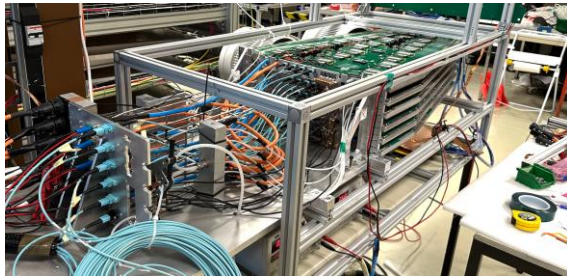


Master's degree in Physics at University of Bari

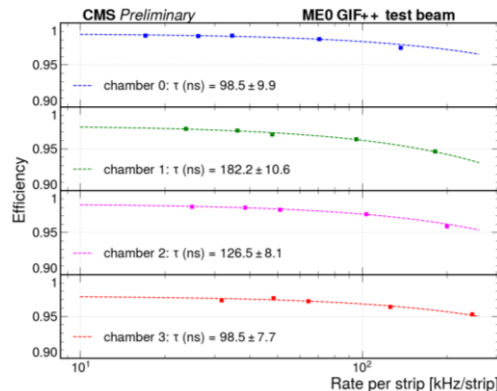
Curriculum: Particle, Astroparticle Physics and Advanced Technologies

Thesis in «Performance in a high-rate environment of triple-GEM detectors for the CMS detector»

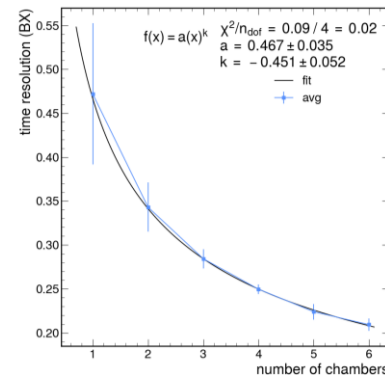


Validation of the performance of the triple-GEM detector for the CMS upgrade

At **GIF++** with a varying background gamma rate, measured efficiency in detecting muons



With **cosmics**, time resolution of the single chambers and the timing performance of the stack



CERN short-term internship

Main activities:

- assembly, production and quality assurance of the GE2/1 detectors
- R&D and system integration of the ME0 detectors. and many other enjoyable experiences...



Test beam



Sociality

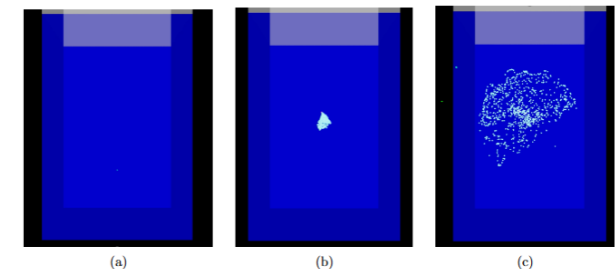


Visit at CMS

INFN Scholarship: 3 month stage at CERN

GOAL: enhance visualization of physics simulations with GPU-based NVIDIA Omniverse platform, in collaboration with the CERN Openlab group

Case study of a photon interacting with a simple detection system



PhD project

Development and exploitation of MPGD detectors for the upgrade of the CMS experiment

Supervisors:
Dott. Piet Verwilligen (INFN Bari)
Dott.ssa Federica M. Simone (PoliBa)

In 2029: High Luminosity LHC → luminosity up to 5 – 7.5 times the nominal LHC luminosity ($10^{34} \text{ cm}^{-2} \text{ s}^{-1}$)

→ Higher rate of particles → **CMS Phase 2 Upgrade**

introduction of MPGDs

Three new GEM stations in the forward region of the endcaps → complement existing muon stations to **reduce L1 trigger rate**

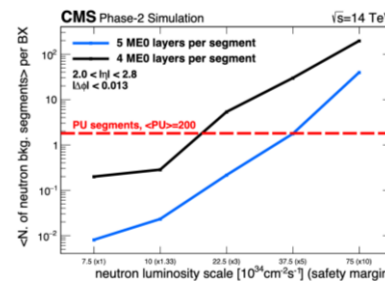
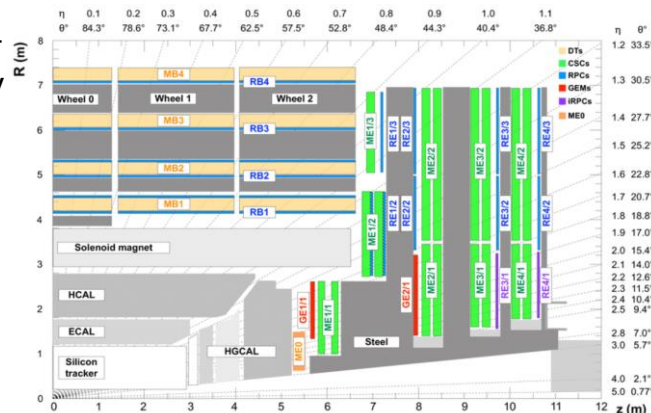
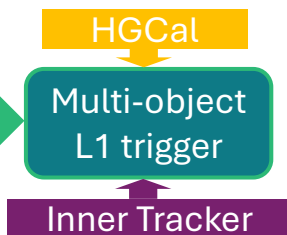
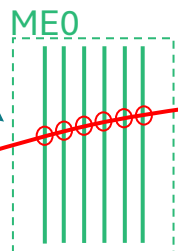
2. ME0

- complement CSCs in $2.1 < \eta < 2.4$
- extend muon trigger coverage $2.4 < \eta < 2.8$

High rates in this very forward region (up to 150 kHz/cm^2)

→ No **standalone** L1 trigger in the extended range

Combining with the other detectors



Good discrimination
low- p_T VS high- p_T
muons

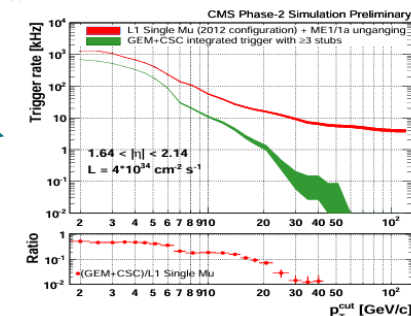
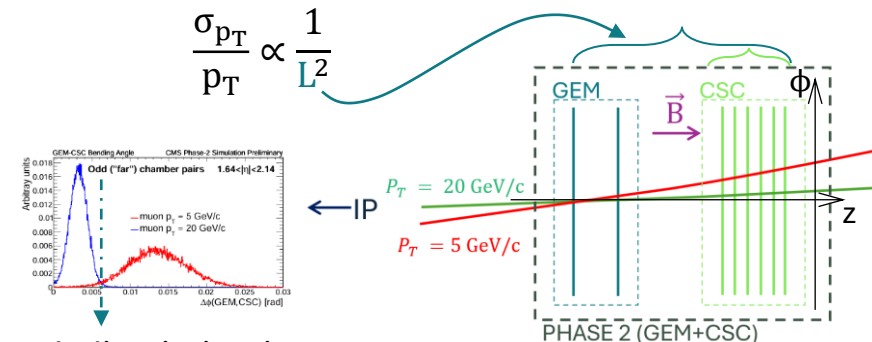
Less «fake» high- p_T muons (i.e. misidentified scattered low- p_T muons) → Lower trigger rate

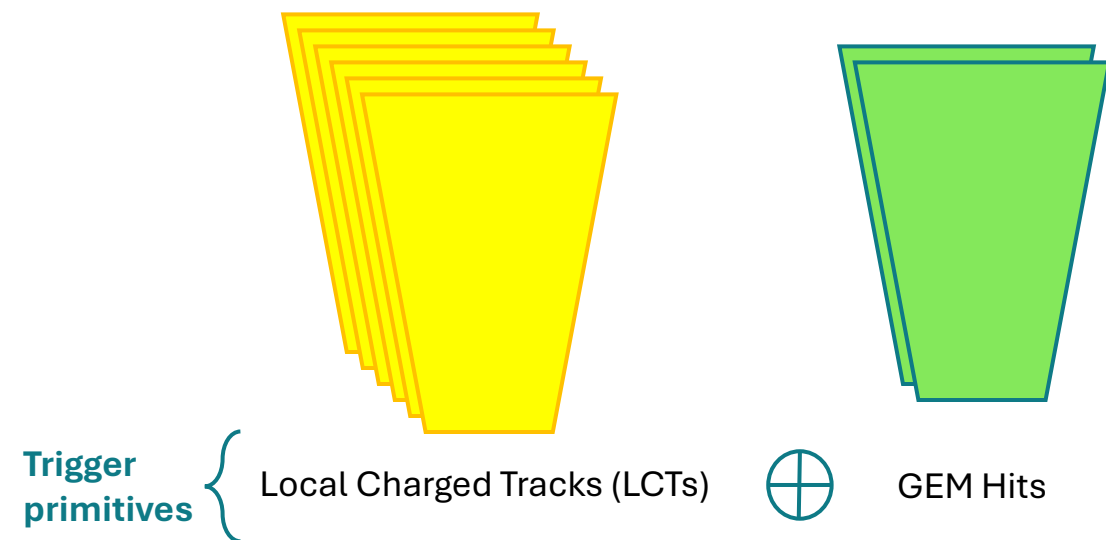
Integration of GEMs in the trigger requires a **good time resolution** to ensure a significant BX identification and reduce effect of the PU

1. GE1/1 & GE2/1

Improve p_T resolution by measuring it within the same station (NO Coulomb scattering) with an enlarged lever arm:

$$\frac{\sigma_{p_T}}{p_T} \propto \frac{1}{L^2}$$





Production and performance analysis of ME0

- ☐ Production of ME0 modules
- ☐ Analysis of the time resolution in high-rate environment in test beams
- ☐ Study of timing uniformity and tracking efficiency with cosmics

Performance of the GE1/1 trigger primitives

- ☐ Study the matching efficiency between CSC LCTs and GEM hits
- ☐ Compare the offline efficiency with the one measured at the trigger level
- ☐ Study of timing and timing uniformity
- ☐ Study on the bending angle



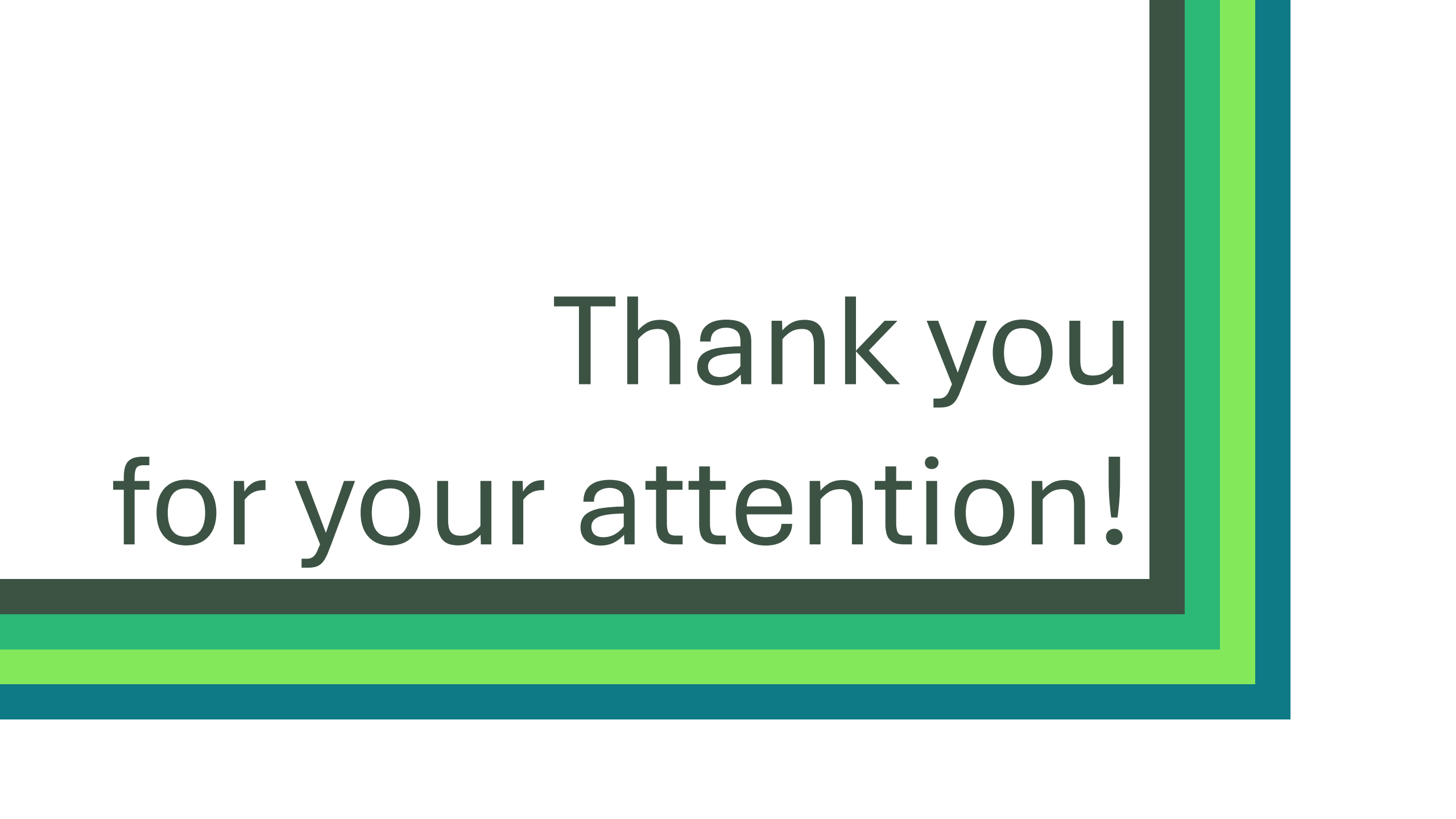
GOAL:

Optimize GEM configuration in the trigger to improve the matching between CSC and GEM trigger primitives

Impact of extended coverage in Physics analyses

Estimate the improvement in the search for Lepton Flavor Violation (LFV) via the analysis at simulation level of the $\tau \rightarrow 3\mu$ decay upper limit.

Thank you
for your attention!

A decorative graphic consisting of four horizontal bars at the bottom of the slide in dark grey, medium green, light green, and teal. A large corner bracket on the right side of the slide is composed of four nested L-shaped lines in the same color sequence.