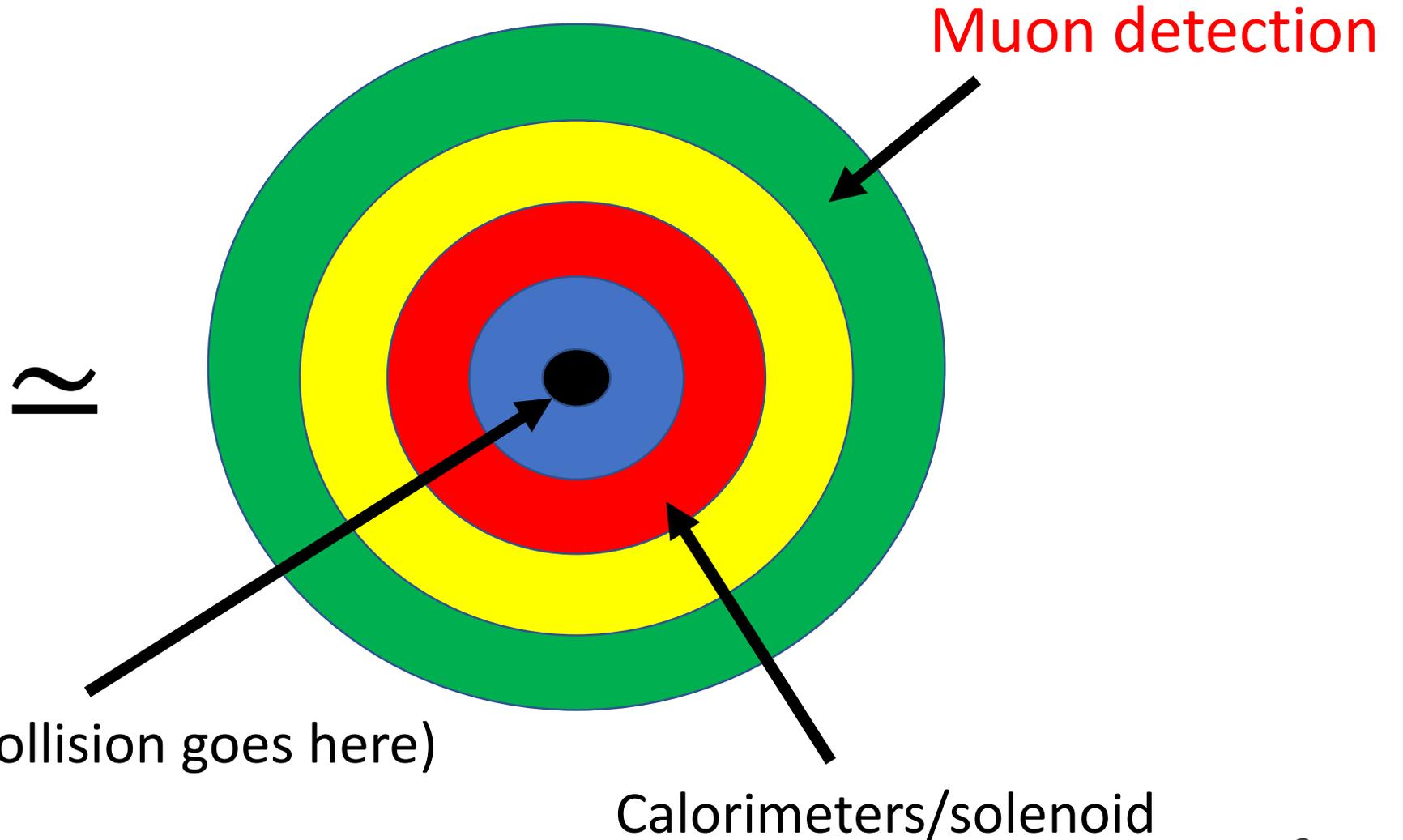
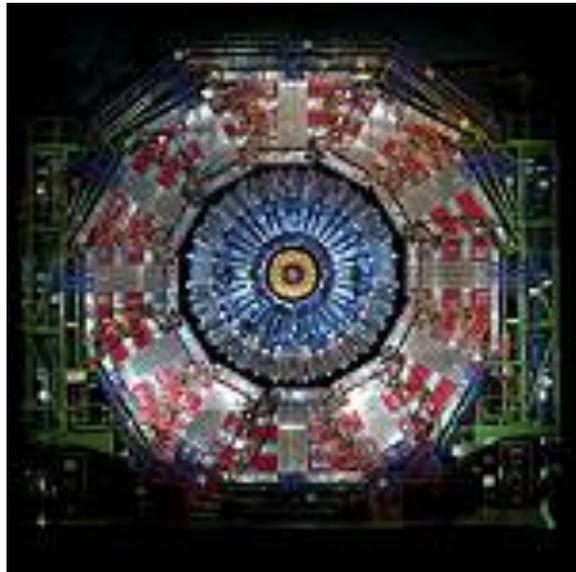


CMS, HiLumi and General Tinkering

Dan Bosworth



CMS detector (simplified)



The LHC needs an upgrade, why?

1. To fully exploit its physics potential
2. Continue probing for physics beyond the Standard Model

If we want to find new physics, we need to go to higher energies.

What comes with the upgrade?

The High-Luminosity (HiLumi) LHC:

Increased **luminosity** → a **greater number** of collisions

Greater **centre-of-mass energy** → **higher-energy** collisions

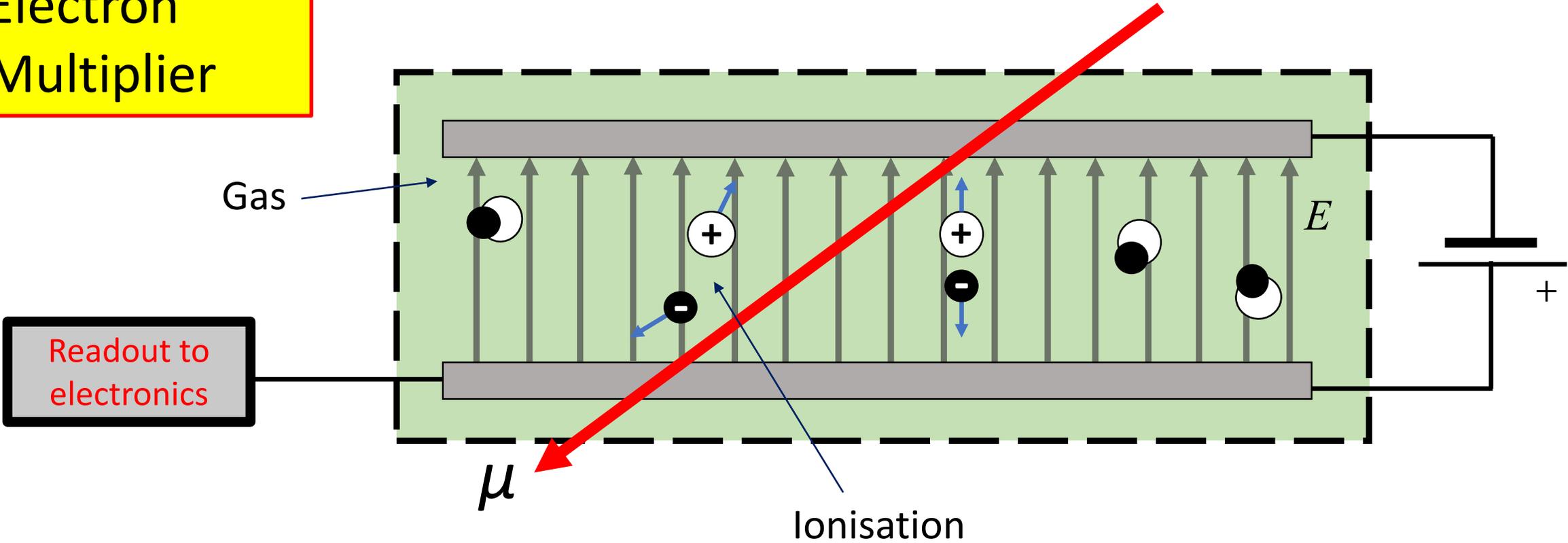
Higher flux of particles poses problems:

1. “Dead time”: detectors need to keep up with the increased number of collisions
→ otherwise we **miss interesting physics**
2. Heightened radiation exposure can damage electronics
→ chemically-active **free radicals** produced

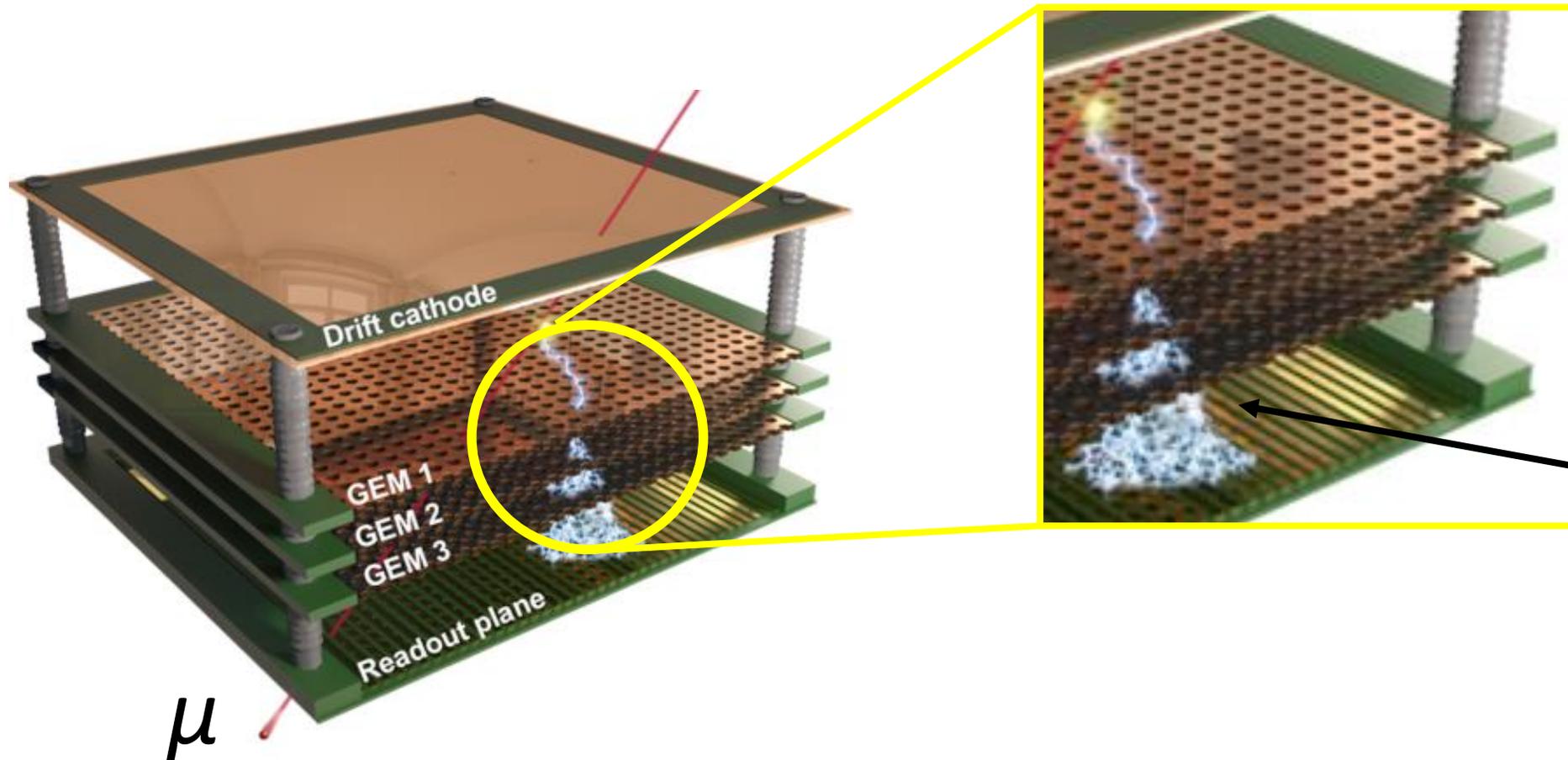
GEM detectors act as a redundancy

Basic principle of a gas detector:

GEM = Gas
Electron
Multiplier



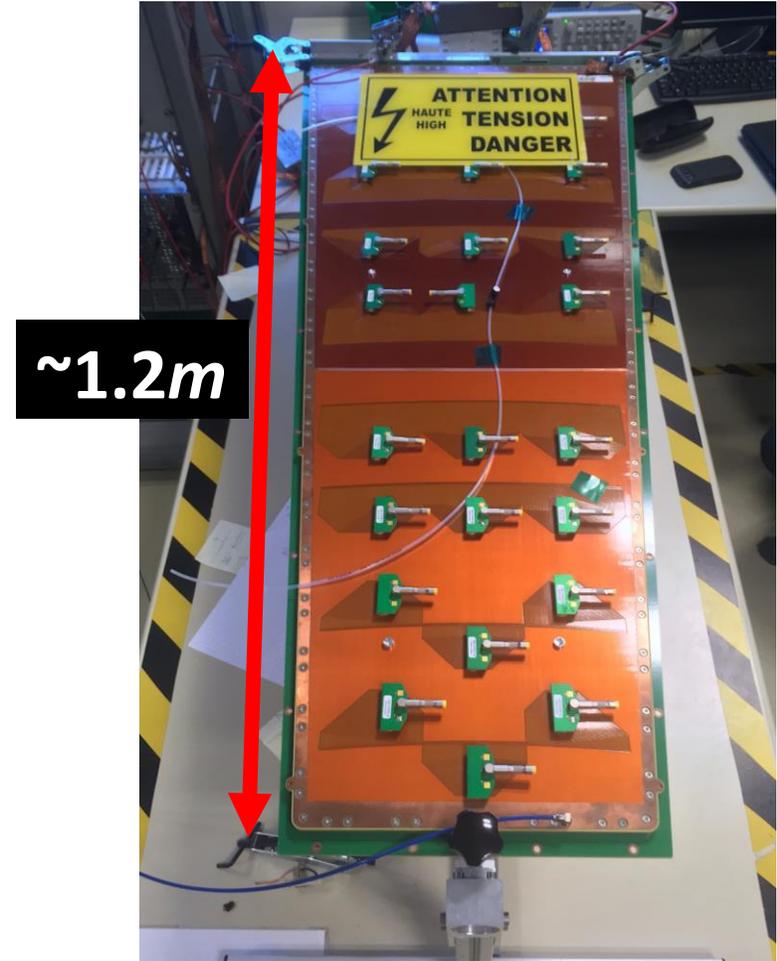
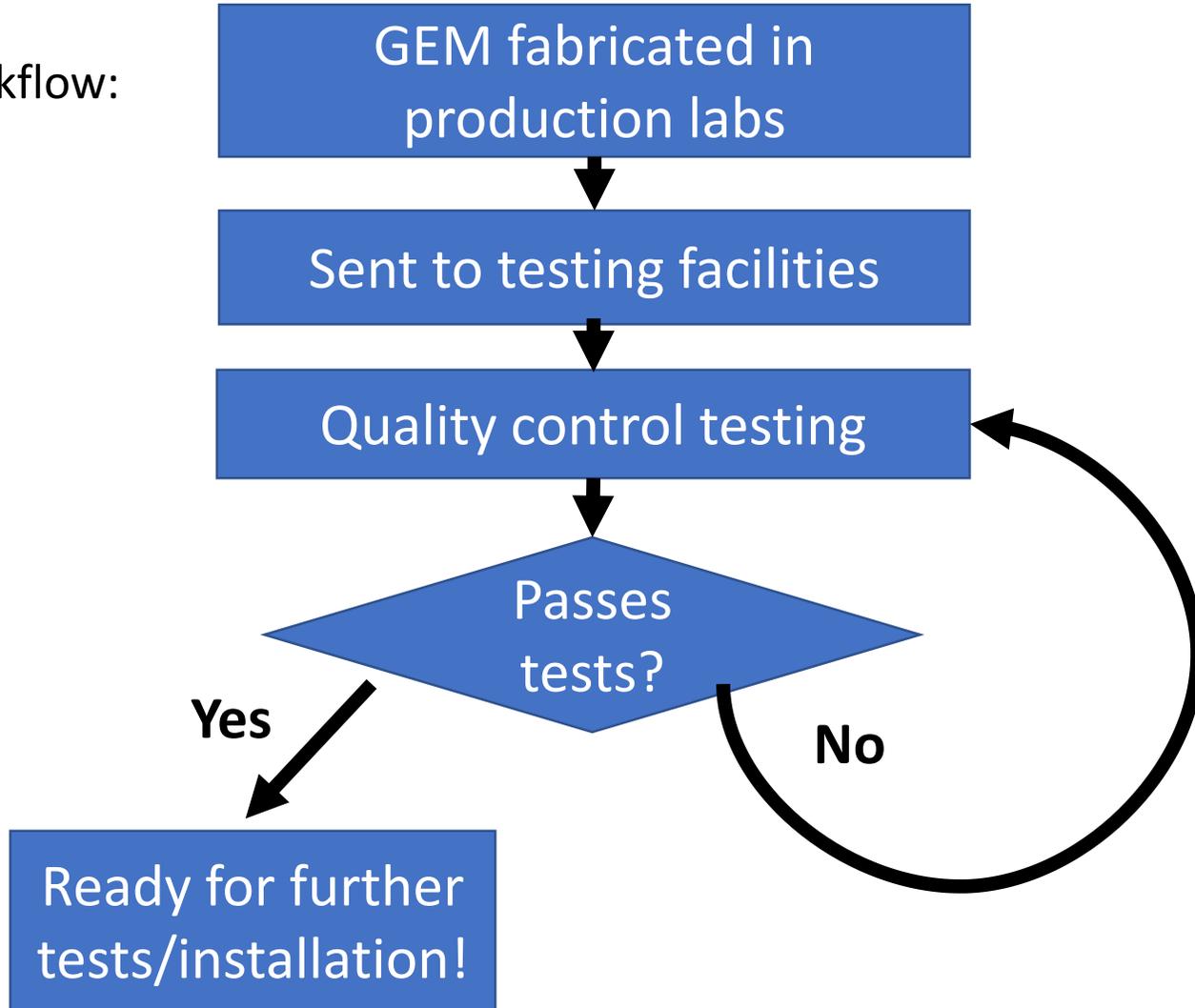
Electrons ionise further atoms



Electron avalanche
(*"Townsend discharge"*)

Assisting in Quality Control (QC) studies

Workflow:



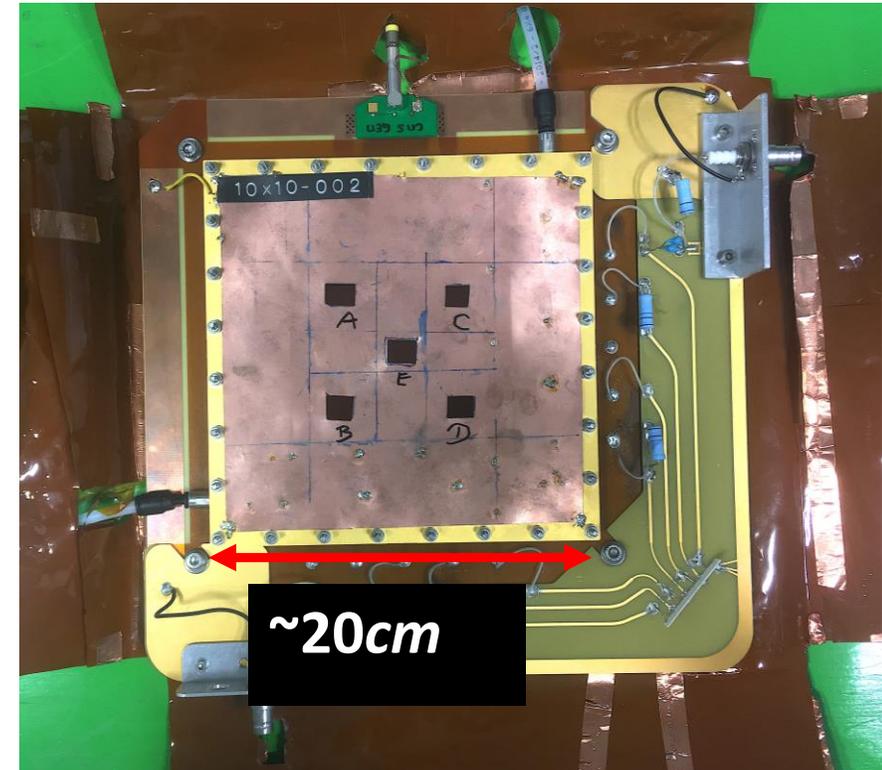
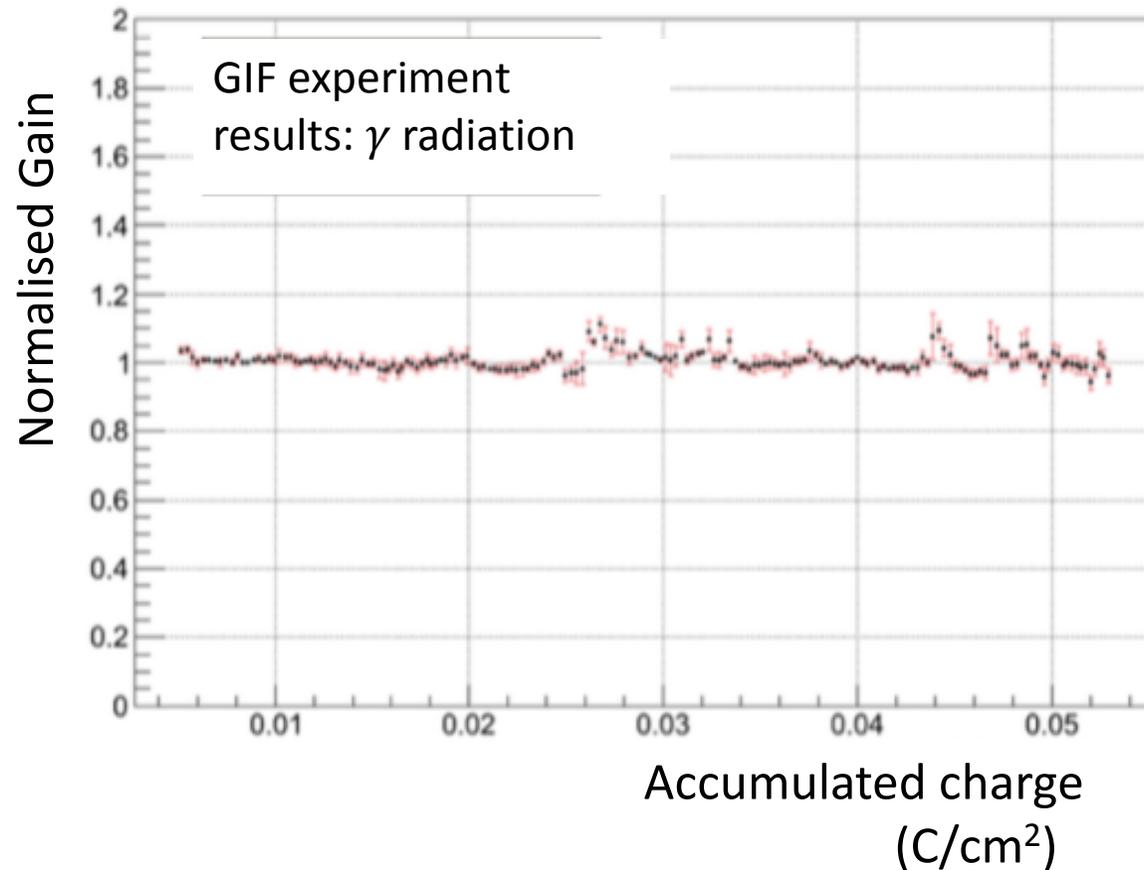
~1.2m

Full size GEM

Studying radiation aging from x-rays



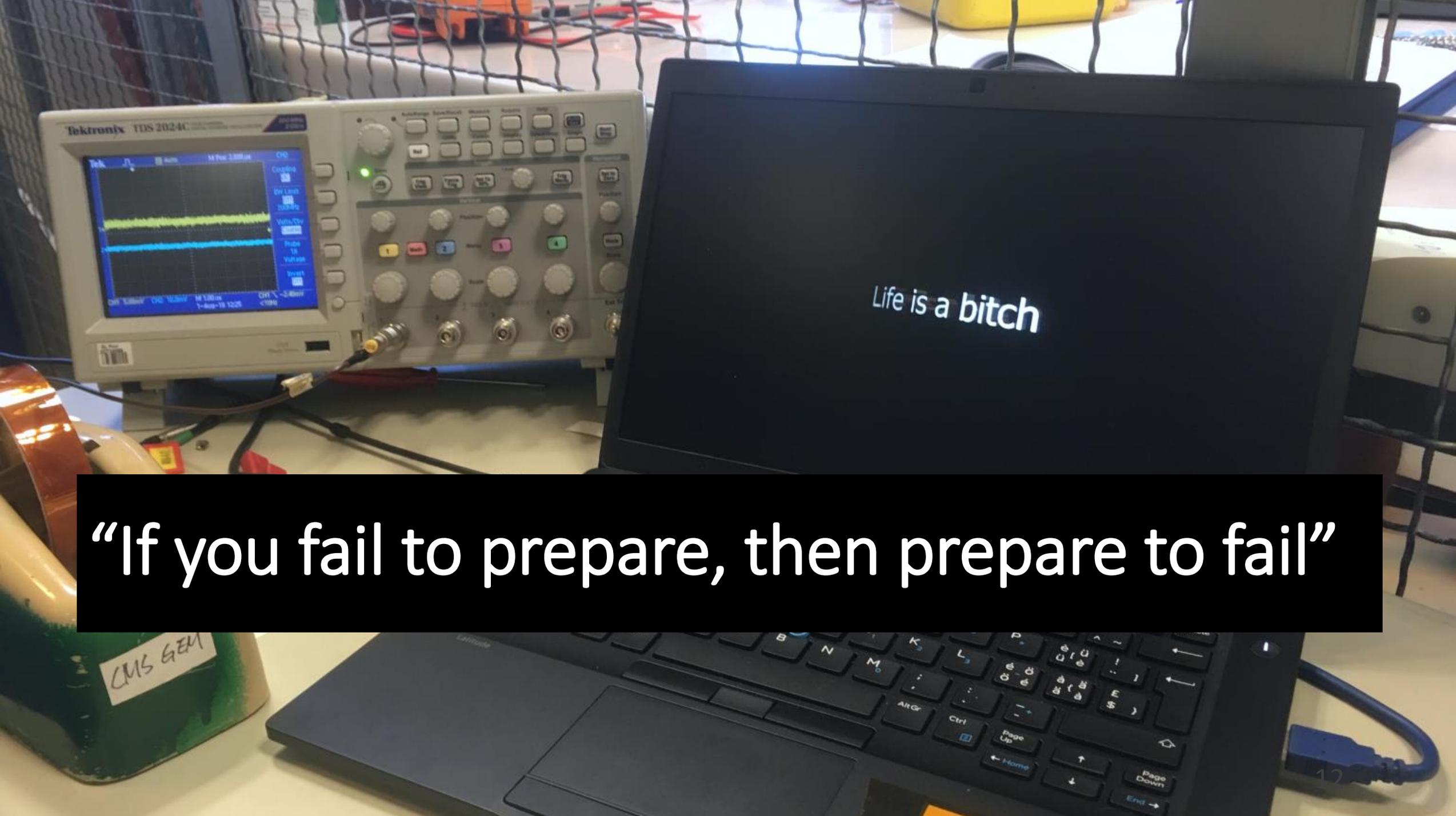
What do we expect to find?



GEM prototype

In closing:

- LHC will be upgraded to explore higher energies
- Detector “dead time” and radiation aging present challenges
- I study the aging of muon detectors – can we **prolong the longevity?**



“If you fail to prepare, then prepare to fail”

CMS GEN