SoLID DAQ

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Outline

- Calorimeter
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- Cerenkov trigger
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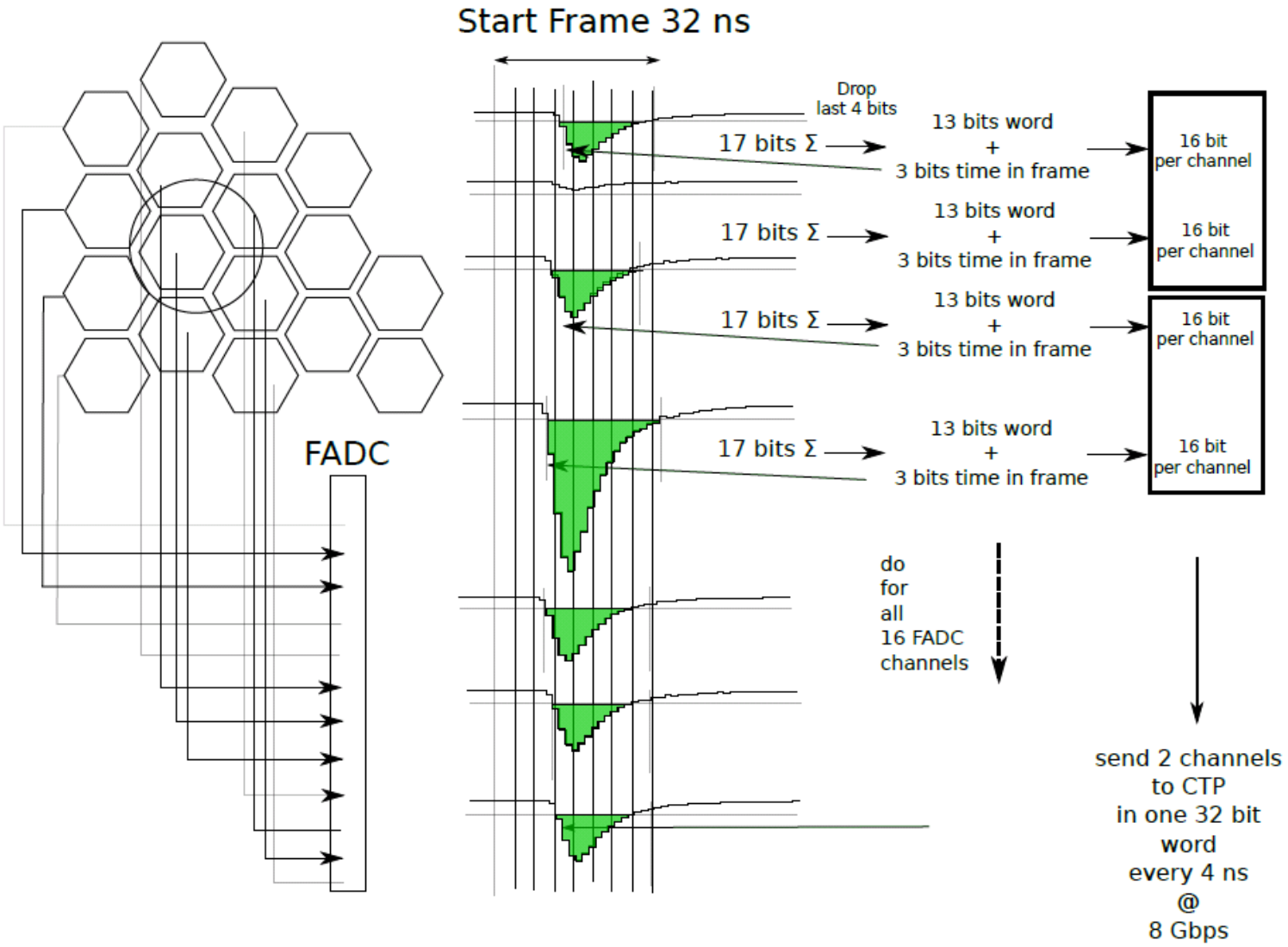
- PVDIS
  - Trigger and rates
  - GEM event size
- SIDIS update
  - Pion trigger
  - Event size
  - Readout mode
- L3 farm
  - Requirement
  - Hall D
- Updated cost and man power
- Conclusion

Calorimeter trigger

- HPS scheme



Calorimeter FADC readout

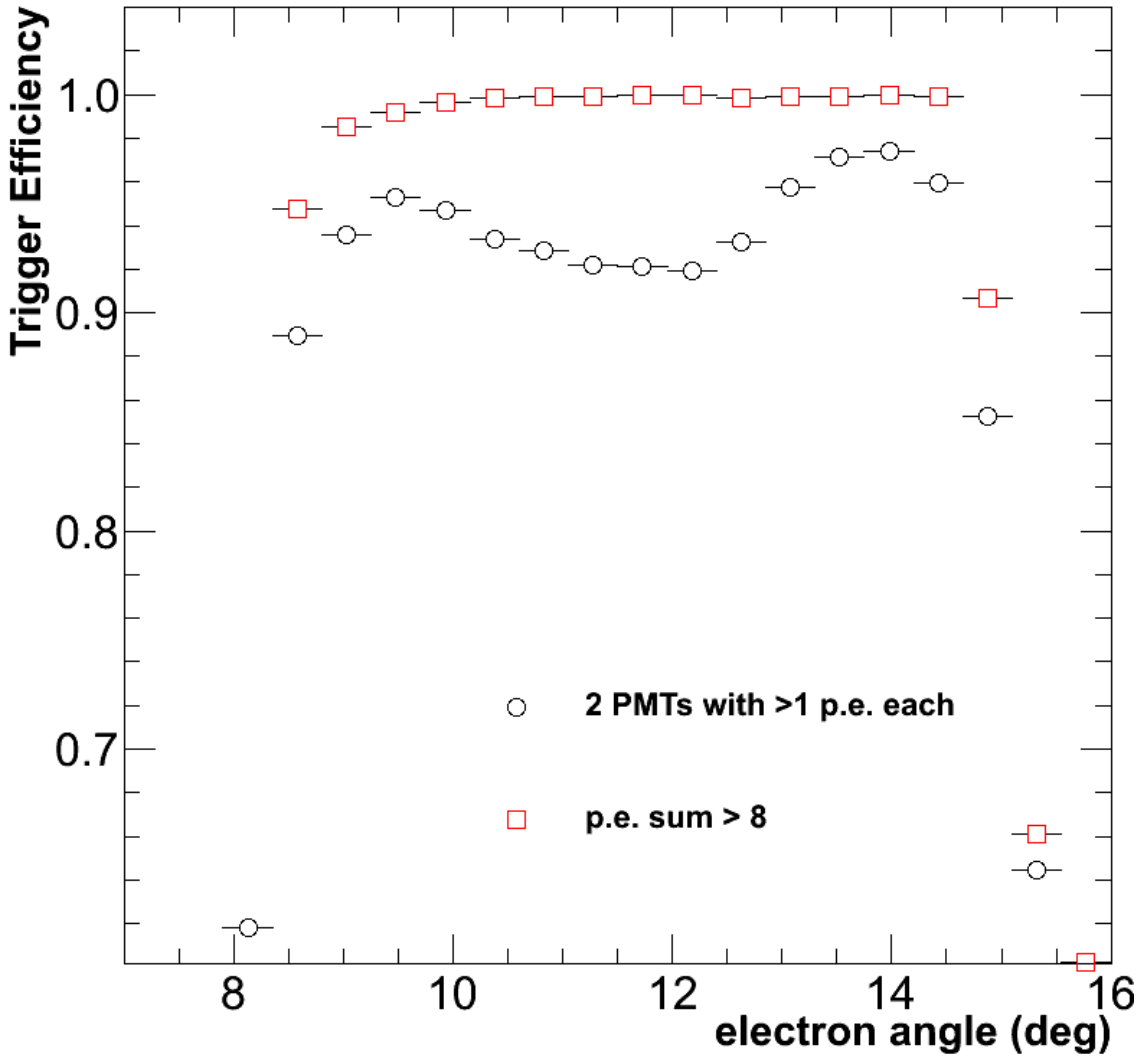
- Individual channel threshold sensitive to background and can reduce efficiency and resolution
- Solution : generate a 64 bit pattern to trigger the FADC of each crate and use trigger path to send to FADC
- Development of new firmware :

  add 1 FTE/year electronics group

Cerenkov trigger

- Coincidence between two PMTs at 2 pe
- Sum of 9 PMTs (better efficiency) might be noisier
- Send information of one sector to the two neighboring sectors to compute sum

Cerenkov trigger efficiency



Cerenkov rates

- Last simulation around 3 MHz

- Assuming 30 ns coincidence window :

60KHz*3MHz*30 ns = 5.4 KHz accidentals

- Need to evaluate efficiency at interface as function of phi

PVDIS trigger rates

- Coincidence cerenkov and Calorimeter
- 5 KHz physics rate ? + 6 KHz accidentals
- 11 KHz trigger rate per sector

GEM event occupancy and size

Sector	Rate	XY	Bytes
0	23	46	184
1	12	24	96
2	10	20	80
3	9	18	72
Total hits / sector	54		432
Data rate / sector	60000		25920000
Data rate (sector Mb/s)			25.92
Total detector	1620		777.6
Occupancy detector	0.011489362		

- Rates with deconvolution 1 sample readout
- Need to check it works well
- 800 MB 3 sample without deconvolution
- Only Geant4 pion background (do we need to add physics pions too ?)

PVDIS FADC event size

- Need full simulation with digitization
- Assume two clusters maximum, cerenkov fires all the time
- For 10 samples :

  event size = 12 + n * 4/2 with n number of channels

Detector	Nb fired	Size (bytes)	
Calorimeter	14	560	
Preshower	14	560	
Cerenkov	9	360	
Total		1480 bytes	

PVDIS data rates

- VME Backplane limitation : 100 MB/s
- Max rate : 65 KHz

- At 30 KHz :
  - 45 MB/s for FADC
  - 13 MB/s from GEM

  - 58 MB/s data rate

  - Total 30 sectors : 1740 MB/s need reduction by factor of 7 by L3

SIDIS event size

- Need to be updated
- Around 2.5 Kbytes
- 500 MB/s with 60 crates
- L3 reduction by factor of 2

SIDIS update

- Jin's study of background
  - Waveform not needed for calorimeter
  - Assume full waveform for scintillator
  - Pion trigger at MIP using clustering algorithm : has good efficiency : can use cluster readout, no issue with background
- Assume 1 sample GEM readout and only integral readout for calorimeter and evaluate feasibility single trigger (200 KHz)

Tape cost

- Current price DLO5 : 75 $ for 1.5 TB
- DLO 6 : 2.5 TB per tape

		Days	Data rate	Seconds	Total data TB	Double	DLO5 in $	DLO6 in $
E12-11-108	Pol proton	120	250	10368000	2592	5184	259200	155520
E12-12-006	J/Psi	60	250	5184000	1296	2592	129600	77760
E12-10-006	Transv. Pol. 3He	90	250	7776000	1944	3888	194400	116640
E12-11-007	Long. Pol. 3 He	35	250	3024000	756	1512	75600	45360
E12-10-007	PVDIS	169	250	14601600	3650.4	7300.8	365040	219024
	Total	474		40953600	10238.4	20476.8	1,023,840	614,304
Actual days	Actual years		Time in s			Per year	394,200	236,520
948	2.60	474	40953600					

Not major limiting factor

L3 Farm

- Hall D performance
  - 27 Hz with tracking (741 cores for 20 KHz)
  - 77 Hz without tracking (260 cores for 20 KHz)
  - For 7000 strip and 2800 calorimeter channels
- 128 cores server about 20 K$, price linear with rate

Rate (KHz)	CPU With tracking	Price sector	Total price	CPU No tracking	Price	Total price
10	500	80 K$	2.4 M$	130	20 K$	0.6 K$
30	1500	240 K$	7.2 M$	390	60 K$	1.8 M$

Can afford non tracking method need to check non tracking

L3 Farm

- Data reduction strategy
  - Region of interest
  - Pulse quality
  - Clustering
  - Tracking
- Need to evaluate algorithm speeds
- Seems can only do non tracking, need to evaluate if sufficient

Updated budget (to be checked)

- Same number of preshower as shower
- Added 60 additionnal FADC channel for SIDIS
- 2 crates : 1 for APV and 1 for FADC

- 3.1 M$, need to check new data rates

- 1.8 M$ L3 at 30 KHz 0.6 M$ at 10 KHz

Things needed for report

- Report
  - Occupancy in calorimeter
  - Efficiency of pion trigger
  - Finalize rates PVDIS
  - Generate trigger rates SIDIS
  - Finalize GEM occupancy
  - Define L3 algorithm and speed and cost
  - Finalize cost

Ideas questions

- Add more FADC channels to Cerenkov

- Go with SRS in proposal instead of VME (saves crates)

Things needed for review

- Finalize DAQ location and radiation studies
- Evaluate and test deadtime when transferring waveform
- Full simulation to evaluate effect of background
- Implementation of trigger at small scale to check latency and logic
- Test of L3 speed
- APV25 high rate test readout

Conclusion

- Progress on PVDIS trigger and readout
  - Only readout of cluster allows 60 KHz
  - Coincidence EC and Cerenkov gives only 6 KHz accidentals
- SIDIS
  - Pion trigger efficiency is good and can use cluster readout
- Need to evaluate effect of background with full simulation
- Need to evaluate L3 performance