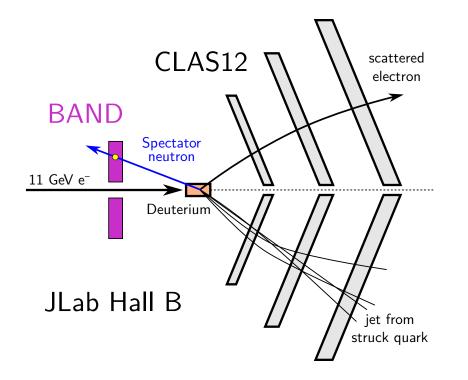
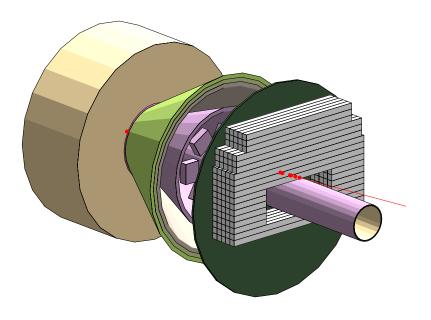
# BAND: Installation and Readout

Florian Hauenstein, ODU Efrain Segarra, Jackson Pybus, MIT CLAS Meeting 11/15/18

#### BAND in Hall Context





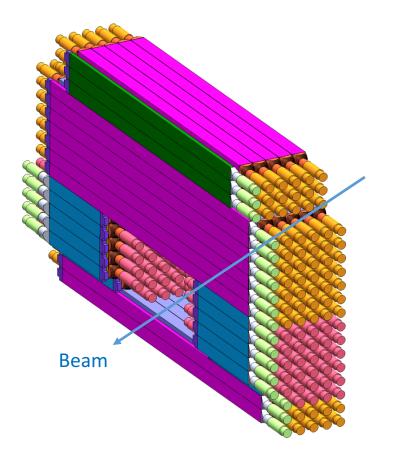
### **BAND** Layout

Plastic scintillator detector

- Covers 160 to 170°
- 40% neutron efficiency
- 116 7.2 x 7.2 cm<sup>2</sup> bars
  - two 2" PMTs per bar
  - 3 scintillator lengths (51, 164 and 202 cm)
  - BC-408 Scintillant
- Hole for beam line

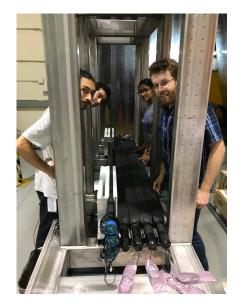
Veto layer

- 2 cm x 7.2 cm
- one 2" PMT per bar
- 24 PMTs



#### **BAND** Construction

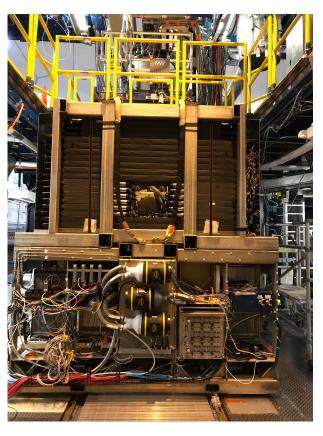
- July:
  - Glue PMTs to bars
  - Test bars and fix light leaks
  - Assemble all bars and some Veto bars into frame
- August:
  - Transport to the hall
  - Install cables and electronics
- First data taking with cosmics
- Still need (in January)
  - Optical fibers for laser calibration system
  - More mu-metal shields
  - More readout channels

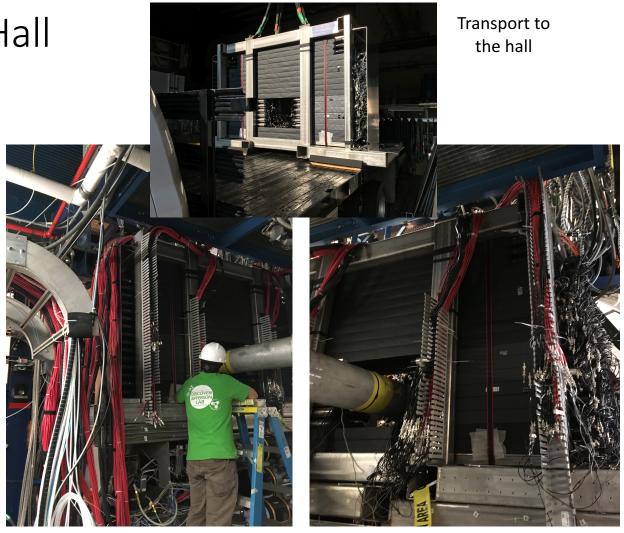


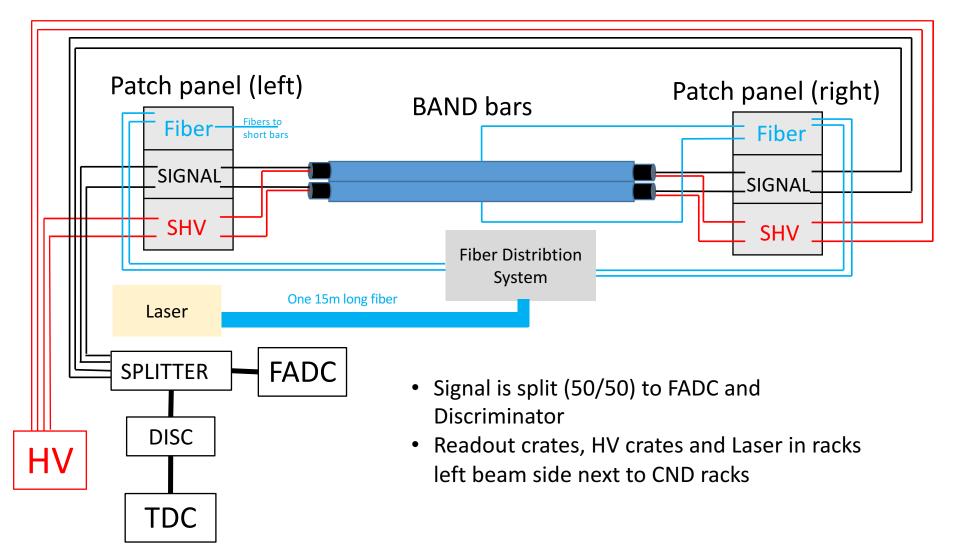


BAND is finished

#### BAND in the Hall

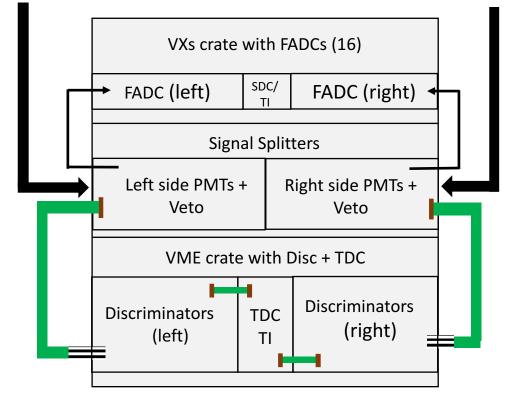






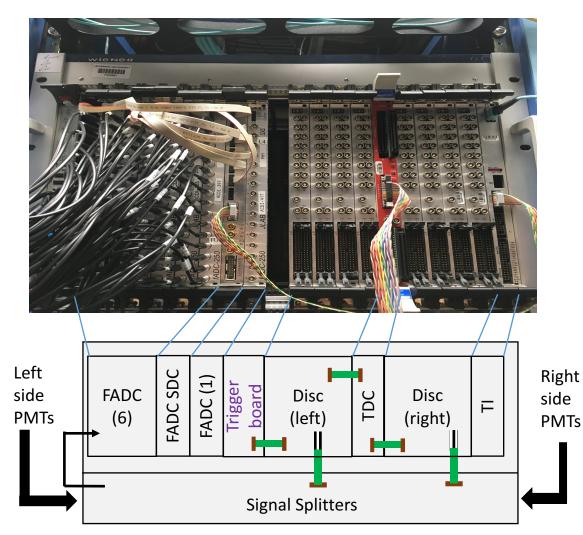
## DAQ Full Setup

Left side PMTs (116 chan.) + 12 Veto Layer channels Right side PMTs (116 chan.) + 12 Veto layer channels



- 1 VXs crate for FADCs
- 1 VME crate for TDC and discriminators
- Splitters between crates
- Groups of 16 channels from nearby PMTs (besides Vetos)
- Detailed mapping files available for each signal

VME crate with FADCs (7), Disc (8) and TDC (Trigger board not in the picture)



### DAQ Fall Setup

- 40% instrumented
- Trigger:
  - stand-alone readout or
  - combined with CLAS
- Extra Trigger board for Fall-2 setup

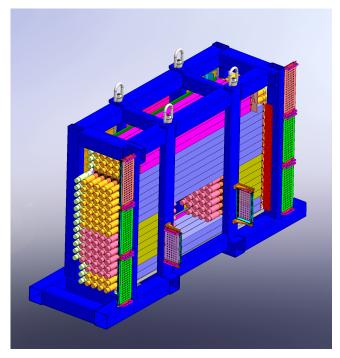


## Electronics and Cables

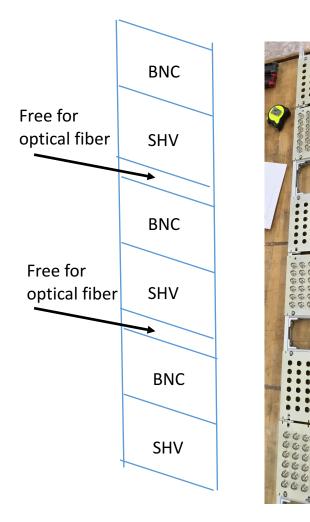


Count	Progress COOC
256	100%
256	100%
256	100% available (50% installed)
16	8 installed in fall (rest available)
2	1 installed in fall (rest available)
16	7 installed in fall, waiting for repairs of rest
256	50% done, rest in production
256	50% done, connectors for rest ordered
2 + 11	2 + 9 installed (1 in repair + 1 ordered)
256	100%
256	100%
2	CPU delivered, VXS should arrive next week
	256 256 256 16 2 16 256 256 256 256 256

## Patch Panel

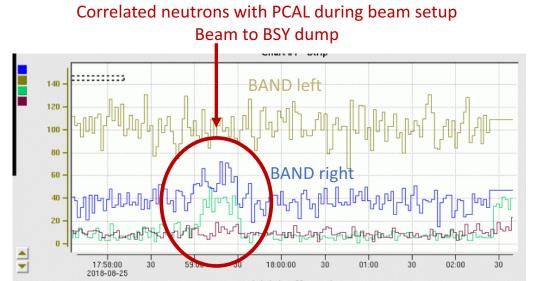


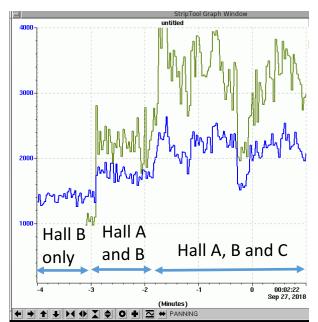
- 2 long and 2 short panels
- 2 Fiber patch panels
- Panels and frames finished
- Installation in January



#### Setup 1 - Fall 18

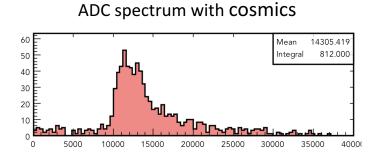
- Startup with only 65 PMTs equipped with available mu-metals, mainly inner PMTs of short bars
- Simple trigger (any PMT fires)
- Stand-alone readout

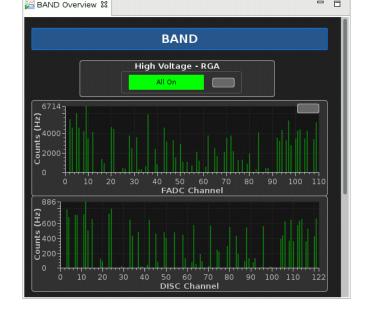




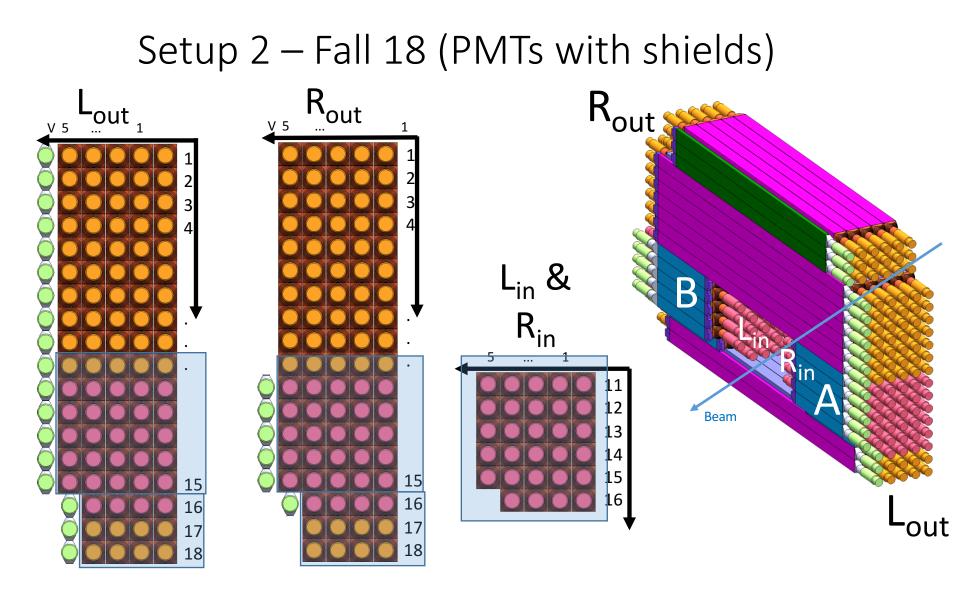
### Setup 2 – Fall 18

- Mu-metal shields on PMTs Row 10 and below
- Readout both sides
  - short bars in row 11 to 15
  - long bars 410 and 510
  - 4 short bars in row 16
- Cosmics trigger with at least 3 coincidence bars per column

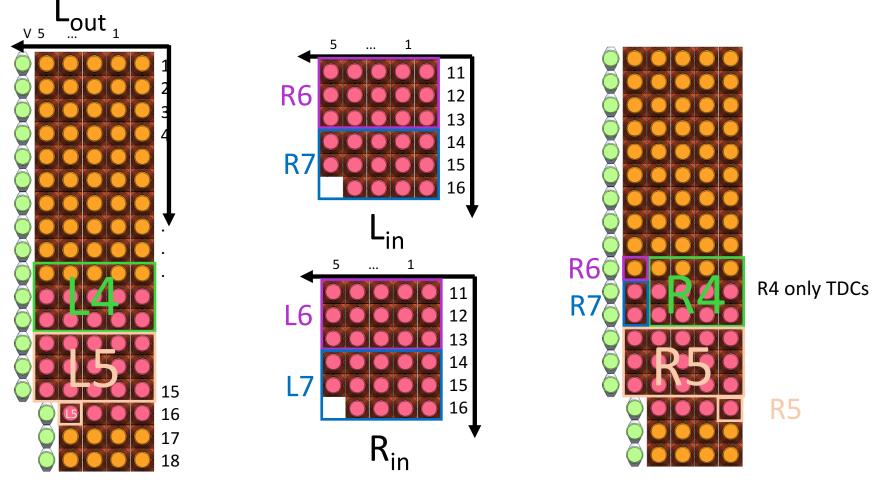




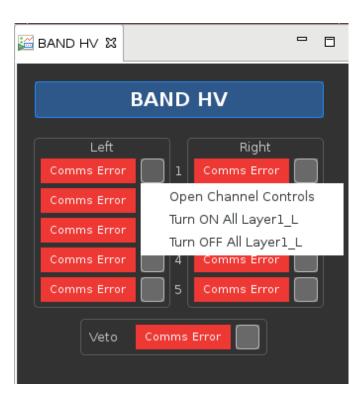
#### Rates with beam at 45nA



#### Setup 2 – Fall 18 (readout PMTs)



#### BAND HV GUI



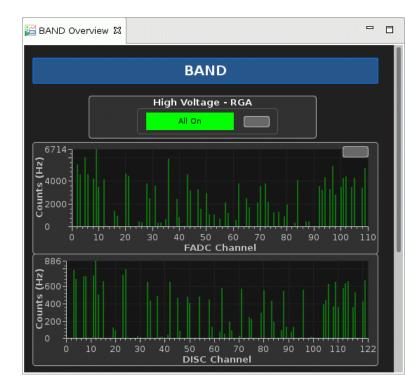
Left and Right side of each column + Veto

🔛 BAND	HV - Veto 🛛							- 6
Exper	BAND H	/ Con	trols	- Vei	to	All	OFF/ON	
#	Description	Pw	∨mon	Imon	Status	Vset	Turn OFF A	All Veto
1	BAND_HV_V01		0.00 V	0.00 uA	COMMS	0.000	Turn ON A	ll Veto
2	BAND_HV_V02		0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
3	BAND_HV_V03	OFF	0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
4	BAND_HV_V04	OFF	0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
5	BAND_HV_V05	OFF	0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
6	BAND_HV_V06		0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
7	BAND_HV_V07	OFF	0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
8	BAND_HV_V08		0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
9	BAND_HV_V09		0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
10	BAND_HV_V10		0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
11	BAND_HV_V11A		0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
11	BAND_HV_V11B	OFF	0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
12	BAND_HV_V12A		0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
12	BAND_HV_V12B	OFF	0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
13	BAND_HV_V13A	OFF	0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
13	BAND_HV_V13B	OFF	0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
14	BAND_HV_V14A	OFF	0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
14	BAND_HV_V14B	OFF	0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
15	BAND_HV_V15A	OFF	0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
15	BAND_HV_V15B		0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
16	BAND_HV_V16A	OFF	0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
16	BAND_HV_V16B	OFF	0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
17	BAND_HV_V17		0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	
18	BAND_HV_V18	OFF	0.00 V	0.00 uA	COMMS	0.000 V	0.0 uA	

#### Detailed GUI to control each channel

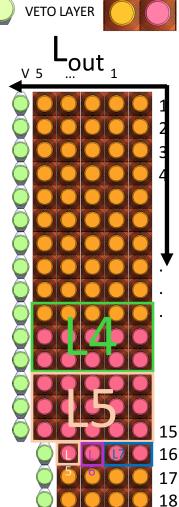
#### **BAND Scaler GUIs**

🔛 BAND FAD	C - Layer l X	🚰 Layer 2	🚰 Vetoes			
Layers		BAND	FADC So	alers	- Layer1	
Layer	1 DCBAND_SIG	0 Ch00:c		101 R	B HW ADCBAND Sl09 Ch00:c	41
Layer:				102 R	B HW ADCBAND Sl09 Ch05:c	62
10 Layer:				103 R	B HW ADCBAND Sl09 Ch10:c	44
10 Layer	nonuun ole			104 R	B HW ADCBAND SI10 Ch00:c	22
10	DCBAND SI			105 R	B HW ADCBAND SI10 Ch05:c	22
10 Layer	5 DCBAND_SIG			106 R	B_HW_ADCBAND_SI10_Ch10:c	36
10 Vetoes	DCBAND_SI	)2_Ch00:c		107 R	B_HW_ADCBAND_SI11_Ch00:c	0
108_L	B_HW_ADCBAND_SIG	)2_Ch05:c	0	108_R	B_HW_ADCBAND_SI11_Ch05:c	0
109_L	B_HW_ADCBAND_SIG	)2_Ch10:c	0	109_R	B_HW_ADCBAND_SI11_Ch10:c	0
110_L I	B_HW_ADCBAND_SIG	)3_Ch00:c	166	110_R	B_HW_ADCBAND_SI12_Ch00:c	0
111A_L I	B_HW_ADCBAND_SIG	)3_Ch05:c	241	111A_R	B_HW_ADCBAND_SI05_Ch00:c	21
111B_L	B_HW_ADCBAND_SI	14_Ch00:c	0	111B_R	B_HW_ADCBAND_SI12_Ch05:c	0
112A_L I	B_HW_ADCBAND_SI	)3_Ch10:c	232	112A_R	B_HW_ADCBAND_SI05_Ch05:c	38
112B_L	B_HW_ADCBAND_SI	14_Ch05:c	0	112B_R	B_HW_ADCBAND_SI12_Ch10:c	0
113A_L I	B_HW_ADCBAND_SI	)4_Ch00:c	12	113A_R	B_HW_ADCBAND_SI05_Ch10:c	158
113B_L	B_HW_ADCBAND_SI	14_Ch10:c	0	113B_R	B_HW_ADCBAND_SI13_Ch00:c	35
114A_L I	B_HW_ADCBAND_SIG	)4_Ch05:c	17	114A_R	B_HW_ADCBAND_SI06_Ch00:c	
114B_L	B_HW_ADCBAND_SI	15_Ch00:c	0	114B_R	B_HW_ADCBAND_SI13_Ch05:c	27
115A_L I	B_HW_ADCBAND_SIG	)4_Ch10:c	28	115A_R	B_HW_ADCBAND_SI06_Ch05:c	
115B_L	B_HW_ADCBAND_SI	l5_Ch05:c	0	115B_R	B_HW_ADCBAND_SI13_Ch10:c	
116A_L	B_HW_ADCBAND_SIG	)7_Ch04:c	0	116A_R	B_HW_ADCBAND_SI07_Ch00:c	82
116B_L	B_HW_ADCBAND_SI	16_Ch00:c	0	116B_R	B_HW_ADCBAND_SI16_Ch04:c	0
117_L I	B_HW_ADCBAND_SIG	)7_Ch08:c	0	117_R	B_HW_ADCBAND_SI16_Ch08:c	0
118_L I	B_HW_ADCBAND_SIG	)7_Ch12:c	14030449	118_R	B_HW_ADCBAND_SI16_Ch12:c	0



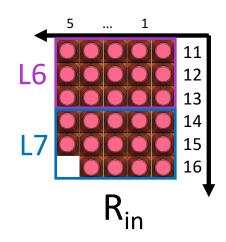
#### Summary

- Total of 116 scintillator bars (+ 24 vetos in BAND)
  - 58 long ones (2m and 1.6 m) + 12 Veto
  - 58 short ones (0.5 m) + 12 Veto
- BAND installed in the hall (without all Veto bars)
- ~40% cabled up for fall for background studies and commissioning
- Mapping files available for next year as well as fall
- Data available with standalone triggering on cosmics
- Readout of BAND with CLAS is available, tests in the next days

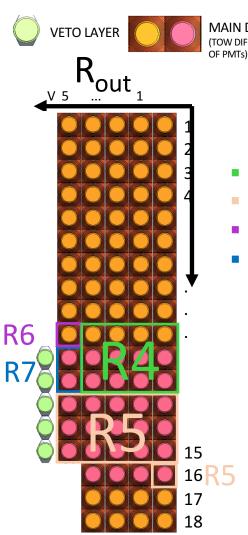


MAIN DETECTOR (TOW DIFFERENT TYPES OF PMTs)

- R<sub>in</sub> fully used and Part of other short and long bars
- 7 FADCs total
- L4-7 means splitter not fully cable strang
- Need mu-metal installed
- L4: (1-5)10\_L + (1-5)(11-12)A\_L + free
  L5: (1-5)(13-15)A\_L + 416A\_L
- L6: (1-5)(11-13)A\_R + 316A\_L
- L7: (1-5)(14-15)A\_R + (1-4)16A\_R + + (1-2)16A\_L

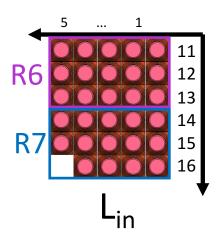


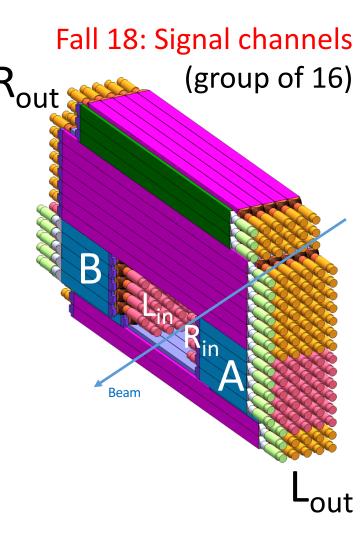
Fall 18 Signal channels (group of 16) R<sub>ou</sub>' Beam



MAIN DETECTOR (TOW DIFFERENT TYPES • Lin a OF PMTs) inste

- L<sub>in</sub> and part of R<sub>out</sub> used (maybe Layer 1 instead of 5)
   B5.7 means colittor pat fully cable
- R5-7 means splitter not fully cable strang itself
- R4 only TDC and trigger
- R4: (1-4)(10-12B)\_R (only TDC)
  R5: (1-5)(13-15)B\_R + 116B\_R
- R6: (1-5)(11-13)B\_L + 510\_R
- R7: (1-5)(14-15)B\_L + (1-4)16B\_L + + 5(11-12)B\_R





#### Row labeling for each column (5th column without row 15-18)

	1/2/3/4/5 01		
	1/2/3/4/5 02		
and another mark	1/2/3/4/5 03		
	1/2/3/4/5 04		
	1/2/3/4/5 05		
	1/2/3/4/5 06		
	1/2/3/4/5 07		
	1/2/3/4/5 08		
	1/2/3/4/5 09		
	1/2/3/4/5 10		
1/2/3/4/5 11A		1/2/3/4/5 1	1B
1/2/3/4/5 12A		1/2/3/4/5 1	12B
1/2/3/4/5 13A		1/2/3/4/5 1	3B
1/2/3/4/5 14A		1/2/3/4/5 1	4B
1/2/3/4/5 15A		1/2/3/4/5 1	.5B
1/2/3/4 16A		1/2/3/4 16	БВ
	1/2/3/4 17		
	1/2/3/4 18		

#### Veto Row labeling

	V 01	
	V 02	
	V 03	
	V 04	
	V 05	
	V 06	
	V 07	
	V 08	
	V 09	
	V 10	
V 11A		V 11B
V 12A		V 12B
V 13A		V 13B
V 14A		V 14B
V 15A		V 15B
V 16A		V 16B
	V 17	
	V 18	