

Production and testing of ITk strip modules

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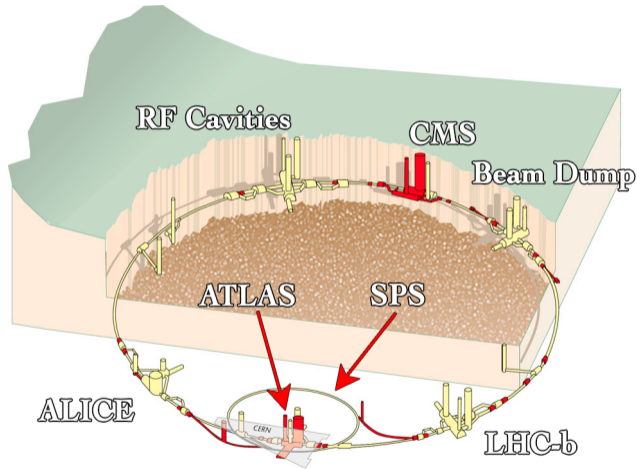
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Particledagarna

16th October 2018

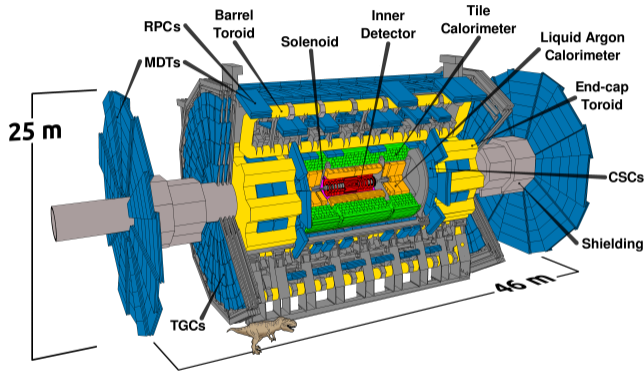


What is the Large Hadron Collider (LHC)?



- ▶ Synchrotron of 27km circumference
- ▶ Protons or heavy ion collider
- ▶ for $p - p \sqrt{s} = 13 \text{ TeV}$ at 40 MHz, instantaneous luminosity $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$
- ▶ Delivered to ATLAS 145 fb^{-1}

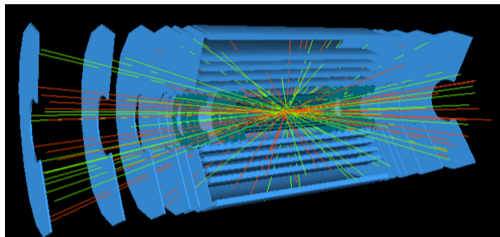
What is A Toroidal LHC ApparatuS (ATLAS)?



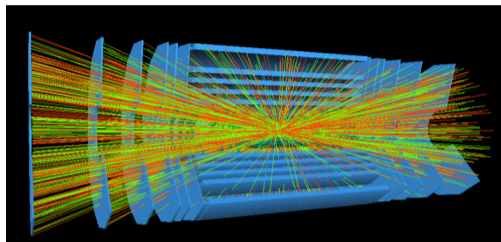
- ▶ (Almost) 4π coverage multi purpose detector aimed at generic searches
- ▶ Build to withstand the LHC design instantaneous luminosity of $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ at Level 1 trigger rate of 100kHz
- ▶ Recorded 136 fb^{-1} with 128 fb^{-1} good for physics

What is the High Luminosity LHC (HL-LHC)?

23 simultaneous events



230 simultaneous events

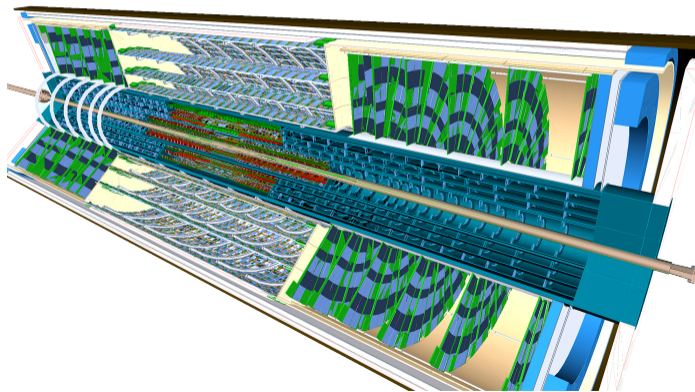


Increase in pileup means we need

- ↳ More bandwidth
- ↳ Higher granularity
- ↳ Higher radiation damage resiliency
- ↳ Better triggering capabilities

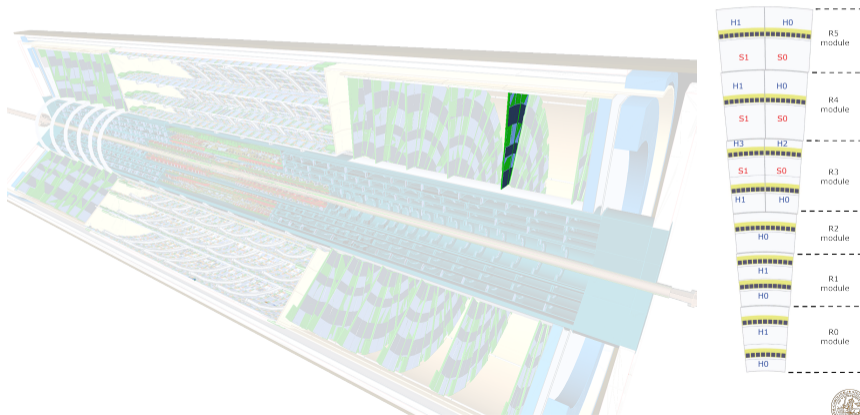
The ATLAS Inner Tracker (ITk)

- ▶ New ATLAS Tracking detector
- ▶ Full silicon
- ▶ Strip 17, 888 Modules 59.87M Channels (current 4088 modules with 6.3M Channels)
- ▶ Pixel 10, 276 Modules \approx 800M Channels (current 2024 modules 92M channels)



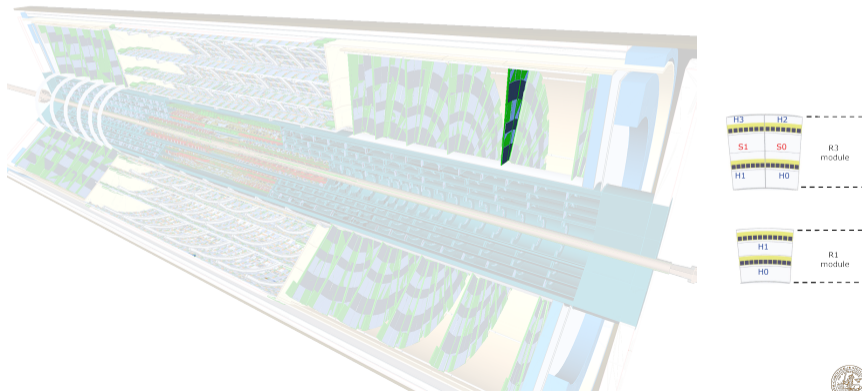
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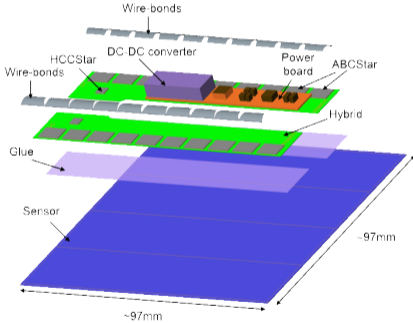
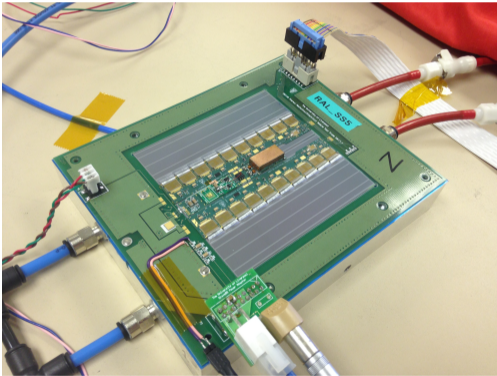
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Silicon Strip Module

Here barrel module just for illustration purposes (End-Caps modules are equivalent)

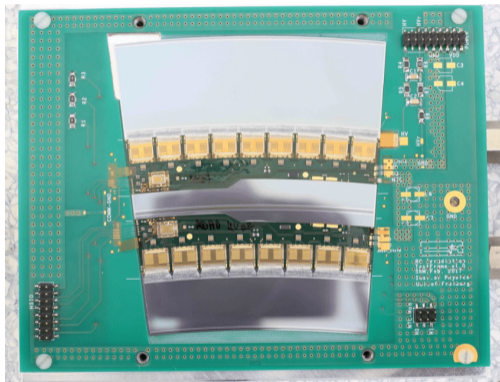


Scandinavian plan

- ▶ Four participating institutes in the Scandinavian ITk
 - ▶  Lund University
 - ▶  Niels Bohr Institute
 - ▶  Uppsala University
 - ▶  University of Oslo
- ▶ Pledged for $\approx 10\%$ of the whole end-caps
 - ↳ 432 modules of two types 50/50 split
 - ↳ R1 and R3 modules
- ▶ Production in industry (NOTE)
- ▶ Test of modules in institutes



Contributions



Module manufacturing

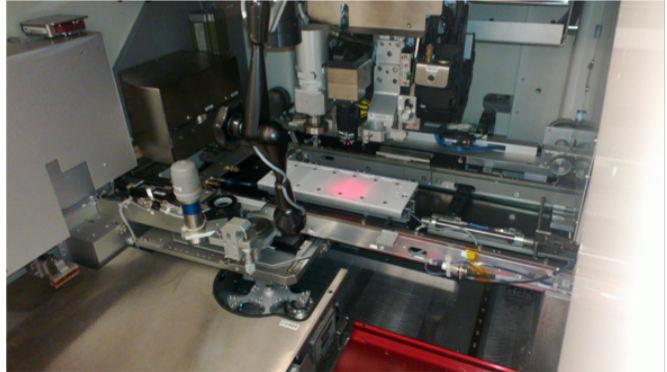
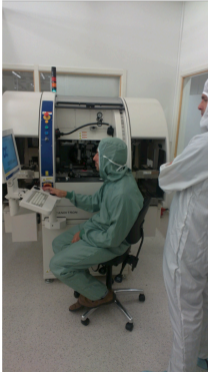
- ▶ Uppsala/NOTE
 - ▶ Oslo
- } Wire bonding
} Gluing

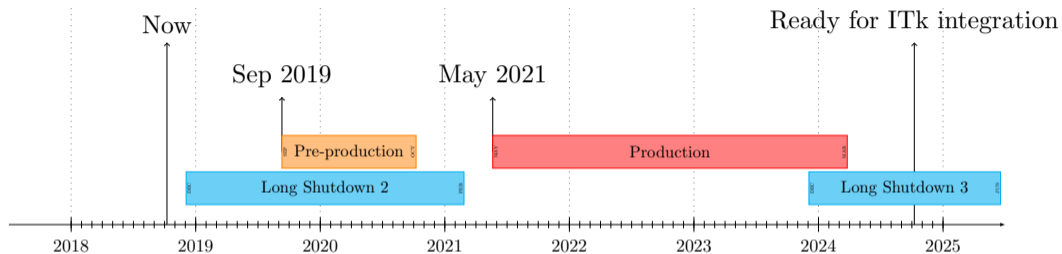
Module testing

- ▶ Lund
 - ▶ NBI
- } Sensor testing
} Electronics testing
} Final DAQ test

NOTE and synergy between academy and industry

- ▶ Agreement with NOTE to work with engineers and technicians on site.
- ▶ Payment for personnel and infrastructure for time booked (Extremely cost efficient for prototyping).
- ▶ Allows for efficient production for large scale project for smaller investments





- ▶ All sites required to pass inspection test to make sure to be up to collaboration standard
- ▶ Done during Pre-prod, 5% of total pledged amount
- ▶ Installation of ITk during LS3

Conclusions

- ▶ The ATLAS Collaboration preparing to manufacture the new ITk
- ▶ The ATLAS Scandinavian ITk cluster is responsible for the production of approximately 10% of the whole ITk End-Caps
- ▶ Tight collaboration in-between four Scandinavian institutes, Lund, Uppsala, NBI, Oslo
- ▶ Pre-Production of 5% of full production planned for September 2019

Thank you for your attention!

Questions?



ATLAS
SCANDINAVIA