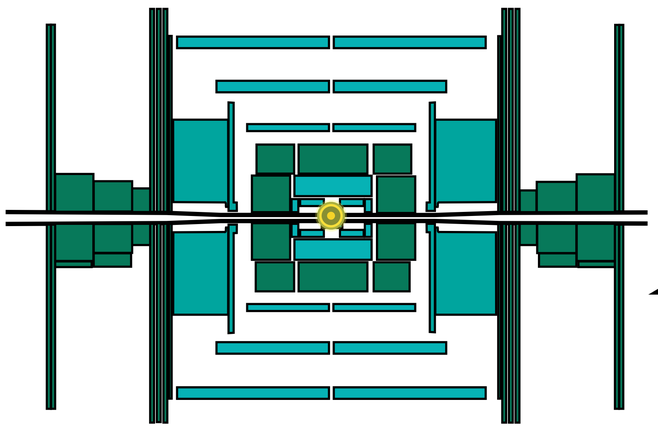


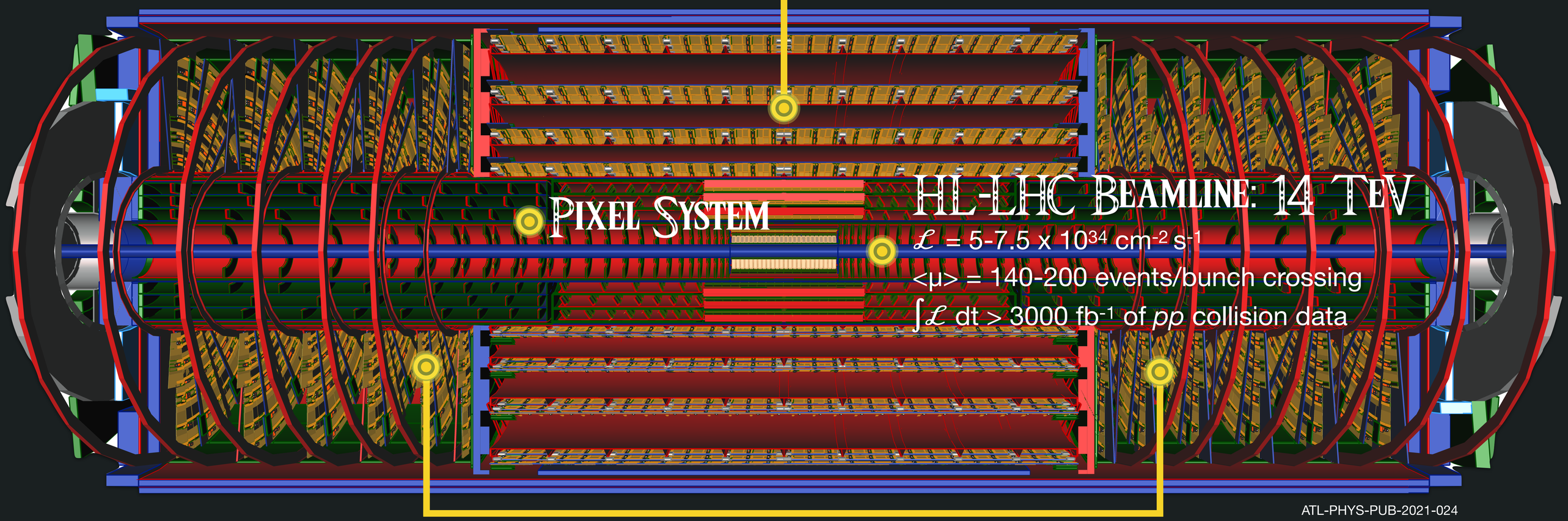
The Legend of the ATLAS Experiment

ATLAS ITk Strip Detector for the Phase-II Upgrade

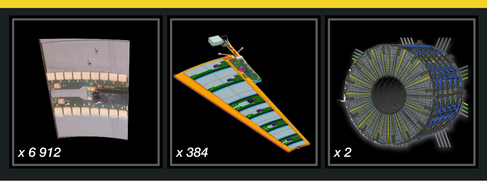
Hannah Herde (Lund University) on behalf of the ATLAS-ITk Collaboration

Inner Tracker (ITk) Strip Barrel

Integrated at CERN



ATL-PHYS-PUB-2021-024

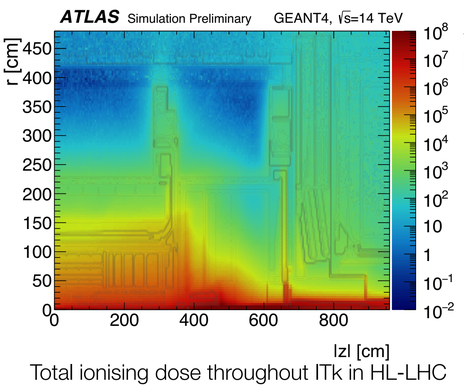


Strip Endcaps

Integrated at DESY and NIKHEF

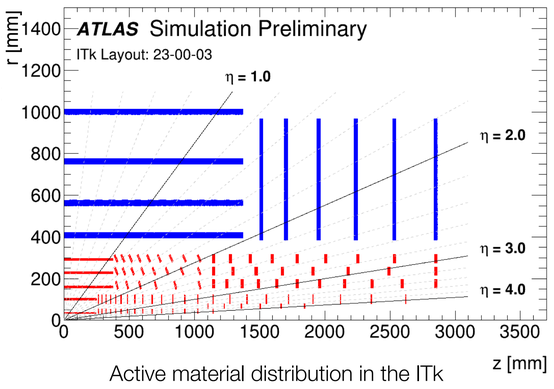
ATLAS Inner Tracker: Full silicon detector solution <u>replacing</u> current Pixel, Semiconductor Tracker (SCT), and Transition Radiation Tracker (TRT) sub-detectors for High Luminosity Large Hadron Collider (HL-LHC) **with similar or better performance in harsher conditions**

Radiation Simulation Public Results, March 2018



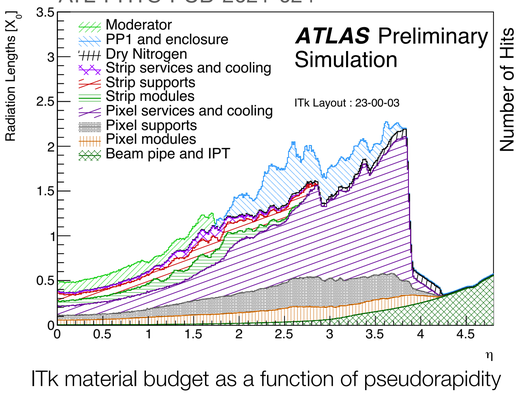
Total ionising dose throughout ITk in HL-LHC

ATL-PHYS-PUB-2021-024



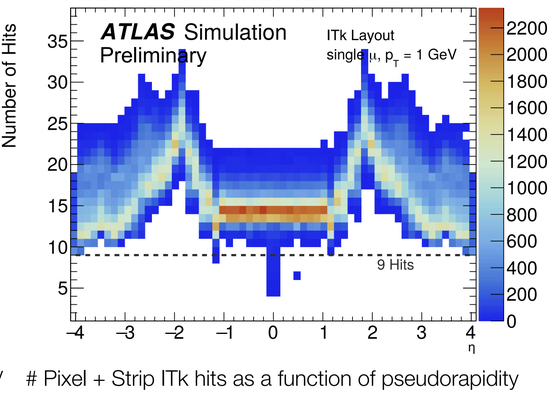
Active material distribution in the ITk

ATL-PHYS-PUB-2021-024



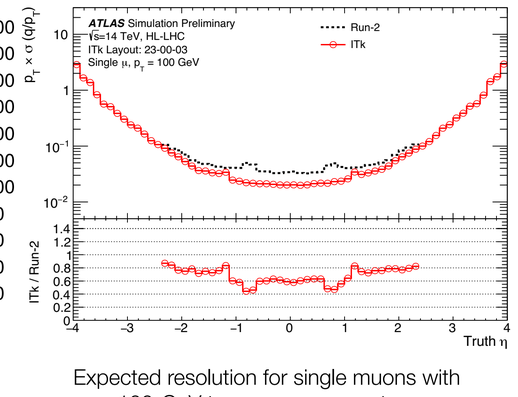
ITk material budget as a function of pseudorapidity

ATL-PHYS-PUB-2021-024



Pixel + Strip ITk hits as a function of pseudorapidity

ATL-PHYS-PUB-2021-024



Expected resolution for single muons with 100-GeV transverse momentum

??? Adventure Log L Map R Album ???	Inner Detector (ID)	Inner Tracker (ITk)
Detector layers	Si (pixels, strips) & gas trackers	Si trackers (pixels, strips)
Coverage, |η|	<2.5 (Pixel & SCT), <2.0 (TRT)	<4.0 (pixels), <2.7 (strips)
Trigger rate	100 kHz	1 MHz
	Pixel detector	**ITk Pixels**
№ of Pixels	92 million (80M Pixel + 12M IBL)	5 billion
Pixel silicon area	1.9 m²	12.98 m²
Pixel size	50x250 μm (IBL), 50x400 μm, 50x600 μm	50x50 μm, 25x100 μm
	SCT	**ITk Strips**
№ of Strips	6.2 M	59.9 M
Strip silicon area	61 m²	165 m²
Pitch	80 μm	75.5 μm
Strip length	12.8 cm	1.4-6.0 cm

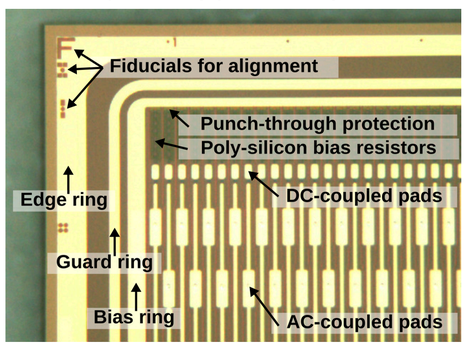
Move L Zoom U,D Select A Return B

Comparison of ATLAS' current Inner Detector and the future ITk for HL-LHC

Strip components

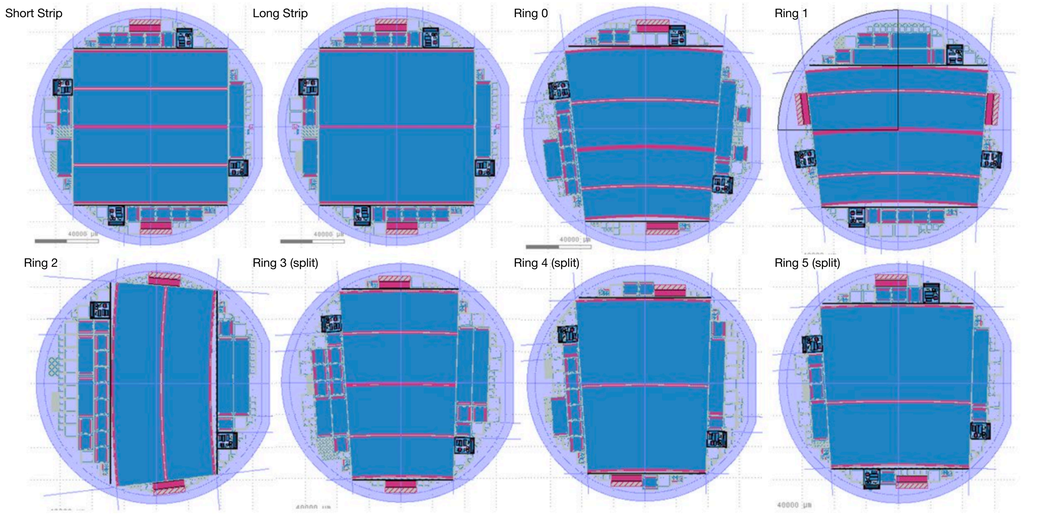
Sensors

FZ n⁺ strips implanted on p-type Si bulk (n⁺-in-p) • 300-μm thick



L. Poley *et al* 2020 *JINST* **15** P09004

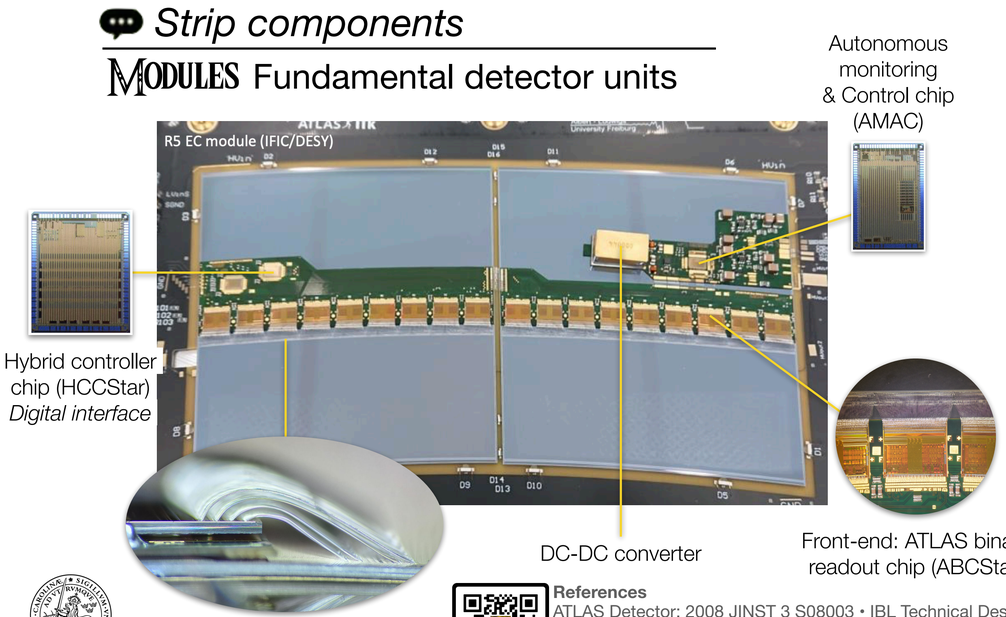
Detail image: Barrel module sensor



Sensors manufactured in 6-cm wafer technology. Split modules (Ring 3-5) are too large for a single wafer.

Strip components

Modules Fundamental detector units



Quality control

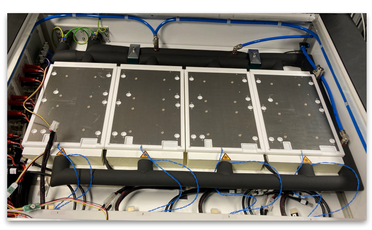
Single Module Verification

Visual inspection • Metrology

Electrical performance and front-end characterisation

Thermal cycling:

x10 -35°C ↔ +40°C



Climate-controlled thermal cycling chamber for 4 modules

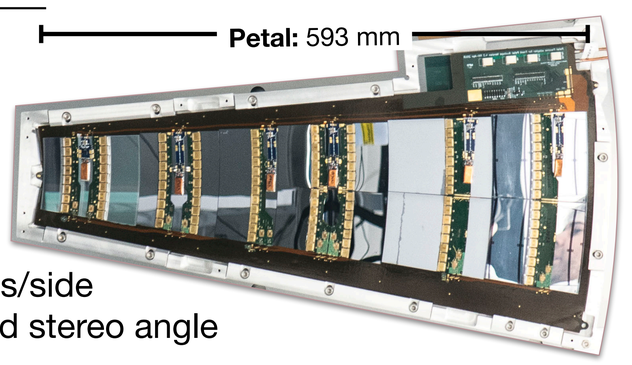
Towards integration

Local Supports

Mechanical support, cooling, electrical lines

Barrel: Stave, 14 modules/side, 52-mrad stereo angle

Endcap: Petal, 6 modules/side (3 split modules), 40-mrad stereo angle



References

ATLAS Detector: 2008 JINST 3 S08003 • IBL Technical Design Report (TDR): CERN-LHCC-2010-013

ITk Pixels TDR: CERN-LHCC-2017-021 • ITk Strips TDR: CERN-LHCC-2017-005

Layout and expected performance: ATL-PHYS-PUB-2021-024 • L. Poley et al 2020 JINST 15 P09004

The Legend of Zelda: Breath of the Wild and *Tears of the Kingdom* are properties of Nintendo. Triforce font from *https://zeldauniverse.net/media/fonts/*. Thank you for making a great (inspirational) game!

About the author

ATLAS 2008 | IBL | ITk Pixels | ITk Strips | Expected performance | L. Poley et al 2020 JINST 15 P09004 | More ITk results

LUND UNIVERSITY

ATLAS ITk