BIGBITE CALORIMETER STATUS

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Jefferson Lab

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- General introduction to the detector
- Current status of shower and preshower
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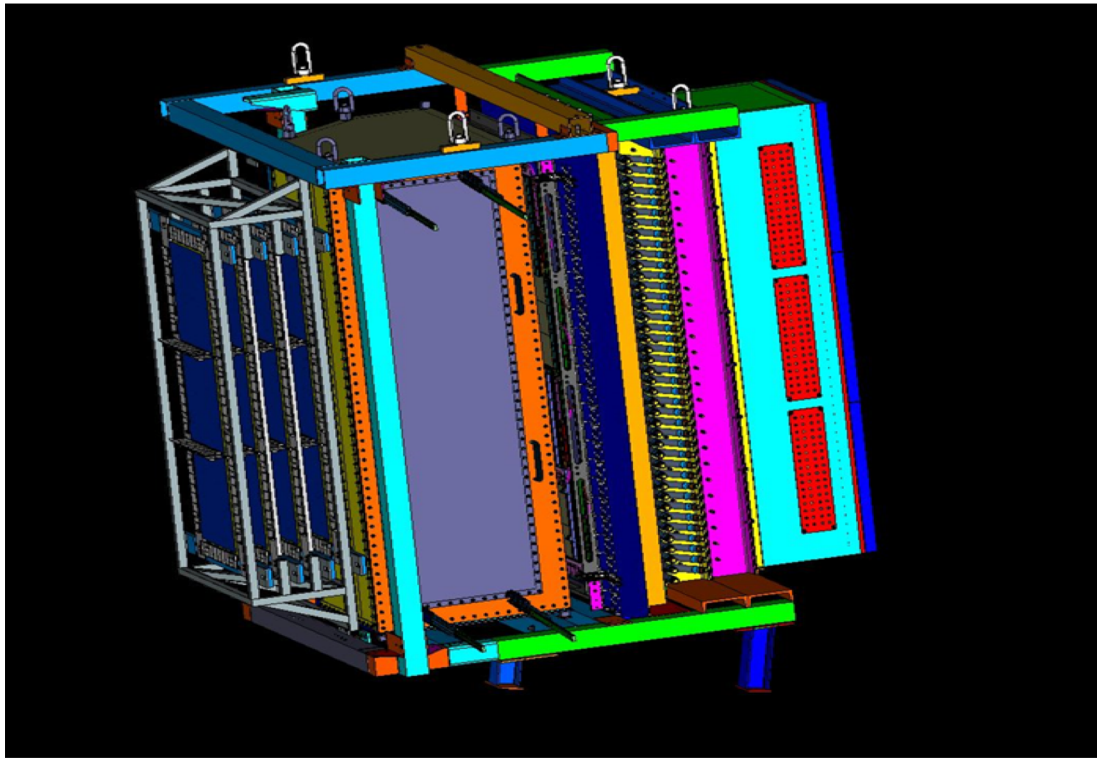
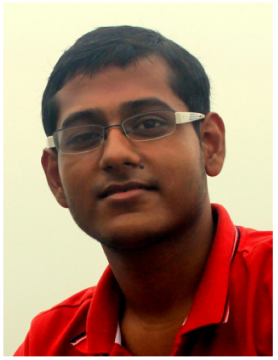
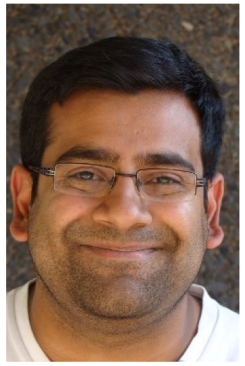
- Summary



BIGBITE WORKFORCE

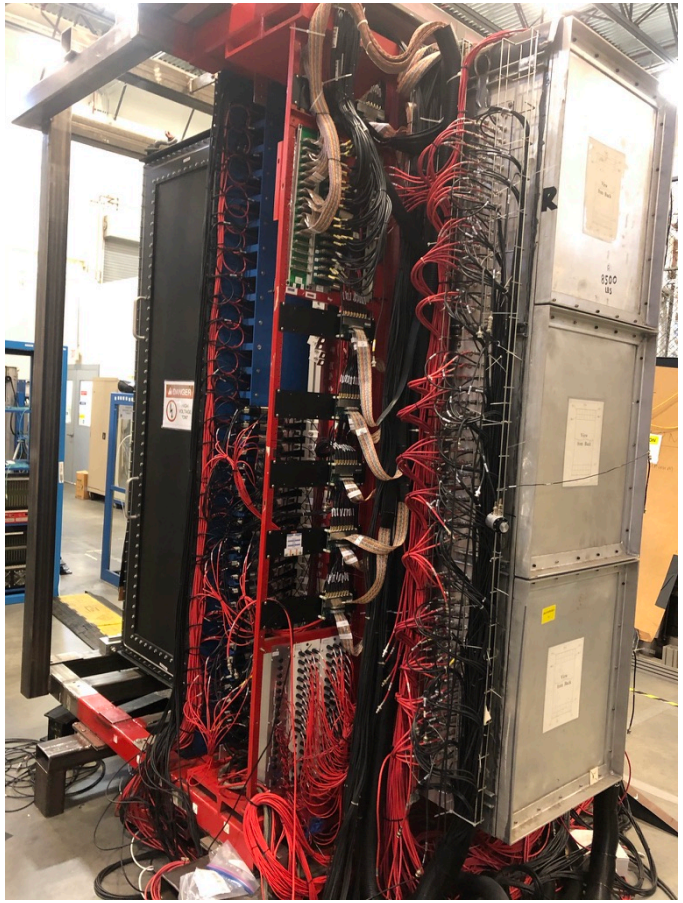


Name	Location	Position	Role	FTE	Comments
Arun Tadepalli	JLab	Postdoc	Contact	>75%	onsite
Bogdan Wojtsekhowski	JLab	Staff	Detector		onsite
Mark Jones	JLab	Staff	DAQ, trigger	20%	onsite
Eric Fuchey	UConn	Postdoc	Software/as needed	15%	remote
Provakar Datta	UConn	Grad Student	WAPP trigger	More?	onsite
Bhesha Devkota	Miss. State. Univ	Grad student	Installation & Misc	40%	onsite
Will Tireman	Northern. Mich. Univ	Prof.	HV calibration using cosmics	< 5%	remote
Gary Penman	Univ of Glasgow	Grad student	Software	40 – 50%	remote
COULD BE YOU!	Anywhere	Alert	Very important!		onsite/remote

GENERAL DETECTOR CAPABILITIES

- Purpose
  - Trigger (for all experiments other than GEp)
  - Determination of energy
  - PID
  - Starting point of track reconstruction and time determination

- General principles
  - Collect Cherenkov light from relativistically charged particles including primaries and secondary e+/e- shower in electromagnetic cascades
  - Long axis of preshower perpendicular to e^- or pion
  - Long axis of shower parallel to e^- or pion

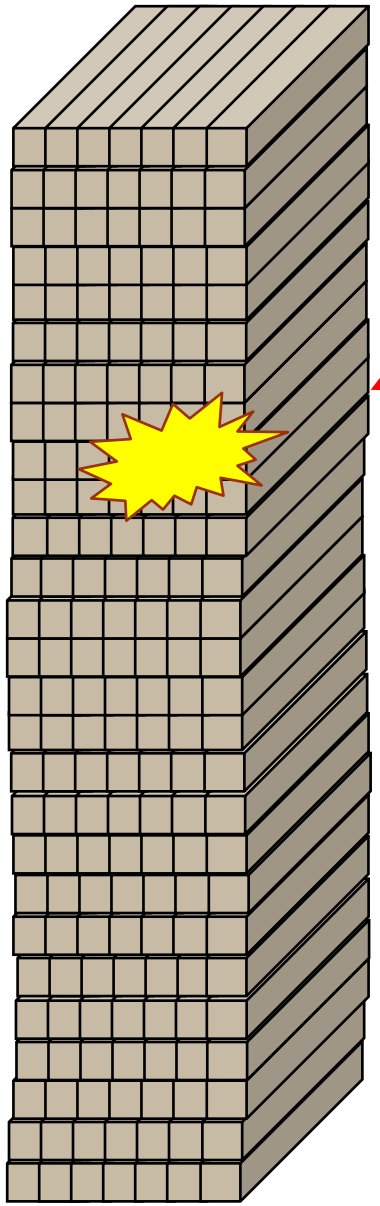


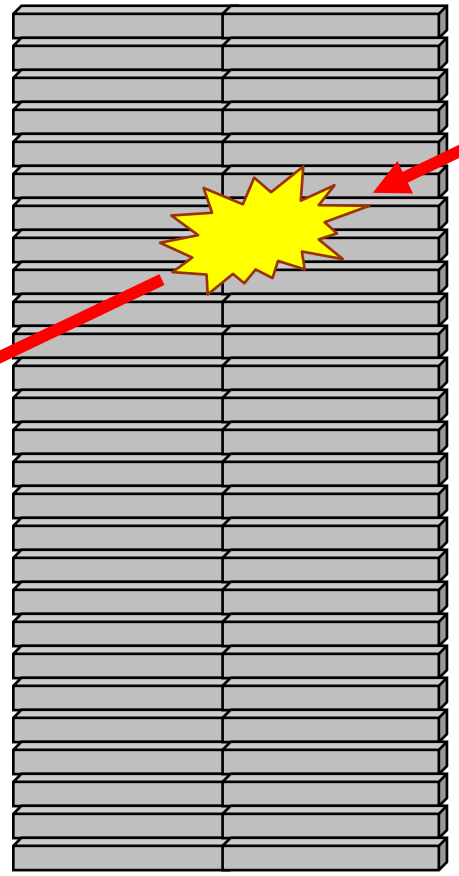
https://drive.google.com/drive/folders/1wp-CWXj9u6otH6OU8Wz1OW3F3scEEEc7?usp=sharing

shower

preshower

Charged particle

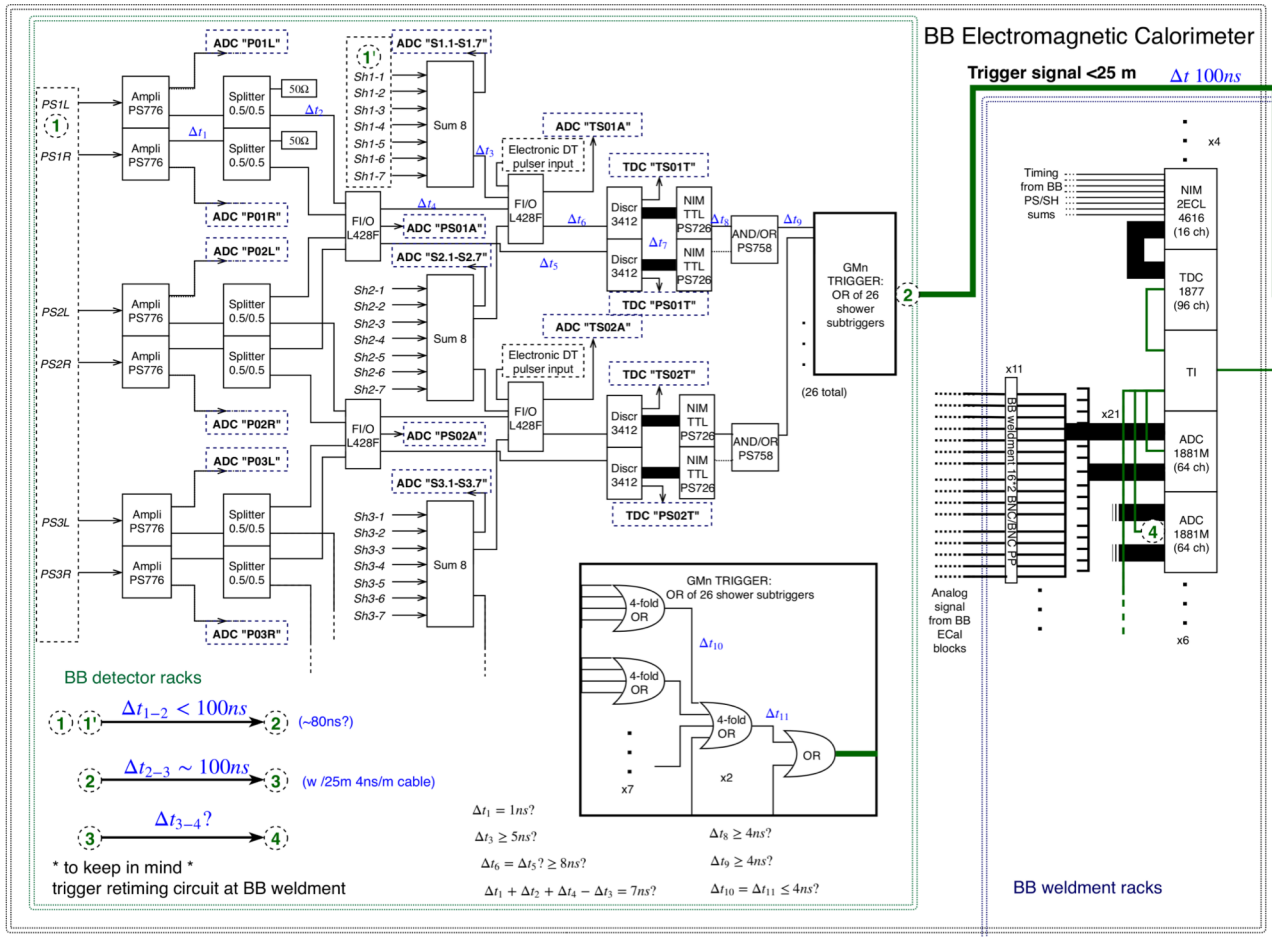




26 row x 2 col blocks
9 x 9 x 30 cm rad hard lead glass blocks

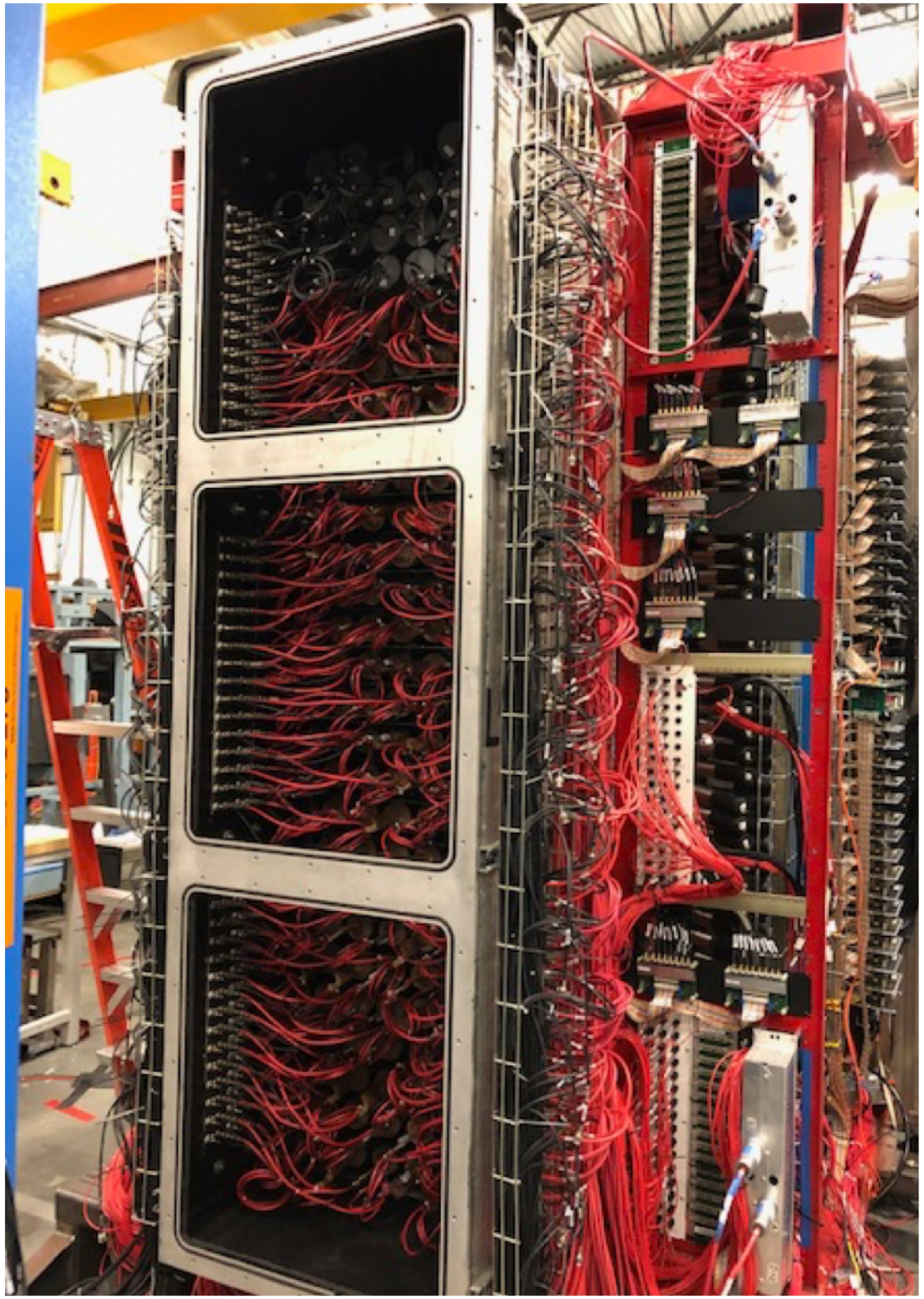
27 row x 7 col
8.5 x 8.5 x 37 cm lead glass blocks

TRIGGER DIAGRAM



Trigger concept:
PS + SH > Adjustable threshold

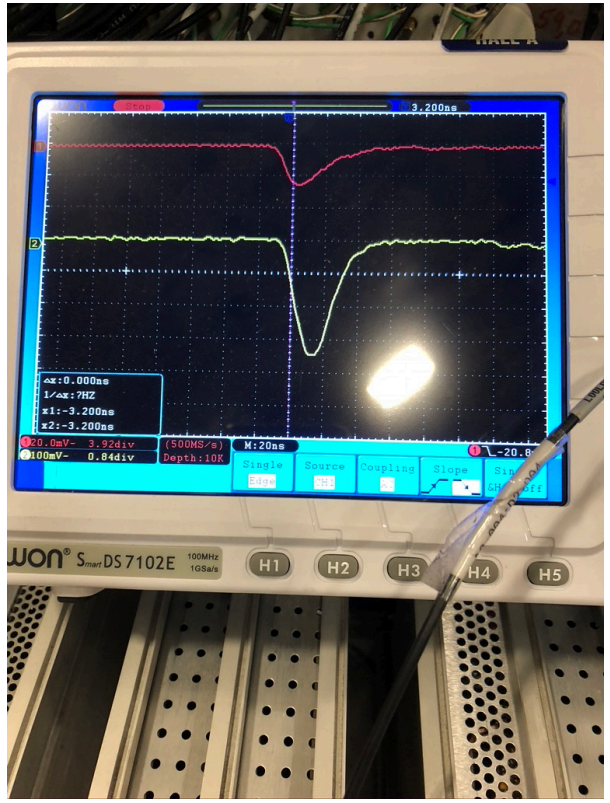
*will be updated after including WAPP trigger



Inside the shower

- Shower stacking with more efficient blocks and mu-metal plates
- Replaced (previously adjusted) top layers of inefficient shower blocks with good preshower blocks
- The HV bases for the shower have been installed

Bogdan applying UV curing light to cure the epoxy



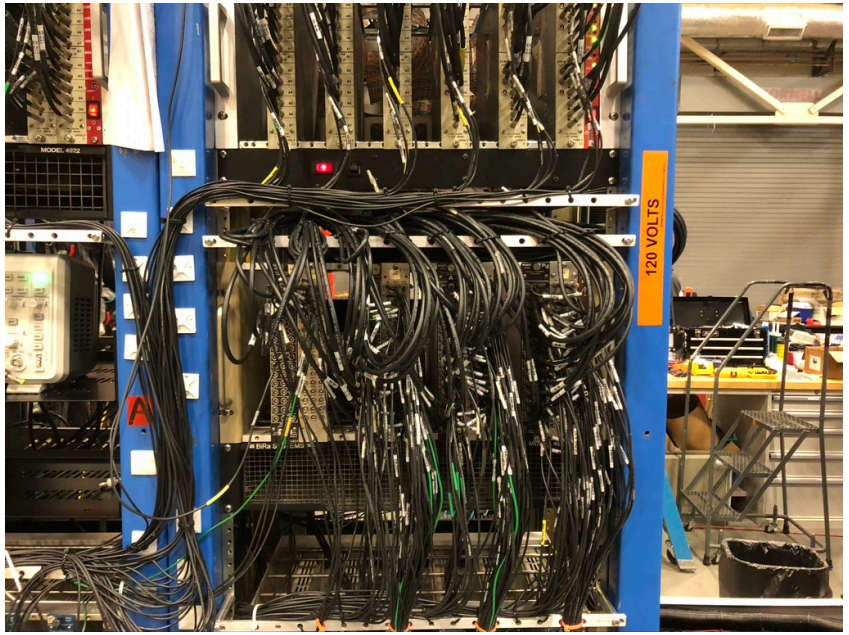
Red = signal from 5.6 top layer

Yellow = signal from 4.6 which is from the replaced PMT

It works!

SBS docid#72

Preshower stacking completed



Cabling work completed

AT TEDF…

- Cabling (signal and HV) - all cables and connectors intact – completed
- Repaired broken modules in place – completed
- Light leak checks (shining flash light and checking for current on pico-ammeter) - completed
- Signals on individual channels - completed
- Looking at pedestals with HV off - completed
- Looking at the amplitude shape of the signals with HV on – completed (general noise issues pertains)
- Attaching the cosmic counter and setting up the FastBus trigger – completed
- Also set up the trigger using the sum of different layers in the shower and preshower – completed
- Checking the shape of amplitude distribution – completed
- Taking data using different HV settings for shower and preshower – completed
- Alpha studies for shower and preshower completed – completed
- Adjusting the gain and offset seen on amplifier summer modules – completed
- Checking individual channels on the discriminator – completed

For more information see BigBite calorimeter status weekly meeting updates on Sep 14th 2020, Nov 9th 2020, Jan 11th 2021

AT TEDF…

- Adding a copy of the trigger to get WAPP pion threshold (Provakar's work) – in progress
- Attaching new discriminators with tweakable discriminator thresholds – in progress
- Remotely monitorable thresholds – need to think about this

FROM THE DAQ SIDE

- FastBus connected and fully operational with cosmic trigger – completed
- Upgrade to CODA3 – completed (thanks to Bryan Moffit, Alex Camsonne and Ben Raydo!)
- Connecting preshower to FADC channels – completed
  - Raw data with 16 channels looks ok. Need to coordinate efforts with HCAL people on FADC software for BBCAL
- Connecting shower to FADC channels – to do
  - LEMO to BNC FADC cable making in progress (120/272 finished by DSG).
  - There are plans (by Alex) to acquire the FADCs ahead of time and return after the shipment arrives in June – We strongly advocate for this!
- No TDCs being used currently
- Until more FADCs for the shower arrive, all calibrations will continue with the FastBus

FROM THE SOFTWARE SIDE

- As mentioned before, software exists to looks at:
  - Raw hits
  - Pedestals
  - Analysis code to monitor ADC spectra
  - HV adjustment
  - Cosmic event display (to do)
  - Cosmic calibrations (Will Tireman's talk)

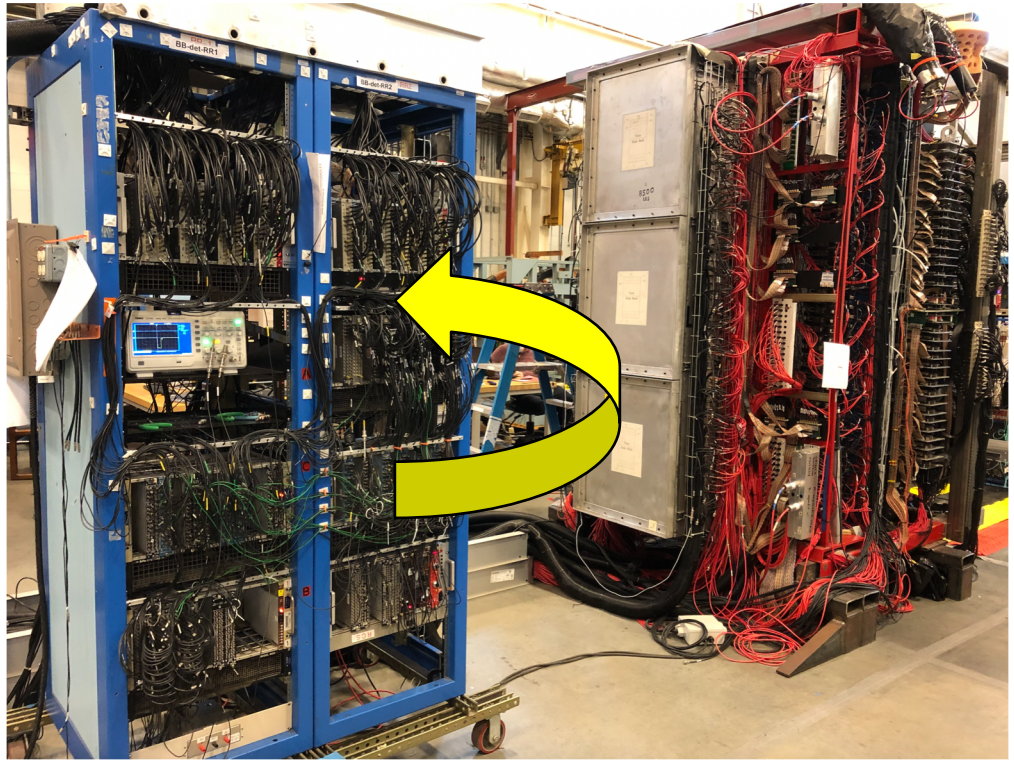
DETECTOR EQUIPMENT

- Detector stack
  - Shower and preshower
- Cable system
  - 52 signal cables for preshower and 189 signal cables with spares for shower
  - 52 HV cables for preshower and 189 HV cables with spares for shower
- Power supplies = 2
  - Adequate number of HV cards with 4 spares
- Blue electronics racks = 1
  - Discriminator modules
  - Amplifier summer modules
  - Trigger (lower and upper threshold copies)
- BigBite weldment
  - DAQ (FastBus or VME), cosmic trigger
  - 4 FADC at hand (12 ordered for shower)
  - LEMO to BNC (64 ready for preshower, 120/252 being prepared by DSG, +16 spare)

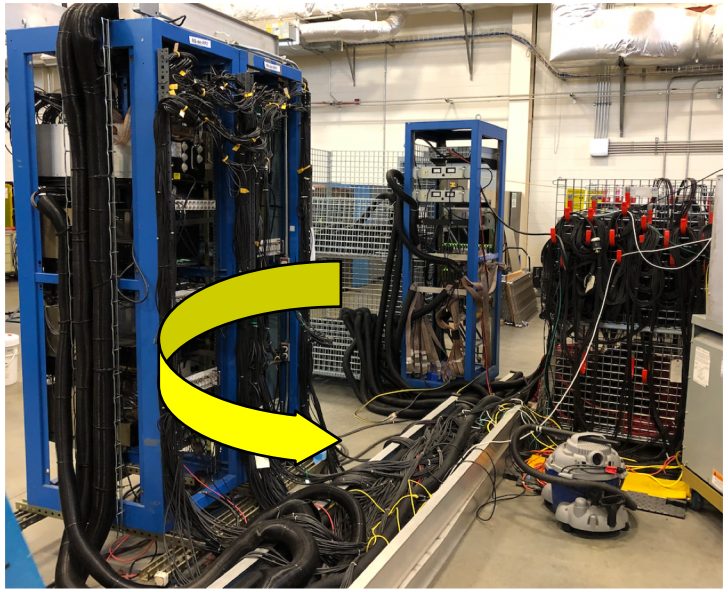
SEQUENCE OF MOVING EQUIPMENT TO THE HALL

- Detector stack
  - After Shower & preshower fully uncabled
- Signal cables from HCAL
  - HCAL will be moved first hence we have to give (up) the signal cables. HCAL TDC cables will have been freed for BigBite by then.
- Front end blue rack + preshower & shower signal cables conduit
  - All cables are in conduit (easy to control and transport)
- HV cables in a basket
  - Limitation is that they are underneath the signal cables which will be moved for HCAL folks so it should be ok
- BigBite weldment that carries DAQ, patch panels, FADC cables and cosmic trigger

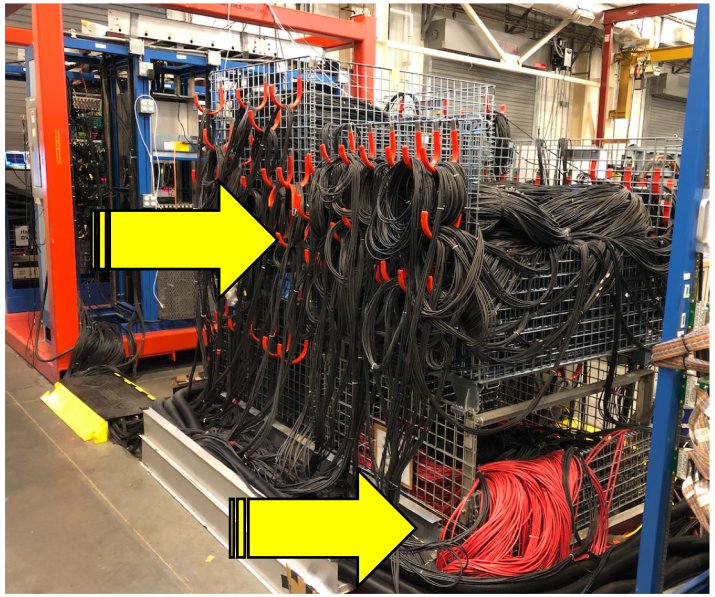
MOVING CABLES TO THE HALL…



Preshower and shower front end signal cables can be taken with this rack

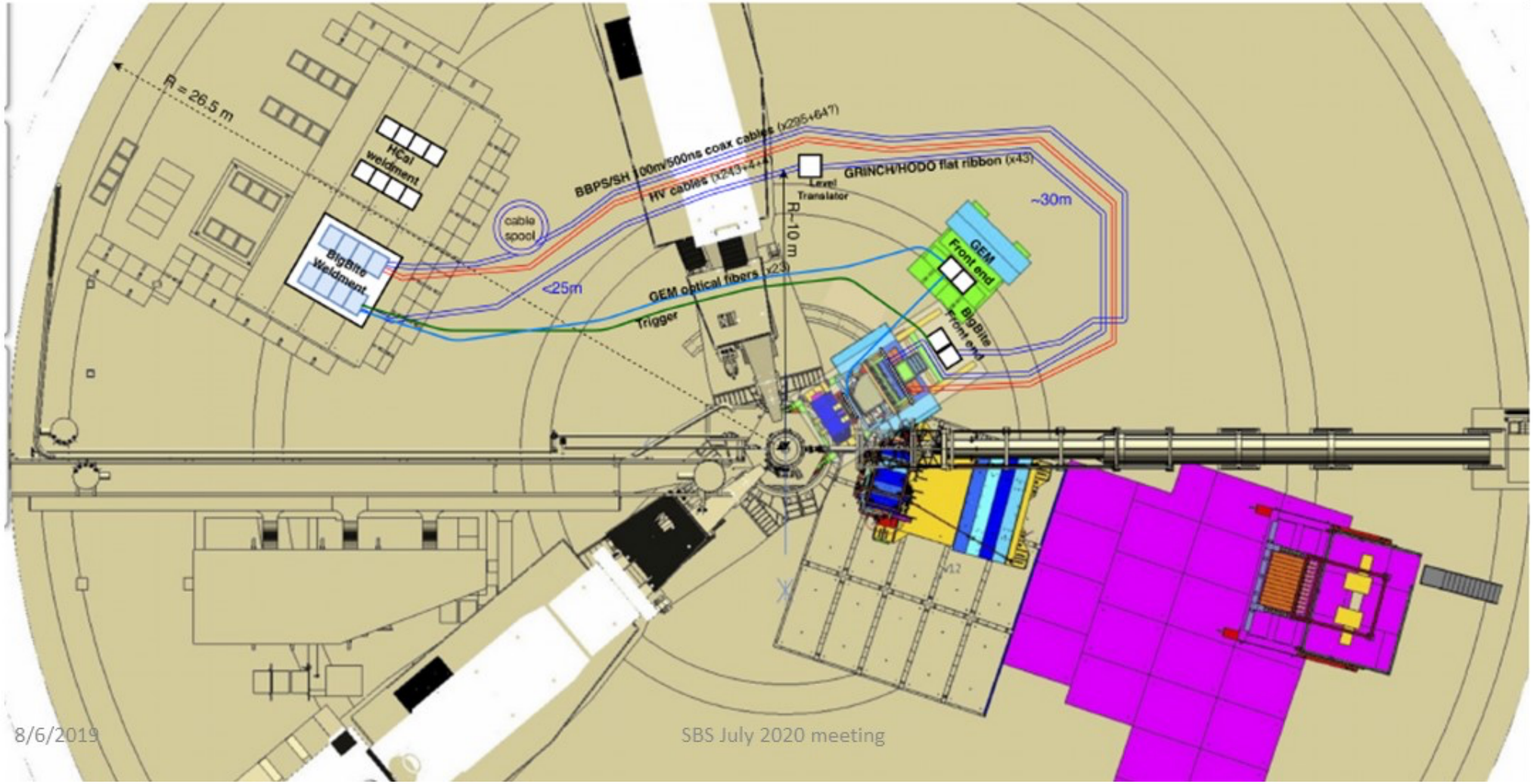


Unplug shower and preshower cables and put in basket



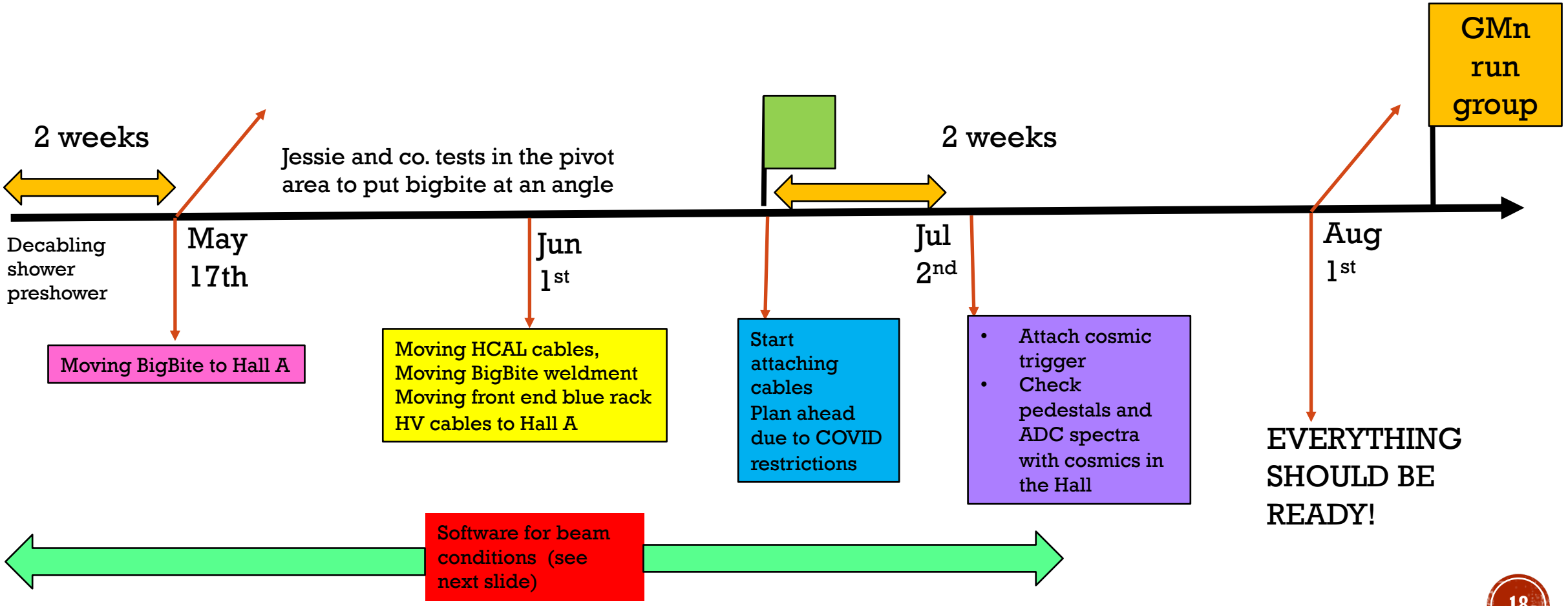
Unplug HV cables and put in basket below

FLOOR PLAN IN HALL A



What we really need is someone to tell us, "Hey, this is where you can layout your cables"

TIMELINE OF BIGBITE TASKS
(AS PER JESSIE'S GANTT CHART)



AFTER MOVE AND BEFORE DAY 1…

- Make sure that:
  - All connections are tested
  - Amplitude and time distributions are seen for all the channels on FADC or Fastbus
  - Online monitoring setup to see the counting rates, cosmic tracks and event display in individual blocks on a 27 x 7 and 26 x 2 grids
  - Trigger has been tested out and the thresholds are tweaked
  - HV display should be simple for shifters (green or red) and alert experts if needed
  - All observations are properly documented in the logbook!

DAY 1

- Will have to monitor all the quantities mentioned in the previous slides under beam conditions

- Plan for calibrations under beam conditions

  - For E02-013 (GEn), calibrations were done using elastics on H2 data for electrons and pions (Seamus Riordan's thesis).

  - Should we do this again? Need to discuss with BigBite group

  - Andrew pointed us to Freddy Obrecht's thesis where the procedure is outlined in detail

DOCUMENTATION / SAFETY

- Documentation
  - BigBite how to – Eric Fuchey (needs to be updated)
  - Making a cosmic trigger using FastBus (https://sbs.jlab.org/cgi-bin/DocDB/private/ShowDocument?docid=74)
  - THA (Task Hazard analysis) – to do

- Safety
  - Ladder safety (to do)
  - COVID restrictions (to do)
  - Procedure to replace a PMT (https://sbs.jlab.org/cgi-bin/DocDB/private/ShowDocument?docid=72)

- How-to for shift workers
  - Instructions on DAQ operation, monitoring ADC spectra etc will have to be written. The person who will do these tasks will write the documentation for shifters. Will have to be written for shifters but not worried at this point

SUMMARY

- Current status of the shower and preshower from detector, software, and DAQ viewpoint
- New people have joined and are enthusiastic about hardware experience and interested in contributing to analysis tasks.
- Some preliminary thoughts on what to anticipate while moving detectors, cables, weldments, front end racks and calibrations were presented to invoke discussions
- Need to communicate and coordinate effectively while following safety and COVID protocols
- Exciting times ahead!!

SPECIAL THANKS TO

- Many people who helped cable up the detector
  - Ashley Yoon, Abby Hellman, Maria Satnik
  - Eric Fuchey
  - Doug Higinbotham
- Chuck Long for all continued help
- DAQ debugging – Alex Camsonne, Bryan Moffit & Ben Raydo
- DSG – Mindy Leffel and Marc McMullan for help with cables
- Calibration software support – Will Tireman
- Hall A staff and engineers