Main news from March Council Week

Fabiola Gianotti, 12 April 2021

March 22-26 Council Week

Reports on accelerator complex,
LHC and non-LHC experiments,computing,
HL-LHC and detectors' upgrades
→ see M. Lamont's and J. Mnich's talks

CERN response to COVID-19
→ see B. Delille's talk

CERN Annual Progress Report 2020
Knowledge Transfer activities in 2020

CERN's main objectives for 2021-2025

Deliverables, timeline and organisational structure
of the FCC Feasibility Study (further discussion in June)

Procurement report for 2020
13 contract adjudications approved
(~ 50 MCHF)

Pension Fund investment performance

Reports of scientific committees,
Audit Committee and Pension Fund
Governing Board

Mandate of the European Large National
Laboratory Directors Group (LDG)

Appointments of two Departement Heads and CEO of Pension Fund

Latvia admitted to the status of Associate Member State

etc.

CERN's main objectives for 2021-2025

3 main objectives

- ❑ Were presented to you at "New Year online meeting" with CERN's personnel on 18 Jan
- ❑ Received very strong support from the Council

Deliver world-class scientific results and knowledge
Current LHC and non-LHC programme
HL-LHC and experiments' upgrades
Accelerator R&D (high-field magnets, CLIC and muon collider technologies, AWAKE, etc.)
Detector R&D, Computing R&D (e.g. Quantum Technology Initiative)
FCC feasibility study
Physics Beyond Colliders
Theory

Increase the return to the Member and Associate Member States
Industrial return
Human resources return
Technological collaborations
Partnership with industry
Scientific education

Strengthen CERN's impact on society
Scientific knowledge
CERN values
Scientific training
Advanced technologies: medical applications, environment and sustainability, computing
→ see next slide

→ more details in spare slides

CERN impacts on society in many ways

- scientific knowledge: our primary mission
  → need to strengthen communication: share excitement with, and importance for, humanity.

- values: collaboration across borders, inclusiveness, openness → as relevant today as ever!
  "CERN model" taken as an example by other institutions; open science (knowledge, technology and education accessible to all) is crucial to reduce inequities and for sustainable society
  → need to strenghten communication (CERN's 70th anniversary in 2024, Science Gateway, etc.)

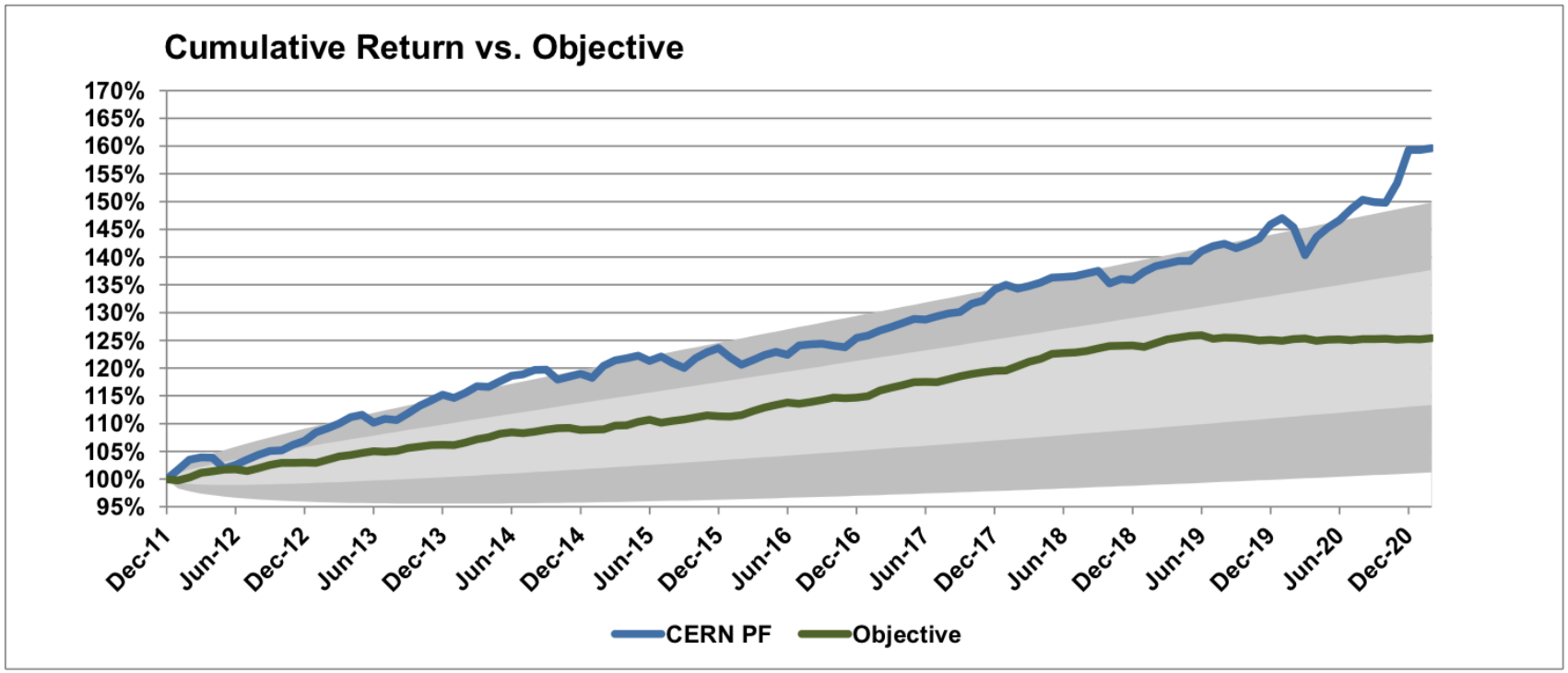
- scientific training: contribution to tomorrow's workforce (society lacks STEM graduates)
  ~ 1600 young people trained annually at CERN (fellows, doctoral and technical students, etc.)
  ~ 3000 PhD students from all over the world
  Several initiaves by experiments, ECFA, CERN to support careers of young people.
  New initiatives at CERN: new Graduate Programme (strong support from Council); actions to support career transition

- development of advanced technologies: broad range, many potential applications
  → decided to focus primarily on: environment and sustainability; health; computing

Note: CERN's values, competencies and technologies also contribute to the UN Sustainable Development Goals, in particular: 3, 4, 9, 16, 17

Pension Fund: excellent return on investment

Courtesy PF Management Unit



The cumulated return of the fund since 31 Dec 2011 exceeds the best-estimate objective by 34%.

+9.21% in 2020

CERN	Swiss Pension Funds
+9.21%	+3.84

Appointments

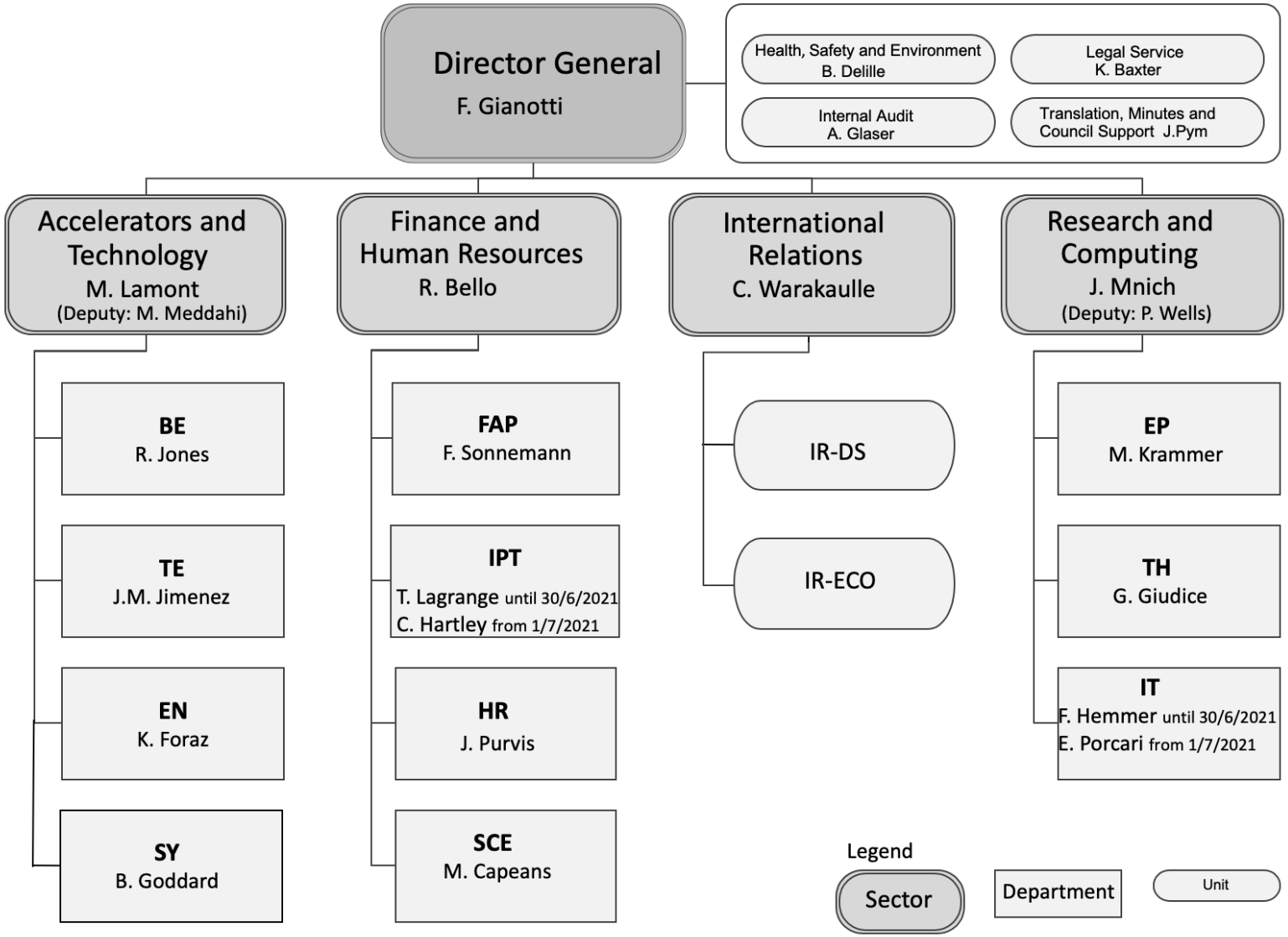
Christopher Hartley (UK)
IPT Department Head
1 Jul 2021 to 31 Dec 2025

Enrica Porcari (IT)
IT Department Head
1 Jul 2021 to 31 Dec 2025

Doug Heron (UK)
CEO Pension Fund
1 Aug 2021 to 31 Jul 2024

- All from outside CERN, all selected through competitive recruitment processes open to internal and external applications.
- Selection boards, including external experts, were chaired by Director for Finance and Human Resources, Director for Research and Computing and Chair of pension Fund Governing Board, respectively.
- With appointments of IPT and IT Department Heads, the Management team for 2021-2025 is complete → see next slide

Management structure and team 2021-2025



14 men and 8 women (36%); 14 new (64%), 8 continue; 17 internal, 5 from outside

CERN's "family" is growing

23 Member States:

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

9 Associate Member States:

Croatia, Cyprus*, Estonia* (as of 1/2/2021), India, Lithuania, Pakistan, Slovenia*, Turkey, Ukraine
* in the pre-stage to Membership

6 Observers:

Japan, Russia, USA, European Union, JINR, UNESCO

~50 ICA (International Cooperation Agreements):

with non-Member States, some with countries with developing particle physics communities (CERN mission is also to help build capacity and foster growth of particle physics worldwide).
Agreement with Bosnia – Herzegovina signed on 16 Feb

Latvia : signing ceremony (virtual) of Associate Member State agreement on Wednesday

Conclusions and THANKS !

Very intense, fruitful and successful March Council Week: lot of progress shown across the full spectrum of CERN's activities, despite the current crisis; very useful input from the committees.

47.3% of 2021 contributions to CERN's budget from Member and Associate Member States received, compared to 44.2% at the same point in 2020, 45.5% in 2019 and 45% in 2018. → Many thanks to them for their continued, strong support despite the troubled times.

The Council and its subordinate bodies (Scientific Policy Committee and Finance Committee) congratulated CERN's Management and personnel on their efficient handling of the Covid-19 crisis, which allowed the health of personnel to be protected and the impact on the scientific programme and schedule to be minimised

Many thanks, on behalf of CERN's Directorate, for your dedication and commitment, in particular in such a difficult period, and congratulations on the many beautiful accomplishments!


CERN

EXTRAs

Current programme: main objectives

Successful Run 3

Full exploitation of LHC physics potential: ALICE, ATLAS, CMS, LHCb and smaller experiments
Challenge: ramp-up of significantly upgraded injectors to target performance

Completion of HL-LHC and Phase-2 upgrade of ATLAS and CMS for installation in LS3

(Current) challenges:

- ❑ Nb_3Sn magnets
- ❑ ATLAS: inner tracker; CMS: end-cap calorimeter; both: microelectronic chips

Scientific diversity programme

HIE/ISOLDE, n_TOF, AD/ELENA, fixed-target experiments, etc.
Physics exploitation of upgraded injectors.

Neutrino Platform

Essential role to support European community engaged in long baseline projects in US and Japan; important scientific and technological contributions to DUNE/LBNF and T2K.
Single-phase “module zero” and validation of “vertical drift” technology are crucial goals in coming years.
Challenge: construction of two cryostats for DUNE (new technology; cost control; etc.)
→ new NP organisation in place; review committees established

Theory

Essential to open new avenues of exploration and motivate experimental investigation.
Will continue to support broad range of studies related to Lab’s experimental programme and beyond
Challenge: increase diversity of workforce in TH department.

Preparation of CERN's future: main objectives

Accelerator R&D

Main goal: develop technologies needed for the future of the field, including:

- High-field superconducting magnets
- High-gradient (warm) accelerating structure and other linear collider key technologies
- Muon collider technologies: new initiative started in 2020
- Plasma wakefield: AWAKE (proton-driven)
- R&D on variety of technologies motivated by new ideas and operational needs from current facilities.

Resources for all of above activities allocated in 2020 MTP and will be adapted in future as needed.
This programme will be reviewed once LDG's Accelerator R&D roadmap completed.

Preparation of CERN's future: main objectives

Options for a future collider

FCC

Assess technical and financial feasibility: tunnel, technologies, external funding, support in community and beyond (communication!)
Goal for next ESPP: "Feasibilty Study Report" (to be completed by end 2025)

CLIC

X-band acceleration technology towards readiness; improve power efficiency; optimise luminosity.
Goal for next ESPP: "Project Readiness Report"

Muon colliders

Work on main challenges: muon source and cooling, fast-ramping magnets and power converters, neutrino background and civil engineering, etc.
Goal for next ESPP: assess if demonstrator and Conceptual Design Report are justified from scientific viewpoint.

Preparation of CERN's future: main objectives

Scientific diversity programme

- Essential to address open questions from perspective complementary to high-energy colliders: e.g. rare processes, searches for feebly interacting particles, etc.
  → Physics Beyond Colliders has become long-term activity; budget tripled in 2020 MTP.
- Some projects may be implemented at European national labs with CERN's support.
- PBC contributes to strengthening collaboration with nuclear and astroparticle physics. It will also explore opportunities offered by new technologies (e.g. quantum sensors)

Computing R&D

Pursue computing technologies to meet requirements of HL-LHC and future projects.
Ongoing initiatives with CERN's participation: CERN openlab, HEP Software Foundation, European Open Science Cloud, CERN's Quantum Technology Initiative, etc.
Opportunities for collaboration with other disciplines (e.g. astroparticle physics, medical applications) and industry.

Detector R&D

Strategic programme on "R&D for future detectors" launched by EP department in 2019:

- develop most promising technologies for detectors at future collider and non-collider experiments;
- particular attention to environmentally friendly solutions;
- emphasis on areas where CERN has significant expertise and infrastructure.

Programme will be reviewed once ECFA's Detector R&D roadmap completed.

Collaborations with neighbouring fields

Collaboration in areas of common interest will be strengthened, as well as sharing of CERN's technologies and competencies, within available resources

Nuclear Physics

- Ongoing programme: HIE/ISOLDE, n_TOF, NA61, heavy ions at LHC.
  Recent significant upgrades, more to come (e.g. ALICE)
- Strong collaboration with facilities in Europe and beyond (e.g. FAIR, ESS, potentially EIC in US)

Astroparticle Physics

Growing opportunities, as more and more similar challenges (project scale and complexity, technologies, ...)
Ongoing support and collaborations include:

- Recognised Experiments (75% from astroparticle);
- development of computing and other technologies of common interest;
- consultancy and assistance in areas where CERN has expertise, such as vacuum, cryogenics, superconducting magnets, RF, geological studies for underground installations, governance of large projects;
- test-beam availability and support at CERN;
- new centre for astroparticle theory (EuCAPT), initially hosted at CERN.

Sustainability and environment

Minimise Laboratory's impact on environment

- ❑ Implement recommendations of CEPS (CERN Environmental Protection Steering) board for 11 high-priority environmental domains → 25 MCHF allocated over 2019-2023. Includes R&D on new, environmentally friendly gases for particle physics detectors.
- ❑ First public environment report released in 2020: current status and ambitious goals for future. Next one Sept 2021, then every two years.

→ CERN aims to establish itself as model for transparent and environmentally responsible research organisation.

Energy saving and reuse

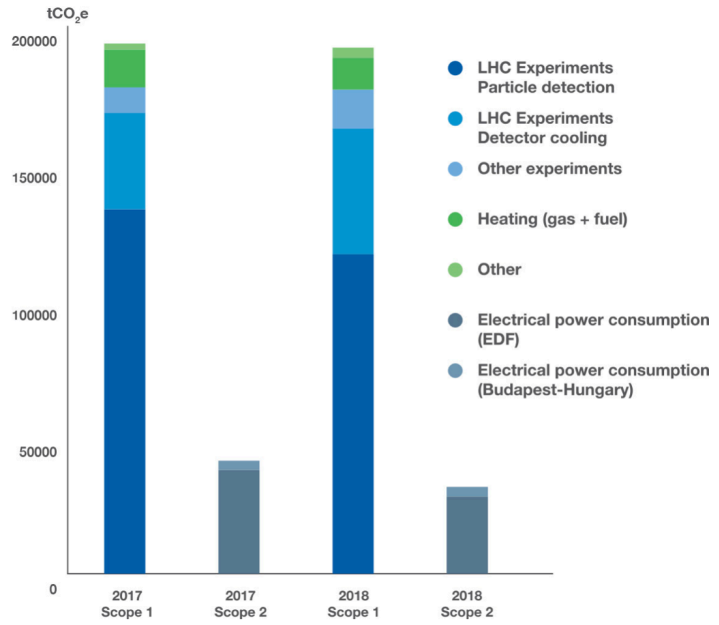
- ❑ Dedicated Energy Management Panel (EMP)
- ❑ East Area renovation in LS2 (pulsed magnets) → from 11 GWh/year to 0.6 GWh/year. North Area renovation in LS3.
- ❑ Heat recovery at LHC IP8 to warm up new housing development in Ferney-Voltaire as of 2022
- ❑ New Computing Centre to provide heating for buildings in Prévessin as of 2024.
- ❑ R&D on efficient power production for future projects (high-efficiency klystrons, etc.) with potential applications to industry

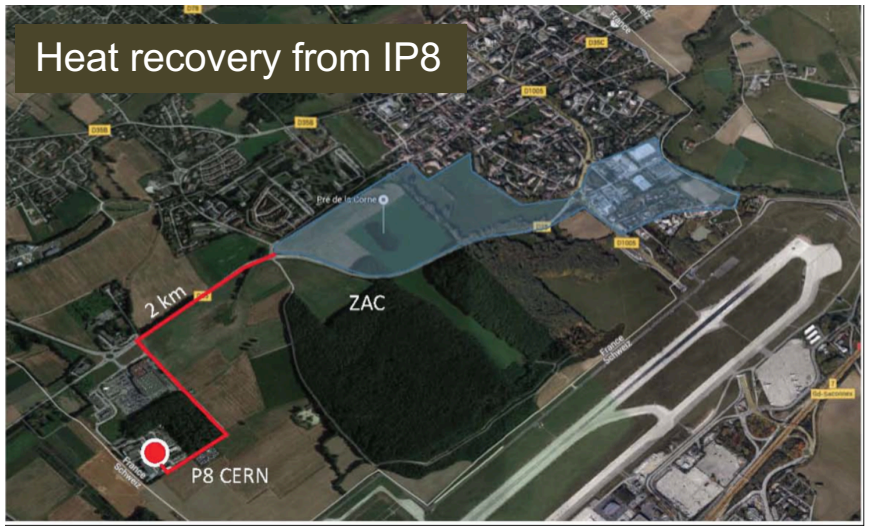
Develop technologies for the environment

- ❑ Vacuum, high-temperature superconducting links for electricity transport, high-efficiency klystrons, etc.
- ❑ Collaboration between Accelerators and Technology sector, HSE unit, KT group

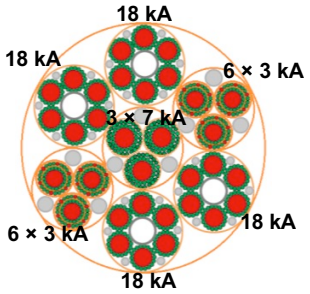
Sustainability and environment

From 2020 Environment Report
Target: reduce emissions by 28% by 2024

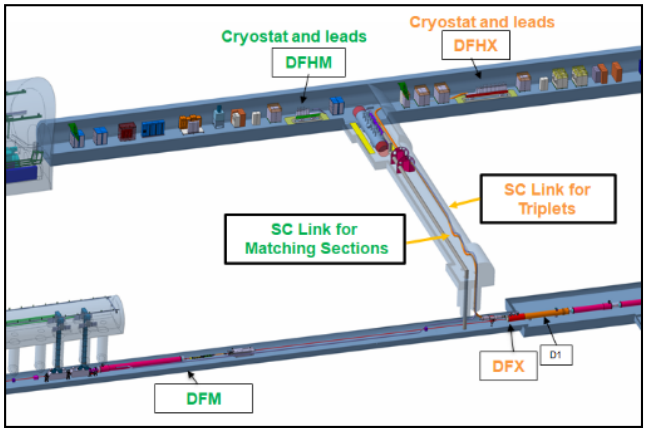




High-current transmission lines for HL-LHC



MgB_2 cable:
$\Phi \sim 90$ mm
$I_{tot} > 100$ kA @ 25 K



Health and computing

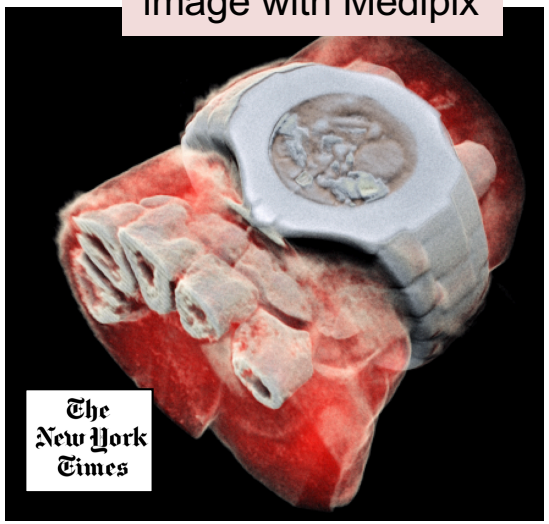
Health

Historically one of best examples of spin-off from the field (cancer therapy, imaging, etc.)
New initiatives include:

- R&D on technologies for innovative ion therapy (NIMMS, Next Ion Medical Machine Study): magnets, ion linacs, improved synchrotron designs, superconducting gantries, etc.;
- radiotherapy facility for irradiation with ultrafast bursts of electrons (FLASH) based on CLIC technology: partnership with University Hospital in Lausanne;
- exploitation of MEDICIS facility for non-conventional radio-isotopes;
- detectors and electronics for imaging and dosimetry;
- computing technologies for data storage, management and analysis.

In strong collaboration with hospitals, research centres and industry in Member States and beyond

3D colour X-ray image with Medipix



Computing

Technology mostly driven by industry but CERN (and HEP) have stringent requirements: big data, complexity of problems and algorithms, etc. → appealing to industry (e.g. 20 years of CERN openlab!).
CERN will continue and expand R&D activities in area where it can bring unique expertise: quantum technology, AI, open-access data repository.