ePIC Collaboration Meeting 2026

Luminosity Systems:
Pair Spec Readout Requirements

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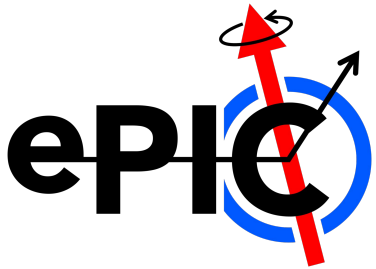


Lumi Pair Spec Readout Requirements: Part 1

- 1. What is the capacitance of the detector per channel? (pF)
  - Unknown - (SiPM capacitance 500 pF)
- 2. What is the lowest signal measurement required? (fC)
  - Unknown
- 3. What is the highest signal measurement required? (fC)
  - Unknown
- 4. Do you have a measurement with certain settings of MIP peak, other fixed signal? (With the H2GCROC and settings)
  - No
- 5. What is the charge resolution requirements? (Percentage as a function of charge, not in bits)
  - Unknown - Aiming for ~10%/√E energy res
- 6. What is your timing requirements/measurements?
  - ~ns-10ns - Need to resolve individual beam bunches
- 7. What is the expected occupancy per channel from simulation? (Including full background)
  - For pair spec, don't expect >1 event per crossing in any beam energy combination
  - See answer to Q8
- Note - In process of finalising SiPM and readout boards in preparation for testing, but UK funding situation has not helped here

SiPMs: S14160-3050HS

Lumi Pair Spec Readout Requirements: Part 2

- 8. What is the maximum hit rate per channels needed if all channels are activated at the same time?
  - From a single event (e+e- pair), each cal might see ~50% of SiPMs produce a signal at most
- 9. What is the expected dark noise rate?
  - Unknown
- 10. What is the maximum hit rate required for a single channel? (If only one receives signal)
  - Highest rate config in calorimeters is ~0.1 e+e- pair events per bunch crossing
  - Singles rate may be slightly higher, no more than ~1 per bunch crossing
- 11. What is the double pulse separation needed? Overlap signals from two independent bunch crossings? (This affects small or large signals differently in your detector?)
  - Need to be able to resolve individual bunch crossings
- 12. How many number of samples you require as minimum (max is 7 now in CALOROC)?
  - Unknown
- 13. What is the preference for A or B for CALOROC?
  - Need further clarity on our SiPM/Readout boards before commenting

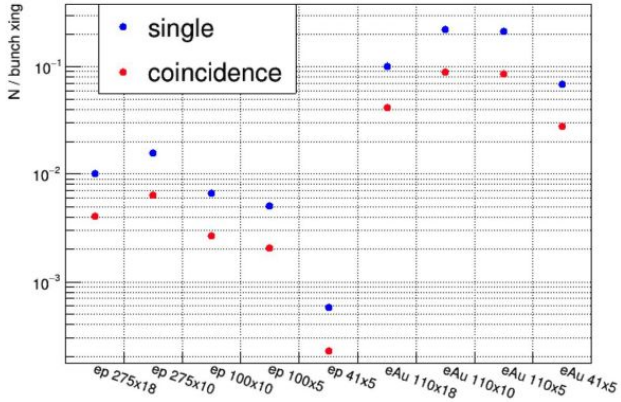
Some extra info from Stephen's slides on cooling requirements is included in the following slides if more info is needed

Note that each calorimeter has ~1680 SiPMs 28 per module, 3 modules per layer, 20 layers per calorimeter

Pair Spectrometer - Expected Rates

- Expected signal rates using nominal $\mathcal{L}$, accounting for -

- Conversion in 1 cm
- Conversion in 37 m air
- Conversion in 1 cm Al vacuum chamber entrance
- All conversions before foil are swept away
- 1 mm Al conversion foil, 1%, detected in pair spec
  - At most, $\sim$ 0.2 electrons per bunch crossing on average



Pair Spectrometer - Heat Generation

- Heat from readout electronics for calorimeters and tracker
- For calorimeters, assume heat production similar to boards/SiPMs from FECal
  - Front-End Boards (FEB) - One per layer, 4.5 W per board, 40 layers total
    - $40 \times 4.5\ \text{W} = 180\ \text{W}$
  - SiPM Boards - One per module, 3 modules per layer, 120 layers total, 0.2975 W per board
    - $120 \times 0.2975\ \text{W} = 35.7\ \text{W}$
  - Total heat from calorimeter electronics -
    - **215.7 W** per calorimeter