

Particles, forces and the Universe at the smallest distances

- What high energy particle physics can tell us.

Particles, forces and the Universe at the smallest distances

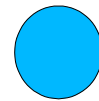
- What high energy particle physics can tell us.
- **How it is done.**

Particles, forces and the Universe at the smallest distances

- What high energy particle physics can tell us.
- How it is done.
- **An equation, a diagram and a plot.**

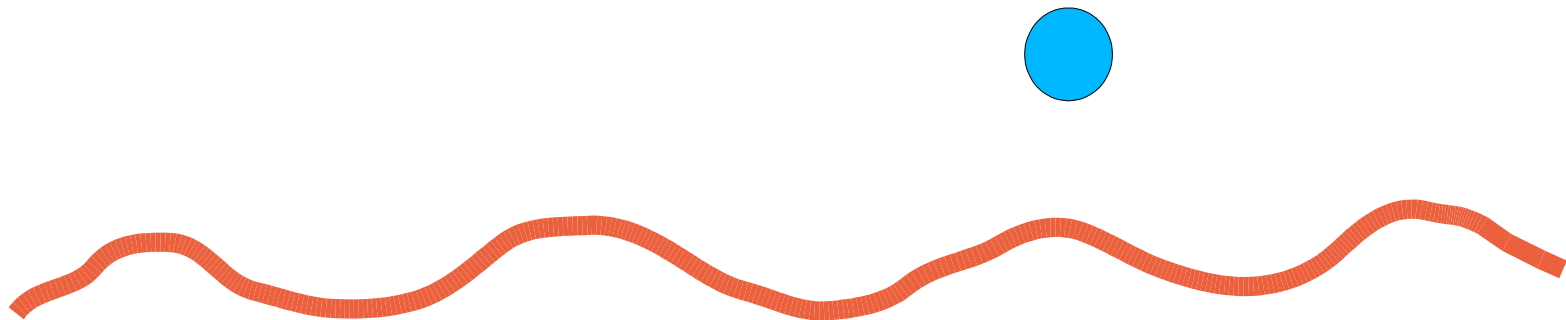
What high energy particle physics can tell us

- Investigating nature at the smallest scales
 - Hopefully things are simpler there (?)
 - Need high energy to gain high resolution.



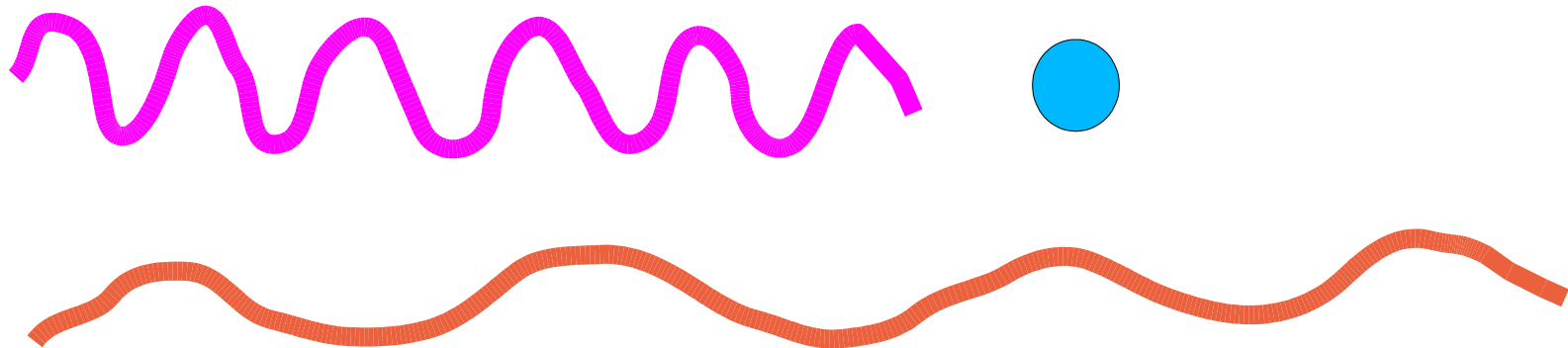
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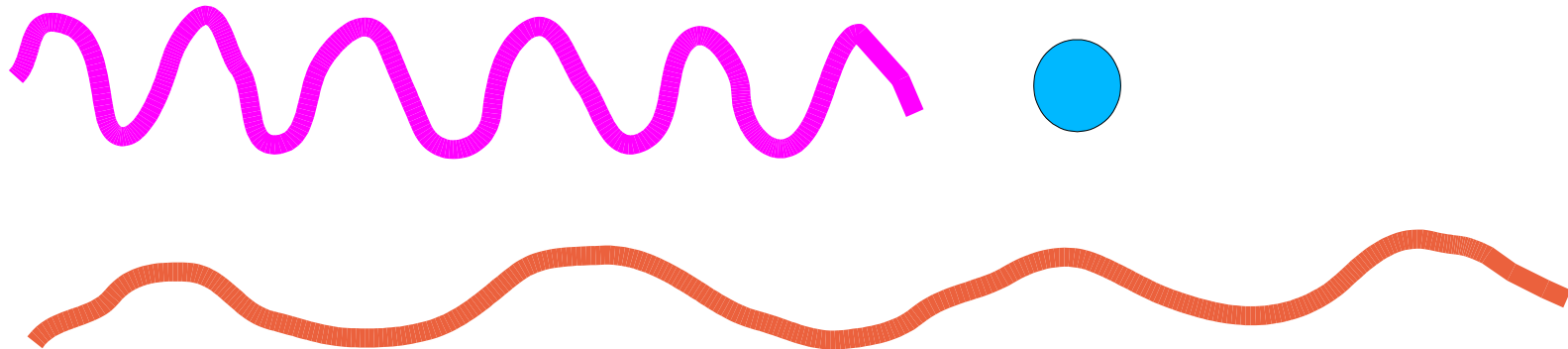
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What high energy particle physics can tell us

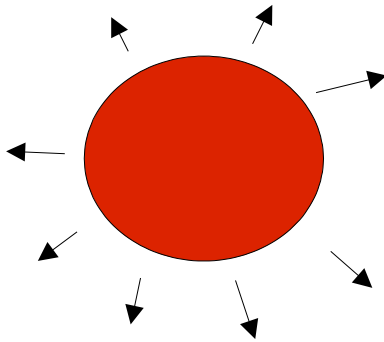
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High energy wave means small wavelength

High Energy means near the big bang

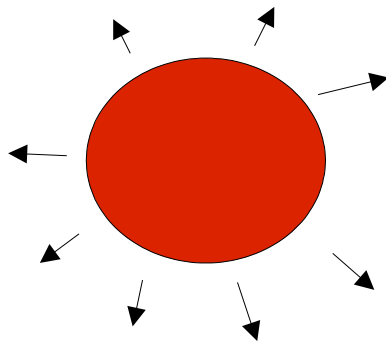
High energy density



THEN

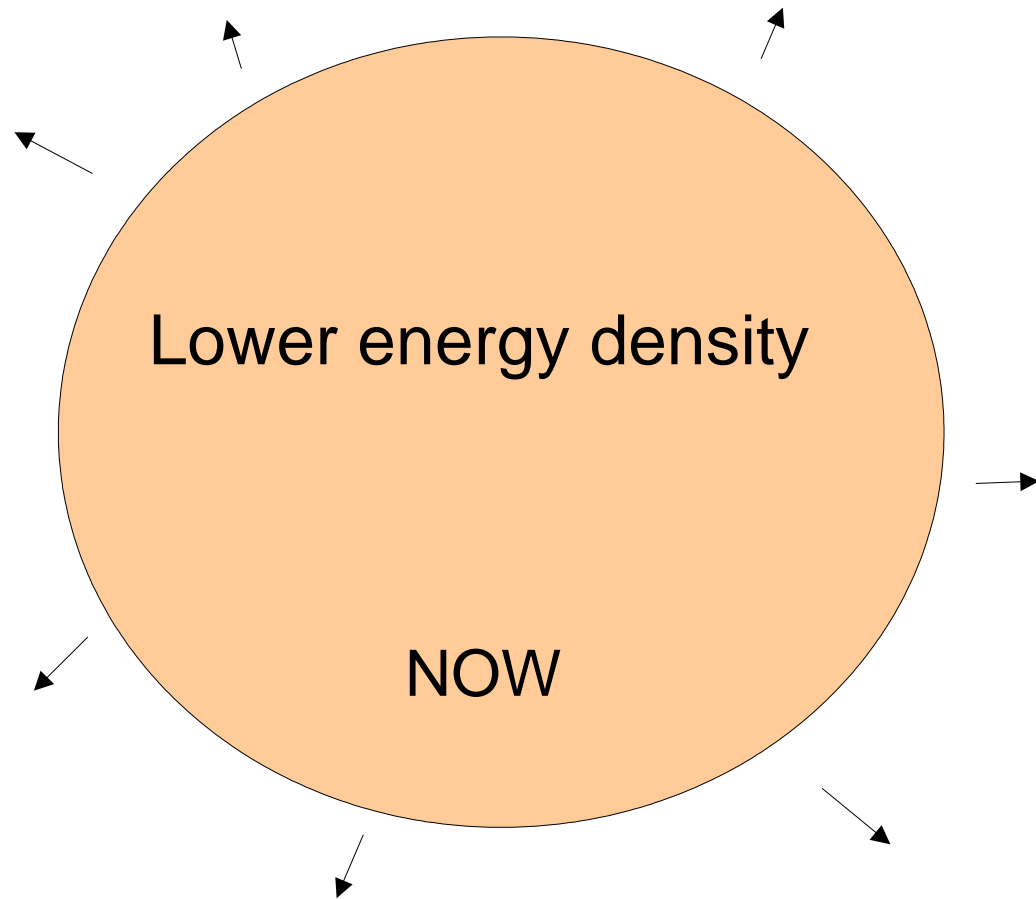
High Energy means near the big bang

High energy density



THEN

Lower energy density



NOW

How are such high energies achieved?

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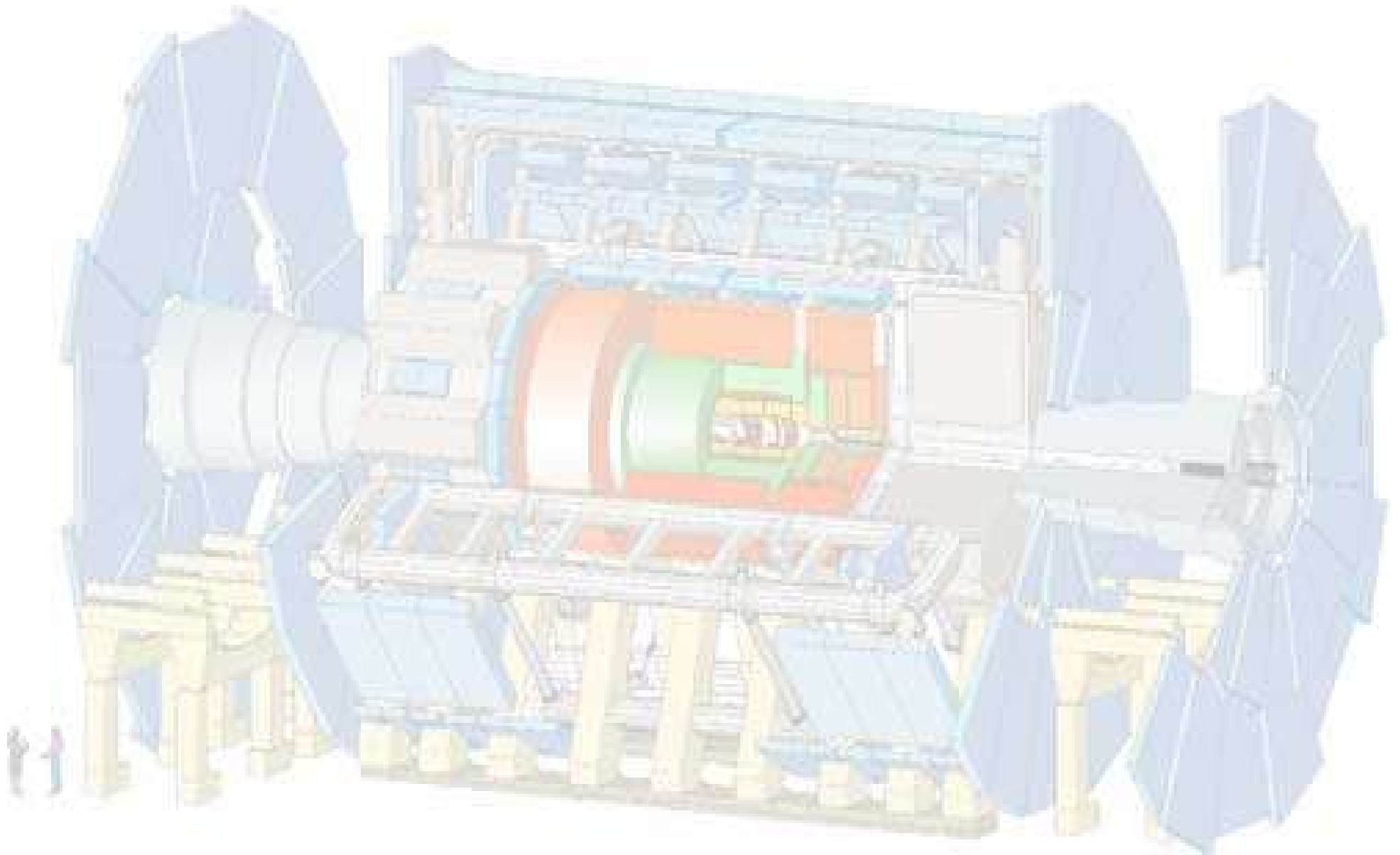
- Collisions at big, and unfortunately expensive, accelerators.



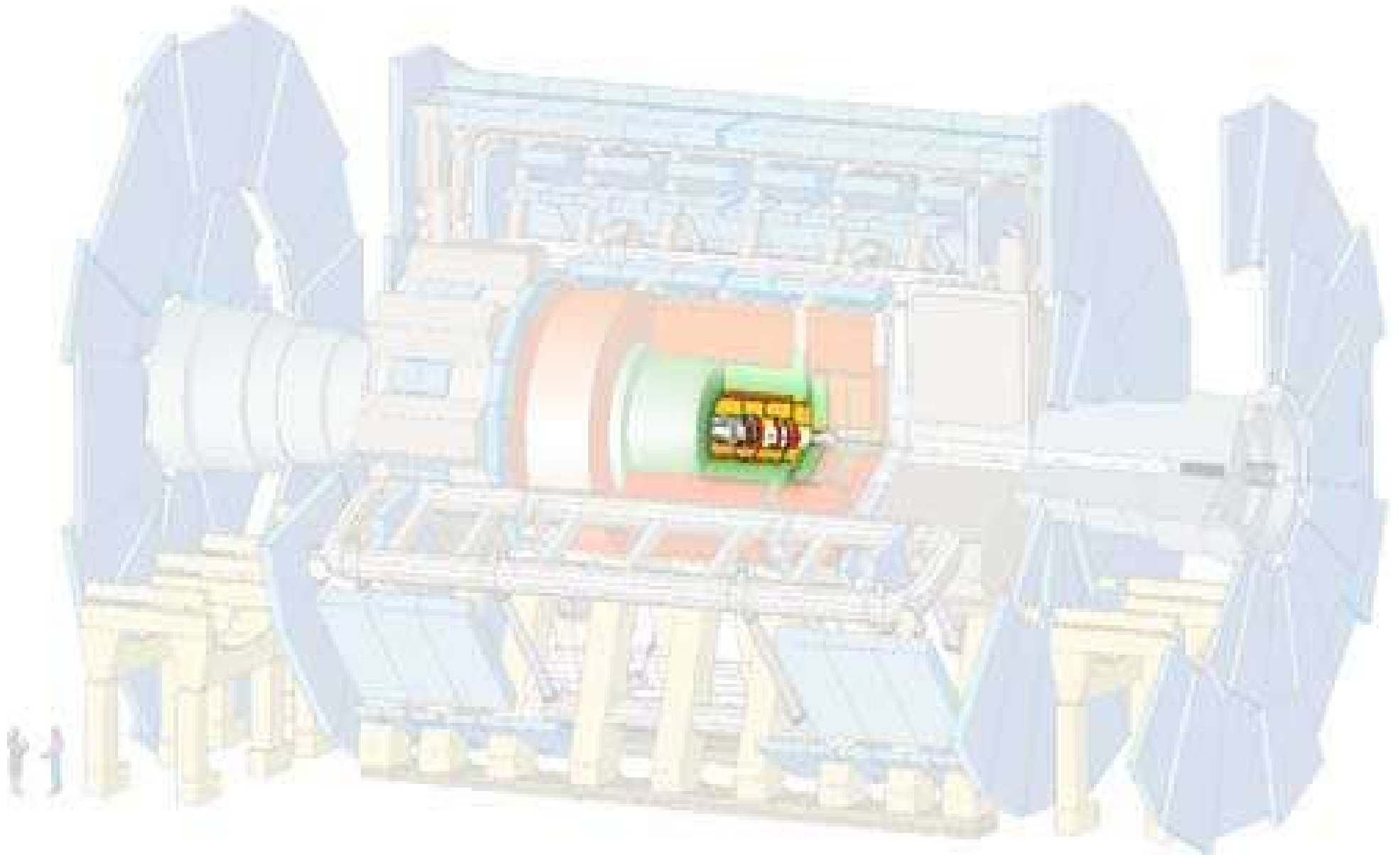
How are such high energies achieved?



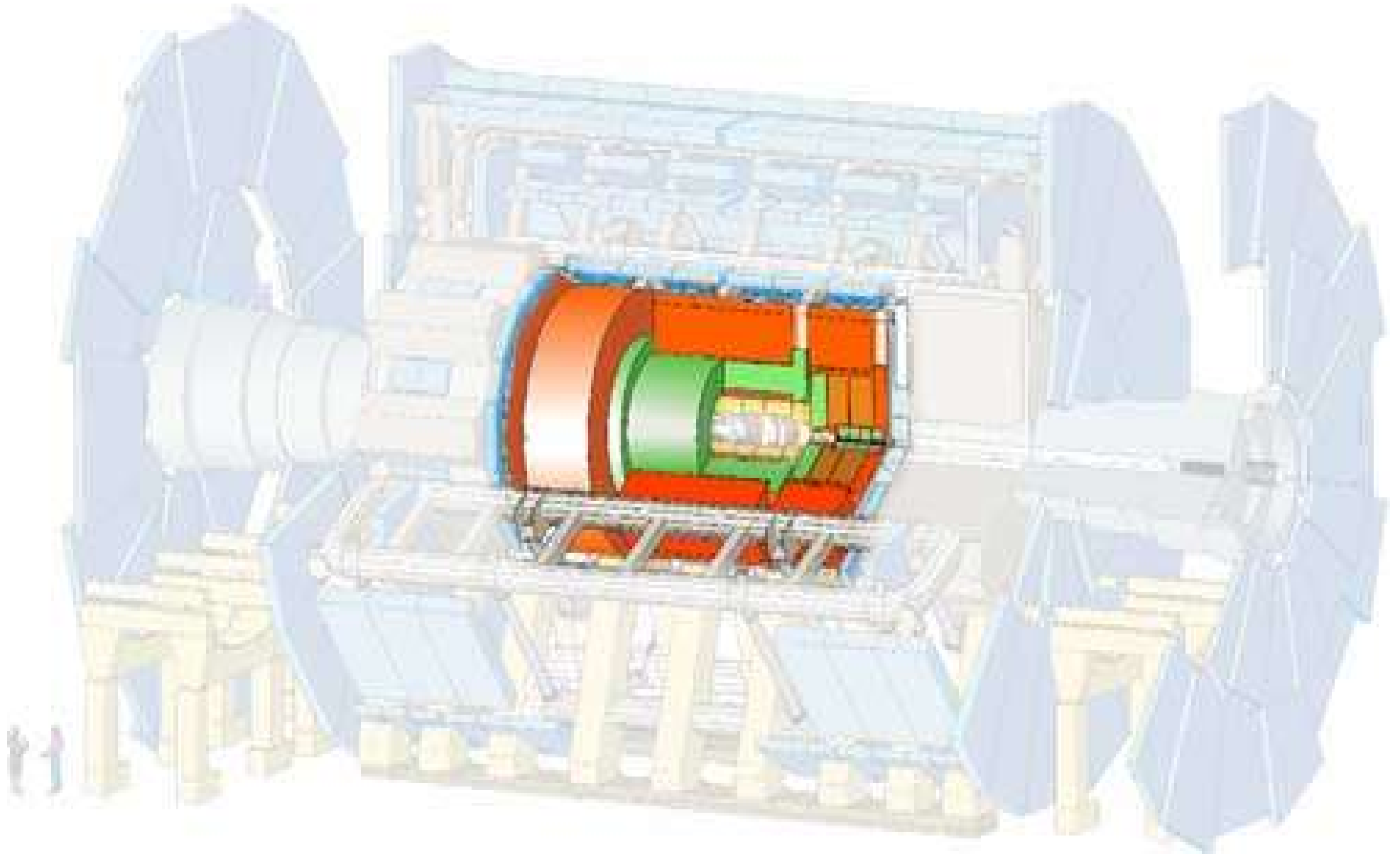
The detectors



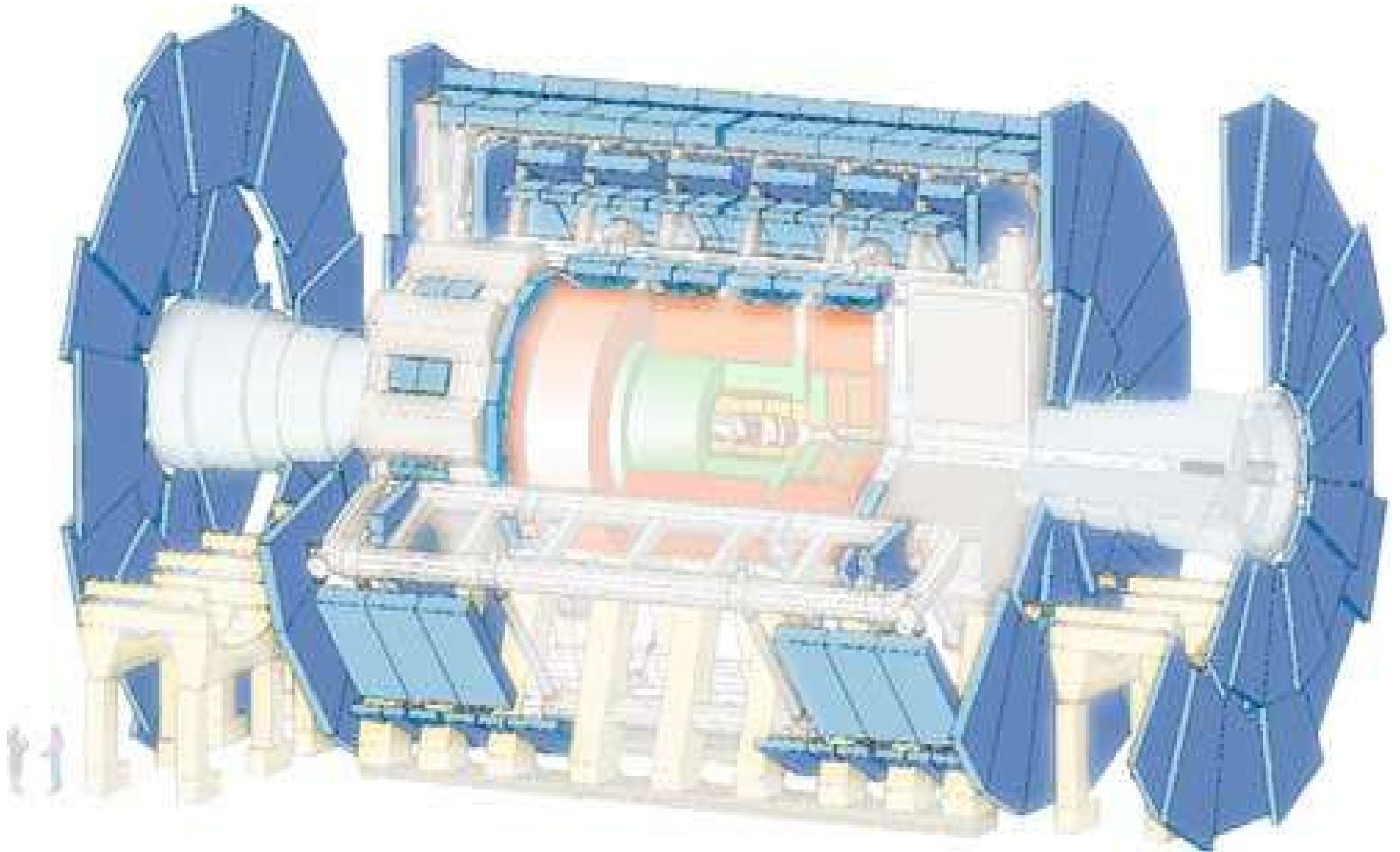
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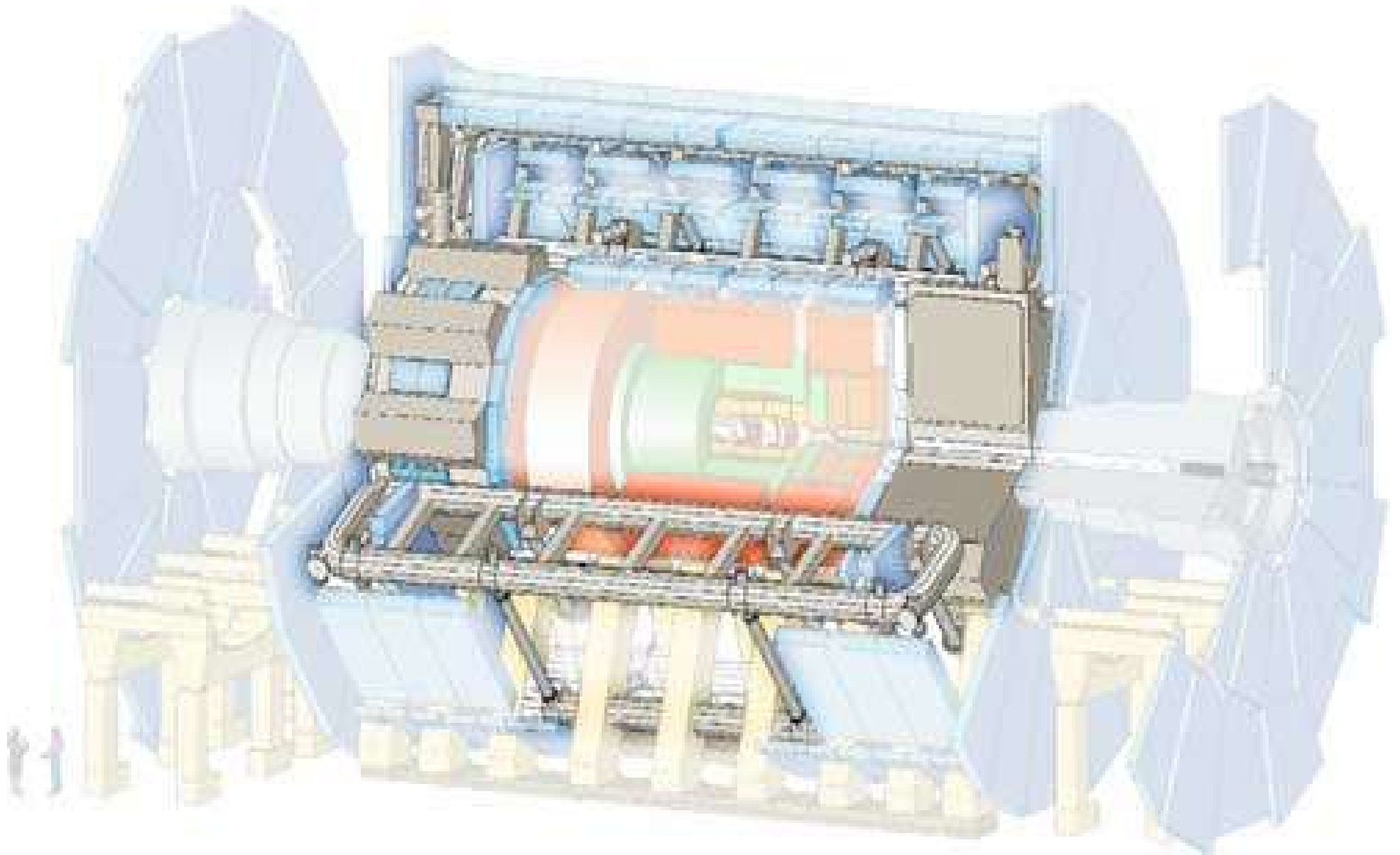
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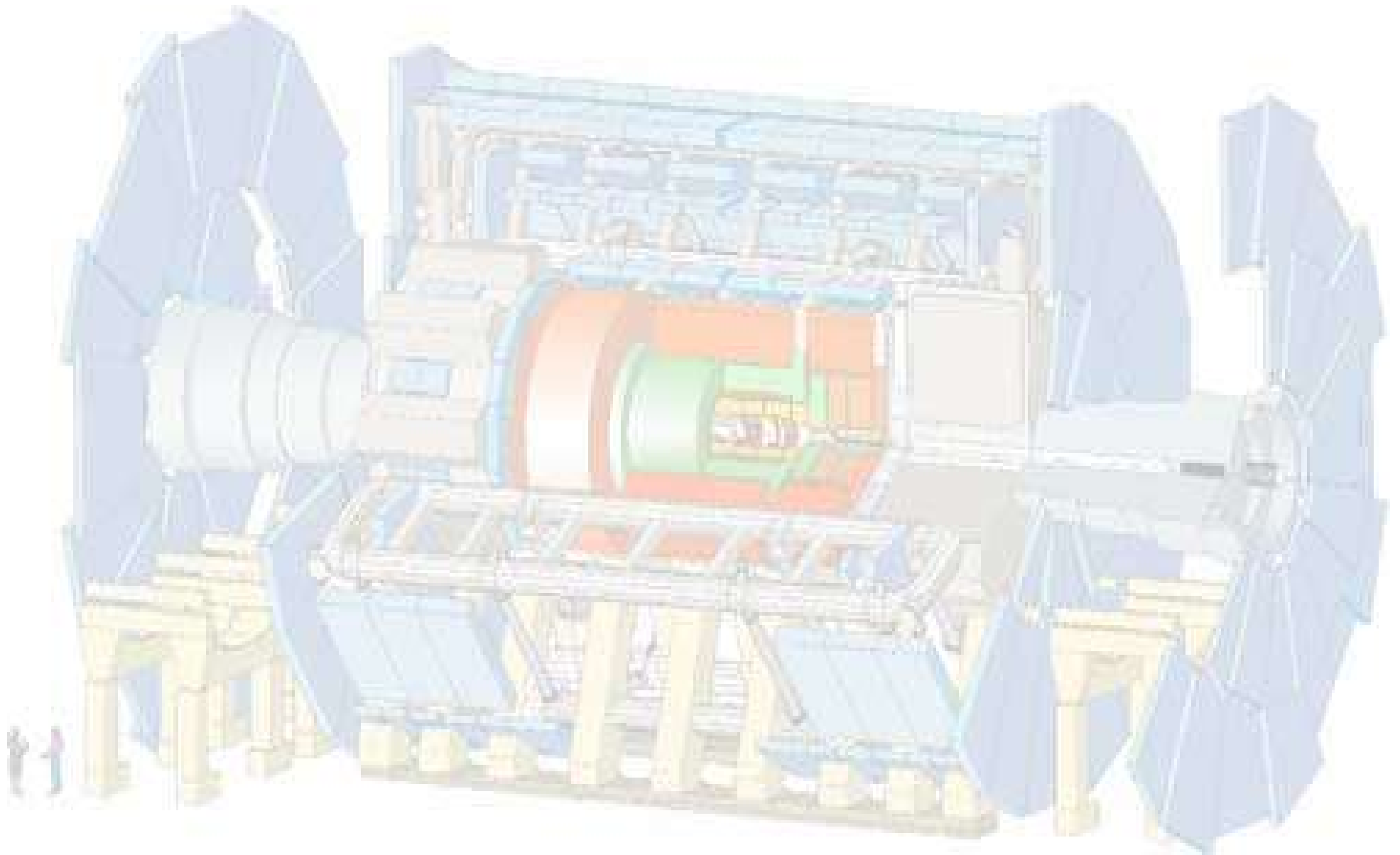
The detectors



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The detectors

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 - High speed, high data volumes

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- Many technological challenges -
 - High speed, high data volumes
 - 55,000 DVDs per second... reduced to 1 DVD every 3 minutes by sophisticated “triggering” system.
 - High resolution
 - 100's of particles in some events.

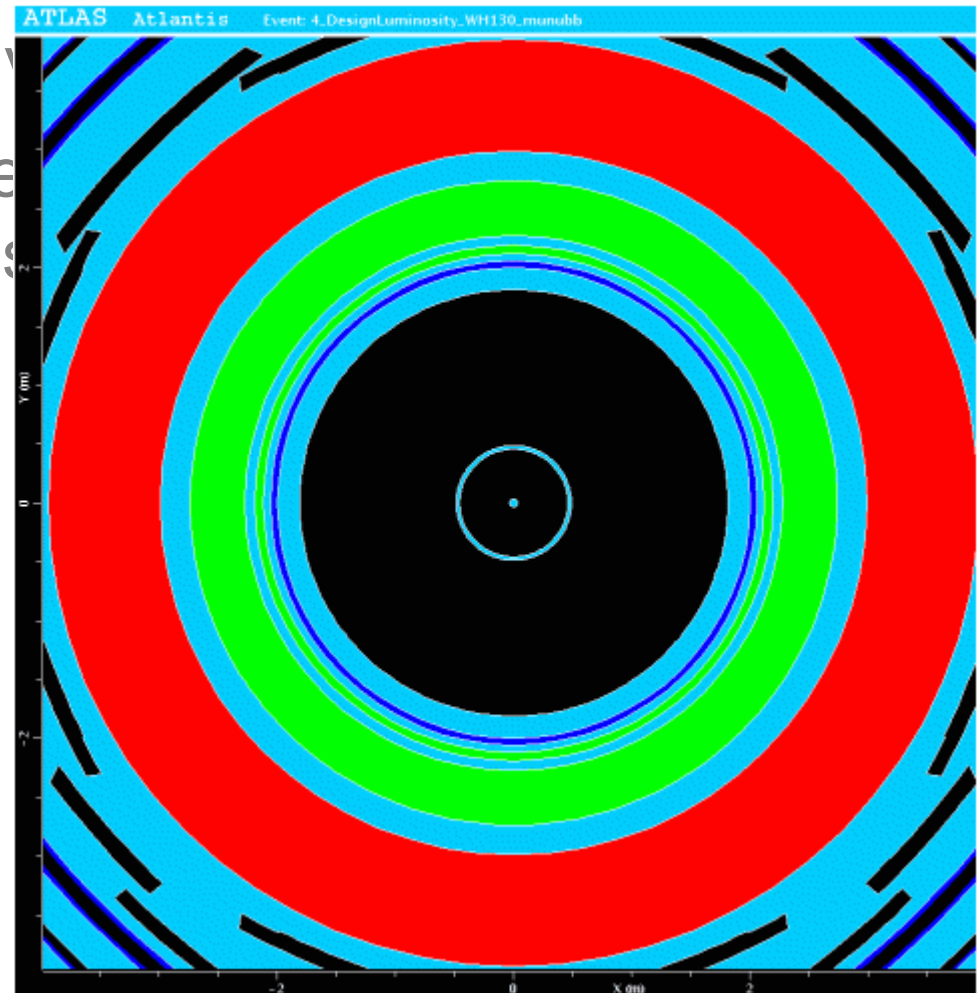
The detectors

- Many technological features
 - High speed, high resolution
 - 55,000 DVDs read every 3 minutes by the system.
 - High resolution
 - 100's of particles



The detectors

- Many technological challenges -
 - High speed, high data volume
 - 55,000 DVDs per second every 3 minutes by storage system.
 - High resolution
 - 100's of particles in



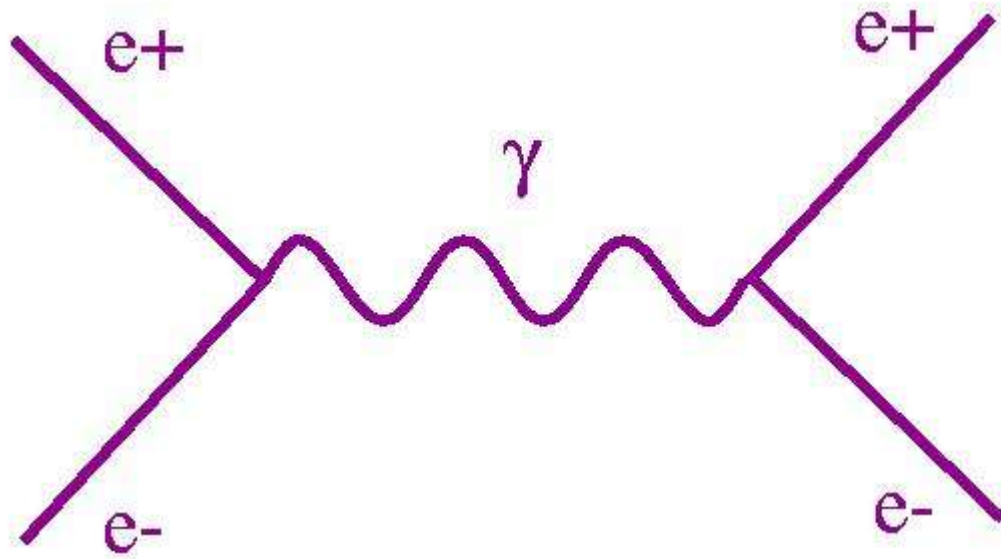
The collaborations



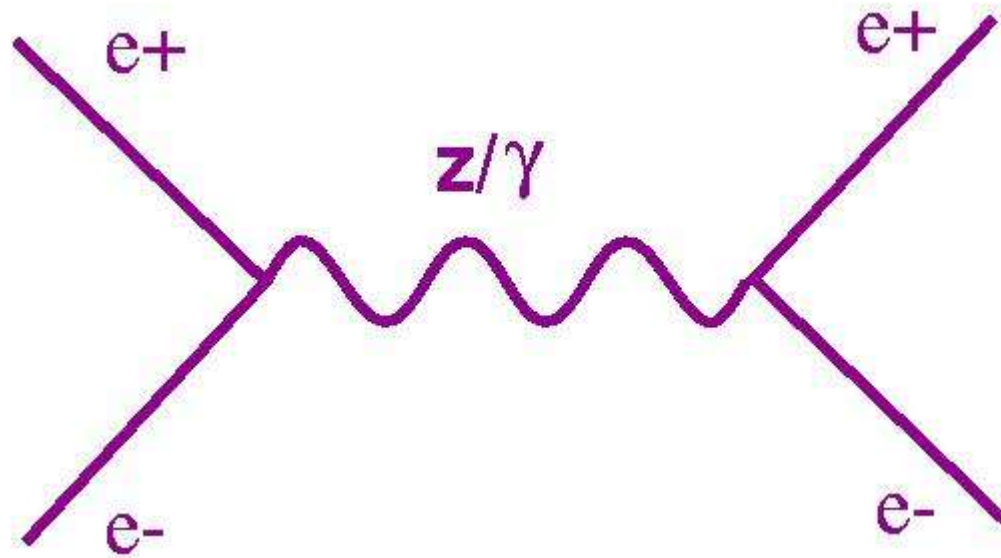
An equation

$$E = mc^2$$

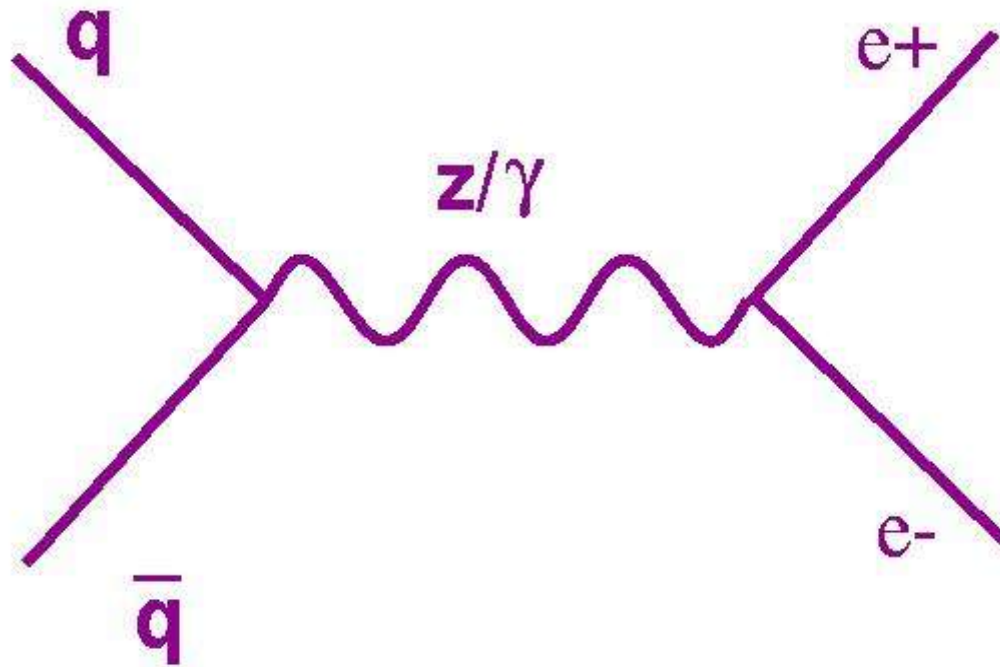
A diagram



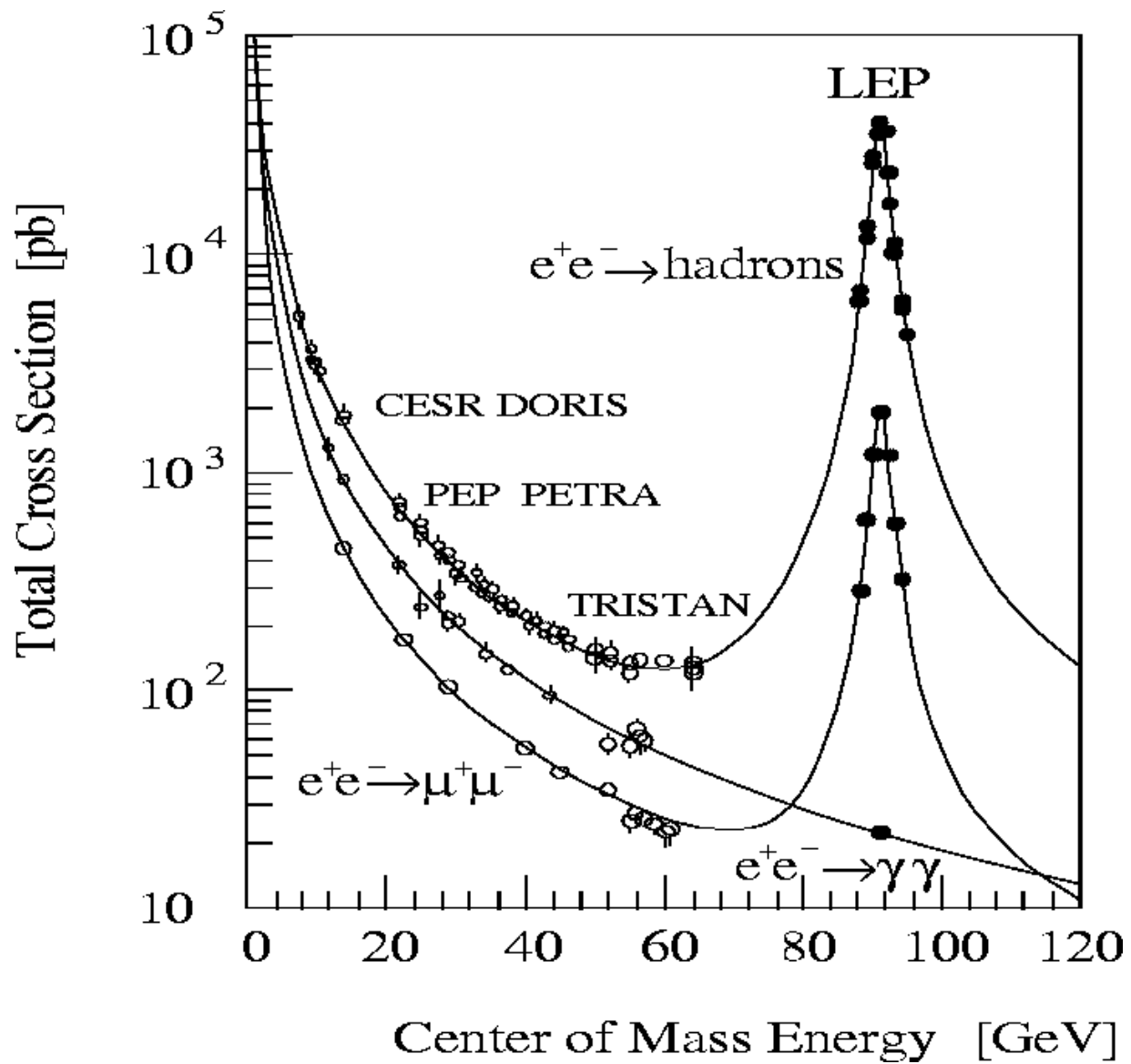
Nearly the same diagram



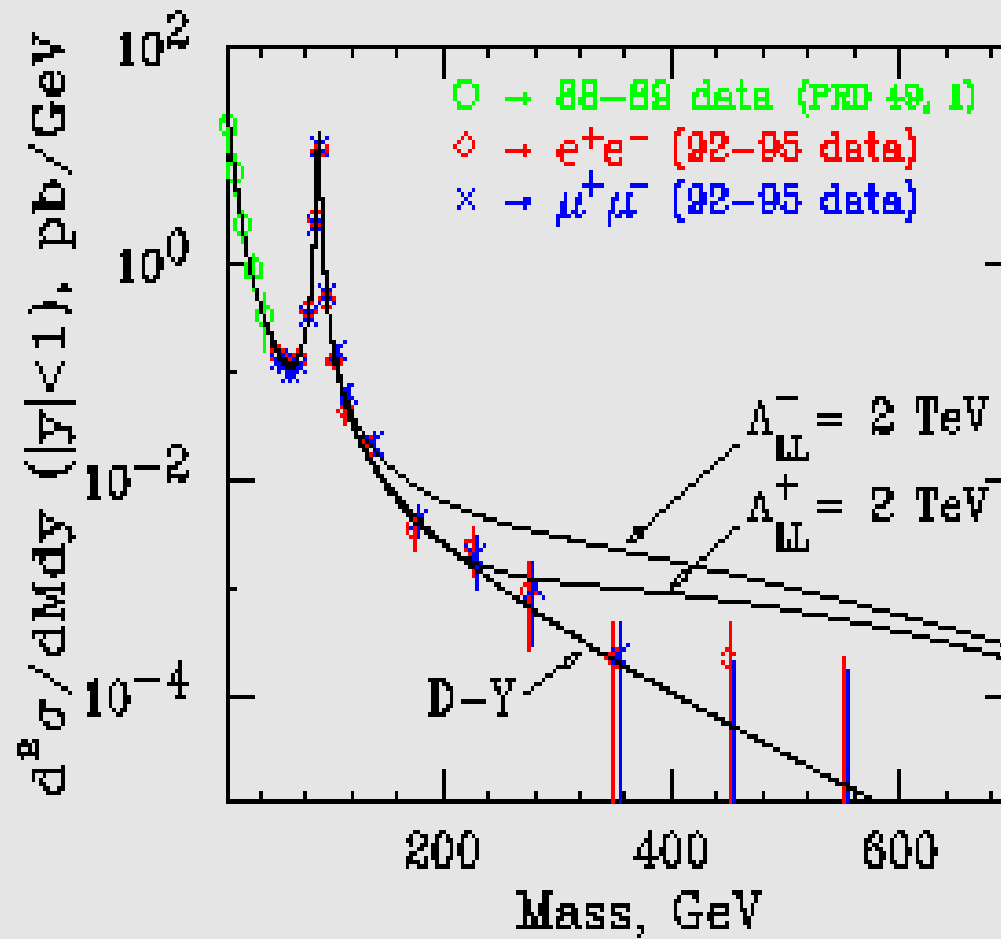
Another slightly different diagram



A plot



A similar plot



Summary

- Brief tour of one aspect of particle physics
 - Missed out neutrinos experiments, precision e^+e^- machines, strong interaction physics...
- The machines & collaborations are big, but there is plenty of data (and work!) to go around.
- Pushing the “small” frontier throws up surprises, and has changed our picture of nature many times.

Summary

- Watch out ... 1997.
 - LHC turns on
 - Either we find the Higgs, or the “standard model” comes crashing down
- And UCL physicists will probably be to blame...