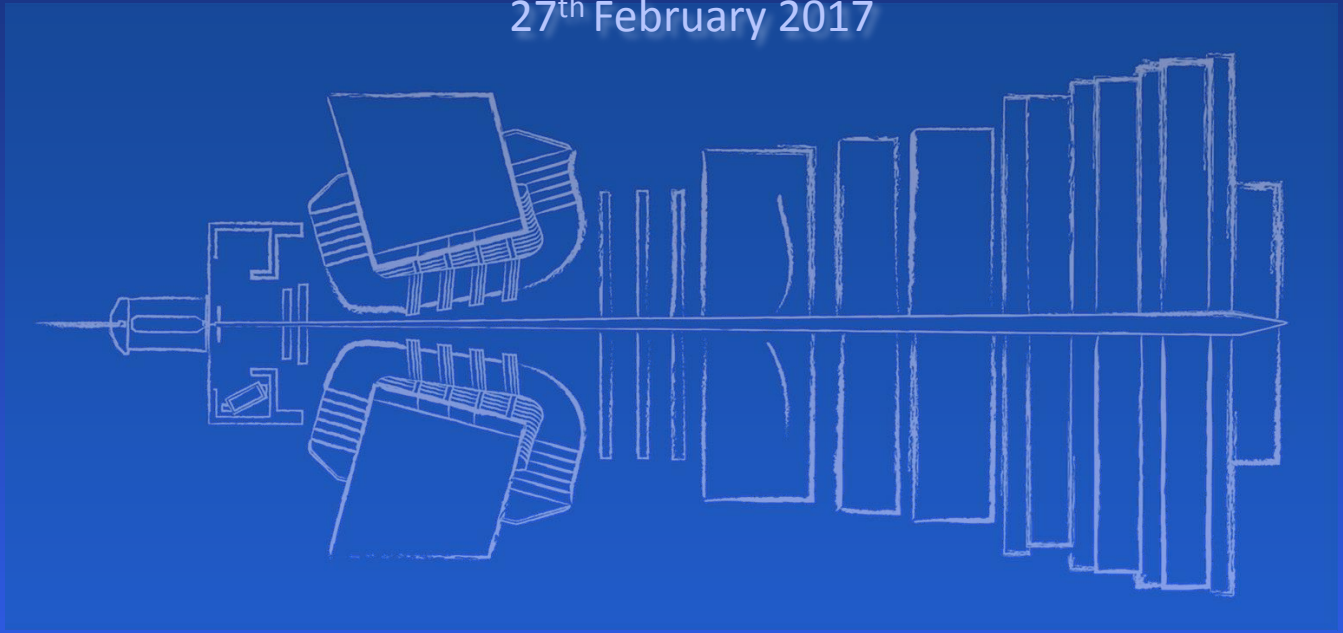
CWP Meeting

27th February 2017

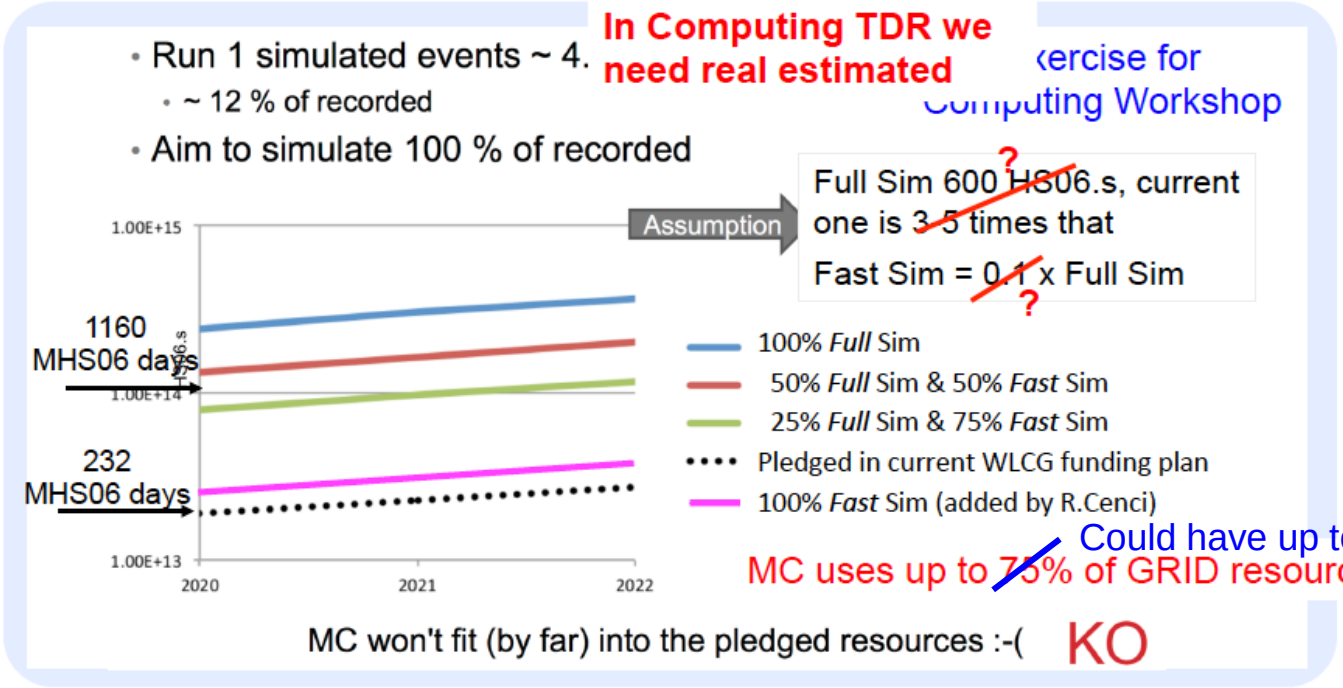


LHCb

Gloria Corti, CERN - **Stefan Roiser**, CERN – **Riccardo Cenci**, CERN

A shopping list in the US&C TDR roadmap

- The available resources will determine the MC statistics that we will be able to produce



F. Stagni, S. Roiser, Paris Computing Workshop, Nov. 2015

"We want FASTER simulationS"

Parallel lines of development

- Fast simulations – wide variety of options being explored from fully parameterized to fast detectors response to reuse of events
  - A lot of progress in developing new options
- Ways to speed up the simulation – GaudiHive, GaudiMP, Geant4 MultiTreading, Geometry
  - Co-existence of different philosophies
- Evolve Gauss to an integrated simulation framework with LHCb specific and experiment agnostic parts
  - Collaboration with FCC on Gaussino (experiment agnostic)
  - Integration of alternative ((ultra)) (fast) simulations

Measure where we spend time

Where CPU time is spent in Gauss v49r0

fraction of time in %, from 10 minimum bias events (*)

	Velo	TT	IT	OT	Rich1	Rich2	Magnet	Spd	Prs	Ecal	Hcal	Muon	Pipe	Converter	**All**
opticalphoton	:0.1	0.0	0.0	0.0	11.6	40.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**52.4**
e-	:0.2	0.1	0.1	0.1	0.3	0.6	0.4	0.1	0.4	7.5	2.5	0.7	0.8	0.5	**16.2**
gamma	:0.6	0.1	0.3	0.3	0.1	0.2	0.2	0.2	1.0	11.1	3.1	0.8	0.6	0.3	**20.6**
pi+	:0.5	0.1	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.8	0.4	0.1	0.1	0.0	**3.3**
neutron	:0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	1.4	1.7	0.2	0.0	0.0	**3.9**
proton	:0.2	0.0	0.0	0							0				**1.8**
pe-	:0.0	0.0	0.0	0.(											**0.4**
kaon+	:0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	**0.3**
alpha	:0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**
kaon0L	:0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.3**
deuteron	:0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**
mu-	:0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**
All	:1.9	0.3	0.6	0.6	12.5	42.2	0.8	0.4	1.5	21.5	8.4	2.0	1.6	0.9	**100.0**

Now run in LHCb nigthtlies

(*) Numbers from MonitorTiming tool expanded to access the time spent by different particle particles

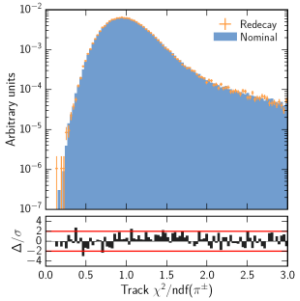
Re-optimization of RICH simulation to deploy in production
Identify where to focus for fast simulations

Fast simulations

- Many options have or are being worked on
  - Deployed as they become available for current detector
- No single size fits all but pick and choose as most appropriate with multiple options organized under a unique framework

  - Build on and ‘upgrade’ the Gauss framework to mix simulation flavors, including for different particles in the same event
- Benchmarks and performance to choose baseline combination

Fast simulations options



ReDecay

Decay signal N times with same underlying event

Under code review for release

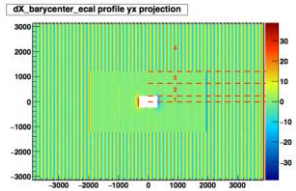
CPU and disk < O(10%)

Calo Shower Library

Prototype of library set up

Studying shower characteristics

Next use and tune showers



Signal ParticleGun

In use (CEP & other)

CPU and disk < O(95-99%)

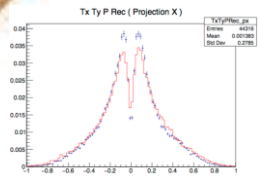
Partial detector

RICHless or Trackers only

In use (special HLT, no L0)

CPU < O(30%), O(80%)

Delphes



Fully parametric ultra-fast

Written LHCb propagator

Efficiency and resolution from full sim

Under development

Other…

One or two part-time developers with small help from core sim

D. Muller *J.-F. Marchand & M.Rama* *B. Siddi*

CPU and Geant4

- Overall performance improvement reported by others
  - Multi-threading with event level parallelization
  - v10.3 vs 9.6
  - Static vs dinamic libraries

Is it the same for us?
Need to measure it!

- And we also are going to review again our choices of simulation parameters and effect on CPU

Parallelization (G4 and Gaudi)

- Investigated how to use G4 10 MT in Gauss as of now
  - We could use it for spill-over or pileup
  - But we need to re-implement quite a few GiGa classes
- We also need to understand how to make Gaudi parallel and G4 MT play nice in a parallel world
  - Different concurrency models and parallelism
  - They manage their 'components' in different ways

"We are moving Gauss to G4 MT and Gaudi parallel in a single go and developing a minimal fully functional Gauss' to try this out"