sPHENIX MVTX Detector Quality Control and Online System

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on behalf of the sPHENIX collaboration

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sPHENIX MVTX Online System

Detector Control System (DCS)
Set the configuration to operate MVTX detector

MVTX Detector

Quality Control (QC)
Get the parameters to monitor MVTX performance

sPHENIX MVTX Online System

- **MVTX**: Monolithic Active Pixel Sensor (MAPS)-based-vertex-detector
- Adapting the inner most 3 layers of the ALICE Inner Tracking System (ITS)
- High granularity of pixel pitches with excellent position resolution (~5 μm)
- Track vertex distance of closest approach (DCA) resolution < 30 μm for $p_T > 1$ GeV/c
- Precise vertexing which enables the heavy-flavor jets and open heavy flavor physics programs
Quality control (QC) system dedicated to monitor the MVTX performance in realtime
- Based on the sPHENIX software framework, with workflow design similar to ALICE ITS
- User friendly interface to display the status of the QC with time stamp for run recording
Example: QC for 2019 Fermilab Test Beam Data

- Four layers of staves facing proton beam at normal incidence
  - Average 4 chips fired per event
  - Proton beam goes through chip 4 of each stave, leaving clear beam spots
- Beam spots in nearly same pixel location for each -> Excellent alignment of the staves
• MVTX detector slow controls system interfaces with the WinCC-OA framework to provide user-friendly controls
• Configure and monitor the parameters such as temperature, voltage, current, and pressure
• Control and monitor various MVTX detector subsystems including power, cooling, and readout

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Summary and Next Steps

- **sPHENIX MVTX Detector**
  - Silicon pixel detector with excellent vertexing capabilities
  - Crucial for open heavy flavor physics program

- **MVTX Detector Online System**
  - **QC**: Monitor the MVTX performance
  - **DCS**: Operate the MVTX detector
  - Ensures detector safety and high-quality data taking

- **Next Steps: 8-Stave Telescope Setup at LANL**
  - Implemented with both QC and DCS
  - Test the readout chain
  - Study alignment performance
  - Get ready for full MVTX system commissioning at BNL in April this year!
  - Installation by the end of this year!

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Back Up
MVTX Detector System Setup

**Power System**

**Cooling System**

**Readout System**

ALPIDE pixel:
- Shaping
- Digitization
- Zero-suppression
- 3x buffer

MVTX Detector Electronics consists of three parts

- **Sensor**-Slave (9 ALPIDE chips)
- **Interaction Region**
- **Experimental Hall**
- **Counting House**

MVTX Detector System Setup

Quark Matter 2022, April 4-10
8-Stave Telescope Setup with Online System

- 8-stave telescope setup at Los Alamos National Laboratory for cosmic muon events
  - Complete readout chain: from the staves -> readout unit -> FELIX -> raw data
  - 6 copies of identical systems for the full MVTX system at sPHENIX
- Use both QC and DCS to operate the staves and monitor their performance in our test
- Study the staves functionality and alignment performance