A multi-channel, multi-audience communications and outreach campaign

Ana Godinho (CERN Education, Communications and Outreach)

23rd IPPOG Meeting | 11.05.2022

Themes and Messaging

Celebration	The discovery of the Higgs boson **changed the field of particle physics and its future perspective**
10 years on	We **know much more today** about the building blocks of the Universe and their interactions than we did 10 years ago and are **following interesting leads** via the full exploitation of the LHC and its high luminosity upgrade (HL-LHC)
Preparing the future	CERN is investigating the **feasibility of a future collider** as a crucial tool to unlock the outstanding mysteries of the universe. The new collider could have a 100km circumference and reach collision energies of at least 100TeV enabling the search of new physics.

Themes and Topics

Celebration

- The result of decades of incremental research
- Questions answered, remaining questions, and new questions
- Impact beyond the field of particle physics (astroparticle physics, cosmology,…)
- Example of successful international collaboration
- A model for global scientific projects
- Discovery underpinned by cutting edge technological innovation (accelerators, detectors, computing)
- Applications in society
- Proven socio-economic benefits (business opportunities, capacity-building, job creation)
- Inspiration for fundamental research and careers in STEM

10 years on

- Compelling results over the decade
- Interesting leads from research at the LHC
- Full exploitation of LHC and HL-LHC
- A decade of successful international collaboration
- Cutting-edge technological innovation (e.g. HL-LHC)
- Current and potential applications in society
- Socio-economic benefits of HL-LHC (and upgrades?)
- Inspiration for fundamental research and careers in STEM

Preparing the future

- Physics case for a future collider
- FCC Feasibility study
- Accelerator R&D programme
- Scientific diversity programme
- Framework for unprecedented global collaboration
- CERN's history of successful ambitious projects
- Cutting-edge technological innovation
- Potential applications to societal challenges – health, environment
- Continued socio-economic benefits, including opportunities for industry and job creation
- Inspiration for fundamental research and careers in STEM
- The cost of a future collider (will be distributed amongst global community and over several decades)

Target audiences*

- CERN community
- Particle physics community
- Decision-makers
- Local communities
- General public
- Teachers and students
- Media (as a vector)

Partners

- Directorate (Governance)
- LHC experiments
- Machine OP team
-
- EPPCN
- IPPOG
- Interactions

* Not listed in order of priority

Components of the campaign

Events

- Higgs symposium (core pillar)
  - 4 July 2022
- Run3 first physics Live
  - 5 July 2022
- Local public events
  - June - July
- Globe event
  - 3 July 2022

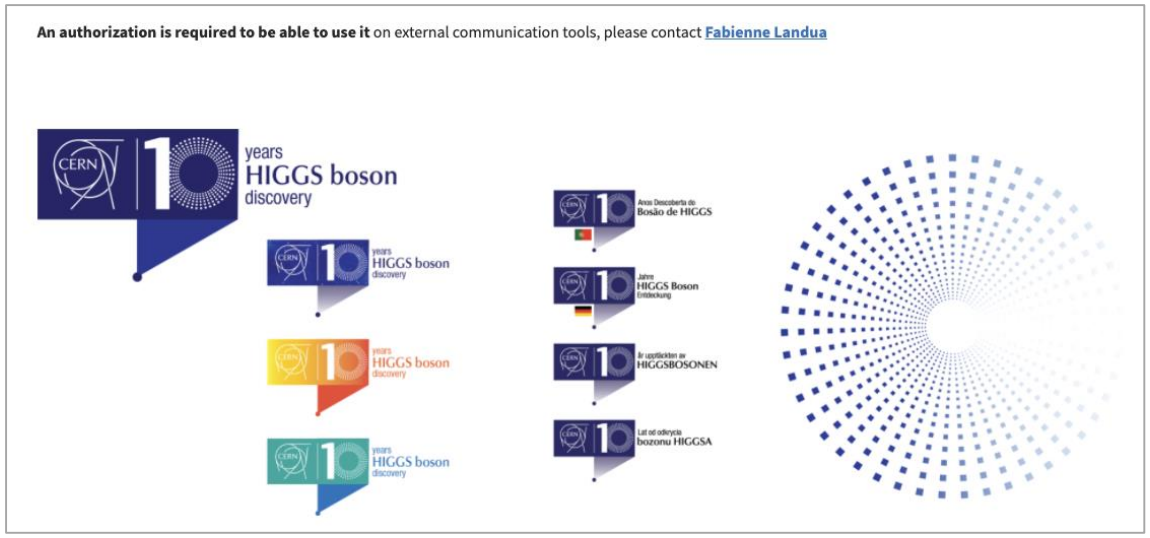
Products

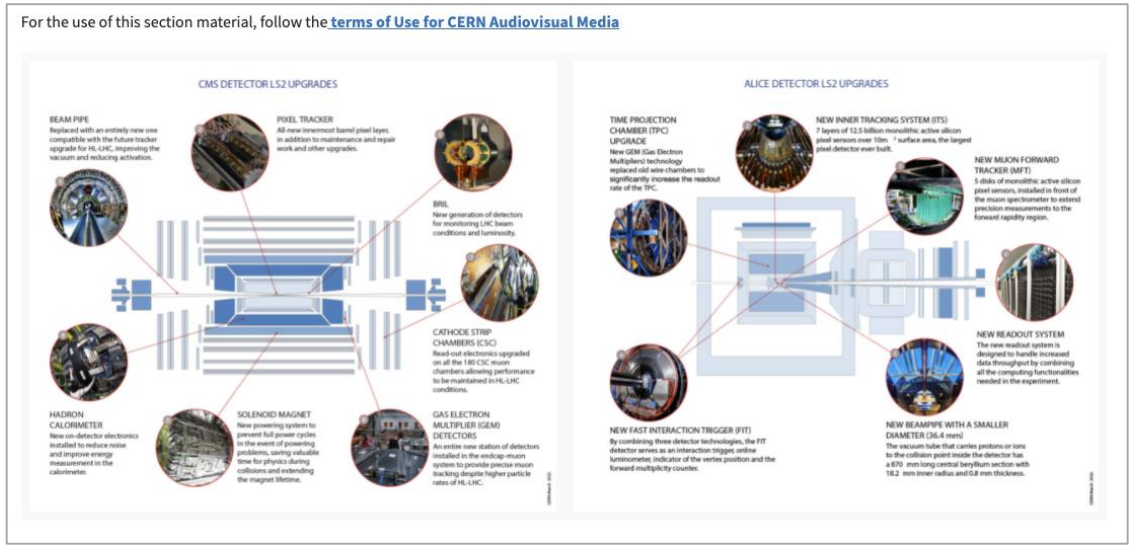
- Visual identity kit
- Videos and animations
- home.cern Higgs portal
- Digital communication kits
- Education resources
- Exhibition

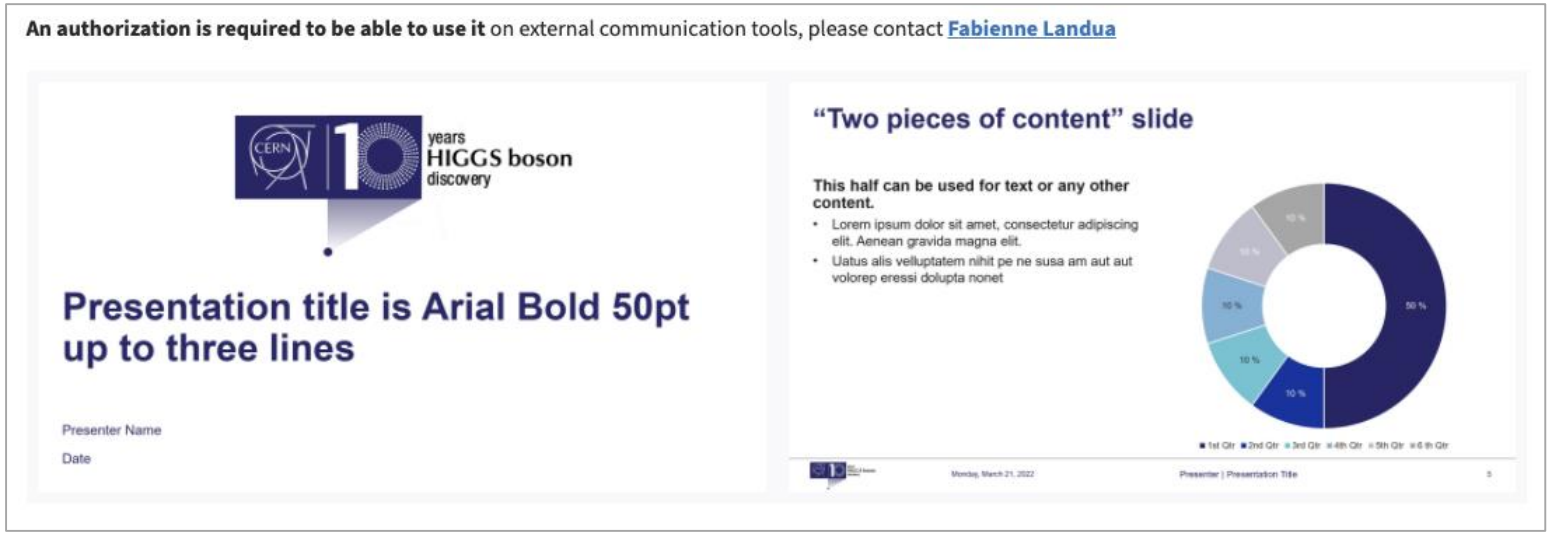
Channels

- home.cern
- voisins.cern
- Social media
- CERN Courier
- CERN Bulletin
- Education programmes
- Media relations

Visual identity pack and guidelines are online







Includes

- Logo in colour and language palette
- PPT templates
- Illustrations
- Email signature
- Exhibition (coming soon)

Higgs scientific symposium 4 July

Celebration | 10 years on | Preparing the future

- Morning – plenary-type talks on past, present and future of Higgs research
- Afternoon – current and future Higgs research, including theory and machine
- Speakers include Rolf Heuer, Fabiola Gianotti, Nima Arkani-Hamed, Lyn Evans, Peter Jenni, Michel della Negra, Mikel Lamont, ATLAS and CMS researchers

In **CERN Main Auditorium + EN and FR webcast + CERN social media**

- **Partners invited to share and/or organise "viewing parties"**

Target audiences:
Particle physics community | CERN community | Media | Teachers and students

Higgs10 – save the date!

On 4 July 2012, half a century's wait came to an end as the ATLAS and CMS experiments announced the discovery of the Higgs boson. Ten years on, we mark the occasion and look forward to a bright future for Higgs research.

6 APRIL, 2022

Live of Run3 first physics – 5 July 2022

Live with running commentary from 4 LHC experiments + CCC (main hub) + data centre

- Streamed on CERN and experiments' social media channels (Facebook, YouTube, Twitter) + CERN webcast
- Commentary in 5 languages
- Volunteers being recruited from experiments: commentary, video-mixer, cameras, microphones, social media
- **Partners invited to organise "viewing parties"**

Media update on the day + VNR (Video News Release) aired via satellite to EBU

- Will be shared with partners in advance

Supporting products will be shared with partners in advance

- Illustrations and animations (accelerator complex, protons accelerating in LHC)
- Pre-recorded interviews with LHC experiment spokes, deputy-spokes, theorists, ATS Director, Deputy-Director
- Run3 physics backgrounder (available online as part of the Higgs10 digital media kit)

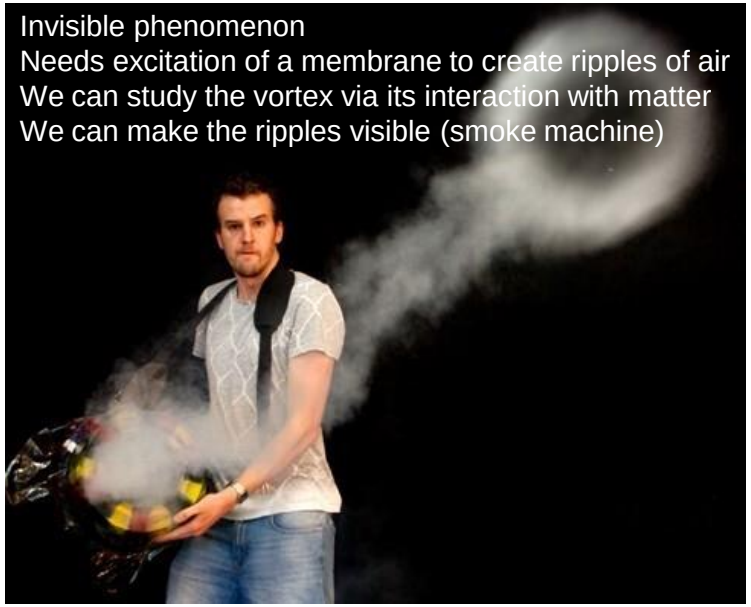
Events for the general public

Screenings of *Particle Fever* + Q&A

- **In CERN local communities** [June]
  - St Julien en Genevois, St Genis, Divonne, Meyrin
  - 11 speakers confirmed – with connections to local area
  - As of 1 June

- **At Globe** as part of Cineglobe Festival [3 July]
  - With En and Fr webcast only (not on social media)
  - Confirmed panel: Fabiola Gianotti, Mike Lamont, Nima Arkani-Hamed.
  - **Partners invited to organise "viewing parties**

Nuit de la Science in Geneva [9-10 July]
- Include educational activity – vortex cannon and smoke machine



Education resources / activities

- **Articles/papers** in journals - connecting important milestones of the Higgs discovery with aspects of nature of science and suitable hands-on activities using mystery boxes
- 1000 Higgs **badges** to distribute during public events

- **Hands-on activity** (also for Nuit de la science & social media content)
- 10-min **Science Show** excerpt for "Science Me!" competition and Nuit de la Science
- Higgs-themed **geocache** – containers have information on Higgs discovery milestones

- **Teacher** event – 43 teachers will join morning of Higgs symposium + dedicated Q&A later
- Event for **high-school student** alumni - special online Q&A session complementing public webcast

Higgs@10 content on home.cern (in prep)

Celebration | **10 years on** | **Preparing the future**

Sketchboard

Particles, fields and symmetries

The Higgs boson was first mentioned in 1964 in a paper by Peter Higgs. Physicists were at that time attempting to create a unified description of the electromagnetic and weak interactions into a single "electroweak" interaction using a framework called quantum field theory. In this approach every elementary particle is a wave in a "field", moving around a bit like waves on the surface of an ocean. **[a simple animated image showing a particle and a wave moving next to each other could work here]** Interactions between particles are "mediated" by special kinds of particles called force carriers (also waves in their respective fields). The most familiar example would be the photon: the same particle that we know as the particle of light and at the same time a wave in the electromagnetic field is actually the particle that transmits the electromagnetic interaction. For example the repulsive force between two like-sign charges is the effect of them exchanging so-called virtual photons.

[add simple animated gif showing electron repulsion by single photon exchange, explanation here or in the caption]

Another important component of this picture are symmetries. Just like a shape can be called symmetrical if it doesn't change after some transformation (a rotation or a mirror-like flip for instance), similar requirements are placed on the laws of Nature. For example the electrical force between particles with an electrical charge of one will be the same irrespective of whether the particles are electrons, muons or protons.

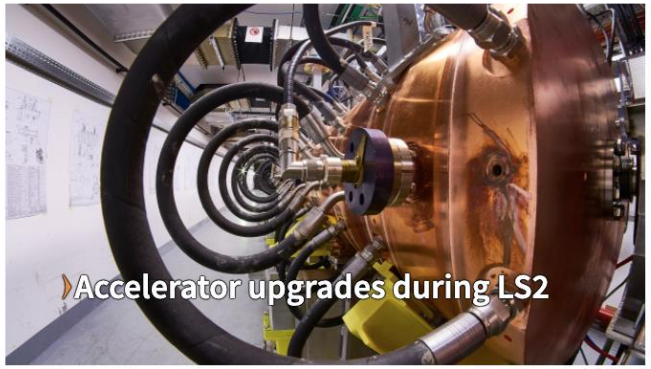
The Brout-Englert-Higgs mechanism

Unfortunately the unified electroweak theory had a problem: it didn't allow for particles to have masses. Specifically, the photon and the W and Z bosons that transmit the weak interaction, all had to be massless. This posed a major problem since the weak force carriers had to be massive to be consistent with the very short range of the weak interaction. The solution came with an ingenious idea called spontaneous symmetry breaking combined with an entirely new quantum field - that we today call the Higgs field. **[mention the authors]** A "spontaneously broken" symmetry is one that is present in the equations of a theory, but broken by the Universe. Imagine a universe coming into existence as a pencil standing on its tip at the center of a table. A perfectly symmetrical situation, but only for a moment: pencil would immediately fall down, forever

Online media kits #RestartingLHC

BACKGROUNDERS

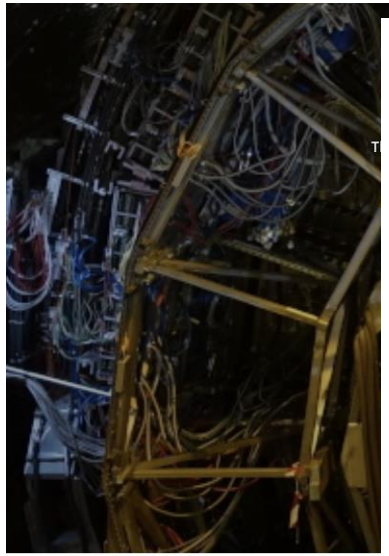
The backgrounders linked below summarise the key upgrades to the accelerators and four main LHC experiments during Long Shutdown (LS2), which began in December 2018 and runs until the LHC restarts in 2022.



https://home.cern/press/2022

Online media kits - #RestartingLHC example

Celebration | 10 years on | Preparing the future



The ALICE experimer

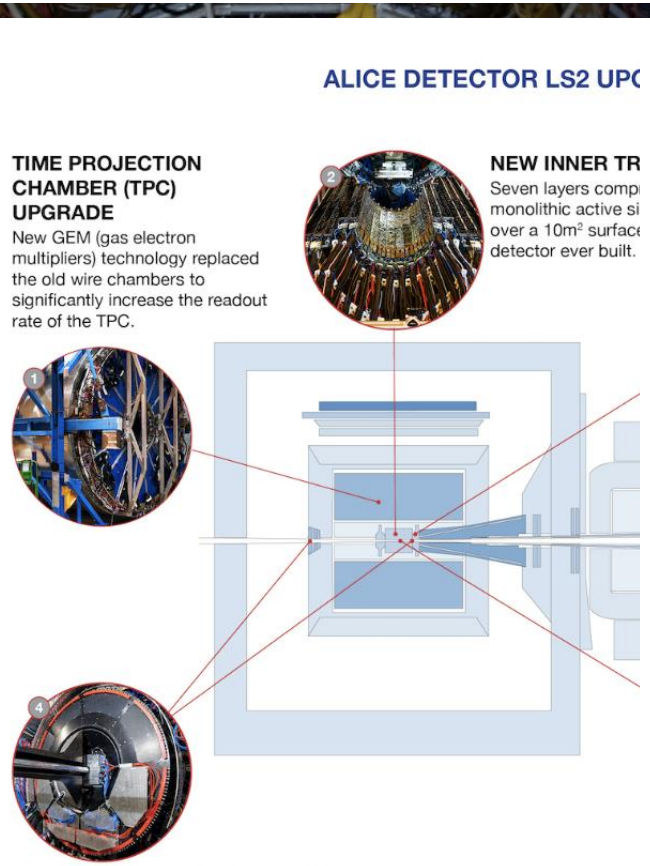
ALICE (A Large Ion Collider Experiment) is a det
the Large Hadron Collider (LHC). It is designed
interacting matter at extreme energy densities
gluon plasma forms.

The ALICE detector weighs 10 000 tonnes, is 26
in a vast cavern 56 m below ground close to th
receiving beams from the LHC.

During the Long Shutdown 2 (LS2), the Collabc
the detector with two main objectives: to incre
orders of magnitude, and to enhance its track
for the detection of short-lived particles contai
ALICE expects to continue its scientific journey

The collaboration includes almost 2000 scienti
countries.

(Image: CERN)



LS2 upgrades

1. Time projection chamber (TPC) upgrade

Weighing an enormous 15 tonnes, measuring 5.1 metres in length and 5.6 metres in diameter, the ALICE time projection chamber (TPC) is a 88-cubic-metre cylinder filled with gas and read-out detectors that follows particles' trajectories in 3D. The readout detectors in the two endplates were previously multi-wire proportional chambers, 72 in total, which have now been replaced by detectors based on Gas Electron Multipliers (GEM), a micro-pattern structure developed at CERN.

These new devices, together with new readout electronics that feature a continuous readout mode, will allow ALICE to record the information of all tracks produced in lead–lead collisions at rates of 50 kHz, increasing the detector's data acquisition speed by a factor of 100.

2. New Inner tracking system (ITS)

Sandwiched between the beam pipe and the Time Projection Chamber (TPC) lies a brand new inner tracking system. This system now improves the ALICE detector's capacity to pinpoint and reconstruct the short-lived particle trajectories.

With its seven layers of 12.5 billion monolithic active silicon pixel sensors over 10m² surface area, the new inner tracking system is the largest pixel detector ever built.

The current upgrade relied on new pixel sensors called ALPIDE, which also make up the new Muon Forward Tracker (see below). Each ALPIDE chip contains more than half a million pixels in an area of 15 × 30 mm² and features an impressive resolution of about 5 µm in both directions – the secret to the subdetector's improved performances.

3. New muon fc

The muon forward tracker (MI
detector. Installed in front of t
precision measurements of th
forward rapidity region. It is a
silicon sensors. Like the new i
the same ALPIDE pixel sensor
half a million pixels in an activ
resolution for high-precision r

The ALICE detector is now equ
offered by the increased lumi

4. New fast interaction trigger (FIT)

The new Fast Interaction Trigger (FIT) is a faster trigger for ALICE, as well as being an online luminometer, an initial indicator of the vertex position and a forward multiplicity counter. In offline mode, FIT provides the precise collision time for time-of-flight particle identification. It also yields the collision centrality and interaction plane, and measures cross sections of the diffractive processes.

FIT relies on three state-of-the-art detector technologies underpinning components grouped into five arrays surrounding the LHC beamline, at -1, +3, +17, and -19 metres from the interaction point.

5. New beampipe with a smaller diameter

As a consequence of replacing the inner tracking system, a beam tube with a smaller diameter needed to be installed to replace the existing chamber.

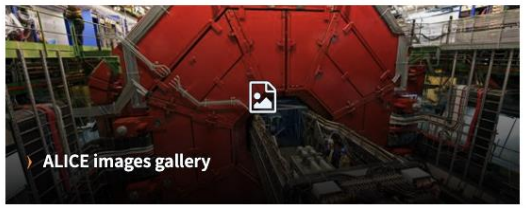
This central vacuum chamber is made of beryllium, a metal that is very light, very resistant and mostly transparent to particles. The new beampipe is about one metre long, 36.4 mm in diameter compared to 50 before, and with a thickness of 0.8 mm, which is at the limit of what can be achieved with current technology.

This change will improve the measurement of the position of particle interactions and help to detect particles with a shorter lifetime, which decay closer to the interaction point.

6. New readout system

The newly upgraded ALICE detector has close to 13 billion electronic sensor elements that are read out continuously, creating a data stream of more than 3.4 terabytes per second. To cope with such a large throughput, a new Online-Offline computing system, called O2, has been deployed

RESOURCES



CERN Bulletin

A century of discovery: CERN's past, present and future relations with the Higgs

- 8 articles
- April - August
- Covering period 1960s to 2040s

https://home.cern/news/series/higgs10/boson-born

"A boson is born" (Matthew Chalmers, CERN Courier editor)
On the 1964 Higgs origins (first paper rejected by CERN-TH's Prentki)

"The Higgs boson and the rise of the Standard Model of Particle Physics in the 1970s" (John Ellis, CERN TH)
On Neutral currents and Higgs phenomenology in the 1970s

"Three quarters of the Higgs discovered" (Paola Catapano, based on an interview with Carlo Rubbia)
On the W&Z discoveries in 1983

"LEP at the limits" (Roger Cashmore and Luciano Maiani)
On LEP and the Higgs (decision to close the LEP despite reluctance in the community

"Big Bang day" or "Just another day at the office"
On the *2008 LHC start up*

"I think we have it"
On the 2012 discovery announcement

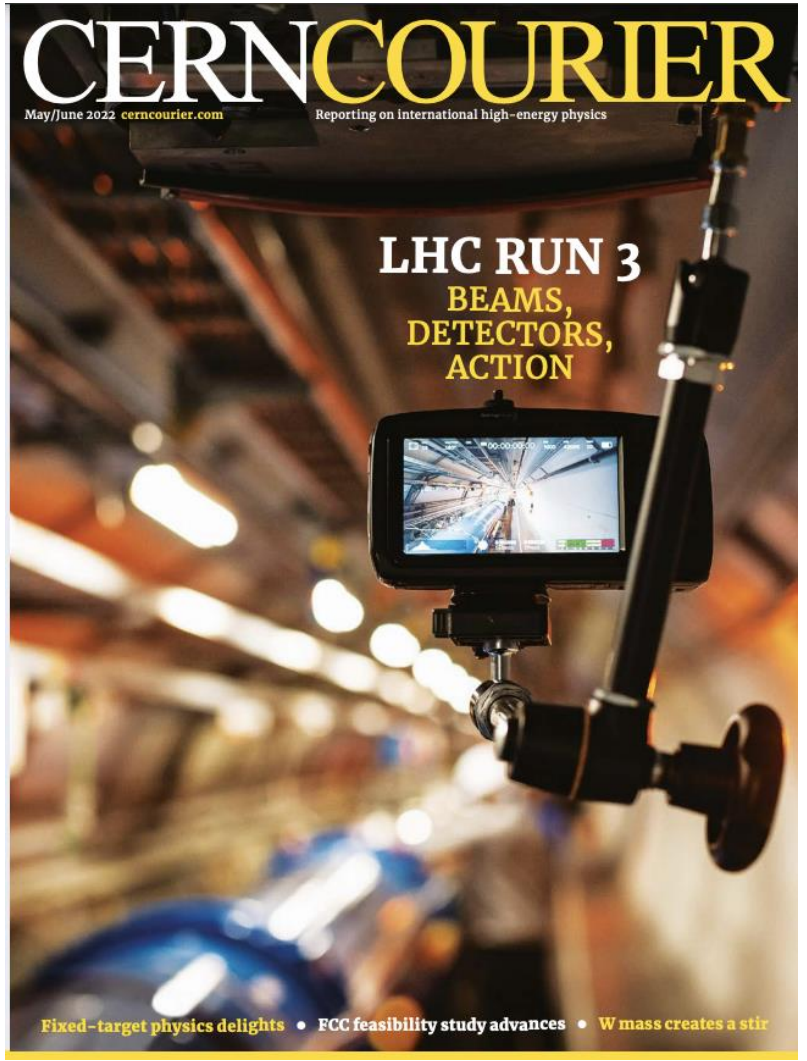
"10 years of interrogation"
On the 10 years of Higgs research since 2012

The Higgs and the universe (Matthew McCullough)
On the Future of Higgs research (HL-LHC / FCC)

CERN Courier – Two special issues

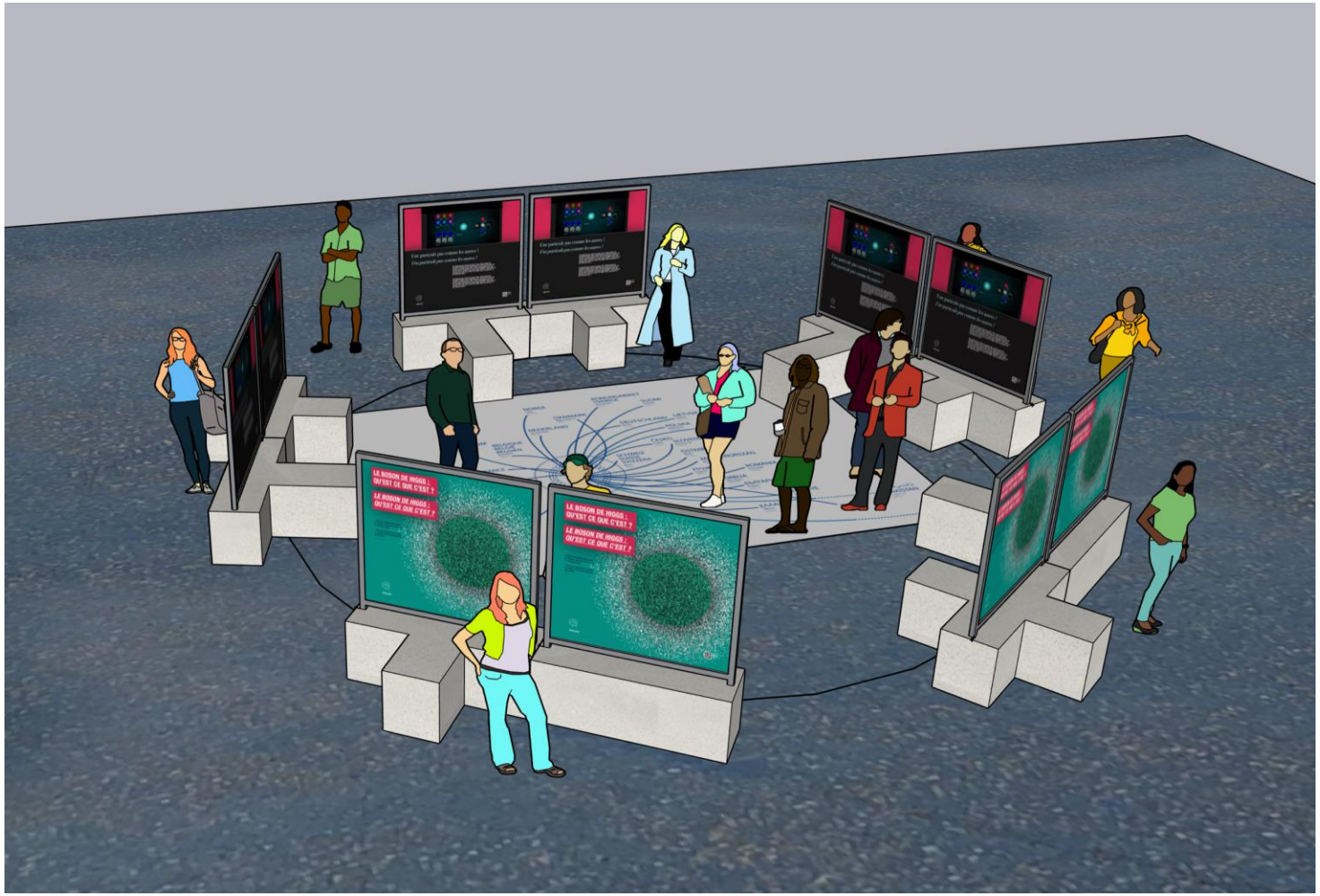
- May / June – “A new chapter for the LHC” - **Run 3**
  - Four features:
    - Prospects in searches for new physics
    - Precision measurements
    - Flavour physics
    - Heavy-ion physics

- Jul / Aug – the **Higgs boson**
  - Most articles have been commissioned
  - Working subject headings include *Higgs and the Nobel prize, The renormalisation revolution, Precursors to discovery, EWSB & baryogenesis, The Higgs & vacuum stability, Naturalness after the Higgs, The Higgs portal, Yukawa force,*



Exhibition

- On *Esplanade des Particules* + Content available to MS, partner labs, etc
  - In French and English
- 10 panels in total
  - 5 Higgs-related
  - 5 about current and future technologies (HL-LHC)
- Installed on *Esplanade des Particules* by 1 July
  - Content in digital format available before then



Social Media - three campaigns

Celebration | 10 years on | Preparing the future

The goal is to build interest towards the tenth anniversary of the discovery of the Higgs boson.

How:

- Promote the events around the three milestones to our key audiences
- Engage our community in positive conversations tailored to each campaign

Hashtags to aggregate campaign content

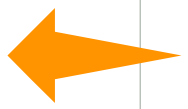
- Can be combined and used with other topic-specific hashtags
- **Partners are invited to use hashtags in their posts**

LHC restarts

- Engineering
- Upgrades
- #restartingLHC

Run 3 begins

- Physics
- Unanswered questions
- Big LIVE event for the first collisions
- #LHCRun3



10th anniversary of the Higgs discovery

- Physics (incl. answered questions)
- Achievements (incl. KT)
- Future projects
- Media event and scientific symposium
- #Higgs10

Media plan - built on 3 milestones

Celebration | **10 years on** | **Preparing the future**

LHC restarts (22 April)

- Engineering
- Upgrades

→

- Media update
- LS2 Backgrounders & LS2 video highlights
- Media training for experiments and Directorate

Run 3 begins (5 July)

- Physics
- Unanswered questions

Higgs@10... (4 July)

- Physics (incl. answered questions)
- Achievements (incl. KT)
- Future projects

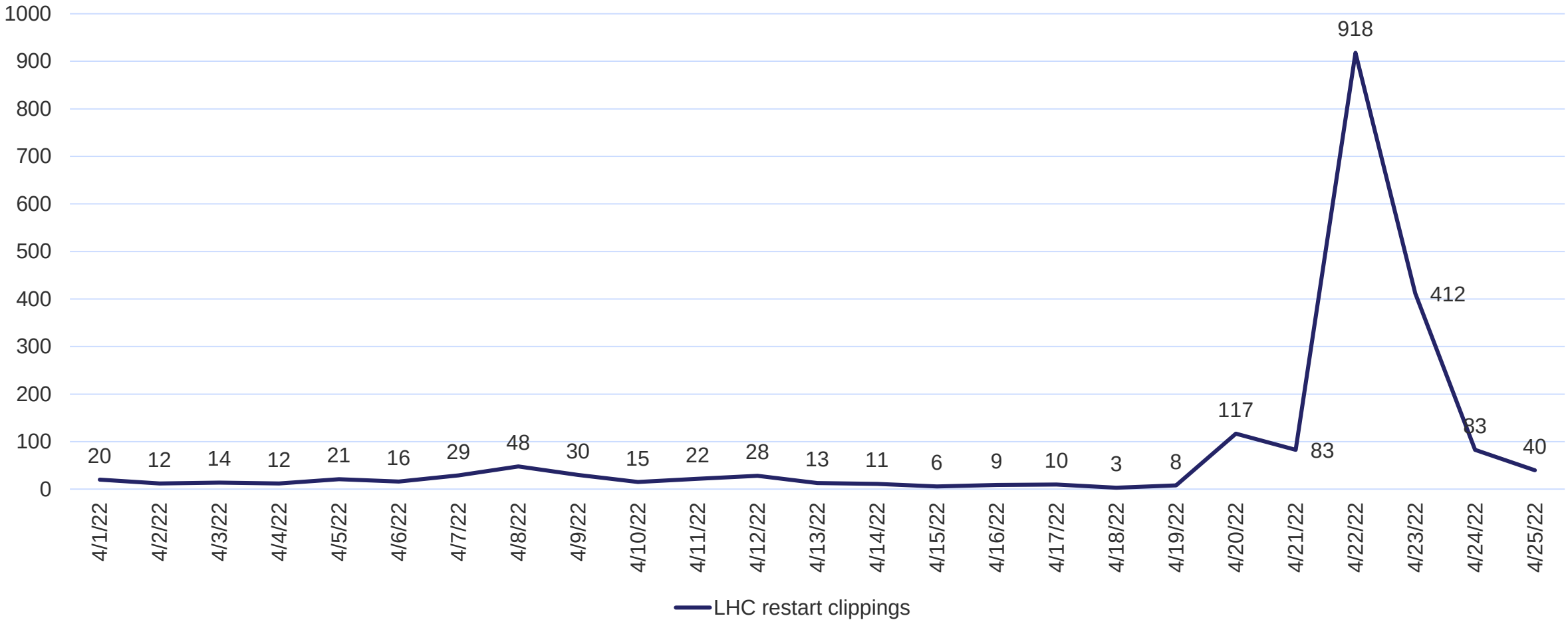
- **Media plan in preparation, for approval by CERN Management**
- **Important to own the messaging around "10 years on" and "Preparing the Future"**

- Media briefing
- Media update + VNR
- Backgrounders & Video interviews

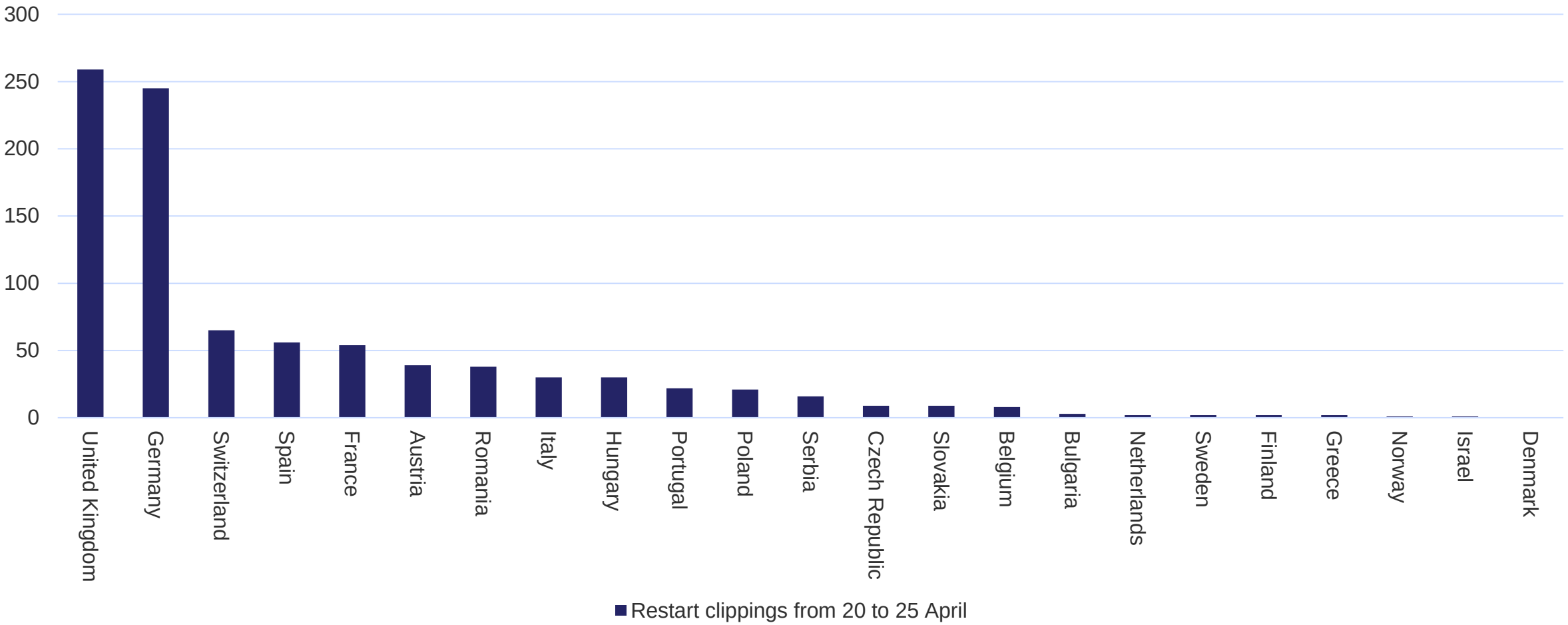
LHC restart - summary of international and national media outlets

LHC restart clippings across all countries

> 1500 clippings within a few days



LHC restart across CERN Member States



Thank you for your attention and especially for partnering with us!
All questions are welcome.

ana.godinho@cern.ch

home.cern