

BSM/EW – NIM-A Paper status

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One combined BSM/EW paper for NIM-A special issue

BSM/EW

- Single paper covering max-capacity estimates of BSM/EW signals at ePIC.
- Draft Overleaf document is created.

Paper structure

Methodology

- Electron identification
- Muon finder
- Tau tagging
- Kinematic reconstruction

Analysis

- Axion-like particle searches
- Leptoquark production& CLFV
- Sterile-neutrino searches
- PVDIS EW

Alessandro Tricoli, Jae Nam, Alyssa Wheeler, Ganesh Parida et al. [BNL]

Channel:

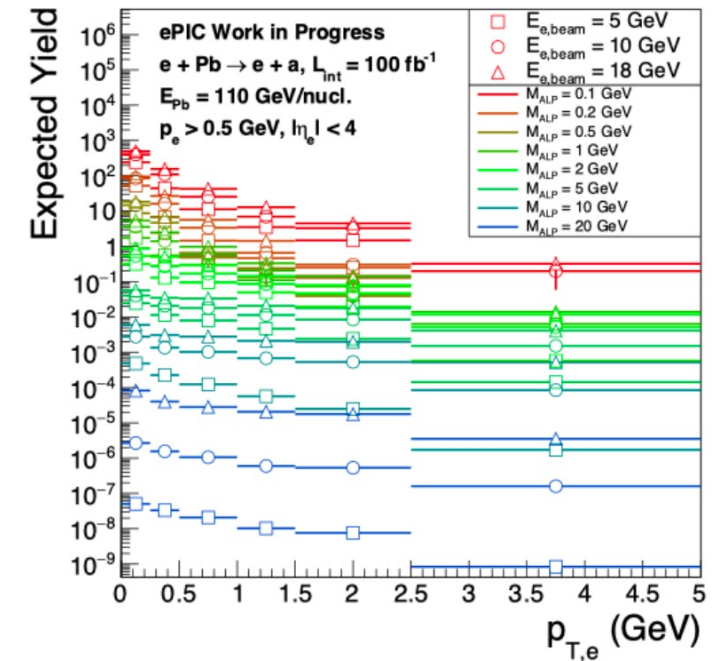
- Non-decaying/invisible electrophilic ALP production via coherent e+A scattering; serves as a benchmark for future ALP measurements

Simulation:

- MadGraph5 3.7.0. (ALP models from K. Xie, H. Liu), EPA coherent-photon scheme; 0.1-20 GeV ALP mass; $E_e = 5/10/18$ GeV on $E_{Pb} = 110$ GeV
- Full sim with EICRecon 26.05.0+ EIC afterburner

Status:

- Tracking/clustering performance characterized; ECAL e vs hadron response in progress
- Full background study is now underway; beam/machine + physics backgrounds (QED Compton, DIS, coherent exclusive meson production)
- Feasibility of a simple M—based (BDT) event selection under study
- Low mass (< 1 GeV) searches feasible at 100 fb^{-1} ; high-mass limit setting; results favor 18 GeV running



Bardh Quni [University of Manitoba]

Framework:

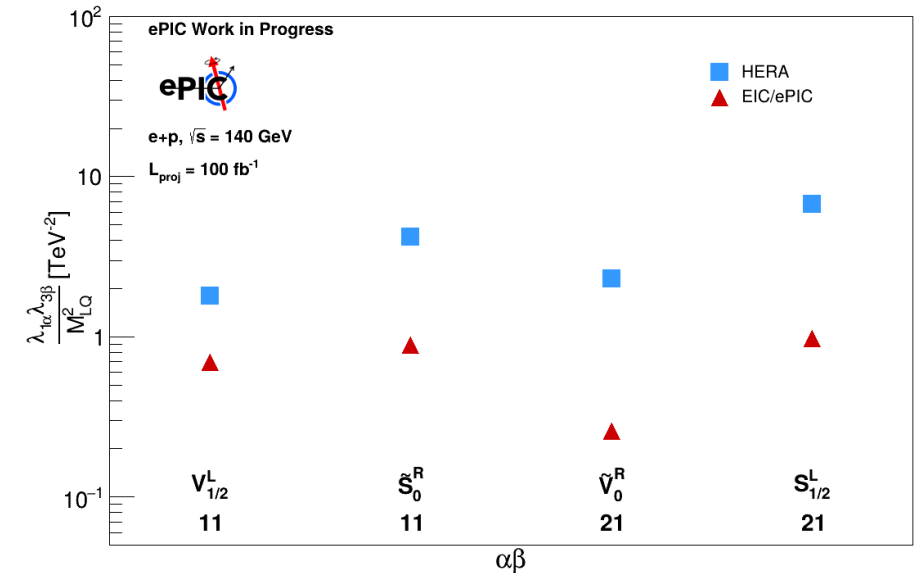
- Leptoquark-mediated charged lepton flavor violating $e \rightarrow \tau$ conversion in DIS
- 14 scalar & vector LQ scenarios at tree level

Signal & method:

- 3-prong hadronic tau decay $\tau \rightarrow \pi^- \pi^- \pi^+ \nu_\tau$
- Dedicated per-scenario BDT training and optimization; benchmark signal sample $\lambda_{1\alpha} \lambda_{3\beta} = 0.3$ at $M_{LQ} = 1.9 \text{ TeV}$

Status:

- Projected EIC sensitivities $\lambda\lambda/M_{LQ}^2$ extracted for four LQ states; improves on existing HERA limits



Leptoquark	Expected Limit	BDT Cut
$V_{1/2}^L$	$0.696 \pm 0.0349 \text{ TeV}^{-2}$	0.483
$\tilde{S}_0^R$	$0.889 \pm 0.0581 \text{ TeV}^{-2}$	0.54
$\tilde{V}_0^R$	$0.258 \pm 0.0161 \text{ TeV}^{-2}$	0.52
$S_{1/2}^L$	$0.975 \pm 0.0593 \text{ TeV}^{-2}$	0.48

Ming Xiong Liu, Yasser Corrales, Xuan Li et al. [LANL]

Status:

- A BSM model from the LANL theory group has recently been produced locally inside the ePIC simulation package.
- Initial checks show no roadblocks.
- Detailed analysis is still in progress.

Summary

Where the BSM/EW paper stands:

- The ALP and Leptoquark are mature and have been presented externally.
- The sterile neutrino model is now in the ePIC sim with no roadblocks.
- No ePIC-specific weak mixing angle projection is underway.
 - The previous ECCE study is considered comprehensive.
 - PVDIS doesn't place stringent demands on detector performance, so ePIC results are expected to be similar to ECCE.
- Aiming for a full draft by the end of August.