PANDA Barrel EMC Electronics

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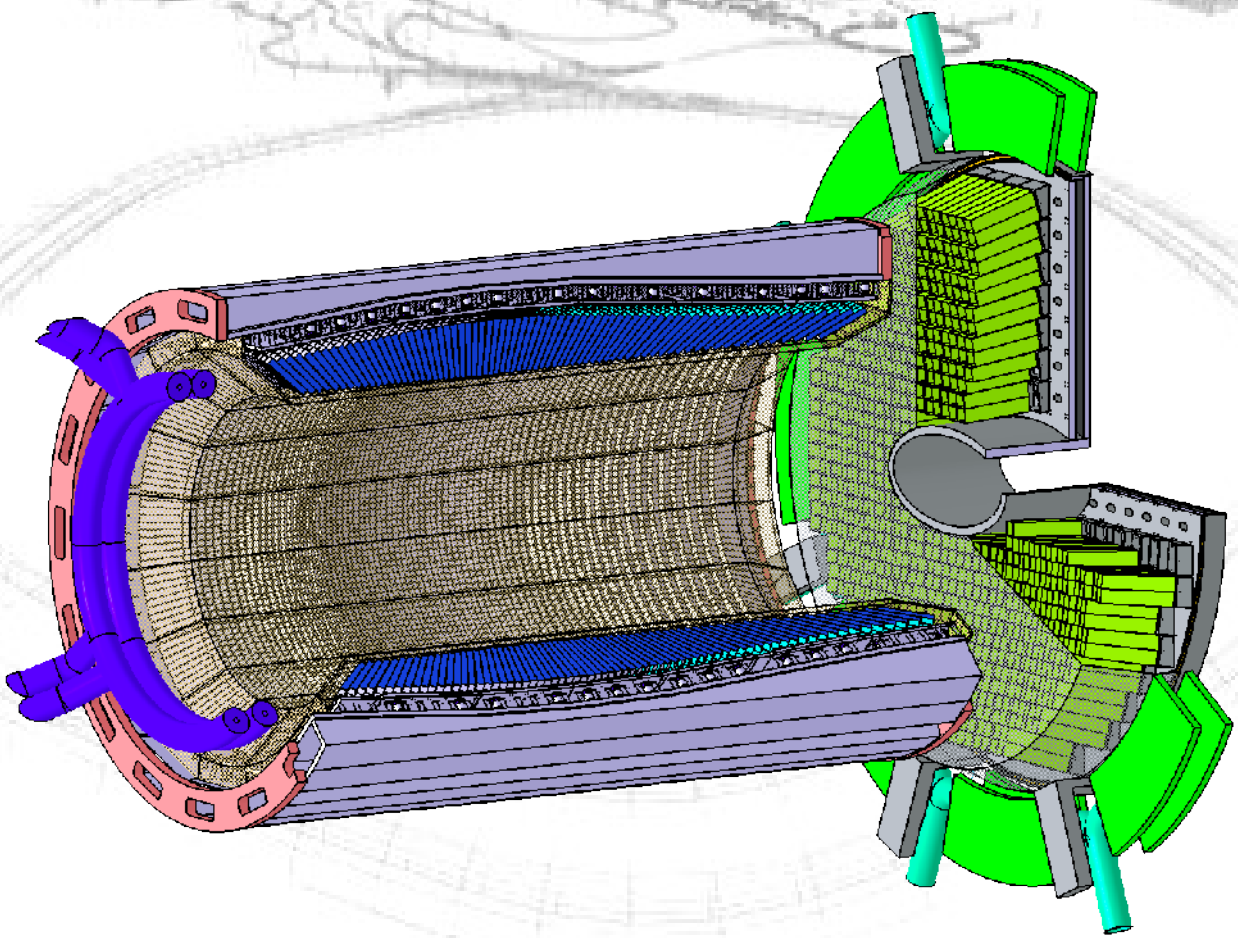
- Present Layout and Problems
- Alternative Proposal
- Open Study Points
- Conclusions

Present Layout

Barrel EMC Electronics mounted in support beams between crystals & cryostat



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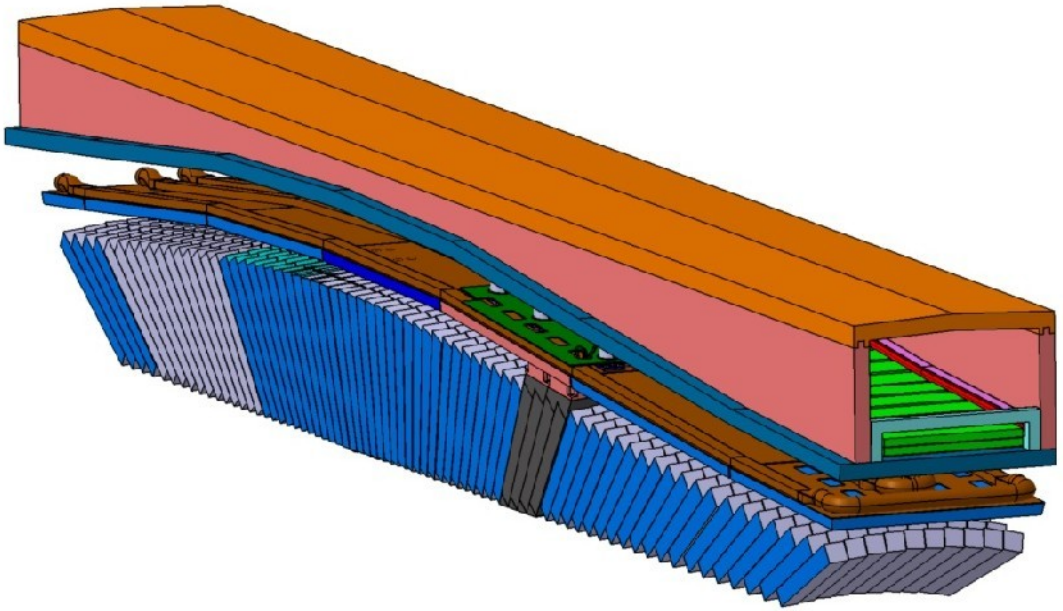

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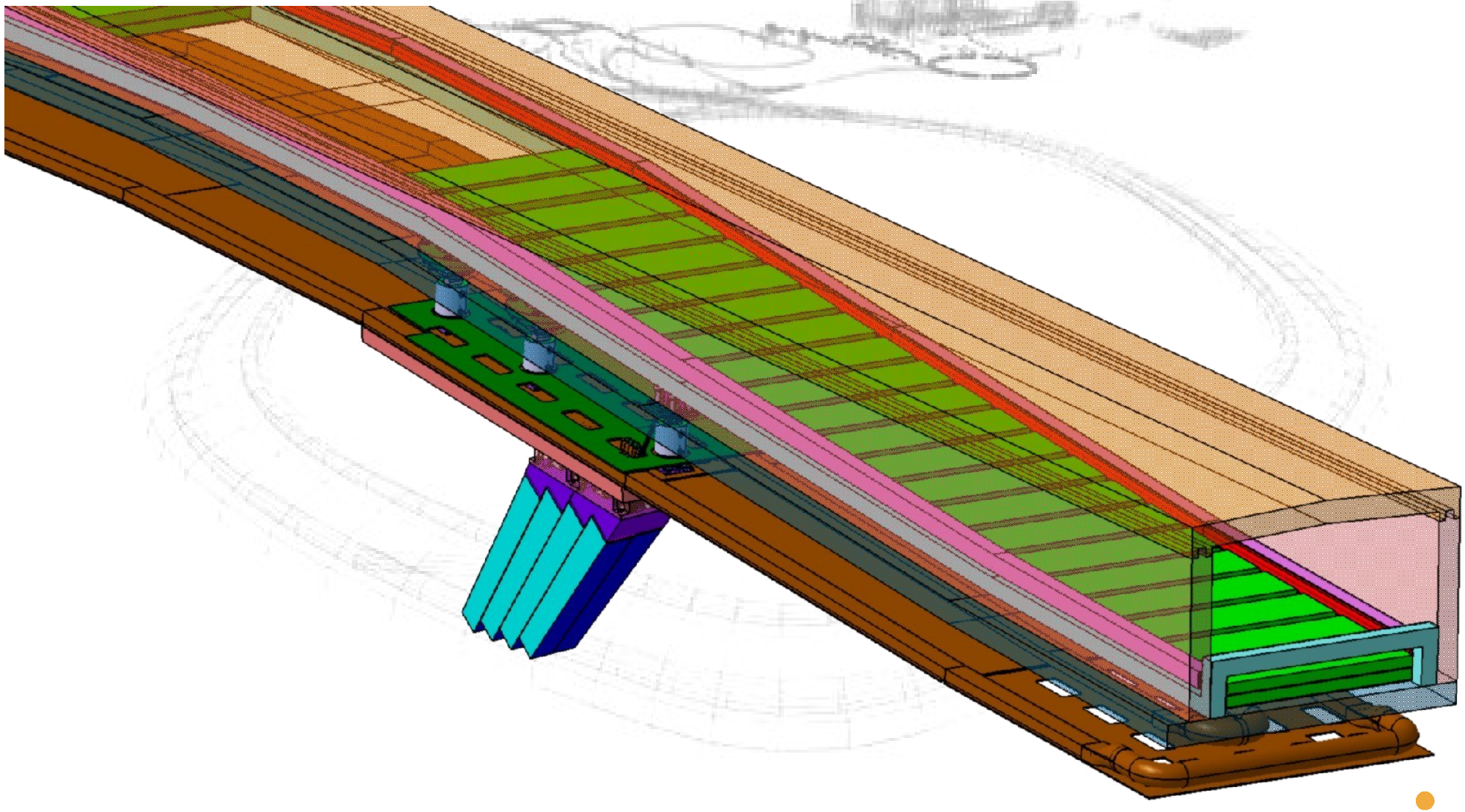

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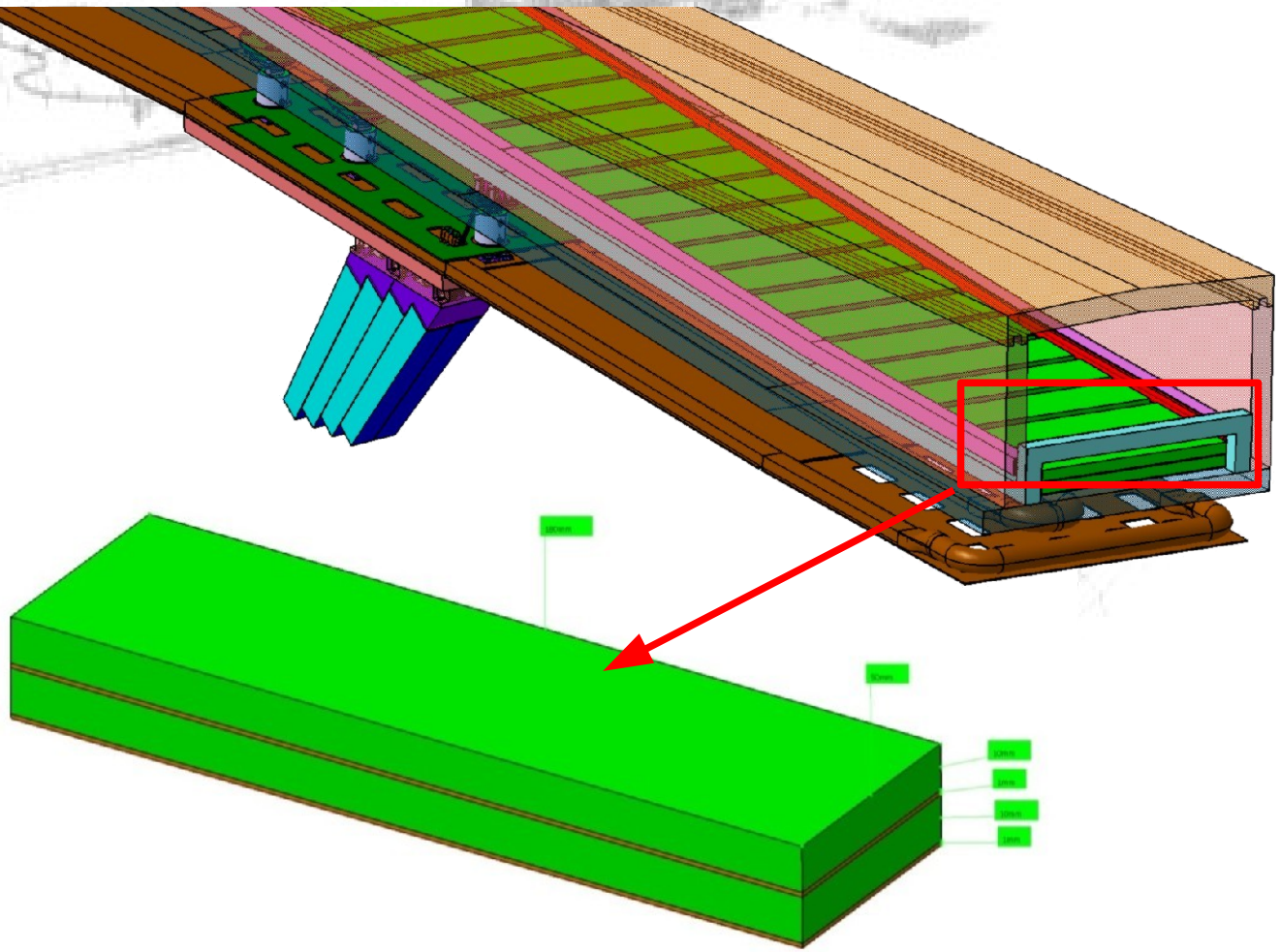

2 Outside PCB stacked, composed of

1 Outside PCB = 180 x 50 x 10
1 Silfox + Cu Layer = 180 x 50 x 1

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Channel density:
36 packages for 1 slice

2 Outside PCB stacked for 1 package

Problems of Present Layout

Main Complications

- The present location is very tight
  - Difficult electronics design
  - Difficult routing
  - Difficult cooling of electronics
- The location is virtually inaccessible
  - For access all inner TS systems would have to be disassembled
  - Electronics can not be serviced at all
- FPGA based ADC cards may suffer from single event upset (SEU)

Consequences

- Burn-in procedure for electronics as for spaceborne equipment
  - Time consuming
  - Very costly
  - Requires a lot of manpower
- Radiation tolerant FPGA code required

Alternative Proposal

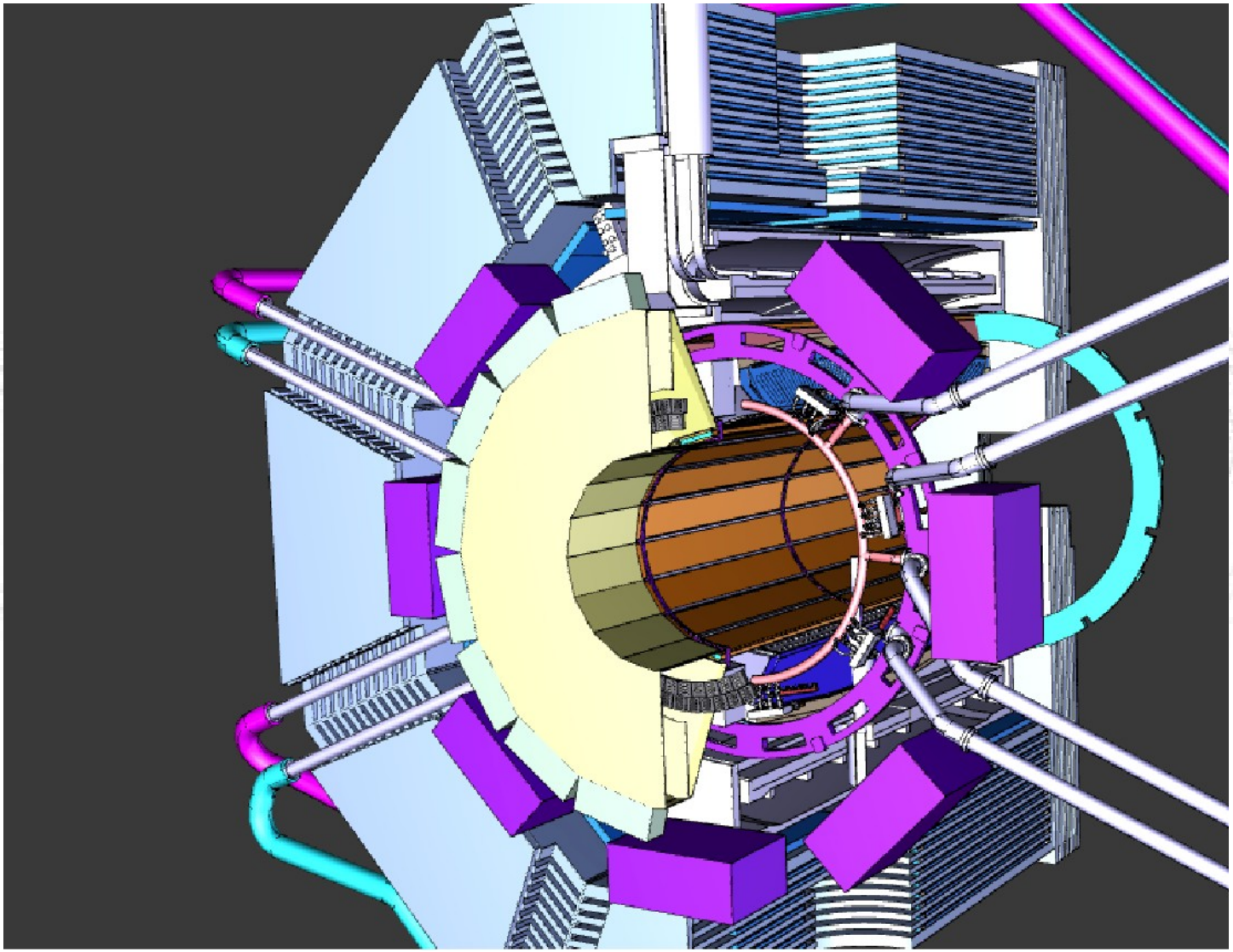
More traditional approach:

- Electronics in accessible location
- Bring signals there by cables
- Line amplifiers after APFEL ASIC to drive longer distance

Location:

- Space surrounding DIRC readout
- Placement just inside barrel yoke
- Access by opening backwards door
- Available space: 7 crates of 440x250x572 mm^3

Alternative Proposal



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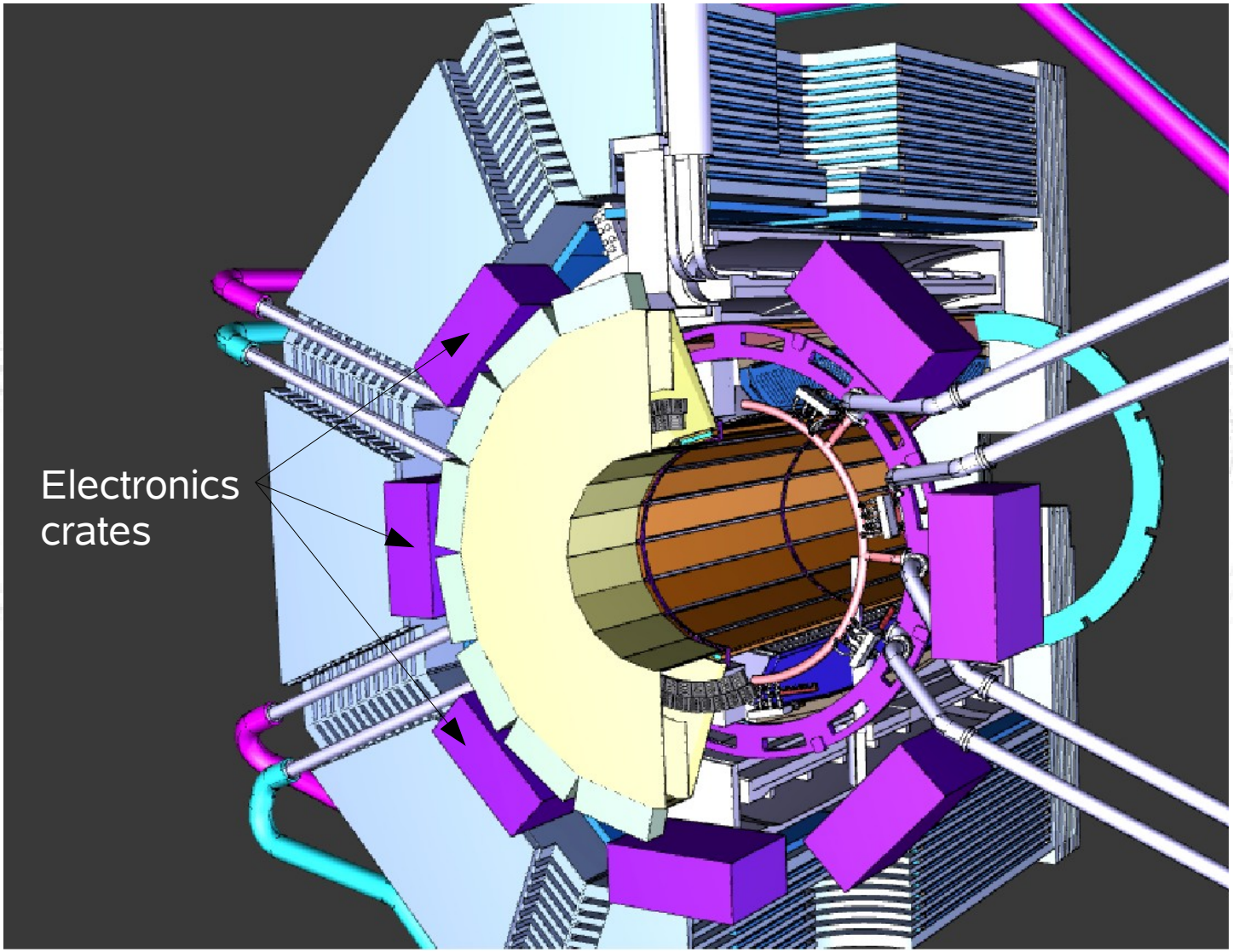

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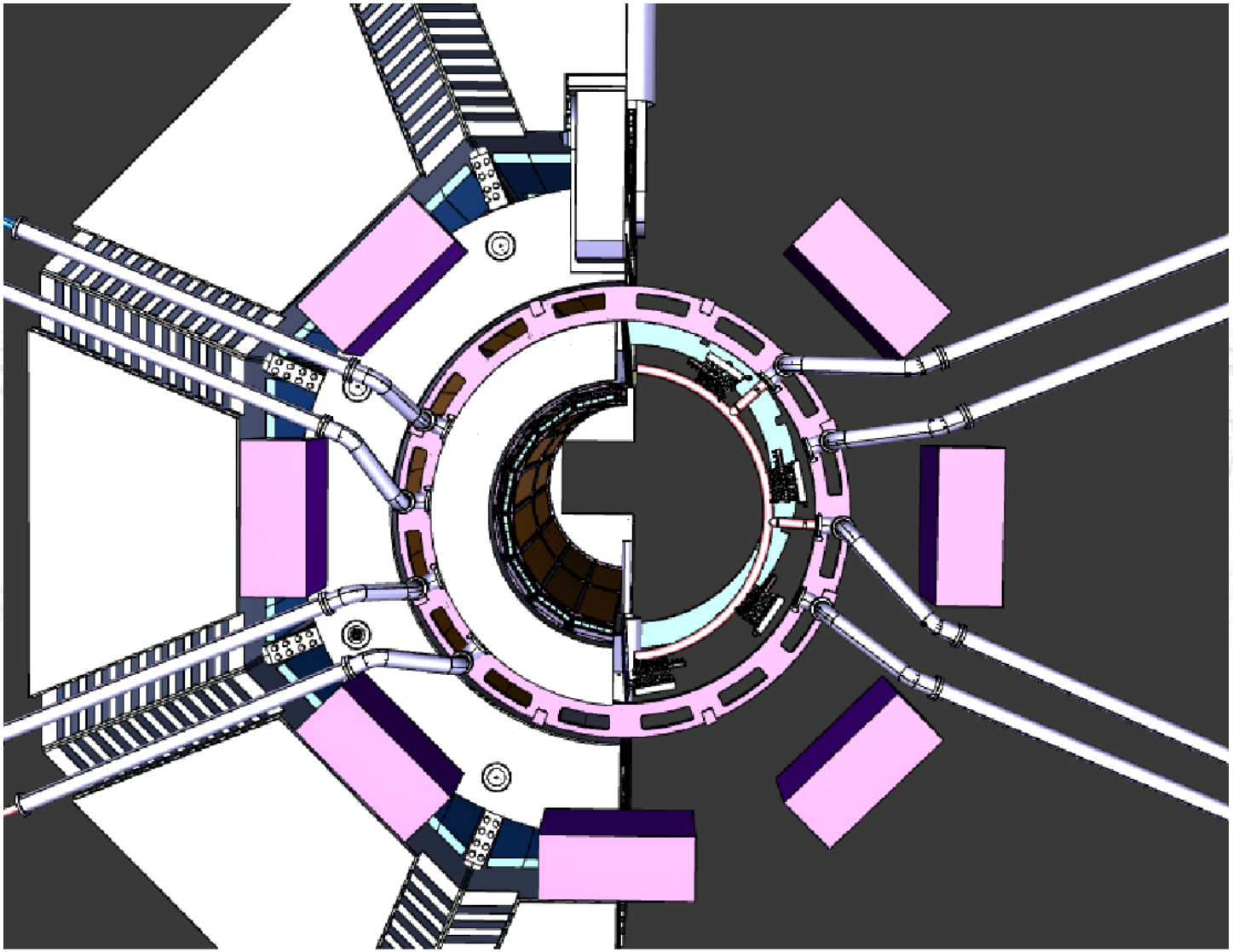

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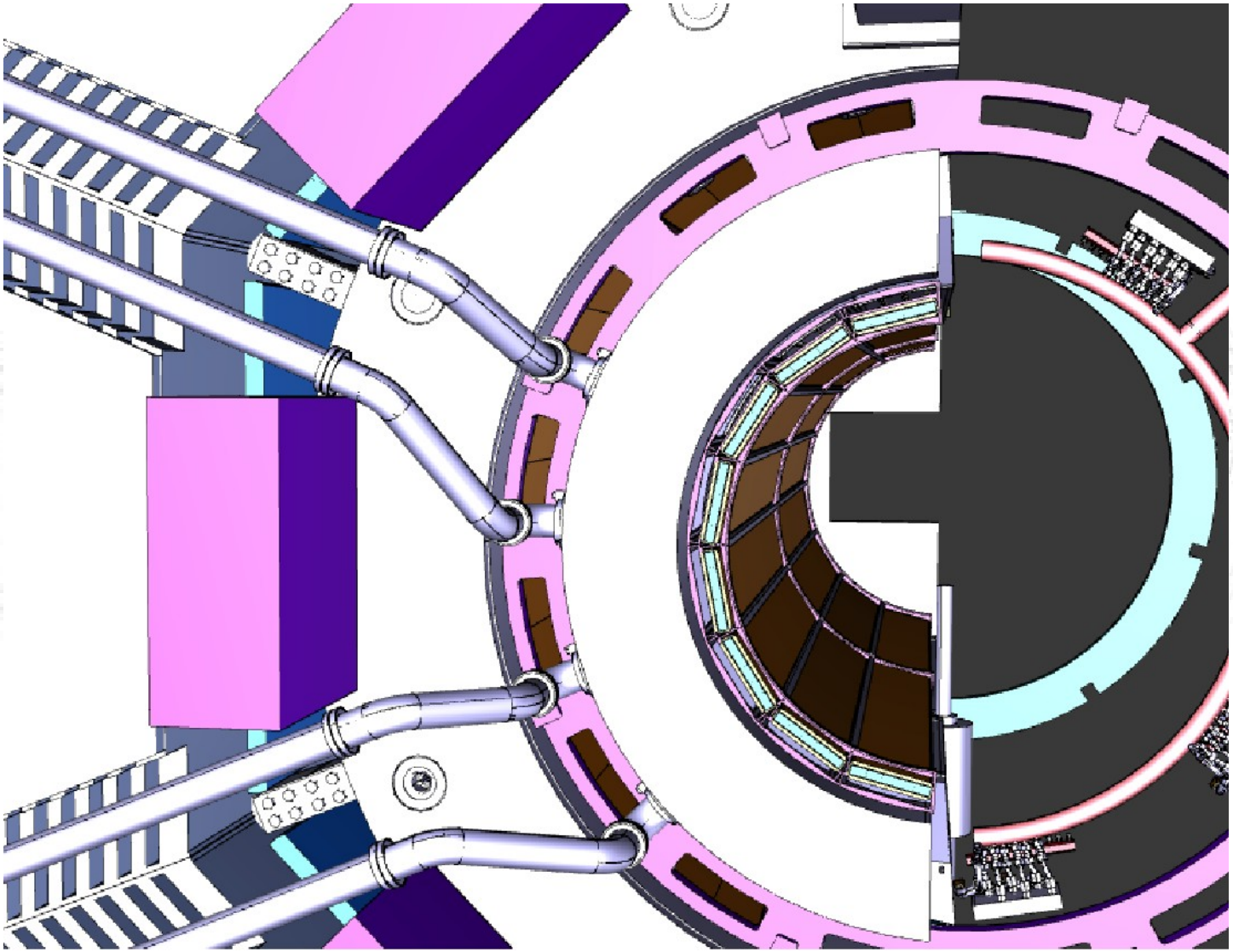

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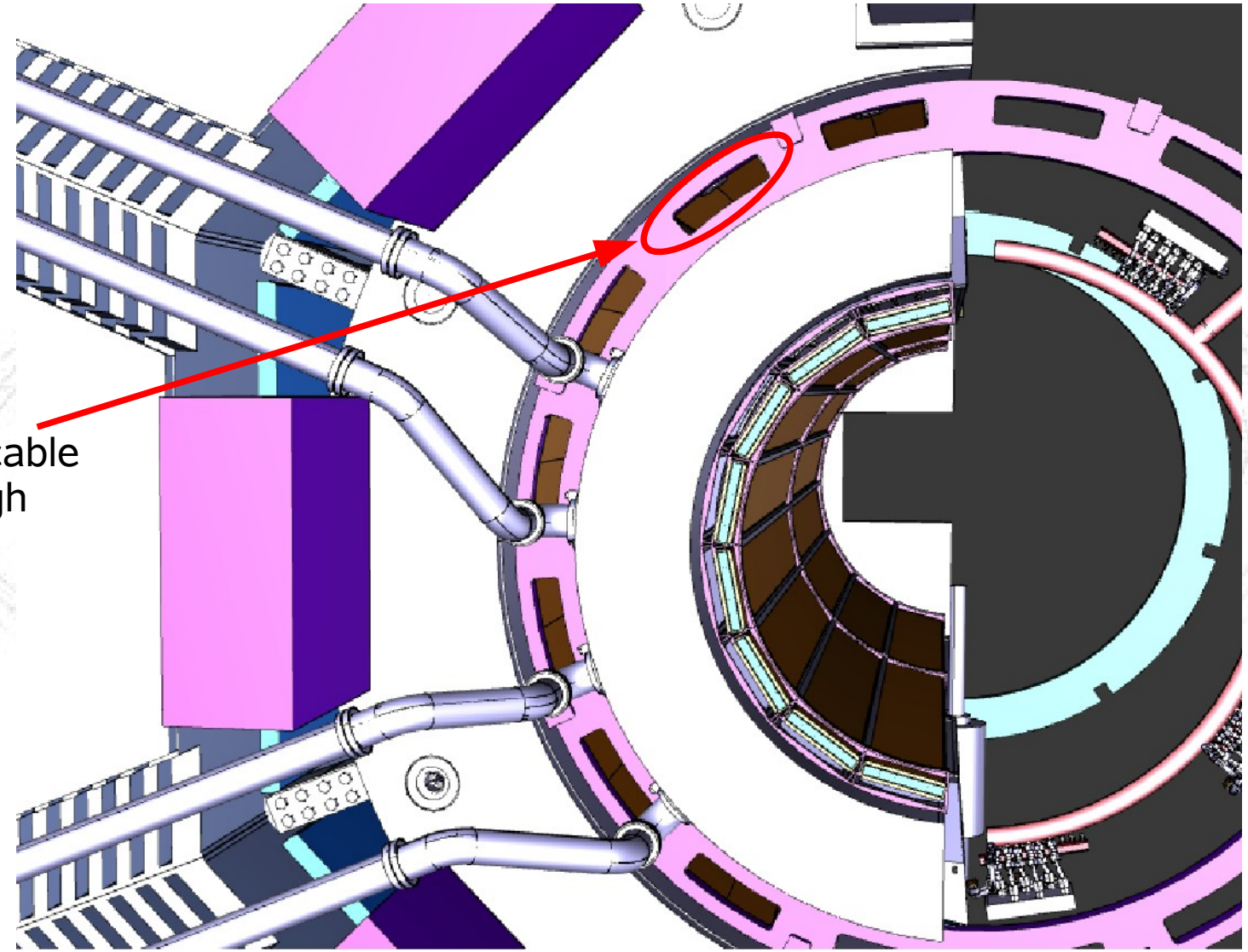


Alternative Proposal

More traditional approach:

- Electronics in accessible location
- Bring signals there by cables
- Line amplifiers after APFEL ASIC
  to drive longer distance

Advantages:

- Servicing even in in-beam position:
  Just open the backwards door
- Lower radiation levels, no problems with FPGAs

Disadvantages

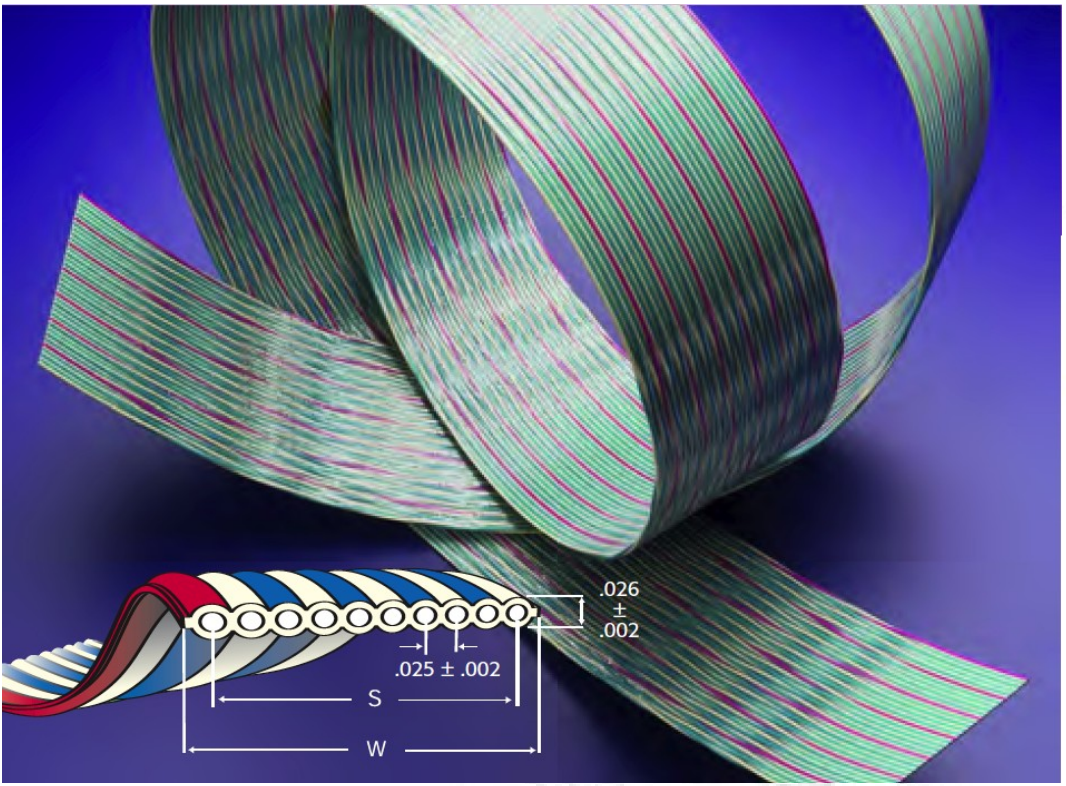
- ~45000 cables to route (and pay)
- Additional line drivers

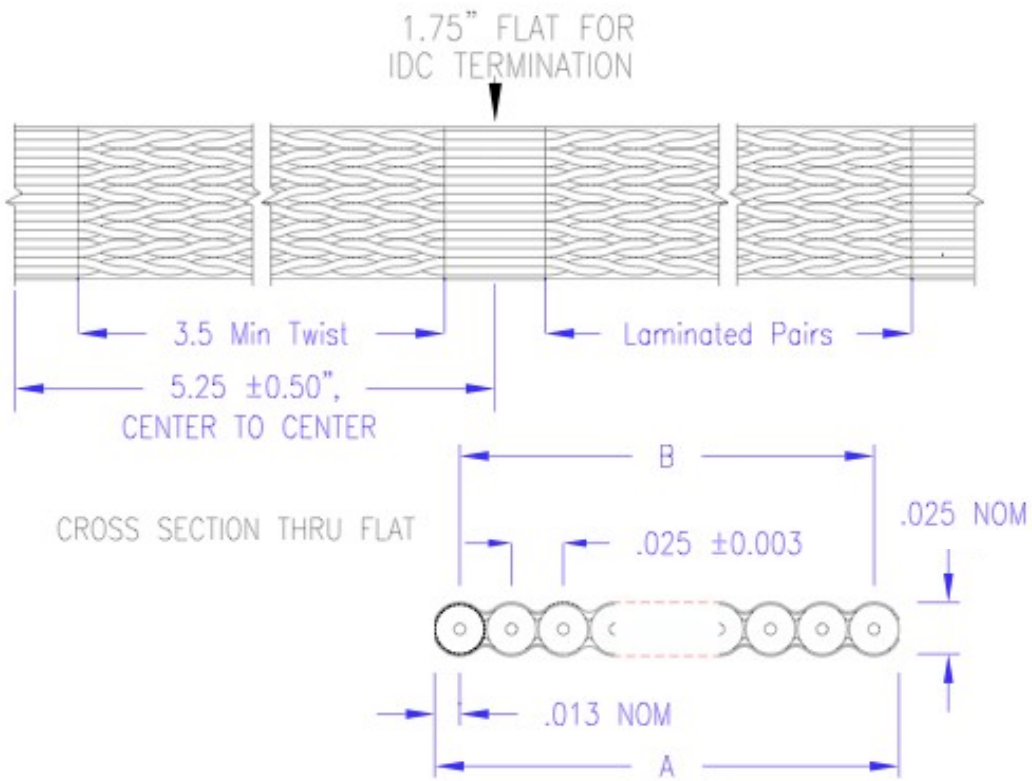
Open Study Points

- Verify that space for electronics is
  - sufficient
  - available
- Find space for cable routing
- Find a suitable cable type
  - Low cross section
  - Low cross-talk
  - Verify that signal resolution is maintained
- Find a suitable line amplifier
  - Maintain signal timing & resolution

Possible Cables

- **Twisted pair ribbon cables** (input from jan Hoffmann)





Hitachi 0.025" TP cable

Amphenol 0.025" TP cable

Differential signals, < 1 mm^2 cross section per pair

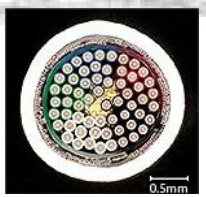
Crimping of multi-channel connectors possible

Possible Cables

- **Micro coaxial cables** (input from Philippe Rosier)

Hitachi micro coaxial cables

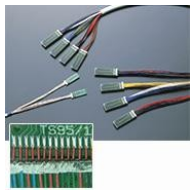
- Linear capacitances down to 40 pF/m
  - Clas12 production: 40 pF/m



- Round cables

→ Up to 300 coaxes in a 6-7 mm diameter

→ Weight of 207-coax assembly : 112 g/m
  - Including (removable) external shielding



- Flat woven cables

→ 32 coaxes in 24 mm x 1 mm

→ Weight of 20-coax assembly : 8 g/m
  - 2 kg for 96 cables of forward region

Samtec 64-channel cable

4 stacked 16-coax ribbons
- 17 mm x 4.5 mm
  → Coax diameter: ~1mm
- Weight of 1.5m cable: ~200 g
  → ~20 kg for 96 cables

Conclusions

- Position of electronics is a major risk factor
  - Operation risk
  - Time delay
  - Cost increase
- The problem has to be looked at with new eyes:
  It is not too late to consider alternatives.
- Work out details of alternative scenario
- Take decision within the year