Integration with LDC & Push-pull impact on LumiCal

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Outline of talk

- Integration with LDC:

  LumiCal inner & outer radius, support, cables & cooling pipes patch, beam pipe shape, opening scenario.

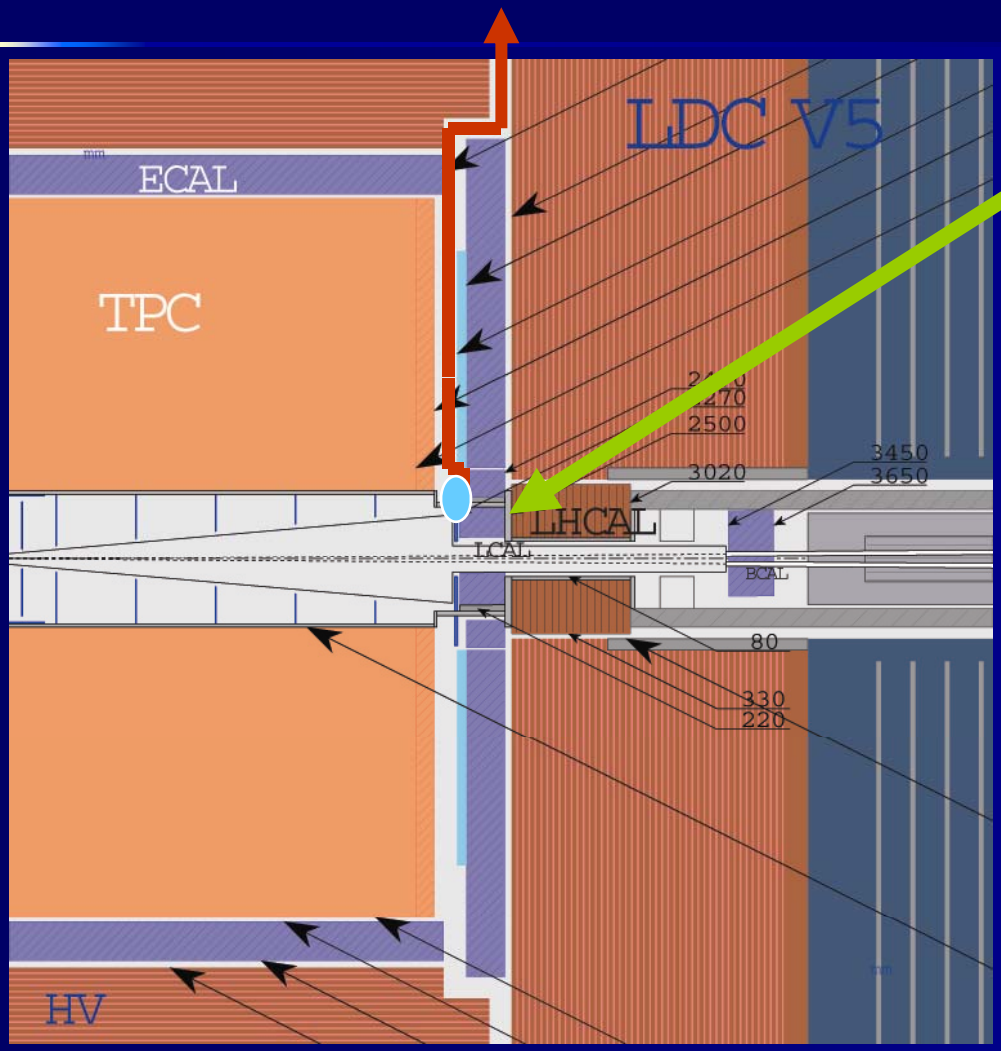
- LumiCal alignment in push-pull concept:

  requirements, solutions, problems

Integration with LDC

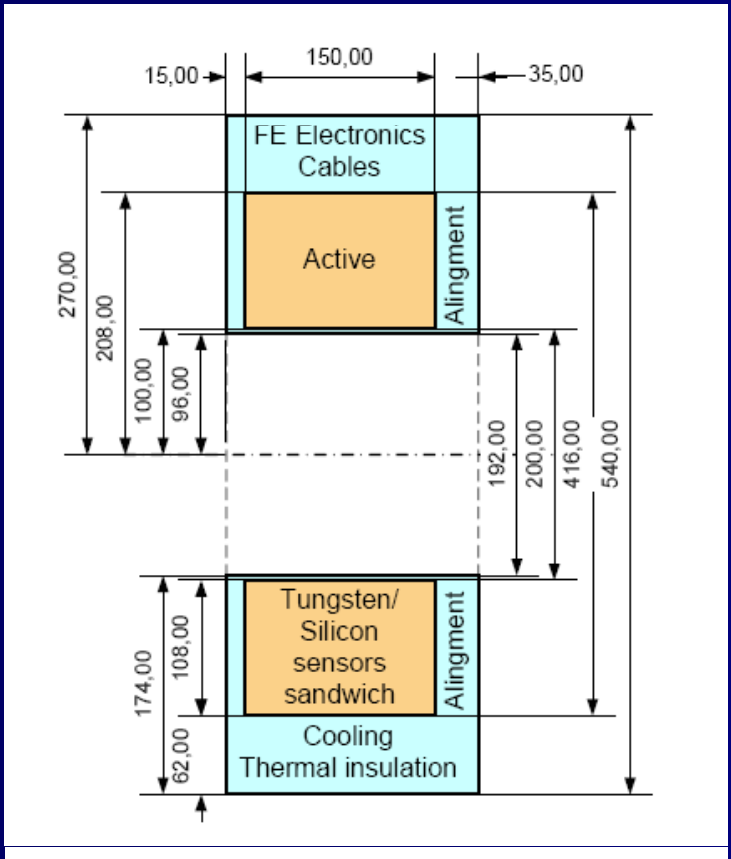
- How to fix LumiCal? (~250 kg)
- Where to put signal, power cables and cooling pipes? (~10-20 cm^2)
- Beam pipe shape – minimize the material in front of LumiCal
- Opening scenario (Vertex, TPC maintenance)

LumiCal inside LDC



- LumiCal can be mounted to special support fixed to the ‘construction’ pipe.
- Cables and cooling water pipes can be feed out in the gap between TPC and ECal endcap.
- Space for connectors
- Access to connectors
- LumiCal has to be centered on the outgoing beam.

LumiCal mech. dimensions



- Inner active radius = 100 mm
- Inner mech. radius = 96 mm
- Outer active radius = 208 mm
- Outer mech. radius ~270 mm

Auxiliary systems

- Output digital links: max. 360 TP cables LVDS (estimated 180)
- Power cables: 180 power lines
- Control cables (+clock): a few TP cables + 2-4 coax cables
- Water cooling: ~4 copper pipes ~10 mm dia.
- Thermal insulation of the LumiCal to prevent temperature changes

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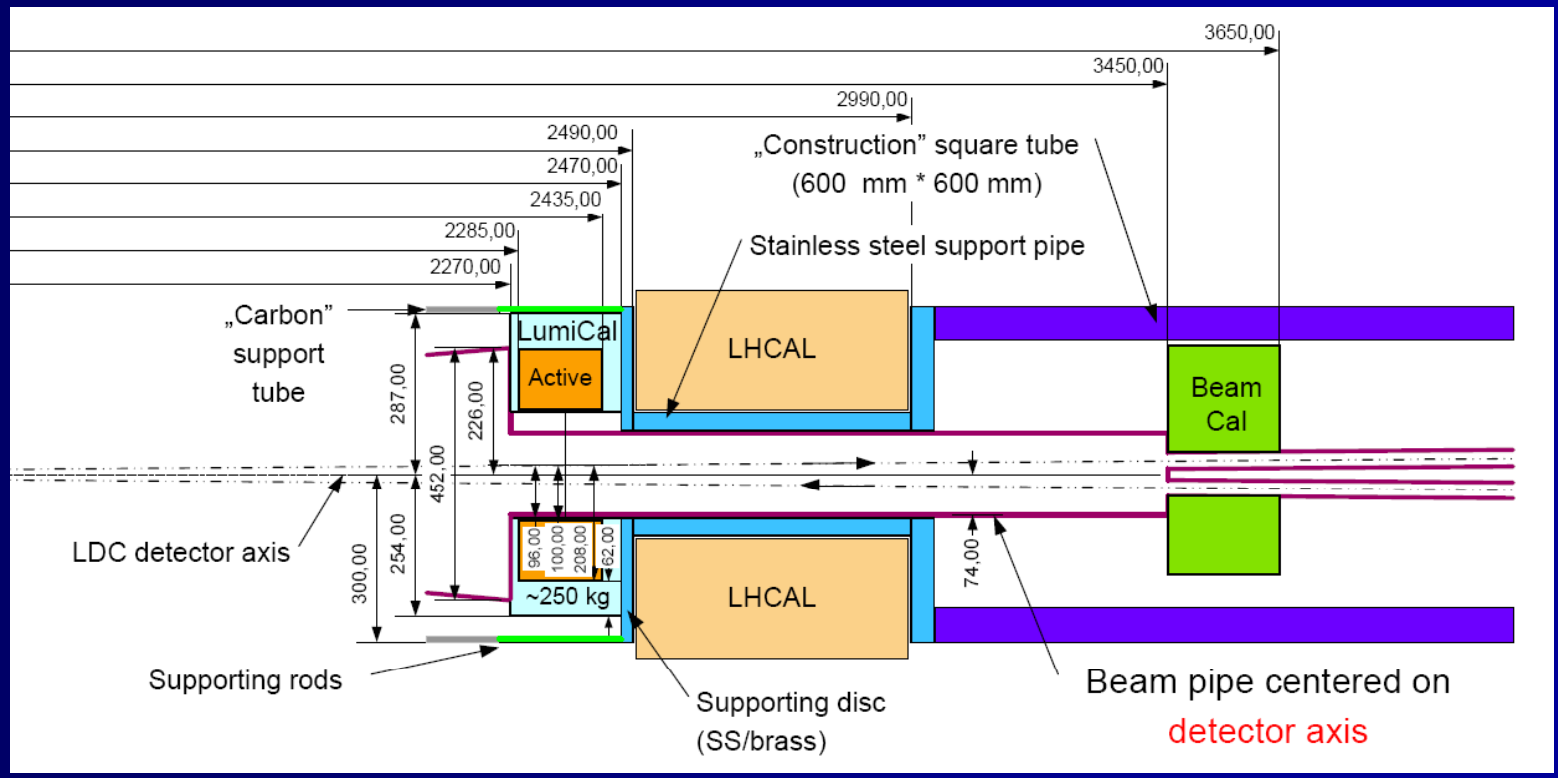
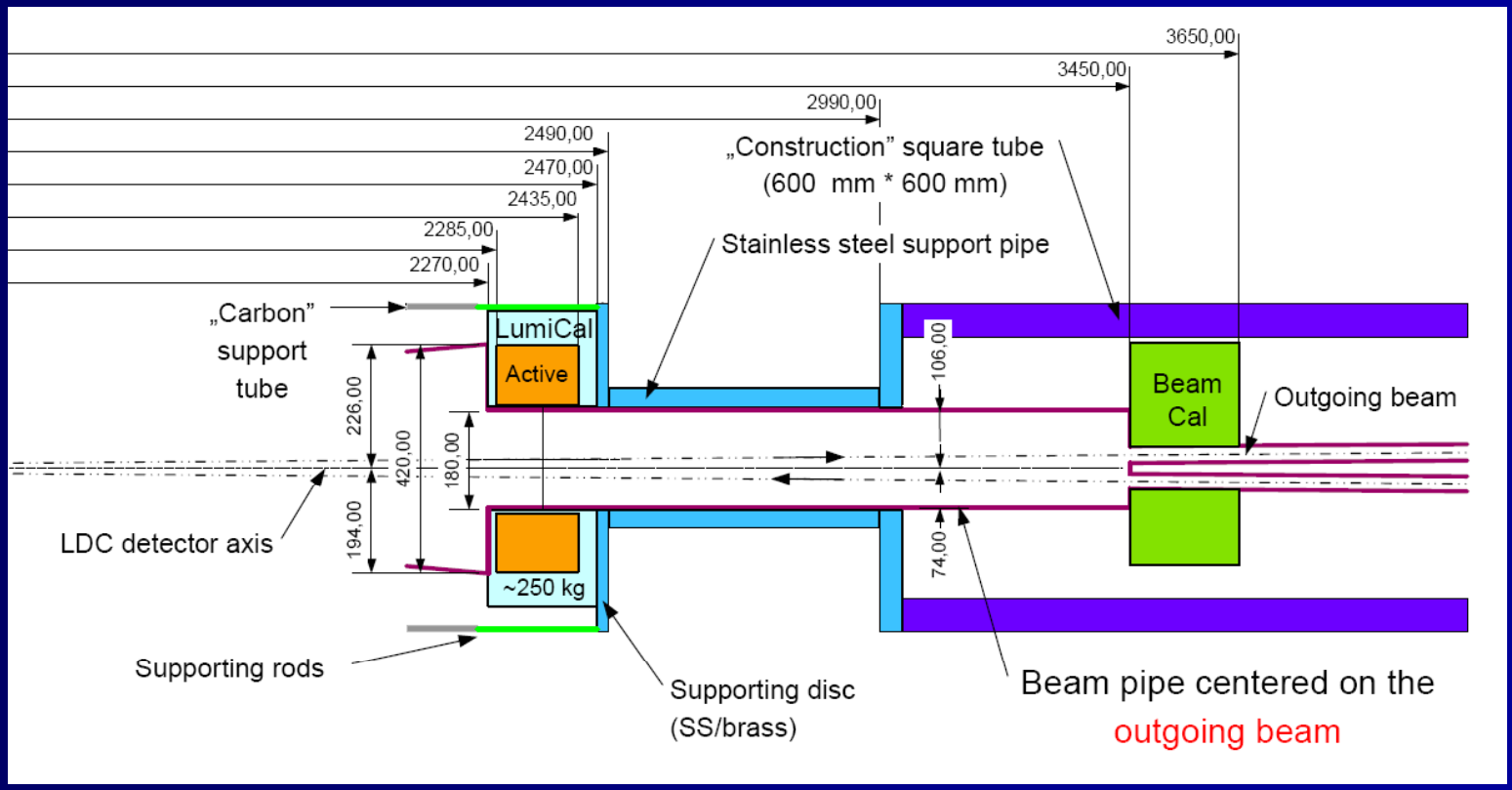
High precision design

Beam pipe centered on detector axis



Solution not convenient for BeamCal and vacuum (to small pipe diameter)

Beam pipe centered on outgoing beam

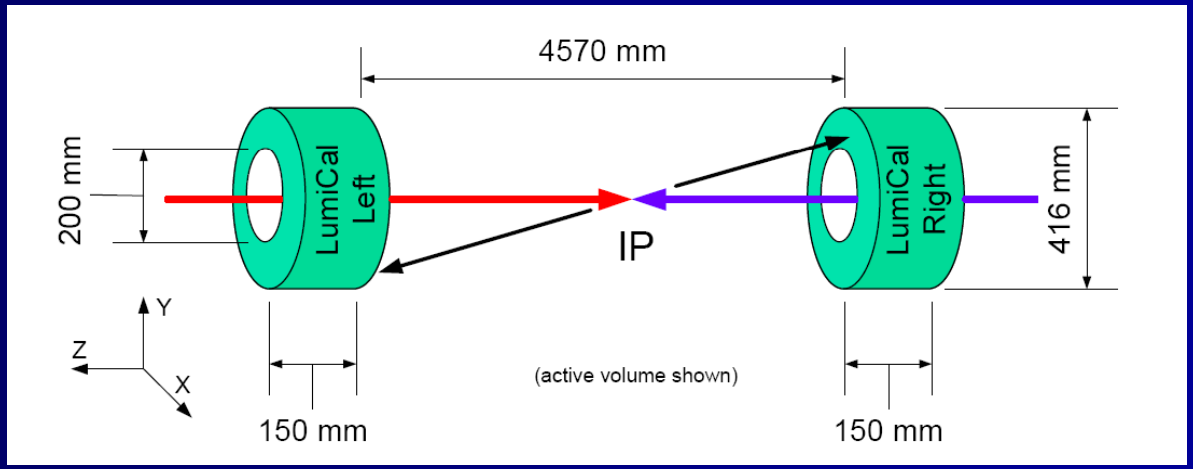


Better for BeamCal and vacuum, the LHCal has to be centered on the outgoing beam. The beam pipe diameter between LumiCal and BeamCal has to be discussed more carefully.

Opening scenario

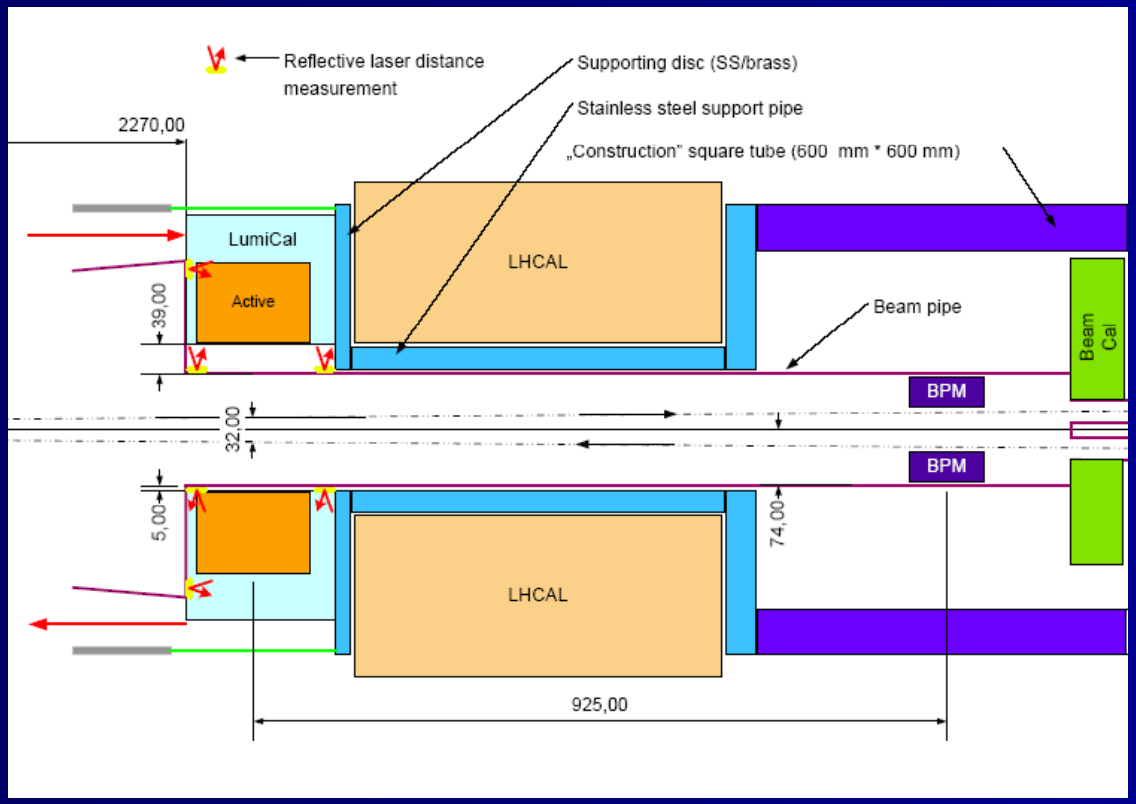
- It is not necessary to open and take out LumiCal for Vertex and TPC maintenance.
- But, to pull out TPC, it is necessary to disconnect cables and cooling pipes.
- Need space for connectors and access to cables and pipes.
- For LumiCal maintenance (beam pipe exchange) it is necessary to install temporary support with movable cars.
- Disconnect cables and cooling pipes
- Unscrew halfbarrels and move both LumiCal parts out.

Two LumiCal's alignment



- LumiCal x, y position with respect to the beam (incoming) should be known with accuracy better than ~700 μm (better ~100-200 μm) (LumiCal's will be centered on outgoing beam)
- Distance between two LumiCal's should be known with accuracy better than ~60-100 μm (14 mrad angle)

Alignment measurement based on beam pipe and BPM.s



- Reflective laser distance measurement – accuracy ~1-5 µm, resolution ~0.1-0.5 µm
- Mirrors glued to beam pipe
- Calibration of sensors procedure – detector push-pull solution (?)
- Calibration of sensors procedure after power fault (?)

- Beam pipe (well measured in lab before installing, temperature and tension sensors for corrections) with installed BPM
  (BPM's also on outgoing beam?)
- Laser beams inside 'carbon' pipe (need holes, but possible)

Summary

- Very challenging project:

  precisely positioned Si sensors (inner radius accuracy < ~4 µm), x & y alignment with respect to the beam < ~700 µm, distance between Calorimeters < ~100 µm, tilts < ~10 mrad.

- Alignment is a crucial task:

  distance between LumiCals (z) should be known better than ~100 µm over 4.5 m.

- A lot of problems to be solved, a lot of work to be done...

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