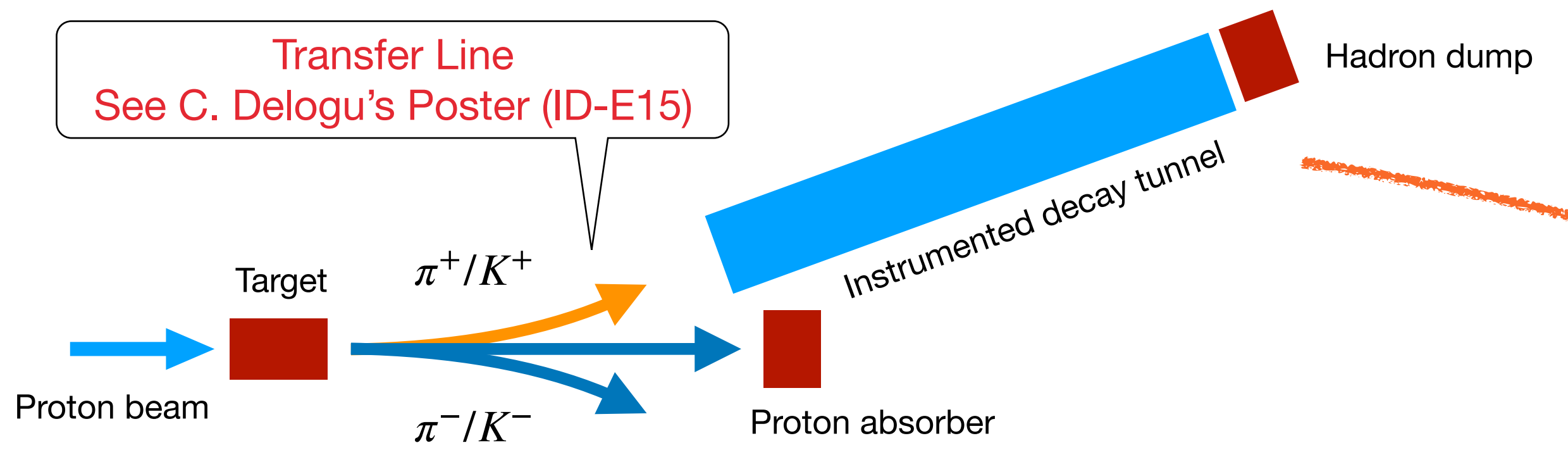


NuPhys2019 - A. Branca on behalf of the ENUBET Collaboration

The instrumented decay tunnel of the ENUBET neutrino beam

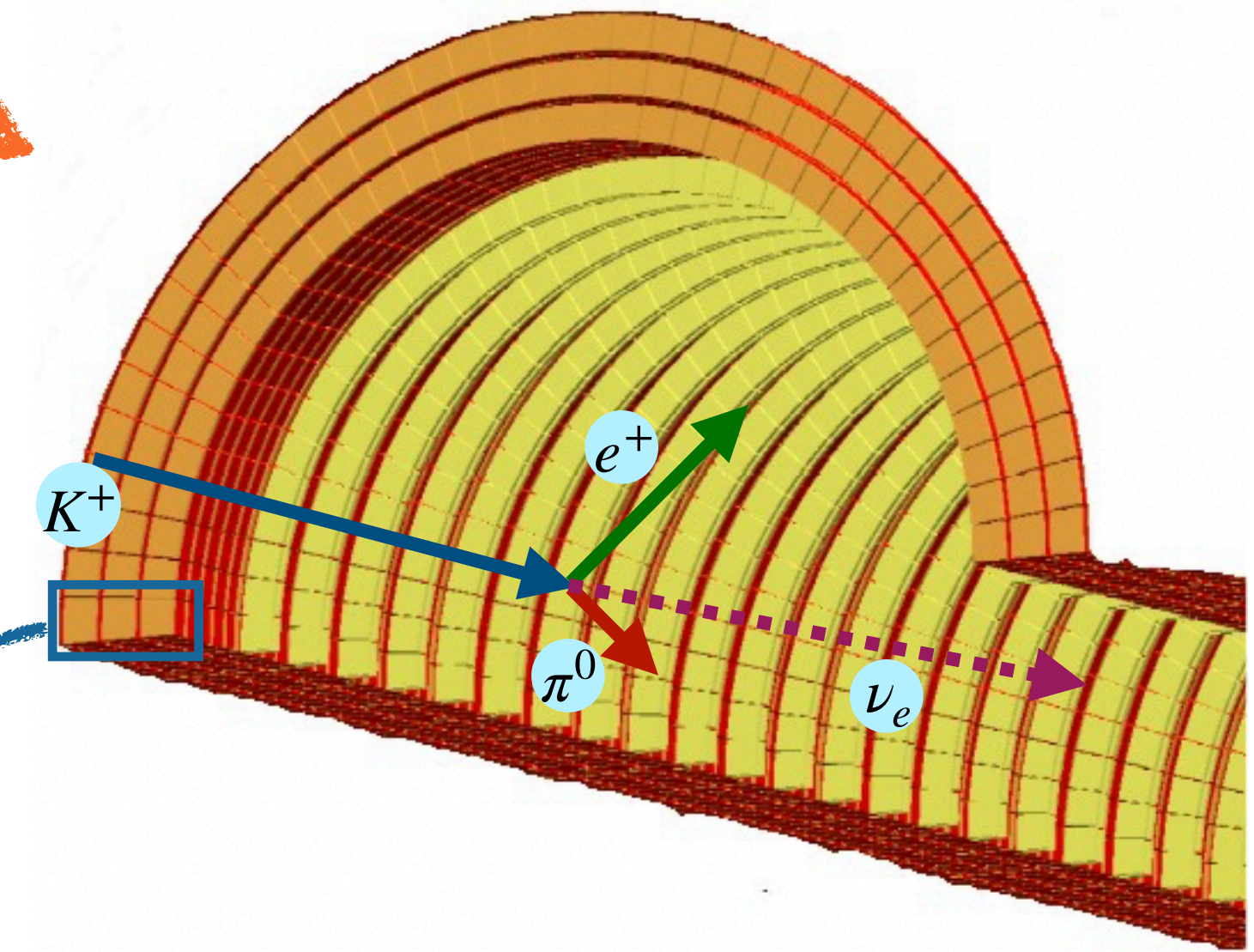
ENUBET = Enhanced NeUtrino Beams from kaon Tagging



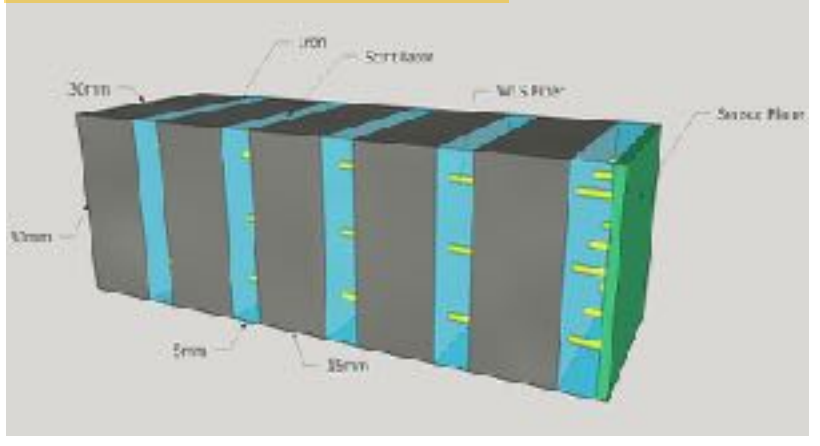
Calorimeter

Monitor positrons from K_{e3} decays ↔ ν_e flux from e^+ counting;

A narrow-band beam for the precision era of ν physics:
 Knowledge ν_e/ν_μ flux at $O(1\%)$ ↔ Leptonic CP violation



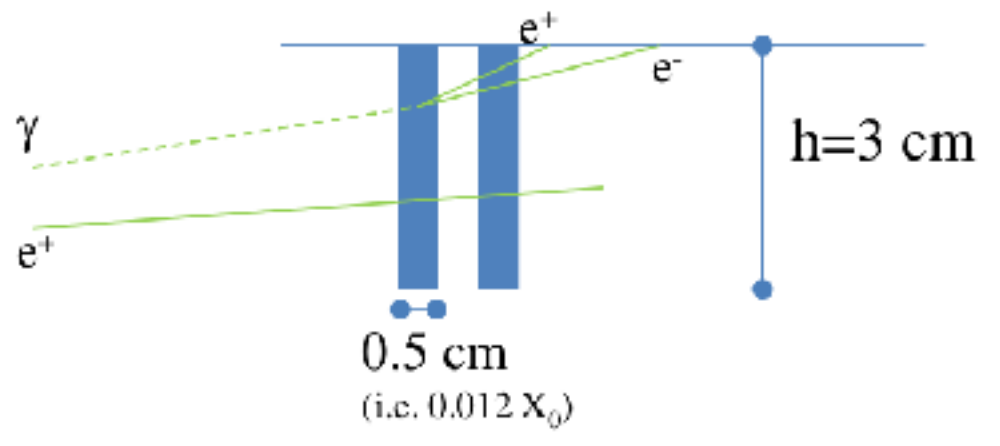
UCM: schematics



• **Ultra Compact Modules (UCM);**



Photon Veto: Working principle



• Plastic scintillator tiles arranged in doublets forming inner rings;

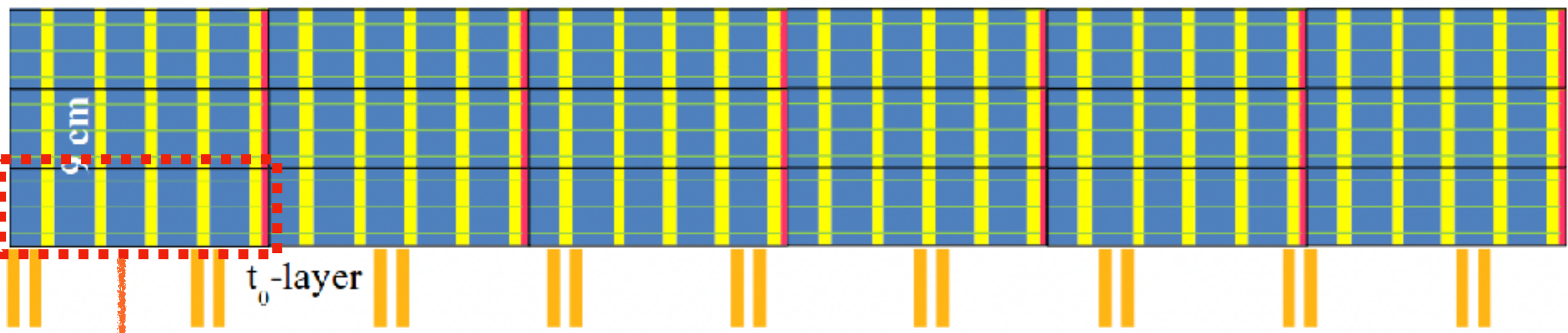
Allows π^0 rejection

- Sampling calorimeter;
- Three radial layers;
- Longitudinal segmentation;

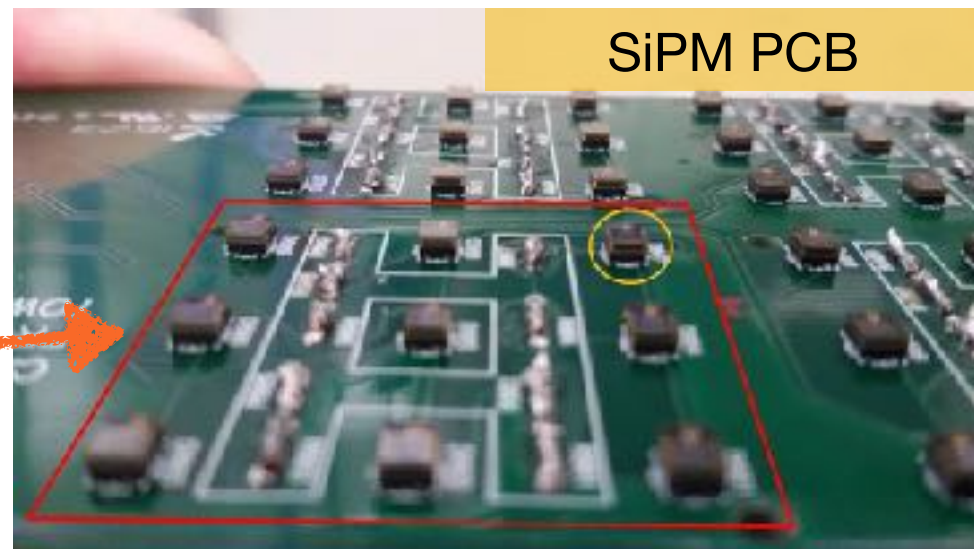
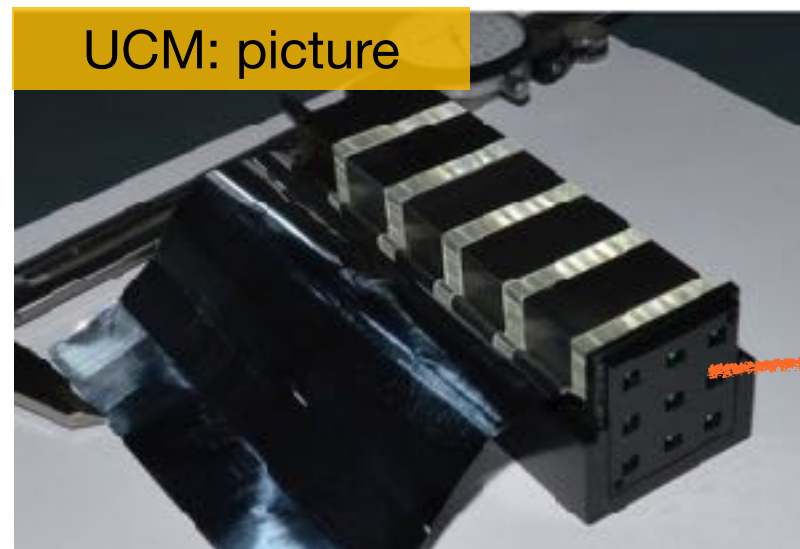
Allows $e^+/\pi^+/\mu$ separation

Baseline for the calorimeter: shashlick technique

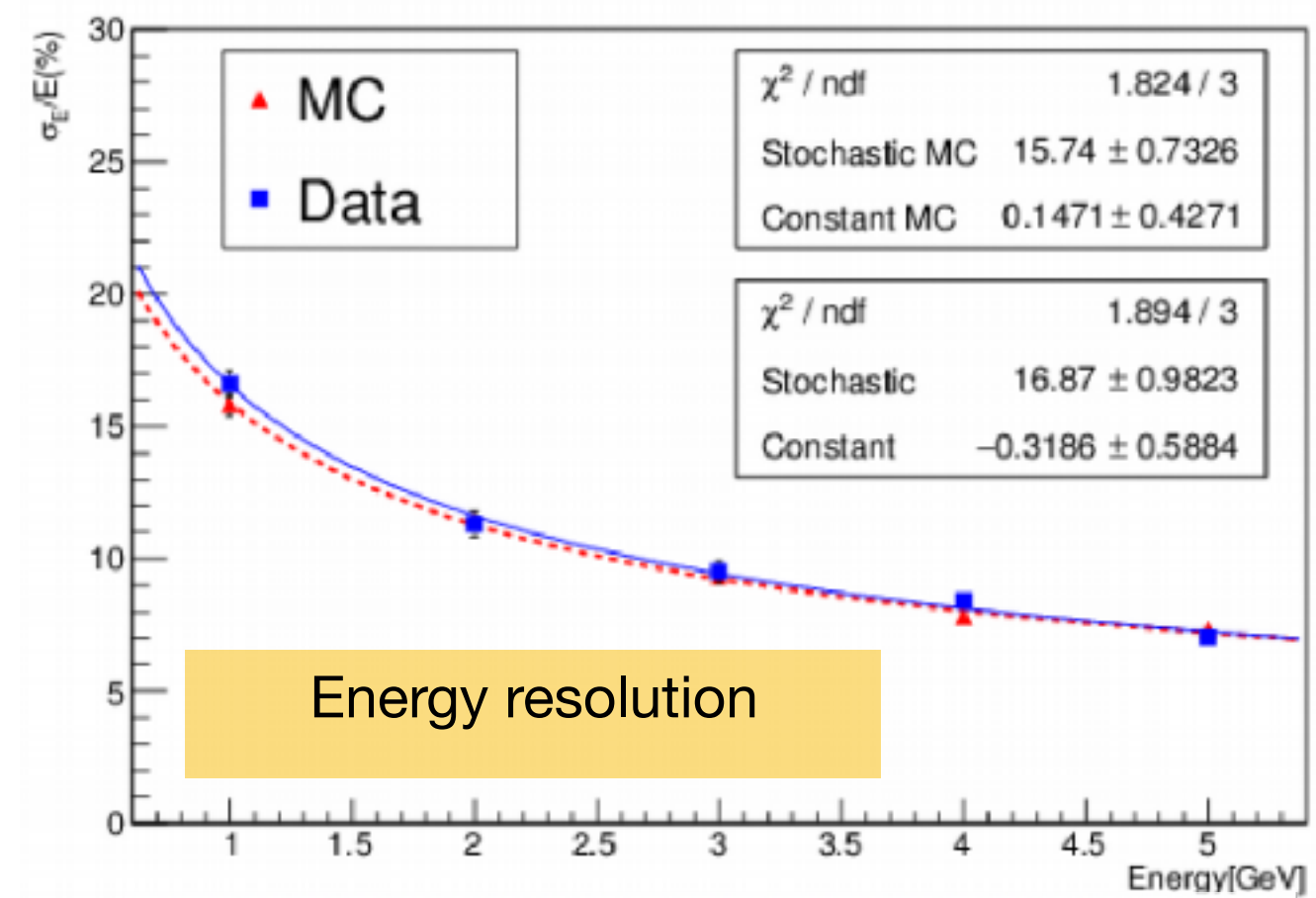
Shashlick prototypes tested @ CERN: response to e^+ , π^+ and MIP



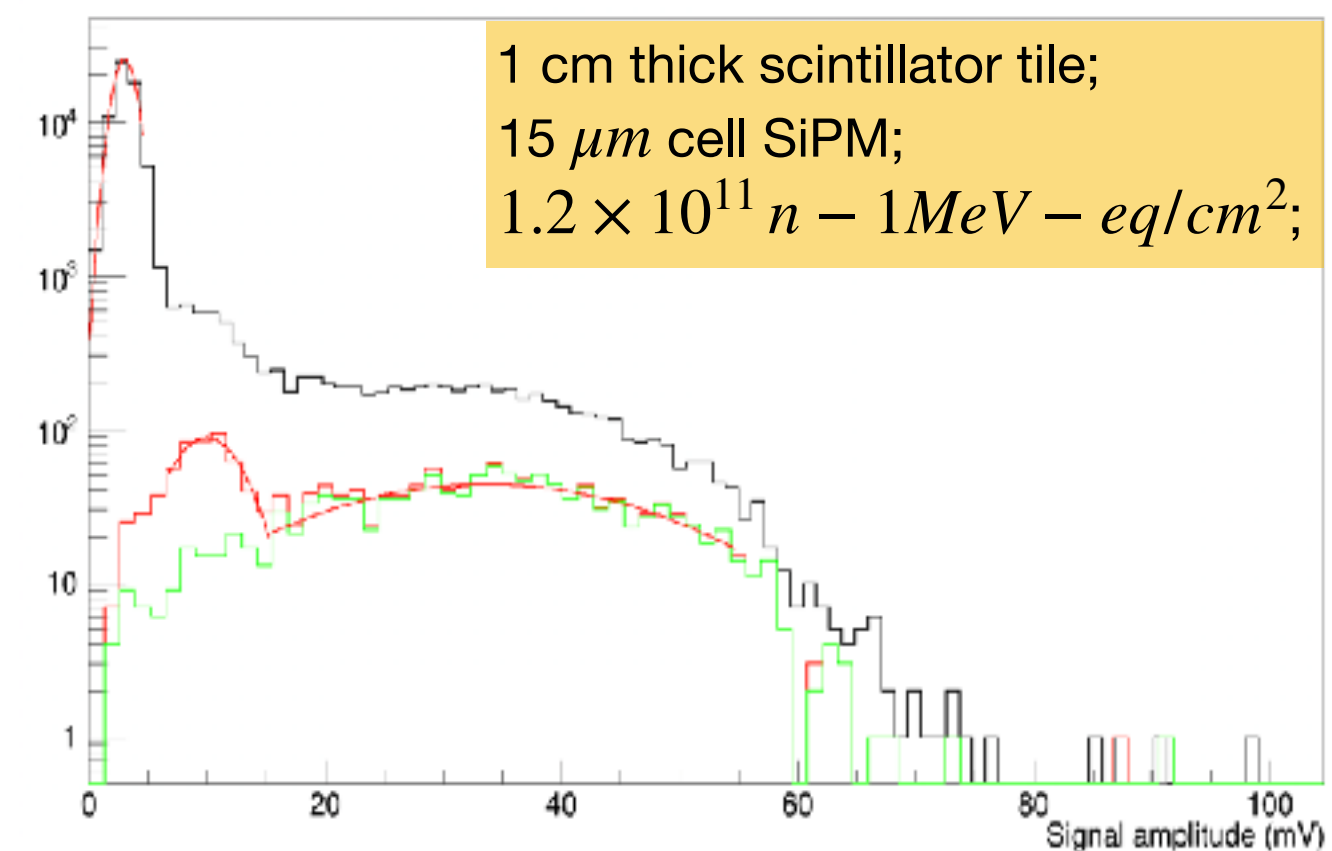
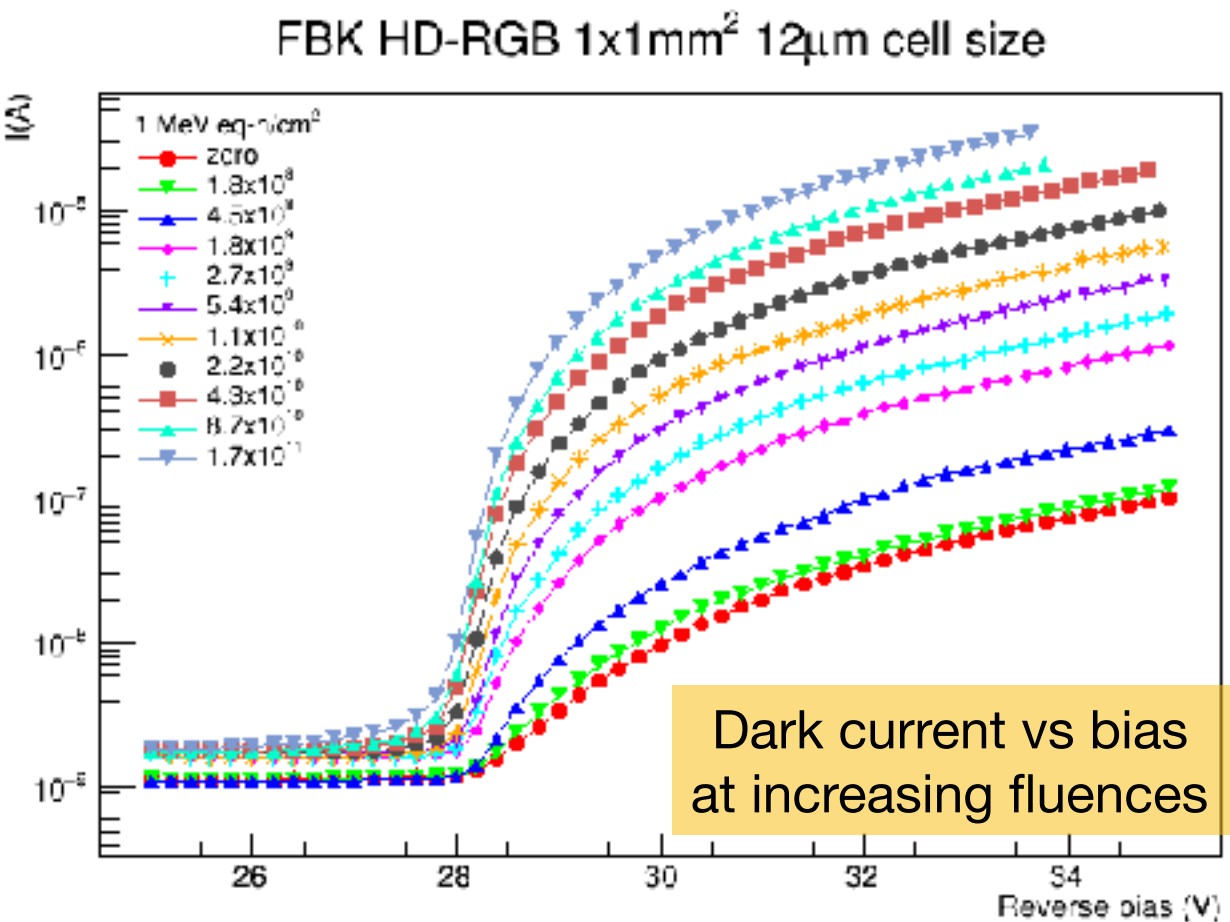
Shashlick: WLS fibers perpendicularly crossing the absorber/scintillator tiles



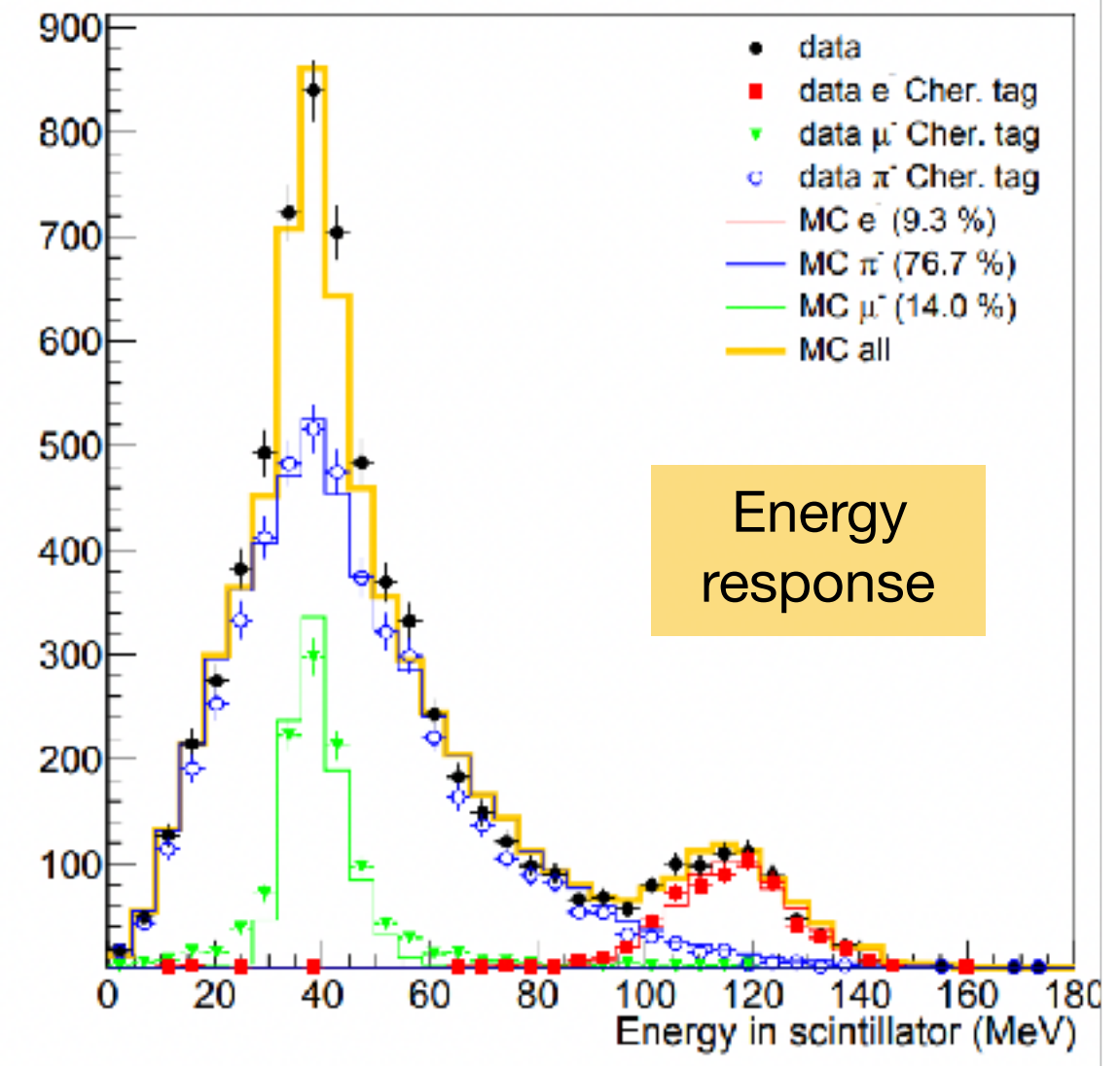
The use of SiPMs embedded in the calorimeter allows a very compact configuration with minimal dead volumes



SiPM irradiation tests @ LNL and beam tests @ CERN:



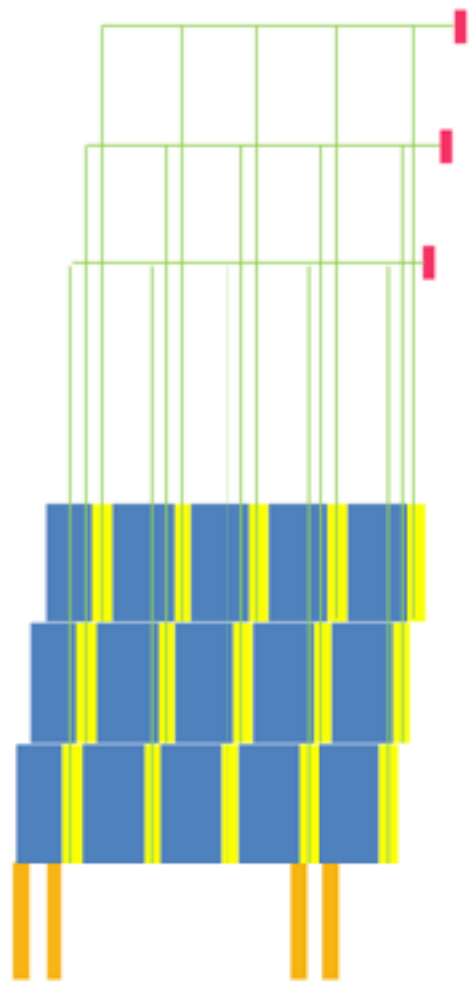
- Dark current after breakdown increases by more than two order of magnitudes @ $\sim 10^{11} n/cm^2$;
- MIP signals remain well separated from dark noise peak if SiPM cell size and scintillator thickness are properly chosen;



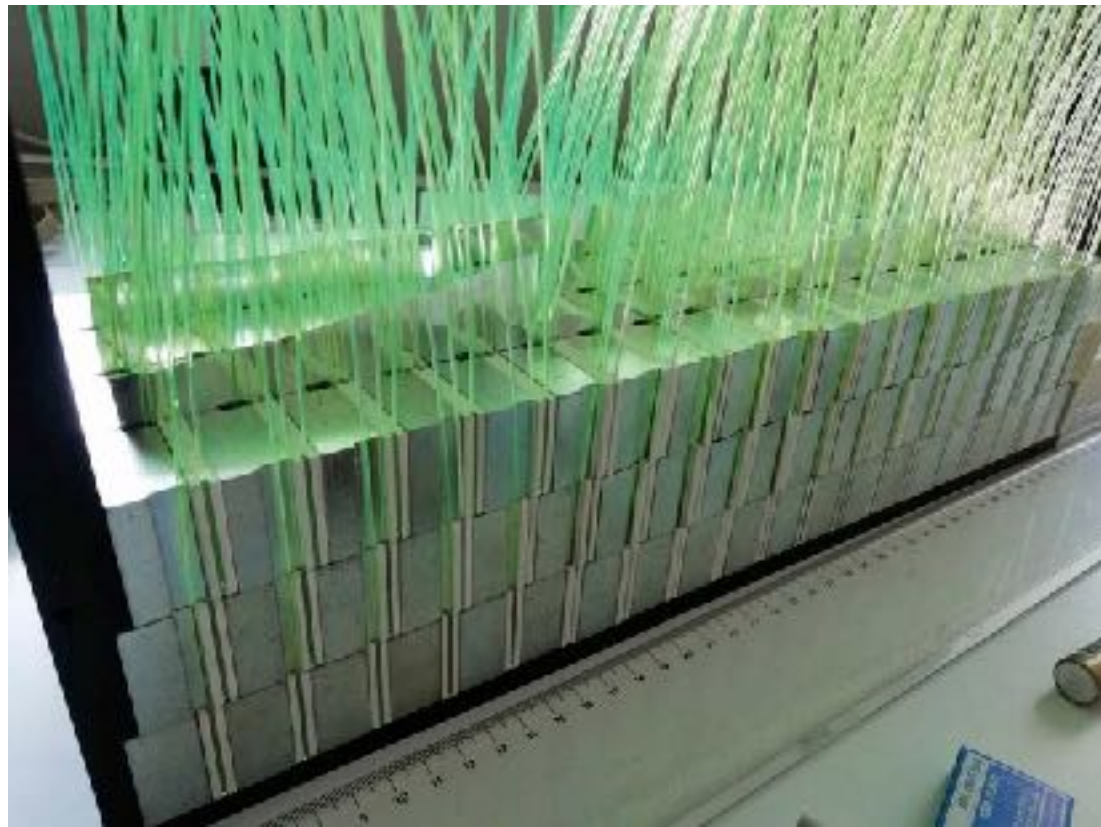
- Energy resolution: $\sim 17\% / \sqrt{E} (GeV)$;
- Good agreement with MC simulation;

Overcome SiPM irradiation ageing: lateral readout option

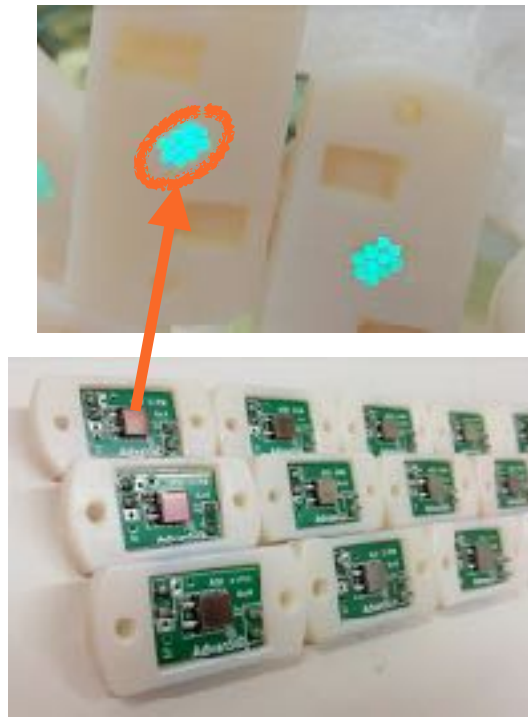
Lateral readout schematic



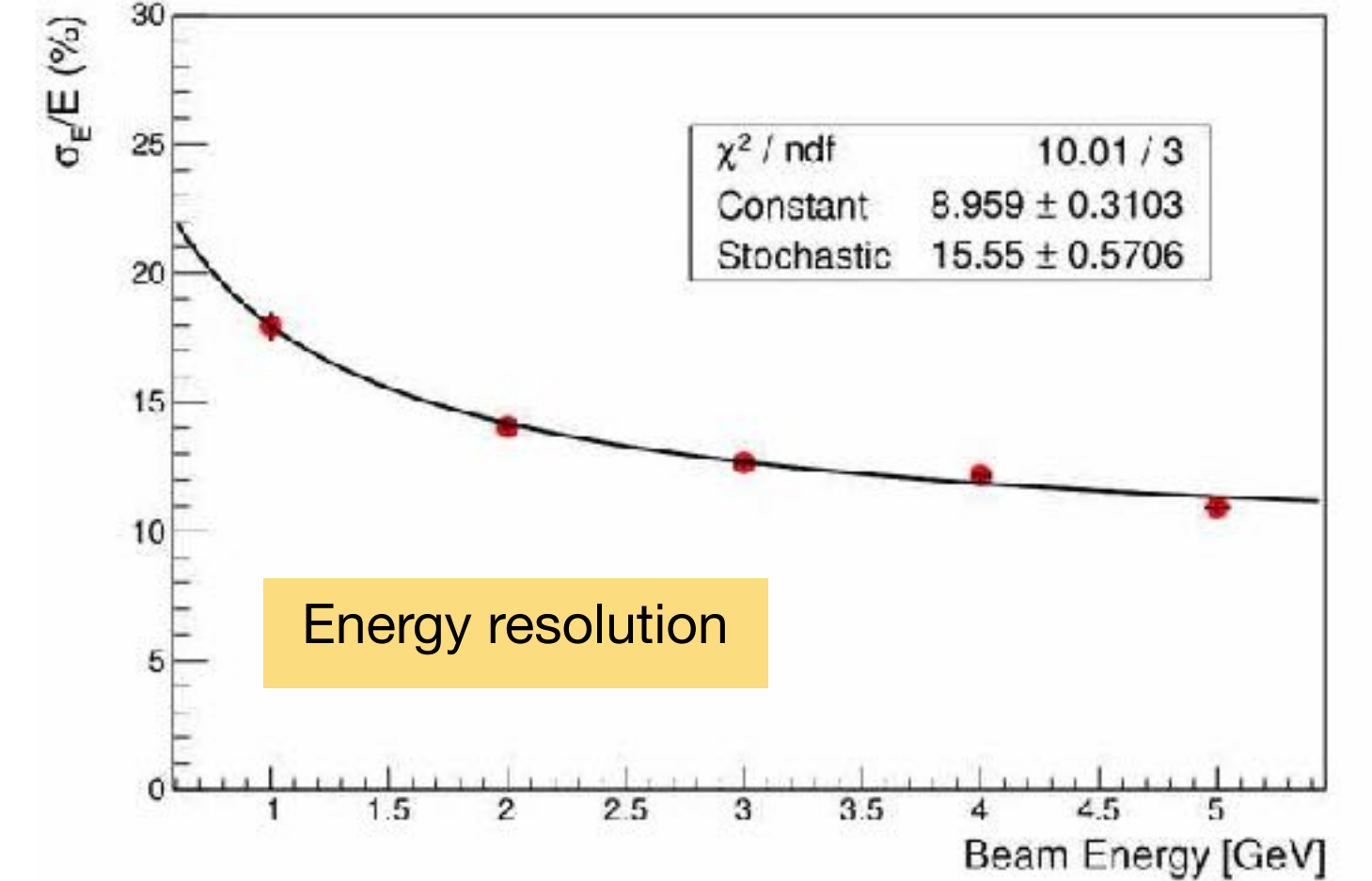
Sampling calorimeter with lateral WLS fibers for light collection



Large SiPM area ($4 \times 4 \text{ cm}^2$) for the readout of 10 WLS



Preliminary results from tests @ CERN: response to e^+ , π^+ and MIP

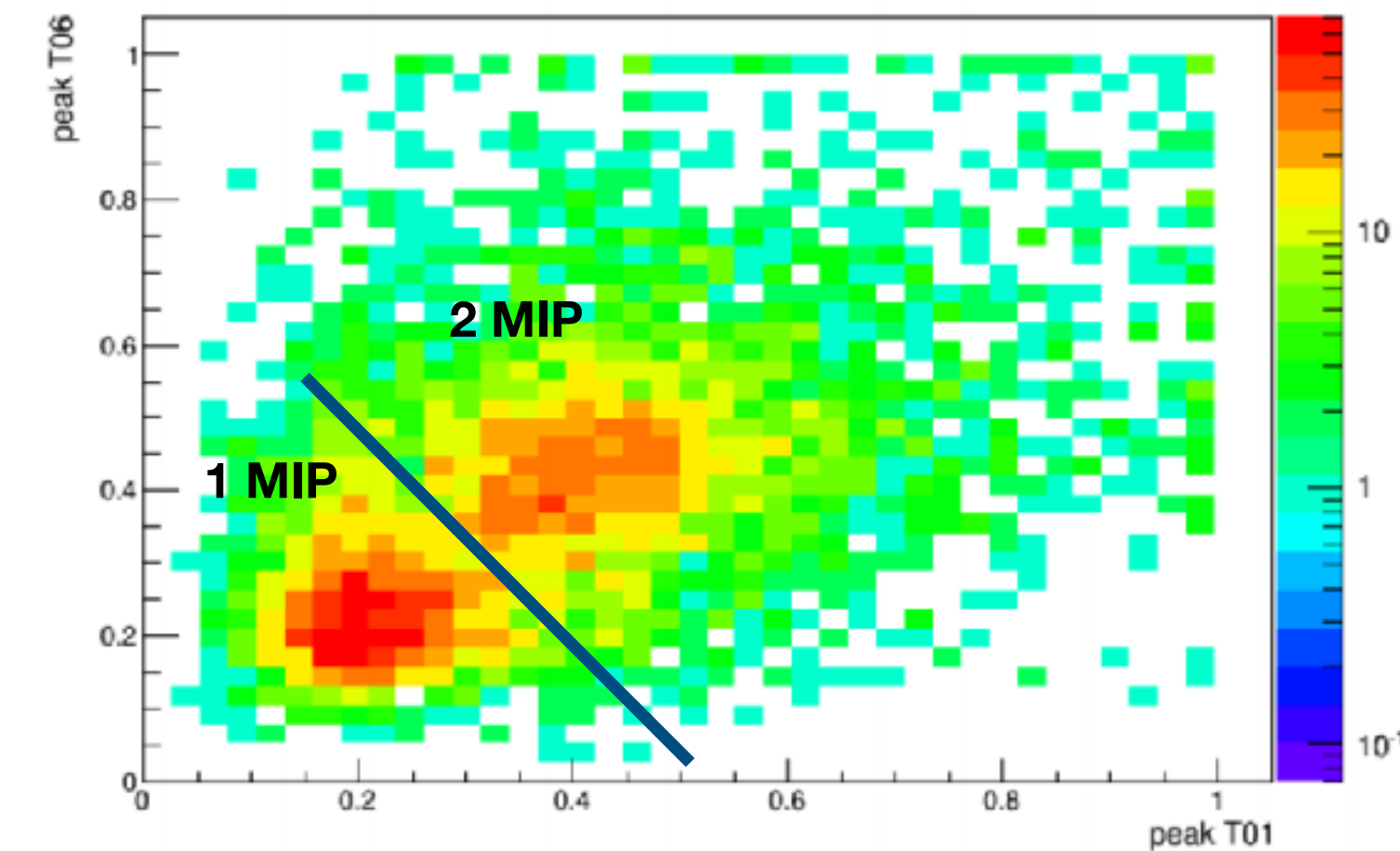


SiPM are not immersed in the hadronic shower: **reduced neutron damage, better accessibility, possibility of replacement, better reproducibility of WLS-SiPM optical coupling;**

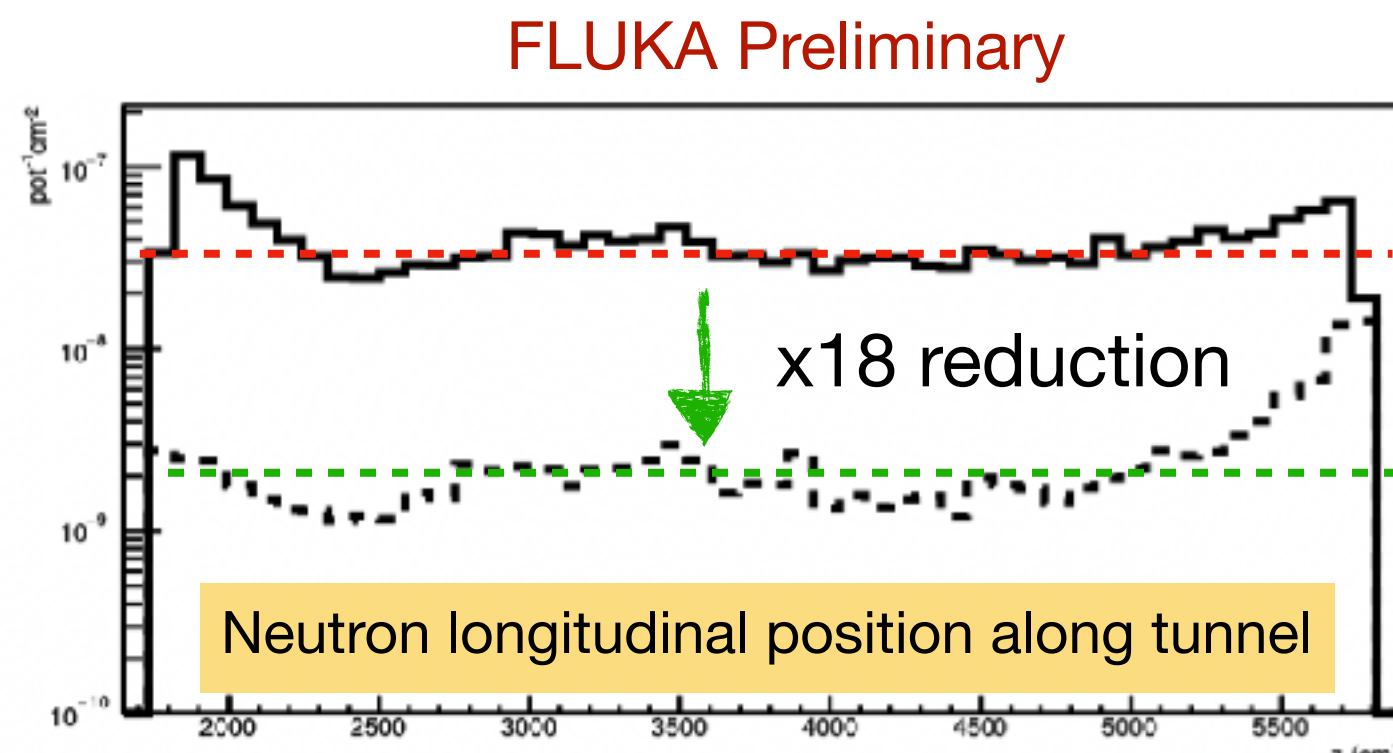
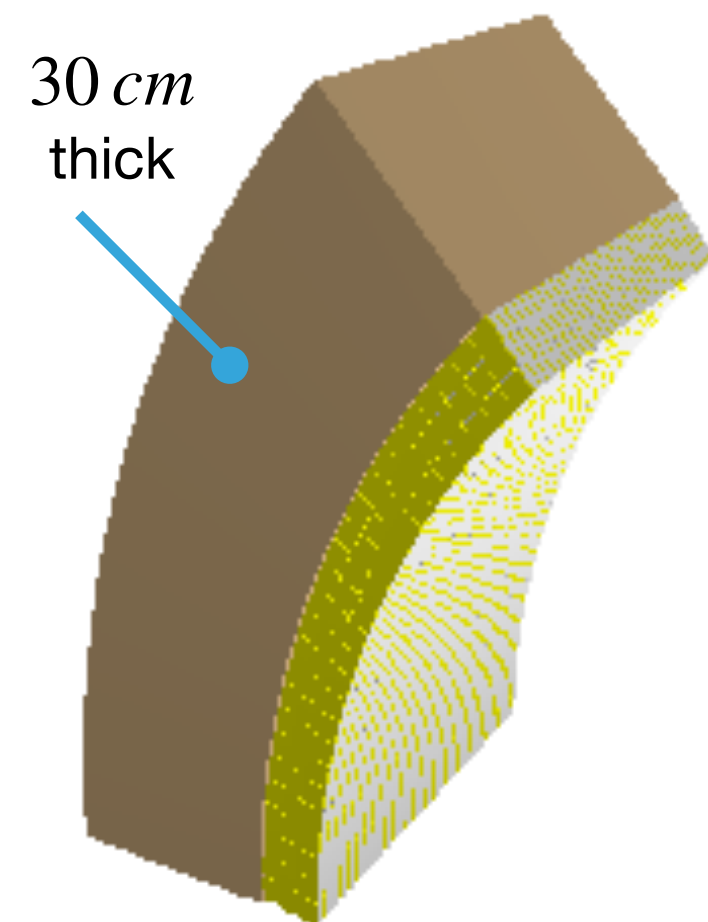
Integrated t0-layer in lateral readout prototype



Test 1 MIP/2 MIP separation



Shielding at the back of calorimetric layers:

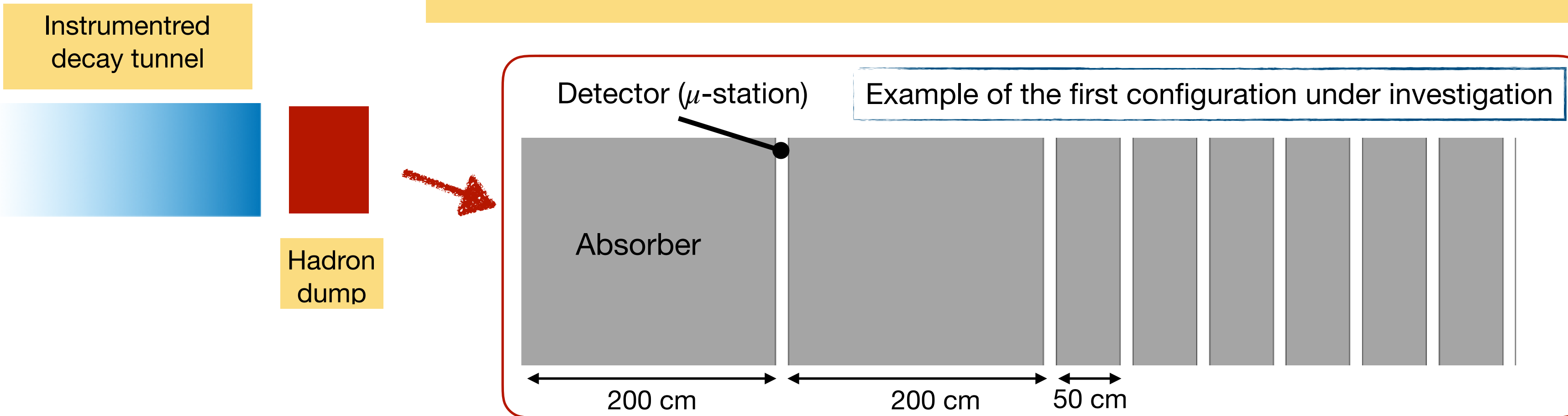


Recognition of ENUBET in the Neutrino Platform as ENUBET/NP06: renovated East Area for the final validation of the demonstrator

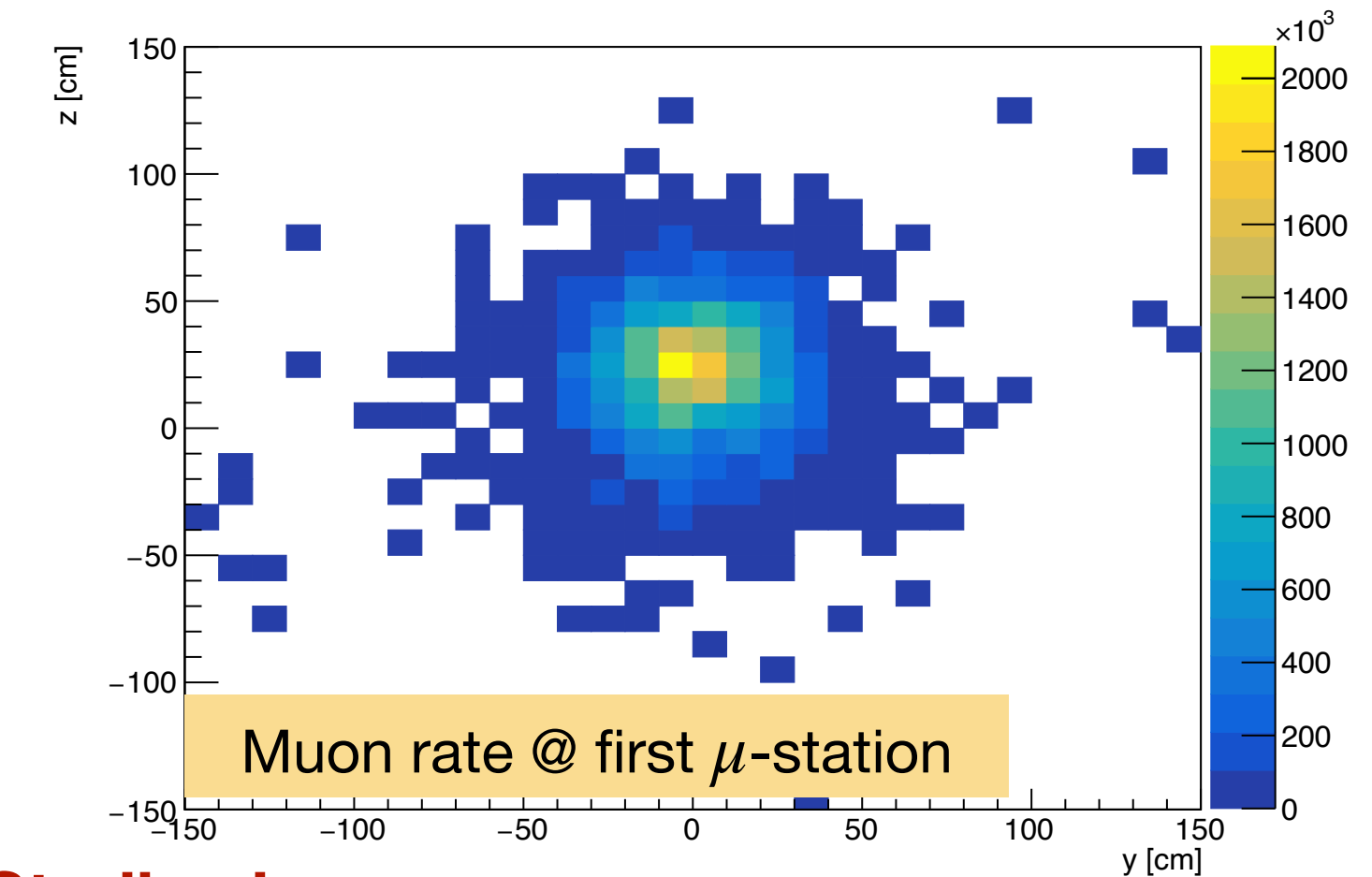
First studies for the development of a muon monitoring system

Use the tagger to constrain the high energy ν_μ spectrum from K^+ decays (in progress), and detectors (μ -stations) following the hadron dump to constrain the low energy ν_μ spectrum from π^+ decays

Alternate absorbers (iron/rock) with muon detector planes (technology under investigation)



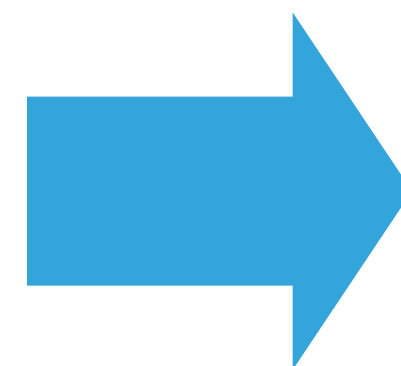
First preliminary simulation tests



Studies in progress:

- Determination of the μ detector technology;
- Studies of the systematics;

Checkout more @
<http://enubet.pd.infn.it>
 & Poster-ID E17



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Enhanced NeUtrino BEams from kaon Tagging

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- Principal Investigator **Andrea Longhin**
- Host Institution: **Universita' degli Studi di Padova (UNIPD)**
- Beneficiary: **Istituto Nazionale di Fisica Nucleare (INFN)**
- Period: 01 June 2016 - 31 May 2021

ENUBET has been designed to open a new window of opportunities in accelerator neutrino physics. The proposed project enables for the first time the measurement of the positrons produced in the decay tunnel of conventional neutrino beams: these particles signal uniquely the generation of an electron neutrino at source.

erc
 European Research Council
 European Commission
 Horizon 2020
 European Union funding
 for research & innovation
 INFN
 The project leading to this application has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement N. 681647)