Digital Part of PARISROC: a Photomultiplier Array

ReadOut Chip

- 16 PMT inputs can be read by 1 PARISROC chip
- SCA depth of 2 for charge and fine time measurements
- FIFO management of SCA
- Triggerless and independent channels
- 24 bits timestamp counter @ 10 MHz (1.67s)
- 40 MHz clock for ADC and SCA management
- 10 MHz clock for Timestamp + Readout
- AMS 0.35µm-3B standard digital cells

Principle of megaton scale Cerenkov water tank

Block Diagram of PARISROC

PARISROC (Photomultiplier Array with Integrated Slic ReadOut Chip) is the front and ASIC designed for the PMD R&D project dedicated to neutrino experiments. It is a new generation of neutrino experiments that will take place in megaton size water tanks and will require very high-efficiency photodetection and volume of data. For the funded project, this large surface of photodetection is segmented in macro pixels made of 16 Photomultiplier tubes (PMT) connected to an autonomous front end ASIC: PARISROC.

High level working

The digital part of PARISROC is built around 4 modules, which are acquisition, conversion, readout, and top manager. Actually, PARISROC is based on 2 memories: during acquisition, discriminated analog signals are stored into an analog memory (the SCA switched capacitor array). The analog to digital conversion module converts analog charges and times from SCA into digital values. These digital values are saved into registers (RAM). At the end of the cycle, the RAM is readout to an external system.

Low level working / block diagram

As the 16 channels of PARISROC are managed independently, 2 state machines are dedicated to handle each channel: 1 for write pointer and 1 for read pointer. This implies 32 registers of 24 bits to save coarse time for each depth of SCA. At a high level point of view, SCA of 1 channel is controlled as an analog FIFO. Conversion is common for all channels and needs 32 registers of 12 bits to store converted data. 16 for charges and 16 for fine time measurements.

As the readout will only treat hit channels, this module will tag each frame with its channel number.

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