

SHMS

Pol  $^3\text{He}$  Target

HMS

e-beam

# Welcome!


















- First beam:
  - December 2019
- *A lot of challenges...*
  - Accel, Target
  - COVID... (blah)
- Last beam
  - September 20, 2020
- But, not done yet!
  - Post run target calibrations, compass measurements, etc, continued into Oct, 2020

## Work continues...

- Many analysis meetings
  - Target and General
- Several talks/updates at Hall A/C Collaboration meetings at JLab *and* external Conferences too, of course.
- First Collaboration Meeting since we wrapped the run!

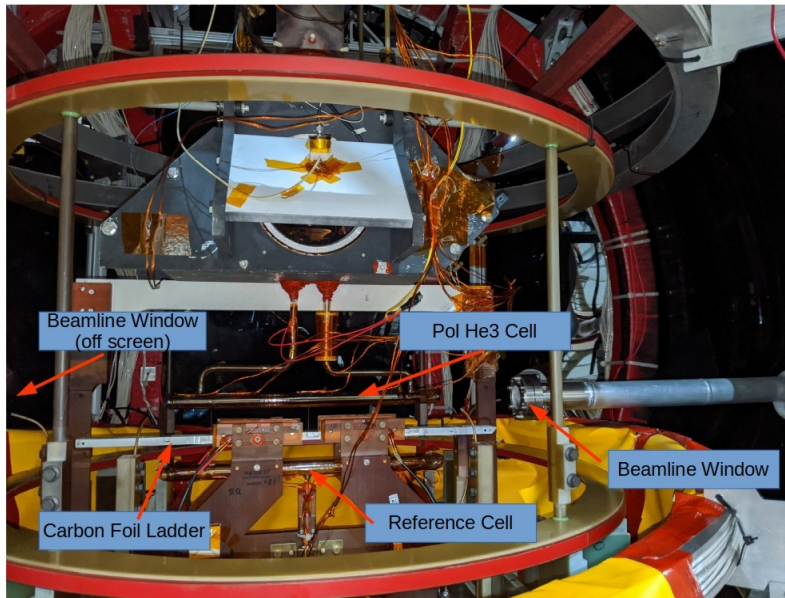
# General Overview

- This will be a fairly “internally focussed” Collaboration meeting
  - Status reports
  - Pending issues
- Want to keep moving, so we'll try to keep to schedule
  - Take notes and we can follow up details and interesting discussions at analysis meetings!
- Some nice theory talks in the afternoon session!
- General Discussion at the end
  - Thesis timelines, etc
  - AOB

09:20	→ 09:35	<b>Welcome / Overview</b> Speakers: Brad Sawatzky (Jefferson Lab), Xiaochao Zheng (University of Virginia)	15m	
09:35	→ 10:00	<b>Target Calibration Update</b> Speaker: Junhao Chen (College of William and Mary)	25m	
10:00	→ 10:25	<b>Target Field / Compass Meas. Status</b> Speaker: Murchhana Roy (University of Kentucky)	25m	
10:25	→ 10:50	<b>PNMR Status Update</b> Speaker: Mingyu Chen (University of Virginia)	25m	
10:50	→ 11:10	<b>Coffee Break</b>	20m	
11:10	→ 11:35	<b>Simulation Status</b> Speakers: Mingyu Chen (University of Virginia), Murchhana Roy (University of Kentucky)	25m	
11:35	→ 12:00	<b>Pol He3 Elastic/QE Meas. Update</b> Speaker: Michael Nycz (Temple University)	25m	
12:00	→ 12:20	<b>Beam Polarimetry Status Update</b> Speaker: William Henry (Jefferson Lab)	20m	
12:20	→ 13:20	<b>Lunch</b>	1h	
13:20	→ 13:45	<b>Detector Calibration and PID Status</b> Speaker: Melanie Rehfuss (Temple University)	25m	
13:45	→ 14:10	<b>Target NMR/EPR Status</b> Speaker: Melanie Rehfuss (Temple University)	25m	
14:10	→ 14:35	<b>HMS/SHMS Optics Status</b> Speaker: Mark Jones (Jefferson Lab)	25m	
14:35	→ 15:00	<b>Replay / Analysis Software Status</b> Speakers: Sylvester Joosten (Argonne National Laboratory), Brad Sawatzky (Jefferson Lab)	25m	
15:00	→ 15:30	<b>Coffee Break</b>	30m	
15:30	→ 16:50	<b>Theory Talks</b>		
	15:30	<b>Review of the JAM global QCD analysis framework</b> Speaker: Nobuo Sato (ODU)	40m	
	16:10	<b>Status and prospects for lattice QCD calculations of <math>d_2^{*n}</math></b> Speaker: Christopher Monahan (Institute for Nuclear Theory)	40m	
16:50	→ 17:50	<b>General Discussion</b> Speakers: Brad Sawatzky (Jefferson Lab), Xiaochao Zheng (University of Virginia)	1h	

# Pol He3 Run Group

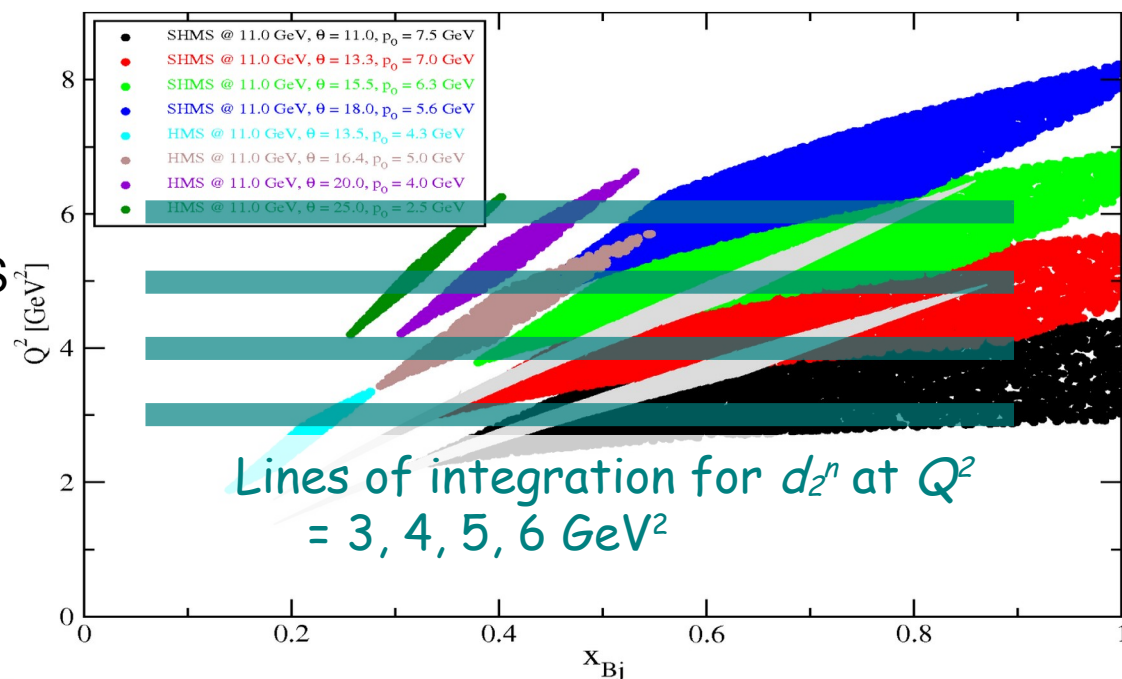
- Ended up collecting data for **three experiments**
  - E12-06-110 (A1n)
  - E12-06-121 (d2n, g2n)
  - E12-06-121A
    - » (3He Elastic Electromagnetic Form Factor Diffractive Minima Using Polarization Observables)
- Resources on the Web:
  - [Main Wiki Page](#)
  - [Analysis Logbooks](#)
  - [Mailing Lists](#)
    - » [a1n\\_d2n@jlab.org](mailto:a1n_d2n@jlab.org)
      - General collaboration communication
    - » [a1n\\_d2n\\_analysis@jlab.org](mailto:a1n_d2n_analysis@jlab.org)
      - Analysis specific details





# Original PAC Kinematics

- Directly measure the  $Q^2$  dependence of the neutron  $d_2^n(Q^2)$  at  $Q^2 \approx 3, 4, 5, 6 \text{ GeV}^2$  with the new polarized  $^3\text{He}$  target.  
→ The SHMS is ideally suited to this task!
- Doubles number of precision data points for  $g_2^n(x, Q^2)$  in DIS region.  
→  $Q^2$  evolution of  $g_2^n$  over  $(0.23 < x < 0.85)$
- $d_2$  is a clean probe of quark-gluon correlations / higher twist effects
- Connected to the color Lorentz force acting on the struck quark (Burkardt)  
→ same underlying physics as in SIDIS  $k_\perp$  studies
- Investigate the present discrepancy between data and theories.  
→ Theory calcs consistent but have wrong sign, wrong value.



# E12-06-121: $d_2^n, g_2^n$

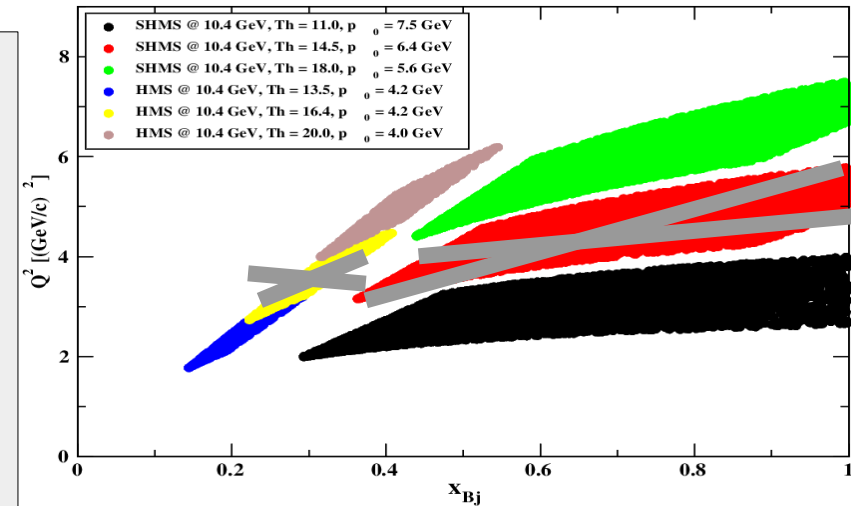
- Two beam energies:
  - 10.4 GeV/c (prod.) [5-pass]
  - 2.1 GeV/c (calib.) [1-pass]
- Beam
  - 30 uA (production)
  - 45 uA (max, 1 calib.)
  - Polarized beam
- Target: 40 cm Polarized  $^3\text{He}$

SHMS Production		
Setting	$P_0$	Angle
A	7.5	11.0°
B	6.4	14.5°
C	5.6	18.0°

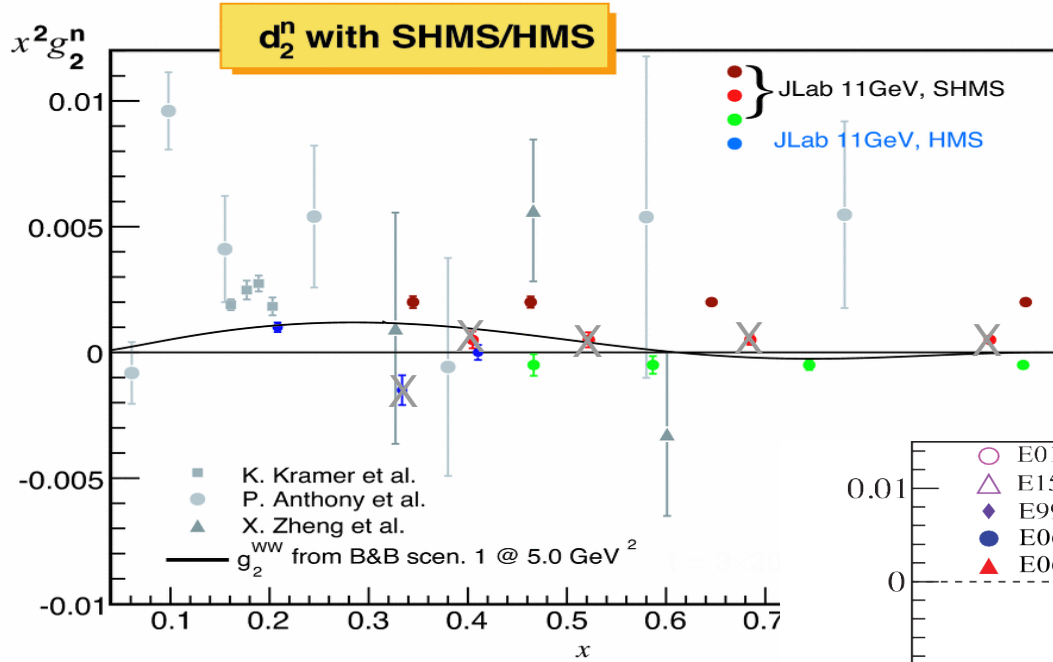
HMS Production		
Setting	$P_0$	Angle
X	4.2	13.5°
Y	4.2	16.4°
Z	4.0	20.0°

Reduced kinematic set vs. proposal to accommodate run-time reduction and lower  $E_{\text{beam}}$

- Collected majority of our longitudinal data (all kin), calib., and unpolarized cell characterization data
- HMS  $\perp$ : 60% of Kin-A; 100% of Kin-C
- SHMS  $\perp$ : 80% of Kin-X; 85% of Kin-Z
- Completed 1-pass running at end of program
  - Collected ~70% of what we needed
    - » Most time on  $P_b P_t$   $^3\text{He}$  elastics meas. at 8.5°
  - Last 24 hours used to collect ancillary  $^3\text{He}$  elastic points for E12-06-121A (hit ~50% of their goal)



# E12-06-121 Projected results

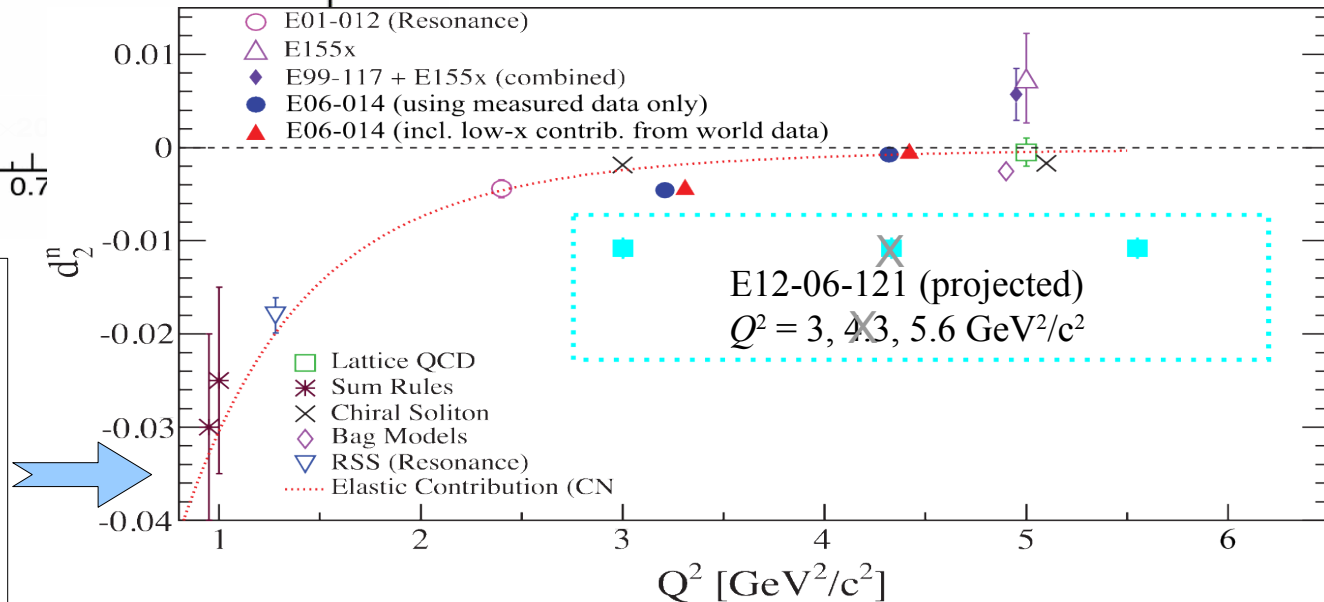


Projected  $x^2 g_2^n$  points are vertically offset from zero along lines that reflect different (roughly) constant  $Q^2$  values from 2.5—6 GeV<sup>2</sup>.

Reduced kinematic set vs. proposal to accommodate run-time reduction and lower  $E_{\text{beam}}$

$Q^2$  evolution of  $d_2^n$  in a region where models are thought to be accurate.

Direct overlap with 6 GeV Hall A measurements.



# Just a Few More Comments

- HUGE effort by a pretty small group!!
  - This group was constrained even further by the constraints and pressures of COVID
  - Students, Post-Docs, Staff and Univ. folks, Techs, and all the people who made themselves “local” (one way or the other) did a fantastic job

**I want to thank everyone again for all the work and sacrifice they have already put in!**



Hand off to Xiaochao!