# UCLA Group Status Report

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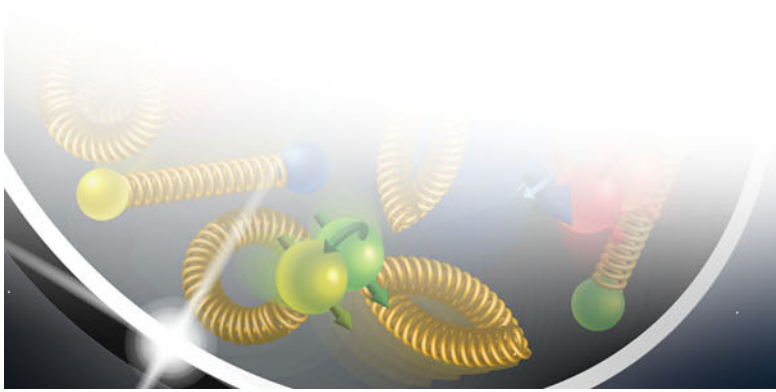
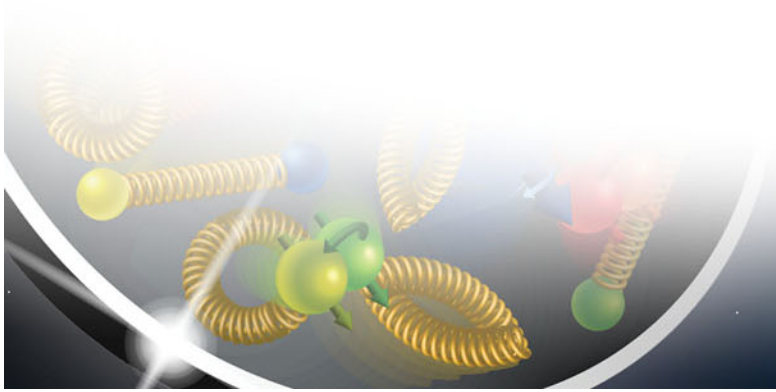


# Outline

1) Update on fEMCal
   Oleg Tsai et al

2) Fanyi Zhao (Zhongbo's student) finished Ph.D.
   and now a post-doc @MIT
   Theory group reports

3) Software/Simulations/Physics –
   Reports from Zhongling et al

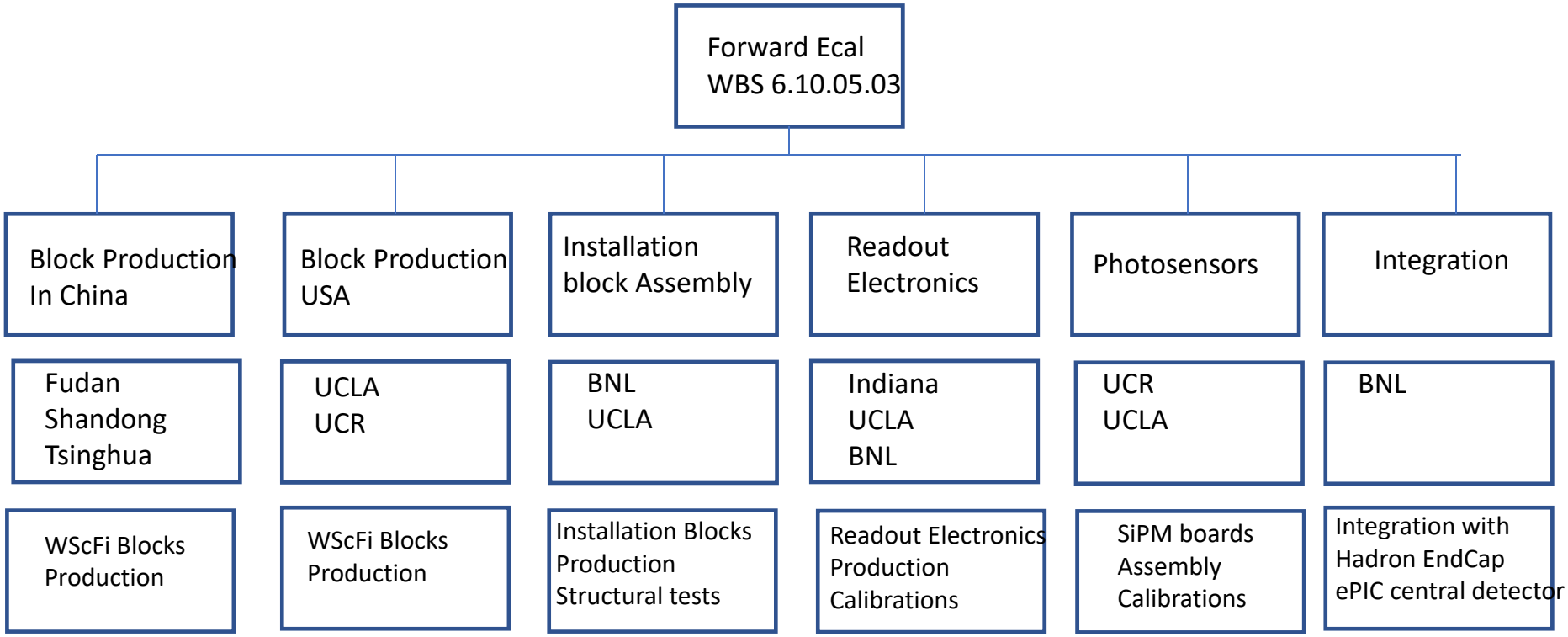


# fECal status

- Mechanical design is in advanced stage with all structural tests completed.
- Consortium worked very close with the project to finalized specs for LLP items, Scintillating fibers and SiPMs, which will be ordered in 2024.
- Readout scheme is in development by Indiana University (eRD109)
- High Level WBS structure identified.
- eRD106 delayed due to issues in the contract agreement between BNL and UCLA, and it finally resolved in Aug.
- Fudan group run first tests to produce ePIC WScFi blocks for the test run.
- Per discussions with the Project all future developments (beyond eRD106) will be under PD.


Last long term stability test at BNL. fECal installation block mounted on mockup fHCal front plate, loaded x4 times nominal

# fECal WBS, Workforce

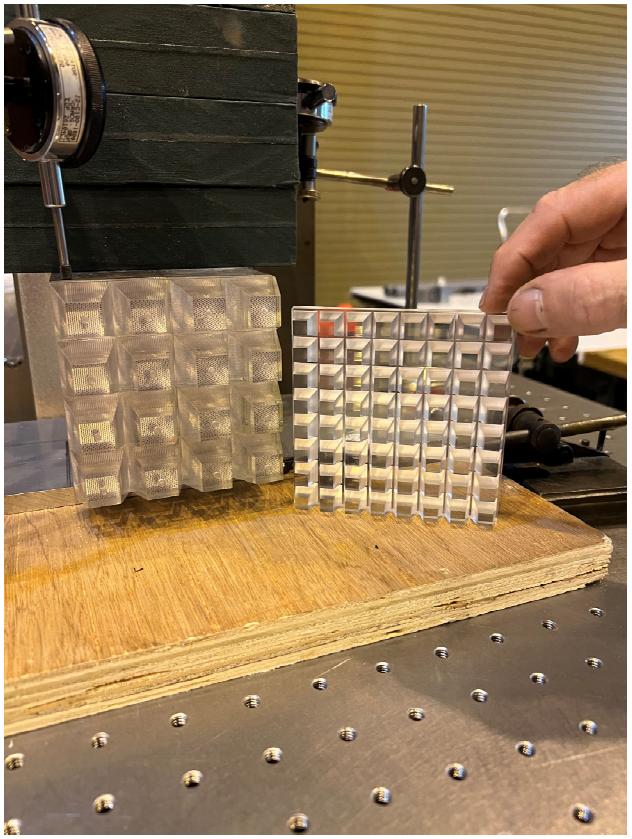



- Chinese Universities Consortia (Fudan University, Shandong University, Tsinghua University)
- University of California EIC Consortium (UCLA, UCR)
- Indian University
- BNL

Groups has extensive expertise and capabilities in executing large scale project in high energy and nuclear physics experiments around the world. (RHIC, JLab, CERN, Super KEKB).

# ePIC R&D Plans for FY23

- Our plan is to build 4 installation blocks (4 x 4 towers) with improved light collection uniformity and test these at FNAL.
- Continue to work on mechanical integration of ECal into ePIC.
- Perform structural tests (sheer and compressions).
- Make comparison of ‘EIC specs’ Saint Gobain and Kuraray fibers.
- Perform optical/mechanical/electrical integration of readout (with eRD109)
- Test run schedule at FNAL for FY24 is still not known. We are aiming to run eRD106 tests there by the end of 2023 (December), assuming operation at FNAL starts in Nov.



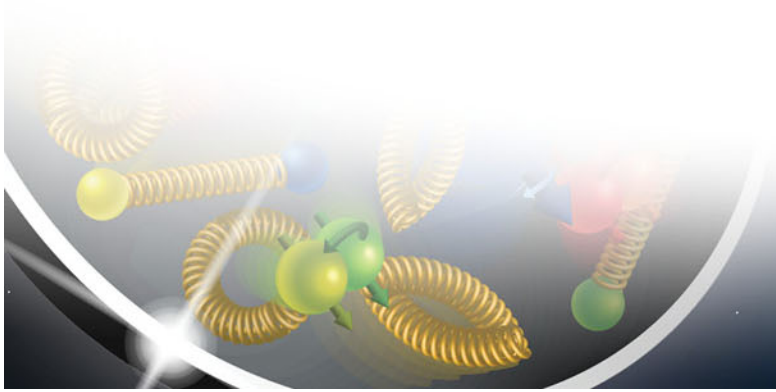
Newly designed light guides.
Blocks were made at UCLA and Indian shops, and soon will be made by BNL central shop as well to find most cost effective production technique.

## Plans beyond eRD106, TDR and Beyond

We discussed with the project a need to keep production sites engage until production start in 2026.

Preliminary plan is to continue fund them at TBD level to improve production methods and to produce by mid 2025 additional ~ 36 installation blocks for a final beam tests at FNAL with fHCal and final readout electronics.

All this will be done as a PD.



# Theory group progress at UCLA

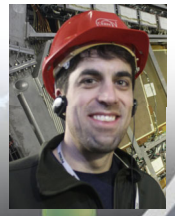
- Energy-Energy Correlator
  - Including azimuthal dependence allows access to TMDs
  - See next couple of slides

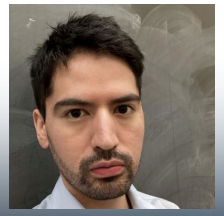
- Heavy flavor jet shape
  - Jared Reiten

- Nuclear TMDs
  - Mishary Alrashed

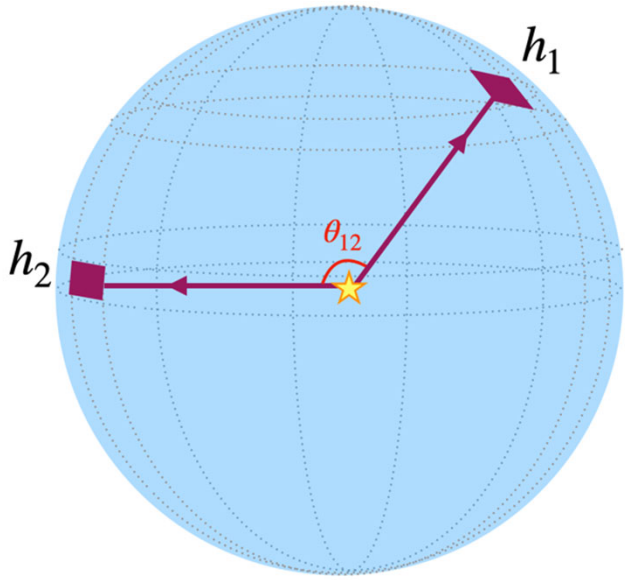
- TMDs from Z+jet production
  - Yiyu Zhou

- Other toics:
  - Andrew Larkoski: a spectral metric for collider geometry
  - Farid Salazar: heavy quarkonium production at e+A in small-x





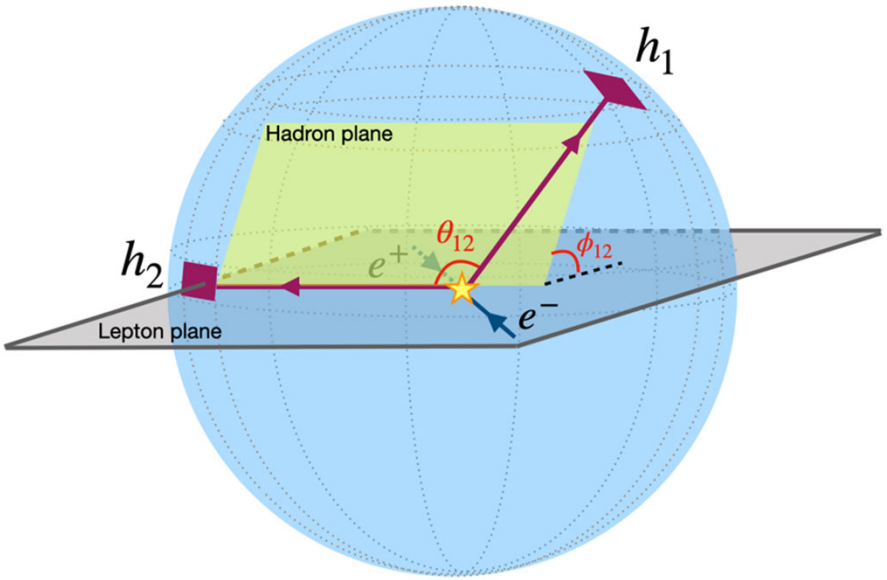
# Energy Energy Correlator (EEC)




$$\frac{1}{\sigma}\frac{d\Sigma}{d\theta} = \sum_{h_1,h_2}\int dE_1 dE_2\, E_1 E_2\, \frac{d\sigma}{dE_1 dE_2 d\theta_{12}}\delta\left(\theta_{12}-\theta\right)$$

- One of the earliest infrared safe event shape observables
- Measure energy correlation as a function of the opening angle $\theta$ between pairs of particles

# EEC can involve more angles

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**Energy Correlations in Electron-Positron Annihilation: Testing Quantum Chromodynamics**

C. Louis Basham, Lowell S. Brown, Stephen D. Ellis, and Sherwin T. Love
*Department of Physics, University of Washington, Seattle, Washington 98195*
(Received 21 August 1978)

$$\frac{d^2\Sigma}{d\Omega\, d\Omega'} = \frac{\alpha^2}{4W^2}\sum_f 3Q_f^2\,\frac{\bar{g}_W^{\,2}}{3\pi^2}\,\frac{1}{32\pi}\,\frac{1}{1-\zeta}\left\{\left[\left(\frac{36}{\zeta^5}-\frac{96}{\zeta^4}+\frac{72}{\zeta^3}-\frac{16}{\zeta^2}\right)\ln(1-\zeta)+\frac{36}{\zeta^4}-\frac{78}{\zeta^3}+\frac{36}{\zeta^2}\right](1+\cos^2\theta)\right.$$

$$+4\zeta(1-\zeta)\left[\left(\frac{6}{\zeta^5}-\frac{8}{\zeta^4}\right)\ln(1-\zeta)+\frac{6}{\zeta^4}-\frac{5}{\zeta^3}-\frac{2}{\zeta^2}\right][\cos^2\varphi-\cos^2\theta\,(1+\cos^2\varphi)]$$

$$\left.+2[\zeta(1-\zeta)]^{1/2}\left[\left(-\frac{36}{\zeta^5}+\frac{72}{\zeta^4}-\frac{40}{\zeta^3}\right)\ln(1-\zeta)-\frac{36}{\zeta^4}+\frac{54}{\zeta^3}-\frac{16}{\zeta^2}-\frac{8}{\zeta}\right]\cos\theta\sin\theta\cos\varphi\right\}. \quad (5)$$

- Including incoming particles, an azimuthal angle $\phi$ between hadron plane and lepton plane
- **Discussed in original paper, but forgotten afterwards**
- We show by including azimuthal angle, one can access unpolarized and polarized TMDs, allowing for 3D imaging

**Other Experimental Group Talks:**

**Zhongling Ji and Nihal Gozlukluoglu Karakus**

**– ePIC fEcal Simulations**

**Thomas Marshall**

**– Parton Energy Loss Dynamics from LHC and RHIC**

**Zhiwan Xu**

**– Neutron Skin, Glauber Model and RHIC/EIC**

**Aditya Dash and Yunshan Cheng**

**-- Have to take the ATC exams on 8/21-22 !**