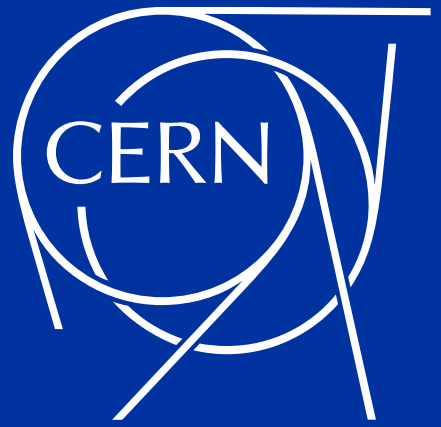


Introduction to CERN and the Accelerator Complex

For the HEARTS kick-off meeting

Rende Steerenberg – BE-OP

20 January 2023

Topics

- CERN & Collaboration
- The Accelerator Complex
- Scheduling Heavy Ions
- Concluding Remarks

Topics

- **CERN & Collaboration**
- The Accelerator Complex
- Scheduling Heavy Ions
- Concluding Remarks

Four pillars underpin CERN's mission

Science for peace

CERN was founded in 1954 with 12 European Member States

CERN's annual budget is 1200 MCHF (equivalent to a medium-sized European university)

23 Member States

Austria – Belgium – Bulgaria – Czech Republic
Denmark – Finland – France – Germany – Greece
Hungary – Israel – Italy – Netherlands – Norway
Poland – Portugal – Romania – Serbia – Slovakia
Spain – Sweden – Switzerland – United Kingdom

3 Associate Member States in the pre-stage to membership

Cyprus – Estonia – Slovenia

7 Associate Member States

Croatia – India – Latvia – Lithuania – Pakistan
Türkiye – Ukraine

6 Observers

Japan – Russia (suspended) – USA
European Union – JINR (suspended) – UNESCO

Around 50 Cooperation Agreements with non-Member States and Territories

Albania – Algeria – Argentina – Armenia – Australia – Azerbaijan – Bangladesh – Belarus – Bolivia
Bosnia and Herzegovina – Brazil – Canada – Chile – Colombia – Costa Rica – Ecuador – Egypt – Georgia – Honduras
Iceland – Iran – Jordan – Kazakhstan – Lebanon – Malta – Mexico – Mongolia – Montenegro – Morocco – Nepal
New Zealand – North Macedonia – Palestine – Paraguay – People's Republic of China – Peru – Philippines – Qatar
Republic of Korea – Saudi Arabia – Sri Lanka – South Africa – Thailand – Tunisia – United Arab Emirates – Vietnam

A 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

A strong commitment to provide particle beams for research by external Users from different sectors from all over the world

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**

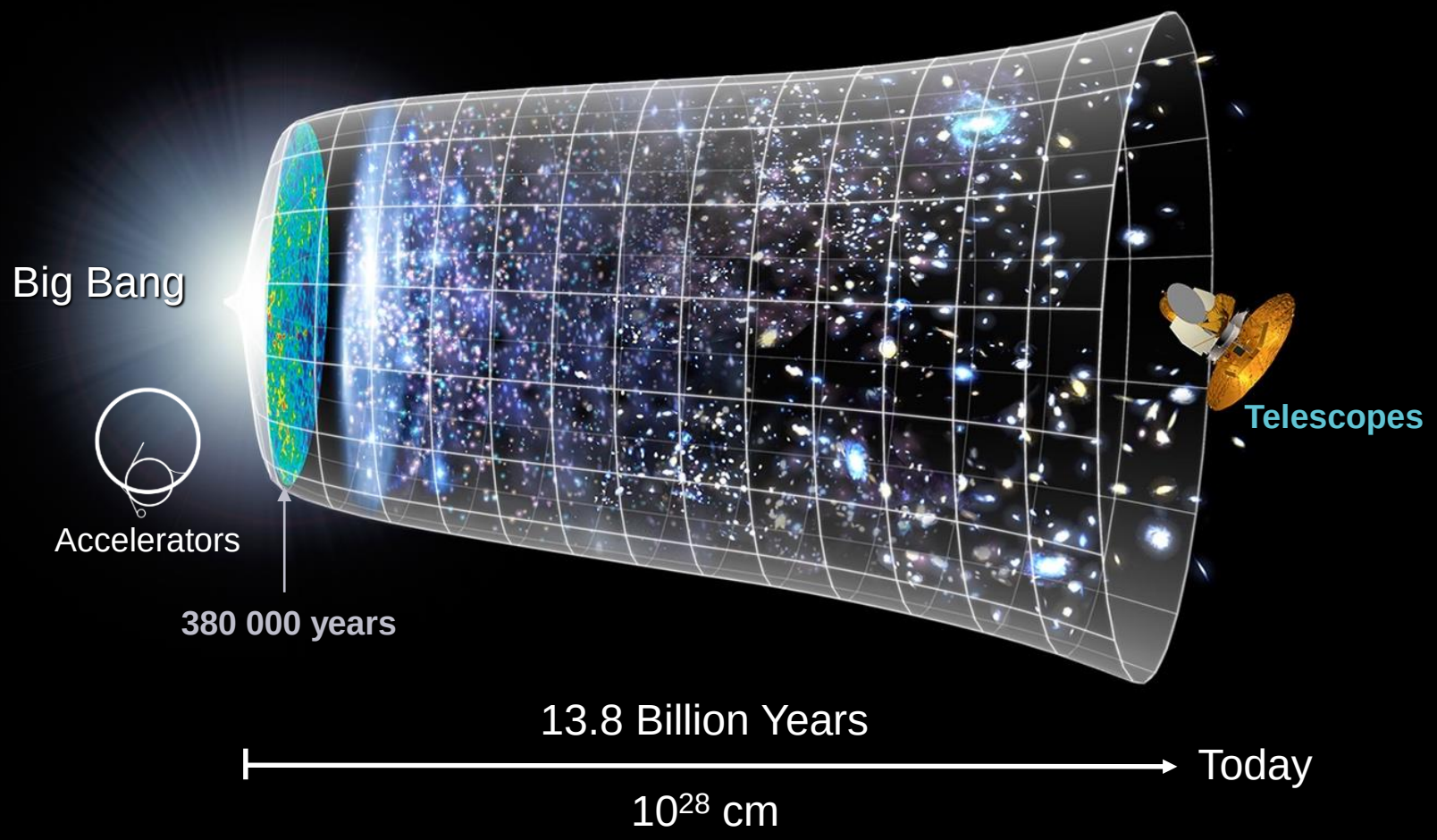
Croatia 36 – **India** 130 – **Latvia** 11 – **Lithuania** 12 – **Pakistan** 30
Türkiye 122 – **Ukraine** 26

Observers **2917**

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

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



CERN & The Universe

We reproduce the conditions a fraction of a second after the Big Bang, to gain insight into the structure and evolution of the universe.

Complementary to the space telescopes

CERN & Space

An antimatter detector attached to the international space station (2011)

Radiation monitoring in space with CERN technology (2022)

Topics

- CERN & Collaboration
- **The Accelerator Complex**
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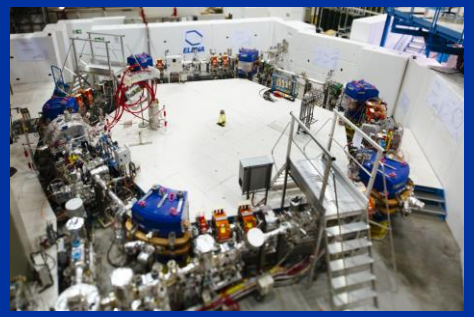
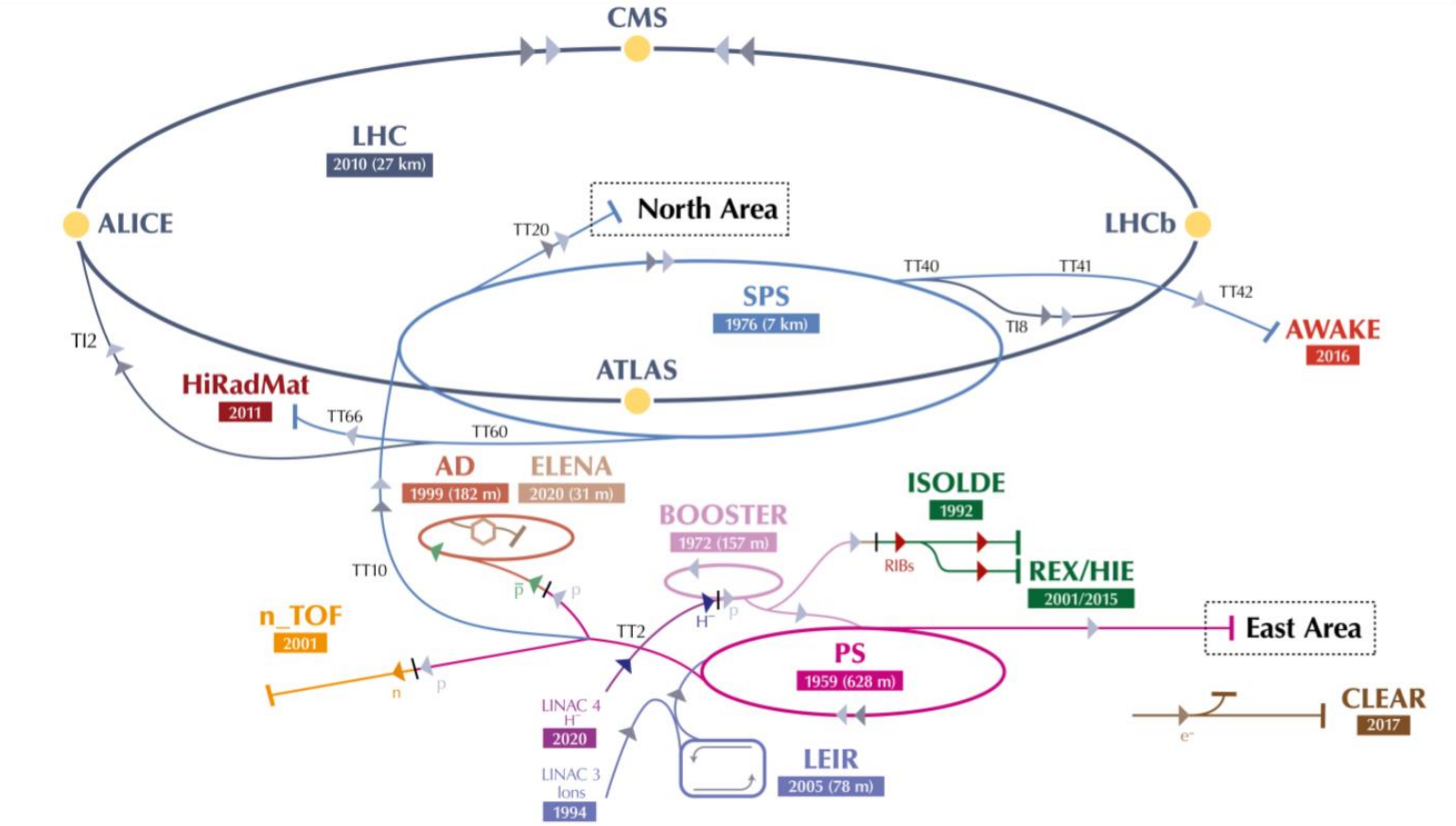
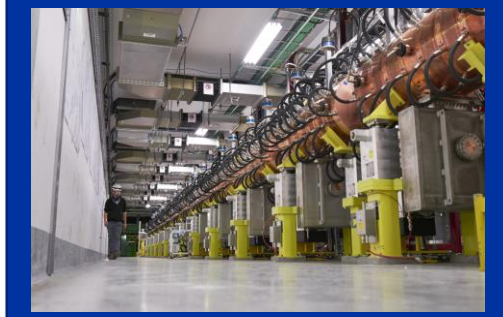
The CERN Accelerator Complex

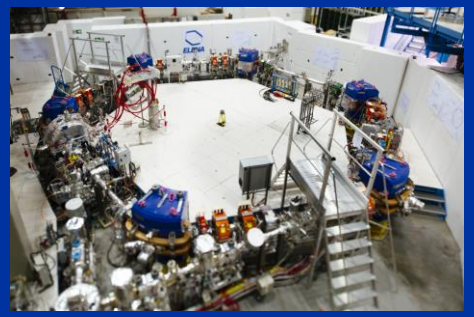


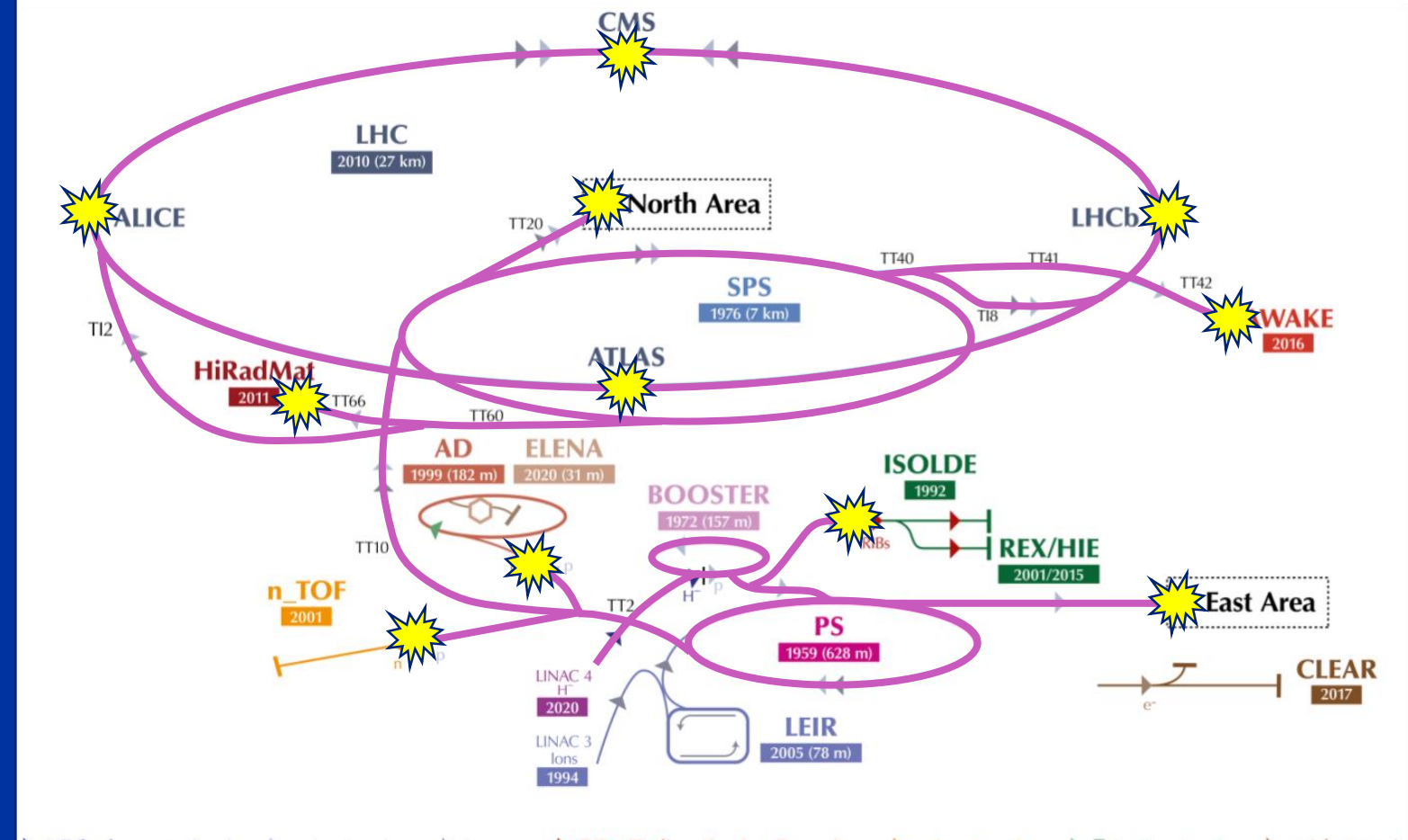




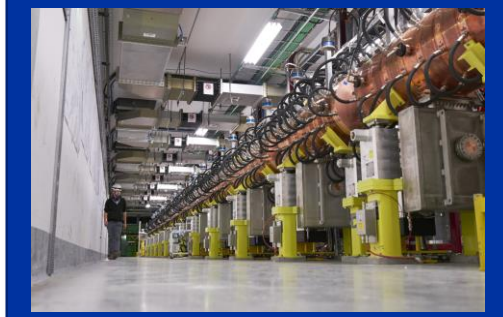
Proton Path & Users





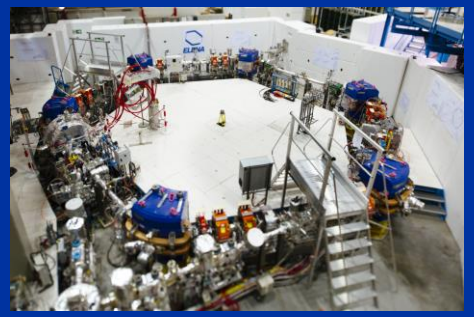



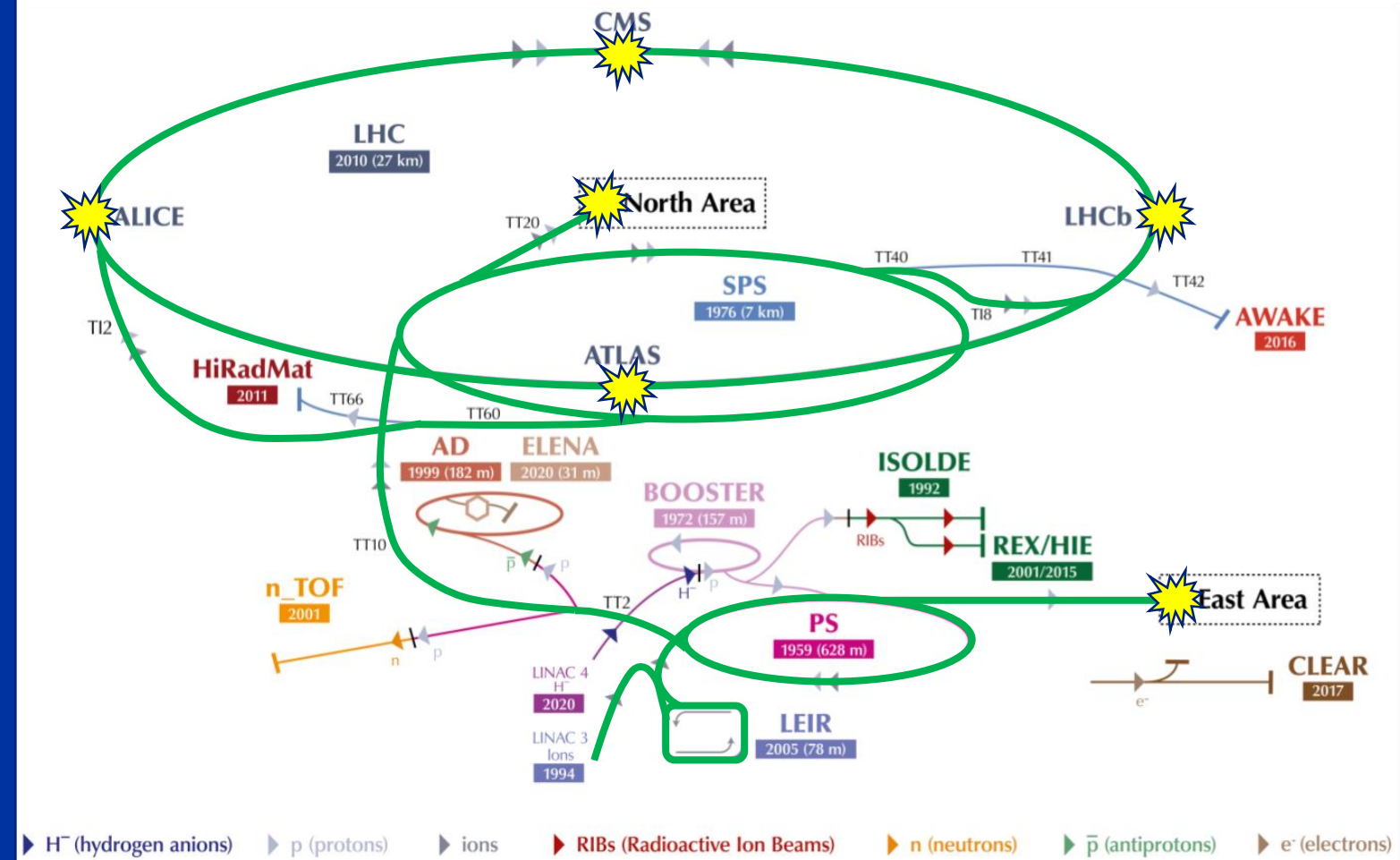




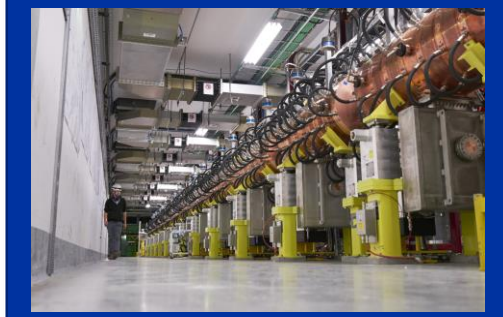

Ion Path & Users





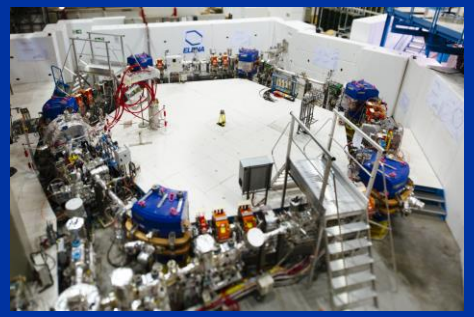



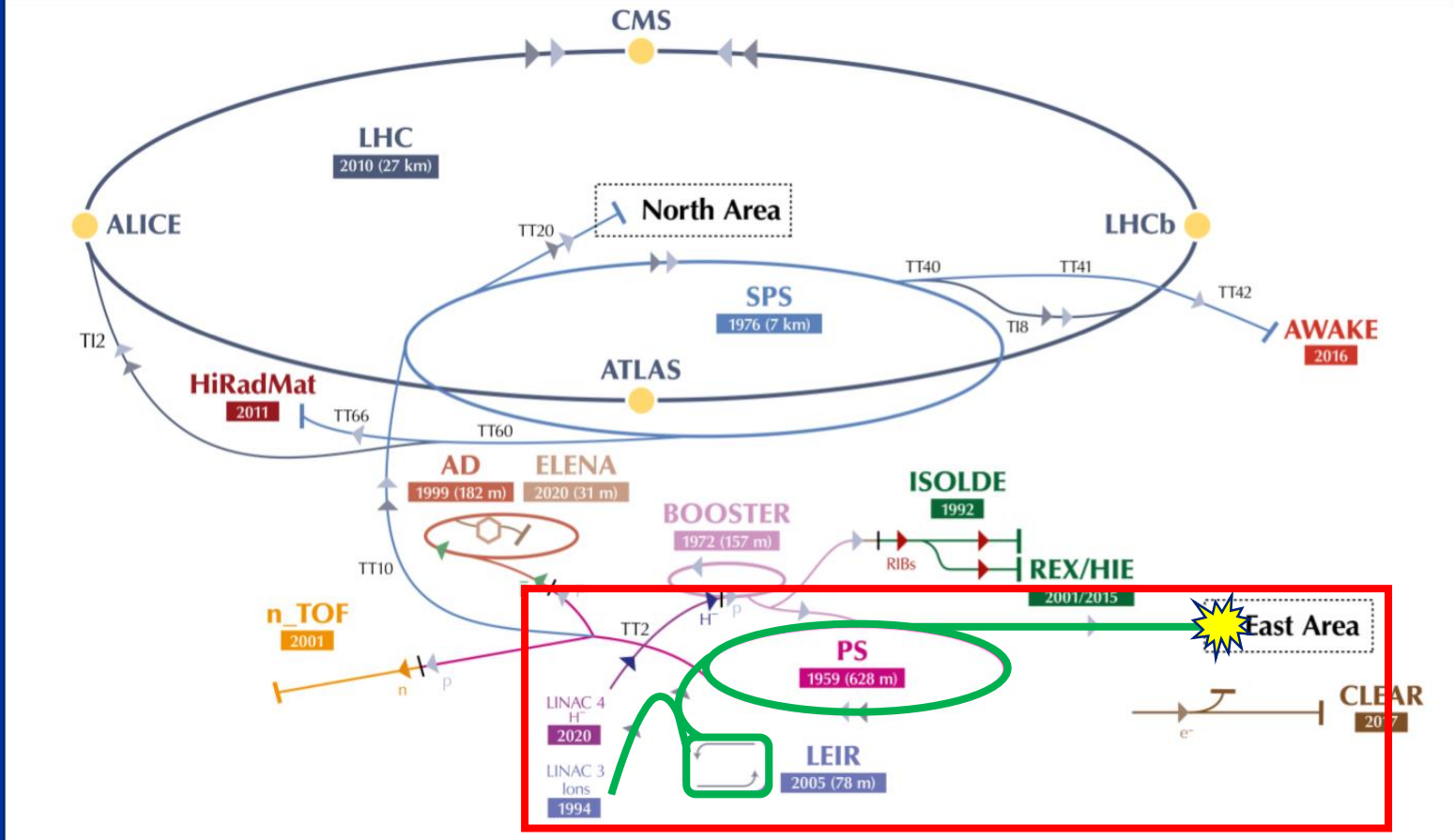




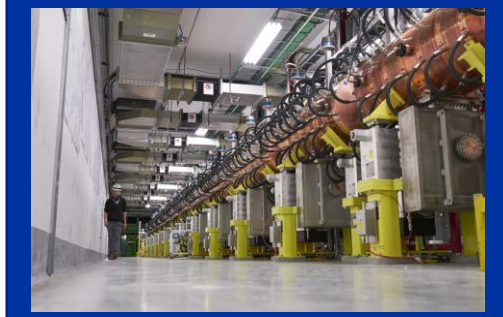

Ion Path for HEARTS



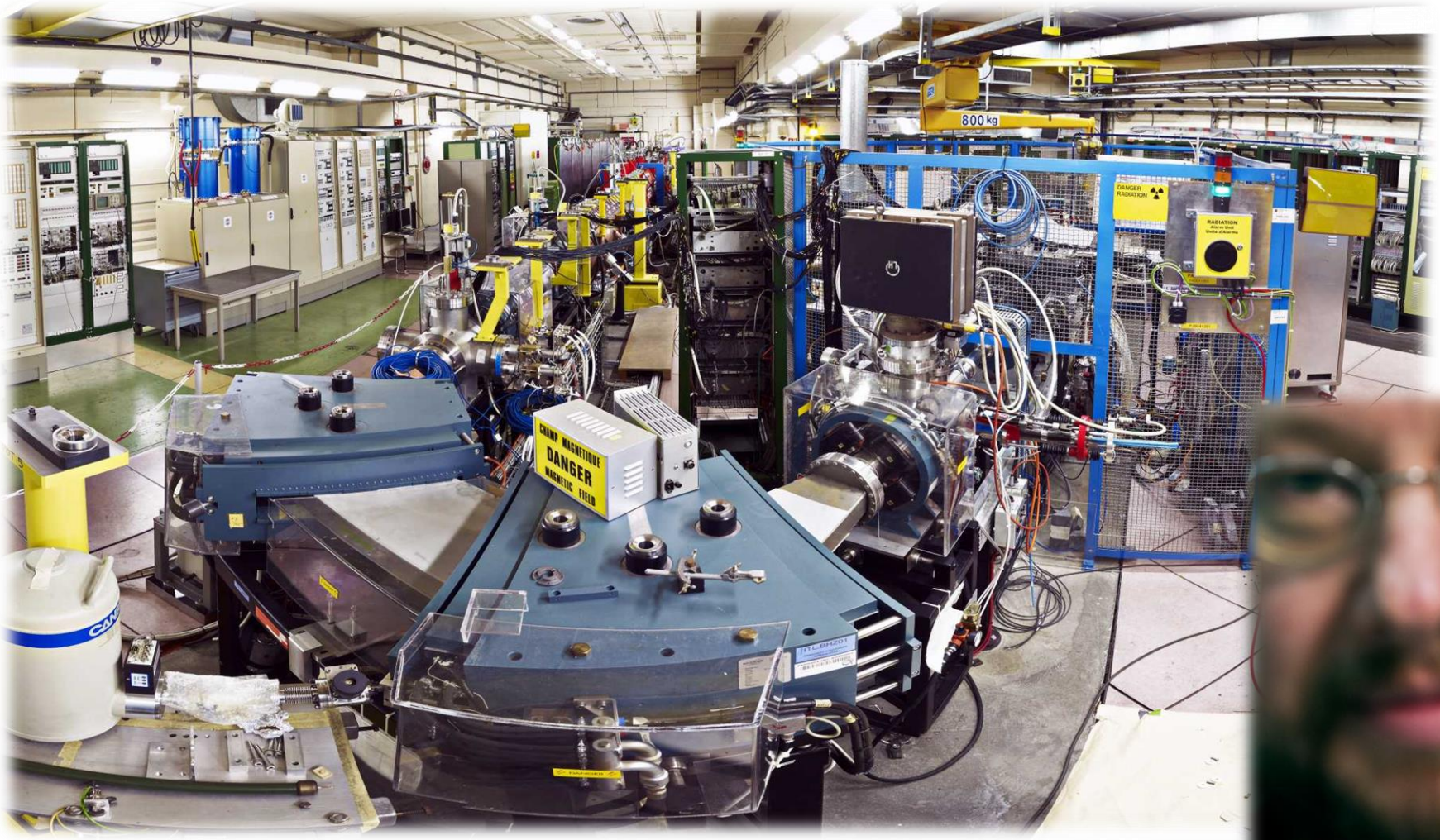


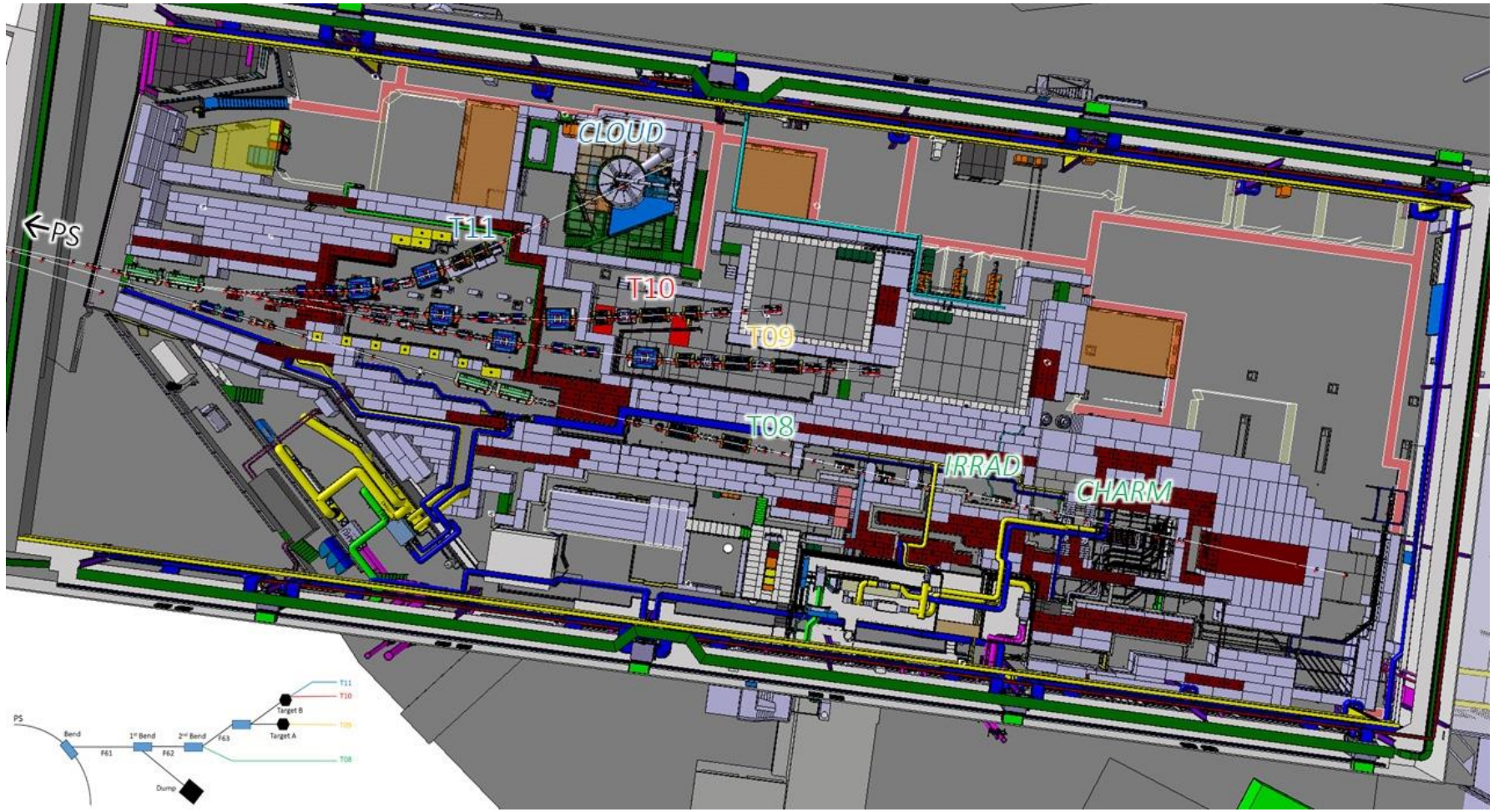





Linac 3: Source of Ions at CERN

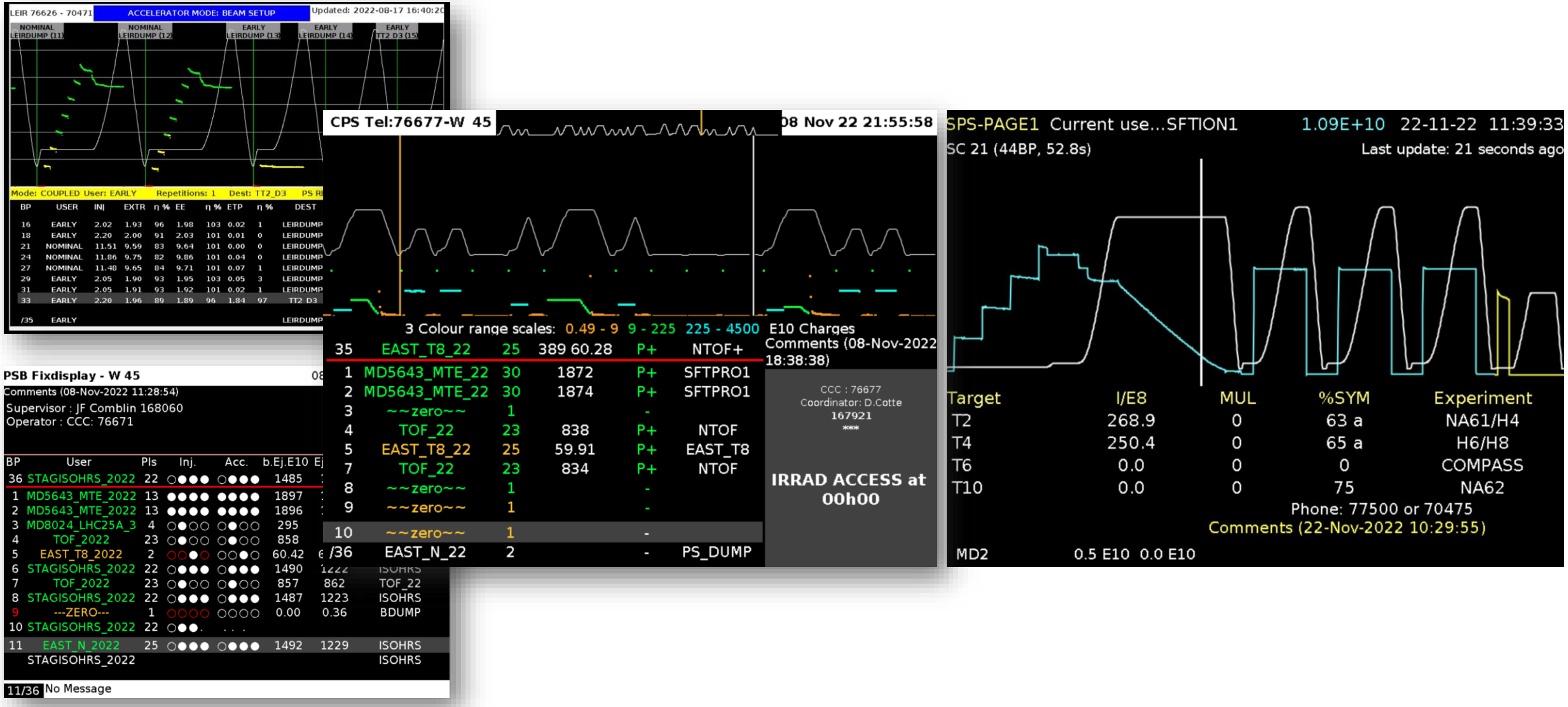


CERN Proton Synchrotron East Experimental Area



- The EA renovation was completed and physics was resumed in October 2021
- Prior to this renovation the CHARM-IRRAD area was already installed
- Both protons and ions can be send by the PS

The Versatile Injectors Complex – serving many Users



Topics

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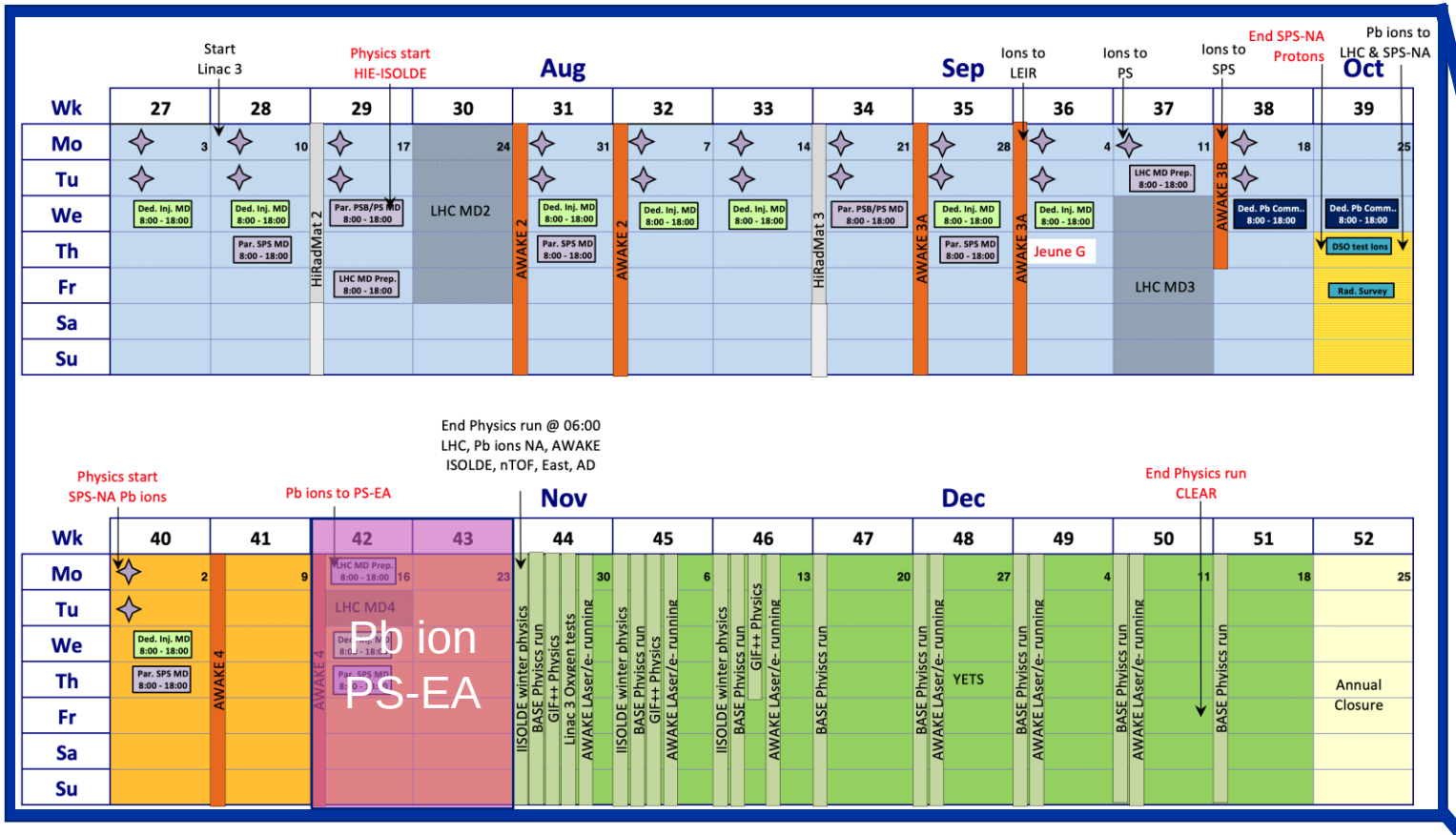
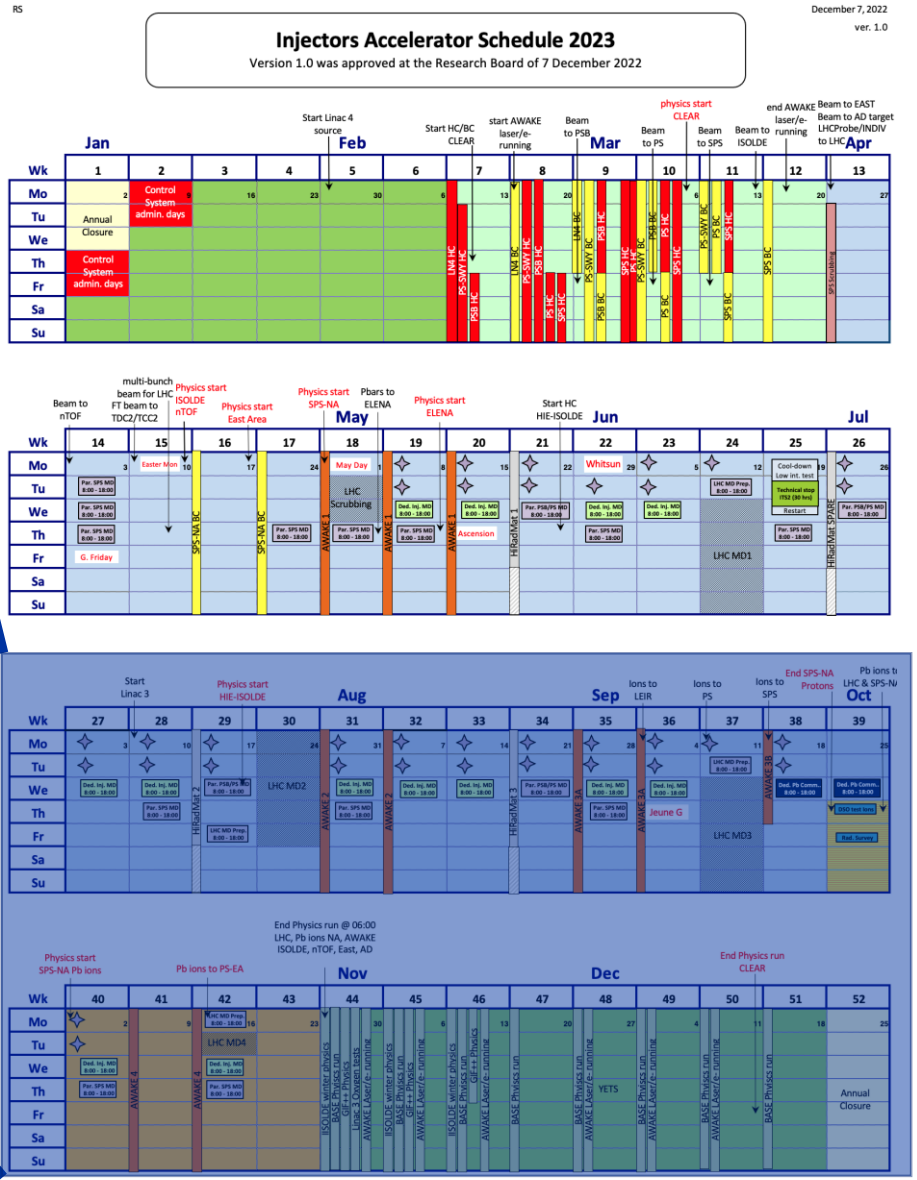
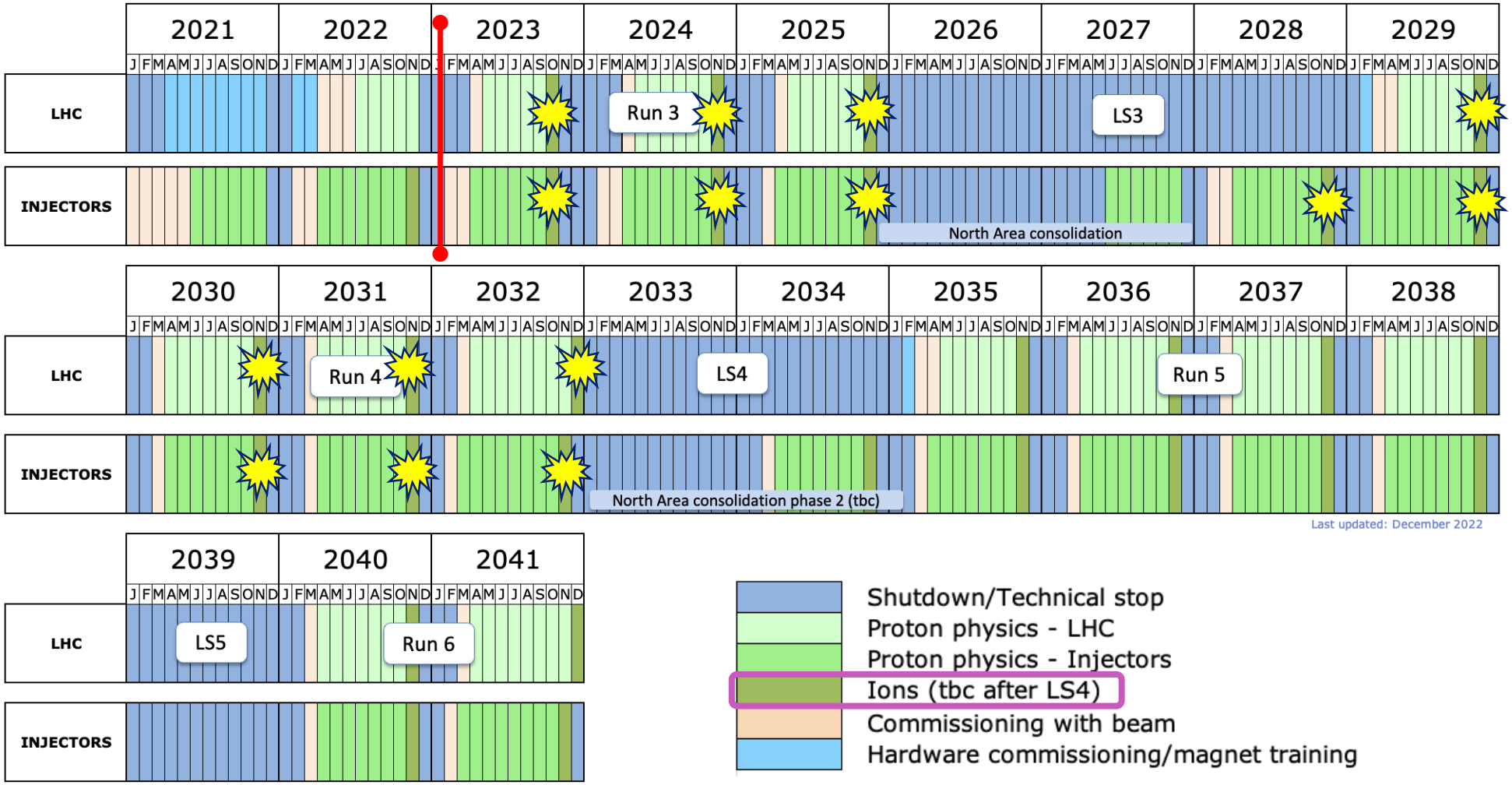
- **Scheduling Heavy Ions**
- Concluding Remarks

The 2023 Injectors Schedule

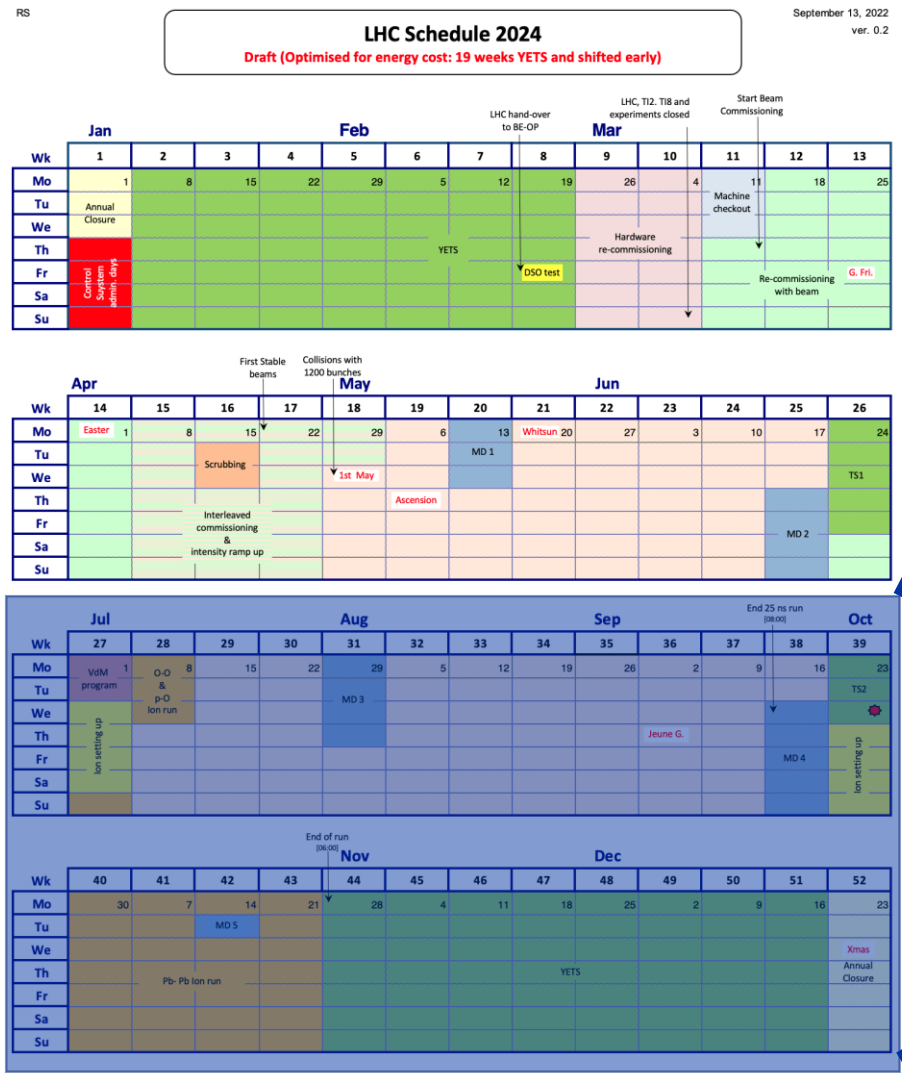


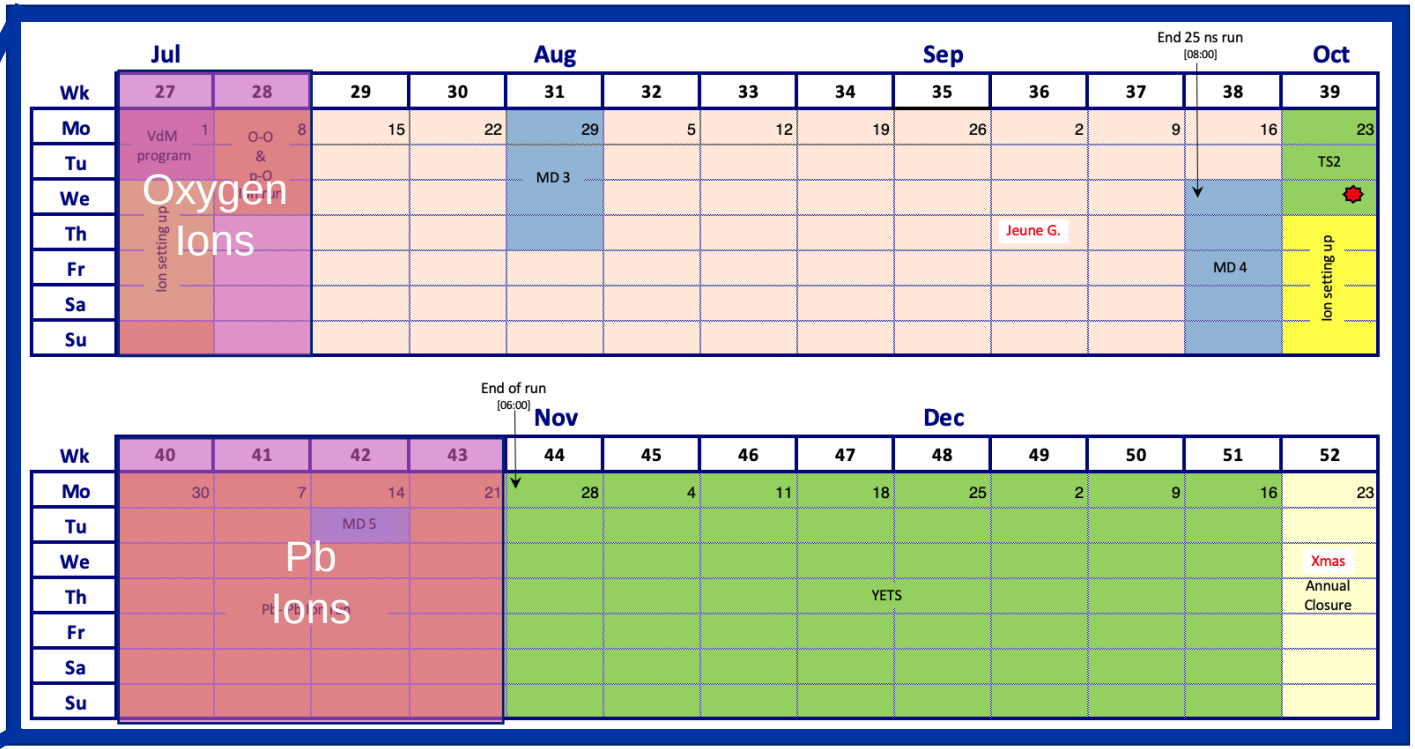


The Long-Term Commitment for Heavy Ions at CERN



Preliminary Draft 2024 LHC Schedule





Topics

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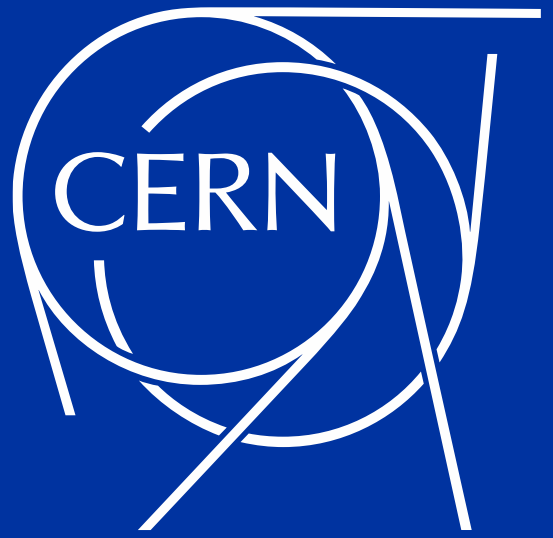
- **Concluding Remarks**

Concluding Remarks

- **CERN and space is a longstanding history, HEARTS strengthens this relationship**
  - It will answer important questions for future space applications
- **CERN has a long-term commitment towards heavy ions physics programmes for the LHC and the Injectors**
  - The CHARM-IRRAD facility behind the PS offers excellent and flexible beam conditions for radiation testing, using heavy ions
- **The CERN Accelerator Complex is highly versatile and offers the possibility to produce protons and ions in the same super cycle**
- **Ions in the PS East Area are scheduled in October 2023**
  - Oxygen ions will potentially also be available in 2024

I wish you a fruitful HEARTS kick-off meeting today
&
a successful project collaboration for the future


CERN