Analyzing ISR Jet Tagging Efficiency

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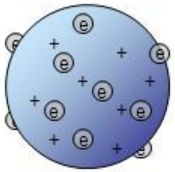
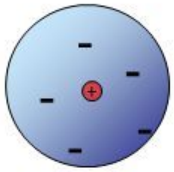
Under the direction of Dr. Zhenbin Wu and Dr. Richard Cavanaugh

Models of the Atom

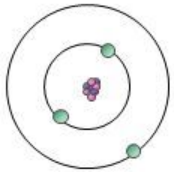
Greek model (400 B.C.)



Thomson's plum-pudding model (1897)



Rutherford's model (1909)



Bohr's model (1913)

Charge-cloud model (present)

1803 John Dalton pictures atoms as tiny, indestructible particles, with no internal structure.

1897 J.J. Thomson, a British scientist, discovers the electron, leading to his "plum-pudding" model. He pictures electrons embedded in a sphere of positive electric charge.

1911 New Zealander Ernest Rutherford states that an atom has a dense, positively charged nucleus. Electrons move randomly in the space around the nucleus.

1913 In Niels Bohr's model, the electrons move in spherical orbits at fixed distances from the nucleus.

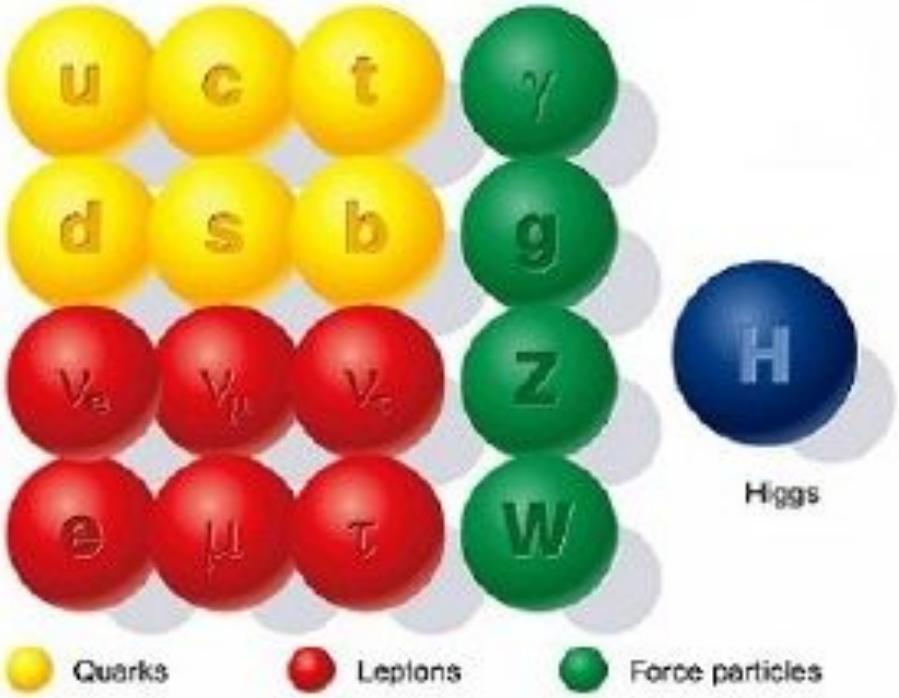
1926 Erwin Schrödinger develops mathematical equations to describe the motion of electrons in atoms. His work leads to the electron cloud model.

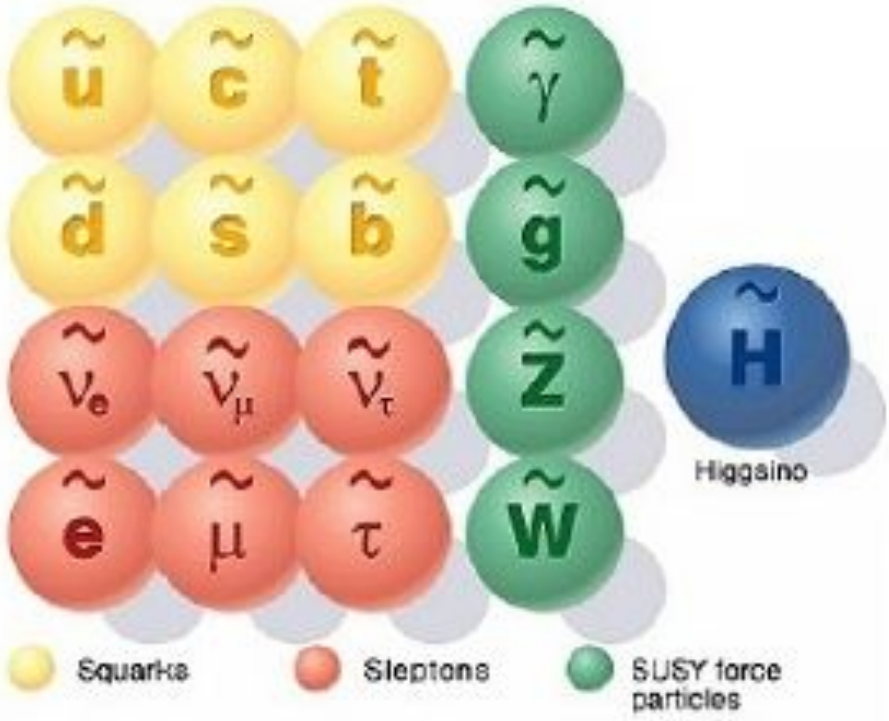
1800 1805 ..... 1895 1900 1905 1910 1915 1920 1925 1930 1935 1940 1945

1904 Hantaro Nagaoka, a Japanese physicist, suggests that an atom has a central nucleus. Electrons move in orbits like the rings around Saturn.

1924 Frenchman Louis de Broglie proposes that moving particles like electrons have some properties of waves. Within a few years evidence is collected to support his idea.

1932 James Chadwick, a British physicist, confirms the existence of neutrons, which have no charge. Atomic nuclei contain neutrons and positively charged protons.



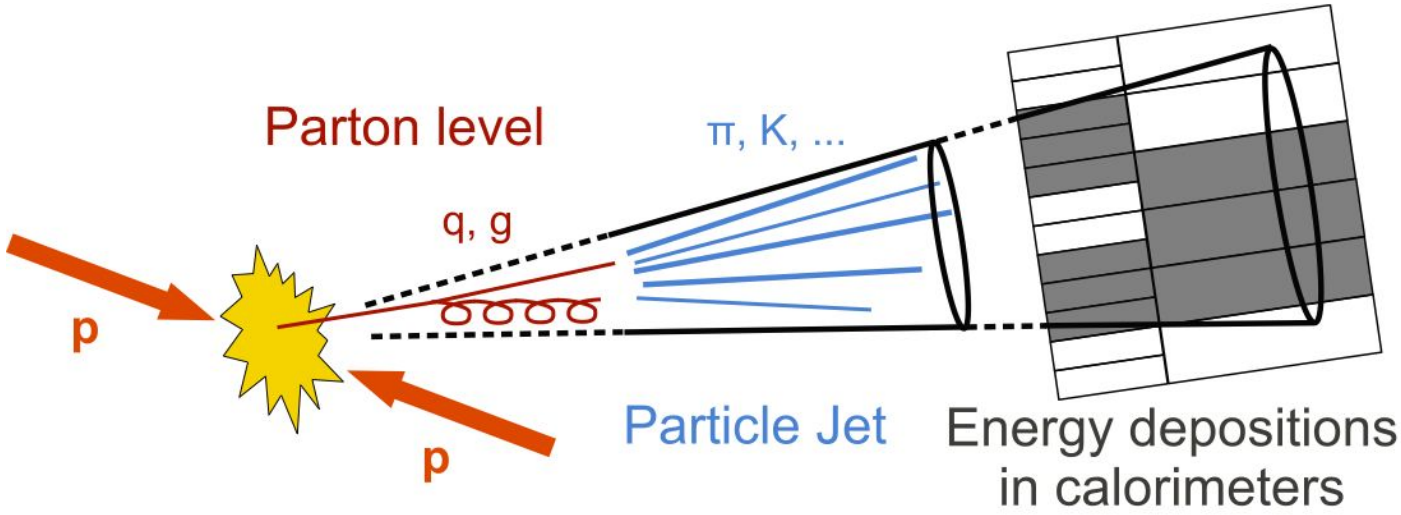


Standard particles

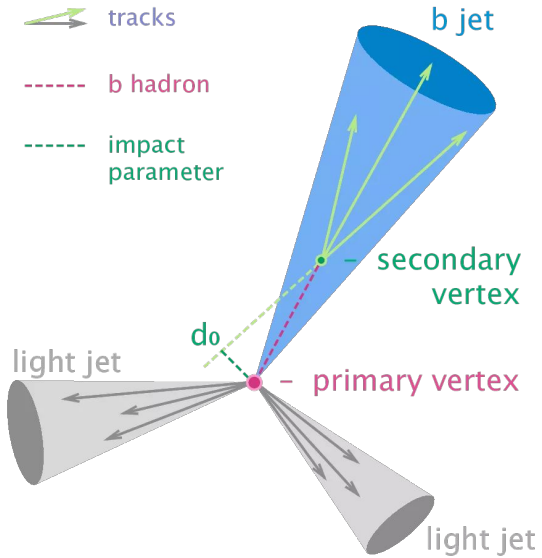
SUSY particles

What are Jets?

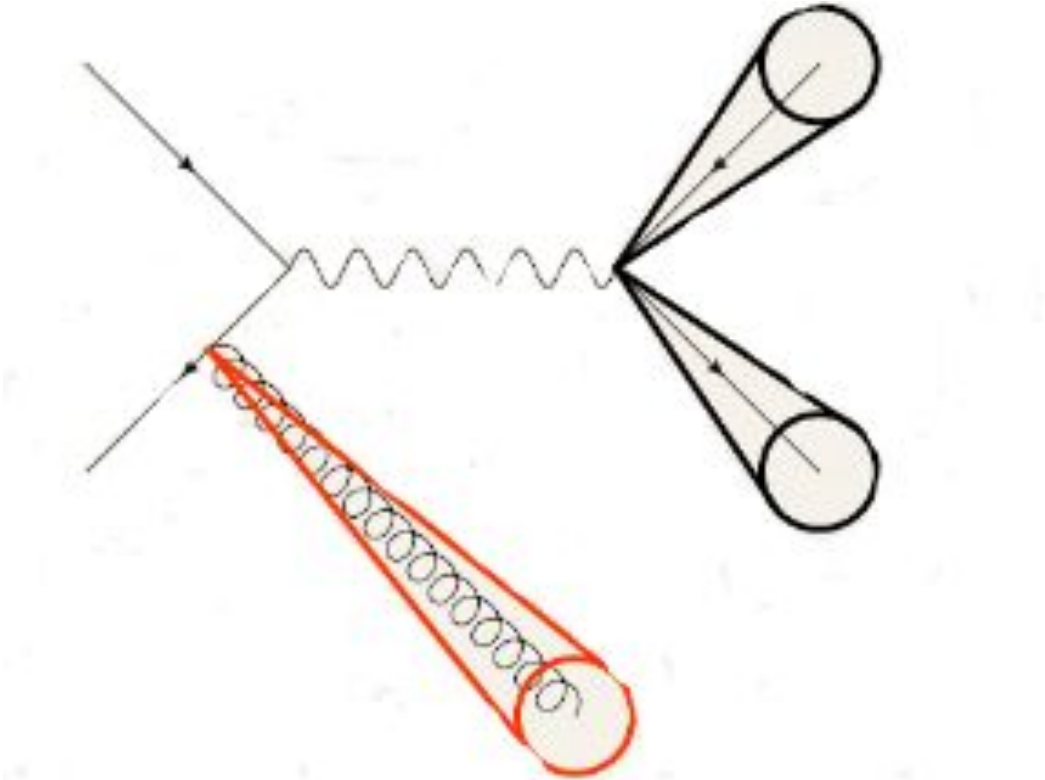
The **hadronization** of gluons and quarks



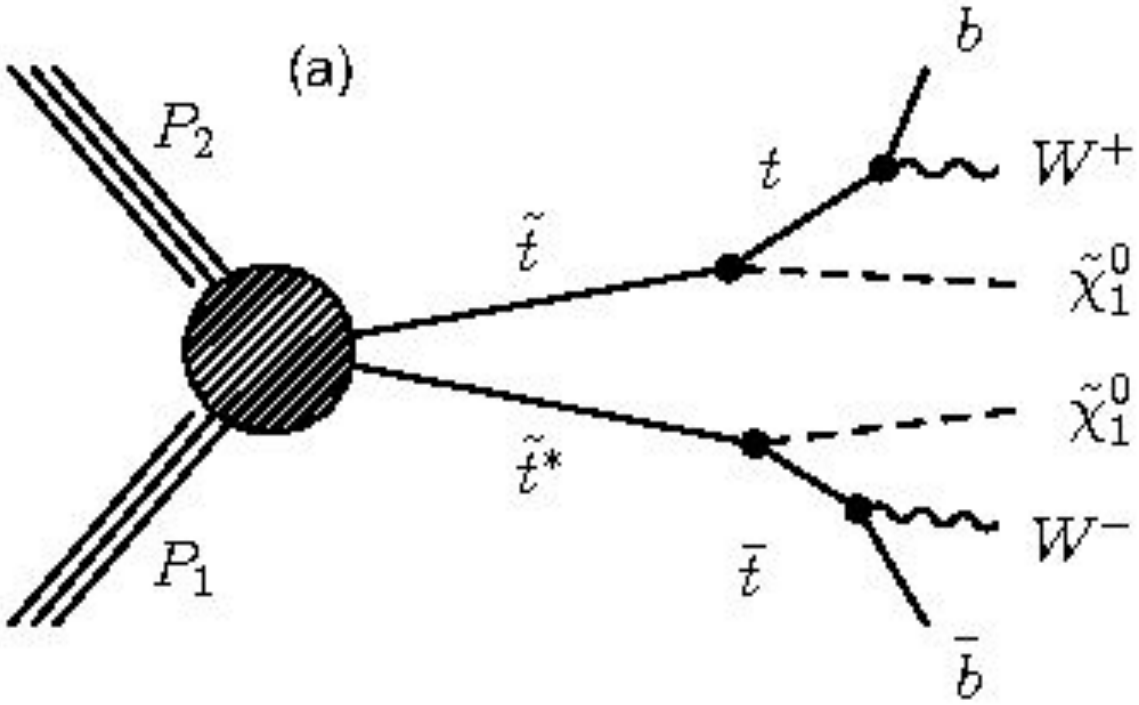
What are Jets?



Initial State Radiation (ISR) Jets

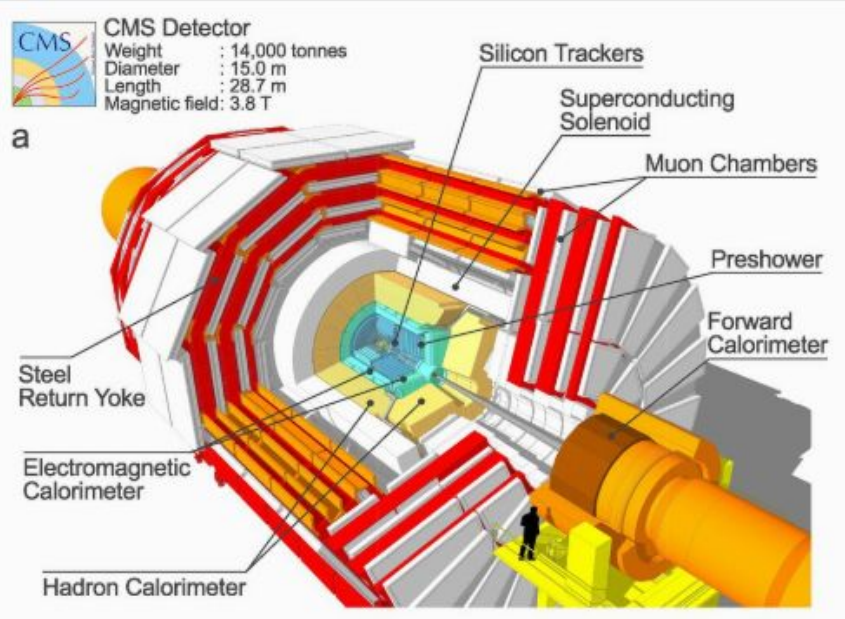


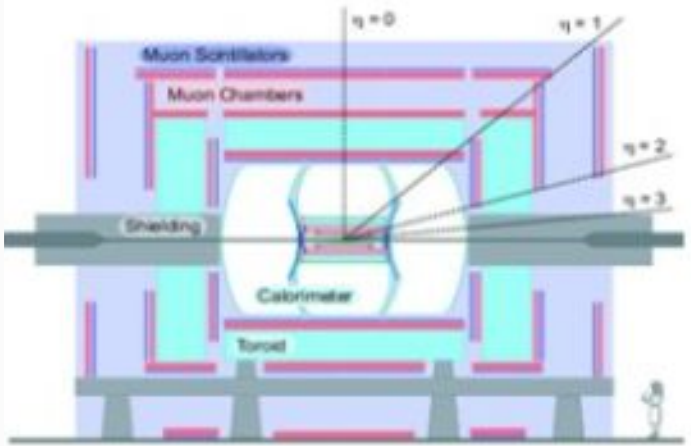
T2tt Signal



Collider Detectors

Large Hadron Collider Detectors: ATLAS, CMS, ALICE, LHCb

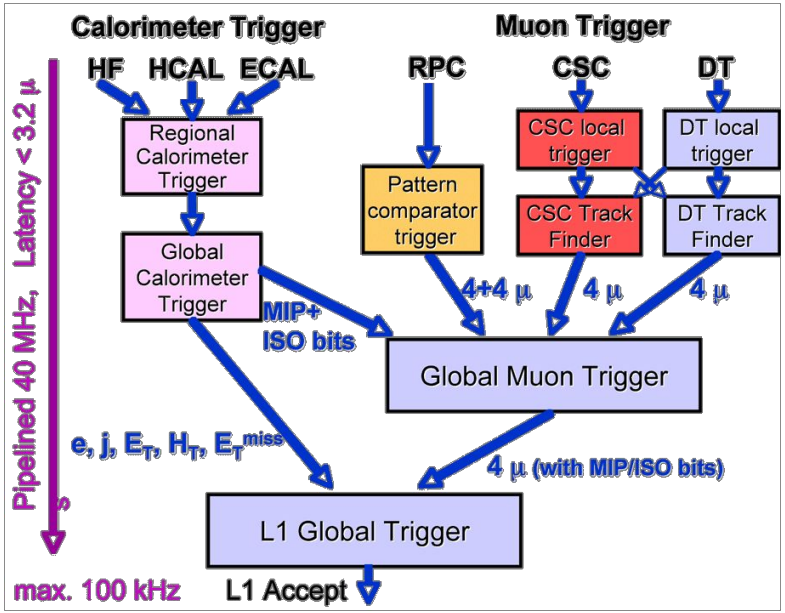




Data Collected

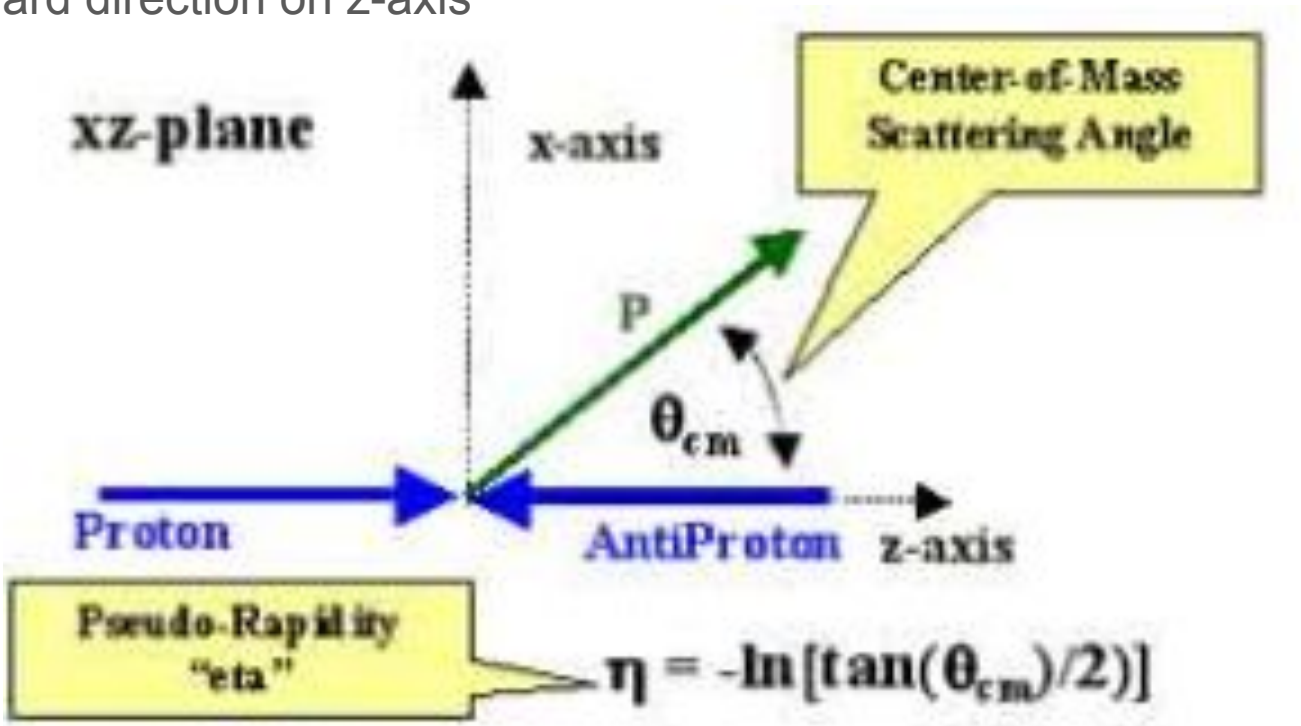
The data flow from all four experiments for Run 2 is anticipated to be about 25 GB/s (gigabyte per second)

- ALICE: 4 GB/s (Pb-Pb running)
- ATLAS: 800 MB/s – 1 GB/s
- CMS: 600 MB/s
- LHCb: 750 MB/s



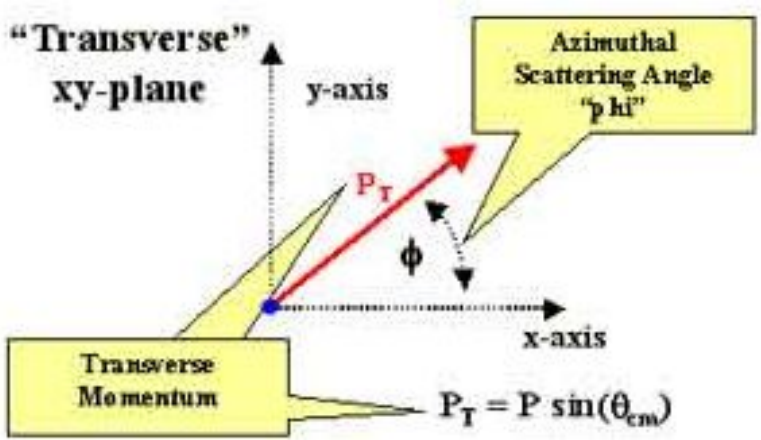
Pseudorapidity

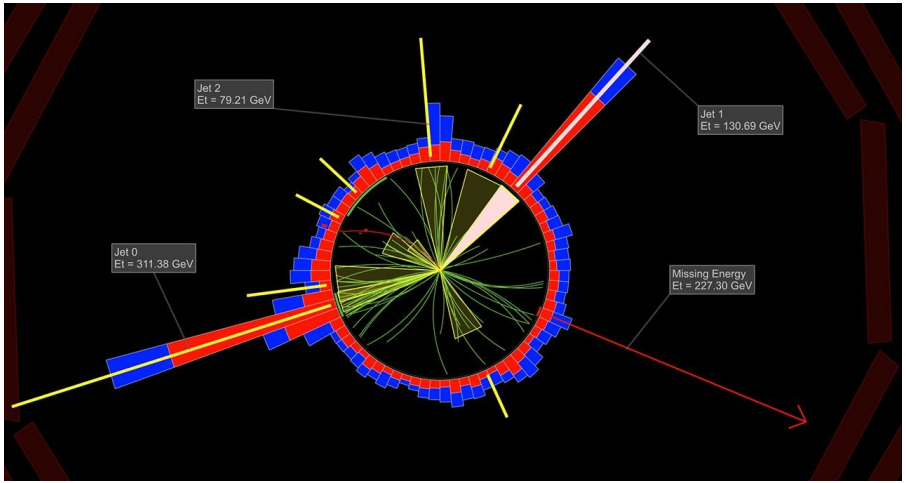
Eta = forward direction on z-axis



Pt and Missing Energy

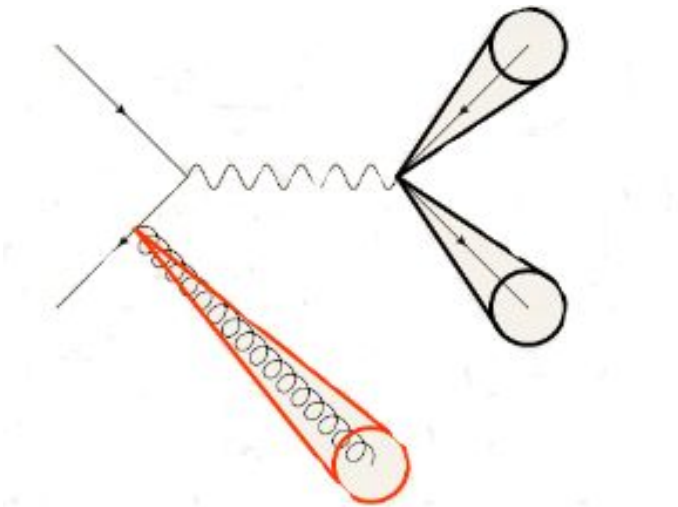
Pt = Transverse momentum



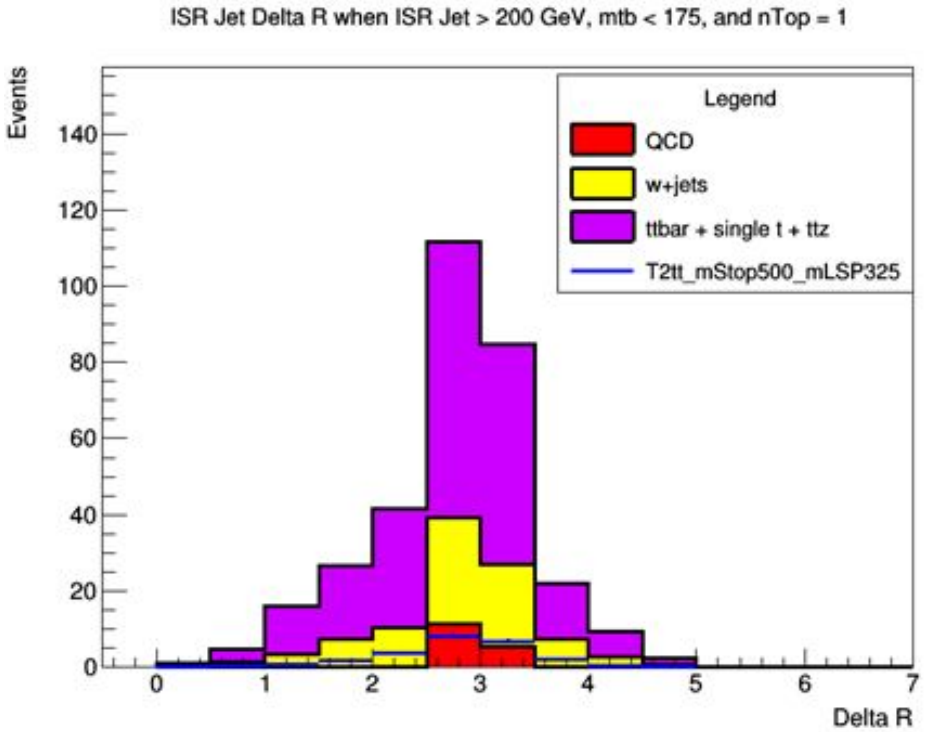


Narrow the Signal Down

- Use ISR jet data to find the signal (SUSY particles)
- Test in simulated data before applying to real data



Pseudorapidity (η)



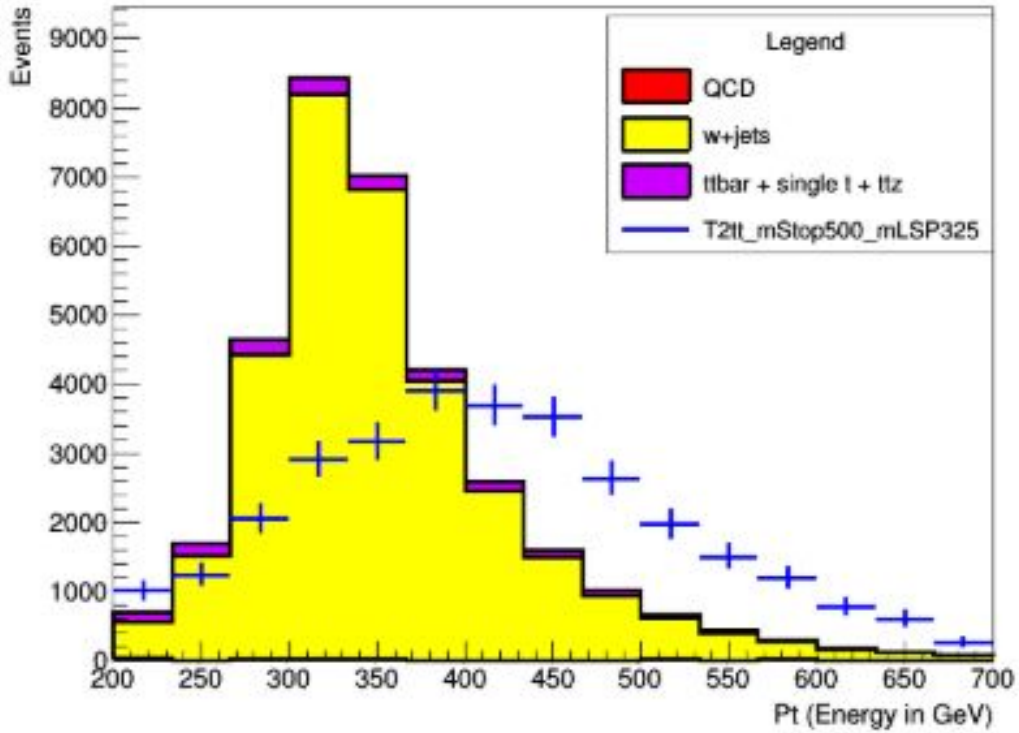
Cuts Applied:

- Baseline Cuts
- ISR Jet > 200 GeV
- mtb < 175
- nTops = 1

Not useful - background and signal have the same distribution

ISR Jet Pt

Useful - background and signal distributions are different



-Normalized by efficiency before SUSY baseline cuts were applied.
-Cuts: baseline, Pt less than 200 cut, and mtb less than 175.
-The signal was increased by a factor of 500 to make it more visible on the graph.

Future Studies

- Use ISR jet Pt value cuts (around 350 GeV) to help analyze the T2tt signal
- Further research how ISR jets can be used to make cuts.

Hay: background events
Needle: the signal
Magnifying glass: ISR jets

Thank You!