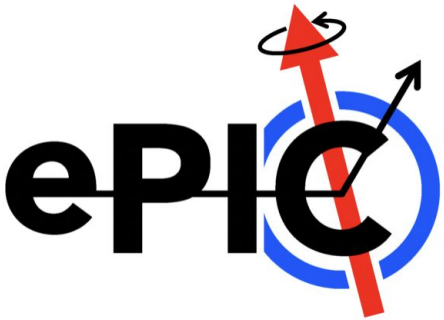


EW-BSM Input

Analysis TDR Kickoff
02/05/2024

Ciprian Gal and Michael Nycz

Electroweak and BSM: Overview and Input to TDR

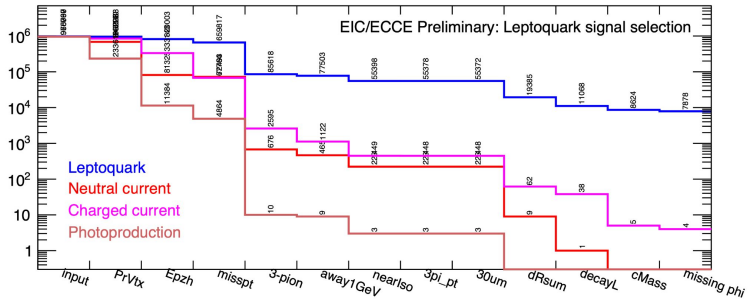
- Group Structure: 5-7 members
- Wouter Deconinck, Ciprian Gal, Andrew Hurley, Sonny Mantry, Michael Nycz, Bardh Quni, Xiaochao Zheng, etc…
  - ~3 working on Electroweak and BSM related topics

<u>Planned Input (plots) to TDR from Electroweak and BSM Working Group</u>

1. Muon Identification
2. Weak mixing angle: $\sin^2\theta_W(Q^2)$ projection

Muon Identification: Andrew Hurley (UMass Amherst)

1. Charged Lepton Flavor Violation (CLFV)
   - Tau ID: 1 Prong decay
   - Electron **and** **Muon ID**
2. Three prong decay study performed for ECCE
   - J.-L. Zhang et al.
   - Ongoing work by Bardh Quni for ePIC (University of Manitoba)
     - CLFV in the Leptoquark framework at the EIC

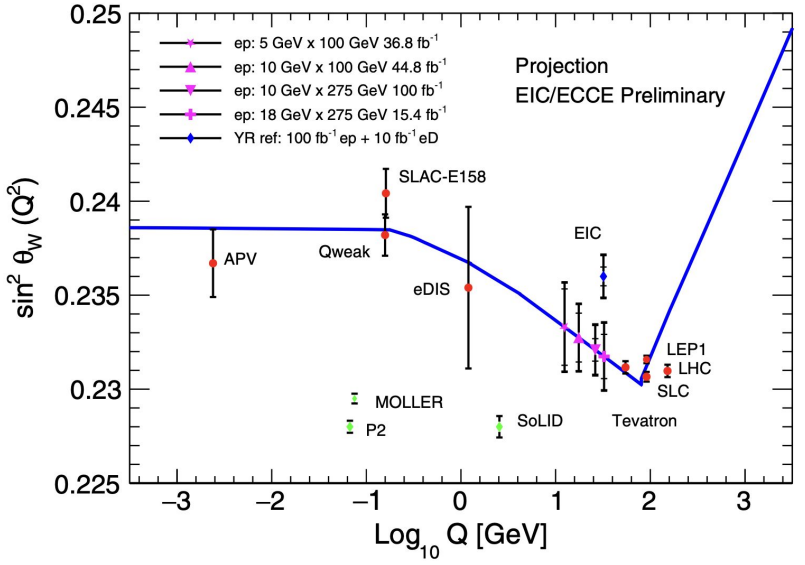


J.-L. Zhang et al.

- **1-prong** **85.24 (0.06)%**
  - $\mu^-\bar{\nu}_\mu\nu_\tau$ 17.39 (0.04)%
  - $e^-\bar{\nu}_e\nu_\tau$ 17.82 (0.04)%
  - $\pi^-\nu_\tau$ 10.82 (0.05)%
  - $\pi^-\pi^0\nu_\tau$ 25.49 (0.09)%
  - $\pi^-2\pi^0\nu_\tau$ 9.26 (0.10)%
  - $\pi^-3\pi^0\nu_\tau$ 1.04 (0.07)%
  - others (kaon, etc) 3.24%
- **3-prong** **14.55 (0.06)%**
  - $\pi^-\pi^+\pi^-\nu_\tau$ 9.31 (0.05)%
  - $\pi^-\pi^+\pi^-\pi^0\nu_\tau$ 4.62 (0.05)%
  - others (kaon, etc) 1.28%
- others 0.21%

Weak Mixing Angle: Michael Nycz (University of Virginia)

1. Yellow Report
2. ECCE
   a. Statistical, beam polarimetry,& PDF uncertainties
3. Updated for ePIC
   a. Also study unfolding uncertainties
4. Previous work
   a. Utilized “fast smearing” from single e^- simulation
5. **Will be updated using recent simulation** (utilizing reconstruction)



Neutral-current electroweak physics and SMEFT studies at the EIC

Electroweak and Beyond the Standard Model Physics at the EIC

- Upcoming (in-person) workshop at the Institute for Nuclear Theory
  - Focus on EW and BSM physics at the EIC
- Will provide an opportunity for
  - Engagement with the community
  - Highlighting recent developments
  - Support for ongoing efforts….

INT WORKSHOP INT-24-87W

Electroweak and Beyond the Standard Model Physics at the EIC

February 12, 2024 - February 16, 2024

ORGANIZERS

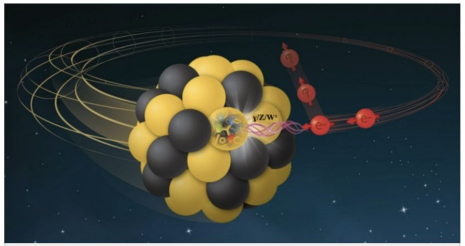
Kaori Fuyuto
Los Alamos National Laboratory
kfuyuto@lanl.gov

Ciprian Gal
Thomas Jefferson National Accelerator Facility
ciprian@jlab.org

Sonny Mantry
University of North Georgia
sonny.mantry@ung.edu

DIVERSITY COORDINATOR

Kaori Fuyuto
Los Alamos National Laboratory
kfuyuto@lanl.gov



Credit: https://www.energy.gov/science/articles/electron-ion-collider-achieves-critical-decision-1-approval

OVERVIEW

SCHEDULE

The application deadline for this event has passed

Electroweak and Beyond the Standard Model Physics at the EIC

- Upcoming (in-person) workshop at the Institute for Nuclear Theory
  - Focus on EW and BSM physics at the EIC
- Will provide an opportunity for
  - Engagement with the community
  - Highlighting recent developments
  - Support for ongoing efforts….

Schedule

9:15 AM	Overview BSM searches at the itensity frontier	Krishna Kumar	University of Massachusetts, Amherst	In-person	C520
10:00 AM	Theoretical aspect of BSM searches at the Intensity Frontier	Vincenzo Cirigliano	University of Washington	In-person	C520
10:45 AM	Coffee Break				
11:15 AM	ePIC Detection Capabilities	Tyler Kutz	Massachusetts Institute of Technology	In-person	C520
12:00 PM	Lunch				
2:00 PM	SMEFT Overview	Radja Boughezal	Argonne National Laboratory	In-person	C520
2:45 PM	Possible new insights into strong parity violation in the nucleon's structure from SIDIS measurements	Matteo Cerutti	University of Pavia and INFN	In-person	C520
3:30 PM	Coffee Break				
4:00 PM	Probing axion-like particles at the EIC in the coherent scattering	Hongkai Liu	Technion	In-person	C520

Tuesday, February 13, 2024

Start Time	Presentation Title	Presenter	Presenter Organization	Format	Location
9:15 AM	ePIC at EIC - Capabilities	Ernst Sichtermann	Lawrence Berkeley National Laboratory	In-person	C520
10:00 AM	Running of weak-mixing angle	Chandan Ghosh	Jefferson Lab	In-person	C520
10:45 AM	Coffee Break				
11:15 AM	Extracting the Weak Mixing Angle at the EIC	Michael Nycz	University of Virginia	In-person	C520
12:00 PM	Lunch				
2:00 PM	Hidden vector bosons at the EIC	Hooman Davoudiasl	Brookhaven National Laboratory	In-person	C520
2:45 PM	Heavy neutral lepton searches	Keping Xie	University of Pittsburgh	In-person	C520
3:30 PM	Coffee Break				
4:00 PM	Compton amplitude and structure function calculations of the nucleon from a lattice QCD perspective	Utku Can	University of Adelaide	In-person	C520

Wednesday, February 14, 2024

Start Time	Presentation Title	Presenter	Presenter Organization	Format	Location
9:15 AM	Spin Asymmetry observables contributions to BSM	Frank Petriello	Northwestern University	In-person	C520
10:00 AM	Experimental view on CLFV at the eic in tau decays with	Andrew Hurley	University of Massachusetts,	In-person	C520

Summary

1. Identified plots which can be completed in time for the TDR
    a. Muon ID
    b. Weak mixing angle: $\sin^2\theta_W(Q^2)$ projection
2. Identifying further physics
    a. Timeline for TDR… (Workforce…)
        i. Collaborating with Inclusive WG