

Preparing CMS' Software for the Next Decade



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for CMS Core Software Team



Free Lunch is Over



Single CPU core no longer double in speed every 18 months
Therefore our programs no longer double in speed every 18 months

Now the number of CPU cores in a computer doubles
More slots to manage in batch systems
We anticipate that the amount of memory for each core may decrease as well

Requires a new paradigm to exploit the new computers



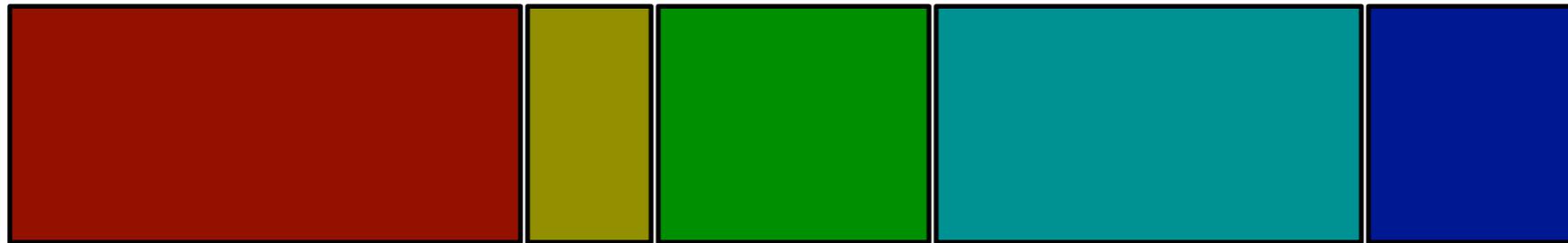
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Parallel Programming

Traditional Programming



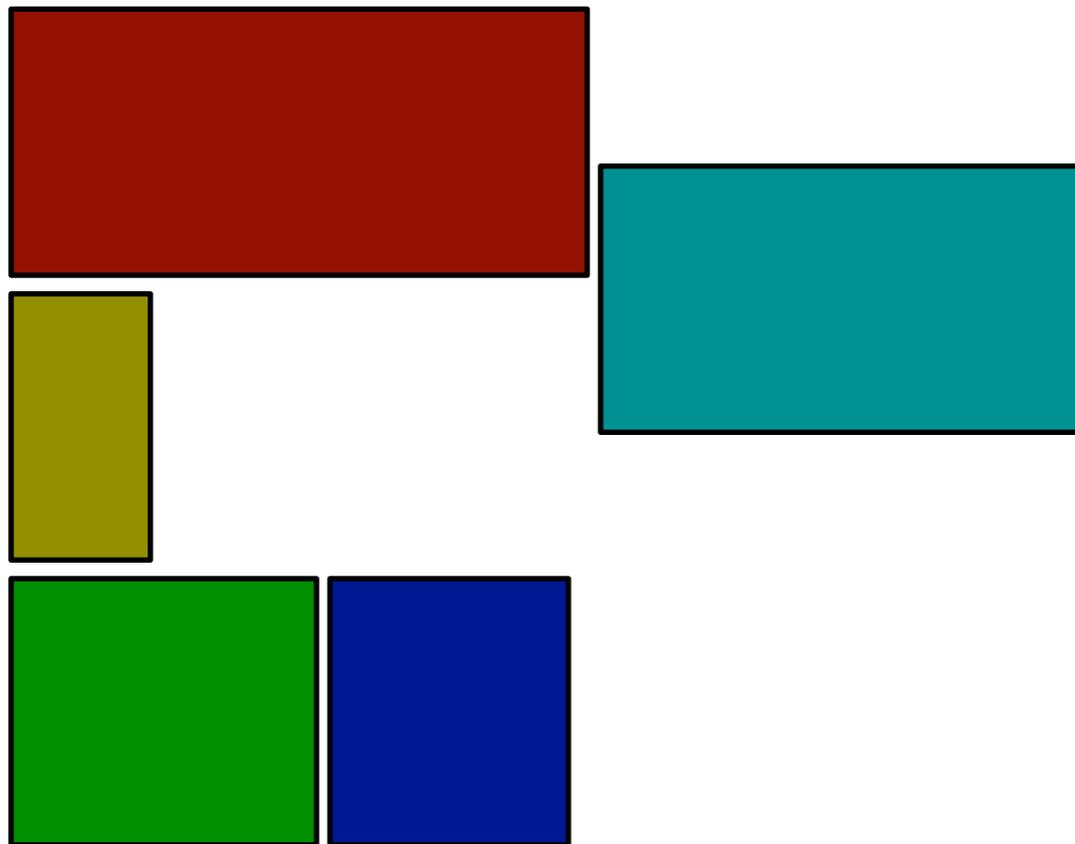
Run a series of tasks in a linear order



Parallel Programming

Run tasks simultaneously

Must identify independent and dependent tasks



Why Change Now?



LHC is starting a two year shutdown

Next long shutdown is not expected till 2018

Already starting to see computers with 64 CPU cores



FNAL Responsibility

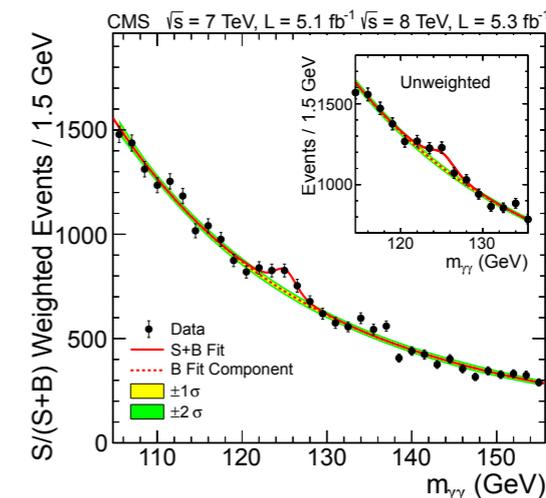
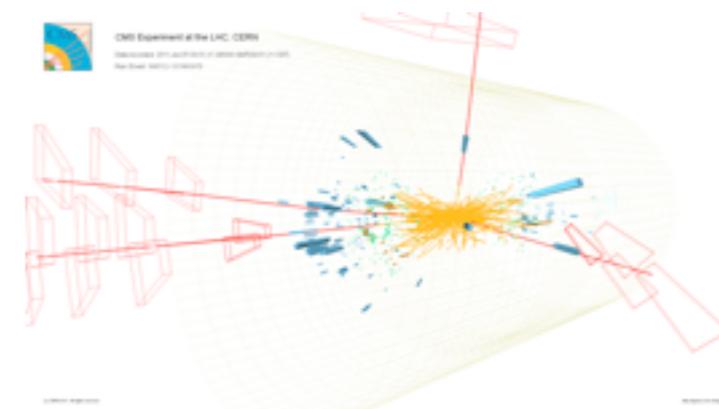
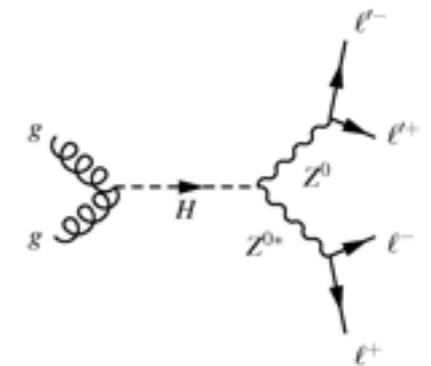
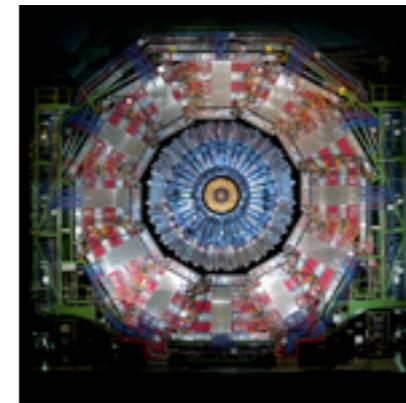


Design and maintain core of CMS' processing software

Three people in the group

David Dagenhart
Christopher Jones
William Tanenbaum

- Core processing software used to
- Record data from the detector
- Simulate data
- Reconstruct the physics event in the data
- Analyze the physics



Designing for the Future



Present processing software

Works on one physics event at a time

Runs one processing task at a time on that one physics event

Future parallel processing software

Works on many physics events simultaneously

limit will depend on number of CPU cores and amount of memory

Runs multiple tasks simultaneously for one physics event

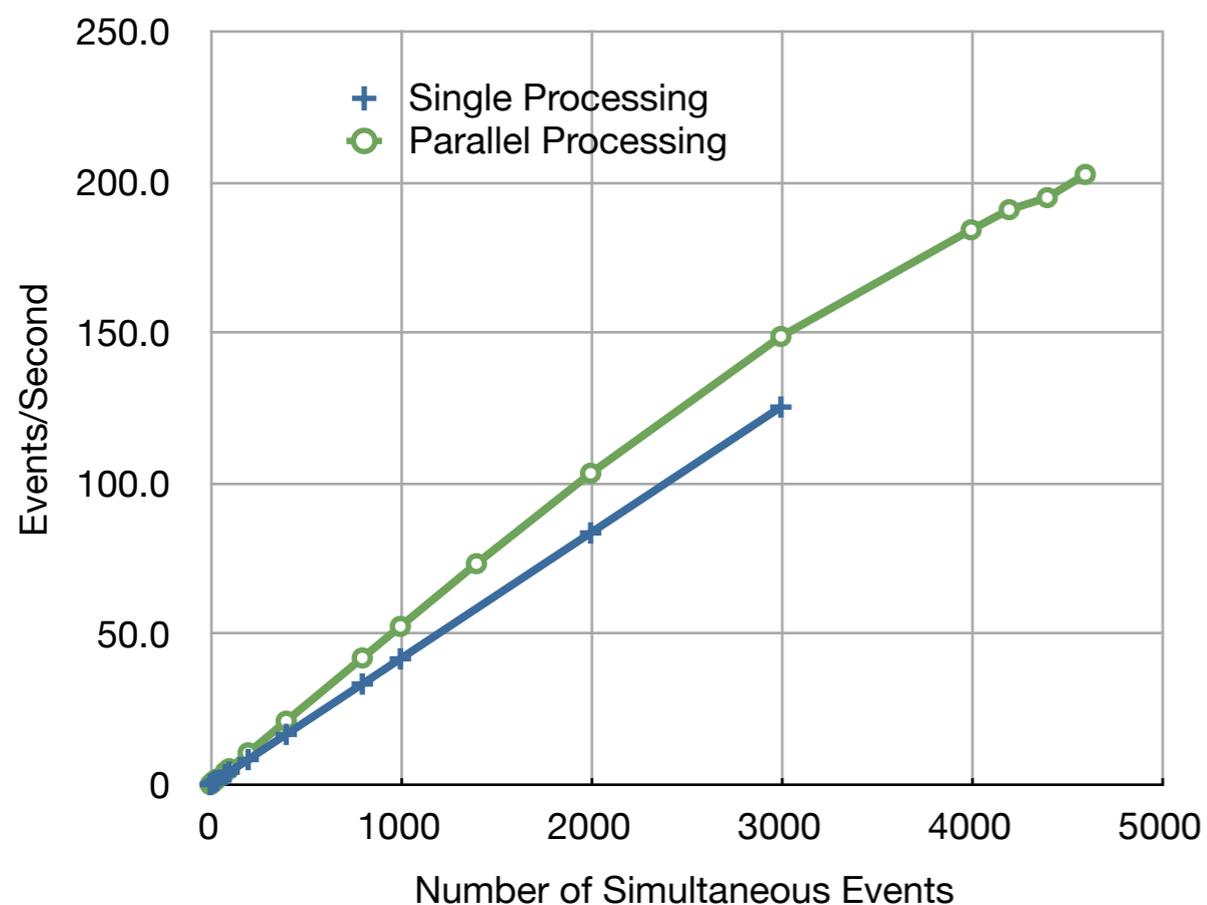
e.g. calibrate hits in all sub-detectors at the same time

Prototyping

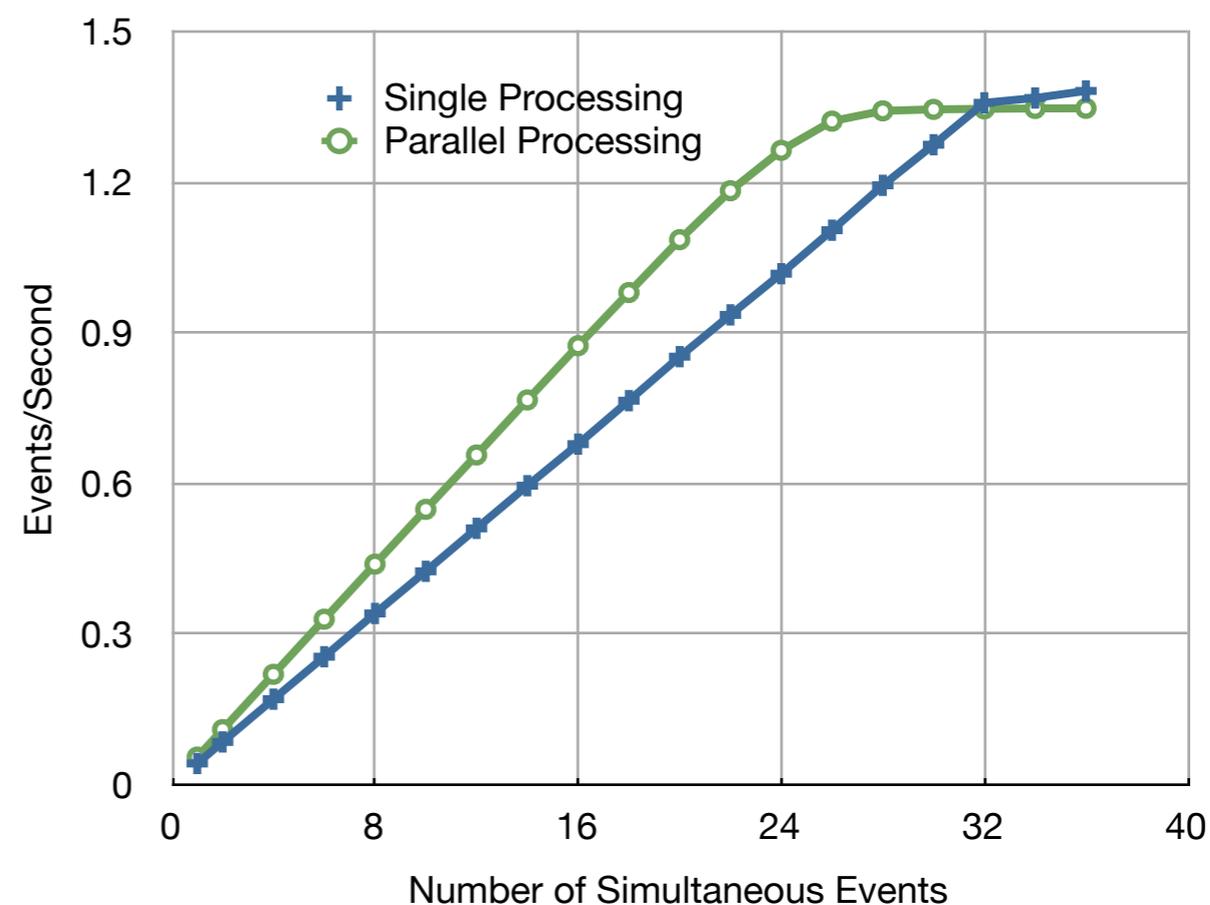


We have created software prototypes showing the design works

Throughput with Infinite Cores



Throughput with 32 Cores



Plan



Start of 2013

Finalize all aspects of the design

Change present code to allow developers to begin migrating to new interfaces

Begin changing the present core software to be parallel programming safe

Spring 2013

Deliver a tool that can find code that is not parallel programming safe

Work on new parallel processing core

Aid developers in changing their code to be parallel programming safe

Fall 2013

Switch CMS' processing software to use the new parallel processing core

Always keep CMS' software functional through the transition

Very aggressive schedule for only three people

Exciting Year Ahead



CMS' software is entering the parallel programming era

Have to go from a simple prototype to a functioning system

Lots of interesting work ahead

