



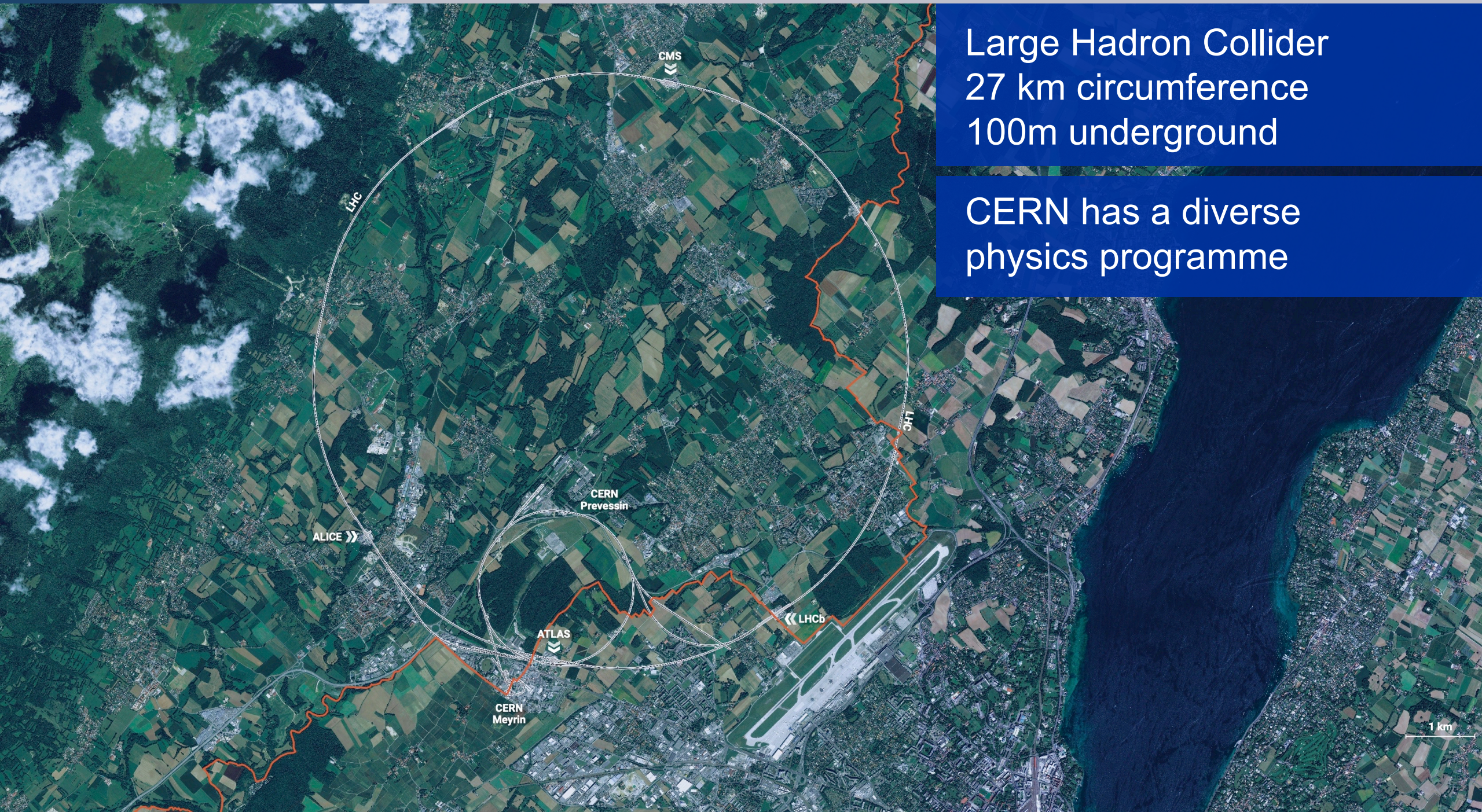
# WELCOME TO CERN

## International Workshop on Hadron Structure and Spectroscopy – 2022

Pippa Wells – Deputy Director for Research and Computing

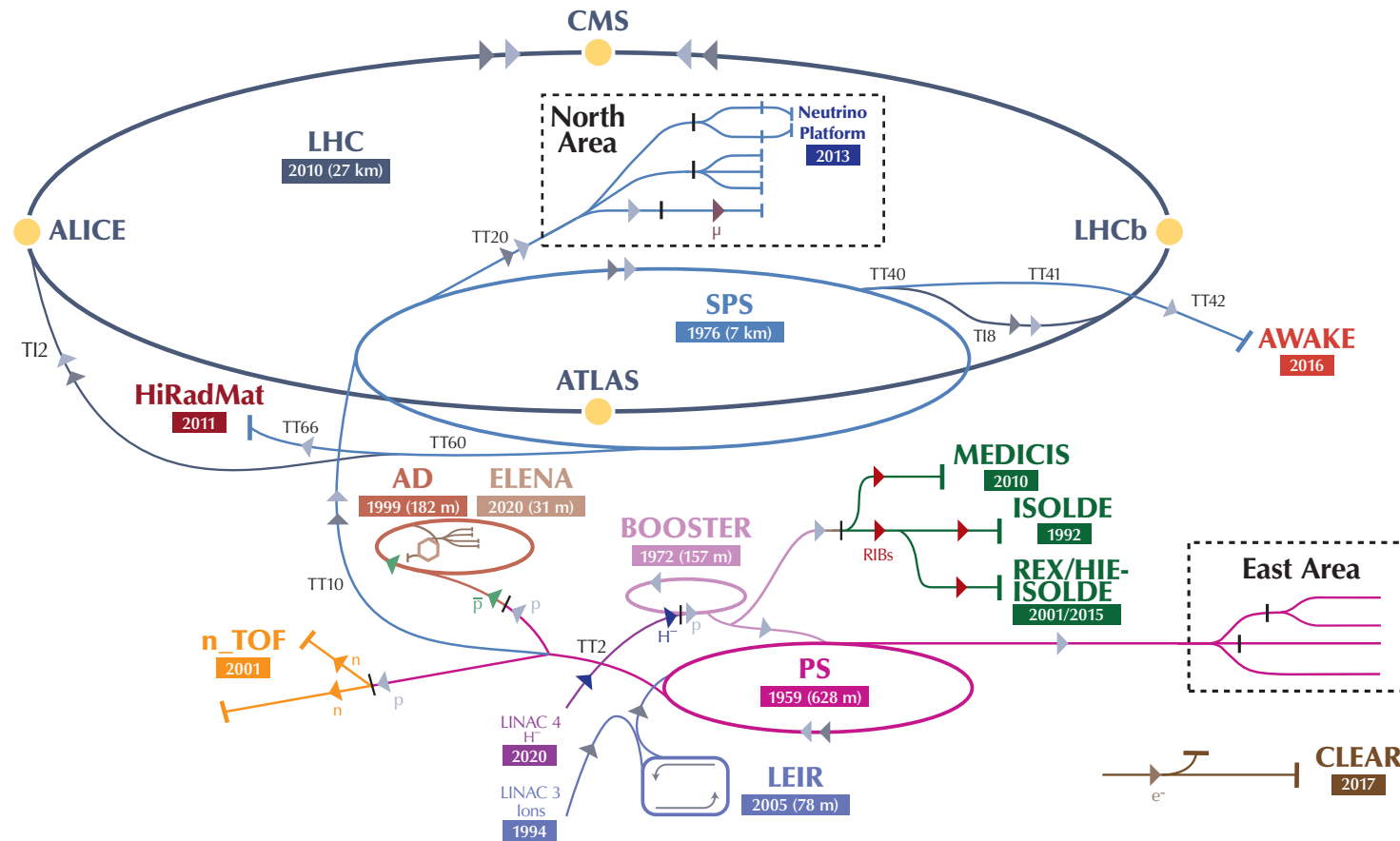
Large Hadron Collider  
27 km circumference  
100m underground

CERN has a diverse  
physics programme



# The CERN accelerator complex

## Complexe des accélérateurs du CERN



▶  $H^-$  (hydrogen anions) ▶ p (protons) ▶ ions ▶ RIBs (Radioactive Ion Beams) ▶ n (neutrons) ▶  $\bar{p}$  (antiprotons) ▶  $e^-$  (electrons) ▶  $\mu$  (muons)

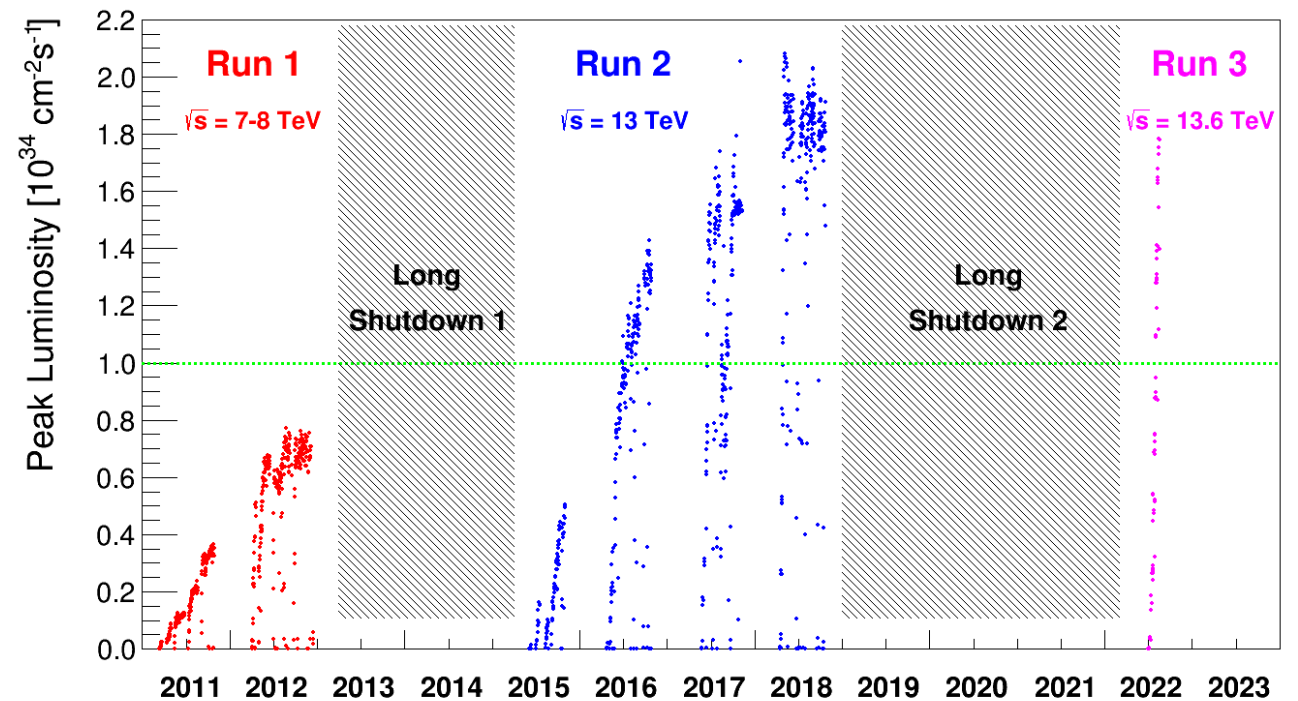
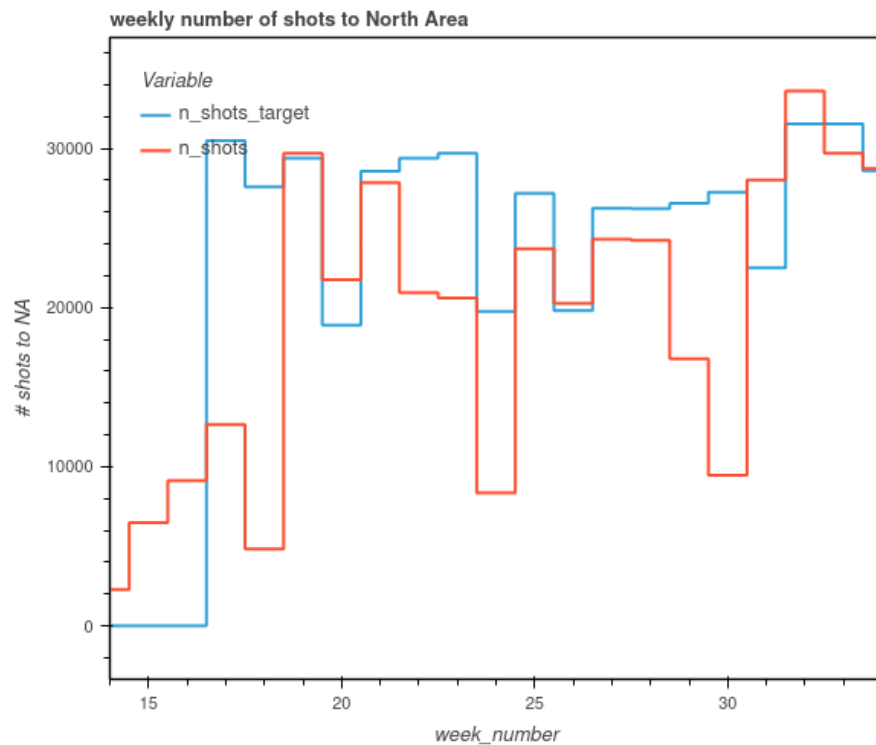
LHC - Large Hadron Collider // SPS - Super Proton Synchrotron // PS - Proton Synchrotron // AD - Antiproton Decelerator // CLEAR - CERN Linear Electron Accelerator for Research // AWAKE - Advanced WAKEfield Experiment // ISOLDE - Isotope Separator OnLine // REX/HIE-ISOLDE - Radioactive EXperiment/High Intensity and Energy ISOLDE // MEDICIS // LEIR - Low Energy Ion Ring // LINAC - LINear ACcelerator //

n\_TOF - Neutrons Time Of Flight // HiRadMat - High-Radiation to Materials // Neutrino Platform

# LHC Run 3 is ongoing (2022-2025)

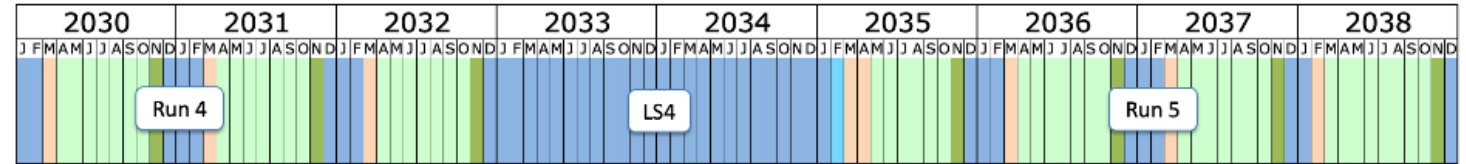
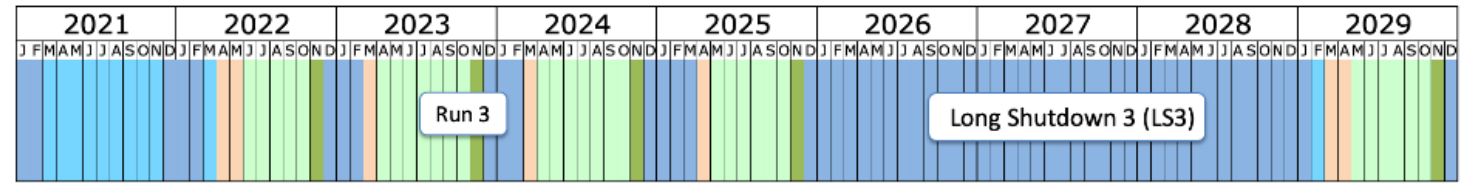
All CERN experimental areas now back in action after Long Shutdown 2. NA spill quality improved in 2022 compared to 2021.

Phase 1 upgrades of 4 big LHC experiments being commissioned – however, just started 4 week stop after cooling plant failure at point 4 (RF)



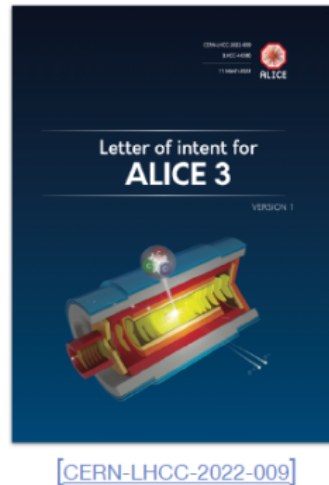
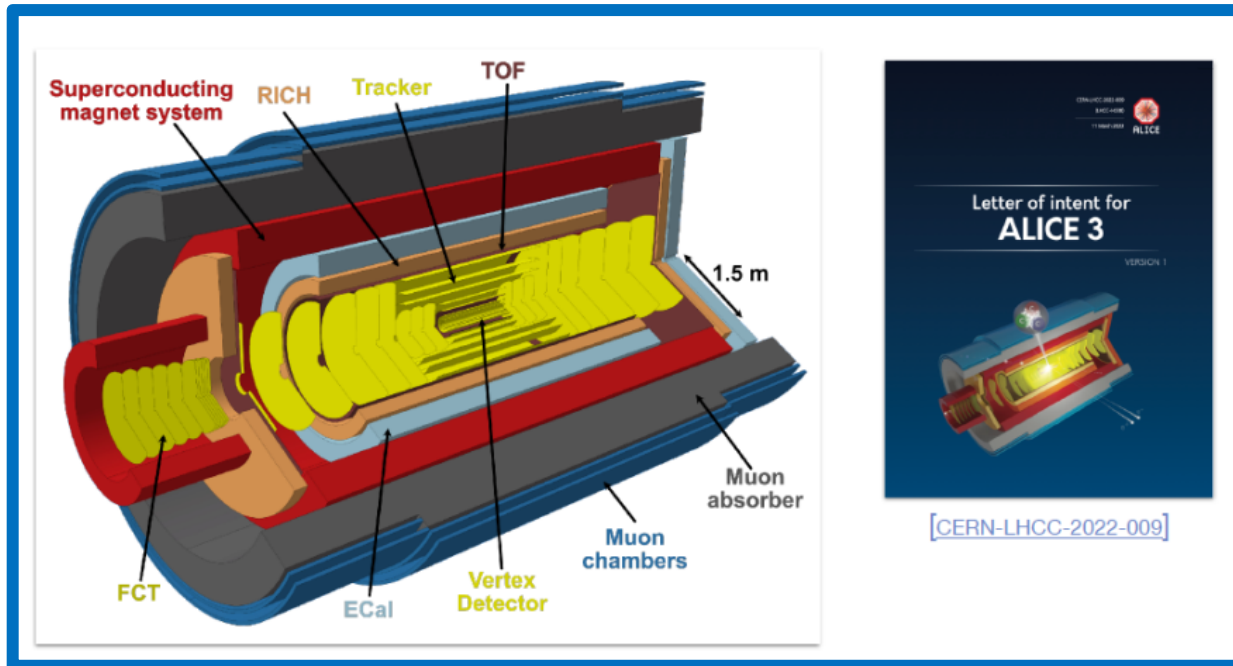
# High-Lumi LHC

HL-LHC should deliver 10x more luminosity than original design to ATLAS and CMS – Phase II upgrades to be installed in LS3



Last updated: January 2022

- Shutdown/Technical stop
- Protons physics
- Ions
- Commissioning with beam
- Hardware commissioning/magnet training

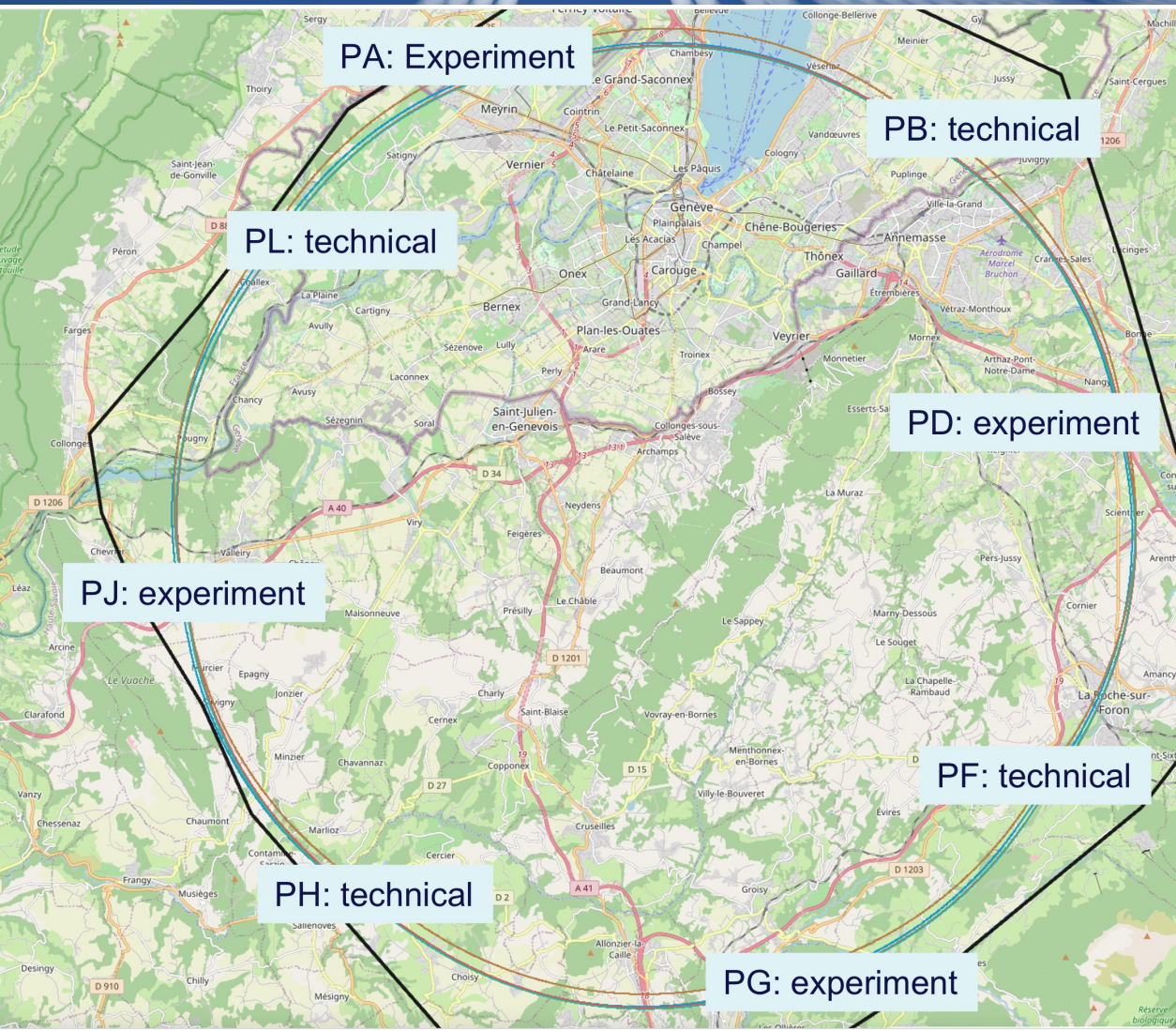


ALICE and LHCb also plan major upgrades for LS4

# Scientific priorities for the future

Implementation of the recommendations of the **2020 Update of the European Strategy for Particle Physics**:

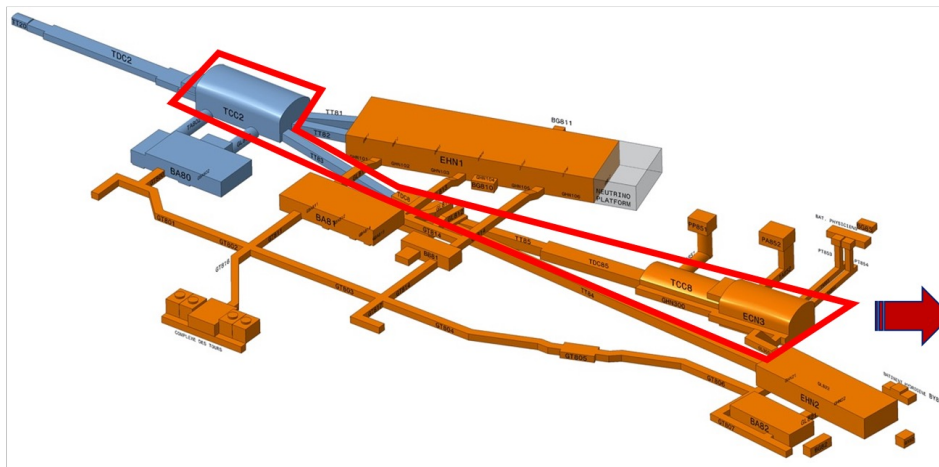
- Fully exploit the High-Luminosity LHC
- Build a Higgs factory to further understand this unique particle
- Investigate the technical and financial feasibility of a future energy-frontier  $\sim 100$  km collider at CERN – mid-term report due in 2023
- Ramp up relevant R&D
- Continue supporting other projects around the world [including Physics Beyond Colliders]



# Physics Beyond Colliders

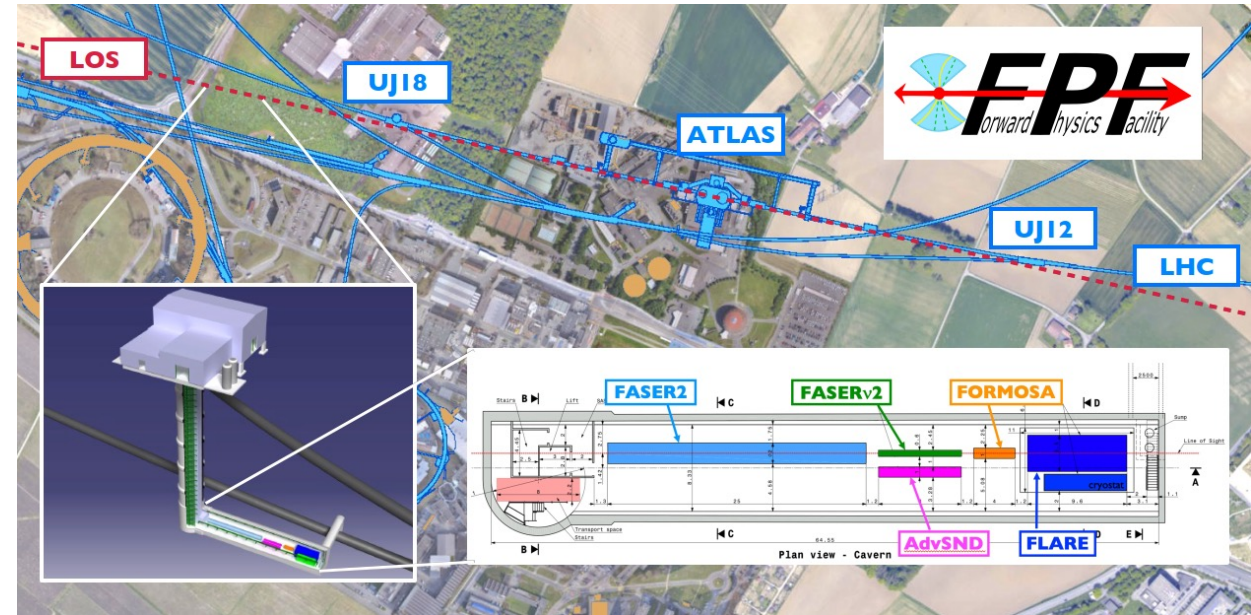
North Area High Intensity Beams ECN3  
 Several experiments under study: HIKE,  
 SHADOWS, Beam Dump Facility with SHiP, TauFV  
 Report on post LS3 options to SPSC in 2023

## Consolidation Phase 1 (funded): 2019 – 2027



Areas concerned with high intensity beams

## Consolidation Phase 2 (not yet funded): 2028 – 2033



Long lived particles (LLP) @ LHC:  
 Forward Physics Facility (in line of sight of ATLAS interaction point) – preparing EoL  
 LLP experiments at large angle to the beam line  
 LHC fixed target: gas targets; crystal extraction



# CERN laboratory for people around the world

Distribution of all CERN Users by the country of their home institutes as of 31 December 2021



Geographical & cultural diversity  
Users of **110 nationalities**  
**19.4% women**



## Member States **6642**

Austria 74 – Belgium 122 – Bulgaria 39 – Czech Republic 227  
Denmark 42 – Finland 71 – France 811 – Germany 1129  
Greece 133 – Hungary 69 – Israel 67 – Italy 1423  
Netherlands 157 – Norway 69 – Poland 278 – Portugal 89  
Romania 105 – Serbia 36 – Slovakia 66 – Spain 328  
Sweden 88 – Switzerland 372 – United Kingdom 847

## Associate Member States in the pre-stage to membership **55**

Cyprus 10 – Estonia 24 – Slovenia 21

## Associate Member States **367**

Croatia 36 – India 130 – Latvia 11 – Lithuania 12 – Pakistan 30  
Türkiye 122 – Ukraine 26

## Observers **2917**

Japan 189 – Russia (suspended) 971 – United States of America 1757

Annual budget: **1200 MCHF**  
Employees:  
**2676 staff, 783 fellows**  
Associates:  
**11 175 users, 1556 others**

## Non-Member States and Territories **1194**

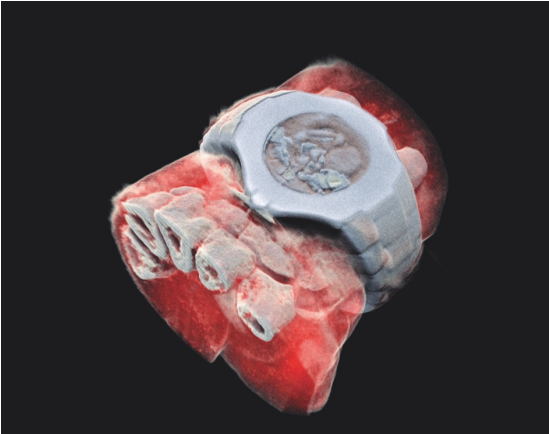
Algeria 3 – Argentina 16 – Armenia 10 – Australia 20 – Azerbaijan 3 – Bahrain 2 – Belarus 24 – Brazil 106  
Canada 189 – Chile 23 – Colombia 18 – Cuba 3 – Ecuador 6 – Egypt 16 – Georgia 36 – Hong Kong 17  
Iceland 3 – Indonesia 6 – Iran 11 – Ireland 6 – Jordan 5 – Kuwait 5 – Lebanon 15 – Madagascar 1  
Malaysia 4 – Malta 2 – Mexico 48 – Montenegro 5 – Morocco 18 – New Zealand 8 – Oman 1 – People's  
Republic of China 314 – Peru 2 – Philippines 1 – Republic of Korea 113 – Singapore 3 – South Africa 52  
Sri Lanka 10 – Taiwan 45 – Thailand 18 – United Arab Emirates 6

# Applications of CERN technologies – accelerators, detectors and computing



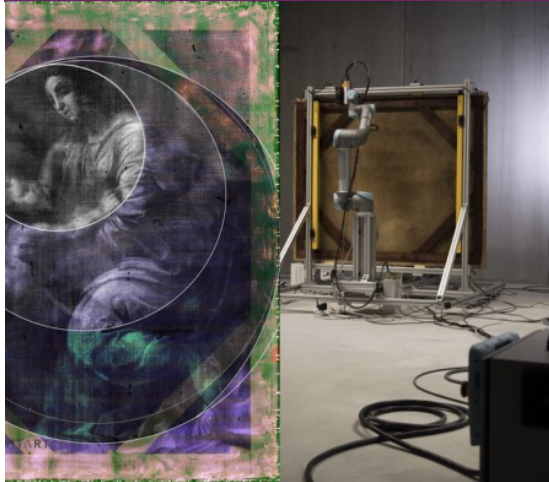
Accelerator technologies for cancer radiotherapy with protons, ions and electrons.

Pixel detectors for radiation monitoring. (NASA – ISS)



Pixel detectors for high resolution 3D colour X-ray imaging.

Cultural Heritage InsightART  
Measuring the DNA of your art



# IWHSS-2022



# CERN Science Gateway



CERN's new education and outreach centre for age 5-plus.

Increase visitor capacity from 150k to >300k per year

Opening summer 2023.

# Recent anniversaries



Web@30 (2019), Higgs@10 (2022), and today: 25/20 years of COMPASS

