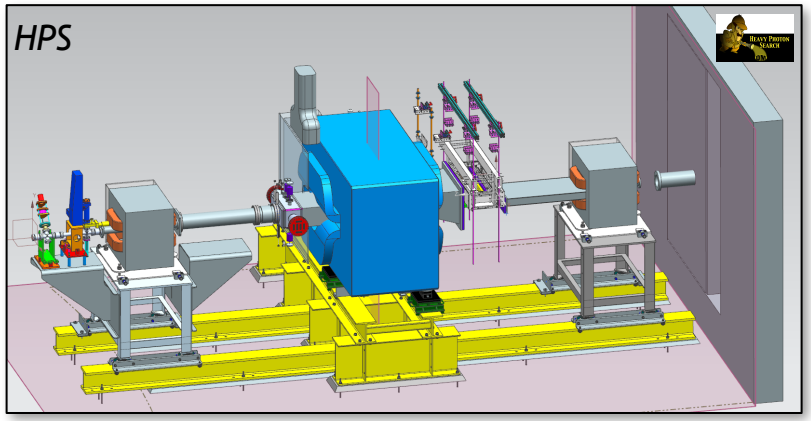
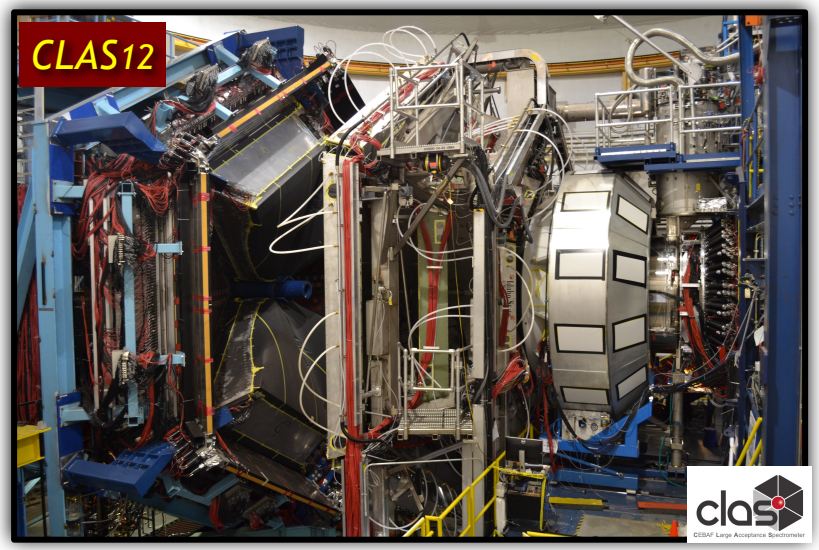
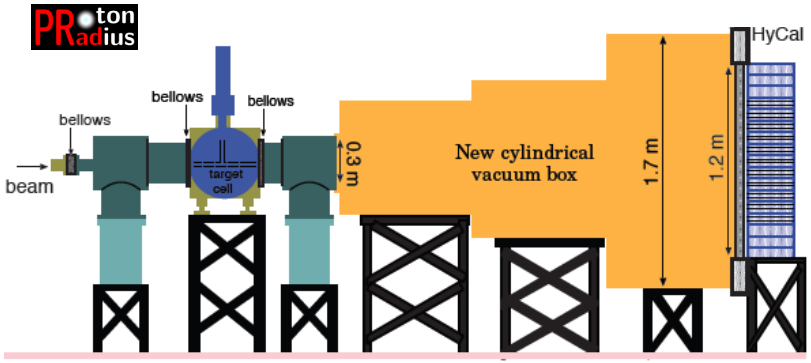






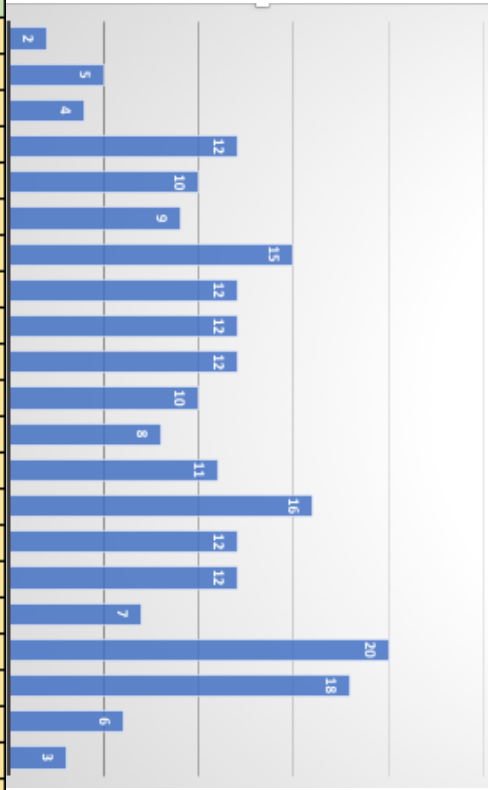
CLAS Collaboration Meeting
July 21-24, 2020

Status of Hall B

Marco Battaglieri
Jefferson Lab

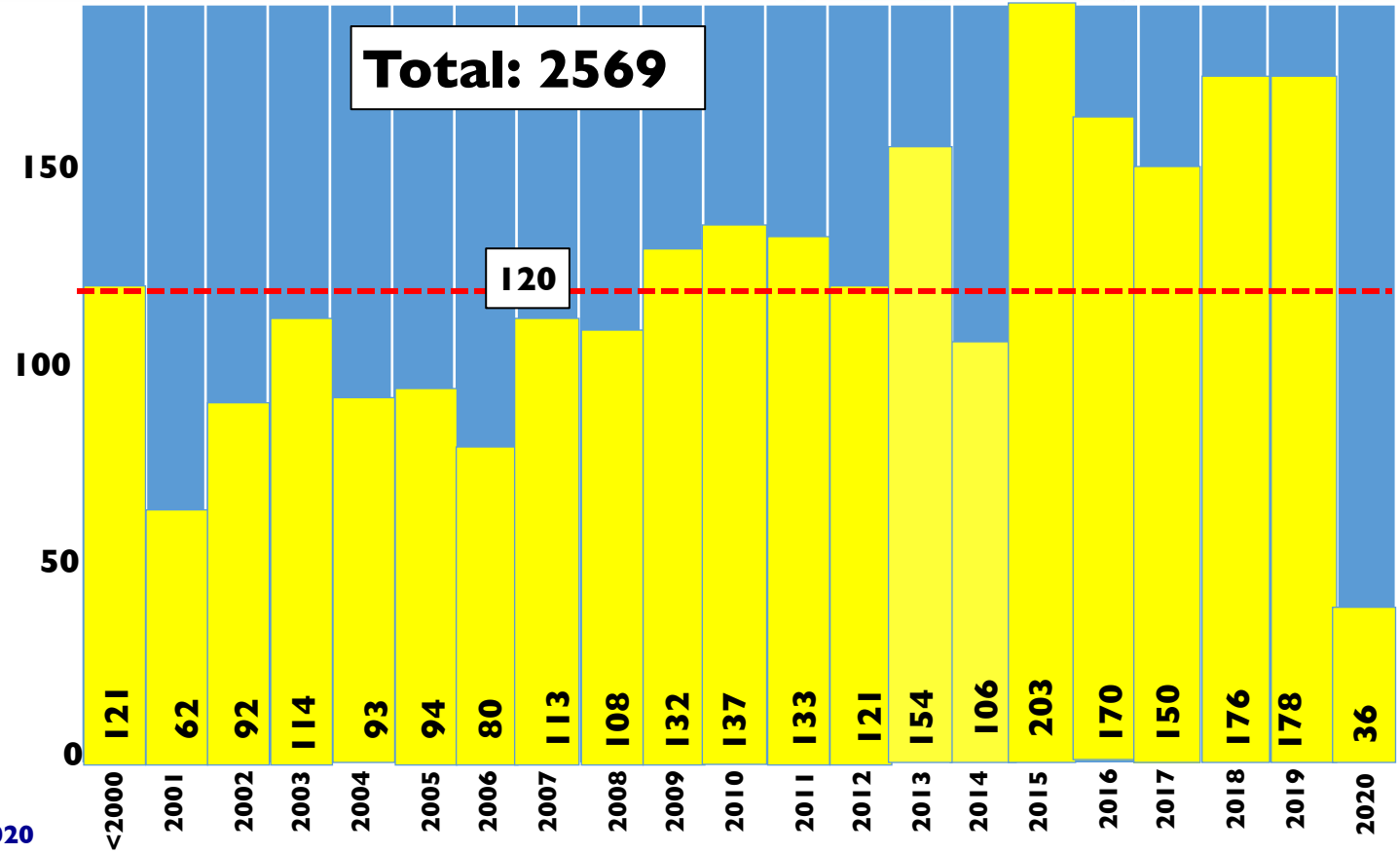
Refereed Physics Publications Hall B

	Spectroscopy	Hard Scattering	Nuclear	ALL
2000		1	1	2
2001	2	3		5
2002	3		1	4
2003	7	4	1	12
2004	3	3	4	10
2005	7	3	2	9
2006	8	4	3	15
2007	7	2	3	12
2008	4	6	2	12
2009	8	7	4	12
2010	4	2	4	10
2011	3	1	4	8
2012	6	3	2	11
2013	8	6	2	16
2014	5	6	1	12
2015	4	5	3	12
2016	7			7
2017	12	7	1	20
2018	10	6	2	18
2019	1	2	3	6
2020	1+2	1	2+3	3+6
SUM	110	61	43	216+6



updated 07/19/2020

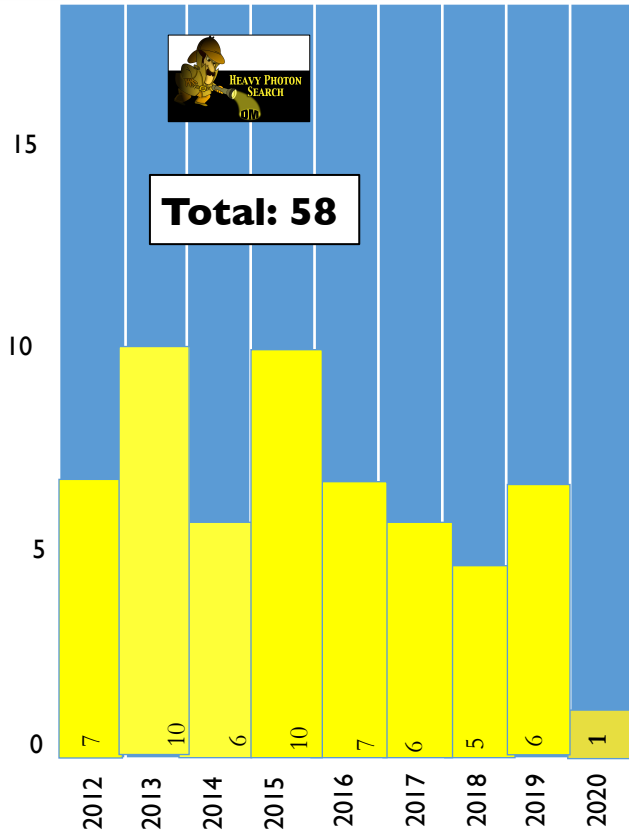
Conference Presentations

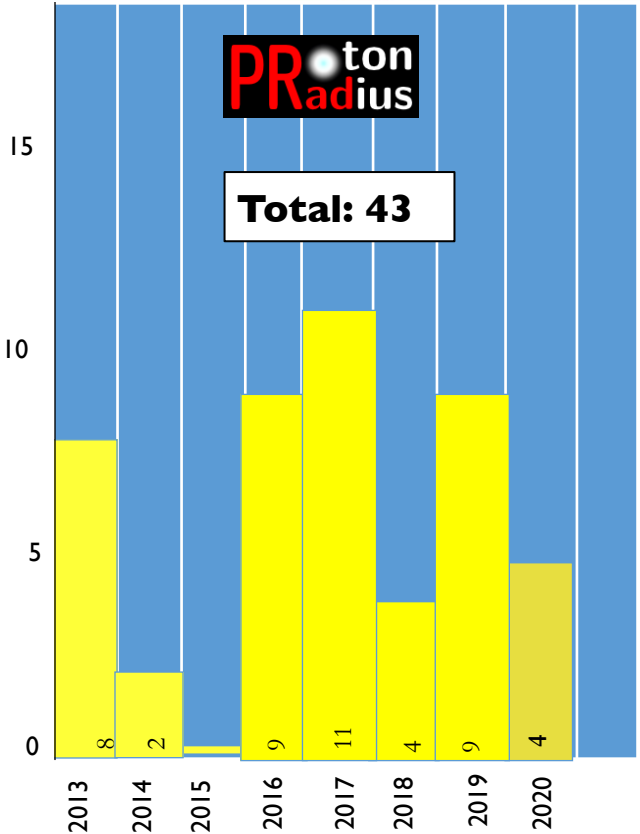


Source: CSC
updated July 19 2020

Conference Presentations

Hall B



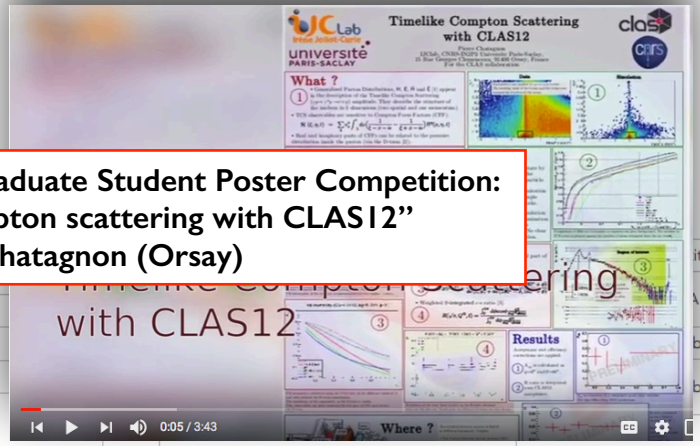


Source: HPS & PRAD wiki

updated Jul 19 2020

2020 JLUO Annual Meeting

Prize in JULO2020 Graduate Student Poster Competition:
Time-Like Compton scattering with CLAS12"
P. Chatagnon (Orsay)



	Monday, June 22		
	Topic	Speaker	Institution
9:00	Welcome	Will Brooks	JLUO Board
9:10	Jefferson Lab Overview	Stuart Henderson	JLab
9:45	DOE Nuclear Physics Perspective	Tim Hallman	DOE
10:15	Break		
10:40	NSF Nuclear Physics Perspective	Jim Thomas	NSF
11:05	Overview of the Jefferson Lab Science Program	Bob McKeown	JLab
11:40	CEBAF Performance and Outlook	Camille Ginsburg	JLab
12:05	Lunch		
1:00	The EIC User Group's path towards detectors	Thomas Ullrich	BNL
1:30	The EIC Project and involvement of JLab and the User Community	Rolf Ent	JLab
2:00	Break		
2:20	The PRad experiment and the incredible shrinking proton	Dipangkar Dutta	MS State
2:40	Preliminary Results from the Lambda-NN Hypernuclear Studies	Liguang Tang	Hampton
3:10	JLUO Business Meeting	Will Brooks	JLUO BOD
3:30	Adjourn		

	Tuesday, June 23		
	Topic	Speaker	
9:00	Overview of Meson Form Factors	Tanja Horn	
9:30	Exotic hadrons from LHCb	Biplab Dey	
10:05	Preliminary Results on the Hall C J/Psi Threshold Production Experiment	Sylvester Joosten	
10:35	Break		
10:55	Deeply Virtual Compton Scattering from the Proton with CLAS12	Maxime Defurne	CEA-Saclay
11:15	Deeply Virtual Compton Scattering from the Neutron with CLAS12	Silvia Niccolai	Orsay
11:35	Frontiers in Lattice Parton-Distribution Calculations	Huey-Wen Lin	MSU
12:05	Lunch		
1:00	The Jefferson Lab @12 GeV Roadmap to Nuclear Femtography	Simonetta Liuti	UVA
1:30	[illegible]	[illegible]	
2:00	The Primakoff Experimental Program at JLab	Liping Gan	UNC-W
2:30	Virtual Poster Sesson (until 4:30pm EDT)		

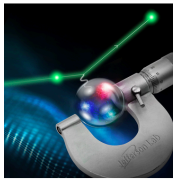
10:45	Machine Learning/Deep Learning	Will Phelps	CNU
11:15	JSA Awards: Thesis Prize, Postdoctoral Prize Poster Award Slides	Elizabeth Lawson	JSA
11:30	JSA Thesis Award Talk	Antoni Woss	Cambridg
11:55	JSA Postdoctoral Award Talk	Wenliang Li	W&M
12:20	Lunch		
1:30	The Heavy Photon Search Experiment	Matt Solt	SLAC
1:55	A Polarized 3He Target in CLAS12	Dien Nguyen	JLab
2:20	SIDIS Single Pion and Di-hadron Beam Spin Asymmetry Measurements with CLAS12	Stefan Diehl	U Giessen U. Conn
2:45	Towards a Better Picture of Parton Distribution Functions at Large x - Results from JLab12	Thia Keppel	JLab
3:15	Adjourn		

Hall B Overview

- **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)
  - 5 papers in Nature, 1 paper in Science (+ new Nature submitted)
  - ~2,600 conference talks (~1,650 invited)

- **Specialized Hall B experiments**
  - PRAD experiment – results published in Nature
  - PRIMEX - results published in Science
  - Heavy Photon Search - Analysis of 2016 data ongoing



Two new proposal for PAC48

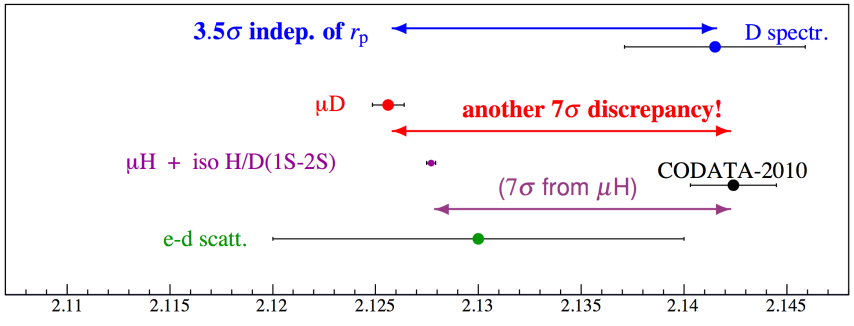
- add second (uRWELL) GEM detector for tracking;
- Modify the HyCal (currently lead-glass/PbWO) to a full omegeneous PbWO calorimeter (+1500 crystals)
- Update the RO electronics (from FASTBUS to fADC250)
- 4 times more statistics;

- **PRadII** **Expect 2.5 times improvement in total uncertainty:**
  R_p = 0.8?? ± 0.003 (stat.) ± 0.005 (syst.) fm (±0.67%)

- **DRad: deuteron charge radius from elastic electron-deuteron scattering**
  - add a Si detector for low energy p and d to the PRad setup

- The "*Proton Charge Radius Puzzle*" is becoming more *Puzzling*.
- There is a newly developing "Deuteron Charge Radius Puzzle"
  - H/D isotope shift: $r_d^2 - r_p^2 = 3.82007(65)$ fm2
  - Muonic deuterium: $r_d = 2.12562(13)_{exp}(77)_{theory}$ fm
  - Electronic deuterium: $r_d = 2.14150(450)$ fm

Projected total DRad uncertainty:
0.25% (2 times less than "e-d scatt.")

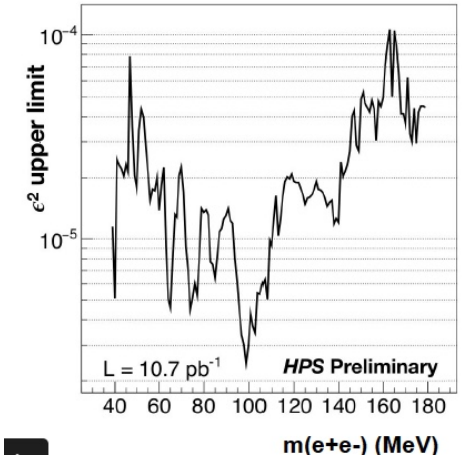


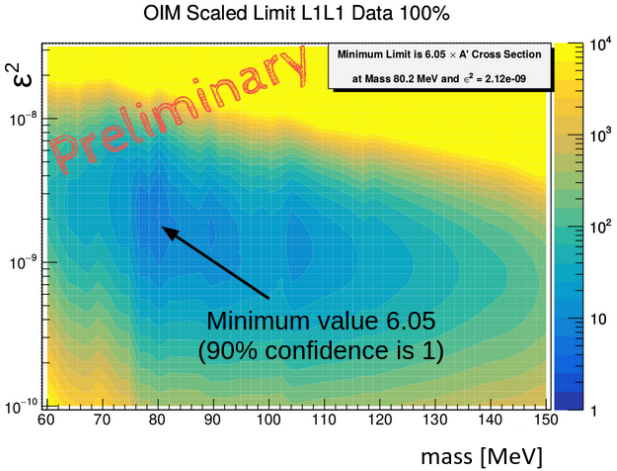
Credit: A.Gasparyan

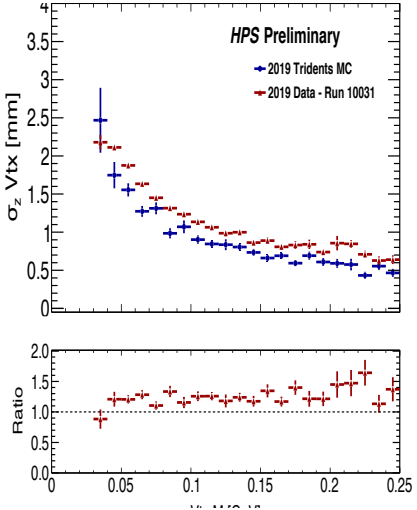
Heavy Photon Search

Hall B

- HPS (remote) collaboration meeting held on May
- Jeopardy: submitted a request for 107 days to PAC48 (used 45/180 PAC days)
- Data analysis: 2016 data RESONANT and DISPLACED VERTEX analyses have been presented to JLab UG Meeting

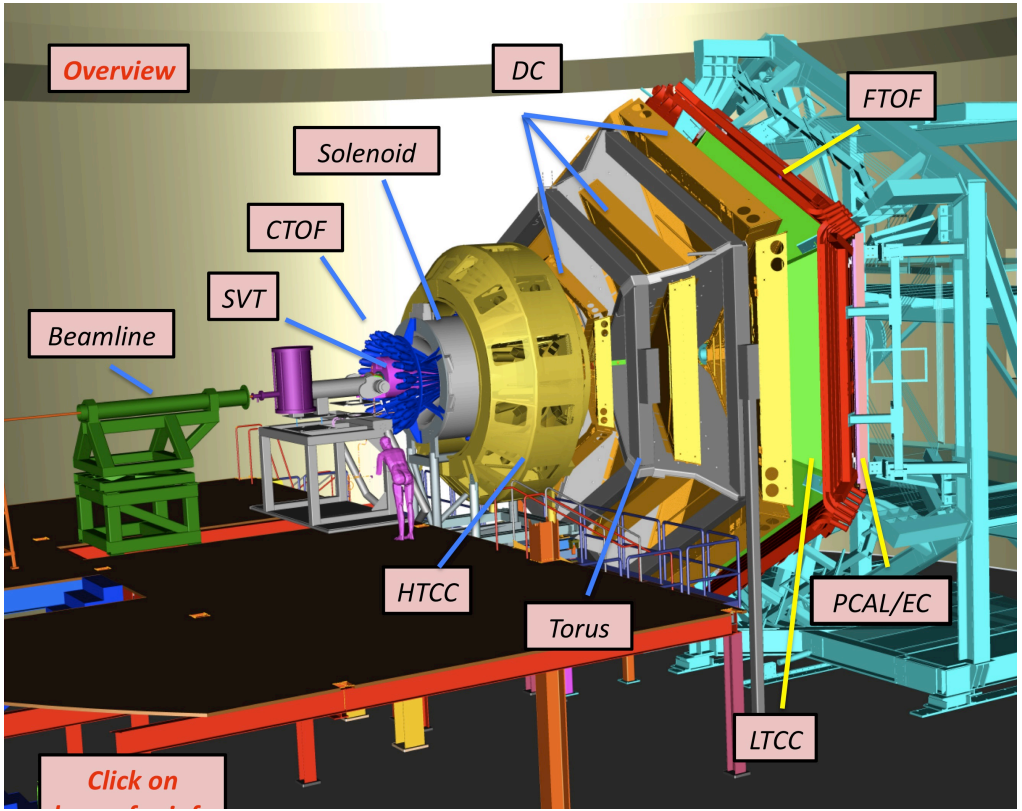


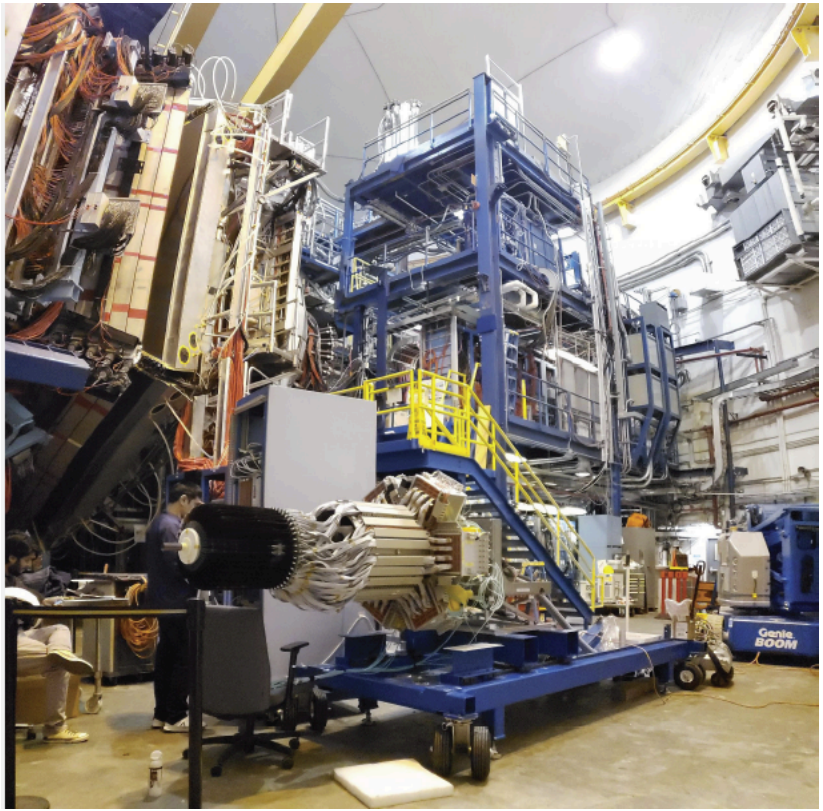




- Calibration of 2019 data is ongoing. Detector groups are making a good progress on Ecal, hodoscope and SVT.
- We expect to start the physics analysis of 2019 unblinded data sample in fall.
- Preparation for 2021 run ongoing

Credit: S.Stepanyan


Overview
DC
FTOF
Solenoid
CTOF
SVT
Beamline
HTCC
Torus
PCAL/EC
LTCC
Click on



- **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

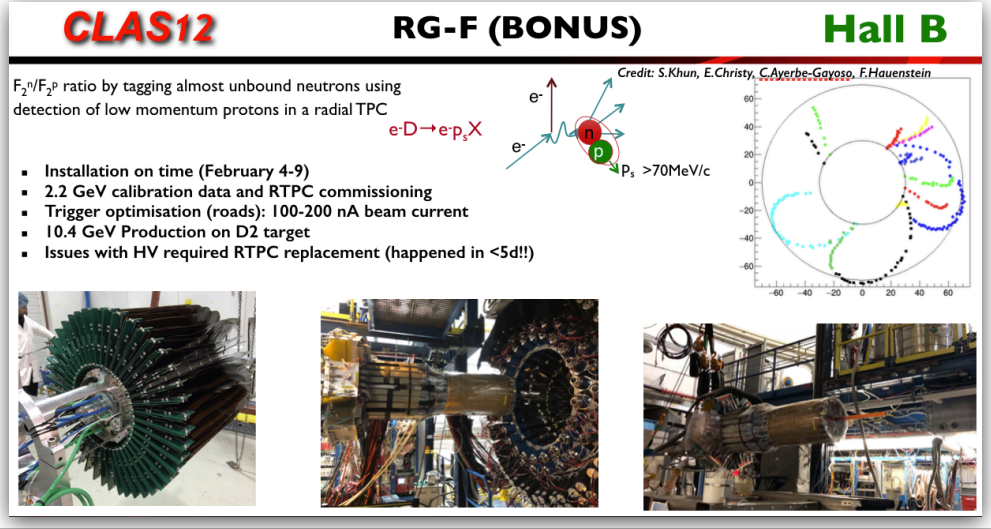
- **Run Group B**:
  - 7 experiments
  - 10.2-10.5 GeV polarized electrons
  - Liquid-deuterium target
  - ~155 mC, ~43% of approved beam time

- **Run Group F (BONUS)**:
  - 7 experiments
  - 10.2 GeV polarized electrons (+2.2 GeV for calibration)
  - Gas-deuterium target +RTPC
  - ~49% of approved beam time

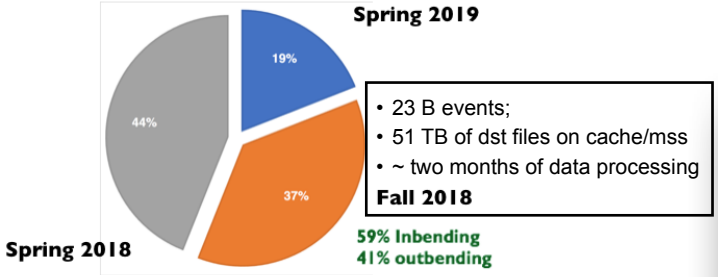
CLAS12 data taking

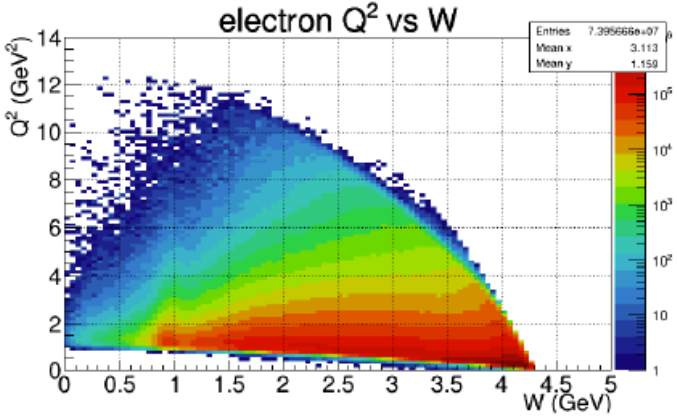
- from Feb 2017 (KPP) to Spring 2020 (physics runs)

- **Nuclear targets test (special run)**:
  - 10.2 GeV electrons
  - LD2, LHe and Pb targets
  - 100% of scheduled time



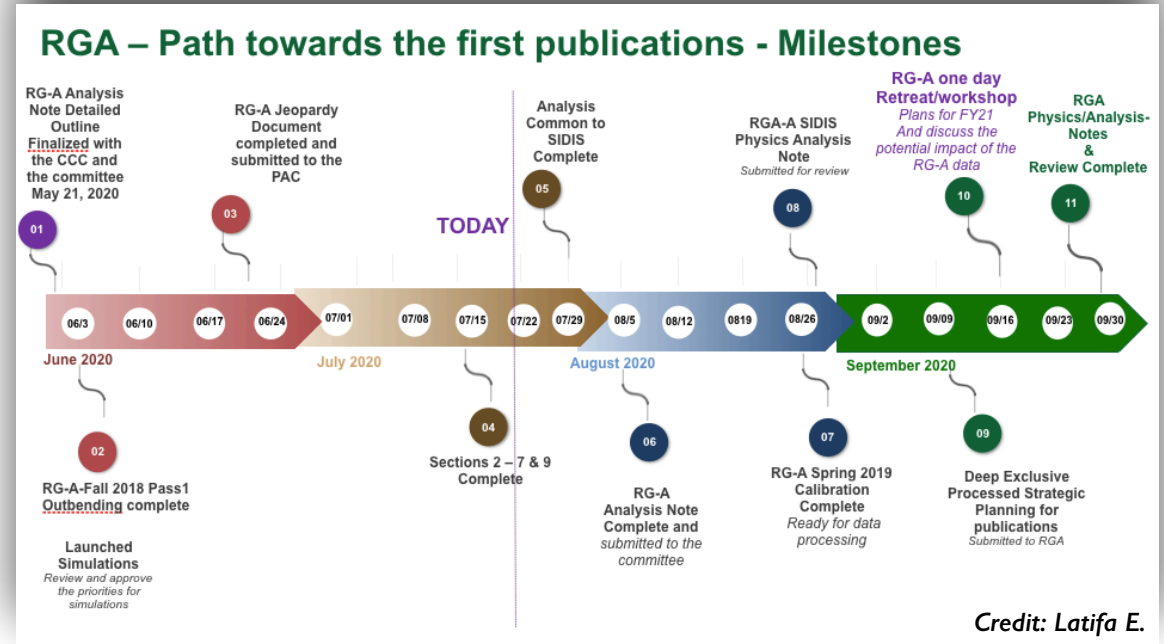
RG-A



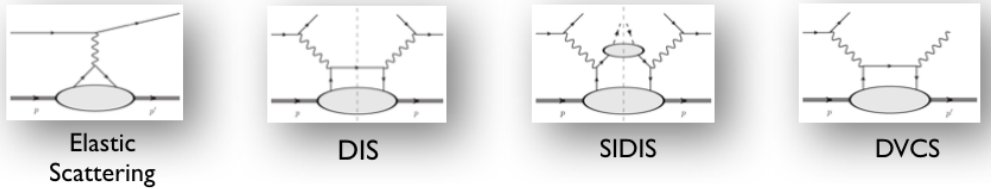


- Concluded the first massive cooking on Fall'18 data set (both In bending and Out bending)
- Initial focus on Transverse Momentum Distribution (TMDs) by SIDID
- Single hadron (S.Diehl) and di-hadron (C.Dilks) analyses well advanced

More details on Wednesday presentations

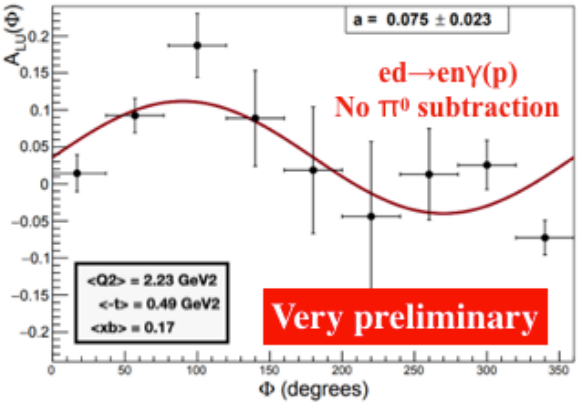


RG-B

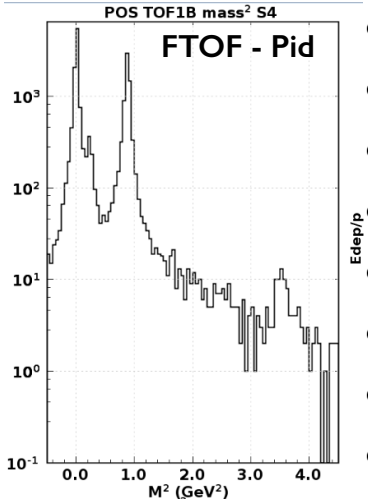


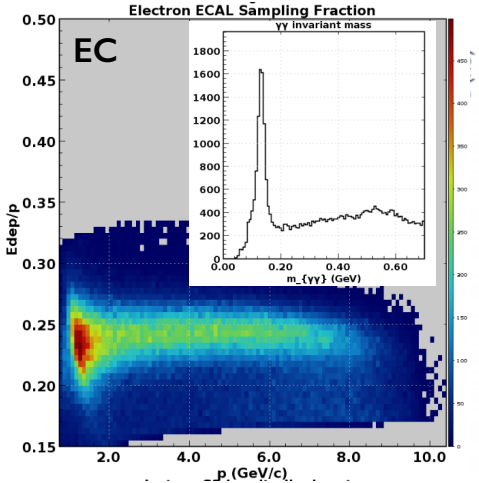
+ J/psi photo-production & SRC

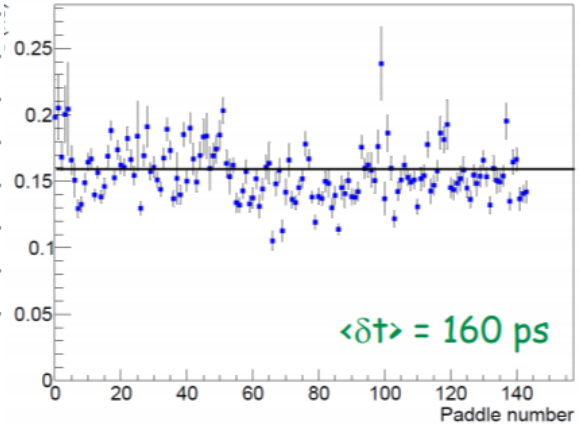
- 43.3 B triggers collected:
  - 10.6 GeV (9.7 B)
  - 10.2 GeV (11.7 B)
  - 10.4 GeV (21.9 B – 9 B are outbending)
- Average beam polarization ~86% Jeopardy proposal to PAC (51 days)
- Pass1 S**pring19** data **50% done**



More details on Wednesday presentations







Credit: S.Niccolai

CLAS12 simulations - OSG

Dedicated, guaranteed:

INFN-T1 ~500 nodes

SCOTGRID ~400-700 nodes

GRIF (tested, upcoming) ~400 nodes

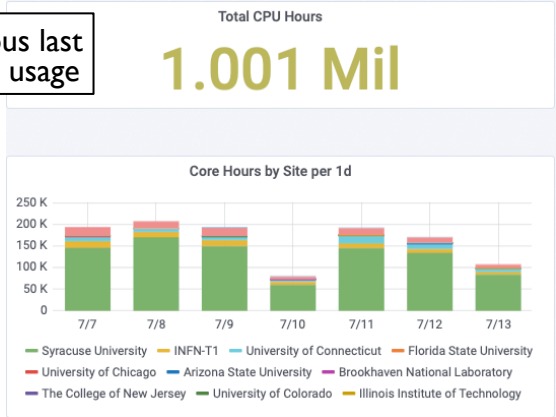
Semi-dedicated:

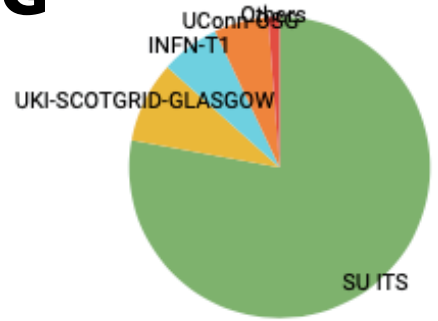
UCONN 0-1000 nodes

Syracuse 0-10000 nodes

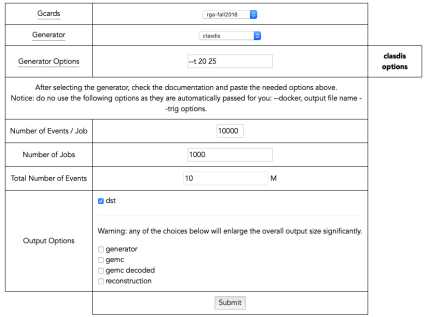
Opportunistic: 0-5000 nodes

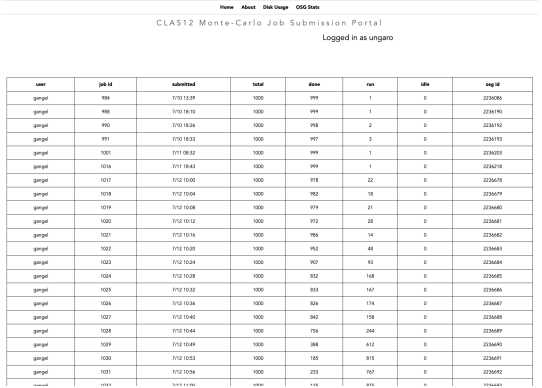
Previous last 7 days usage





120K jobs completed successfully





Priority system in place: high priority RGA production

JLAB Credentials:

Web portal submission form / monitoring.

Credit: M.Ungaro

Nuclear targets test

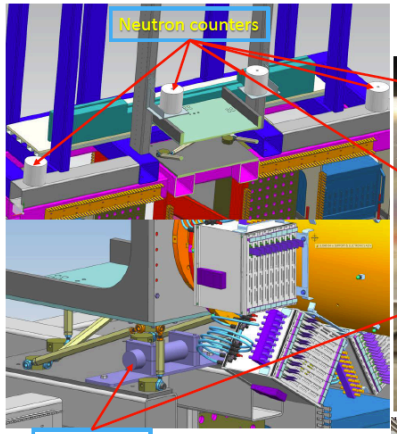
- SVT current increase: 2 times w.r.t.un-irradiated sensors
- ~10 times less vs. the first beam tuning in December 2017 with liquid hydrogen target

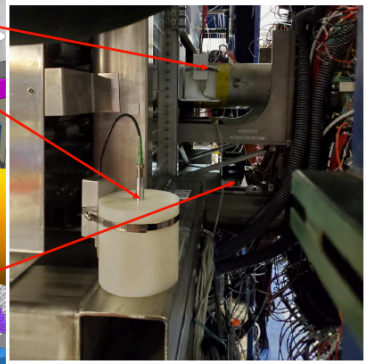
GOALS:

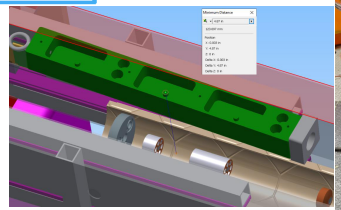
- Measure **occupancies and the leakage currents** in the silicon sensors
- Measure **rates** of CLAS12 detectors
- **Validate simulations** by measuring radiation dose at various locations around the target

- Run Feb 3-6 2020
- Beam energy: 10.4 GeV
- Standard CLAS12 config (no CVT, no BAND)
- 5 cm LD2, 5 cm LHe, 0.125 mm Pb (250 nA, $1.3 \cdot 10^{35} cm^{-2} s^{-1}$)
- Neutron activation In counters (n) + TLDs (charge) + n, γ monitors
- Run performed with the support of the RadCon Group

Credit: E.Pasyuk, Y.Gotra







Sample Id	Irradiation Stop	115m Bq	115m unc Bq	116m Bq	116m unc Bq
1_2	2/2/2020 6:17	5.88E+00	1.14E+00	1.26E+03	3.11E+01
3_4	2/2/2020 6:17	1.79E+00	6.10E-01	8.79E+02	2.67E+01
5_6	2/2/2020 11:42	8.01E-01	1.22E-01	1.77E+02	5.89E+00
7_8	2/3/2020 11:42	8.43E-01	2.70E-01	1.96E+02	4.51E+00
9_10	2/6/2020 12:02	2.51E+00	7.64E-01	7.17E+02	1.48E+01
11_12	2/6/2020 12:02	1.92E+00	3.46E-01	6.26E+02	1.37E+01

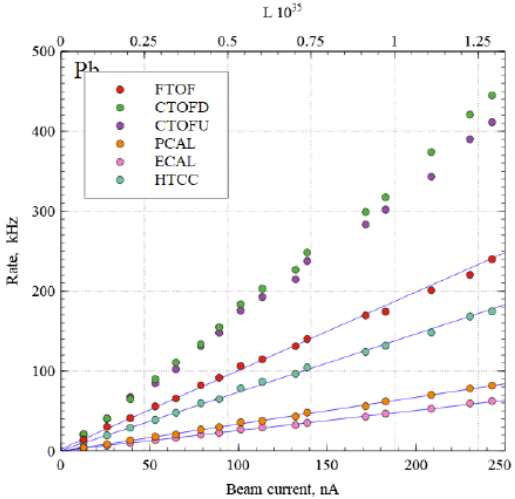
Credit: E.Pasyuk

Preliminary results

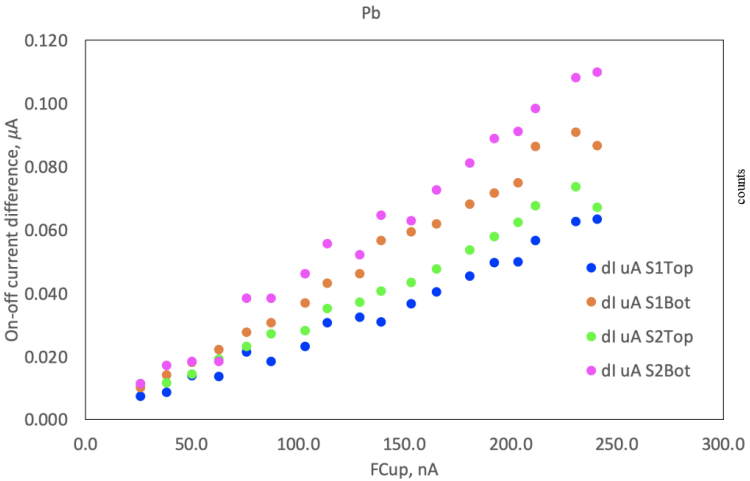
- Preliminary results presented to the Hall-B TF Friday Meeting (E.Pasyuk)
- Strong and efficient collaboration between HallB and RadCon
- Short report expected by the end of June and the full report expected by August

CLAS12 can handle nuclear targets with $L \leq 10^{35}$ cm^{-2}s^{-1}

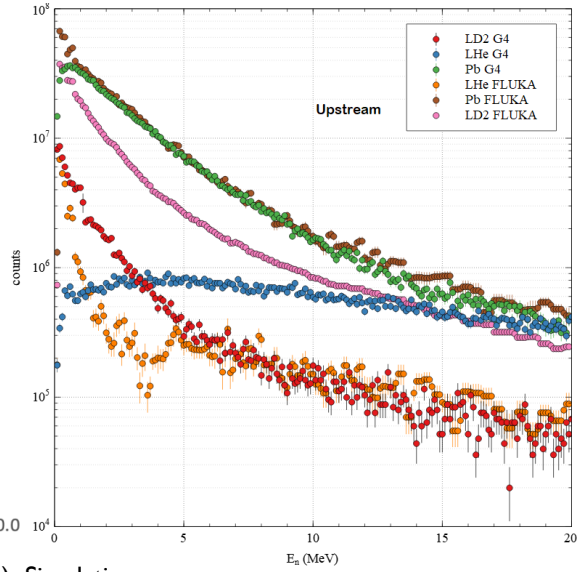
Necessary step to run any future nuclear target in HAll-B



1) CLAS12 detectors rates
Linear behaviour up to >1.5 (Hadronic) $L_{Nominal}$



2) SVT current
Occupancy as expected from CLAS12 H2 and D2 runs



3) Simulations
Agreement with FLUKA, issues with G4 for light nuclei

- **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
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- **Run Group F (BONUS)**:
  - 7 experiments
  - 10.2 GeV polarized electrons (+2.2 GeV for calibration)
  - Gas-deuterium target +RTPC
  - ~49% of approved beam time

CLAS12 data taking

- from Feb 2017 (KPP) to Spring 2020 (physics runs)

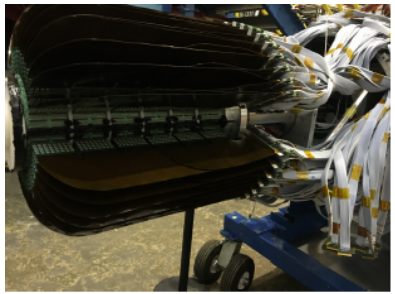
- **Nuclear targets test (special run)**:
  - 10.2 GeV electrons
  - LD2, LHe and Pb targets
  - 100% of scheduled time

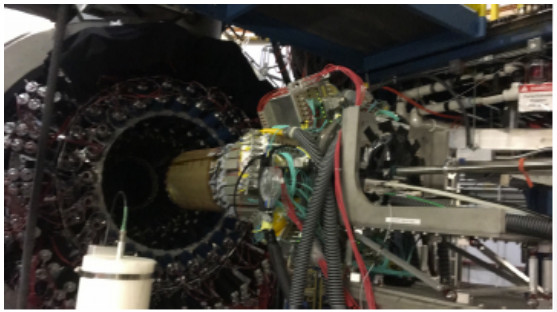
Plans for FY20

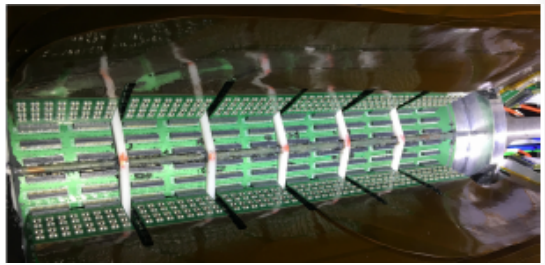
- On June 8 Hall-B resumed operations (MEDCON5)
- Gas systems and detector are all on
- Cosmic data to check systems integrity
- Accelerator is resuming from forced shutdown (injector is on!)
- Expected to run RGF (BONUS) from July 27 to September
- Beam-on-target (10.4 GeV) expected from July 27 to September 6 2020 to complete RGF program (6 weeks)

RUN preparation

- TRPC operated from March 19 to 24; good performance but suspected a leak in He line
- Leak investigated initially in place (CVT kart out, FMT removed) but attempt to seal with silicone failed
- Craned detector on the floor and successfully sealed again using epoxy
- Tested RTPC integrity with a working DAQ
- FMT reinstalled and surveyed (Survey Group), detector craned back in position
- Cosmics (CTOF as a trigger)

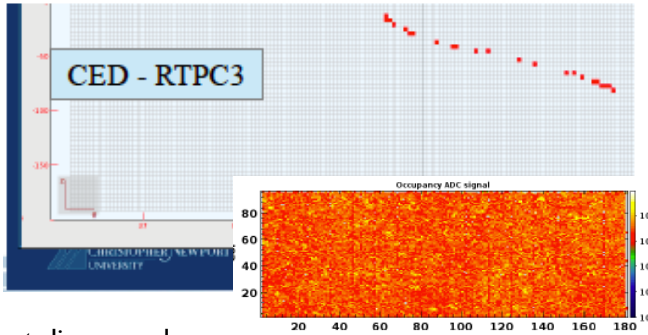






Credit: M.Hattawy

BONUS RTPC-3 fully operational!



… but,

- d2 gas target leak just discovered …
- target disassembled and new cell manufactured
- currently under gas pressure test ready to be mounted

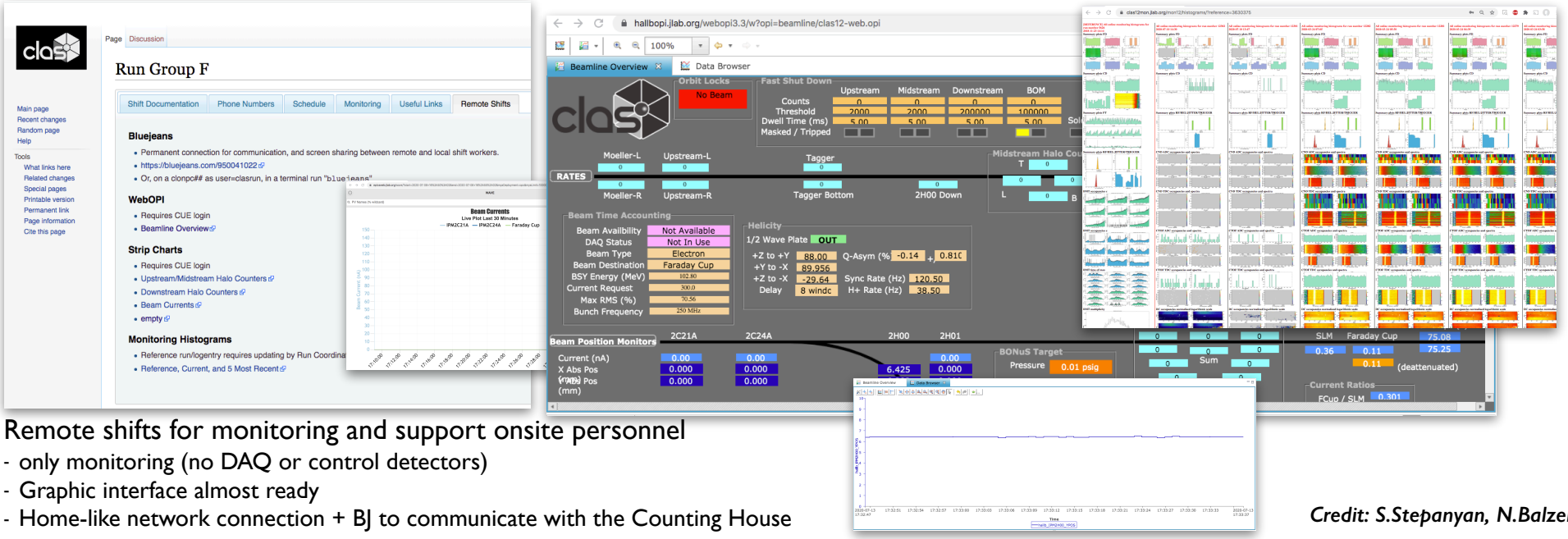
- Tuesday
  - Morgan
    - final test of target assemblies
  - Bob
    - install target assembly into RTPC
  - Bob
    - pressurize target to 68 psi and leak check connections
    - perform leak down test of target assembly
  - Morgan
    - install BOM and beam tube into target assembly
  - Bob
    - pump down beam tube at bulkhead connector to verify beam tube window integrity
  - Morgan
    - install Tedlar cover on BOM, turn on and test BOM
  - Bob
    - silicone and clamp extension tube in place
- Wednesday
  - Mohammad
    - remove clamp from extension tube
    - Start He4/CO2 gas flow
    - Leak check He4/CO2 system
    - Connect all Bonus cables
    - Test RTPC
- Thursday
  - Yuri, Bob
    - install FMT
  - Yuri
    - cable FMT
    - purge gas
    - install Faraday cage
    - test FMT
- Friday
  - Bob
    - move Bonus into Solenoid
    - assemble beam line
    - pump down beam line
    - change HTCC to CO2

Spiritus durissima coquit!

Many thanks to Hall-B tech staff, reaserchares and BONUS team for the generous effort

CLAS12 shifts

- Expected to run in August under MEDCON5 condition
- Follow the procedures for on-site access and correct behaviour (message sent to the whole Collaboration)
- CLAS12 shifts will have a single expert for day and swing + 'ghost' shifters and expert + worker for owl
- CLAS12 shift list generated with contribution of JLab staff, ODU, CNU, W&M, RichmondU + local postdocs
- Progress report of CLAS12 restoration available on-line: https://www.jlab.org/Hall-B/clas12-web/progress-update.html



Remote shifts for monitoring and support onsite personnel

- only monitoring (no DAQ or control detectors)
- Graphic interface almost ready
- Home-like network connection + BJ to communicate with the Counting House

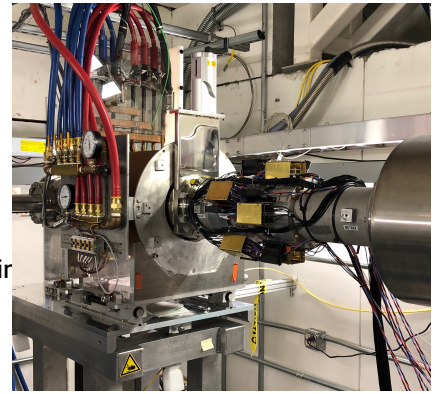
Credit: S.Stepanyan, N.Balze

- In support of CLAS12 run group (all transverse experiments designated as **High Impact** for Hall B)

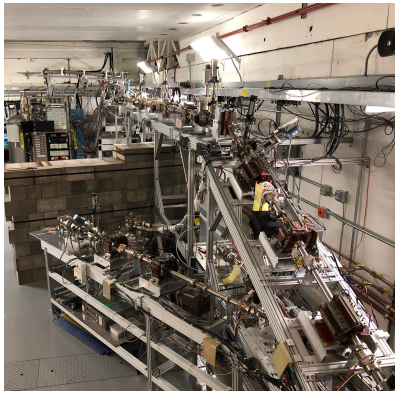
  - challenge: transverse holding fields bend electrons into the detector !
  - mitigation: small B•dL ⇔ frozen-spin HD

Original plan (before COVID):
- *Run 0* – UITF machine commissioning (cave-1)
- *Run 1* – cave-2 & HDice IBC beamline commissionir
- *Run 2* – Studies with unpolarized HD
- *Run 3* – Studies with *frozen-spin* HD

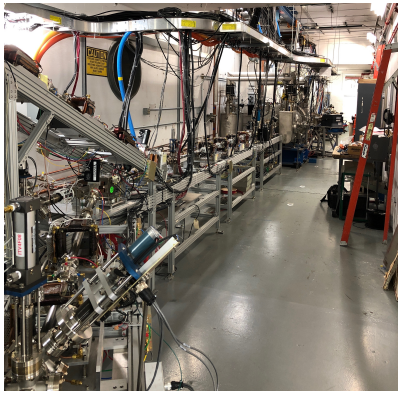
between Mach - August



HDice In-Beam Cryostat



cave-2 elevated beam line



cave-1 with BOOSTER

- New tests planning (boosted by S&T Review recommendation)
- Cryolines from the CTF switched over to UITF; BOOSTER is now at 4K and 80% full ⇔ pump to 2K this week
- Injector (cathode) and beam-monitoring (Rogowsky coil) and shielding in place to protect cave-2 electronics during Run 0
- ready to start Run 0 commissioning in these days(for 2 –to- 3 weeks) ⇔ milestones at 0.5 MeV, 1 MeV, and 10 MeV
- Working on requirements for Run 1 (cave-2 beamline commissioning): Official Start-up procedure and DOE Site Office approval
- Run 1: cave-2 commissioning (beam line)- target date: Aug 20 Run 1 ~ readiness: 90 % complete. ~16.5 days
- Run 2: run on UNpolarized HD ~16.5 days
- Run 3: run on Polarized HD ~34.5 days

Credit: A.Sandorfy

RGX Integration in CLAS12

Goal

Support the hardware and software integration of RGX in CLAS12

Charge

- In coordination with X team develop an integration plan for the new equipment
- In coordination with X team define the beam line components and special requirements
- In coordination with X team define and support the experiment-related simulation , monitoring and reconstruction framework
- In coordination with X team define and support the integration of RGX slow controls into CLAS12 framework
- In coordination with X team define and support the integration of the RGX FE and DAQ into CLAS12 framework
- In coordination with X team define and support the integration of the RGX trigger into CLAS12 framework
- If not yet approved, assist the X team in preparation of the ERR (Hall-b and PhysDiv) with regular meeting and dry runs

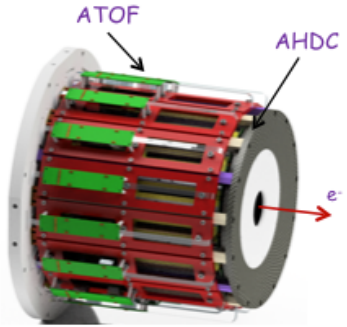
Resources

- Time: till installation
- Task force: AA(PI), BB (equipment integration), CC (beam-line), DD (software), EE (detector expert), FF (detector expert)
- Deliverable: document the TF activity in a dedicated wiki page, inform the Hall-B leader and the staff about issues/progress

Model tested with RGL but under construction for RGI (HPS), RGM and RGC

RG-L (ALERT) Integration in CLAS12

- RGL (ALERT): Nuclear exclusive and semi-inclusive measurement with a new CLAS12 Low Energy Recoil Tracker
- He4 recoil in the new detector to measure coherent DVCS, DVMP and quasi-free/bound nucleons GPDs on d and He4
- Stereo DC (AHDC) for tracking and array of scintillators (ATOF) for pid in place of CLAS12-SVT



New ALERT Central Detector

- TF established Apr. 2020 to partner with ALERT team to follow preparations and to help coordinate work toward a successful ERR
- Task force: D.S. Carman (lead), N. Baltzell, Y. Gotra, B. Miller, E. Pasyuk
  - May 2020 meeting: hardware/software status and work plans
  - June 2020 meeting: define JLab responsibilities for hardware, software, slow controls, engineering/design
- Aiming for Hall B dry runs end of Sep. 2020 with ERR in Dec. 2020

Work Status:

- New TOF system (ATOF):
  - Module design finalized (including material choices)
  - Scintillators ordered and received
  - Prototyping support structure
  - PCB and readout electronics development in progress
- New drift chamber system (AHDC):
  - Prototyping parts and finalizing materials
  - Developing stringing procedure and tooling
  - Developing and testing readout electronics
  - Gas system design being finalized
  - Prototype testing done by beginning of fall
- Reconstruction software:
  - Development underway, including preparation of a tracking tools library

Credit: D.Carman

- Virtual meeting August 10 - 14 2020
- Hall-B proposals:

Proposal ID	Hall	Title	Days
Letters of Intent			
LOI12-20-001	B	Measurement of the Neutral Pion Transition Form Factor and Search for the Dark Omega	30
New Proposals			
PR12-20-002	B	A Program of Spin-Dependent Electron Scattering from a Polarized He-3 Target in	30
PR12-20-004	B	PRad-II: A New Upgraded High Precision Measurement of the Proton ChargeRadius	40
PR12-20-005	B	Precision measurements of A=3 nuclei in Hall B	60
PR12-20-006	B	Precision Deuteron Charge Radius Measurement with Elastic Electron-Deuteron	40
PR12-20-009	B	Beam charge asymmetries for Deeply Virtual Compton Scattering on the proton at	100
Run Group Additions			
E12-06-106A	B	Nuclear TMDs in CLAS12	0
E12-09-007A	B	Studies of Dihadron Electroproduction in DIS with Longitudinally PolarizedHydrogen and	n/a
E12-09-117A	B	Dihadron measurements in electron-nucleus scattering with CLAS12	n/a

PAC48 - Jeopardy

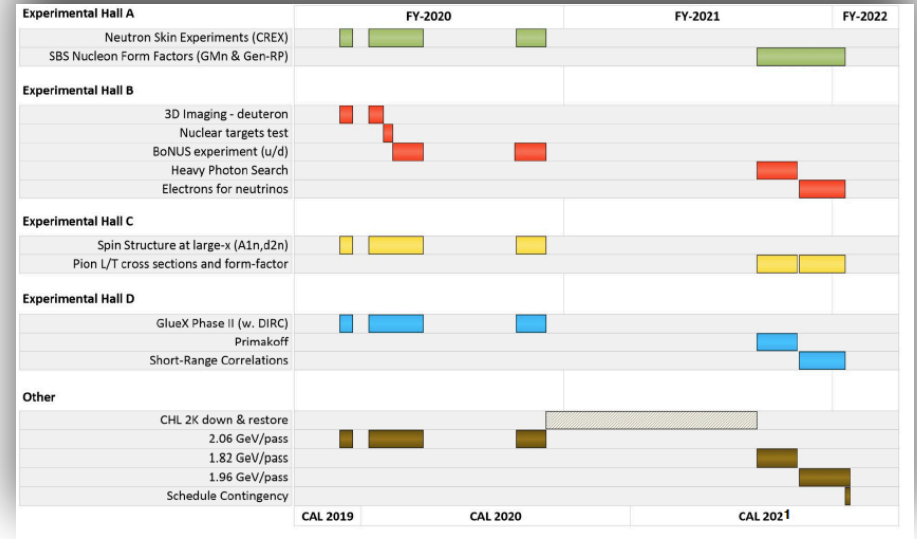
- Jeopardy: dedicated meeting on September 25 2020

Proposal ID	Hall	Title	Days
Jeopardy Proposals			
A	B	CLAS12 Run Group A (RG-A)	70
B	B	CLAS12 Run-Group B: electroproduction on deuterium with CLAS12	51
C	B	CLAS12 Run Group C	185
D	B	Study of Color Transparency in Exclusive Vector Meson Electroproduction off	60
E	B	Quark Propagation and Hadron Formation	60
G	B	The EMC Effect in Spin Structure Functions (CLAS Run Group G)	55
H	B	Run Group H Jeopardy Update Document. CLAS12 Experiments with a	110
I	B	Search for Massive Photons at Jefferson Laboratory (HPS)	105
K	B	RG-K Quark-Gluon Confinement & Strong QCD	88

Long range - FY21 schedule

- **Schedule**
  - FY21: long CEBAF shutdown for HCL Cold Box repair
  - FY21: 20 weeks (Jun-Oct), 10.9 max E_b, only two RGs that requires low beam energy will be able to run (HPS and RGM)
  - FY22 (tentative): polarized longitudinal target
  - … : nuclear targets, transverse polarized target, completion of RGA, RGB, RGK, HPS, …
  - … : new proposals (PRAD-II, polarized 3He, …)

* Caveat: assuming NO COVID-19 emergency, MEDCON3 status and a a reasonable CLAS12 resumption of operations (domestic/ international collaborators available)



Working on mitigation of long delay:

- Involving RG in scheduling
- Reducing any installation overhead to maxim run efficiency
- Splitting the run time to have at least 50% RG data available
- Providing some sort of priority to RG not running soon

In summary:

… difficult time but:

- Difficult times but JLab is doing the best to complete the experimental program planned for FY20
- Hall-B staff members and the CCC are doing their best to provide data ready for physics analysis