

Nikhef



ALICE UPGRADE

Goran Simatović
for the Dutch ALICE team

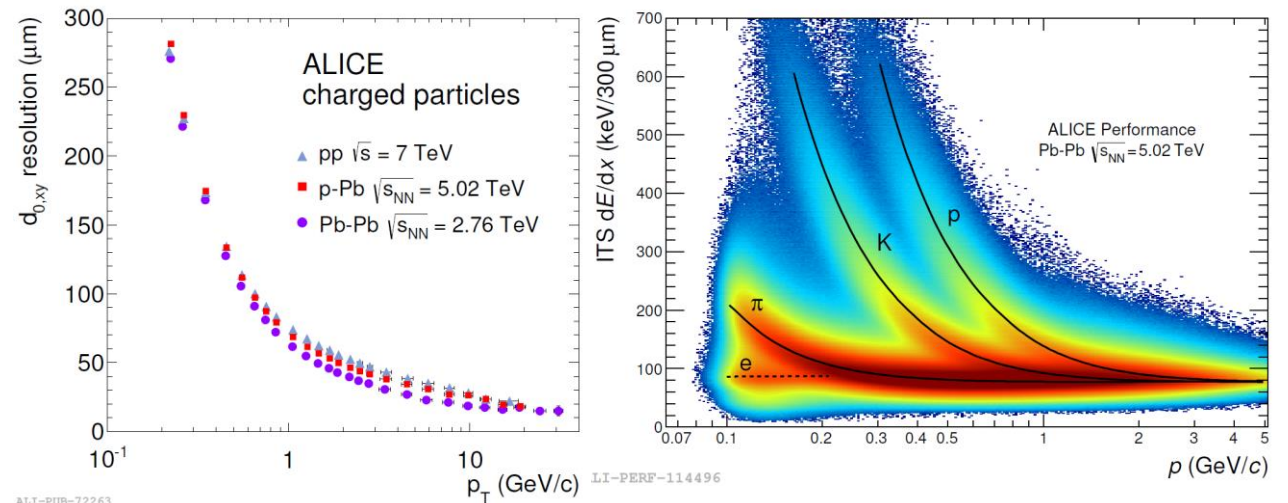
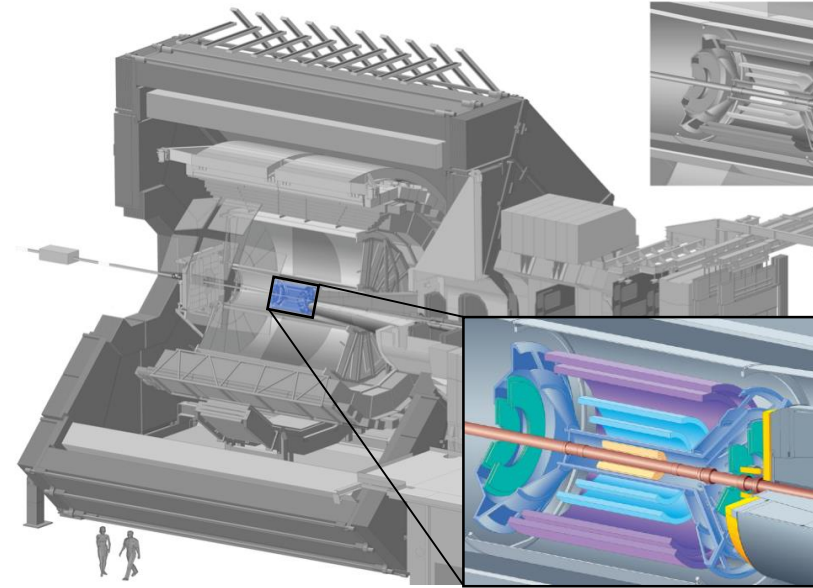
Nikhef Jamboree 2018



Current ITS has successfully finished its mission!

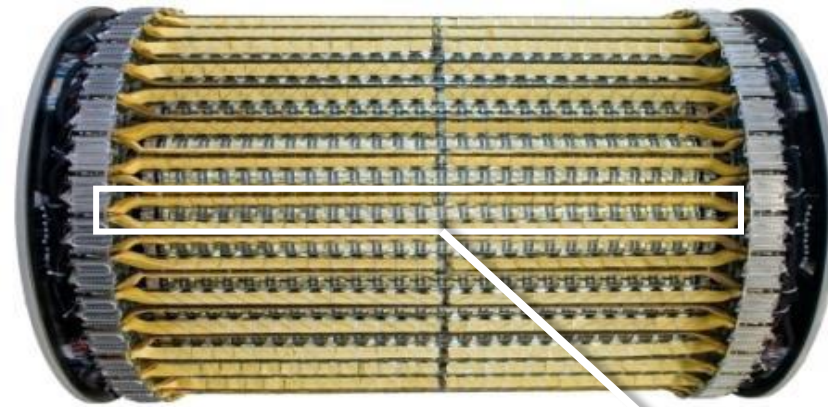
Inner Tracking System

- SPD: Silicon Pixel Detector for the two inner layers
 - SDD: Silicon Drift Detector for the two central layers
 - SSD: Silicon double-sided Strip Detector for the two outer layers
-
- primary vertex reconstruction, momentum and angular resolution of tracks from outer detectors
 - secondary vertex reconstruction with high resolution
 - tracking and PID of low p_T particles, also in stand-alone



ALI-PUB-72263

LI-PERF-114496

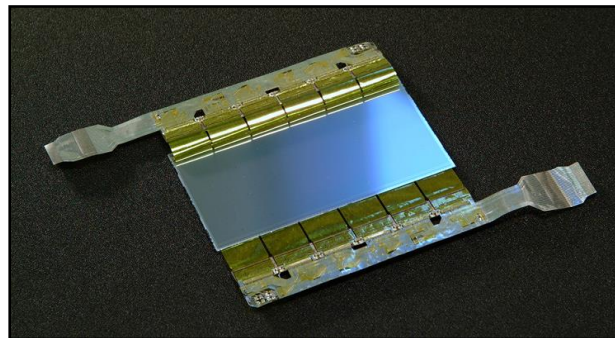
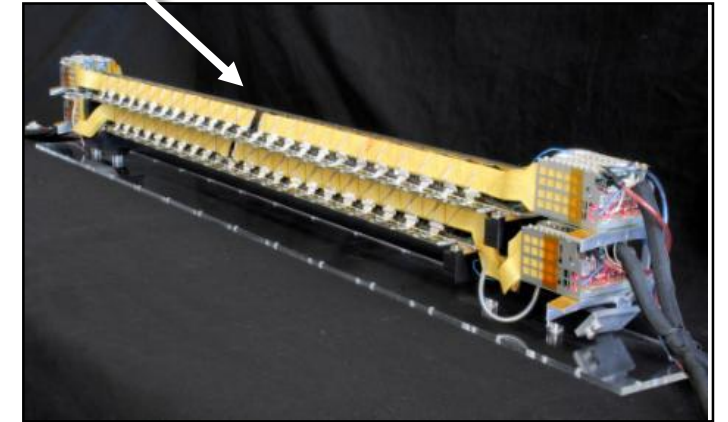
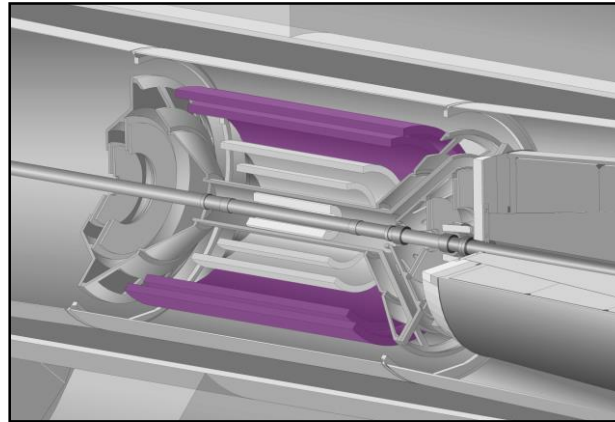


Silicon Strip Detector

- Strip: pitch ($r\phi$): 95 μm ; length (z): 40 mm
- Leak-less water cooling system + air dryer system

Dutch contributions:

- Read-out unit (UU/IGF)
- ASICs for power regulation and signal buffering (ET)
- Ladder assembly (Nikhef)
- Barrel assembly (UU)
- Significant role in TPC-ITS track matching
- Complementary role in participle identification



SSD	Availability in Data Taking	Acceptance [# of Modules]
RUN1	96%	91%
RUN2	98.6%	91%

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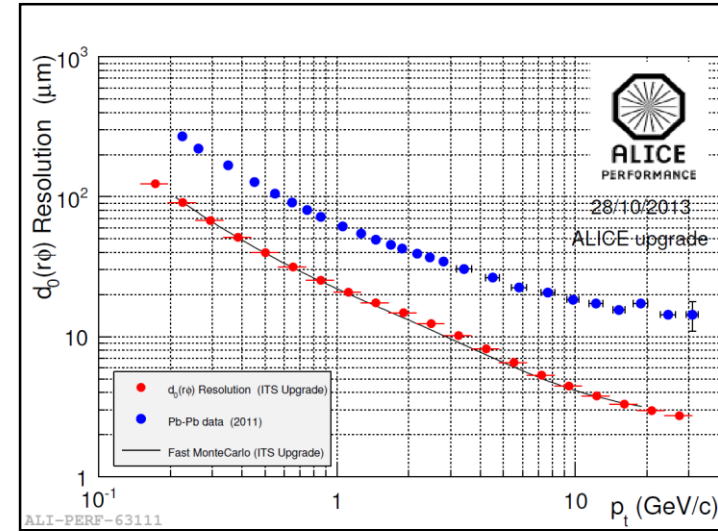
Thank you to the whole Dutch SSD crew for making this happen !

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What are the new plans ?

ITS Design Goals



Improve impact parameter resolution by a factor of ~ 3

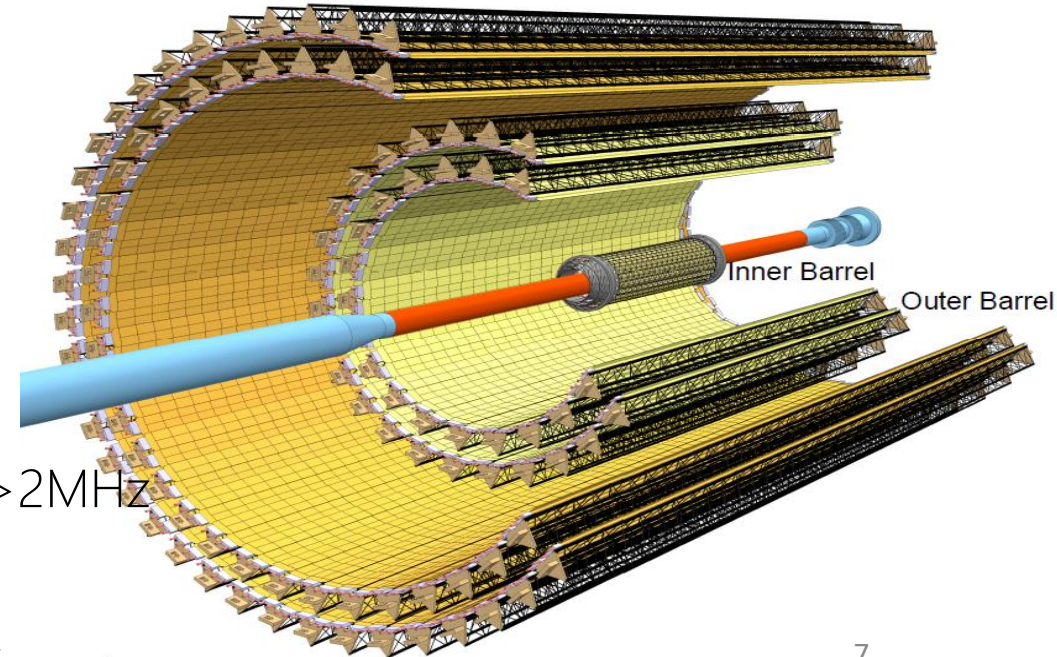
- Get closer to IP (position of first layer): 39mm \rightarrow 22mm
- Reduce material budget: 1.14% \rightarrow 0.3% X_0 per layer or better
- Increase pixel density: 50 μ m x 425 μ m \rightarrow 20 μ m x 20 μ m

High standalone tracking efficiency and p_T resolution

- Increase granularity: 6 layers \rightarrow 7 layers, reduced pixel size
- Larger radial extension 39-430mm \rightarrow 22-430mm

Fast PbPb (and pp) readout

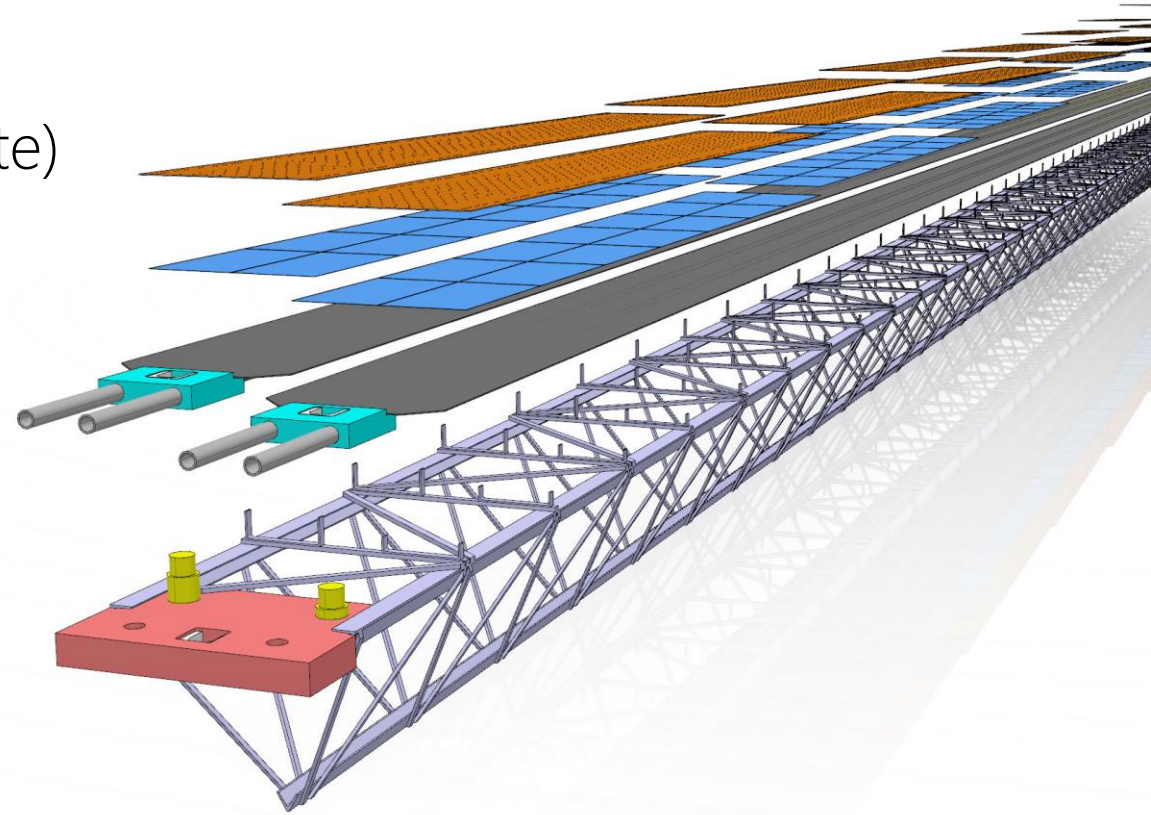
- Current ITS setup allows a maximal readout at 1kHz
- New setup: Pb-Pb collisions are readout at >50 kHz and pp at >2 MHz



Production @Nikhef / schedule

- **Nikhef will produce 25% of the OB staves**
- OB assembly started in March 2018
- commissioning starts July 2019 (300 days estimate)
- production in ongoing at 5 assembly sites

- Expected production rate – 0.5 staves/week
- Nikhef has produced 9 staves so far
- First two staves delivered to CERN
 - Tested and OK

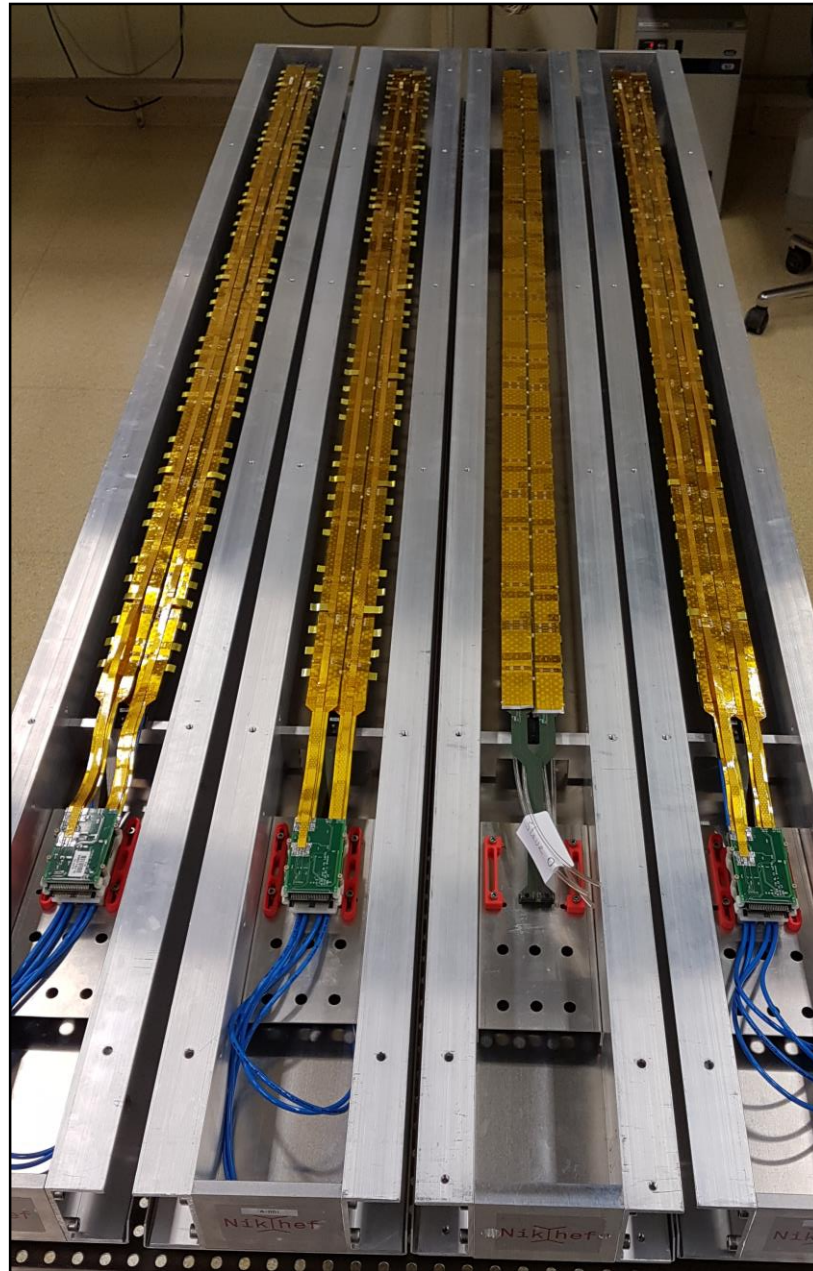


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What does it take to make an ITS stave?

- Acceptance testing (QA)
 - Powering
 - FIFO
 - Memory tests
 - Threshold, Noise, ...
- HIC preparation and testing
 - 10um precision cutting
 - Post-cut testing
- Half-Stave assembly
 - Gluing/soldering
 - Testing
- Stave assembly
 - alignment/gluing
 - Testing
- Packaging and Shipment



Large student involvement

Nikhef contributed significantly to the assembly tooling

Readout board testing also performed at Nikhef

Nikhef can keep the desired production rate

- Half/Slave assembly
 - 10 μ m precision alignment
 - powering system soldered after initial assembly
- Student involvement
 - three PhD students involved with the ITS upgrade via Service Tasks
 - all procedures demonstrated and documented (online manuals)
 - student work is independent and needs little supervision



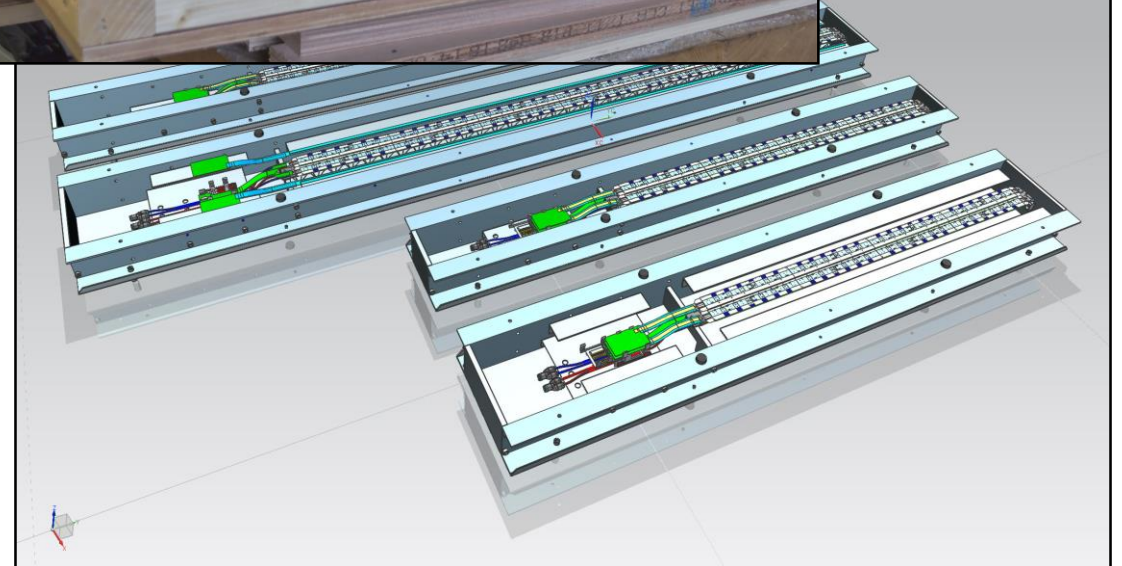
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- Stave Storage and Transport
 - Boxes, springs, bags, and other tooling needed for stave storage and transport designed and selected by Nikhef



- Inner aluminum box cradled and suspended with springs inside the wooden transport crates
- vibration and acceleration levels regulated
- aluminum bags used to control humidity levels
- each shipment has data loggers (next slides)



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- Students can't have all the fun!





ALICE

Electronics

Read-out unit

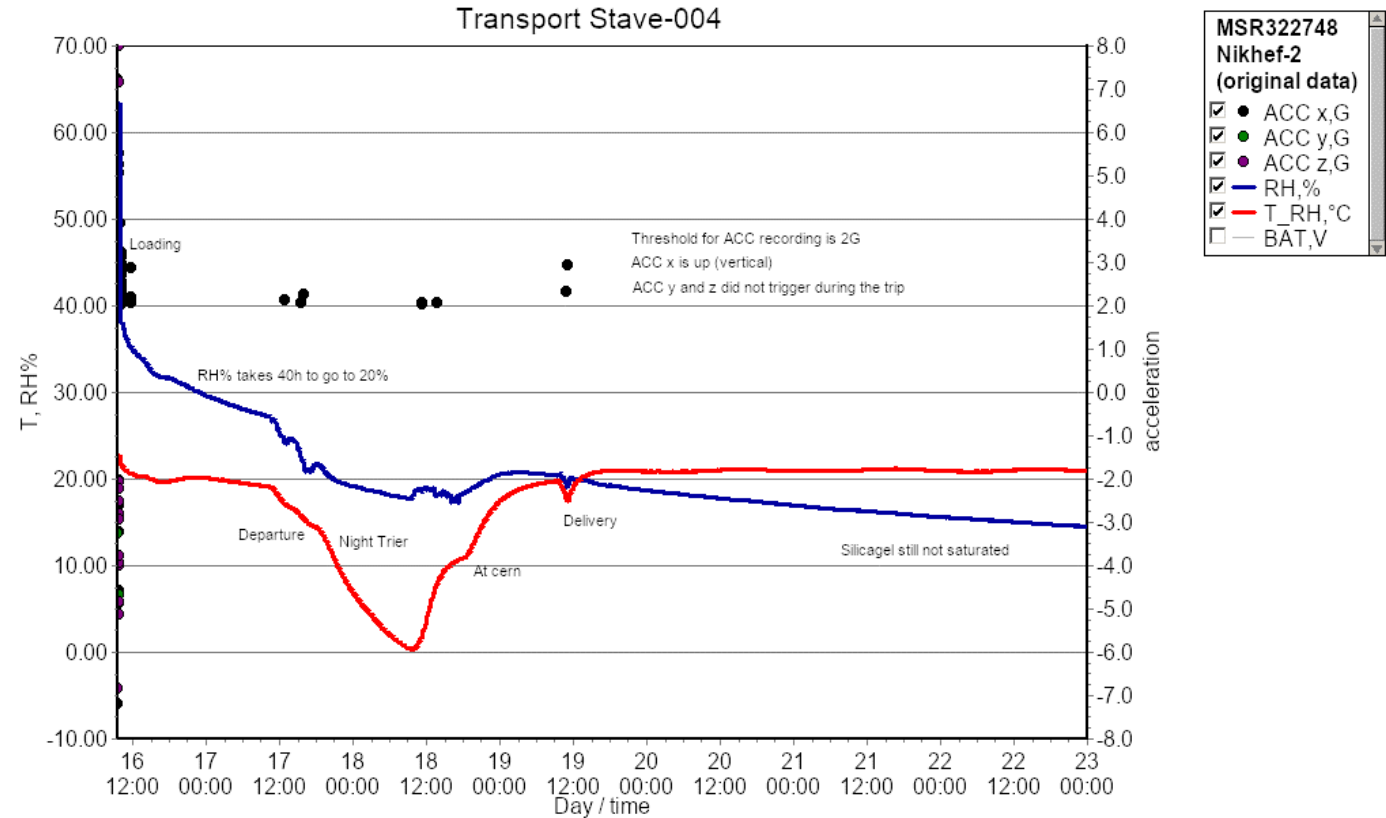
- Connects the front-end chips to the DAQ
- Connects the power supplies to the DCS
- Designed by Utrecht+Amsterdam
 - Marcel Rossewijn
 - Jan-David Schipper
- Firmware made by Berkeley+CERN
- Pre-series boards now under test
 - Using Nikhef climate chamber
 - Functionality is ok!





How far along are we?

- First transport successful!
- Thanks to Roman (LHCb) for generously offering to take our staves to CERN aswell!
- Data logger measures relative humidity, 3D acceleration, temperature
- Transportation via Nikhef van seems to be a viable method of transportation to CERN



Start time : 2018-11-16 09:39:47
 Asmterdam-CERN 17-18 November 2018



CERN
@CERN

Follow



Building the new Inner Tracking System (ITS) for the ALICE collaboration at the Dutch National Institute for Subatomic Physics (Nikhef) in Amsterdam. #FollowFriday @_nikhef

- our very own Syaefudin Jaelani (aka J) was featured on the CERN #FollowFriday campaign.
- the photo was used by the Nikhef PR department for the Nikhef website and social media channels (Facebook, Twitter ..)



ALICE

• by Marco Kraan

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Outer-Limits @spudnickrocket · Aug 3

Replying to @CERN @_nikhef

Great thanks Satan!



1



2



I have no clue. @AndresS45303251 · Aug 5

End times. Gonna be awesome to be in Heaven!!!



I have no clue. @AndresS45303251 · Aug 5

Replying to @TheSmit01963313 @CERN @_nikhef

It isn't the chip, it is the nano particles in the chem trails.



• by Marco Kraan



ALICE

ALICE ITS upgrade in the Netherlands

- major contributions to the overall project
- wide spread efforts in both hardware and software
- Strong involvement of students (master/PhD)

- Active international collaboration and visibility (Torino, Frascati, Bari, Liverpool, Daresbury, Berkeley, ...)

- Dutch ALICE team is strongly involved in physics with future ITS
 - Thermalization, heavy quark in-medium energy loss
 - Anisotropic flow, quarkonium dissociation

Inner Tracking System Upgrade Team

Marco Kraan, Gerrit Brouwer, Jean-Paul Fransen, Martijn van Overbeek, René de Boer, Sheifudin Jaelani, Zhanna Khabanova, Lennart van Doremalen, Marcel Rossewij, Jan-David Schipper

Many thanks to our staff
and students !!

Back up

- Hybrid Integrated Circuit (HIC)
 - Classified by quality and type
 - Tests before and after handling assure quality is kept
- HIC preparation and testing
 - powering, FIFO, memory, noise, threshold ..
 - 15 μ m precision cutting
- HIC Flipper / Cutter
 - Designed, tested and distributed by Nikhef
 - Software for cut line definition with twin microscopes also provided by Nikhef
 - Spares in storage (no site requested)

