

CMS Forward Pixel Electronics

- Pixel Front-End Issues:
 - Digital Control Chain
 - ✓ Gate Keeper and LCDS Driver chips
 - ✓ Tracker CCU + Tracker FEC
 - ✓ Custom Pixel FEC
 - Analog Readout Chain
 - ✓ Analog Level Translator (ALT)
 - Front-End Block Diagram
 - ✓ Gate Keeper chip changes
 - ✓ New Fan-In/Fan-Out chip features
- Conclusion

Digital Control chain

- Current PSI proposal for barrel:
 - Convert standard LVDS signals to LCDS (PSI terminology) to transmit via Kapton flat cable with less crosstalk
 - Buffer and distribute LCDS signals on the End Flange board to barrel modules
 - Use serial OR chain to send TBM's response to the FEC

Gate Keeper and LCDS Driver

- Both have to be designed a new
- LCDS Driver introduces variable delay to the SDA signal sent back to the FEC
- Multiple LCDS Driver inputs connected to one differential pair cannot be properly terminated
- Barrel needs individual delay adjustment for each module using LCDS Driver delays

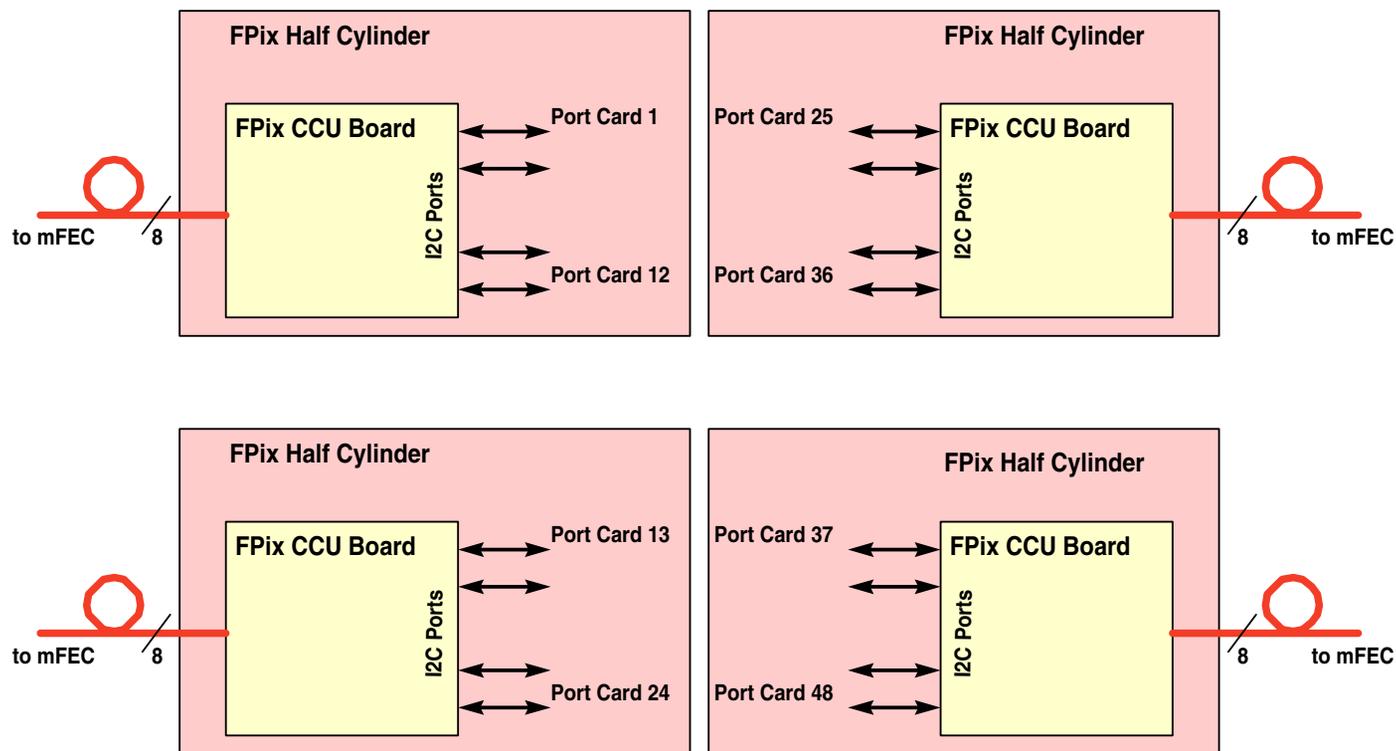
Tracker CCU + Tracker FEC

- PSI proposal:
 - Use standard Tracker FEC and CCU chips to provide I2C interface to DOH, AOH, TPLL and DCU
 - Additional optical links are needed for CCUs
 - Additional boards are needed to mount CCUs
 - Additional twisted pair connections are needed to connect I2C devices to CCUs

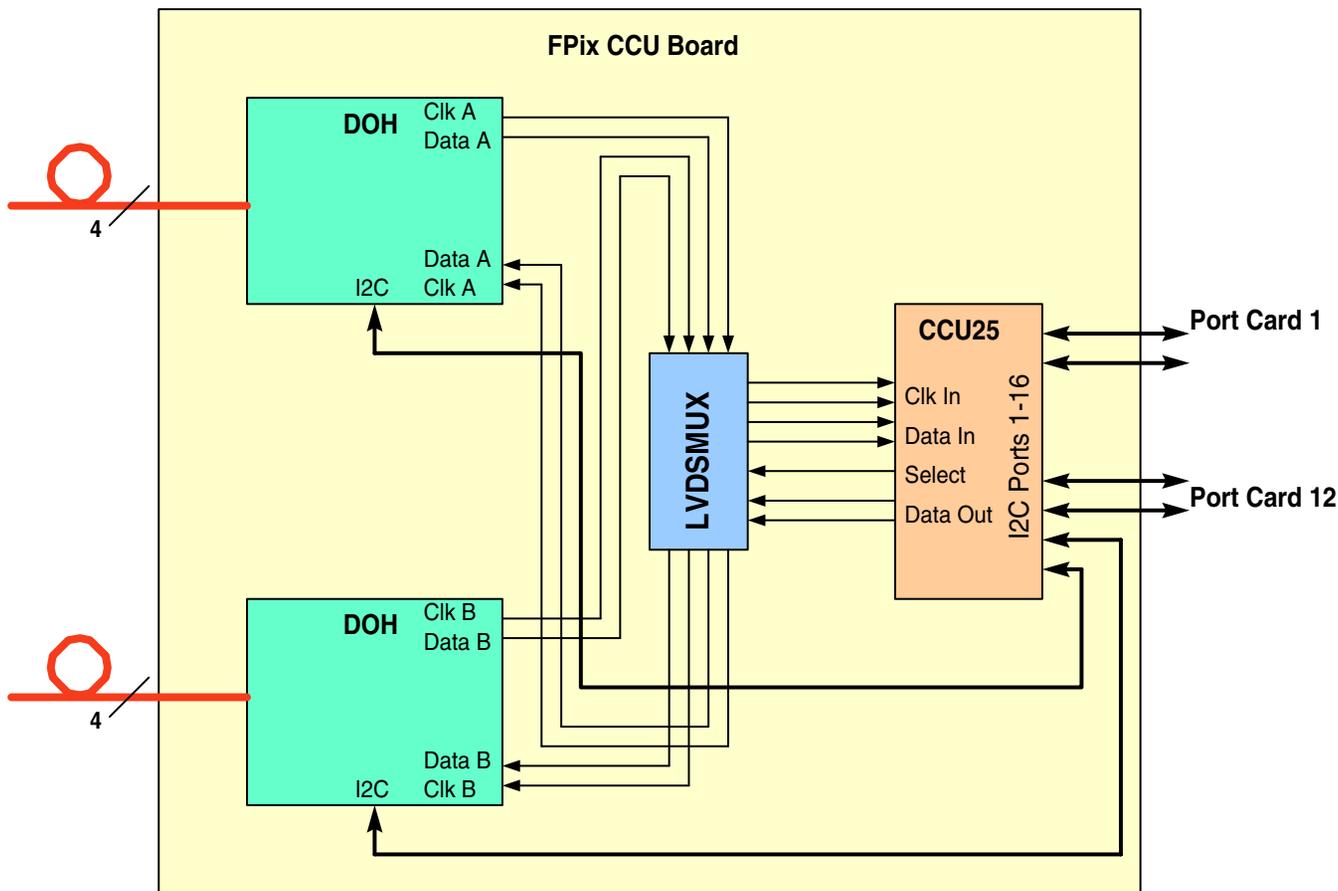
Forward Pixel CCU Boards (1)

- Need four CCU boards (due to mechanical constraints) to cover four half cylinders
- Each board will have one CCU chip, one LVDSMUX chip and two digital optohybrids (DOH)
- Twelve (12) of the CCU's I2C ports (out of 16) will have individual point to point connections to Port Cards

Forward Pixel CCU Boards (2)



Forward Pixel CCU Boards (3)



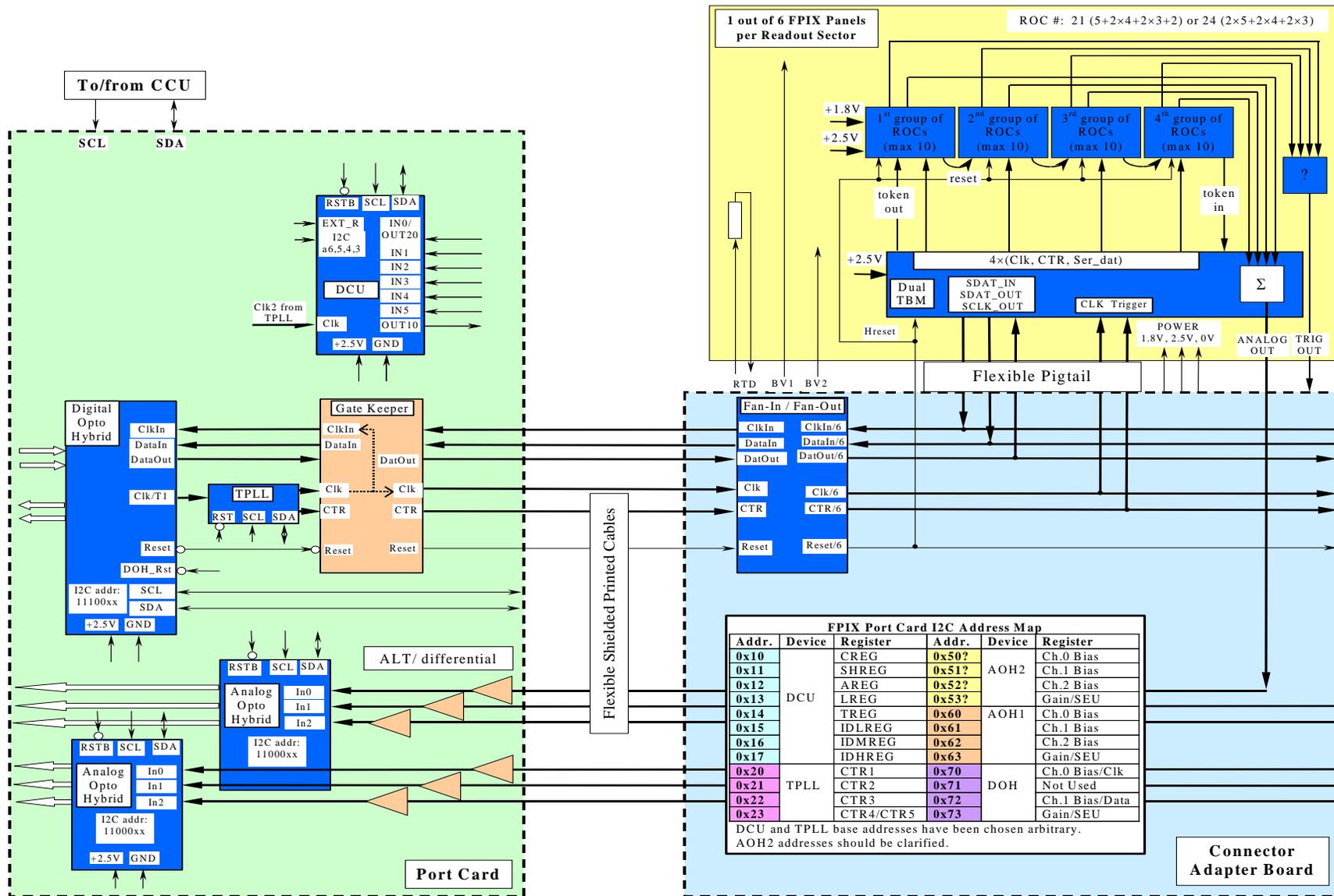
Custom Pixel FEC

- FEC spec proposed by Fermilab accepted
- CERN MIC group suddenly decided to re-design mFEC board to satisfy Pixel requirements
- Not certain that MIC group will be able to add 1..4 Mbytes of memory required by Pixel and implement other requirements

Analog Readout Chain

- PSI reported that TBM signal levels are not compatible with AOH
- A new chip – Analog Level Translator (ALT) is required
- No impact on Forward Pixel design so far
- AOH with two different I2C addresses needed, or number of CCUs will double

CMS Forward Pixel Front-End



Gate Keeper chip changes

- Add Return Clock Input pins to maintain SDA/SCL phase for the TBM response
- Add Return Clock Control pin to switch between barrel and forward modes
- At this point we do not see a need for an additional delay adjustment for SDA signal relative to the clock on the Port Card – better to do it in the FEC (a requirement)

Fan-In/Fan-Out chip features

- Forward Pixel proposes to use Fan-In/Fan-Out chip(s) instead of the LCDS driver chip
 - Simple buffer with six-fold OR inputs and six-fold Fan-Outs
 - No delay adjustment between FPix panels is necessary – no delay needed
 - CMOS buffer and Fan-Out for Reset signal

Conclusions

- Forward Pixel can use CCU and Tracker FEC for slow control
- If a custom FEC is built by CERN, it has to comply with all Pixel requirements
- Gate Keeper chip needs minor modifications to improve signal transmissions to the FEC
- A new Fan-In/Fan-Out chip(s) is needed for proper signal distribution
- Need two versions of the AOH with different or configurable I2C addresses (e.g. 0x6X and 0x5X)