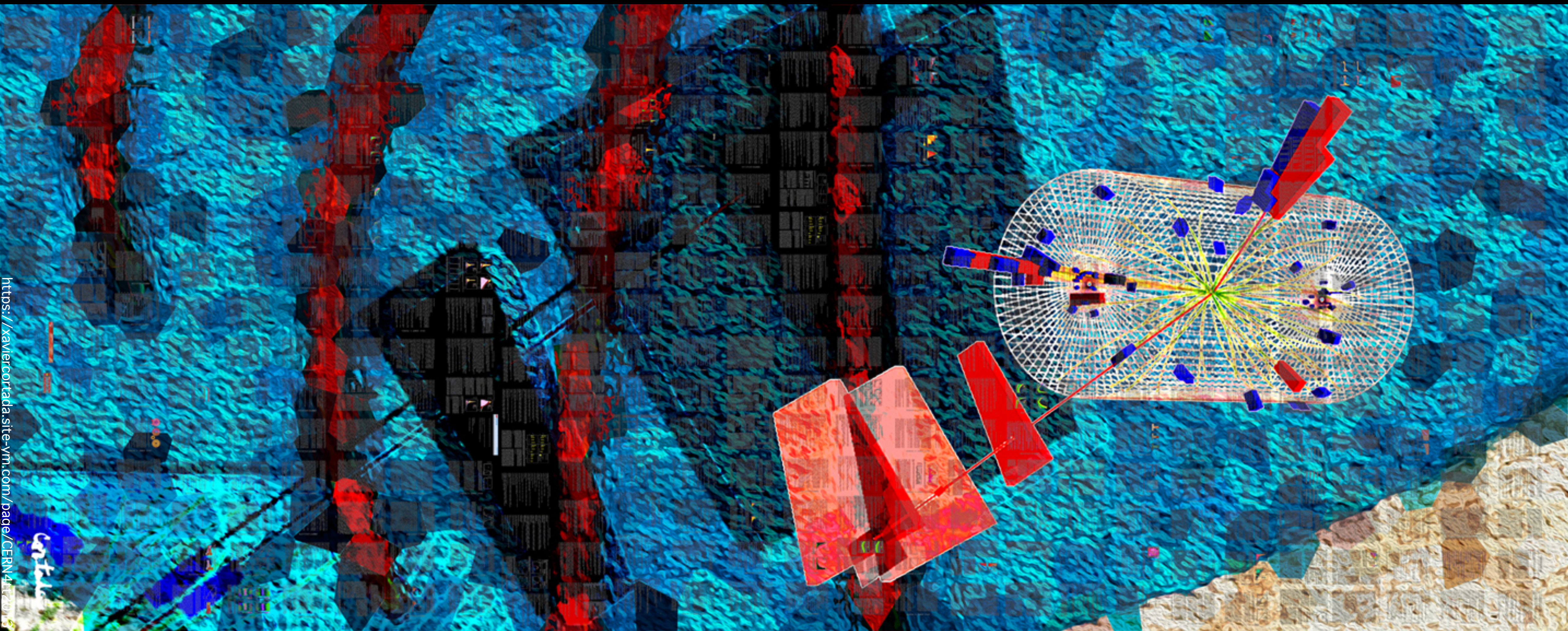


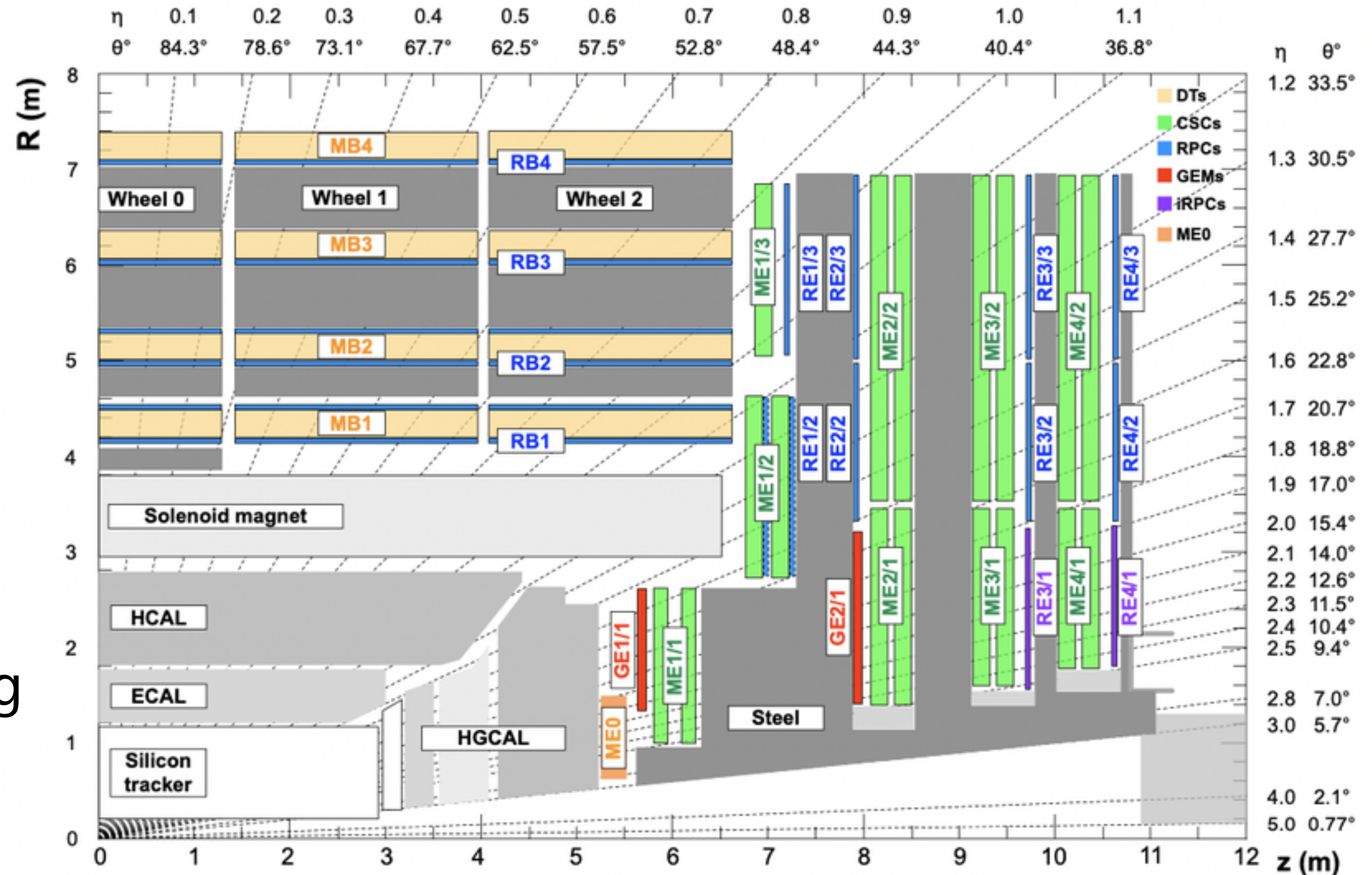
# CMS Muon B904 Laboratory

David Morse  
(Northeastern University)



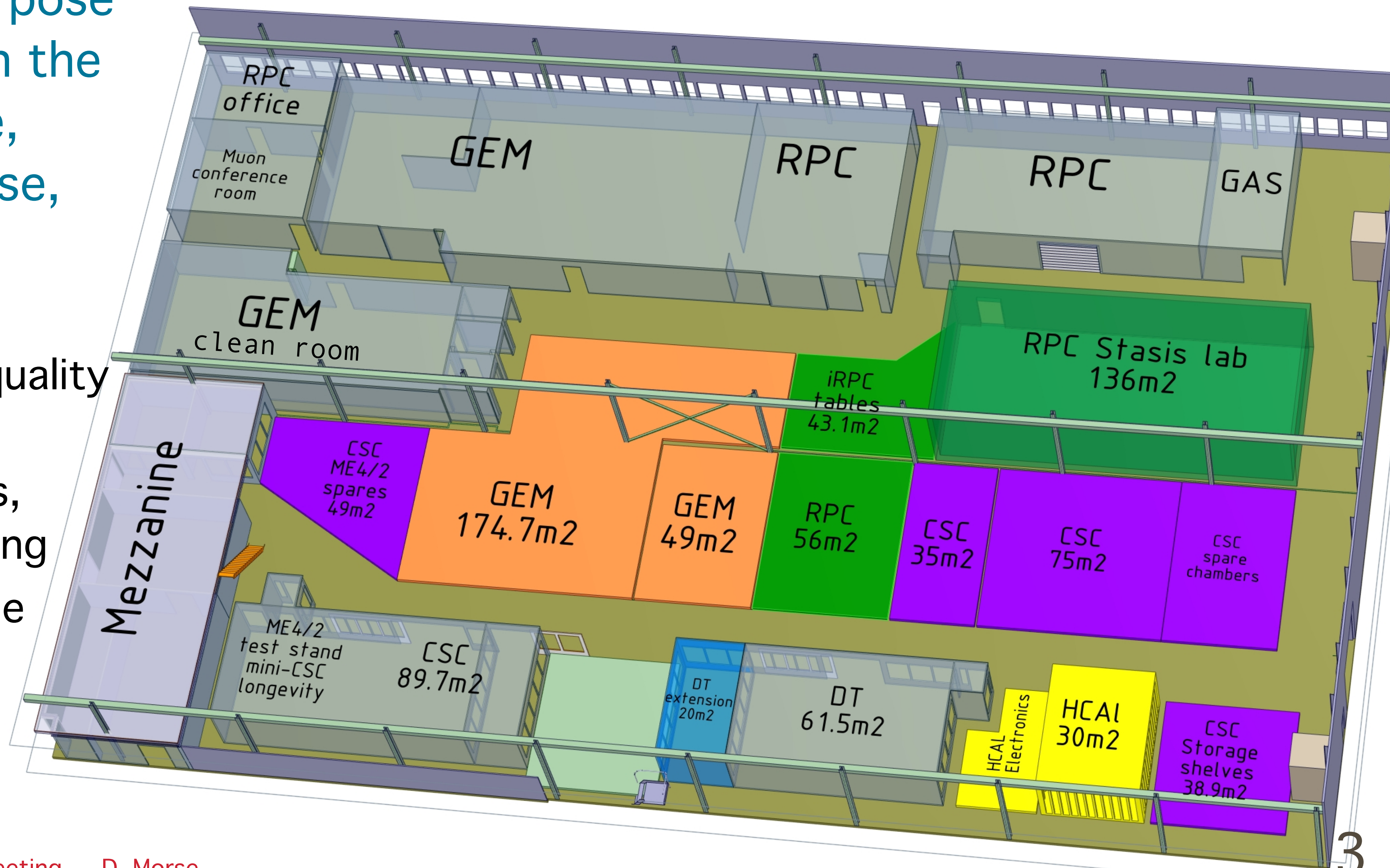
# CMS Muon detectors

- 4 gaseous detectors:
  - DT, CSC, RPC, GEM
  - Majority of system taking data since 2010
- New inner ring GEM (GE2/1, ME0) and improved RPC (RE3/1, RE4/1) chambers currently in production
- All detectors undergoing significant upgrade for High-Lumi LHC



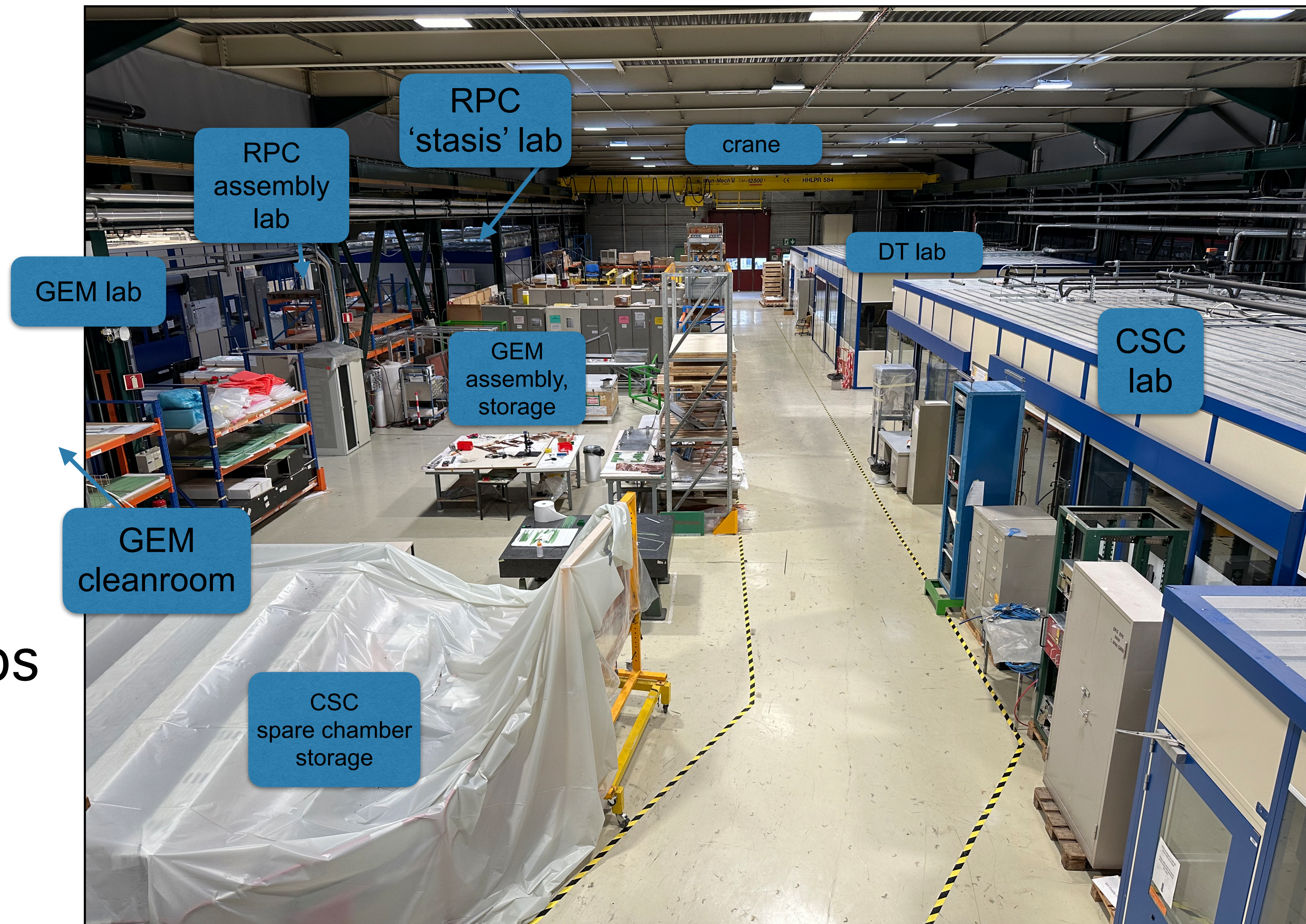
# CMS Muon B904 Laboratory

- ~1500m<sup>2</sup> multi-purpose laboratory facility in the CERN Prévessin site, occupied for CMS use, over all stages of detector lifetime
  - chamber assembly, quality control, storage
  - testing of electronics, HW, SW, FW, triggering
  - development in all the above categories
  - R&D for future improvements



# Infrastructure 1/2

- Mixture of open lab spaces, enclosed laboratories, and clean rooms, including ‘controlled’ radio-protection zone
- Movable cranes, heavy lifting equipment
- Significant testing setups using internal and external triggering



# Infrastructure 2/2

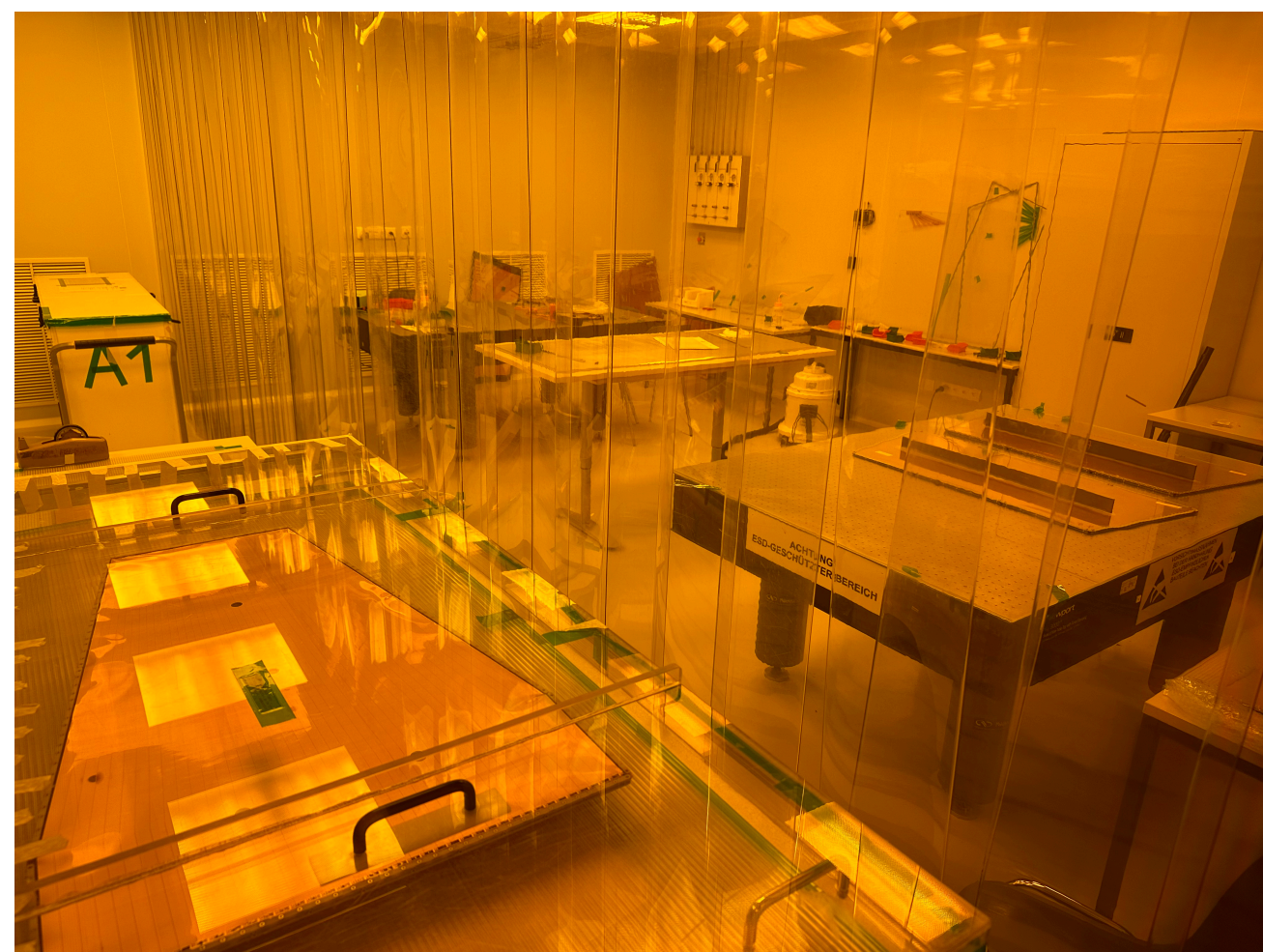
- Extensive power systems and water cooling available throughout the building
- Centralized gas mixing and distribution, as well as premixed bottle setups



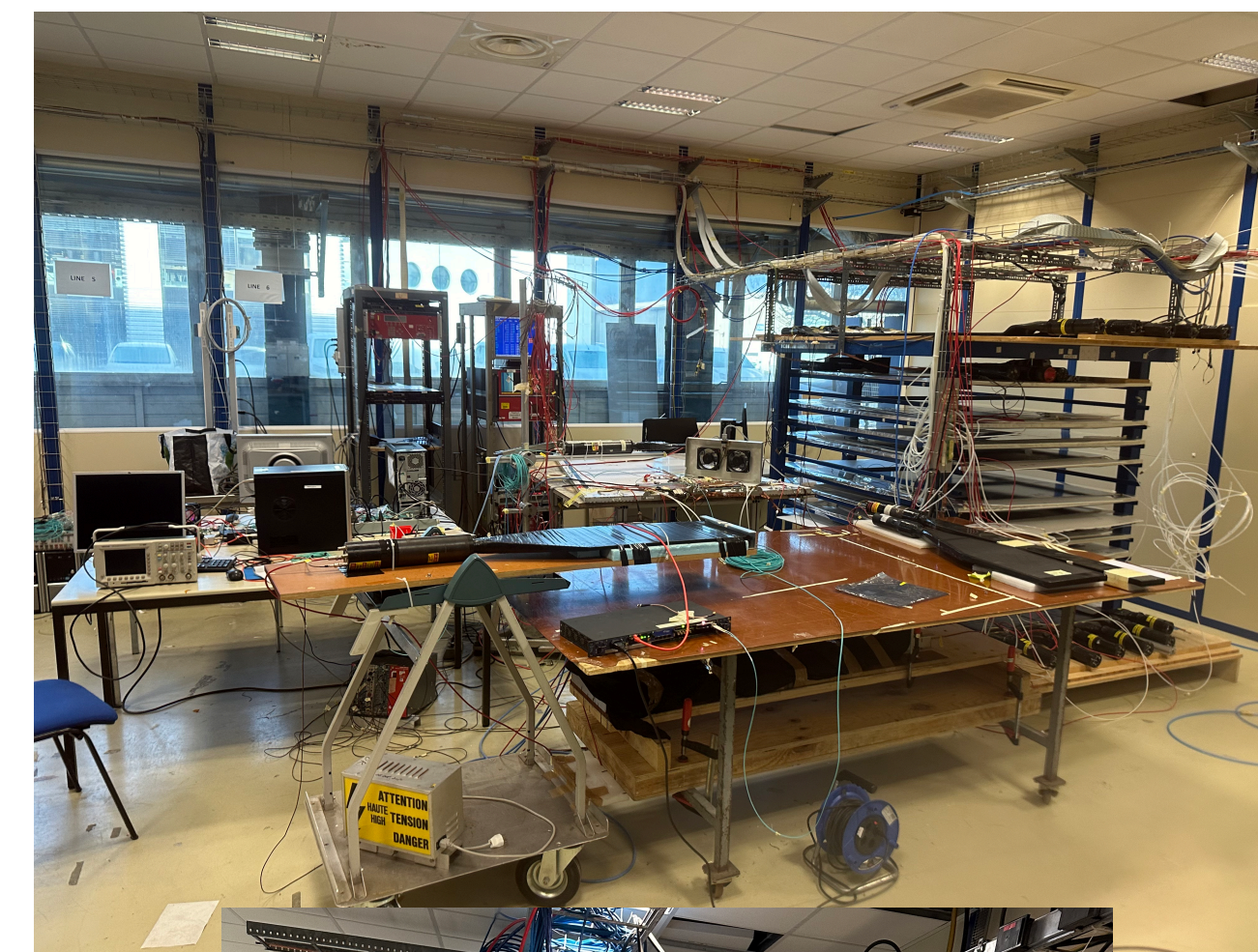
# Chamber Assembly, QC, Testing, Development

Large program of ongoing muon detector work. Just a few examples:

GEM module assembly in clean room



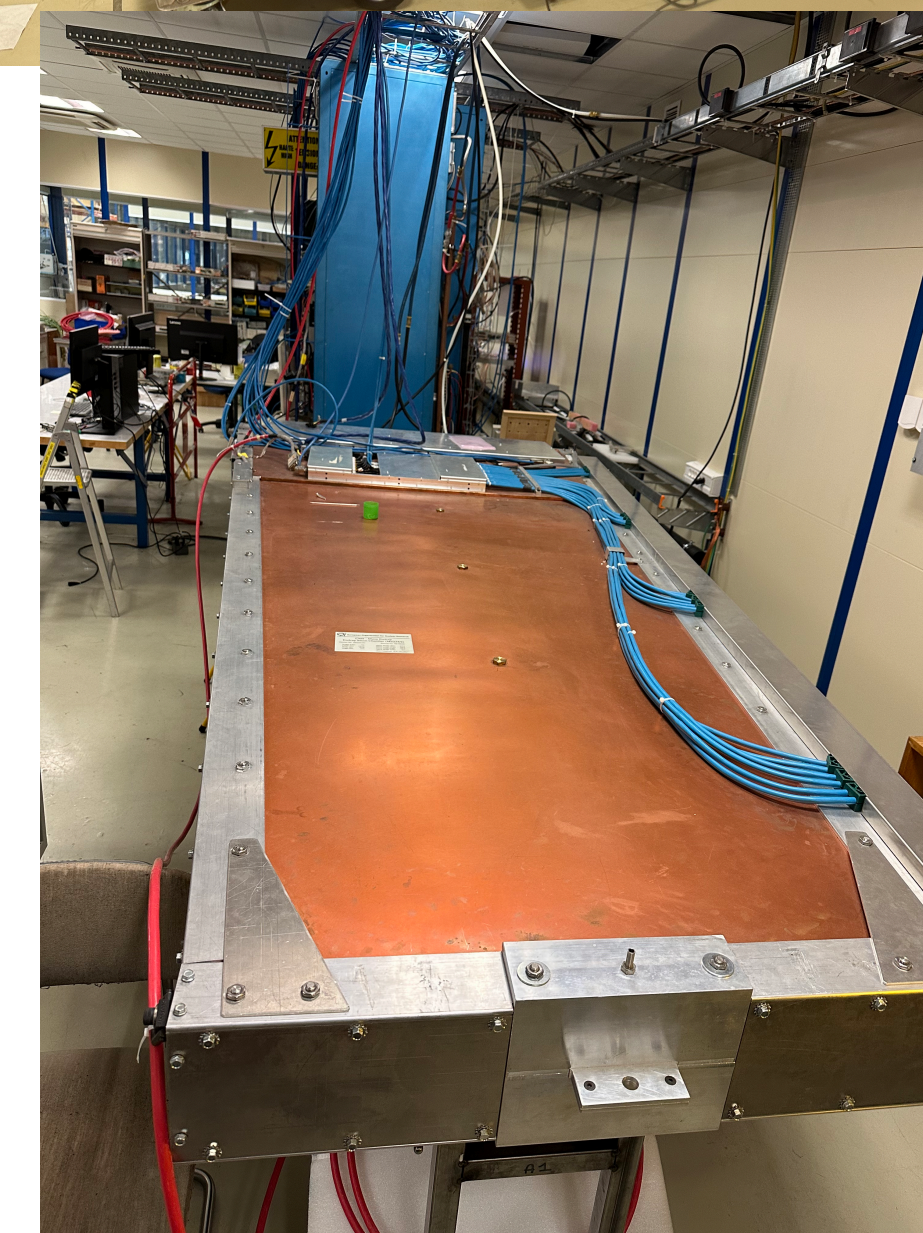
RPC chamber QC, testing, using external trigger



GEM chamber QC, testing. Includes prototype validation of future ME0 detector



CSC chamber test- and development-stand, irradiation area



# Ongoing detector R&D

- Vibrant ongoing program of R&D, with large interplay/overlap between B904 lab and GIF++ facility:

- Gaseous detector longevity and aging, see e.g. [K. Kuznetsova talk WG7](#)

- Long-term beam aging studies in all detector types
- Accelerated aging with CSC prototypes using 250 MBq Sr source

- Searches for viable reduction or replacement of greenhouse gases, see e.g. [M. Abbrescia talk in WG3 session](#). Detailed talks ([CSC, RPC](#)) in [3rd International Conference on Detector Stability and Aging Phenomena in Gaseous Detectors](#)

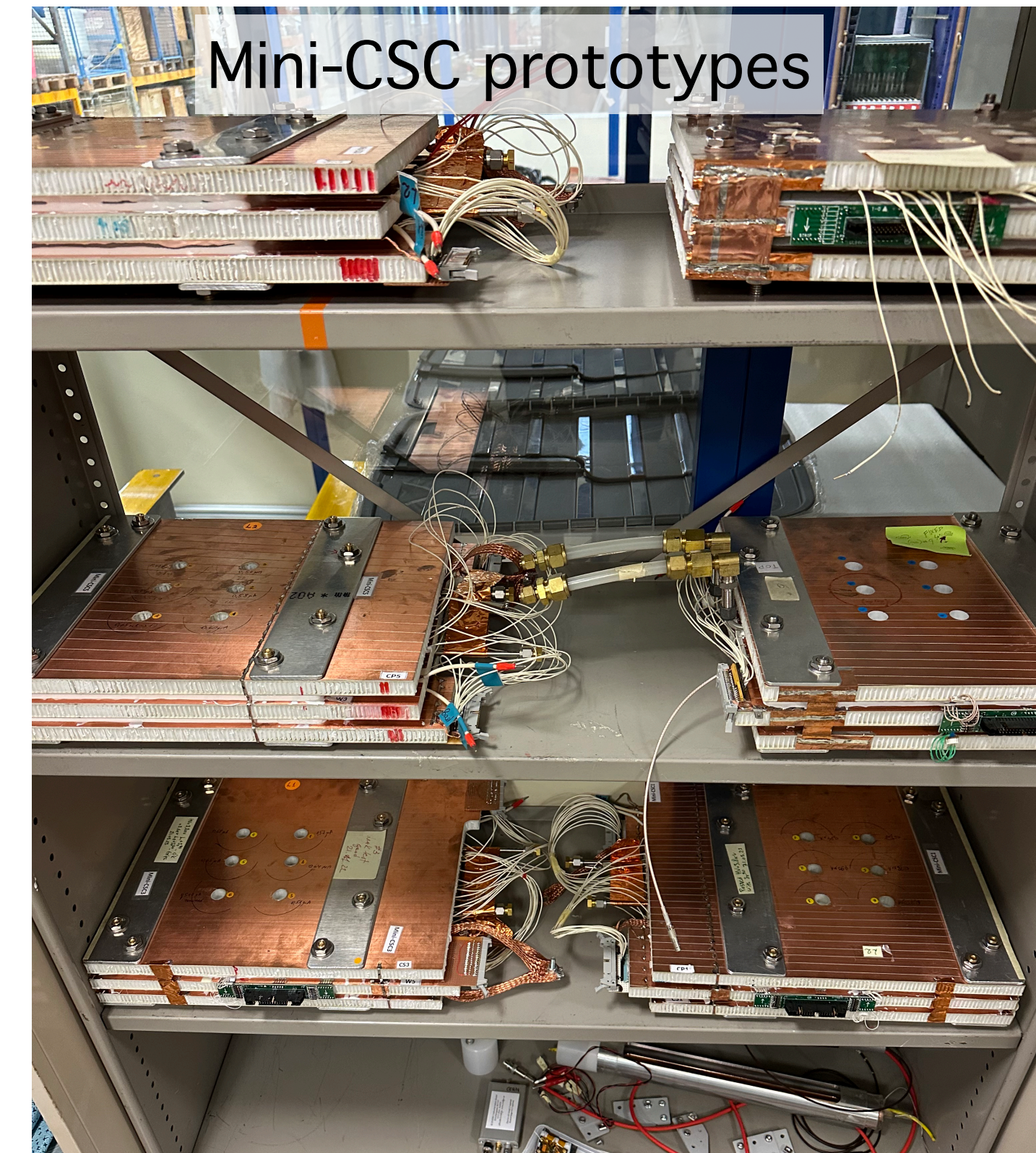
- Gas Mixtures:

- CSC: 50% CO<sub>2</sub> + 40% Ar + 10% CF<sub>4</sub> (GWP 7390)
- RPC: 95.2% TFE (GWP 1430) + 4.5% iC<sub>4</sub>H<sub>10</sub> + 0.3% SF<sub>6</sub> (GWP 22800)

- CSC eco-gas studies using 250 MBq Sr source

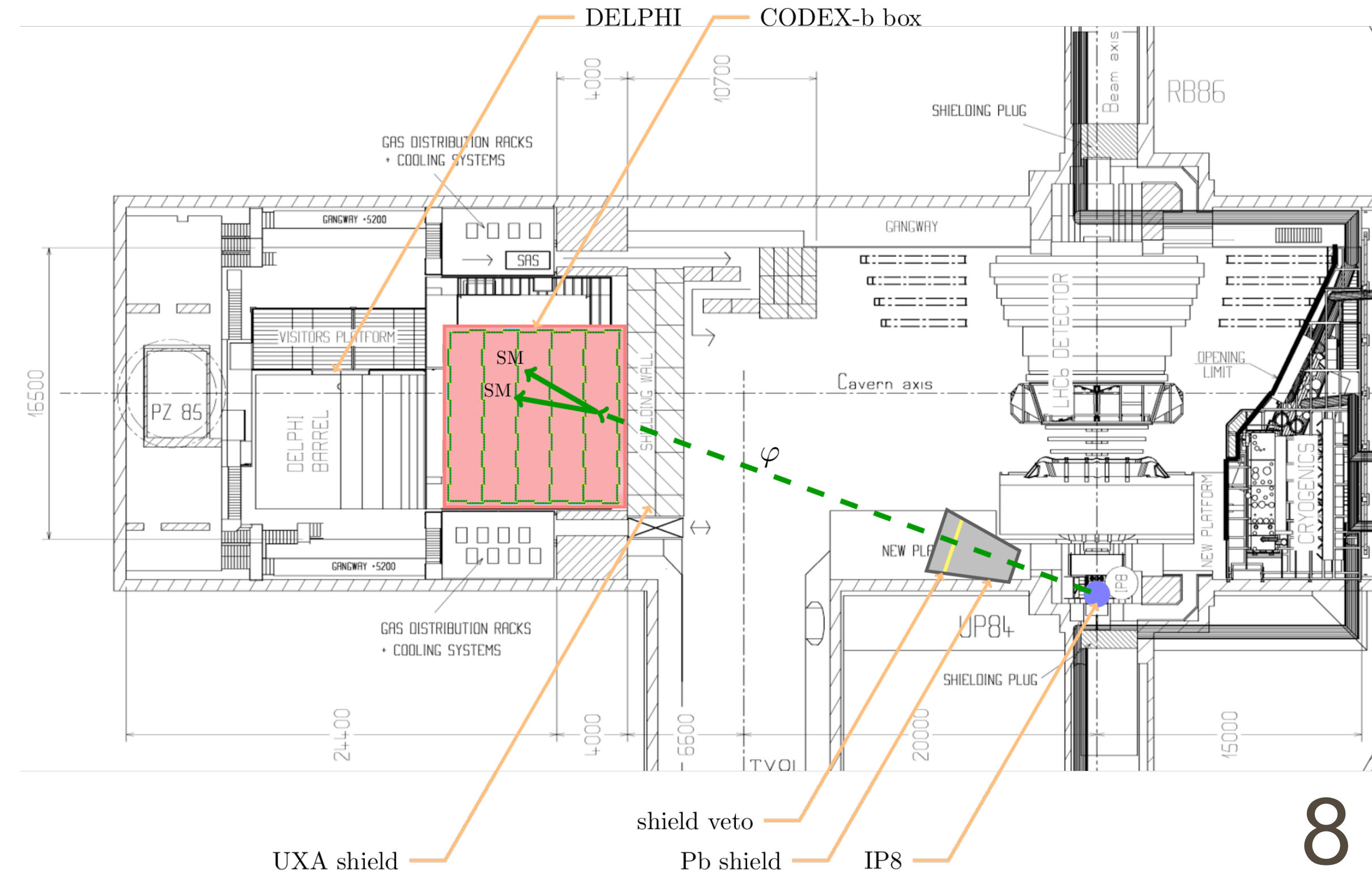
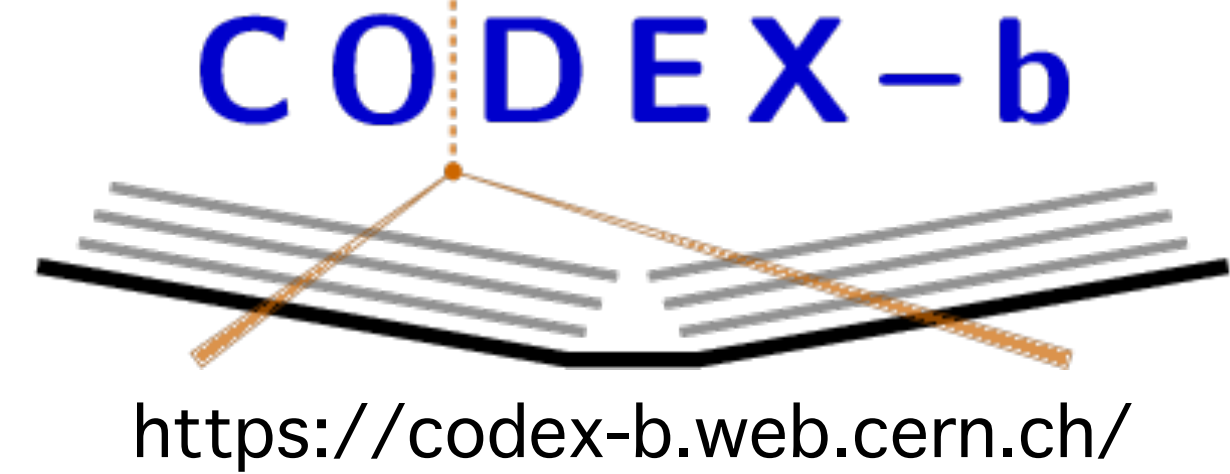
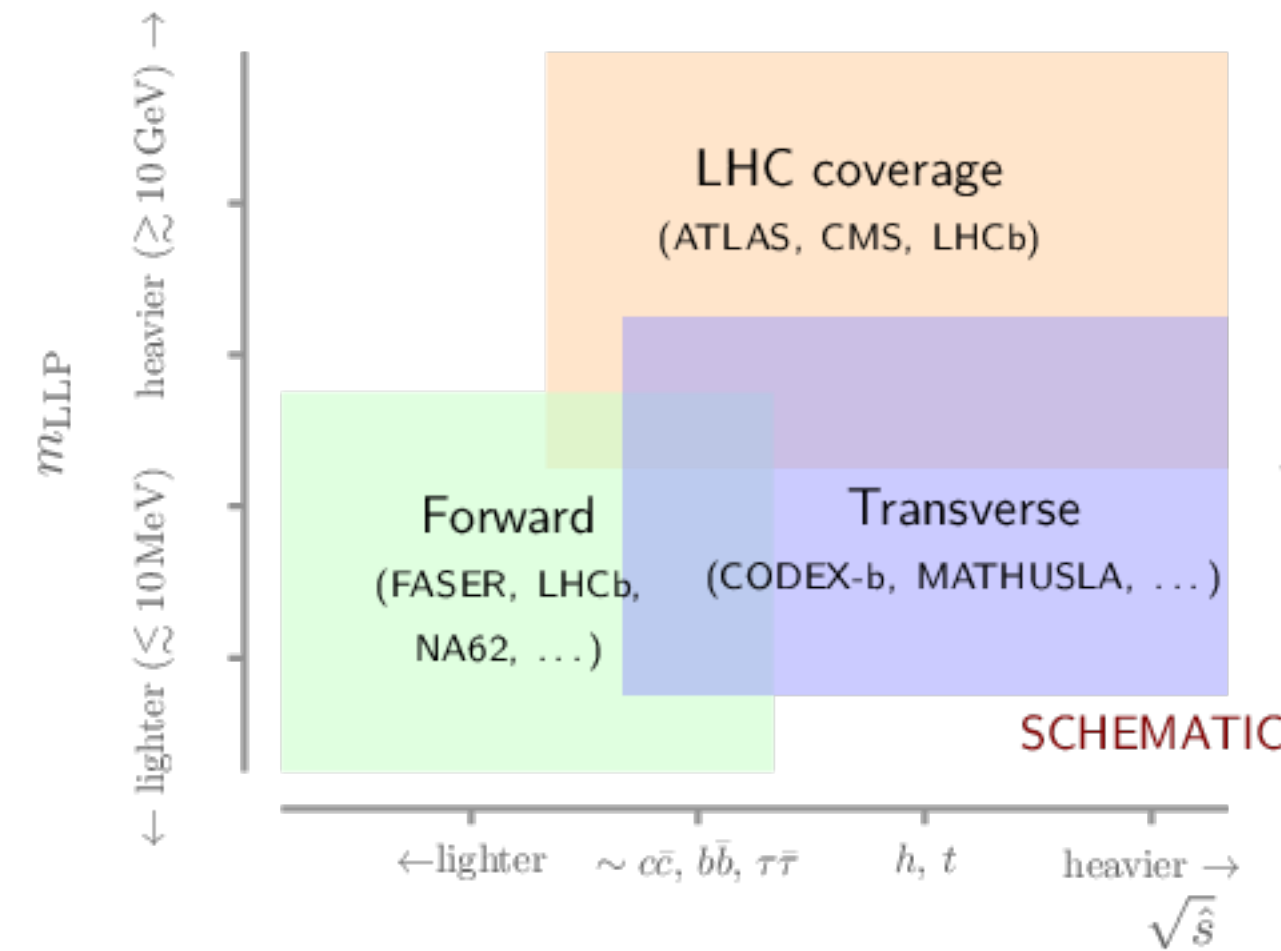
- Additional studies proposed by EP-DT gas group for better understanding of Fluorine ion production in CSC gas mixture

- GEM X-ray setup using AMPTex miniX source for GEM detector R&D (rate capability, prototyping, etc.) and also for production chamber QC



# Opportunities for Collaboration

- Strong collaboration already with CERN EP-DT group in gas studies - provides personnel and expertise that allows much deeper R&D, beneficial to both sides
- CODEX-b is a future RPC detector searching for long-lived particles decaying to muons, to be installed adjacent to LHCb
- Assembly and testing of some of these RPC chambers will happen in B904 before installation
- Space use follows formal approval process with CMS Safety and Technical Coordination





# Summary

- CMS Muon B904 laboratory is a well-developed laboratory with significant infrastructure and expertise in all stages of gaseous muon detector lifetimes
- Understanding detector longevity and aging, as well as study of sustainable but effective gas compositions, are crucial to both CMS Muon detectors as well as future detectors
- There are interesting opportunities for collaboration, dependent on approval by CMS Management