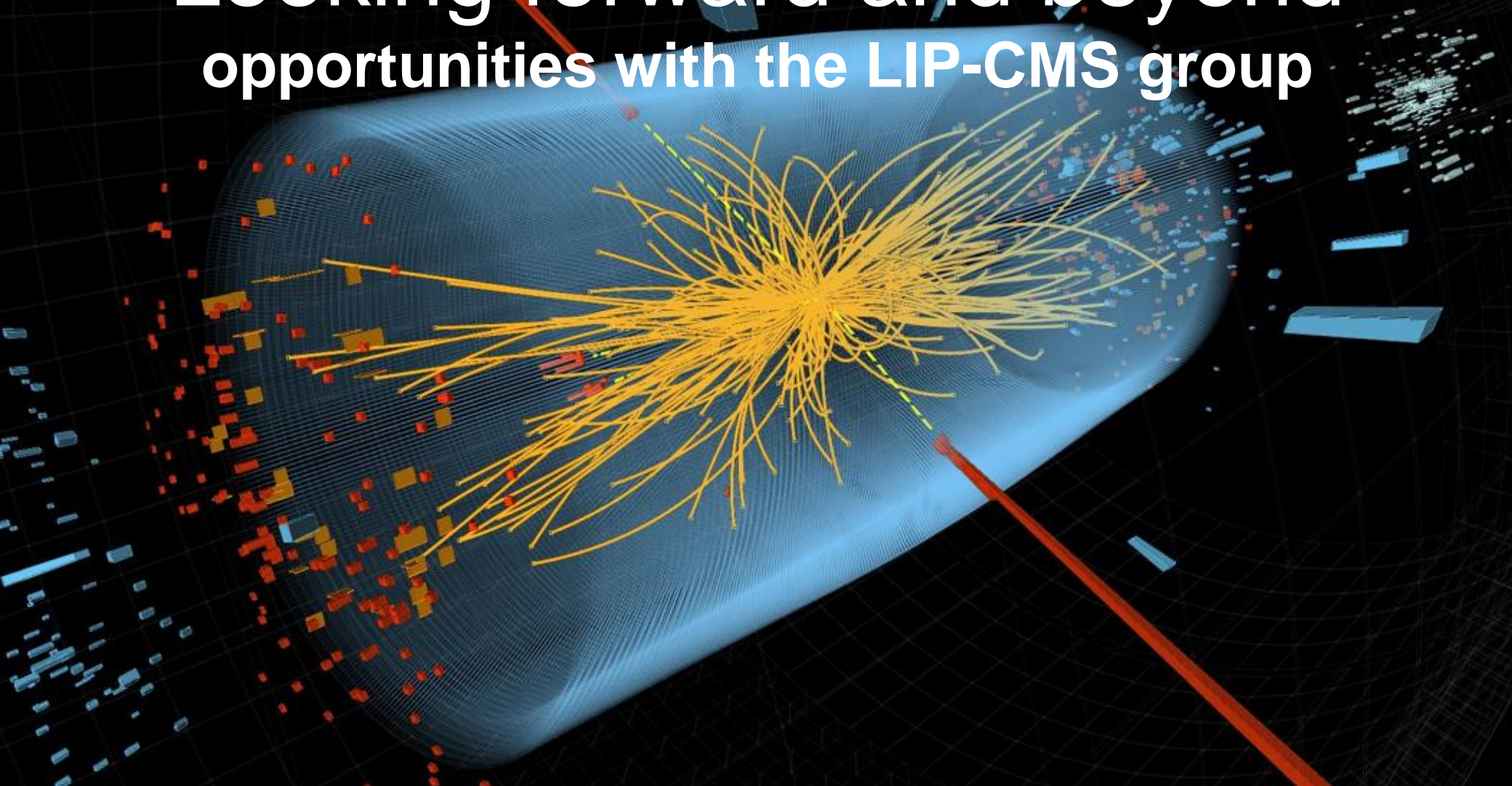




# Physics goals at the LHC: Looking forward and beyond opportunities with the LIP-CMS group



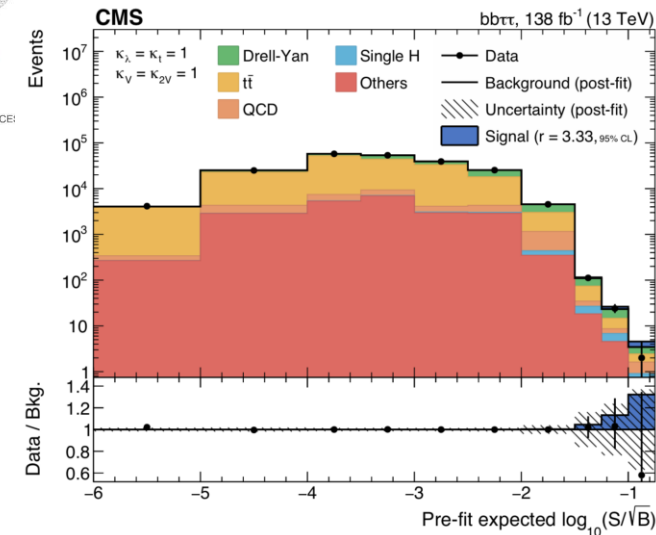
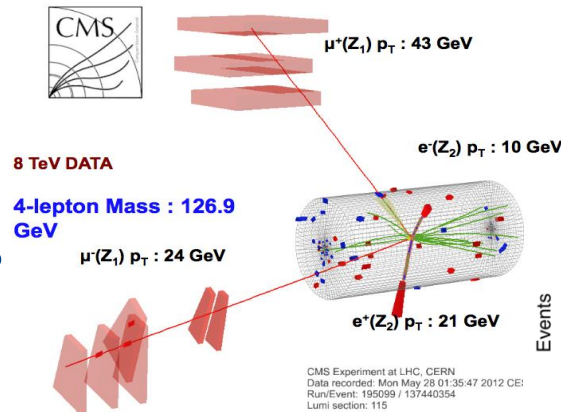
Michele Gallinaro (LIP/IST) - [michgall@cern.ch](mailto:michgall@cern.ch)

# The Higgs boson and beyond...

M. Araújo, P. Bargassa, D. Bastos, A. Boletti, C. Beirao, R. Bugalho, P. Faccioli, M. Gallinaro, <sup>[SEP]</sup>J. Hollar, H. Legoinha, N. Leonardo, T. Niknejad, M. Pisano, J. Seixas, <sup>[SEP]</sup>P. Silva, J. Silva, J.

## ...we are in uncharted territory

- Data analysis
  - Tests of the SM, Higgs boson studies, BSM searches
- R&D and detector upgrades
  - PPS and Timing detector
- Involvement in running of the experiment
  - understanding, operation, direct involvement



## ⇒ There is a lot to learn & contribute



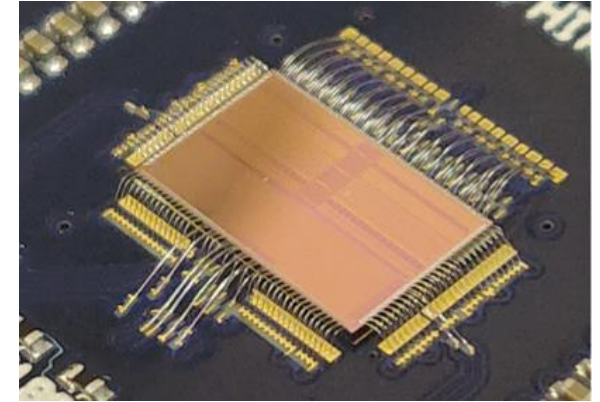
# Detector Upgrades

M. Araújo, P. Bargassa, D. Bastos, A. Boletti, C. Beirao, R. Bugalho, P. Faccioli, M. Gallinaro<sup>[1,SEP]</sup>, J. Hollar, H. Legoinha, N. Leonardo, T. Niknejad, M. Pisano, J. Seixas<sup>[1,SEP]</sup>, P. Silva, J. Silva, J.

## MIP Timing Detector (MTD):

Precise time measurement of charged particles

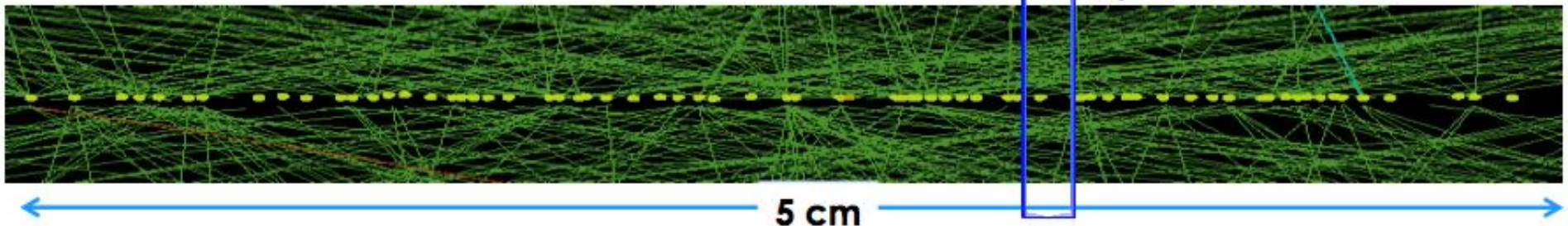
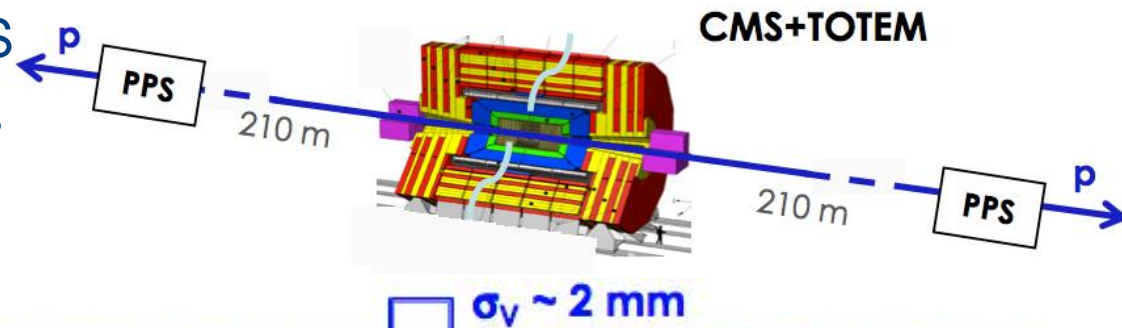
- LIP/CMS group responsible for BTL readout electronics



## Precision Proton Spectrometer (PPS):

Tags the protons on both sides of CMS

- Precise timing and tracking detectors
- A member of the LIP/CMS group is coordinating the project



# Recent MSc and PhD theses

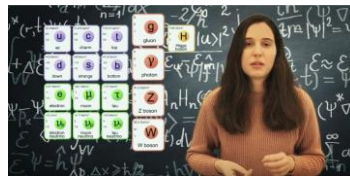


Measurement of b-quark fragmentation fraction ratios at the CMS experiment: a key ingredient for the  $B_s^0 \rightarrow \mu^+ \mu^-$  rare decay analysis

[CERN-THESIS-2018-274](#), May 2018

Now at LLR, Paris

Bruno Afonso Fontana Santos Alves



Probing the quark gluon plasma medium through B meson production measurements in PbPb collisions at the LHC

Júlia Manuela Cardoso Silva

[CERN-THESIS-2019-256](#), Oct. 2019

Now at U. Manchester, UK

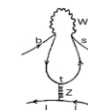


Search for exclusively produced top quark pairs at the LHC

[CERN-THESIS-2019-280](#), Dec. 2020

Now at DESY, Hamburg

Beatriz Ribeiro Lopes



Investigating the flavour anomalies through the rare beauty decay  $B^0 \rightarrow K^{*0} \mu^+ \mu^-$

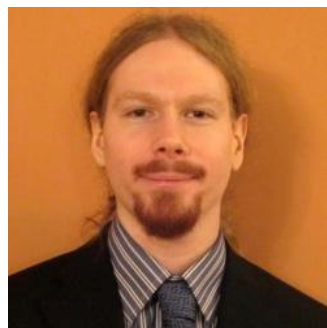
Maria Carolina Feliciano Faria

[CERN-THESIS-2021-220](#), Oct. 2021

Now at EPFL, Lausanne



UNIVERSIDADE DE LISBOA  
INSTITUTO SUPERIOR TÉCNICO



DEEP LEARNING METHODS  
APPLIED TO HIGGS PHYSICS AT THE LHC

Giles Chatham Strong

[CERN-THESIS-2021-211](#)

arXiv:1902.00134, Mach. Learn. Sci. Techn.1 045006, Dec. 2020

Now at U. Padova, Italy



Universidade de Lisboa  
Instituto Superior Técnico



Top quark physics and search for physics beyond the Standard Model at the Large Hadron Collider

Author: Oleksii Toldaiev

[CERN-THESIS-2020-203](#)

JHEP 02 (2020) 191, Oct. 2020

Now at Cern with U. Indiana, USA

# Thank you!

- Interesting analysis topics available
- Strong involvement of students
- Master and PhD thesis projects

⇒ **Join, your contribution will make the difference!**



Citing the report of the recent Institutional Evaluation performed by an international review panel nominated by FCT: “The LIP-CMS group, while small in size, is really outstanding and world-class”.

If you want to know more: [Course on Physics at the LHC – March-May 2022](#)

COURSE ON  
**PHYSICS at the LHC**