Cooling

7.4: EXTREME ENVIRONMENT AND LONGEVITY

IMPLEMENTING DRD7:
AN R&D COLLABORATION ON ELECTRONICS AND ON-DETECTOR PROCESSING

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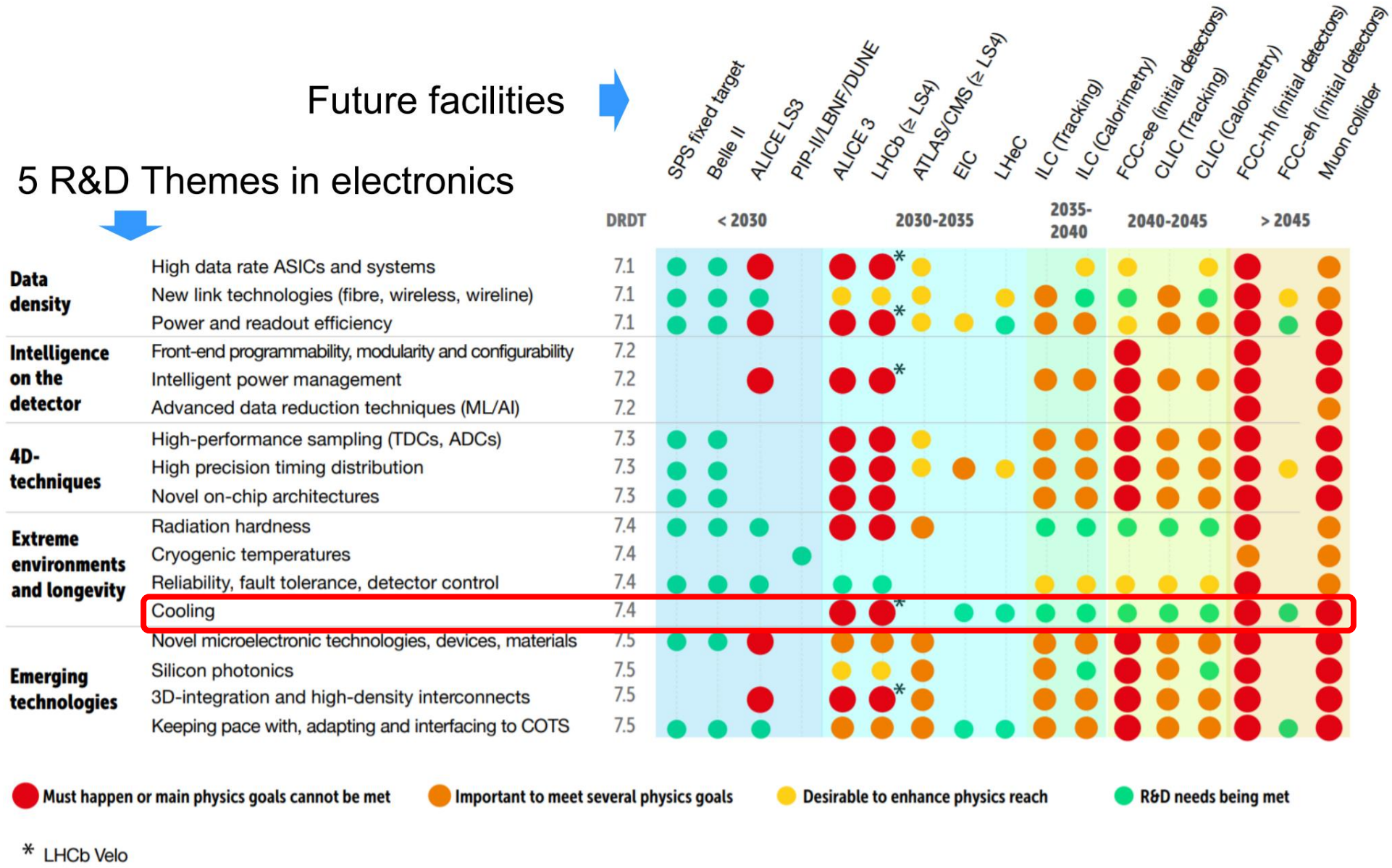
Future facilities

5 R&D Themes in electronics



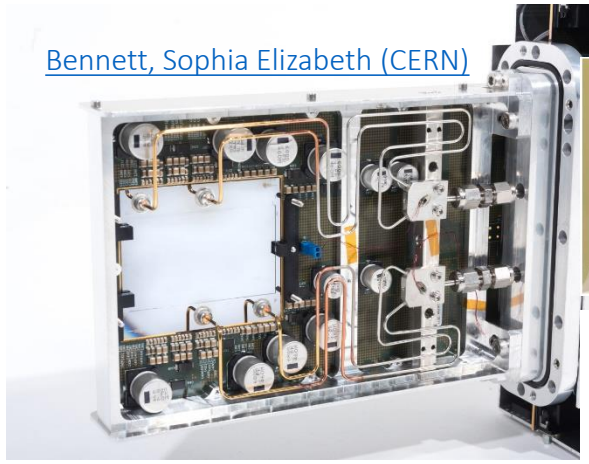
Cooling

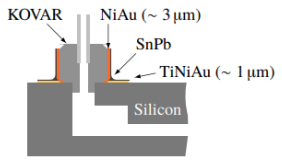
- Vacuum
- Operating Temperature
- Material Budget
- Power density
- Thermal figure of merit
- Integration
- Area/Cost

NA62 GTK

Bennett, Sophia Elizabeth (CERN)

arxiv



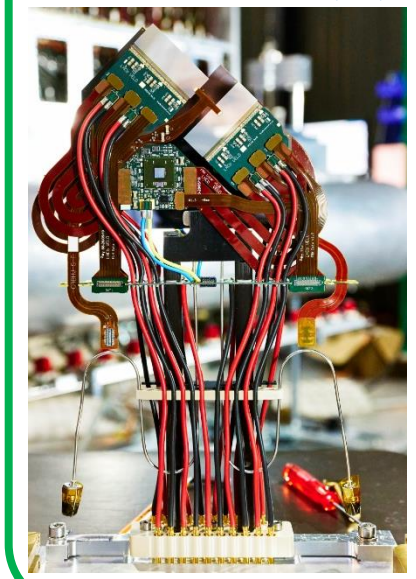


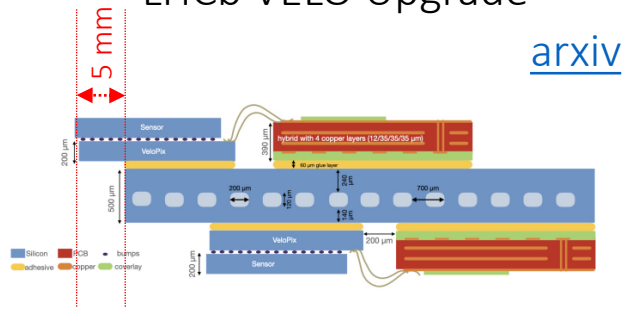
0.5% X0, 200 × 70 μm^2 micro-channels, C6F14 liquid coolant, 0.32 W/cm^2 in the pixel matrix, Sensor < 5C, Vacuum

LHCb VELO Upgrade

Brice, Maximilien; Ordan, Julien Marius (CERN)

arxiv

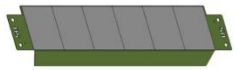




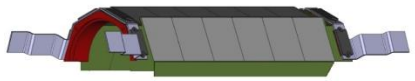
0.4-0.9% X0 (innermost region)
ASIC/Sensor overhangs by 5 mm,
Microchannels 120x200 μm^2,
CO2 bi-phase, 1W/cm^2,
Sensor < -20C, vacuum

Mu3e

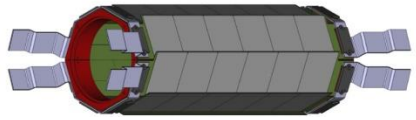
SciPost Phys. Proc. 5, 020 (2021)



Ladder

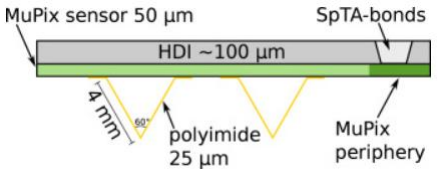


Module



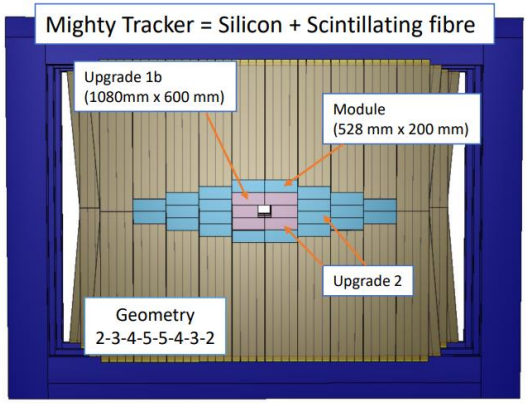
Layer

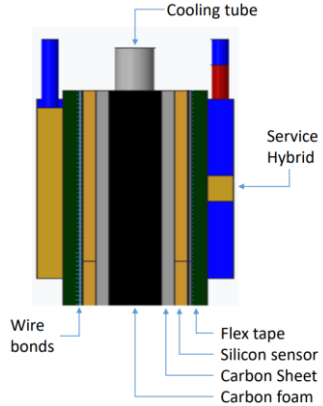
0.1% X0, Helium gas cooling, 0.4W/cm^2, Temperature < 70C



LHCb Mighty Tracker (2032)

FTDR





$18 m^2$, 1-2% X0, Kapton tubes, Liquid cooling (Novec?), 0.3W/cm^2, Temperature $\leq$ 0C

Remarks

- On the coolant side
  - CO_2 has an temperature operational limit (-47C cooling plant ATLAS Baby demo, solidification at -56C)
  - New R&D will be required to push this limits observing the environmental restrictions (Krypton Cooling)

- **No single solution for the cooling structure nor coolant**
- How to narrow down to fewer options?
  - Please fill this quick survey: here
  - Feel free also to contact the section 7.4 conveners if you have suggestions/comments

- Invited talk: "**On-detector cooling systems based on low-mass carbon dioxide evaporators**" by Desiree Hellenschmidt