DAQ for SBS GEM

SBS collaboration meeting

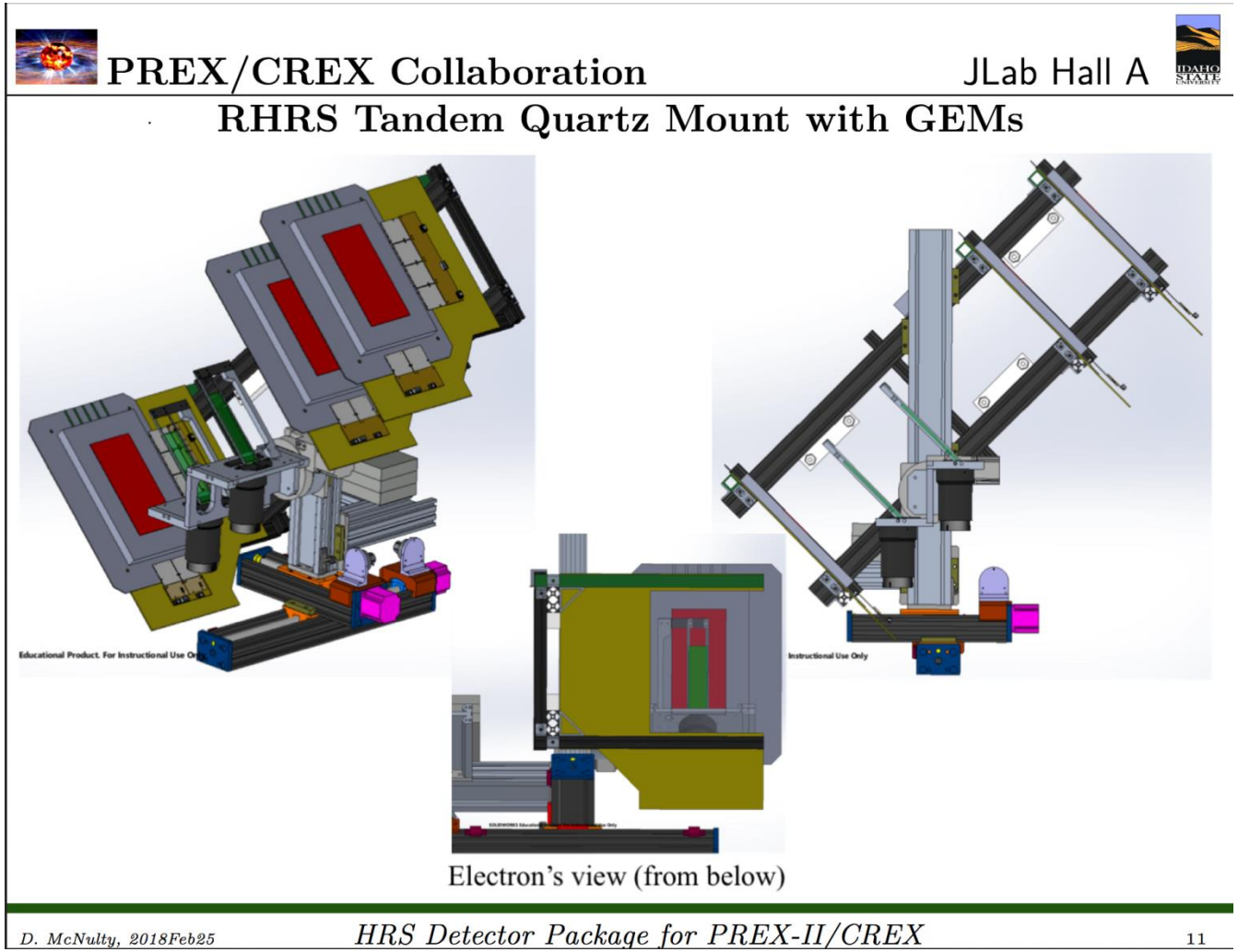
August 6th 2019

Alexandre Camsonne

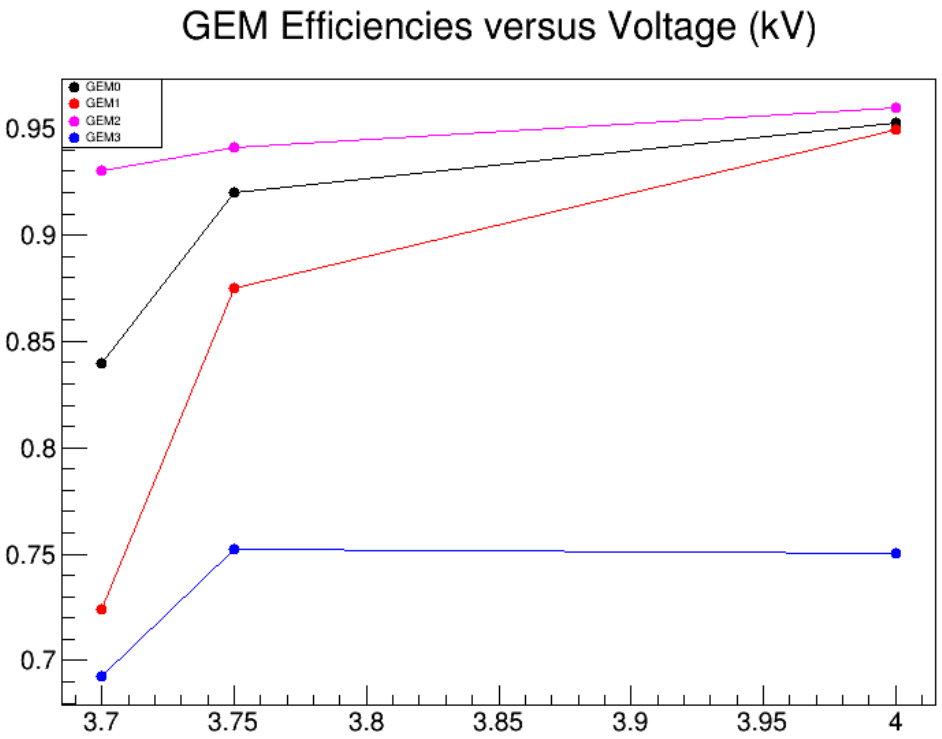
Outline

- GEM configuration for Gen RP
- Inventory
- PREX test
- SSP readout
- Timeline
- Manpower

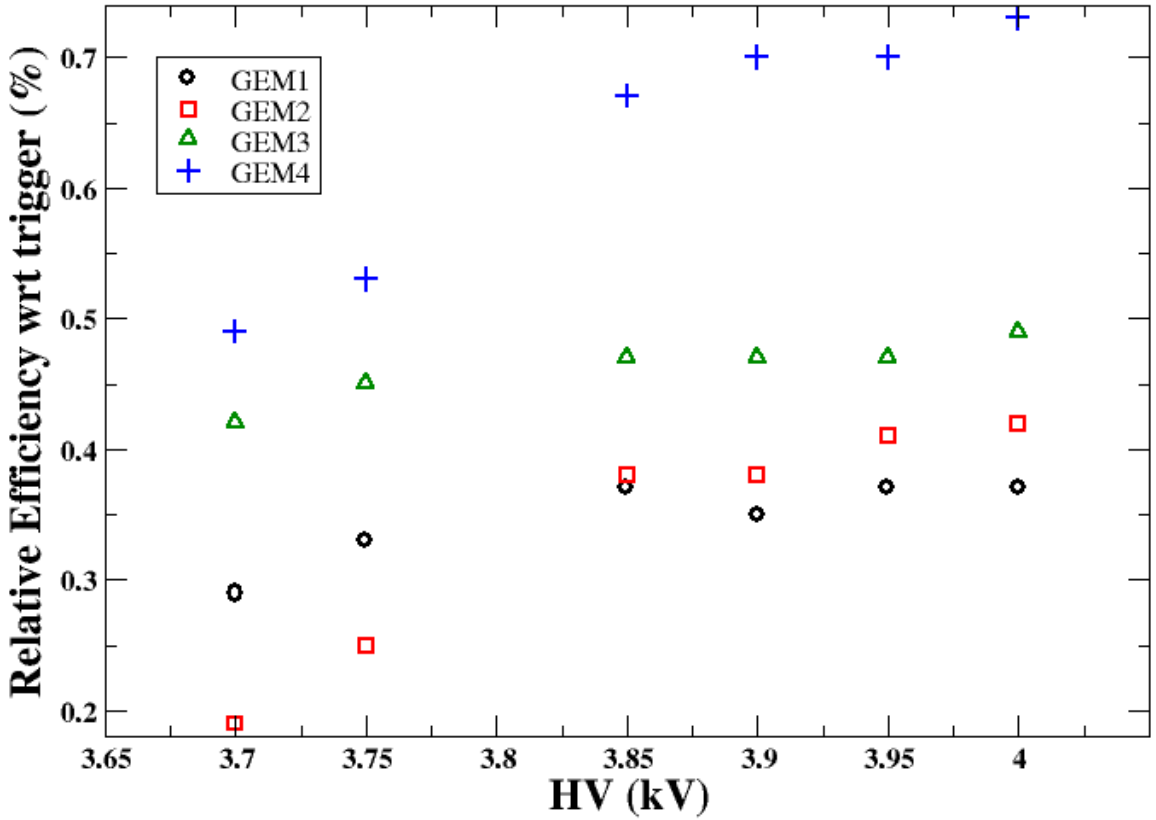
PREX test


PREX/CREX Collaboration
JLab Hall A
RHRS Tandem Quartz Mount with GEMs
Electron's view (from below)
D. McNulty, 2018Feb25
HRS Detector Package for PREX-II/CREX
11

PREX test

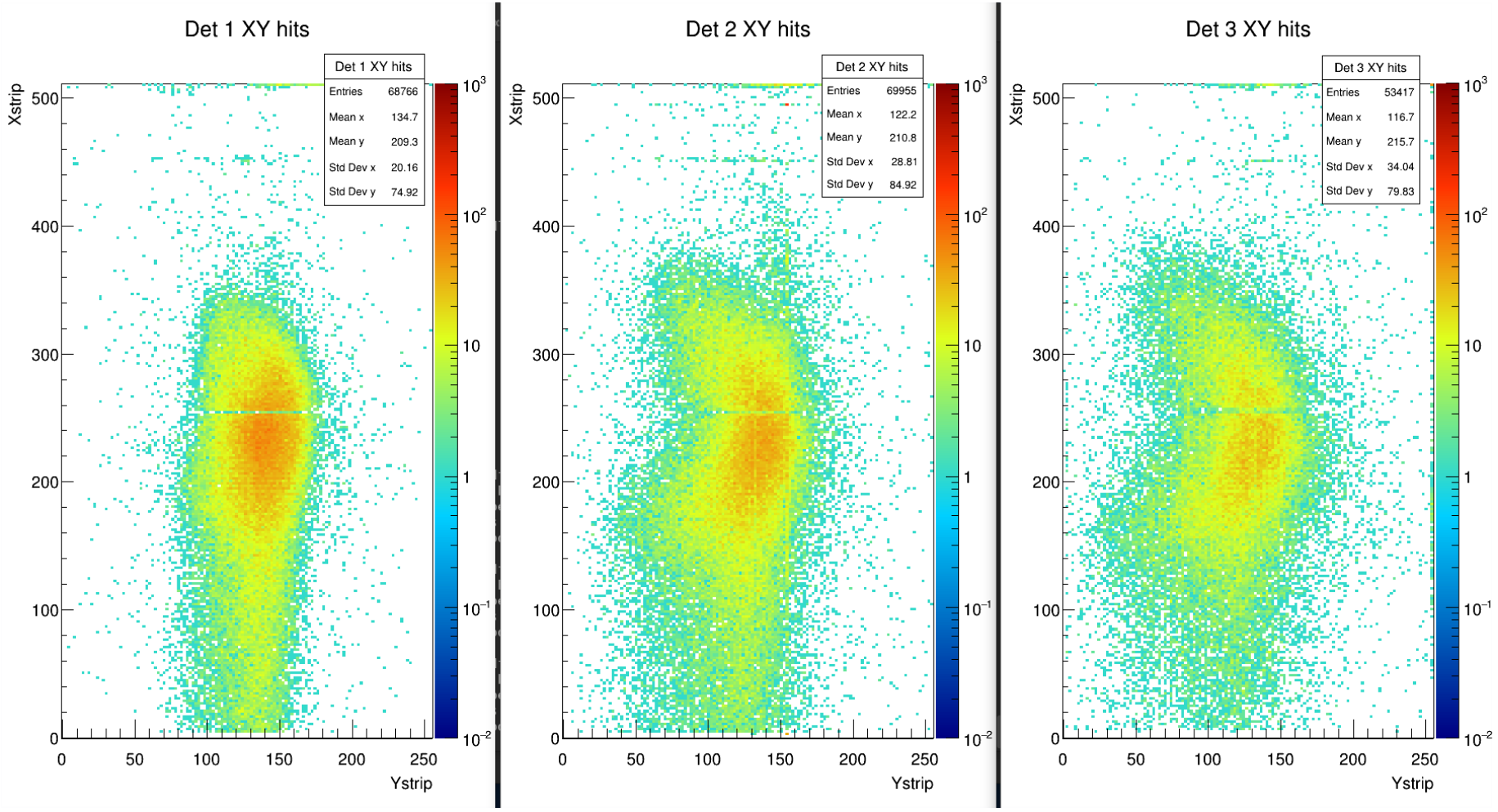


Efficiency vs HV cosmics

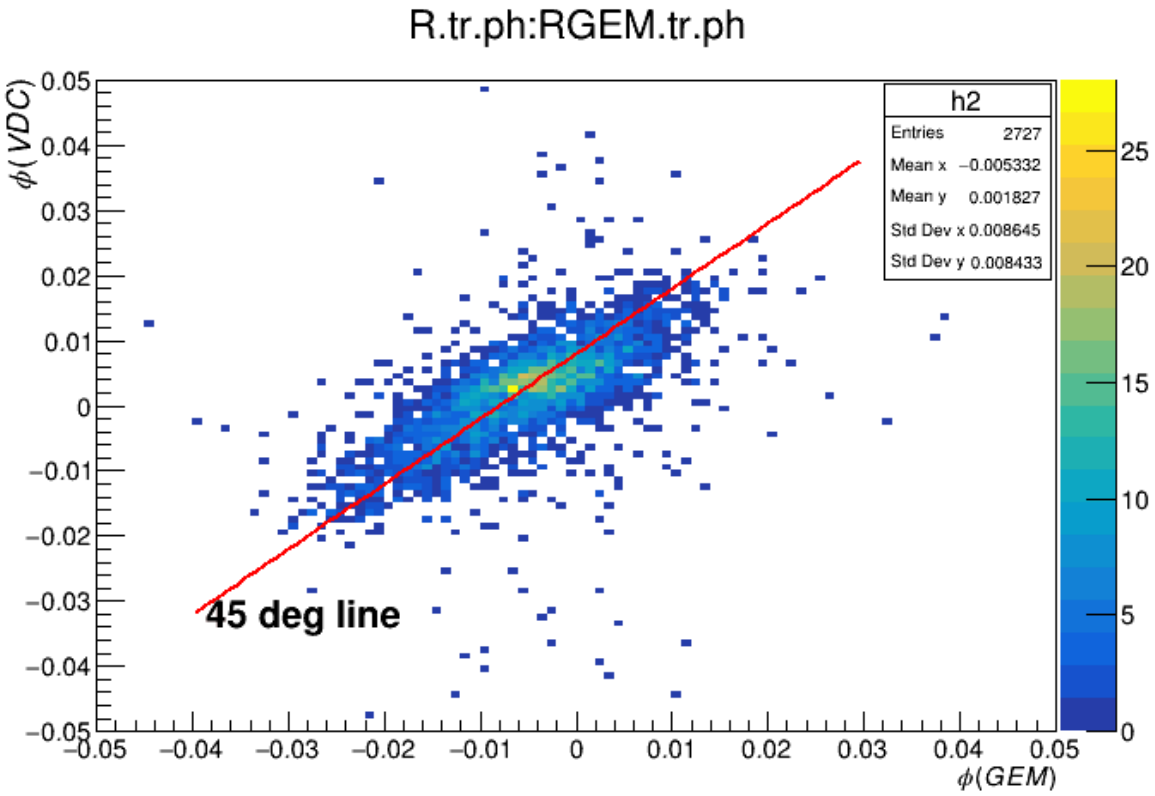


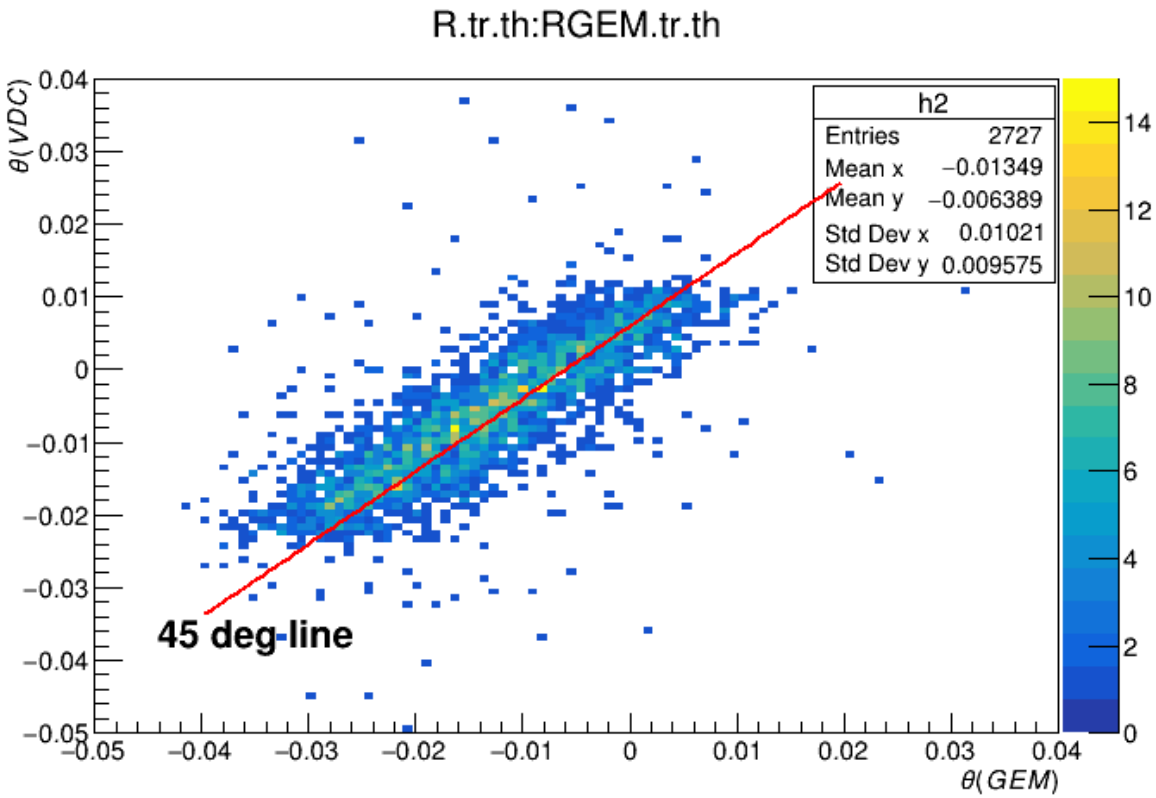
Efficiency with respect to trigger

PREX test


Det 1 XY hits
Det 1 XY hits
Entries 68766
Mean x 134.7
Mean y 209.3
Std Dev x 20.16
Std Dev y 74.92
Xstrip
Ystrip
Det 2 XY hits
Det 2 XY hits
Entries 69955
Mean x 122.2
Mean y 210.8
Std Dev x 28.81
Std Dev y 84.92
Xstrip
Ystrip
Det 3 XY hits
Det 3 XY hits
Entries 53417
Mean x 116.7
Mean y 215.7
Std Dev x 34.04
Std Dev y 79.83
Xstrip
Ystrip

PREX test





GEM VDC correlations

GEM – Readout Electronics

- 128 analog ch / APV25 ASIC
- 3.4 μs trigger latency (analog pipeline)
- Capable of sampling signal at 40 MHz
- Multiplexed analog output (100 kHz readout rate)

	Channels	APV25	MPDs
Front Tracker	28000	216	16
Rear Tracker	12000	100	7

MPD (INFN)

MPD Main Block

Arriga GX FPGA
128 MB DDR2-RAM
Firmware V4.0 (74% resources):
FIR Filter (16 param)
Zero Suppression
Common mode and pedestal subtraction
Remote config,
≈2 ns trigger time resolution

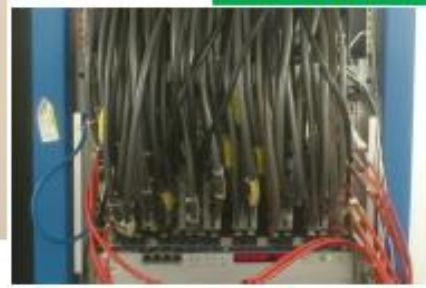
MPD-SSP Interface → SSP-Protocol → Aurora Protocol

MPD-VME Interface → VME-Protocols → 2eSST, 2eVME, VME32 ..., VXS

Optical Fiber

VME (64x)

All major firmware issues fixed so far

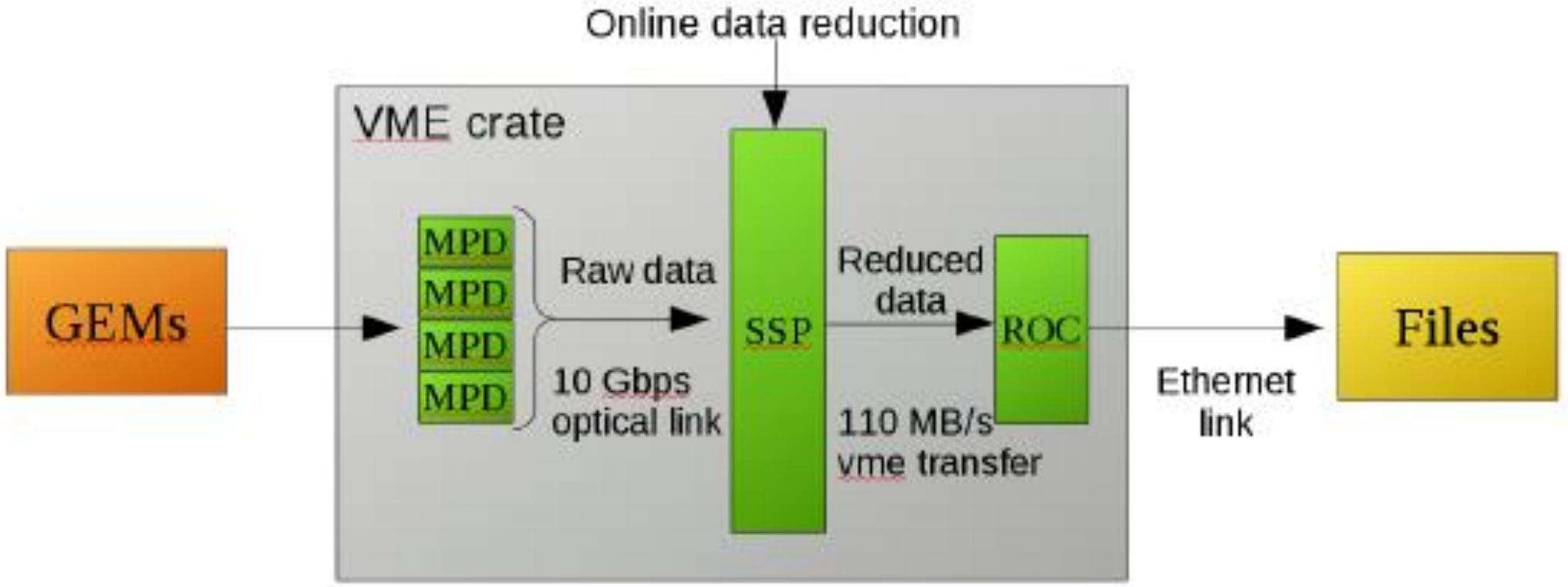


Electronics is up and running (or going to run) on:

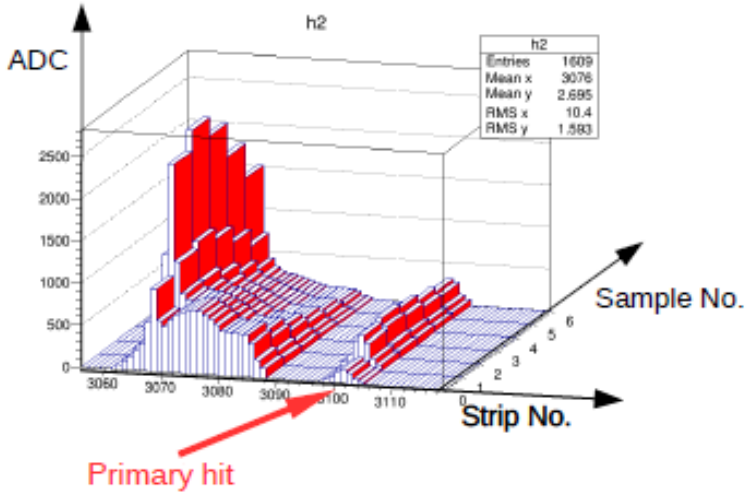
- Front-GEM cosmic test in VME mode
- SSP mode in Rear GEM cosmic test
- PREX UVa GEM

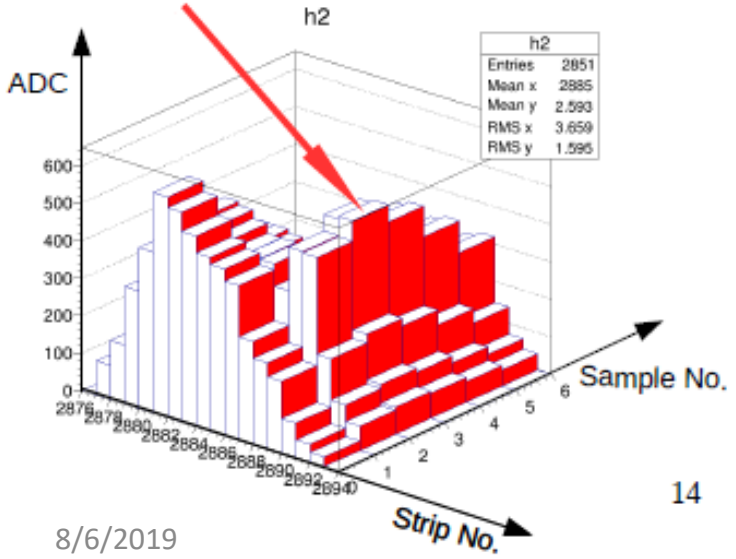
05/Aug/2019

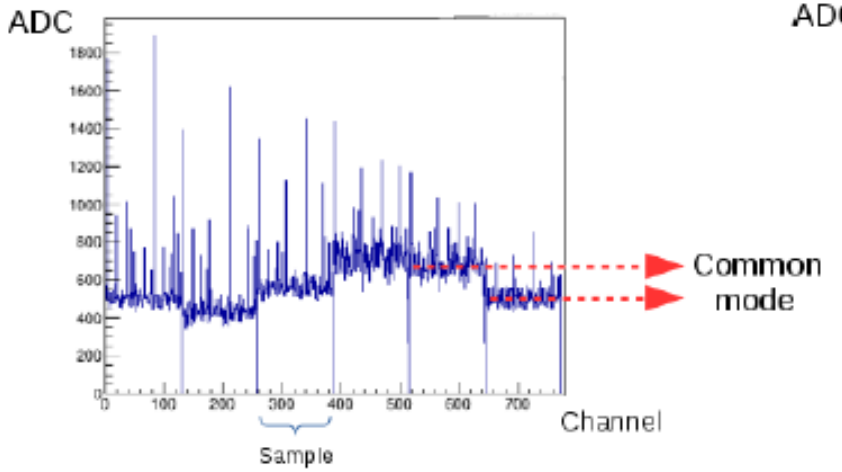
SSP data reduction

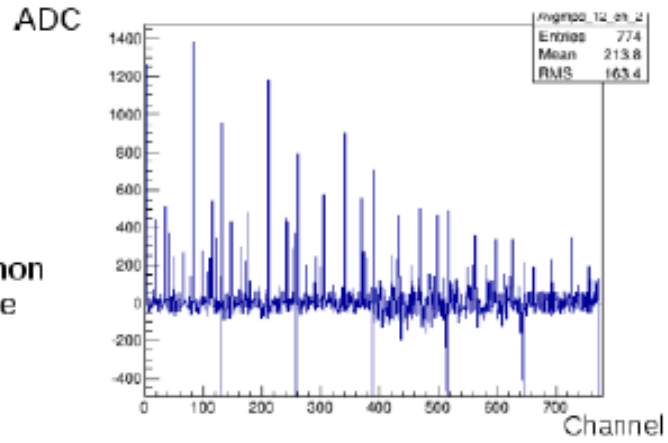


SSP data reduction





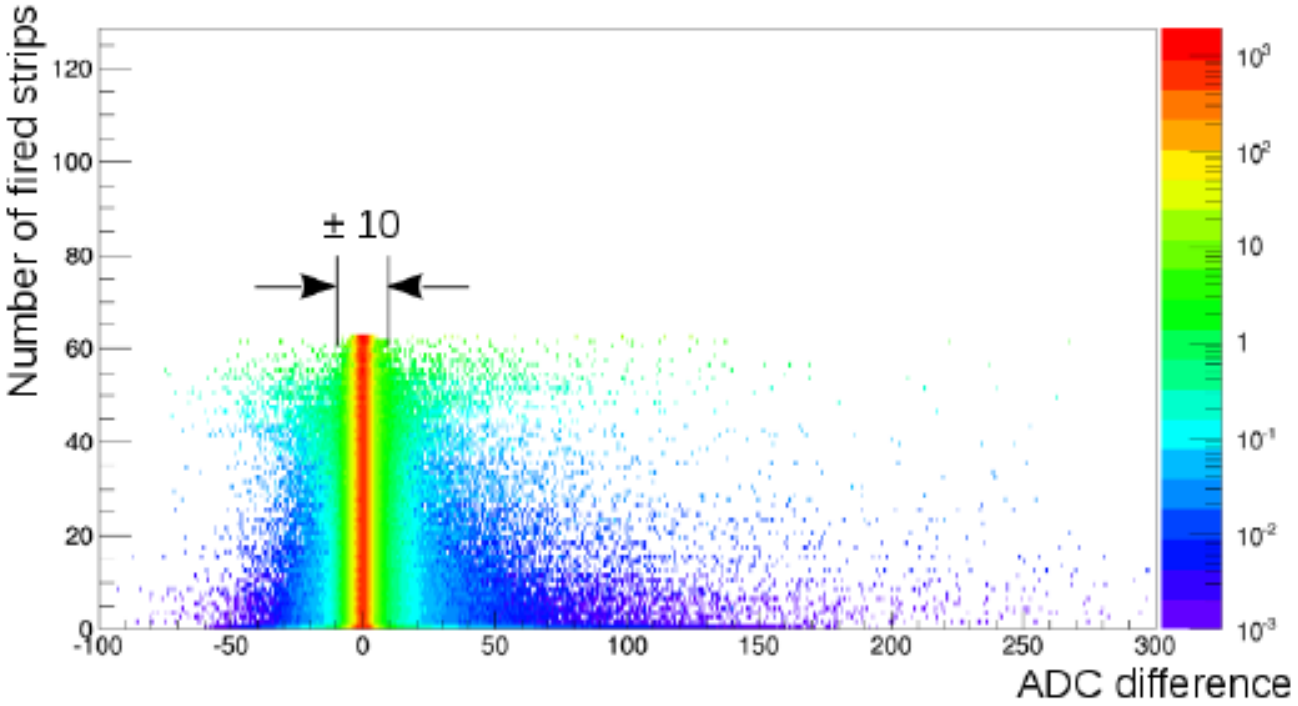




- Common noise subtraction
- Zero supression
- Transfer 6 samples

SSP implementation

- First implementation up to 4 MPDs



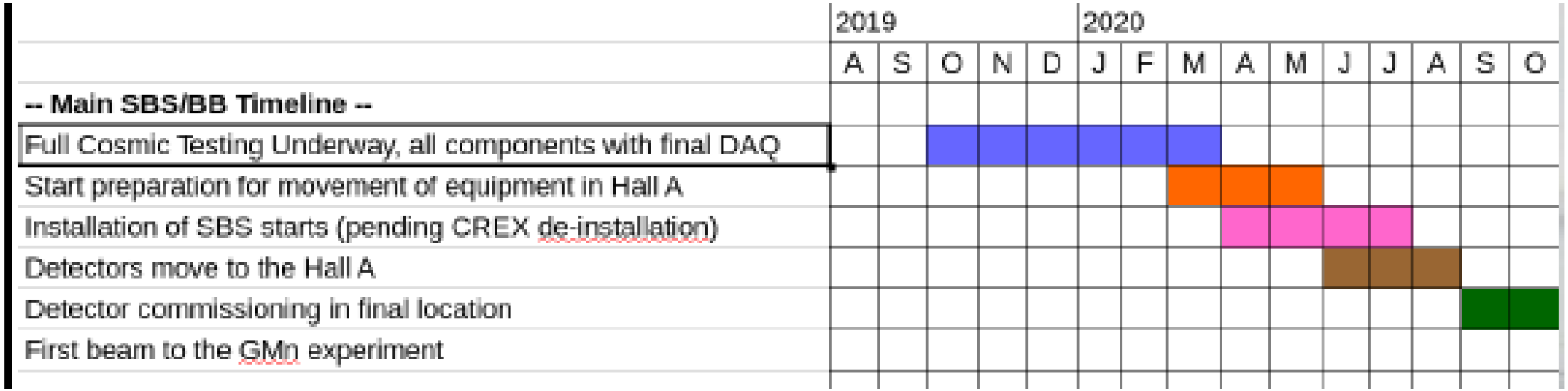
- Offline vsonline treatment
- Very good efficiency of online treatment

SSP final implementation

- Needed new MPD firmware to reorder samples packing in event so do not need to record 6 full event to do common noise suppression : done since last year

- Implementation in SSP this August

Timeline


2019
2020
A S O N D J F M A M J J A S O
-- Main SBS/BB Timeline --
Full Cosmic Testing Underway, all components with final DAQ
Start preparation for movement of equipment in Hall A
Installation of SBS starts (pending CREX de-installation)
Detectors move to the Hall A
Detector commissioning in final location
First beam to the GMn experiment

Data rates Gen RP BigBite

Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column9	Column10
	Rate per cm2	Rate per plane	hits in 325 ns	occupancy	strip hits	XY	6 samples	bytes	Rate MB/s
1	86	516	167.7	26%	586.95	1173.9	7043.4	28178	95.81
2	94	564	183.3	28%	641.55	1283.1	7698.6	30794	104.70
3	93	558	181.35	28%	634.725	1269.45	7616.7	30467	103.59
4	92	552	179.4	28%	627.9	1255.8	7534.8	30139	102.47
5	54	324	105.3	16%	368.55	737.1	4422.6	17690	60.15
								Total	466.71
									311.14263

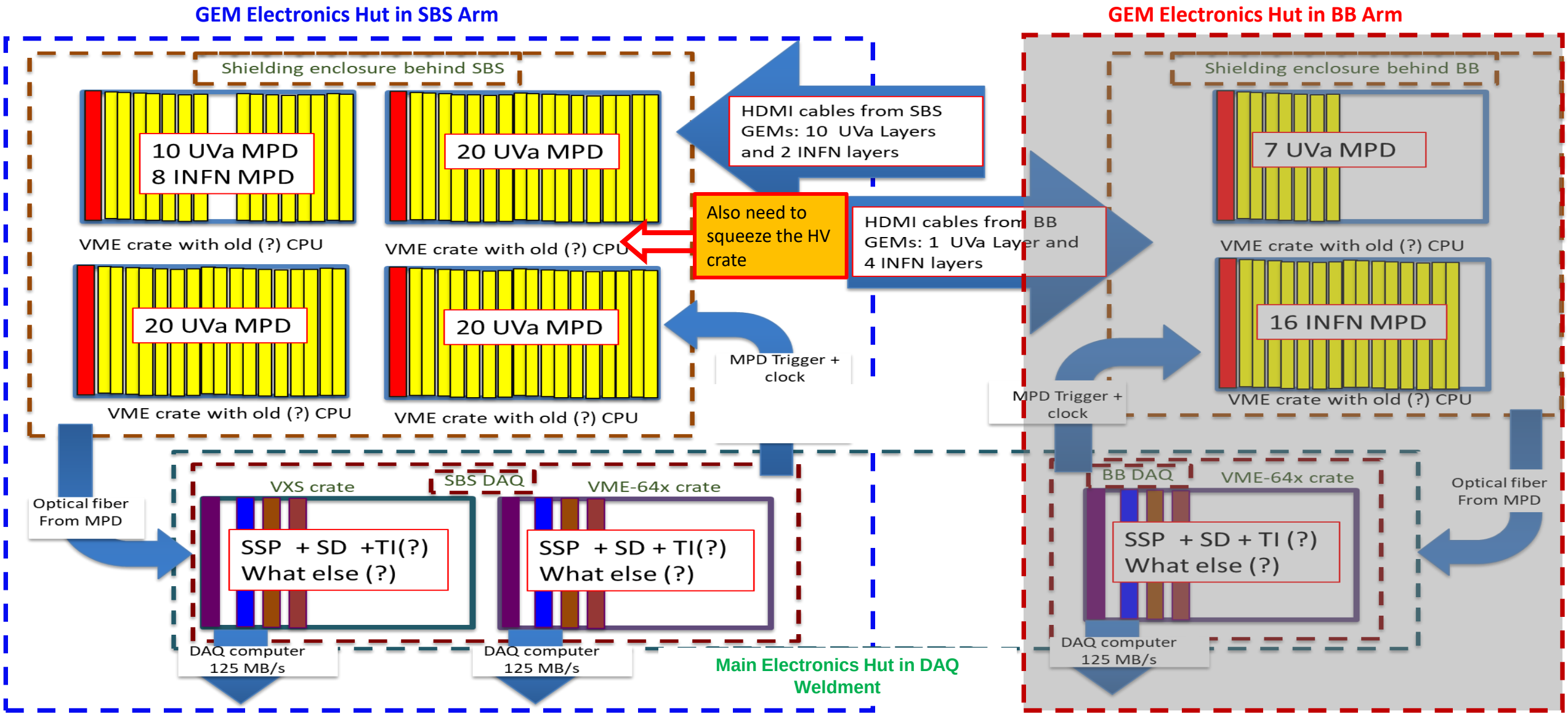
Bigbite rate : about 311 MB/s expect factor of 3 reduction from SSP about 100 MB/s

Data rates Gen RP polarimeter GEMS

	Rate per cm2	Rate per plane	hits in 325 ns	occupancy	strip hits	XY	6 samples	bytes	Rate MB/s
1	62	372	120.9	19%	423.15	846.3	5077.8	20316	69.07
2	63	378	122.85	19%	429.975	859.95	5159.7	20639	70.17
3	62	372	120.9	19%	423.15	846.3	5077.8	20311	69.06
4	11	66	21.45	3%	75.075	150.15	900.9	3604	12.25
5	11	66	21.45	3%	75.075	150.15	900.9	3604	12.25
6	14	84	27.3	4%	95.55	191.1	1146.6	4586	15.59
7	9	54	17.55	3%	70.2	140.4	421.2	1685	5.73
8	27	162	52.65	9%	210.6	421.2	1263.6	5054	17.18
9	5	30	9.75	2%	39	78	234	936	3.18
10	19	114	37.05	7%	148.2	296.4	889.2	3557	12.09
									286.59

- About 300 MB/s so 100 MB/s after online reduction
- Total GEM data rate about 200 MB/s , 4 VXS crates total bandwidth 400 MB/s , computer wth 10gigE adapter

SBS GEM Electronics for Gen-RP



- JLab custom device to distribute the clock & trigger to the MPD from the SSP instead of the Phillips 757 modules to save money
- **Statements yesterday that these modules have 16 inputs, we would need 20 inputs according to this scheme**

Status of SBS GEM Electronics (for GEn-RP arm)

Items for	Need	In hand (total)	Spares
MPDs (UVa GEMs)	70	yes	~2
APV25 FE Cards (UVa GEMs)	880	yes	yes (A few)
12-slots backplane (UVa GEMs)	40	42	Not yet
5-slots backplane (UVa GEMs)	80	82	Not yet
MPDs (INFN GEMs)	8	yes	A few
APV25 FE Cards (INFN GEMs)	108	yes	yes
Backplanes (INFN GEMs)	Flex: 6 Rigid: 18	yes	yes

SBS GEM Electronics - components

Item	Status
3 SSP modules	3 in hand: 2 with UVa, 1 with Paolo (Italy) 4th (for BB) identified to be in Ben's hand in Hall A
3 VME64x / VXS (for SSP, TI …)	3 **VXS** crate ordered (Alex) – How about the 4th (for BB)?
4 VME crate (no master) for MPDs	6 in hand for SBS and BB (Alex) + 3 more in RHRS as spares
TI – Trigger supervisor	Available (Alex) + spares
Master VME (for SSP and TI)	12 ordered (Alex)
Trigger / clock fan-out (78 channels)	JLab custom boards (under test in EEL and Test lab)
1 VME minicrate for slow control + Master	Available (Alex) Do we use the same for BB?
Short HDMI cables (+ spares) : connected to the GEMs	In hand (in EEL 124)
Long HDMI cables (374 + 14 spares): to the MPDs	In hand (in EEL 125 ⇨ Could it be store in EEL 126?)
78 Optical fiber MPD – SSP connection and tranceivers	30 optic fibers and 150 transceivers ordered (Alex)
2 × 78 (+ 1) NIM cables trigger and clock distribution	To be identified / procured (1 from SBS GEM hut to electronic hut)
46 x HV cables (15 m?, 55 m? ...)	To be produced / provided at JLab
6 x LV cables pairs (15 m?)	To be identified / procured
HV power supplies for 46 channels (40 UVa GEMs + 6 INFN GEMs)	In hand: 1 Wiener crate & **6 HV modules** (8 ch. each) => 42 channels To be procured: 1 spare crate + at least one more HV module
LV power supply	Available at Jlab, Currently used / tested in cosmic (+spare)
SBS GEMs Electronic Hut	JLab Engineering - (R. Wines talk)

Conclusion

- GEM hardware available or ordered
- Gen RP GEM data rate about 200 MB/s
- Implementation of full scale SSP implementation from 4 to 32 MPDs per SSP

- Test full system by end of 2019