



ATLAS FCPPL Projects

Session Introduction

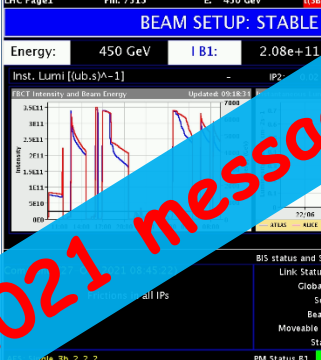
Emmanuel MONNIER (CPPM)



FCPPL 13th workshop
Zhuhai 7th November 2023



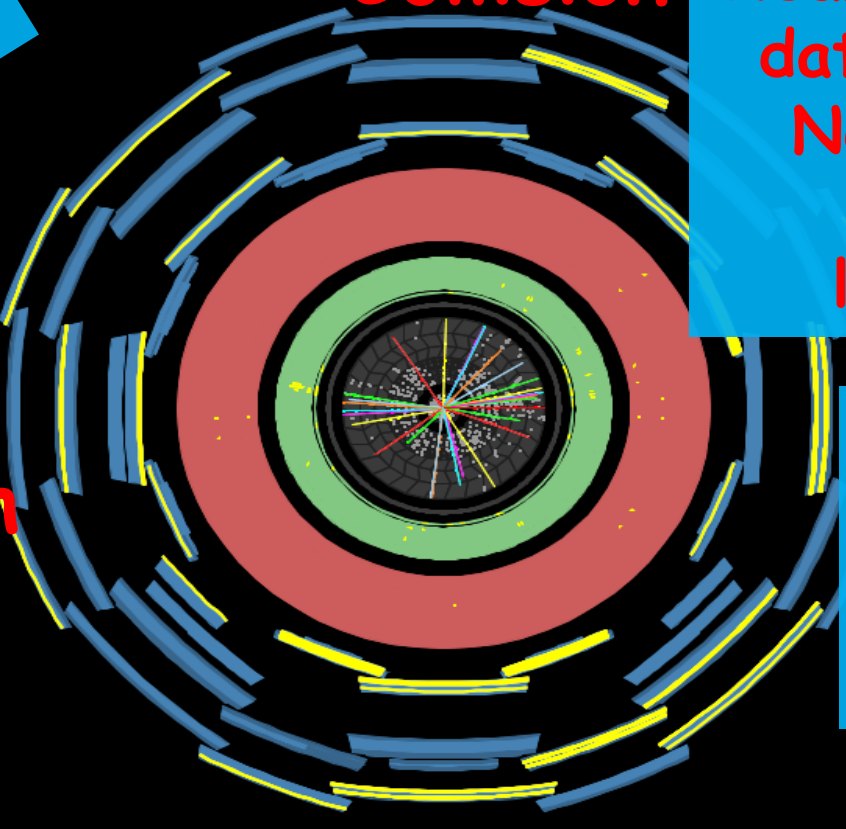
FCPPL 2021 message



Splash

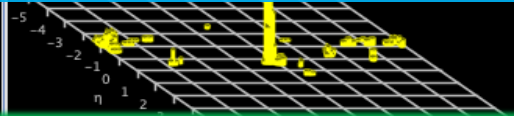


Collision

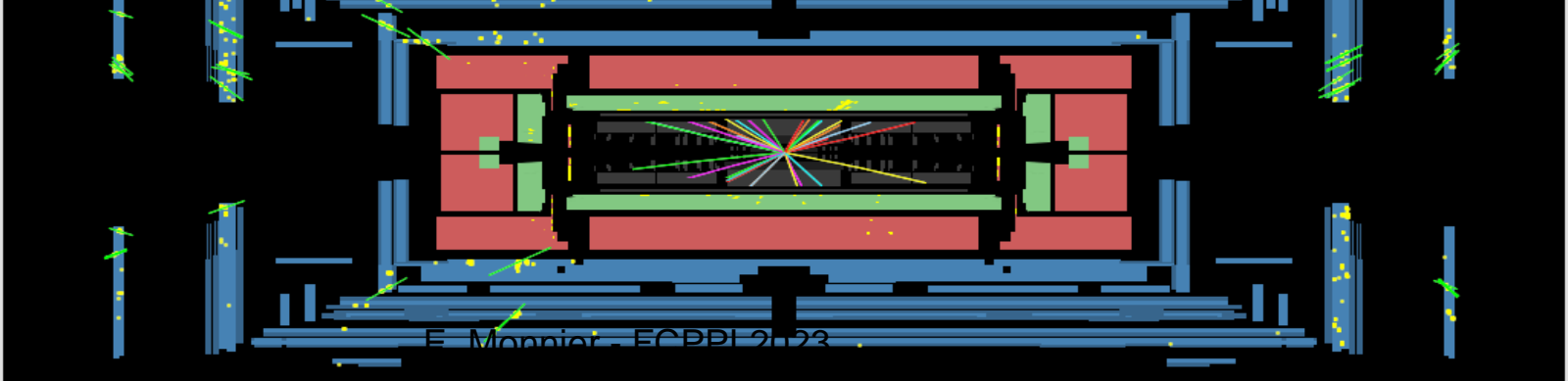
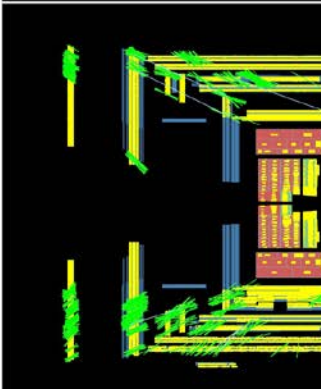


Clear Road for new Run3 data taking in 22-25, New Higgs property studies and new limits@13.6TeV...

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



ATLAS ready for Run3 in 2022 !



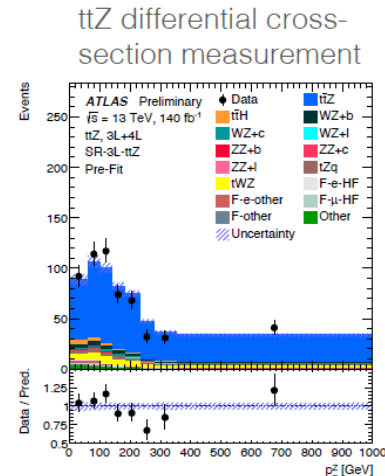
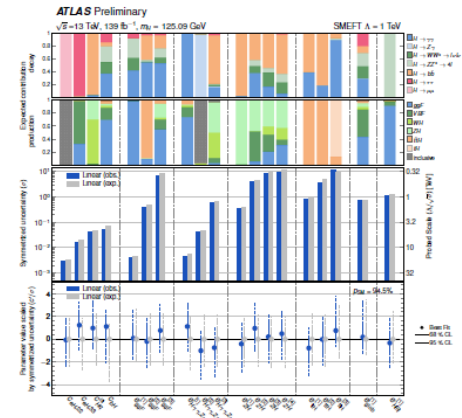
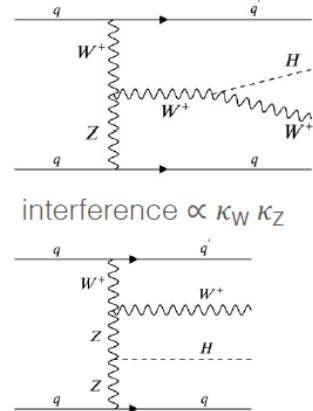
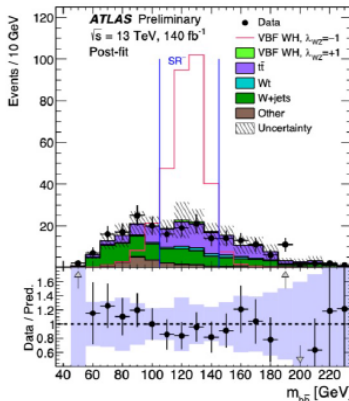
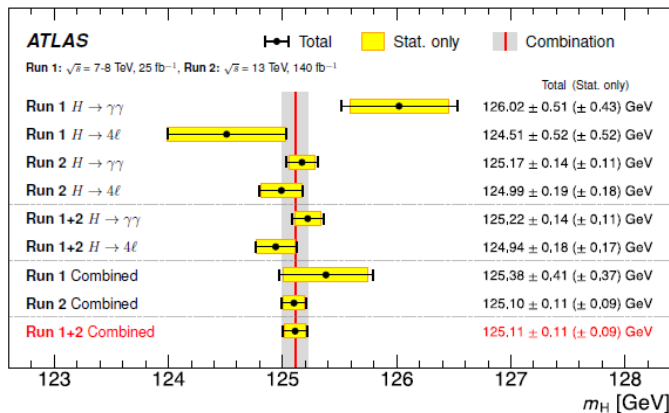
E. Monnier - FCPPL 2023

Among the recent Run-2 physics results



In 2022/2023 ATLAS continued Run 2 analysis!

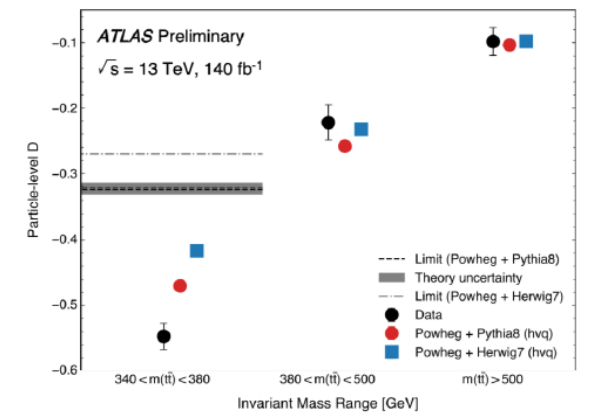
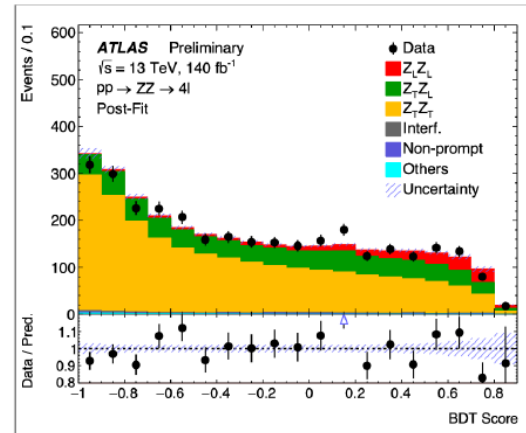
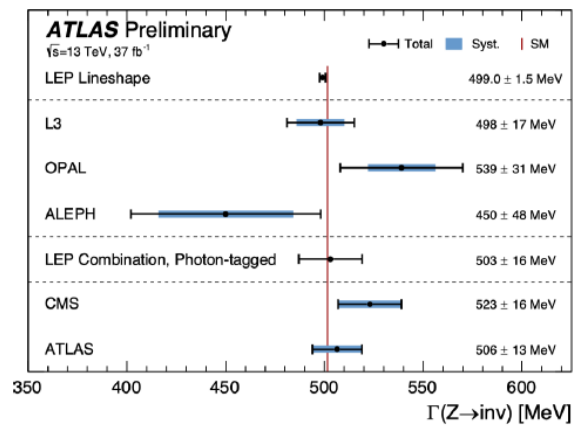
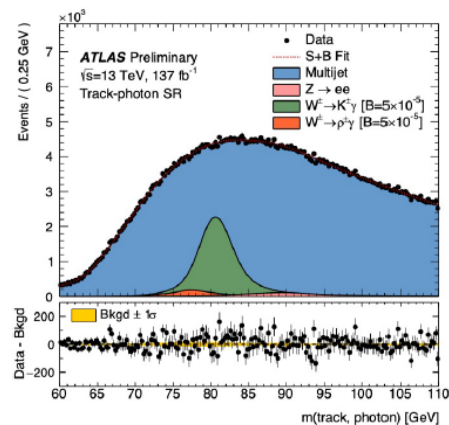
Huge recent harvest of important and beautiful physics & performance results by ATLAS



World's best measurement of the Higgs boson mass

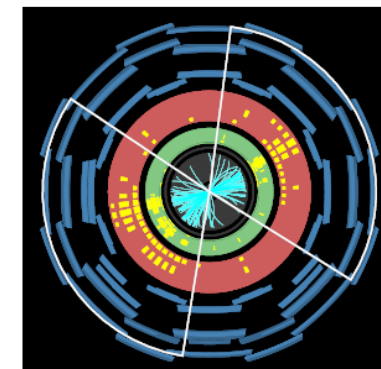
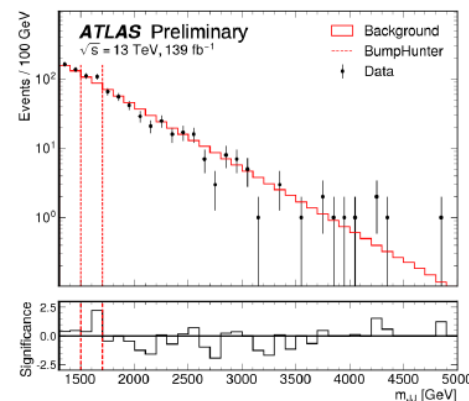
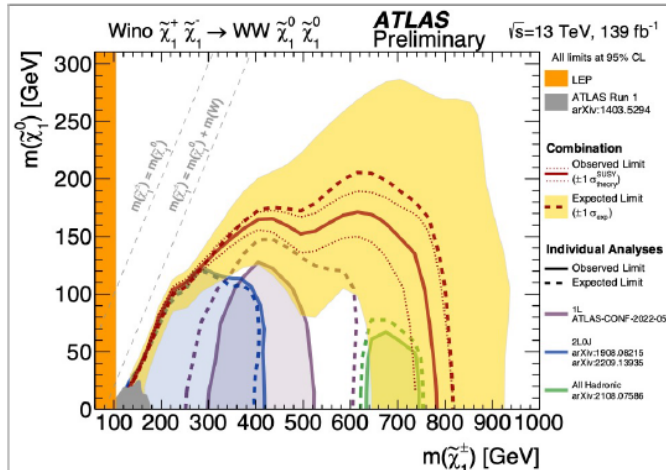
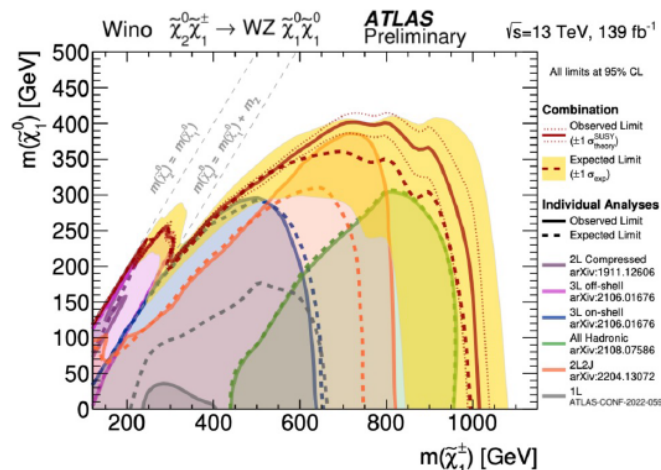
$\lambda_{WZ} = \kappa_W / \kappa_Z > 0$, using VBF + WH(\rightarrow bb)

Comprehensive Higgs EFT / BSM study



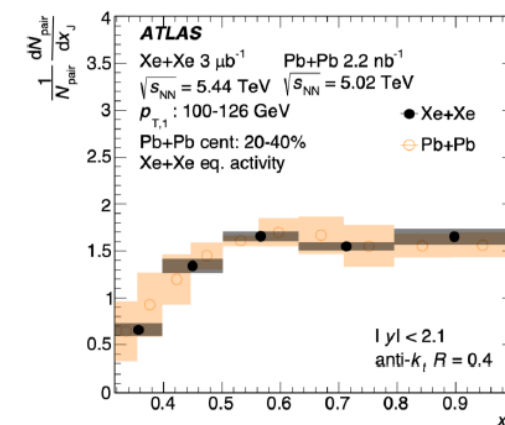
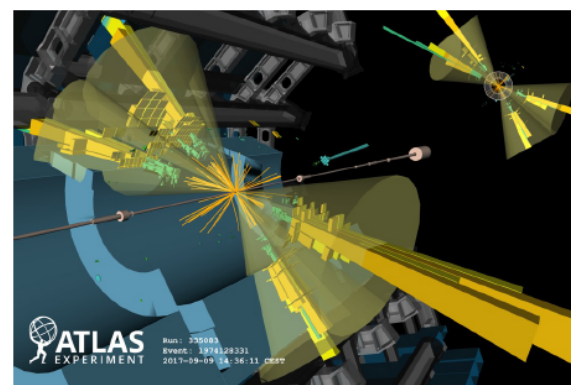
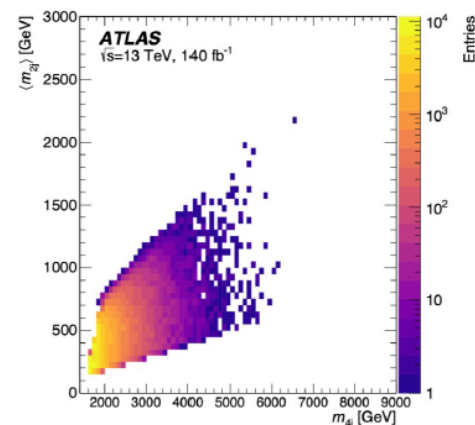
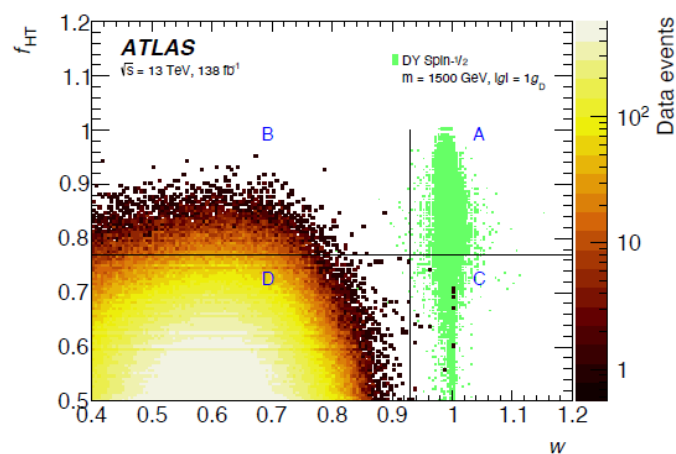
In 2022/2023 ATLAS continued Run 2 analysis !

Huge recent harvest of important and beautiful physics & performance results by ATLAS



Combined searches for electroweak SUSY (incl. comprehensive pMSSM analysis)

Search for $Z' \rightarrow$ dark hadrons

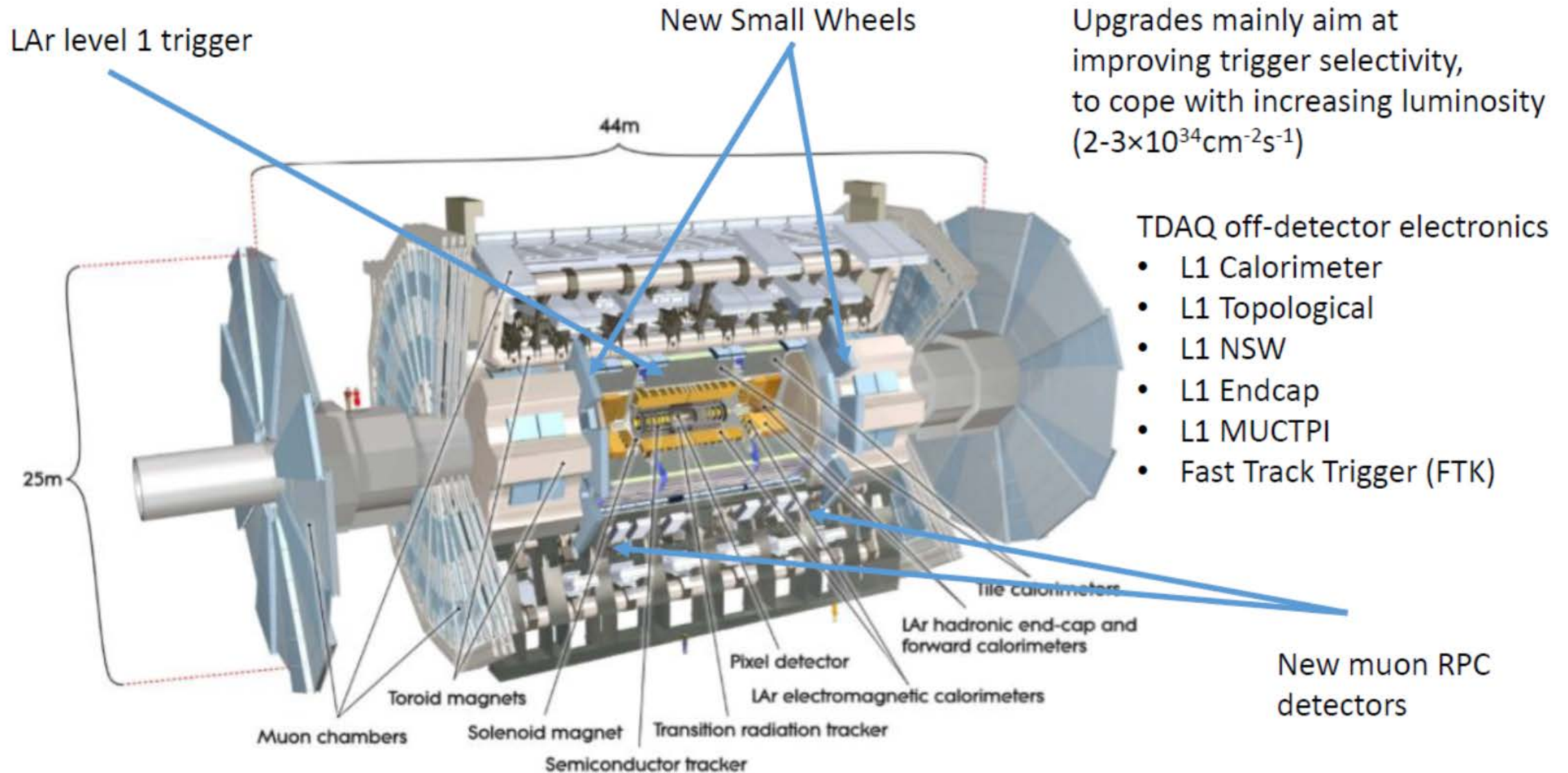


Search for highly ionising particles (magnetic monopoles)

Search for $Y \rightarrow XX \rightarrow jjjj$

Jet quenching similar in Xe and Pb

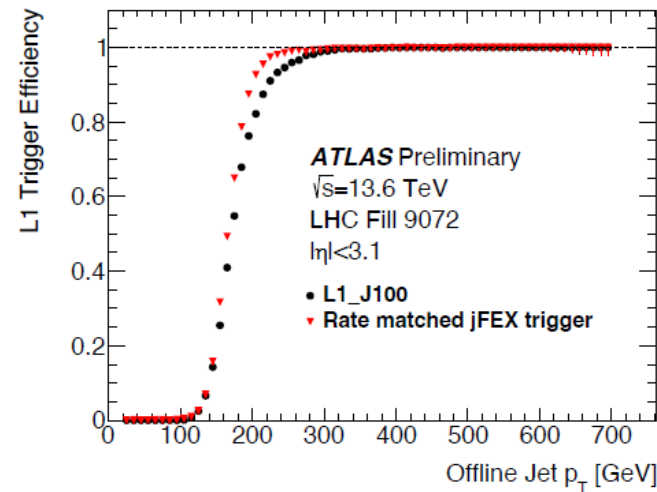
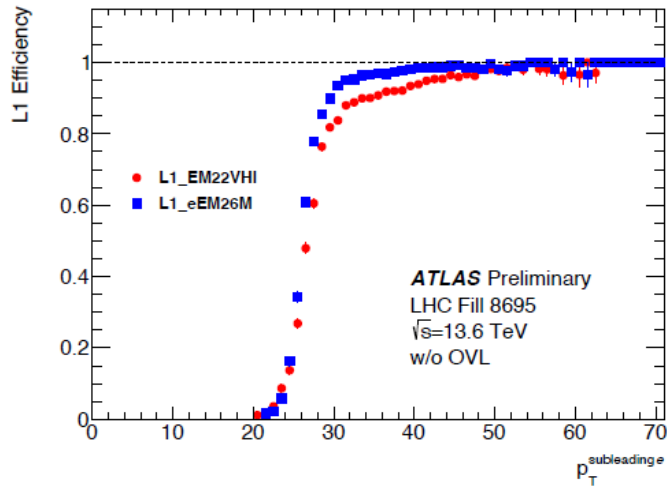
ATLAS Phase-I upgrades (LS2,2019/21) + Commissioning 2022/23



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



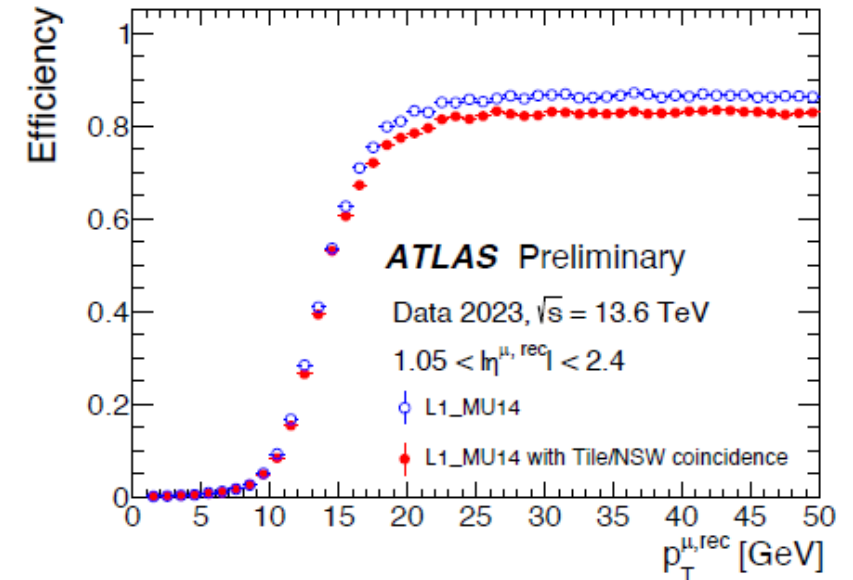
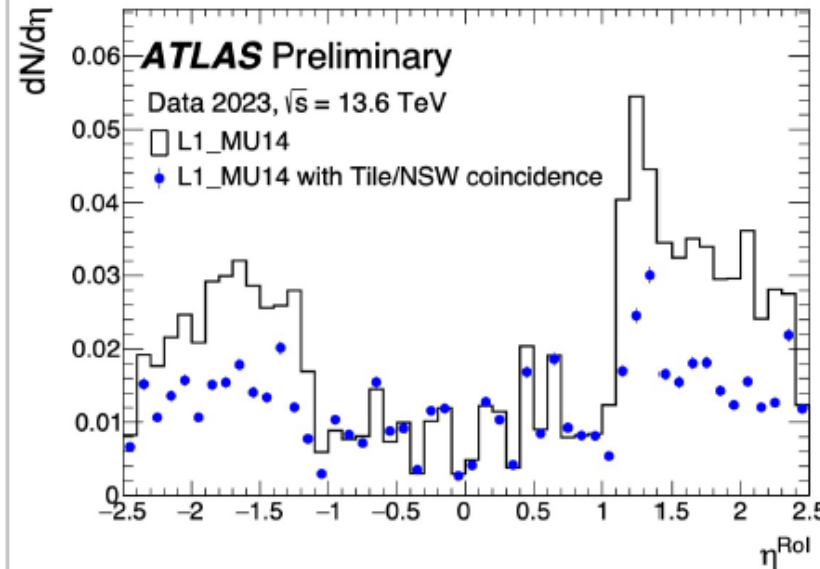
Upgrades mainly aim at improving trigger selectivity, to cope with increasing luminosity ($2-3 \times 10^{34} \text{cm}^{-2}\text{s}^{-1}$)

TDAQ off-detector electronics

- L1 Calorimeter
- L1 Topological
- L1 NSW
- L1 Endcap
- L1 MUCTPI

NSW: efficient sTGC pads (75% of acceptance) included in trigger selection since July 2023: 6 kHz rate reduction with > 95% eff. plus 2 kHz reduction by Tile-Muon coincidence ($1.0 < |\eta| < 1.3$)

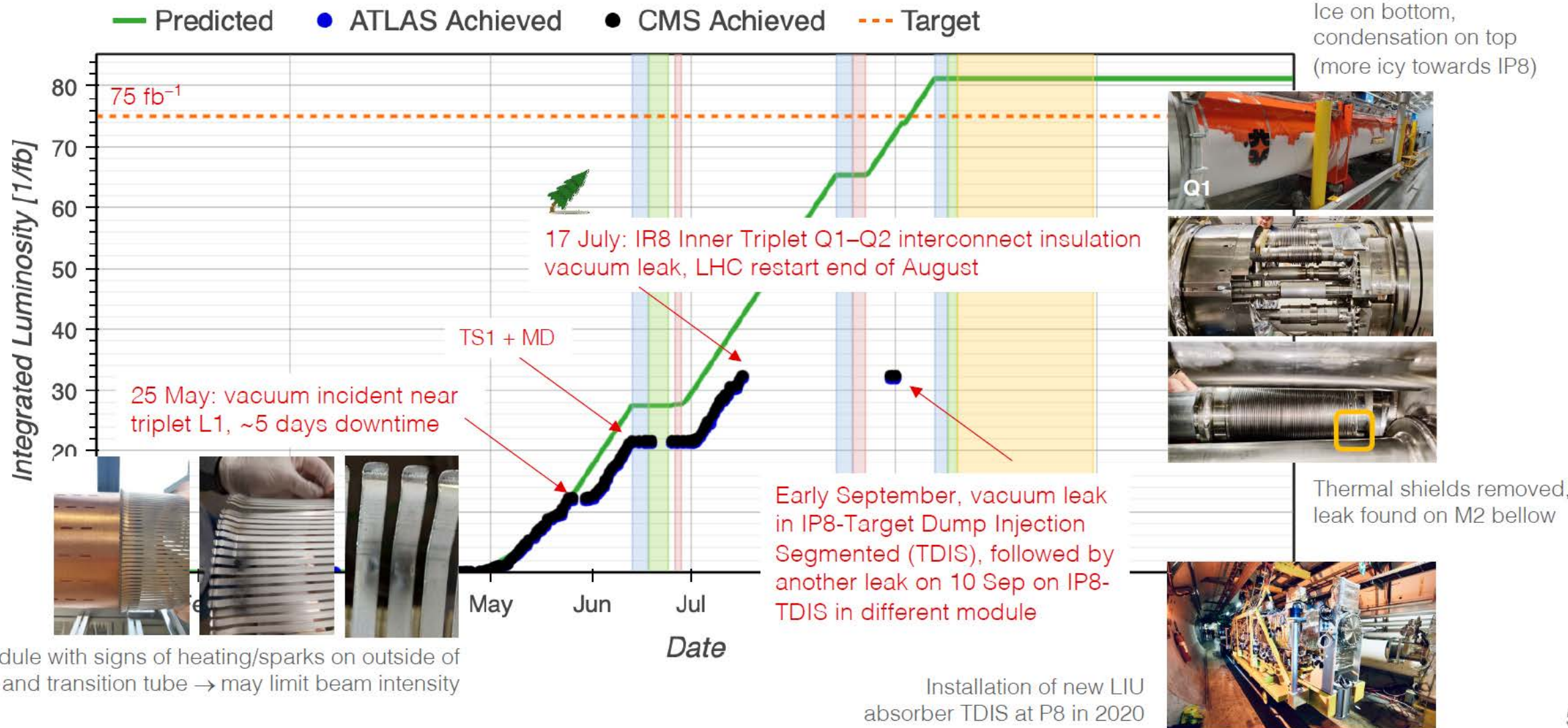
New Small Wheel



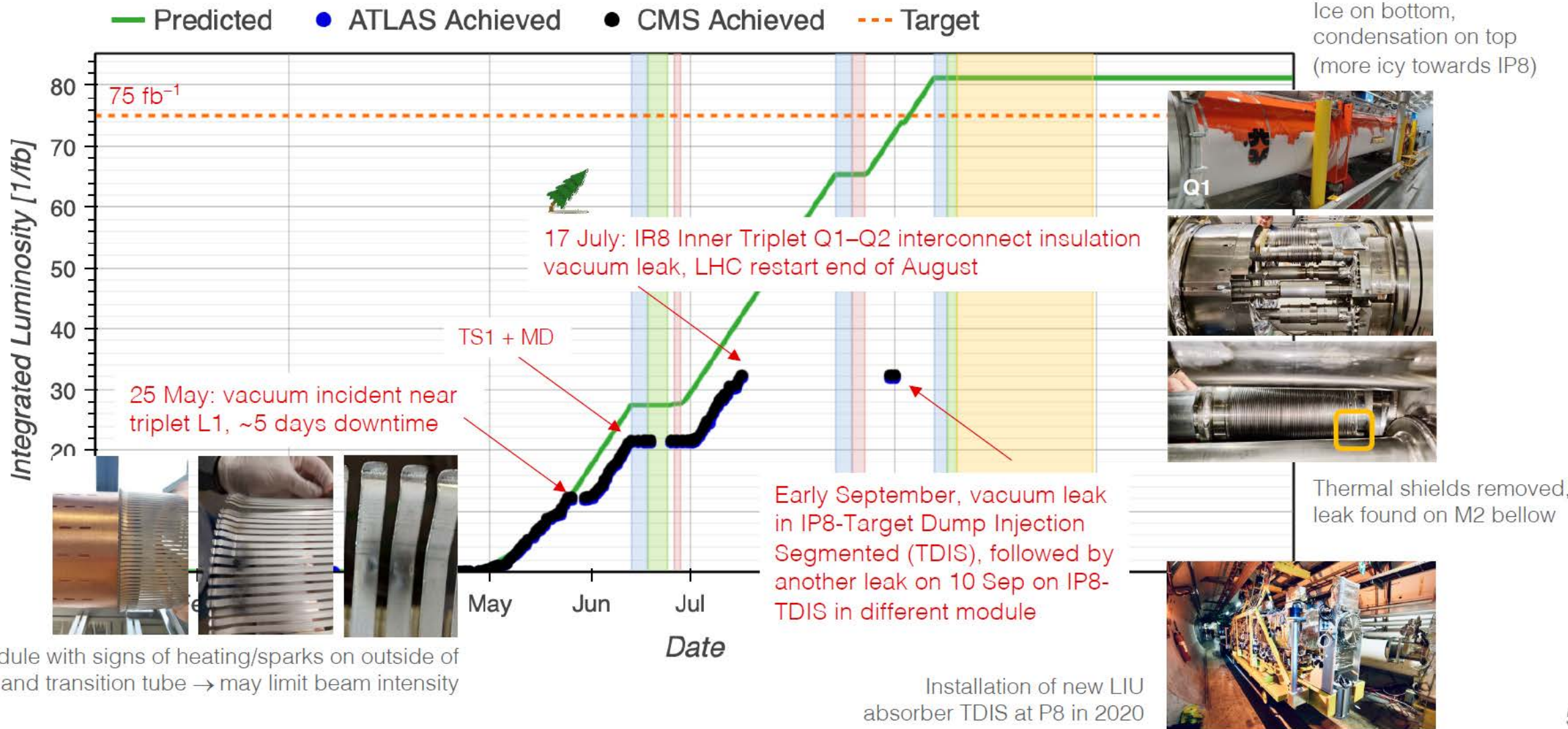
First beam in 2023...



AND despite a very bumpy road in 2023...



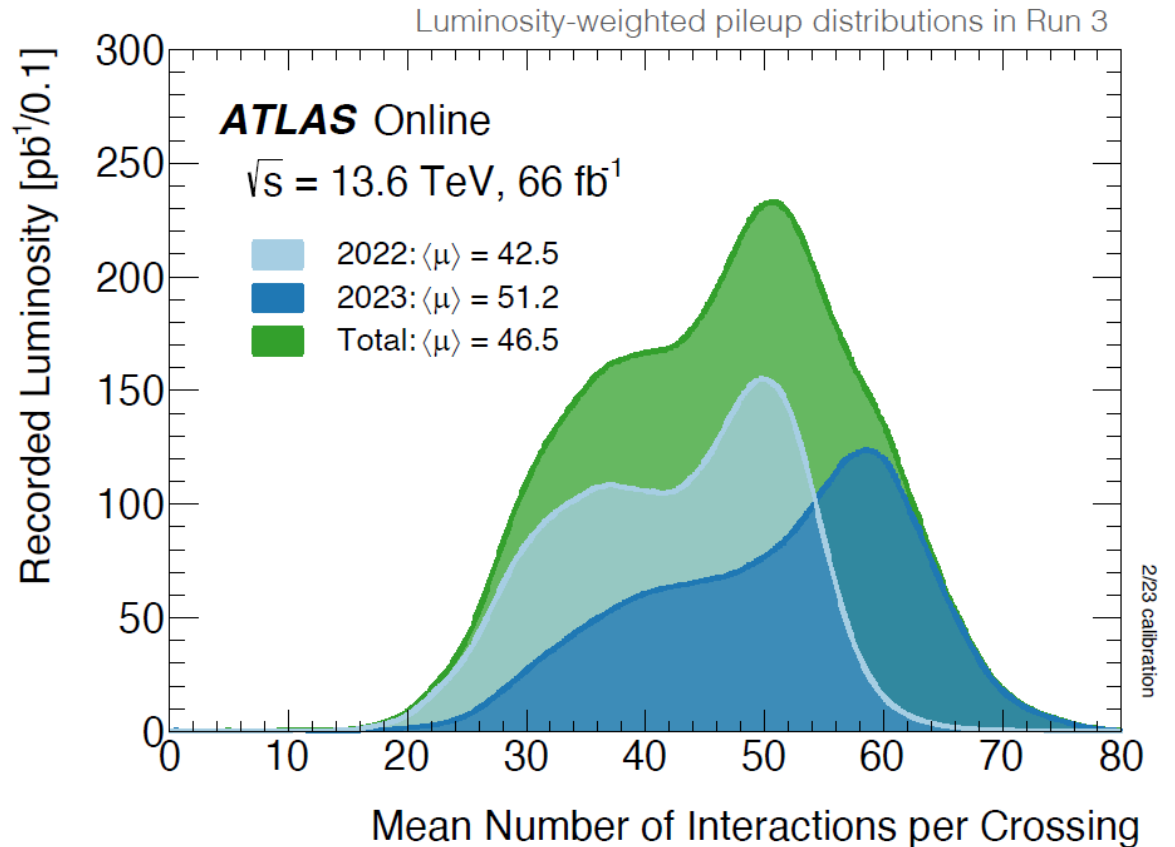
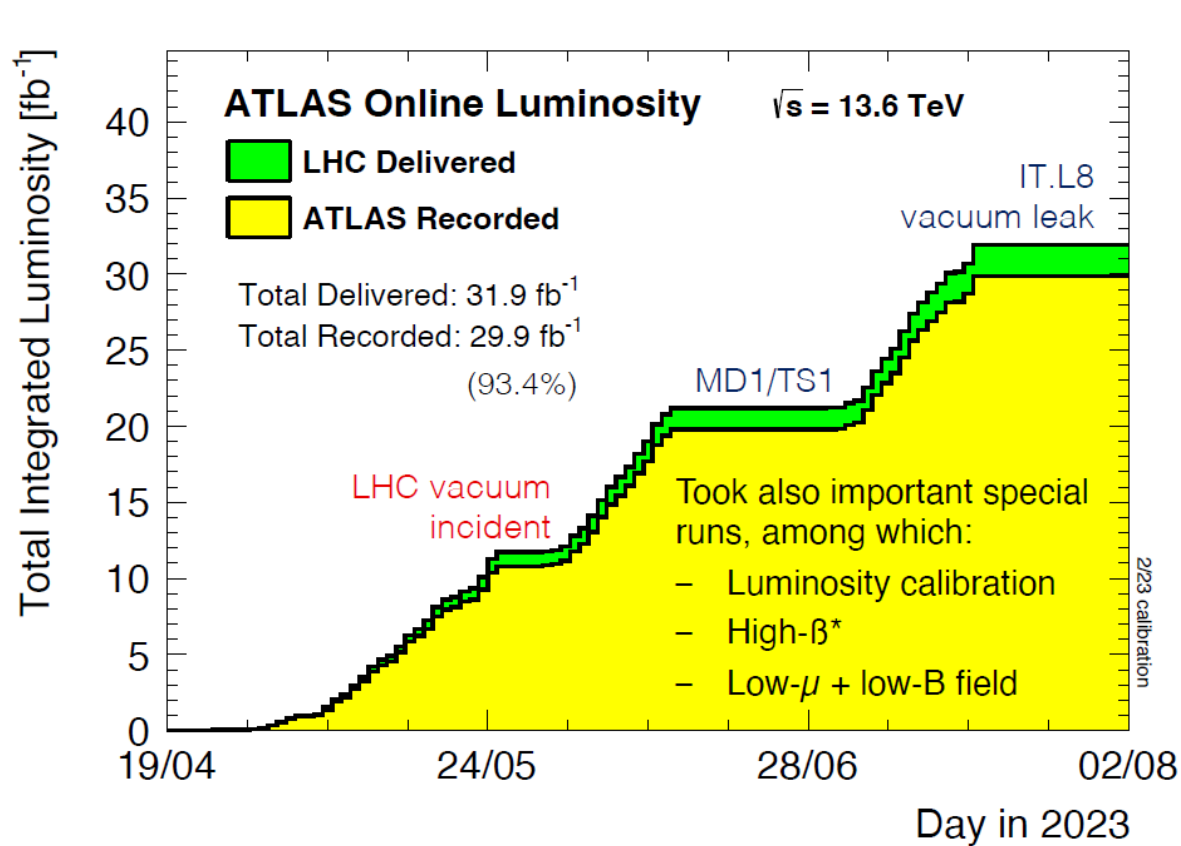
AND, despite a very bumpy road in 2023...



in 2022/2023 ATLAS took 65.5 fb⁻¹ of pp Run 3 data !

Delivered target of 75 fb⁻¹ not reached: 31.9 fb⁻¹, recorded luminosity 29.9 fb⁻¹ (93.7%)

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

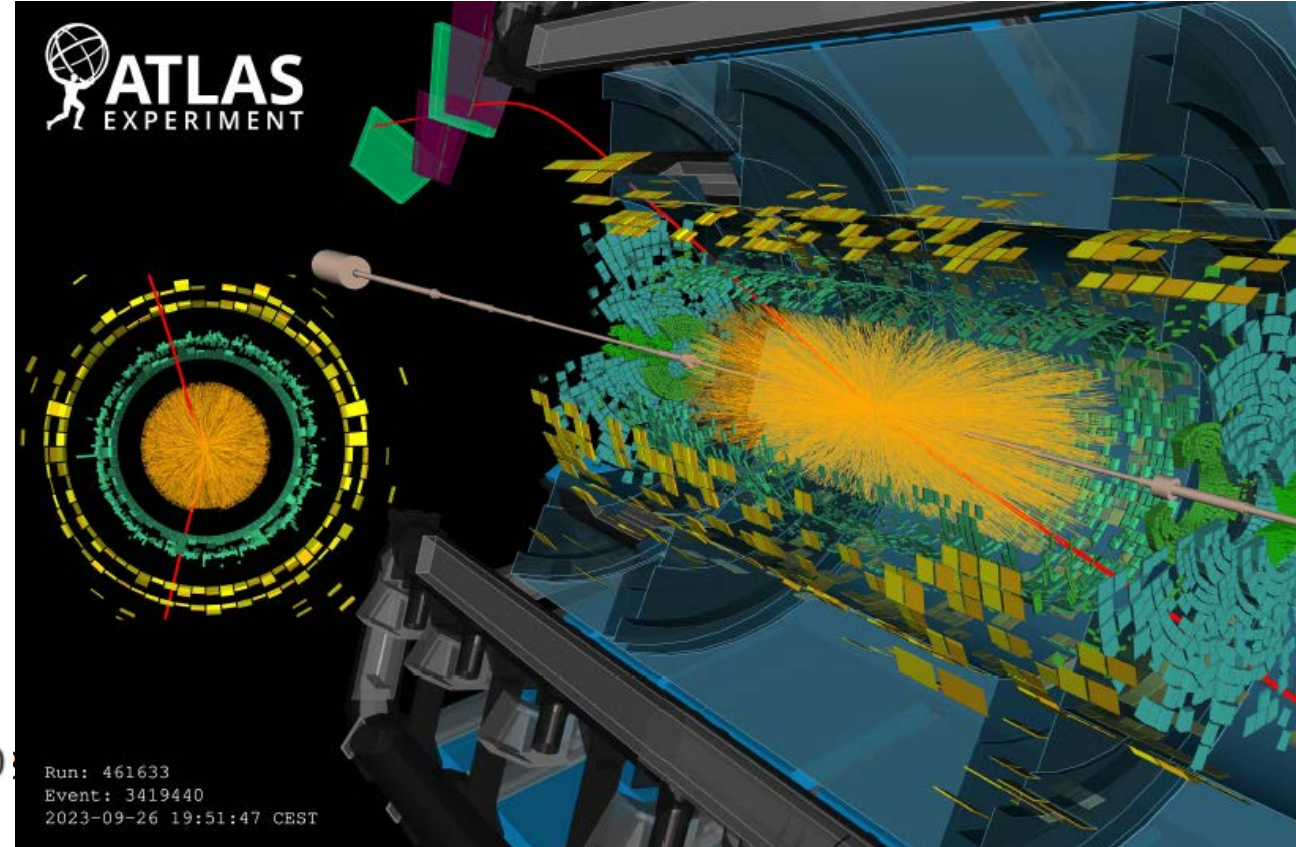
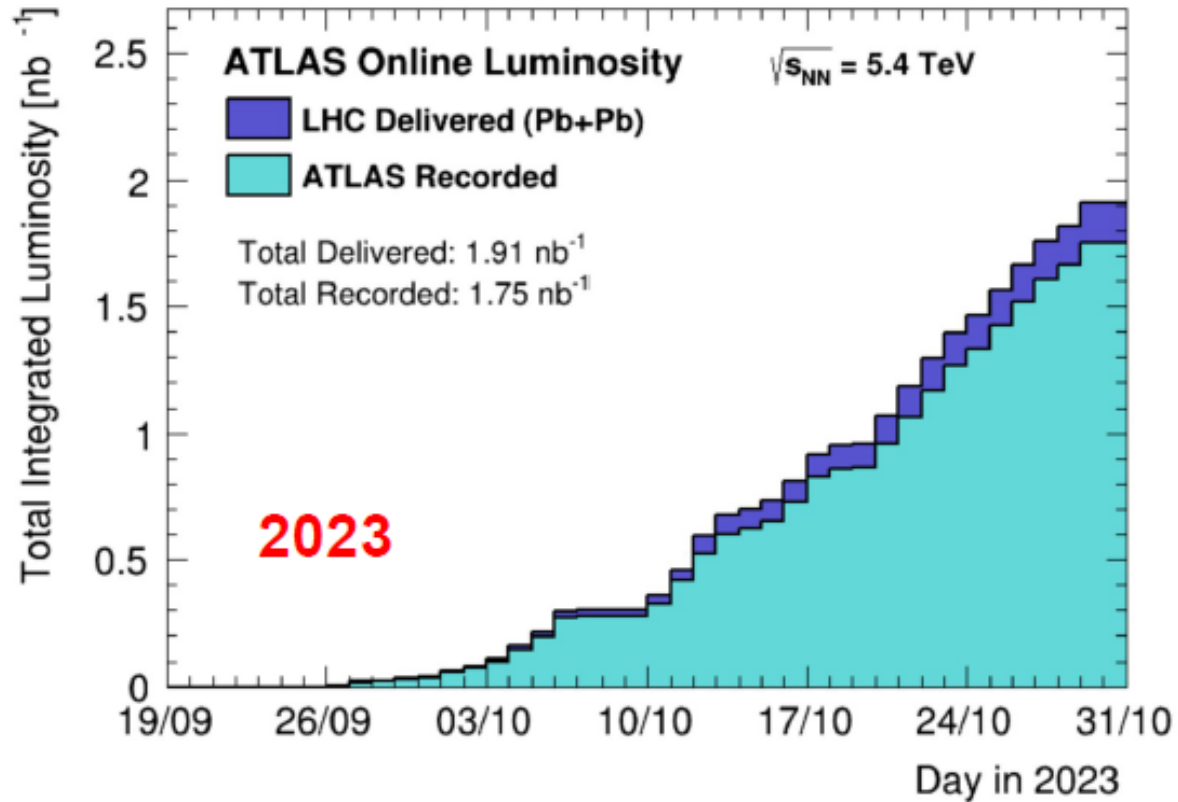


2023 good-for-physics efficiency up to 96.5% (up to 93.1% in 2022) → 27.8 fb⁻¹ (2023) + 31.4 fb⁻¹ (2022) = **59.2 fb⁻¹**

in 2022/2023 ATLAS took 1.75 fb⁻¹ of PbPb Run 3 data !

Delivered target of 75 fb⁻¹ not reached: 31.9 fb⁻¹, recorded luminosity 29.9 fb⁻¹ (93.7%)

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



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

Run-3 data analysis

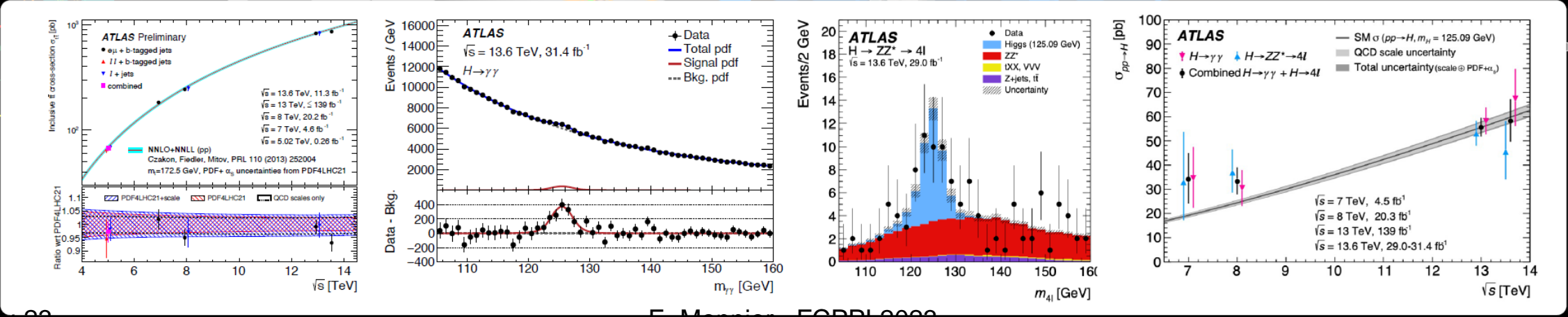
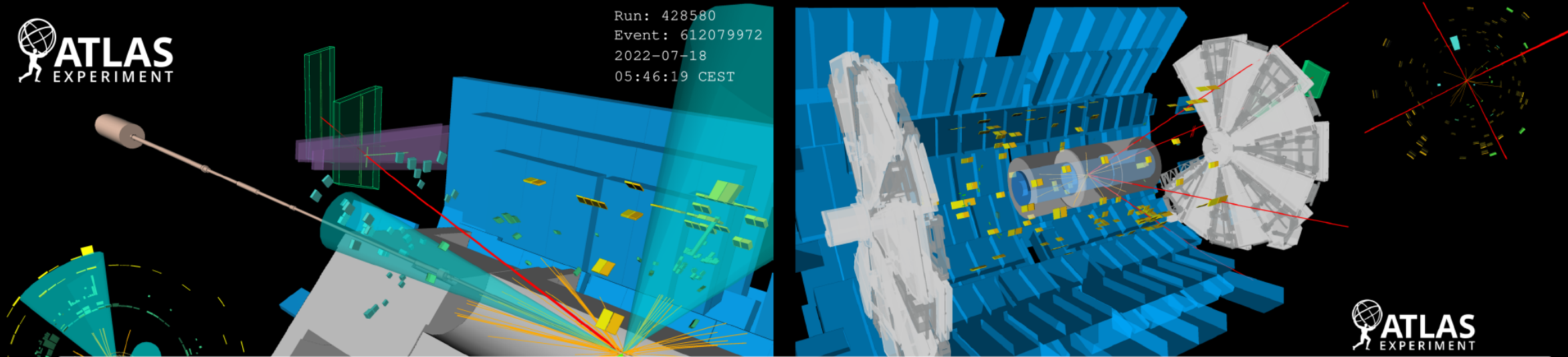
Excellent detector and reconstruction performance, 4 papers, 3 CONF notes, 5 PUB notes released on Run-3 data

Top-antitop to e- μ candidate event at 13.6 TeV

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

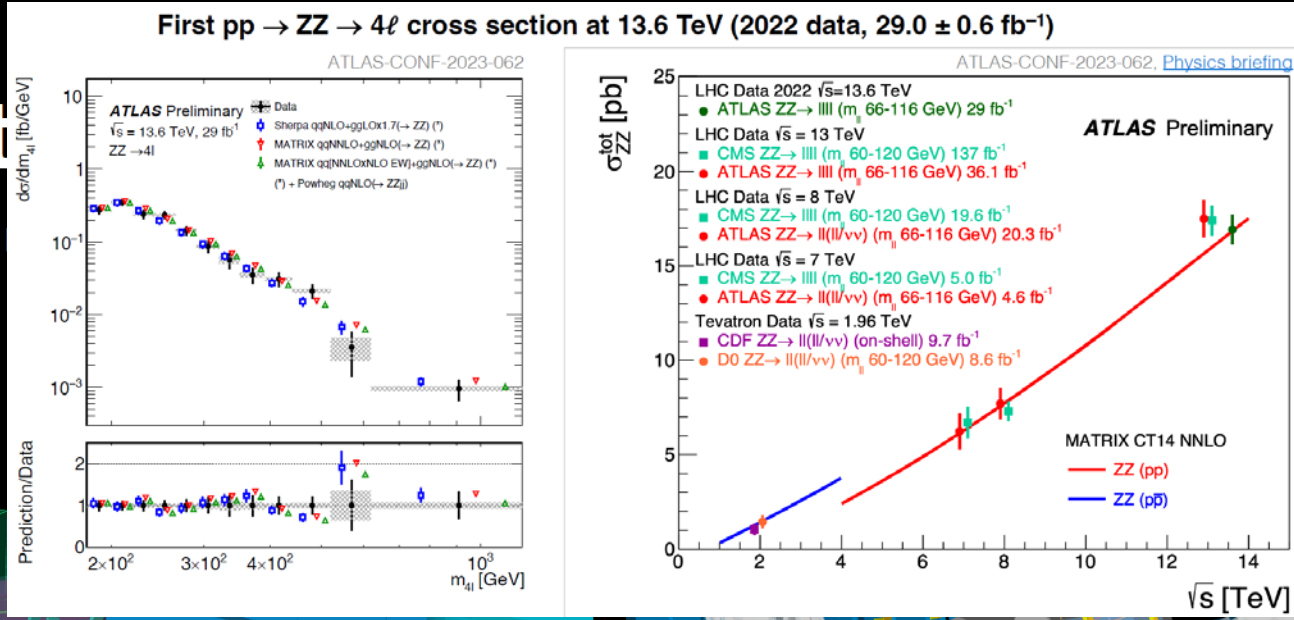


Run: 428580
Event: 612079972
2022-07-18
05:46:19 CEST



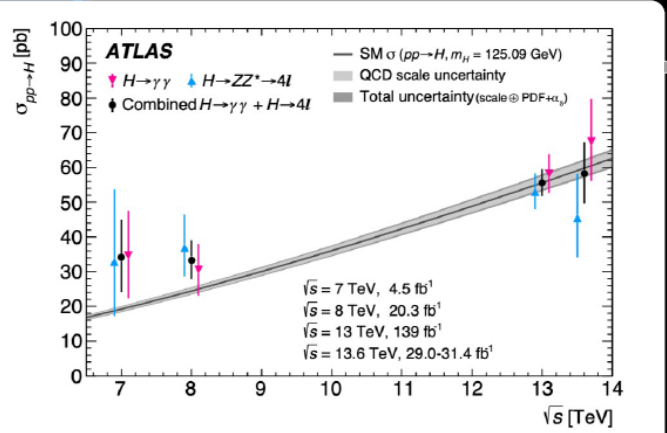
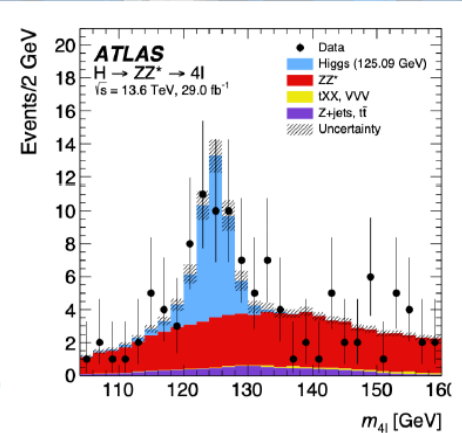
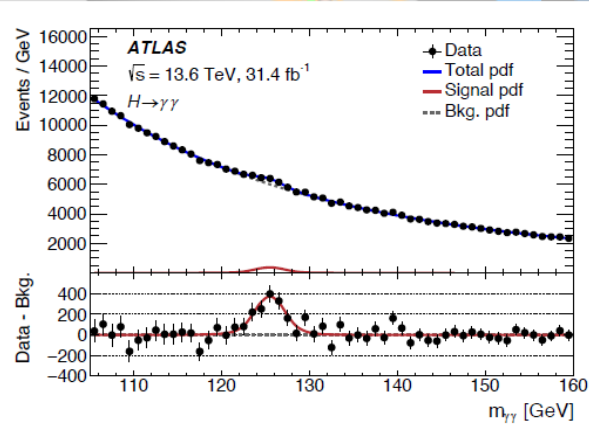
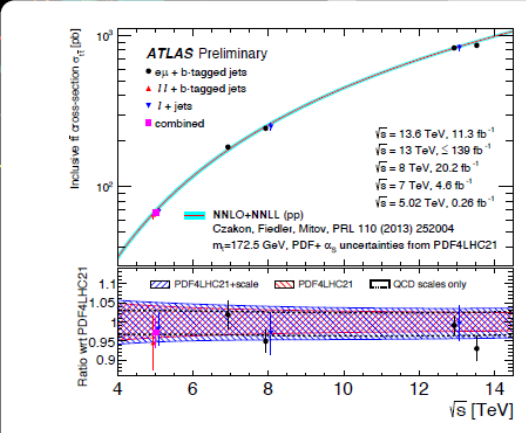
Run-3 data

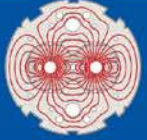
Excellent detector and



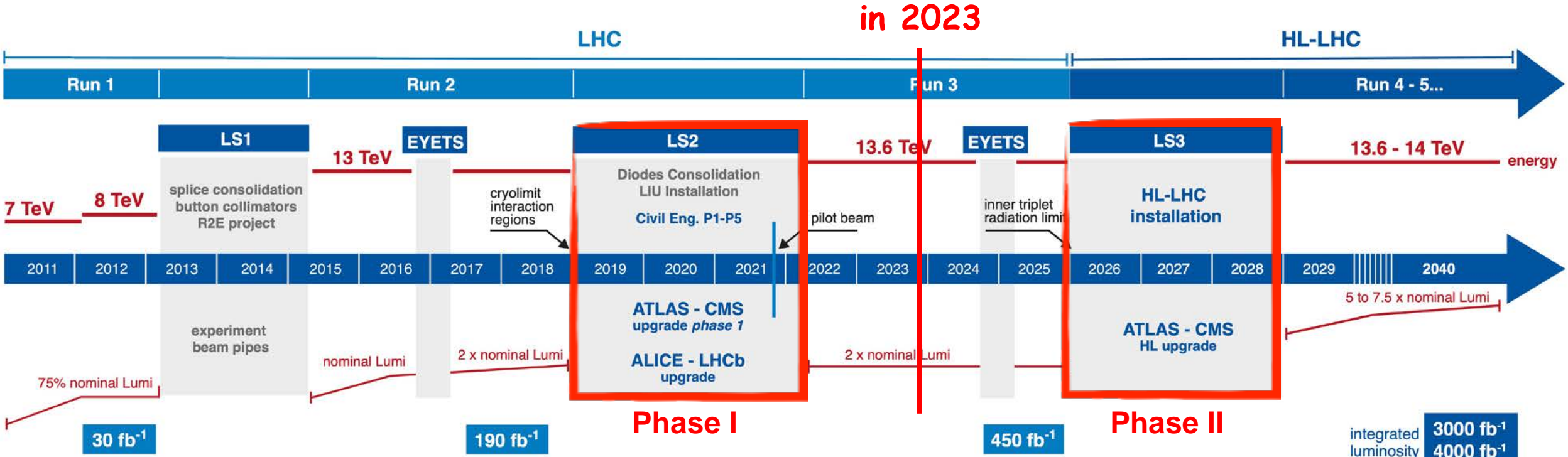
released on Run-3 data

ATLAS well into Run3 in 2023 and ready for 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

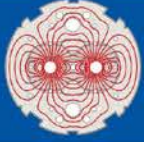
LS3: Phase-II Upgrade goals

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

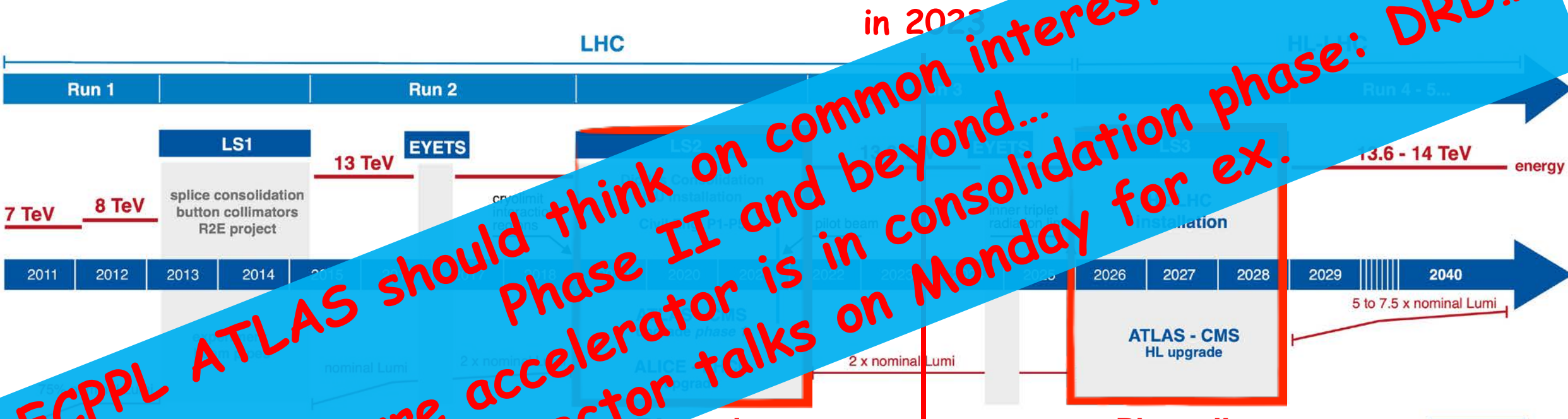
Upgrade of LAr main readout*

integrated luminosity **3000 fb⁻¹**
4000 fb⁻¹

PHYSICS



LHC / HL-LHC Plan



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

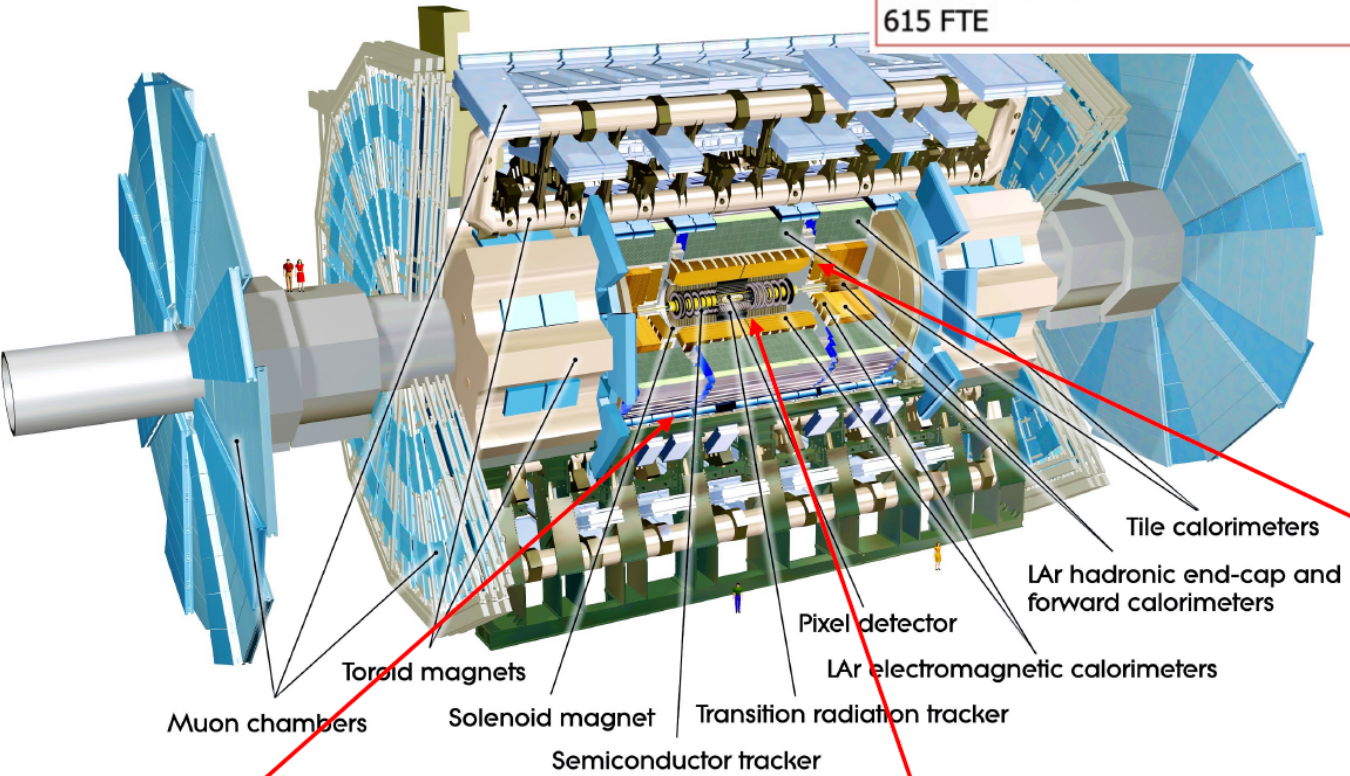
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integrated luminosity **3000 fb⁻¹**
4000 fb⁻¹

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

New Muon Chambers

Inner barrel region with new RPC and sMDT detectors

New Inner Tracking Detector (ITk)

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

Additional small upgrades

Luminosity detectors (1% precision goal)
HL-ZDC

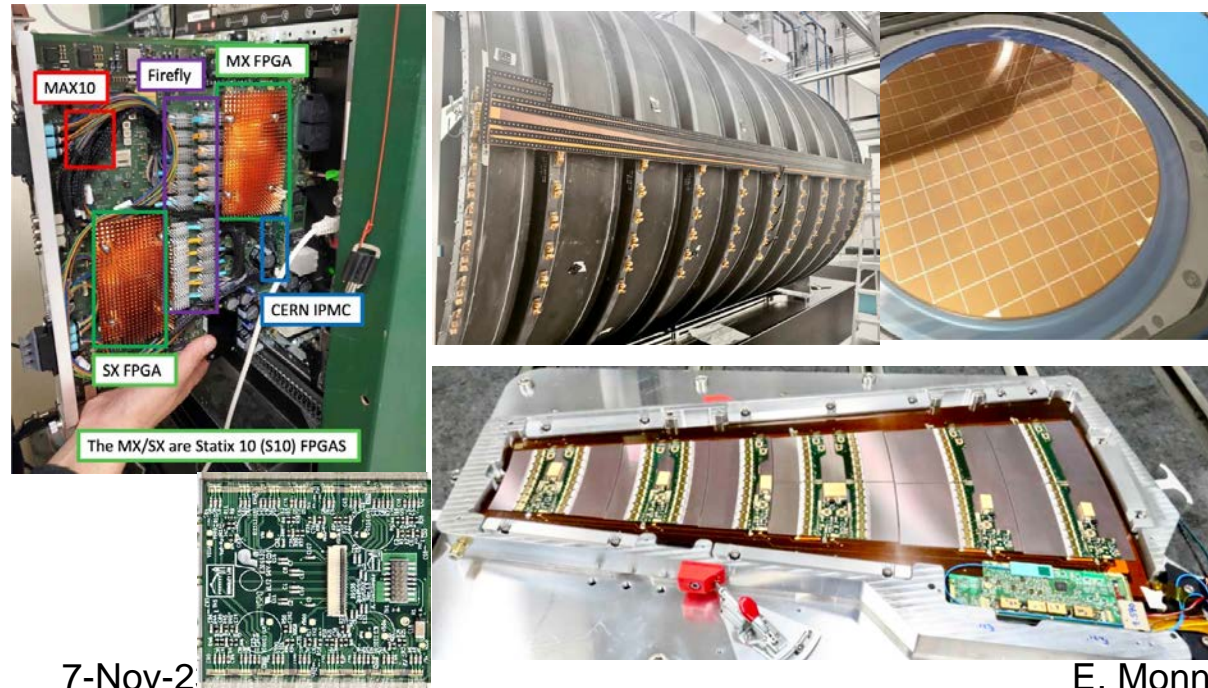
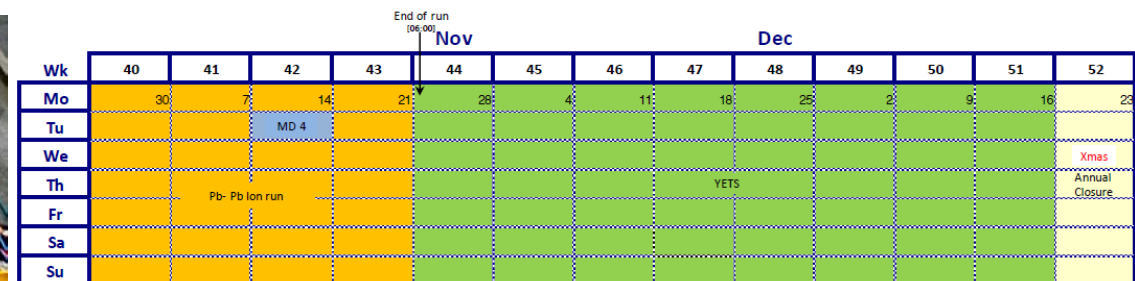
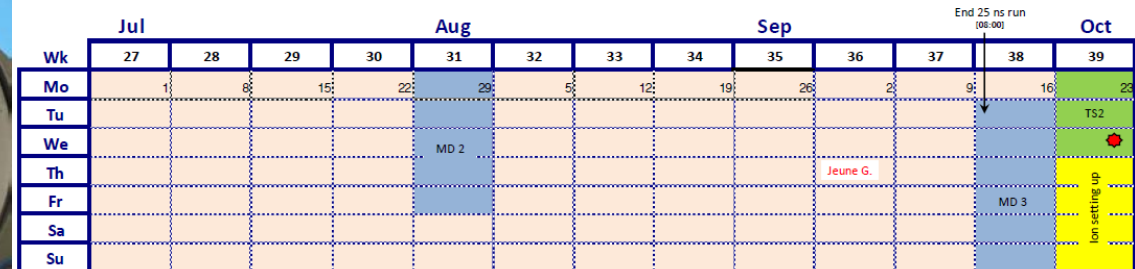
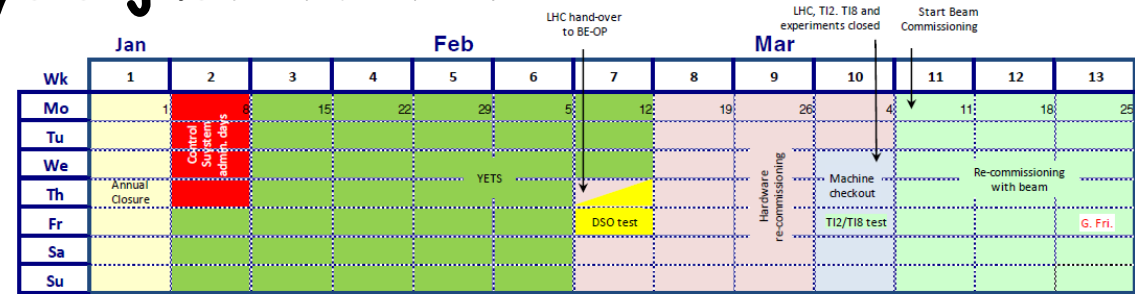
LHC & ATLAS into Run 3 at full swing !

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



LHC & ATLAS into Run 3 at full swing !

Run 3 analysis just ahead !

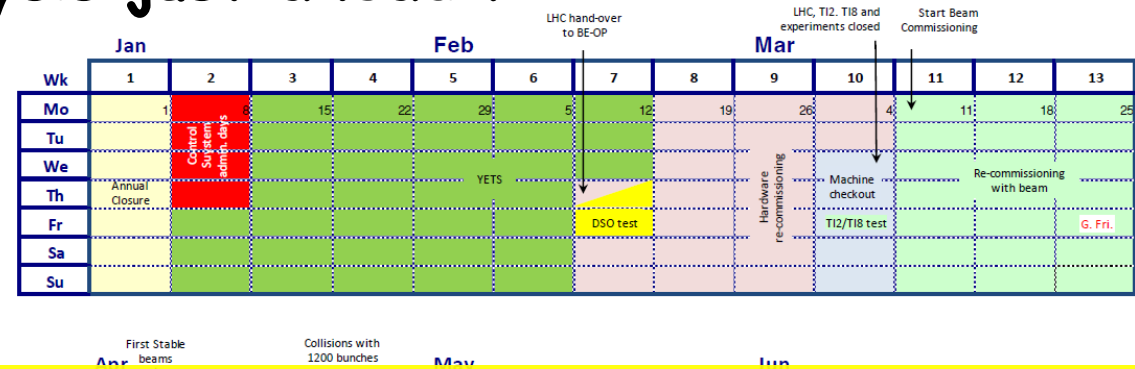
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ATLAS has completed Phase-I commissioning and Run 3 is in full swing !

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 summer and fall 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, (through $\gamma\gamma$, WW final states and also lepton/jet/bjet/top final states such as in ttH, VH, H⁺⁺, HH...)
(Q. Shen, X. Su, C. Wang, X. Wang, Y. Zhang 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 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)
- Strong Coop. on computing, IHEP/IN2P3/CEA (C. Gang/F. Hernandez)
- New Phase II (HGTD, ITK,...) & new accel. coop. started (V. Boudry, J. Guimaraes, C. Hu-Guo, I. Laktineh, W. Wu, L. 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.

- 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 (started 10/19)
 - Q. Shen (APC/SJTU) APC/SJTU/CSC funded (started 10/20)
 - X Su (IJCLAB) IJCLAB funded (started 10/20)
 - X. Wang (CPPM/SJTU) CPPM/SJTU/CSC funded (started 09/21)
- 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 manpower/funds for strong ATLAS Run 2/Run 3 analysis and for ATLAS upgrade and future detectors R&D.

So Happy to be with all
of you and working
together again
谢谢！

Highlights

| | | |
|-------|--|--|
| 14:00 | Highlight of recent ATLAS results <i>Room C103, Haiqin Building #6, Institut Franco-chinois de l'Energie Nucléaire, SYSU Zhuhai Campus</i> | <i>Elizabeth PETIT</i> 14:00 - 14:20 |
| | ATLAS project within FCPPL <i>Room C103, Haiqin Building #6, Institut Franco-chinois de l'Energie Nucléaire, SYSU Zhuhai Campus</i> | <i>emmanuel monnier</i> 14:20 - 14:45 |
| | -ttw & ttH <i>Room C103, Haiqin Building #6, Institut Franco-chinois de l'Energie Nucléaire, SYSU Zhuhai Campus</i> | <i>Chenliang WANG</i> 14:45 - 15:05 |
| 15:00 | Constraints on Higgs Self-Coupling at the LHC with $\sqrt{s}=13$ TeV <i>Room C103, Haiqin Building #6, Institut Franco-chinois de l'Energie Nucléaire, SYSU Zhuhai Campus</i> | <i>Yulei Zhang</i> 15:05 - 15:25 |
| | Search for a heavy scalar X decaying to a scalar S and a Higgs boson in the $X \rightarrow S (bb)H(\gamma\gamma)$ channel with the Run 2 13 T... <i>Xi Wang</i> | |
| 16:00 | Precision measurements of electroweak parameters at the LHC <i>Room C103, Haiqin Building #6, Institut Franco-chinois de l'Energie Nucléaire, SYSU Zhuhai Campus</i> | <i>Xiaowen Su</i> 16:20 - 16:40 |
| | Studies of new Higgs boson interactions through nonresonant HH production in the bbyy final state in pp collisions at ... <i>Qiu-Ping Shen</i> | |

New CERN Visiting Center !

谢谢！
Merci !
Thank You !

