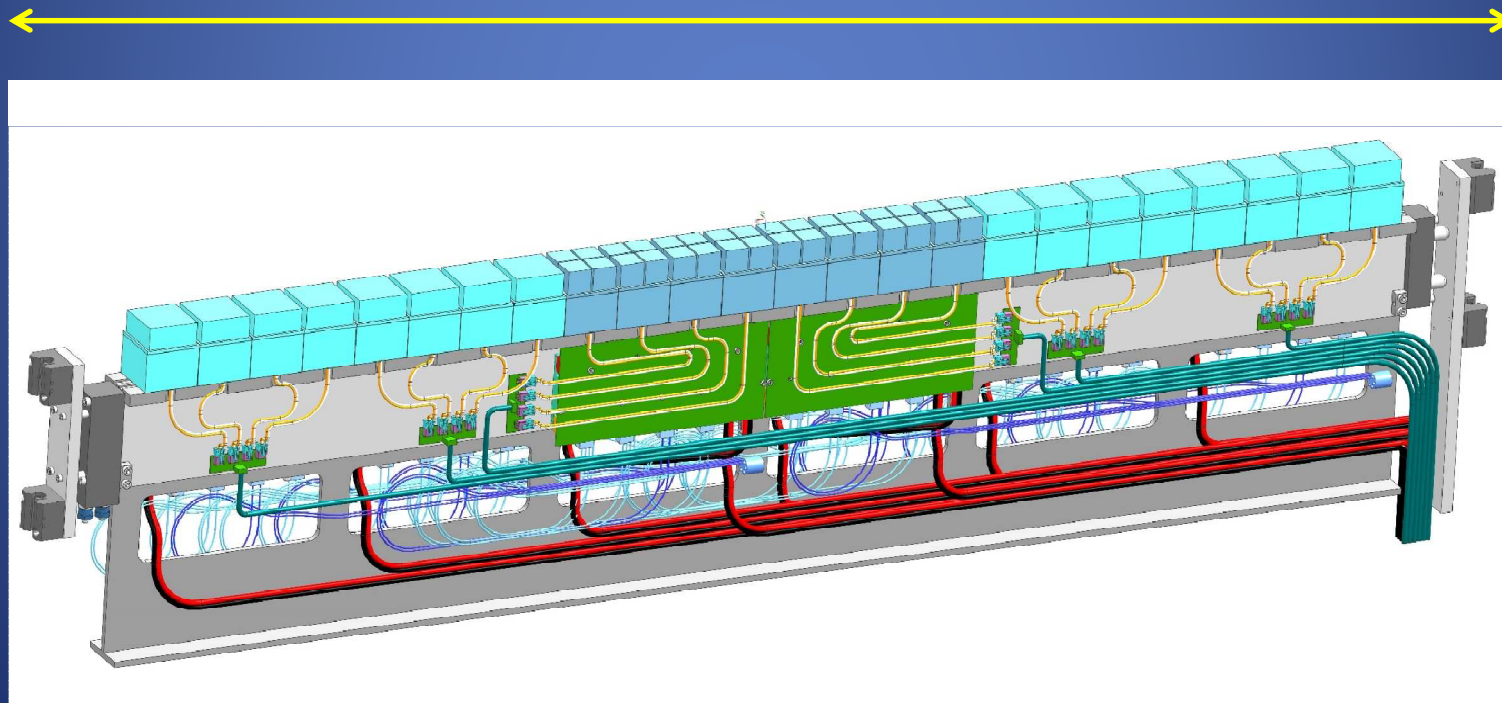


RICH

Column testing

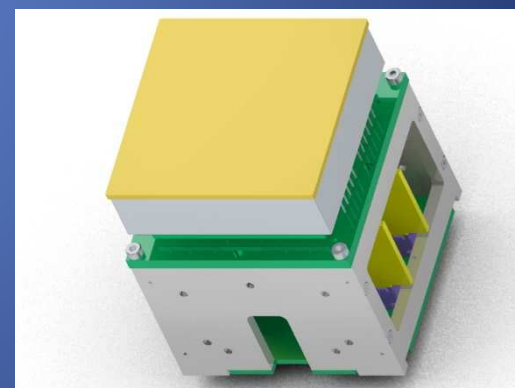
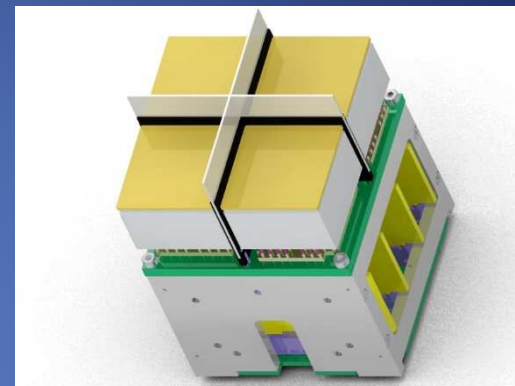
Prepared by Steve Wotton
on behalf of the RICH upgrade group

1.4m



Overview

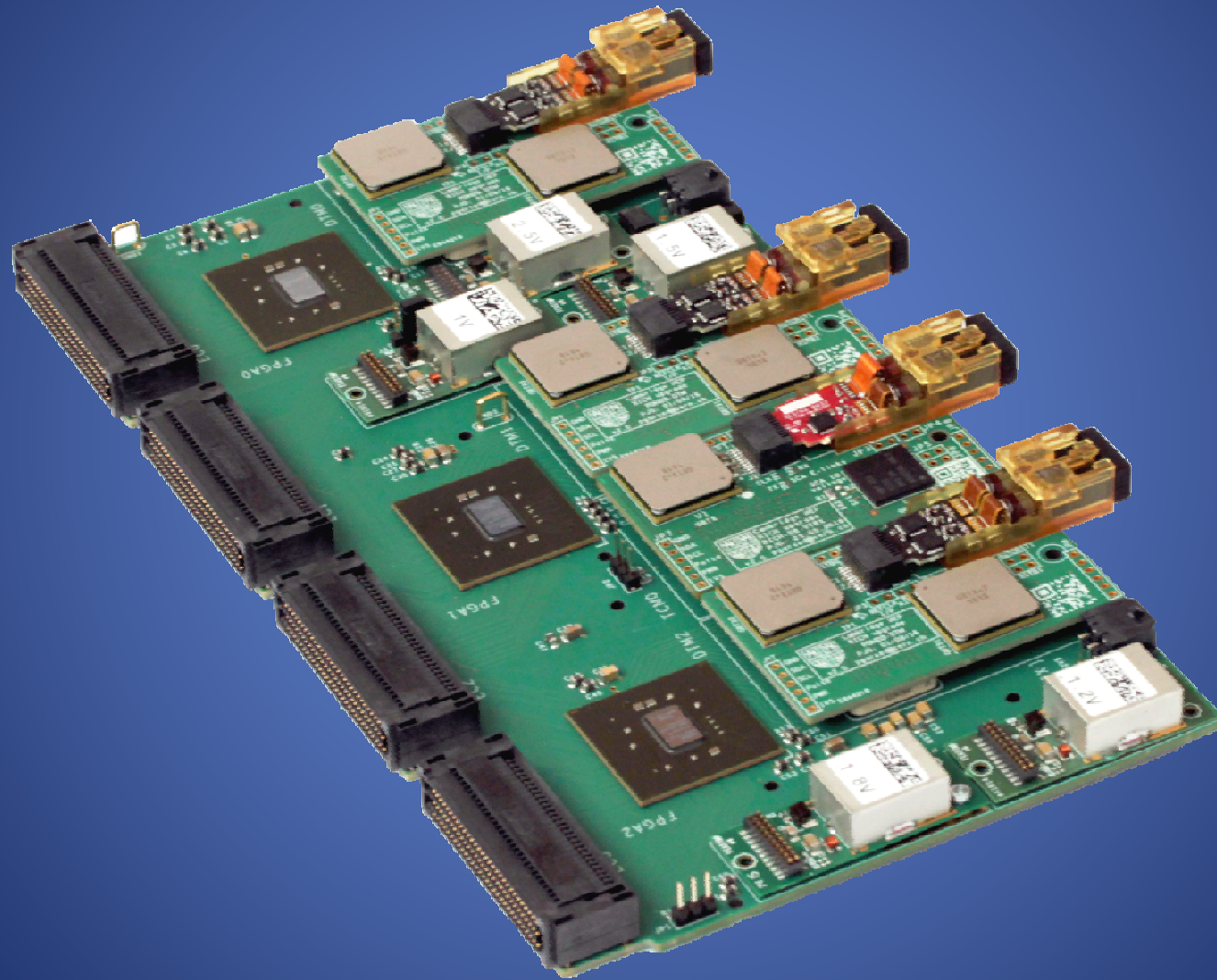
- Complete PD columns will be tested before installation.
- A column consists of:
 - Actively cooled spine supporting:
 - 96 MaPMTs (~6000 pixels)
 - 24 Elementary cells (MAPMTs, HV board, FE ASICs, interface board, mechanics)
 - 12 PDMDBs (FPGA readout board with data and controls plug-in modules)
 - 72 GBTX data transmitters
 - 12 GBTX controls transceivers



Infrastructure requirements

- LV Power
 - Equivalent to two Maraton channels ($\sim 40\text{A}$ @ $\sim 6\text{V}$ each)
- HV
 - $\sim 1\text{kV}$, Remote controllable CAEN power supply (Mainframe + 18 channels)
- Cooling
 - Active cooling of column required
 - $\sim 350\text{W}$
 - Fluorinated coolant
- Dry atmosphere
 - Nitrogen flow

DAQ requirements



13/04/2017

LHCb Upgrade, RICH Column test facility

DAQ requirements

- PCIe40
 - Minimum 3 24-channel PCIe40 for data from a full column
 - 12 SOL40 channels (i.e. one SOL40 module)
- Controls
 - Integrate with, as closely as practicable, the LHCb upgrade controls environment.
 - WinCC, run control, DCS, ECS etc.
 - Some special functionality for tests might be needed (not yet defined).
- TFC
 - Use the LHCb TFC infrastructure (SOL40) to provide synchronous readout.
 - Will need to integrate hardware support for triggered test equipment (pulser).
- Event-building
 - We assume this will be necessary since we will use more than one PCIe40.
- We expect that the system we have developed will be very close to the LHCb upgrade architecture and therefore can serve as a reference system for the LHCb architecture.

Light tests

- Laser pulser used as test source
- Synchronously triggered
- Column in light-tight enclosure
- A pulser trigger interface is under review

Location

- A large complex system – we do not want to duplicate test-stations unnecessarily.
- Need easy access to well-equipped workshops.
- System will be in constant use during installation phase (no sharing possible).
- A test system meeting our current requirements is already well-established on Meyrin site.
 - System will evolve towards a full column readout system as hardware becomes available.
- Production components will be delivered to Meyrin site.

Conclusion

- Pre-installation column-testing is best done at the Meyrin site.
- However, after the column production testing is completed we might want to re-locate our testing system at IP8.
- After first installation there are two scenarios for testing columns that develop faults during commissioning/running:
 - Take columns back to the test facility at Meyrin
 - Permanently relocate our test facility to IP8 (we would probably always keep a smaller scale set-up at Meyrin).
- The current consensus is to return the column to the Meyrin site but RP issues might make us review this.
- At this stage we prefer not to rule out the possibility to have access to a testing facility at IP8. However, to be useful it will need to be similar in scale and functionality to the system we are building in Meyrin.

Q&A

- Q) Support?
 - A) We will need a certain level of support to help us continue to build our set-up. We anticipate that this will mainly be operating/debugging the centrally provided infrastructure.
- Q) Where?
 - A) Our column testing will be on the Meyrin site. A test facility at IP8 may be useful later during operation/commissioning for fault diagnosis/repair.
- The remaining answers address what would be needed to make a test system at IP8
- Q) LV power
 - 2 Maraton channels
- Q) Copper cables
 - 2 two power + 2 return rated up to the maximum Maraton channel capability. Source connector types compatible with Maraton. Load connection not yet specified.

Q&A

- Q) Fibres?
 - A) Breakouts at detector end are integrated onto columns. Need 6 12-fibre ribbons for data + 2 twelve fibre ribbons for TFC TX and RX. Breakouts probably not needed at PCIe40 end. Depending on location of column and PCIe40, a few metres seems likely. 12-way fibre gender to be checked.
- Q) Cooling?
 - A) 350W fluorinated liquid cooling plant. Chiller outlet temperature 10-14degC
- Q) Gases
 - A) Dry nitrogen flow would be needed.
- Q) Total power
 - 350W

Q&A

- Q) PCIe40?
 - A) 3 TEL40 + 1 SOL40 for a fully equipped column
- Q) Event building?
 - A) Probably
- Q) Local data buffering
 - A) Some needed. Mainly local monitoring.
- Q) Monitoring granularity
 - A) Mainly single channel (2D hitmaps, occupancy plots etc.)
Monitoring/archiving of temperatures required. Automatic safety features will be needed.
- Q) Screens
 - A) Probably a couple of workplaces is OK
- Q)
 - A) We think our test system will also serve as a reference for DAQ.