CERN Summer 2024 Project:

R&D of Crystal-based EM calorimeter for precision particle energy measurements

Jessaly Zhu

28 May 2024

Calorimeters

In a dense material, primary particles will create showers of secondary particles.

2 Types of Showers:

Electromagnetic Showers

- Small
- well understood

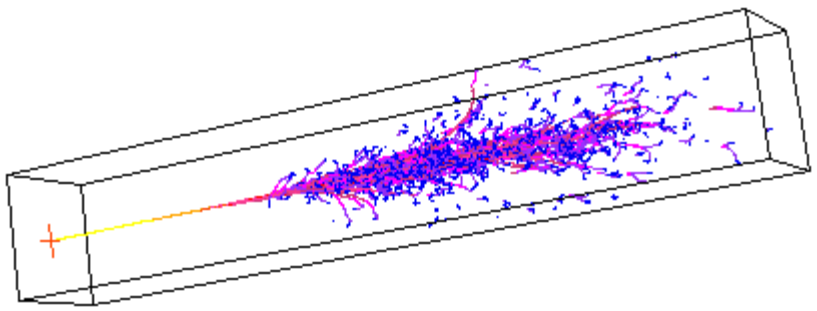


Image Source: https://www.mpp.mpg.de/~menke/elss/

Hadronic Showers

- strong force: complex and unpredictable
- “invisible” energy

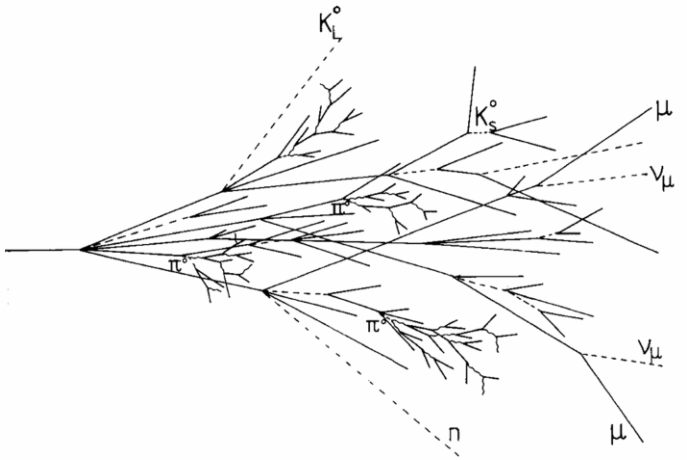


Image Source: https://www.fisgeo.unipg.it/~fiandrin/didattica_fisica/rivelatori1617/lez09_310317_riv1617.pdf

Scintillation and Cherenkov light

Scintillation light

- Dominant radiation

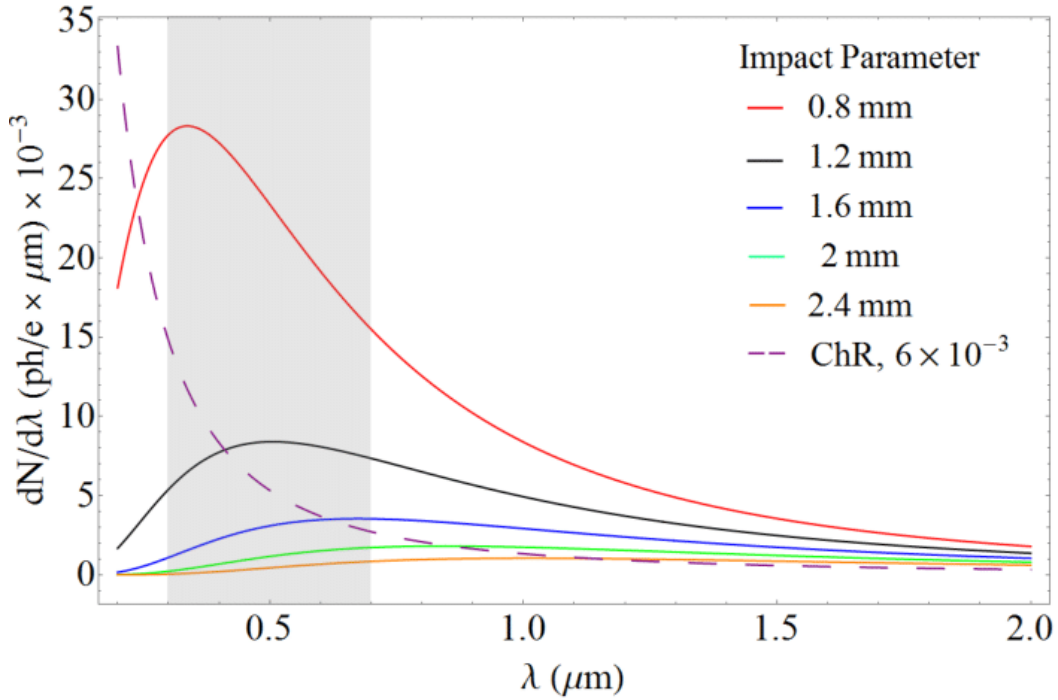
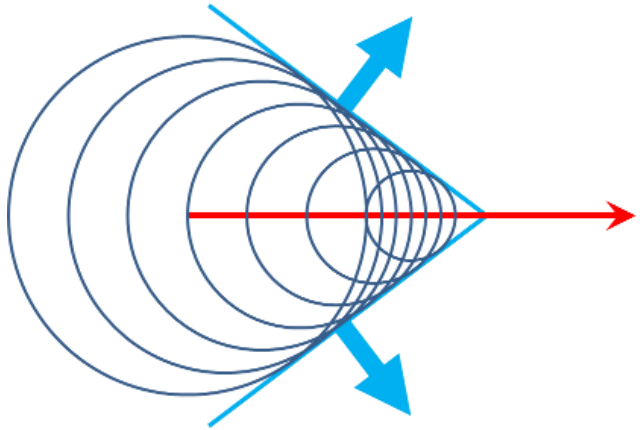


Image Source: https://www.researchgate.net/figure/Cherenkov-diffraction-photon-spectrum-from-a-53-GeV-positron-propagating-at-impact_fig2_326752664

Cherenkov light

- Produced when particle is traveling faster than the speed of light in the medium



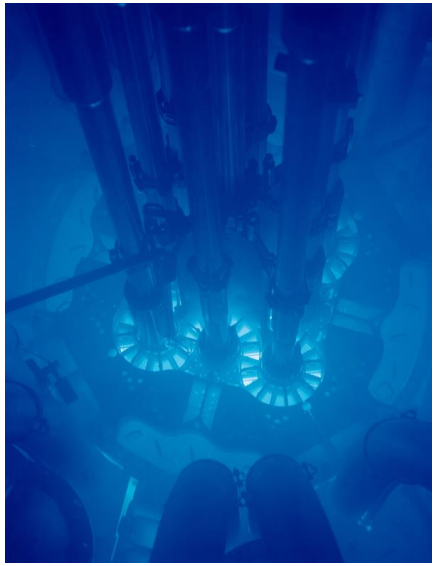
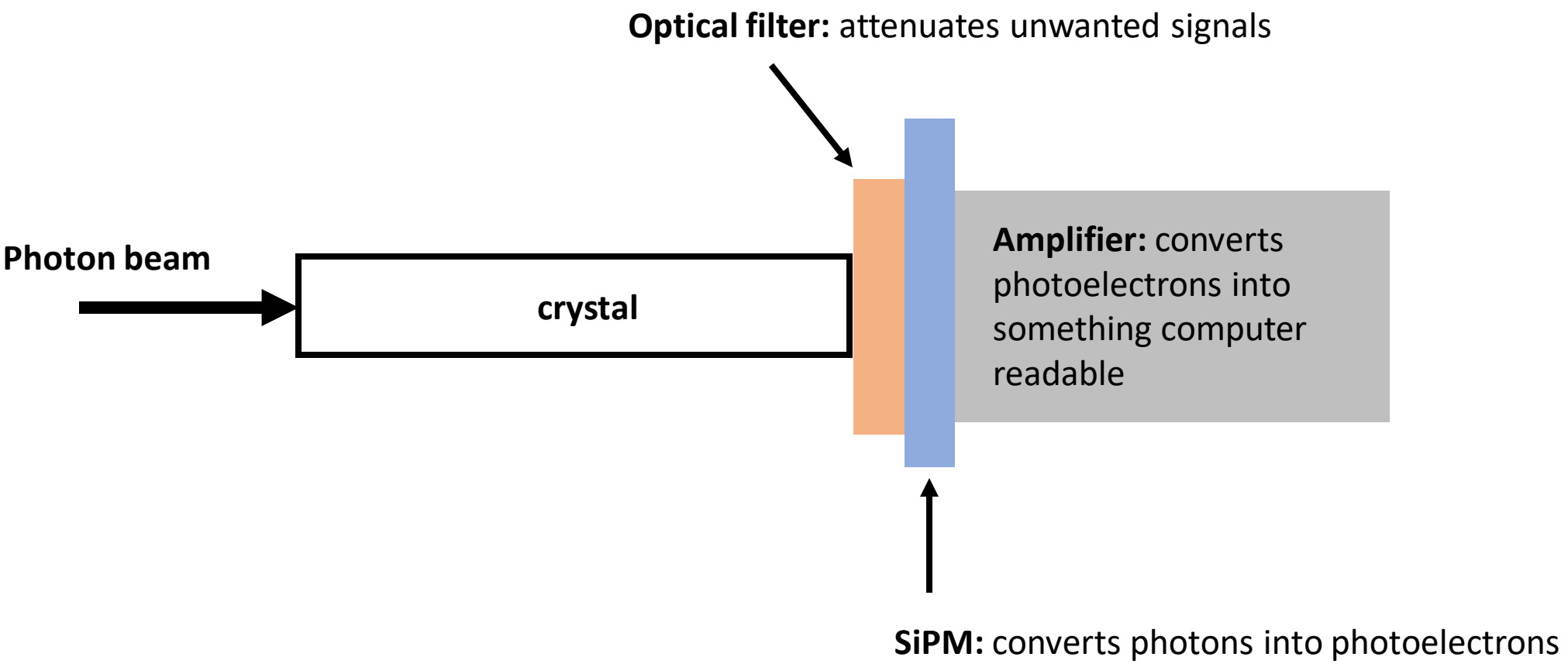
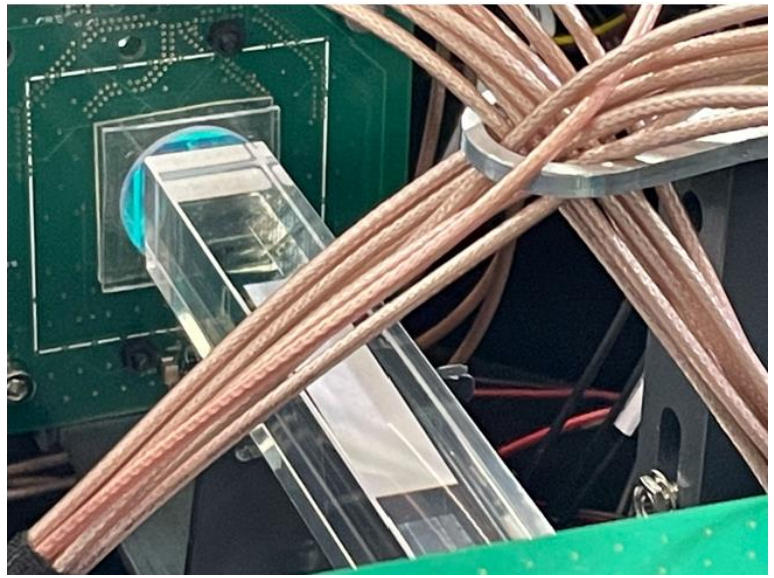


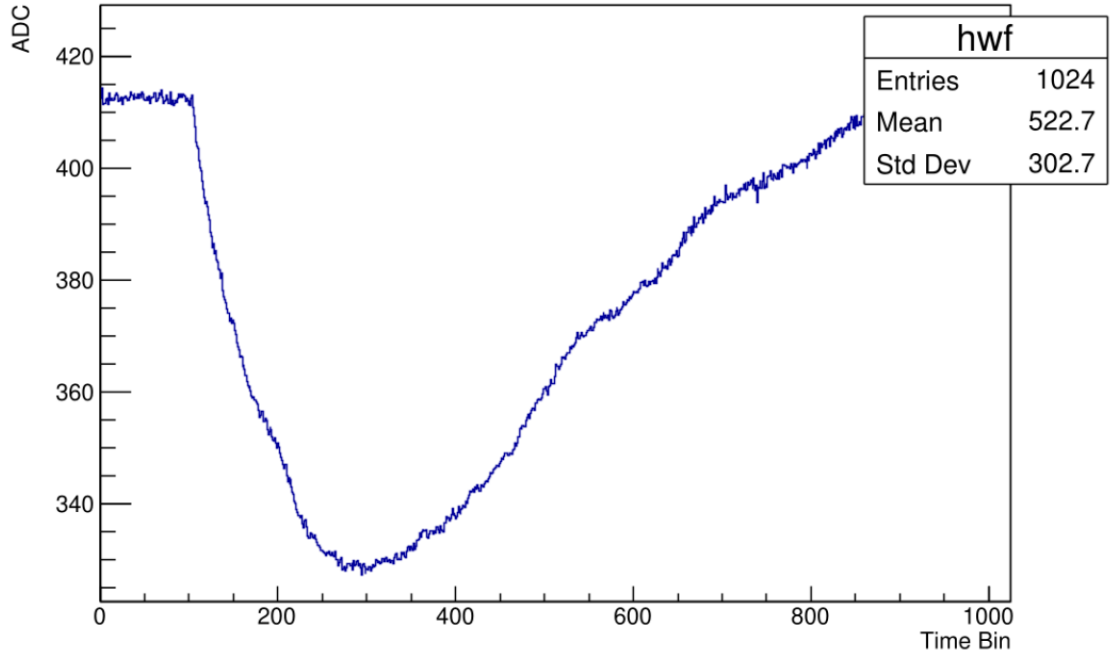
Image Sources:
https://essnusb.eu/glossary/water-cherenkov-detector/ (left), https://en.wikipedia.org/wiki/Cherenkov_radiation (right)

Experimental Setup



The Project



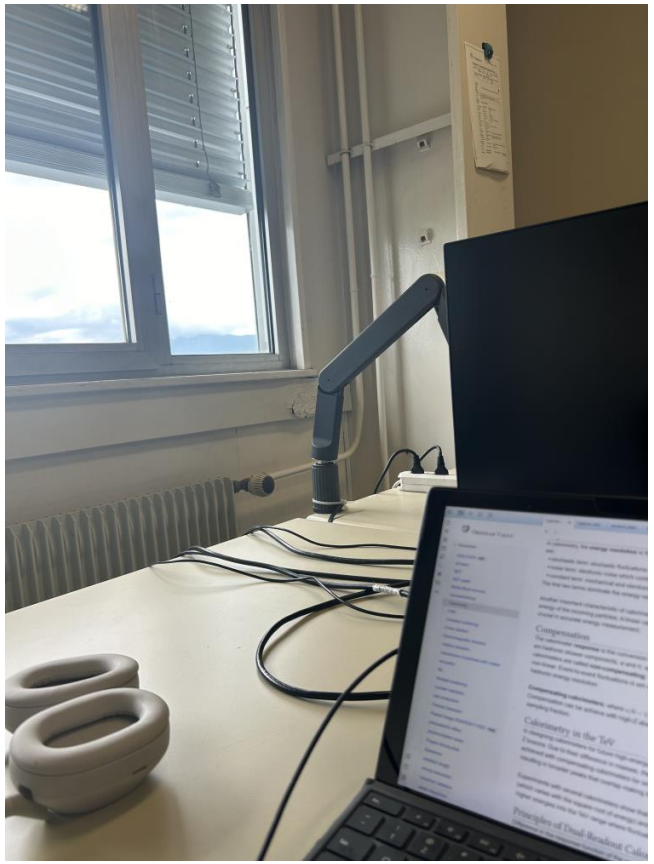


My role: Analyze the noise in the waveforms produced by crystal-based electromagnetic calorimeter

Mentors: Liang Guan and Hui-Chi Lin in collaboration with Calvision

Accomplishments since arrival

Project Background Research



Accomplishments since arrival

Trip to Bern