

#### Uli / Mainz

## **fFEX** Status

- Current baseline:
  - four ATCA modules, Xilinx based
  - 2 processor FPGAs each : XCVU13P-L2FLGA2577E
  - Each FPGA covering a phi quadrant, full eta, one detector end
  - 25Gb/s links, ~65 per FPGA (depends on fill factor)
- capturing requirements for Lar/fFEX interface (somewhat belatedly wrt. schedule)
- Mapping requirements discussed earlier this week (backup slide)
- Find a suitable Lar/fFEX protocol  $\rightarrow$

# fFEX input protocol requirements

Sliding window algorithms operate synchronously to LHC bunch clock

- $\rightarrow$  synchronize huge number of input links to common clock
- → Near-fixed & low latency link / protocol required
- $\rightarrow$  Keep resource use low
- Xilinx MGT block providing **synchronous gearbox**
- Fixed pattern of payload/gaps
- Seems to provide near fixed latency at 40.08 MHz bunch clock
  - If line rate is chosen appropriately
- Any algorithms directly supplied at higher clock multiple might need buffering in terms of sub-ticks
  - On fFEX, parts of the synchronizer might need to be replicated in super logic regions (4 per FPGA)

Not sure what would need to be done on Intel FPGAs to achieve compatibility / near fixed latency at source

### conclusion

- Looking into suitable fFEX input protocol with
  - near-fixed and low latency
  - Resource efficient synchronizer required
- Prefer common protocol with Global
- Though: might possibly need to come up with modifications

#### BACKUP

# fFEX mapping requirements

- Sliding window algorithms with jet environment .8 in phi (and eta)
- Phi quadrant mapping
- fFEX FPGAs covering a core of pi/2 x full eta range per detector side
- Requiring environment of pi/4 each side shared with neighbour → 100 % link duplication upstream
- Opto fibre bundles at fFEX front panel: 2\*12-way ribbon on 24-way MTP (probably)
- $\rightarrow$  Do not mix data from any octants on same fibre !!!
- $\rightarrow$  Avoid mixing octant data in same 12-way ribbon if ever possible
- $\rightarrow$  Try to also keep octants apart at 24-way MTP level ideally
- Expect to cover two quadrants per module.
- Limited re-ordering on-module might be possible.
- Re-ordering between modules will require external unit (fFOX)
- Symmetry for mapping of +/- eta ? Reflective ? Rotation ? Linear ?