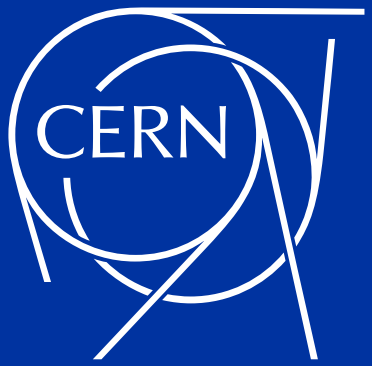


Highlights of the September Council week and other news

Fabiola Gianotti, Raphaël Bello, Mike Lamont, Joachim Mnich, Charlotte Warakaulle

Town Hall meeting, CERN, 17 October 2022

Outline

Highlights of the Council week	F. Gianotti
News on the accelerator complex	M. Lamont
News from the experiments	J. Mnich
Energy-saving measures on CERN campus	R. Bello

September 26-30 Council week: main topics

Reports on accelerator complex,
LHC and non-LHC experiments, computing,
HL-LHC and detectors' upgrades

FCC Feasibility Study: plans and deliverables
for 2023 mid-term review approved
https://indico.cern.ch/event/1197445/contributions/5034859/attachments/2510649/4315140/spc-e-1183-Rev2-c-e-3654-Rev2_FCC_Mid_Term_Review.pdf

Implementation of Detector R&D roadmap (developed
under ECFA's auspices) approved by Council
https://indico.cern.ch/event/1197445/contributions/5034860/attachments/2517863/4329123/spc-e-1190-c-e-3679-Implementation_Detector_Roadmap.pdf

Report on technical deliverables and progress of CERN's High-Field Magnets programme

Report on site maintenance and consolidation and new buildings

Report on Science Gateway

9 contract adjudications approved (~ 87 MCHF)

Appointment of new Chair of Scientific Policy Committee (as of 1 Jan 2023): Dr. Hugh Montgomery (JLAB, USA)

Medium-Term Plan (MTP) 2023-2027
(**2023 budget approved**)

Financial matters, including preliminary
Cost Variation Index (CVI) for 2023: ~ 10%

First discussion of a package of possible measures to mitigate impact of inflation and energy prices on CERN's budget

98.2% of annual contributions received from Member and Associate Member States (98.6% at the same point in 2021 and 98% in 2020) → **HUGE THANKS!**

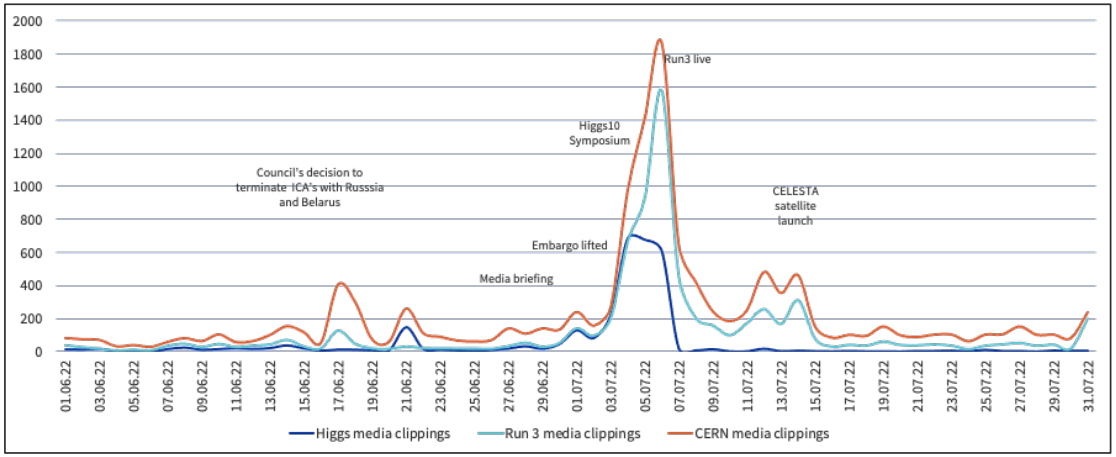
Terms of Reference of Finance Committee approved

Reports of scientific committees, Audit Committee,
Pension Fund Governing Board, Council WG on Governance of CERN, etc.

Higgs boson@10 and start of Run 3: 4-5 July

Higgs boson@10 symposium:

- Morning sessions: review and celebration
- Afternoon sessions: new results
- CERN Auditorium oversubscribed
- Peak online audience (webcast): ~1150 people

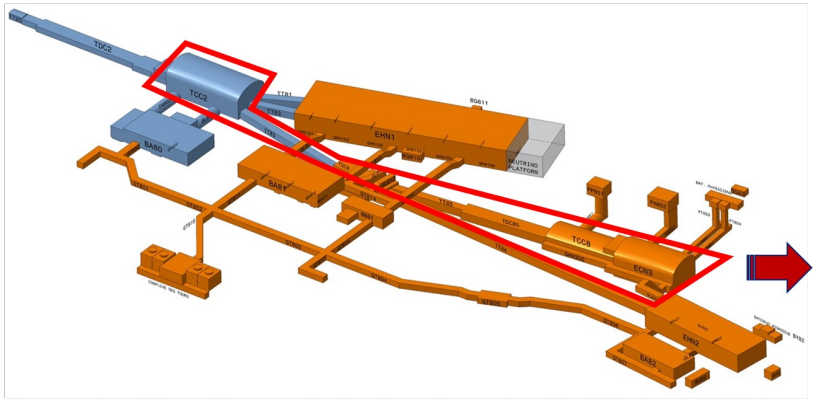


- ~ 7000 articles from 1 June to 31 July
- International and national media outlets, including BBC, NYT, Reuters, Repubblica, The Economist, Deutsche Welle, Libération, El País, SRF, Euronews
- On-site media briefing (30 June): > 60 journalists in person/online, 16 countries
- Large volume of clippings in major national media outlets of Member States and beyond

Many thanks to IR/ECO

Future opportunities for scientific diversity programme: example

Consolidation Phase 1 (funded): 2019 – 2027



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

Areas concerned with high intensity beams

North Area upgrade to higher-intensity beams:

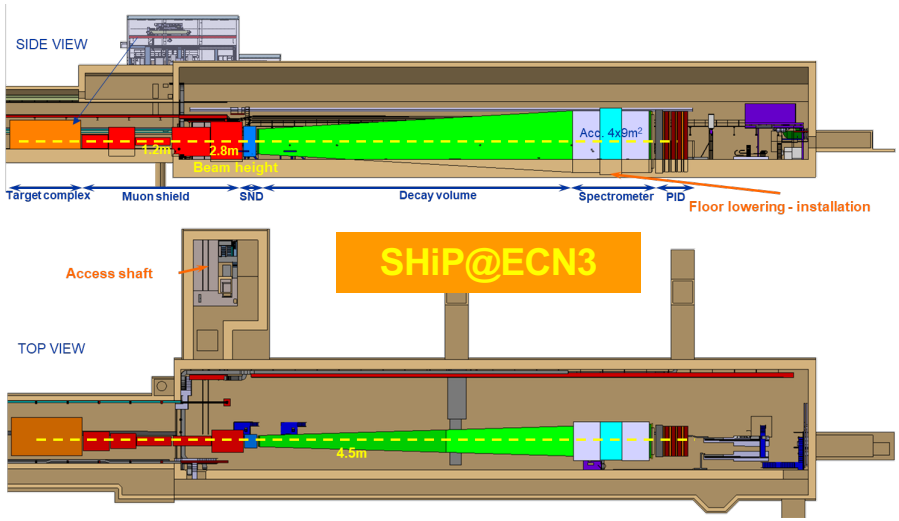
up to ~ 4 x 10^{19} POT/year (slow extraction) post-LS3 (exp. request: 6-20x today's perf.)

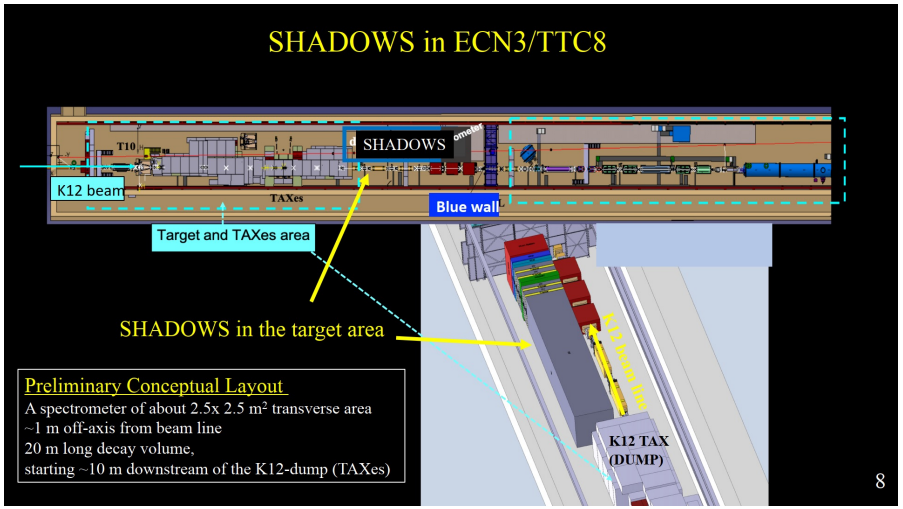
Current interest: kaon physics (HIKE), beam dump experiments for dark sector and other studies (SHADOW, SHiP), lepton-flavor violation through τ → 3μ (TauFV), …

If work done during LS3 → operation can start ~ 2029

Two "task forces" established to assess physics case (SPSC) and technical aspects

→ Funding may be secured in 2023 MTP and experiment(s) may be selected by end 2023



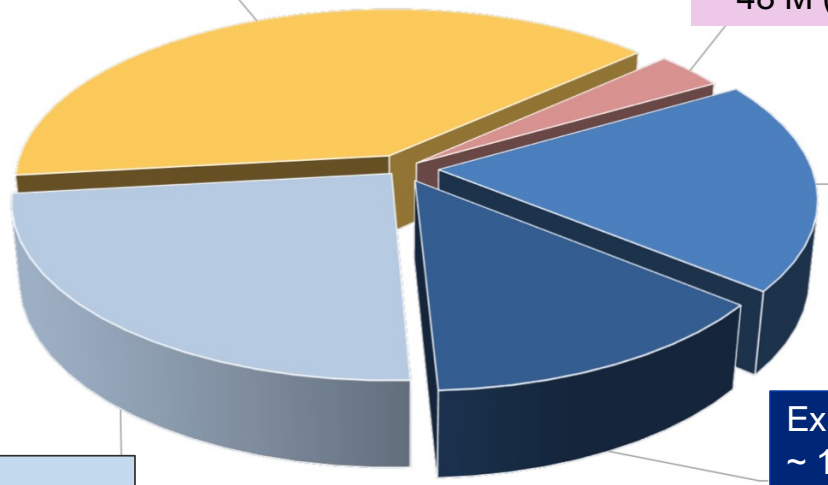


MTP: 2023 budget (M+P expenses) in 2022 prices

Infrastructure, services and centralised expenses(*)
~ 565 M (42%)
Safety, environment, energy, technical infrastructure, computing support, buildings and site facilities, international relations, etc.
(*) Some offset by corresponding revenues

Revenues: 1360 MCHF
Total expenses: 1420 MCHF

Capital repayment, recapitalisation of Pension Fund:
~ 48 M (3.5%)



Accelerator programme:
~ 277 M (20%)
Injectors, LHC, accelerator support

All fractions are normalised to revenues

Experiments and research programme
~ 190 M (14%)
LHC and non-LHC experiments, theory, computing, scientific support

Scientific projects
~ 340 M (25%)
HL-LHC, detectors upgrades, Neutrino Platform, Accelerator R&D, Detector R&D, Future colliders studies (FCC, LC, MC), Physics Beyond Colliders

~ 60% of Budget invested directly in the scientific programme
~ 40% for safety, environment and for maintenance and renovation of scientific and general infrastructure → attractive lab and efficient services for worldwide CERN community

Main elements affecting this year's MTP

- New LS3 schedule (decided in January 2022): postponement by 1 year, extension by 6 months
  → LS3 now covers the period 2026-2028 → HL-LHC starts in 2029

- New, major crisis: Russia's invasion of Ukraine, with human, financial and schedule consequences for CERN's scientific programme and its community

- Post-COVID market volatility and increased cost of electricity and raw materials, exacerbated by the war in Ukraine → 2023 preliminary CVI (dominated by electricy prices): ~ 10%

Examples of new investment and expenses in this year's MTP

Potentially missing contributions from Russia and JINR
Russia's deliverables to HL-LHC insourced, CERN's share of Russia and JINR contributions to Phase-2 upgrades of ATLAS and CMS covered

HL-LHC increased cost-to-completion (in part due to more expensive contracts)

LHC experiments
Additional host lab responsibility; increased cost of raw materials for Phase-2 upgrades; additional personnel for ASIC developments, etc.

Neutrino Platform
CERN's contribution to construction of vertical-drift module of DUNE at LBNF (50% of anode planes)

AWAKE
Work to dismantle (still radioactive) CNGS target area and make room for two plasma cells

Environment
E.g. new heating plants in Meyrin and Prévessin to use waste energy from technical installations to heat buildings on both sites

Offset to a large extent by savings or expense reprofiling

Electricity at CERN

Annual electricity consumption at CERN: ~ 1.3 TWh in running periods (> 90% for scientific facilities); 0.56 TWh during long shut-downs

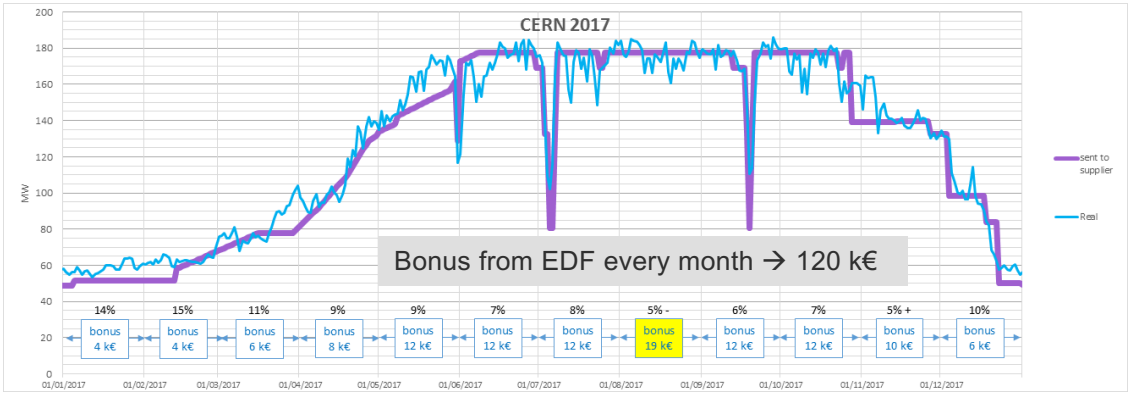
BIG efforts to reduce consumption over past years (dedicated Energy Management Panel in place since 2015) → examples:

- ~ 100 GWh/y saved since 2010 (computing centre, cryo, SPS operation, etc.) through optimisation and dedicated actions
- Online tool to monitor energy consumption by actvity → "virtual invoices" sent annually to all main consumers to raise awareness
- As part of East Area renovation (completed in LS2): old magnets replaced with pulsed magnets and energy recovery between cycles → from 11 GWh/y to 0.6 GWh/y
- Energy re-use: three MW-class heat-recovery projects (Ferney-Voltaire, Meyrin, Prévessin); Science Gateway (green building; unused solar panel energy injected into CERN's grid)
- Applied for ISO 50001 certification (up to 3 MCHF/year discount on eletricity transmission): Plan de Performance Énergétique completed

More recently: development of comprehensive plan to face the current price escalation and energy shortage

Heat recovery from LHC Point 8:
25 GWh/y to ZAC Ferney-Voltaire
(heating for ~ 8000 people)

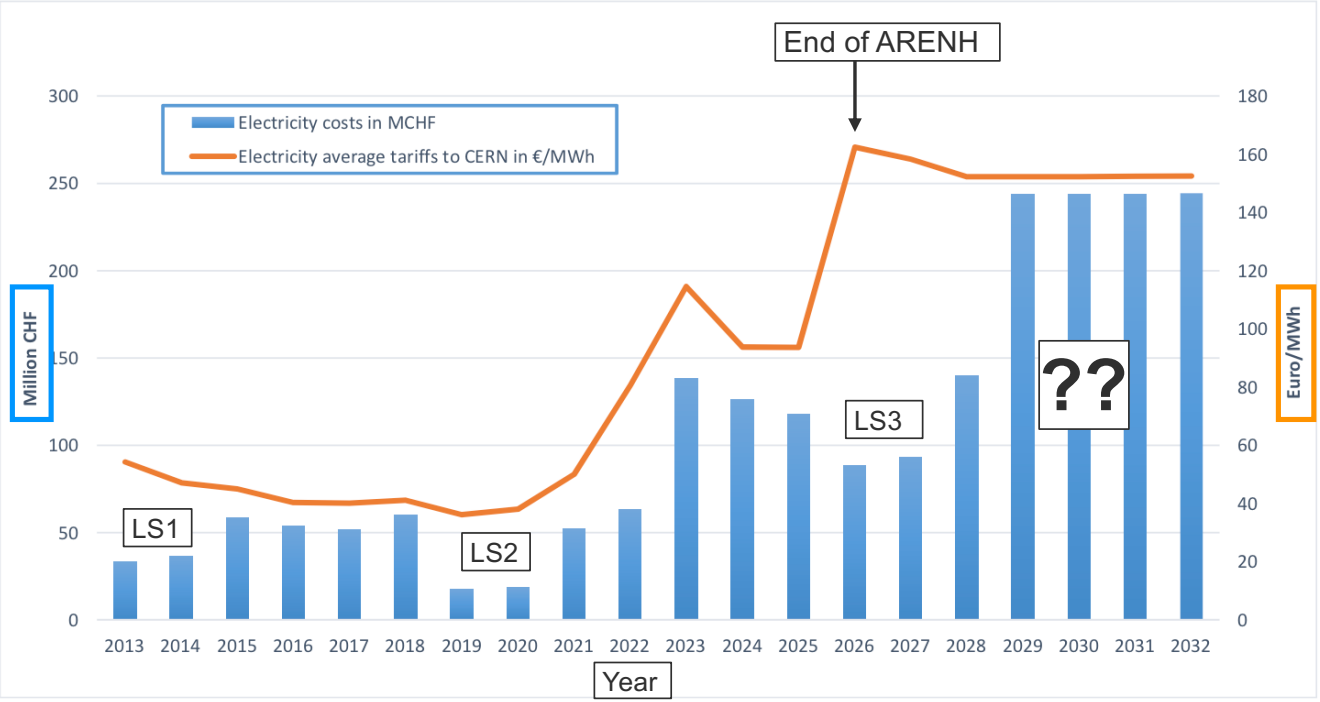
Power consumption over the year predicted with few percent accuracy



Evolution of electricity costs

- Current contract (with EDF, France, until 2025):
  ~ 70% of electricity purchased at regulated tariff (ARENH mechanism), ~ 30% at market prices
  ARENH (Accès Régulé à l'Electricité Nucléaire Historique) regulated tariff: 42 €/MWh in 2022

- 2 problems in the future:
  - Market price: used to be similar to ARENH tariff in the past; recently huge escalation: 90 (2022), > 1100 (2023) €/MWh
    Note: huge volatility!
  - ARENH terminates end 2025 → from 2026 onwards, CERN electricity procurement will be fully subject to market volatility
    (unless similar, new mechanism established; discussions started with the EC; working also on long-term purchasing strategy)



Currently: huge market volatility and HUGE uncertainties when projecting over 10 years.

Current scenario may be over-pessimistic due to concurrence of adverse situations (war in Ukraine, > 50% of nuclear plants in France are in maintenance/repair).

However: Council wants to see possible measures to mitigate financial impact of such a scenario and of 10% CVI in 2023 on CERN's budget in the short and long terms.

Measures to save energy and mitigate impact of electricity costs and limited supply

- 2022 YETS (Year-End-Technical-Stop) starts 2 weeks earlier (28 Nov)
  → mark of social responsibility; savings

- In 2023, the accelerator complex operation will be reduced by 20% (i.e. YETS will be extended from 15 to 19 weeks)
  → mark of social responsibility; savings

- Package of measures for 2024-2032 being prepared (preliminary discussions at the Sept Council → will continue in Dec):
  efforts from all stakeholders: savings from CERN's activities; savings on personnel costs; possible indexation of Member and Associate Member States contributions beyond 2% "ceiling".
  Aim is to bring cumulative budget deficit to ~ zero in the early 2030s, so as to be able to start investment in a new big facility at CERN

- Reduced power configurations prepared to cope with possible EDF load shedding

- Crisis procedures to face total (prolonged) blackouts being prepared

- Measures to reduce energy consumption on CERN campus being implemented

→ More in M. Lamont's and R. Bello's presentations

Conclusions

The Council and its subordinate bodies (Scientific Policy Committee and Finance Committee) congratulated CERN and its personnel on the successful start of Run 3 and the other accomplishments across the full spectrum of the lab's activities.

The 2023 (draft) budget was unanimously approved.

Development of a package of possible measures to mitigate the impact of the 2023 CVI and the increased electricity prices on CERN's budget started. More discussions are foreseen at the December Council.

Measures to reduce energy consumption in 2022 and 2023 taken, as a mark of social responsibility.

We thank the Member and Associate Member States for their strong support at these difficult times.

A big thank you to all of you for your strong commitment to CERN!