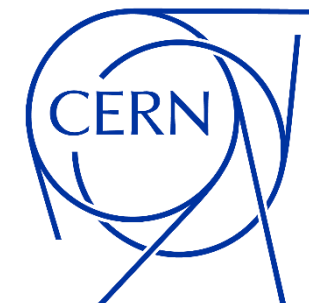


ATLAS Upgrades

Jornadas do LIP
18/10/2024

Nuno dos Santos Fernandes on behalf of the ATLAS Group

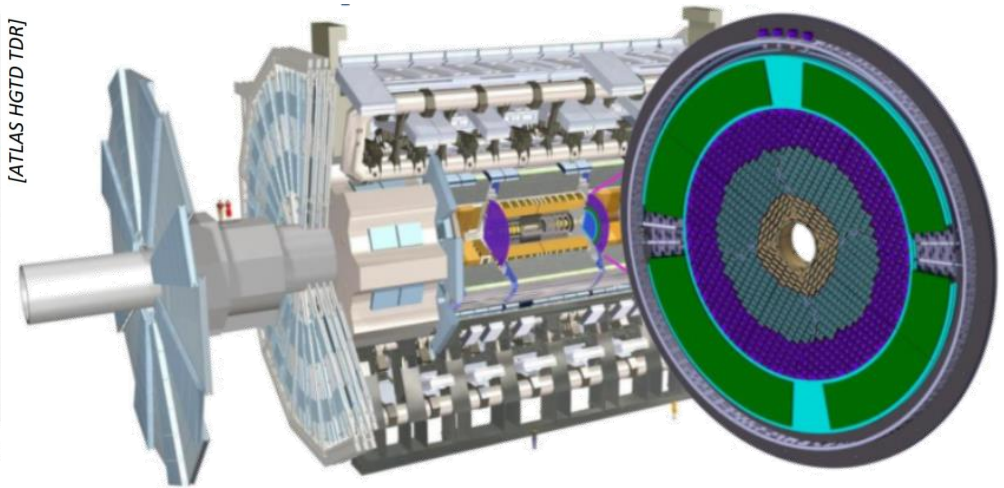
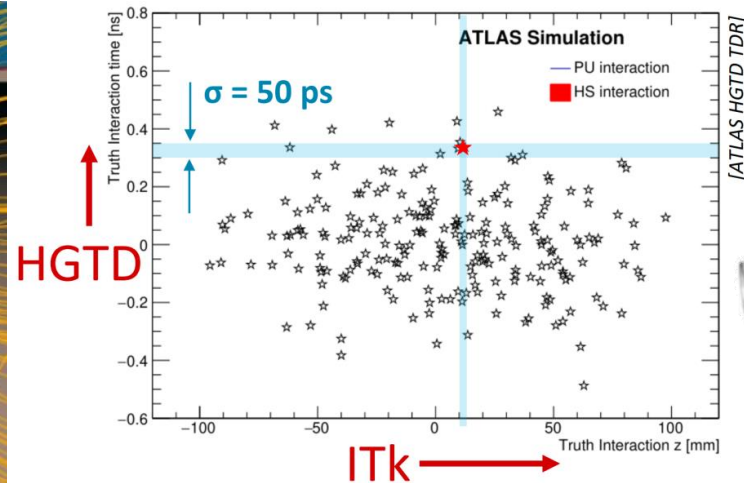
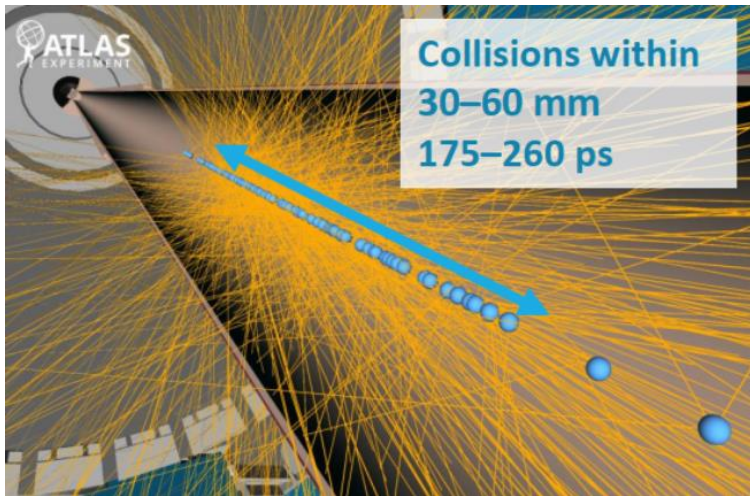


LABORATÓRIO DE INSTRUMENTAÇÃO
E FÍSICA EXPERIMENTAL DE PARTÍCULAS



LIP Contributions to ATLAS Upgrades

- **ATLAS upgrades for Phase II:** accommodating the challenging new conditions of High-Luminosity LHC
- Three main areas of LIP contributions:
 - **Tile Calorimeter Phase II:** managing the radiation damage of electronics, PMTs and scintillators
 - **High-Granularity Timing Detector:** new detector to replace MBTS, better timing resolution for pile-up removal



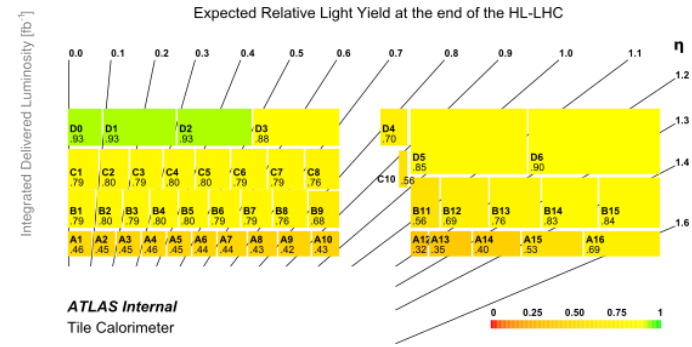
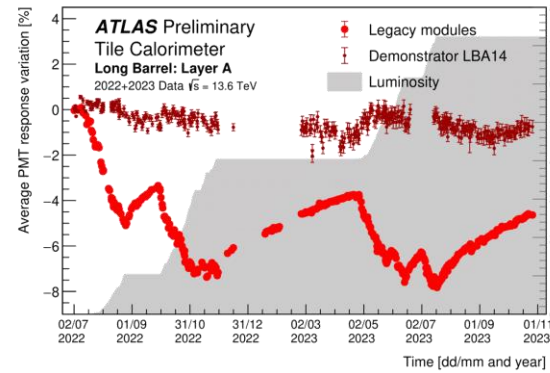
- **Trigger Software Upgrades and GPU Acceleration:** cope with increased computational demands of HL-LHC

TileCal

(Tile Calorimeter)

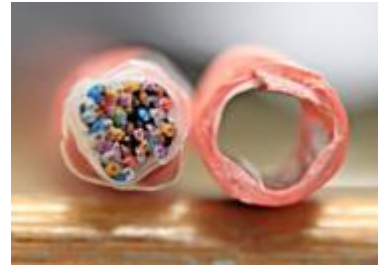
- **Performance of PMTs and Scintillators for Phase II:**

- Stability of the new R11187 PMTs
- Aging and degradation of the cells for Run 4



- **High Voltage Power Supplies:**

- Design and testing of HV bus, supply, remote and interface boards
- Design and production of the cabling (32 and 12 pair cables)
- Development of the crate firmware



- **Interlock crate firmware**

- **Detector Control System (DCS) upgrades:**

- ***We are responsible for the whole system***



HVSupply

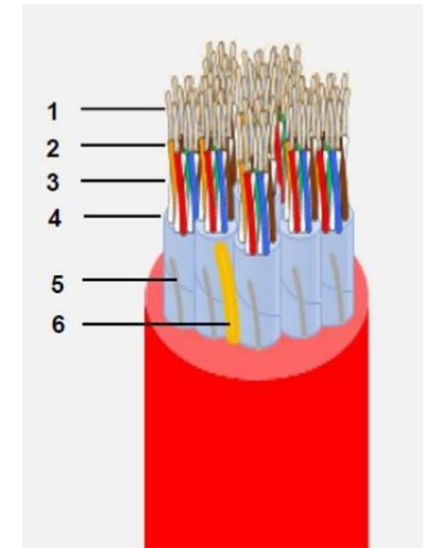
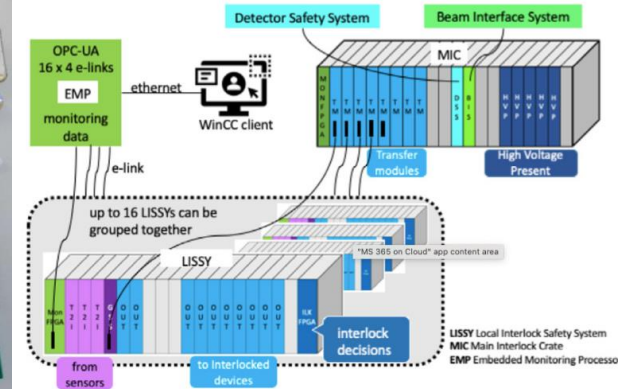
HVRemote

HVInterface

HGTD

(High-Granularity Timing Detector)

- **Data Acquisition (DAQ) and Control:**
 - ALTIROC total integrated dose measurements and functional testing
 - Embedded Local Monitor Board (ELMB) carrier boards development
 - Interlock: ***we are responsible for the whole system***
 - Detector Control System (DCS) for High and Low Voltage supplies
- **High Voltage System:**
 - Patch panel filters
 - Cables (same as TileCal) and “pigtailed”



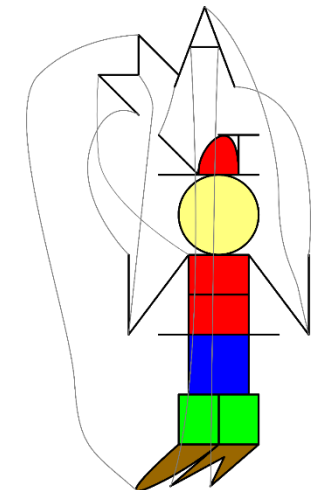
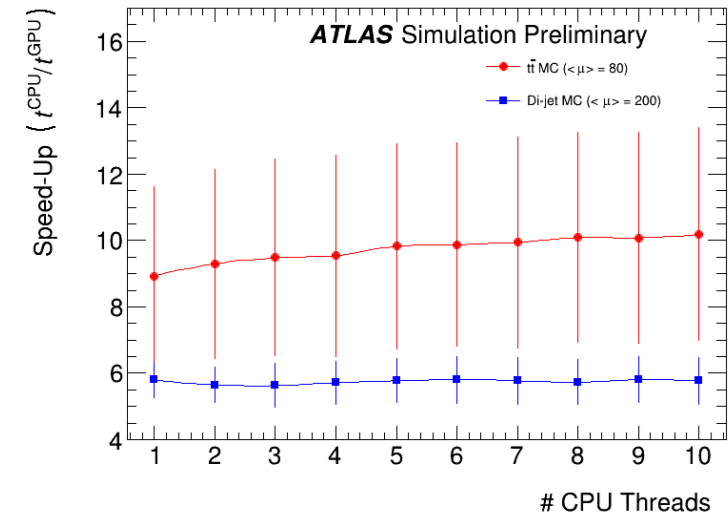
Trigger Software & GPU Acceleration

- **Topo-Automaton Clustering: GPU-Accelerated Calorimeter Reconstruction**

- First GPU-accelerated algorithm merged with the codebase (used for both offline reconstruction and the trigger)
- Speed-ups in excess of a factor of 5 ($\frac{2}{3}$ of the execution time is data structure conversions)
- 100% agreement with CPU results
- Work starting on expanding to other stages of reconstruction (cluster calibrations, bytestream decoding)

- **Marionette: GPU-Accelerated Event Data Model (EDM) Framework**

- Save any future GPU-accelerated projects the work of defining an EDM by hand
- Describe GPU and CPU compatible data structures with “automatic” conversion
- Arbitrarily extend the interface to match the API of existing code
- Everything handled at compile time, performance equivalent to handwriting the relevant structures and conversions



Thank you for your attention!