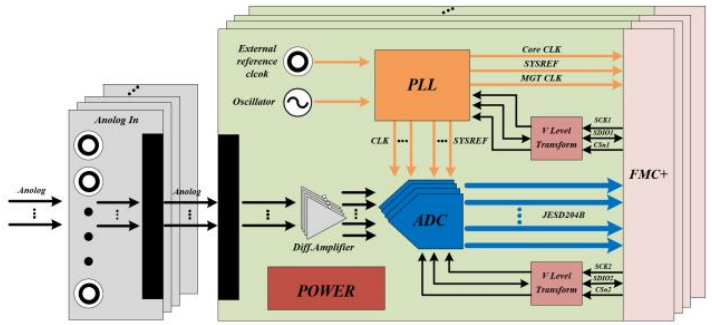
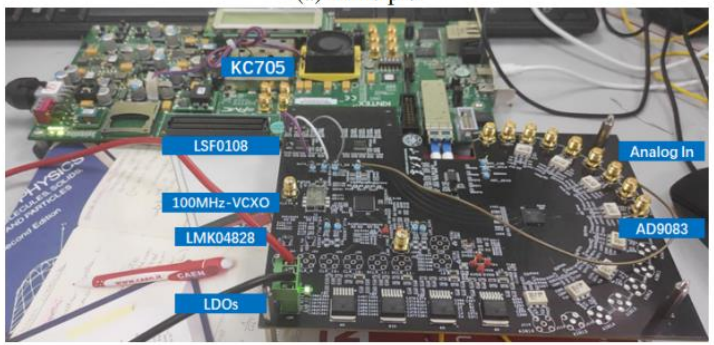
Triggerless Electronics based on HTM Method for Cosmic Ray Muon Imaging

- **Motivations & Challenges:**
  - The optical scintillation fiber detector requires thousands of readout channels
  - Multi-board data synchronization: front-end & back-end
  - Huge amount of data high speed data rate: up to 64 Gbps / ADC chip
  - Memory pressure & dead time
  - Empty data packages problem
- **Methods & Advantages:**
  - Triggerless method, Time stamp, HTM method and Sorting algorithm
  - Discrimination algorithm
  - Compressed packets & DDR3 (as a buffer)
  - Real time data receiving, analysis and storage without dead time

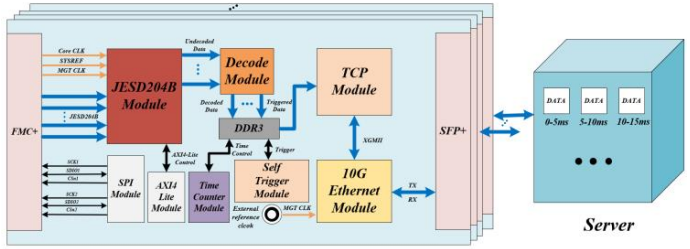


(a) Principle

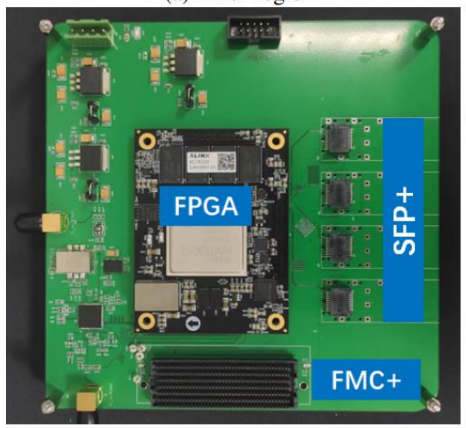


(b) Test board

Fig. 1: The digitized part of DAQ



(a) Inner logic



(b) FPGA board

Fig. 3: The FPGA part of DAQ

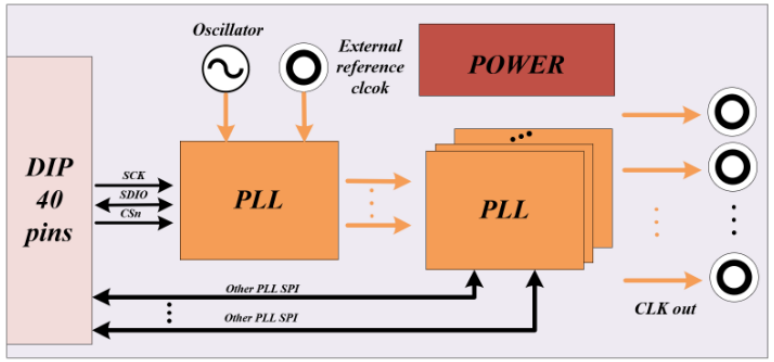


Fig. 4: Homologous clock source of DAQ

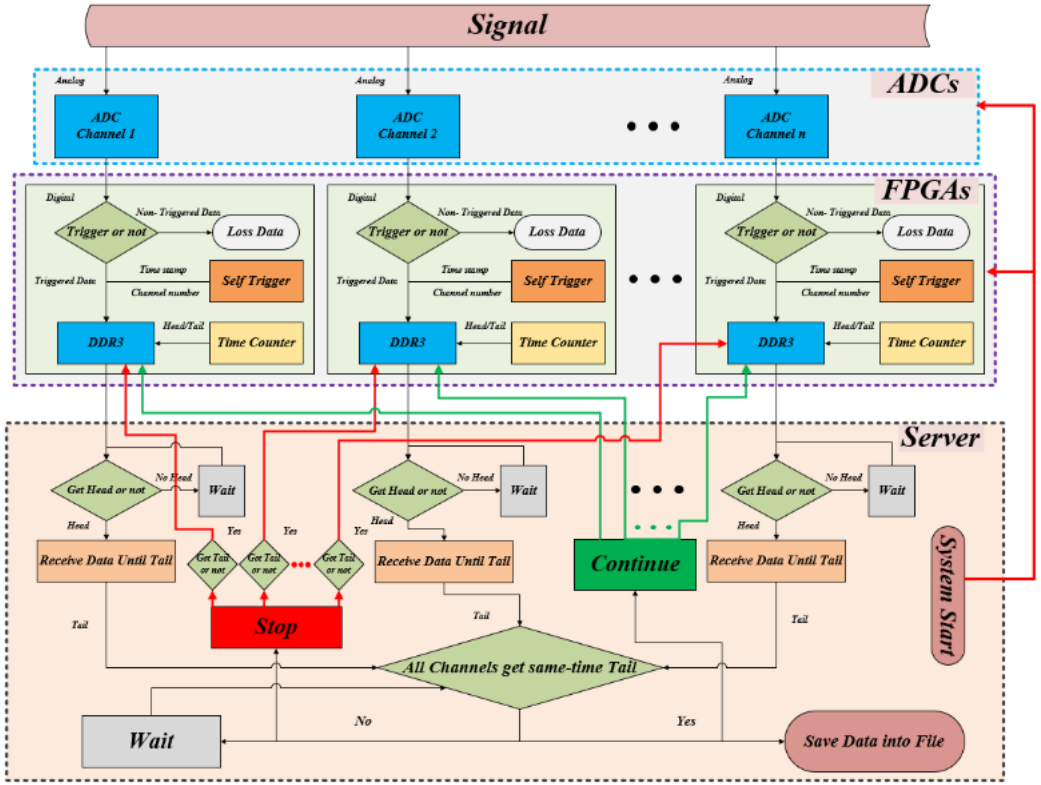


Fig. 5: The back-end synchronization principle