Simulation tasks for UT Upgrade II

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18 May 2021

UT chapter in FTDR

- Latest draft (11/05 U2UT FTDR meeting):
  - https://indico.cern.ch/event/1037937/contributions/4360433/attachments/2242610/3803614/FTDR-UT.pdf

- Contents
  - Motivation for upgrade (introduction)
  - Performance studies
    - Occupancy *(IHEP)*
    - VELO-UT matching (*French groups*)
    - UT standalone track reconstruction (*French groups*)
  - Design and technology
    - (Tentative) data rate and collection plan
    - Pixel technology: LV-CMOS and HV-CMOS
  - R&D plan and budget
    - Task list!
    - Budget (~8.85 MCHF)

Limited studies so far, where Chinese groups could contribute a lot post-FTDR

R&D plan as in FTDR draft

There are open questions that need to be answered soon or in a near future. Work of some topics already started.

- The effect of precision time measurement, and whether a separate timing layer of a different technology will work.
- Can the number of planes be reduced from 4 to 3? How does it affect the reconstruction of downstream tracks and long lived particles?
- What is the material budget?
- What is the radiation hardness level that the sensor technology can deliver?
- Can the detector operate in a room temperature? This would significantly reduce the difficulty and cost of the cooling system.
- Whether it is possible that the central modules can be replaced after certain level radiation damage.

A few examples where simulation should start soon ...

TASK: Performance of long-lived particles?

- Long-lived particles like Λ or K_S will depend on downstream tracks, i.e. No VELO hits

- The performance needs to be studied
  - Verify or develop downstream tracking (UT+SciFi) in the tracking software
  - Study the reconstruction efficiency and ghost rate etc with dedicated simulation samples

TASK: 4 vs. 3 layers?

- Current UT has 4 stations
  - Based on silicon strips
  - X-U-V-X (strips in U/V layers provides stereo angle to determine the y position)

- However after upgrade pixel-based CMOS will provide position in both x and y!
  - Why not reduce 4 layers to 3? It will save a lot of money☺

- Does it work? Performance study needed!
  - Put in the 3 layer detector description
  - Generate MC with new config
  - Study the reconstruction efficiency etc

TASK: Interplay with Magnet station?

- Magnet station proposed in UII to catch low momentum tracks
  - https://indico.cern.ch/event/1025939/contributions/4310377/attachments/2237369/3793348/Magnet_Station_in_FTDR_March_01_21.pdf
- This means increase of the effective acceptance => Can UT cope with it, or does it require increased coverage of UT?
  - It should be answered by dedicated simulation