Forward Physics Facility
Pheno 2021

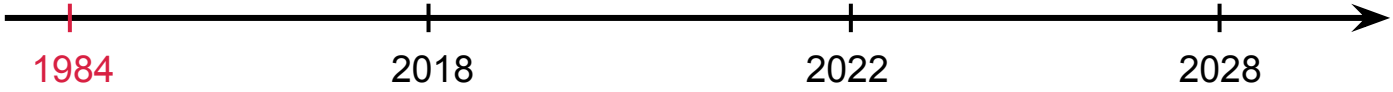
Snowmass LOI:
https://zenodo.org/record/4059893

Kickoff Meeting:
https://indico.cern.ch/event/955956/

Next Workshop (May 27th/28th):
https://indico.cern.ch/event/1022352

Felix Kling

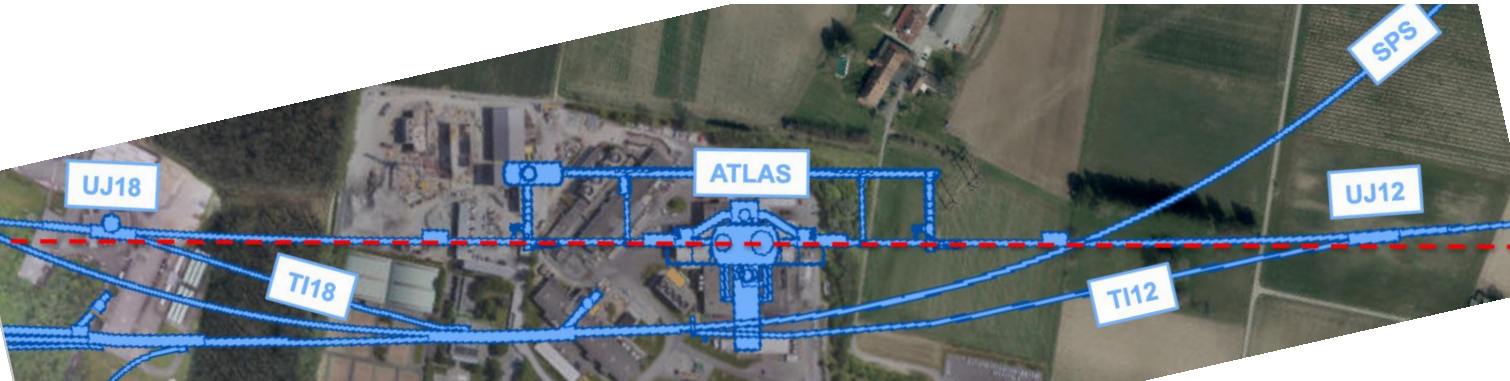
SLAC NATIONAL ACCELERATOR LABORATORY



Neutrinos detected from many sources, but not from colliders.

But there is a huge flux of neutrinos in the forward direction, mainly from π, K and D meson decay. De Rujula et al. (1984)

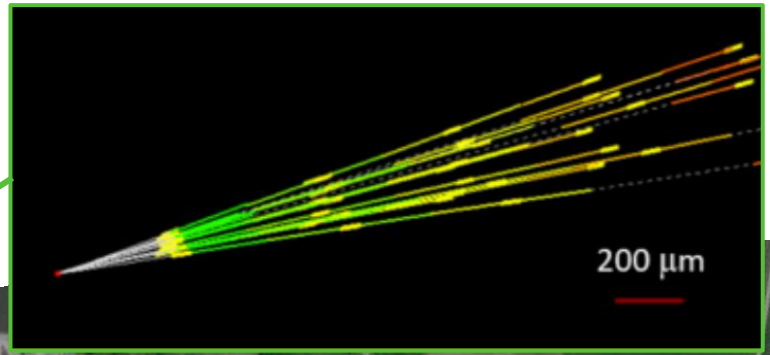
ATLAS provides an intense and strongly collimated beam of TeV-energy neutrinos along beam collision axis.

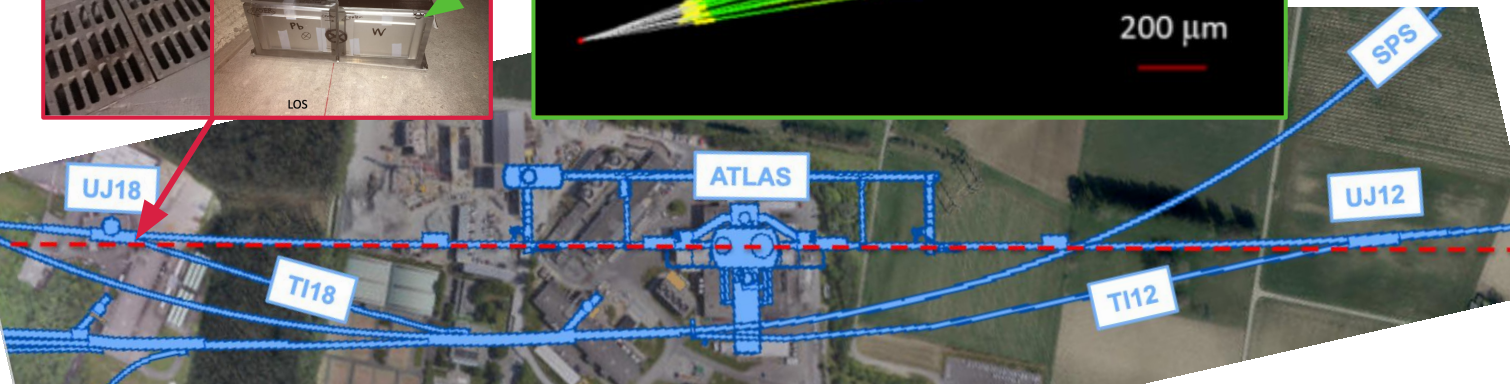


1984 2018 2022 2028

In 2018, the FASER collaboration placed ~30 kg pilot emulsion detectors in TI18 for a few weeks.
Expect ~10 neutrino interactions

First neutrino interaction candidates at the LHC were recently reported.

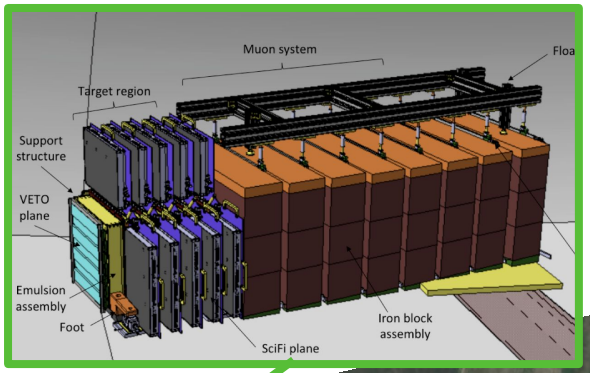




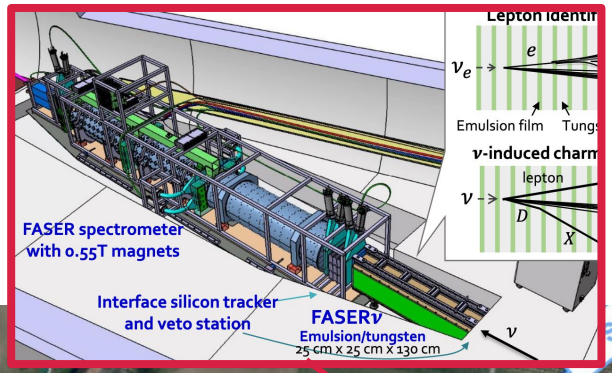
1984 2018 2022 2028

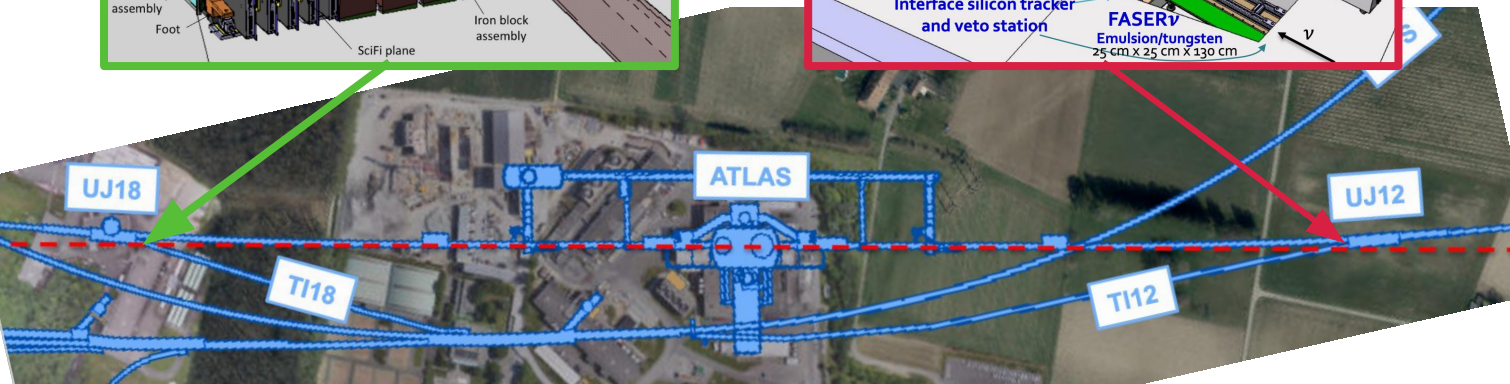
During Run 3 of the LHC, two new experiments will detect about electron 1000 neutrinos, 10000 muon neutrinos and 10 tau neutrino

SND@LHC



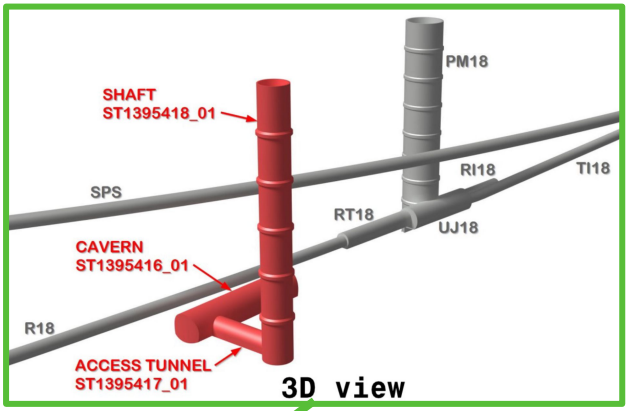
FASERnu

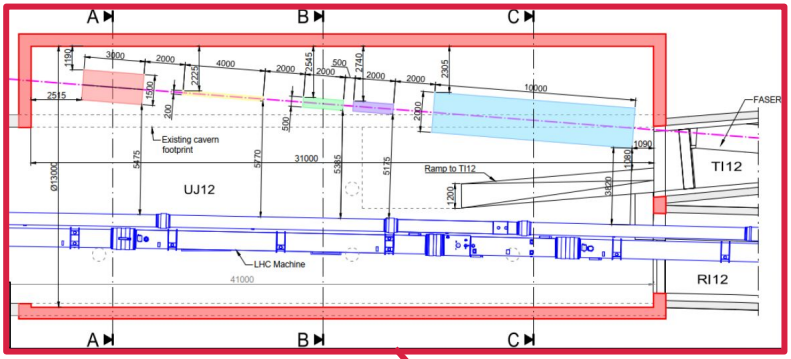


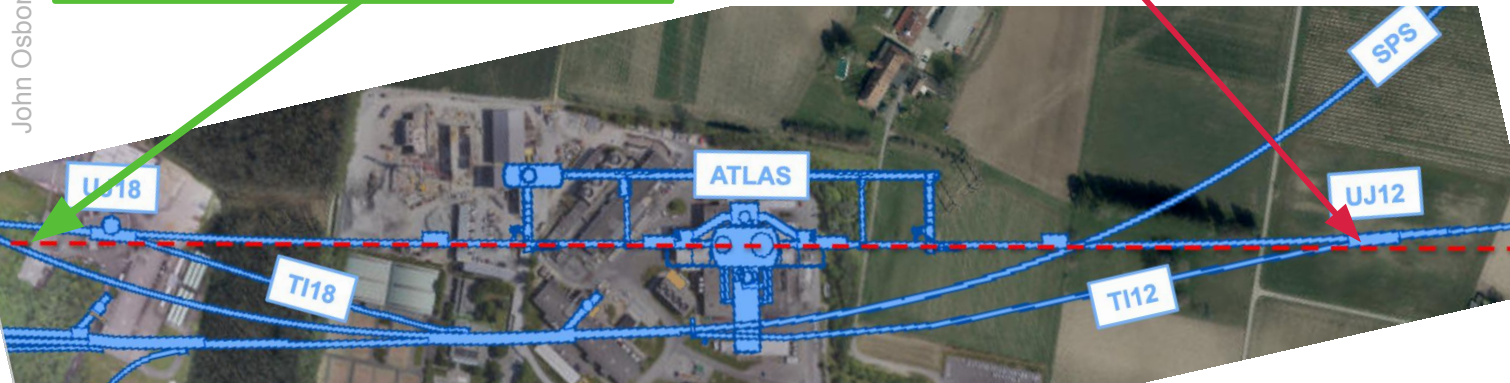


1984 2018 2022 2028

The proposal: create a Forward Physics Facility (FPF) for the HL-LHC to house a suite of experiments. Two promising locations were identified.



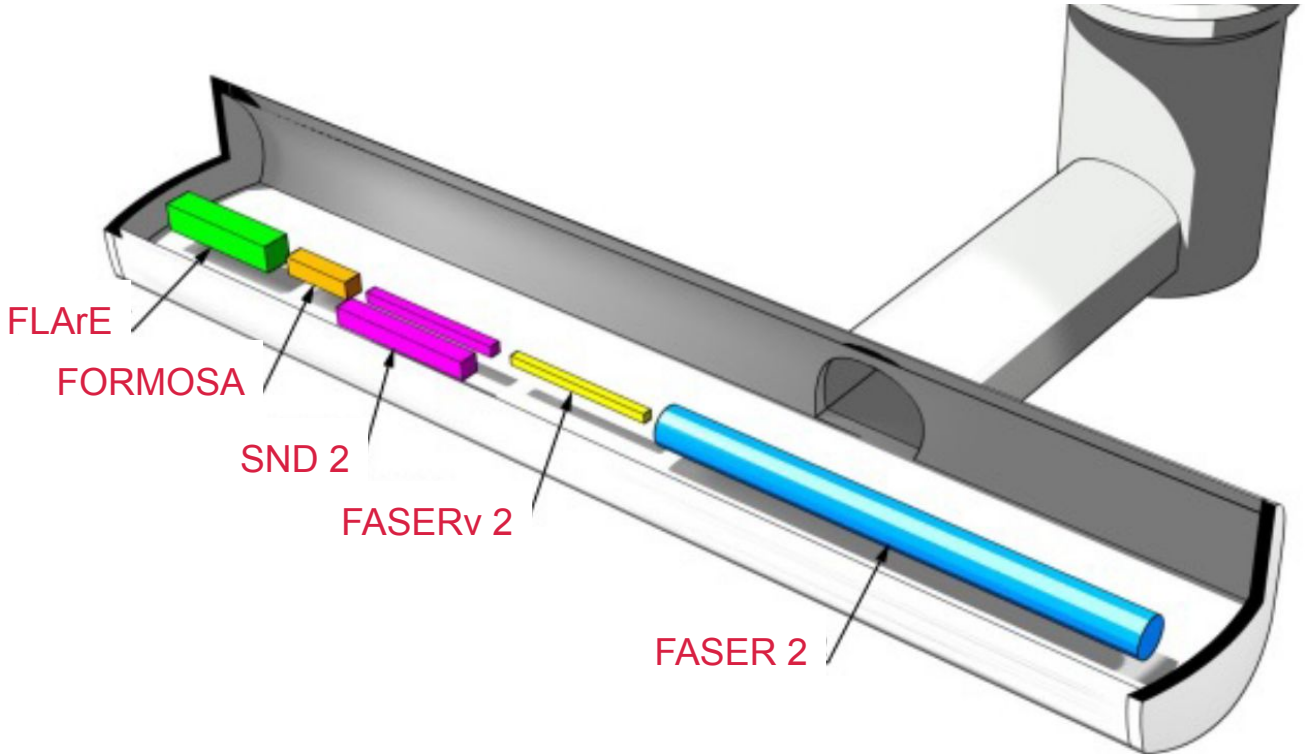




John Osborne, Kincso Balazs, Jonathan Gall

Physics Potential

The FPF would house a suite of experiments that will greatly enhance the LHC's physics potential for BSM physics searches, neutrino physics and QCD.



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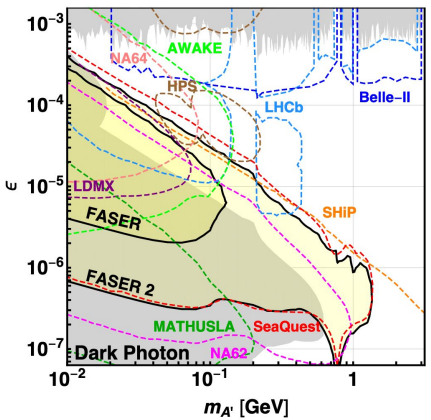
BSM Physics:

- long-lived particle searches with **FASER 2**
- DM scattering searches with neutrino detectors, **FASERv 2, SND 2, FLArE**
- millicharged particles searches with **FORMOSA**

1811.12522



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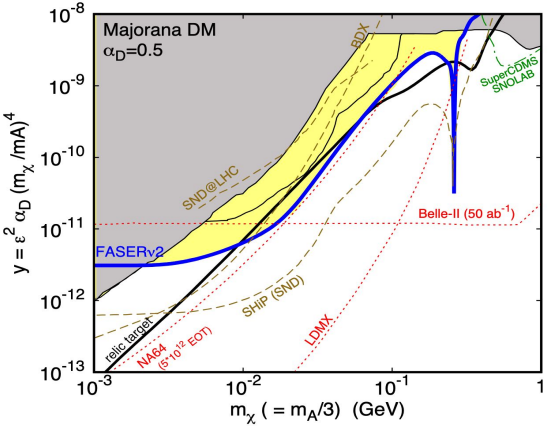

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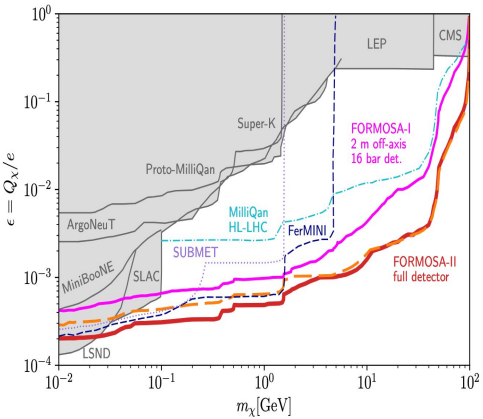

→ see Sebastian's talk

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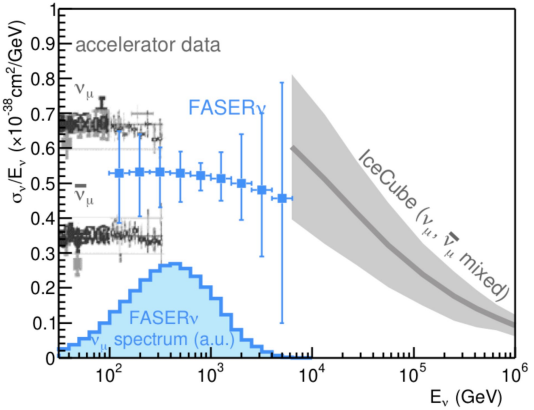
Neutrino Physics:

- about 100k electron, 1M muon and few 1000 tau neutrinos at **FLArE, FASERν 2**
- measurement of neutrino cross section at TeV energies
- tau neutrino precision physics
- neutrino related new physics: NSI, neutrino magnetic moments, sterile neutrino oscillations, sterile neutrino decay, neutrinophilic DM, ...

1908.02310



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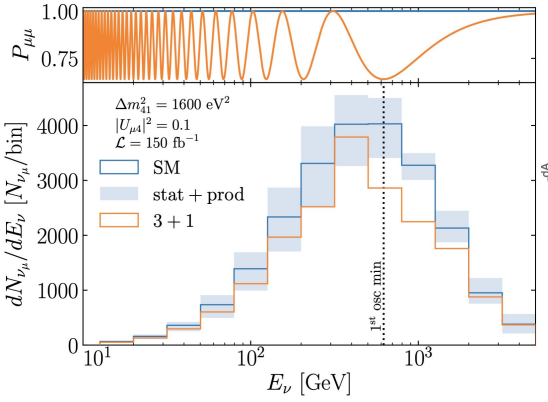

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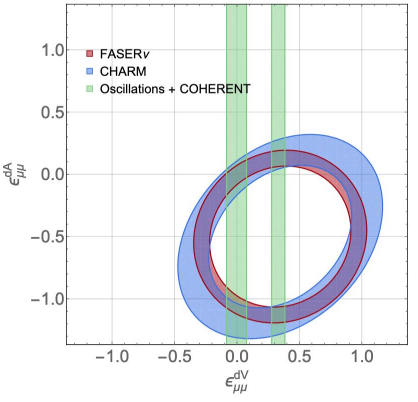

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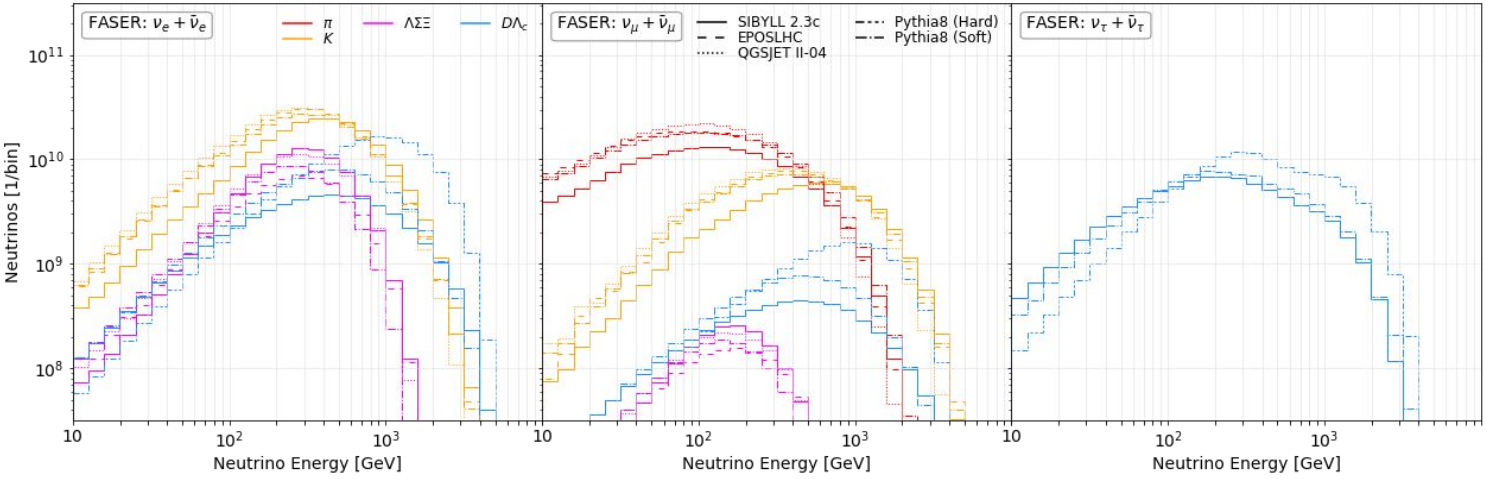
QCD:

- forward neutrinos originate from forward hadron decays



Physics Potential

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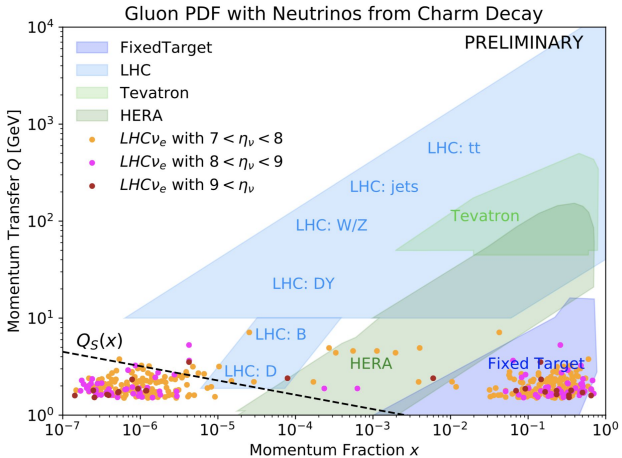
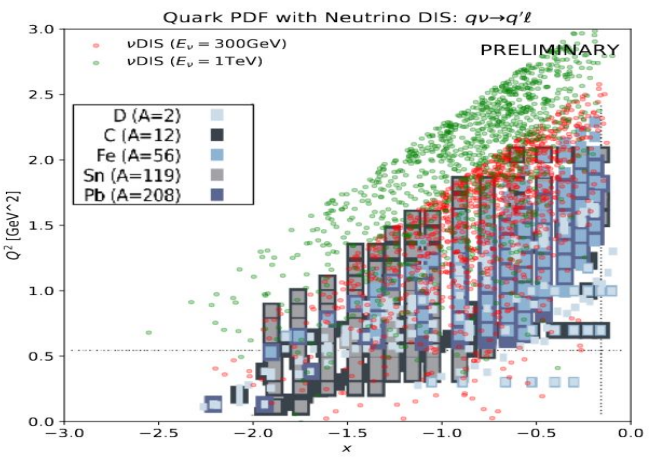
QCD:

- forward neutrinos originate from forward hadron decays
- improve/validate hadronic interaction models
- neutrinos from charm decay could allow to test transition to small-x factorization and gluon saturation, constrain low-x gluon PDF, and probe intrinsic charm
- provide valuable input for astro-particle physics
- constrain PDFs via DIS neutrino scattering





Next FPF Meeting

Upcoming 2nd FPF workshop on May 27th/28th will discuss these topics in great detail.

https://indico.cern.ch/event/1022352

The Pheno community is invited to join!