Cables and boards for the Luminosity Detector

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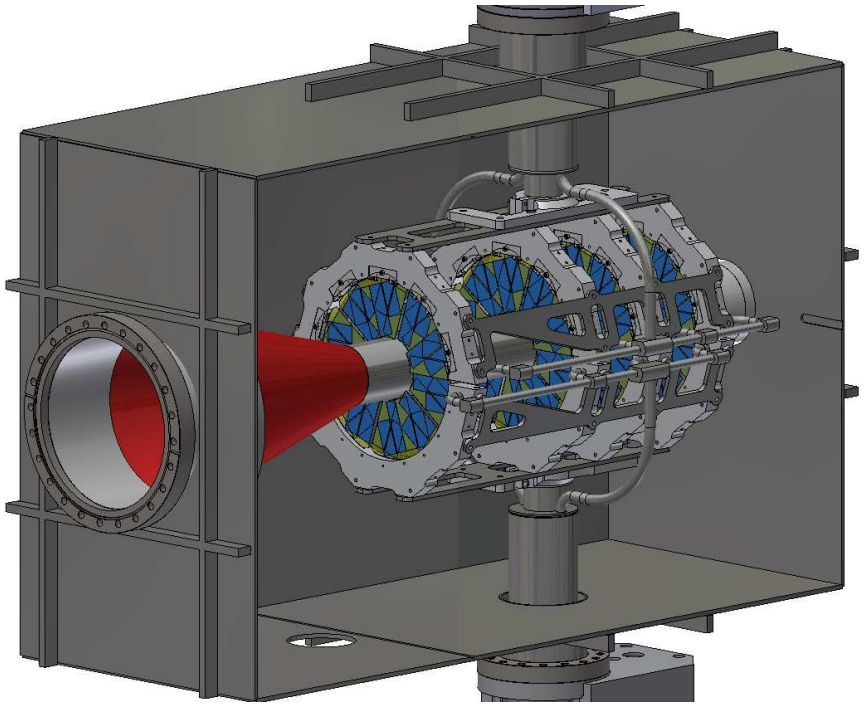
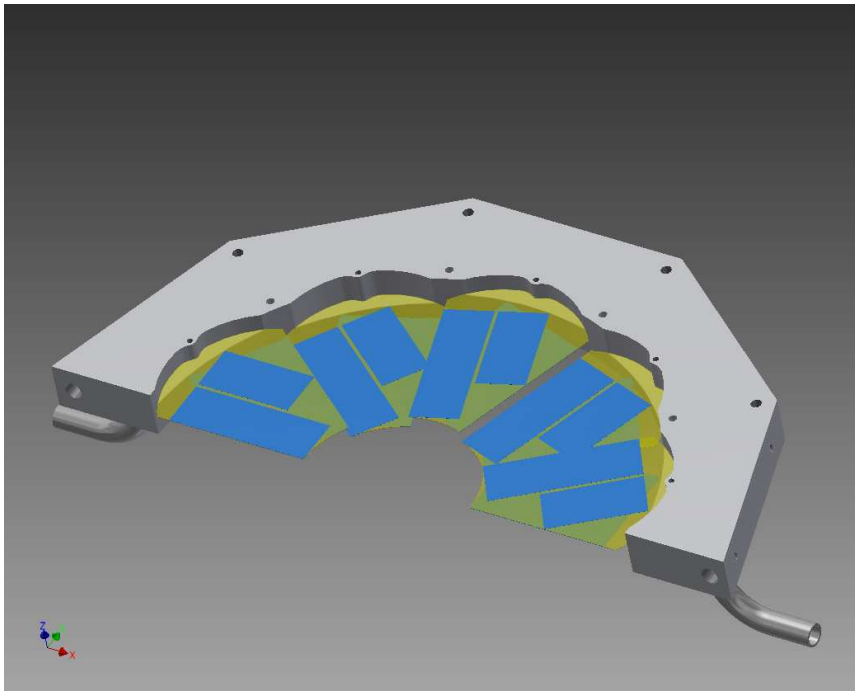
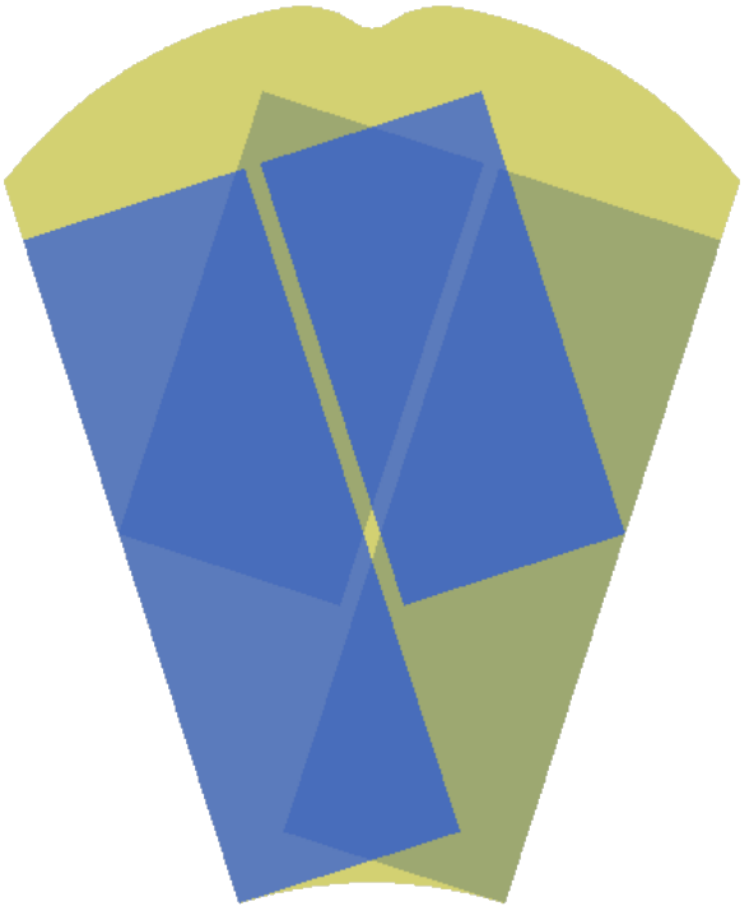
Overview

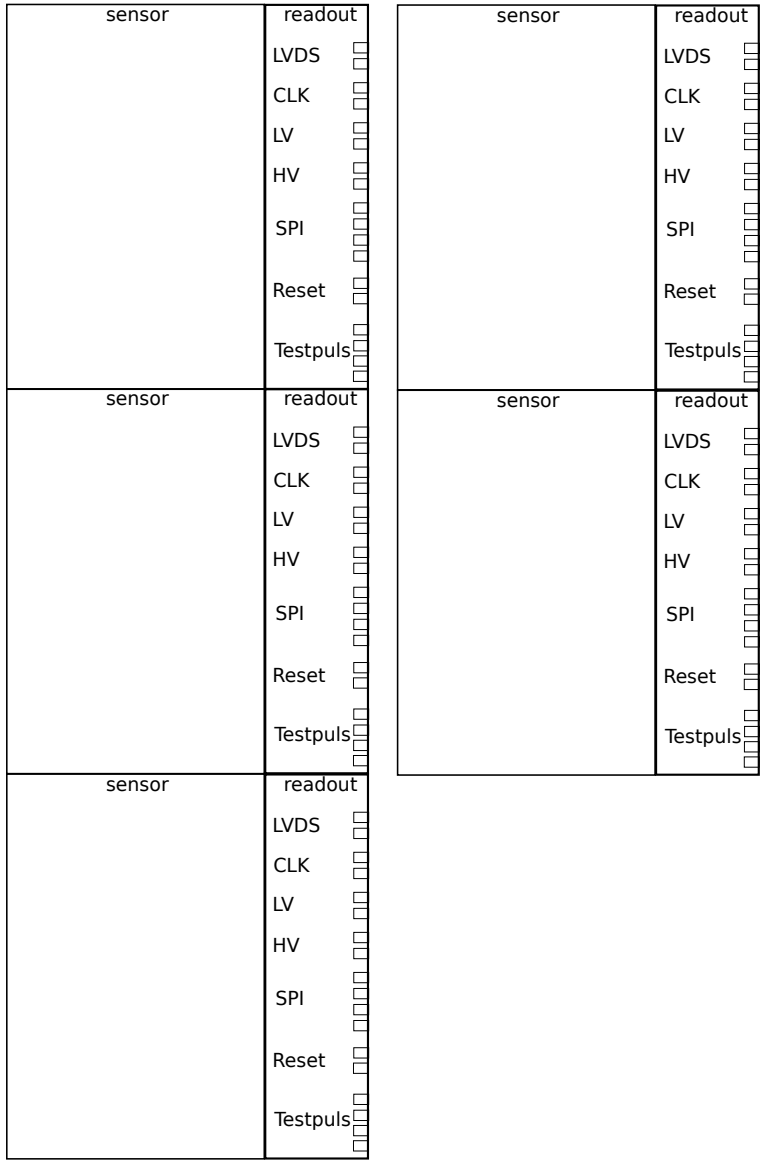




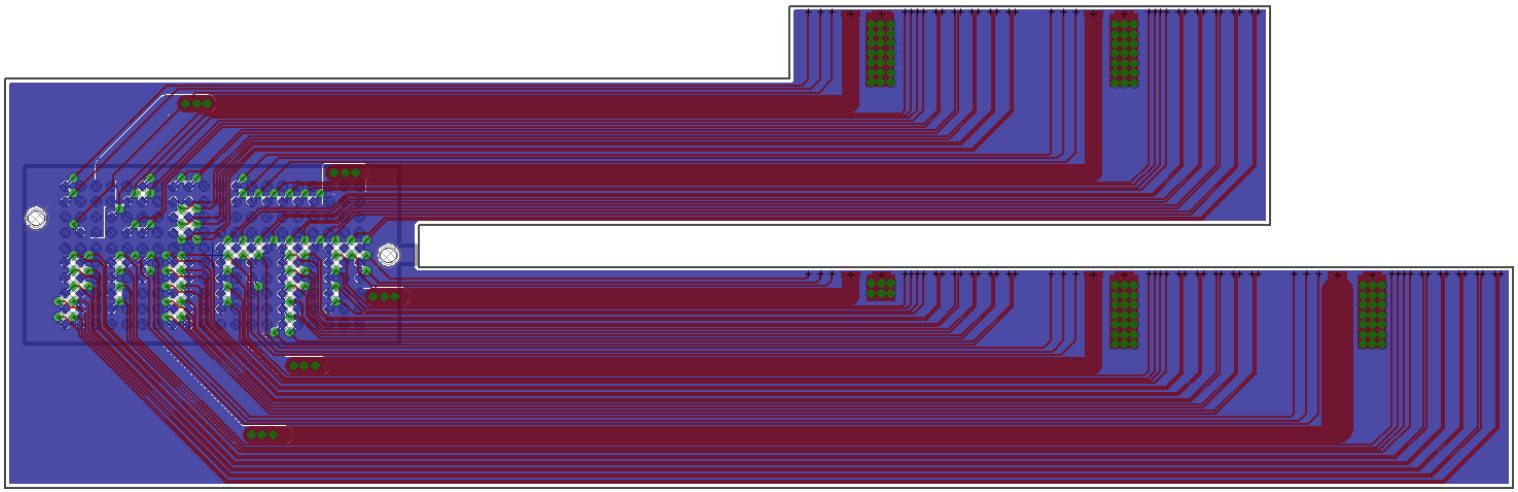
- Flex cables from the sensors to a PCB on the half ring
- PCBs with µC, LVDS repeater and linear regulators
- Rigid flex cables from the PCB to the feedthroughs

Sensor modules



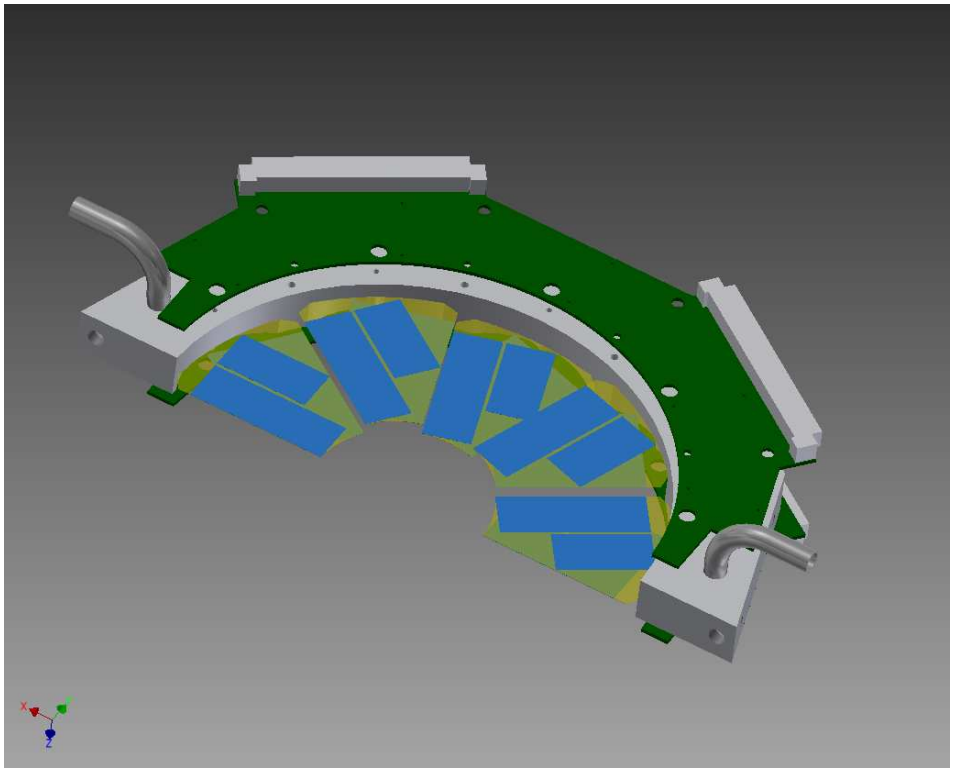


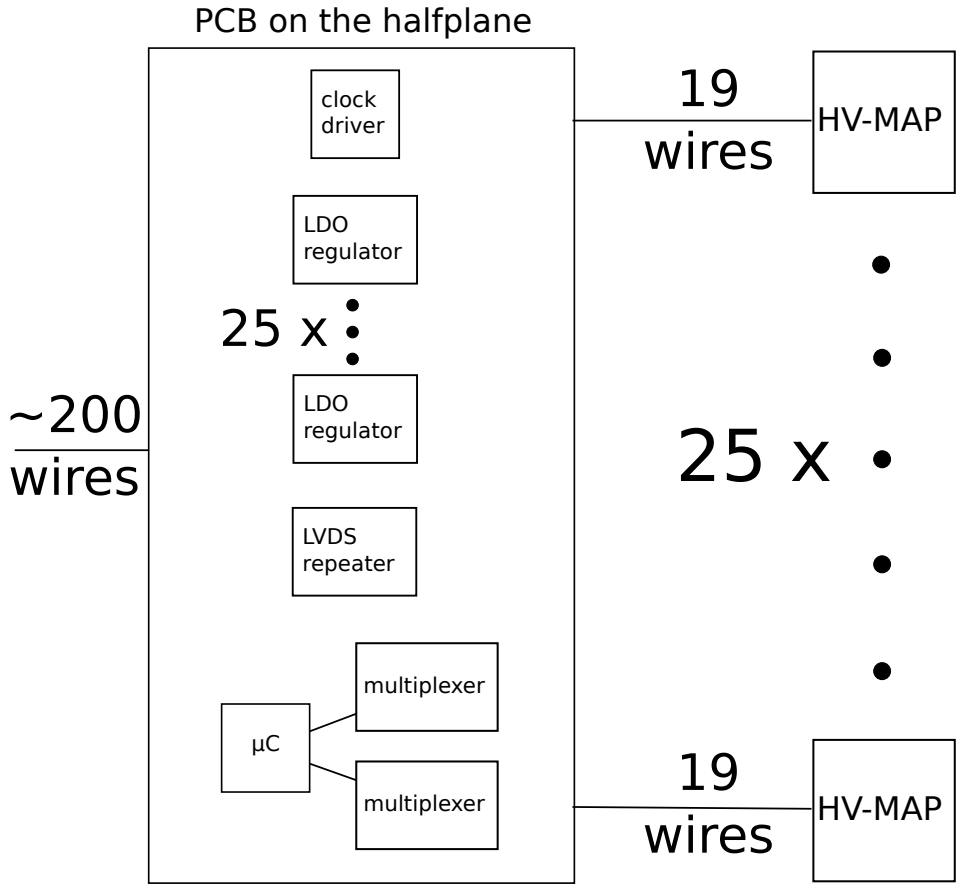
Flex cable



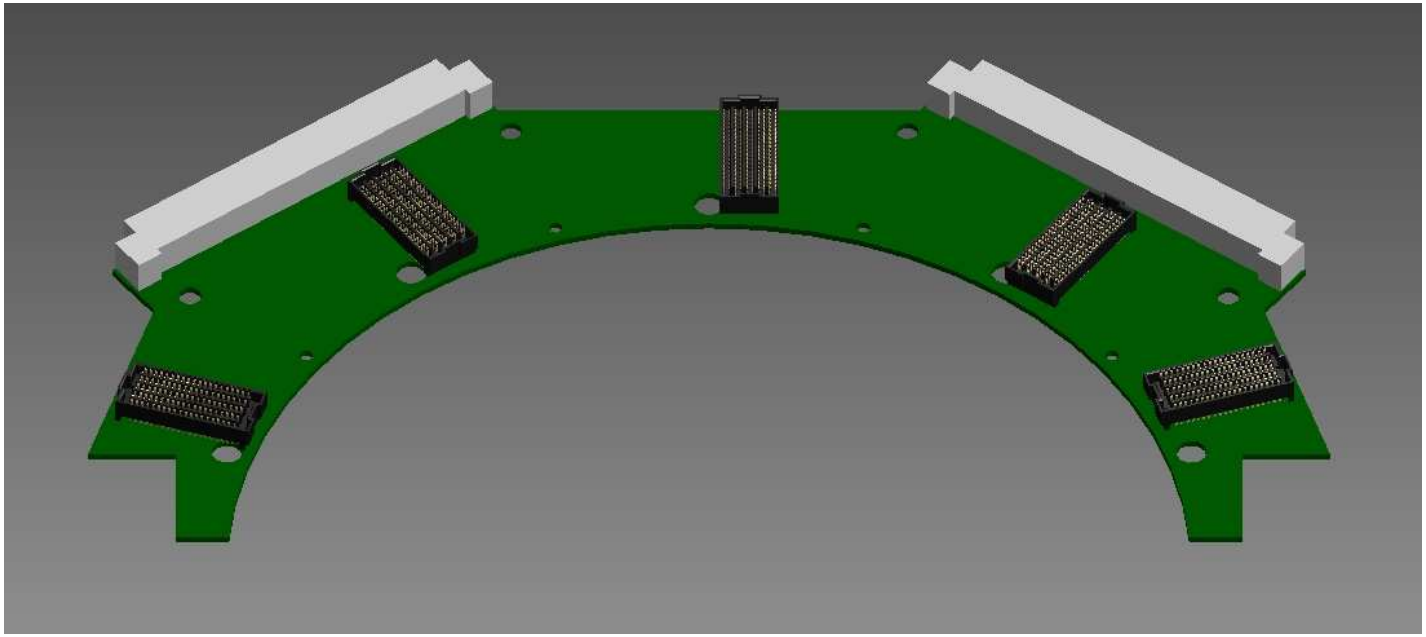
- Characteristics:
  - Trace material: aluminum
  - Trace width:
    - Differential (Edge-Coupled Microstrip): 100 µm
    - LV: 1400 µm
  - Trace spacing: >100 µm
  - Trace thickness: 15 µm
  - Dimensions: 40 mm$\times$110 mm
  - Cover: Parylene: 5 µm
- Advantage of aluminum:
  - Short radiation length
- Disadvantage of aluminum:
  - High electrical resistance
    $\rightarrow$ voltage drop
    $\rightarrow$ high power dissipation

PCB



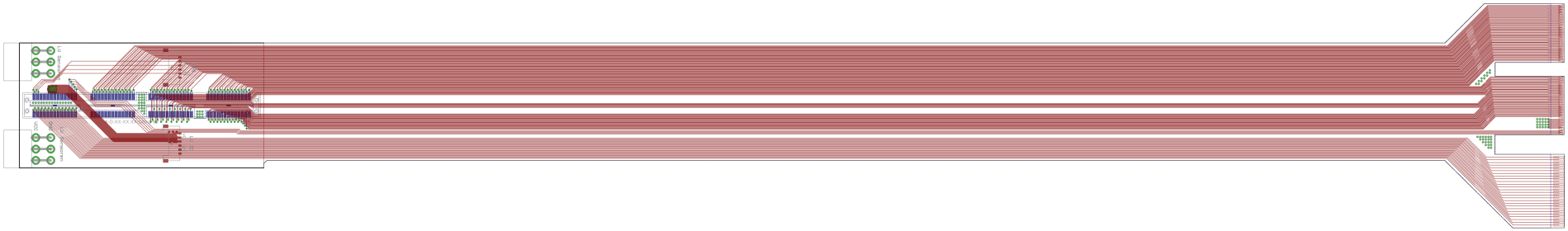

PCB on the halfplane
clock driver
LDO regulator
25 x
LDO regulator
LVDS repeater
µC
multiplexer
multiplexer
~200 wires
19 wires
HV-MAP
25 x
19 wires
HV-MAP

PCB

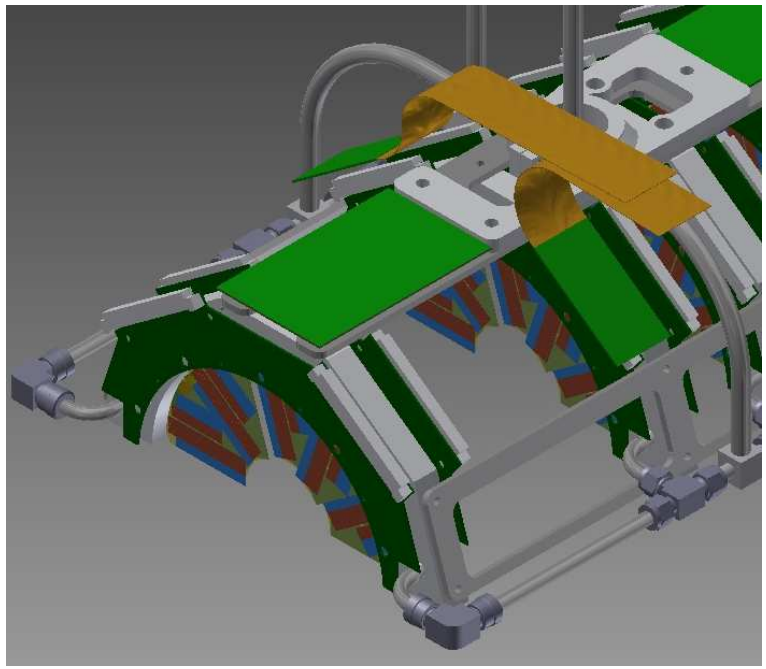


- ICs are placed on the bottom side of the PCB
- Power dissipation of the ICs about 25 W
  $\rightarrow$ thermal contact between ICs and halfplane necessary
- Connectors (Samtec SEAF and QMS) are placed on the top side of the PCB

Rigid flex cable



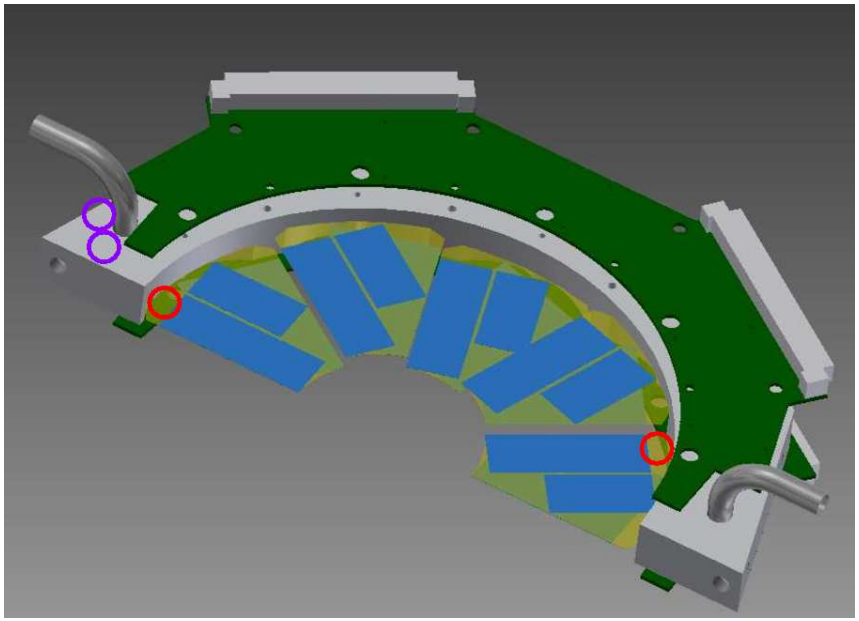
- Dimensions: 83 mm $\times$ 570 mm
- Flex area: $\sim$500 μm thick
- Flex area (3 layers):
  - Signal, clock, reset, testpulse
    $\rightarrow$ 40 differential pairs
    (Edge-Coupled Stripline, $Z_{diff} = 100\,\Omega$)
  - HV (26 wires)
  - JTAG (5 wires)
- Rigid area (6 layers):
  - LV
  - CAN bus

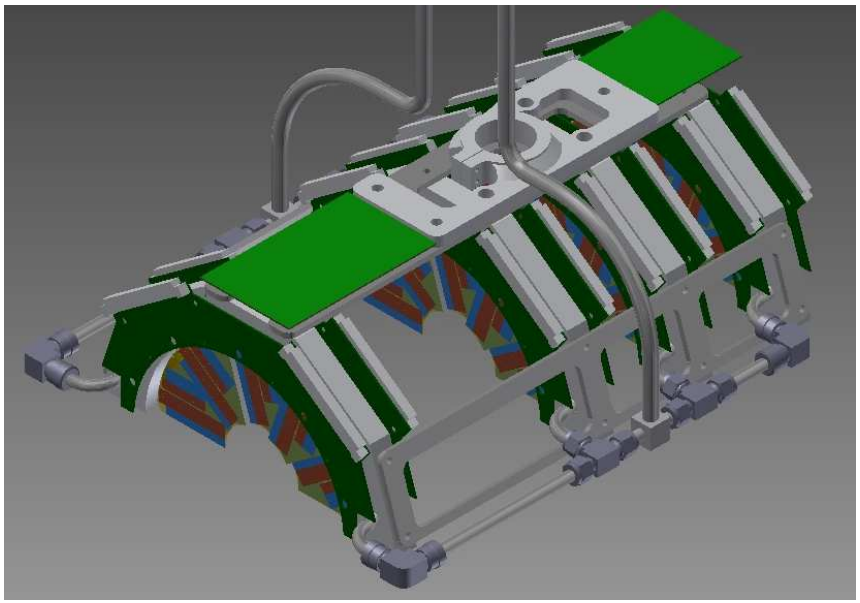


Temperature sensors

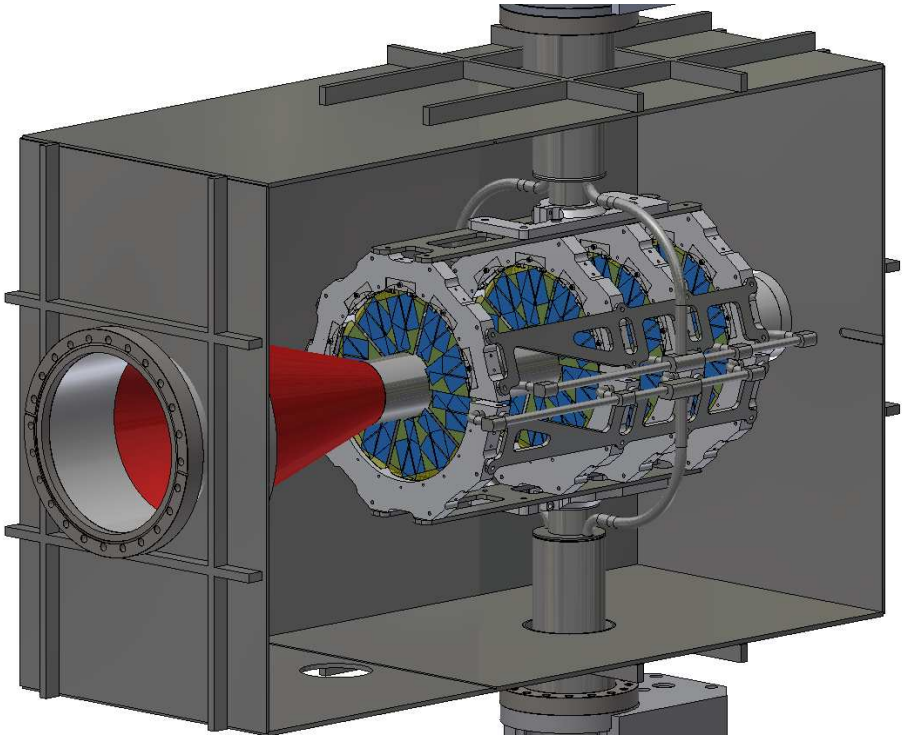
- Temperature measurement inside of the detector necessary
- 88 temperature sensors (PT100) foreseen:
  - 40 temperature sensors (on the diamonds) for monitoring
  - 48 temperature sensors (on the halfplanes and PCB) for overheating protection

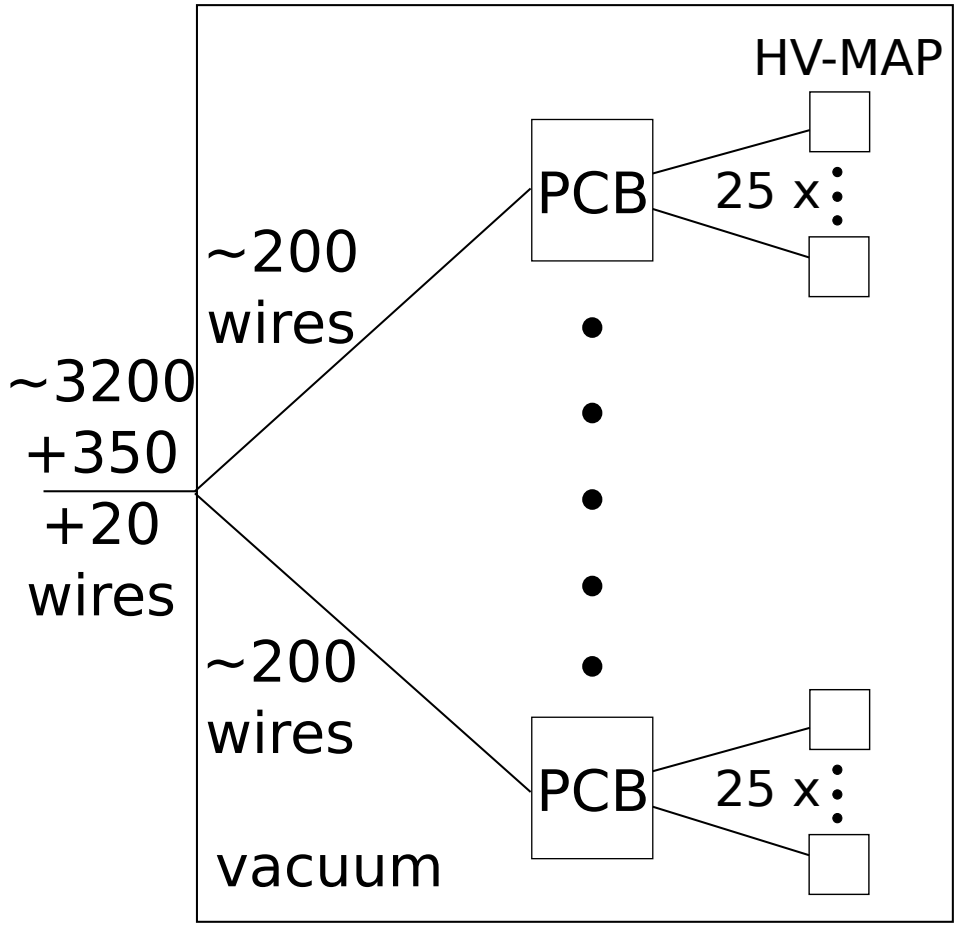
  $\rightarrow$ 352 wires
- Maybe NTC Thermistors on the HV-MAPS
- Patch panel to combine single wires to a FPC





Feedthroughs

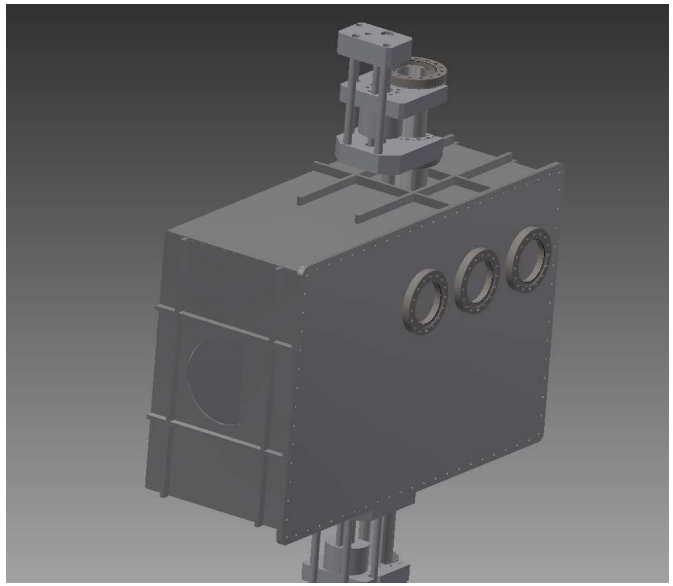




Feedthroughs

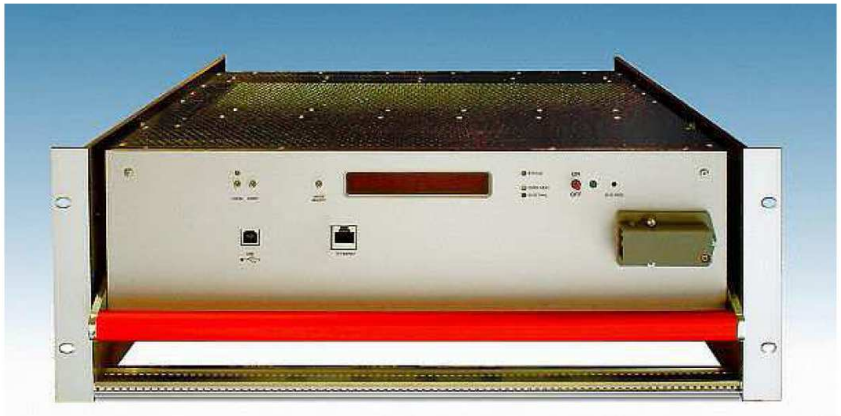
- Feedthroughs necessary for about 3600 wires
- Flex cables glued in a flange for
  - Signal
  - Clock
  - JTAG
  - Reset
  - Testpulse
  - HV

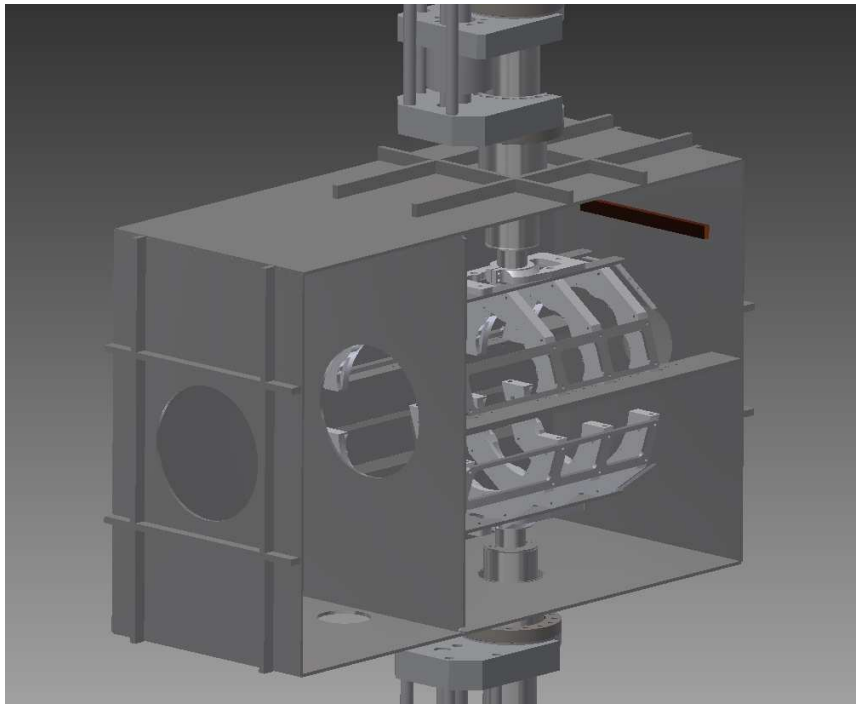
  $\rightarrow$ less space necessary than connectors
- FPC of the temperature sensors use the same flange
- Use of high current feedthroughs for the LV
- Seperate feedthrough for CAN bus



Low Voltage

- HV-MAPS need 1.8 V (< 1.6 A)
- Voltage drop on flex cable up to 0.2 V $\rightarrow$ LDO regulator with sense pin necessary
- Use of ADP1740
  - Regulation: < 300 mV
  - $I_{Out} < 2$ A
  - Dimensions: 4 mm $\times$ 4 mm
- Power supply: Wiener PL506 with MEH-02/07
  - Up to 115 A per channel
  - Master-Slave mode for paralleling of channels
  - Noise and ripple (datasheet): < 10 mV
- Use of a current bar in the detector to split the LV to the PCBs





Summary and Outlook

- Cables from the sensors to the PCB have to be very thin
  $\rightarrow$ Use of flex cables (thk $\sim 70\,\mu$m)
- Estimated voltage drop for the LV up to 0.2 V
  $\rightarrow$ Use of LDO regulator with sense pin
- $\sim$3600 feedthroughs necessary
  $\rightarrow$ Use of flex cables glued in feedthroughs

Work in progress

- Test of the LVDS repeater and clock distributor
- Test of rigid flex cables
- Radiation tests