Beamline for Schools

More than a decade of dreams, teens, teams, screams, and beams

Powered by CERN and DESY!

EPS HEP
Marseille, France
July 7-11 2025

What is BL4S?

It is a **worldwide competition** for high-school students **(≥ 16 years old)**.

Teams (**min. 5, max. 9 people**) of high school students propose an experiment that they want to perform at a particle accelerator.

Each teams is led by an adult the "**team's coach**"

Prizes 2025

Five winning teams, invited to CERN, DESY and Bonn/ELSA

Award for the best video proposal: BL4S t-shirts and DIY cloud chamber – **3 teams**

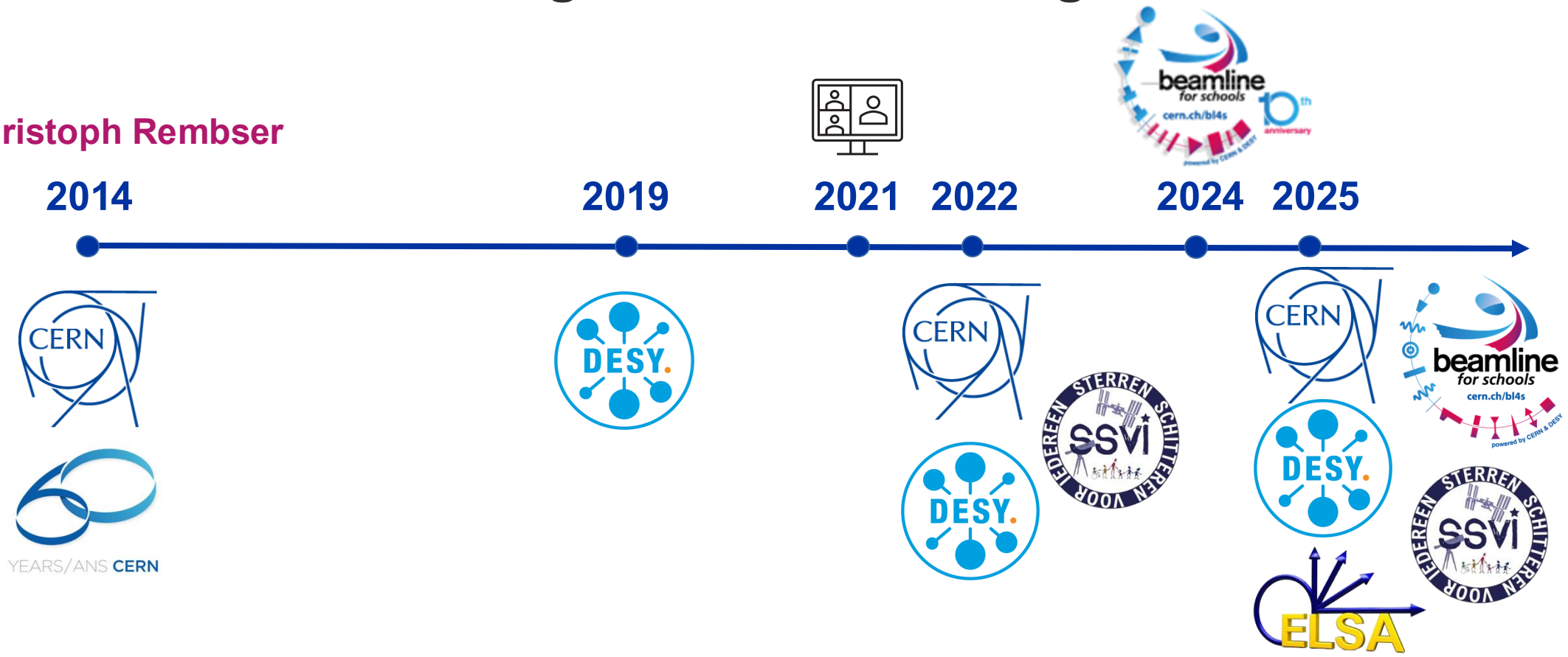
Award for the best outreach proposals: BL4S t-shirts and telescopes (sponsored by the Belgian project "Stars Shine For Everyone") – **15 teams**

Shortlisted teams: BL4S t-shirts and DIY cloud chamber and beta/gamma detector – **50 teams**

Milestones

New facilities, increasing number of winning teams,…

Christoph Rembser



Students' motivation

“We want to go beyond the classroom and do real science with our own hands.”

“We’re not just curious about science, we want to use it to solve real-world problems.”

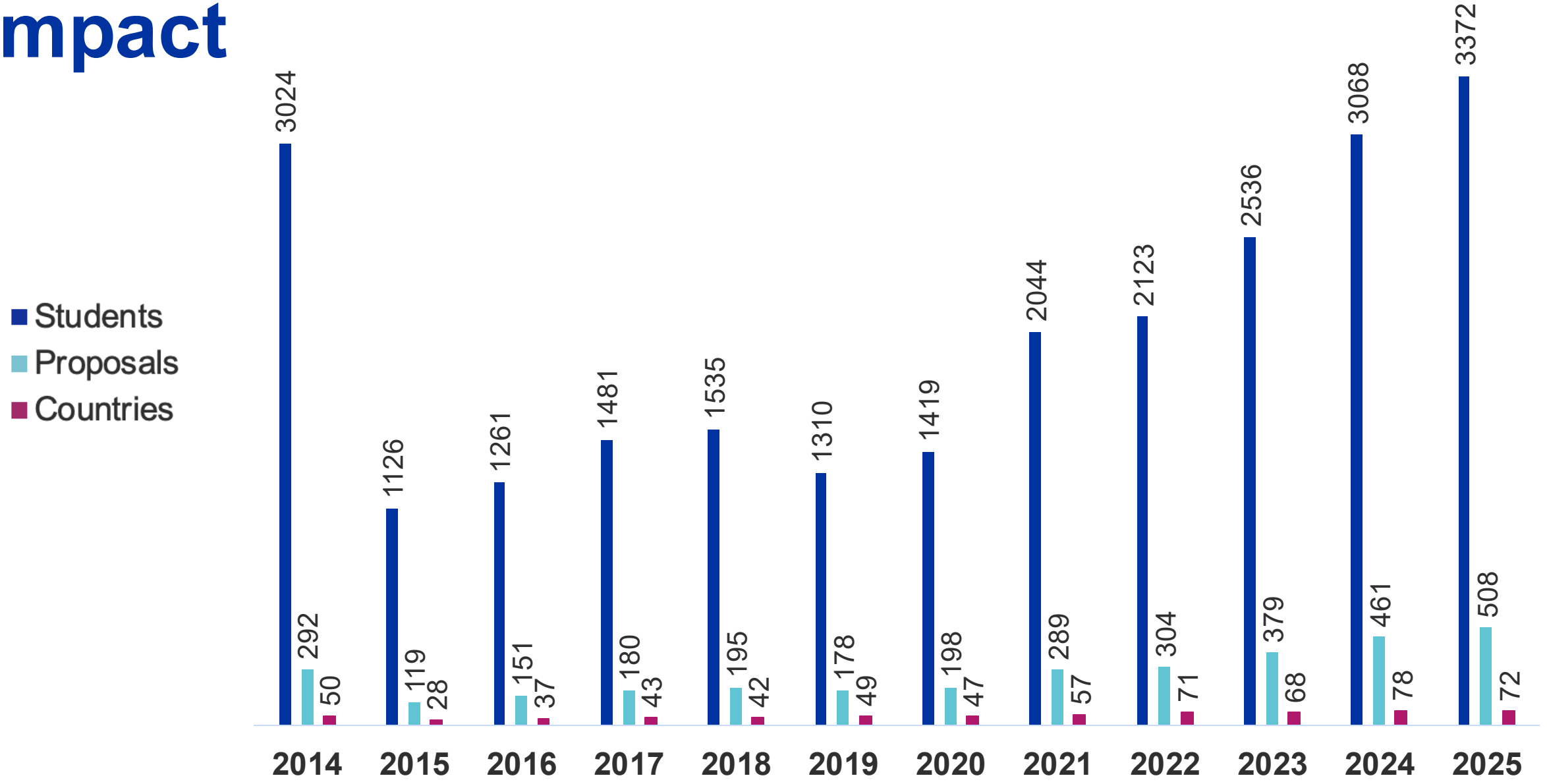
“It's not just about winning, it's about discovering what we're capable of.”

“We wanted to take what we learned in books and apply it in a meaningful, tangible way.”

“Working on this proposal made us feel like real scientists, not just students.”

“We’re driven by the idea that science can help improve society.”

Impact


Students
Proposals
Countries
3024
292
50
1126
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195
42
1310
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2014
2015
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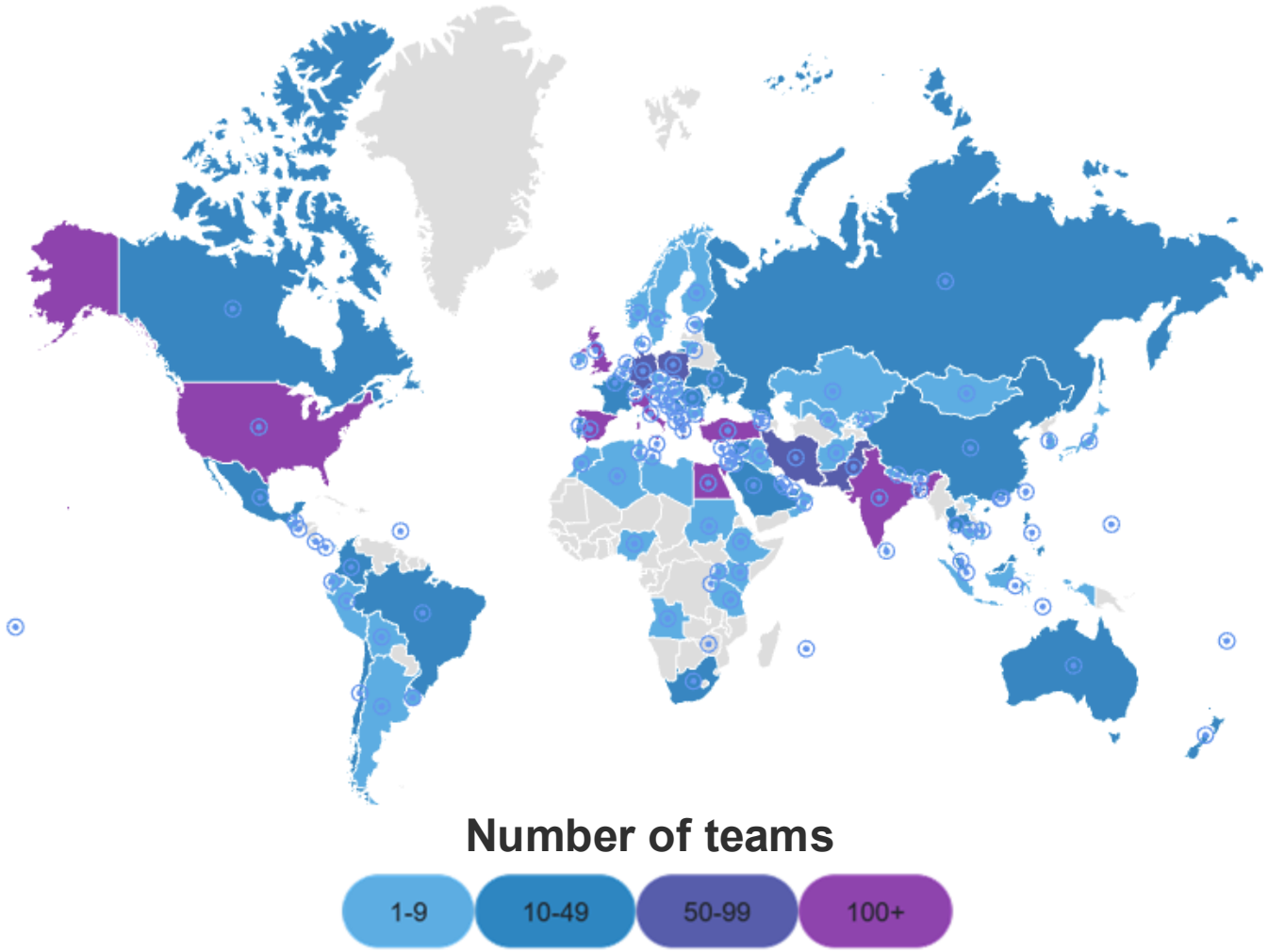
2025

Countries participating in BL4S since 2014



Winning teams

America:

Canada (x2), Mexico (x2), USA (x4)

Africa:

Egypt, South Africa

Asia:

India, Japan, Pakistan, Philippines

Asia-Europe: Türkiye

Europe:

Belgium, Estonia, France, Germany, Great Brittain, Greece, Italy (x3), Netherlands (x3), Poland, Spain, Switzerland

Past Experiments (Proposal / Realization)

2023 – Myriad Magnets, USA. Design of a versatile Halbach magnet

Excessive energy usage is a major contributor to climate change, a pressing world issue. Electromagnets used at accelerator facilities can consume large quantities of energy – it is therefore worthwhile to investigate alternative technologies that provide the same capabilities

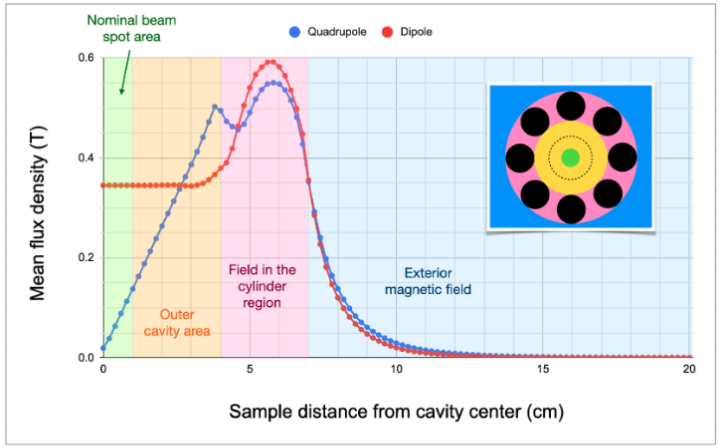
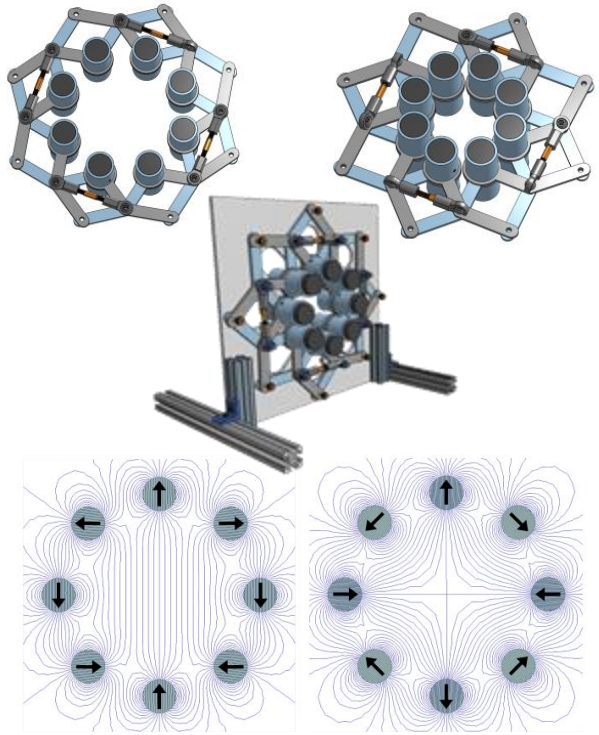


Figure 5: Mean flux density at a given radial sample distance from the cavity center for dipole and quadrupole configurations with $d = 5.5$ cm. As shown by the dotted black line in the top right diagram, the mean flux density at a given radial distance is found by uniformly sampling points around a circular ring and averaging the flux density. As seen in the blue region, the exterior flux density decreases to about 0.2 mT within 20 cm from the cavity center – this is a level considered safe for most electronic devices.



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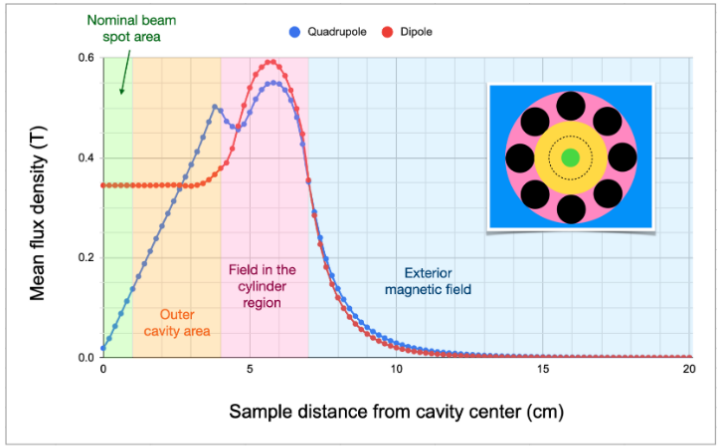

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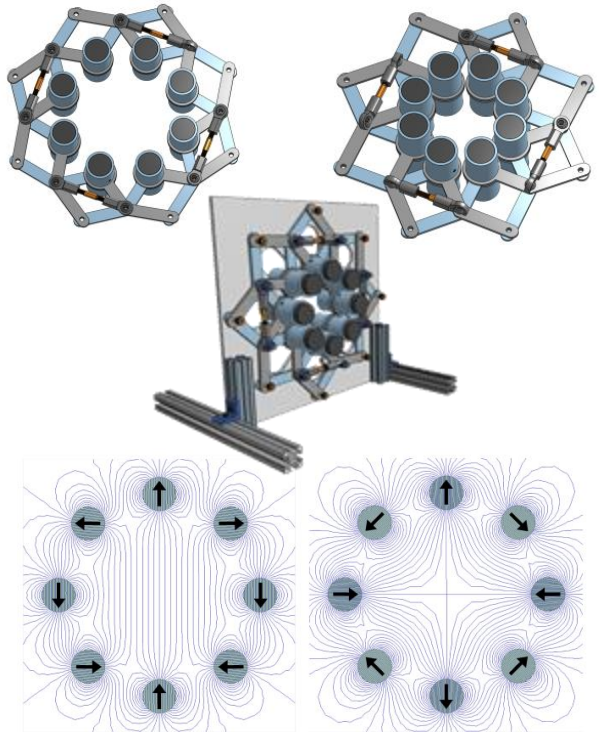
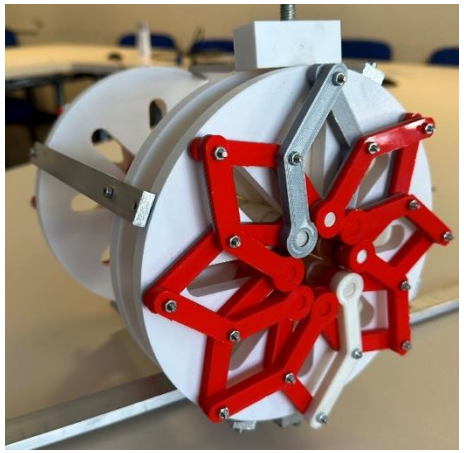
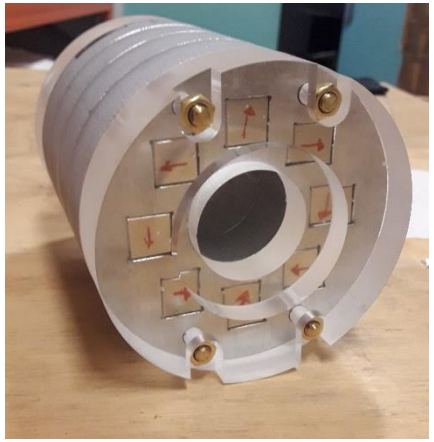


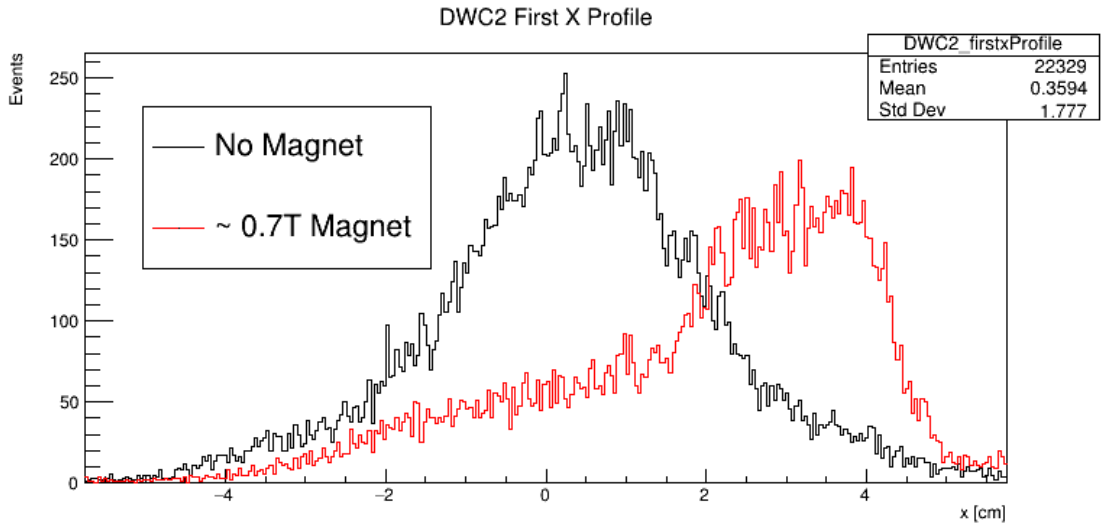


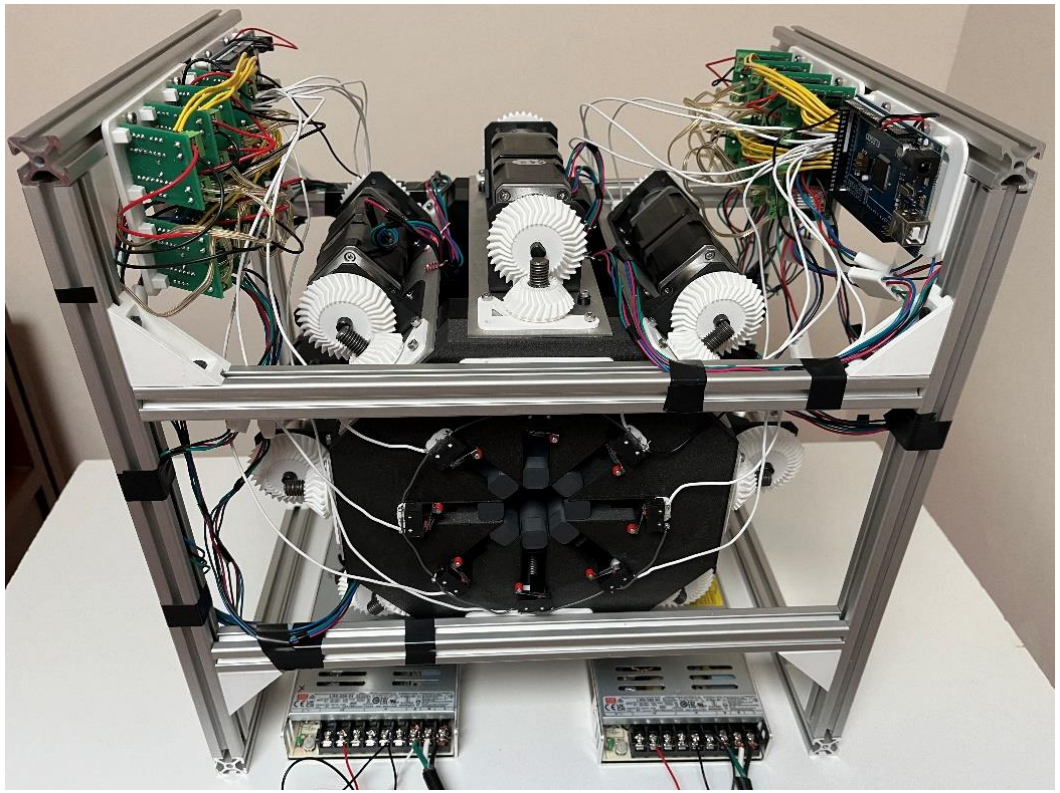


Past Experiments (Results / Publications)

- A 3D printed mangle with weaker magnets works fine
- Magnetic field measurements done in two dipole configurations

- Main Challenges:
  - Alignment of DWC and Magnet relative to the beam centroid
  - Noise and reflections in the DWC
  - Off-Centre particles scattering off the magnet structure





Past Experiments (Results / Publications)

2024: work in progress! At least, two new articles coming up.

2023

- Ruhrberg Estevez, S. et al. Cherenkov diffraction radiation emissions from single electrons and positrons on a fused silica radiator. Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 168287 (2023).
- Mazziotta, M. N. et al. The EXTRA-BL4S experiment for the measurement of the energy and angular distributions of transition radiation X-rays. JINST 18 P04017 (2023).

2022

- Boselli, M. et al. A Teacher's Perspective on the CERN Beamline for Schools Competition. The Phys. Educat. 04, 2250004 (2022).

2021

- Arce-Larreta, E. et al. Behind the Scenes: The Two-Weeks Stay of Beamline for Schools Winning Students at DESY. The Phys. Educat. 03, 2150001 (2021).

2020

- Chatterji, S. et al. A Highschooler's Guide to GeV-Range Electromagnetism. The Phys. Educat. 02, 2050013 (2020).
- McKarris, P. et al. CERN Beamline for Schools 2017 Student Experiment: Search for Isolated Fractionally Charged Particles. The Phys. Educat. 02, 2050007 (2020).
- Aretz, S., Beirão da Cruz e Silva, C., Joos, M., Schütze, P. & Stanitzki, M. An Overview of the CERN Beamline for Schools Competition. The Phys. Educat. 02, 2050001 (2020).

2018

- Broomfield, H. et al. Testing the validity of the Lorentz factor. Phys. Educ. 53, 055011 (2018).
- Gutowski, B. et al. The secret chambers in the Chephren pyramid. Phys. Educ. 53, 045011 (2018).

2016

- Biesot, L. et al. Building and testing a high school calorimeter at CERN. Phys. Educ. 51, 064002 (2016).

Support 2025

10 yrs
Bridging science and society
CERN & Society Foundation

WILHELM UND ELSE HERAEUS-STIFTUNG

ROLEX

Future challenges

- Access to beamline facilities (CERN, DESY and ELSA in Bonn)
- Outreach communities spreading the word about the competition
- National contacts
- Volunteers (proposal evlauation, data analysis, online events among many others)

Donate now and make the difference for the next generation of scientists

Support 2014-2025 (CERN, DESY, Bonn/ELSA)

Original idea: Christoph Rembser

Support Scientists

2014-2017:
Cenk Yıldız, Saime Gürbüz, Candan Dozen Altuntas, Tim Brooks, Theodoros Vafeiadis, Oskar Wyszynski, Alexander Hristov, Branislav Ristic, Ina Carli

2018-2021:
Gianfranco Morello, Cristovao Beirao Da Cruz E Silva, Paul Schütze

2022-2024:
Martin Schwinzerl, Berare Göktürk, Seyma Esen, Antoine Laudrain, Paul Malek

2025:
Berare Göktürk, Seyma Esen, Antoine Laudrain, Antonios Athanassiadis, Saime Gürbüz, Sebastian Laudage

Project Leaders

2014:
Christoph Rembser

2015-2016:
Markus Joos

2017-2020:
Sarah Aretz

2021-2023:
Margherita Boselli

2023-2025:
Sarah Zöchling

2025:
Jorge Andrés Villa Vélez

Volunteers

Jorgen Petersen
Louis Tremblet
Jean-Pierre Grootaerd

Members of the proposal evaluation
Data analysis
National contacts
High school teachers
Many colleagues at the institutes

Core team 2025

Dennis Proft, Klaus Desch, Marcel Stanitzki, Markus Joos, Sascha Schmeling


CERN
2014


CERN
2015


CERN
2016


CERN
2017


CERN
2018


CERN
2024


DESY.
2019


DESY.
2020
Beamline
for Schools


DESY.
2020

Thank you!

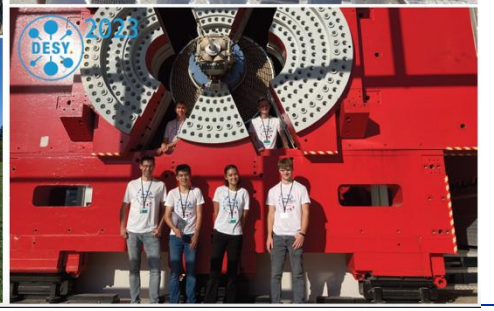

TECHNISCHER NOTDIENST
DESY.
2021

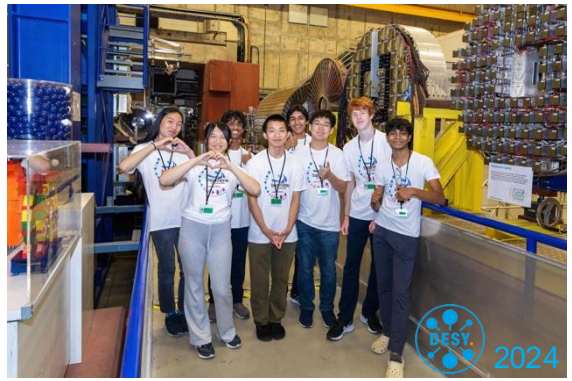

2023
CERN


CERN
2022


2022


DESY.
2022


DESY.
2023


DESY.
2024