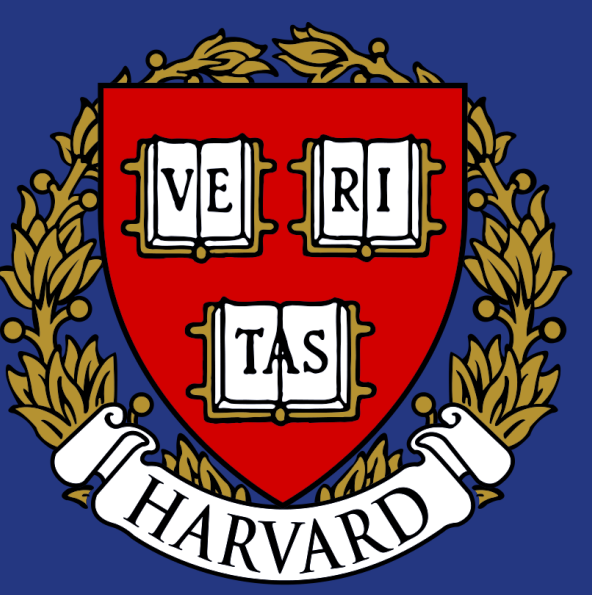


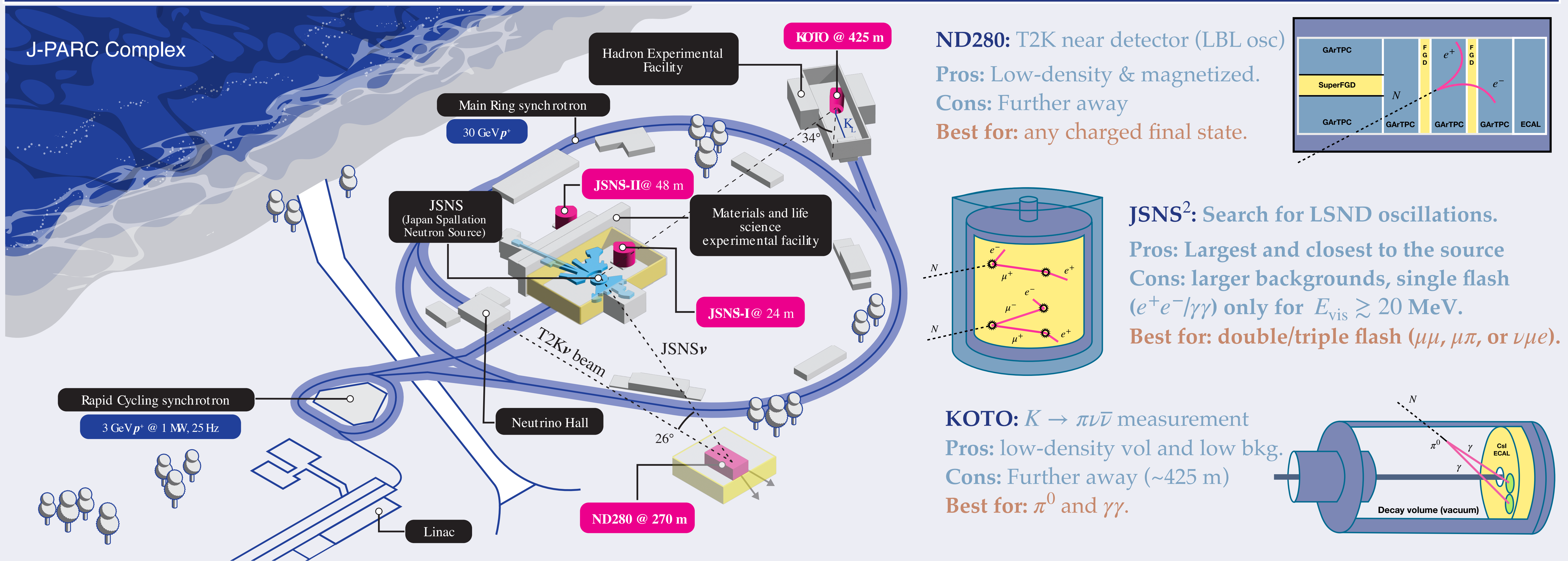
Long-lived particles at spallation sources: new targets for J-PARC

Matheus Hostert with C. Argüelles (Harvard University) and S. Urrea (IFIC, Valencia) — in preparation

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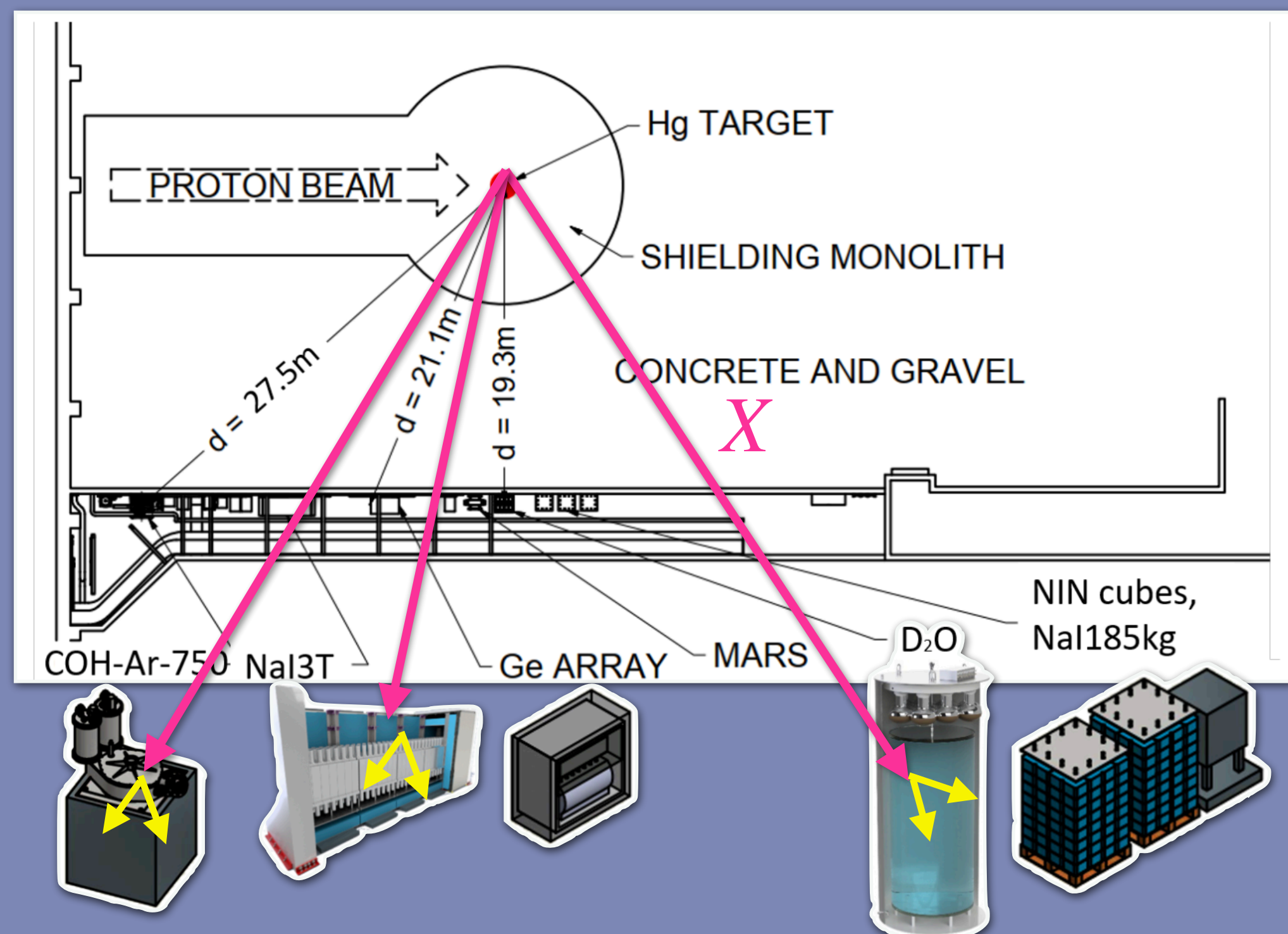
New opportunities at the Japanese Proton Accelerator Research Complex (J-PARC)



New Opportunities at SNS and LANSCE

Spallation Neutron Source (Oak Ridge) COHERENT detectors

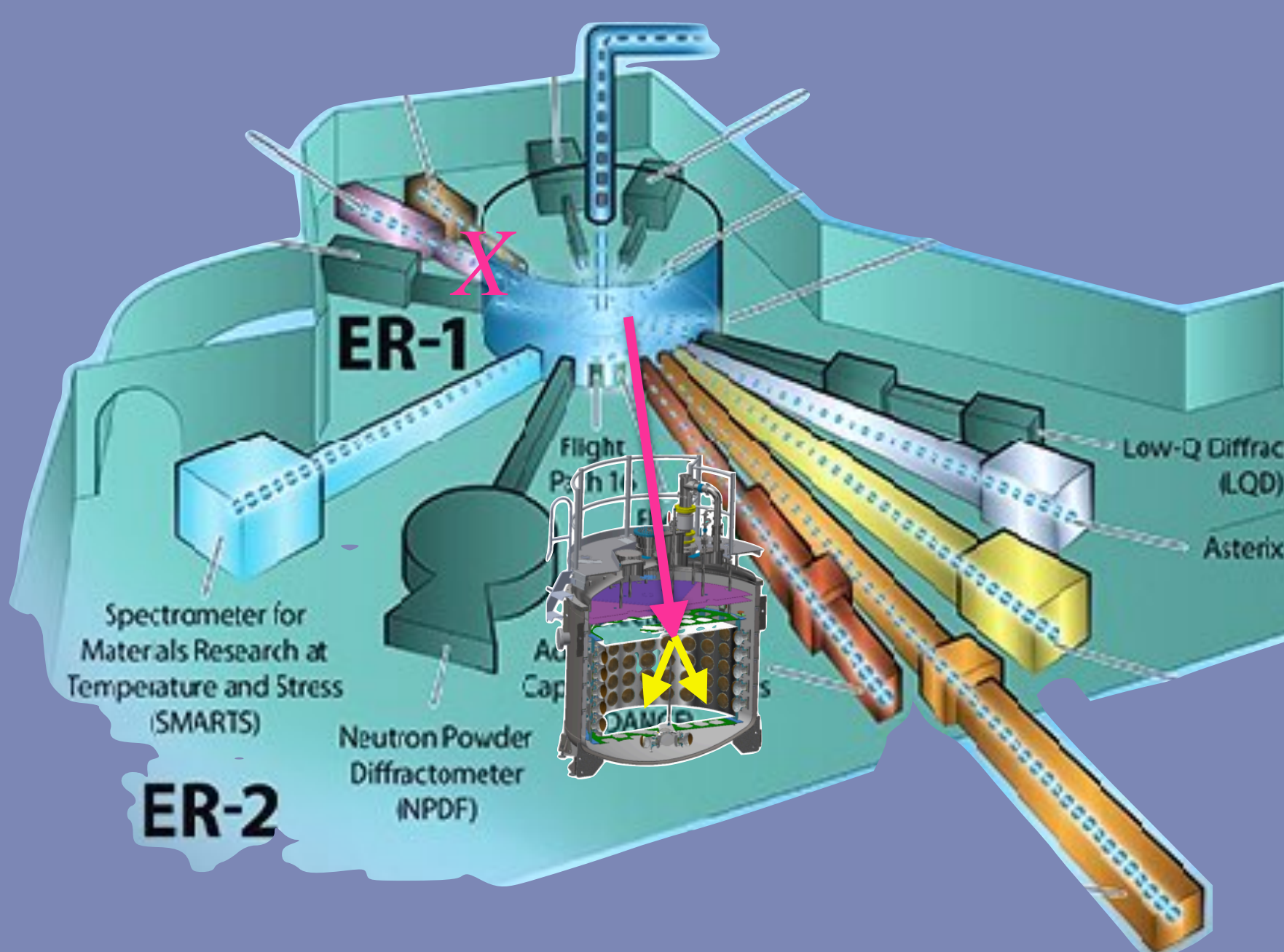
Coherent elastic neutrino-nucleus scattering, now employing larger detector modules for ν_e CC measurement. These can be used for LLP searches.



750 kg (LAr) + 590 kg (D₂O) + 590 kg (H₂O)
 Requiring 50 events/3 years of operation

Los Alamos Neutron Science Center Coherent-Captain-Mills (CCM)

Employed for searches for dark particles. Large volume and great timing for background reduction.



CCM: 7 tons of LAr
 Requiring 40 events/3 years of operation

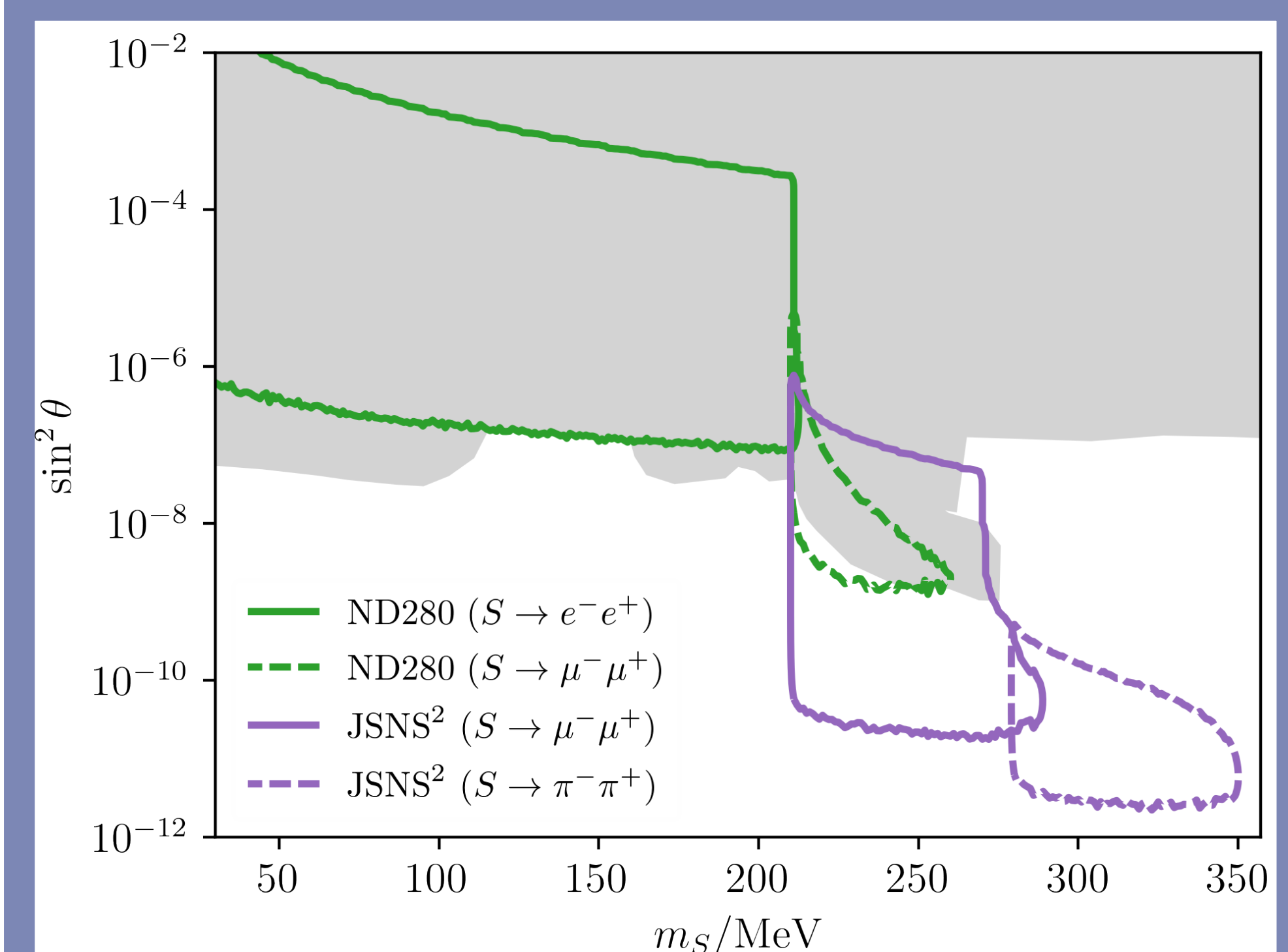
Higgs Portal Scalar

Arguably the simplest extension of SM. Scalar singlet that mixes with the Higgs:

$$-\mathcal{L}_{\text{HPS}} \supset \sin\theta S \sum_f \left(\frac{m_f}{v} \bar{f}f \right)$$

Production: $K^+ \rightarrow \pi^+ S$

Decay: $S_M \rightarrow e^+e^-, \mu^+\mu^-, \pi\pi$



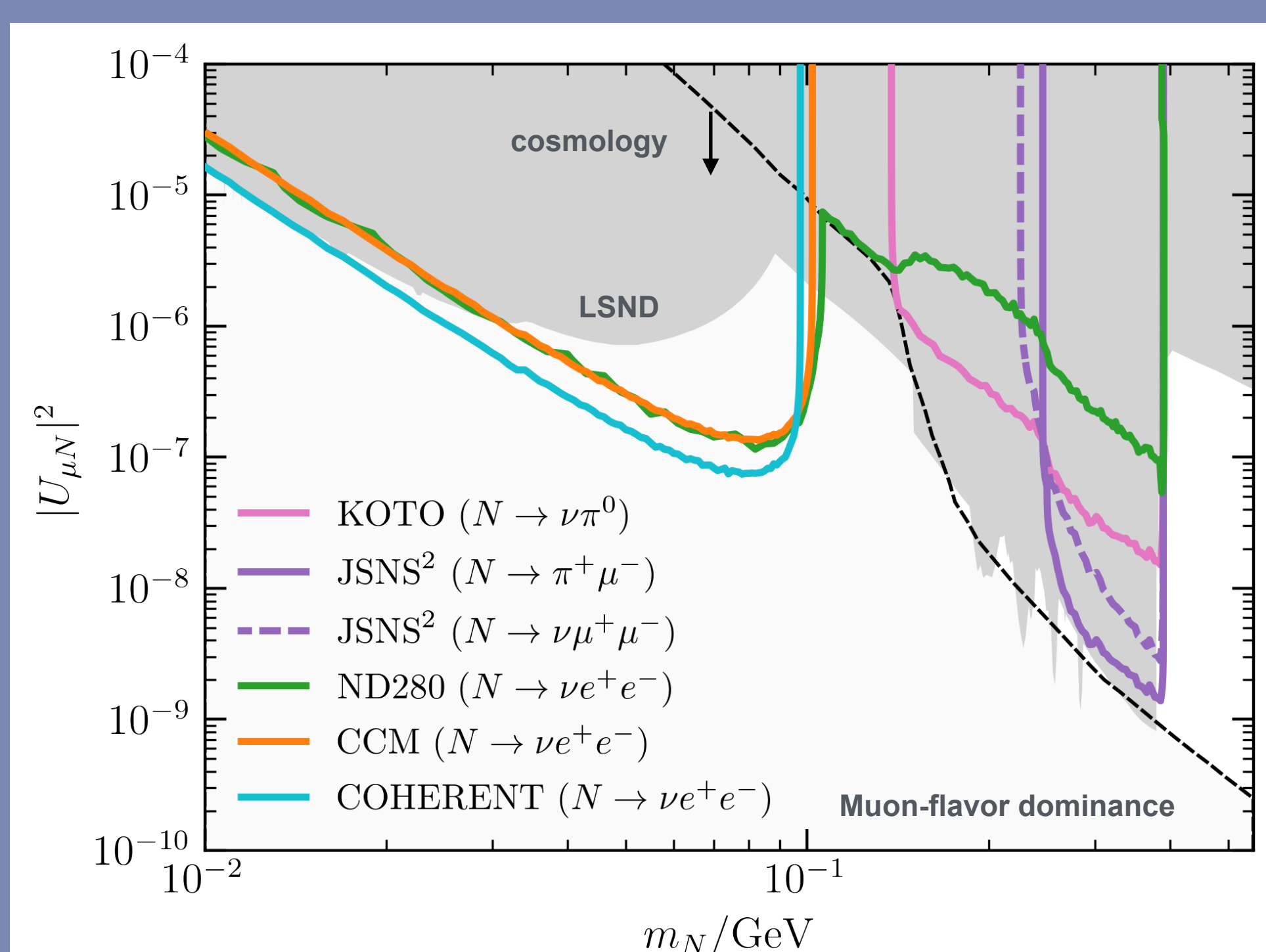
Heavy Neutral Leptons

Low scale neutrino mass model (Pseudo-)Dirac heavy neutrinos:

$$-\mathcal{L}_{\text{HNL}} \supset \frac{g}{\sqrt{2}} U_{\alpha N}^* \bar{\ell}_\alpha \mathcal{W} N + \text{h.c.}$$

Production: $\pi^+ \rightarrow \ell^+ N$ and $\mu^+ \rightarrow e^+ \nu N$

Decay: $N \rightarrow \nu e^+ e^-, e\pi, \mu\pi$.



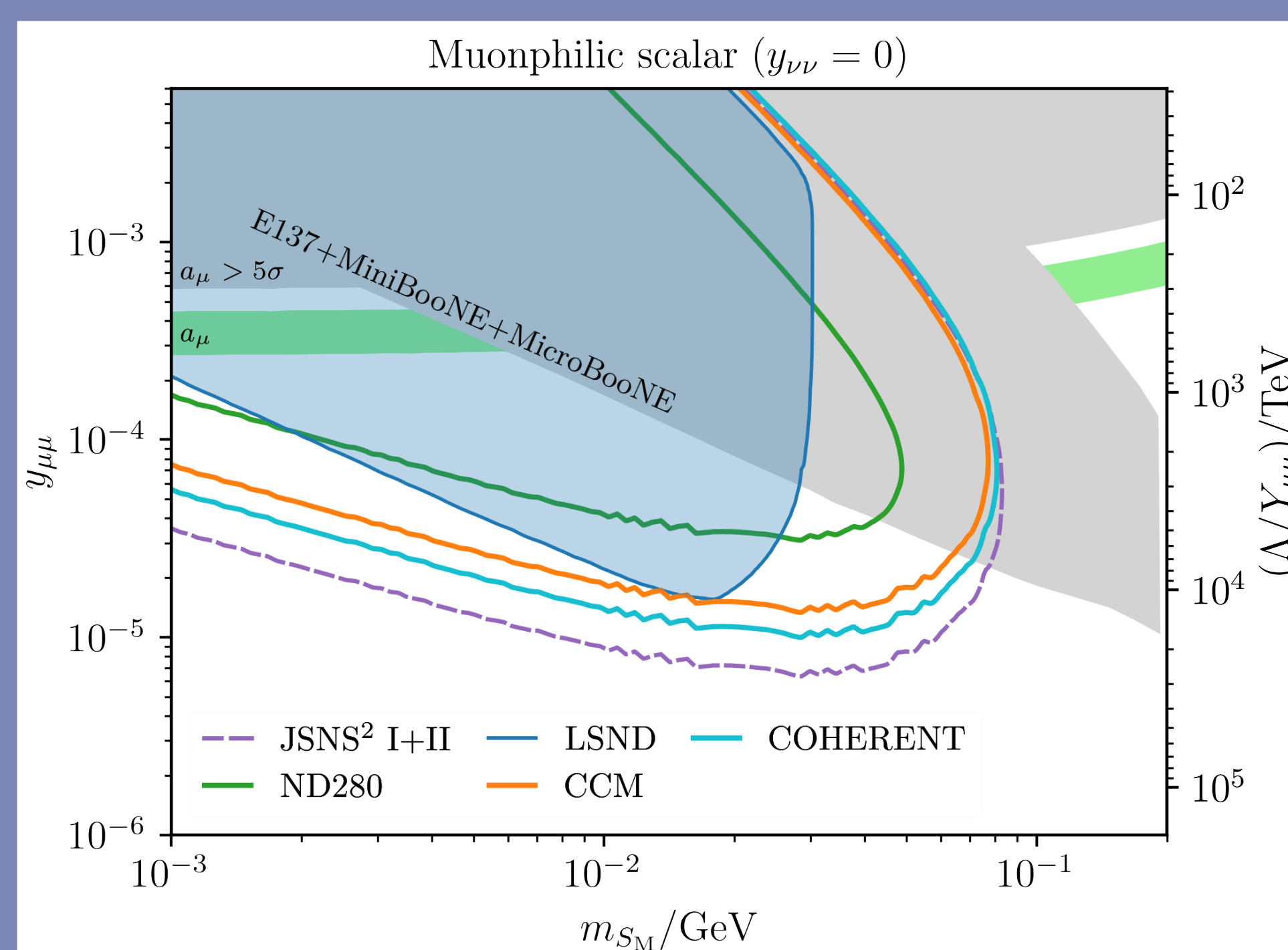
Muonphilic Scalar

Popular $(g-2)_\mu$ explanation.

Scalars coupled to 2nd generation,

$$-\mathcal{L}_M \supset \frac{Y_{\mu\mu}}{\Lambda} S_M \bar{L}_\mu H \mu_R \xrightarrow{\text{EW}} y_{\mu\mu} S_M \bar{\mu} \mu,$$

Production: $\mu^+ \rightarrow e^+ \nu \nu S_M$
 Decay: $S_M \rightarrow \gamma\gamma$



Flavor-violating axion-like-particles

Goldstone boson from high-scale charged lepton flavor violation,

$$-\mathcal{L}_{\text{lv}} \supset \frac{\partial_\mu a_{\text{fv}}}{2f_{a_{\text{fv}}}} \left(c_{e\mu} \bar{e} \gamma^\mu \mu + c_{ee} \bar{e} \gamma^\mu e \right)$$

Beats invisibles searches in $\mu \rightarrow e\gamma$ and $\mu \rightarrow eee$.
 Production: $\mu \rightarrow e a_{\text{fv}}$, Decay: $a_{\text{fv}} \rightarrow e^+e^-$

