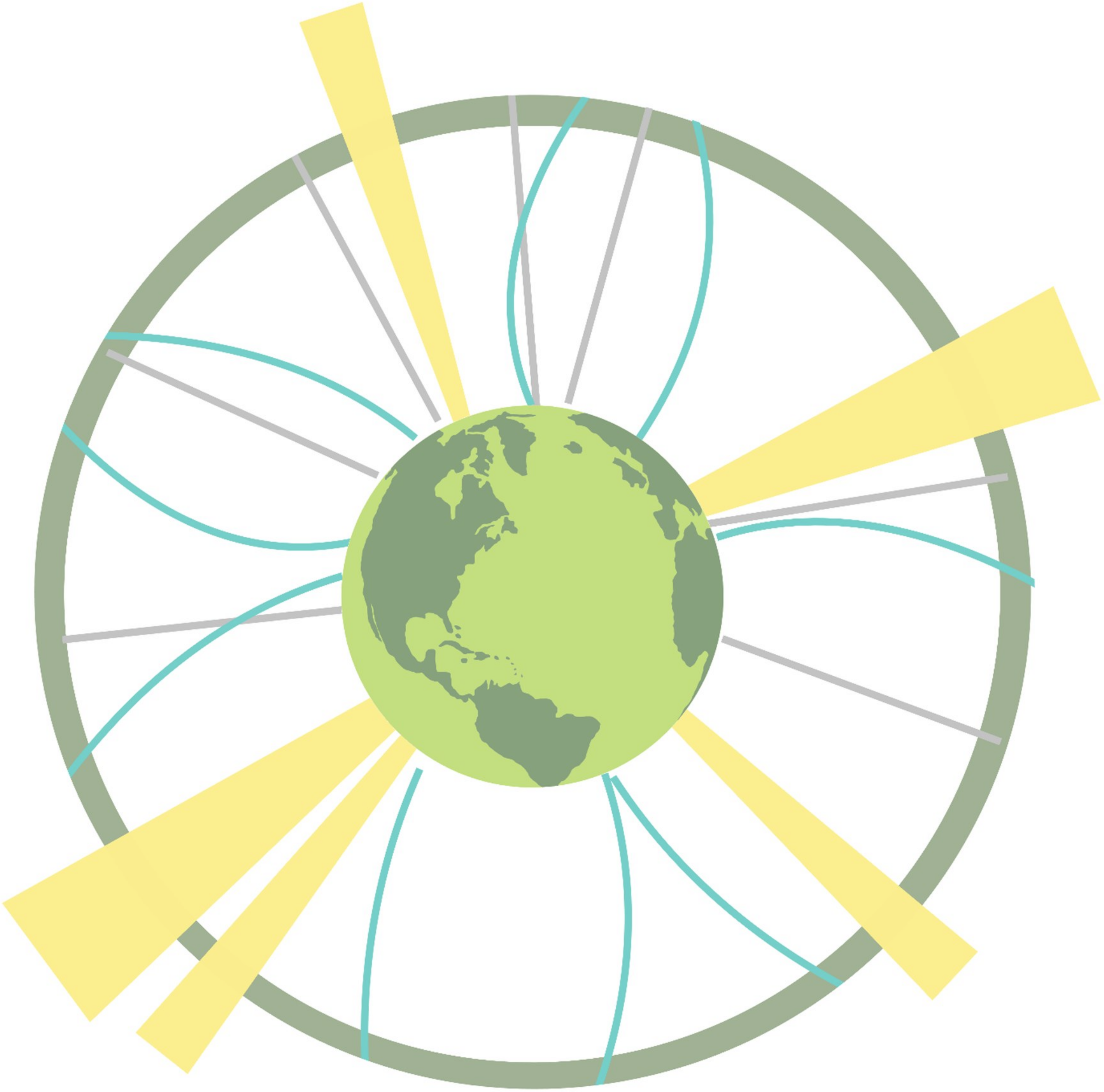
5th Edition of the

Sustainable High Energy Physics Conference 2026

8 - 10 July, 2026



Contact: susthep26 “at” physics “dot” ox “dot” ac “dot” uk

John Adams Institute for Accelerator Science

Royal Holloway University of London

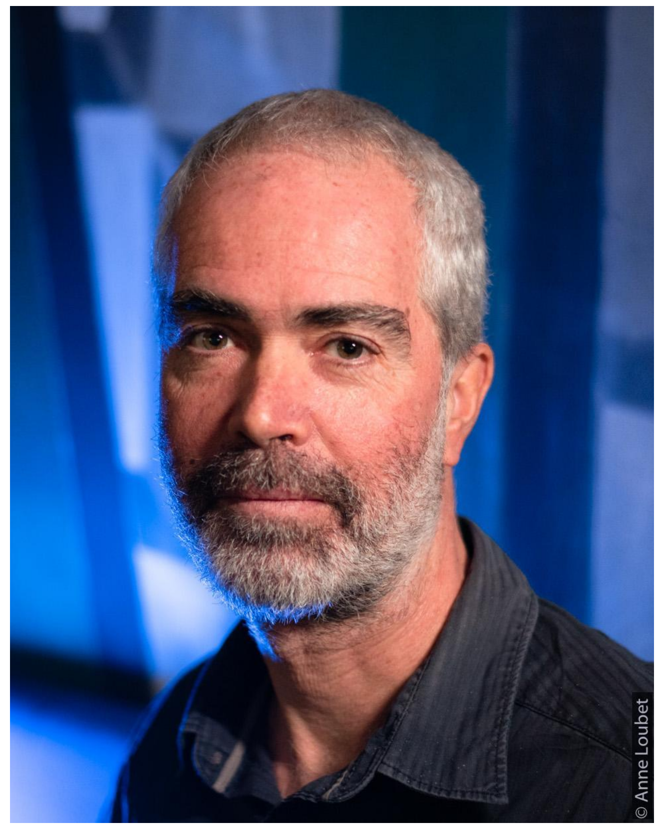
University of Oxford Department of Physics

CERN

Organisers

Shreyasi Acharya

Chandramauli Agrawal



Yann Coadou

Kristin Lohwasser

Hannah Wakeling

Contact
Email: susthep26 “at” physics “dot” ox “dot” ac “dot” uk
Mattermost: “#Contact SustHEP26 Organisers”

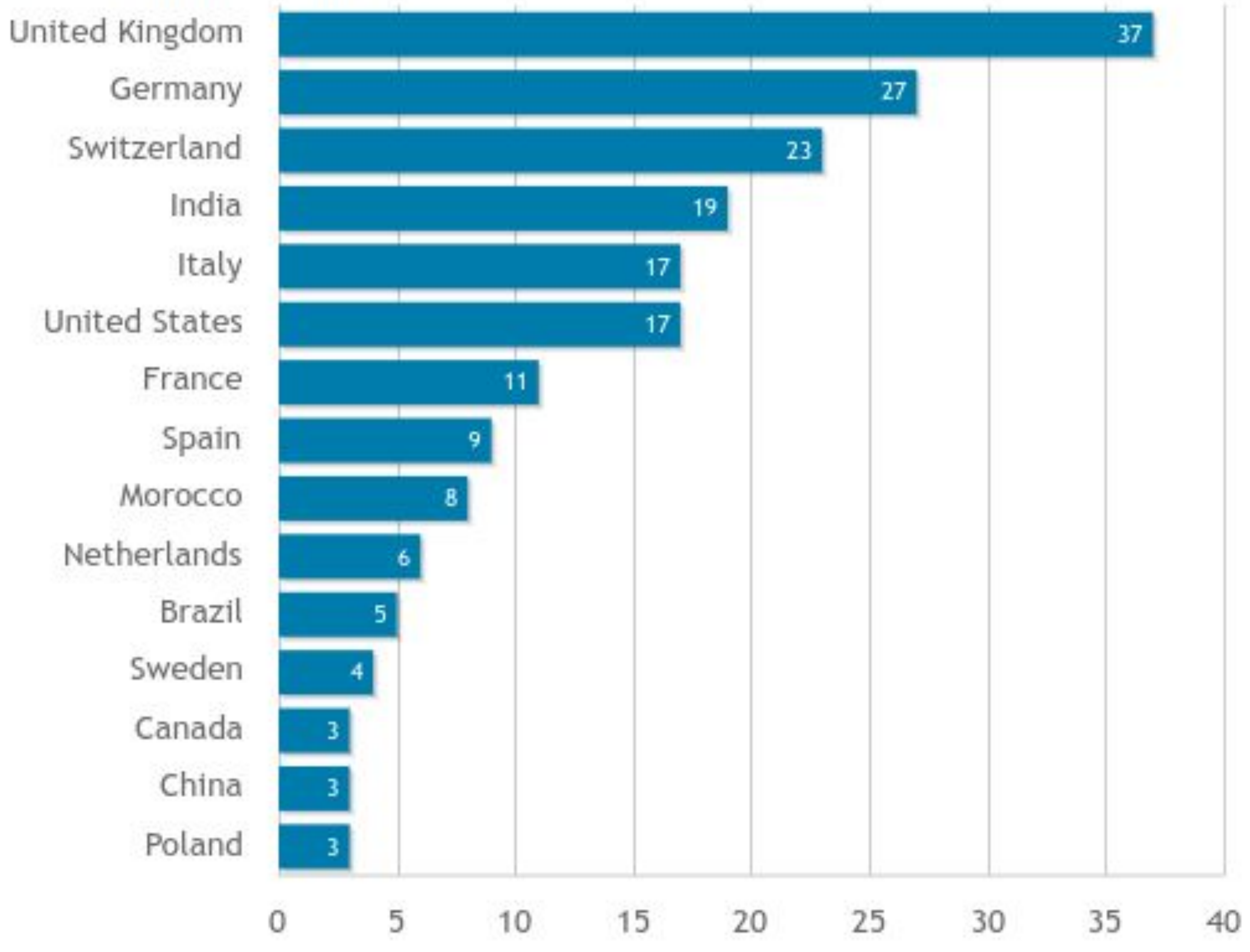
Sustainable HEP 2026

215
Registrations

0
Days left
to register

32
Countries

Registrants per country



Thank you to our in-kind sponsors!

John Adams Institute for Accelerator Science

ROYAL HOLLOWAY UNIVERSITY OF LONDON

CERN

UNIVERSITY OF OXFORD DEPARTMENT OF PHYSICS

Code of Conduct

Zoom Display Name

We encourage you to include your full name and preferred pronouns in your Zoom display name.

Updatable in participants list by clicking on "..." next to your name

Mic & Interaction

Please ensure that your microphones are muted when you are not speaking.

Please use the raise-hand button (✋) or Mattermost (💬) to attract the attention of session convenors.

Respect & Professionalism

All participants are expected to treat one another with courtesy, respect, kindness and professionalism.

Inappropriate language or behaviour, including bullying or harassment, will not be tolerated across any sessions or platforms.

Global Sensitivity

All participants are expected to act with sensitivity toward the many distressing and ongoing troubles around the world.

Communication

Cameras On

We encourage you to turn your cameras on when speaking.

Having a profile picture and a meaningful display name is useful.

Strict Timing

We will have to be strict with timing your talks.

We have a wonderfully packed schedule! So that we don't have to interrupt you, please keep to time.

Upload Slides

Please upload your slides before your session starts.

Links & Socials

Sustainable HEP LinkedIn Group and social media:

https://linktr.ee/susthep

Mattermost Channel

For questions and further discussions during and after the workshop.

Find the link on the left-hand menu of the Indico page. Channel: #Town Square

(Zoom chat is disabled)

Post-conference

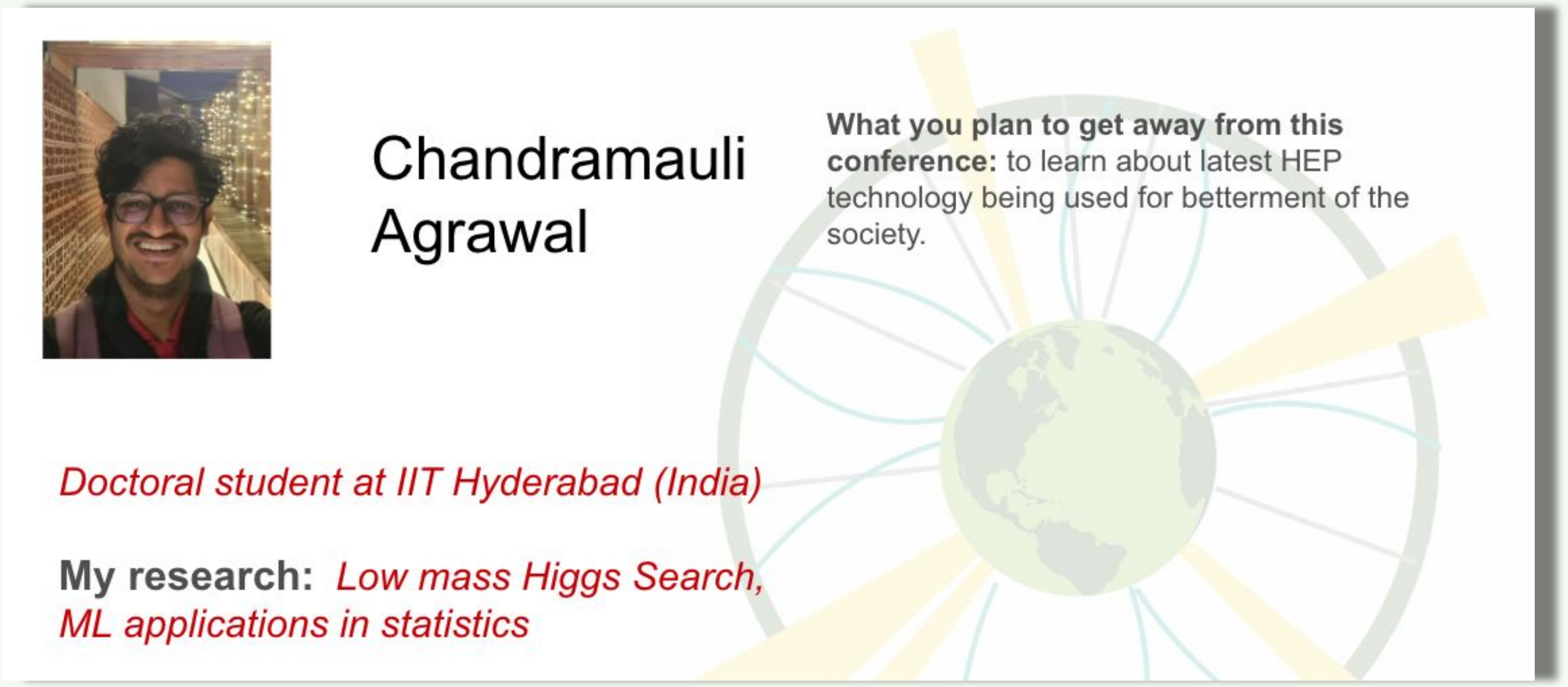
All sessions will be **recorded** and uploaded to YouTube as soon as possible.

Written **proceedings** will be available: https://scipost.org/SciPostPhysProc.202607001
Deadline 30th September

Note: These slides are available on the Indico schedule for access to the links!

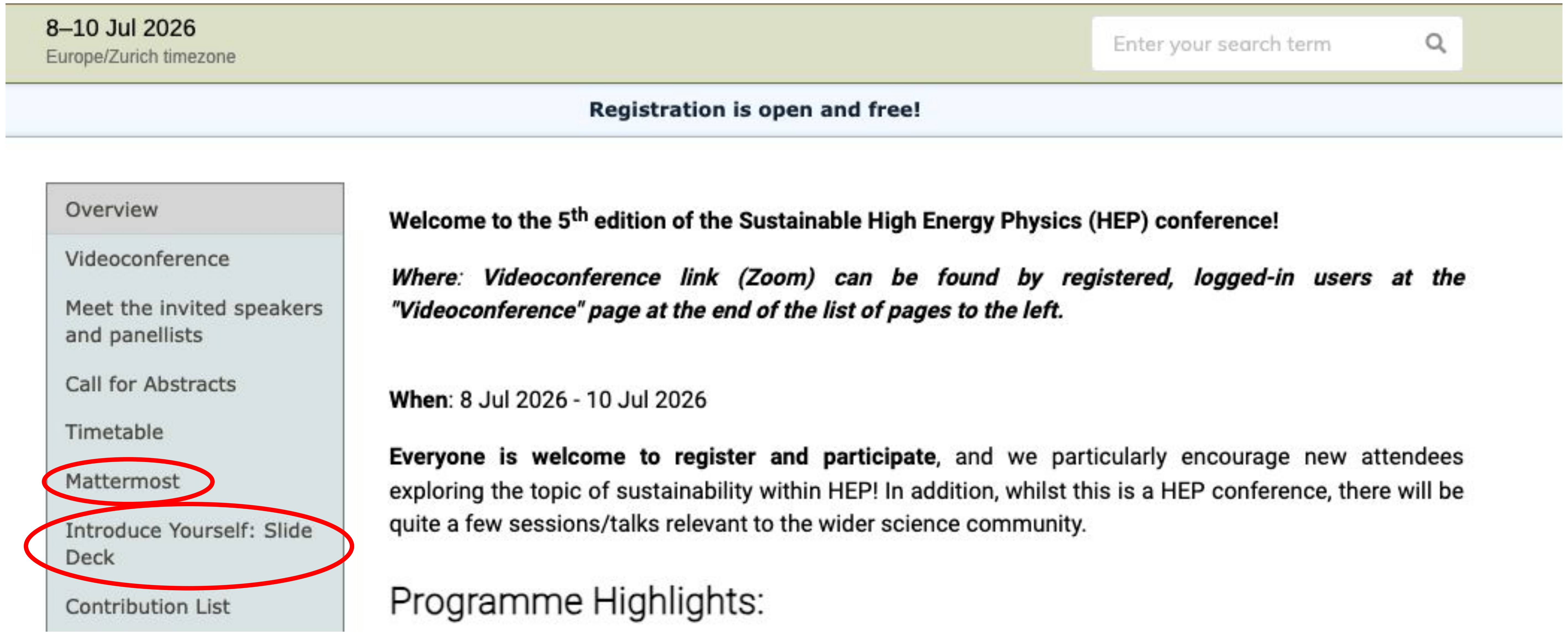
Introduce yourself!

Slide deck



Mattermost channel

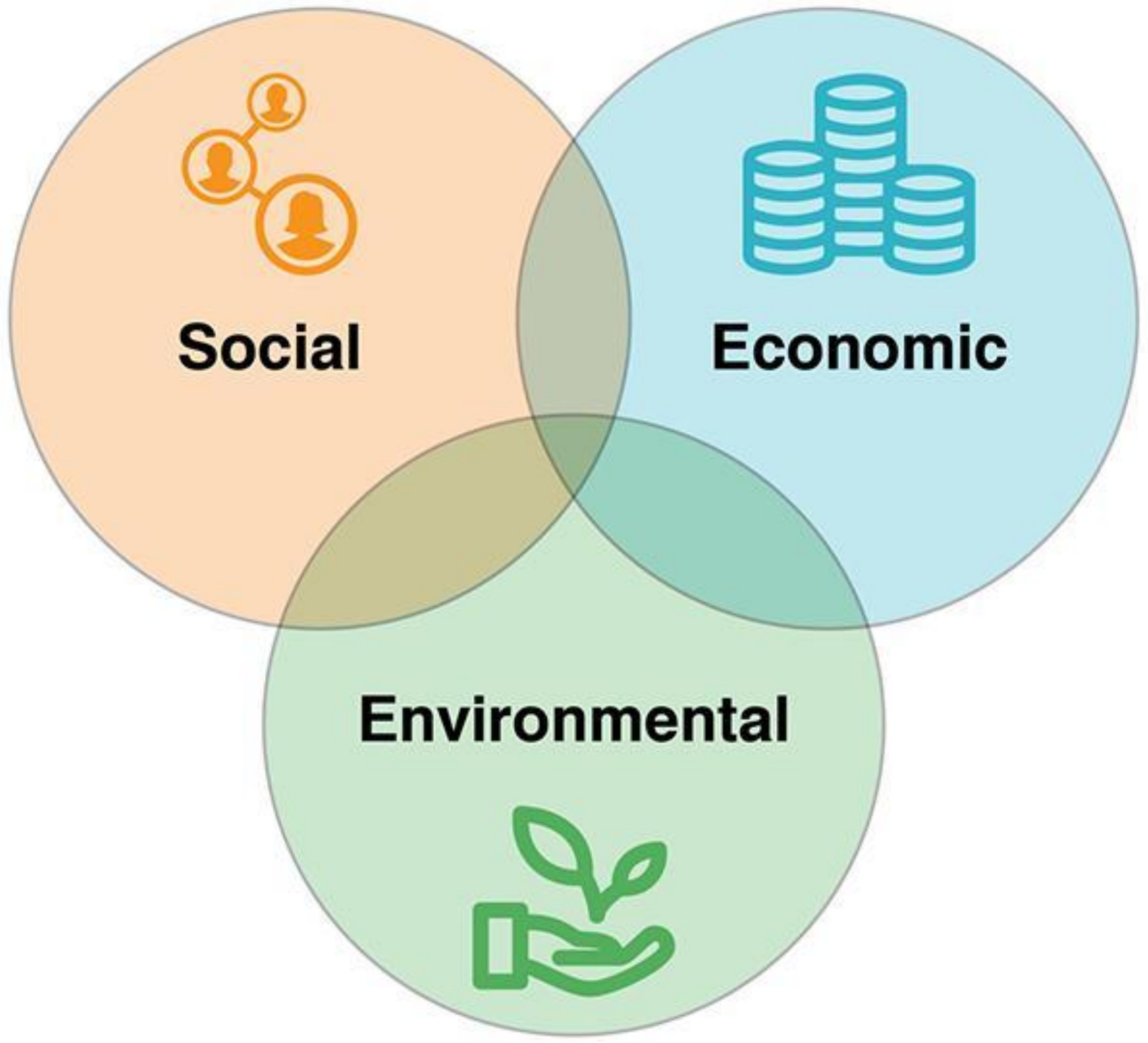
Introduce yourself and your work to spark connections and further discussions (during and after the workshop) on the #Town Square channel



Sustainability Context

"To meet the needs of the present without compromising the ability of future generations to meet their own needs."
— *Our Common Future (Brundtland Report), 1987; Section 3*

Three Pillars of Sustainability



Social & Economic Pillars

Address the deeply rooted social and economic inequities of big science projects at the heart of high-energy physics.

Environmental Sustainability

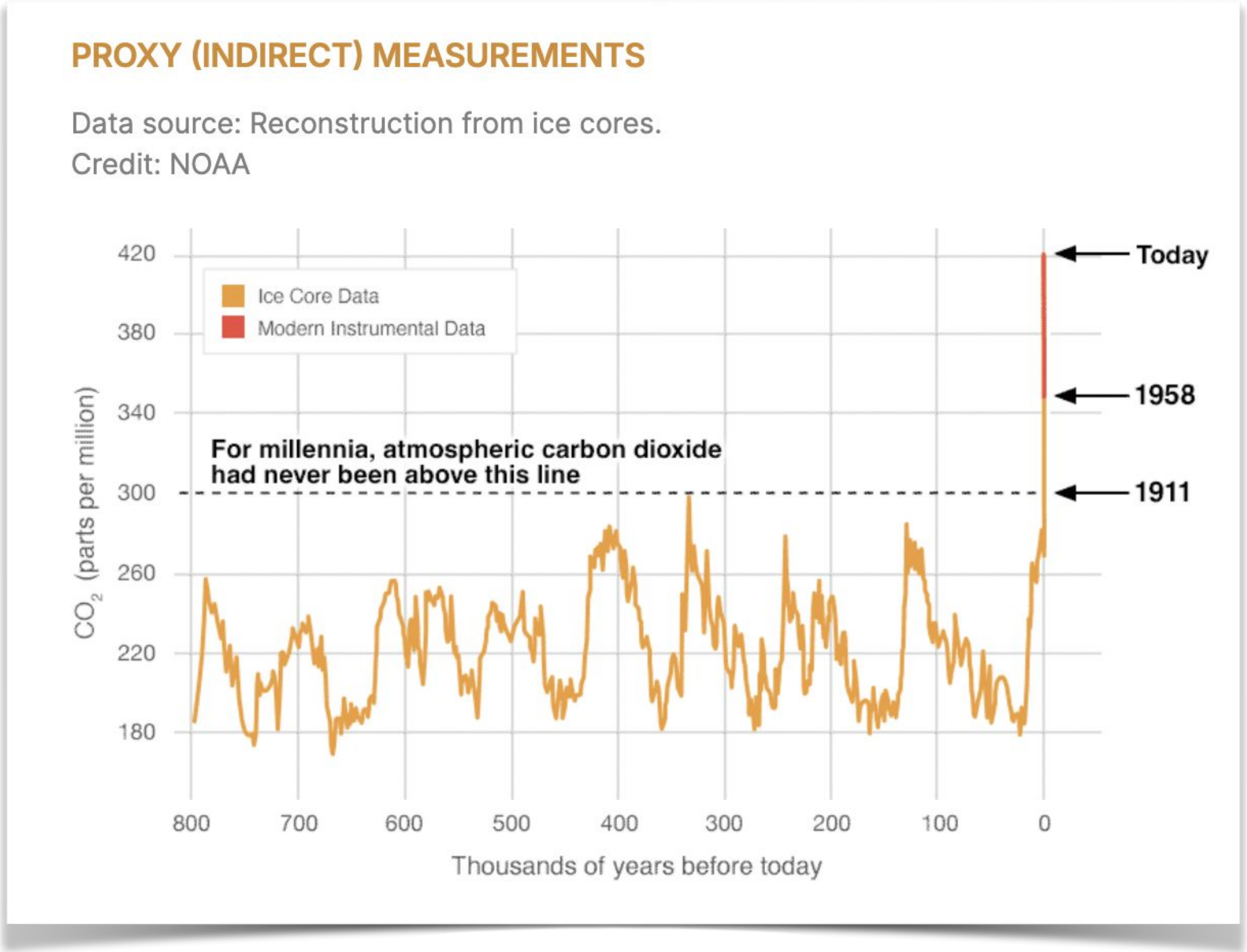
Focusing on critical ecological challenges: **Climate Change**, **Pollution**, and **Loss of Biodiversity**.

Sustainable HEP Focus

Prioritizing the direct intersection of high-energy physics (HEP) and environmental action without losing sight of broader human impacts.

For more information on incorporating sustainability into daily actions, explore the 17 UN Sustainable Development Goals (SDGs) at https://sdgs.un.org/goals

Sustainability Context



https://climate.nasa.gov/vital-signs/carbon-dioxide/?intent=121

1896: First Scientific Milestone

First study of heating of Earth's surface observed since pre-industrial era due to CO_2.

Ref: Philosophical Magazine and Journal of Science 41 (251) (1896) 237–276.

The Greenhouse Effect

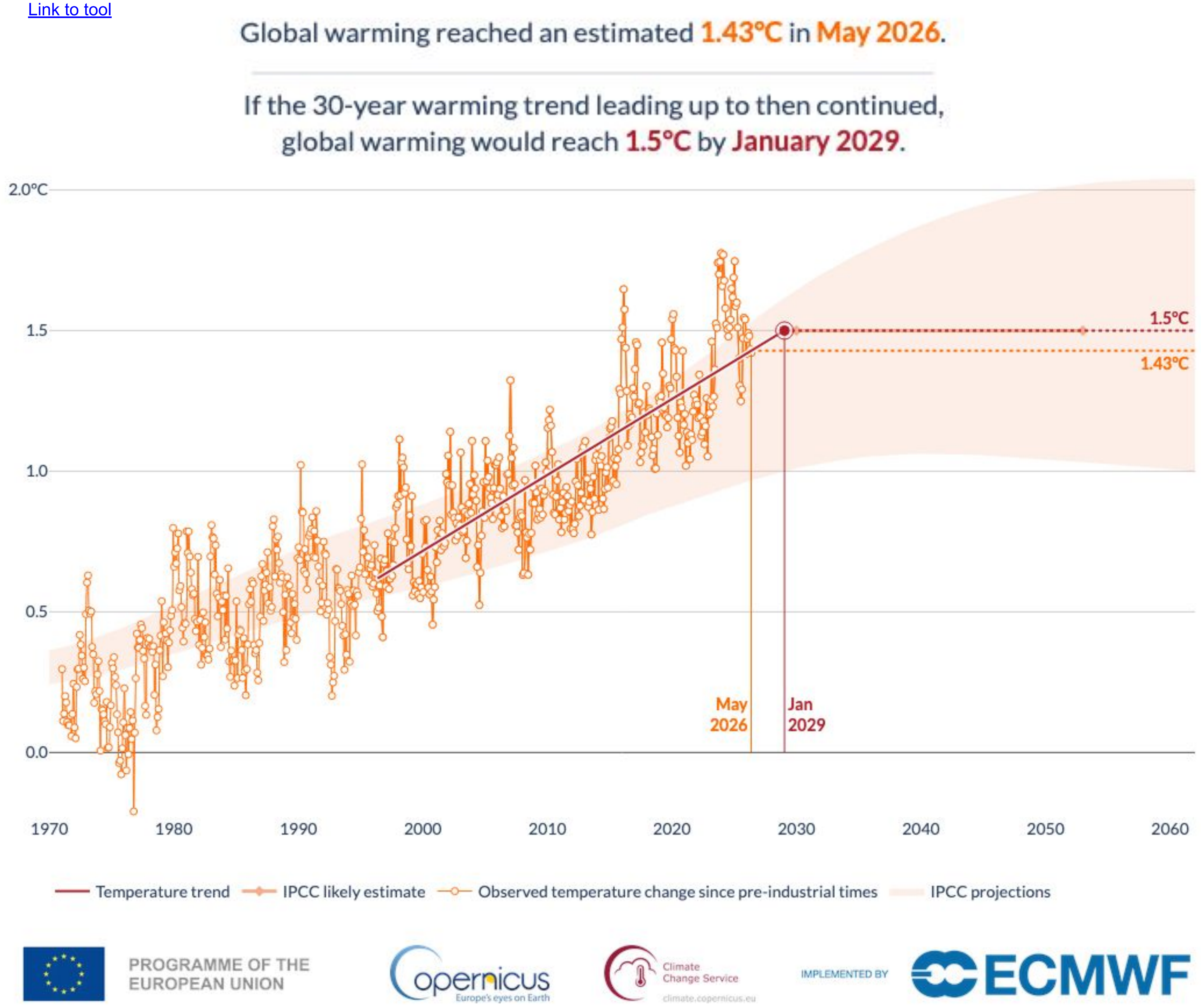
Greenhouse gases (CO_2, methane, etc.) trap some of the heat that results when sunlight heats the Earth's surface.

Human Activities (Anthropogenic Causes)

Burning of fossil fuels (coal, oil, gasoline, etc.), deforestation, agriculture, and transport are primary and direct contributors of greenhouse gases (GHGs).

Sustainability Context

[Link to tool]



Extreme danger of exceeding 1.5°C warming in 2029 with current trends

The world is heading to a warming of 2.4°C with 2030 targets and even higher, 2.7°C, with current policies.

Global average temperature during ice age, approximately **4°C cooler** than today. What will the world look like with **2+°C of warming?**

What is your summer looking like right now? Does it feel normal?

Source: https://www.carbonbrief.org/explainer-how-the-rise-and-fall-of-co2-levels-influenced-the-ice-ages/

HEP and Sustainability

Where does high energy physics intersect with emissions of Greenhouse Gases (GHGs)?

Examples

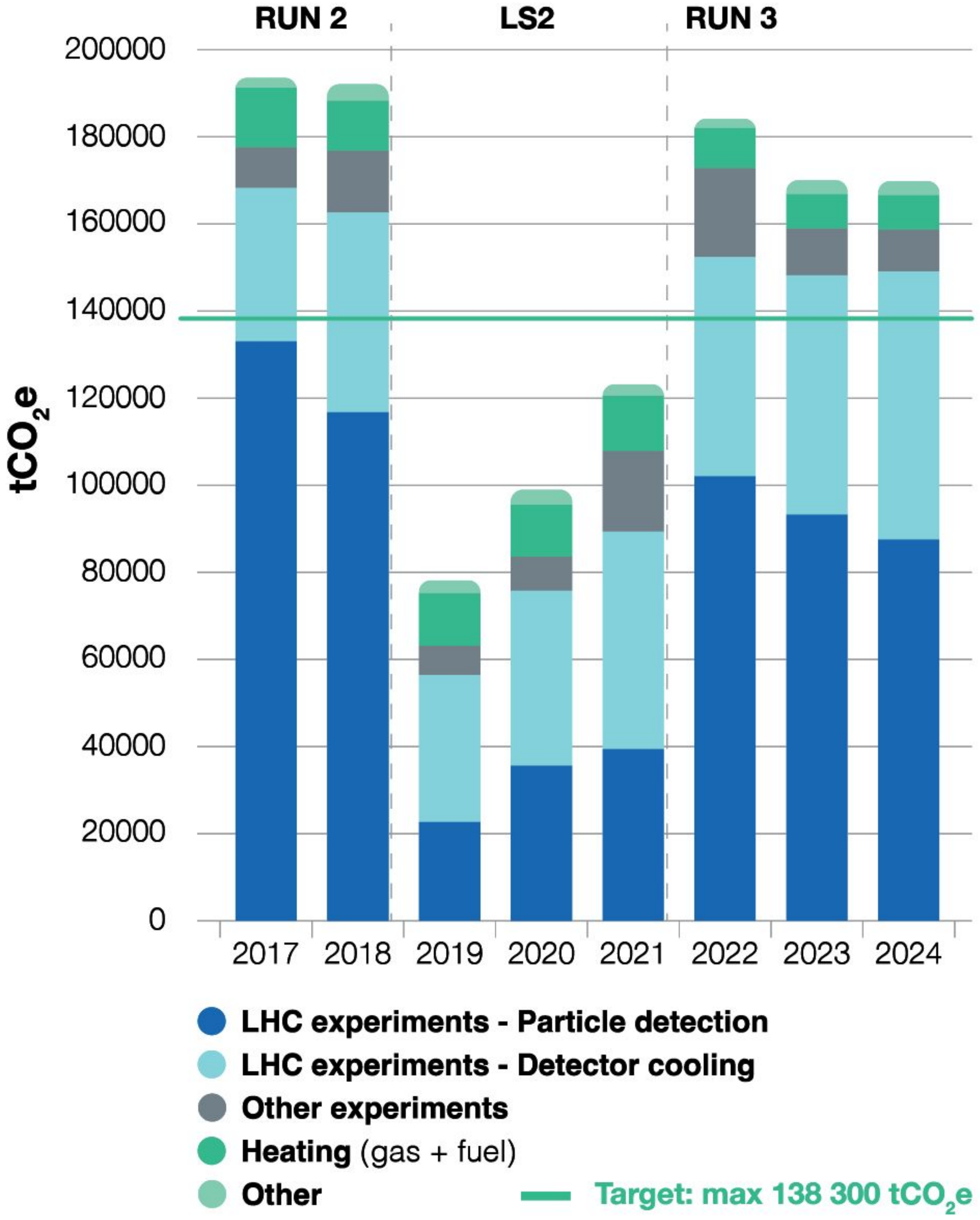
- **Construction**
  Of complex experimental facilities and specialized detector components.
- **Resource Consumption**
  Heavy demand on electricity (energy), specialized industrial gases, and cooling water.
- **Computing**
  High-throughput data storage, global grid processing, and active data analysis.
- **Travel**
  Global collaboration logistics and physical commuting to research facilities.

Our Aim

To sustainably and mindfully move forward into the future.

We must facilitate the design and implementation of greener technologies, optimized systems, and sustainable practices.

By joining the global effort of climate crisis mitigation, we aim to deliver tangible, positive ecological outcomes for high energy physics.



Ref: CERN environment report

European strategy for particle physics

Progress in integrating sustainability issues in our roadmap?

[ESPPU website]

2020 strategy update

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Environmental and societal impact

A. The energy efficiency of present and future accelerators, and of computing facilities, is and should remain an area requiring constant attention. Travel also represents an environmental challenge, due to the international nature of the field. ***The environmental impact of particle physics activities should continue to be carefully studied and minimised. A detailed plan for the minimisation of environmental impact and for the saving and re-use of energy should be part of the approval process for any major project. Alternatives to travel should be explored and encouraged.***

2026 strategy update

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Sustainability and environmental impact

Environmental considerations, in particular those relating to climate change, are driving the community's efforts to reduce the environmental impact of particle physics research and to develop sustainable solutions, which may also benefit society. Assessing and mitigating environmental impact is important at all levels: institutional, project and individual.

Energy consumption and emissions must be minimised when realising and operating facilities and projects. This requires the implementation of sustainability strategies, many of which can be coordinated among particle physics laboratories, environment protection, preservation of local biodiversity, energy reuse and climate-change resilience.

In general, the best time to influence the whole-life environmental impact of any large accelerator facility is at the conception, optioneering and design stages. In the early stages, these assessments should be used primarily to find areas of high potential for impact reduction, to give approximate figures for competing options and to highlight critical gaps in knowledge. It is important to adapt the Life Cycle Assessment (LCA) scope and the anticipated level of detail to the status of the project, with the goal of improving its environmental performance, identifying the main drivers for environmental impact and addressing them in successive phases of a project.

Civil engineering work contributes in a substantial way to the environmental impact of major accelerator projects. It is typically the largest single contributor to emissions during construction and is driven mainly by the very large amount of concrete employed. Mitigation measures are being developed globally to reduce the environmental impact of major civil engineering work. Particle physics infrastructures should aim to benefit from such measures, even if this means incurring additional costs. Full sustainability considerations are also required at the earliest stages of projects for the materials extracted during the excavation of underground structures.

Most of the energy used to operate the technical infrastructure and subsystems of a particle accelerator is eventually converted into heat. This includes, for example, the energy used to operate accelerator magnets, the RF energy driving accelerating structures, absorbed synchrotron radiation, energy for air management systems and for operating electronics and data processing equipment. Many new infrastructures are successfully building in heat-recovery systems, right from project inception, so as to provide office and district heating. All future major accelerator projects should carefully assess the recovery and reuse of the low-grade heat generated so that a quantified, informed decision can be made on its most sustainable implementation.

Significant scope exists to decrease the environmental impact of almost all accelerator technologies. Available R&D funding should be focussed on those with large savings potential. The key areas identified are RF sources, thin-film superconducting RF cavities

operating at higher cryogenic temperature, permanent magnets, and HTS magnets as well as luminosity optimisation through lower emittance to reduce run times and the application of AI/ML to increase operational efficiency. In addition, increased support and attention should be placed on the further development of accelerator technologies with energy recovery modalities, especially ERLs.

The design of new particle physics infrastructures should be as sustainable as possible, balancing important sustainability aspects with cost and physics performance.

A. For new proposed projects, a detailed life cycle assessment should be carried out at each stage, from concept to design and implementation, in order to quantify and minimise environmental impact.

The field of particle physics is expected to make every effort to actively mitigate the consequences of its large-scale research activities by minimising energy consumption, greenhouse gas (GHG) emissions etc., in the planning, realisation and operation of HEP facilities and projects. Developing new energy-saving technologies and replacing traditional materials, in particular gases, by environmentally-friendly ones, should be done wherever possible. Solutions found and knowledge gained should be transferred to society.

Computing demands will continue to grow in the future, leading to significant additional energy efficiency and cooling requirements. The improvements in the energy efficiency of data centres, wider implementation of AI, GPUs and state-of-the-art central processing units, together with wider usage of more efficient programming languages should be strongly supported. The distributed computing infrastructure, in particular the WLCG, is encouraged to develop a coherent strategy revolving around energy efficiency and sustainability.

Laboratories are encouraged to formulate strategies for the environment and sustainability together with periodic reports about their implementation. It is desirable that these strategies should be as coherent as possible among HEP research infrastructures. Also, stringent and transparent strategies for the disposal of waste of all origins (concrete, electronics, radioactive, etc.) should be implemented, based on the following chain of priorities: prevention, reduction of volume, sorting, reuse, recycling, recovery, and disposal. It is advisable to manage existing research sites and to design future ones in a way that ensures the preservation/enhancement of biodiversity, minimises the use of water and takes all relevant environmental issues into account. Whenever possible, these actions should be conducted in collaboration with environmental/biodiversity experts.

A robust educational framework to equip future generations of particle physics researchers with the necessary knowledge and skills for sustainable practices should be developed. Research oriented in these directions should be recognised and promoted.

Communication and collaboration are at the core of the scientific life and productivity of the particle physics community, but must be balanced against the environmental consequences.

B. The particle physics community should continue and intensify its efforts to develop and adopt sustainable solutions.

As a worldwide activity, particle physics research is characterised by a high degree of human exchange and mobility and consequently by travel. It is estimated that air travel accounts for only 2.5 to 3% of global CO_2eq emissions, but this fraction is expected to be more difficult to de-carbonise than those in other domains. Given that current and future projects at energy-frontier accelerators and experiments are, to a large extent, concentrated in a few leading laboratories, the CO_2eq emissions associated with business trips should be optimised. There is a clear need for a balanced approach, weighing appropriately the mitigations of travel against the benefits of personal exchange, the latter being of primary importance especially for early-career researchers. In-person interactions could be facilitated by the further development of regional HEP centres, with possibilities of longer-term residence and advanced capabilities for remote operation. It is also advisable to further expand remote experiment operation capabilities.

Among the best-practice approaches to optimising air travel are: shifting to environmentally-friendly land-based travel for short distances, taking the CO_2eq travel emissions into account in the choice of venues for conferences, workshops and meetings. Moreover, environmentally-friendly, sustainable means of transport for daily commutes should also be supported.

C. An effective balance between in-person and online meetings should be considered in order to mitigate the environmental impact of carbon-intensive travel.

Discussed later today and Thursday

Goals of Sustainable HEP

01

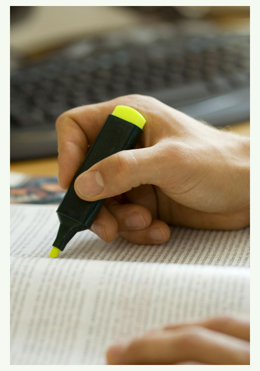
Increase awareness
of the impact of High Energy Physics (HEP) on the environment.

02

Discuss the intersection
of HEP and climate crisis.

03

Highlight initiatives
ongoing within and alongside the HEP community.



04

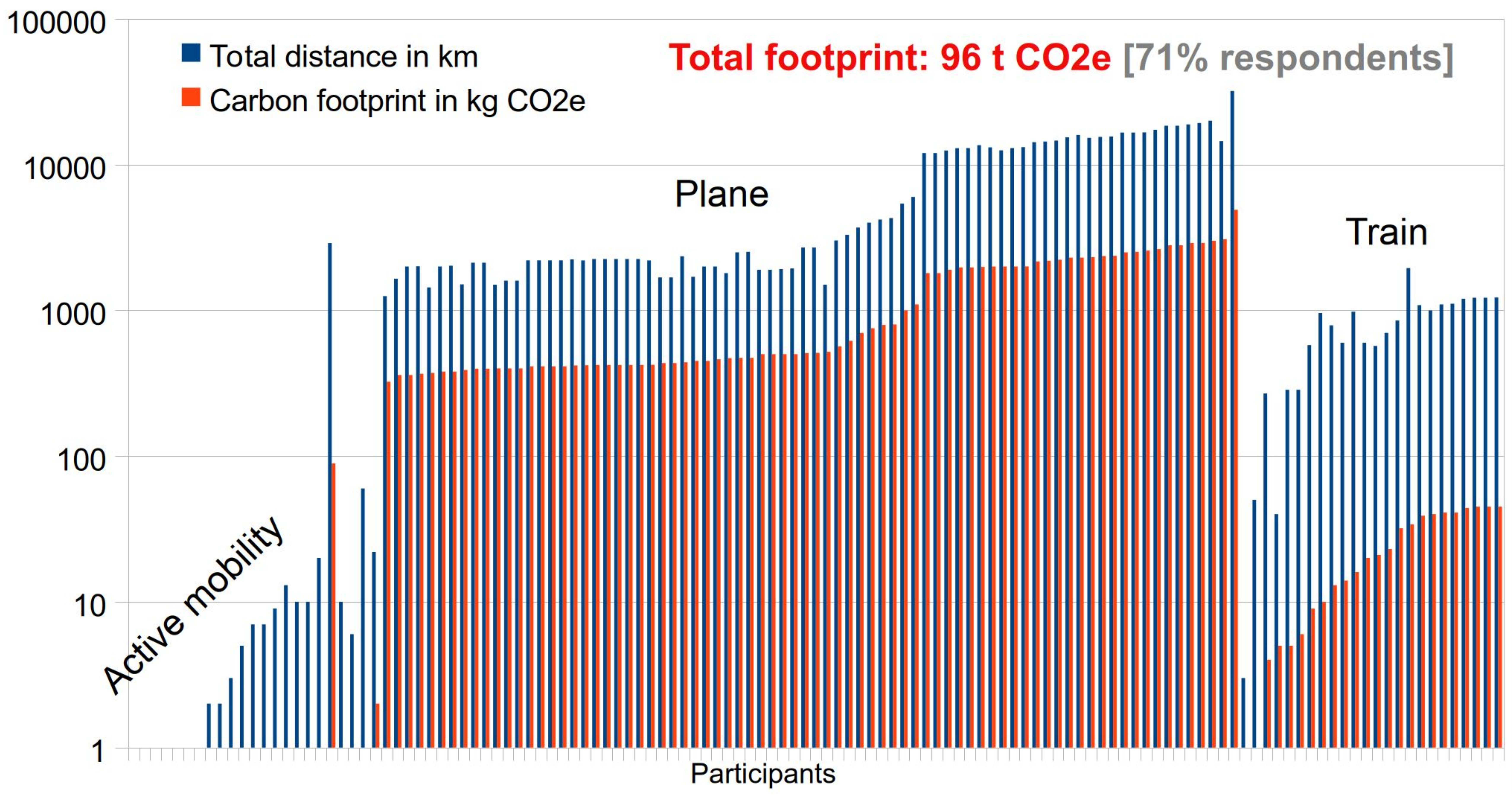
Ask tough questions
that tackle the status quo.

05

Exhibit and deliver
positive tangible steps forward.

Sustainable HEP 2026

Avoided travel carbon footprint by running online-only meeting



(tCO2e not scaled to number of participants)

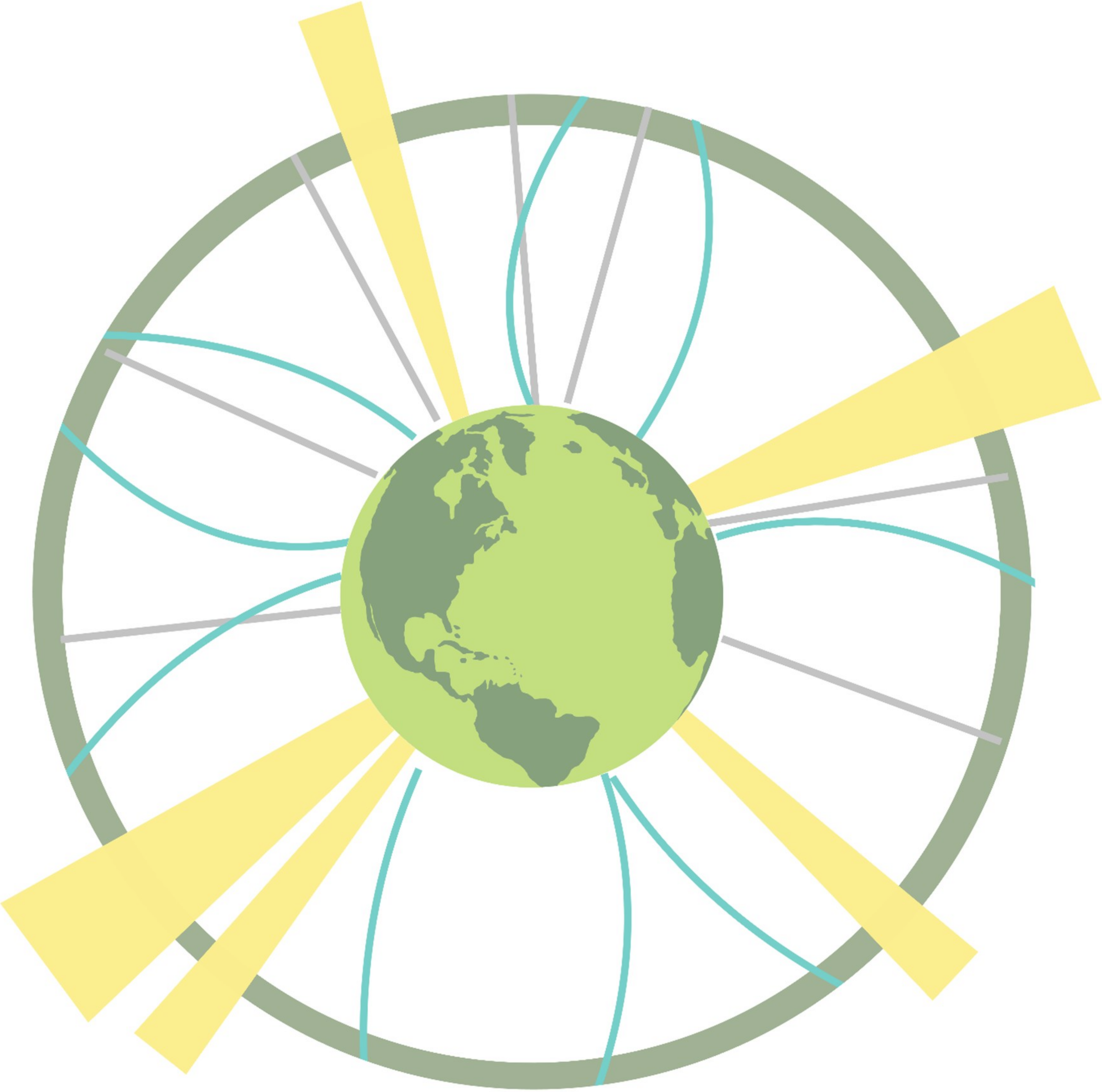
Plane:
98% of emissions

Day 1 agenda

Wednesday 8th July
Starting 14:00 CEST

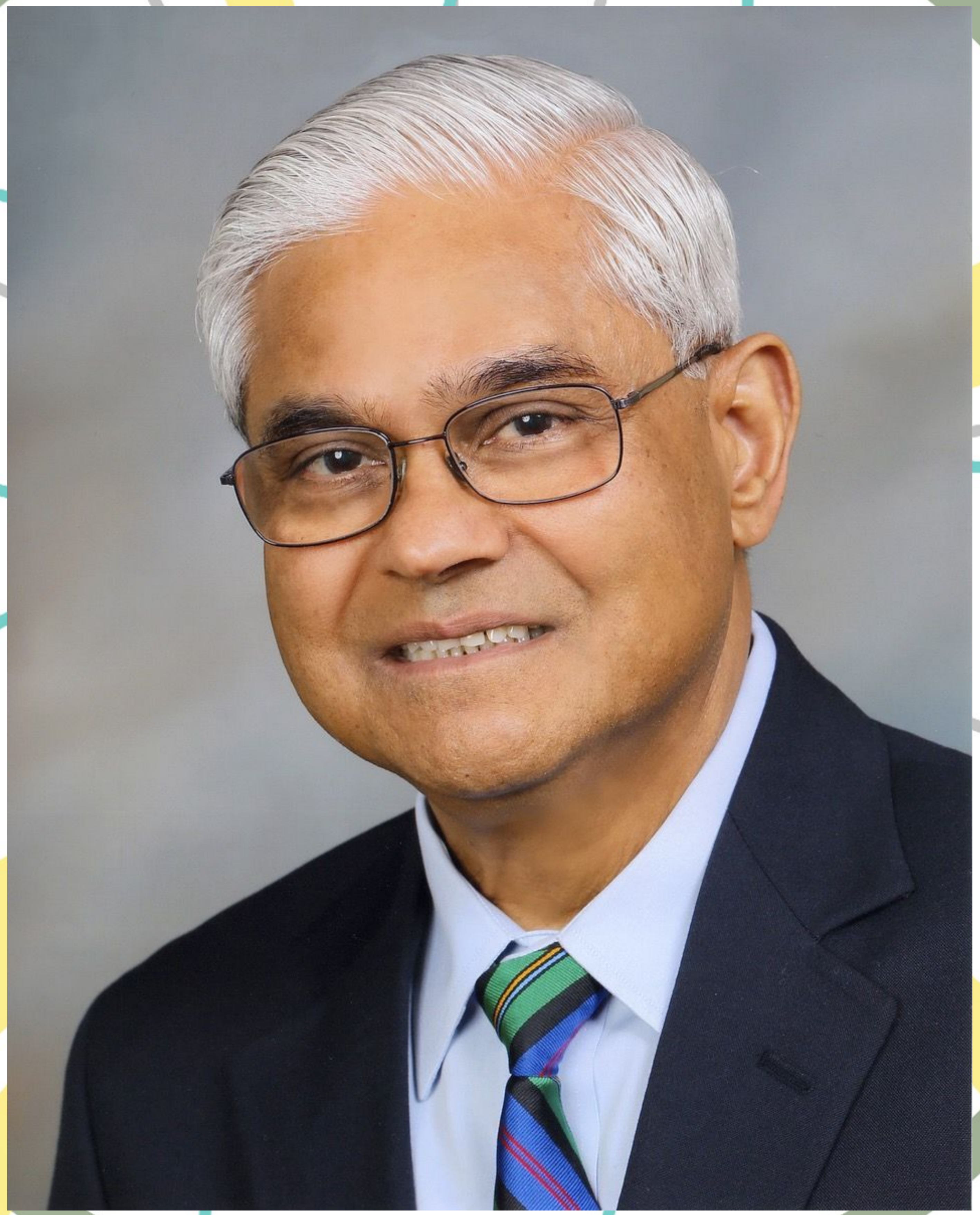
Hour	Session	Speaker	Time
14:00	**Welcome/Opening note**		14:00 - 14:10
	Keynote opening talk	*Prof. Jagadish Shukla*	14:10 - 15:05
15:00	**Sustainability for Gaseous HEP Detectors**	*Prof. Archana Sharma et al.*	15:05 - 16:00
16:00	**Health Break**		16:00 - 16:15
	News from SC4RC 2026	*Rakhi Mahbubani*	16:15 - 16:30
	Sustainability recommendations from the European Strategy: a historical perspective	*Veronique Boisvert*	16:30 - 16:45
	Nikhef's sustainability roadmap	*Catharina Vaendel*	16:45 - 17:00
17:00	**The ULISSE Project: an Opportunity for CERN's waste heat large-scale recycling**	*Mr William van Sprolant*	17:00 - 17:15
	Open Event Generation	*Julie Hogan et al.*	17:15 - 17:30
	Reducing simulation-related emissions in rare-event searches through optimised event biasing	*Dr Lachlan Milligan*	17:30 - 17:45
	Energy efficiency of a GPU-based computing system in HEP	*Jiahui Zhuo*	17:45 - 18:00
18:00	**Reducing the compute used for calorimeter simulation**	*Henry Day-Hall*	18:00 - 18:15

Welcome!



Prof. Jagadish Shukla

George Mason University (US)



Prof. Archana Sharma

CERN
(Switzerland)