PD system for CERN 2023 beam tests

Lorenzo Pacini for the PD working group.

General overview of the 2023 prototype with PD

- All the crystals will be read-out with both PDs and WLF systems.
- The last PDs production will be employed
- The LPD/SPD signal ratio is ~500 while for the flight model the ratio will be ~1300.
- New long kapton cable has been designed.
- New HiDRA3 chip, front-end (TROC2) boards will be used.



Preliminary tests of new PDs

- Expected ration LPD/SPD signals: ~1300.
- Measured ratio between new LPD and SPD signal in Florence: ~500
 - using blue LED, IR laser, low energy photons, etc..

- A difference between expected and measured ratio is still present:
 - we are in contact with Excelitas.







LPD/SPD low energy γ

New kapton cable, noise and MIP measured with HiDRA2



- Expected noise with long cable ~ 25 ADC
- Measured noise ~ 19 ADC,
- The MIP peak is ~ 90 ADC, as expected.



First test of HiDRA3 and new TROC2

- Promising results obtained with a joint laboratory session (CIEMAT-Trieste-Firenze)
- The noise of the system with then new HiDRA3 chip and TROC2 board is <~ 20 ADC.
- The gain switching circuit works as expected.
- Standard acquisition and calibration modes were tested.



PD system development: next steps

- Investigate some minor problems (e.g. ADC data checksum errors)
- Study the new anti-saturation circuit with laboratory test
- Minor hardware modifications on TROC2 boards (e.g. the buffer mounted on the HiDRA3 output)
- Preparation of next BTF-Frascati beam test:
 - May 29 June 4.
 - High multiplicity, hundreds MeV electron beam
 - The main goal is to test the new PDs, kapton cable, front-end electronics before CERN beam tests.
 - The detector configuration is not yet defined.

PD system assembly inside IHEP prototype

- 1050 PDs arrived in IHEP with sylgard 95-300 silicone glue.
- Oleksandr and Lorenzo will arrive in IHEP on May 8th to start the PD-LYSO gluing procedure.
- Kapton cable and few TROC2 boards should arrive in IHEP early June.
- PD team will stay in Beijing during June for one week to start the soldering procedure, assembly of TROC2 boards and to test the PD system.
- We should define the exact period asap (e.g. from June 26th to July 1st).
- The complete set of TROC2 boards will arrive in IHEP early July.
- How to handle the connections between TROC1-TROC2 is not completely defined so far.
 - We will discuss during next CALO meetings

Expected PD-system status on August 27

- We expect that all the PDs, kapton cable and TROC2 boards will be assemble in IHEP.
- The sensor and front-end components of PD system will be available on August 27.
- It is not clear to me if TROC1 will be mounted in the prototype in IHEP. Then, it is not clear if I2C trigger test will be done in IHEP or at CERN.
- Florence team will arrive at CERN in August 28.
- From Augst 29 to September 1, our goals are:
 - Finalize the assembly of TROC1, PD bias, TROC2 power, etc...
 - Test the noise of the entire system.
 - Test I2C communication with main trigger board.
- We guess that the PD system will be ready during the first runs of PS beam test.
- Modification will be not needed for SPS.

Beam request for PS and SPS: idea of Florence group

- This is a list of idea discussed in Florence, comments of different members of the CALO group are welcomes.
- Electrons at SPS: we think that acquiring high energy electrons is high priority. Even few days of electron data taking is relevant.
- Muon for calibration: we should calibrate each column of the CALO with muons. If the rate will be high enough, we could acquire muons at PS.
- Nuclei at SPS: we suggest to acquire nuclei in a wide range of "Z", starting from Helium, up to at least Ar, to properly characterize the scintillator non-linearity and the hadronic shower development.
- Electrons at PS: acquiring low energy electro-magnetic showers it will be very important especially if we will not be able to acquire electrons at SPS
- Protons at PS: for PD system, these runs are not the priority.