FIPs@SPS: SHiP

FPC meeting

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Intesity frontier experiments

- HL-LHC as well as future colliders such as FCC will be able to explore Intensity frontier.
- However, domain of “low” masses $m \lesssim m_B$ is complicated to explore.
SHiP [1504.04956] - no compromise experiment to

\[ m_{\text{FIP}} < m_B \]

To be installed at BDF@SPS

\[ N_{\text{PoT}} = 2 \times 10^{20} \] during 5 years of operation

Hadronic absorber followed by muon shield

Almost ultimate no compromise experiment which may probe masses \( < m_B \)
What SHiP may tell about portals?

Consider HNLs as an example.

- Natural lower (BBN/seesaw) and upper (baryogenesis) bounds for couplings
- SHiP probes couplings very close to BBN/seesaw line
Similarly, SHiP may probe other portals.
Model parameters reconstruction

Two “types” of sensitivity:
- Based on the number of events for the given model
- Based on the ability to distinguish models and reconstruct their parameters

What SHiP may say about parameters?

For HNLs, SHiP may:
1. Distinguish from other portals by semileptonic decays
2. Mass (decays $N \rightarrow \pi l$), mixing pattern (searching for various modes)
3. Dirac/Majorana (by different spectrum of decay products)
4. Mass splitting (by oscillations)

\[ U_{e}^{2}/U_{\mu}^{2} \]

\[ N_{\text{obs}} = 811 \]
\[ \bar{n}^b = 982.42 \]
\[ x_e = 0.33 \]
\[ x_\mu = 0.33 \]
\[ N = 1000 \]
\[ x_e^b = 0.34 \]
\[ x_\mu^b = 0.34 \]
Currently, R&D study is ongoing: optimize the BDF by reducing costs, but without compromising the sensitivity.