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# THE CENF-ND AND THE UPDATE OF THE EUROPEAN STRATEGY OF PARTICLE PHYSICS

# CALL FOR INPUTS FOR EUROPEAN STRATEGY FOR PP.

## Open call to all members of the particle physics community

The [CERN Council](#) has set itself the objective of updating the European Strategy for Particle Physics by May 2020. To achieve this, it has established a Strategy Secretariat to which it has assigned the task of organising the update process.

The Strategy update process will include two major events: an “Open Symposium” and a “Strategy Drafting Session”.

At the Open Symposium, to be held in the second half of May 2019, the community will be invited to debate the scientific input into the Strategy update, which will take the form of a “Briefing Book”. This will be prepared over the summer of 2019 by a Physics Preparatory Group (PPG) and submitted to the European Strategy Group (ESG) for consideration before and during its Strategy Drafting Session to be held in the second half of January 2020.

To prepare the Open Symposium, the Strategy Secretariat hereby calls upon the particle physics community in universities, laboratories, national institutes and institutions to submit written input following the enclosed guidelines.

The deadline for input is **18 December 2018**.

Input should be submitted via a portal that will be created on the Strategy update website, which will be available from the beginning of October 2018, once the Strategy update has been formally launched by the CERN Council. The link to this website will appear on the CERN Council’s web pages - <https://council.web.cern.ch/en> - and be widely communicated through the appropriate channels.

The Strategy Secretariat  
Update of the European Strategy for Particle Physics  
[EPPSU-Strategy-Secretariat@cern.ch](mailto:EPPSU-Strategy-Secretariat@cern.ch)

# 2013 EUROPEAN STRATEGY

- ▶ Path to document described in [Phys. Scr. 2013 014019](#)
  - CERN council appointed the Strategy Group in 2011, members from SPC, ECFA, European Labs ..with observers from various committees (EU, APPEC, FALC , ESFRI and NuPECC )
  - Preparatory Group also appointed. This collected inputs for a total of 160 contributions and organized a symposium (Sept 2012 <https://indico.cern.ch/event/182232/>)
  - Preparatory Group produced the Scientific briefing Book ([http://europeanstrategygroup.web.cern.ch/europeanstrategygroup/Briefing book.pdf](http://europeanstrategygroup.web.cern.ch/europeanstrategygroup/Briefing%20book.pdf)).
  - Neutrino experiments reviewed in chapter 4 of the Book
  - In January 2013 the Strategy Group met in Erice for the drafting session.
  - Agreed by CERN Council in May with minor amendments

# 2013 EUROPEAN STRATEGY

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CERN-Council-S/106

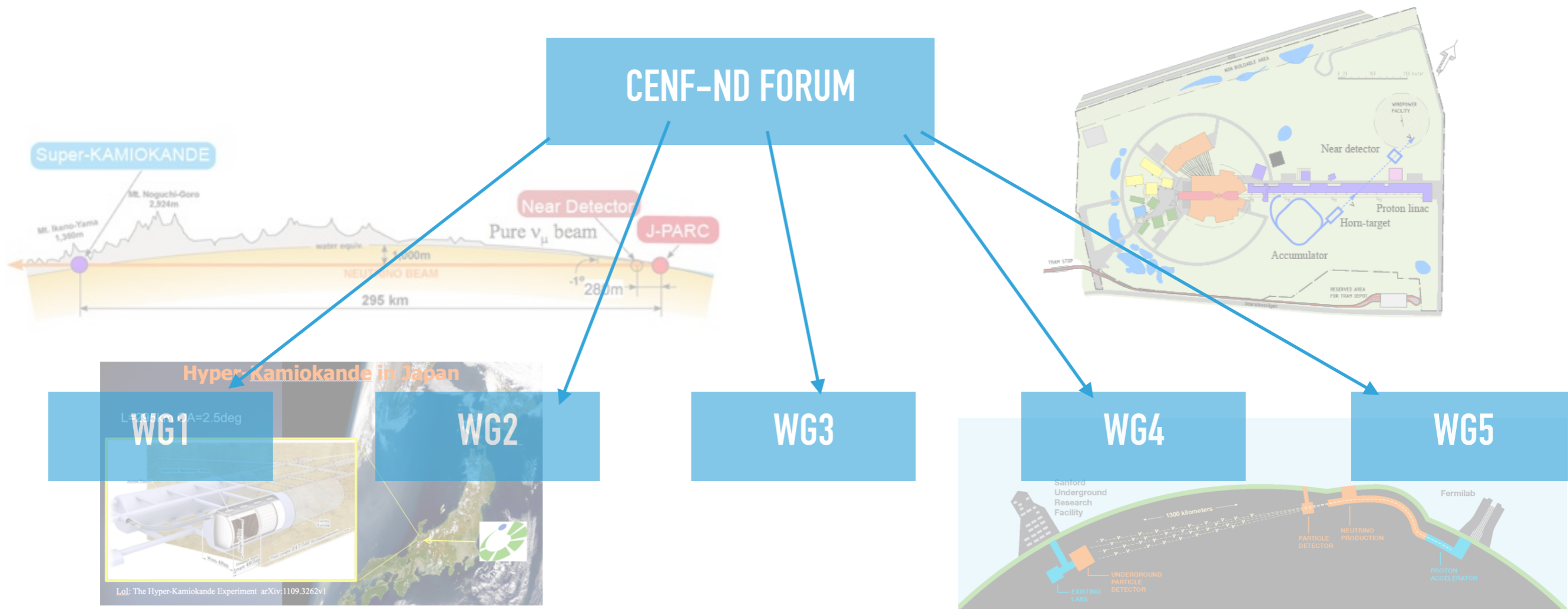
*accelerator R&D programme, including high-field magnets and high-gradient accelerating structures, in collaboration with national institutes, laboratories and universities worldwide.*

e) There is a strong scientific case for an electron-positron collider, complementary to the LHC, that can study the properties of the Higgs boson and other particles with unprecedented precision and whose energy can be upgraded. The Technical Design Report of the International Linear Collider (ILC) has been completed, with large European participation. The initiative from the Japanese particle physics community to host the ILC in Japan is most welcome, and European groups are eager to participate. *Europe looks forward to a proposal from Japan to discuss a possible participation.*

f) Rapid progress in neutrino oscillation physics, with significant European involvement, has established a strong scientific case for a long-baseline neutrino programme exploring CP violation and the mass hierarchy in the neutrino sector. *CERN should develop a neutrino programme to pave the way for a substantial European role in future long-baseline experiments. Europe should explore the possibility of major participation in leading long-baseline neutrino projects in the US and Japan.*

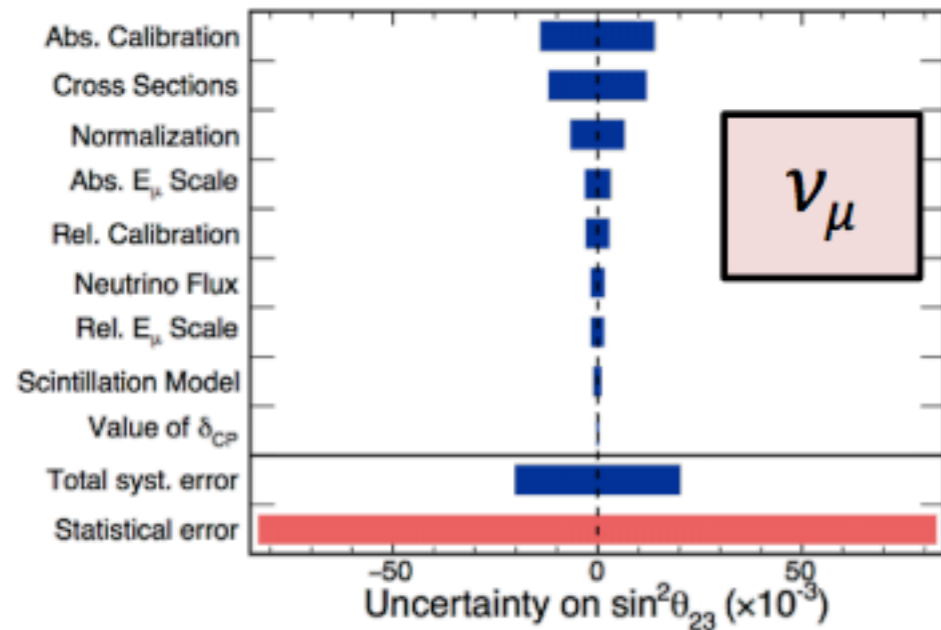
# HOW WE CAN CONTRIBUTE ?

- ▶ CENF-ND is regrouping Institutes from EU but also from Japan and US. This put together many experts in LBN neutrino experiment
- ▶ The CENF-ND has all elements to propose an input to the UESPP.

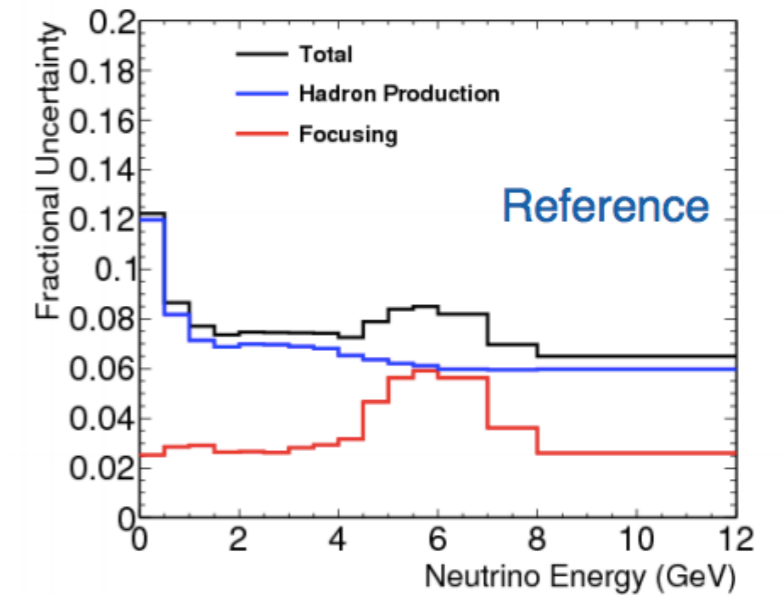


# CURRENT LBN SYSTEMATICS UNCERTAINTIES

NOvA seminar [at CERN](#)

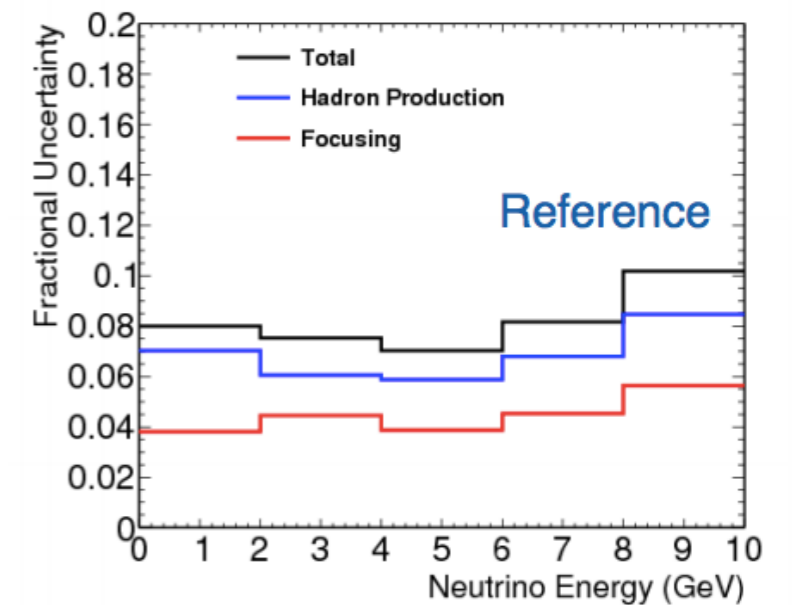


DUNE Total uncertainties [L.Field talk](#)



T2K seminar at [KEK](#)

| Error Source  | % Errors on Predicted Event Rates, Osc. Parameter Set A |             |             |             |               |             |
|---|---|-------------|-------------|-------------|---------------|-------------|
|   | 1R $\mu$ -Like  |             | 1R e-Like   |             |               |             |
|   | FHC   | RHC         | FHC         | RHC         | FHC CC1 $\pi$ | FHC/RHC     |
| SK Detector   | 1.86  | 1.51        | 3.03        | 4.22        | 16.69         | 1.60        |
| SK FSI+SI+PN  | 2.20  | 1.98        | 3.01        | 2.31        | 11.43         | 1.57        |
| ND280 const. flux & xsec  | 3.22  | 2.72        | 3.22        | 2.88        | 4.05          | 2.50        |
| $\sigma(\nu_e)/\sigma(\nu_\mu)$ , $\sigma(\bar{\nu}_e)/\sigma(\bar{\nu}_\mu)$ | 0.00  | 0.00        | 2.63        | 1.46        | 2.62          | 3.03        |
| NC1 $\gamma$  | 0.00  | 0.00        | 1.08        | 2.59        | 0.33          | 1.49        |
| NC Other  | 0.25  | 0.25        | 0.14        | 0.33        | 0.98          | 0.18        |
| <b>Total Systematic Error</b>   | <b>4.40</b>   | <b>3.76</b> | <b>6.10</b> | <b>6.51</b> | <b>20.94</b>  | <b>4.77</b> |



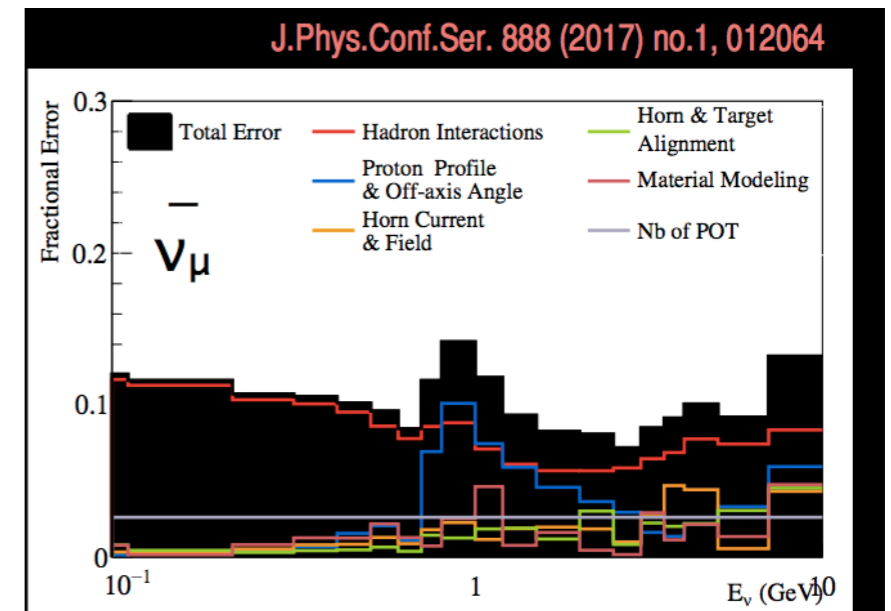
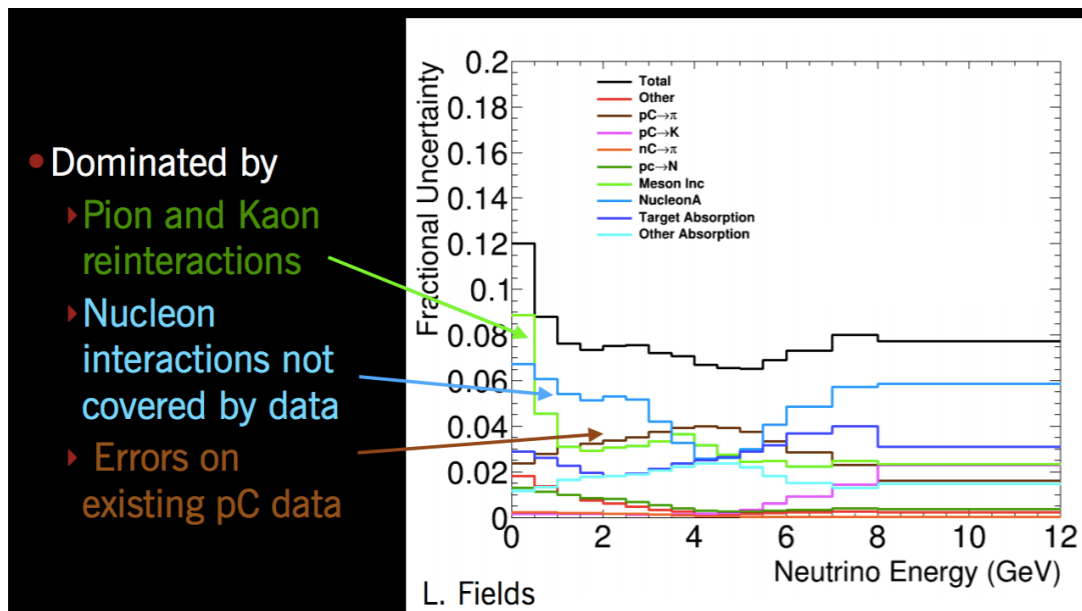
## HOW WE CAN CONTRIBUTE ?

- ▶ Since the CENF-ND forum group several collaborations together, the input will be likely a white paper
- ▶ Not explicitly push toward an experiment but have a critical view of what the current and next generation of experiment can achieve and which are the limitations (systematics!)
  - ▶ Support existing (propose new) auxiliary experiments to provide key data when missing
  - ▶ Support an explicit detector design if this can have a broad positive impact to the community (e.g. nuPRISM/E61, DUNEPrism)

# SOME IDEAS (1)

(WG1+WG4)

- ▶ Flux measurements are crucial for all LBN detectors.
- ▶ T2K/T2HK use NA61 measurements to constrain flux uncertainties.
- ▶ NA61 is submitting a proposal to the SPSC to extend the data taking after the LS2 and perform measurements also for DUNE
- ▶ CENF-ND can support NA61 with studies of the impact of those systematics on the final sensitivities

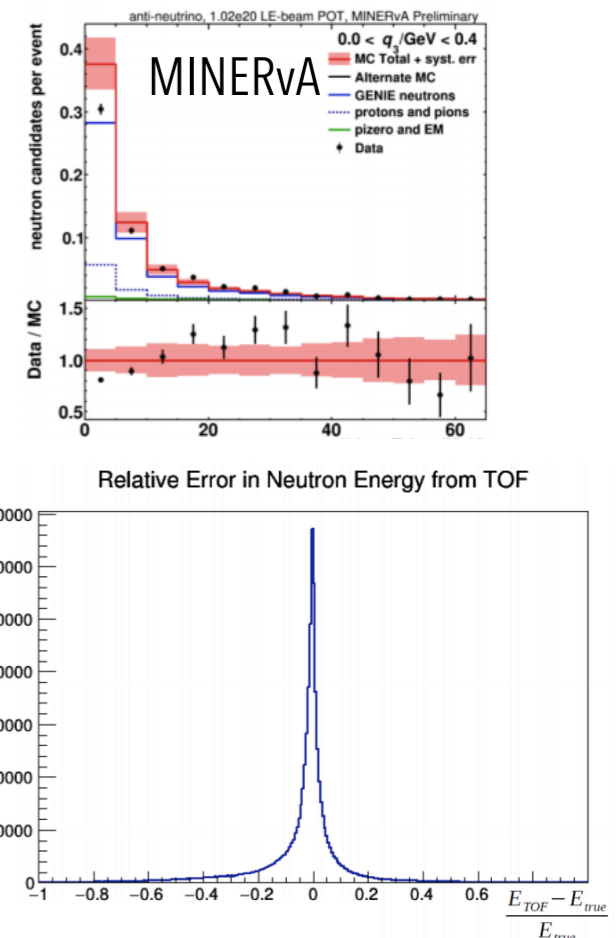
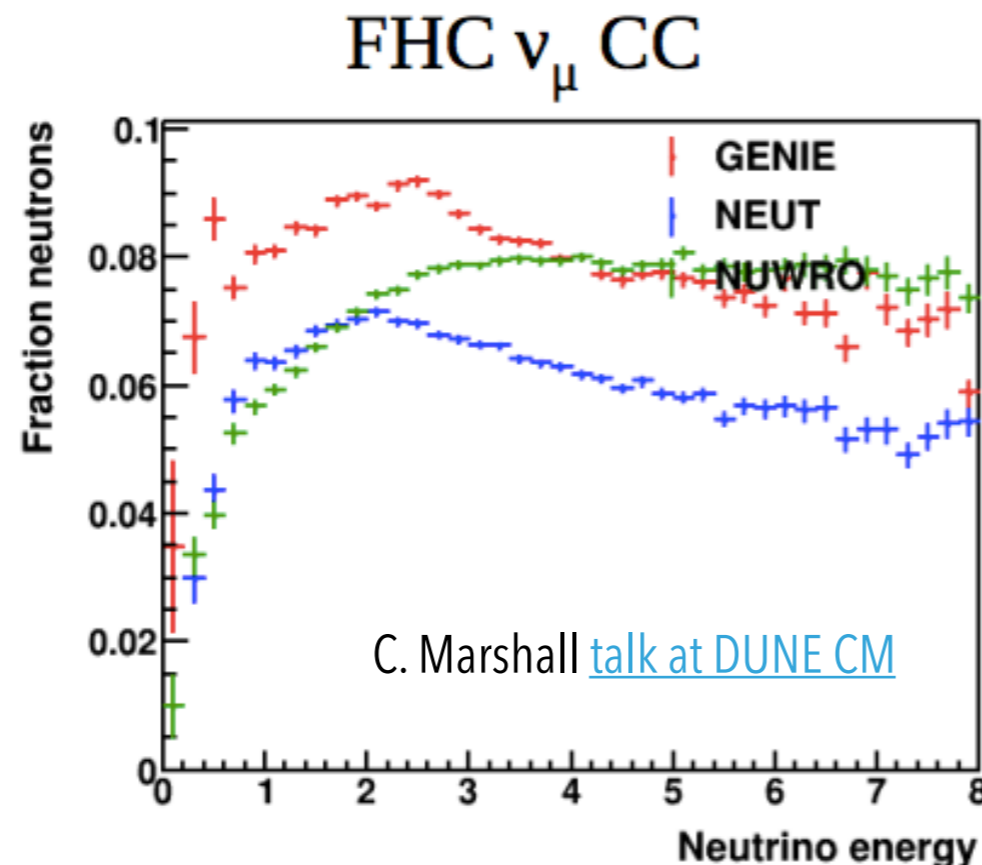




## SOME IDEAS (2)

(WG1+WG2/3+WG5)

- ▶ Test beam are really valuable to validate and fully characterise the detector response.
- ▶ Response to invisible energy, energy/angular resolution performances are of interest for flux, cross-section and neutrino energy reconstruction
- ▶ The CENF-ND might propose to use existing facilities or set up a new one to address those topics



## SOME IDEAS (3)

- ▶ MC generators: status, area of development, impact on sensitivities (WG2+WG4)
  - ▶ CENF-ND can set up a centre for generators : *à la* EP-TH but focused on generators. e.g. asking fundings for contracts having CENR and UniGe as main centre
  
- ▶ Cross-section measurement dedicated experiments (e.g. MINERvA) are deeply used to validate our MC modelling (WG3+WG2)
  - ▶ CENF-ND can support those kind of experiments, propose new measurements

# PRACTICAL INFOS: PAPER FORMAT

- ▶ **Cover page** : (1 page) title, contact person, abstract
- ▶ **Overview**: (max 10 pages) scientific context, objectives, methodology, readiness and expected challenges
- ▶ **Addendum**: interested community, timeline, construction and costs (if), computing requirements

## Distribution

Both documents submitted (main and addendum) will be passed on to the Physics Preparatory Group (PPG) and the European Strategy Group (ESG). Unless explicitly requested otherwise, they will also be made public. The option not to make either document public will be available upon submission via the dedicated portal.

# PRACTICAL INFOS: SCHEDULE

- ▶ July/September : CENF-ND general @ CERN → structure defined, studies ongoing
- ▶ November: CENF-ND general @ CERN: → draft ready
  
- ▶ WGs should organise independently meetings to organise the work