

Measurement of the HNL properties at the FCC-ee

Status and prospects

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<https://indico.cern.ch/event/1392179/>

Status

We've been focused on both the potential for discovery and the determination of the structure of the model

Channel: $Z \rightarrow N\nu, N \rightarrow \mu jj$

1. Sensitivity to discovery, in the mass range 5-85 GeV

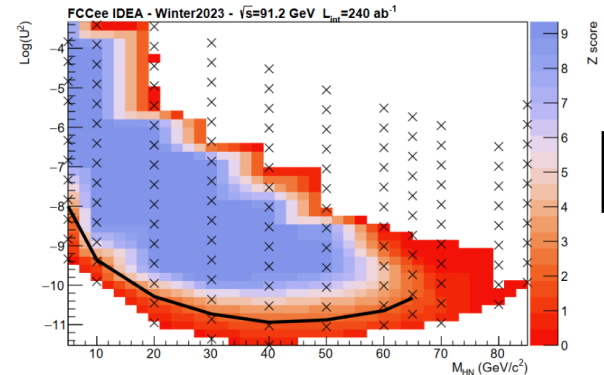
- Single neutrino model
- MG/Pythia + DELPHES IDEA **fast-sim**. Background included
- HNL- ν mixing angle: **exclusion limits** both for a **prompt** and **long-lived analysis**
- Preliminary insight on jet resolution **requirements**
- Public note <https://new-cds.cern.ch/doi/10.17181/28t3j-yxk20>, part of the midterm report

2. Timing-based mass measurement

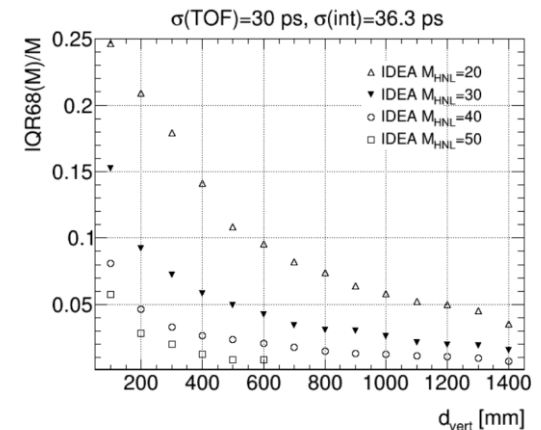
- Same benchmark model and channel
- Nice proof-of-concept: **mass resolution at the percent level** with timing precision of O(40 ps)
- indico.cern.ch/event/1307378/

3. Sensitivity to $HNL - \overline{HNL}$ oscillation

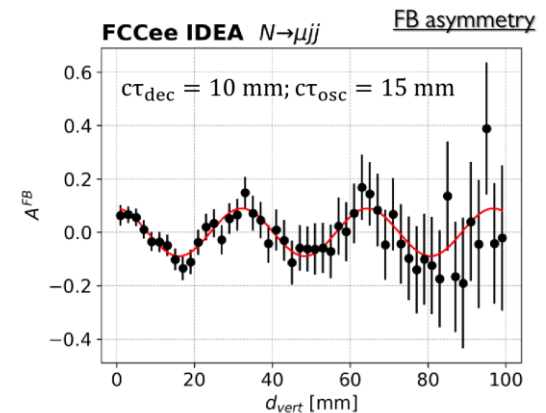
- Model: [arXiv/2210.10738](https://arxiv.org/abs/2210.10738)
- Long-lived analysis, with **full background rejection**
- Studied as a function of HNL decay length and oscillation period
- **F/B asymmetry** measurable in the detector all over the investigated parameter space
- indico.cern.ch/event/1307378/



1.



2.



3.

Prospects

Observation of lepton-charge asymmetry

- ❑ Helpful for:
 - ❑ Measurement of HNL oscillation
 - ❑ Discrimination against Dirac/Majorana nature of neutrino
- Developing more robust statistical algorithms
- Testing ML techniques

Playing around with event topology and kinematics

- ... to exploit all the experimental handles for the determination of the structure of the couplings and properties of the HNLs
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Optimistic jet resolution from DELPHES (Winter2023 cards)

- ❑ Gaussian response, PFA, no confusion term
- To be verified with parametrization from full-sim
- More in-depth studies can provide further inputs for detector requirements