The ATLAS Trigger System...

...or how to find Mr. Right

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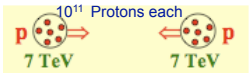
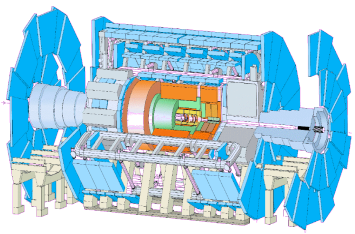
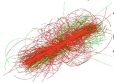
The ATLAS Trigger System

At the Large Hadron Collider (LHC) at CERN in Geneva, the proton (p) bunches cross 40 million times each second. It takes the LHC only seven seconds to generate as many events as human beings living in the whole world!

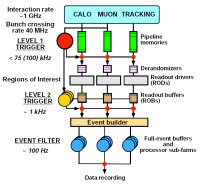




→1 billion proton-proton collisions/sec corresponding to 100 000 CDs each second
→ Find an efficient way to distinguish interesting events (p-p interaction) from the vast background

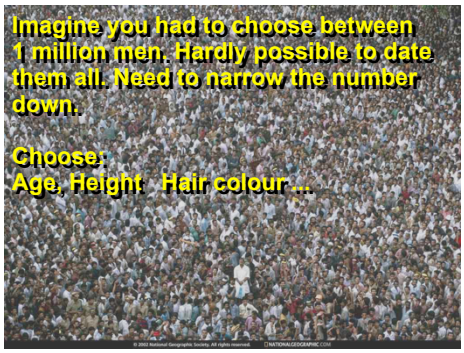


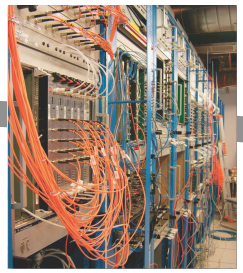
This is what a bunch crossimg looks like for the detetctor

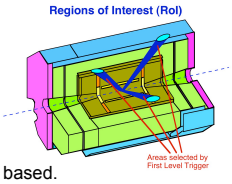


→ In the ATLAS experiment this is done by a 3 Level Trigger system
→ This Trigger system throws away 99.9995 % of the events
→ BUT how does this actually work?
→ ACTUALLY this is quite similar to the way we choose our Mr./Mrs Right!

How does the ATLAS Trigger system work







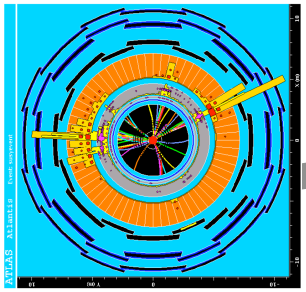
- Level-1 Trigger: Hardware based.
- Uses information from a subset of the detector.
- Looks for regions in the detector where a lot of energy is deposited → Regions of Interest (RoI)
- List of 200 trigger items
- Incoming event rate: 40 000 000 events/sec
- Outgoing event rate: 100 000 events/sec
- Time: µs

Now you have 2500 left...Still quite a big number...so what could we do next..Look at their hobbies and at pictures of them, to see if all the settings chosen on Level-1 actually fit together .

- Level-2: Software based.
- Uses large computing farms ~500 PCs
- Combines the Information from the RoI
- Full access to all data in the RoI region
- Incoming event rate: 100 000 events/sec
- Outgoing event rate: 3 000 events/sec
- Time: ms

Ok, now there are 83 left. A date with each might take quite a long time, but a speed date might be the option...

Simulation of a Super-symmetric event in ATLAS



- Event Filter: Software based.
- Uses large computing farms ~1700 PCs
- Has access to the whole detector information
- Able to do offline like analysis,
- Incoming event rate: 3 000 events/sec
- Outgoing event rate: 200 events/sec
- Output rate: 320 Mbytes per second
- Or more than 27 CDs per minute.
- Time: several seconds

Wow, now there are only 5 out of 1.000.000 left! But take care the output depends heavily on your search criteria!