ATLAS Event Reconstruction to HL-LHC

Graeme Stewart (as the avatar of the ATLAS Reco Hive Mind)

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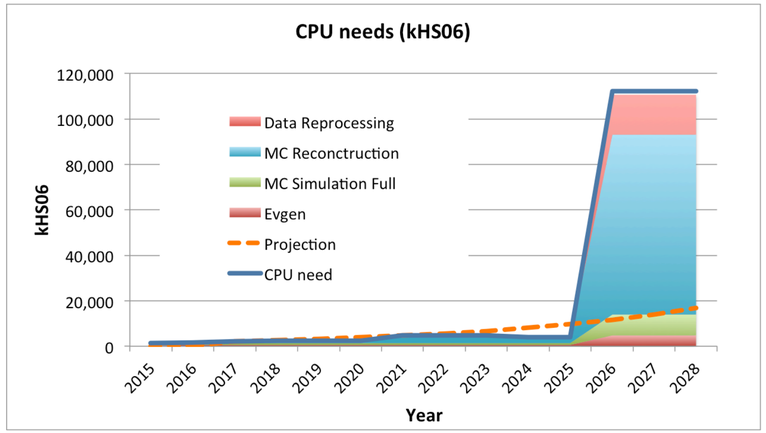
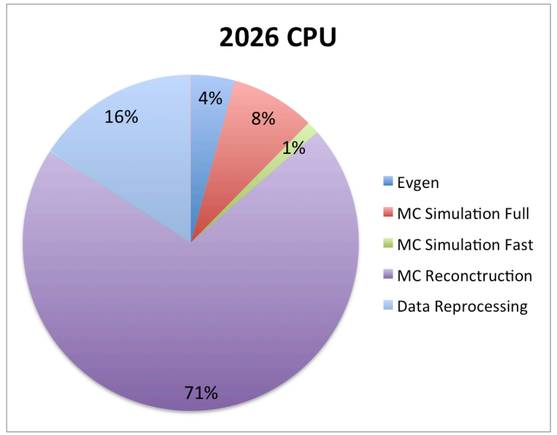
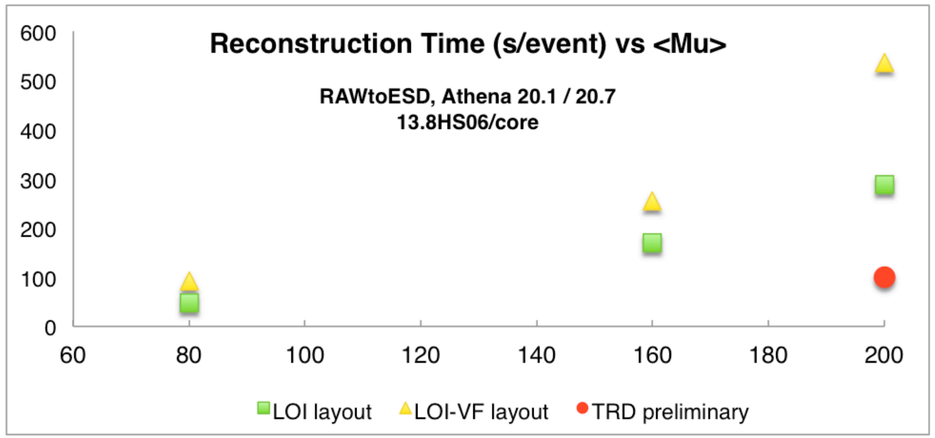
ATLAS Needs…

- Trigger rate for ATLAS in HL-LHC will jump to 5-10kHz (from 1kHz)
  - Linear scaling for our computing
- Pile up will jump to 140-200
  - Super-linear scaling for our computing
- Even though overall profile of simulation to reconstruction shifts heavily to reconstruction we do far more MC reconstruction than data reconstruction
  - This makes a difference in terms of techniques we might use to optimise the CPU time
  - But also means we need to have optimised pile-up digitisation as well as reconstruction







ATLAS wants…

- The whole thing to go fast, fit in budget and maintain or improve physics quality (a.k.a. *Mom and Apple Pie* or *The Bleedin' Obvious*)
- How to manage that
  - Make reconstruction multi-threaded, *primarily to save memory*
    - No cycle left behind… on architectures with lower memory/core
  - Exploit MC bias in computing
    - Truth track seeding and vertex finding (without any bias); part of the *fast chain*
    - Digitisation speed ups (ATLAS has shied away from pre-mixing, so we are i/o heavy)
  - Improved and new algorithms
    - Machine learning is everyone's buzzword these days, but understanding how even present day algorithms work has led to x5 speed-ups
  - However, ATLAS ITk is brand new detector — need to learn in practice what can be targeted as an improvement
- ATLAS collaborating on a new tracking framework: A-Common-Tracking-Software
  - Used also by FCC
  - Framework and experiment neutral, but includes all ATLAS and CMSish Run I and II optimisations
  - Thread friendly — can be parallelised by whatever means the framework desires