Torino, June 19, 2009

Working plan for EMC readout design

Based on the results presented during the EMC meeting on Tuesday and proposals communicated in several discussions during the PANDA CM at Torino, we arrived at the following schedule for optimizing and finalizing the readout scheme of the Barrel EMC. The project involves finalizing several components and the time-lines should be coordinated such that we arrive at a final test setup as soon as possible and as close as possible to the final layout needed for the EMC Barrel readout.

The main sequence of tasks is the following:

1) The noise performance of rectangular APDs will be studied and optimized at Frankfurt APD lab. Final results are expected end 2009. A capsule design has been provided and was modified at KVI to accommodate the ASIC electronics.
2) A small amount of ASIC APFEL II chips (ca. 10 ?) are available at GSI. A new iteration with some improvements, e.g. the way of setting the offset-voltages and the possibility to operate the 2 inputs in parallel, is planned for 2010.
3) At KVI the ASIC board fitting to the capsule and accommodating the minimal electronics needed near the APD has been designed. The performance of the decoupling capacitor at maximum required HV (600-1000V) will be studied. The flexible flat cable connecting the ASIC Board to the readout board (containing HV-filters and line drivers) and the design of the readout board are in development at KVI. A test of reading 2 APDs in parallel with ASIC is ongoing. A final design and prototype is expected end 2009.
4) At Orsay the design of the inserts for one type of Barrel crystals (probably type 1 with a maximum end-face cross section to allow the attachment of 2 rectangular APDs and, alternatively for comparison, even two quadratic APDs). This design has to be compatible with the capsule (point 1) and the ASIC board (point 3) containing the ASIC (point 2). The design should be ready end 2009. A design for all other crystal shapes for mass production of inserts is only reasonable after performance tests of the assembly have been done.
5) The GSI group is presently assembling a 4x4 matrix of straight crystals with a readout via a single quadratic APD and the present ASIC APFELII. This unit will allow to perform some principal studies of the ASIC operation and measurements of the noise level at room and low temperature using the energy deposition by cosmics. The tests will be done in the cooling box at Giessen and the digitization will be performed with the KVI S-ADC system.
6) A test with tagged photons at MAMI with the above setup (mentioned under 5) is not considered useful. Instead, we should build (who will do this?) a 4x4 matrix of tapered crystals for which the inserts have been designed (discussed under 4). The crystals should be contained in 4 alveoles (who will built these?) and the sensors and FEE attached with a first version of insert and an adapted version of a capsule and the ASIC board (see 3). This device, close to the final design, would allow to test the APD attachment, the required space, problems with read-out of 2 APDs, cross talk etc.. The studies would complete the picture gathered in point 5)

and obtained in many systematic tests done by the KVI group of energy and time response, where ASIC and Basel-LNP readout were compared and digital filtering methods have been developed and applied.

7) The test with the above setup (under 6) would be started first again in the box at Giessen and would be used latest in spring 2010. It would give additional input also for the modification and the next iteration of the ASIC.

As an outcome of this sequence of tasks and tests we would be prepared to design a nearly final version of the inserts and the ASIC board starting in spring 2010. From that point on we would be ready to work effectively on all other details of the final mechanical design. Even if the present version of the ASIC can not use both channels in parallel, we could switch connections and investigate the performance of 2 APDs operating nearby on one crystal, which has never been tested so far.

Additional remarks on work planned at Orsay:

- The use of barrel type #6 would be advantageous since all tools for alveoles are available at Orsay (PROTO60). However, the integration of 2 quadratic LAAPDs would be excluded.
- Any design studies of ASICs integration with all other parts as inserts, capsule... can be made before end 2009. This can be done with a type 1 crystal with 2 rectangular or quadratic APDs.
- Orsay can produce carbon-fiber alveoles, capsule frame and a support for a 4x4 matrix of type 1. This will be home-made and simplified as much as possible (no type 1 mould available). Orsay can machine 4 inserts in 2010 from the design of end 2009. The support of electronics must fit as needed for tests in the Giessen cooling box.
- Philippe insists on the integration of the cooling finger also in the Giessen cooling box... Special adaptation must be foreseen like a heat sink.

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