

GMn experiment ERR DAQ

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Outline

- Experimental setup
- GEM readout
- Expected trigger rates
- Expected data rates
- Manpower
- Conclusion

Experimental setup GMn

- BigBite
 - Shower
 - Preshower
 - Scintillator
 - GRINCH

Detector	Channels	NINO	Readout	ADC	TDC
Shower	7x27 = 189 27 sums		Fastbus	X	
Preshower	2x27 = 54 2 sums		Fastbus	X	
Scintillator	200 x 2	X	VME	X	X
GRINCH	550	X	Fastbus/VME ?	?	X
GEM	5 planes		VME		

- Neutron detector
 - CDET
 - HCAL

Detector	Channels	NINO	Readout	ADC	TDC
HCAL	288	?	VME	X	X
CDET	2352	X	Fastbus		X

Expected trigger rates

Q ²	n+p QE xsec	L(per atom)	QE rate	Shower	Total	Total x4
GeV ²	fb	10 ³⁸ /cm ² /s design	Hz	Hz	Hz	Hz
3.5	6700	0.35	235	400	635	2540
4.5	1015	0.7	70	300	370	1480
5.7	97.9	1.4	13.5	200	213.5	854
8.1	47.4	1.4	6.6	200	206.6	826.4
10.2	31.6	0.7	1.5	100	101.5	406
12	5.04	1.4	0.7	100	100.7	402.8
13.5	6.25	1.4	0.87	200	200.87	803.48

Maximum trigger rate 2.5 KHz, assume max 5 KHz for low Q²
 Less than 2 KHz at high Q²

GEM occupancy and data rates

- Q2 = 13.5 GeV², with luminosity $2.8 \cdot 10^{38} \text{ A}^{-1} \text{ cm}^{-2} \text{ s}^{-1}$ (44uA on 10cm LD2 target)

Chamber	Rate per cm KHz	Rate detector MHz	Hit in 25 ns	strips	XY	3 samples	bytes	Rate MB/s
1	143	858	21.45	85.8	171.6	514.8	2059.2	10.296
2	156	936	23.4	93.6	187.2	561.6	2246.4	11.232
3	139	834	20.85	83.4	166.8	500.4	2001.6	10.008
4	131	786	19.65	78.6	157.2	471.6	1886.4	9.432
5	260	2496	62.4	249.6	499.2	1497.6	5990.4	29.952
							Total Max	70.92

Worse case scenario : typically 35 MB/s
Will be reduced further using deconvolution

GEM MPD readout

- SSP readout implemented in December
- 2.5 Gbit/s = link MPD to SSP
- Up to 32 SSP per MPD
- 30 KHz with 3 samples 100 MB/s for 3 APV25 (disk / network / VME backplane limit) expect around 10 KHz for 8 APV with 3 samples
- Ben implemented
 - 2 GB buffer on SSP
 - Working on deconvolution and zero suppression on SSP

GEM readout

- 5 planes
- MPD readout
- VME backplane readout
- 2 VME crates = 2 x 100 MB/s

- Max rate 70 MB/s

HCAL data rate

- 2 VME crates
- 18 FADCs
- 5 TDCs
- Estimated data max at 5 KHz at 100 % occupancy
 - FADC amplitude only : 3.6 MB/s
 - TDC : 6 MB/s
- 10 MB/s maximum

Fastbus configuration

- Fastbus crates
 - CDET + Bigbite weldments $3 \times 3 + 3 = 12$ Fastbus crates (on hand ready)
- 700 ADC channels = 11 ADCs (on hand)
- $2352 + 550 = 2900 = 31$ TDCs (on hand)
- 1 ADC per crate and 3 TDCs per crate
- 1440 bytes per event up to 14 KHz assuming 100 % occupancy and 1 hit per channel in TDC
- 7 MB/s per crate at 5 KHz
- 80 MB/s no suppression
- 10 MB/s or less with suppression

VME

- V1190 (available from Glasgow or use F1)
 - No LVDS adapter required
 - 400 channels = 4 modules
- FADC
 - 288 channels = 18 boards (on hand)
- F1
 - 288 channels = 5 boards (on hand)
- MPD : 5 planes = 20 MPDs (on hand)
- 1 VXS crate TS (on hand)
- 2 VXS crates for FADC, TDC (on hand)
- 2 VME64X for GEM (on hand)

- If all MPD readout through VME : MPD limiting because of SSP readout at 100 MB/s backplane speed
 - 6 MPD per crate about 50 Kbytes for 1 sample = 2 KHz at 100 % occupancy
 - 20 % occupancy reach 10 KHz with 1 sample
 - 6 % occupancy for 10 KHz with 3 samples
 - GMn occupancies around 1%

Infrastructure

- Network
 - 1 gigE from each ROC to router
 - 10 gigE to DAQ computer
 - 1 gigE to silo upgradable to 2x
- Disks
 - 5.5 TB x2 Raid 5 up to 250 MB/s
- Expected data rate : 90 MB/s

Manpower

- GEM readout (done)
 - Danning Di
 - Evaristo Cisbani
 - Paolo Musico
 - Alexandre Camsonne
- FADC readout (done)
 - Alexandre Camsonne
- Fastbus (done)
 - Robert Michaels
 - Mark Jones

Conclusion

- Trigger rate of 2.5 KHz expected
- Data rates at 5 KHz around 90 MB/s expects 40 MB/s
- Link to SILO sufficient but will be upgraded to 2x gigE or 10 gigE
- Well within network and electronics capability
- All systems ready since requirements lower than Gep (no HCAL trigger, no event switching , GEM occupancy low no SSP readout needed)