The whole data acquisition system (DAQ) is designed to be modular and scalable. The DAQ can be configured to acquire the trigger rate, the accidental coincidences rate, the single channel counts, the OR32 counts, the SiPMs analog signals either in random acquisition or by satisfying a combinatorial logic. 

Acquired data are digitized and then transmitted from the FEE board to the ARM single-board computer embedded in the MASTER board. The DAQ software is developed in C and Python programming languages. Thanks to the connection through the GPIO interface, it is possible to program the EASIROC. An asynchronous communication protocol developed at the OMEGA group at IN2P3/LAL at the Orsay laboratory specifically for SiPM read-out. Realized with 350 nm Si-GE technology, it is an auto-triggered, bi-gain, 32 channel chip which allow to measure the charge from one to 2500 photoelectrons. It can provide to each SiPM a fine gain adjustment. The power consumption is up to 155 mW per chip. The analog output from the EASIROC will be digitized by a dedicated electronics that also provide data transmission. A fast shaper followed by a discriminator provides a trigger path set by an integrated 10-bit DAC.

The signals produced by SiPMs are amplified of a factor depending on a feedback capacitance setting. Two separated amplification path (High and Low Gain) are available. In each path a tunable shaper followed by a Track and Hold circuit determine the amount of charge measured. The measured values for each SiPM are converted by a 12-bit ADC.

The EASIROC (Extended Analog SiPM Integrated Read-Out Chip) ASIC has been developed by OMEGA group at IN2P3/LAL at the Orsay laboratory specifically for SIPP read-out. Realized with 350 nm Si-GE technology, it is an auto-triggered, bi-gain, 32 channel chip which allow to measure the charge from one to 2500 photoelectrons.

The DAQ software is developed in C and Python programming languages. Thanks to the connection through the GPIO interface, it is possible to program the EASIROC. An asynchronous communication protocol developed at the OMEGA group at IN2P3/LAL at the Orsay laboratory specifically for SiPM read-out. Realized with 350 nm Si-GE technology, it is an auto-triggered, bi-gain, 32 channel chip which allow to measure the charge from one to 2500 photoelectrons. It can provide to each SiPM a fine gain adjustment. The power consumption is up to 155 mW per chip. The analog output from the EASIROC will be digitized by a dedicated electronics that also provide data transmission. A fast shaper followed by a discriminator provides a trigger path set by an integrated 10-bit DAC.

The signals produced by SiPMs are amplified of a factor depending on a feedback capacitance setting. Two separated amplification path (High and Low Gain) are available. In each path a tunable shaper followed by a Track and Hold circuit determine the amount of charge measured. The measured values for each SiPM are converted by a 12-bit ADC.

On the left is shown the Dark Counts Rate of 32 SiPMs as a function of threshold - lower DAC10 values correspond to higher threshold levels - for different overvoltages. The vertical dash line is drawn in correspondence of the 7th ph.e. at 4 V overvoltage and it corresponds to the dash line in the photocathode spectrum of the SiPM (bottom right plot) at the same overvoltage. It crosses the 5 V overvoltage curve at 5th ph.e., denoting a change in the whole dynamics of the SiPMs not limited to the gain only. The increase in overvoltage produces a stretching of the spectrum towards higher ADC values, while the ADC value of the main peak remains quite constant as shown in the top right plot where the mean value of the SiPM spectrum is plotted in function of the run number in a 24 hours test.

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