



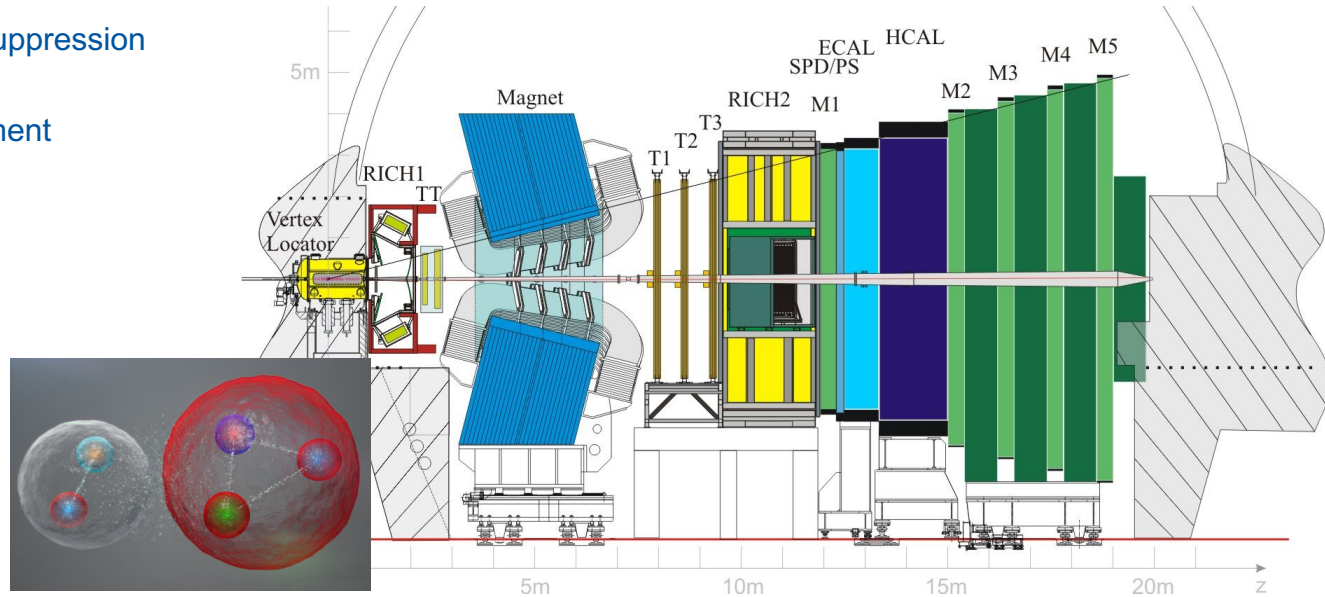
Microchannel Cooling Characterization in VELO Detectors

Benjamin Lunday



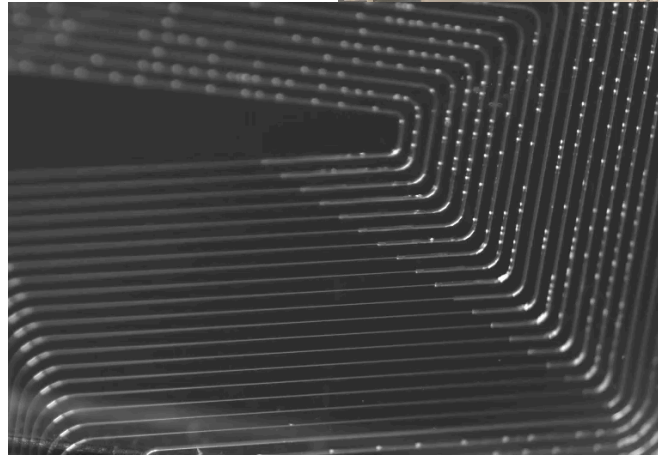
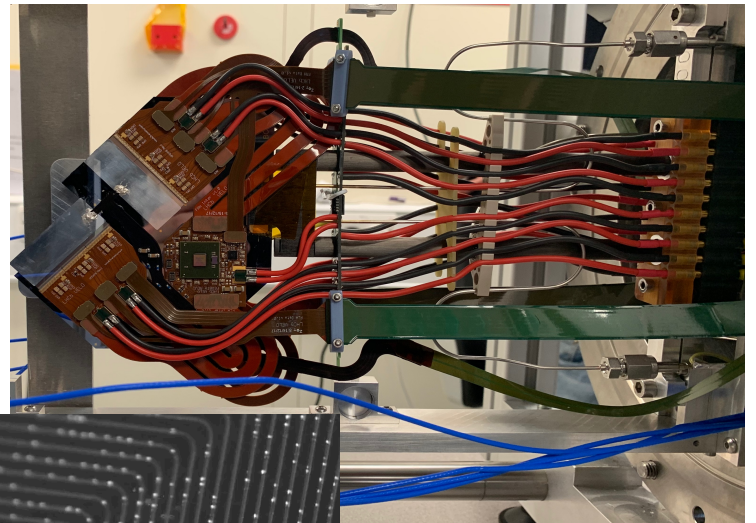
LHCb: An Overview

- Primary physics objective: CP violation characterization through heavy flavor decay
 - B meson decays
 - Branching fraction suppression
 - Rare decays
 - CP phase measurement
 - Linear design
 - Notable discoveries
 - Pentaquarks
 - Excited χ baryons
 - $B_s \rightarrow \mu^+\mu^-$ branching fraction



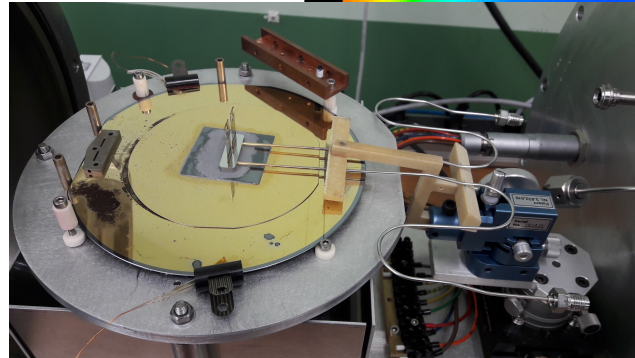
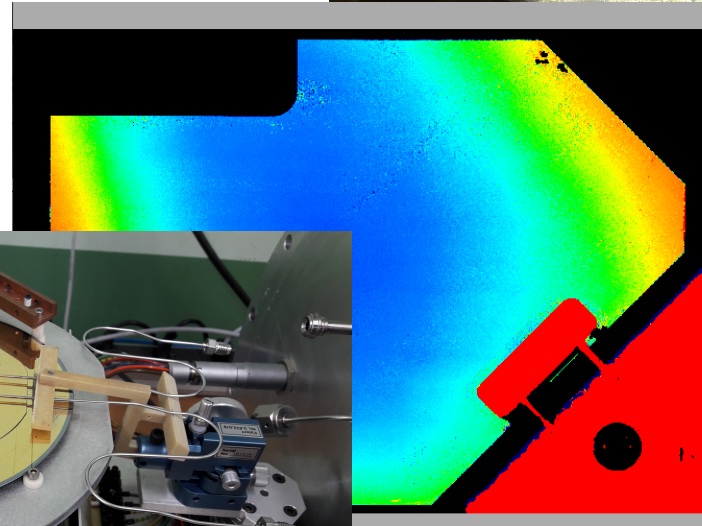
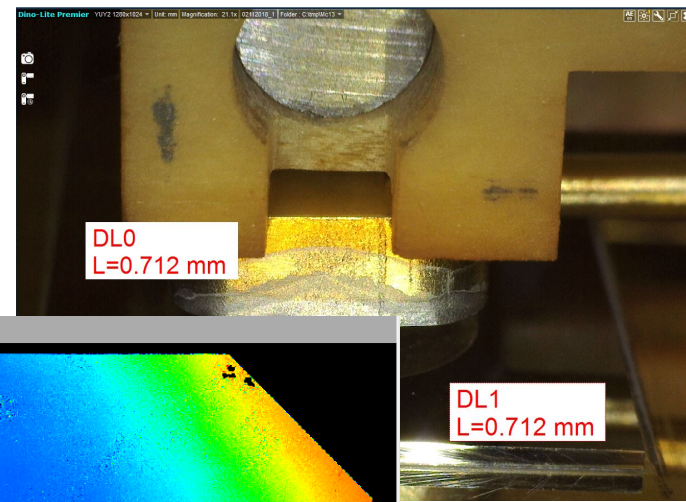
VELO Subdetector

- VELO – Vertex Locator
 - Tags primary decay vertices
 - Used to reconstruct primary decays before magnet
- Design/Requirements
 - Dynamic pixel detector
 - ~10 year lifespan
 - High bandwidth (~15 Gbit/s)
- Microchannel cooling
 - Liquid-vapor CO₂ mixture
 - Substrate integration
 - ‘ μ -channel’ principle



Current Work/Goals

- Detector Soldering
 - Alignment
 - QC/Characterization
- Mitigating production slowdowns
 - Tight schedule
 - Varying/inconsistent problems
 - > Offsite production
- Database management
 - Automate uploads



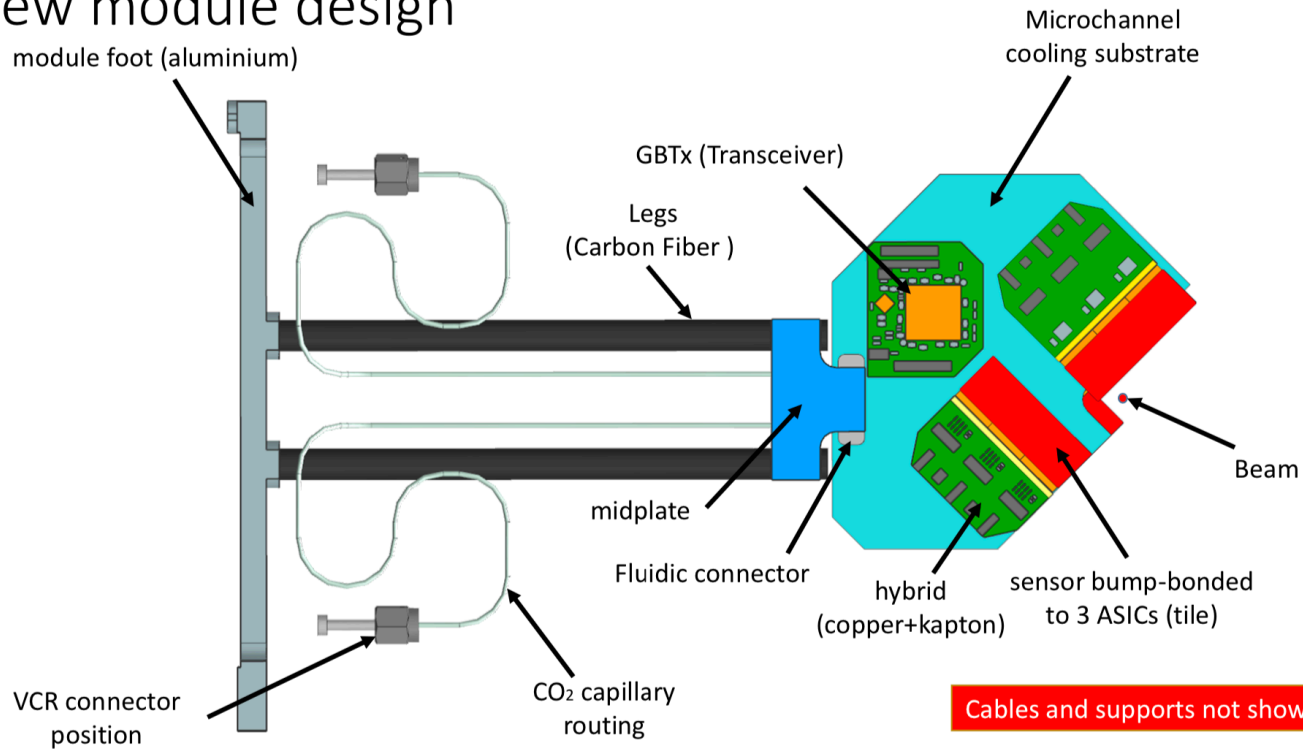
Experiences

- Geneva:
 - > Record Stores
 - > Independent Coffee Shops
- Travel:
 - > Rome
 - > Annecy
 - > Vienna
- Upcoming:
 - > Montreux
 - > Chamonix/Zermatt



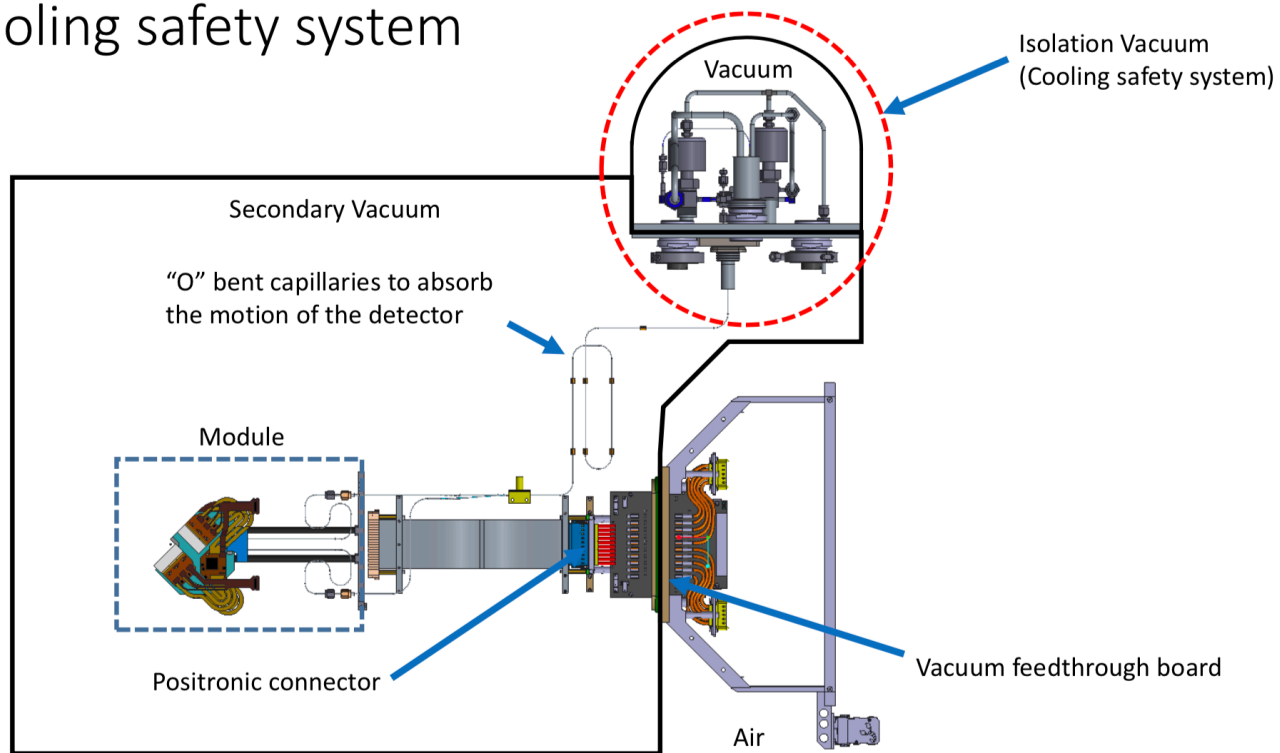
Backup

New module design



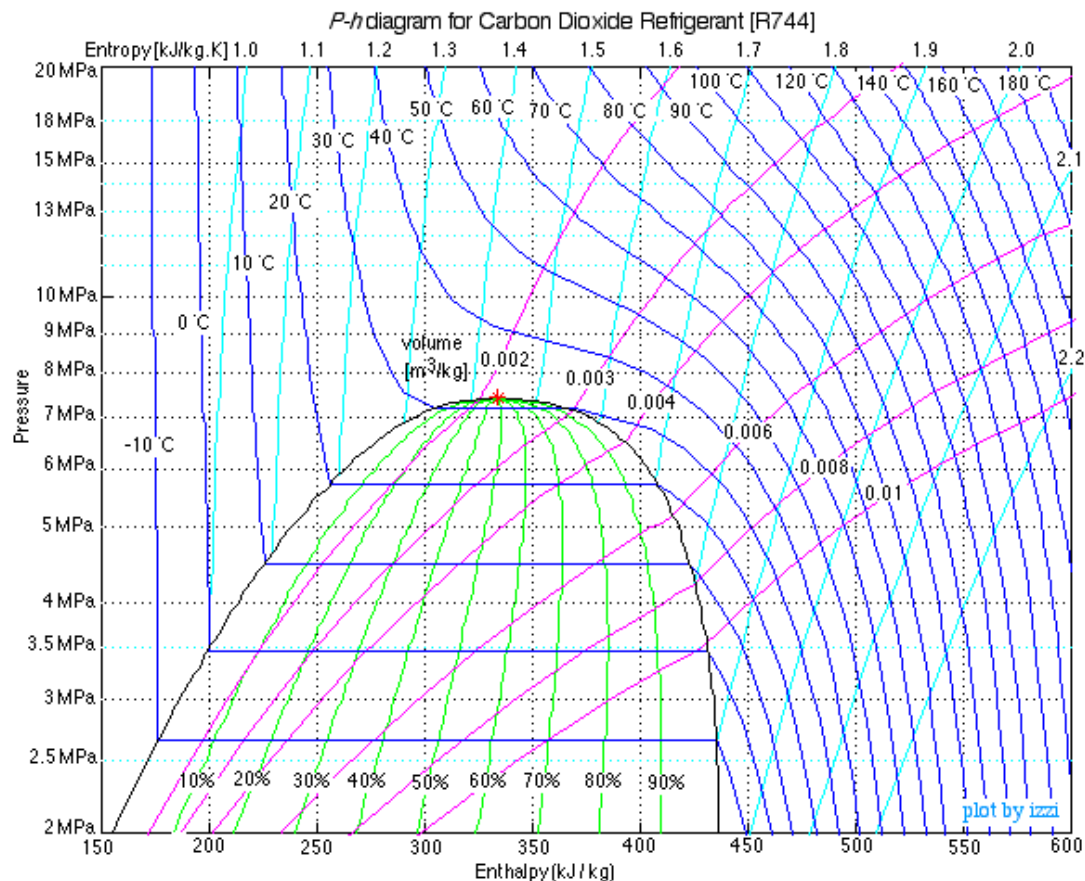
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Cooling safety system



21

CO2 Enthalpy



Full Soldering Process

- —> Chips delivered from NIKHEF
- 1) Detape/separate substrates and PT chips
- 2) Pressure test substrate samples
- 3) Substrate planarity measurement
- 4) Substrate visual inspection
- A. Cleaning/recleaning/investigation
- 5) Storage



- —> Connecters delivered from Oxford
- 1) Visual inspection under microscope
- 2) Polishing
- 3) Visual inspection
- 4) Grinding
- 5) Visual inspection
- 6) Metallization
- 7) Planarity measurement
- 8) Visual inspection
- 9) Cleaning
- 10) Visual inspection
- 11) Pre-tinning
- 12) Visual inspection
- A. Reflow as necessary
- 13) Alignment
- 14) Visual inspection/confirmation of alignment
- 15) Soldering
- 16) X-ray tomography
- 17) Pressure test
- 18) Helium leak test
- 19) Final visual check
- 20) Packing