

# Comparison of Various Jet Algorithms

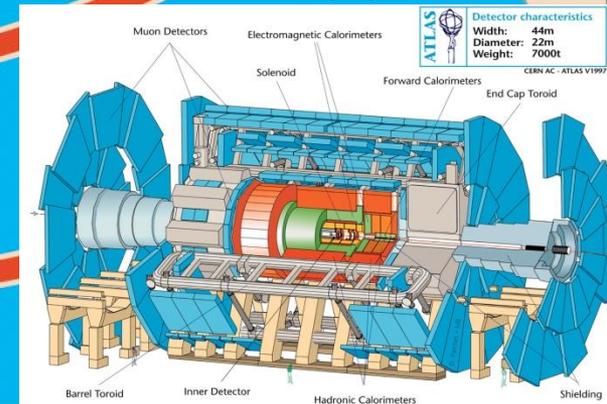
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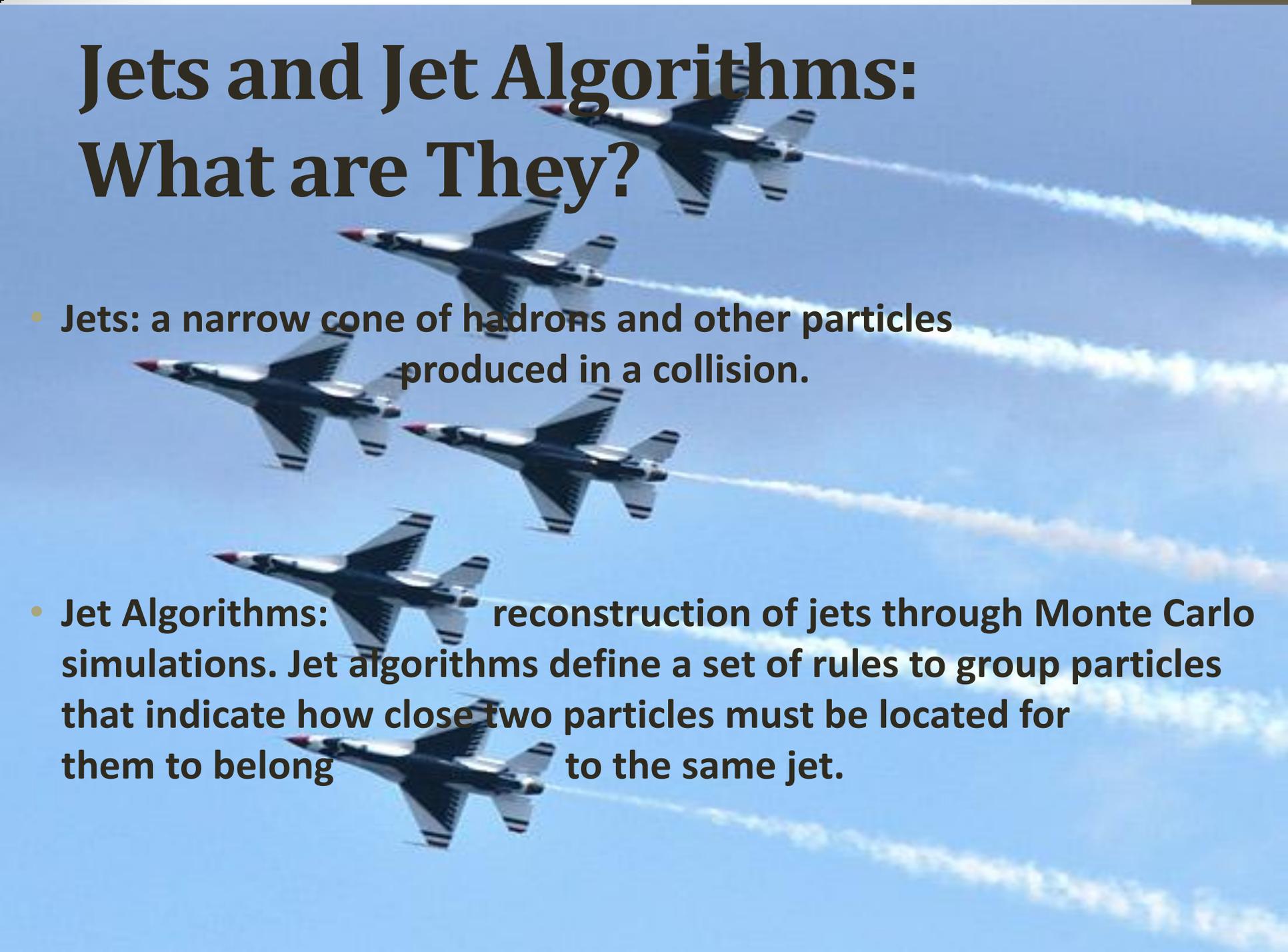
# CMS

## CMS: Objectives

- Strong evidence for the existence of a Higgs-like particle!
- Probing the existence of Beyond the Standard Model properties.
- Experimental Particle Physics has had numerous indirect effects on other fields through the technological innovations that are necessary to conduct this research. Some examples include innovations in computing necessary to process the raw data generated in these experiments, as well as radiation therapy for treating cancer.



# Jets and Jet Algorithms: What are They?



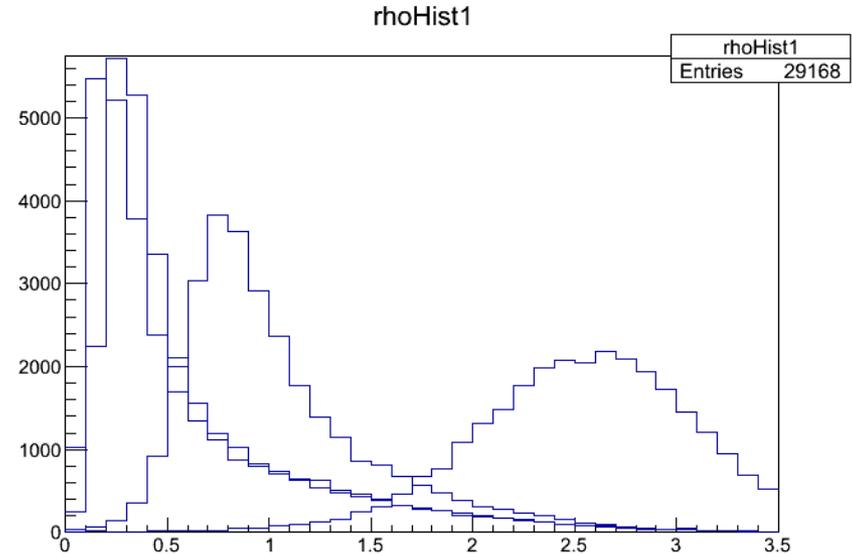
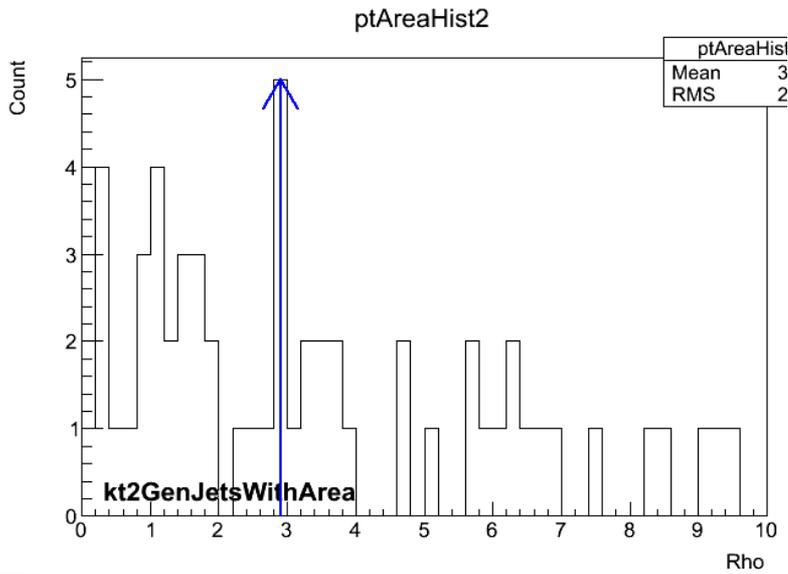
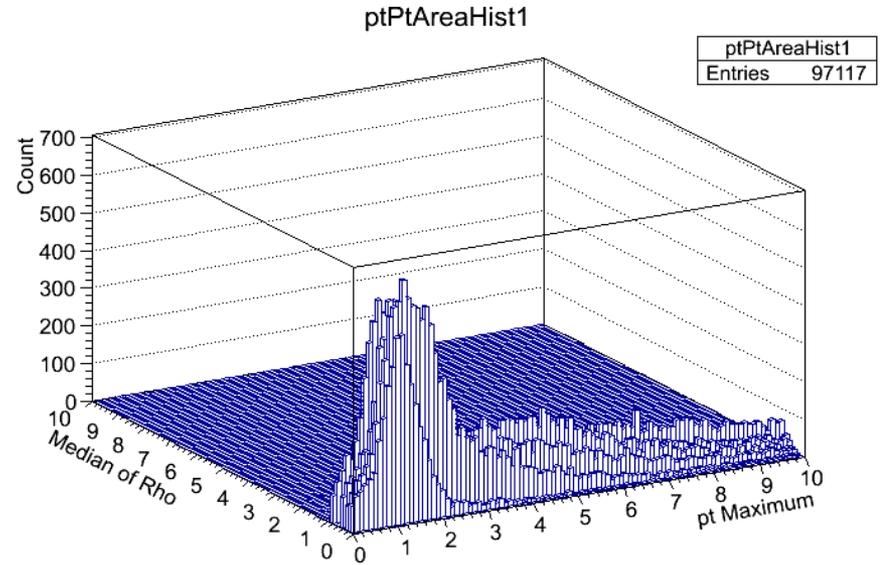
- **Jets:** a narrow cone of hadrons and other particles produced in a collision.
- **Jet Algorithms:** reconstruction of jets through Monte Carlo simulations. Jet algorithms define a set of rules to group particles that indicate how close two particles must be located for them to belong to the same jet.

# Motivation: How can we Differentiate Between the Different Jet Algorithms?

- Many kinds of jet algorithms have been developed
- kt2GenJetsWithArea, kt4GenJetsWithArea, kt8GenJetsWithArea, kt12GenJetsWithArea each calculate the jet area differently. Calculating jet area is non-trivial!
- In the presence of multiple events (ie, pile-up), how do the jet algorithms fare in differentiating between the various events?
- Resolution is extremely important so that we distinguish between disparate collisions and interactions!

# Plots

Variables that we are interested in:  
Transverse Momentum (pt), Jet  
Area (ja),  $\text{Rho} = \text{pt}/\text{ja}$



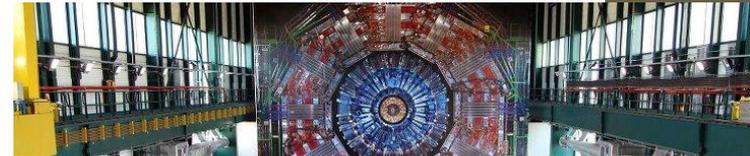
# Accomplishments and Further Work

- Program that successfully analyzes CMS data from a variant number of files, program that selectively merges (based on a text file that the program reads) histograms.
- Future work: Within the next day, I will have all of the pile-up data analyzed, so we can compare how well the algorithms can resolve multiple events at once. Once we know how well they can be distinguished, the jet algorithms themselves can be modified to get better results, or we will look at other jet algorithms as well.

# References

- [1] D. J. Griths, Introduction to elementary particles. John Wiley and Sons, Inc., 1987.
- [2] CERN-THESIS-2010-233; CMS-TS-2011-040. Statistical Combination of Higgs Decay Channels and Determination of the Jet-Energy Scale of the CMS Experiment at the LHC. Piparo, Danilo (CERN); Quast, Gunter (dir.) (Karlsruhe U., EKP)

# Auf Wiedersehen, Au Revoir, Arrivederci, A Revair!



Thanks!