

# European Physical Society

The EPS High Energy and Particle Physics Division  
and the EPS HEP 2025 Conference award the

Poster Prize

to

***Ludivine Ceard***

*Creating a living archive of an active experiment: the CMS experience*

Thomas Strebler

Conference Chair

Cristinel Diaconu

Conference Chair

Fabio Maltoni

Chair

Marseille, France, 11 July 2025

**Creating a living archive of an active experiment: the CMS experience**

Ludivine Ceard (ludivine.ceard@gmail.com), Sofia Hurst (sofia.hurst@cern.ch), Nefeli Stathaki (nefeli.stathaki@cern.ch), Dave Barney (Dave.Barney@cern.ch) on behalf of the CMS Collaboration



**01 Benefits of Archives**

It is essential that we capture and maintain what is happening NOW at CMS in order to future-proof our history. CMS is truly an incredible experiment and we need to be able to look back on it and tell the exciting stories that made it up! For a collaboration of over 6000 people and 250 institutes spread around the globe, this is not an easy task! This is especially true now, when there is so much work being done for Hi-Lumi CMS!

**02 CCP Set Up**

Communications Contact Persons are selected across the different subsystems and areas of CMS. They:

- feed information about important milestones to the central communications team for articles, pictures, videos, timelapses etc
- encourage their subsystems to create and share footage with the communications team e.g. through dedicated comms sessions
- collect entries for the image of the month competitions

**03 Short vs Long Term**

Short term footage:

- Social Media

Long term footage:

- CERN archive (CDS)
- Website cms.cern or
- Newsletter
- CMS Photobook



**04 Timelapses**

Making sure key constructions and deliveries come to life



**05 Milestones**

Captured by the Comms Team in articles, blogs, photos, and videos.



**06 Images of the Month**

IoM competitions involve our online audience and also gives direct visibility to individuals, institutes, and funding agencies



**COMMUNICATIONS CONTACT PERSONS (CCP)**



The chart shows the following connections:

- CCP: Ece Asilar (HGAL), Ludivine Ceard (Tracker), Alessandro Lapertosa (TC), Tristan Loiseau (PPS), Cristina Huesca (DAQ), Roberto Perruzzi (HCAL), Beatrice Bressan (ECAL), Deniz Sunar Cercl (MTD), Adi Bornheim (L1 Trigger), Alexandre Zabi (BRIL), Andres Delannoy (OBC), TBC, Andrea Masironi (Run Coordination), Cecilia Uribe Estrada (Muons).



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**Pierluigi Fedeli**

*Enhancing Proton Extraction for the Mu2e Experiment*

Thomas Strebler

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Fabio Maltoni

Conference Chair

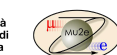
Conference Chair

Chair

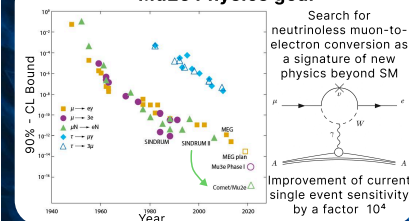
Marseille, France, 11 July 2025

## ENHANCING PROTON EXTRACTION FOR THE MU2E EXPERIMENT

Pierluigi Fedeli  
(University and INFN of Ferrara)  
On behalf of the Mu2e Collaboration



### Mu2e Physics goal



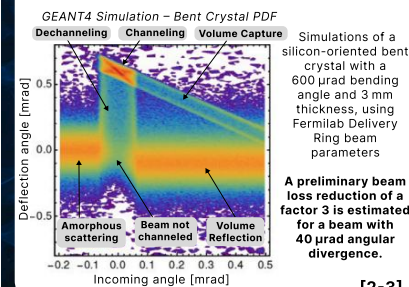
### Mu2e requirements

1. High statistics: highest intensity muon beam in the world
  2. High background rejection: **pulsed proton beam structure to reject Radiative Pion Capture**
  3. High detector precision
- The pulsed proton beam is extracted via resonant extraction. **Issue:** a fraction of the beam interacts with the septum material, causing about 1.5% of beam losses and unwanted radiation damage. [1]

### Septum shadowing with bent crystals

1. **Channeling:** particles aligned with atomic planes are bound to oscillate in the atomic potential well. Channeling works very well with **positively charged** particles such as protons.
  2. In a **bent crystal** channeled particles **follow the curvature** of the lattice plane which acts as a sort of wave-guide.
  3. Idea: implement an optimized bent crystal upstream of the electrostatic septum to **reduce particle loss**.
  4. A large steering power can be obtained in **few millimeters of crystal**, equivalent to that of **hundreds of Tesla** magnetic dipole. This technology is already implemented into LHC.
- | Energy (GeV) | Deflection (μrad) | Size (mm) | Equivalent dipole (T) |
|--------------|-------------------|-----------|-----------------------|
| 4500         | 50                | 4         | 271                   |
| 8            | 300-600           | 3         | 2.65-5.30             |
| 8            | 300-600           | 2         | 4-8                   |
- [2]

### Simulations



### Silicon bent crystal realization

1. **Cutting**  
Parallelepiped-shaped samples were obtained with micrometric precision using dicing blades bonded with micro-diamonds.
  2. **Crystal bending scheme**  
A holder forces the crystal into arched position. A very uniform secondary antistatic curvature appear as elastic reaction of silicon.
  3. **Curvature characterization**  
A 2D measure of surface profile is achieved with nanometric precision with interferometric profilometer.
  4. **Torsion Characterization**  
Torsion <10 μrad/mm is required for good steering efficiency. The optical characterization estimates ~5 μrad/mm.
5. First beam test scheduled in August 2025 at CERN H8

### References:

- [1] Mu2e Collaboration, Universe 2023, 9(1), 54.  
DOI: 10.3390/universe9010054  
[2] V. Nagaslaev, et al., Nucl. Instr. Meth. A, 1058 (2024) 168892.  
DOI: 10.1016/j.nima.2023.168892  
[3] S. Miscetti, et al., Nucl. Instr. Meth. A, 1073 (2025) 170257.  
DOI: 10.1016/j.nima.2025.170257

Discover more!  
Scan the QR code or join my  
parallel talk at EPS-HEP:  
10 July 2025 - 08:30  
Session T13





## Poster Prize

to

***Duc Minh Hoang***

# Advancing the CMS Level-1 Trigger: Jet Tagging with DeepSets at the HL-LHC

## Conference Chair

## Conference Chair

Marseille, France, 11 July 2025

Chair

Duc Hoang, Chris Brown, Stella Schaefer, Sebastian Wuchterl, Sioni Summers, Philip Harris.



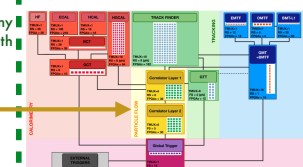
At the **Large Hadron Collider** — (LHC), galaxies of protons collide **40 millions times per second.**

- Identifying jets in real time at data rates of roughly **Petabit/s** is a crucial task at the LHC.

- Successful jet identification allows scientists to **reconstruct collisions** and probe the **fundamental physics** behind them.

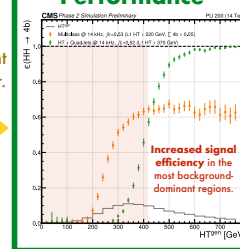
CMS Detector	Level 1
O(Pb/s) data rate	trigger

- A farm of **500 FPGAs** will receive data from the detector

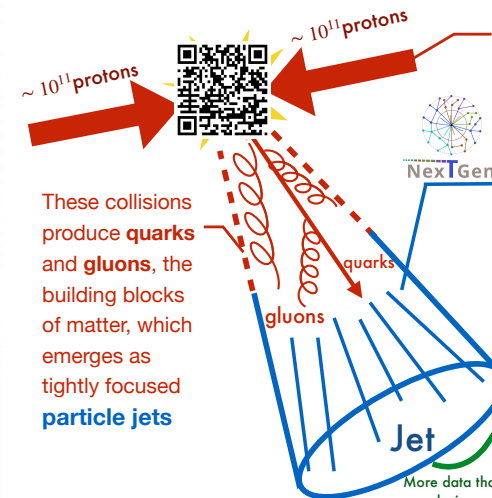


- The system have a  $12.5 \mu s$  time
- window to process an event.

### Increased Physics Performance



**Yes/No?**



## Real-time Machine Learning

