

# LHCb challenges and GPU

## GAP meeting - Pisa

M.Corvo

13 Gennaio 2014



# LHCb Trigger

- LHCb is facing some big changes that will take place with the upgrade in 2018 and are already under development
- The major point, for our point of view, is the need to increase data readout to a full 40 MHz rate
- This clearly affects the trigger system

# LHCb Trigger II

- The proposal is to implement a triggerless DAQ system and delegate all decisions to a software trigger, potentially GPU (or accelerator) based
- LHCb Padova is committed in rewriting the Velo tracking code by the end of 2014 and test it in parasitic mode in 2015
  - This means attaching a parasitic (small) farm of GPU to the online system

# LHCb Trigger III

- Currently HLT is a sequence of two distinct trigger codes, Hlt1 and Hlt2, running on a 16 kcore farm
  - Hlt1: VELO tracks and primary vertices, high  $p_T$  tracks with non zero IP
  - Hlt2: Full track reconstruction, w/o particle id.
- A process to split up for real the two codes is ongoing
  - Hlt2 will be deferred ("quasi offline" reconstruction quality) to make more extensive use of PID information

# LHCb Trigger IV

- GPU based trigger could be used for both Hlt1 and Hlt2
- Clearly this has to be assessed taking into account the upgrade of the detectors
  - Velo algos are good candidates but also Rich could be investigated
- For sure a tight interaction with detector experts, and good computer scientists, is needed

# GPU4LHCb

- Given the size of LHCb events it is crucial to exploit parallelism not only inside the event, but also processing multiple events
- LHCb's most time consuming algos are those for tracking/pattern recognition and particle ID
- Efforts on the tracking side has started already (Velo, Velo Pixel, Velo-UT tracking)
  - mu/electron tracking could be considered
- Particle ID is somewhat unexplored, and harder to achieve, at the moment
  - In the current trigger, PID is not fully exploited as it's computationally expensive
  - The standard algo is a minimization of a large global likelihood