

SBS DAQ GMn/Gen RP

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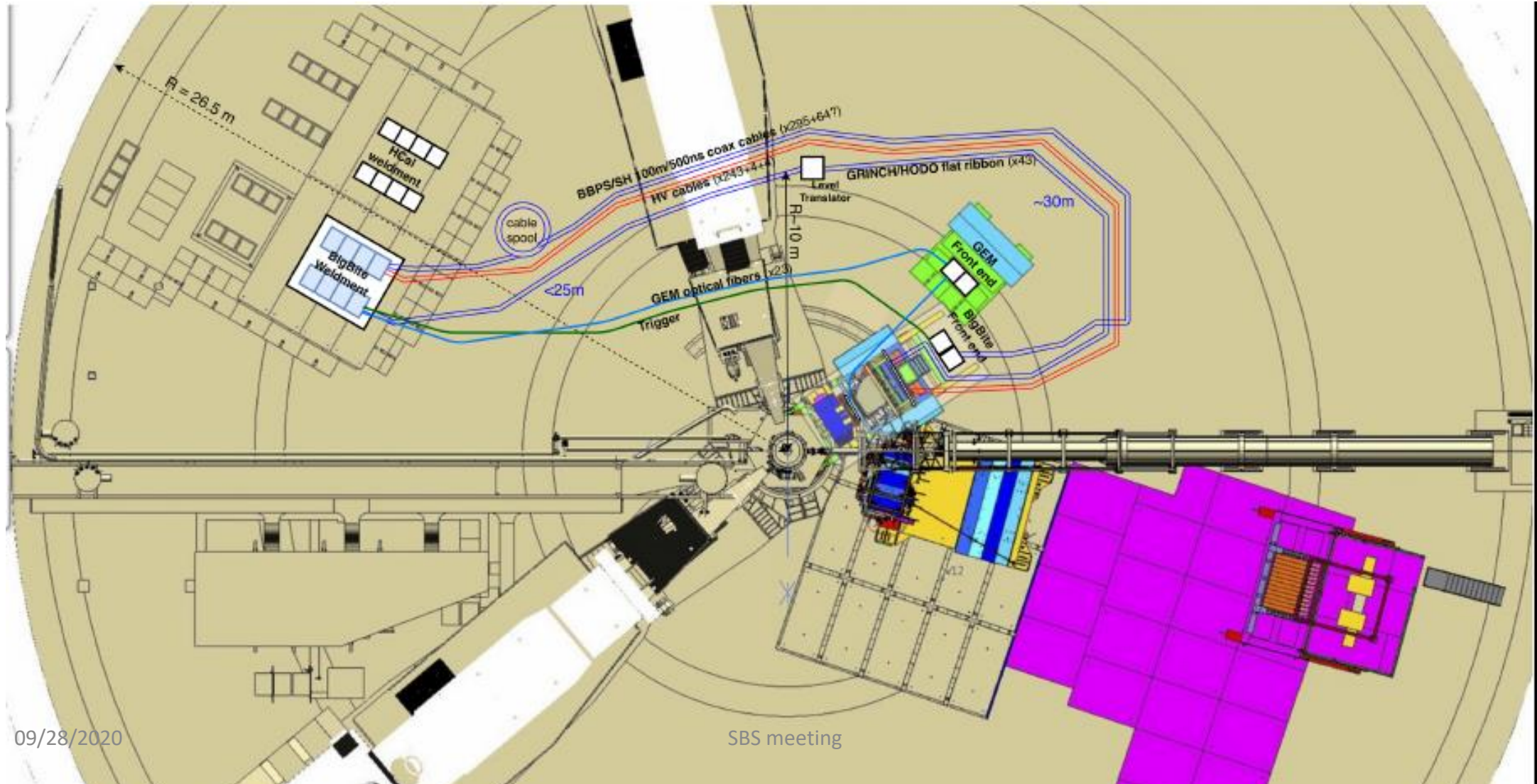
GMn / GEn RP

- Superbigbite used as neutron detector
- Bigbite : electron detector
- Add polarimeters on SBS side
- Start in 2021

SBS configuration GMn/Gen/Gen RP

		Channels	Modules	Nb modules
BigBite	Shower	189	FADC	12
	Preshower	54	FADC	4
	Scintillator	180	V1190	2
	Cerenkov	550	VETROC	6
	GEM INFN	14000	MPD	24
	GEM UVA	113000	MPD	77
BigBen				
	HCAL	288	FADC	18
	CDet	2520	VETROC	13
HRS				
	S2m	32	FADC	2
	S0	2	FADC	1
	Cerenkov	10	FADC	1
	PRL	68	FADC	4
	VDC	1536	1877	16
	Raster	4	FADC	1
	BPM	8	FADC	1
RP				
	Proton Large Angle	96	FADC	6
	Active analyzer	32	FADC	2
09/28/2020		SBS meeting	TDC	1 3

Hall Layout



Procurement

- All fibers,optical transceivers ordered
- Most hardware on hand using ECAL/RHRS
- 3 VXS crates , 3 SDs and 3 TIs received
- 6 standard VME crates for GEMs in clean room
- 3 VME64X crate available and 3 SD

Trigger

- Baseline L1 (500 ns delay about 25 meters trigger cable)
 - Bigbite shower trigger
 - Coincidence BigBite shower and HCAL analog sum

New trigger rates GMn

	Q^2 (GeV ²)	E_e (GeV)	θ_{BB}/d_{BB} (deg)/(m)	E'_e (GeV)	Thrsh. (GeV)	Eff. %	Trig. Rate. (kHz)					Total (kHz)
							El.	Inel.	π^+	π^0	π^-	
	3.5	4.4	32.5/1.80	2.18	1.81	96.9	0.8	5.3	0.04	3.5	0.1	9.7
Gen/RP	4.5	4.4	41.9/1.55	1.70	1.35	94.0	0.2	2.3	0.2	7.3	0.2	10.2
Can	5.7	4.4	58.4/1.55	1.14	0.89	94.8	0.02	0.6	0.4	12.9	0.6	14.5
Run	6.1	6.6	30.3/1.55	2.90	2.38	95.9	0.08	1.7	0.006	1.0	0.02	2.8
Lower	8.1	6.6	43.0/1.55	1.94	1.56	95.5	0.007	0.4	0.06	1.6	0.03	2.1
luminosit	10.2	8.8	34.0/1.75	2.92	2.37	96.8	0.003	0.3	0.003	0.3	0.002	0.6
y	12	8.8	44.2/1.55	2.05	1.62	95.4	0.0008	0.1	0.005	1.2	0.02	1.3
	13.5	11	33.0/1.55	3.30	2.60	94.0	0.0008	0.2	0.003	0.2	0.002	0.4

Q ²	n+p QE xsec	L(per atom)	QE rate	Beam time	Total
GeV ²	fb	10 ³⁸ /cm ² /s design	Hz	Hours	kHz
3.5	6700	0.35	235	12	2.100
4.5	1015	0.7	70	12	1.400
5.7	97.9	1.4	13.5	18	0.140
8.1	47.4	1.4	6.6	18	0.390
10.2	31.6	0.7	1.5	24	0.210
12	5.04	1.4	0.7	36	0.200
13.5	6.25	1.4	0.87	96	0.100

Q ² (GeV ²)	E _e (GeV)	θ _{BB} /d _{BB} (deg)/(m)	E' _e (GeV)	Thrsh. (GeV)	Eff. %	Trig. Rate. (kHz)					Total (kHz)
						El.	Inel.	π ⁺	π ⁰	π ⁻	
3.5	4.4	32.5/1.80	2.18	1.81	96.9	0.8	5.3	0.04	3.5	0.1	9.7
4.5	4.4	41.9/1.55	1.70	1.35	94.0	0.2	2.3	0.2	7.3	0.2	10.2
5.7	4.4	58.4/1.55	1.14	0.89	94.8	0.02	0.6	0.4	12.9	0.6	14.5
6.1	6.6	30.3/1.55	2.90	2.38	95.9	0.08	1.7	0.006	1.0	0.02	2.8
8.1	6.6	43.0/1.55	1.94	1.56	95.5	0.007	0.4	0.06	1.6	0.03	2.1
10.2	8.8	34.0/1.75	2.92	2.37	96.8	0.003	0.3	0.003	0.3	0.002	0.6
12	8.8	44.2/1.55	2.05	1.62	95.4	0.0008	0.1	0.005	1.2	0.02	1.3
13.5	11	33.0/1.55	3.30	2.60	94.0	0.0008	0.2	0.003	0.2	0.002	0.4

GMn kinematics

Preferably single electron trigger to avoid biased in neutron detector

Q ²	n+p QE xsec	L(per atom)	QE rate	Beam time	Total
GeV ²	fb	10 ³⁸ /cm ² /s design	Hz	Hours	Hz
3.5	6700	0.35	235	12	9700
4.5	1015	0.7	70	12	10200
6.1				18	2800
8.1	47.4	1.4	6.6	18	2100
10.2	31.6	0.7	1.5	24	600
12	5.04	1.4	0.7	36	1300
13.5	6.25	1.4	0.87	96	400

GMn data rates 13.5 GeV2

Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column9	Column10	Column11	Column12	Column13
	30 uA 15 cm LD2			Trigger rate :	10000							
	Rate per cm2	Rate per plane	hits in 325 ns	occupancy	strip hits	XY	6 samples	bytes	Rate MB/s		Rate	Rate MB/s
1	110	660	214.5	33%	750.75	1501.5	9009	18020	180.20		1.8E+08	180.20
2	130	780	253.5	39%	887.25	1774.5	10647	21296	212.96		2.13E+08	212.96
3	120	1440	468	48%	1638	3276	19656	39314	393.14		3.93E+08	393.14
4	105	1260	409.5	42%	1433.25	2866.5	17199	34400	344.00		3.44E+08	344.00
5	40	480	156	16%	546	1092	6552	13106	131.06		1.31E+08	131.06
												1,261.37
Samples	20											
FADC		Event size										
	288	20880	208.8									
		Total	1470.17									

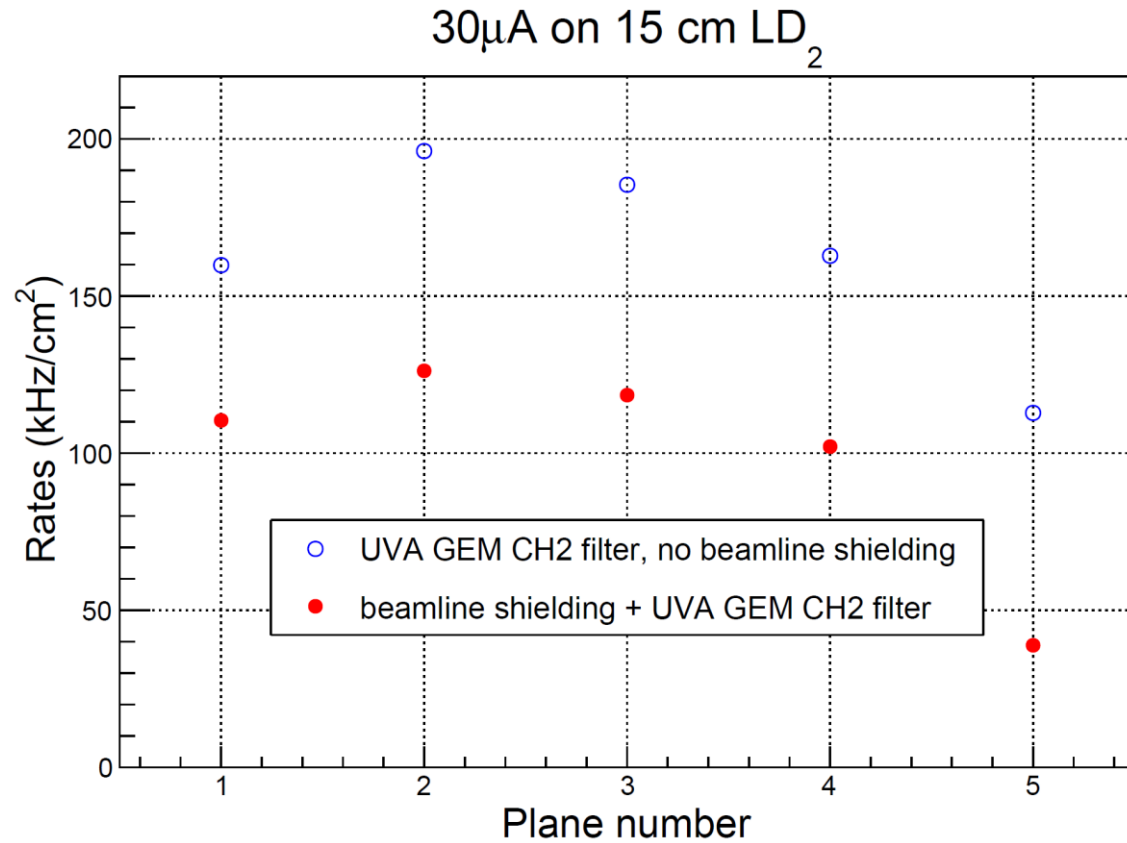
10 KHz single arm gives 1.5 GB/s if SSP give factor 3 reduction around 500 MB/s
 Luminosity could be decreased by 2

HCAL rates

Expt.	Q^2 (GeV ²)	BeamE (GeV)	SBS ang./dst. (deg)/(m)	SBS Bdl	HCAL dst. (m)	Thrsh. (GeV)	HCAL Trigger Rates (MHz)
GMn	3.5	4.4	31.1/2.00	1.71	7.2	0.08	3.83 ± 0.07
GMn	4.5	4.4	24.7/2.25	1.71	8.5	0.10	3.65 ± 0.04
GEN-RP	4.5	4.4	24.7/2.25	1.71	8.5	0.08	1.25 ± 0.04
GMn	5.7	4.4	17.5/2.25	1.71	11.0	0.14	5.09 ± 0.05
GMn	6.1	6.6	24.7/2.25	1.71	8.5	0.13	4.39 ± 0.07
GMn	8.1	6.6	17.5/2.25	1.65	11.0	0.20	5.31 ± 0.08
GMn	10.2	8.8	17.5/2.25	1.60	11.0	0.23	5.91 ± 0.08
GMn	12	8.8	13.3/2.25	1.50	14.0	0.28	8.08 ± 0.10
GMn	13.5	11	14.8/3.10	0.97	17.0	0.26	4.46 ± 0.01

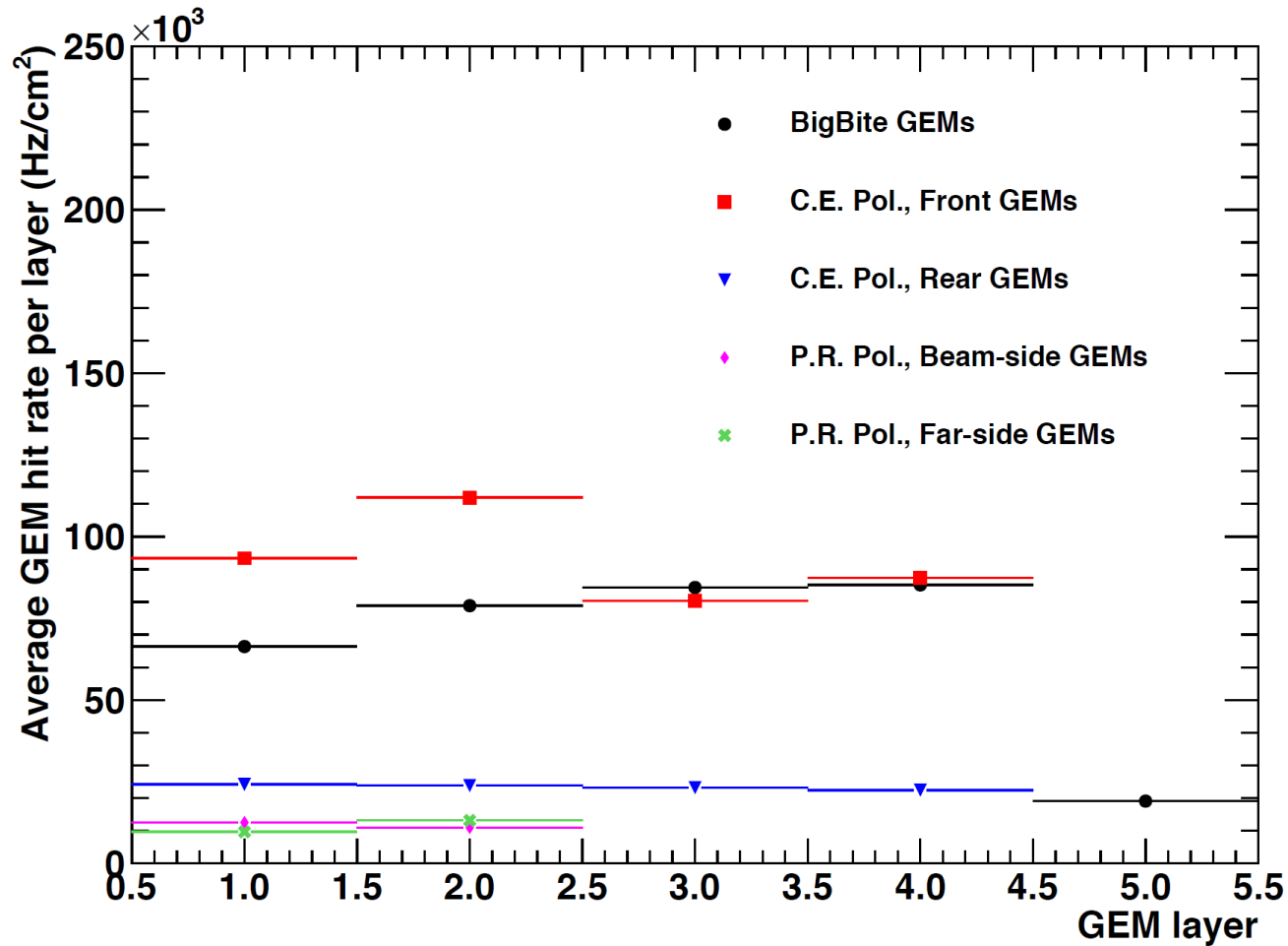
GEN-RP coincidence : 1.25 MHz x 10 KHz x 50 ns = 625 Hz

GMn GEM rates 13.5 GeV2



- Bigbite
 1. 110 KHz
 2. 120 KHz
 3. 115 KHz
 4. 100 KHz
 5. 40 KHz

New GEMs rates Gen RP



- Bigbite
 1. 65 KHz
 2. 80 KHz
 3. 85 KHz
 4. 85 KHz
 5. 85 KHz
- SBS
 1. 95 KHz
 2. 112 KHz
 3. 80 KHz
 4. 85 KHz
 5. 85 KHz
- Polarimeter
 1. 10 KHz
 2. 10 KHz

Gen RP data rates (625 Hz coincidence)

	Rate per cm2	Rate per plane	hits in 325 ns	occupancy	strip hits	XY	6 samples	bytes	Rate MB/s
1	65	390	126.75	20%	443.625	887.25	5323.5	21298	13.84
2	80	480	156	24%	546	1092	6552	26208	17.04
3	85	1020	331.5	51%	1160.25	2320.5	13923	55692	36.20
4	85	1020	331.5	51%	1160.25	2320.5	13923	55692	36.20
5	85	1020	331.5	51%	1160.25	2320.5	13923	55692	36.20
6	95	1140	370.5	57%	1296.75	2593.5	15561	62244	40.46
7	112	1344	436.8	77%	1747.2	3494.4	10483.2	41933	27.26
8	85	1020	331.5	58%	1326	2652	7956	31824	20.69
9	85	1020	331.5	58%	1326	2652	7956	31824	20.69
10	85	1020	331.5	58%	1326	2652	7956	31824	20.69
11	10	120	39	7%	156	312	936	3744	2.43
12	10	120	39	7%	156	312	936	3744	2.43
Samples	20								
FADC		Event size						Total	274.12
	288	13968	9.0792						
	128	6208	4.0352						
		Total	287.23						

Expect factor 3 reduction from SSP zero suppression about 100 MBs

Plan for factor 500 MB/s - 5 crates for SSP (can use VME64X crates – need 2 more SSPs) or VTP readout (2 crates)

GEM readout

- SSP based readout
 - 4 VXS crates, SSP, TI and SD
 - 101 MPDs
 - 4 SSPs
 - Received MPD transceivers and fibers
-
- VXS crate at Umass, can implement MPD readout and send back crate to install when GEM go in Bigbite

SSP readout (Ben Raydo)

- SSP readout up to 32 MPD
- Being tested with 12 MPDs right now
- Zero suppression algorithm implemented
- Noisy supply to optical link
- Dropped link speed from 2.5 Gbps to 1.25 Gbps
(Max trigger rate 16 APVs one MPD 100 % occupancy 8.5 KHz)
- Moving common noise, zero suppression to SSP, and packing of 2 samples in 32 bit word : firmware development on-going

HCAL FADCs (Bruan Quinn, Juan Carlos Cornejo, Scott Barkus)

- All hardware on hand : 2 SD, 18 FADCs, 2VXS crates, 2 VTP, 2 CPU, 2 TI, 5 F1
- Single crate trigger available
- HCAL trigger needs transfer two FADCs through VTP optical link about 1 month
- VXS, VTP and SD installed
- Working on HCAL trigger with 2 crates

BigBite

- Shower (Eric Fuchey, Arun Tadepalli , Mark Jones)
 - Bigbite trigger cabling complete
 - Taking cosmics with Fastbus
 - VXS crate ordered, borrowing 10 FADCs from FEG, 6 FADCs ordered by Glasgow
- Hodoscope (Rachel Montgomery, Ralph Marinaro)
 - 1 VME64X crate, 2x V1190, 2 V792 (might be an issue with beam)
- GRINCH (Bradley Yale, Todd Averett)
 - 1 VXS crate, 6 VETROCs

Beamline (David Flay)

- Keep LHRS
- Move RHRS beamline to SBS weldment
 - BPM
 - BCM
 - Raster
- FADC readout
- Digital readout ?

Scalers (Bob Michaels, Holly ?)

- LHRS keep as is
- Move RHRS scalers to SBS weldment

Left HRS (Bob Michaels)

- Reinstall pion rejector and cable FADCs
- Recable S0 S2m and Gas Cerenkov
- Upgrade to Intel CPU and new TI

- VDC readout only for calibration point to reduce deadtime at high rate
- Question : if CDET not used can we use VETROCs for VDC ?

CDET (Peter Monaghan)

- VXS crate ordered
- VETROC in ordering process

- Start setting up with another crate

Network upgrade

- Hall Fiber upgrade
 - 12 fibers from 10 to 40 Gbit each

- Computer upgrade
 - Network upgrade to 10 gigE
 - More disks
 - Link to DAQ computer to 40 gigE

CODA3

- GRINCH, HCAL and GEM running CODA3
- Shower will switch after cosmics done
- Can start with LHRS now CREX is done

Conclusion

- Trigger rates higher because of π^0
- GEM firmware development and plan for VTP readout
- Hall network upgrade from 1 to 10 GBit
- Work for Gen RP with coincidence trigger
- Bigbite FADC readout being implemented
- CDET VETROC upgrade