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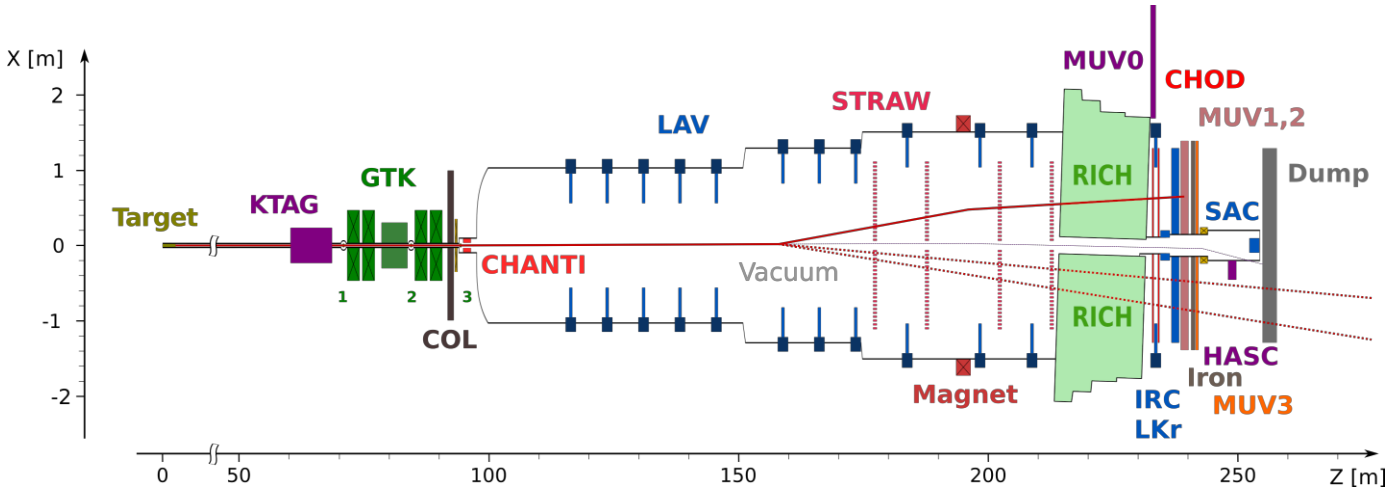
Calorimetric Particle Identification at NA62

Main goal: Study the rare **K →πνν** decay
Probe for new physics

$$\mathcal{B}_{\text{exp.}} = \left(10.6^{+4.0}_{-3.4}\Big|_{\text{stat.}} \pm 0.9_{\text{syst.}}\right) \times 10^{-11}$$

[NA62 Collaboration, 21']

Kaon decay-in-flight: Main backgrounds are the common kaon decay modes (K →μν, K →ππ, etc.)



Multiple handles:

- Event kinematics,
- K/π timing O(100 ps),
- Track multiplicity,
- μ/ɣ vetos,
- **Particle identification**.

$$K^+ \to \mu^+\nu_\mu \quad (\mathcal{B} \approx 0.64)$$
$$\downarrow \text{mis} - \text{id}$$
$$K^+ \to \pi^+\nu\bar{\nu} \quad (\mathcal{B} \approx 10^{-10})$$

Particle identification systems:
RICH, MUV3, and calorimeters (LKr, MUV1 and MUV2)
Overall Muon rejection > **10^7**

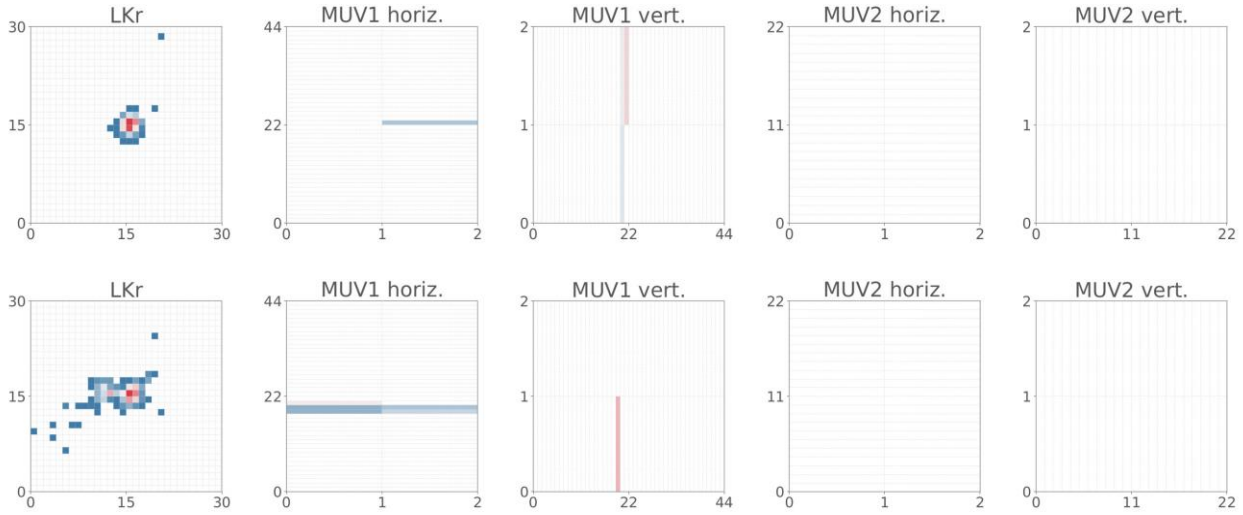
CNN-Based Approach for "CaloPID"

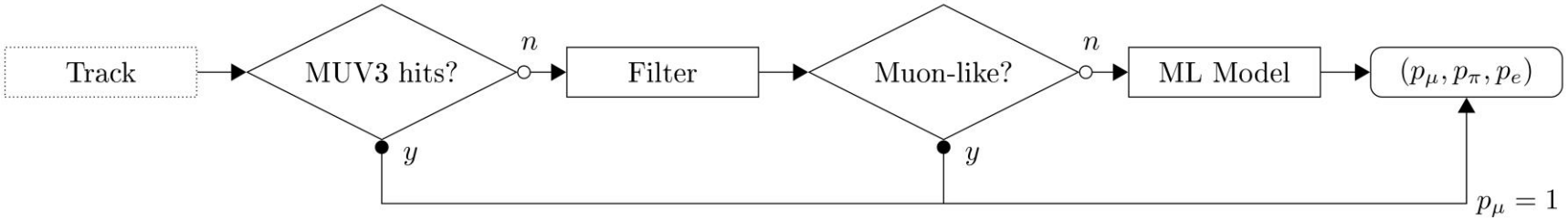
Focus on three calorimeters:

- LKr: Electromagnetic calo.
- MUV1 & MUV2: Hardronic calo

No depth information, the 3D shower is projected on a 2D plane by the readout.

Direct correspondence with a 5-channel image

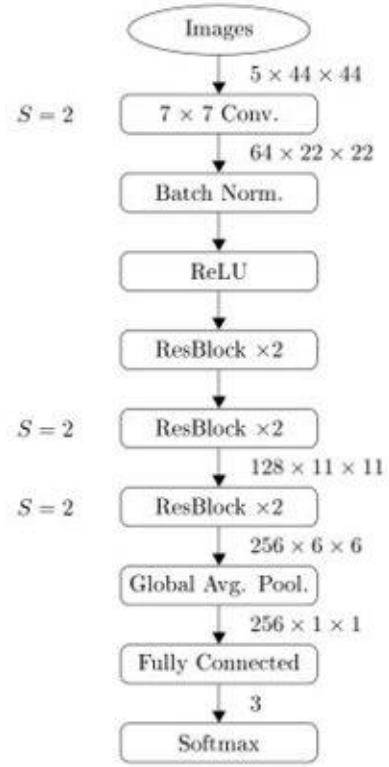


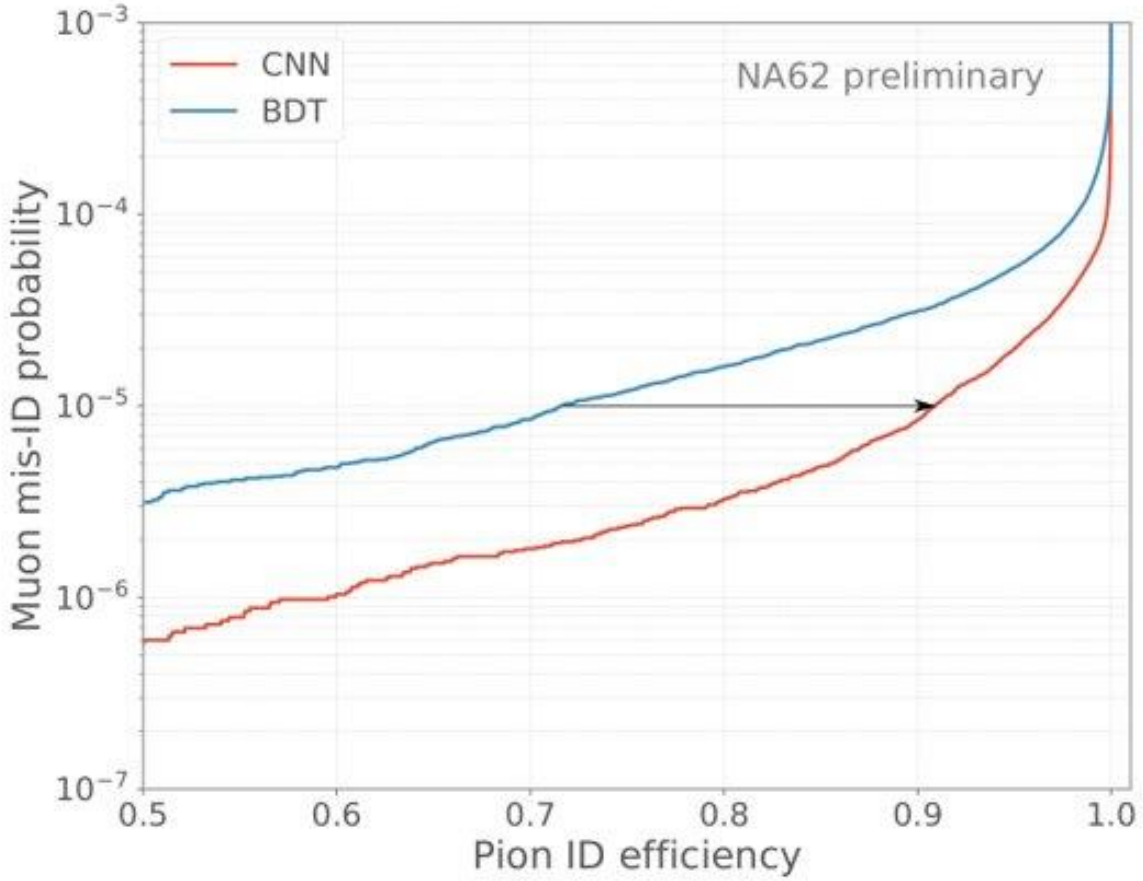


Data driven approach, training, validation and testing samples selected directly from the data. Independent test sample (*minimum bias*) used for the final evaluation.

Significant Improvement of the μ/π ID

Architecture derived from ResNet





Pion acceptance can be increased from **72 % to 92 %** over the 15 to 50 GeV/*c* (muon mis-id 10^{-5})