

Phase-2 CMS tracker upgrade and Drell-Yan process analysis

Marijus Ambrozas

PhD student

Faculty of Physics, Vilnius University

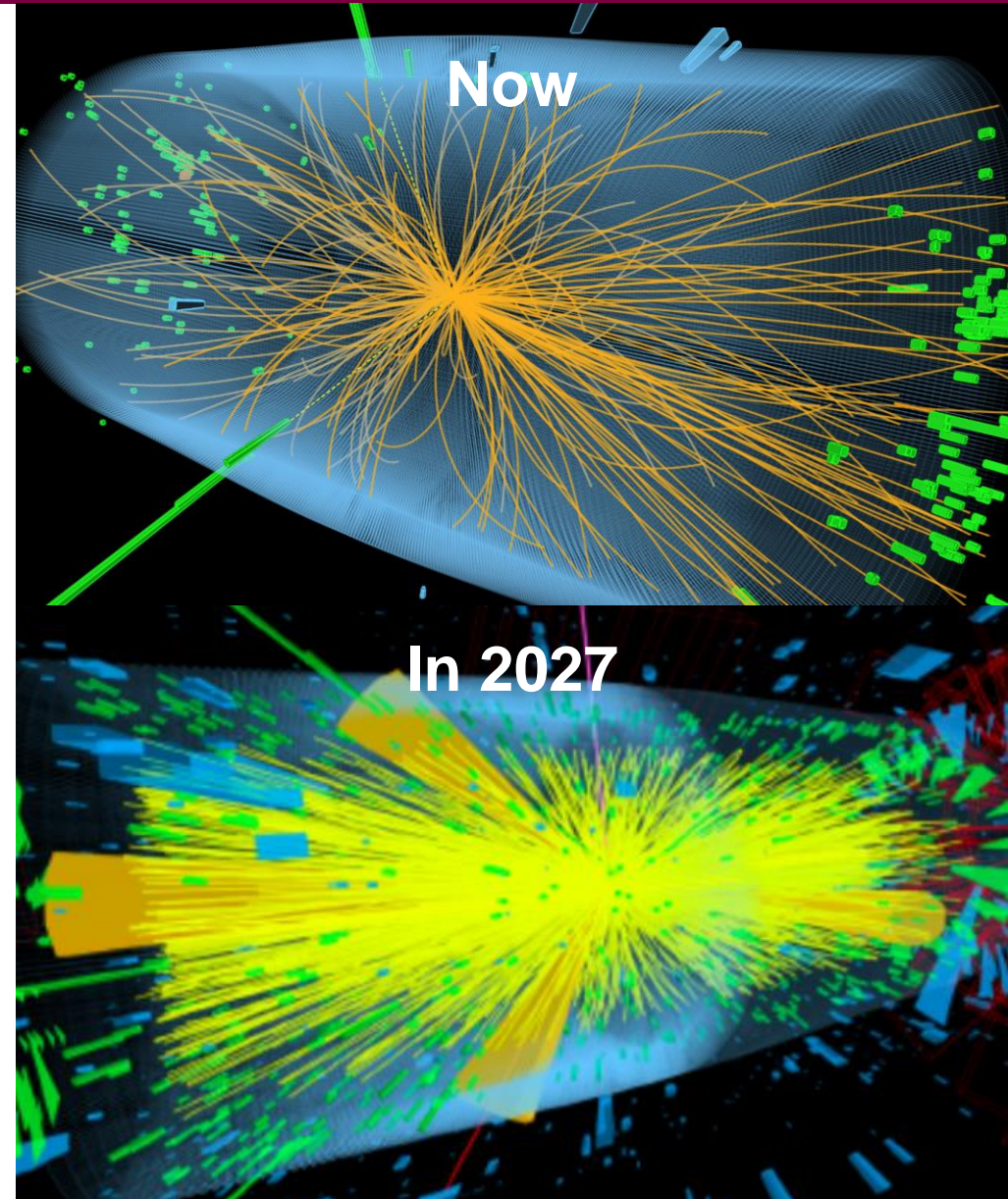


**Fizikos
fakultetas**

2022-04-11

CMS Phase-2 upgrade

- The High-Luminosity LHC upgrade is planned for 2025-2027 which will result in tenfold increase in luminosity
- This means ~ 10 times more proton-proton collisions occurring during the same crossing of proton bunches
- This poses a big challenge for particle detectors, especially its innermost layers
- The CMS tracker (the innermost layer) will have to be significantly upgraded
- The new tracker must have:
 - A lot better granularity to separate many tracks
 - High radiation-hardness to withstand ten times increased radiation doses



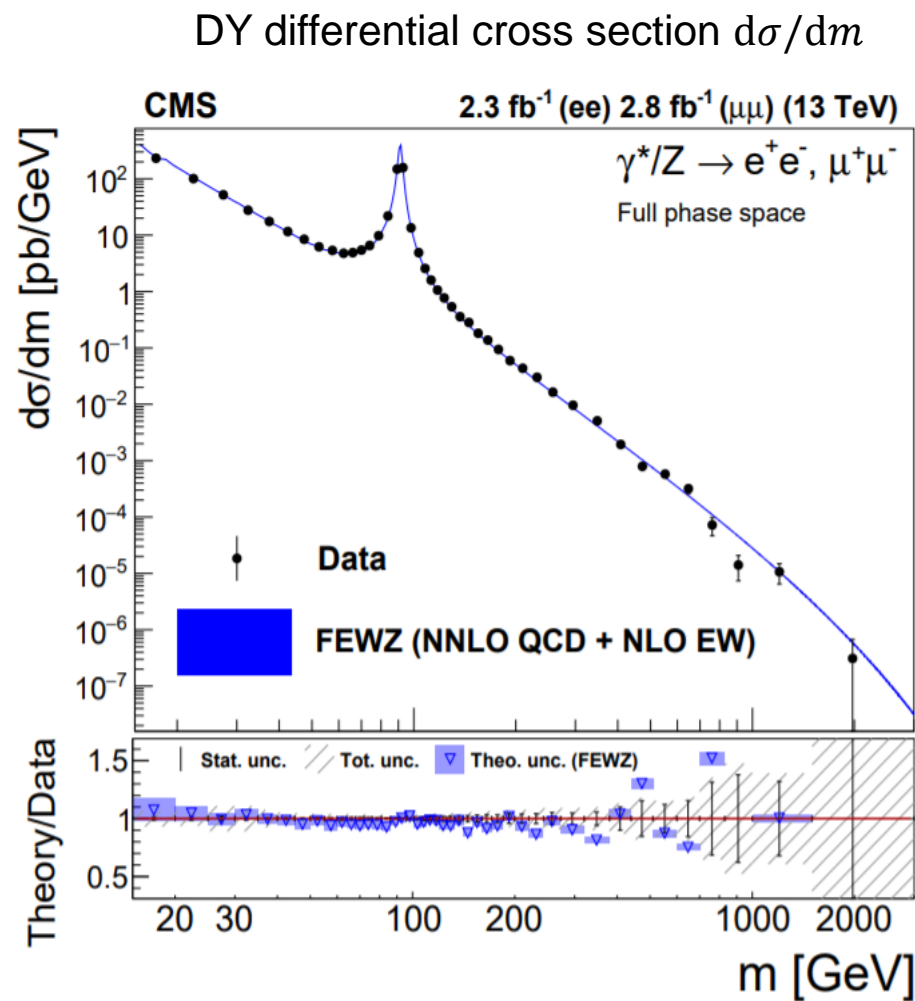
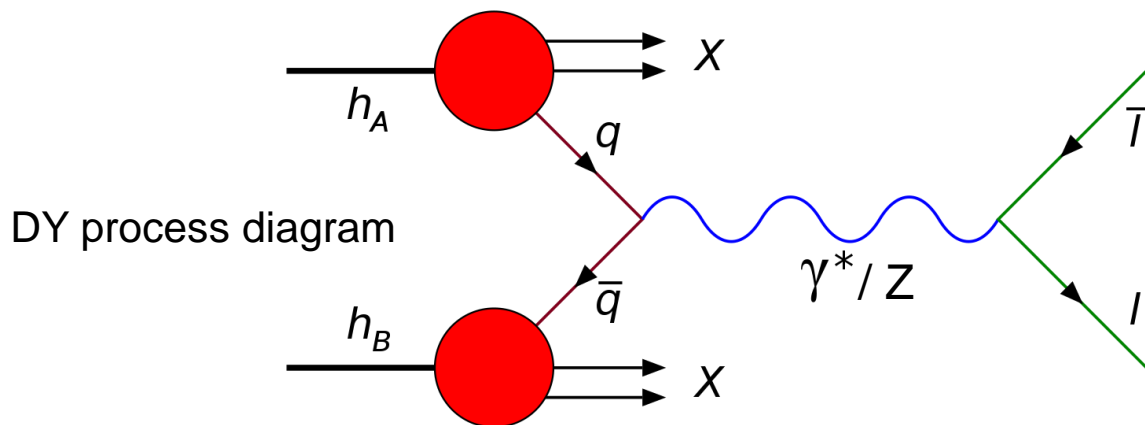
My work

- The new tracker prototypes are already in preparation
- I am currently working with pixel detector prototypes for Inner Tracker
- My work involves:
 - Developing the data acquisition software for the new tracker
 - Performing test measurements to characterize the prototypes, testing their performance and reporting to chip designers and other software developers
 - Optimizing tracker calibration routines by finding optimal parameters for calibration
- I currently use the setup that is present at CERN via remote connection



Drell-Yan process (DY)

- When two protons collide, a quark and an antiquark may annihilate and create a photon or a Z boson
- The newly produced particle then decays into a lepton-antilepton pair
 - E.g., an electron and a positron
- Physicists measure the Drell-Yan process cross section with increasing precision every year
 - This is done by measuring the frequency of the occurrence of this process
- More and more precise measurements help theorists better understand the inner structure of the proton

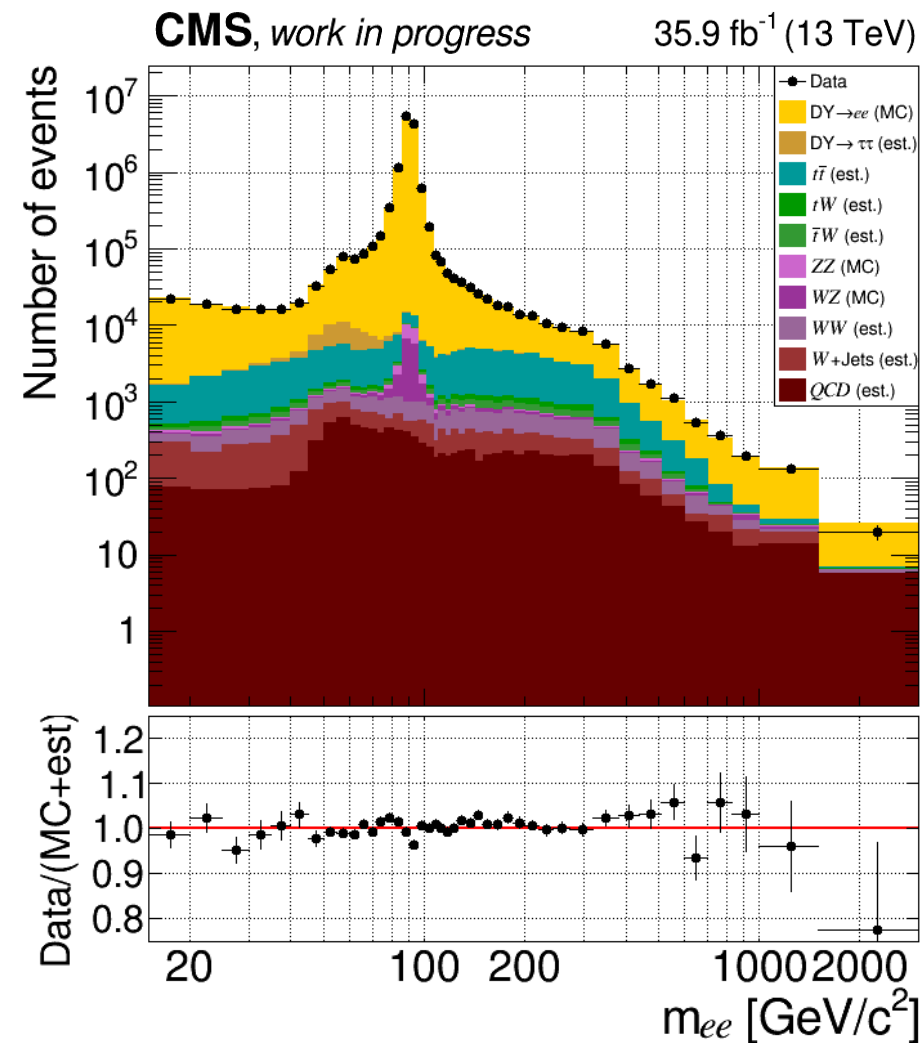


The CMS Collaboration. JHEP 12 059, 2019

My work

- As with any real-life measurement, there is some amount of background distorting our results
- In our case this corresponds to all the other physics processes that may produce the same or similar particles as the Drell-Yan process
- The background needs to be estimated and subtracted from measured distributions
- The simplest way to do this is by using computer simulation
- My task is to make higher quality estimations using data-driven methods
 - ep method for real lepton (irreducible) backgrounds
 - Fake rate method for fake lepton (reducible) backgrounds
- I am working in collaboration with the international Drell-Yan analysis group
 - The group unites scientists from Belgium, USA, South Korea, Montenegro

DY signal (yellow) and backgrounds (other colors)



Thank you for your attention!

Marijus Ambrozas

marijus.ambrozas@gmail.com



Fizikos
fakultetas