Vertex 2017 poster session summary

Las Caldas 10-15 September 2017

Abraham Gallas
Poster sessions

- Eleven contributions on several topics:
  - Sensor development
  - Front End Electronics for vertexing
  - Mechanics and detector assembly
  - Performance
  - Integration
- Two poster sessions on 11\textsuperscript{th} and 12\textsuperscript{th} September during the coffee break (16:15-16:55)
- Quick review on the highlights of the poster exposition and following discussions
- For further reference go to the poster sessions in the indico page of the conference
Sensor development (I/III)

**MuPix8: A large-area D-MAPS chip.** Heiko Augustin

- Ultralight-pixel (1‰ RL p/l) tracker with high-rate capabilities for the Mu3e experiment.
- First large area (2x1 cm$^2$) 50 µm thick prototype
- 128 x 200 pixel (81x80 µm$^2$)
- Time-resolutions < 10 ns
- 4x1.25 Gbit/s data links
- 2x more electrons
- Increased TID hardness
- Voltage and temperature stability
- Time walk suppression
- Being tested @ moment
Sensor development (II/III)

- 50 µm thin LGAD fabricated for the High Granularity Time Detector of the ATLAS experiment. Giulio Pellegrini
  - Produced within RD50 collaboration
  - A stack of 3 UFSD reaches 15 ps time res.
  - LGAD with Ga implants fabricated in 2016
  - LGAD fabricated in 6” wafers. 2017
  - Good stability for small pads
  - up to a gain of 40
  - Interest from LHC exps:
    - HGTD, TOTEM,
    - ATLAS-AFP, CMS CT-PPS
  - First LGAD detectors installed in CMS CT-PPS experiment at CERN
Sensor development (III/III)

- **Edge-TCT Characterisation on TowerJazz CMOS Sensor**
- **Towards the ITK Phase II Upgrade.** Abhishek Sharma

ATLAS will upgrade its tracking detector for the HL-LHC

Upgraded ITK will consist of a barrel of 5 concentric layers (5 pixels + 4 Strips)

Requirements:
- Rapid charge collection
- High Spatial resolution
- Reduce charge-sharing
- Radiation hardness up to $1.5 \times 10^{15} \text{ 1 MeV neq/cm}^2$

- TowerJazz prototype with diff pixel sizes (20µm to 50µm)
- Radiation Tolerance (Bulk damage via neutron irradiation, Surface damage via X-ray irradiation)
- Bias voltage scan
- Non-irradiated

13/09/2017
Sensor Simulation

- Radiation Damage Modeling for 3D Pixel Sensors in the ATLAS Detector. Veronica Wallängen
- New digitization model with radiation damage effects to the 3D Pixel sensors for the ATLAS detector.
- Each “hit” of deposited energy is divided into charge chunks propagated separately.
- Diffusion, charge induced, relevant corrections, and trapping taking into account for each charge chunk individually.
- Charge contributions from all chunks added and converted to Time-over-Threshold (ToT) value, or “digit”.

Predictions from 3D digitizer model proved to agree with experimental data.
Material budget measurements with the DATURA beam telescope. Hendrik Jansen

EUDET-type beam telescope (6 Mimosa26 MAPS)

Electrons @ diff energies in the GeV range

Measurement principle:

- Measure kink angle for every track
- Angular distribution is a function of material budget
- Distribution accessible as function of position

Effective scattering angle for each track extracted by a dedicated track model (General Broken Lines model, … )

Calibration with Al plates known thickness

Track-based multiple scattering tomography

Example of technological transfer from HEP to non-destructive material testing
• The VeloPix ASIC test results. E. Lemos

• ASIC for upgraded LHCb Vertex Locator
• Tests:
  • Analog and digital functionalities
  • TID with X-ray up to 400 Mrad
  • SEE (heavy ions and Laser)
  • Beam Test at Fermilab
  • High speed GWT (~5 Gbps)
Front End Electronics (II/II)

- LHCb vertex locator upgrade: front - end electronics and firmware. A. Fernández (presented by E. Lemos)
  - New Front End electronics
  - LHCb MiniDAQ2 with specific firmware.
  - Full electronics validation with GBT and GWT signals (~5 Gbps)
Mechanics and detector assembly (I/II)

• Development of CMS silicon strip detector module mechanics for Phase-II upgrade. Ngangkham Peter Singh (presented by Prafulla Kumar Behera)

• Light, high precision, durable structure for CMS Silicon tracker detector:
  • Al-CF structure with CF stiffeners
  • Very innovative technique using:
    • Micro Abrasive Water Jet (M-AWJ)
    • Precision milling
  • Significant reduction in cost and time
Automated assembly of stacked sensor modules for the CMS outer tracker upgrade. James Keaveney

- Robust, reliable and fast robot
- Relative rotational alignment of sensors to 0.8 mrad
- Built-in metrology
- Build time ~80 minutes
Performance

• **Vertex Reconstruction and Performance in ATLAS.**

  Ben Whitmore
  
  • Physics output of the ATLAS experiment will increase in the HL-LHC
  • However, the increasing pile-up will degrade the vertex resolution
  • Novel methods to reconstruct vertices in such environments are being developed for the upgrade conditions of ATLAS
  
  • **Upgraded Inner Tracker (ITK) will replace current tracker**
  • Improve coverage $|\eta|<2.5 \rightarrow |\eta|<4$.
  • Designed to cope with high radiation doses, bandwidth and $<\mu> = 200$
  • Preliminary optimization of the tracker layout performed
  • Order of magnitude improvement in track resolution
Integration

- EMC characterization of vertex detectors within the framework of AIDA2020 project. *M. Iglesias* (presented by F. Arteche)
  - Electromagnetic Compatibility Test facility at ITAINNOVA focused on EMC tests for electronic noise characterization and grounding diagnostics in HEP:
    - Noise emission test
    - Noise immunity level
  - 2-year running:
    - Belle II PXD, SVD detectors
  - Goals of the tests:
    - Grounding topologies evaluation
    - FEE designs, Noise distributions, Filter designs, …