

3rd Forward Physics at the LHC informal get together

Studies including simulations that are
needed or ongoing

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1) Detector Simulations (focus on LAr):

- **needed:** conceptual detector design
- **needed:** understand capabilities: acceptance / energy resolution / particle and charge ID / identify neutrino detection / interface with other detectors ...

probably most important

2) Estimate of neutrino fluxes and their uncertainties:

- neutrino fluxes from pions/kaons
 - * **done:** comparison between different commonly used generators by Felix
 - * **ongoing:** Forward Physics Tune in Pythia8 (incl. tuning uncertainties) by Fieg, Kling, Schulz, Sjöstrand
 - * **needed eventually:** similar studies for other generators, consensus on how to quantify uncertainties, impact on CR physics
- neutrino fluxes from charm decay
 - * **done/ongoing:** NLO approach by Maria, Hallsie, Milind, ...
 - * **ongoing:** kT factorization approach by Ina, Anna, Atri, Felix
- muon fluxes:
 - * **ongoing:** BDSIM study by FASER collaboration

**efforts started,
more work
needed**

**dedicated efforts
needed**

3) Neutrino Interaction Simulations:

- **needed:** reliable neutrino interaction event generators at TeV energies ideally including uncertainties (especially for hadronization / final state interaction):
correct physics modelling somewhat unclear, current generators such as GENIE or GiBUU essentially just run Pythia6

4) Physics Sensitivity/Motivation Studies:

- SM:
 - * **needed:** neutrino cross section measurements
 - * **needed:** dedicated motivations for physics with tau neutrinos
 - * **needed:** physics potential for QCD/astroparticles using neutrino flux measurements
 - * **ongoing:** probing (n)PDFs via neutrino scattering by Arakawa, Kling, Smith, Tait, Waterbury
- BSM:
 - * **done:** dark matter scattering by Batell, Feng, Trojanowski
 - * **ongoing:** LLP decays in LAr by Trojanowski
 - * **possible:** millicharged particles in LAr ?
 - * **possible:** sterile neutrino oscillations in LAr?
 - * **possible/ongoing:** NSIs, neutrino philic dark matter, neutrinos with EM dipoles, ...

**maybe not so
urgent**

... + other ideas from the FPF report ...