KINEMATIC DISTRIBUTIONS OF THE DRELL-YAN PROCESS IN THE ELECTRON CHANNEL IN ASSOCIATION WITH JETS

Made by Ismoilov Farrukh

A senior student of the physics department of National university of Uzbekistan

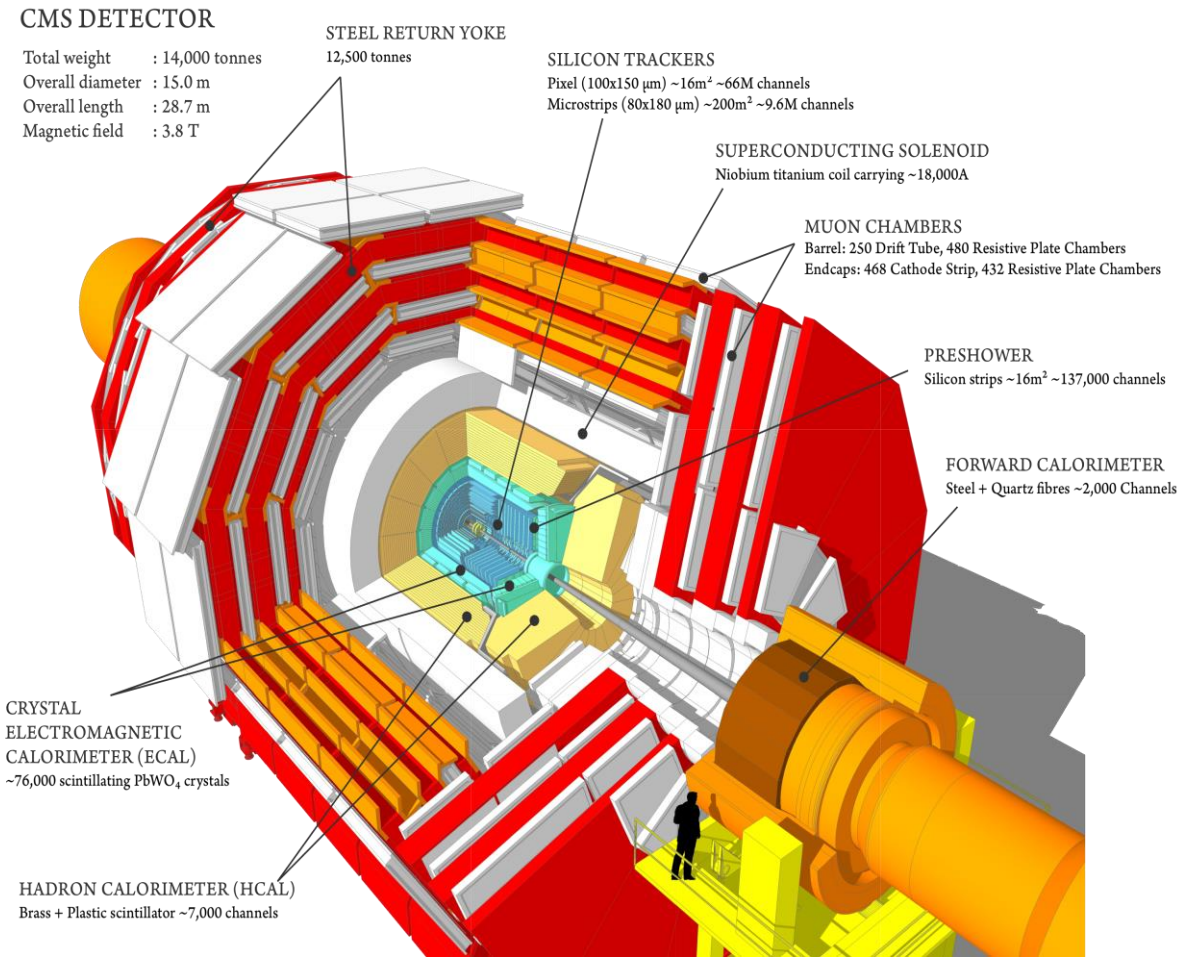
Supervised by Gorbunov Ilya

JINR Dubna, Russian Federation

OUTLOOK

- LHC and the CMS Detector
- Drell-Yan process
- Drell-Yan process and associated jets
- Main kinematic distributions
- Results
- Conclusion

LHC AND THE CMS DETECTOR



COORDINATE CONVENTIONS

- The CMS coordinate system is oriented such that the x -axis points south to the center of the LHC ring, the y-axis points vertically upward and the z-axis is in the direction of the beam to the west. The azimuthal angle φ is measured from the x-axis in the $x\,y$ plane and the radial coordinate in this plane is denoted by r . The polar angle θ is defined in the $r\,z$ plane and the pseudorapidity is $\eta = -\ln \tan(\theta/2)$. The momentum component transverse to the beam direction, denoted by Pt , is computed from the x- and y-components.

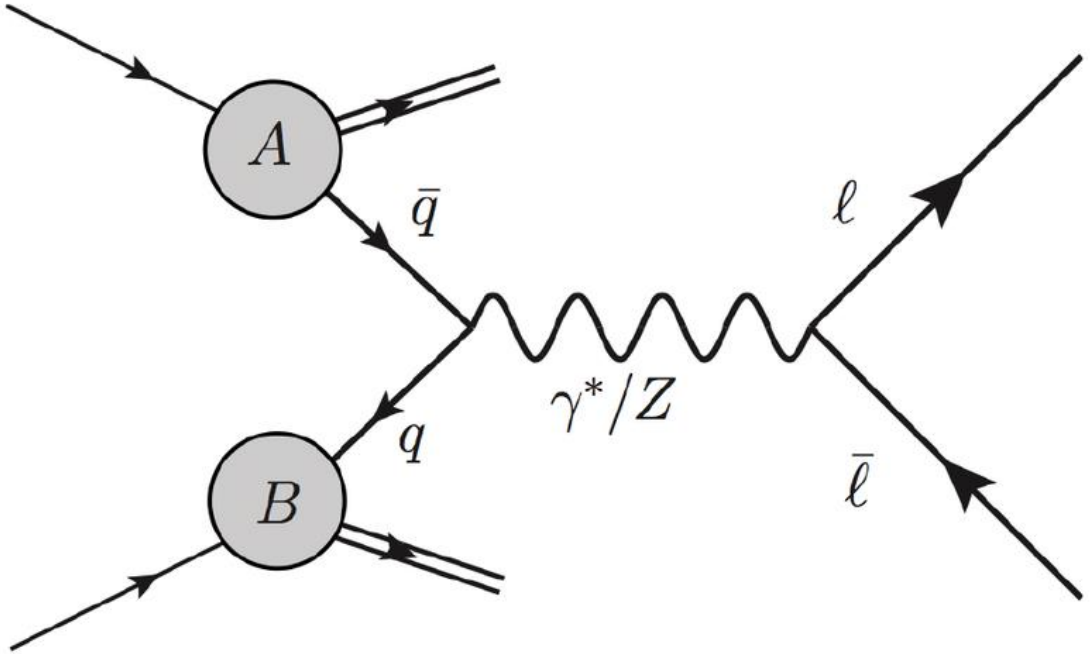
RESOLUTION OF THE CMS DETECTOR

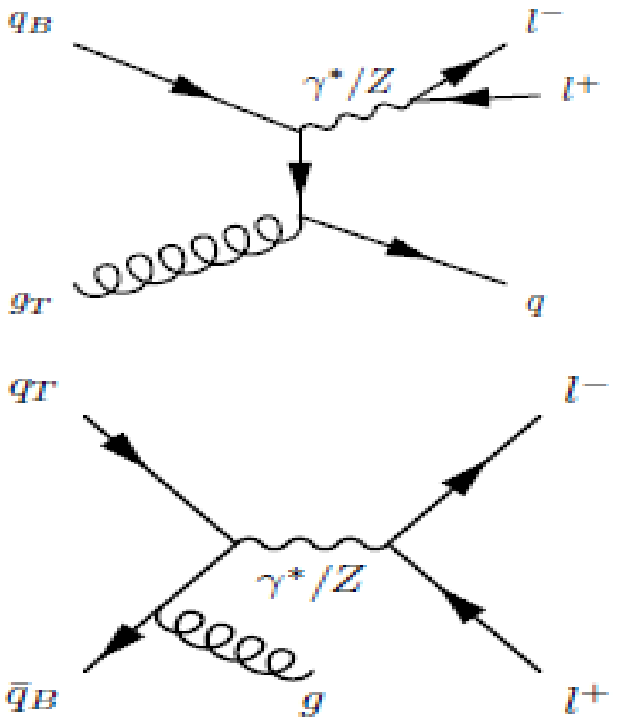
- The electron momentum is estimated by combining the energy measurement in the ECAL with the momentum measurement in the tracker. The momentum resolution for electrons with Pt approximately 45 GeV ranges from 1.7% to 4.5%

- The jet energy resolution amounts typically to 15% at 10 GeV, 8% at 100GeV, and 4% at 1TeV, to be compared to about 40%, 12%, and 5% obtained when the ECAL and HCAL calorimeters alone are used..

Drell-Yan process

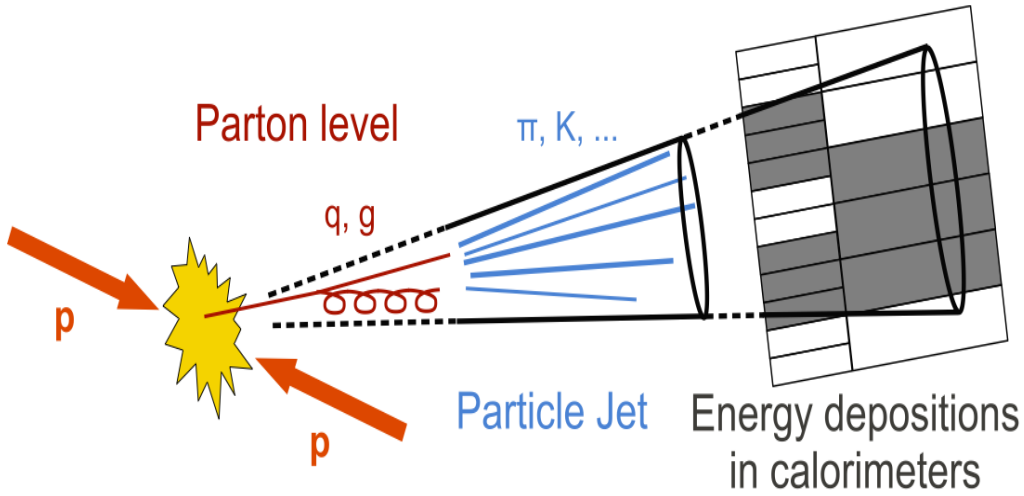
THE DRELL–YAN PROCESS OCCURS IN HIGH ENERGY HADRON–HADRON SCATTERING. IT TAKES PLACE WHEN A QUARK OF ONE HADRON AND AN ANTIQUARK OF ANOTHER HADRON ANNIHILATE, CREATING A VIRTUAL PHOTON OR Z BOSON WHICH THEN DECAYS INTO A PAIR OF OPPOSITELY-CHARGED LEPTONS.





JETS

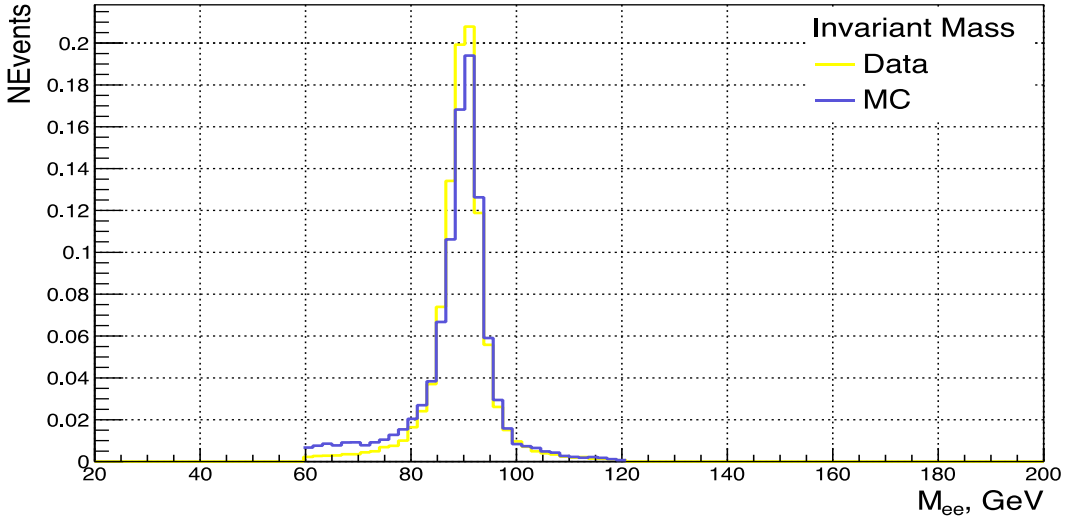
Jets are the experimental signatures of quarks and gluons produced in high-energy processes



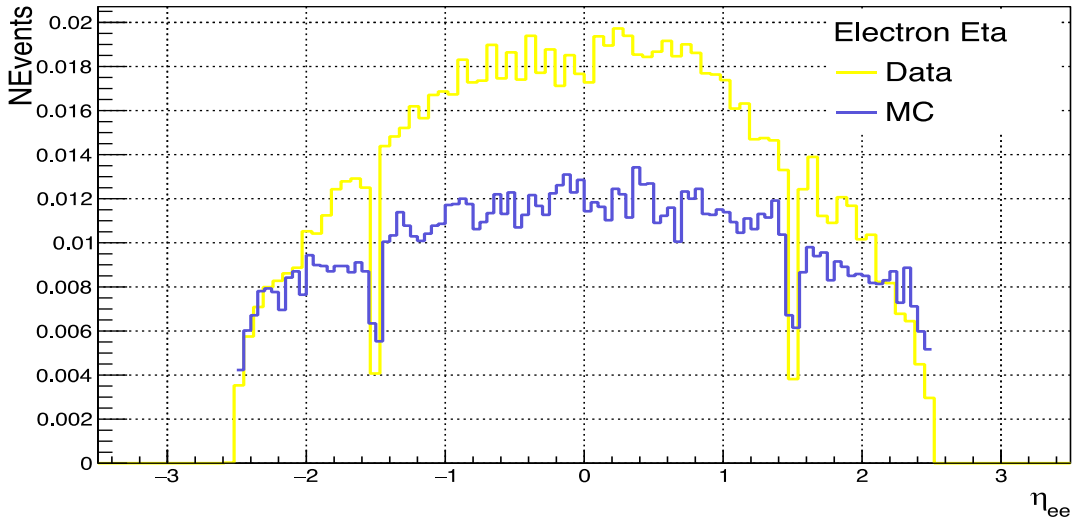
pp-collision and resulting collimated spray of particles

KINEMATIC DISTRIBUTIONS I

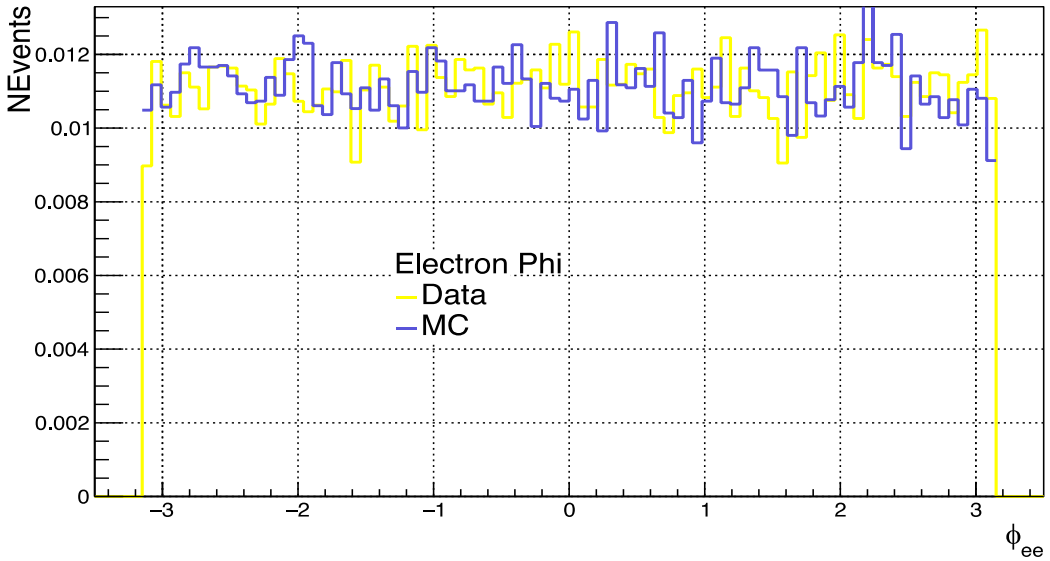
Invariant mass



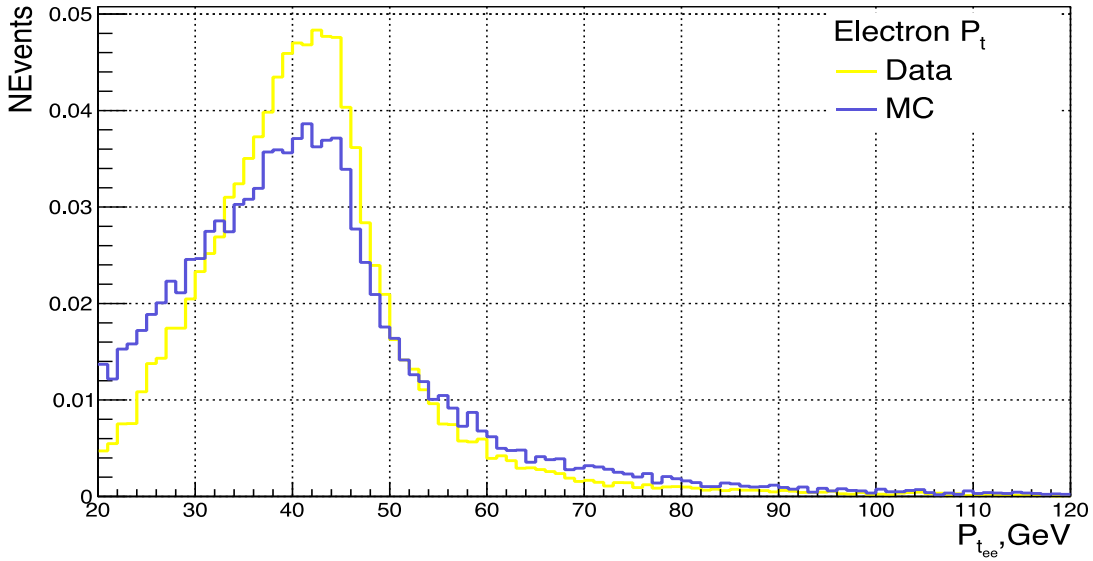
Pseudorapidity distribution of electrons



Azimutal distribution



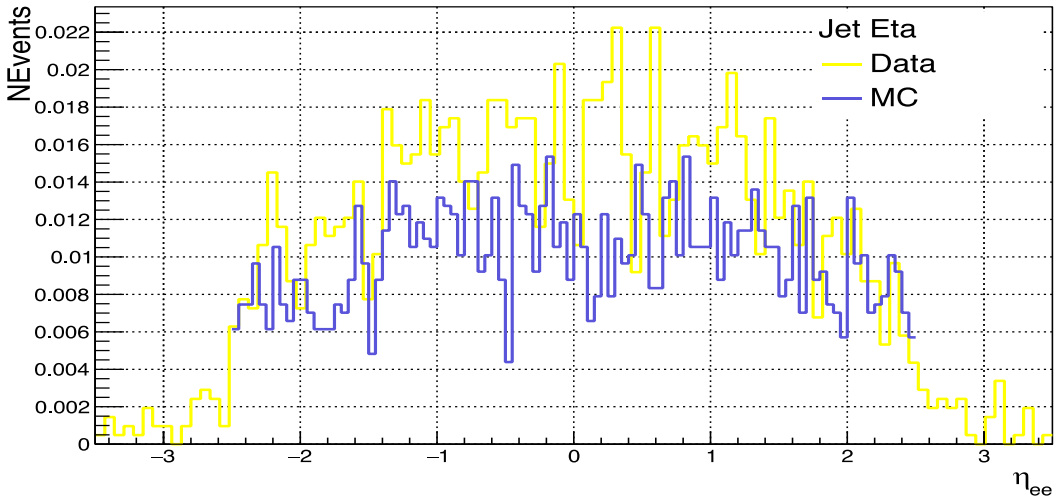
P_t of electrons



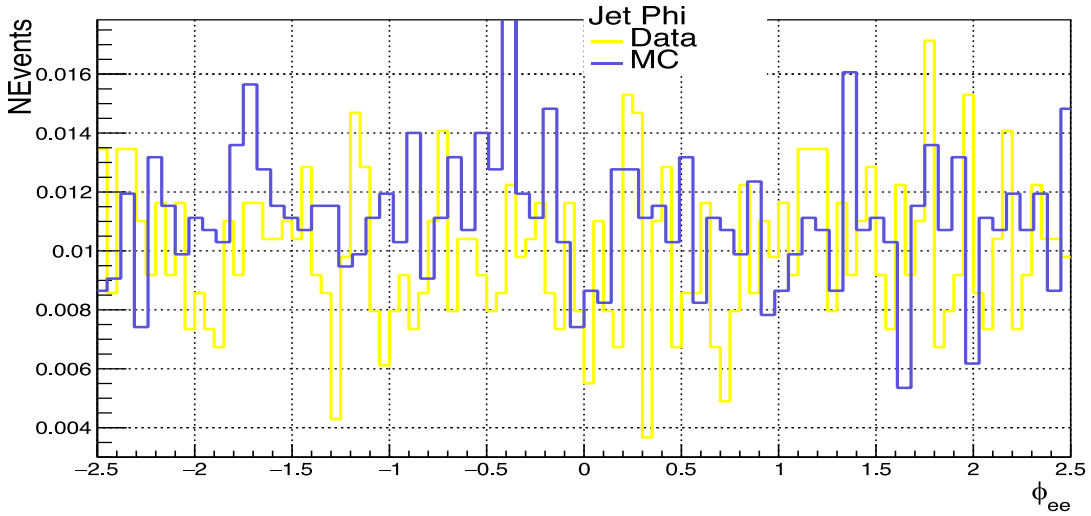
Histogramms normalized to 1

KINEMATIC DISTRIBUTIONS II

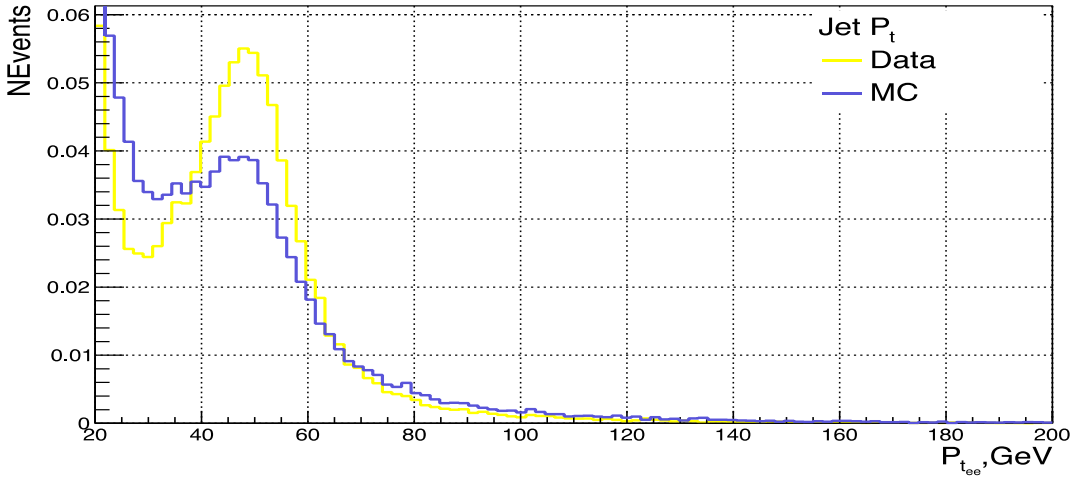
Pseudorapidity distribution of Jets



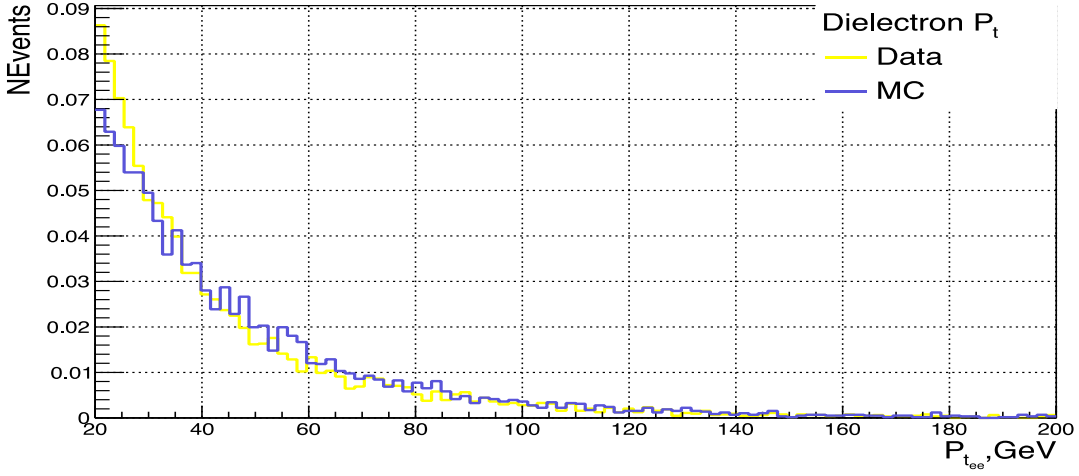
Azimutal distribution of Jets



P_t of Jets



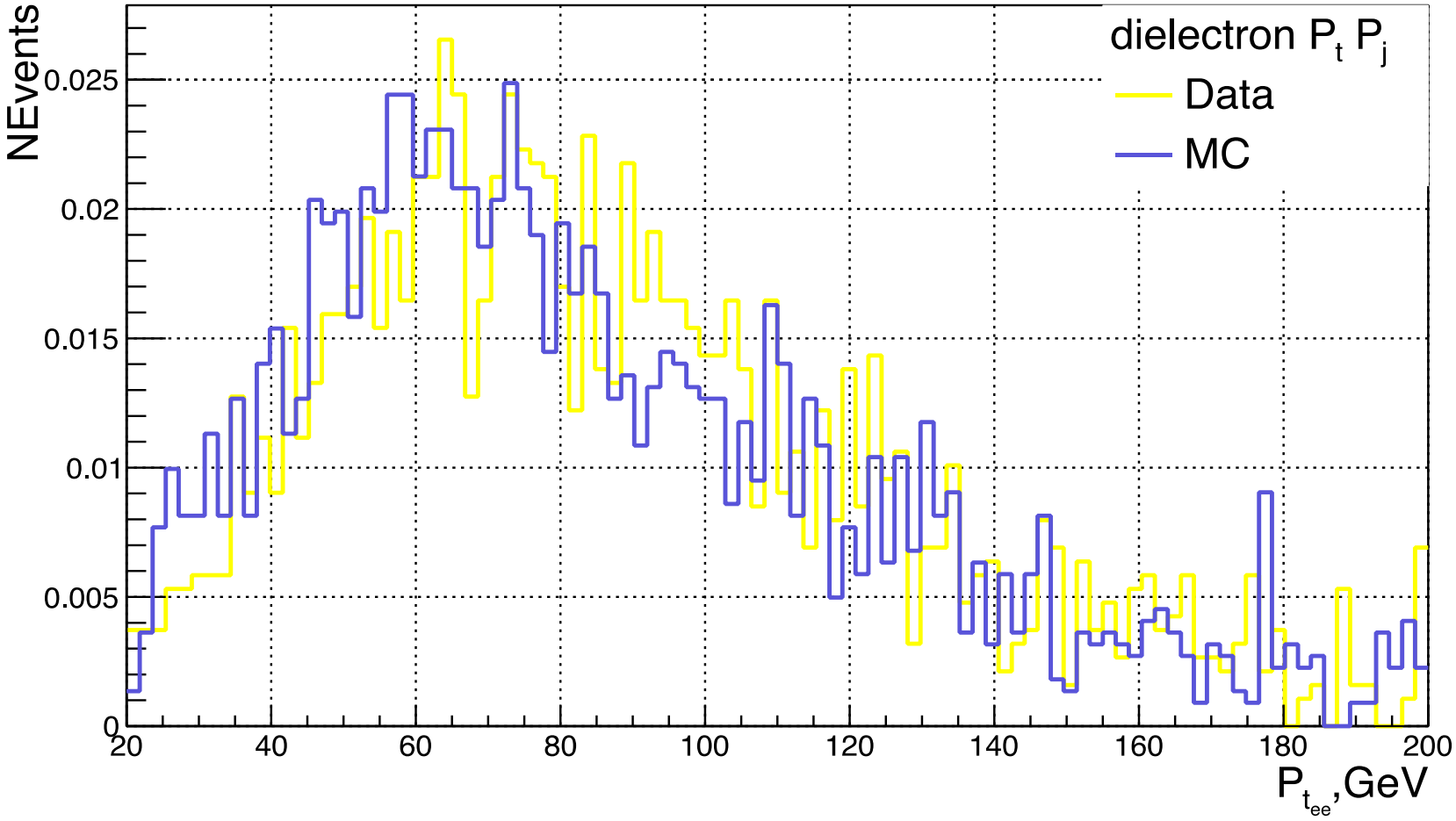
Transverse momentum of dielectron



The following conditions have been imposed

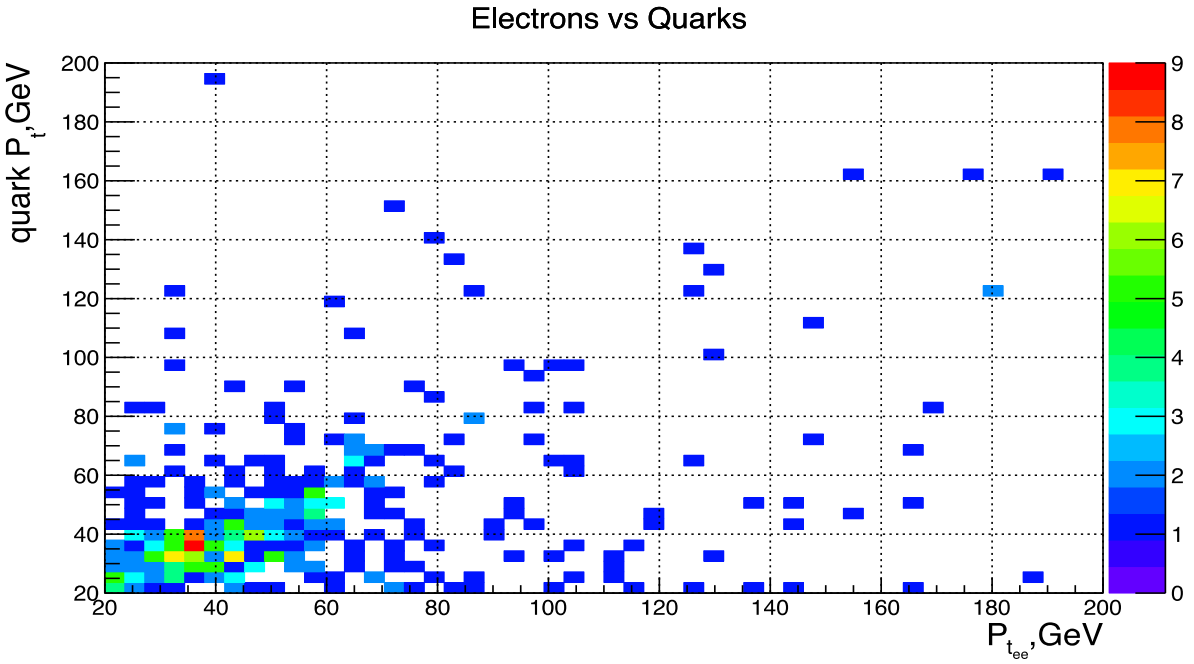
- for Jet: Pt>80 GeV
- for electrons: 60≤Pt≤120 GeV

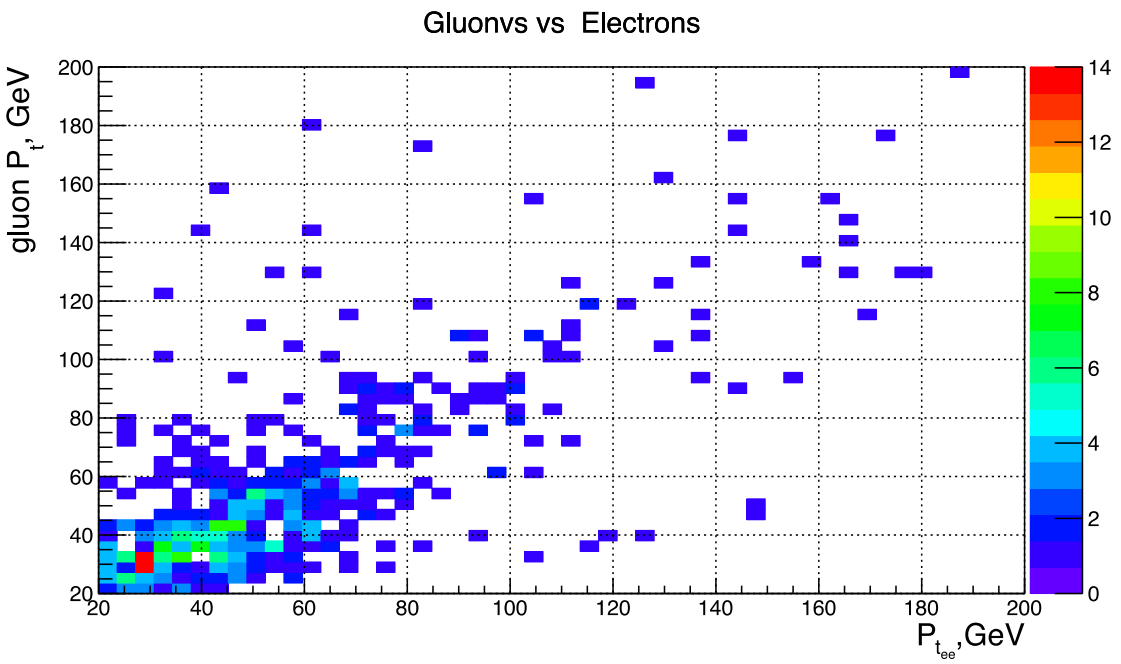
Dielectron P_t if assosiated with jets



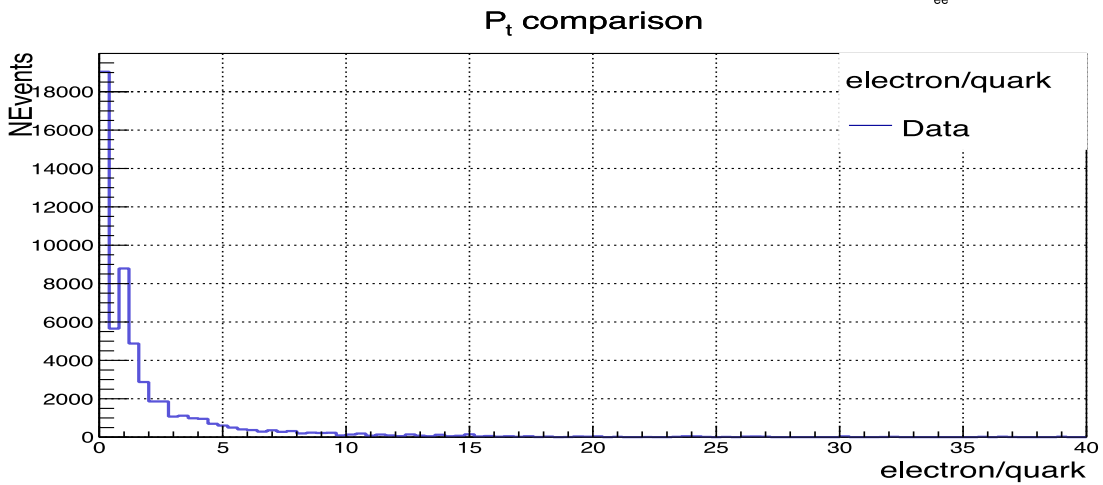
Requiring a high Pt Jet in the event shifts dielectron Pt distribution to higher values, so high Pt jets are associated to dielectron production

JET VS DIELECTRON PT





The resemblance of stream Pt and Pt of electron pairs can be used for selection the streams associated with electron pairs



CONCLUSION

- 1. Got familiar with the CMS data processing framework
- 2. Got familiar with root and c++
- 3. Studied to select electrons and jets from data
- 4. Built main kinematic distributions for electron pairs produced in DY processes
- 5. A criteria to select jets associated to electron pairs was proposed

THANKS FOR YOUR ATTENTION!!!