

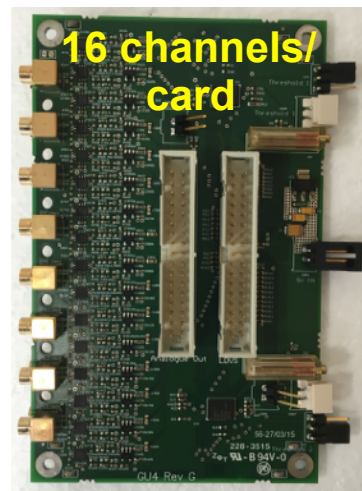
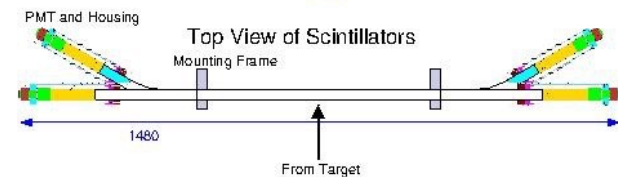
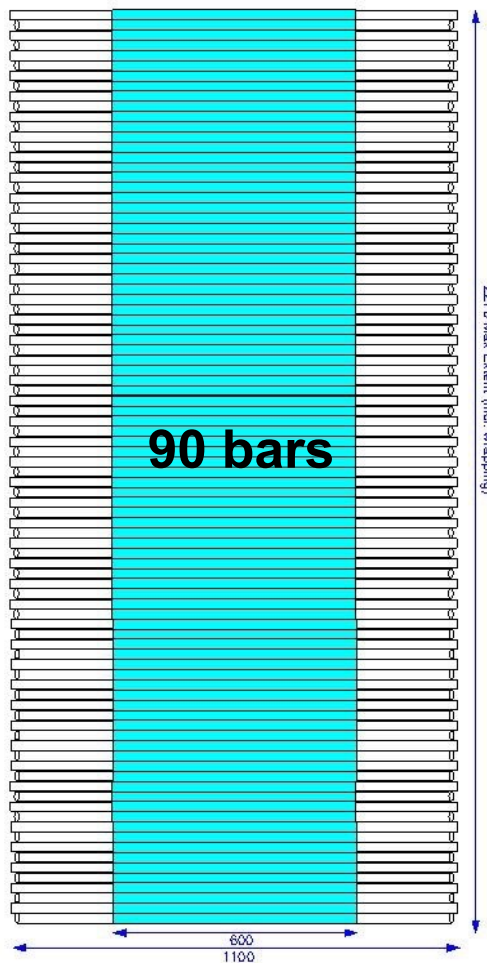
R. Montgomery on behalf of hodoscope
colleagues and SBS Collaboration

GMn Experiment Readiness Review
Jefferson Lab, 08/05/19



Hodoscope Design Reminder

Front View of Scintillators



- Eljen EJ200 plastic **scintillator** (600x25x25mm)
- Straight/curved **light guides**
- Glued w/ UV curable cement
- ET9124 **PMTs** (2/bar) w/ **custom bases**
- Front end amplifier/discriminator cards (**NINO**)





- 4 x HV distribution boxes - CAEN 52 pin high density connector to 48 individual HV channels
- 200 x 4m HV cables from distribution to PMTs, custom connectors @ base and commercial CAGE connectors
- 4 x 60m 48 channel multiway cables for HV from mainframe to distribution boxes, copper braided shielding, CAEN 52 pin connector each end
- Distribution box for NINO LV
- LV cables for NINOs
- July 2019 UoG installations with help from JLab, UConn/CNU students (plus GRINCH help)

Current Scheme in TEDF

Left (L)

Electron into page

Right (R)

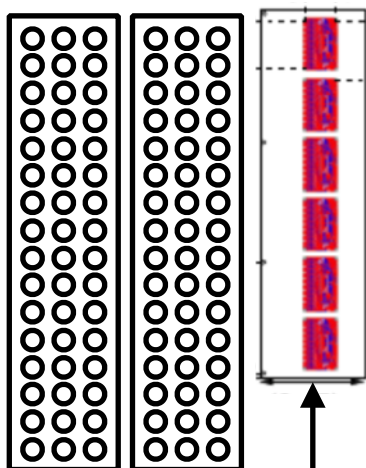
1x 17-pair to BNC PP

1x 17-pair PP

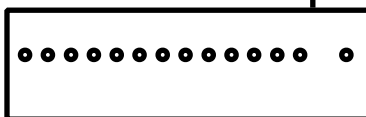
1x 17-pair to BNC PP

1x 17-pair PP

2x NINO panels

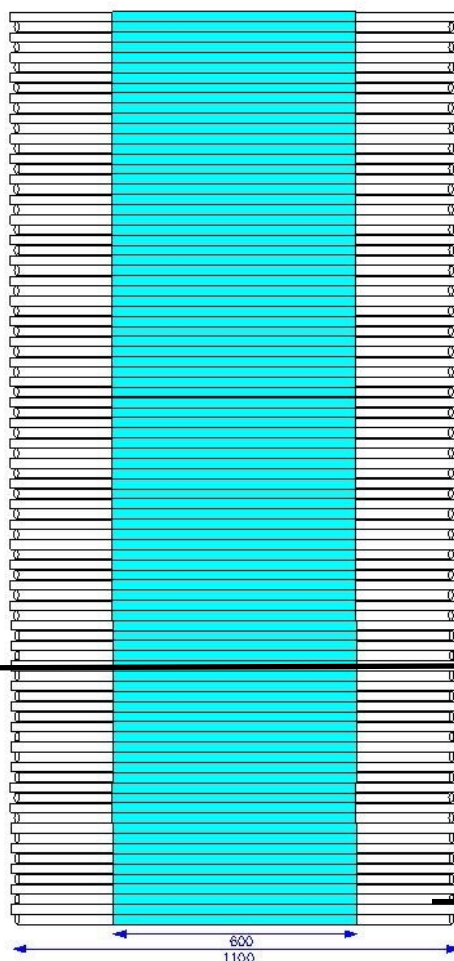


1x NINO LV distribution,
12x 4m LV, 2x 4m thresh

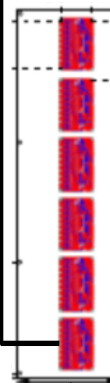


2x 10m NINO LV
plus 2x 10m NINO
thresh to weldment

Front View of Scintillators



4x 17-pair analogue
12x 17-pair LVDS



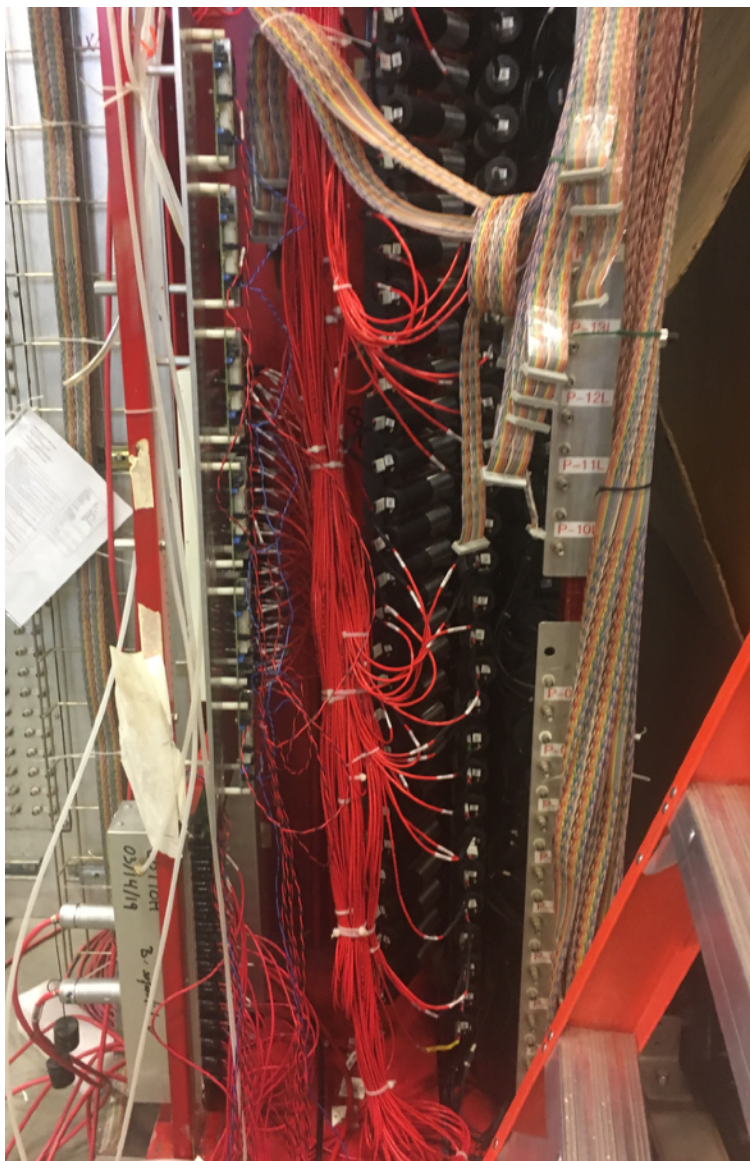
4x HV
boxes

4x 60m
multiway HV
cables to
weldment

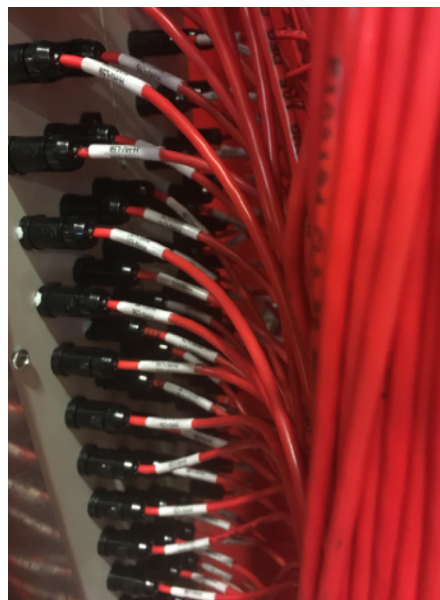
200x 4m HV

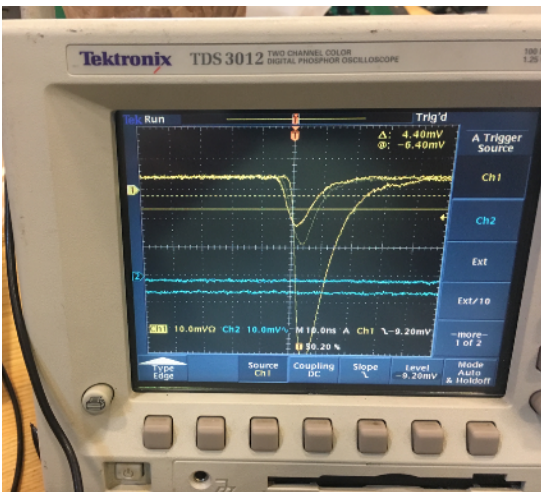
200x 1.5m short
co-ax PMT-NINO

Current Status of Cabled Assembly



- HV cables labelled, connected, tested
- HV mainframe installed, tested, network/telnet control tested
- LV cables labelled, connected, tested
- LV PSU for NINO tested
- Temp PSU for thresh tested - need to source final option
- Plan to re-route HV cables and add cable trays this week (JLab/CNU)





- 200 1.5m cables PMT to NINO labelled, connected, tested
- Spare NINO cards used due to issue with poorly soldered connectors - will ship more spares
- **Analogue signal from each channel checked ok after HV/LV/signal cable installs**

Status of Equipment

Item	Status
90 scintillator bars/light guides	Glued/wrapped. On site pre-Aug 2015.
200 PMTs	Procured 2016. On site Jul 2017. Tested Jun/Jul 2018.
200 PMT Bases	Procured 2016. On site Jul 2017. Tested Jun/Jul 2018.
180 PMT assembly/mu metal parts	Final parts on site May 2018.
PMT/mu metal assemblies	Final testing/assembling summer 2018. Completed Jul 2018.
Assemblies fitted to bars	Completed Jun/Jul 2018.
Final bar assemblies checked	Jul 2018 initial bar tests/checks using oscilloscope/cosmics.
Stacking of bars	Final bars stacked Fall 2018. Some need repair, will need to be re-stacked spring/summer 2020.
PMTs gain matched	Initial, very rough matching performed via oscilloscope w/ cosmics Jul 2018. Await tests with DAQ.

Status of Electronics/Cabling

Item	Status
High Voltage	
CAEN SY1527LC mainframe, A1531 primary PSUs, 48 channel A1932AN HV power supply boards	On site May 2018: 1x SY1527LC (spare mainframe Hall C?); 8x A1932AN (4 spare); 3x working A1531 (2 spare). Tested
Distribution panels	4x 19" panels, on-site July 2019, tested
Cabling mainframe - distribution	4 x 60m shielded multi-way cables. on-site July 2019, tested
Cabling distribution to PMTs	200 custom cables. On-site July 2019, tested
Low Voltage	
AGILENT N5761A LV for NINO power	On-site July 2019, tested (no spare)
1 ~2V, 50mA, PSU for NINO threshold , with remote control (e.g. ethernet)	Temporary one used for testing cables - need to source
Distribution on BB frame	1x 19" panel on-site July 2019, tested
Cabling PSUs - distribution panel	10m cables, on-site July 2019, tested
Cabling distribution panel - cards	4m cables, on-site since July 2019, tested

Status of Electronics/Cabling

Item	Status
Front End	
12 NINO cards	On-site Oct 2018, tested . Need to ship spares
Cables PMTs - NINO	200 cables on-site Jul 2017, tested
VME Electronics	
VME crate : 1 Wiener 6U VME64x 6023	On-site July 2019, in weldment, need testing
CAEN v1190A TDC	3 on-site May 2018. Need testing
CAEN v792 QDC	2 on-site May 2018. Need testing
Analogue Signals for Calibration	
4x short 17 pair cables NINO - PP	Need to install (should be available in TEDF)
PP for frame	Located from JLab, installed .
60m 64x co-ax BB frame - weldment	Sourced (sharing w/ GRINCH)
PP for weldment	Need to install (should be available in TEDF)
4x short 17 pair cables PP - QDC	Need to install (should be available in TEDF)

Item	Status
TDC Signals	
17-pair cables NINO - LVDS/ECL convertor	Located, install/labelling started, to be completed in coming few weeks.
LVDS to ECL convertors	Located @ JLab, may need extra PSU/ share power set up with GRINCH? To be installed in coming weeks.
17-pair cables for LVDS/ECL convertor - TDCs	Located, install/labelling started, to be completed in coming weeks.
CAEN A967 32-channel adapter for Robinson-Nugent input on v1190A	On-site July 2019, 6 (+2 spare), to be tested w/ DAQ.

Item	Status
Pressurised air/cabling (180 cables to PMT plus 12 to NINO cards)	Required (not for cosmics to start but final set up in Hall)
DAQ (apart from VME crate, QDCs, TDCs). Require controller, CODA set up and PC.	Required (share DAQ with another sub-system for cosmic running?)
HV/LV slow control	Required (not for cosmic running but for final set up in Hall)
Space for LV PSUs (plus one additional PSU for threshold)	Require space for PSU's to be as close as possible to BB (preferable 10m) not for cosmic running but final set up
Weldment	Use existing
Software	Use existing but must extract code

Engineering/Tech Support

Item	Status
Construction/shielding hut for LV PSUs?	Possibly required (depending on final location), only for final set up, not cosmic running
Power supply set up LVDS - ECL converter	Required (share with GRINCH?)

For cosmic running to begin:

- By fall 2019 manpower to install signal cables (couple days), already initiated expect to happen over next couple weeks (D. Higinbotham/A. Yoon)
- By fall 2019: tech support for PSU set up for logic converter (couple days)
- By fall 2019: expert support for DAQ set up (~1 week)

Someone on-site to assist in running cosmics essential (Fall 2019 - Spring 2020), will likely take at least rest of year to understand/de-bug detector

Manpower available at UoG:

- Fractional time and research trips from R. Montgomery, D. Hamilton, A. Clarkson (also J. Annand remains involved)
- SBS PhD student from CNU starting Fall 2019 R. Marinaro - have to check funding for travel/availability/level of involvement

For final installation manpower likely needed from JLab:

- Summer 2020: require space allocated for LV PSUs and depending on location possible design time/construction extra shielding (couple weeks)
- Summer 2020: tech support for air supply system (couple weeks)

- All detector components assembled in BigBite
- LV/HV cabling/distribution system manufactured 2018/2019
- July 2019 successful install and testing of cabling took place (signals ok from all channels)
- To start cosmic tests will require:
 - install of signal cables (inventory from JLab indicates enough cables, already in TEDF, underway, expected completion in next few weeks - JLab/CNU)
 - set up of DAQ stand or incorporation into existing DAQ
- Bars must be de-stacked to allow repairs to take place Spring/Summer 2020 before/during move to Hall (likely to take a few weeks)

Proposed Layout in Hall

4x 60m HV multi-way
shielded cables

12 30m reels for LVDS
before converter and 12 30m
reels for ECL after converter

Space required for 2 LV PSUs
preferably 10m away

- 1 19" 1U for NINO power
- 1 TBD for threshold control
- 2 10m LV to BB frame
- 2 10m LV thresh to BB frame

Space and cabling required for
air supply to BB frame

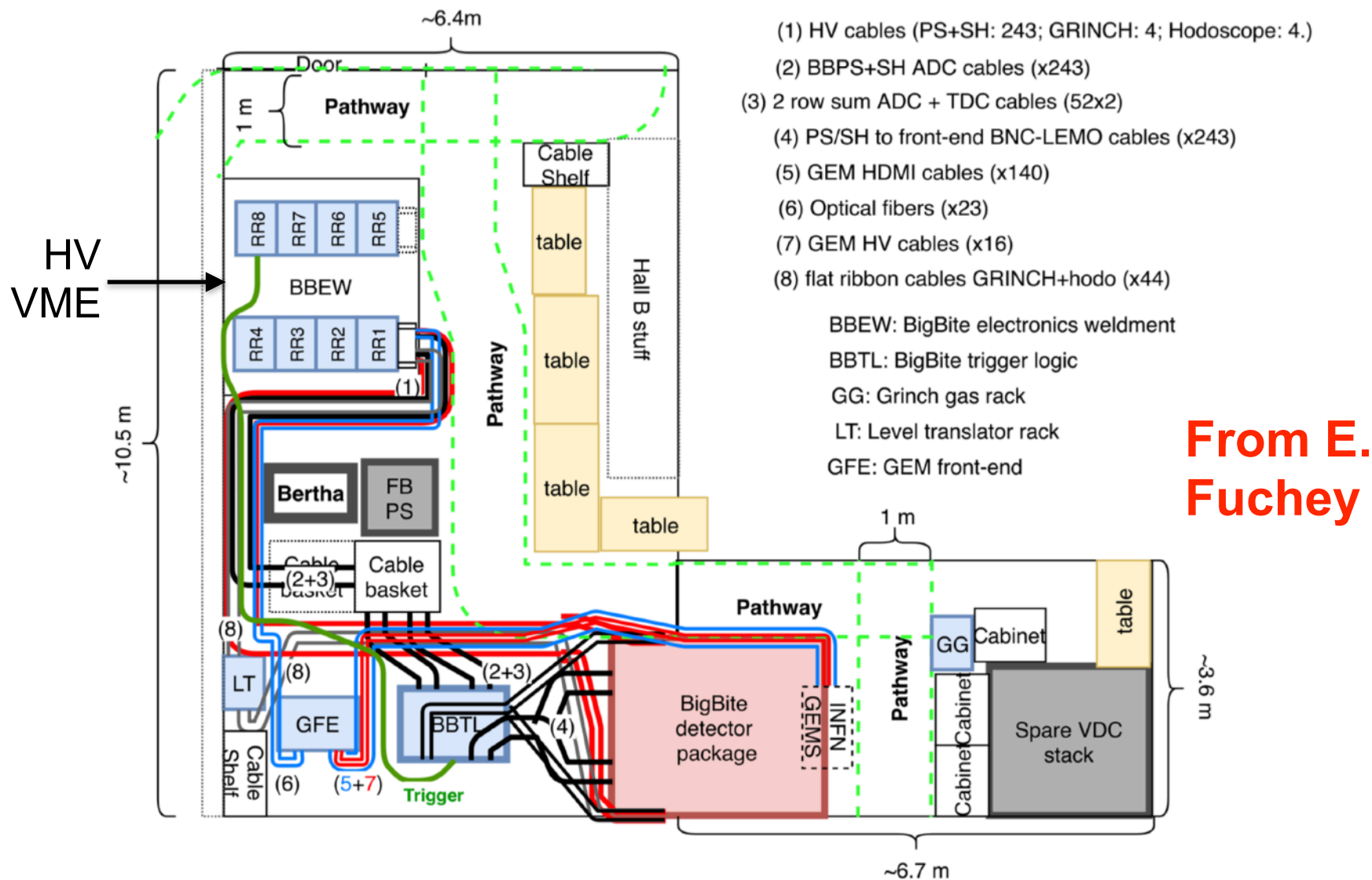
BB racks in weldment:

- 6U VME crate containing 2 QDCs, 2 TDCs, 1 ROC
- 1 8U HV mainframe

Distributions on BB frame:

- Air - 180 to PMTs + 12 to NINOs
- 4 HV distribution panels - 180 4m to PMTs
- 1 LV distribution panel - 12 4m LV to cards 2 4m daisy chained thresh to cards
- 2 mounting panels for 12 NINO cards
- 200 1.5 co-ax PMT to NINO cards
- 2 BNC-BNC PP for 64 analogue channels
- 2 PP for short 17-pair LVDS from NINO out

Layout in TEDF for Cosmic Tests



Outstanding - location of LV PSUs w/10m cables (informed that probably space in GG); pressurised air supply (not essential to start cosmic running)

Readout Chain

