19 (sufficient to equip Ch 5)

next batches 150 per month until 12/19

Passive components

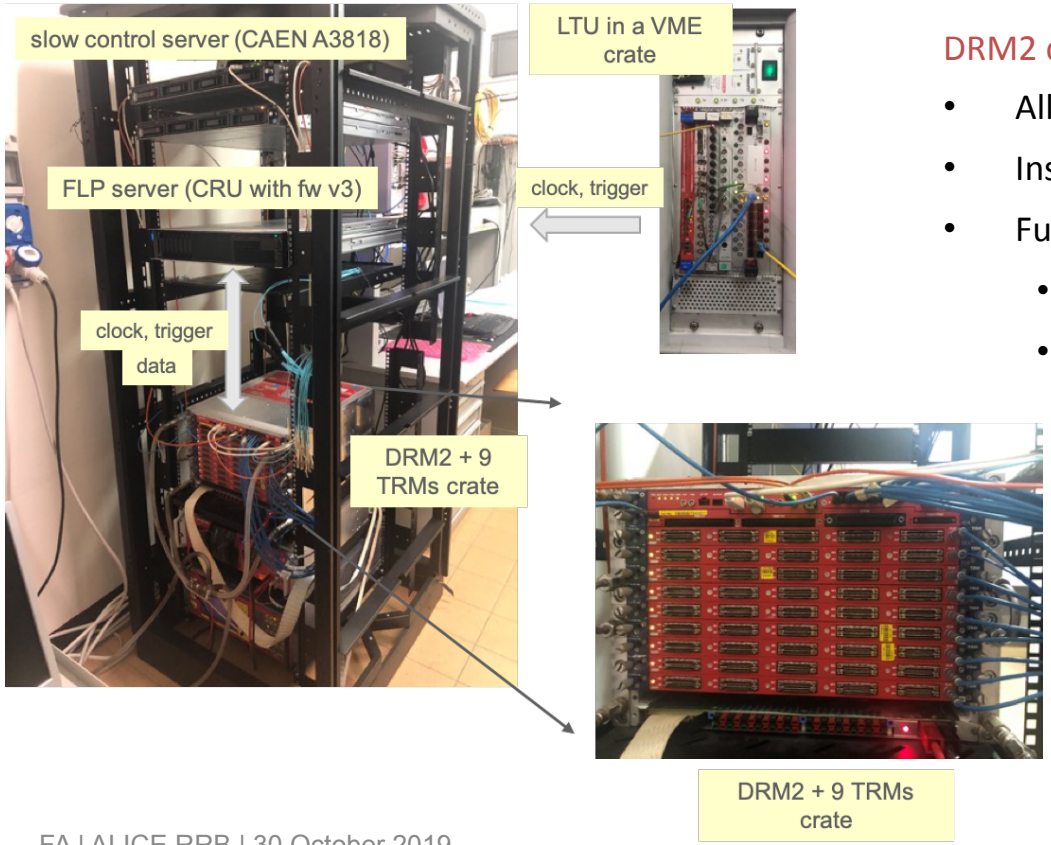
Flex hybrid (3270): mass production finalized

Large PCB: most types tested, production started

Full system tests ongoing

- Including chambers & read-out chain (1 FLP & 2 CRUs)

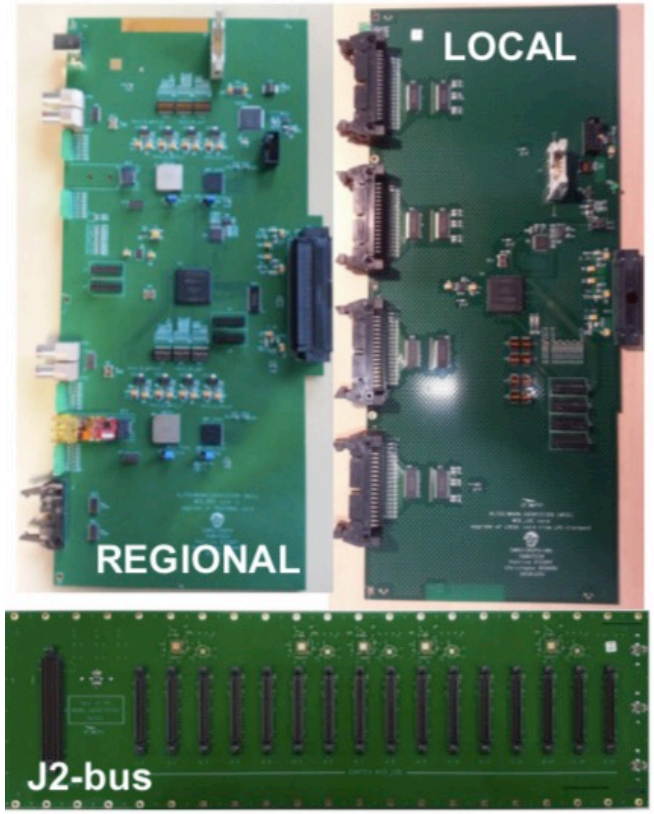
Time-of-flight detector (TOF)



DRM2 card (72 x)

- All cards produced and tested
- Installation in ALICE started
- Full system read-out setup
  - Including CTP & CRU
  - Full read-out sequence (HB frame) validated with CRU & LTU & O2 SW

Muon Identifier (MID)



Regional cards (16 x), local cards (234 x)

20 local & 3 regional pre-series card in system test

Full crate and stress test validation completed

Local card series production (280) under way

Regional cards: pre-production (3) 10/19, remaining 11/19

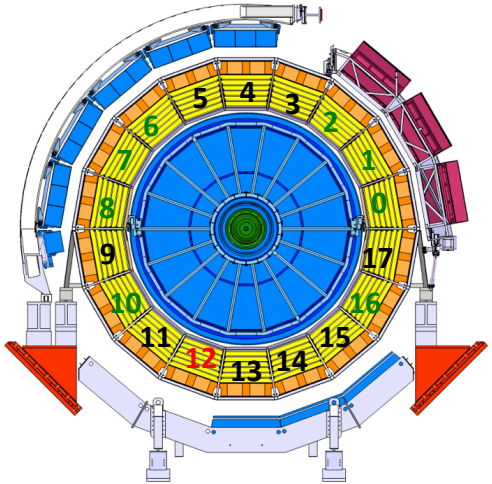
Cavern installation 04/20

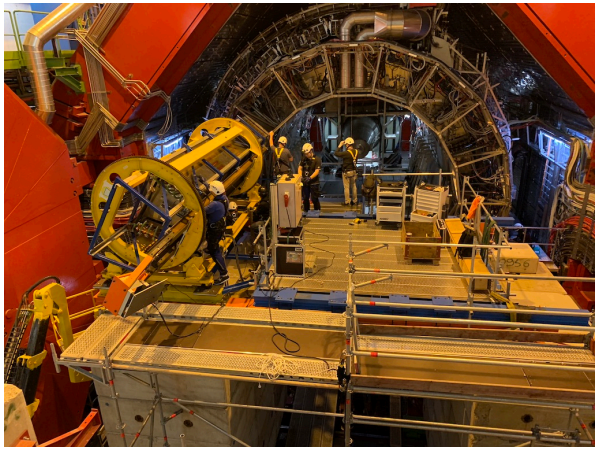
TRD rework

- 9 modules in total (50%)
- HV repair: remove broken HV capacitors
- LV rework: modify LV patch panel

TRD 0, 1, 2, 6, 7, 8, 10, 16 done

TRD 12 will be reworked in December (w 49,50)





TRD7 reinstallation last week

O^2 System

- focus on rare, soft probes
  - → non-triggerable (low S/B)

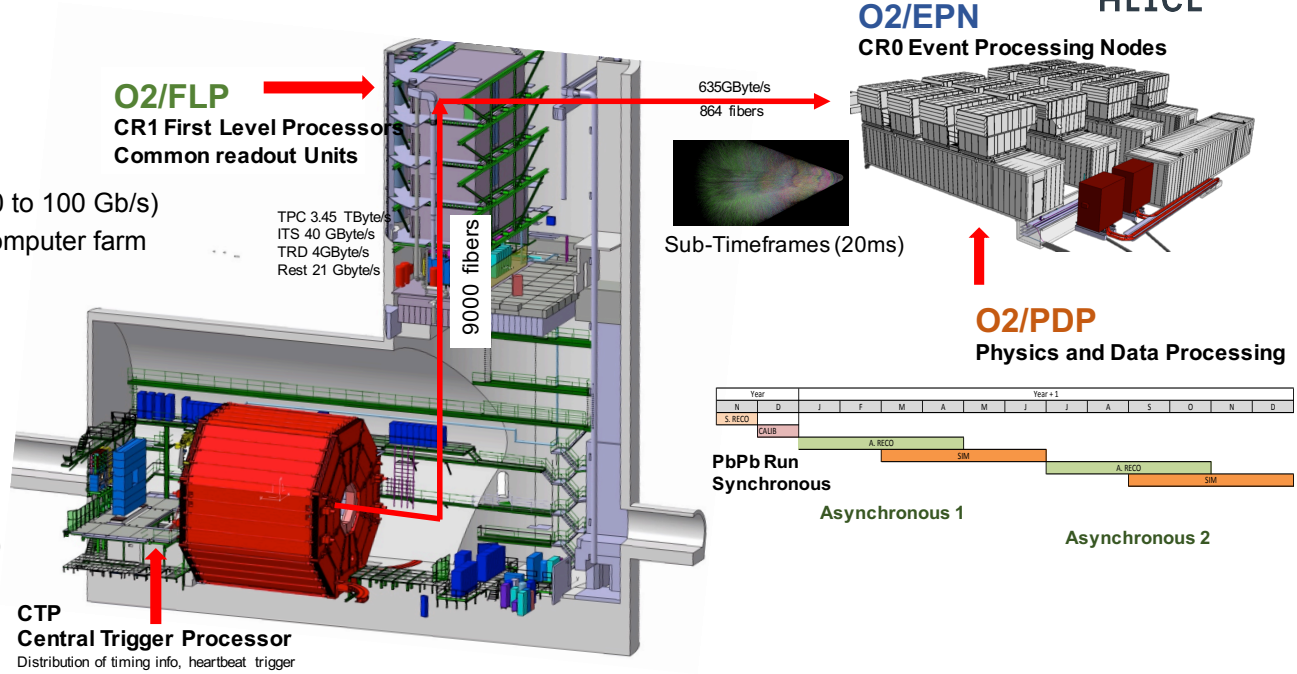
→ continuous readout

  - significant compression needed (500 to 100 Gb/s)
  - online reconstruction in dedicated computer farm

organised in 3 projects:

- First Level Processors (FLP)
  - PL: Pierre Vande Vyvre (CERN)
- Event Processing Nodes (EPN)
  - PL: Volker Lindenstruth (FIAS)
- Physics and Data Processing (PDP)
  - PL: Andreas Morsch (CERN)

reporting to Technical Coordination



FLP

January - July | August-October | October-December

Hardware

✓ **Qualification done**

3 candidate servers selected
Qualification criteria
- Compatibility with up to 3 CRUs
- Input bandwidth: 110 Gb/s per PCIe
- Input+output bandwidth 87 Gb/s
- Data flow and processing 60 Gb/s
  Max. data flow with CPU 100% busy
- Cooling adequate for CRU
  (airflow 3 m/s min.)

Procurement of 206 FLPs in progress

Delivery in 3 batches:
- Batch 1: 16 nodes for acceptance test
  Acceptance OK on October 9th
- Batch 2: 150 nodes deliveredd to CERN on October 25th
- Batch 3: 40 nodes in November

Installation

Final FLPs for detector tests
Already installed
- TOF: 1 FLP with 2 CRUs
- MCH: 1 FLP with 3 CRUs
In progress
- CPV
- HMPID: FLP with 3 C-RORCs
- EMCAL: FLP with 2 CRORCs

Software

✓ **FLP Suite 0.1 - 25 July**

Gitlab software repository
System provisioning and installation
- Server provisioning using Foreman
- All roles defined in Ansible
- Automatic installation and configuration

System logging
System monitoring
Data flow:
- CRU read-out

Quality Control (QC)
- Custom sampling conditions

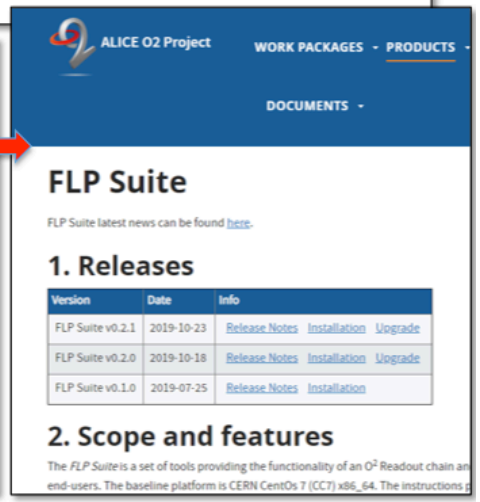
Control
- Readout + QC workflow

✓ **FLP Suite 0.2 - 18 October**

Release notes, installation and upgrade available online

Data flow
- Performance improvements
- Monitoring improvements

Quality Control
- Simpler data sampling syntax
- Workflow merging



EPN

- all four IT-containers delivered and installed
- full load tests performed with static load scenario and fixed internal fan speed
- test in November with dynamic load scenario
  - fans to be steered by updated control system
- first IT load to be installed in November
  - ~ 130 Run 2 servers for testing
- fibres installed
  - connectivity to Meyrin, CR1
- first part of Infiniband network delivered
  - to be installed, tested first half of November

PDP (i)

- **reconstruction**
  - successful Barrel Tracking EDR in June 2019
    - Out-of-barrel Tracking EDR in December
  - tests on AMD GPUs ongoing

- **simulation**
  - successful GRID tests including parallel simulation on multiple cores and HPC
    - prototyping use of opportunistic High-Performance Computing resources
  - Monte Carlo-to-Monte Carlo embedding successfully tested in Run2 productions
  - Geant4: optimisation of physics lists and physics validation finalized
    - working on computing time optimisation (example VecGeom integration)

PDP (ii)

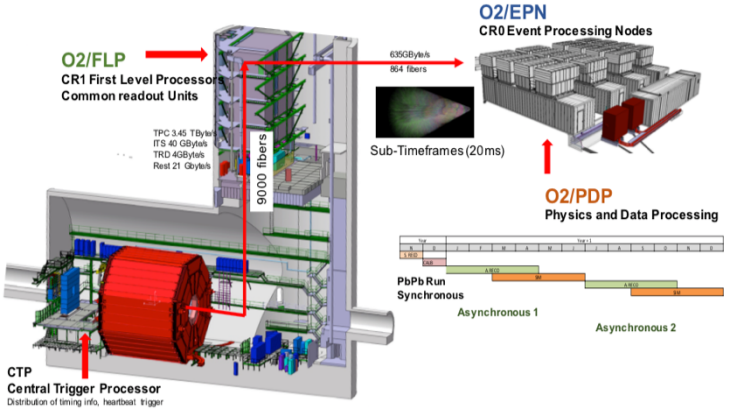
- **analysis**
  - new Framework based on DPL, Apache Arrow and RDataFrame under development
  - first tests with Run2 data converted to Run3 format running

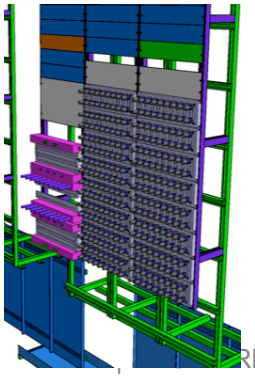
- **infrastructure**
  - Calibration and Constants Database in production for commissioning
  - Data Storage
    - 10% validation test already during 2018 Pb-Pb run
    - standardised on IT hardware. Joint purchase in 2020

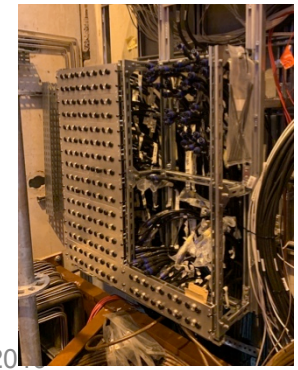
Services: cables, fibres

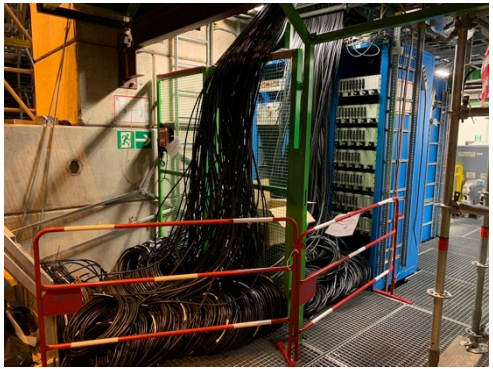
- 3107 copper cables (70km), 50% installed
- Completion dates:
  - **Cable pulling cavern: finished**
  - **Connectors in the cavern: finished by December 2019**
  - **Cables and connectors on Miniframe: finished by March 2020**

- 221 fibre trunk cables, 45% installed and tested
- ITS and TPC trunk cables in miniframe installed in October
- TPC C-side installation in completion by **March 2020**



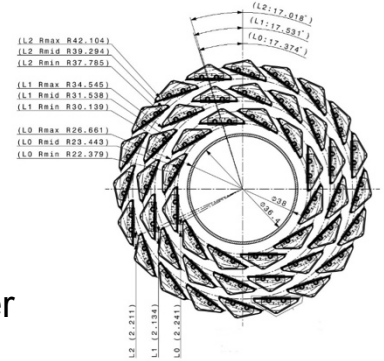


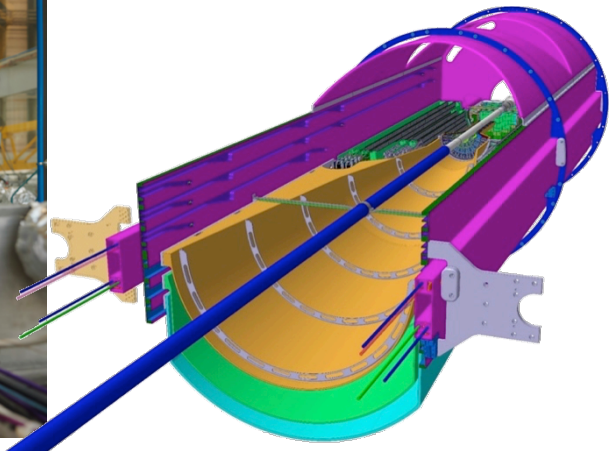




New beam pipe

- approved by LMC in September 2014
- central beampipe section: OD: 38 mm, ID: 36.4 mm, 0.8mm wall
- chamber received at CERN mid-April 2019
- chamber straightness and concentricity within the specification
- final NEG acceptance and permanent bakeout installation in November
- installation in LS2 in March 2020





	Old beampipe	LS2 beampipe
Outer diameter	60mm	38mm (only central part)
Wall thickness	800um	800um
Length	482cm	550cm
Beryllium length	395cm	88.8cm
Bellows/flanges	SS	Al
Nb. of supports	3	3

Contents

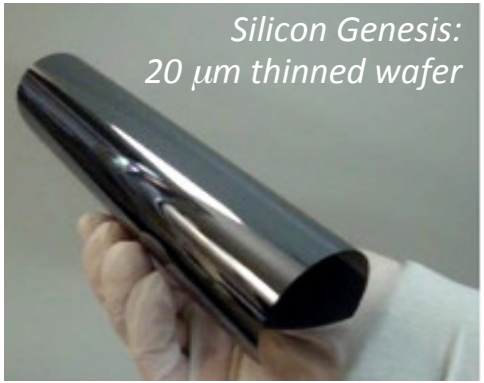
- Collaboration news
- Computing update
- Physics update
- LS2 upgrades update
- ITS3 upgrade
- Conclusions

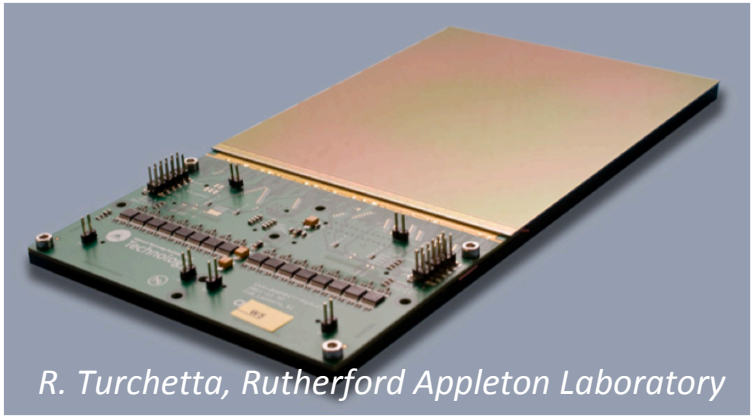
A new ultra-light inner barrel in LS3

- driving requirements of ITS2 upgrade
  - reduce material budget
  - move closer to beam-line

Crucial for thermal dileptons and low-p_T HF

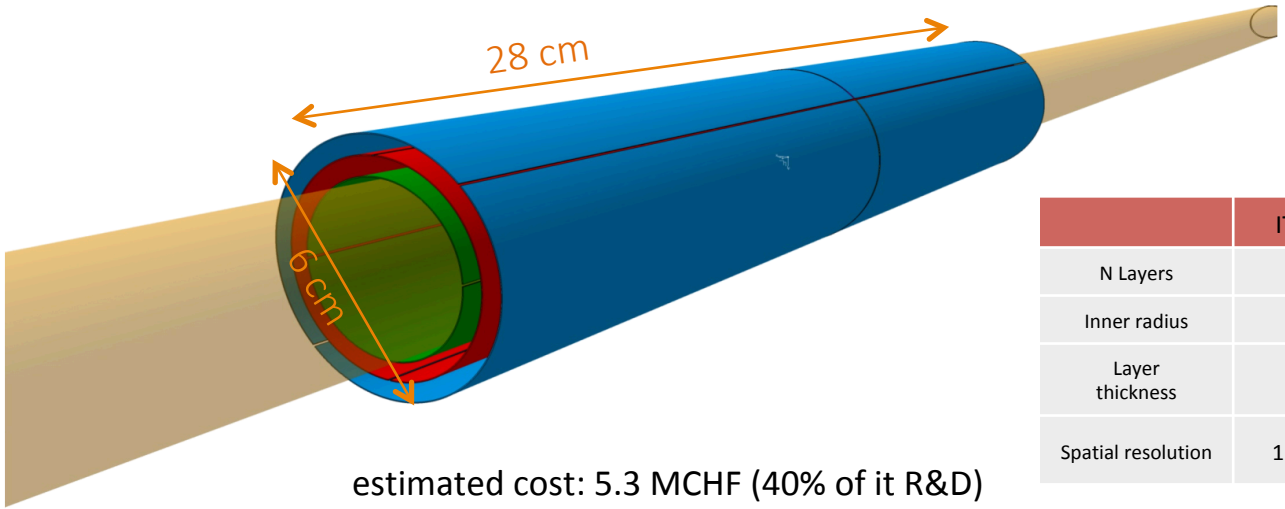
- can be pushed further using technologies that are quickly becoming mature
  - thinning to ~30 μm → cylindrical sensors
  - silicon stitching → sensors of ~ 10x10 cm^2
  - Letter of Intent for the **"ITS3"** inner barrel: ALICE-PUBLIC-2018-013

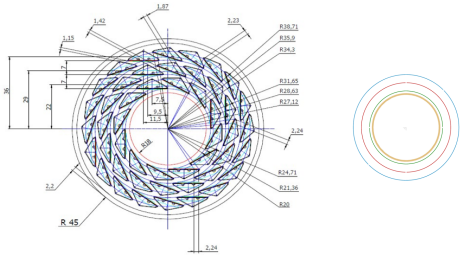




ITS3: concept

- 3 truly cylindrical layers made of ~7x14 cm^2 sensors thinned to 20-40 μm
- Readout circuitry (power consumption) at periphery, outside acceptance
- No water cooling, minimal support structure in acceptance
- **Total material at R < 4 cm: ~1.3% → ~0.3%**

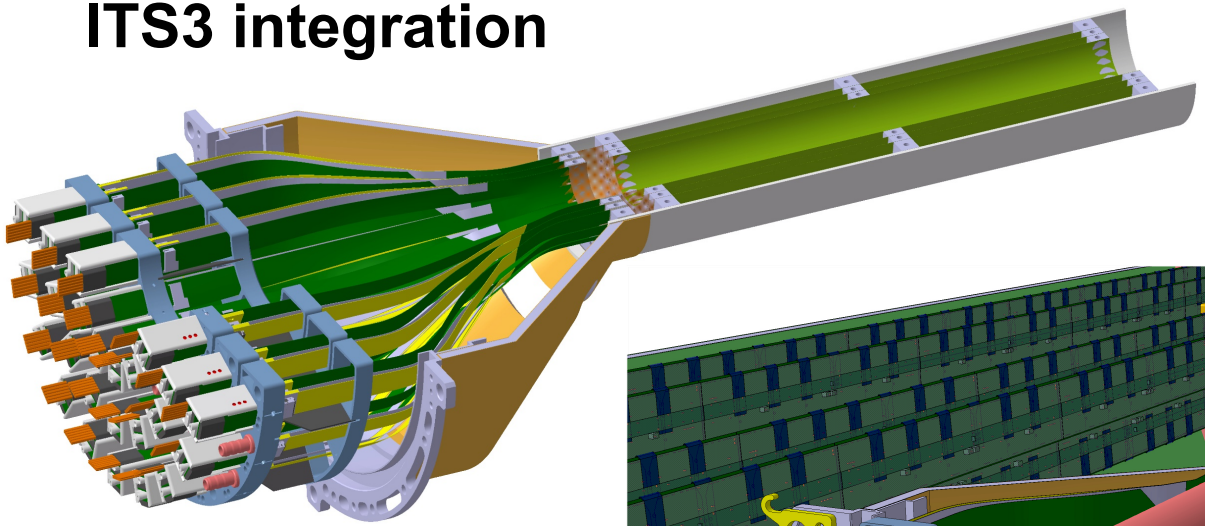


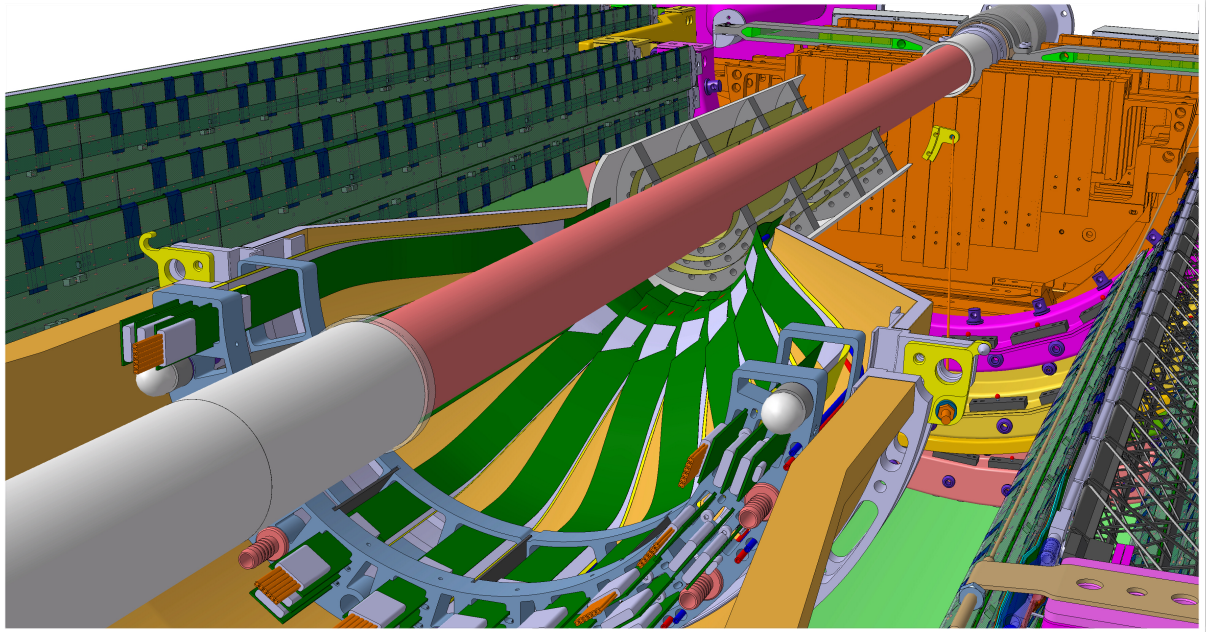


	ITS (inner)	ITS2 (inner)	ITS3 (inner)
N Layers	2	3	**3**
Inner radius	3.9 cm	2.3 cm	**1.8 cm**
Layer thickness	1.1% X_0	0.35% X_0	**0.05% X_0**
Spatial resolution	12x100 μm^2	~5x5 μm^2	**~5x5 μm^2**

estimated cost: 5.3 MCHF (40% of it R&D)

ITS3 integration

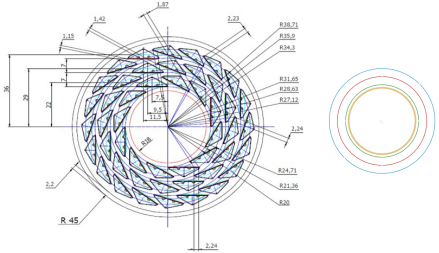




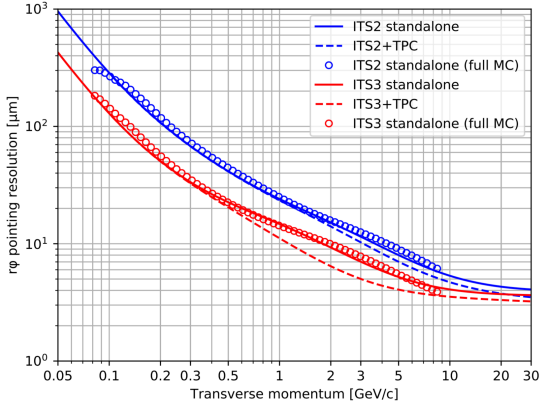
Replaces the ITS2 Inner Barrel

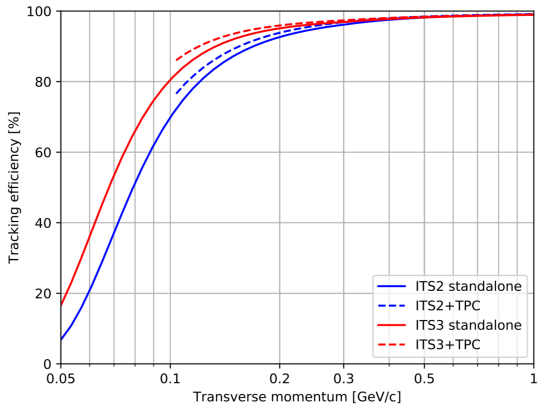
Remaining ITS2 (Outer Barrel) stays in place

ITS3: impact on ALICE Upgrade measurements



x/X_0 at R < 4 cm:
~1.3% → ~0.3%





- **low-mass dielectrons:**
  1. less conversions (x 1/3), one of the main “soft” backgrounds
  2. better low-p_T standalone efficiency to reconstruct and reject conversions
  3. better precision to reject or subtract conversion and charm-decay electrons (displaced)
- **Heavy flavour, in particular hadrons with small cτ (Λ_c ~ 60 μm, D_s ~ 150 μm)**
  1. better precision to separate secondary vertex
  2. increased efficiency → significant improvement in multi-prong decays

Excerpt from LHCC minutes

LARGE HADRON COLLIDER COMMITTEE

Minutes of the one-hundredth-and-thirty-ninth meeting held on

Wednesday and Thursday, 11-12 September 2019

- The **LHCC is impressed** by the new concept for the ITS3 with significantly reduced material budget, recognises the physics case presented in the LoI and in the dedicated ITS3 session and appreciates the on-going simulations on various physics channels to further demonstrate the expected gain from better resolution and efficiency at low transverse momentum. The **LHCC endorses** the plan of ALICE to carry out the necessary R&D studies to demonstrate the technical feasibility of this upgrade project. A TDR to be submitted on a timescale compatible with installation in LS3 will have to include in addition a comprehensive study of its physics gains with respect to the ITS2 detector.

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Conclusions

- rich physics output continues
  - charm interaction, hadronisation, initial effects
  - reference processes in pp
  - large release of results from 2018 sample coming up

- upgrade activity proceeding on schedule
  - problems with TPC CRU funding, but procurement ongoing

- ITS3 upgrade preparations have starter

- we are grateful for the funding agencies for their continued support!


Thank you!