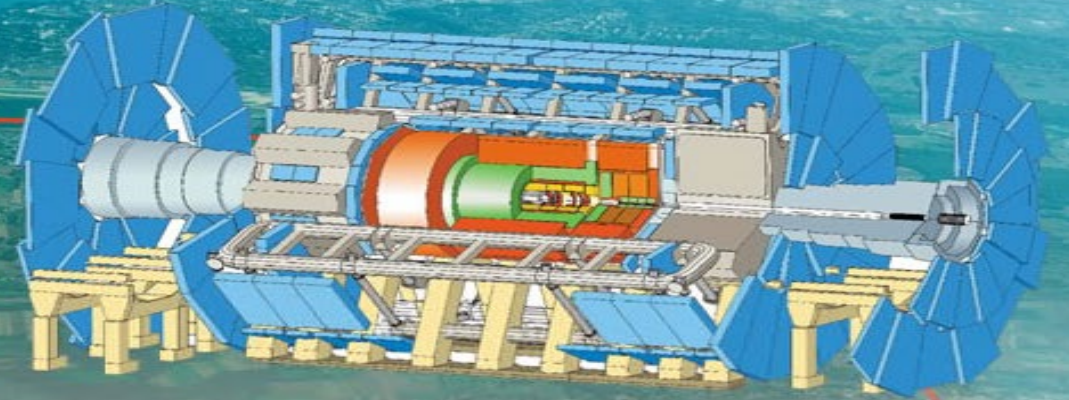




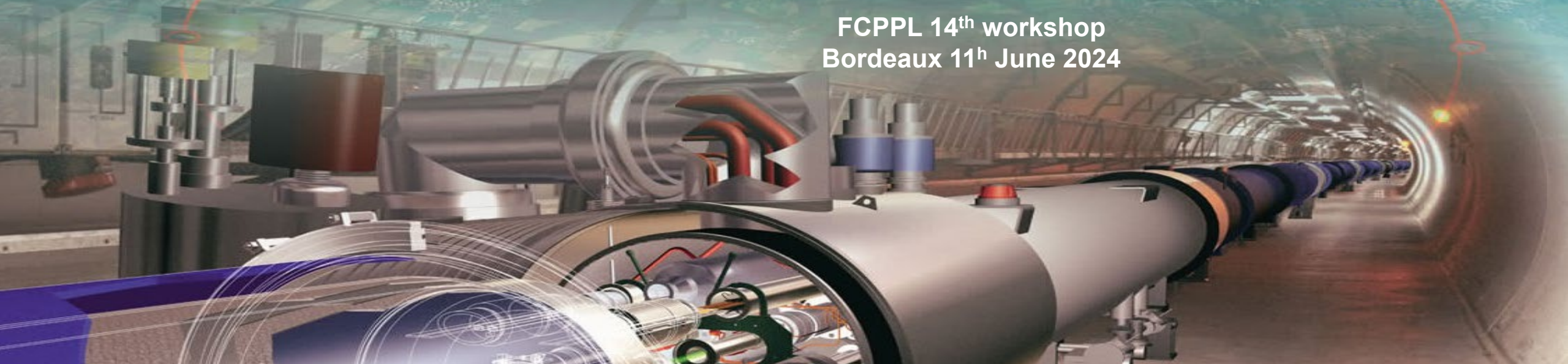
# ATLAS FCPPL Projects

## Session Introduction

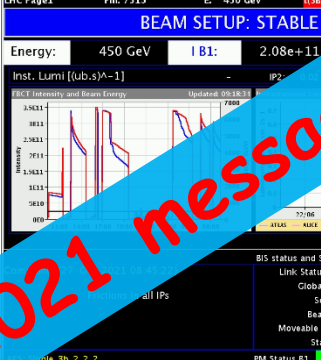
Emmanuel MONNIER (CPPM)



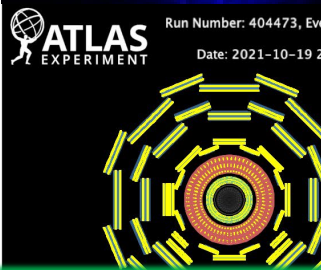
FCPPL 14<sup>th</sup> workshop  
Bordeaux 11<sup>h</sup> June 2024



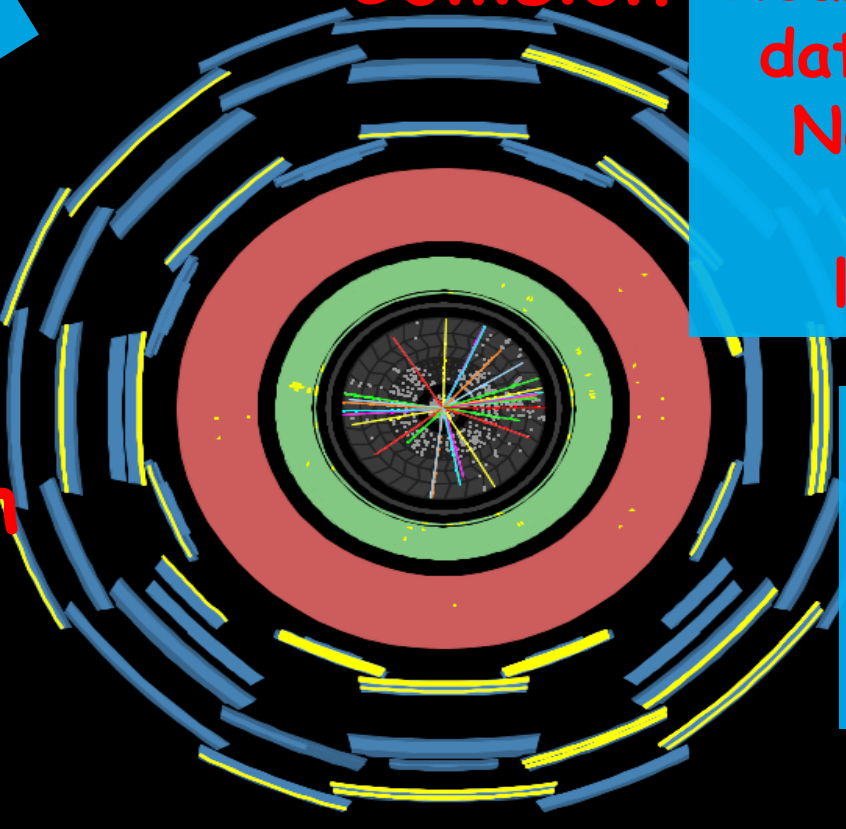
FCPPL 2021 message



Splash



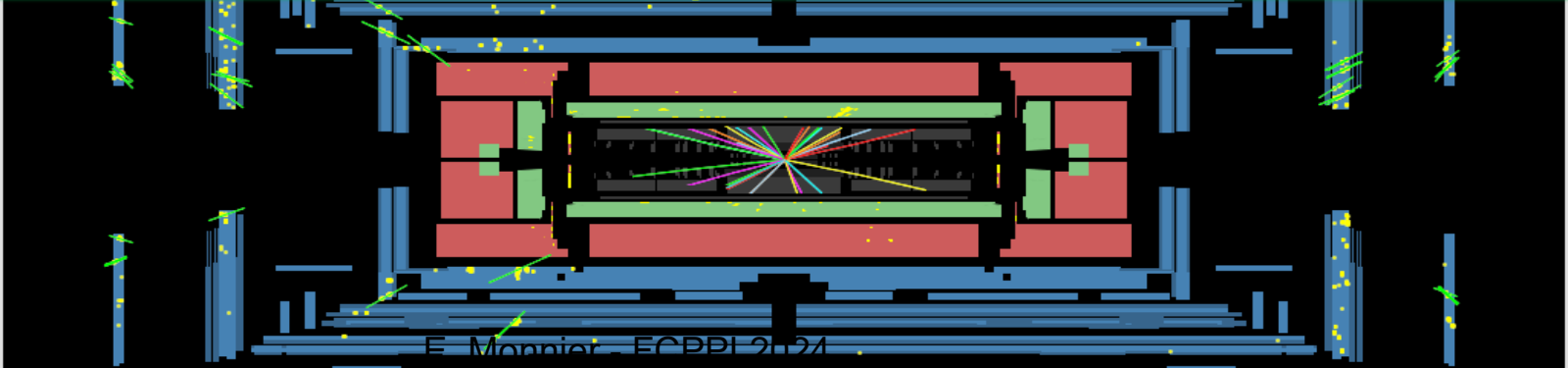
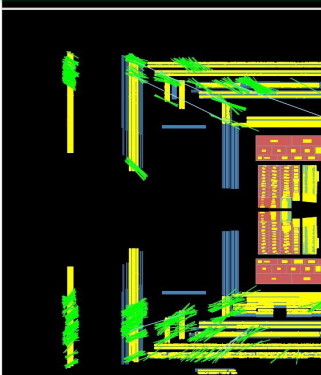
Collision



Clear Road for new Run3 data taking in 22-25, New Higgs property studies and new limits@13.6TeV...

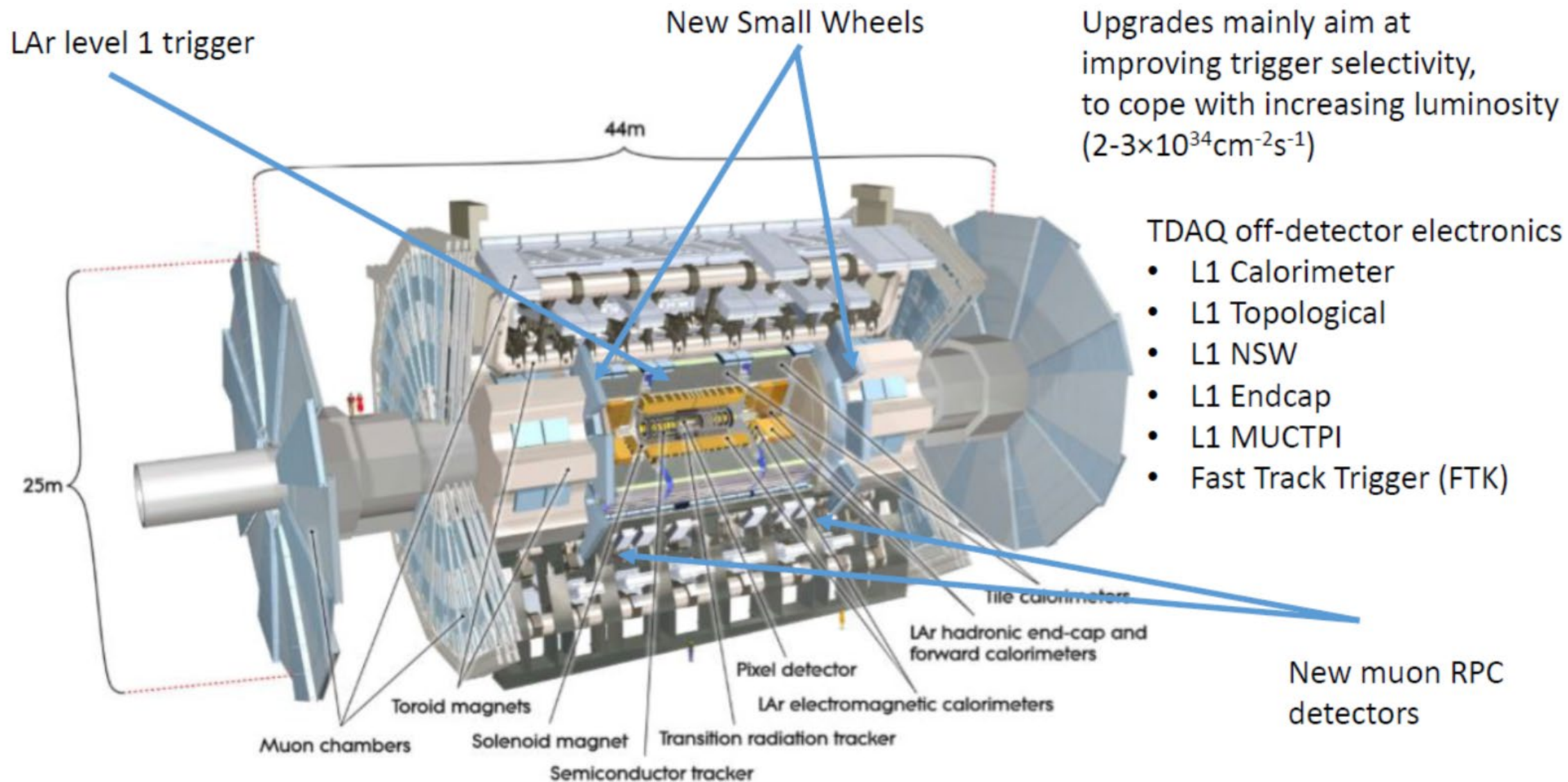
Many legacy full run2 results published (~100), with more precise Higgs property studies and new limits...

ATLAS ready for Run3 in 2022 !





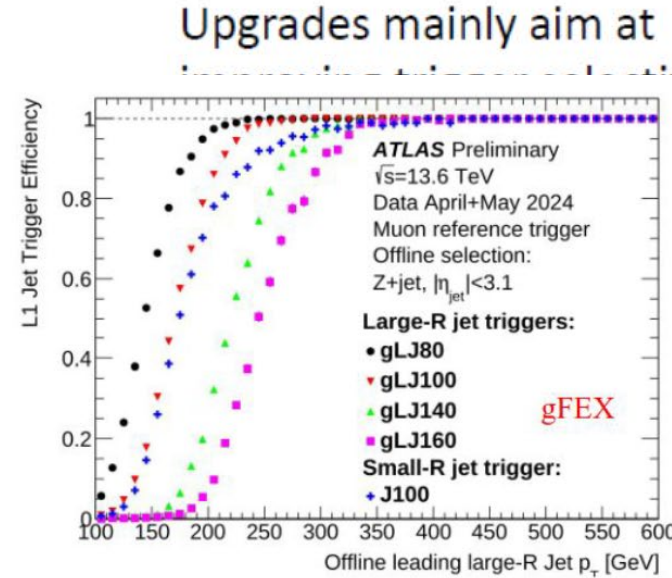
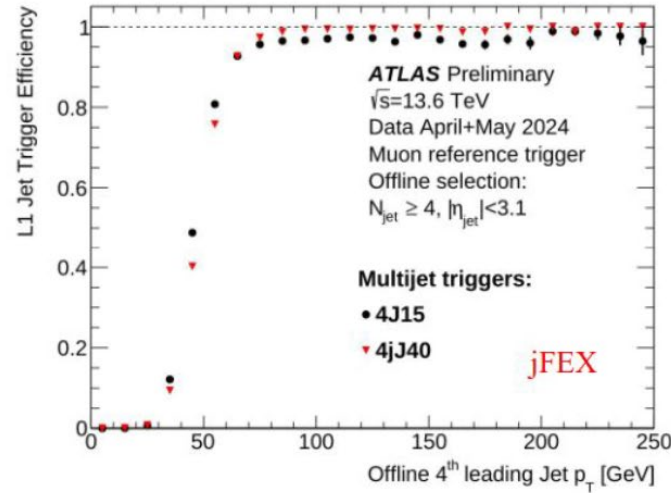
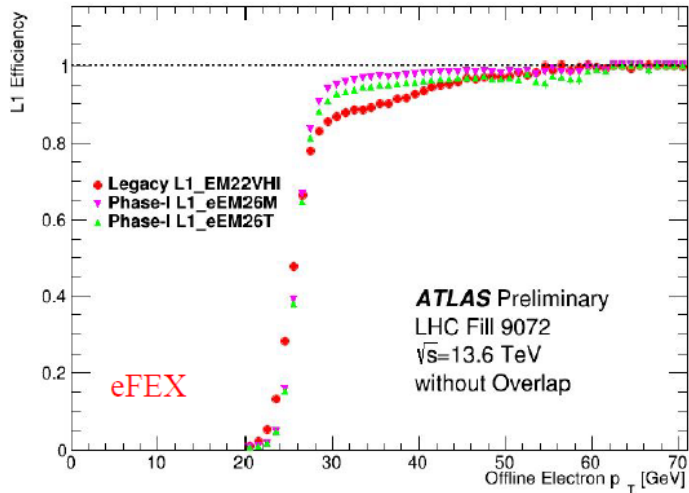
# ATLAS Phase-I upgrades (LS2,2019/21) + Commissioning 2022/23



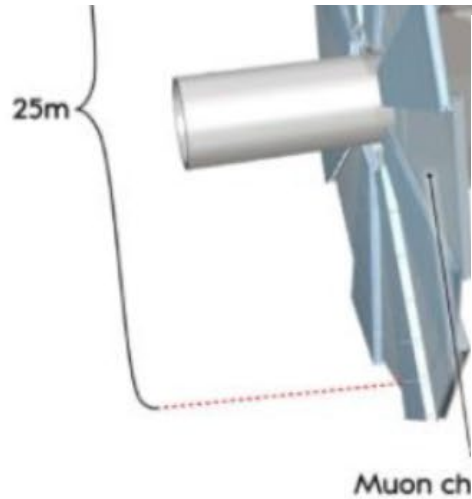
# ATLAS Phase-I upgrades (LS2,2019/21) + Commissioning 2022/23

## LAr Level 1 Trigger

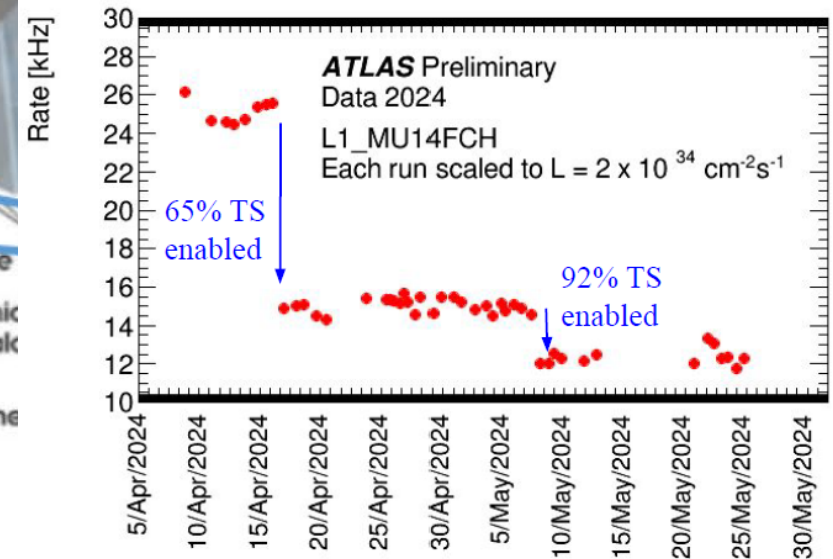
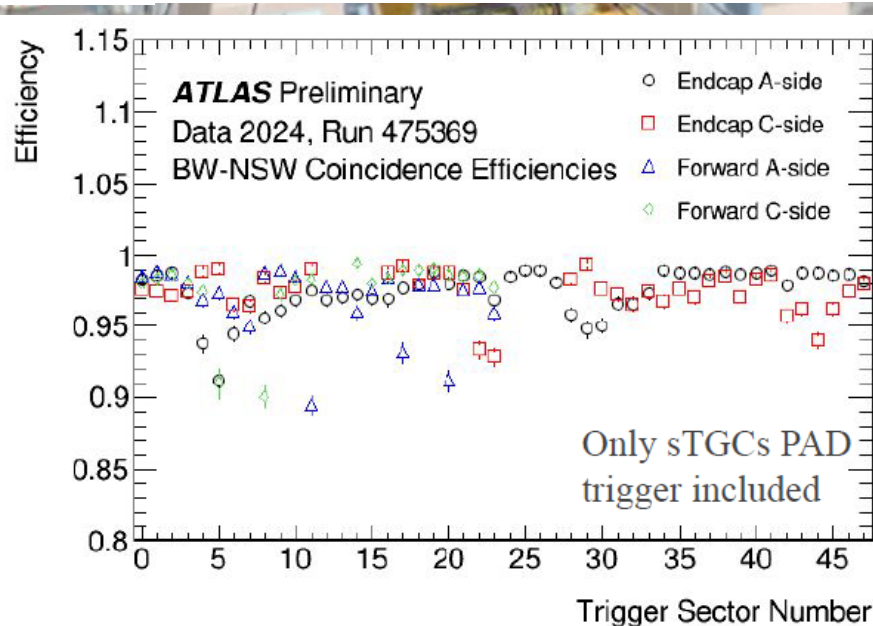
Phase-I eFEX electron trigger achieves higher efficiency at lower L1 accept rate (~5 kHz),  
jFEX features steeper jet trigger turn-on



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minosity  
  
lectronics



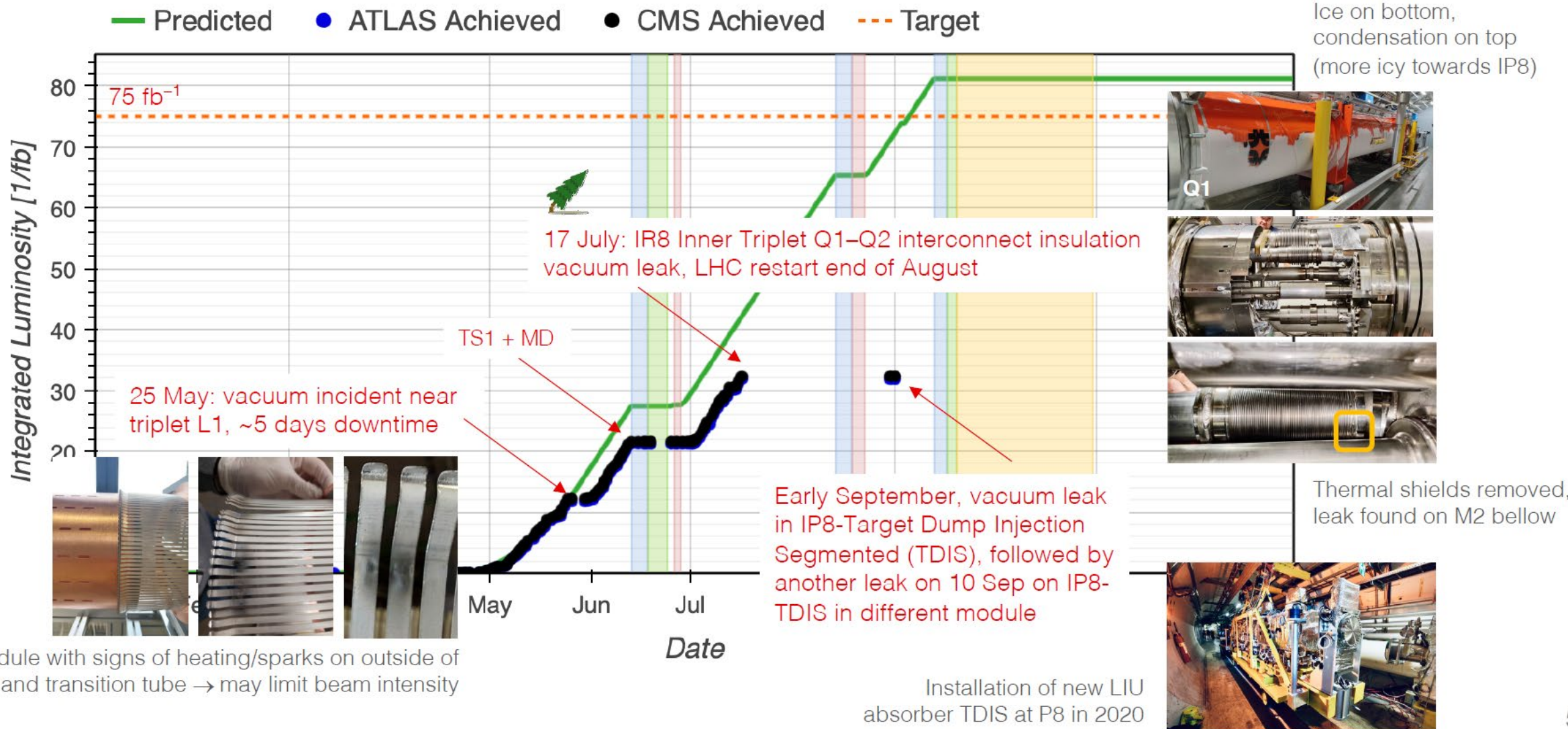
New Small Wheel



First beam in 2023...



# AND, despite a very bumpy road in 2023...

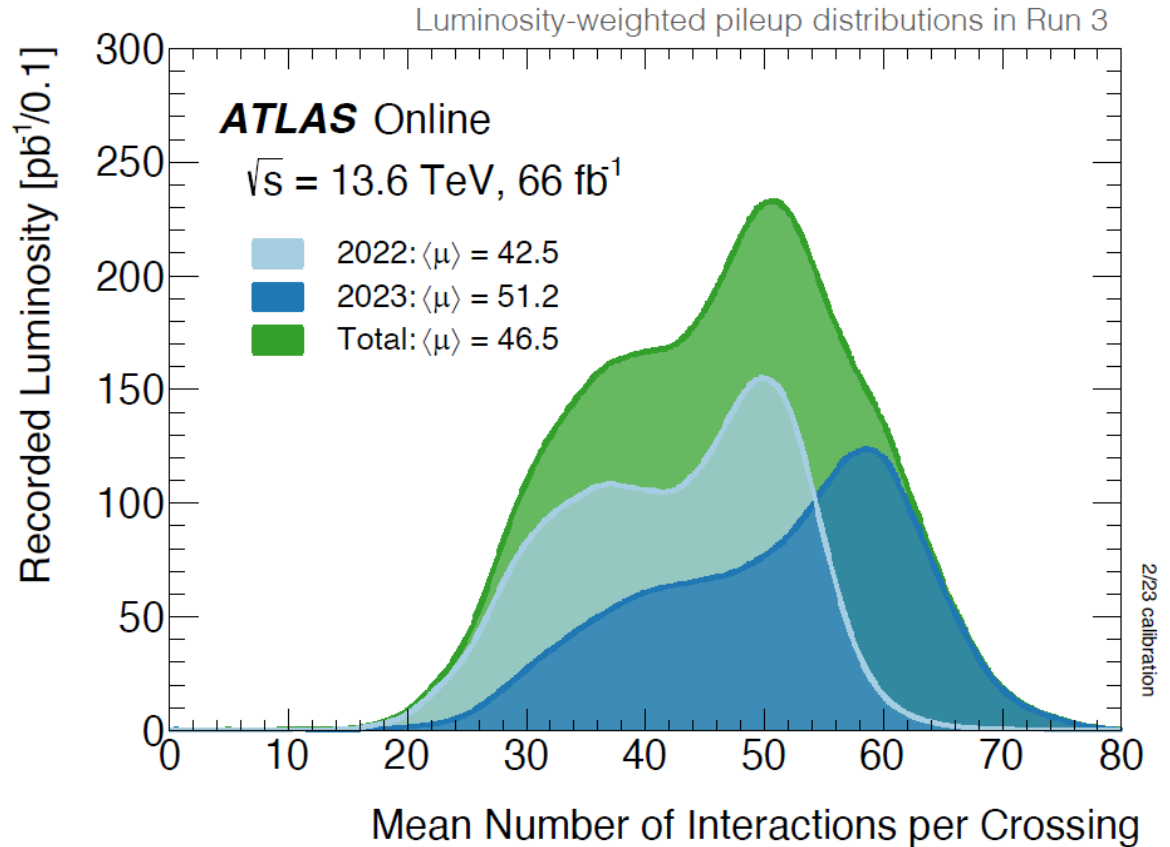
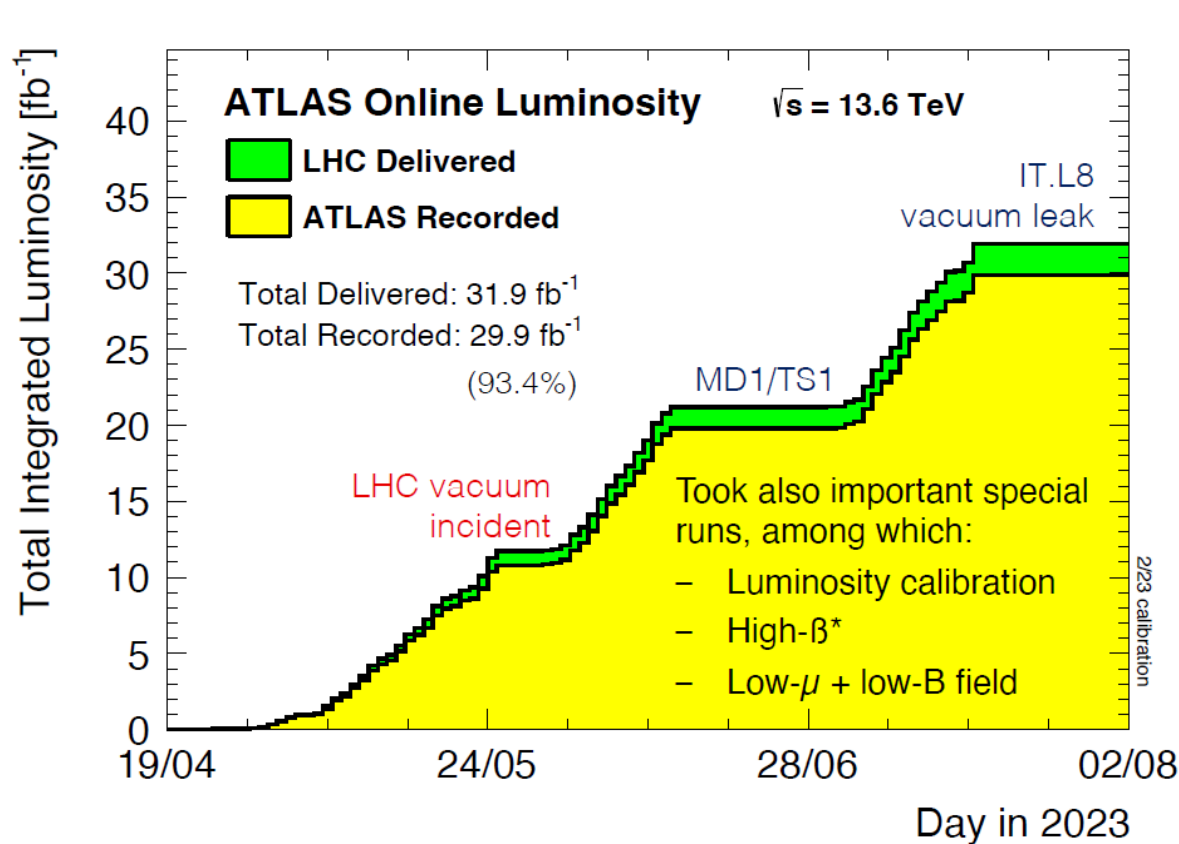


Vacuum module with signs of heating/sparks on outside of RF fingers and transition tube → may limit beam intensity

# in 2022/2023 ATLAS took 65.5 fb<sup>-1</sup> of pp Run 3 data !

Delivered target of 75 fb<sup>-1</sup> not reached: 31.9 fb<sup>-1</sup>, recorded luminosity 29.9 fb<sup>-1</sup> (93.7%)

Recorded 2023 luminosity adds to that collected in 2022 (delivered / recorded / good-for-physics: 38.5 / 35.7 / 31.4 fb<sup>-1</sup>): **65.6 fb<sup>-1</sup>**



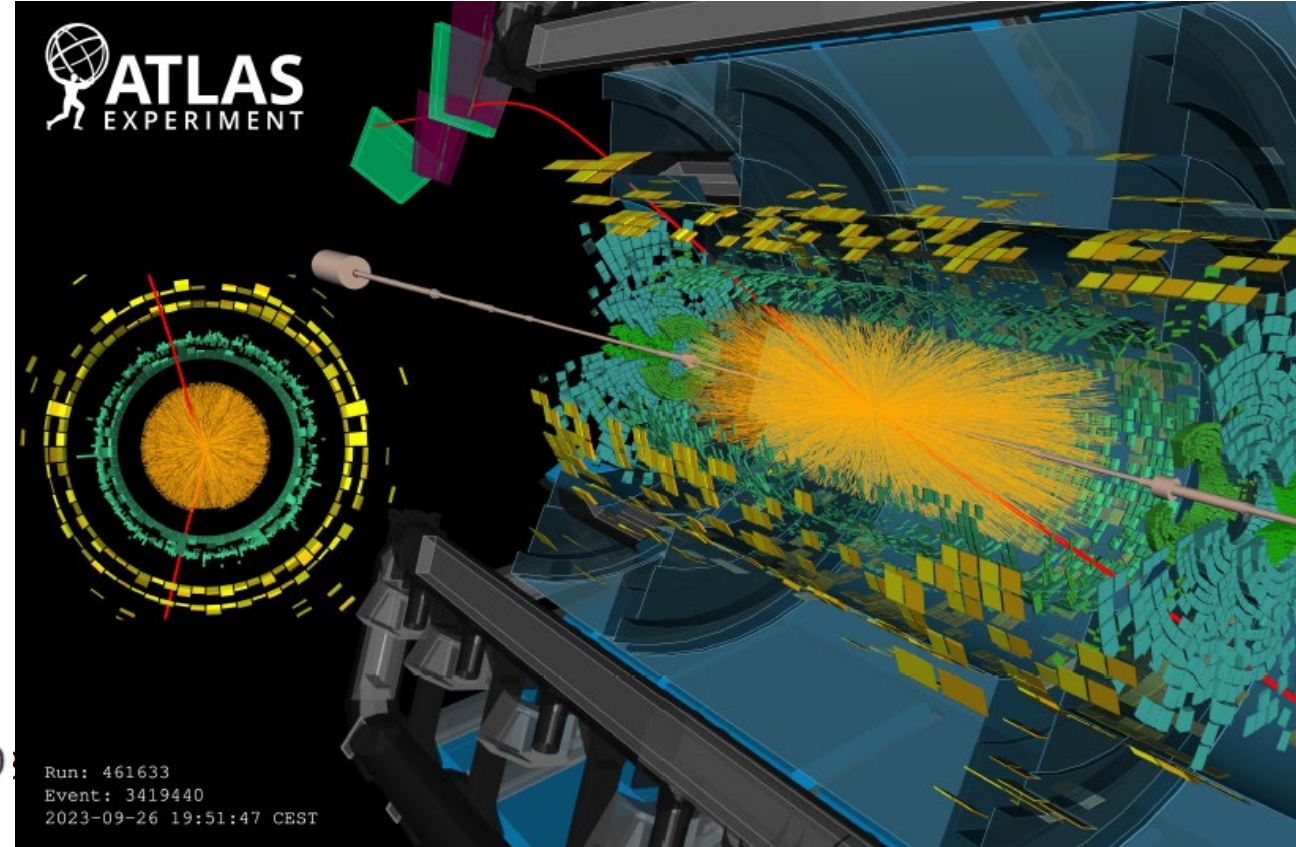
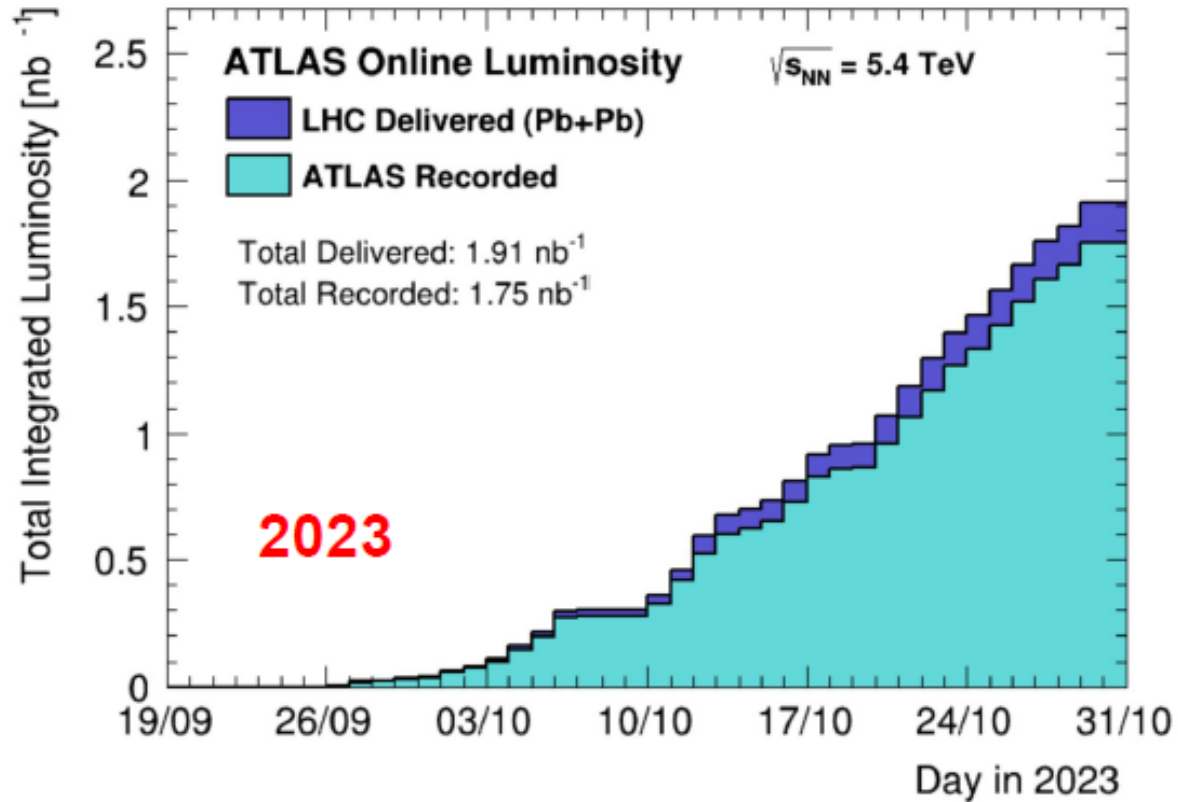
2023 good-for-physics efficiency up to 96.5% (up to 93.1% in 2022)  $\rightarrow$  27.8 fb<sup>-1</sup> (2023) + 31.4 fb<sup>-1</sup> (2022) = **59.2 fb<sup>-1</sup>**



# in 2022/2023 ATLAS took 1.75 fb<sup>-1</sup> of PbPb Run 3 data !

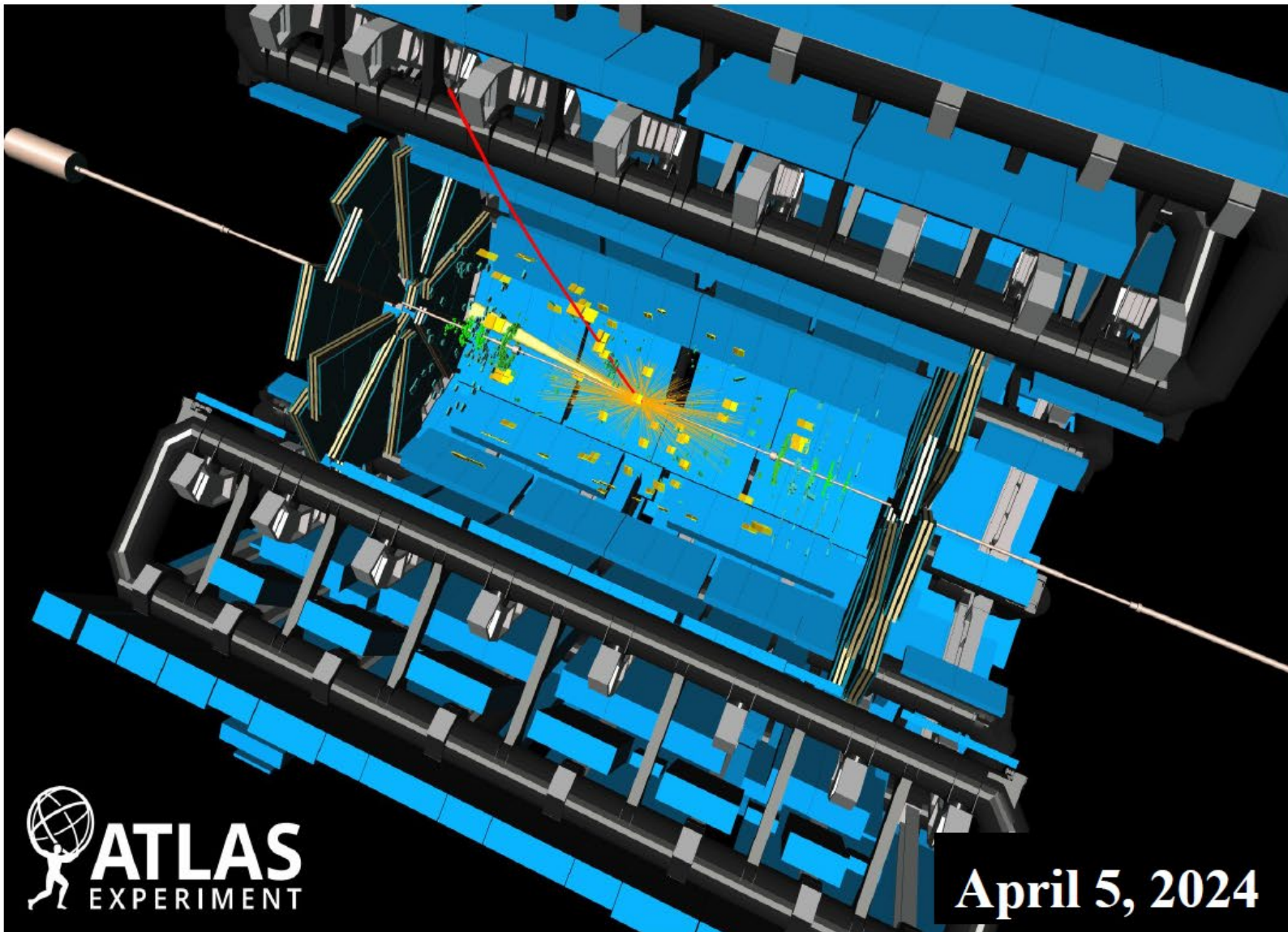
Delivered target of 75 fb<sup>-1</sup> not reached: 31.9 fb<sup>-1</sup>, recorded luminosity 29.9 fb<sup>-1</sup> (93.7%)

Recorded 2023 luminosity adds to that collected in 2022 (delivered / recorded / good-for-physics: 38.5 / 35.7 / 31.4 fb<sup>-1</sup>): **65.6 fb<sup>-1</sup>**



2023 good-for-physics efficiency up to 96.5% (up to 93.1% in 2022) → 27.8 fb<sup>-1</sup> (2023) + 31.4 fb<sup>-1</sup> (2022) = **59.2 fb<sup>-1</sup>**

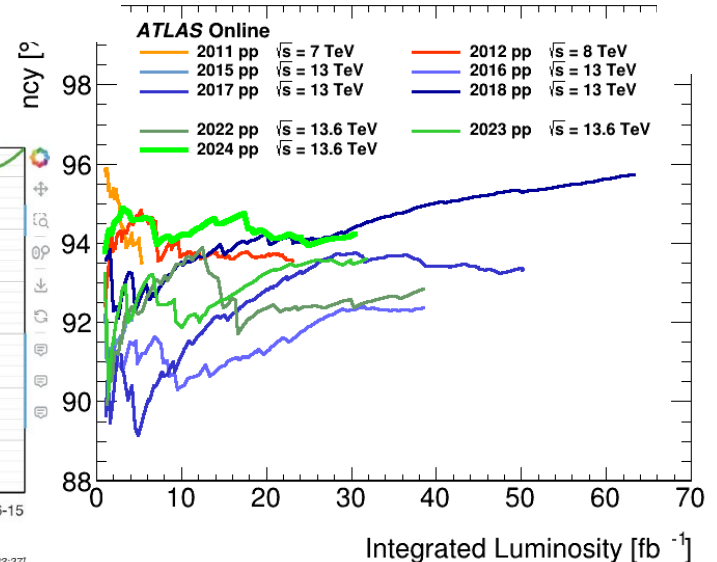
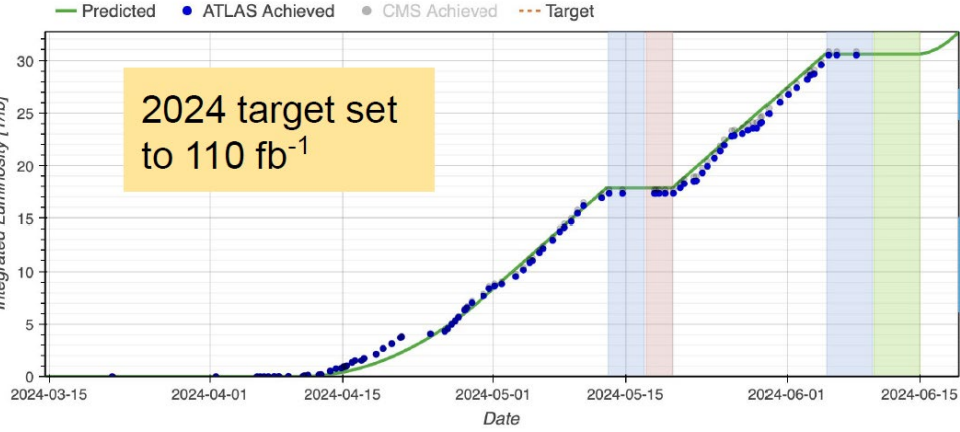
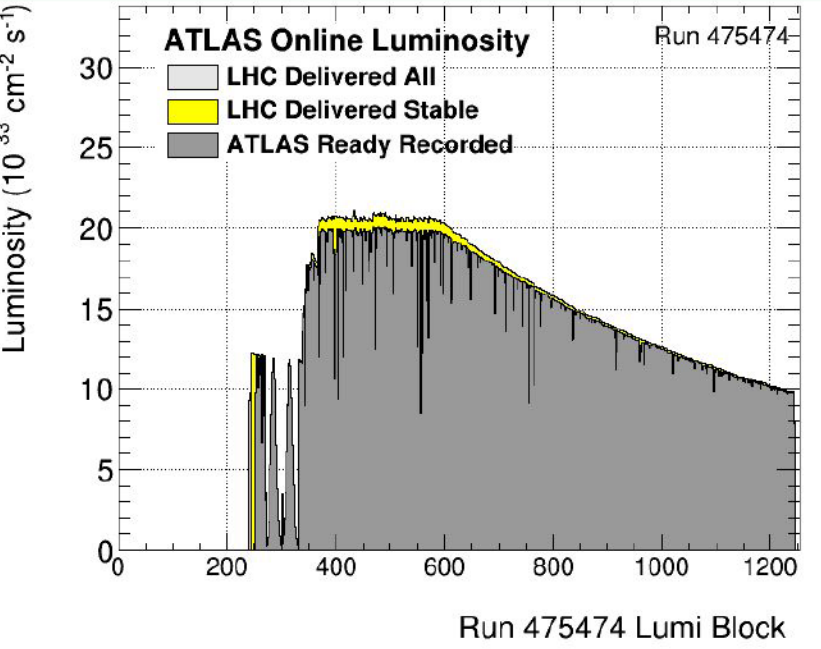
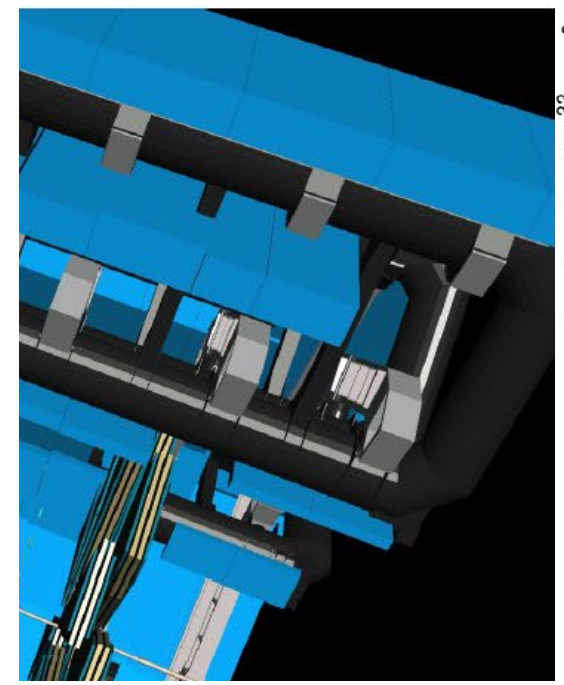
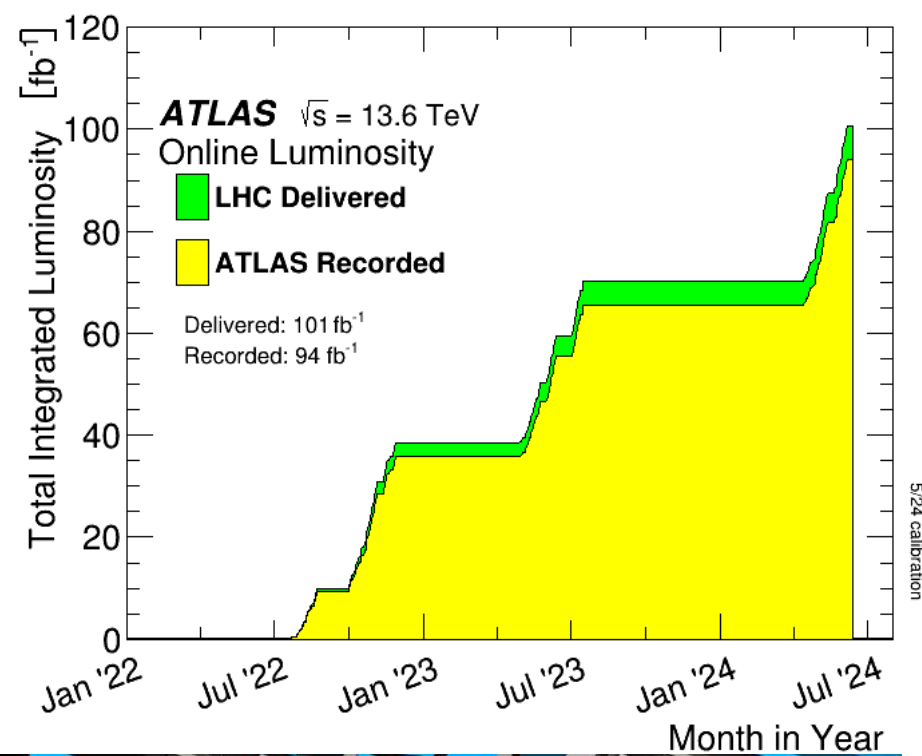
# First beam in 2024...



Collision event from first stable beam run of 2024 at 13.6 TeV



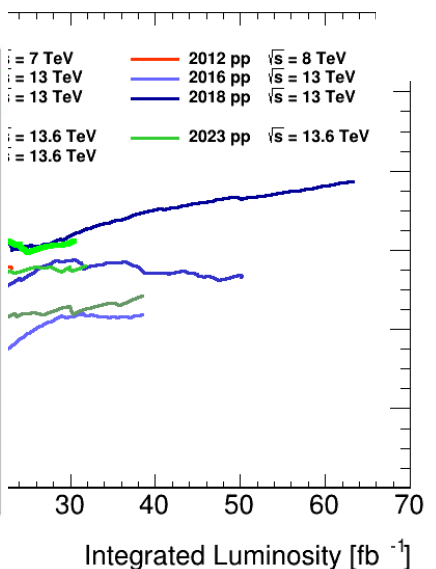
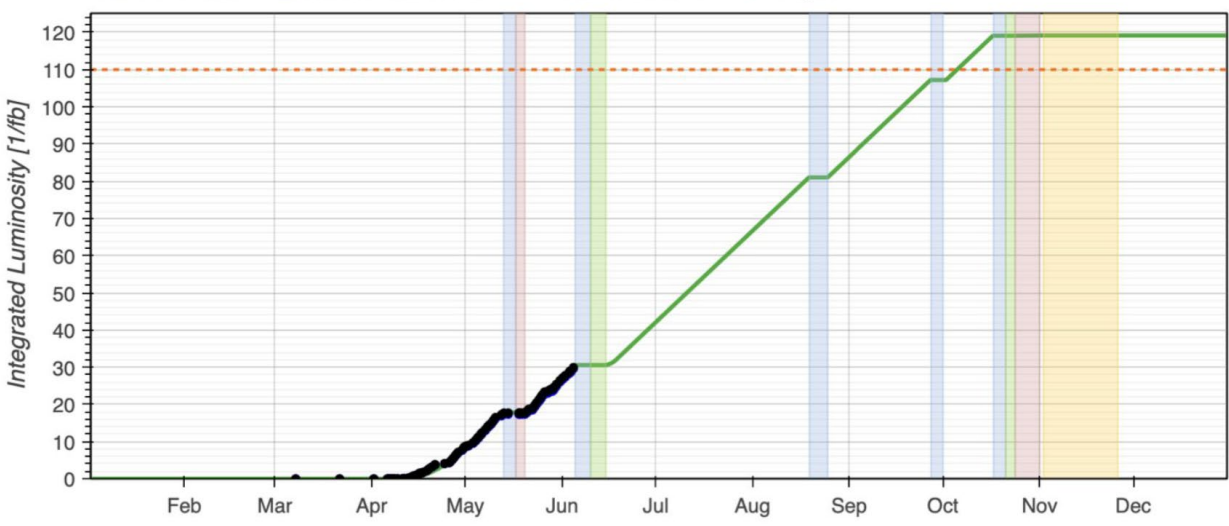
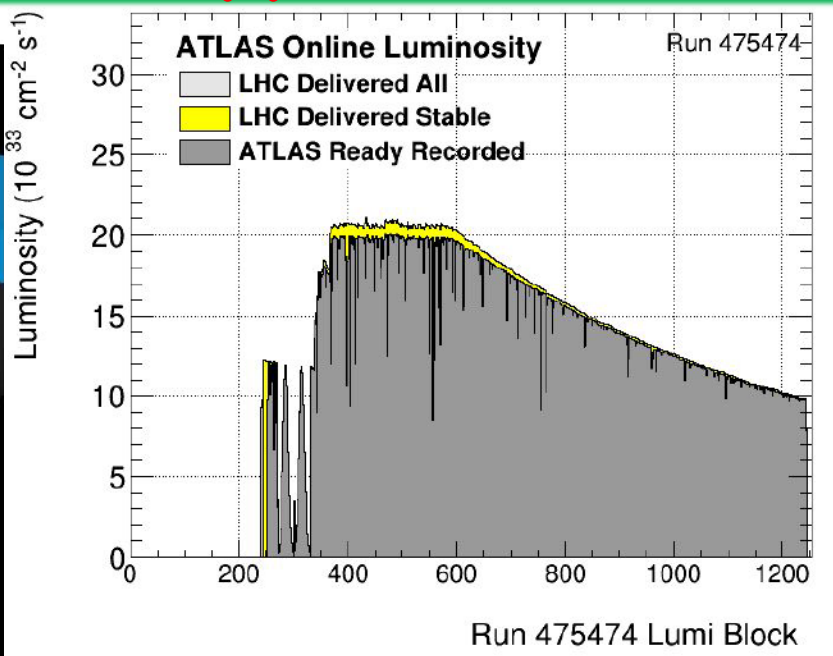
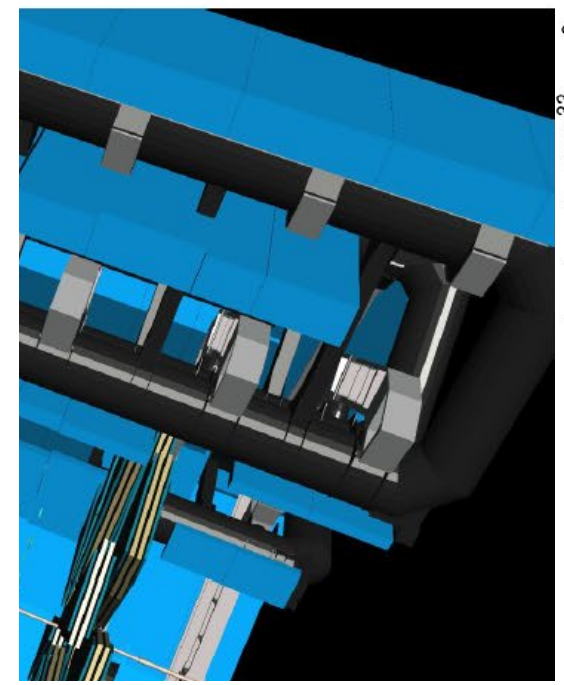
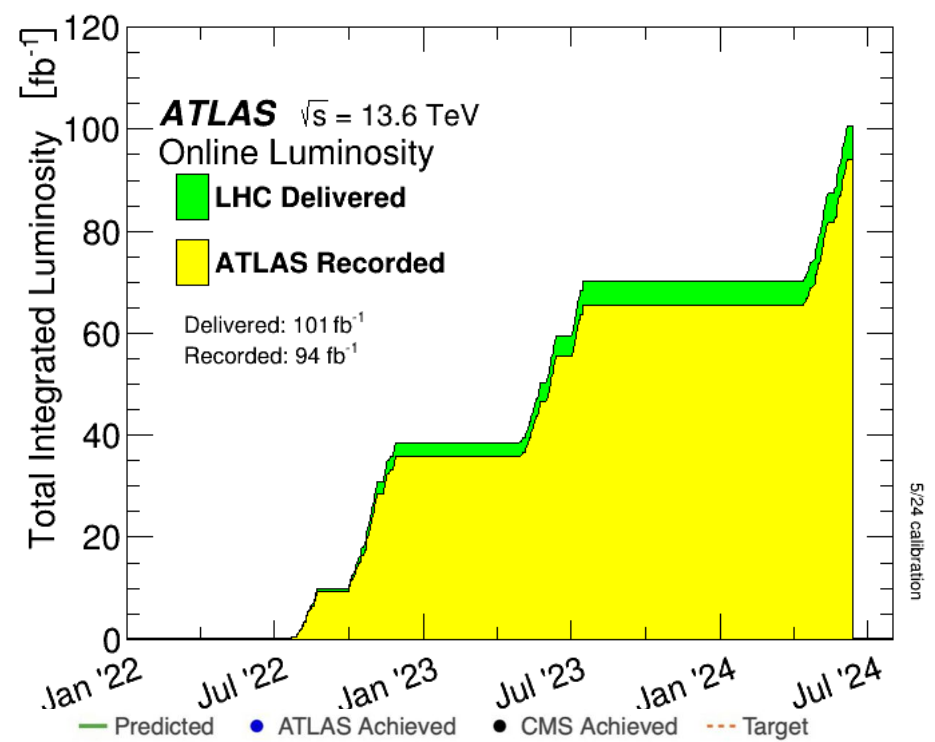
# And now ATLAS has recorded 94 fb<sup>-1</sup> of pp Run 3 data !



- Currently running at a L1A rate of ~95 kHz at  $\mathcal{L} = 2.1 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$  at a peak  $\langle \mu \rangle = 63$



# And now ATLAS has recorded 94 fb<sup>-1</sup> of pp Run 3 data !



- Currently running at a L1A rate of  $\sim 95$  kHz at  $\mathcal{L} = 2.1 \text{e}34 \text{ cm}^{-2} \text{ s}^{-1}$  at a peak  $\langle \mu \rangle = 63$



# Run-3 data analysis

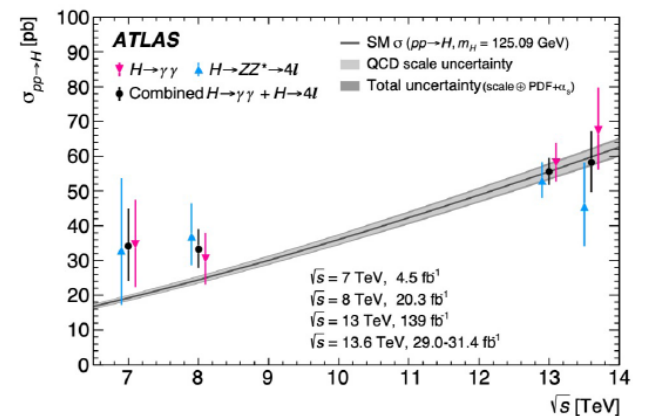
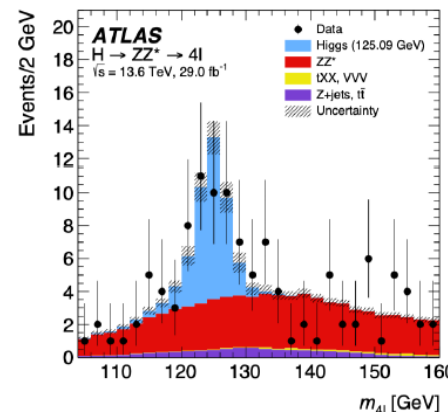
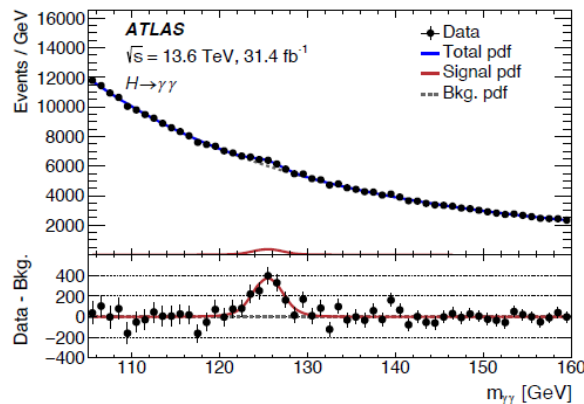
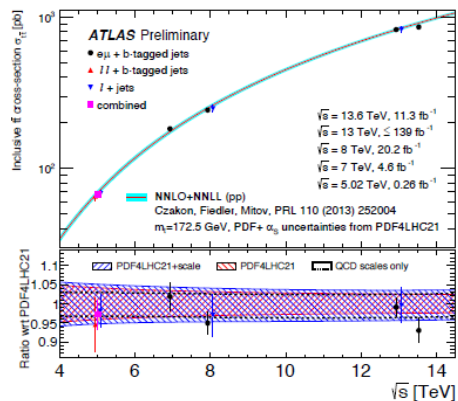
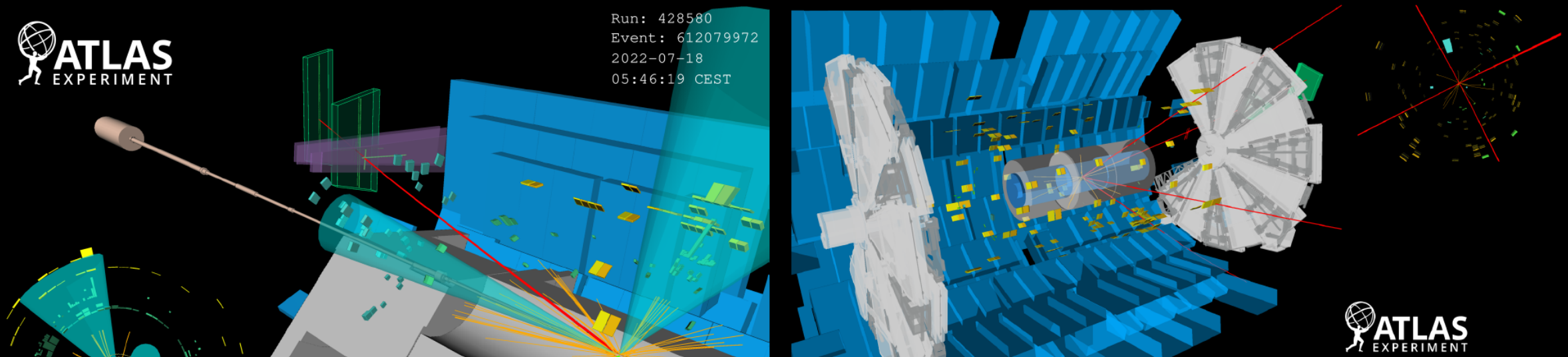
Excellent detector and reconstruction performance, 4 papers, 3 CONF notes, 5 PUB notes released on Run-3 data



Top-antitop to e- $\mu$  candidate event at 13.6 TeV

$H \rightarrow 4\mu$  candidate event at 13.6 TeV

Run: 428580  
Event: 612079972  
2022-07-18  
05:46:19 CEST

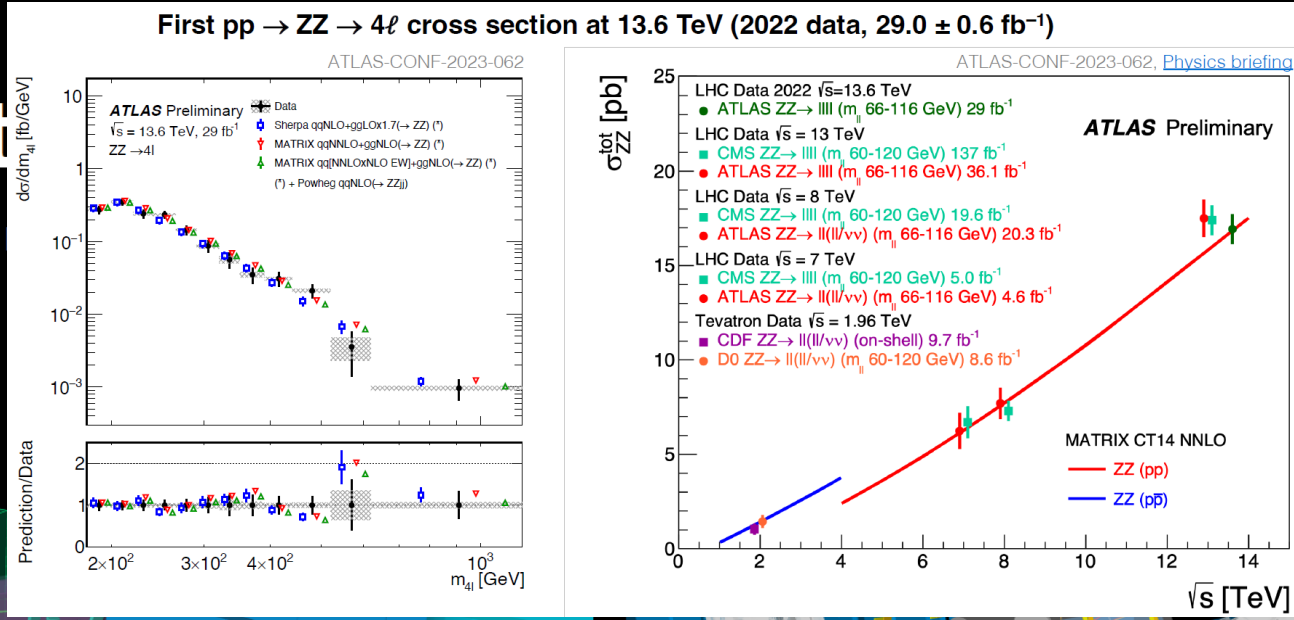


# Run-3 data

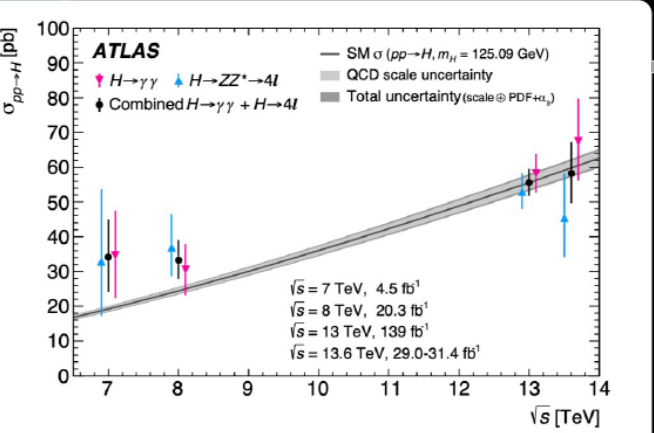
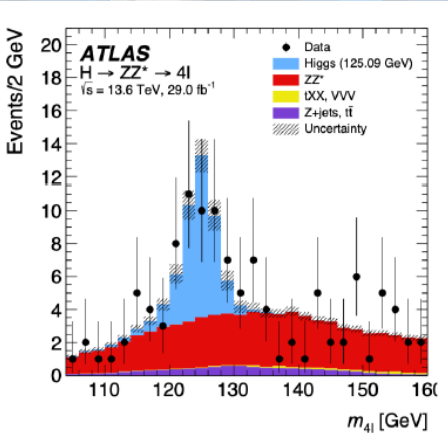
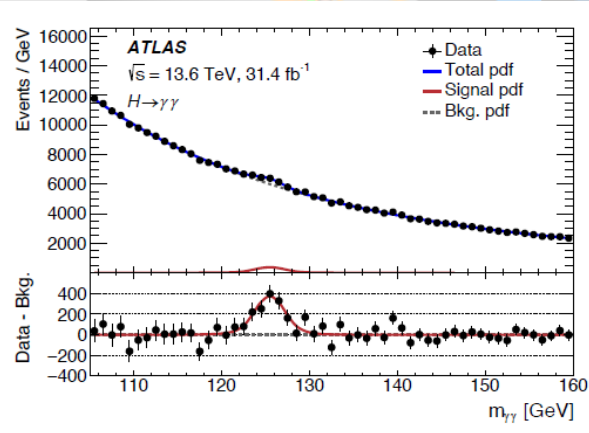
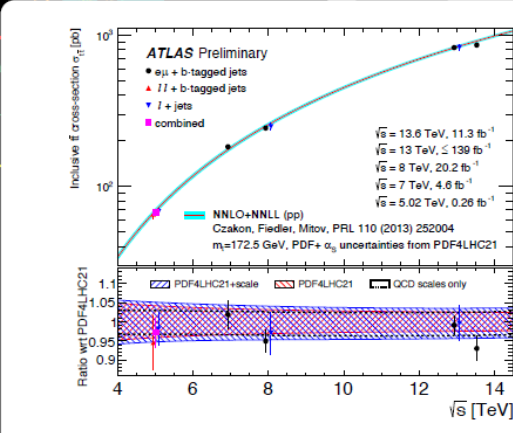
Excellent detector and

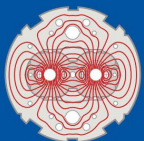


released on Run-3 data

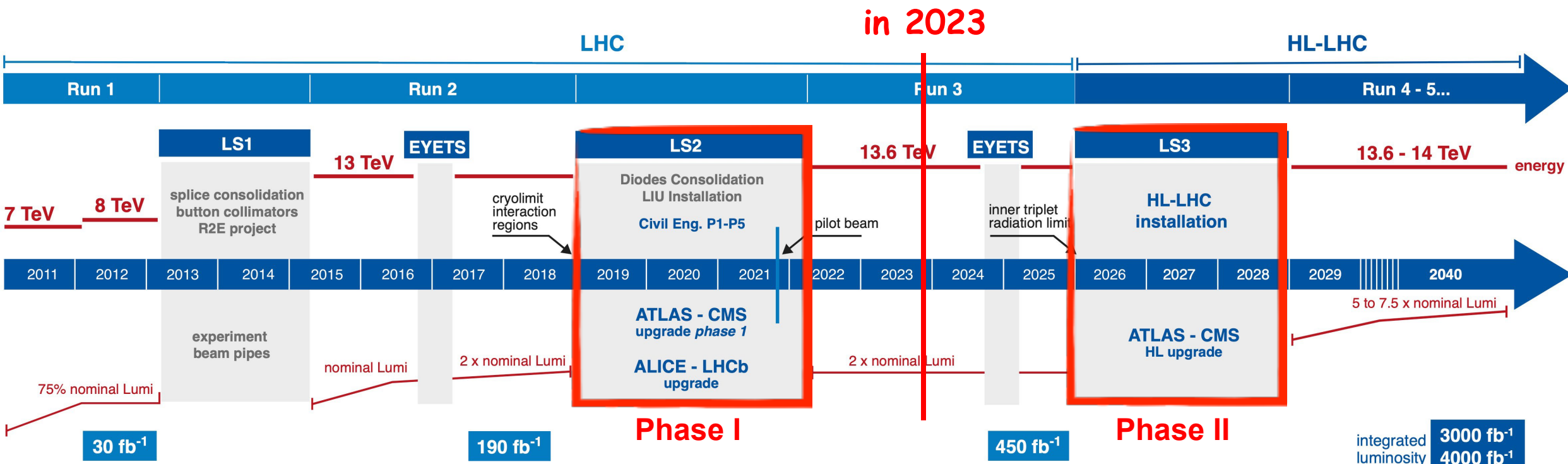


ATLAS well into Run3 in 2023 and now in 2024





# LHC / HL-LHC Plan



## HL-LHC TECHNICAL EQUIPMENT:



**LS2: Phase-I Upgrade goals**

- $\mathcal{L} \cong 3 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$
- $\langle \mu \rangle \cong 80$
- Keep trigger (max) 100 kHz; latency  $\leq 3 \mu\text{s}$

Upgrade of LAr trigger readout

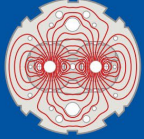
**LS3: Phase-II Upgrade goals**

- $\mathcal{L} \cong 7.5 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$
- $\langle \mu \rangle \cong 200$
- Upgrade trigger to 1 MHz; latency  $\leq 10 \mu\text{s}$

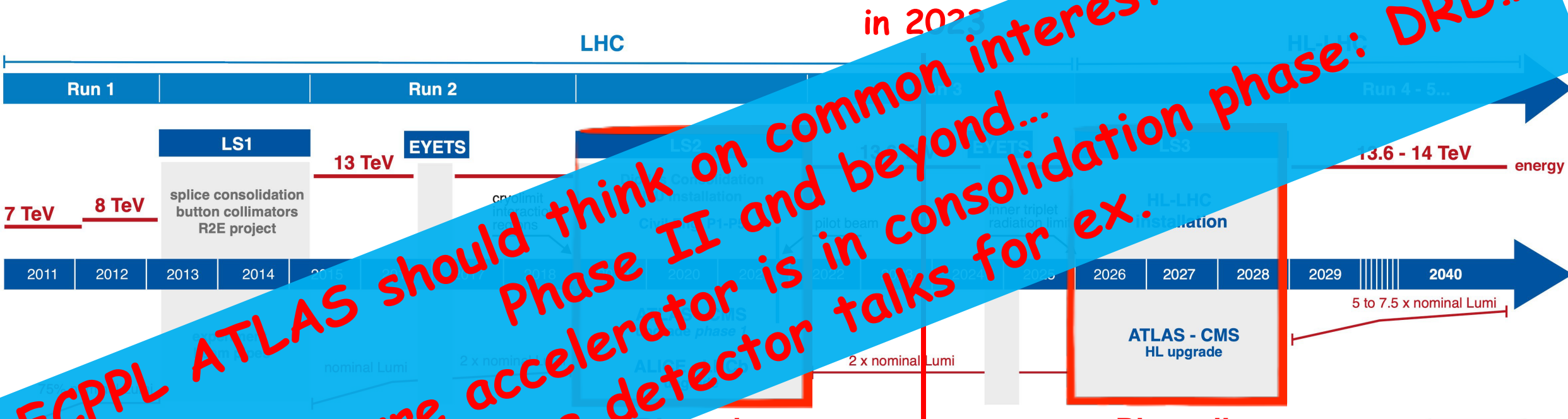
Upgrade of LAr main readout\*

integrated luminosity **3000 fb<sup>-1</sup>**  
**4000 fb<sup>-1</sup>**

**PHYSICS**



# LHC / HL-LHC Plan



**FCPPL ATLAS should think on common interest for Upgrade**  
**R&D for future accelerator is in consolidation phase: DRD...**  
**Phase II should think on common interest for Upgrade**  
**Phase II and beyond...**  
**See detector talks for ex.**

- LS2: Phase-I Upgrade goals**
- $\mathcal{L} \cong 3 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$
  - $\langle \mu \rangle \cong 80$
  - Keep trigger (max) 100 kHz; latency  $\leq 3 \mu\text{s}$
- Upgrade of LAr trigger readout

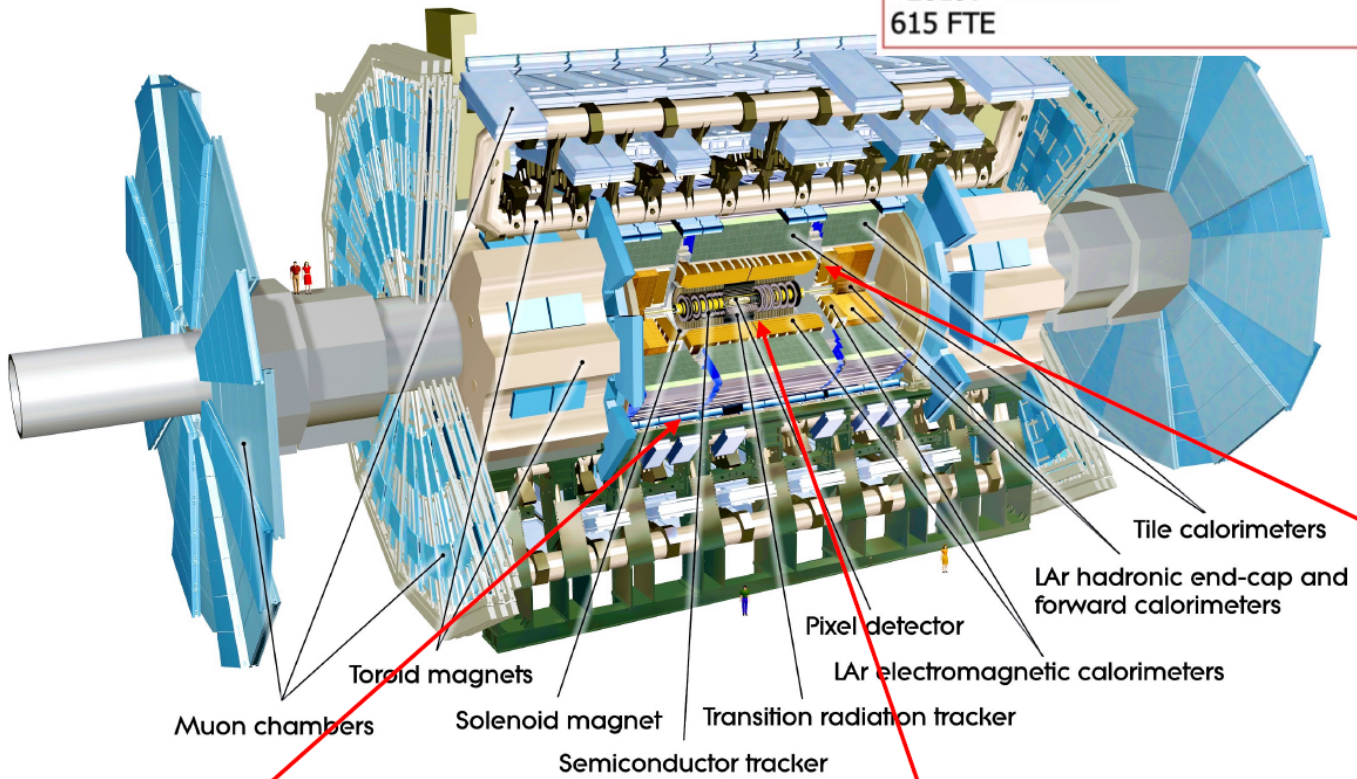
- LS3: Phase-II Upgrade goals**
- $\mathcal{L} \cong 7.5 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$
  - $\langle \mu \rangle \cong 200$
  - Upgrade trigger to 1 MHz; latency  $\leq 10 \mu\text{s}$
- Upgrade of LAr main readout\*

integrated luminosity **3000 fb<sup>-1</sup>**  
**4000 fb<sup>-1</sup>**

**PHYSICS**



# ATLAS Phase-II upgrade



## Upgraded Trigger and Data Acquisition system

Level-0 Trigger at 1 MHz  
 Improved High-Level Trigger (150 kHz full-scan tracking)

## Electronics Upgrades

- LAr Calorimeter
- Tile Calorimeter
- Muon system

## High Granularity Timing Detector (HGTD)

Forward region ( $2.4 < |\eta| < 4.0$ )  
 Low-Gain Avalanche Detectors (LGAD) with 30 ps track resolution

## Additional small upgrades

Luminosity detectors (1% precision goal)  
 HL-ZDC

## New Muon Chambers

Inner barrel region with new RPC and sMDT detectors

## New Inner Tracking Detector (ITk)

All silicon, up to  $|\eta| = 4$

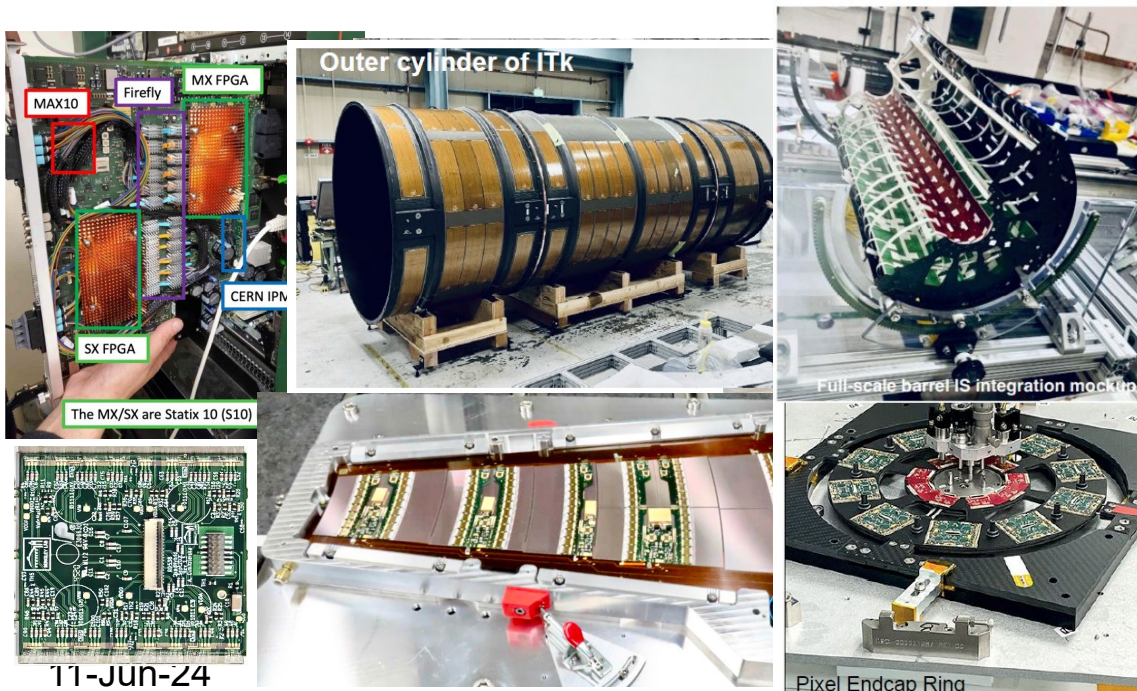
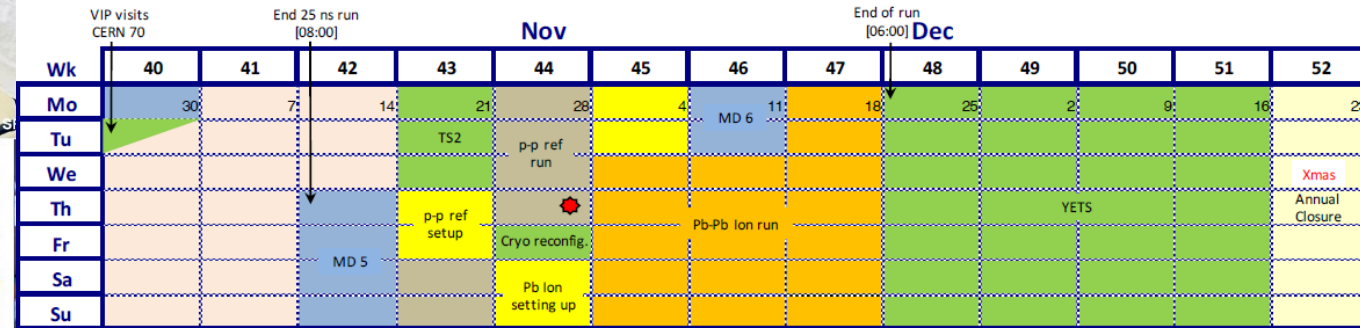
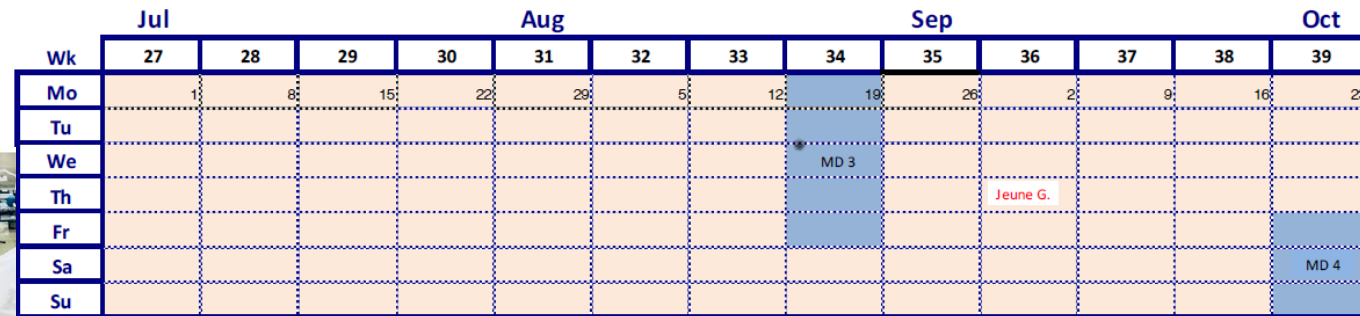
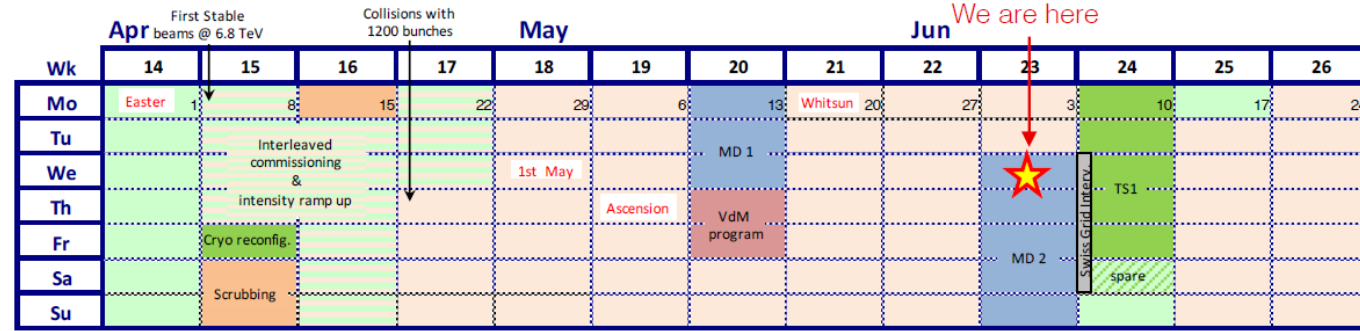
# LHC & ATLAS into Run 3 at full swing !

## Run 3 analysis just ahead !

### LHC calendar for 2024:

Start beam commissioning: mid-Mars  
 First stable beams: mid-April  
 1200 bunches: end-April  
 Machine @ full capacity (>2350b)  
 HI run : November

### ATLAS: Record/Analyse data ! & Continue the Phase-II ramp-up



# LHC & ATLAS into Run 3 at full swing !

## Run 3 analysis just ahead !

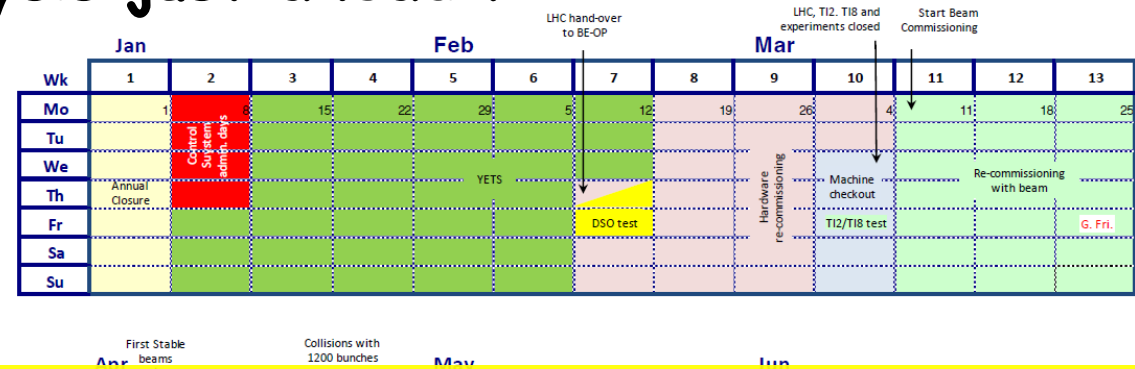
### LHC calendar for 2024:

Start beam commissioning: mid-Mars

First stable beams: mid-April

1200 bunches: end-April

HI run : October



**ATLAS has completed Phase-I commissioning and Run 3 is in full swing !**

**FCPPL cooperation strongly contributes to many "Run 2" legacy papers as well as now to the first "Run 3" data analysis.**

**See today's talks as well as winter and summer conference slides and related conf. notes for ATLAS new results.**

**ATLAS Upgrade Phase II is also in full swing and FCPPL is strongly involved !**

**AND:**

**ATLAS FCPPL has opportunities to further cooperate: ITK, LAr Calo, HGTD,...**

**BUT: also in the emerging future detector R&D DRD program for ex...**

**AND FCPPL cooperations have a role to play in it !**

- Strong cooperation program between the Atlas Chinese Clusters and IN2P3 labs since many years:
  - Higgs, Susy studies, SM (through  $\gamma\gamma$ , WW final states and also lepton/jet/bjet/top final states such as in 4t, ttH, VH, H<sup>++</sup>, HH...)  
(X. Chen, T. Li, X. Wang talks)
  - Performance studies (E/gamma, b tag, trigger, calorimeter)
  - Phase I commissioning for Run3 (Several FCPPL PhD students)
  - Silicon detector R&D and Phase II (D. Xu)
  - Numerous presentation in Atlas meetings, conferences as well as in internal, public/conf notes and publications. (See FCPPL reports)
  - Senior physicists visits (France and China) on hold but cooperation work between physicists continued despite the aftermath of the pandemy
  - Several co-PhD thesis defended in 2022&23, K. Han, C. Wang, J. Tafoya, and more to come in 2024... (Co-PhDs important strengthening force for the FCPPL)
- On computing, IHEP/IN2P3/CEA (C. Gang, F. Qi, F. Hernandez)
- New Phase II (HGTD, ITK,...) & new accel. coop. started (V. Boudry, J. Guimaraes, C. Hu-Guo, I. Laktineh, Y. Lu, J. Zhang) + Ramp up on theory cooperation for future accelerator.

# ATLAS ACC-IN2P3 continued full Run2 data analyses & performance studies aiming at "legacy" full Run2 publications + started first Run3 analysis

- PhD :
  - X. Yang (LPSC/SDU) CSC funded (defended 06/20)
  - Y. Wang (LPNHE/USTC) USTC funded (defended 12/20)
  - H. Atmani (IJCLAB) IJCLAB funded (defended 12/20)
  - H. Xu (CPPM/USTC) CPPM/USTC funded (defended 09/21)
  - Z. Li (CPPM/SDU) CPPM/SDU/CSC funded (defended 09/21)
  - K. Han (IJCLAB/USTC) USTC funded (defended 03/22)
  - C. Wang (CPPM/SJTU) CPPM/SJTU/CSC funded (defended 02/23)
  - J. Tafoya (IJCLAB) IJCLAB funded (defended 10/23)
  - Y. Zhang (APC/SJTU) APC/SJTU/CSC funded (defended 12/23)
  - Q. Shen (APC/SJTU) APC/SJTU/CSC funded (started 10/20)
  - X Su (IJCLAB) IJCLAB/USTC funded (started 10/20)
  - X. Wang (CPPM/SJTU) CPPM/SJTU/CSC funded (started 09/21)
  - C. Mo (APC/SJTU) APC/SJTU/CSC funded (started 10/23)
- Many former Co-PhDs now postdocs or permanent positions: Core for future Accelerator Prog
- HL-LHC (Calo, ITK, HGTD...) & future accelerator (Silicon detector, Calo...) cooperation program ongoing, but need new PhD students & short stay scientists to strengthen it !
- Need to strengthen person power/funds for strong ATLAS Run 2/Run 3 analysis and for ATLAS upgrade and future detectors R&D.

谢谢！  
Merci !  
Thank You !

<b>Highlights</b>	14:00	<b>ATLAS FCPLL project</b> <i>Auditorium de l'AGORA, BORDEAUX</i>	<i>Emmanuel Monnier</i> 14:00 - 14:10
		<b>ATLAS highlights</b> <i>Auditorium de l'AGORA, BORDEAUX</i>	<i>Adriana Milic</i>  14:10 - 14:35
		<b>Search for a resonance decaying into a scalar particle and a Higgs boson in the final state with two bottom quarks and t...</b> <i>Xi Wang</i>	
	15:00	<b>Search for Higgs boson pair production with ATLAS Run2 and Run3 data</b> <i>Auditorium de l'AGORA, BORDEAUX</i>	<i>Tong LI</i> 14:55 - 15:15
		<b>Observation of Four-Top-Quark Production in the Multi-lepton Final State with the ATLAS</b> <i>Auditorium de l'AGORA, BORDEAUX</i>	<i>Xiang Chen</i> 15:15 - 15:35