CyMBaL tracker for Athena@EIC: Some frontend features

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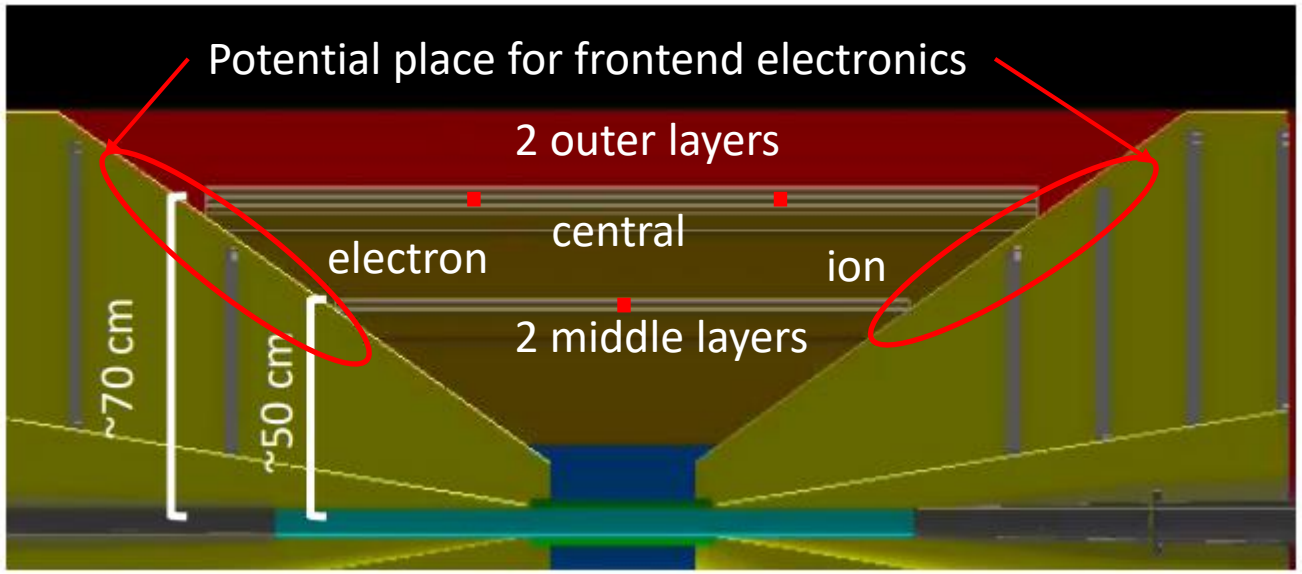
A reminder: CyMBaL (CYlindrical Micromegas BArrel Layers) tracker for Athena@EIC

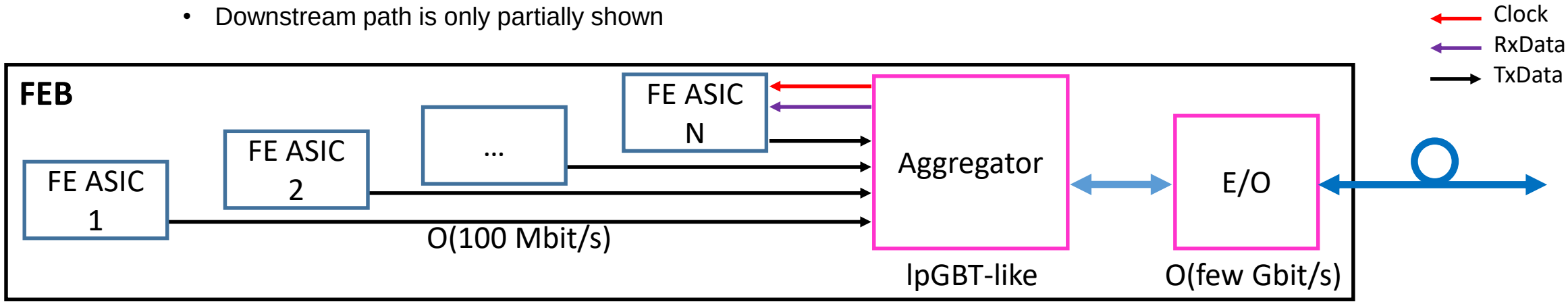
- 4 layers
  - → 2 middle and 2 outer
  - → 2D strip readout
    - Z + C strips per layer
  - → Middle layers built in 2 modules along Z (beam) axis: electron side and ion side
  - → Outer layers built in 3 modules along Z (beam) axis: electron side, central and ion side
    - On-going study on how to connect central modules to electronics (flex cables?)
- Number of channels
  - → 1.45 mm pitch: 66 000 strips
    - 28K Z-strips & 39K C-strips
    - Assume as a baseline
      - May vary though
- Environment
  - → Scarce space for electronics
    - Can nevertheless be placed on both sides
  - → Magnetic field
  - → Material budget restrictions
    - Impact on cooling
  - → Radiation?



See our presentation on Sep 30, 2021 for more details

A simplified sketch of CyMBaL tracker frontend

- LHC-like frontend organization?
  - → A bi-directional link for clock, synchronization (run control), data, slow control
  - → Assumes existence of lpGBT-like aggregator ASIC or requires a new development
    - Point to point connections between frontend ASICs and an aggregator ASIC
      - Downstream path is only partially shown

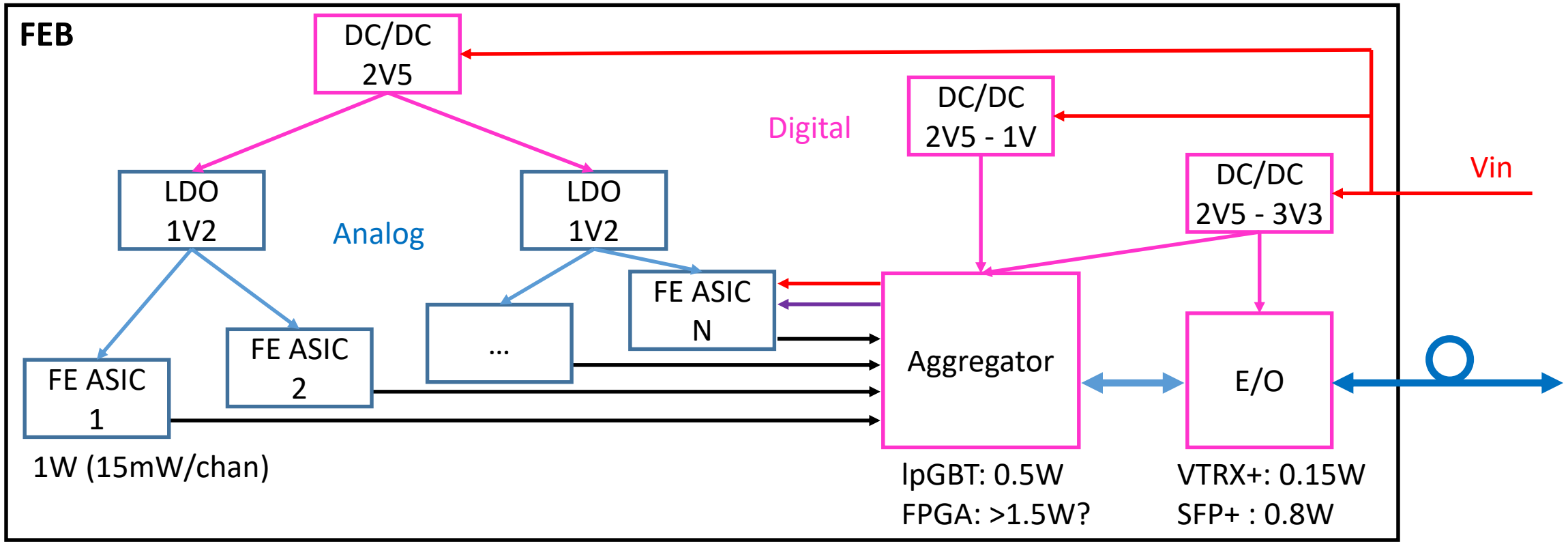


It is not clear if there will be a central (Athena, EIC) group responsible for aggregation / frontend link

- In general: is the LHC-like frontend organization acted for Athena?
  - → Single link encoding clock, synchronization, data and slow control
  - → Separate clock, data and slow control networks

Frontend power distribution

- 3 T magnetic field requires efficient power regulation
  → High efficiency DC/DC converter for digital power
  → LDO regulators for analog circuitry

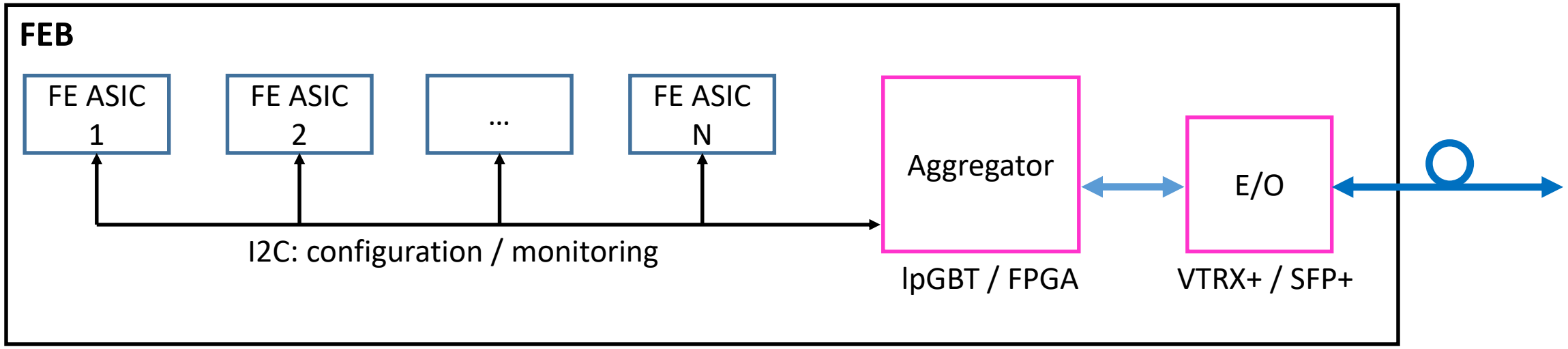


Common effort for magnetic field (and low radiation) tolerant power supply components?

- In general: will there be a common effort to uniformed power distribution and cooling scheme
  → Serial vs. parallel
  → CO2 / liquid / airflow

Frontend run control

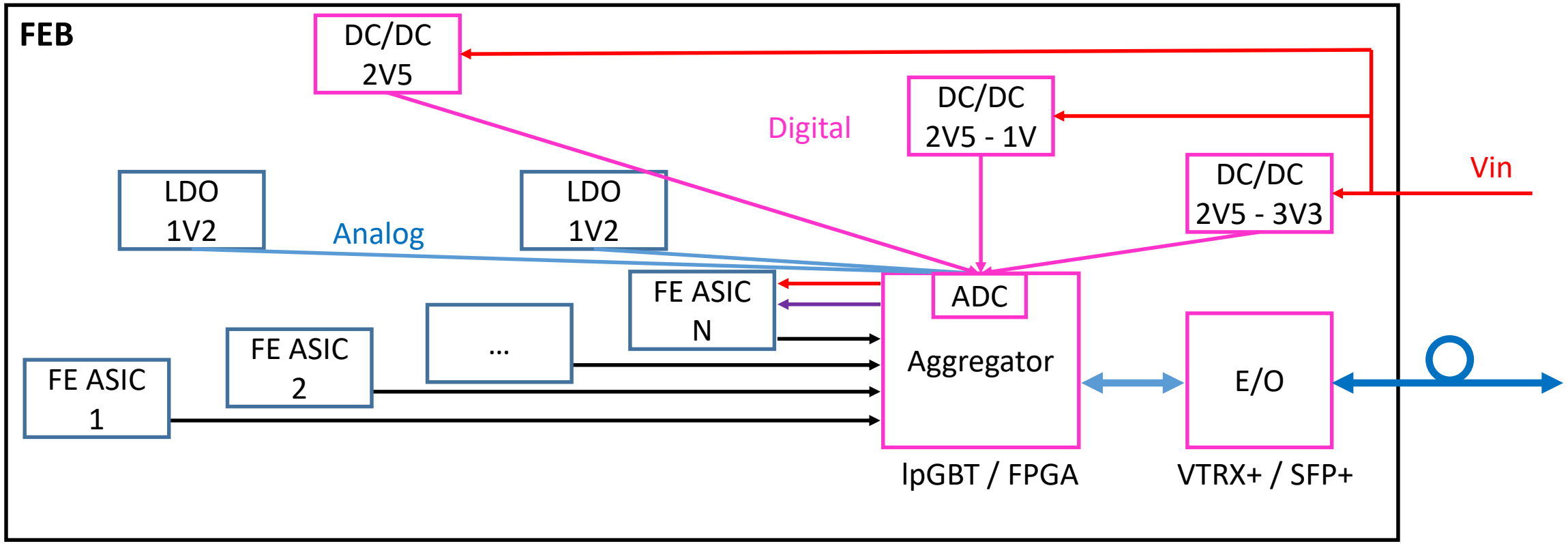
- LHC-like frontend organization?
  - → A bi-directional frontend / backend link conveys I2C protocol
  - → There is a companion GBT-SCA chip if several I2C chains are needed for large number of frontend ASICs



- Should an alternative slow control pass be considered
  - → Extra resources
  - → Robust to data link failure?
  - → Possibility to understand failures?
  - → Possibility to restart frontend without power-cycling?

Frontend slow control monitoring

- LHC-like frontend organization?
  → Embedded ADC to monitor on board generated voltages, current, temperature



- An alternative of some kind field-bus and on-board micro-controller?
  → Possibility to detect corruption due to radiation and reboot frontend (firmware)

Summary

- Several other obvious functionalities to be implemented on frontend in addition to read-out

- Design can benefit from unified approach
  - → Common FE-BE link
  - → FE aggregation – design of a common aggregator unit
  - → Precision clock distribution
  - → Magnetic field and radiation compatible components