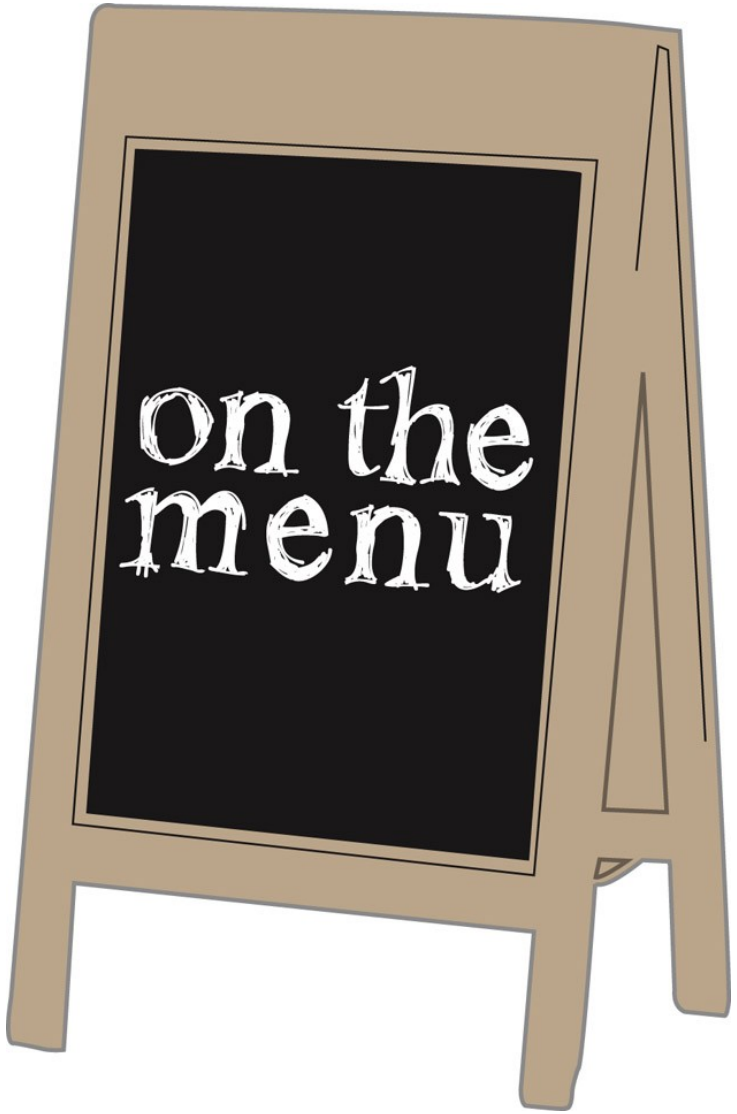
Beamline for Schools
A Physics competition for high-schools students

An online meeting with the BL4S team
23 March 2022

Overview of the competition ~ 20’

- Requirements to take part
- The test-beam facility
- The particle detectors

Q&A session ~35’

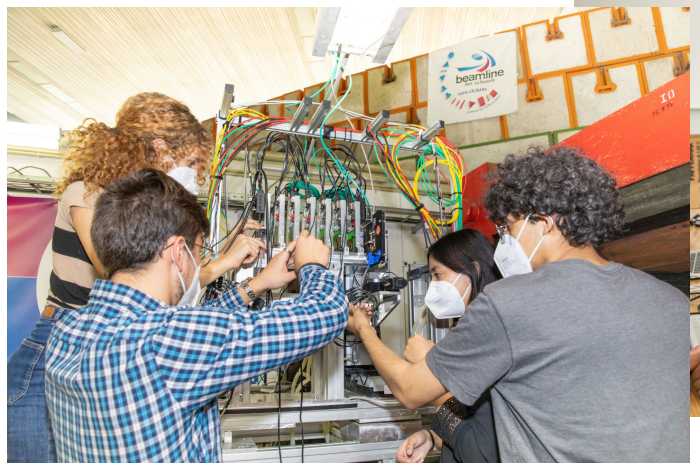


Beamline for Schools – About it

Teams of high-school students can propose an experiment to be performed at the testbeam facility of a particle accelerator.

It is a great opportunity to get in touch with the world of physics research.

You can interact with scientists from CERN and many other institutions around the world.



Practical information

- Teams: min 5, max 9 people, ≥ 16 years old (Sept. 2022).
- Enrolled in high-school in the school year 2021-2022.
- Each team has to be led by an adult, «coach », max 2.

Prizes:

- Two teams will be invited to CERN.
- Up to 30 teams included in the shortlist.
- Special award for the best video.
- 5 «physics outreach » awards offered by «Stars shine for everyone » (SSVI).
- Participation certificates for all participants.

Experiment proposal

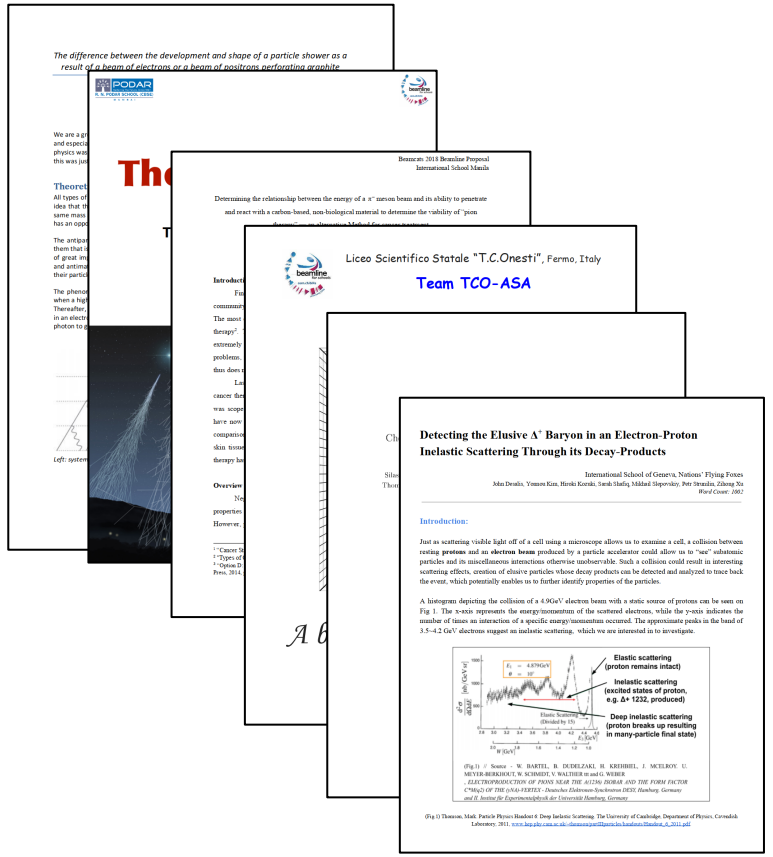
Written proposal (~1000 words):

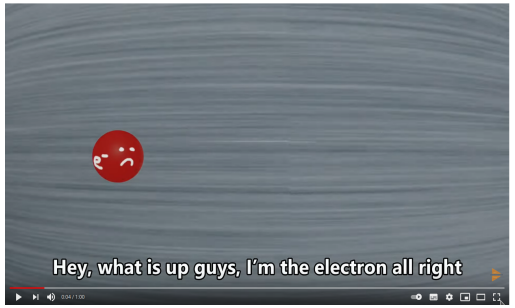
- Give us your motivation (~ 100 words)
- Detail how you would like to use the beam (~800 words)
- What you hope to take away from this experience (~100 words)

Realise a **creative video** to explain your idea. 1 minute, optional.

Deadline: April 15 2022!

Submit it here





Experiment proposal

Optional extension of the proposal:

Use ~100-200 extra words to describe an outreach/ education activity that you plan to organise for promoting science in an inclusive way!

Target audience: a part of your community usually less exposed to science.

We encourage to make good use of what you will learn through BL4S!

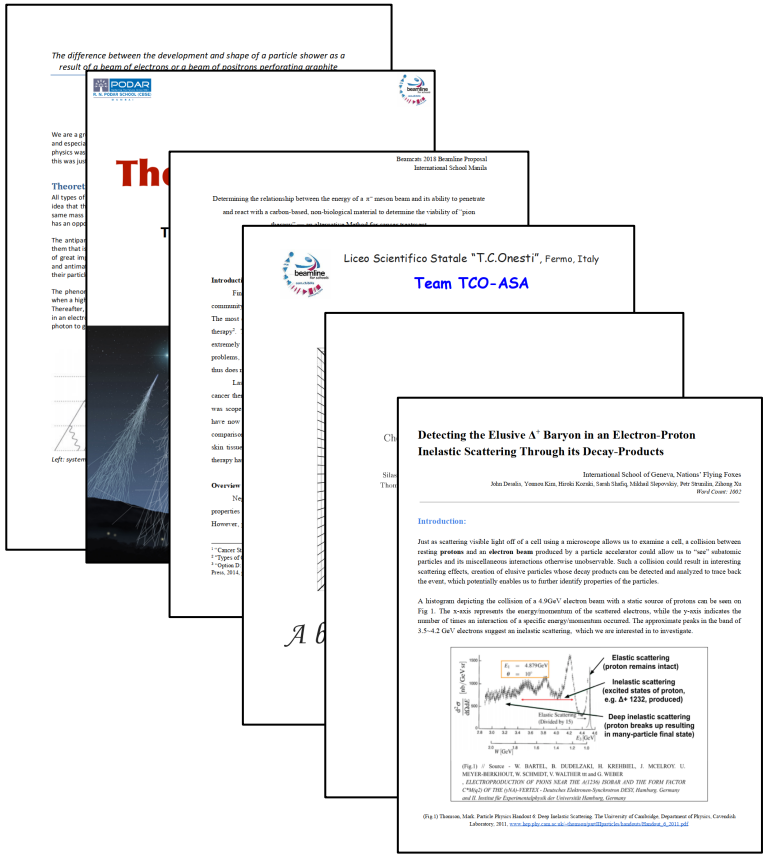
This extra proposal will give you access to the prizes offered by SSVI: optical telescopes.

Experiment proposal

The proposals will be evaluated by a committee of scientists.

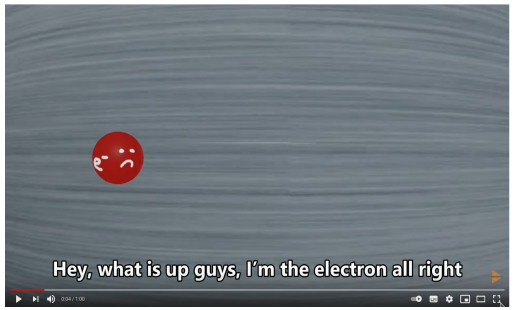
Evaluation Criteria:

- Feasibility of the experiment.
- Motivation of your experiment idea and your participation.
- Creativity of the experiment.
- Ability to follow the scientific method



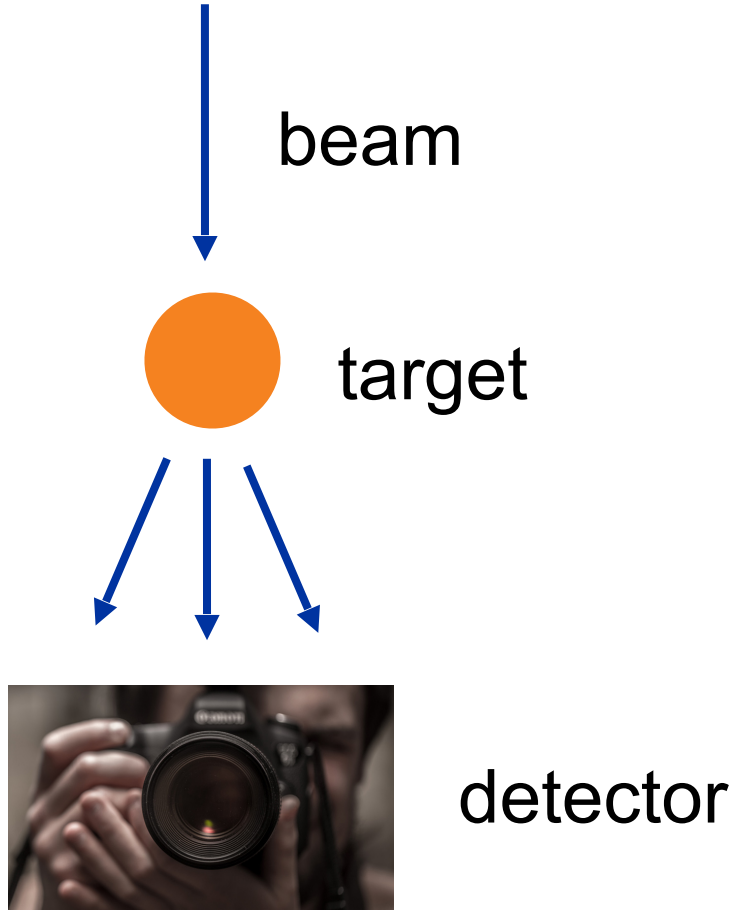
You are not alone!

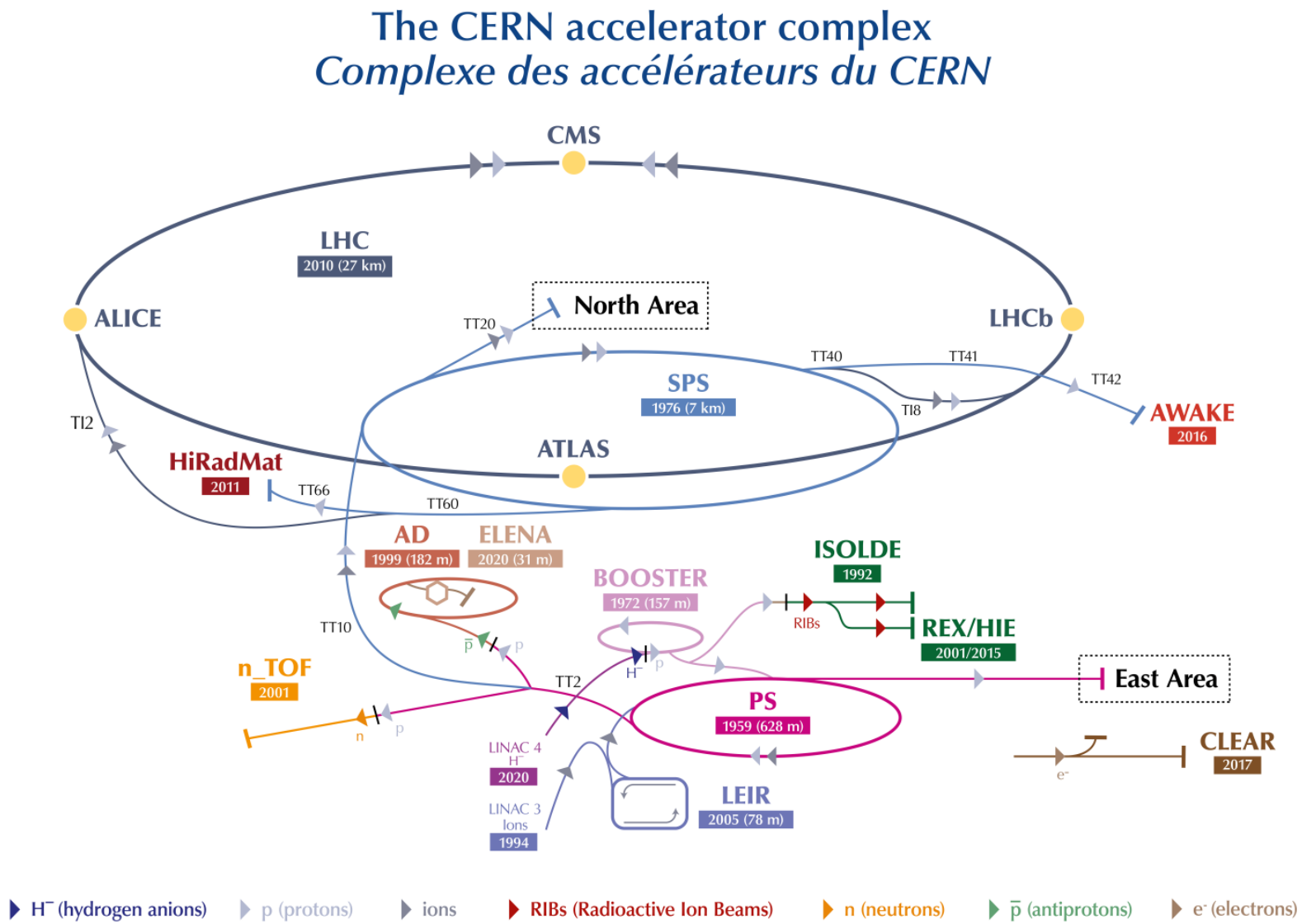
Get in touch with the national contacts or with us at : bl4s.team@cern.ch



Experiment requirements

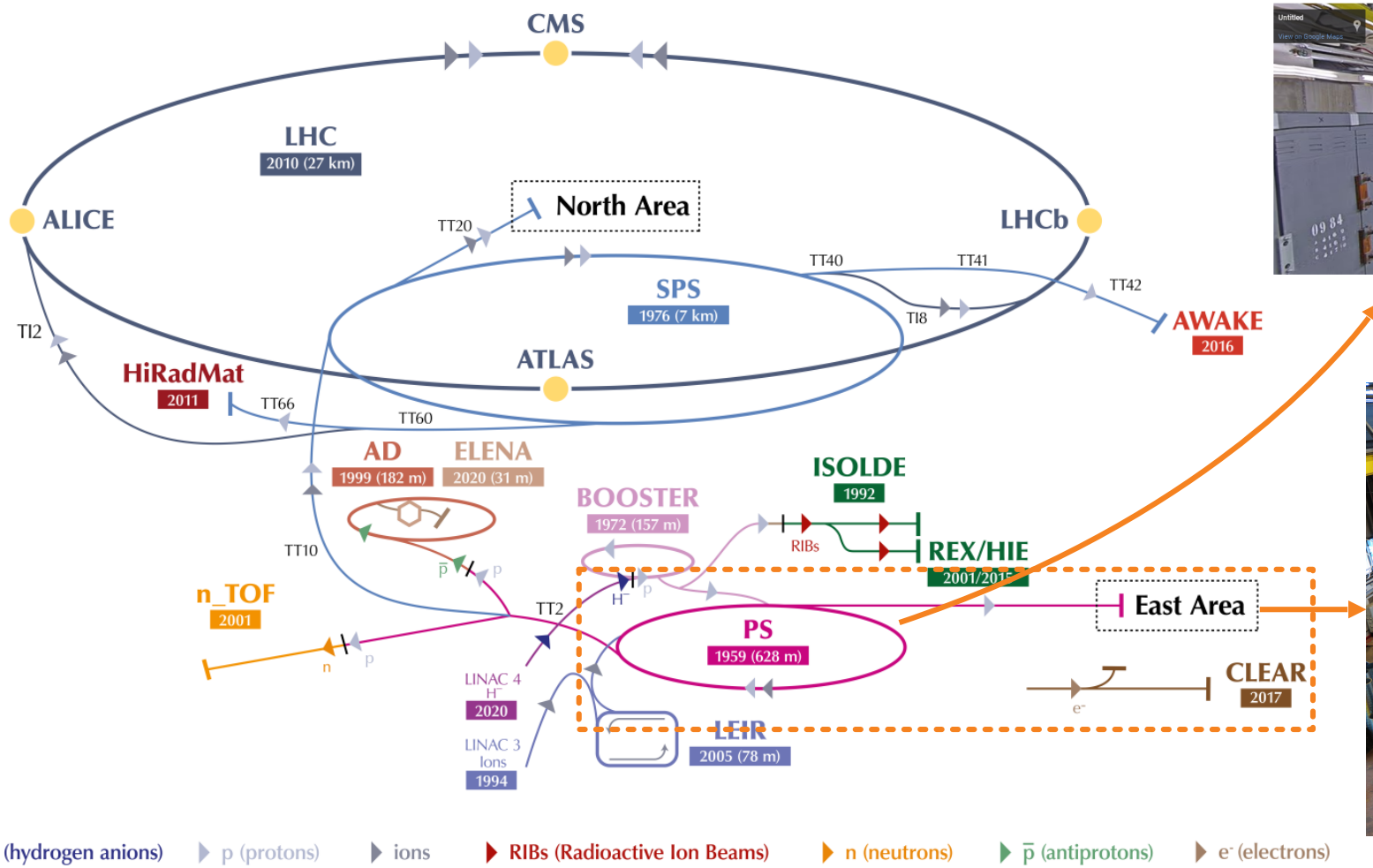
- The proposal has to be design for the test-beam facility of the CERN Proton Synchrotron accelerator.
- Fixed target configuration: particle beam crossing or passing close to a target (solid, liquid, gas).
- Experiment design:
  1. Beam
  2. Target
  3. Detectors
  4. Trigger/readout





- Particles are accelerated for different purposes.
- Different types of particles are available for fixed experiments (ATLAS, CMS, ALICE, LHCb, etc..) and for temporary users.
- BL4S winners are temporary users of the CERN beams.

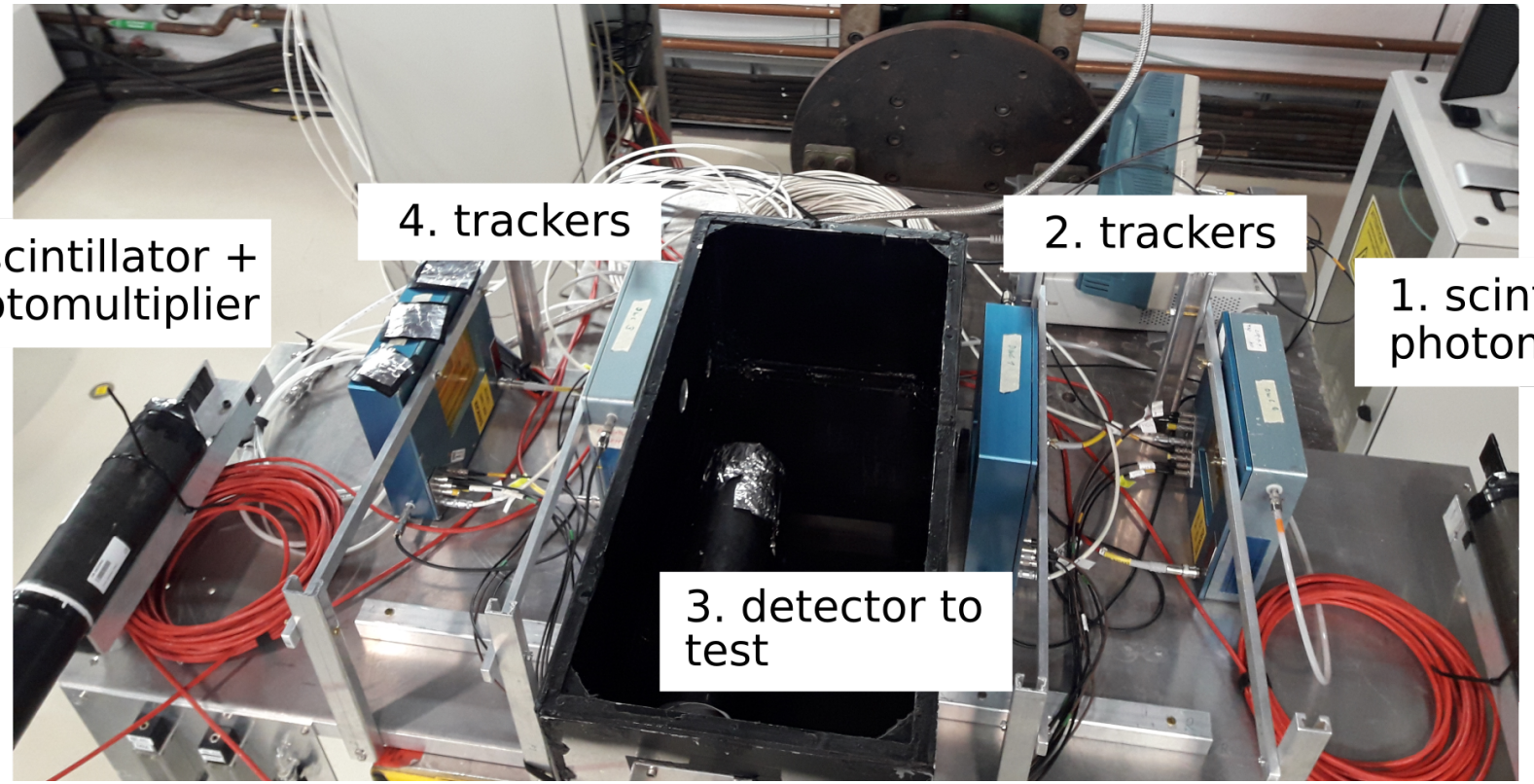
The CERN accelerator complex
Complexe des accélérateurs du CERN



T9 Beamline

- The beam is extracted in a dedicated room.
- It might look empty, but you will fill it with your experiments !

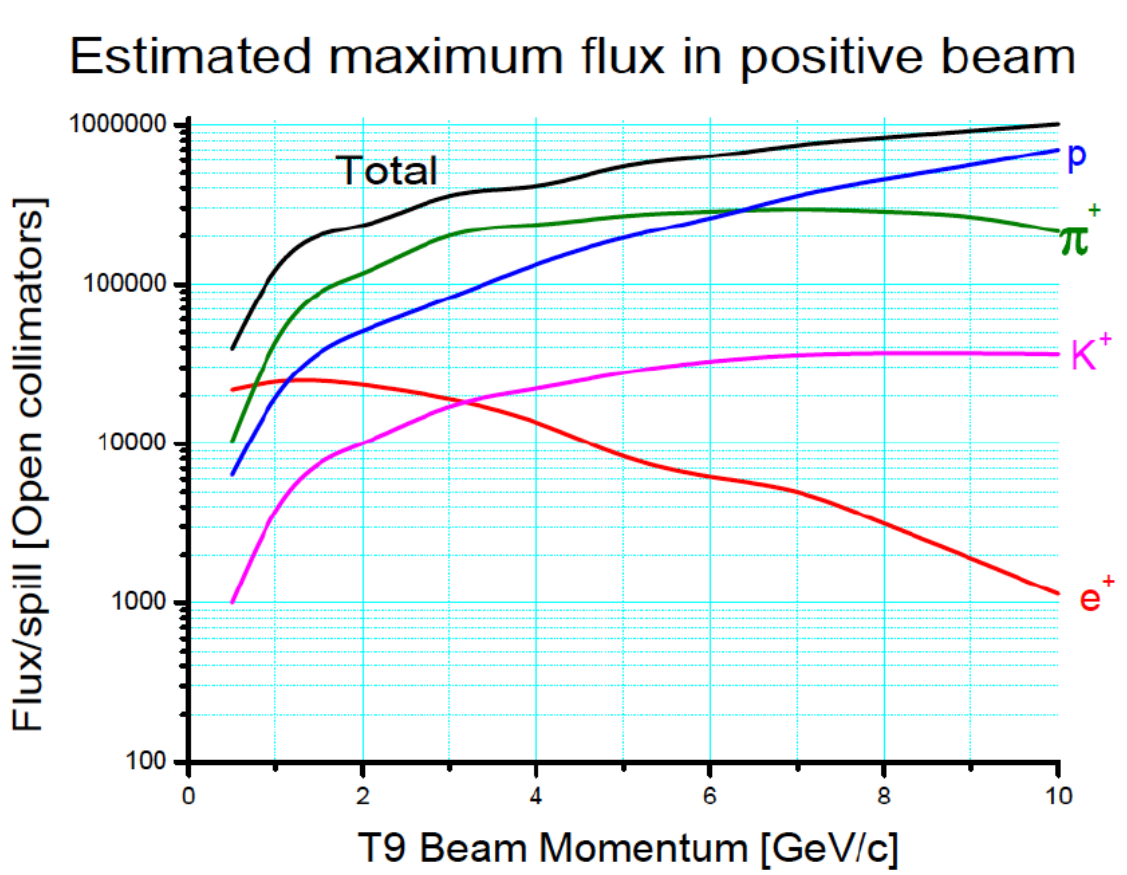
An experimental setup

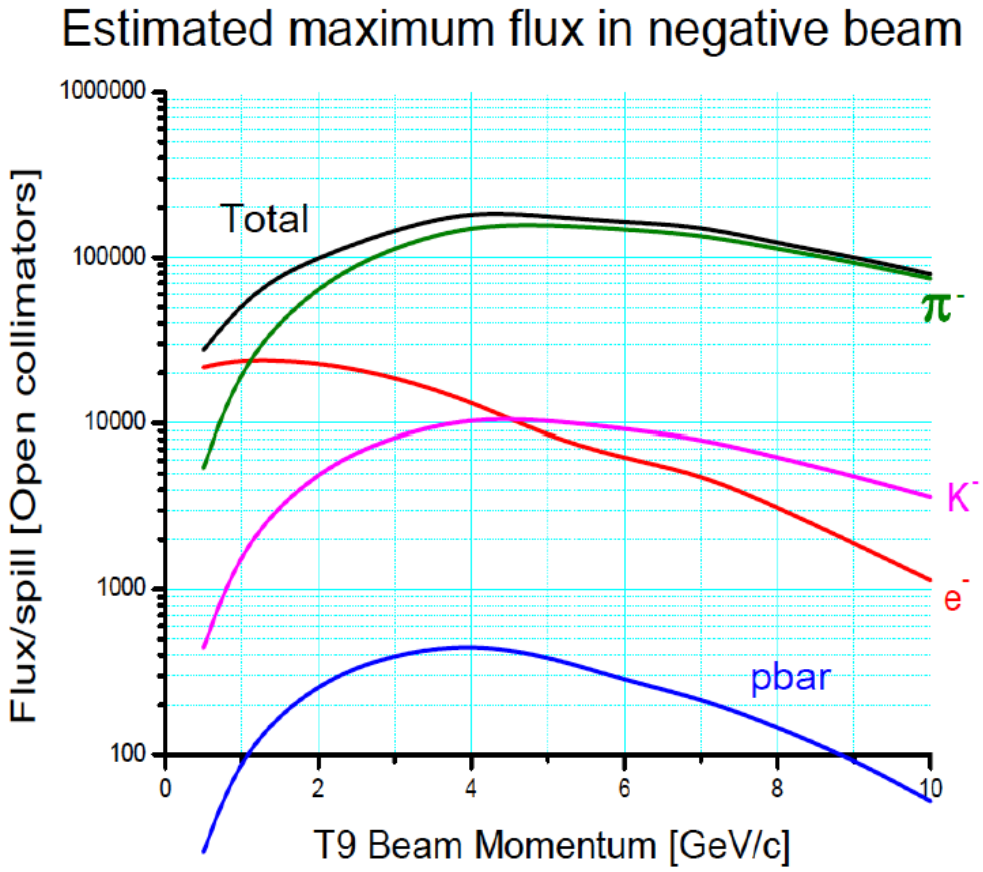


Beam properties

- The protons accelerated by the PS (up to 26 GeV) are smashed into a target.
- The debris resulting from this interaction form a beam of particles, «secondary beam », available for the users.
- The user can select the particle type (positive or negative), their energy, the opening of collimator.
- Beam-spot size: diameter of ~ 2 cm

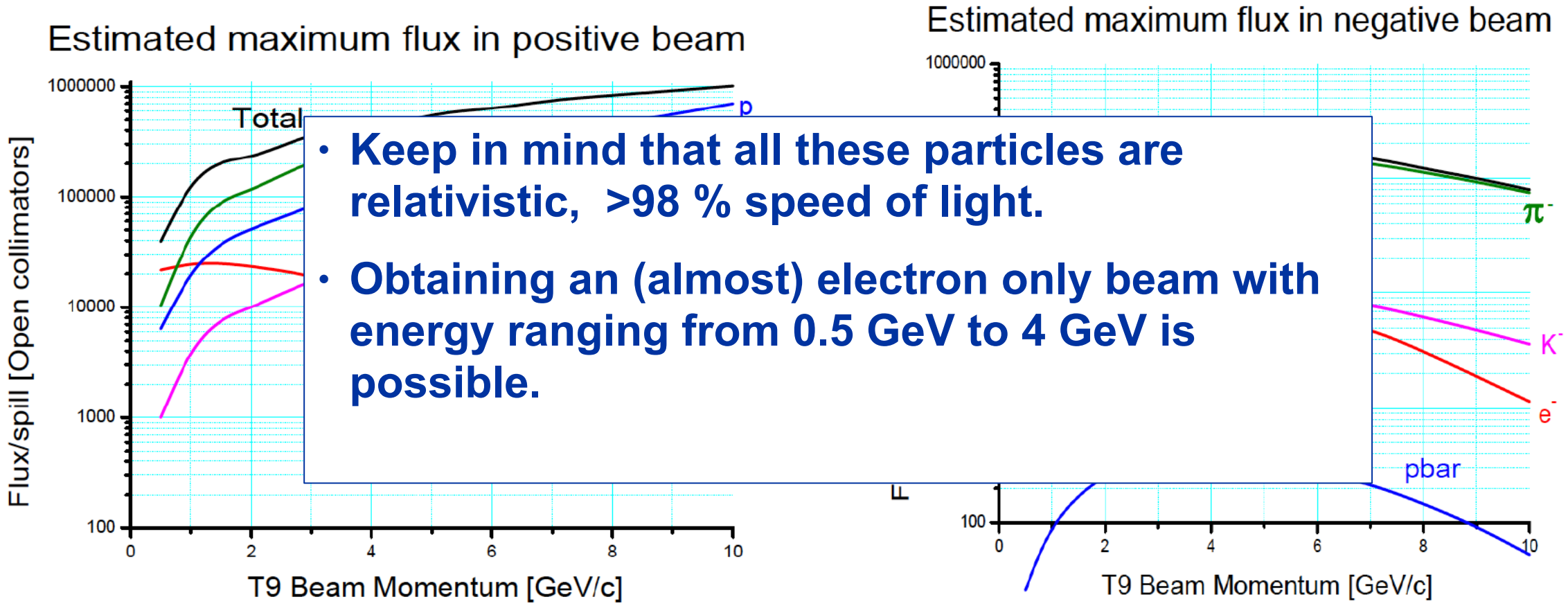
Beam properties





Protons and pions are the most abundant particles
Energy range : 0.2-15 GeV

Beam properties



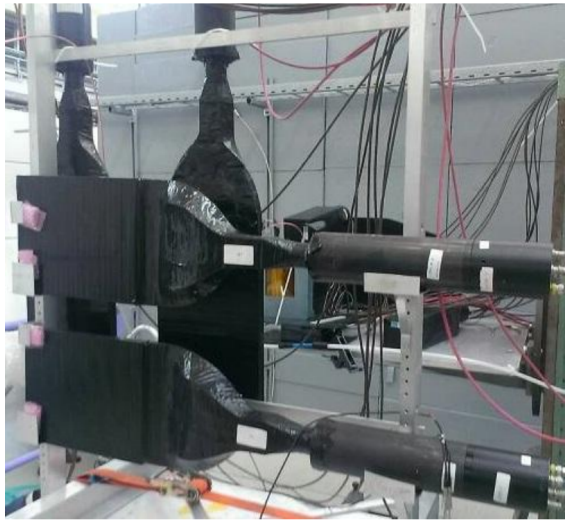
- **Keep in mind that all these particles are relativistic, >98 % speed of light.**
- **Obtaining an (almost) electron only beam with energy ranging from 0.5 GeV to 4 GeV is possible.**

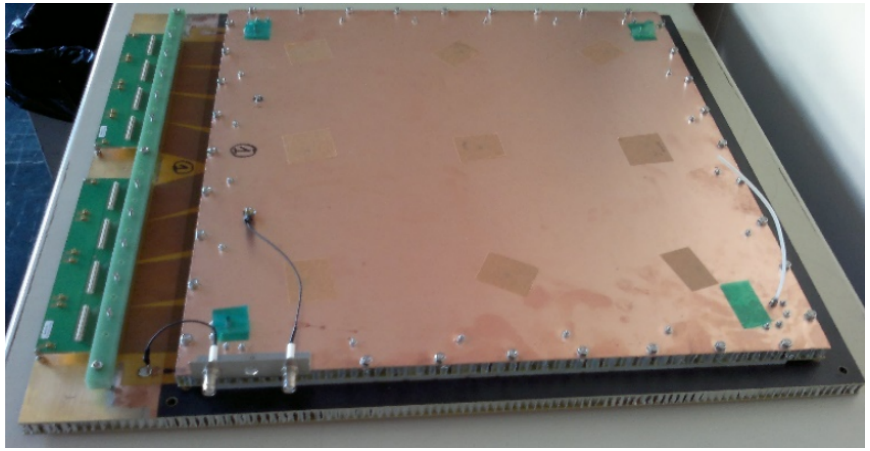
Detectors

- Different detectors are available for BL4S.
- The choice depends on the purpose of your experiment.
- Each detector has its own readout system.
- The data-acquisition systems controls all the detectors and the experiment (you don’t need to worry about that).

Detectors

- Scintillators + photomultipliers – particle counting, trigger, TOF measurements. At least 6 available.
- Delay Wire Chamber – 2D tracker – active area 10x10 cm, resolution 200-300 um.
- MicroMegas detectors – 1D tracker – 40x40 cm, resolution 200 um. 4 available
- Silicon pixel detectors – 2D tracker – 2x2 cm, resolution ~ um – contact us if interested.





Detectors

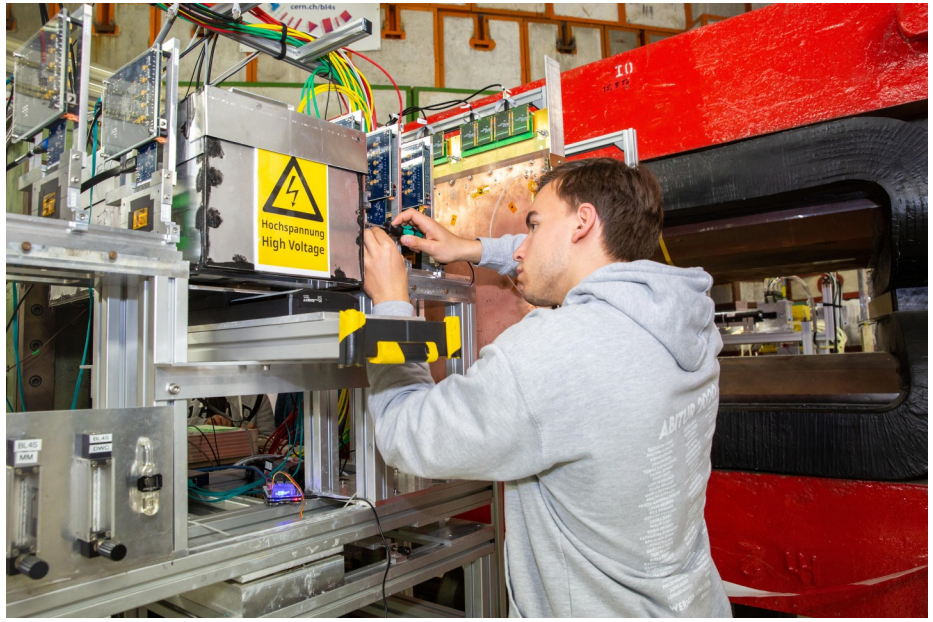
- Muti-gap resistive plate chambers (MRPC)-trackers – 30x30 cm, suitable for time of flight measurements (particle speed), time resolution 100 ps (10^{-10} s).
- Cherenkov detectors – gas detectors that can give information on the particle type.
- Lead crystal calorimeter – Energy of particles – 16 available, 10x10x37 cm.
- You are free to conceive and test your own detector!

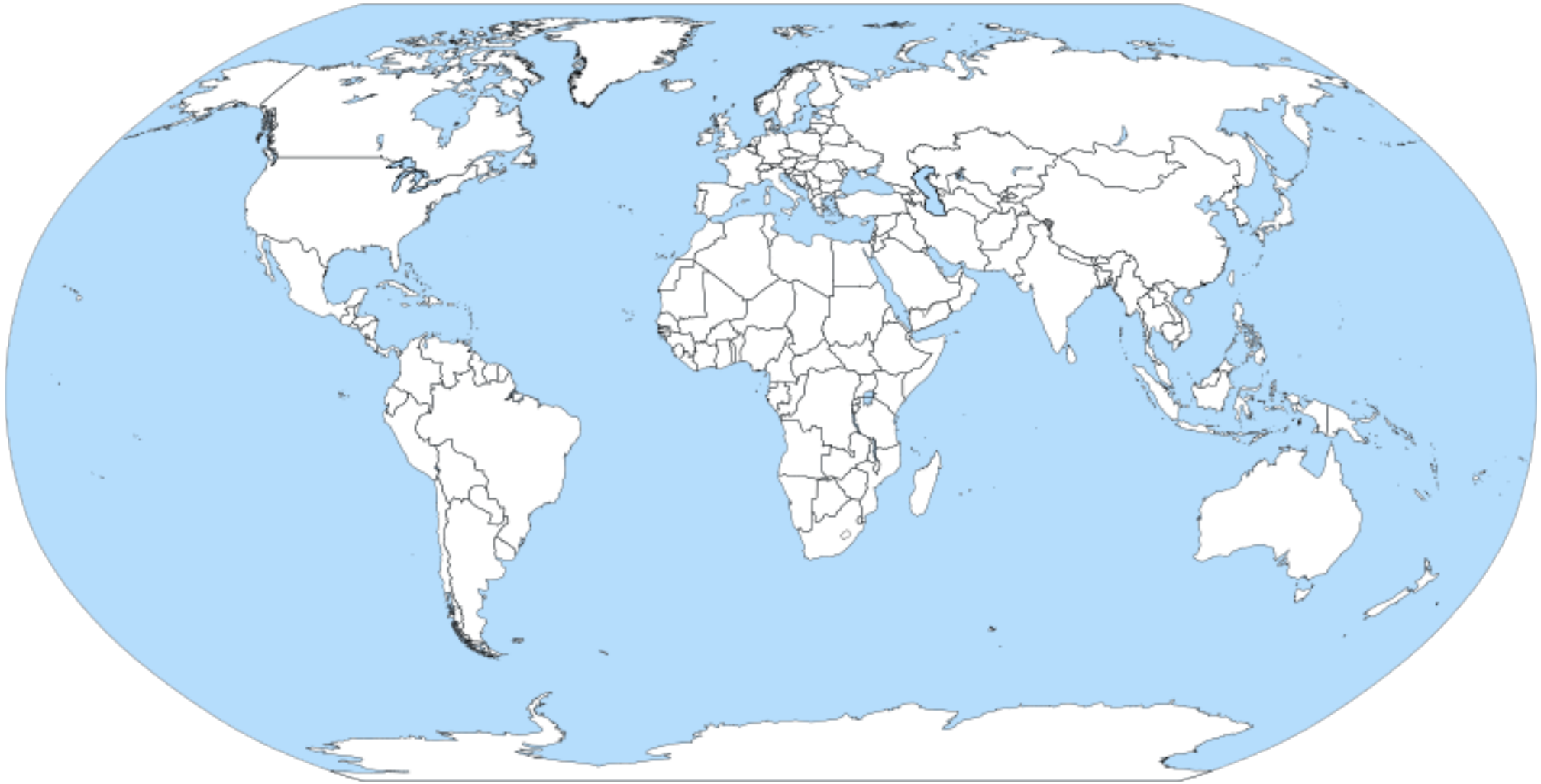
It’s time to build your experiments!

Beam &Detector Document

Example Experiments

Questions?





Beam properties

- Protons : uud
- When they interact with a target they can produce different particles, both elementary and not.
- Given the energy provided by the PS, one can have **electrons, muons and particles composed of u,d, and s quarks (pions and kaons)**.