Discussion LLP session

Open questions for discussion

LLP searches are designed to be, in general, model independent

- Is this true?

If model-dependence is unavoidable, should we prioritize some benchmarks more than others?

- Are these inline with benchmark used outside the LHC?

Open questions for discussion

Resources are limited → Need guiding principles to prioritize searches

- Should identify the uncovered phase space with the largest discovery potential

Beyond the "B(**H** → **XX)** vs **$c\tau$" benchmark results** for specific final states (one should be able to compare with previous searches and the LHC LLP Summaries)

What other interpretations would be useful?

- Facilitate communication with other communities
- Consider the interplay with other decay modes explored at LHC

How should these extra interpretations be provided?

- As part of the full analysis by experimental collaborations?
- Through reinterpretation (e.g arXiv:2509.02564)?
- Within the BSM working group?

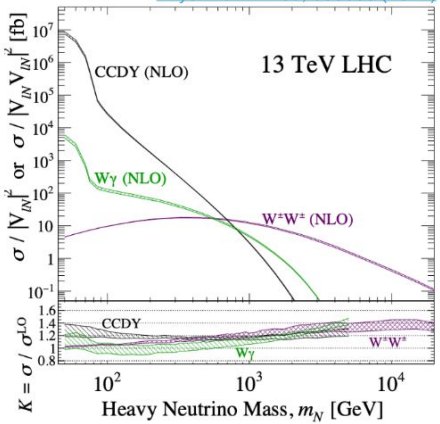
Need quick turn-around!

Discussion 1

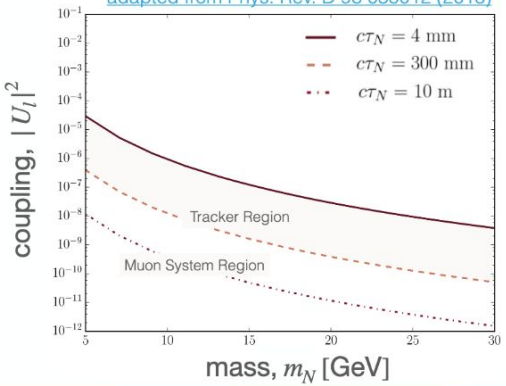
- Two examples now of summary plots across LHC experiments. With this in mind, when is a good moment to update the LHC LLP summary plots? They should not get outdated

- **Extensions** to HNL summary plots (could be done now):
  - Consider should 1st and 2nd generation mixing on the same plot to compare (e.g. muon vs electron channels)
  - Consider showing expected and observed limits
  - Consider doing a LHC best plot showing the cross-section of the different production modes of the HNL that are relevant for LHC searches or constant cτ lines

Phys. Rev. D 103, 055005 (2021)

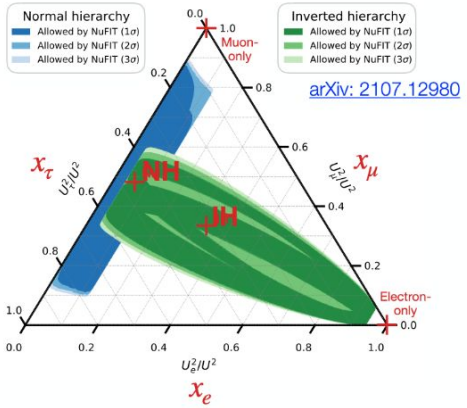


adapted from Phys. Rev. D 98 035012 (2018)

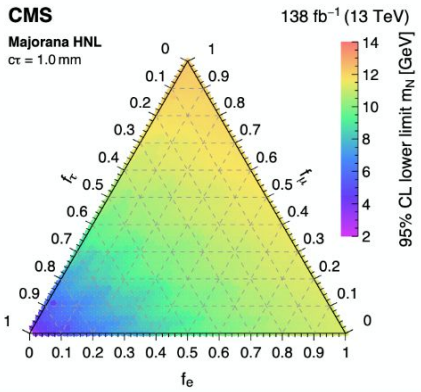


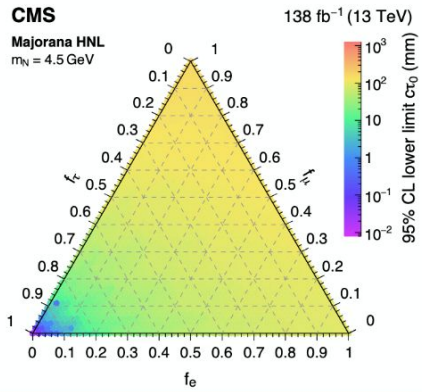
Discussion 2

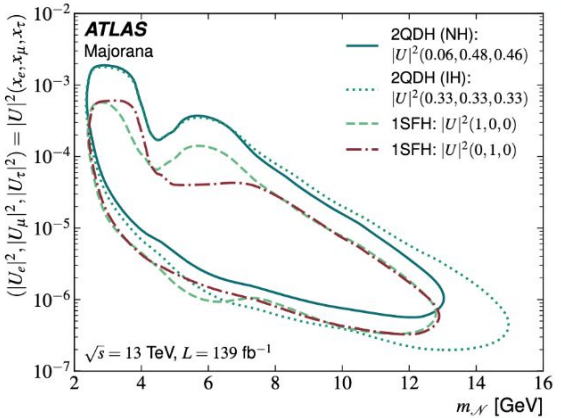
- **Extensions** to HNL summary plots (for the future):
  - Extend to tau sector (missing input from ATLAS)
  - Providing limits for realistic coupling scenarios
    - ATLAS examples with fixed mixing ratio; CMS examples with fixed mass/cτ and varying mixing ratios
    - Not (currently) available for all searches
    - Should discuss and converge on benchmarks for the LHC?
    - Need ways to compare with the past (single-flavour mixing), but also more motivating to look at sensitivity to realistic models moving forward



arXiv: 2107.12980







Discussion 3

- Thoughts on which benchmarks to next address? Original list from 2022 ~ ordered by complexity?

1. ~~$H \rightarrow SS$; $S \rightarrow bb, qq, \tau\tau$, for hadronic searches~~
2. ~~HNLs~~
3. $H \rightarrow Z_D Z_D$; with $B(Z_D)$ from Hidden Abelian Higgs model (HAHM), for leptonic searches
4. GMSB SUSY
5. RPV SUSY

- Other ideas?