

CLAS Collaboration Meeting  
November 12 -15, 2019

# *Status of Hall B*

Marco Battaglieri  
Jefferson Lab

# My background

## Studies

- PhD in hadron physics (Genova University IT)

## Working position (from Sept 16 2019 ...)

- Senior staff scientist at INFN - Genova

## Research activity

- Research fields: hadron spectroscopy, hadron structure, exotic hadrons, extreme energy events (neutrino, cosmic), Dark Matter search at accelerators, applications of hep/nuclear techniques (tech transfer), calorimetry, scintillation detectors + mentor and outreach

## HallB/JLab

- **CLAS collaboration:** active in CLAS collaboration from 1997 (!) Large Angle Calorimeter (CLAS), Polarized NH<sub>3</sub> target (CLAS), ST (CLAS), FT (CLAS12), MesonEx, Haspect
- **HPS collaboration:** active in HPS collaboration from 2010 ECAL
- **BDX collaboration:** proponent of the BDX experiment since 2013
- **EIC (proto)collaboration:** co-PI of eRD23 (Streaming ReadOut) since 2017
- **PD:** in 2018 I served as JLAB Program Deputy
- Chairman for 6 years of JLAB12 Collaboration (all italian activities at JLab)

**My whole scientific career has mainly been spent at JLab!**



# Hall-B leadership

Our mission is to make JLab capable of running the best hadron physics program in the world

- *USERS* are our customers and OPS is our main assignment

## Run the experiment

Detector operation, maintenance and test for new detector design

- Assign a staff to each system/subsystem (+ a deputy)
- Work closely with the Collaboration (Users/Experts)
- Info sharing (web page)
- Full involvement of engineers and tech staff
- Work closely with other lab Divs/Res (FastElectronic, IT, CODA, ACC, DSG)

## Provide data for physics analysis

From raw data to 4-vectors

- SW REC + MC framework (data format, DB, distribution to Users, explore new avenues e.g.AI)
- Lead/steer CALIBRATION and COOKING effort
- Work closely with the Collaboration (Users/Experts)
- Work closely with other lab Divs/Res (CC, IT, other Halls experts) for a common framework definition

## Data preservation

Store data for a true future use

- CLAS data mining effort showed this is a valuable opt
- Set the framework for a true OpenAccess
- REC/MC/GEN distribution together with data
- Work closely with the Collaboration (Users/Experts)
- Work closely with other lab Divs/Res (CC, IT,)

## Physics Analyses

- All Hall-B staff involved
- Stimulus for Users
- link with other Lab resources (TheoryGroup, JPAC, Femtography Center)

# How to

- Balance reality, day-by-day duties, with new projects to prepare the future
- Together Define, Discuss and Adopt (DDA) work-plans and path-forward
- Clear assignments and responsibilities
- Info exchange and communication (within Hall-B staff and with Lab management)
- Continuous contact with the Users (Collaborations)
- Continuous contact with the other Lab resources (Halls, IT, Acc ...)

★ Short term goal:

provide to the users a comfortable environment where to run experiments

★ Long term goal:

take the great opportunity of running the best approximation of EIC physics program and test new detector/technologies

# Hall-B organization

## Offline

+

**framework, tools,  
reconstruction and high-  
level analyst**

+

**CLAS Coll SW  
Coordinator**

- G.Gavalian - SW Architect
- M.Ungaro - Simulations
- V.Ziegler - algorithmes/validation
- N.Baltzell - Computing infrastructure
- N.Markov - Data processing
- *New hired* - Rec support
- + *W.Phelps (CNU)* - Data process support
- + *D.Heddle (CNU)* - CED

## Detectors/Hall

- S.Stepanyan (Deputy) - Operations
- A.Sandorfi - HDIce & Team
- M.Mestayer - DC
- Y.Gotra - SVT/MM
- D.Carman - FTOF/CTOF/CND
- E.Pasyuk - Beam-line/FT
- V.Kubarovsky - RICH/LTCC
- Y.Sharabian - HTCC/LTCC
- *C.Smith* - ECAL/PCAL
- R.Miller - Lead engineer & TechStaff

## Calibration/Analysis

- L. Elouadrhiri - First experiment
- D.Carman - CALCOM

## Online

- S.Boyarinov - DAQ
- V.Kubarovsky - Trigger
- *New hired* - L3 trigger
- N.Baltzell - Slow control

## Physics programs

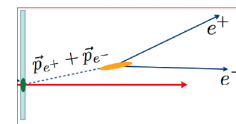
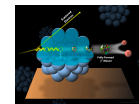
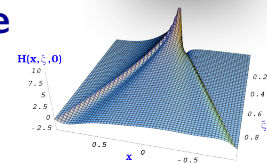
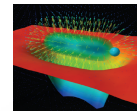
- V.Burkert - New avenues
- H.Havakyan - DIS/perturbative
- E.Pasyuk - Dedicated runs
- V.Mokeev - Resonance/non-perturb.
- S.Stepanyan - BSM
- + *A.Vossen (Duke)* - DIS/perturbative

## R&D

- Y.Sharabian - Detectors
- S.Boyarinov - Streaming RO
- G.Gavalian - AI

# JLab Scientific Mission

- What is the role of gluonic excitations in the spectroscopy of light mesons?
- Where is the missing spin in the nucleon? Role of orbital angular momentum?
- Can we reveal a novel landscape of nucleon substructure through 3D imaging at the femtometer scale?
- What is the relation between short-range N-N correlations, the partonic structure of nuclei, and the nature of the nuclear force?
- Can we discover evidence for physics beyond the standard model of particle physics?



**Hall B science program is decisive in addressing these questions**

# Hall B Overview

- **101 CLAS members have registered for the collaboration meeting**
- **CLAS12 first physics runs:** RG-A (13 proposals, 139 PAC days), RG-K (3 proposals, 100 PAC days), RG-B (7 proposals, 90 PAC days), RG-C (BONUS, 185 PAC days)
- **Continued flow of results from Hall B (CLAS+PRAD+HPS+PRIMEX..)**
  - > 220 physics papers in peer reviewed journals (> 10,000 citations)
  - 4 papers in Nature (+1 submitted), 1 paper in Science
  - ~2,530 conference talks (~1,620 invited)
- **Specialized Hall B experiments**
  - PRAD experiment – results published in Nature
  - Heavy Photon Search - Analysis of 2016 data ongoing, 2019 run



<u>Proposals/LOIs</u>	<u>Physics</u>	<u>Contact</u>	<u>Days</u>
<u>PR12-19-004</u> (RGN) <u>E12-11-003C</u> (RGB) <u>E12-07-104A</u> (RGF)	Search for $\phi$ -N bound state Photoproduction of hadrons Tagged neutron DVCS with BoNuS12	Gao Hauenstein Hattawy	45
<u>LOI12-19-001</u> <u>LOI12-19-005</u>	Charged current production in Bjorken kinem. Next generation Tritium experiments in CLAS12	Siddikov Hen	

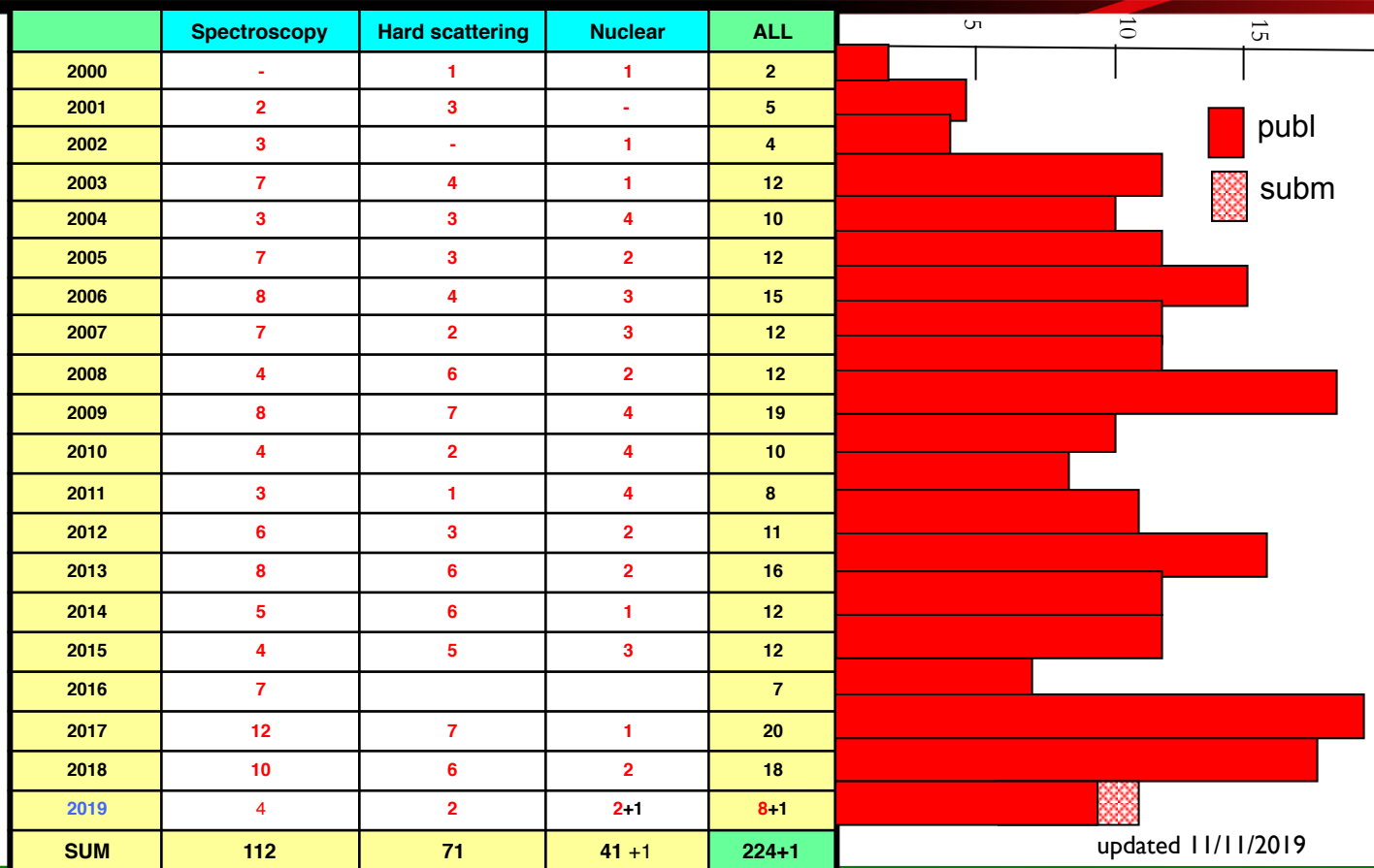
New beam time requested for Hall B Proposals:

~~45~~

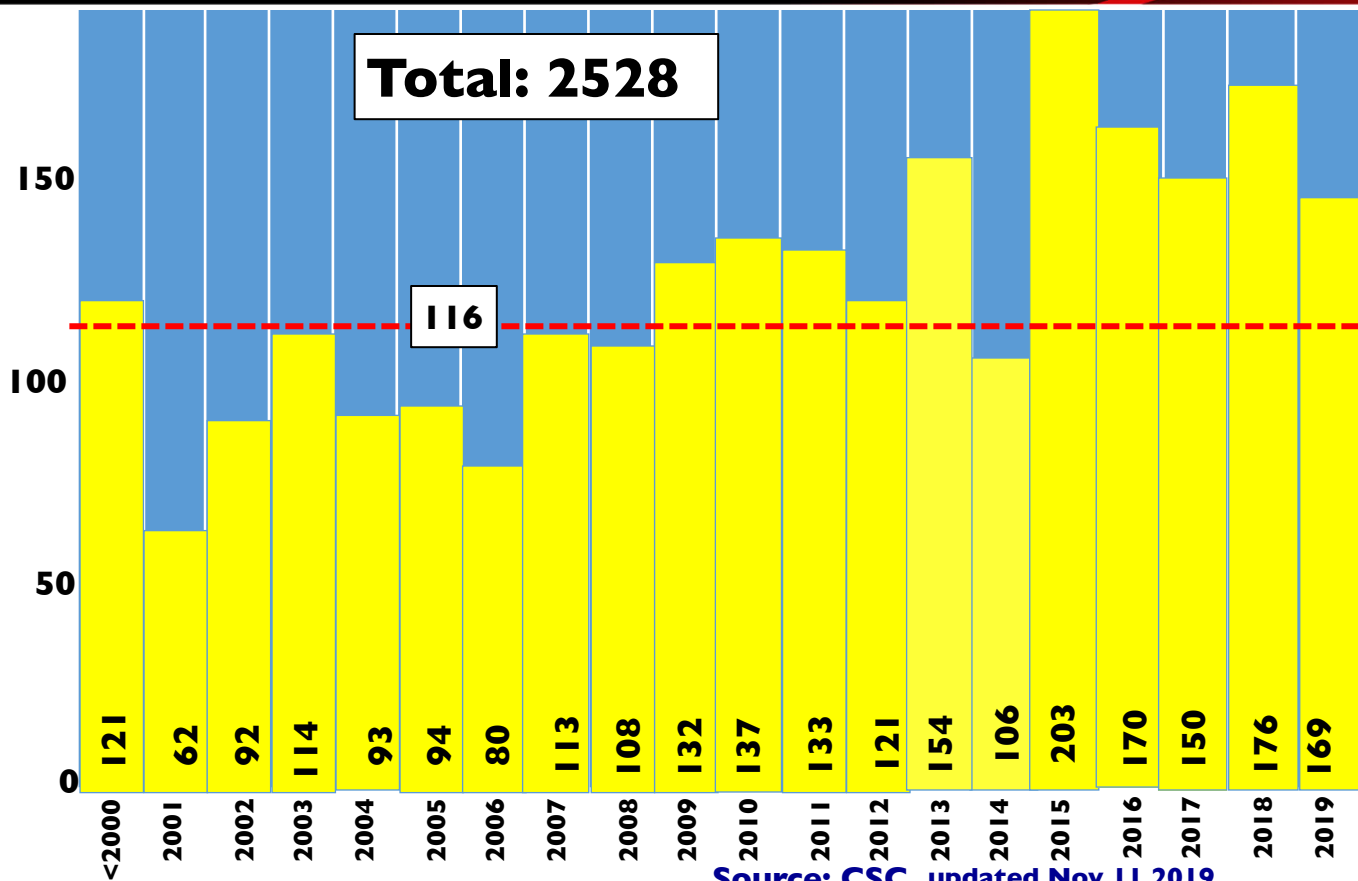
- PAC48: Hall-B experiments jeopardy

# Refereed Physics Publications

## Hall B

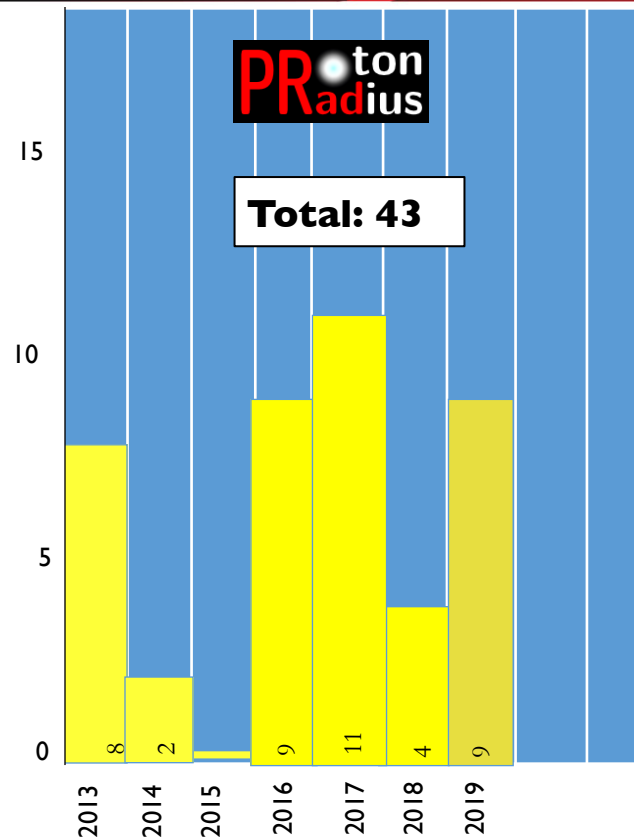
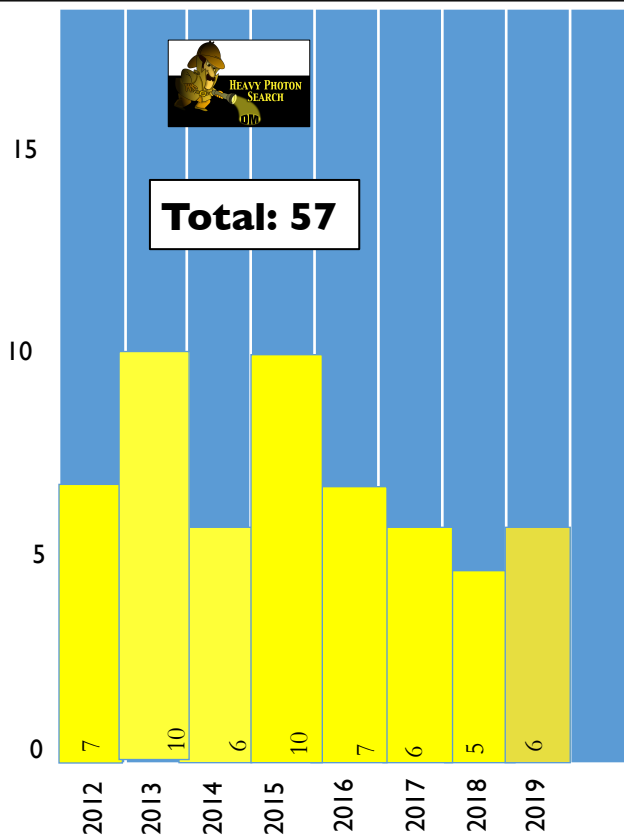


# Conference Presentations



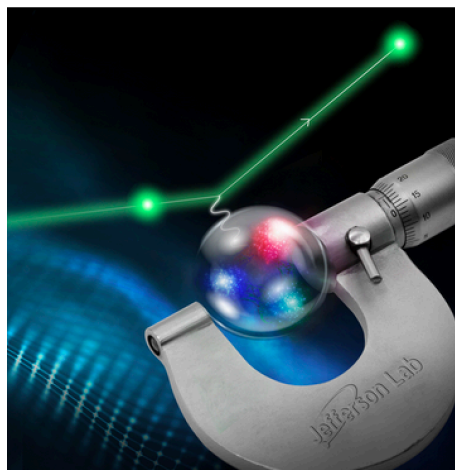
# Conference Presentations

## Hall B

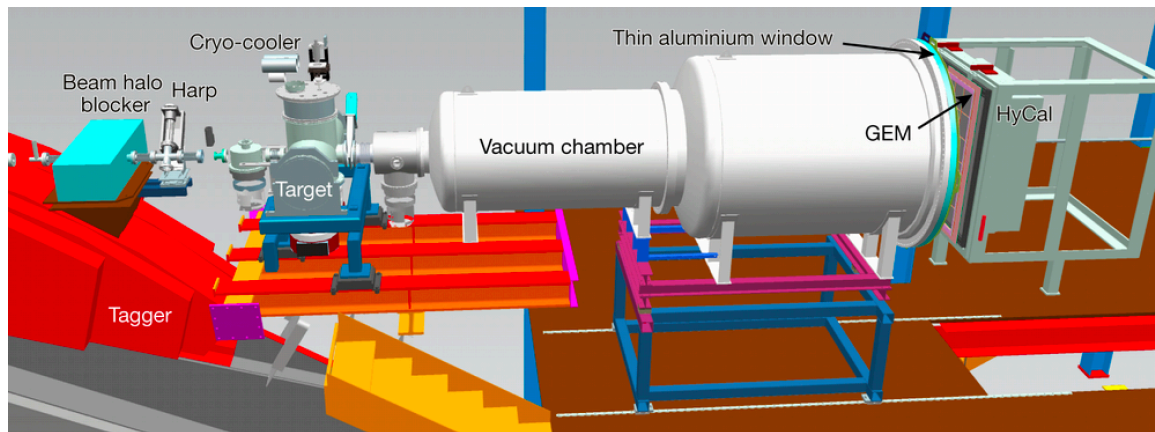


Source: HPS & PRAD wiki

updated Nov 11 2019



*Nature* volume 575, pages 147–150 (2019)



- High precision experiment
- New windowless target system
- Use a calorimeter as a spectrometer
- Use e-e scattering to renormalise e-p scattering data
- Very small angle coverage

#### Article

### A small proton charge radius from an electron-proton scattering experiment

<https://doi.org/10.1038/s41586-019-1721-2>

Received: 17 June 2019

Accepted: 19 September 2019

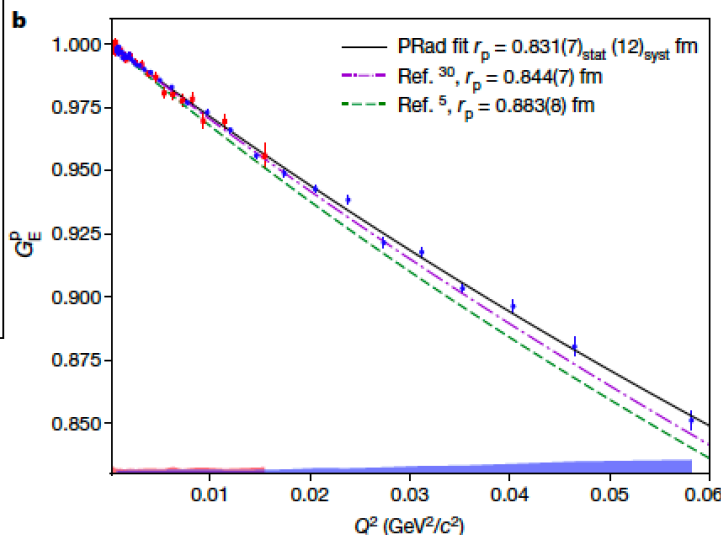
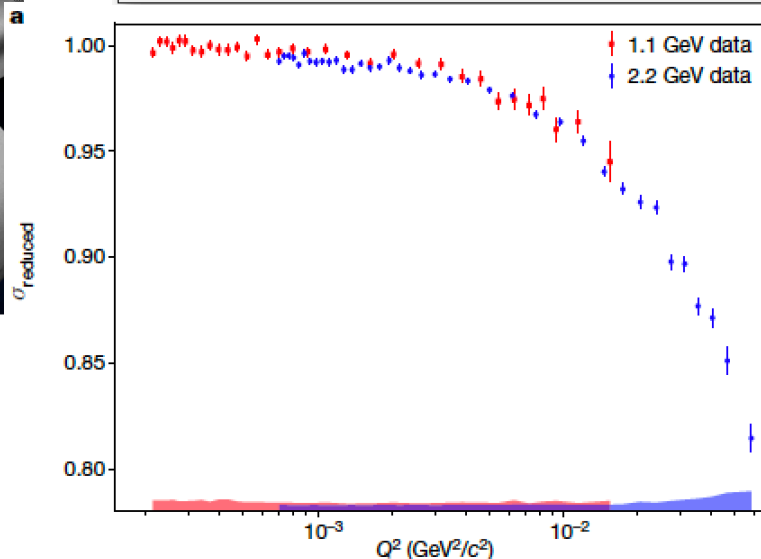
Published online: 6 November 2019

W. Xiong<sup>1</sup>, A. Gasparian<sup>2\*</sup>, H. Gao<sup>3</sup>, D. Dutta<sup>2\*</sup>, M. Khandaker<sup>4</sup>, N. Liyanage<sup>5</sup>, E. Pasyuk<sup>6</sup>, C. Peng<sup>7</sup>, X. Bai<sup>8</sup>, L. Ye<sup>9</sup>, K. Gnanvo<sup>10</sup>, C. Gu<sup>1</sup>, M. Levillain<sup>11</sup>, X. Yan<sup>12</sup>, D. W. Higinbotham<sup>13</sup>, M. Mezziane<sup>14</sup>, Z. Ye<sup>15</sup>, K. Adhikari<sup>16</sup>, B. Aljawrneh<sup>17</sup>, H. Bhatt<sup>18</sup>, D. Bhetuwal<sup>19</sup>, J. Brock<sup>20</sup>, V. Burkert<sup>21</sup>, C. Carlin<sup>22</sup>, A. Deur<sup>23</sup>, D. Delf<sup>24</sup>, J. Dunne<sup>25</sup>, P. Ekanayake<sup>26</sup>, L. El-Fassi<sup>27</sup>, B. Emmich<sup>28</sup>, L. Gar<sup>29</sup>, O. Glamazdin<sup>30</sup>, M. L. Kabir<sup>31</sup>, A. Karki<sup>32</sup>, C. Keith<sup>33</sup>, S. Kowalski<sup>34</sup>, V. Lagerquist<sup>35</sup>, I. Larin<sup>36,37</sup>, T. Liu<sup>38</sup>, A. Liyanage<sup>39</sup>, J. Maxwell<sup>40</sup>, D. Meekins<sup>41</sup>, S. J. Nazeer<sup>42</sup>, V. Nelyubin<sup>43</sup>, H. Nguyen<sup>44</sup>, R. Pedroni<sup>45</sup>, C. Perdrisat<sup>46</sup>, J. Pierce<sup>47</sup>, V. Punjabi<sup>48</sup>, M. Shabestari<sup>49</sup>, A. Shahinyan<sup>50</sup>, R. Silwal<sup>51</sup>, S. Stepanyan<sup>52</sup>, A. Subedi<sup>53</sup>, V. V. Tarasov<sup>54</sup>, N. Ton<sup>55</sup>, Y. Zhang<sup>56</sup> & Z. W. Zhao<sup>57</sup>





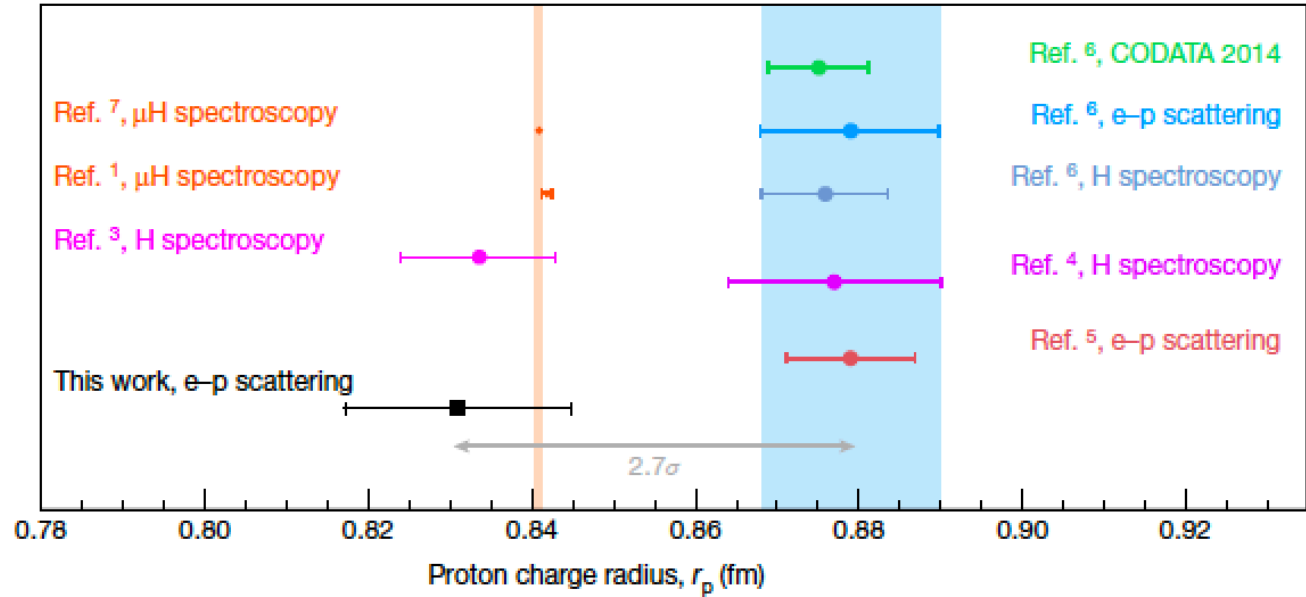
$$\sigma_{\text{reduced}} = \left( \frac{d\sigma}{d\Omega} \right)_{e-p} / \left[ \left( \frac{d\sigma}{d\Omega} \right)_{\text{point-like}} \left( (4M_p^2 E' / E) / (4M_p^2 + Q^2) \right) \right]$$



- The slope of  $G_E^p(Q^2 \rightarrow 0)$  is proportional to  $r_p^2$
- Careful scrutiny of systematic errors



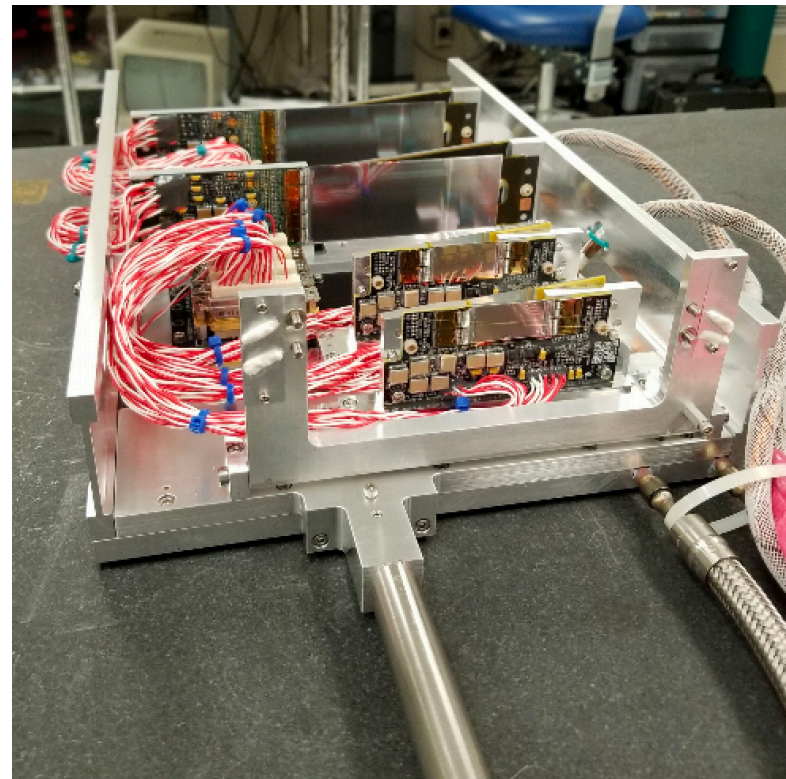
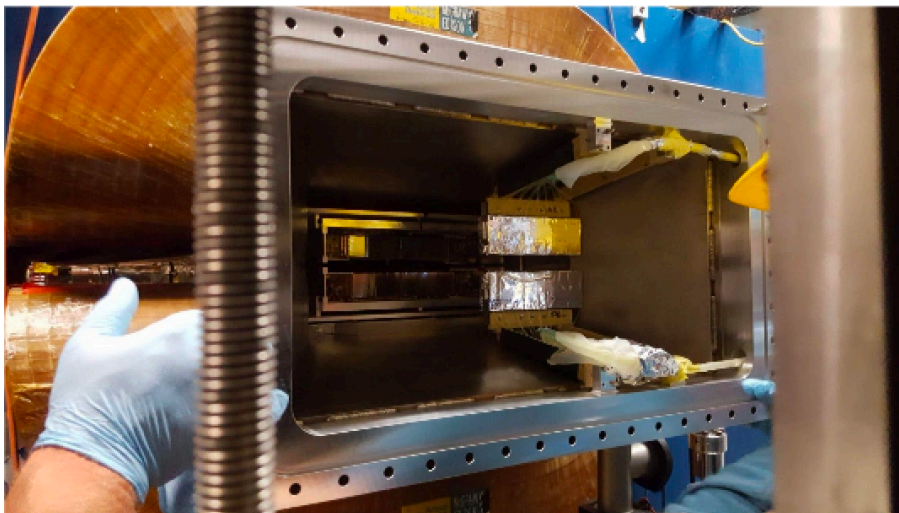
PRad found a proton radius closer to the spectroscopy results



$$r_p = 0.831 \pm 0.007_{\text{stat}} \pm 0.012_{\text{syst}}$$

- PRad Collaboration meeting: Dec 6 2019 JLab

- HPS run during summer 2019
- Two major upgrades: +1 layer Si tracker to extend the coverage and added a new hodoscope to trigger on  $e^+e^-$  pairs out of ECal acceptance



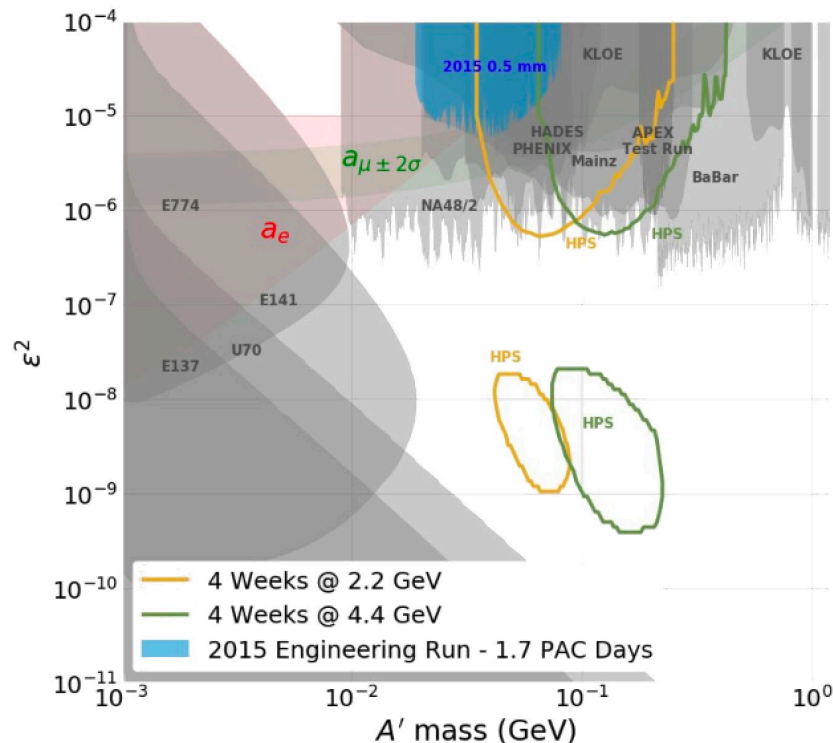
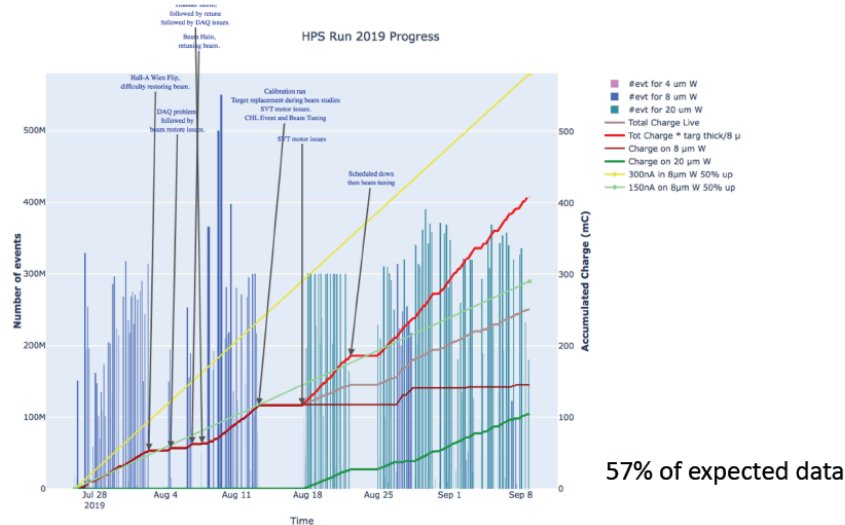


# Heavy Photon Search

# Hall B

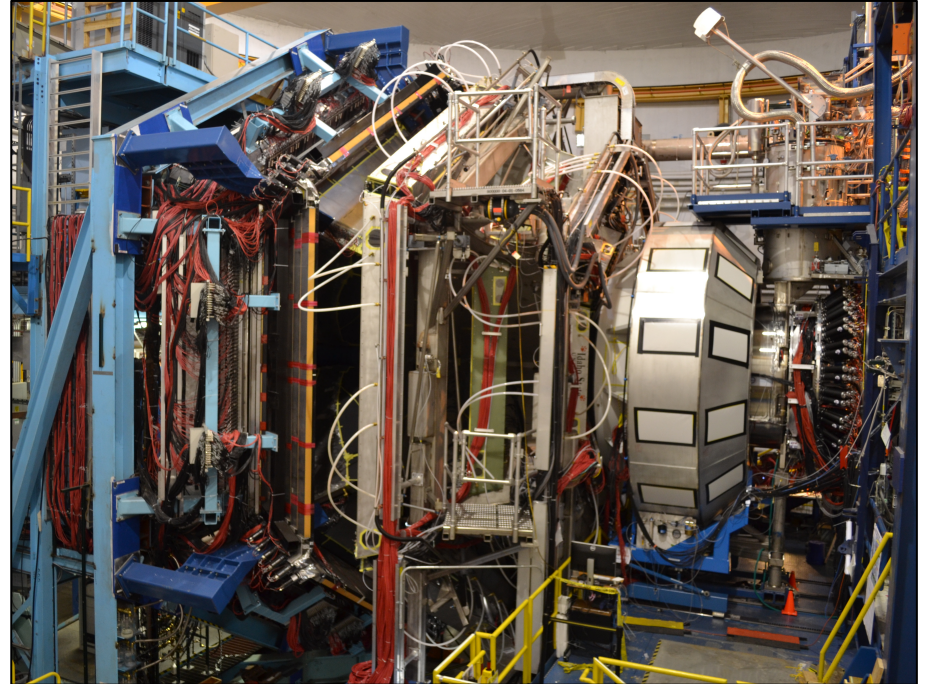
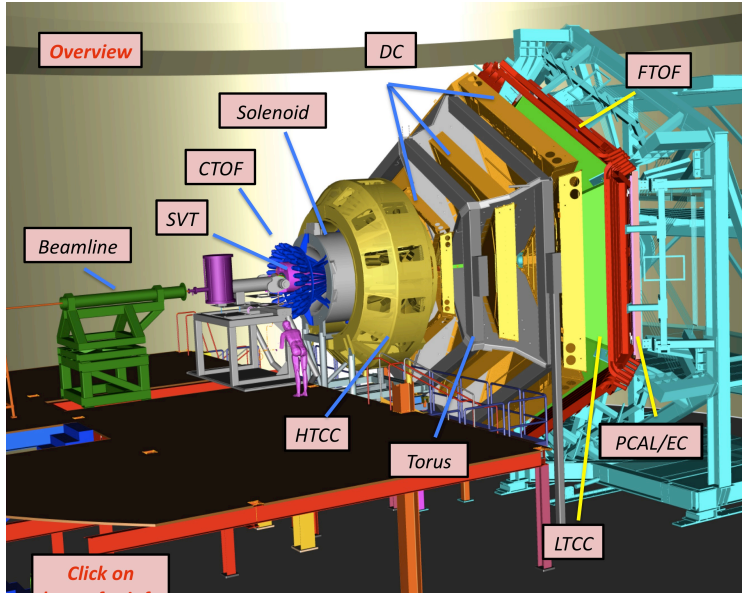
- Different combinations of energy (4.4 GeV), targets (8 $\mu$ m to 20 $\mu$ m) and currents (100-300nA)
- Collected about 60% of the expected data

## Data collected, as of Sunday 2pm



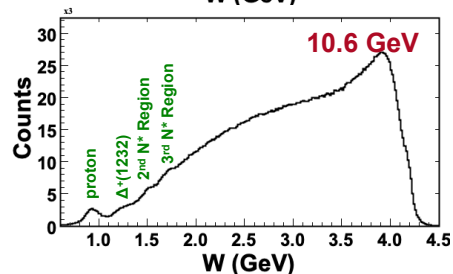
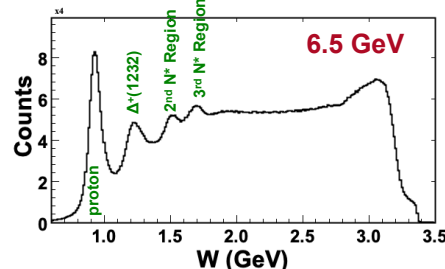
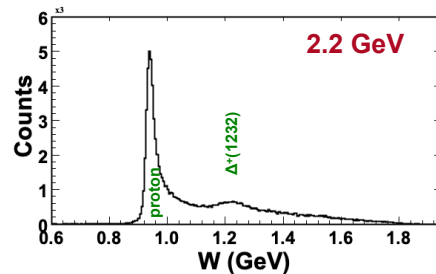
- HPS Collaboration meeting: Nov 18-19 2019 JLab

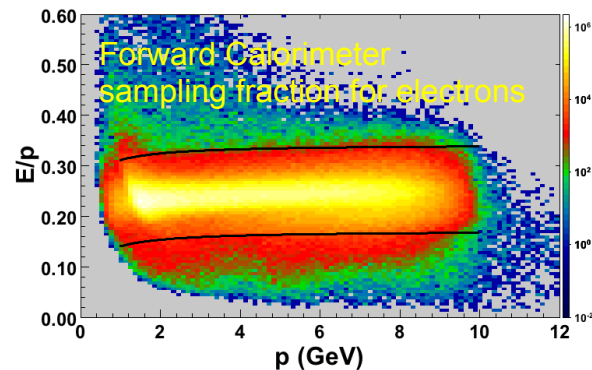
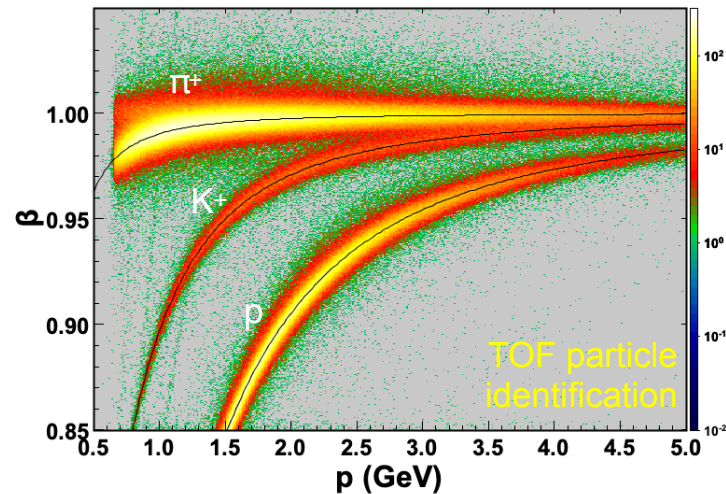
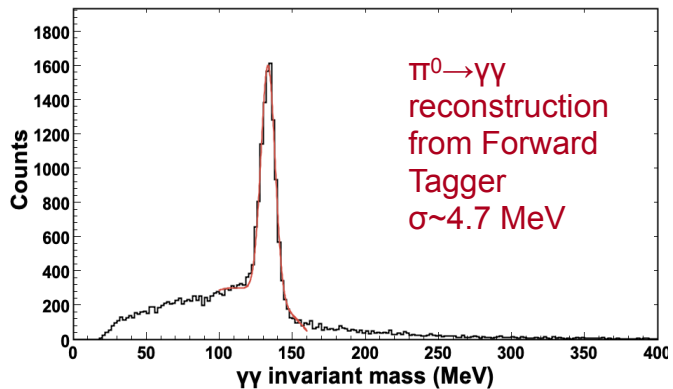
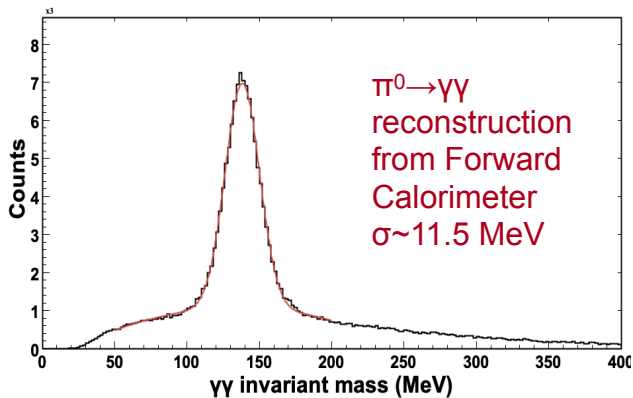




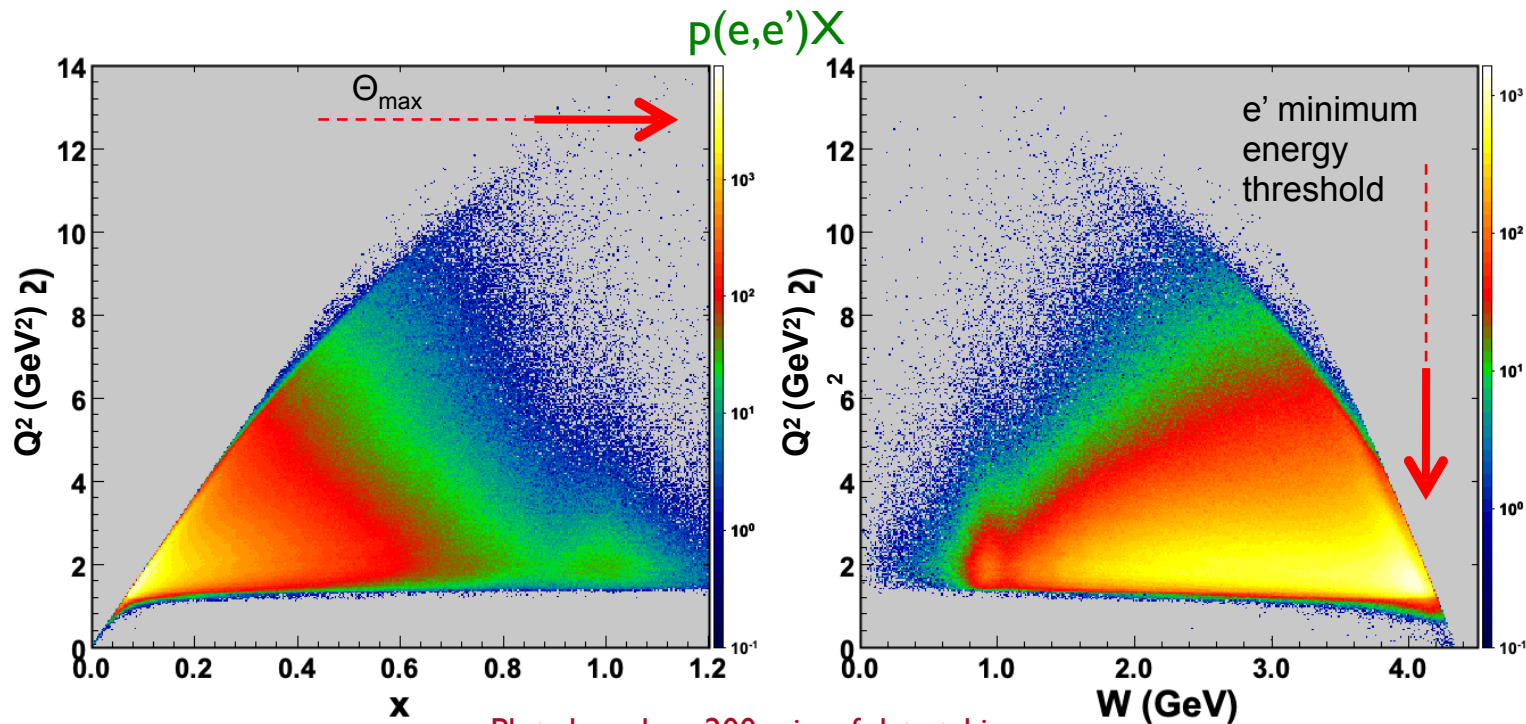


- **CLAS12 data taking**
- from Feb 2017 (KPP) to Spring 2019 (physics runs)
  - **Run Group A:**
    - 13 experiments
    - 10.2-10.6 GeV polarized electrons
    - Liquid-hydrogen target
    - ~300 mC, ~50% of approved beam time
  - **Run Group K:**
    - 3 experiments
    - 6.5, 7.5 GeV polarized electrons
    - Liquid-hydrogen target
    - ~45 mC, ~12% of approved beam time
  - **Run Group B:**
    - 7 experiments
    - 10.2-10.5 GeV polarized electrons
    - Liquid-deuterium target
    - ~84 mC, ~24% of approved beam time





Beam energy at 10.6 GeV Torus current 3770 A, electrons in-bending, Solenoid magnet at 2416 A



Plots based on 200 min. of data taking

## Run Group Overview and results

RGA: 13 different experiments

SIDIS BSA

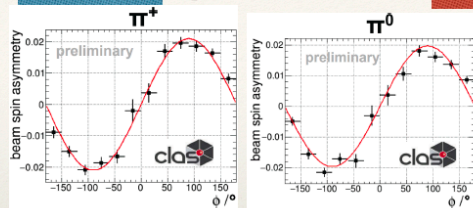
 $pe \rightarrow e'\pi X$ 

Hall B CLAS12

64 PAC days or 53.5%  
of planned data

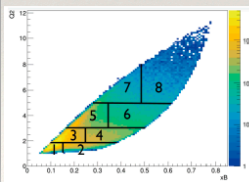
10.6 GeV Polarized Beam

Hydrogen target

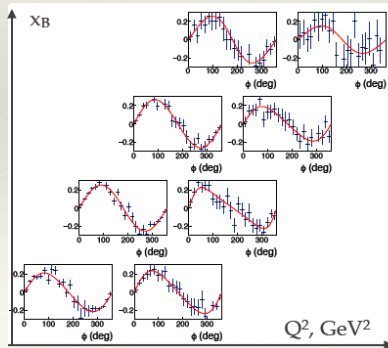


S. Diehl

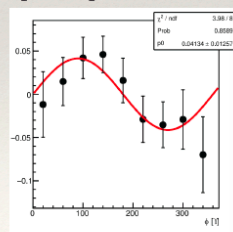
DVCS BSA

 $pe \rightarrow e'\gamma\gamma$ 

G. Christiaens



DVMP BSA

 $pe \rightarrow e'p\pi^0$ 

A. Kim

- from N.Markov presentation at the DNP, Fall 2019

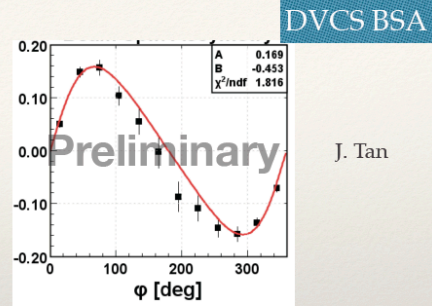
## Run Group Overview and results

RGK: 3 different experiments

12.1 PAC days or 12% of planned data

7.5 GeV Polarized Beam

Hydrogen target

 $ep \rightarrow e'\gamma\gamma$ 

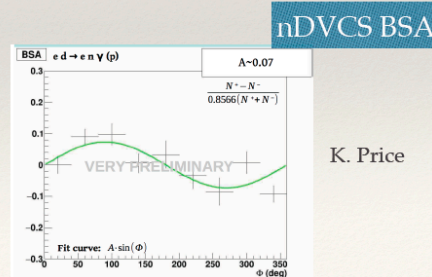
J. Tan

RGB: 7 different experiments

21.8 PAC days or 24% of planned data

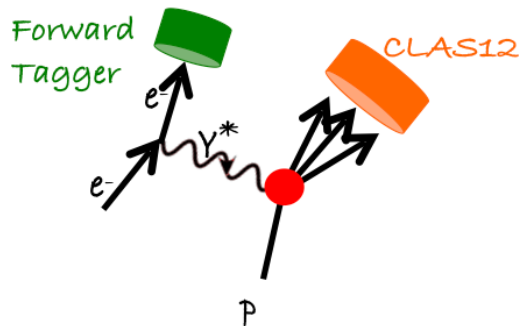
10.2 GeV Polarized Beam

Hydrogen target

 $ed \rightarrow e'\gamma(p)$ 

K. Price

- more details during the Collaboration Meeting

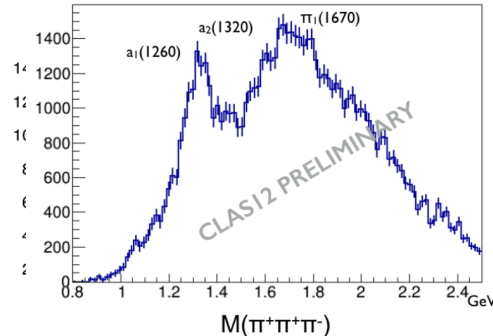


- Detailed mapping of the meson spectrum up to masses of 2.5 GeV
- Search for rare or poorly known states (strangeness-rich, scalars, ...)
- Search states with unconventional quark-gluon configurations

### CLAS12 $\pi^+\pi^+\pi^-n$ preliminary data

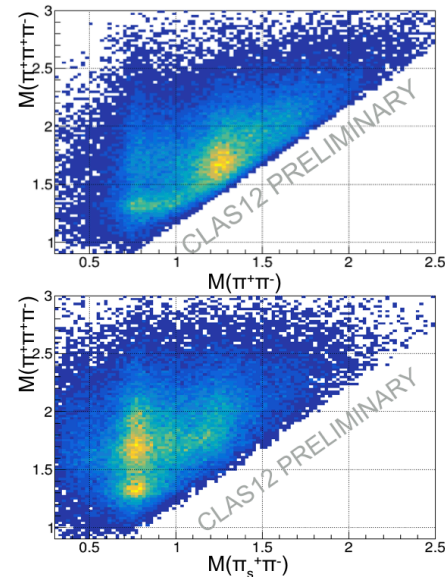
- First analysis of 3 pion channel from the 10.6 GeV data
- Candidate for search of the exotic  $\pi_1(1600)$
- Richness spectrum already accessible with few % of the expected data

See talk by M. Battalieri



The CLAS12 Experiment at Jefferson Lab

19

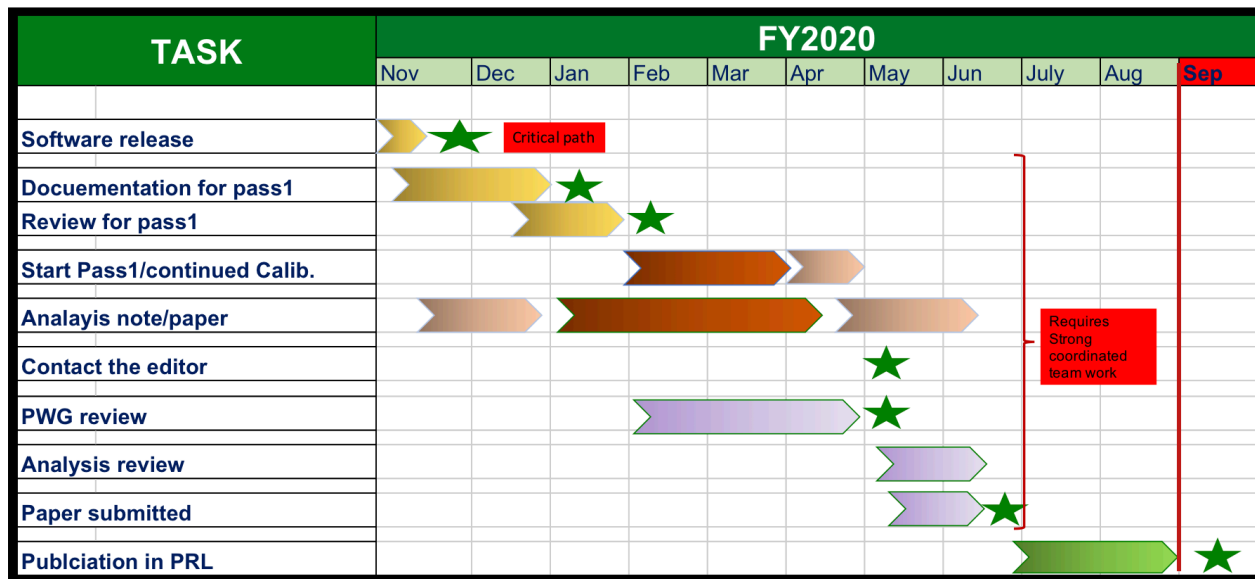


- D.Glazier results presented by R.De Vita at DNP Fall 2019



## Requirements:

- Publication by FY20
- From 12 GeV beam
- Vetted results and cross checked analysis
- Demonstrating the 12GeV & CLAS12 reach
- Science impact
- PRL



The editorial board approved at unanimity the **CLAS12 Special Issue** proposal. We are thrilled to publish it in NIMA journal.

## NIM Overview Paper Status

The CLAS12 Spectrometer at Jefferson Laboratory

Y.D. Bakht, I. Khoshdel, D. Anderson, S. Azar, H. Asadian, S. Balazli, M. Battaglini, V. Batris, S. Batzner, P. Bozars, K. Brubaker, D.S. Cussler, A. Czirak, M. Costantini, S. Christ, M. Dehnen, G. Dodge, H. De Vita, K. Ghasseini, F.S. Ghod, L. Guo, R. Guther, Y. Guts, K. Haldi, D. Haddi, P. Hecker, K. Heide, D. Isely, K. Joo, D. Kady, A. Kim, W. Kim, Y. Kishimoto, S. Klein, M. Kneidel, I. Kneipfing, N. Markov, C. Mao, M. Mataranga, Z. Meidan, H. Mider, M. Minato, S. Nishida, G. Pader, E. Paredes, O. Pappas, R. Papp, F. Pasi, F. Salati, N. Shalunov, D. Sakai, S. Sengupta, M. Ungaro, A. Vlasov, D. Warr, E. Weinand, C. Wiggins, A. Yegorov, G. Young, M. Zerkow, V. Zerkow. [arxiv.org/abs/1605.02841](http://arxiv.org/abs/1605.02841).

The CHEF Lab Arcsight Spectrometer for operation at 12 GeV/beam energy (CLAS12) at Jefferson Laboratory is used to study electro-weak and hadronic reactions, and provides efficient detection of charged and neutral particles over a large fraction of the full solid angle. CLAS12 has been part of several ongoing projects of Jefferson Lab's Continuous Wave Electron Beam Accelerator Facility, funded by the U.S. Department of Energy. CLAS12 is a large detector system that combines the strengths and construction of detector hardware, developed the software packages for the simulation of complex event patterns, and commissioned the detector system. CLAS12 is based on a dual-arm system with a superconducting dipole magnet, a large acceptance calorimeter, and a large acceptance particle detector, and a solenoid magnet and detector covering the polar angles from  $90^\circ$  to  $120^\circ$ , with full central coverage. Theoretical reconstruction is the forward direction using drift chambers and in the central direction using a water target radiator in momentum resolutions of  $\sim 1\%$  and  $\sim 2\%$ , respectively. Chemical identification is achieved using particle identification techniques such as time-of-flight and Cherenkov. Fast triggering and high data-acquisition rates after operation at a luminosity of  $10^{30}$  cm $^{-2}$  s $^{-1}$ . These capabilities are being used in a broad program to study the structure and interactions of nucleons, under the leadership of the CLAS12 Collaboration, and in a number of other experiments. CLAS12 is the largest detector system in the world, and is the largest detector system in the world.

## 1. Introduction

Electron scattering has been proven as effective for the study of the internal structure of adsorbent particles as probes, acetone, and metal. Exploiting emergent electron beams led to rapid progress in our understanding of the internal structure of adsorbent particles. The first electron probe was first supported out in the mid-1990s, and the internal probe structure was discovered in the late 1990s. The electron probe structure and spin-polarized beams, the internal probe facility constructed following was supported out in the 1990s and the following decade, and it is still in use today. The electron probe structure is currently only used for electron measurements, where only the beam particle, electron or neutron, that is used to probe the structure is measured.

In the decades following these discoveries, it was realized that a more detailed understanding of the internal structure of adsorbent probes requires the reconstruction of fully coherent or semi-coherent probe beams. The electron probe structure was constructed of additional mirrors and beryllium to the final stage was required. Other constraints come from the fact that the electron probe is currently a single negative deflection, which makes it necessary to require large acceptance devices to serve the purpose. The Coherent Electron Beam Probe (CEBP) was designed and constructed by J. B. and other experimental experts at Juelss Laboratory (JLAB) were designed and constructed.

cutting off the tract were detected and kinemat

In the decades following these discoveries, it was realized that a more detailed understanding of the internal structure of nucleonic resonances (the reconstruction of fully exclusive or semi-inclusive processes, and hence the detection and kinematical reconstruction of additional mesons and baryons in the final state) was required. Other constraints came from the desire of baryon spectroscopy to measure complete angular distributions, which made it necessary to employ large acceptance devices to accept that purpose. The Continuous Electron Beam Accelerator Facility (CEBAF) [1], the CLAS detector [2], and other experimental equipment at Jefferson Laboratory (JLab) were designed and re-

October 22, 2012

Outline:

1. Introduction
2. The JLab Facility at 12 GeV
3. The CLAS12 System
4. CLAS12 Central Detector
5. CLAS12 Offline Software
6. CLAS12 Operational Performance
7. Data Acquisition and Trigger System
8. Electron Beam Operation
9. Summary

Review Status:

Initial review in progress

Remaining Work to Completion:

1. Finalize authors list
2. Include graphs/info from subsystems
3. Update performance graphs with improved calibrations
4. Fill summary table with up-to-date numbers

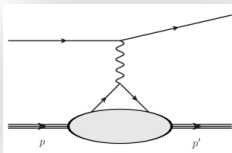
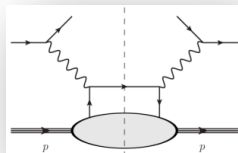
## Status of CLAS12 NIM Papers – 11/5/19

System	Lead	% Comp	Pages	Rev. 1	Fig. Rev.	Reviewer	Rev. 2	Status Update
SVT	Gotra/Elouadrhiri	100	38	✓	✓	Alexander Sukhanov, FNAL	in prog.	Rev. 2 in progress
MVT	Bossu/Defurne	100	14	✓	in prog.	Sebastian Kuhn, ODU	in prog.	Rev. 2 in progress
CTOF	Carman	100	26	✓	✓	Brian Raue, FIU	✓	Done
CND	Niccolai	100	12	✓	✓	Cole Smith, JLab	in prog.	Rev. 2 in progress
HTCC	Sharabian	100	34	✓	in prog.	Stepan Stepanyan, JLab	in prog.	Rev. 1 underway
DC	Mestayer	100	26	✓	in prog.	Simon Taylor, JLab	in prog.	Rev. 1 underway
LTCC	Ungaro	90	21	TBD	TBD	Youri Sharabian, JLab		finalizing draft
RICH	Rossi/Contalbrigo	75	11	TBD	TBD	Xiaochun He, GSU		working on initial draft
FTOF	Carman	100	26	✓	✓	Beni Zihlmann, JLab	✓	Done
ECAL	Smith/Stepanyan	100	17	✓	in prog.	Andrea Celentano, INFN	in prog.	Rev. 2 in progress
FT	Battaglieri/De Vita	75	20	TBD	TBD	Tanja Horn, CUA		finalizing draft
Beamline	Stepanyan/Raue	100	13	✓	✓	Eugene Pasyuk, JLab	✓	Done
DAQ	Boyarinov	100	22	✓	in prog.	Alexander Somov, JLab	in prog.	Rev. 2 in progress
Trigger	Kubarovsky	100	26	✓	in prog.	Graham Heyes, JLab	in prog.	Rev. 2 in progress
Sim	Ungaro	100	28	✓	✓	Will Brooks, UCSM	in prog.	Rev. 2 in progress
Recon	Ziegler/De Vita	75	25	TBD	TBD	David Lawrence, JLab		working on initial draft
Magnets	Fair	100	33	✓	✓	GianLuca Sabbi, LBL	in prog.	Rev. 2 in progress
Overview	Burkert/Elouadrhiri	100	33	in prog.		Elton Smith, JLab		Rev. 1 underway
OVERALL		95.6%	426					

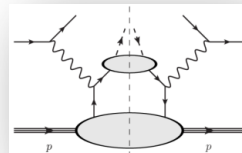
- **NIM status assessment review in October boosted the process**
- **All papers completed by Nov 11**
- **All final review by Nov 26**
- **All papers and reviews completed by Dec 16**
- **Submission to NIM from Dec 1 to Dec 20**

Repository:

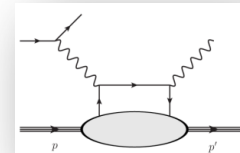
<https://github.com/JeffersonLab/clas12Nim>

Elastic  
Scattering

DIS



SIDIS

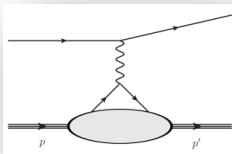


DVCS

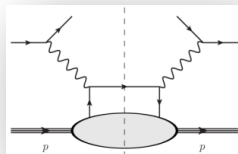
+ J/psi photoproduction &amp; SRC

	Physics	Contact	Rating	Days	% complete	comment
E12-07-104	Neutron magnetic form factor	Gilfoyle	A-	30	72.7	
E12-09-007(a)	Study of partonic distributions in SIDIS kaon production	Hafidi	A-	30	36.3	2 LTCC, 1 RICH
E12-09-008	Boer-Mulders asymmetry in K SIDIS w/ H and D targets	Contalbrigo	A-	30	36.3	2 LTCC, 1 RICH
E12-09-008B	Collinear nucleon structure at twist-3	Mirazita	NR	(56)	38.9	
E12-11-003	DVCS on neutron target	Niccolai	A	90	24.2	
E12-11-003A	In medium structure functions, SRC, and the EMC effect	Hen	NR	(90)	24.2	
E12-003B	J/Psi production on deuterium	Ilieva pentaquark J/Psi	NR	(80)	5.5 *) 8.3	Suffers from low energy
RG-B completion				21.8	24.2	

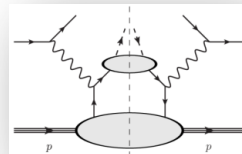
\*) Entries are weighted with factor less than 1 to account for reduced beam energy during part of the run.



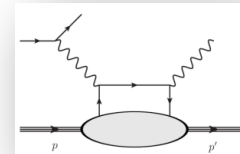
Elastic  
Scattering



DIS



SIDIS



DVCS

+ J/psi photoproduction & SRC

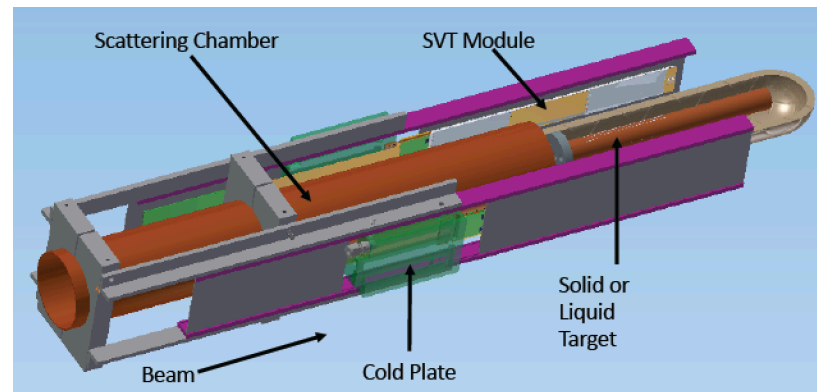
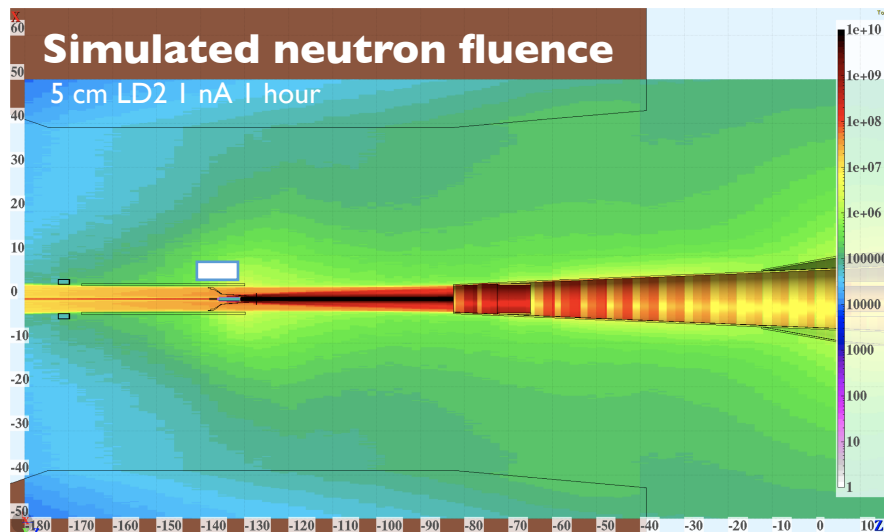
- $d_2$  target
- $\sim 11.0 \text{ GeV } E_{\text{beam}}$
- 2019: Nov 25 - Dec 19 (last 2 days at low energy for BAND calibration)
- 2020: Jan 10 - Jan 29
- Tot = 25+20 = 45/2 PAC days (added to 22 PAC days already run makes  $\sim 50\%$  of RG-B)

- Between RG-B and BONUS, scheduled 2 weeks for solid target test

01/30/20	Thursday	2.1	Physics	E12-12-004	2.22/150/p/500	INSTALL	
01/31/20	Friday	2.1	Physics	E12-12-004	2.22/150/p/500	INSTALL	
02/01/20	Saturday	2.1	Physics	E12-12-004	2.22/150/p/500	INSTALL	
02/02/20	Sunday	2.1	Physics	E12-12-004	2.22/150/p/500	Test Run (Note 1)	10.6/100/~
02/03/20	Monday	2.1	Physics	E12-12-004	2.22/150/p/500	Test Run (Note 1)	10.6/100/~
02/04/20	Tuesday	2.1	Physics	E12-12-004	2.22/150/p/500	Test Run (Note 1)	10.6/100/~
02/05/20	Wednesday	2.1	Physics	E12-12-004	2.22/150/p/500	Test Run (Note 1)	10.6/100/~
02/06/20	Thursday	2.1	Physics	E12-12-004	2.22/150/p/500	Test Run (Note 1)	10.6/100/~
02/07/20	Friday	2.1	Physics	E12-12-004	2.22/150/p/500	Test Run (Note 1)	10.6/100/~
02/08/20	Saturday	2.1	Physics	E12-12-004	2.22/150/p/500	Test Run (Note 1)	10.6/100/~
02/09/20	Sunday	2.1	Physics	E12-12-004	2.22/150/p/500	INSTALL	
02/10/20	Monday	2.1	Physics	E12-12-004	2.22/150/p/500	INSTALL	
02/11/20	Tuesday	2.1	Physics	E12-12-004	2.22/150/p/500	INSTALL	

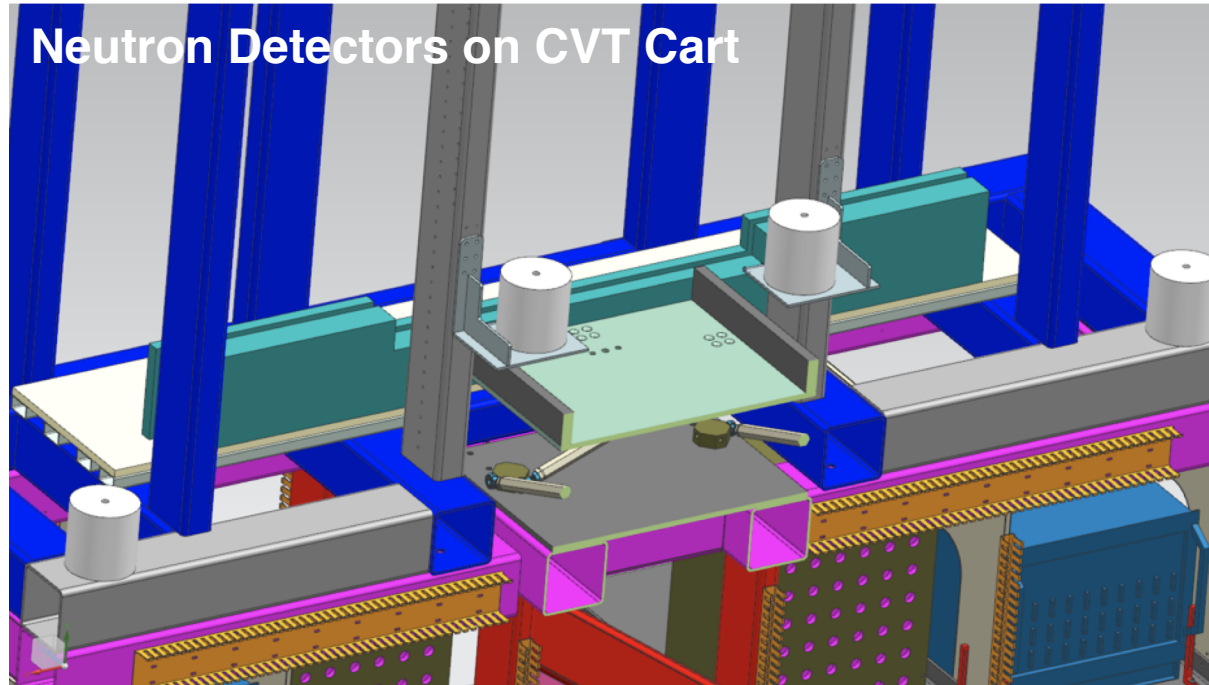
## GOALS:

- Validate simulations by measuring radiation dose at various locations around the target
- Measure occupancies and the leakage currents in the silicon sensors



5 cm LD2, 5 cm LHe, 0.125 mm Pb, .25 mm Sn

- ERR scheduled for Dec 3 2019



Neutron Detectors on CVT Cart



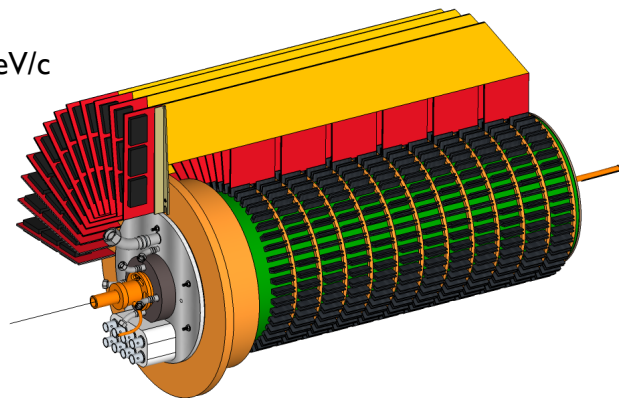
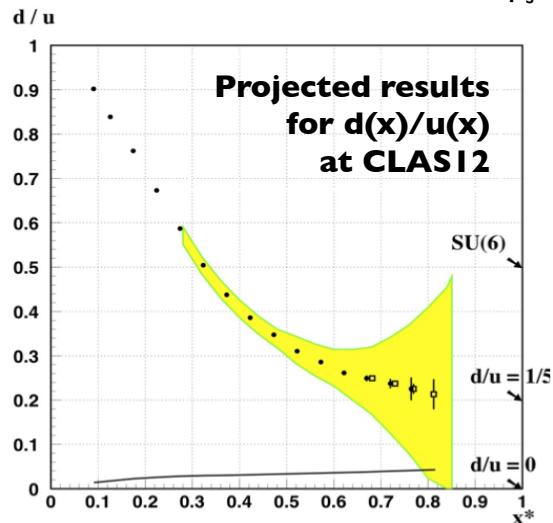
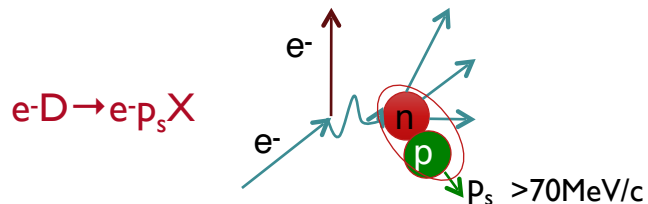
BF3 proportional counter with polyethylene moderator

Neutron activation In counters (n) + TLDs (charge)

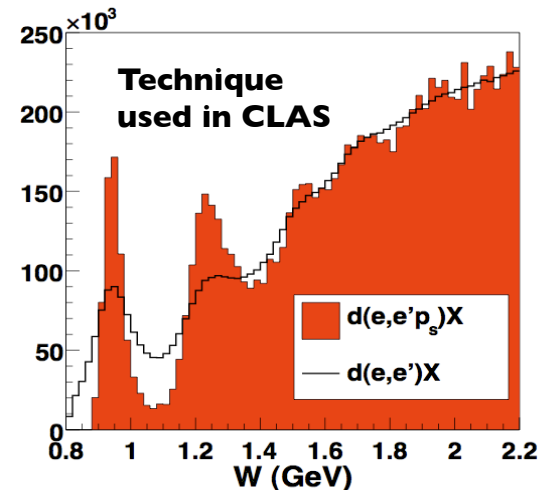




$F_2^n/F_2^p$  ratio by tagging almost unbound neutrons using detection of low momentum protons in a radial TPC



- Scheduled from Feb 12 to May 1st (+5 days contingency) = 80/2 PAC days



**Proposed schedule**

- Acc ops expected to resume in Jan-21 after a long shutdown for the ColdBox replacement
- Assume 30 weeks operations split between Spring/Fall runs
- Assume to restart at 5 passes (11 GeV)
  - 8/10 weeks RG-D/E (~50% PAC days allocated) - nuclear targets - Color transparency + hadronization
  - 6/8 weeks RG-M - neutrino's and SRC in nuclei
- May be difficult due to the several configuration changes (several combination of  $E_{\text{beam}}$  and target)
- Summer 2021: NH3/ND3 installation (~2 months)
  - Fall 2021 (10/12 weeks): ~30% of RG-C completed
- Meet on Wed with RG representatives
- Discuss the schedule with the CCC
- Back to the Lab Scheduling Committee



# Summary/Outlook

- \* Continuous flow of publications from CLAS6 and PRad (Nature)
- \* During summer, HPS collected 60% of the expected statistics at 4.5 GeV
- \* Continuous progress of the CLAS12 common analysis framework and data processing
- \* RG-A, RG-B and RG-K first results presented at the DNP 2019 in DC
- \* CLAS12 NIM publication almost ready (expected submission in December 20219)
- \* Proposed a strategy for the CLAS12 first publication
- \* RG-B (II part) and BONUS ready to run in Fall 2019 / Spring 2020
- \* Nuclear target test scheduled for late January 2020
- \* Preliminary draft of FY21 schedule includes nuclear target runs (RG-D/E and RG-M) and NH3/ND3

Thank you, Volker, for the  
outstanding scientific  
achievements and the inspiring  
leadership!



... it is not easy to fill such big shoes but Volker  
formed an incredible team I can count on ...

