The **ENUBET ERC** project aims to develop an instrumented decay tunnel for future neutrino beams. Elisabetta Parozzi, on behalf of the ENUBET collaboration, presents the project.

### Physics Programme

**Improvement by one order of magnitude the measurement of $\nu_e$ and $\nu_\mu$ cross sections**

Highly beneficial for tackling the main open neutrino-related issues: lepton CP violation,

- Mass hierarchy: $\delta_{23}$ octant.

**First step towards a time tagged neutrino beam: direct production/detection correlation.**

### Ultra-Compact Calorimeter Prototypes

**Shashlik with integrated readout**

- Basic Shashlik Calorimeter: stack of alternating absorber and scintillator materials, pierced by a wavelength shifting fiber (WLS) perpendicular to the absorber and scintillator tiles.

- Ultra-compact Shashlik Calorimeter: basic shashlik prototype where each WLS fiber is readout by one SiPM.

**Polysiloxane shashlik calorimeters**

- First use in HEP, elastomeric material with interesting properties:
  - Superior radiation hardness: transparent after 10 kGy dose exposure.
  - Easier fabrication process: initial liquid form poured at 60°C.
  - No drilling of the scintillator.
  - Good optical contact with fibers.

- Prototype tested at CERN (PS-T9)
  - 12 UCMS: 3 (beam direction) x 2 x 2
  - Active layer 3 times thicker: 15 mm compensate 30% lower light yield w.r.t. EJ200

- Energy resolution: 17%/√E (comparable with plastic scintillator based prototype)

**Lateral scintillation light readout calorimeter**

- Light collected from scintillator sides and bundled to a single SiPM reading 30 fibers/3 scintillators.

- SiPM are not exposed in the hadronic shower, thus less compact design.

### Other characteristics:

- Reduced neutron damage:

- Better accessibility:

- Safer WLS-SiPM coupling

- Uniformity response, $\pi$/$\nu$ separation: in progress.

### Test of SiPM radiation-hardness

In ENUBET, the use of compact calorimetric modules is a very effective solution but results into exposing the SiPMs to fast neutrons produced by hadronic showers.

**Prototype tested at CERN (PS-T9)**

- Loss of single p.e. sensitivity after 1 - 3 $10^9$ MeV (μA eq.

- Constant MPK-readout peak gain loss recovered with an increased over-voltage.

### More information:

- **Enhanced Neutrino Beams from kaon Tagging**

- **New technique employed to determine the absolute $\nu_e$ flux based on the reconstruction of large angle positrons in the instrumented decay tunnel from three-body $K^+ \rightarrow \pi^+ \nu_e \bar{\nu}_\mu$ decays**

- **Reduction of the systematic uncertainties on the knowledge of the initial neutrino flux to 0.1% level.**

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**Enhanced Neutrino Beams from kaon Tagging**

**NEW TECHNIQUE EMPLOYED TO DETERMINE THE ABSOLUTE $\nu_e$ FLUX BASED ON THE RECONSTRUCTION OF LARGE ANGLE POSITRONS IN THE INSTRUMENTED DECAY TUNNEL FROM THREE-BODY $K^+ \rightarrow \pi^+ \nu_e \bar{\nu}_\mu$ DECAYS**

**REDUCTION OF THE SYSTEMATIC UNCERTAINTIES ON THE KNOWLEDGE OF THE INITIAL NEUTRINO FLUX TO 0.1% LEVEL.**