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A fast convolutional neural network for online particle track recognition

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Timepix4 and particle dataset

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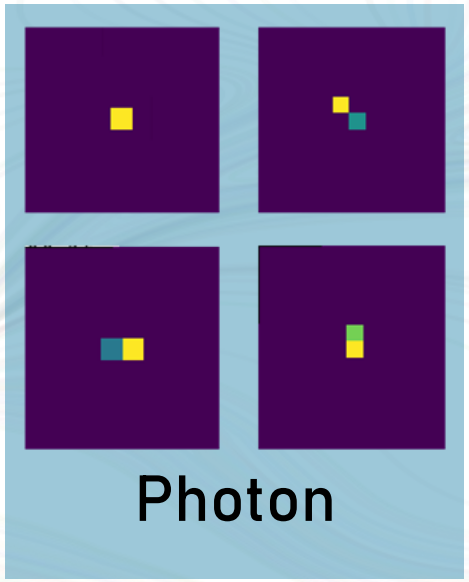
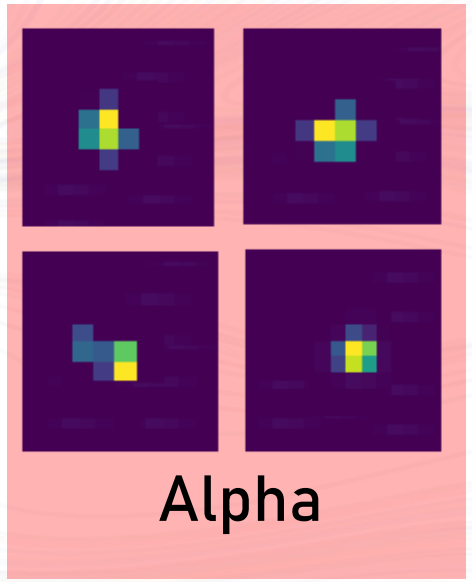
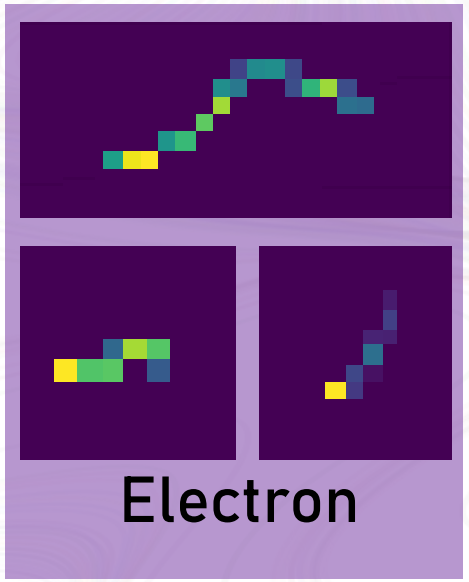
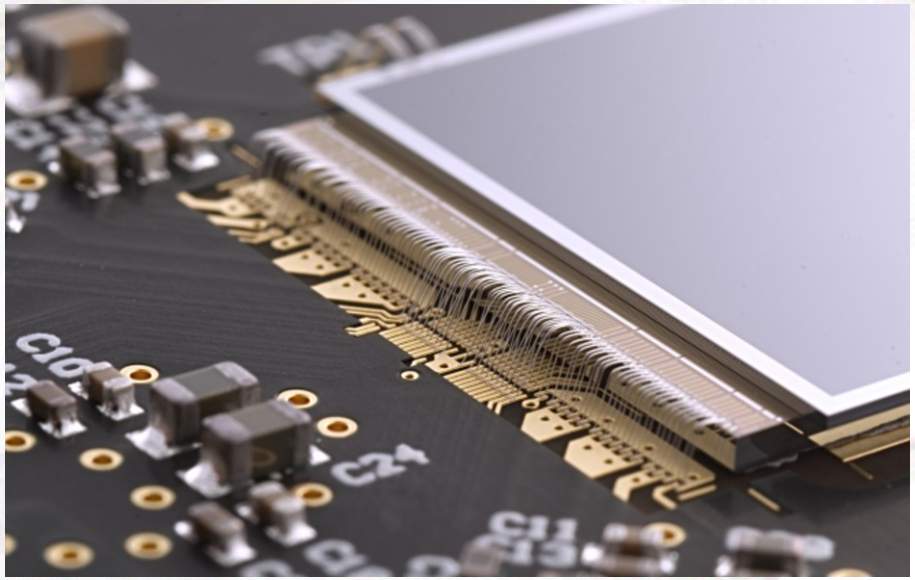
Timepix4 is a **hybrid pixel detector readout** ASIC developed by the **Medipix4 Collaboration** (CERN).

It consists of a **matrix of ~230k pixels** with 55 µm pitch. Each can measure **time-of-arrival** and **time-over-threshold** when hit.



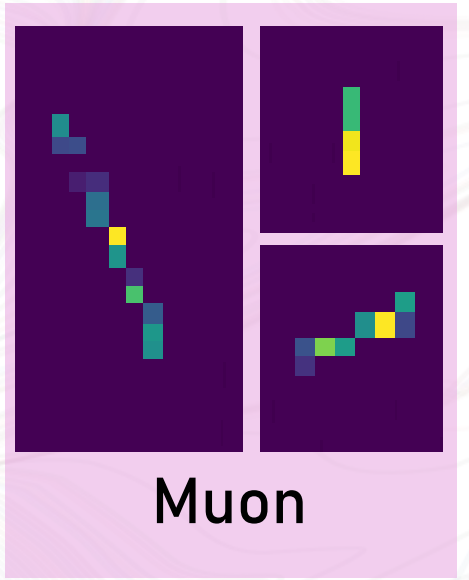




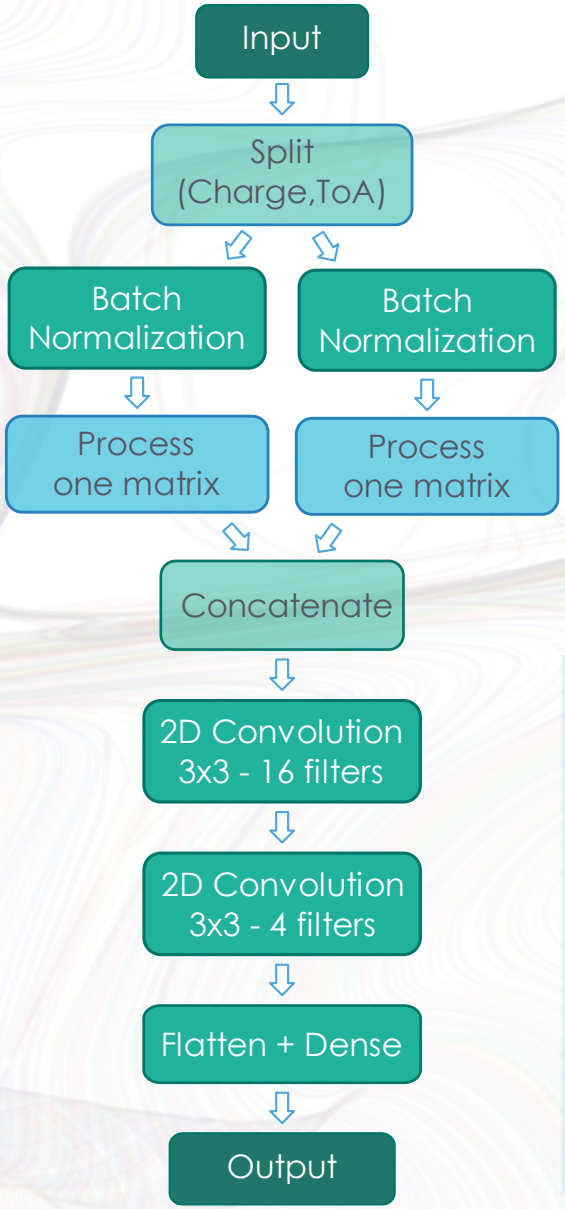


Natural radioactivity dataset acquired with Timepix4 bump-bonded to a **500 µm** thick **Silicon sensor**.

Dataset size: 4000 Clusters

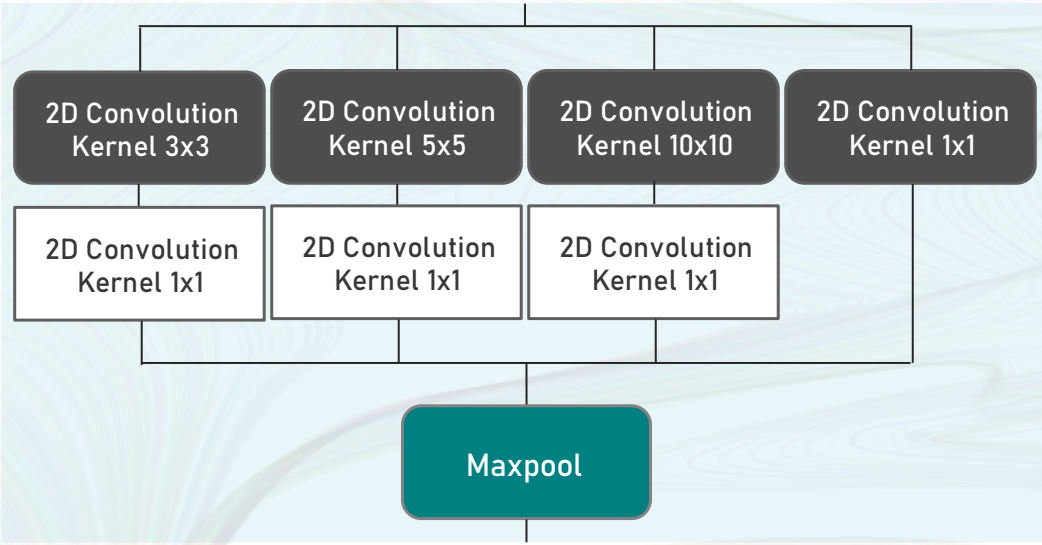


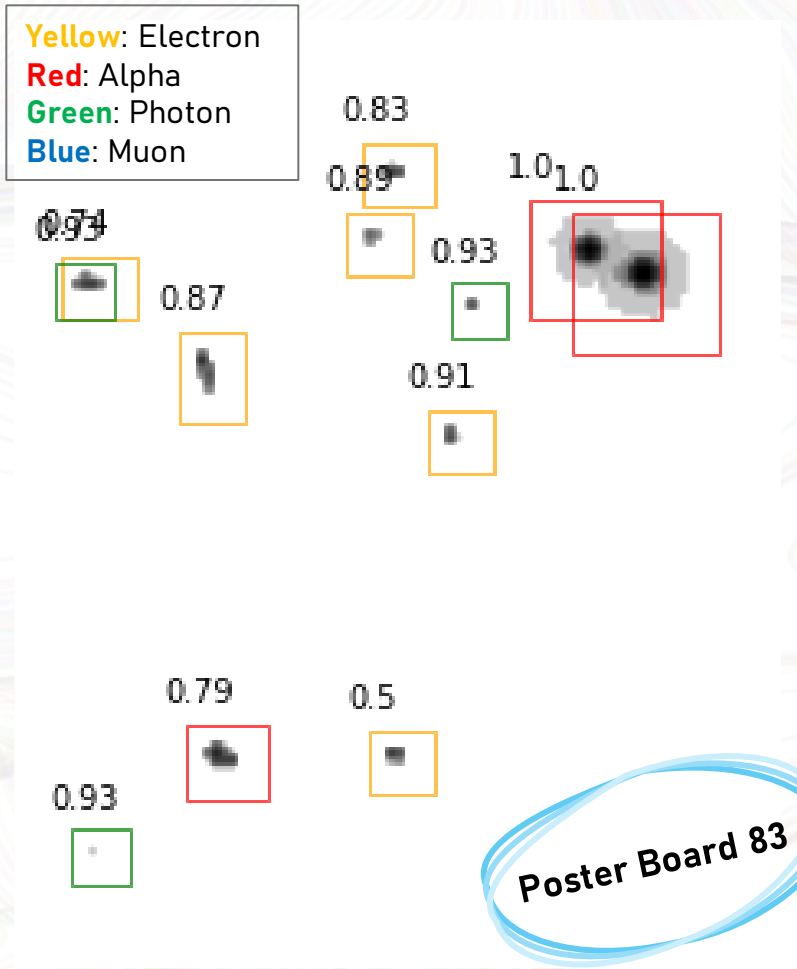
Network structure and performance



The network takes as input a 50x50x2 matrix, that is split into **two 50x50 matrices**: **ToA + Charge**.

Each 2D matrix is **individually processed** by a series of **inception blocks** and the results are **concatenated** together.





Accuracy on validation set: ~**81%**
Loss on validation set: ~ **0.86**