

VELO Upgrade Electronics Cooling

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Not covered by this talk

Front-end electronics: CO_2 cooled in vacuum

Off-detector electronics: racks in D3 and on the surface

Covered by this talk

Electronics mounted on the vacuum tank (OPBs)

Front-end control, O/E and DC/DC conversion

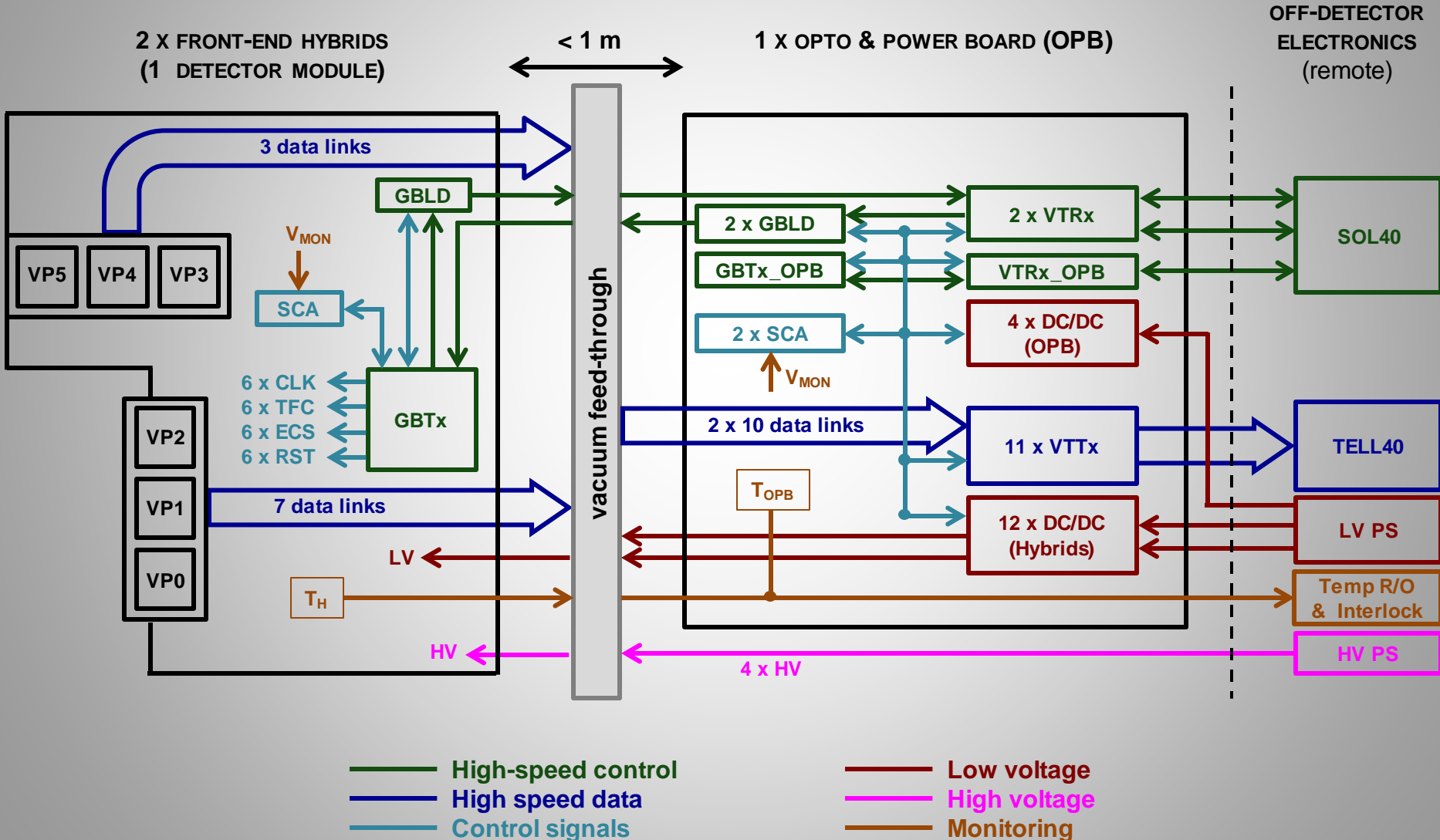


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VELO Electronics overview





Power dissipation



- OPB: Opto- and Power Boards, mounted on the vacuum tank
- Each OPB has 5 supply voltages: 5 V @ 0.8, 4.5, 4.5, 2.2 & 2.2 A
 - Estimates are hopefully conservative
 - Assuming 0.5 and 1.0 Ω cable resistance
 - Fits just about in the current CAEN LV specs
 - Long distance cable voltage drop close to the limit

Upgraded VELO	PS output power (W)	Power dissipation (W)		
		Cables	OPB	Module
1 module	100.5	30.1	33.8	36.6
½ VELO	2610	780	880	950
Full Velo	5220	1560	1760	1900



Power dissipation: current vs. upgrade



Current VELO*	PS output power (W)	Power dissipation (W)		
		Cables	Repeater Boards	Module
1 module	42.2	13.4	12.3	16.5
½ VELO	930	300	270	363
Full Velo	1860	600	540	725

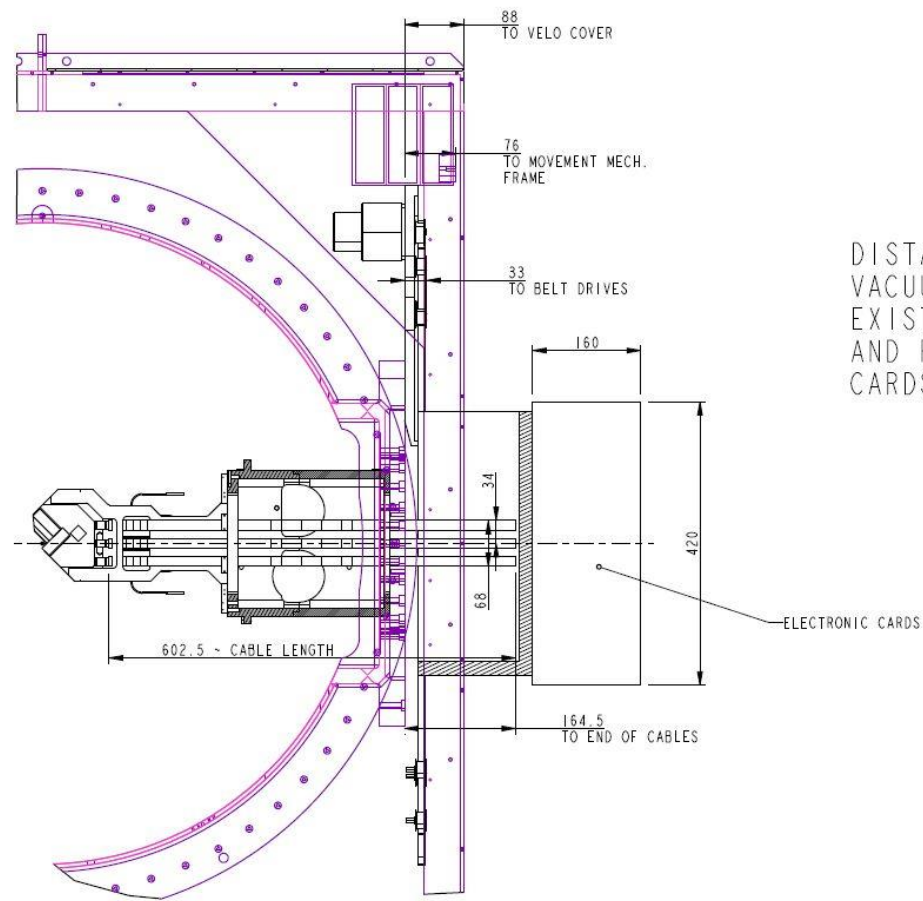
*Measured values, ignoring binary part of the pile-up modules & RPT boards

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*Conservative estimates, hopefully less



OPBs: physical location

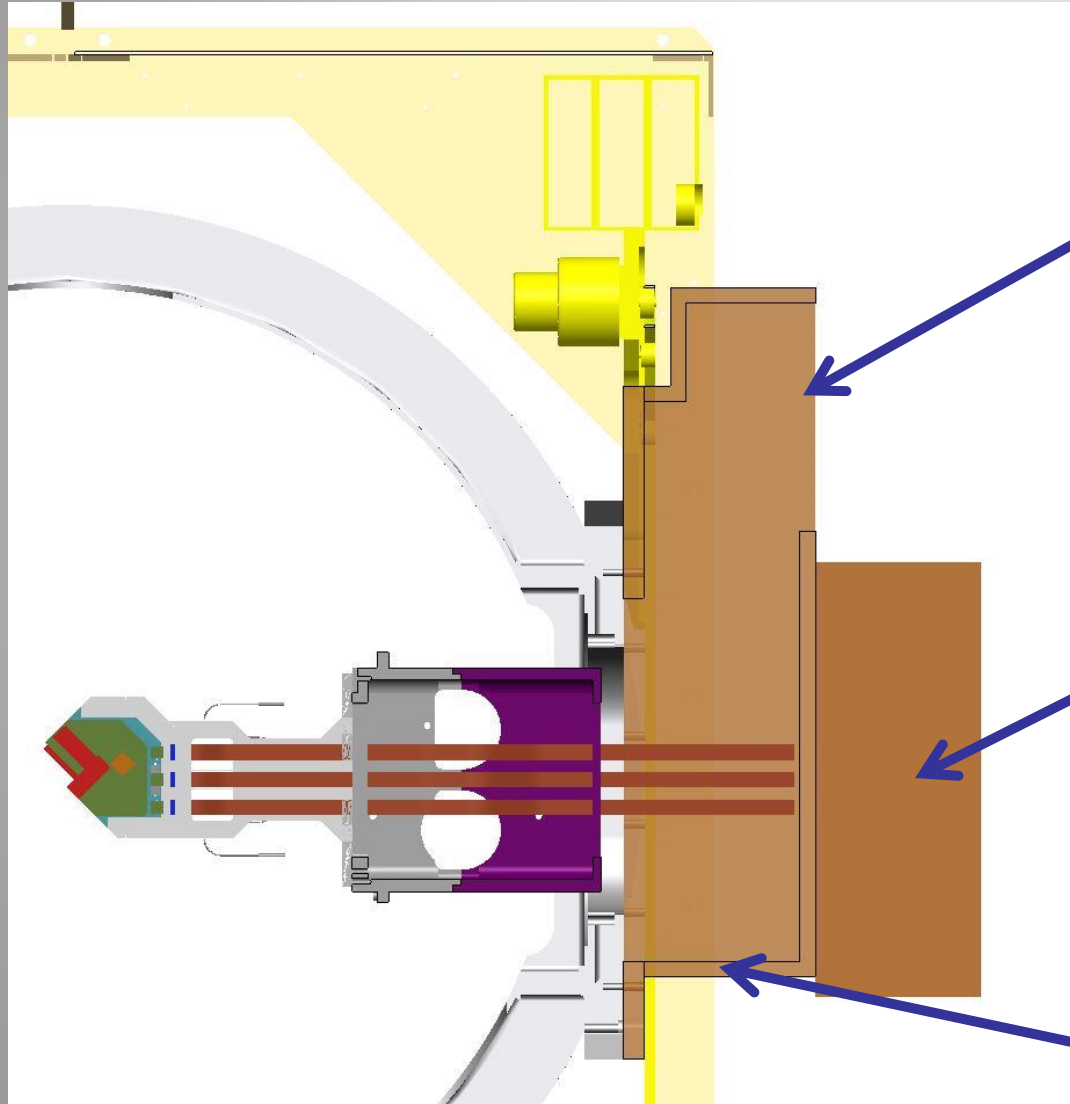


DISTANCES IN X FROM THE VACUUM TANK FLANGE TO EXISTING COMPONENTS AND PROPOSED ELECTRONIC CARDS/CABLES

SECTION A - A



OPBs: physical location



Tertiary vacuum: CO2 distribution & safety valves (access required)

OPBs: indicates the card size, not including crates or cooling

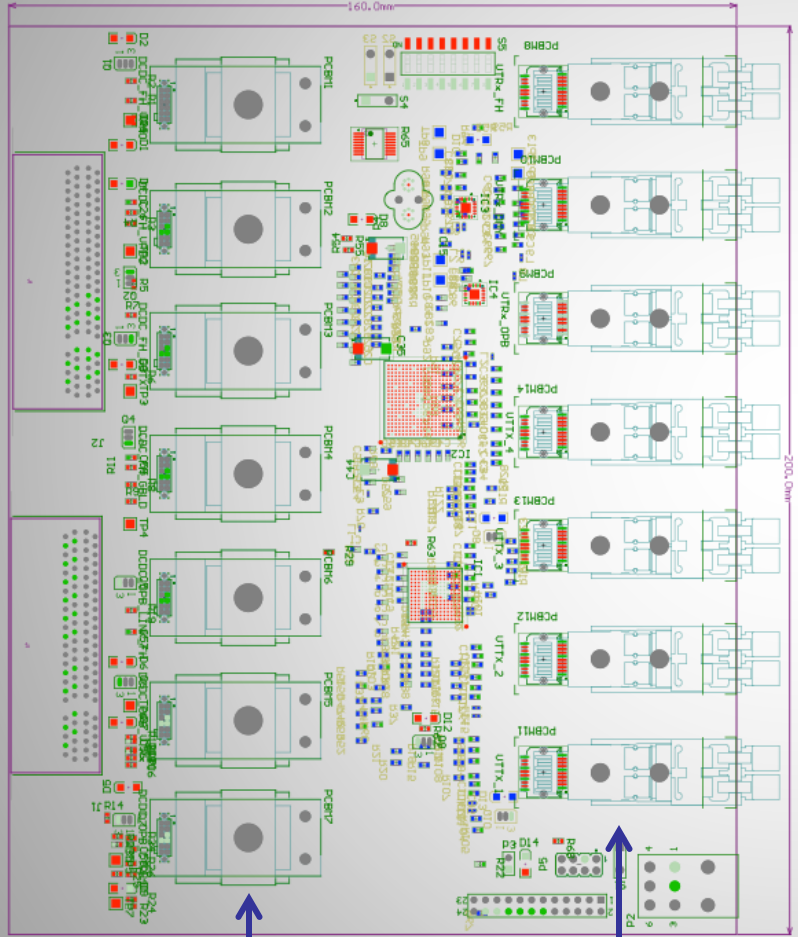
Vacuum ports for pumping



OPB: cooling, heat path

Layout of prototype OPB, full size board expected to be 160 x 420 mm²

vacuum feed-through



DC/DC converters

VTT/Rx

optical fibres & LV connection

- Heat dissipation mainly in
 - DC/DC converter
 - VTT/Rx modules
- Distance between boards
 - 30 mm
- Maximum component height
 - approx. 20 mm
- Cooling concept
 - Vertical heat sinks (bars) on the board
 - Running along the 'hot' component
 - Fins for air cooling?
 - Transport the heat to the board edge?



Cooling options



- Passive air cooling
 - Crates have open top and bottom to allow vertical air flow
 - Pros: Simple, cheap, no maintenance
 - Cons: Probably not enough and heats up the VELO alcove
- Forced, chilled air cooling
 - Heat exchanger plus fans, like most off-detector crates
 - Pros: Simple on the PCBs, relatively simple crates
 - Cons: Radiation and magnetic field tolerance
- Circulating chilled water
 - Either in the crate, cooling the bars from the card edges
 - Or through the cooling bars themselves
 - Pros: chilled water is easy to provide
 - Cons: Complicates board and crate designs. The area is already very busy (CO₂ distribution, feed-thoughts, ...)