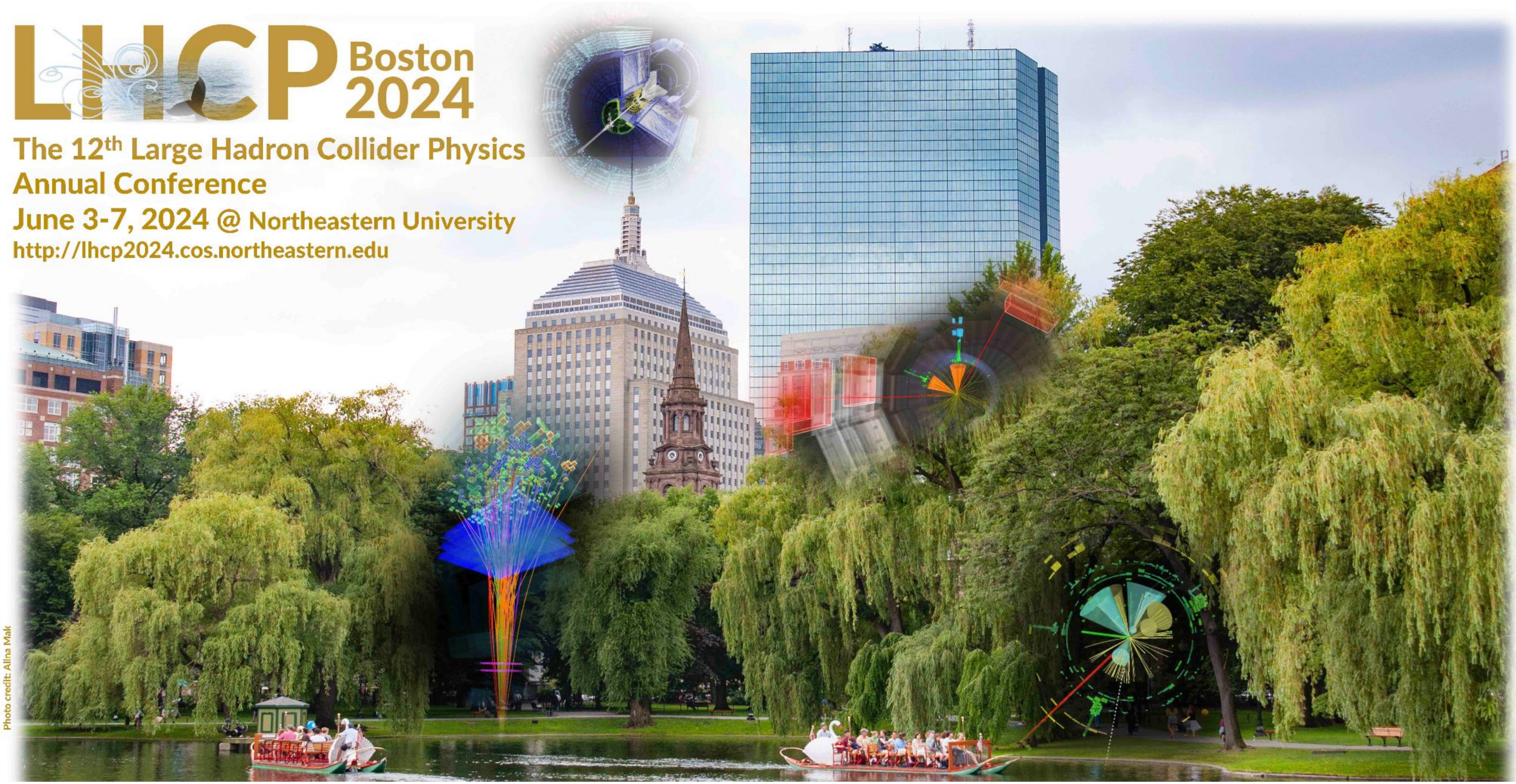


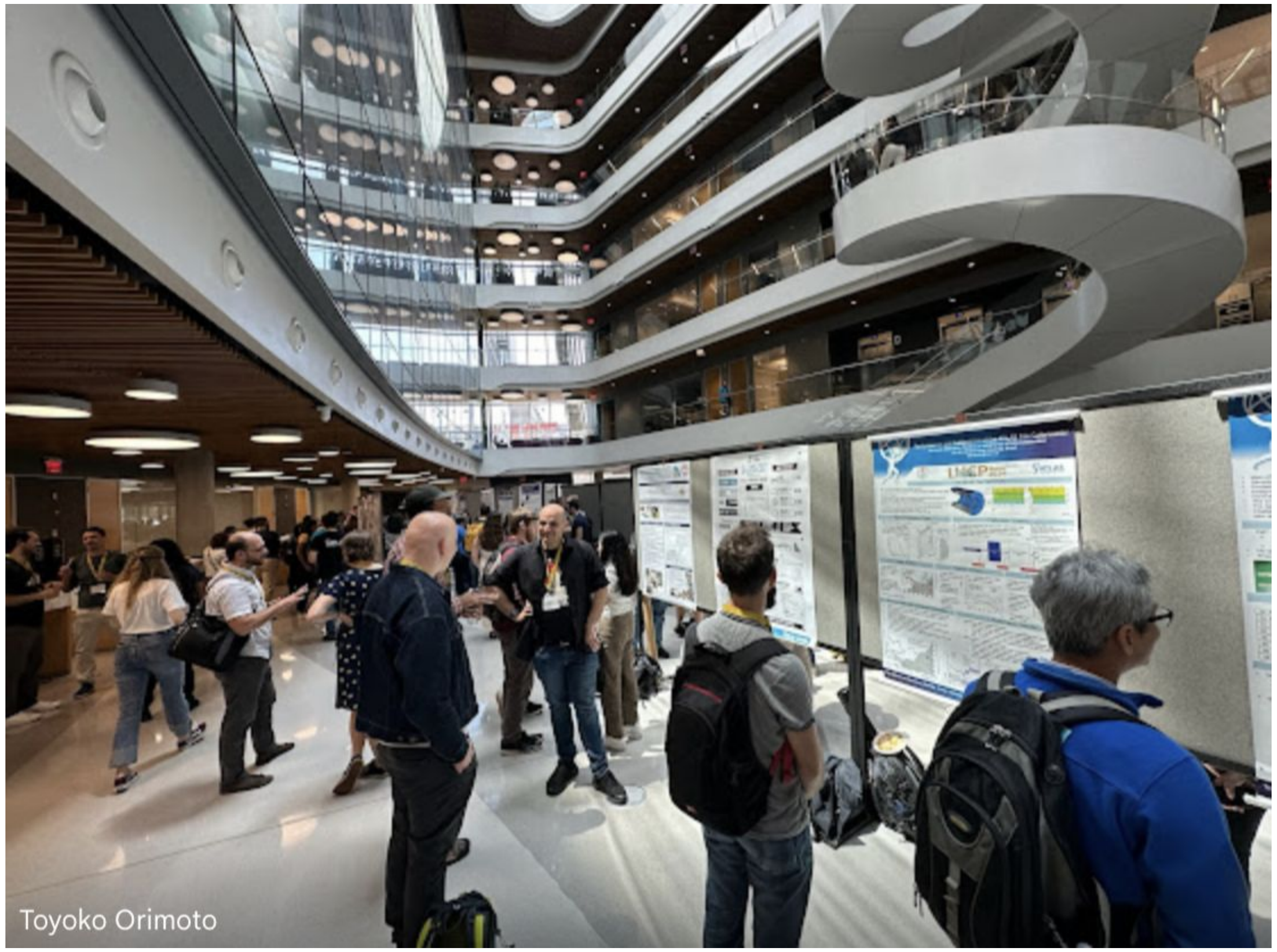
Poster Awards

Sarah Demers, Yale University

Chair of the LHCP2024 Poster Award Committee
Conference Co-Chair

First, some thanks!

- **Thank you** to the local organizers who put the poster session together, with special thanks to Darien Wood
- **Thank you** to IUPAP for the Conference sponsorship that enabled us to give out awards.
- **Thank you** to the team of judges
  - Marina Artuso, Andrea Beraudo, Stefania Bufalino, Rebeca Gonzalez Suarez, Laura Havener, Larry Lee, Ian Moult, & Matt Reece
- **Thank you** to the poster presenters for engaging presentations of wonderful work
- **Thank you** to all for engaging with the posters

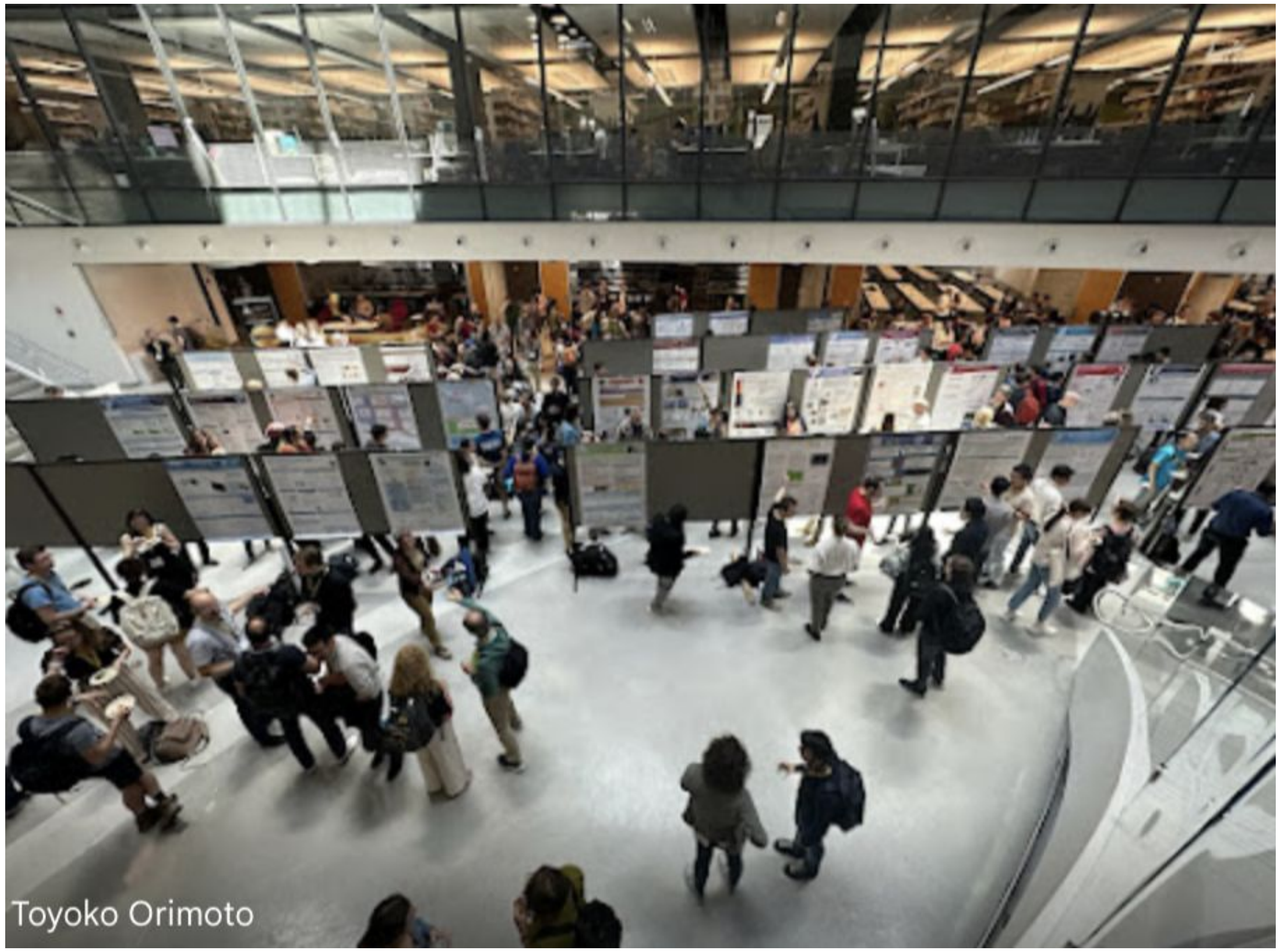


We had almost 100 posters spanning many topics.

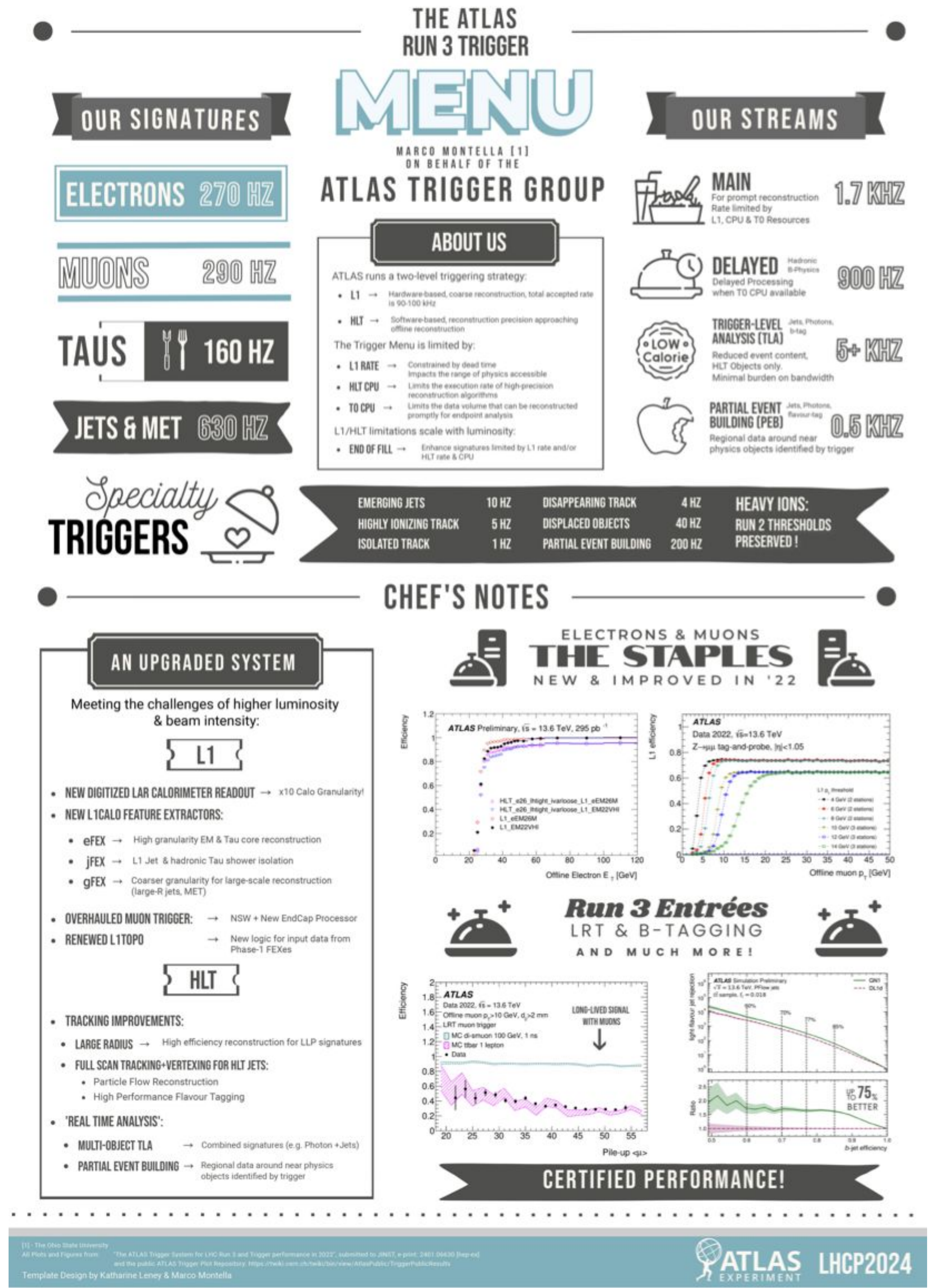
Judges were looking for well-crafted posters and for clear and engaging presentations.

The quality of posters and presentations was so high that it was very difficult to choose our five winners!

BSM (1 TeV)	22
BSM (Feebly Inter. Particles)	6
Electroweak Physics	4
Higgs Physics	8
Top Physics	2
Flavour Physics	2
QCD Physics	3
Heavy Ion Physics	4
Performance & Upgrade Tools	15
Upgrades	18
Future Prospects	5
Outreach, Diversity, Inclusion	8



Carrying the trigger “menu” analogy to a flawless conclusion, this poster wowed the judges not only with its creative layout, but it also served as excellent support for a great overview of the ATLAS Run 3 Trigger system by Marco!



LHCP2024 Poster Award

Marco Montella, Ohio State University

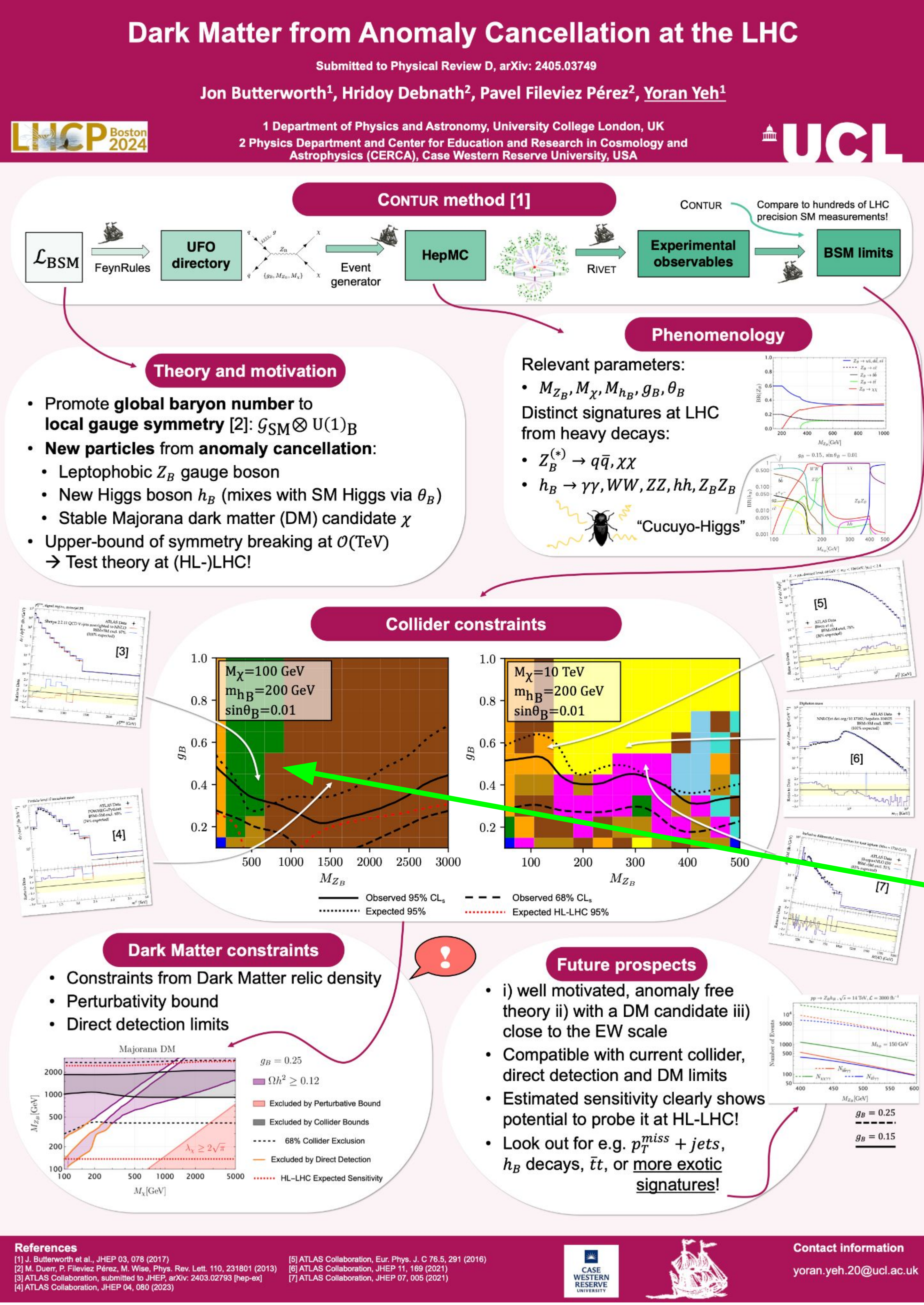
For the poster entitled:

"ATLAS Trigger Menu in Run 3"

Shahram Rahatlou
Chair of the LHCP2024
International Advisory
Committee

7 June 2024

Sarah Demers
Chair of the LHCP2024
Poster Award Committee



Who doesn't want to see their analysis have a second life by feeding into other searches and constraints? This clear poster tells an interesting story that not only highlights LHC measurements, but also pulls in direct detection dark matter experiments.

(Yoran's analysis is in green…)

LHCP2024 Poster Award

Yoran Yeh, University College London

For the poster entitled:

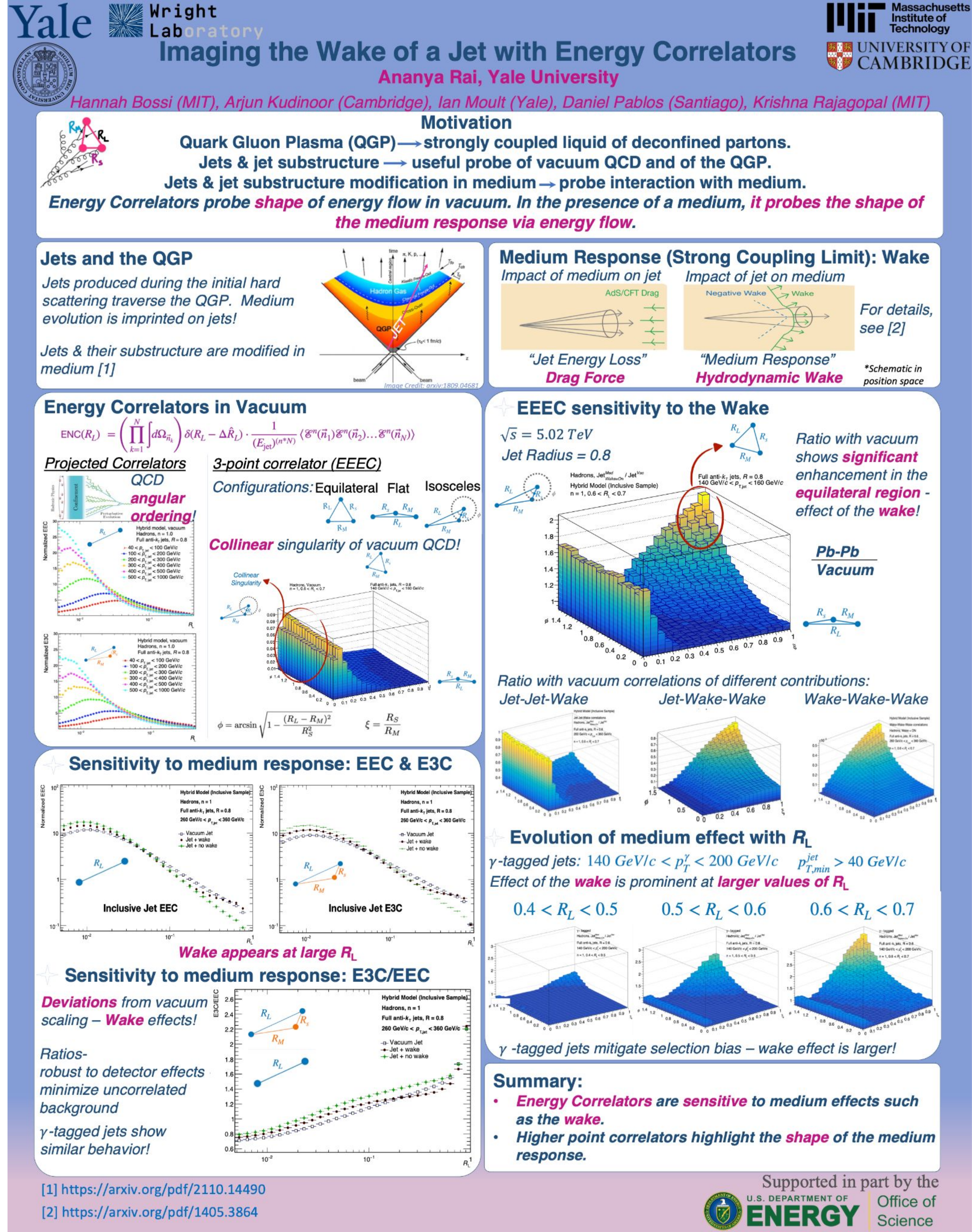
"Dark Matter from Anomaly Cancellation at the LHC"

Shahram Rahatlou
Chair of the LHCP2024
International Advisory
Committee

7 June 2024

Sarah Demers
Chair of the LHCP2024
Poster Award Committee

This poster’s display of the beauty and challenge of heavy ion collisions was expertly explained. A wonderful combination of theory and experiment!



LHCP2024 Poster Award

Ananya Rai, Yale University

IUPAP

For the poster entitled:

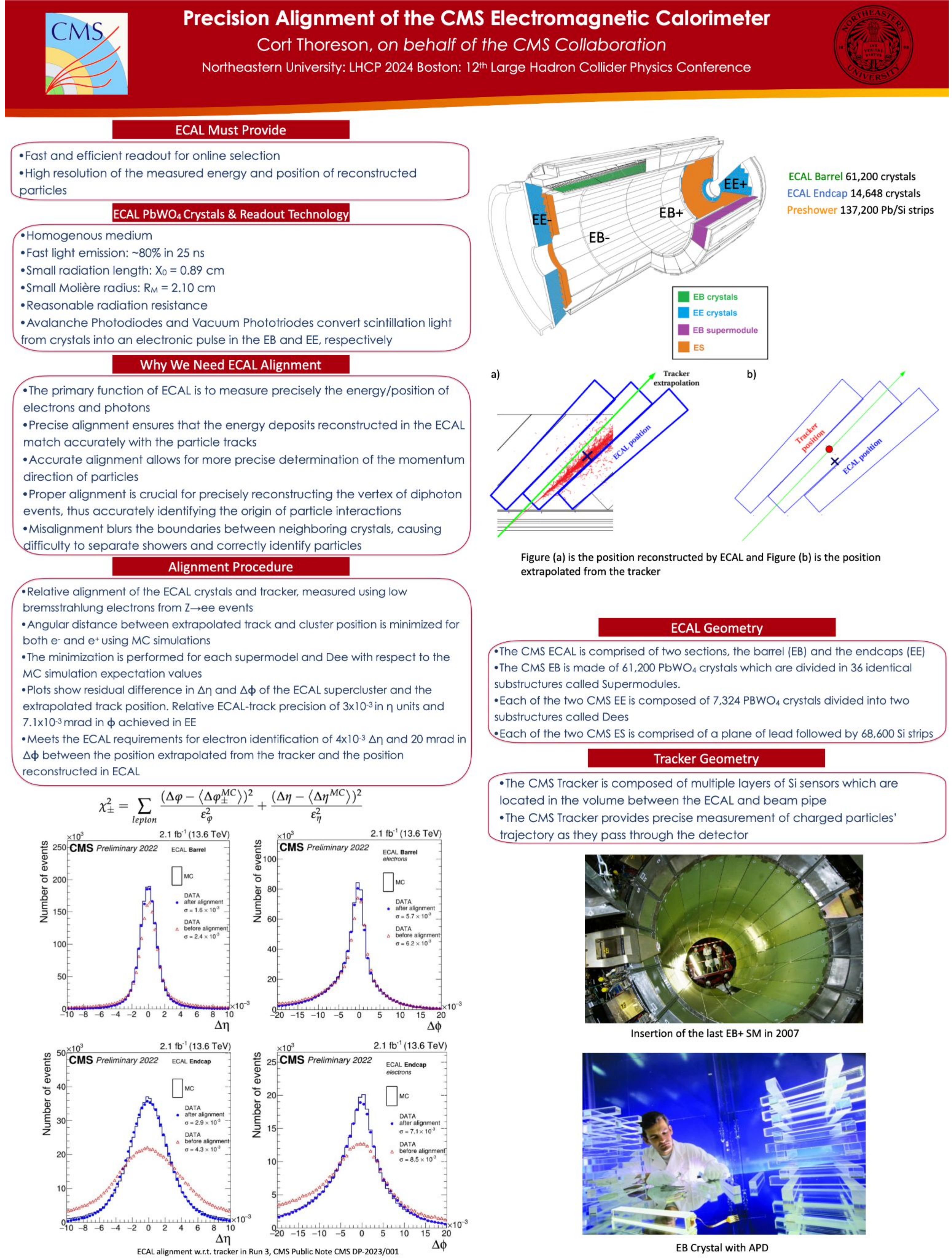
CERN

"Imaging the Wake of a Jet with Energy Correlators"

Shahram Rahatlou
Chair of the LHCP2024
International Advisory
Committee

7 June 2024

Sarah Demers
Chair of the LHCP2024
Poster Award Committee


Precision Alignment of the CMS Electromagnetic Calorimeter

Cort Thoreson, *on behalf of the CMS Collaboration*

Northeastern University: LHCP 2024 Boston: 12th Large Hadron Collider Physics Conference

ECAL Must Provide

- Fast and efficient readout for online selection
- High resolution of the measured energy and position of reconstructed particles

ECAL $PbWO_4$ Crystals & Readout Technology

- Homogenous medium
- Fast light emission: ~80% in 25 ns
- Small radiation length: X_0 = 0.89 cm
- Small Molière radius: R_M = 2.10 cm
- Reasonable radiation resistance
- Avalanche Photodiodes and Vacuum Phototriodes convert scintillation light from crystals into an electronic pulse in the EB and EE, respectively

Why We Need ECAL Alignment

- The primary function of ECAL is to measure precisely the energy/position of electrons and photons
- Precise alignment ensures that the energy deposits reconstructed in the ECAL match accurately with the particle tracks
- Accurate alignment allows for more precise determination of the momentum direction of particles
- Proper alignment is crucial for precisely reconstructing the vertex of diphoton events, thus accurately identifying the origin of particle interactions
- Misalignment blurs the boundaries between neighboring crystals, causing difficulty to separate showers and correctly identify particles

Alignment Procedure

- Relative alignment of the ECAL crystals and tracker, measured using low bremsstrahlung electrons from Z→ee events
- Angular distance between extrapolated track and cluster position is minimized for both e- and e+ using MC simulations
- The minimization is performed for each supermodel and Dee with respect to the MC simulation expectation values
- Plots show residual difference in $\Delta\eta$ and $\Delta\phi$ of the ECAL supercluster and the extrapolated track position. Relative ECAL-track precision of $3x10^{-3}$ in η units and $7.1x10^{-3}$ mrad in ϕ achieved in EE
- Meets the ECAL requirements for electron identification of $4x10^{-3}$ $\Delta\eta$ and 20 mrad in $\Delta\phi$ between the position extrapolated from the tracker and the position reconstructed in ECAL

$$\chi^2_\pm = \sum_{lepton} \frac{(\Delta\varphi - \langle\Delta\varphi^{MC}_\pm\rangle)^2}{\epsilon^2_\varphi} + \frac{(\Delta\eta - \langle\Delta\eta^{MC}\rangle)^2}{\epsilon^2_\eta}$$

ECAL alignment w.r.t. tracker in Run 3, CMS Public Note CMS DP-2023/001

ECAL Barrel 61,200 crystals
ECAL Endcap 14,648 crystals
Preshower 137,200 Pb/Si strips

Figure (a) is the position reconstructed by ECAL and Figure (b) is the position extrapolated from the tracker

ECAL Geometry

- The CMS ECAL is comprised of two sections, the barrel (EB) and the endcaps (EE)
- The CMS EB is made of 61,200 $PbWO_4$ crystals which are divided in 36 identical substructures called Supermodules.
- Each of the two CMS EE is composed of 7,324 $PBWO_4$ crystals divided into two substructures called Dees
- Each of the two CMS ES is comprised of a plane of lead followed by 68,600 Si strips

Tracker Geometry

- The CMS Tracker is composed of multiple layers of Si sensors which are located in the volume between the ECAL and beam pipe
- The CMS Tracker provides precise measurement of charged particles' trajectory as they pass through the detector

Insertion of the last EB+ SM in 2007

EB Crystal with APD

"Precision" and "Alignment", two words that are a personality litmus test, either striking fear or sparking excitement. Regardless, this kind of critical work lays the foundation for the kind of precision physics measurements that the LHC is becoming famous for.

LHCP2024 Poster Award

Cort Thoreson, Northeastern University

For the poster entitled:

"Precision Alignment of the CMS Electromagnetic Calorimeter"

Shahram Rahatlou
Chair of the LHCP2024
International Advisory
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7 June 2024

Sarah Demers
Chair of the LHCP2024
Poster Award Committee

To be uploaded!

The judge was so impressed with the energy and clarity of this presentation that they were still advocating for this poster to be chosen for an award even after it was… We are are excited about the LHCb SciFi upgrade!

LHCP2024 Poster Award

Carina Trippl, La Salle, Ramon Llull University

For the poster entitled:

"LHCb SciFi Tracker and Future Upgrades"

Shahram Rahatlou
Chair of the LHCP2024 International Advisory Committee

7 June 2024

Sarah Demers
Chair of the LHCP2024 Poster Award Committee