Application of artificial intelligence in the reconstruction of signals from the PADME electromagnetic calorimeter

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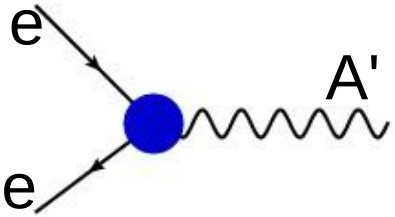
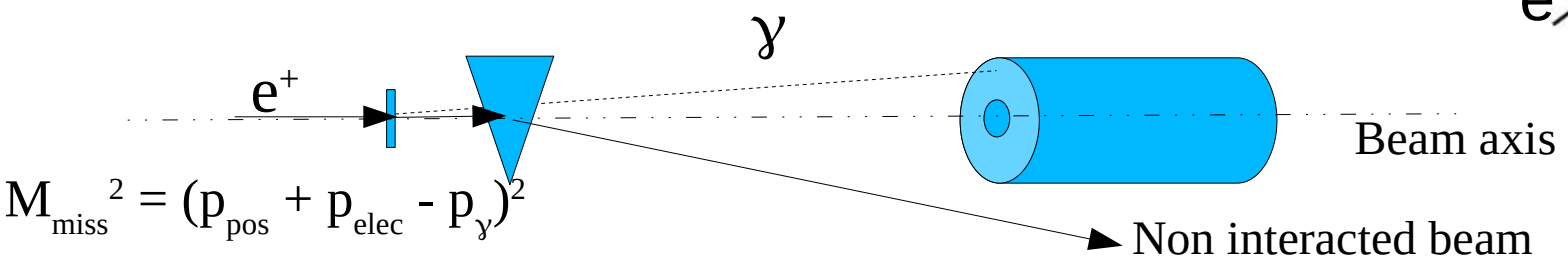
5th Inter-experiment Machine Learning Workshop
?.05.2022

** partially supported by **BNSF: KP-06-D002_4/15.12.2020***
*within **MUCCA, CHIST-ERA-19-XAI-009***

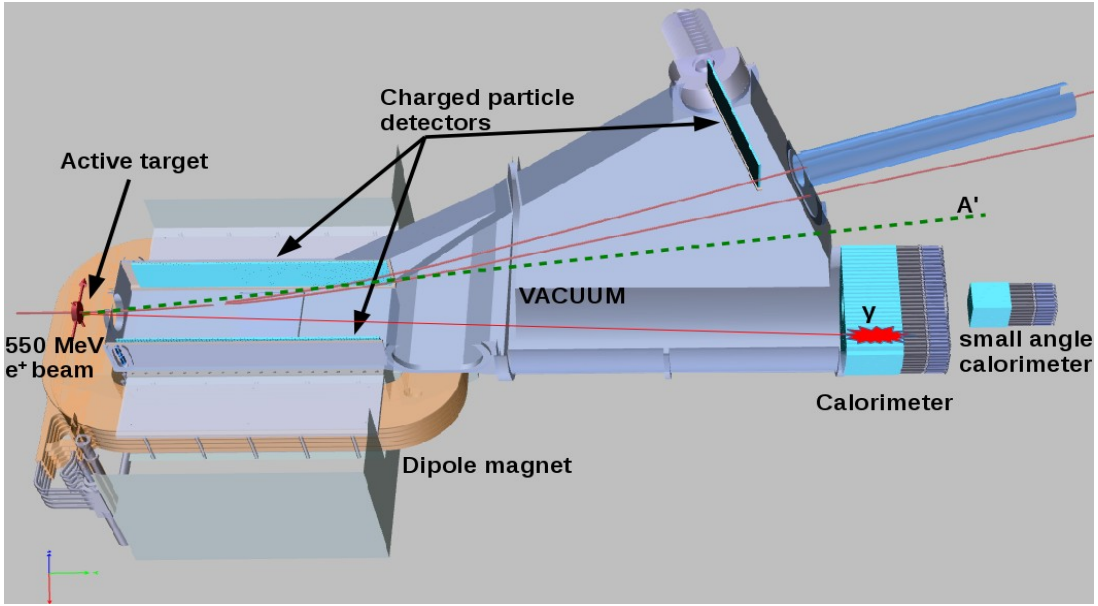
The PADME Experiment

Positron Annihilation into Dark Matter Experiment



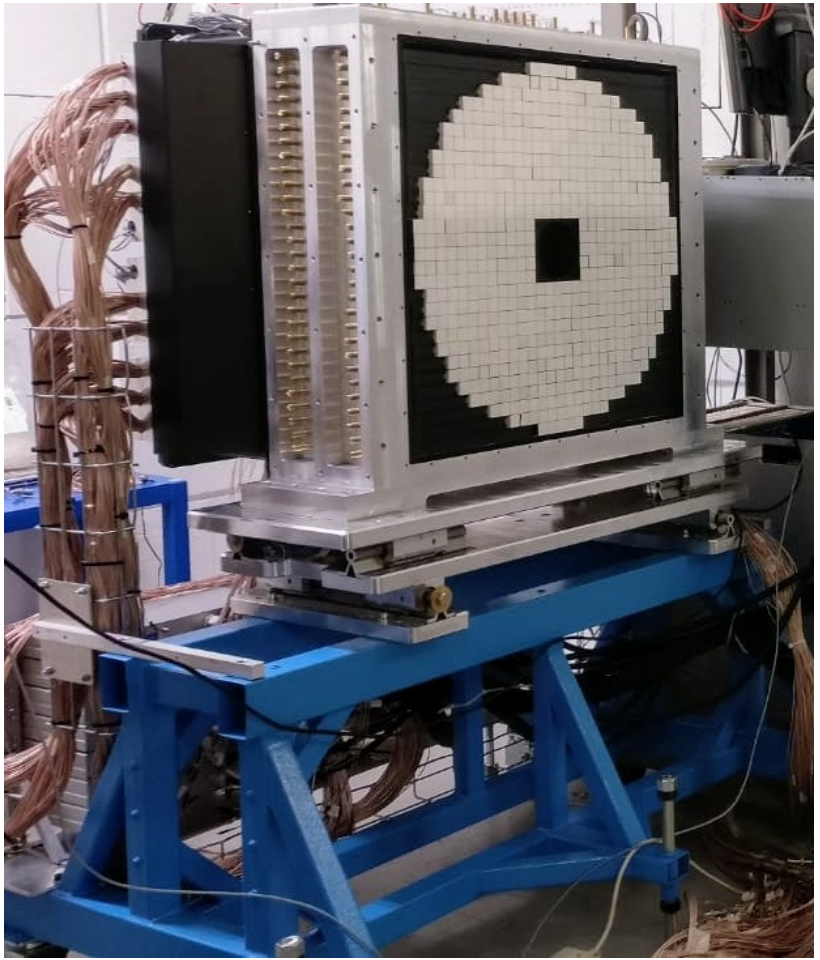


$$M_{miss}^2 = (p_{pos} + p_{elec} - p_\gamma)^2$$

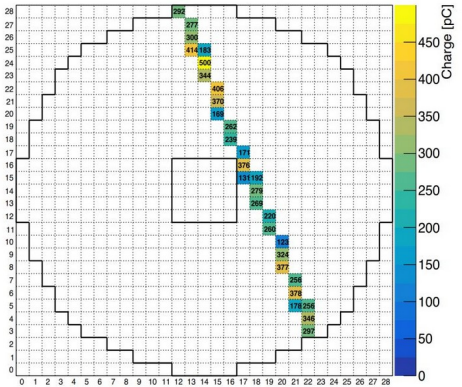


- Small scale fixed target experiment
  - e^+ @ Frascati Beam Test Facility
  - Solid state target
  - Charged particles detectors
  - Calorimeter
  - Beam monitoring system

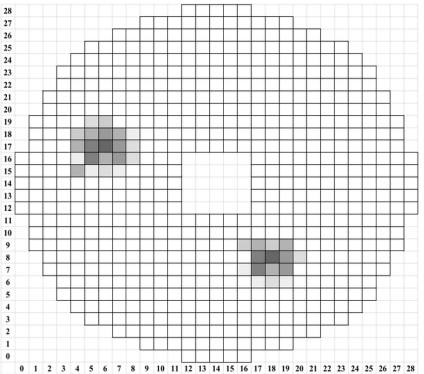
PADME calorimeter



Muon track

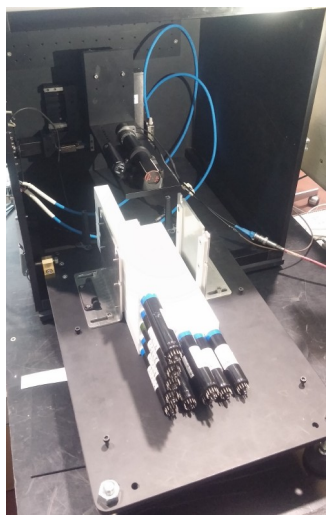


Two photon showers

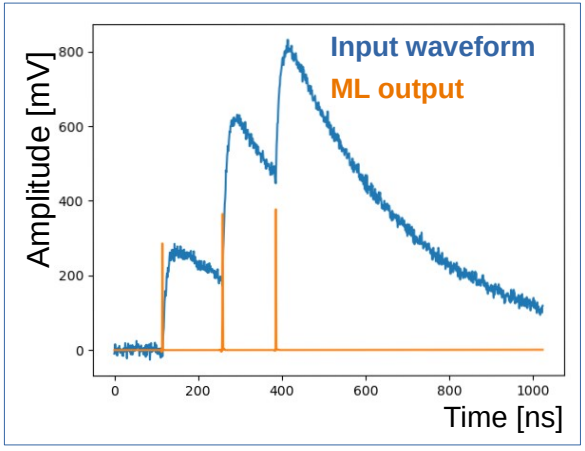


ECAL: The heart of PADME

- 616 BGO crystals, 2.1 x 2.1 x 23 cm^3
- BGO covered with diffuse reflective TiO_2 paint
  - additional optical isolation: 50 – 100 μm black tedlar foils
- Scintillation light decay time – O(300 ns)



Signal reconstruction



CNN with input and output size of 1024; convolution layers followed by deconvolution layers

- Efficiency drops for amplitude less than 50 mV
- Closely spaced signals (<20 ns difference) are not recognised as individual