ePIC Electronics and DAQ WG Meeting

1. EICROC / HGCROC versions and specs
2. Data Rates
3. Trying to make progress defining readout chains and RDO versions

EICROC and HGCROCs

The EICROC and HGCROCs have been the focus of the last 2 TIC meetings

These ASICS share a lot of characteristics including

- Operation modes
  - Data is readout with: 10 bit ADC, 10 bit TOA, 12 bit TOT
  - Both have to make changes to use the 98.5MHz EIC clock
  - Both will stay with the internal 40ns digitization clock
  - Both need to be modified to work in the triggerless mode

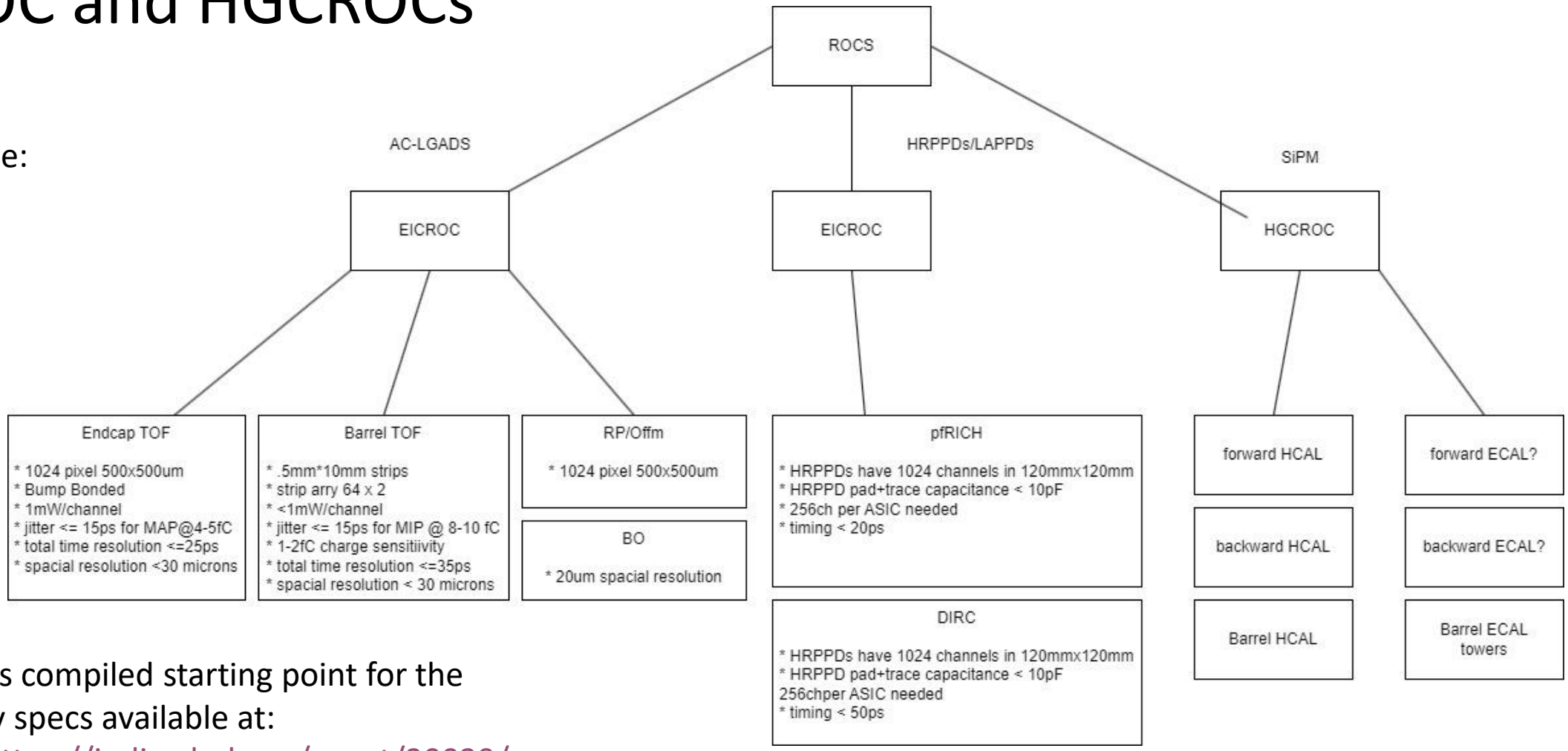
- One of the things that became extremely clear though is that the ASICs will have more than just 2 flavors
  - Different form factors / channel counts and configurations / mechanical connections
  - Different requirements as to timing resolution
  - Different requirements for power consumption, cooling
  - Different form factors (2-d pixel readout and 1-d channel readout)
  - Different analog parameters for capacitance, gain, shaping etc.
  - Calorimeters / AC_LGADS / HRPPDs might operate differently (1 bunch readout using just TOA/TOT, vs multi time sequences making use of ADC and TOA/TOT

- We need to be clear on:
  - How many versions are there
  - What are the specifications of each are
  - Who is implementing them all,
  - And we also need to have a clear way of specifying which one we are talking about… version names or ASIC names.

- Fernando with/and/or Norbert were given the task collecting the specifications for each detector

EICROC and HGCROCs

For example:



Norbert has compiled starting point for the calorimetry specs available at:

https://indico.bnl.gov/event/20029/

End of July: define the SiPM requirements (first two pages)

End of August: define the ASIC requirements (shaper, peaking time, dynamic ranges, #bits etc)

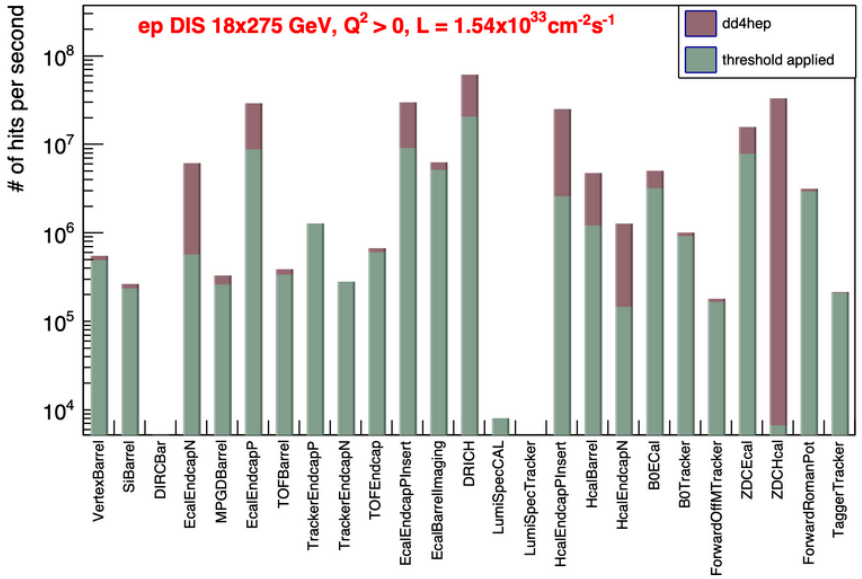
Sept - Dec: Discussions with omega about modifications to HGCROC

Data Volumes

Have hit rates from background group:

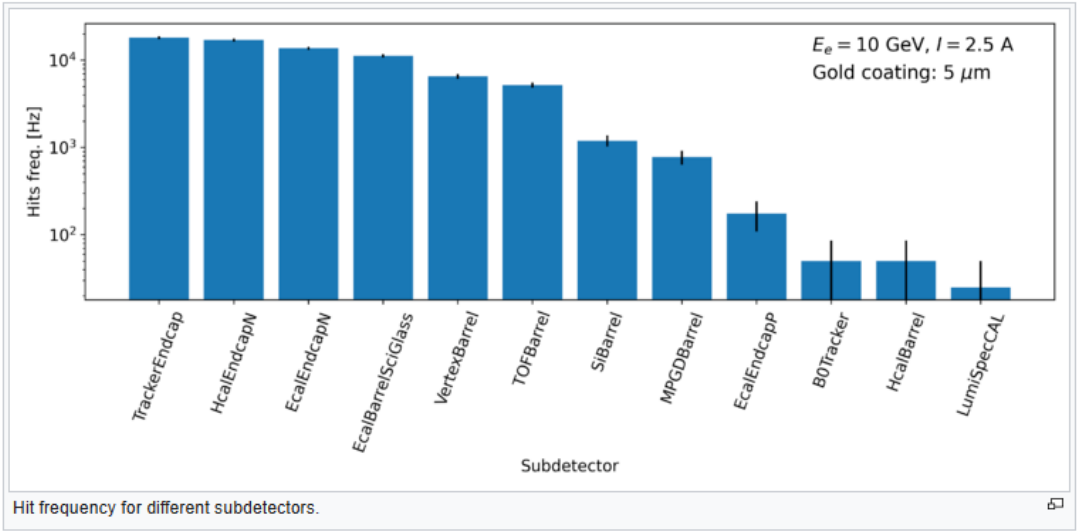
DIS @ 18x275 (83kHz)

Scaled to 500kHz and assumed kinematics “same” for 10x275



Synchrotron Radiation

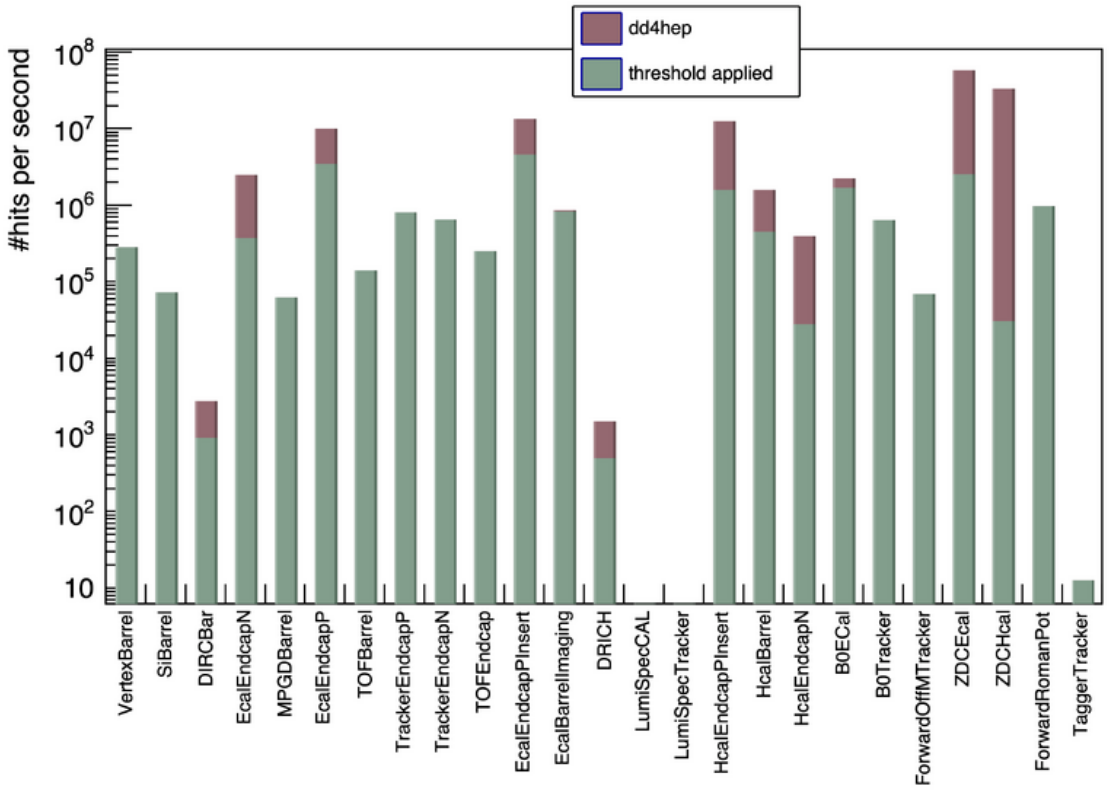
- These are hits by particles converted from the synchrotron Radiation
- Radiation induced outgassing incorporated in vacuum profile
- 10GeV / current 2.5A which is worse case

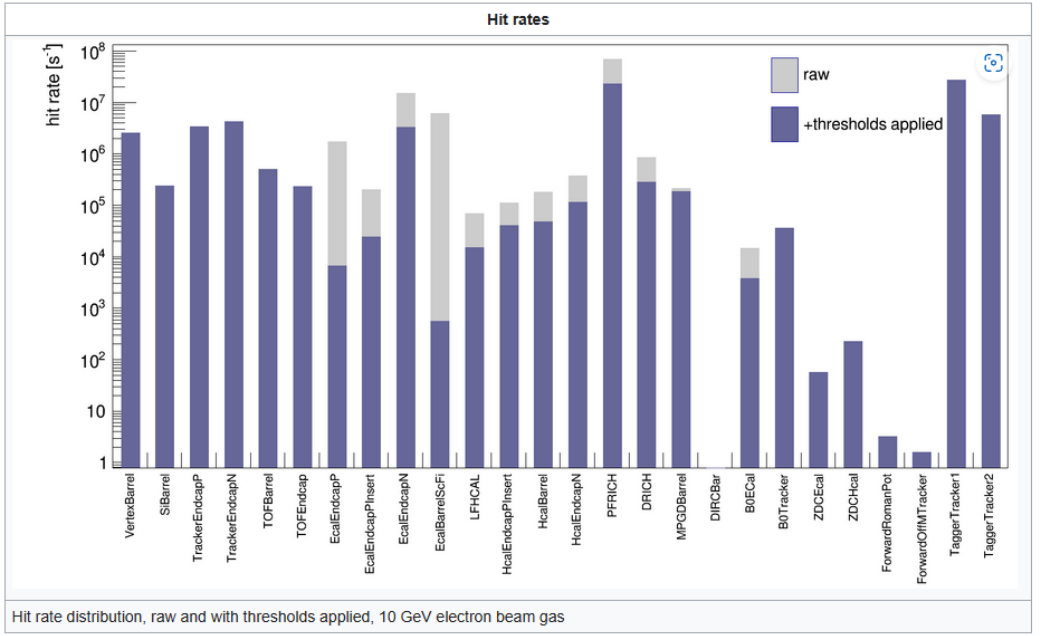


Hit frequency for different subdetectors.

Data Volumes

Electron Beam Gas
- 10GeV Electrons





Hit rate distribution, raw and with thresholds applied, 10 GeV electron beam gas

Hadron Beam Gas
- 275GeV x 10GeV
- Vacuum at 100 Ahr

Data Volumes

Method:

1. For background/beam:
   - Assume #bits per pixel or channel hit (64 bits)
   - Assume “charge sharing” of N adjoining Pixels/Channels
   - Assume “time sharing” of N strobes for a hit
   - Throughput = hits * #bits * chargeShare * timesharing
2. I assume 2 forms of data size reduction
   - Cluster finding (reducing chargeShare and timeShare to single hit (in principle clustersize can be different but set to 64 bits as well)
   - Software Triggering for dRICH & FB lumi only
3. Some detectors had no simulation, so I assumed a rate based upon similar detectors

4. For noise estimates I compiled rates from the digitization spreadsheet &/or DAQ meeting presentations
5. I assumed noise estimates were single pixel and uncorrelated so
   - Throughput = hits * #bits
6. I assumed detectors with charge/time sharing would reduce the hit noise by 1e5. In all cases this made the noise rate after cluster finding (if applicable) negligible.

7. I Tabulated contributions from beam/background/noise before and after data reduction

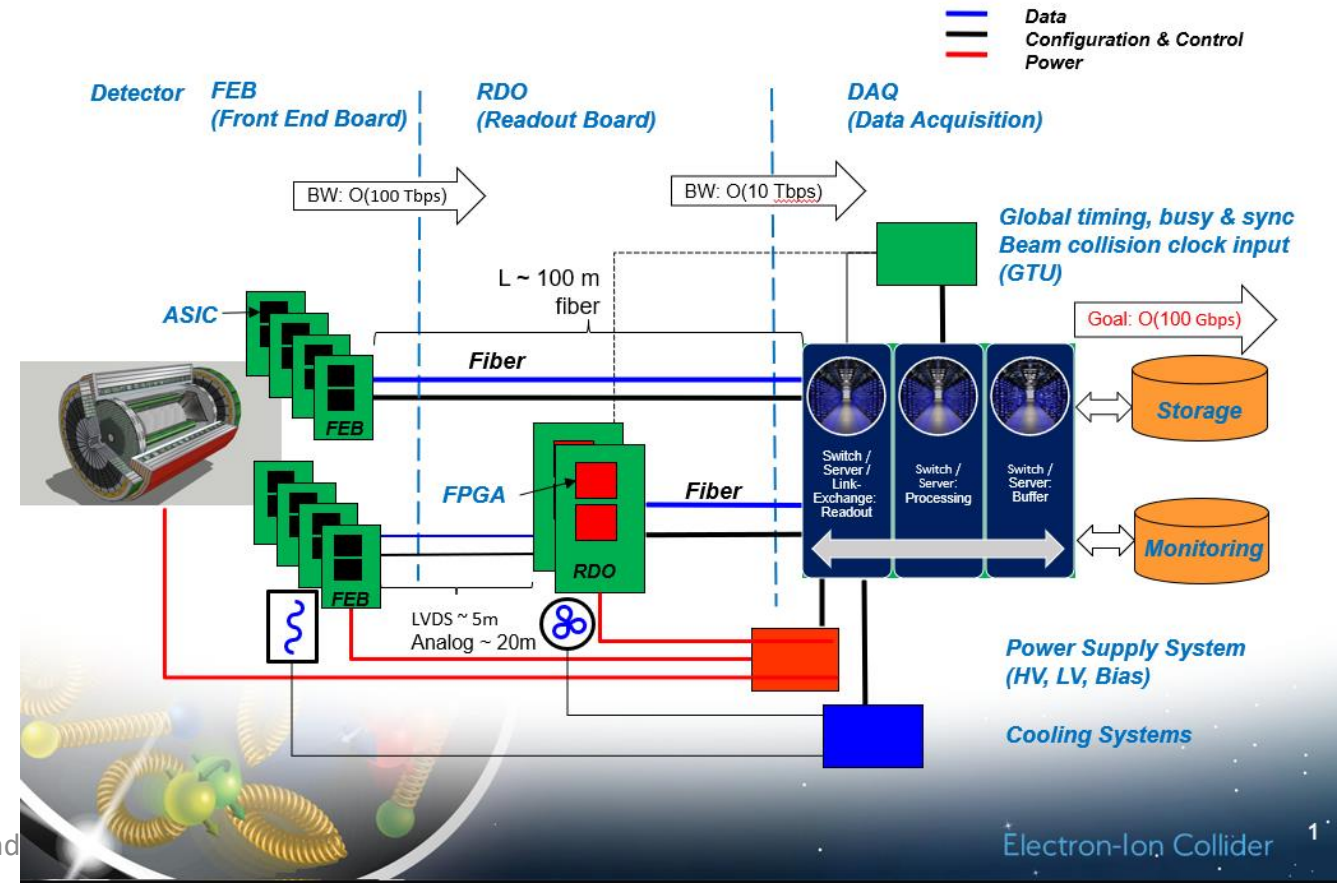
Detector | FEB | RDO | DAM | Readout Computer

Rate through DAQ =99Gb/sec
35% is noise

“ Fake” Black event rate=1760Pb/sec
27.5-1760 Pb/sec

Rate through RDO=3.3Tb/sec

Summary



RDO

- Need to make progress on RDO placement
- Placeholder for RDOs
  - Mechanical groups need to have a board envelope to place
  - Electrical groups need to have a board envelope as a goal