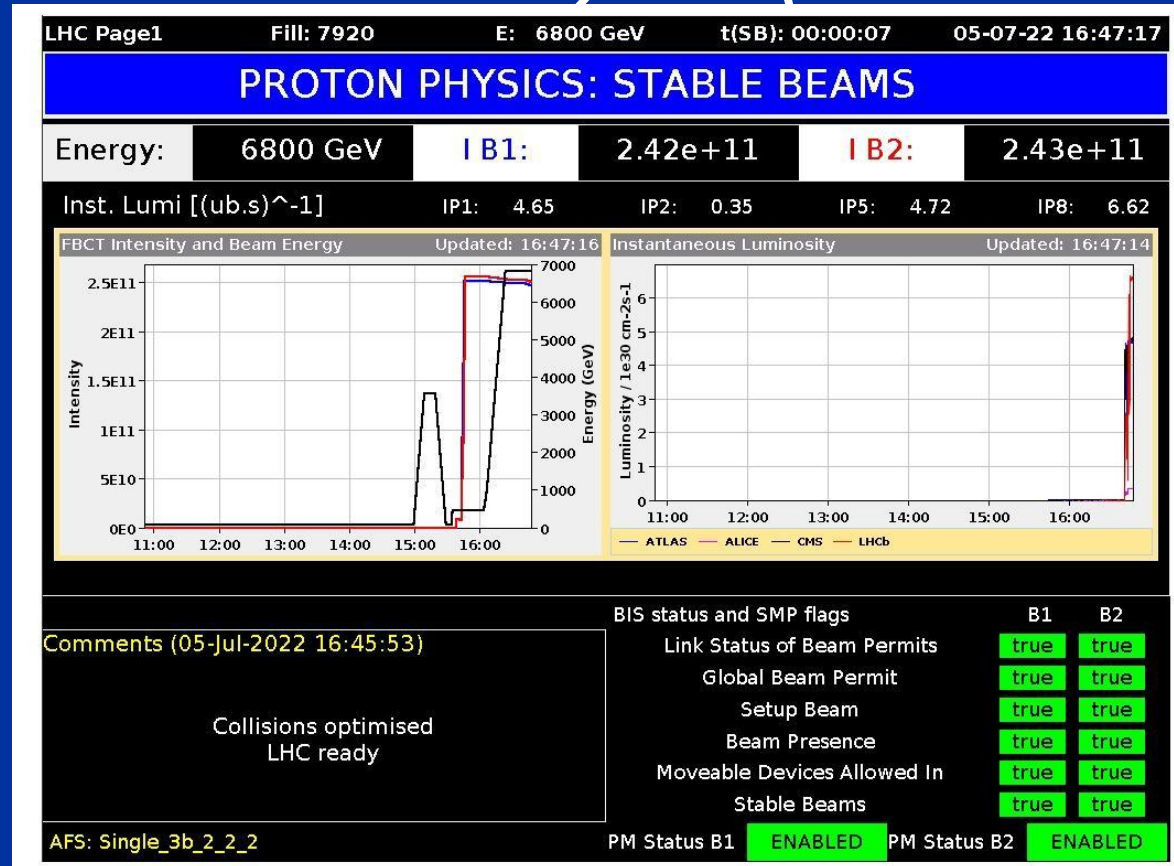


Report from CERN

110th Plenary ECFA Meeting

Joachim Mnich

July 21th, 2022



pp collisions
at 13.6 TeV!

CERN on July 5th



LHC – Dipole Training to 6.8 TeV Completed April 11th

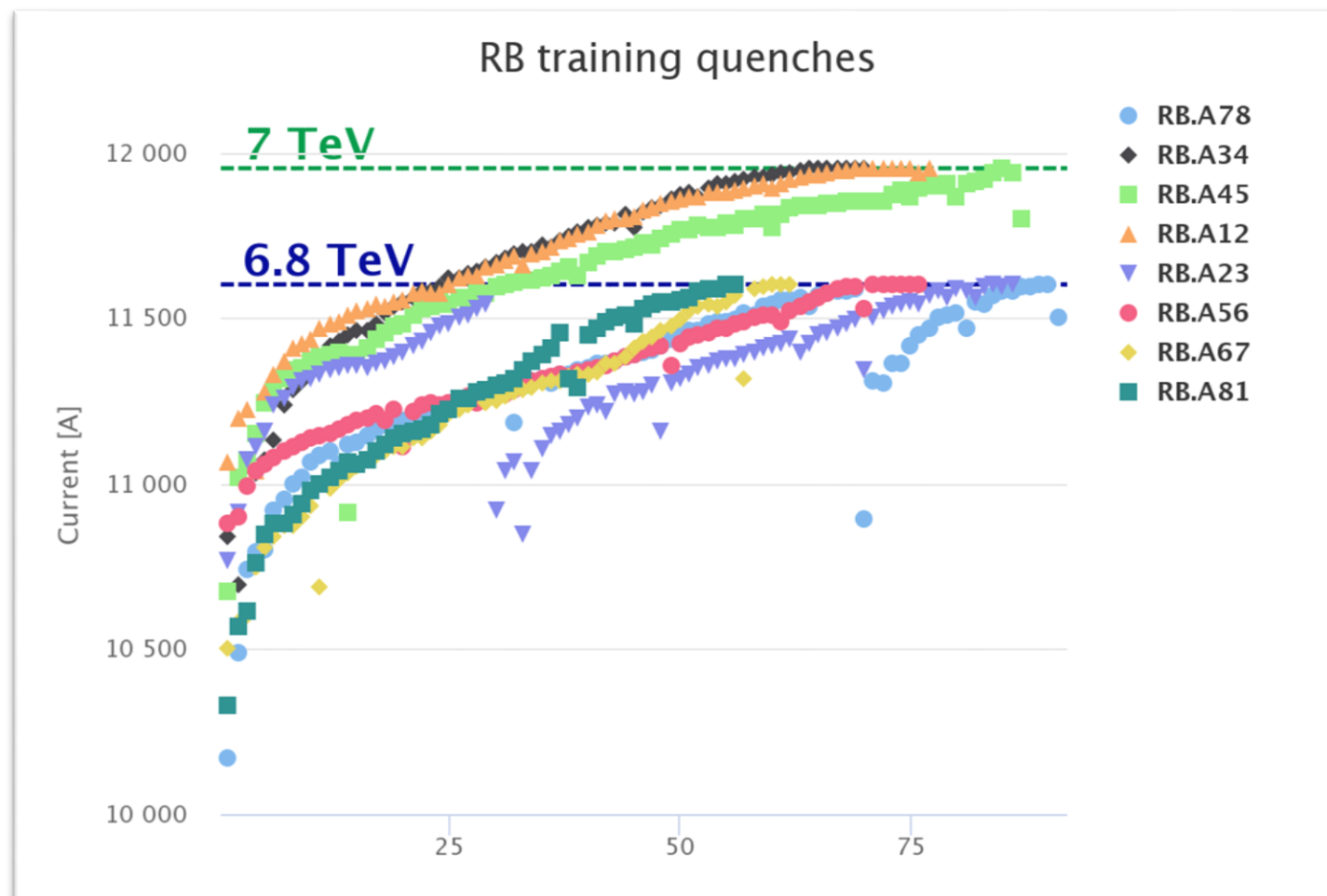
New record beam energy: 6.8 TeV

During the main dipole training campaign spanning 2021 and 2022 over 600 primary training quenches

- 3 sectors trained to 7 TeV
- 2 sectors (78 & 23) were trained twice

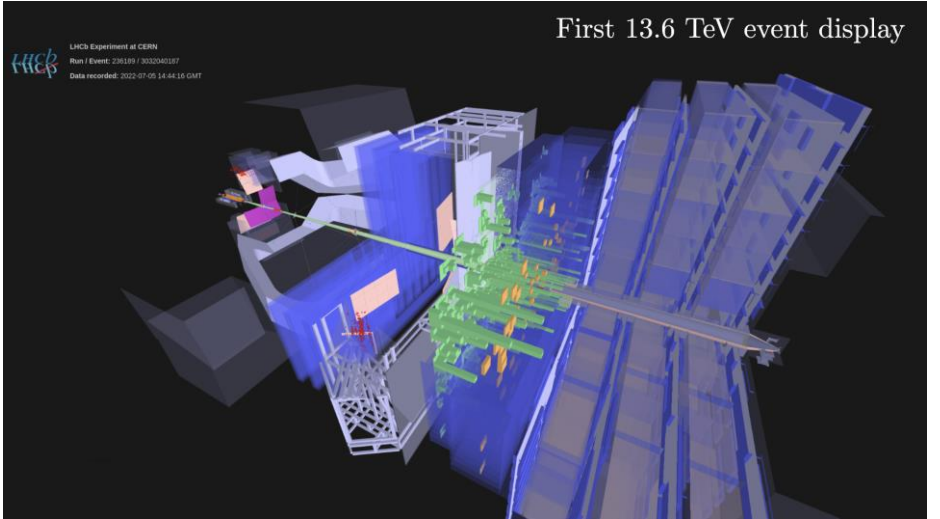
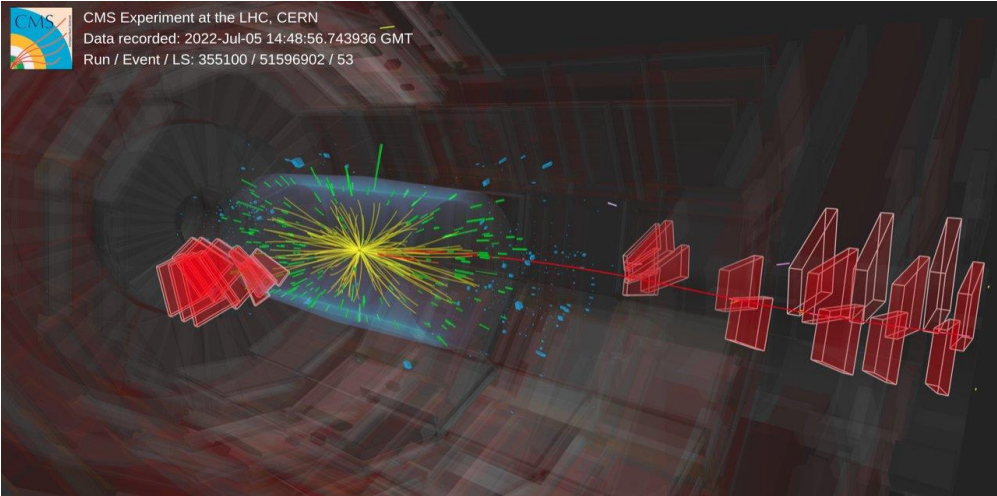
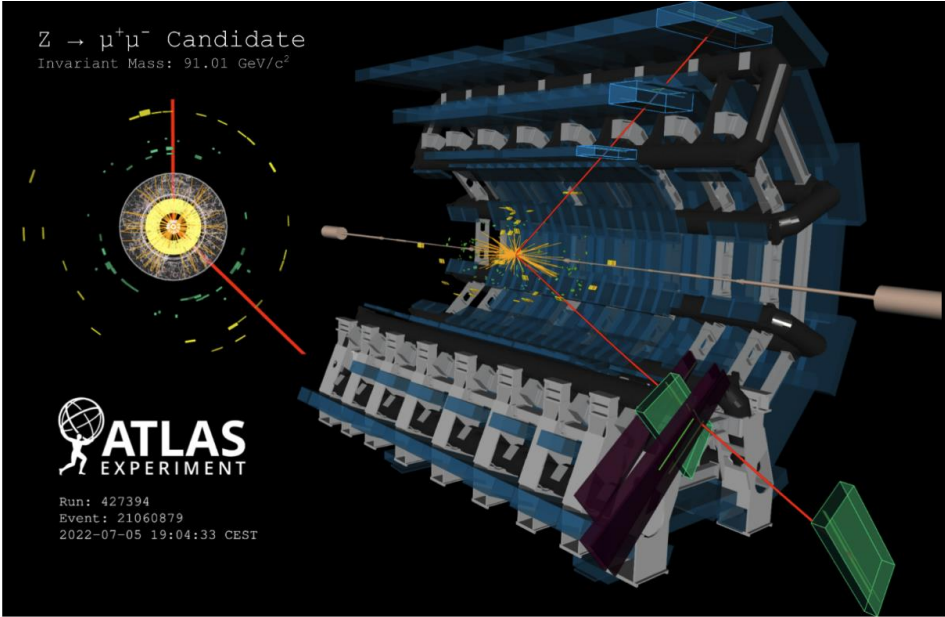
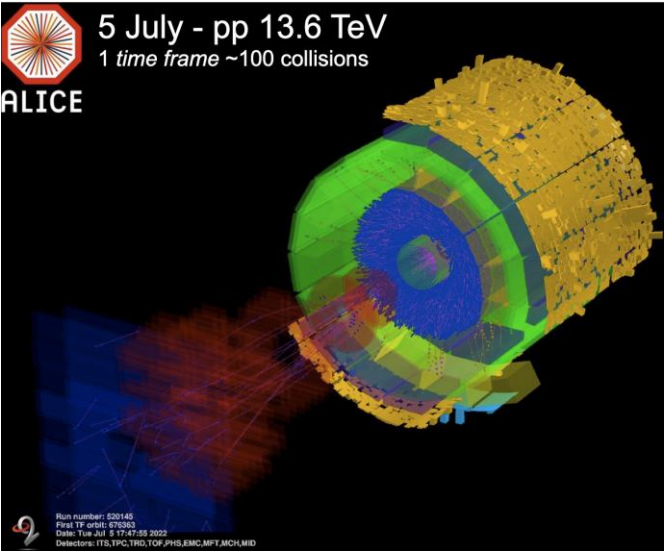
Very long training and powering test campaign

- **risks have to be well managed throughout**



Experiments: Phase I Upgrades Completed & Ready for Run 3

All 4 experiments are taking data



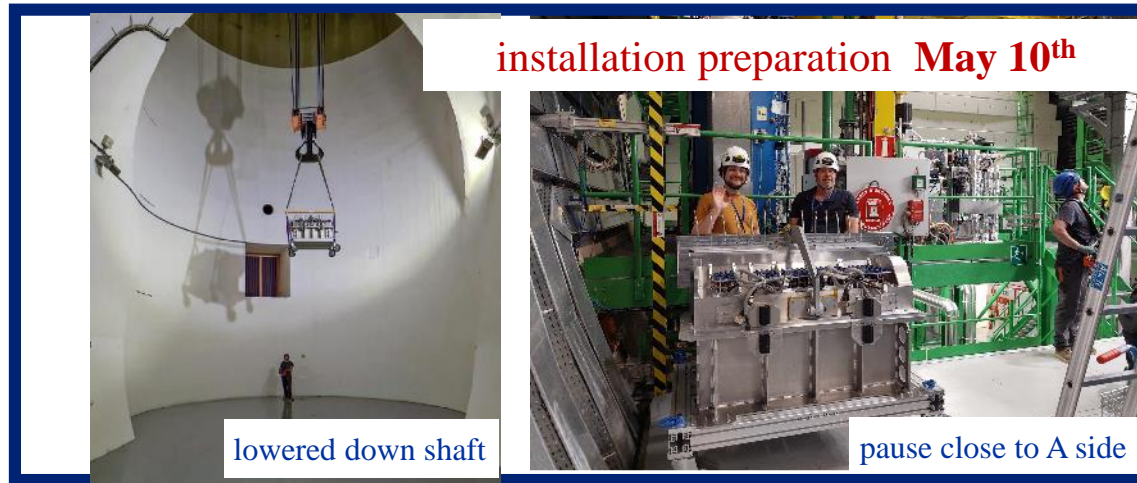
LHCb: Completion of VELO Installation



leaving Liverpool
April 27th



Arrived at CERN
April 29th



lowered down shaft

installation preparation May 10th

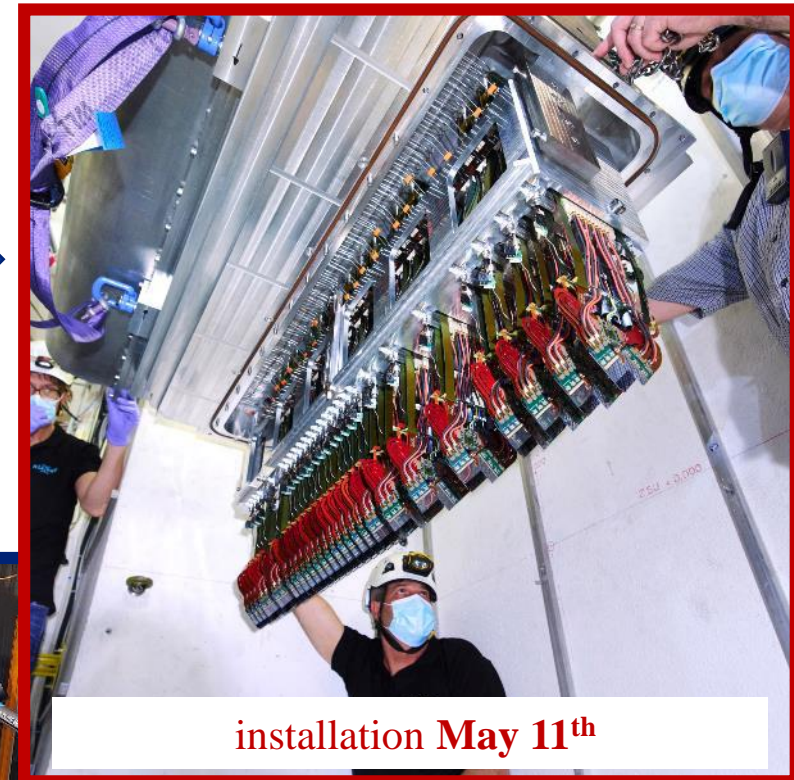
pause close to A side



Connectivity tests & leak tests

surface test April 30th – May 9th

Grey Room preparation

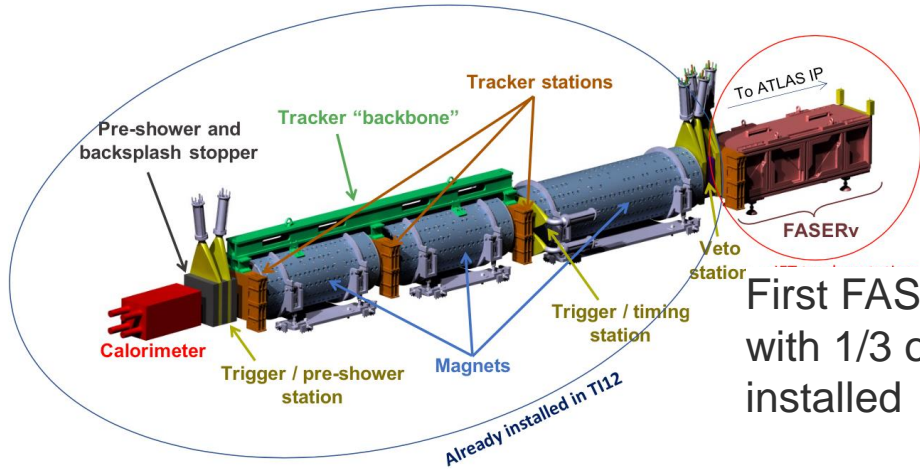


installation May 11th

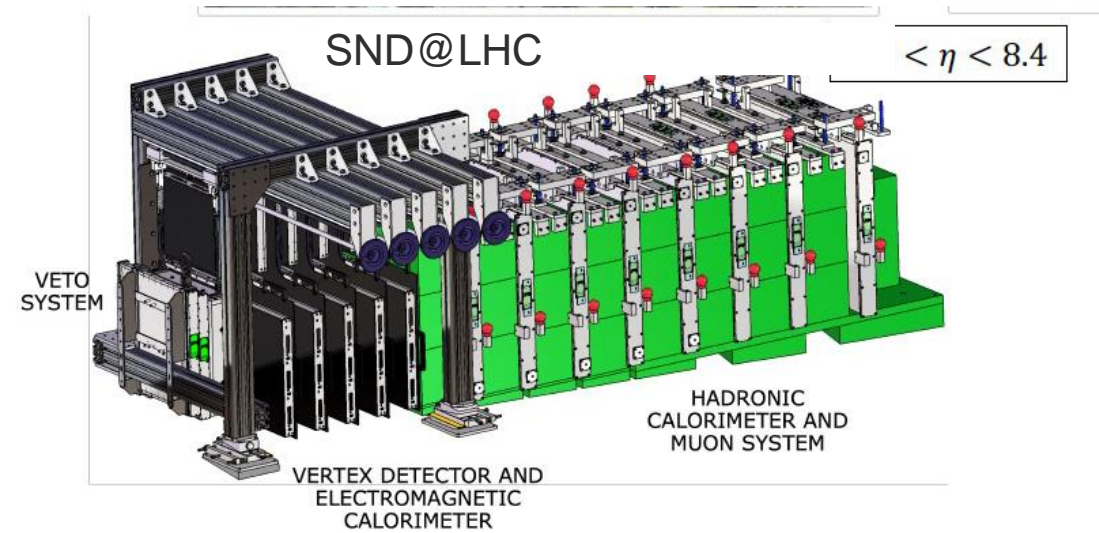
May 12th – 16th
electrical connectivity
fibres connectivity
cooling commissioning
...

FASER(nu) & SND@LHC

Reminder: FASER Detector

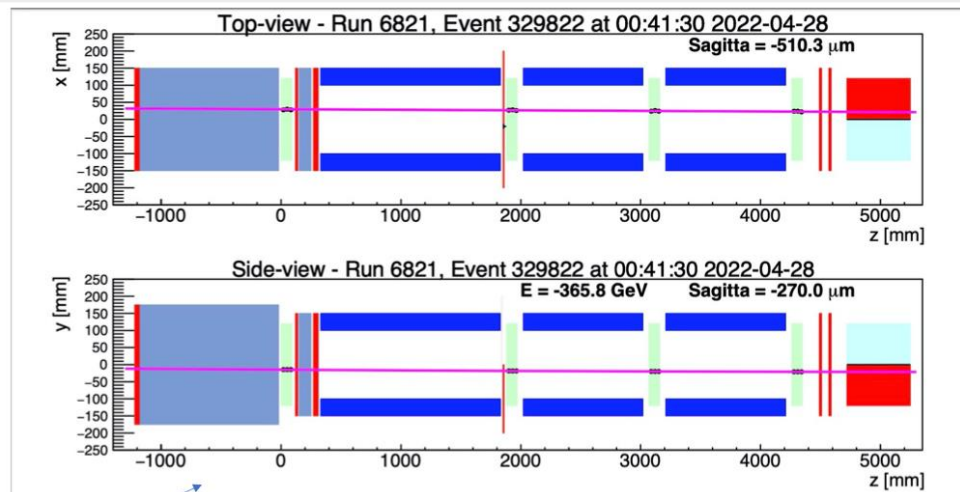


First FASERnu box with 1/3 of emulsion installed



Active detector components and neutron shield installed

Single muon beam background event from high energy beam

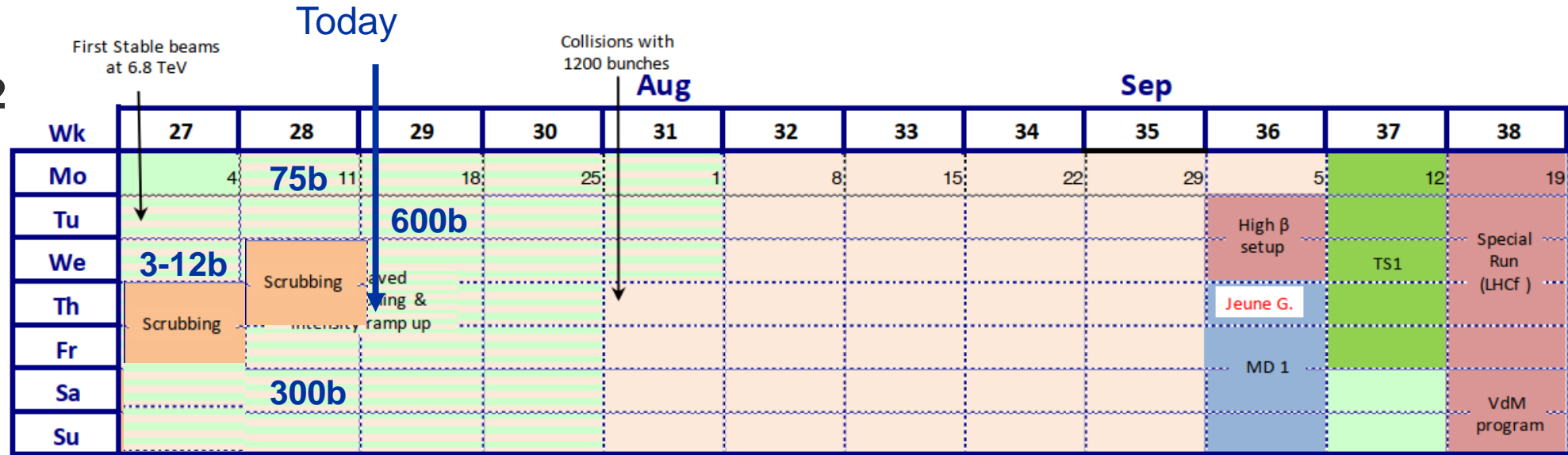


LHC Plans 2022

Q3/2022

Up to 600 bunches by Tuesday 19th July

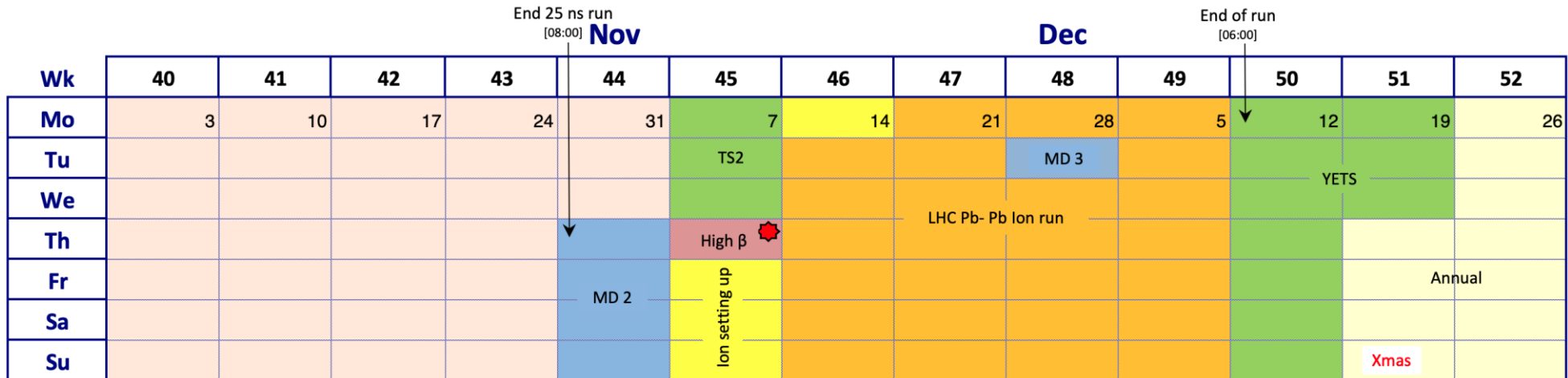
End July 1200 bunches thereafter up to 2748 bunches in quanta of ~300 bunches - dictated by machine protection considerations



Q4/2022

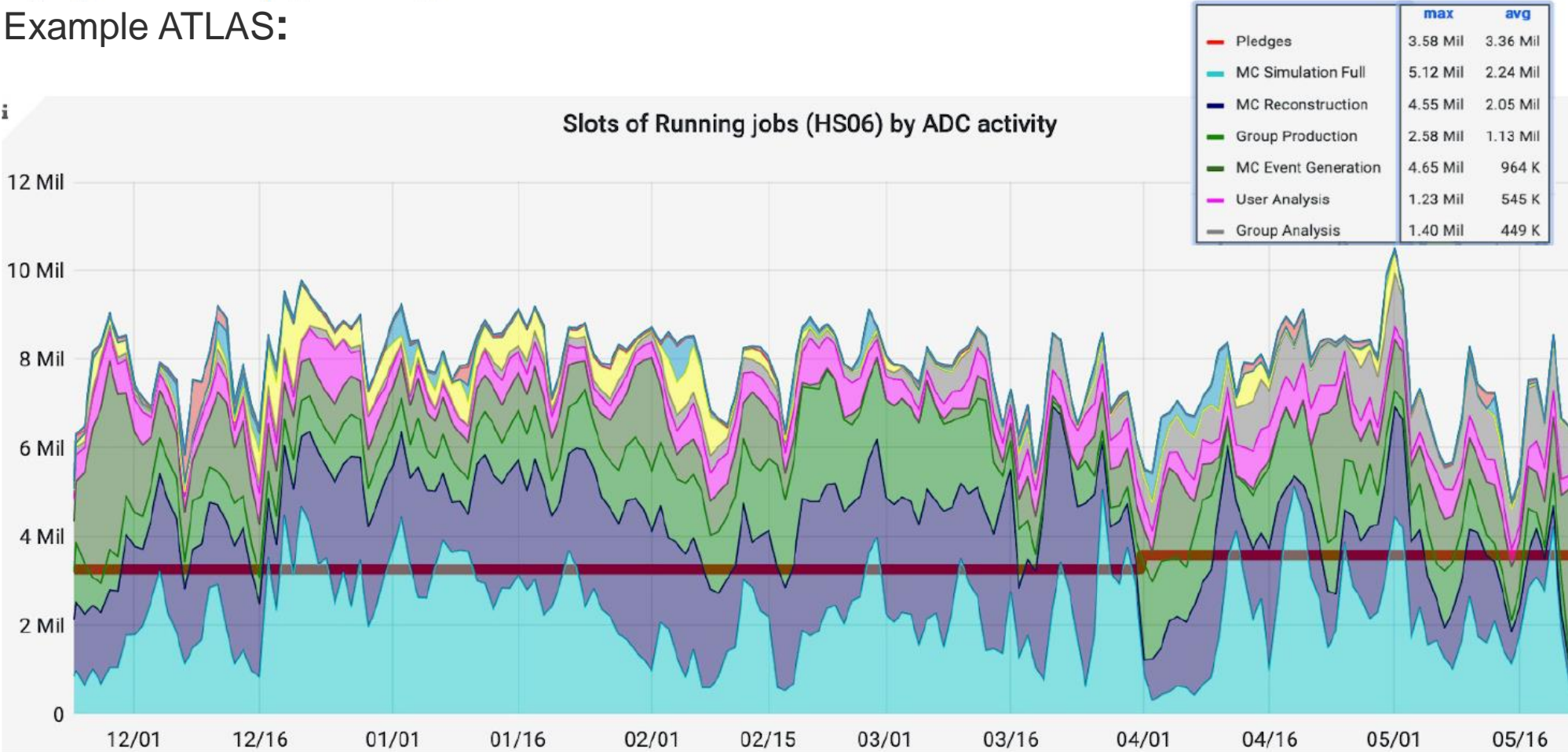
End 25 ns proton run: 08:00 3rd November

End of 2022 run: 06:00 12th December



Status Computing

Example ATLAS:



Distributed computing infrastructure continues to perform extremely well

New Data Centre in Prévessin - Timeline

2022

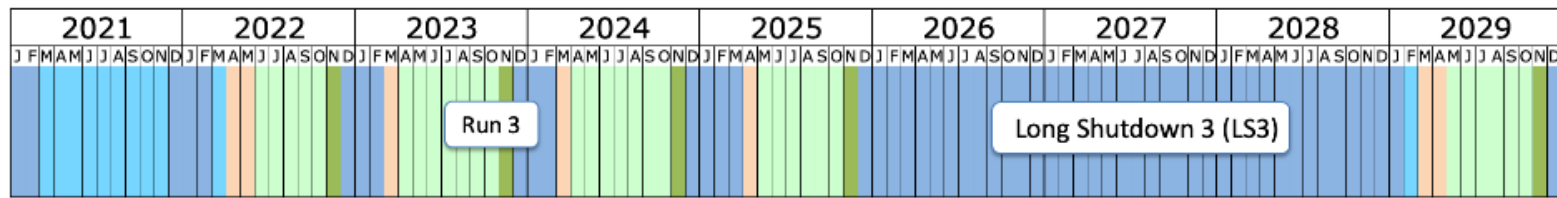
- January: Construction works started
- April: First Stone Ceremony held on the 22nd
- End 2022: Civil engineering and structural work to be completed
- December: Tender for first installation of servers to be adjudicated at the FC

2023

- Summer: Delivery and installation in PCC planned (very dependent on actual delivery delays at the time)
- 3rd quarter: Data Centre ready for commissioning
- End 2023: Inauguration Ceremony foreseen

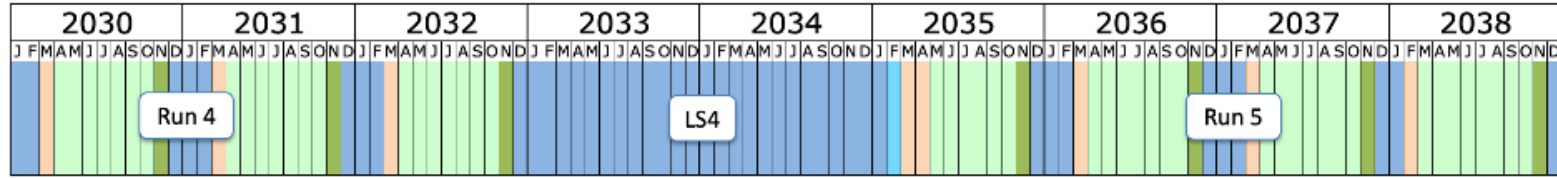


HL-LHC

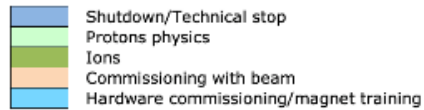


New schedule released early 2022

- Extension of Run 3 until end 2025
- Extension LS3 by ½ year to end 2028

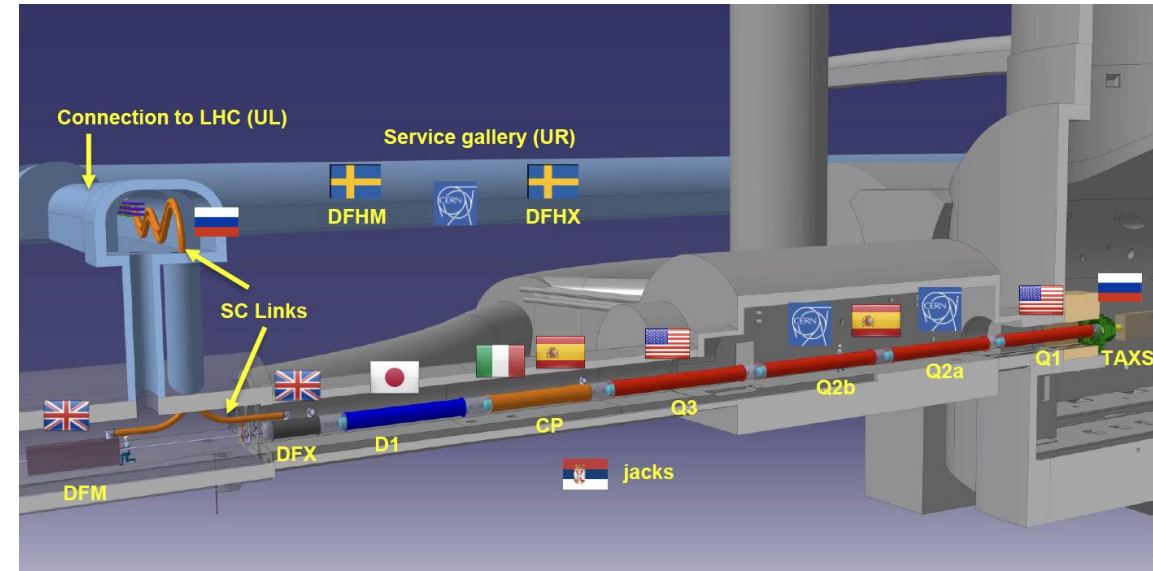


Last updated: January 2022



Accelerator:

- Good progress in 2021/22 on all fronts despite COVID-19
- Completion of prototypes and start of series production for many components
- 2022 is a crucial year:
 - Production phase, resolution of important technical issues to be confirmed
 - Procurement (& in-kind contributions) in very challenging global market conditions
 - Plan B for in-house production of Russian in-kind contributions being fully developed



Point 1 surface buildings



Progress SC Magnets

June 2022: MQXFBP2 (Q2) and corrector
MCBXFBP1 on the alignment bench
(second full-size prototype of the MQXFB magnet family)



MgB₂ flexible prototype electrical transfer line (SC Link)
for the powering of the HL-LHC triplets



Progress ATLAS & CMS Phase II Upgrades

Adapting to the new HL-LHC schedule (re-baselining)

Brings all projects back on schedule

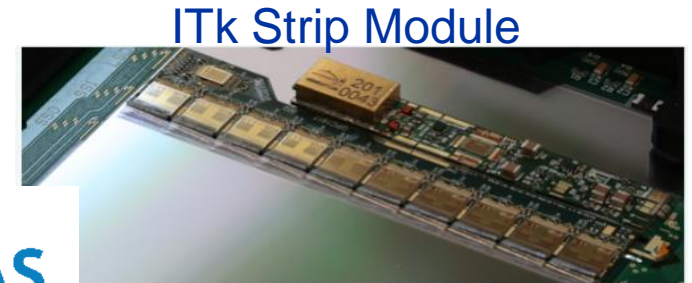
- i.e. no negative floats
- but ATLAS ITk and CMS HGCal remain on critical path

Additional person power at laboratories and universities is needed to mitigate schedule risks

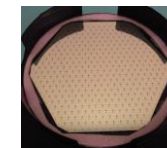
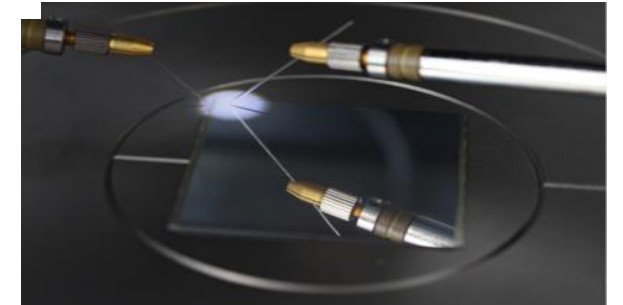
Challenges:

- Price increase: inflation, energy, material cost,...
- Procurement, e.g. electronics, FPGAs,
- Impact of Russian invasion of Ukraine is being studied

- But also a lot of progress



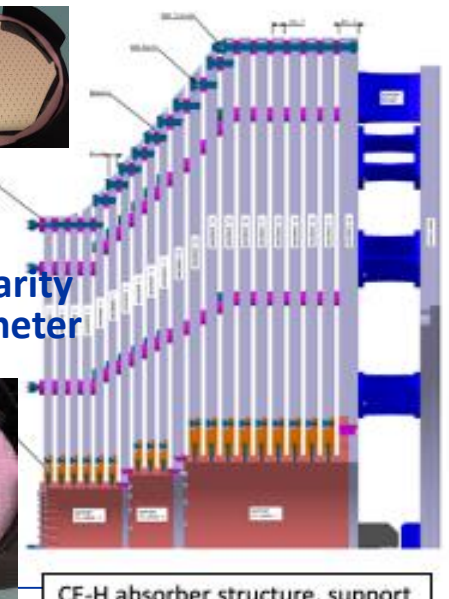
ITk strip sensor testing



High-Granularity Calorimeter



Partial sensors



CE-H absorber structure, support wedges, and back-flange

ALICE Future Plans

ITS3:

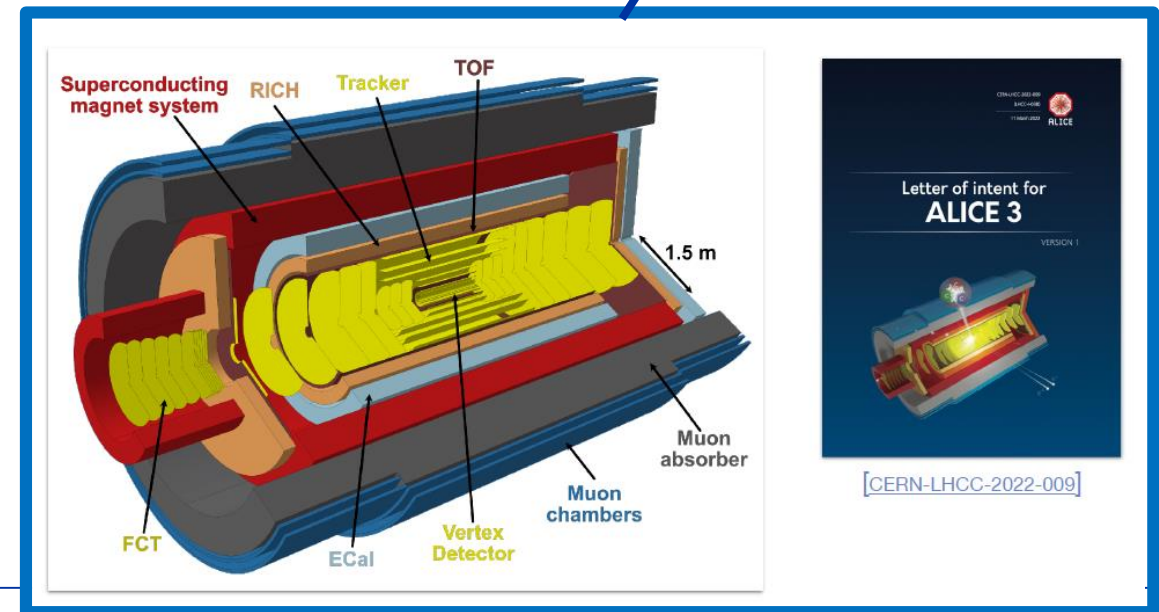
- Replace ITS2 barrel innermost 3 layers
- Reduced inner radius (22 mm → 18 mm)

FOCAL:

- Physics: saturation & shadowing at low x

ALICE 3 (for installation in LS4):

- Compact low-mass all-Si tracker, excellent vertex reconstruction and PID
- Letter of Intent reviewed by LHCC in March
- First discussion with funding agencies took place June 27th



LHCb Future Plans

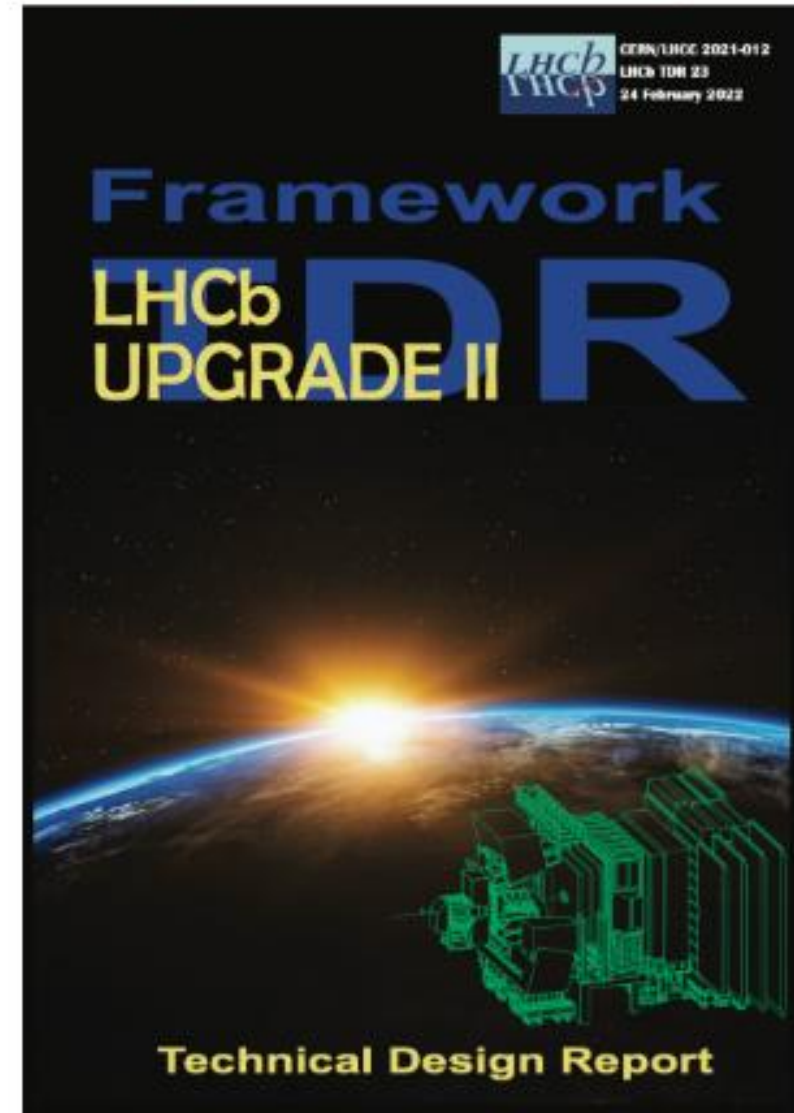
LHCb Upgrade II (for installation in LS4):

- Fully exploit the HL-LHC for flavour physics

$$L_{\text{peak}} = 1.5 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$$

$$L_{\text{int}} \sim 300 \text{ fb}^{-1} \text{ during Runs 5 \& 6}$$

- Targeting same detector performance as in Run 3, but with pile-up $\sim 40!$
- New detector technologies (e.g. precision timing, low-cost monolithic pixels)
- Framework TDR reviewed by LHCC in March
- First discussion with funding agencies June 24th

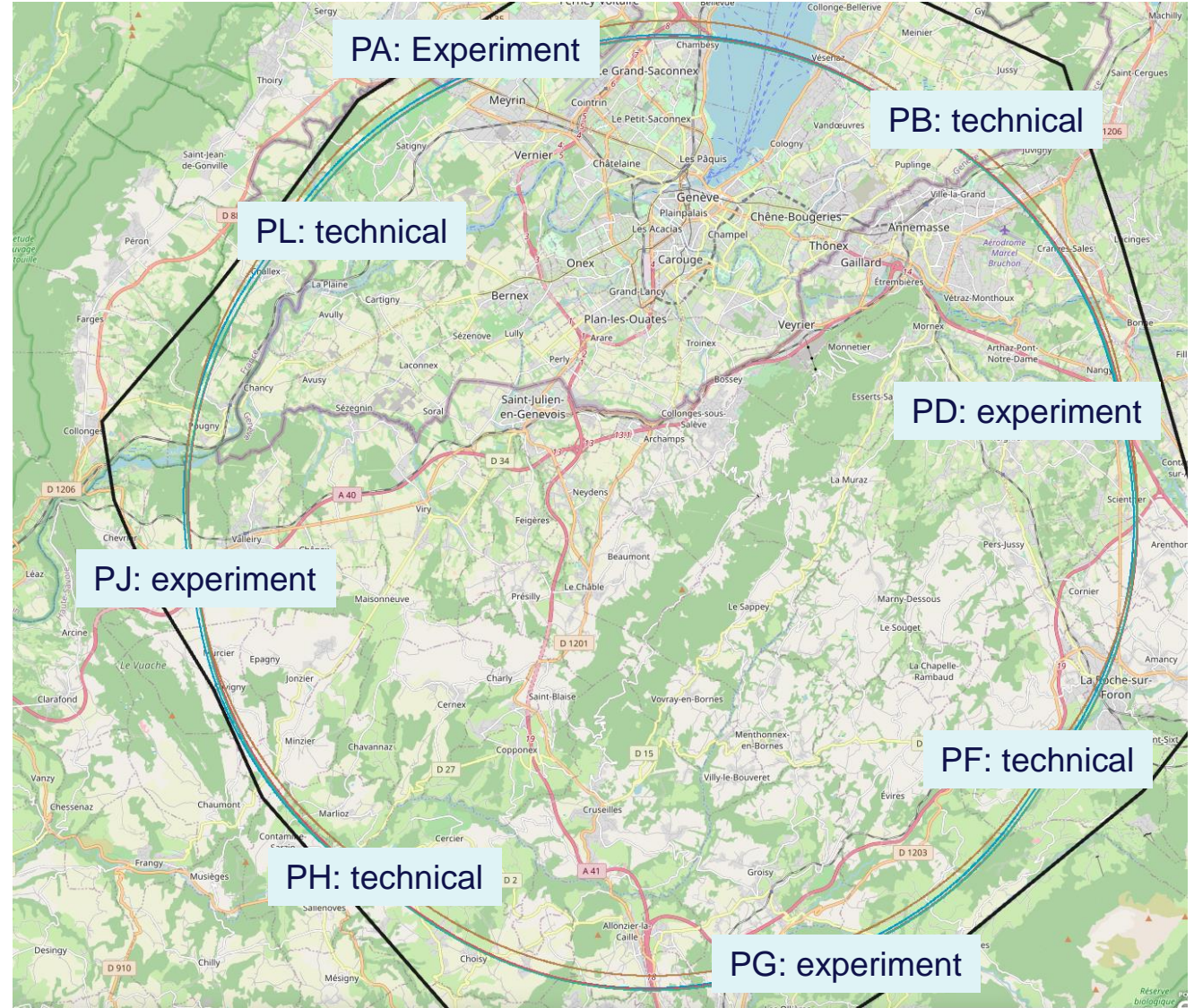


FCC Feasibility Study

Mid-term review end 2023 regarded as an important milestone

Deliverables include:

- Infrastructure & placement
- Technical Infrastructure
- Accelerator design FCC-ee and FCC-hh
- Physics, experiments, detectors
- Organisation and financing
- Environmental impact and sustainability studies
- Socio-economic impact

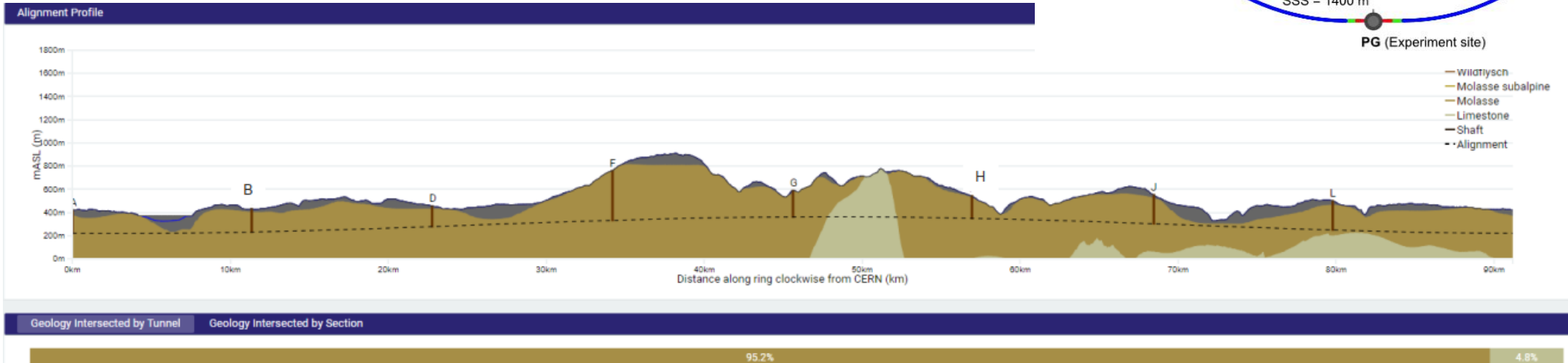
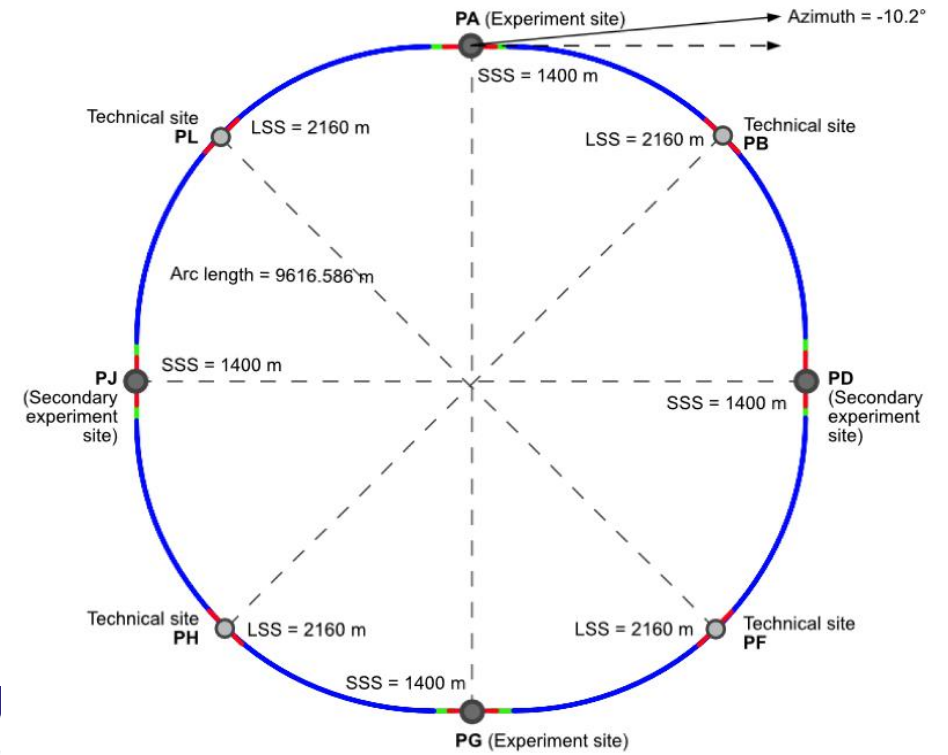


New: “lowest risk” placement

- 8 surface sites
- $C = 91.2 \text{ km}$
- 4-fold symmetry and 4-fold superperiodicity
- FCC-ee 2 or 4 IPs
- FCC-hh 4 IPs

Present implementation variant was established considering:

- Geological 3D model and tunnelling risks
- 95% in molasse geology for minimising tunnel construction risks



Neutrino Platform: Vertical Drift Studies in NP02

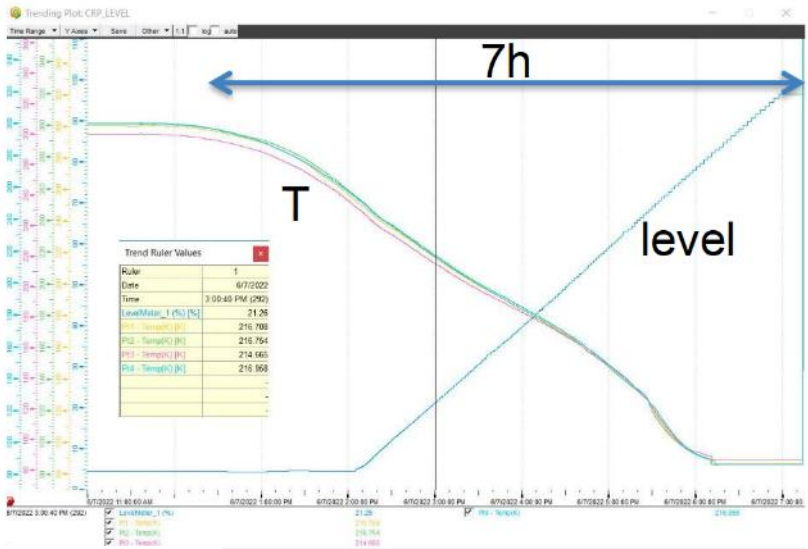
01.06.2022:

- Closing NP02 coldbox w/ CRP1 prototype



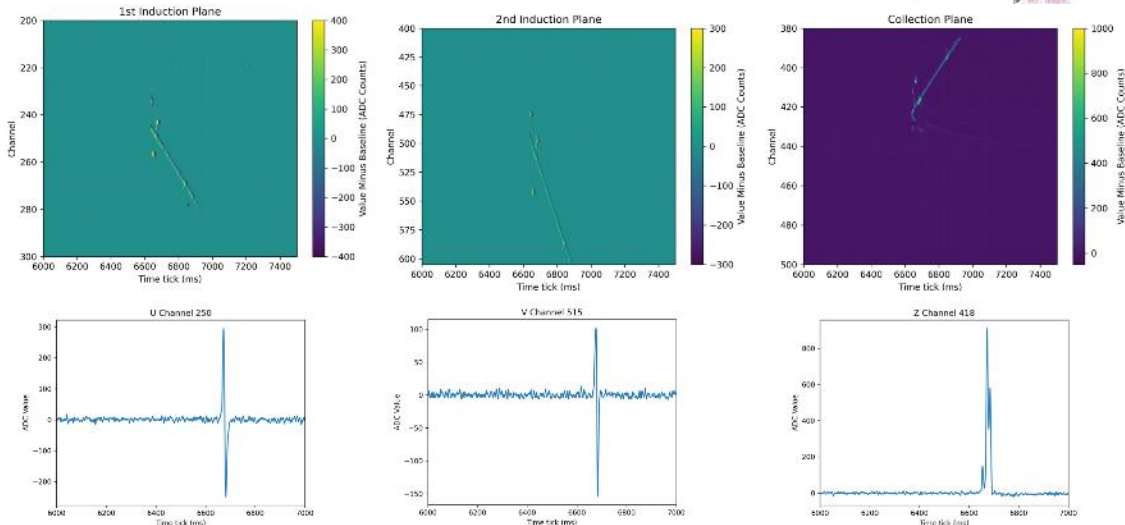
07.06.2022:

- Cooldown and filling



08-10.06.2022:

- Noise studies and data taking
- Examples of muon tracks from both Top Detector Electronics and Bottom Detector Electronics



CERN Council Resolutions wrt Russia and Belarus Institutions

The Council:

- strongly supported the people of Ukraine as well as the independence, sovereignty and territorial integrity of Ukraine
- condemned the military invasion of Ukraine by the Russian Federation with the involvement of Belarus
- deplored the resulting loss of life and the humanitarian impact
- strongly condemned the statements of Russian institutes which had expressed support for the illegal invasion of Ukraine

The Council:

- suspended the Observer's status of Russia and JINR
- decided that CERN would not engage in new collaborations with Russia, Belarus and JINR
- commended the appropriate and timely measures taken by the Management, including compliance with all applicable international sanctions and the effective suspension of all exchanges of funds, materials and personnel in both directions
- suspended the participation of CERN scientists in all scientific committees of JINR and institutions located in Russia or Belarus and viceversa
- suspended all events jointly arranged between CERN and JINR or institutions located in Russia or Belarus
- suspended the granting of contracts of association to any new individuals affiliated to home institutes in Russia or Belarus

CERN Council Resolutions wrt Russia and Belarus Institutions

The Council **denounced**:

The continuing illegal military invasion of Ukraine by the Russian Federation with the involvement of the Republic of Belarus, which has resulted in a widespread humanitarian crisis and significant loss of life;

The Council **declared**:

That it intends to terminate the International Cooperation Agreement between CERN and the Russian Federation and Belarus effective at their expiration dates (December 2024 for Russia and June 2024 for Belarus).

However, the situation will continue to be monitored carefully and the Council stands ready to take any further decision in the light of developments of the situation in Ukraine.

The Council **declared**:

That it intends to review CERN's future participation under the International Cooperation Agreement concluded between CERN and JINR well in advance of its expiration date (January 2025).

The Council **reaffirmed**:

That all decisions taken to date by the Council and all the actions undertaken by the Management, which have had a marked impact on the involvement of the Russian Federation and the Republic of Belarus in the scientific programme of the Organization, remain in force until further Council decision.

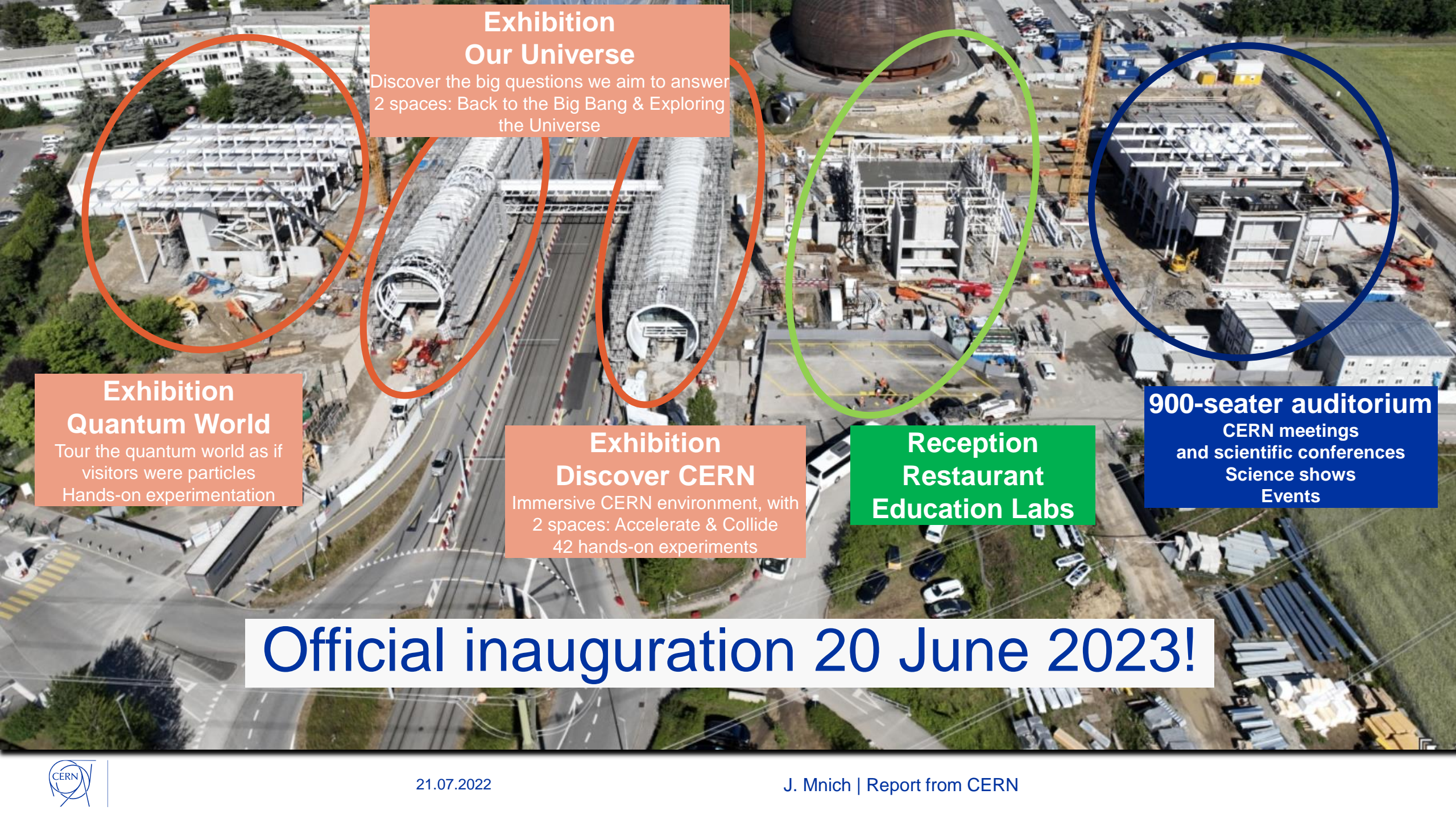
10th Anniversary of Higgs Boson Discovery

On 4 July 2022, CERN marks 10 years since the ATLAS and CMS experiments announced the discovery of the Higgs boson

Centrepiece was a full-day scientific symposium in CERN's main auditorium celebrating the discovery, give an overview of what's been learned since then, and take a look forward at what's still to come

<https://indico.cern.ch/event/1135177/>





Exhibition Our Universe

Discover the big questions we aim to answer
2 spaces: Back to the Big Bang & Exploring
the Universe

Exhibition Quantum World

Tour the quantum world as if
visitors were particles
Hands-on experimentation

Exhibition Discover CERN

Immersive CERN environment, with
2 spaces: Accelerate & Collide
42 hands-on experiments

Reception Restaurant Education Labs

900-seater auditorium

CERN meetings
and scientific conferences
Science shows
Events

Official inauguration 20 June 2023!

Summary

- LHC Run 3 successfully started
 - Goal is doubling pp integrated luminosity by end 2025
- All experiments are taking data at 13.6 TeV
 - Phase I upgrades successfully completed
- Computing ready for Run 3
- HL-LHC and Phase II upgrades proceeding well
 - Impact of Russian invasion of Ukraine under study to develop mitigation plans
- 10th anniversary of Higgs discovery on July 4th, 2022
- Science Gateway opening June 20th, 2023

Thank you for your attention!

