Straw Man Run Plan

Running mode 1 – "Triggered"

- 5 Hz Trigger: Horiz counters 2 Hz + Vertical counters prescaled to 2 Hz + PD internal prescaled to 1 Hz
- Zero suppression in RCEs
- PD readout in "external+internal trig" mode, 5 us readout window

Data volume: (3.5+2) Mbytes/sec 500 V/cm or (5.3+3) Mbytes/sec for 250 V/cm – plenty of headroom

- TPC: 2048*10000*2*0.01 = 0.41 MBytes/trigger (=5 ms) – zero suppression factor of 1/100 assumed
- PD: 625*71*2 = 0.090 MBytes/flash, (0.35+0.20) MBytes/trigger (0.20 from radiologicals) for 5 us readout window
- PTB: 1 MB/sec = 0.5 kB/trigger OR 0.2 MB/trigger if cont readout.
- Red highlights data that could be discarded in the event builder, requires lots of coding and testing to implement
- Total of (0.76+0.40) Mbytes/trigger at 500 V/cm

Running mode 2 – “Untriggered”

- Zero suppression in the RCEs, extreme if necessary
- PD readout headers only

Data volume: 84 Mbytes/sec

- TPC: 2048 channels*2 MHz*2 bytes/sample*0.01 = 82 Mbytes/sec – zero suppression factor of 1/100 assumed
- PD: (70+40) Mbytes/s (16 from radiologicals) for 5us readout window and waveform readout
- Option: PD – headers only readout – negligble?
- PTB: <1 Mbyte/sec
- Red highlights data that could be discarded in the event builder

BOTTOM LINE: We need a factor of two in the disk write speed everywhere in the chain to run untriggered!!!

Ongoing

Pedestal runs: 1 event, 0.33 sec duration, RCEs only, feed data to online mon for ped mean and width calculation. Plots to evaluate goodness of values appear.

Regular calibration runs: need to develop DAQ infrastructure and shifter instructions

- FEMB (charge injection / gain) – weekly?
- Noise runs (HV off)
- PDs (flasher) – weekly?

Cooldown requests:

- Noise and FEMB calib runs every 15-20 minutes

Commissioning (January)

Check of pedestal mean and rms algorithm with signals (HV on and HV off) – 2 hours
Zero suppression (rest of studies on this page can be done without ZS)

- Intact data for first guess at ZS params
- turn on ZS and measure reduction factor for different tunings

TPC wire plane bias scans for transparency ~4 hours

- event display
- tracks close to wire planes identified with a pair of counters (1-2 tracks/min)

Counter/TPC/PD timing with APA crossing tracks.

- N-S counters at ~1 Hz.

Scan of FE ASIC parameters (gain and shaping)

- use counters to get tracks close to wire planes, 1-2 tracks/minute,
- need only 10 tracks per setting?

PD with full window length/ firmware hit finder evaluation

- Horiz counters? ~ 1 Hz.
- Required purity?
- Iterates as hit finder in firmware is improved?

DAQ studies while purity is poor, between commissioning and running!

- Try running in continuous mode

Outline of Run Plan (February)

- 1 week of horiz triggered muons for bread and butter at 250 V/cm
- 1-2 weeks for charge/light yield vs field (drift field scan)
- 1 week of “gobs of data”, continuous readout, at 500 V/cm
- 1 week of high quality data with good purity to repeat bread and butter at 500 V/cm plus diffusion measurement (drift field scan)

Running week 1 . . .

Low purity, 250 V/cm. “triggered mode”

Data size: 0.9 MBytes/trigger (5 Mbytes/s) assuming

- no radiologicals in PD data, (weeding efficiency 100%)**
- PD data only with RCE data,
- PD readout window = 2 us,
- ZS factor of 100
- PTB data only with RCE data** (if ** don’t happen, factor of 1.3 in file sizes)

Measurements:

- APA crossers (ongoing)
- Gap studies and deflector voltage scan (dedicated)
- Purity (ongoing)
- “S” part of S/N, ASIC parameters scan (dedicated)

Put dedicated DAQ studies here while purity improves (add an extra week??)

Also, boundary between commissioning and the above is fuzzy.

Running week 2

Charge/light yield vs voltage (includes S/N data)

- 12-24 hours of data at each voltage
- “triggered” running mode

Drift field (V/cm)	Drift vel (m/ms)	Drift window (us)	Drift window (ticks)	Microslice Pre+trig +post
250	~1.05	2.143	4350	5+1+9=15
300	~1.20		3800	4+1+8=13
350	1.305	1.724	3500	4+1+8=13
400	1.402	1.605	3300	4+1+7=12
450	1.488	1.512	3100	4+1+7=12
500	1.566	1.437	2950	3+1+6=10

Running week 3

Untriggered, continuous acquisition at 500 V/cm for

- Pi zeros
- Protons
- Stopped muons
- ??

Note that 2 hours of continuous data (200 Hz) becomes 20 days of triggered data at 2 Hz.

Not a typo! – the inability to stitch due to gaps means that there is only one usable event per millislice

Running week 4

Diffusion measurement requires good purity

- 2 days at 3 field values 300, 400, 500 V/cm
- “triggered” running mode
- Other measurements will also use this data

- Field distortion measurements accumulate statistics (J. Klein)

Data size considerations

500 V/cm, PD window 2 us, PD threshold rejects all noise and radiologicals, PD reads out only for “trigger”

- TPC: 2048*10000*2 = 41 MBytes/trigger (=5 ms)
- PD: 250*71*2 = 0.036 MBytes/flash, 0.14 MBytes/trigger

250 V/cm

- TPC: 62 MBytes/trigger (trigger = 7.5 ms)
- PD: 0.18 MBytes/trigger

To note: (1 trigger = 5 ms)

- If ZS gets us a factor of 100 for the TPC data, then we have 0.4 Mbytes/trigger and continuous readout is 80 MBytes/s for the TPC.
- PTB is another 1 Mbyte/s and PD is 28 Mbytes/sec.
- Ethernet link from PC4 to the outside world is only 1Gbit/sec = 125 MBytes/s. Disk write speed is limited to 50 MBytes/s?

Solutions?

- Force ZS factor of 200 and reduce sampling frequency of PDs by a factor of 4 . . .. . . 40+7+1 = 48 MBytes/s
- Employ file compression (factor of 2??)
- Double disk bandwidth and “catch up” data transfer during owl shifts (125 Mb/s = 0.5 TB/hour)