

# Full EMC Raw Data for a Level II Trigger

*(some thoughts)*

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## The Actors:

- Barrel Towers
- Barrel SMD
- Endcap Towers & misc pre- post- Shower Detectors
- Endcap SMD

## The Stage:

- Level II implemented in a fast Linux machine
- **Level II directly connected to “DAQ” via Myrinet (fast!)**
- Existing EMC DAQ system in the DAQ Room.

## “Raw Data”:

- All the data from the various EMCs that DAQ knows about.
- Could be gain corrected & pedestal subtracted as well...

## The Plot:

- **As soon as the data arrives into the DAQ crates it is shipped directly to a Level II CPU over the fast network. The data could be gain corrected and pedestal subtracted either while still in the DAQ system or by the Level II node. The DAQ-EMC crates and their CPUs become VME-to-Myrinet-to-Level2 bridges.**

## The “Miracle”:

- **All the hardware exists and nothing has to move or be added!**

## Some small changes though...

- **The misc. Tower Data Collectors should be reprogrammed not to wait for a “Level 2 Accept” but to send their data immediately.** [Willie Hunt’s TDC has that option already. Barrel SMD needs a modification.]
- **“Trigger” should take care not to ABORT them if their data is used in the ABORT decision.**

### Barrel Towers

- 1 fiber with ~5000 data strobes @ 30 MHz (1 channel per strobe)
- 1 X ~10 kB of raw data
- Time to ship an event to L2:
  - 200 us transfer + 300 us to L2 (no data corrections in DAQ)
  - **0.5 ms total == 2000 evts/sec**

### Barrel SMD

- 8 fiber with ~2500 data strobes @ 30 MHz (2 channels per strobe)
- 8 X ~10 kB of raw data
- Time to ship an event to L2:
  - 100 us transfer + 8 X 300 us to L2 (with data correction in DAQ)
  - **2.5 ms total == 400 evts/sec**

### Endcap Towers & pre- post-showers

- 1 fiber with ~5000 data strobes @ 30 MHz (1 channel per strobe)
- 1 X ~10 kB of raw data
- Time:
  - 200 us transfer + 300 us to L2
  - **0.5 ms total == 2000 evts/sec**

### Endcap SMD

- 1 fiber with ~5000 data strobes @ 30 MHz (1 channel per strobe)
- 1 X ~10 kB of raw data
- Time:
  - 200 us transfer + 300 us to L2
  - **0.5 ms total == 2000 evts/sec**

## Conclusion

- The data rates shown can be achieved right now without any additional hardware – just some reasonably small amount of software work.
- The rates are good enough (IMHO) for the proof of principle as well as some first physics results (if a good Level II decision can be made with the EMC raw data only...).
- The main bottleneck is the VME bandwidth ( $\sim 40 - 50$  MB/s) so to achieve higher rates one would have to redesign the DAQ Receiver Boards for another bus (i.e. PCI) or rearrange the boards so that one fiber exists in only one crate (costly but easy!).
- As a side remark, the raw data from the EMCs becomes a part of the “Trigger Detectors” set (same as i.e. the raw CTB, BBC & ZDC data) and is finally passed to storage via the standard Trigger->DAQ data path upon a “L2 Accept” issued by Trigger.