SoLID DAQ update

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SoLID collaboration meeting

Overview

- Document
- Updated trigger artes
- New FADC readout
- PVDIS deadtime
- Cerenkov readout
- TOF readout options
- Simulations needs
- L3 farm

Hardware

- FADC availables
- VXS crates and Intel CPU
- GTP borrowed
- VETROC available
- R&D need
  - Individual FADC reading
  - Trigger setup
  - Deadtime measurement for PVDIS
  - (High resolution TDC)

DAQ document summary

- Add parity specific requirements ?
  - Deadtime
  - Helicity
  - BPM/charge measurement
  - Pion trigger
- Address comment :
  - L3 farm performance and cost
- Integrate new FADC fast readout
- TOF electronics options
- New GEM chip option
- Tape price
- Network upgrade

- Give total price with dependencies and project price

- Steve Wood summarizing preCDR and develop in contact with electronics and DAQ group

PVDIS electron trigger

- Coincidence ECAL and Gas Cerenkov

Singles ECAL	290 KHz
Singles rates Cerenkov	1.9 MHz
Accidental 30 ns	16.5 KHz
DIS electron	10 KHz max
Total rate	**27 KHz**

Updated PVDIS electron trigger

- Coincidence ECAL and Gas Cerenkov

Singles ECAL	170 KHz
Singles rates Cerenkov	1.9 MHz
Accidental 30 ns	9.7 KHz
DIS electron	10 KHz max
Total rate	**20 KHz**

Calorimeter FADC readout

- New readout scheme through VTP
  - VME backplane 100 MB/s
  - VXS 16x500 MB/s

- Can transfer a full ADC (16 channels * 20 samples =1.3 KB) up to 390 KHz, transfer is not a bottle neck any more
- GEM is limiting factor

Deadtime measuremt

- Can deadtime affect PVDIS asymmetry ?

- Test stand Compton FADC
- Helicity gated scalers
- TI firmware modification
- Generate assymmetry same order of PVDIS
- Add random background
- Check asymmetry value
- Target date August

Cerenkov PMT readout

- MAROC3 close to what we need
  - 64 channels
  - Variable gain
  - Discriminated fast logic signal
  - Missing : analog sum of 8, need sum of 64

  8 sum of 8 available just need to sum them, will check with INFN for modified RICH board, requested 10 K$ preRD money
  - Radiation hardness is pretty good, need to be tested, possibility of new version to handle Single Event Upset
  - MAROC default option
  - MAROC testboard available

  - Will check design with electronics group for FADC analog output
- Possible readout schemes
  - FADC only (default)
  - FADC + VETROC
  - VETROC only : needs to be evaluated

  - Preferred : Add TDC readout for each Cerenkov channel 232 VETROC additionnal 700 K$, could improve Cerenkov trigger

  - Need simulation to evaluate options
  - Need to follow with electronics group to start testing (anyone from Cernkov group interested ?)

TOF options

- Expected timing resolution 80 to 50 ps
- Default readout
  - NINO + TDC : 20 ps timing resolution
- R&D MRPC : 20 ps
  - Sampling TDC ASICs : PSEC4/5, SAMPIC, DRS4 give 5 to 1 ps resolution
  - Need new chip DRS5 or PSEC5 to handle SoLID trigger rate (analog pipeline) (might develop for EIC)
- Depends on final detector choice

- Need to determine effect of photon background, might need sampling to deal with pile up

GEM readout

- SRS deployed in Hall B Prad
- MPD implemented in CODA
  - BLT testing few KHz
  - Optical fiber readout to be implemented for high rate test
- Preliminary results from Weizhi : one sample no deconvolution not sufficient
- High priority to one sample + on chip deconvolution (implemented in MPD) will test this summer

Pre RD hardware : detector test stand

FADC 250	4500	4	18000
VETROC	4500	2	9000
TD	3000	1	3000
CTP	7000	1	7000
SSP	5000	1	5000
TID	3000	1	3000
SD	2500	1	2500
FADC trigger Dist	4000	1	4000
VXS crate	15000	1	15000
VME CPU	4500	1	4500
Optical fiber	100	20	2000
Computer	3000	1	3000
MPD	4500	1	4500
Network router	10000	1	10000
Total			72500

Added additionnal 10 K$ for MAROC and 15 K$ for VMM3 : total 97 K$

Manpower

- JLAB :
  - Alexandre Camsonne
  - Robert Michaels (Compton development)
  - Steve Wood
  - Electronics group
  - DAQ group
- Stony Brook
  - Seamus Riordan
  - Krishna Kumar
  - Postdoc
  - Student
- UVA : Danning Di GEM readout (SBS / Tritium)

Simulations needs

- GEM occupancies and digitization SIDIS for event size, occupancy and tracking (Ole, Zhiwen, Weizhi Duke)

- Updated trigger rates PVDIS, SIDIS(Zhiwen, Rakitah)

- FADC digitization PVDIS : realistic PID (?)

- Cerenkov simulation only timing readout no FADC(?)

- Effect 1 sample vs 3 samples GEM (Weizhi) and 20 samples vs time integral SIDIS (?)

- Full FADC trigger simulation

- MRPC simulation : response to background

L3 farm

- Have digitized data for GEM for SIDIS and PVDIS

- Weizhi has tracking algorithm

- Need :

  - Other detector data

  - Additionnal reduction algorithm

  - Implement tracking

  - Test on Hall D or DAQ cluster

PreRD tasks

Ecal trigger	3
GEM performance	3
FADC performance	3
Deadtime for PVDIS	3
Data reduction algorithm implentation	6
L3 farm need evaluation	3
Cerenkov readout	3
Test stand - beam test	6
PVDIS trigger prototype	3
SIDIS trigger prototype	3

Beam test

- 11 GeV beam available
  - Test detectors :
    - GEM
    - Calorimeter
    - MRPC
    - Cerenkov
  - Background measurements
- Some hardware available :
  - FADCs, MAROC

Hardware

- Trigger test HCAL : 16 FADC + GTP
  - Trigger test completion in about 2 months

- GEM :
  - 5 MPDs
  - First iteration of CODA library
  - Implementation optical link readout (2 months)
  - SRS : PRAD this year

Timeline before next collaboration meeting and director review

- SBS projects
  - GTP/VTP calorimeter trigger test
  - GEM : preliminary performance

- DAQ document
- PVDIS deadtime systematic using Compton test stand, implement simulation if enough time
- L3 first implementation results

Conclusion

- Still need simulation data for
  - Reevaluate with new background
  - L3 Farm evaluation
  - Trigger rates and efficiencies
  - TOF background
  - Ocuppancies and event size
- MAROC default option for Cerenkov readout
- PreRD task to be done before directors review
- Start work on document update