

DIS-parity DAQ test

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We describe here the setup of DAQ test for DIS-parity (E05-007). The goal is to setup prototypes of both scaler-based and FADC-based counting DAQs and study their feasibilities (dead-time, pile-up etc..) The setup is to be completed before the Hypernuclear experiment (end-May) and is intended to be non-invasive such that parasitic tests can be done with upcoming experiments (hyper-nuclear and HAPPEX).

1 The setup

- A total of 16 cables have already been installed, connecting a patch panel in the 2nd level of the HRS-R detector hut to the test cage in the counting house 2nd floor;
- Bob already setup the FADC and has included it into CODA;
- A total of seven (nine) signals – one Čerenkov analog sum, four analog signals from Preshower (and their sum) and two analog signals from Shower (and their sum) – will be sent from the HRS-R detector hut to the test cage;
- The four channels from the Preshower should consist adjacent two blocks from the left column and two opposing blocks from the right column;
- The two channels from the Shower should be both from the central column and are right behind the chosen Preshower blocks;
- All seven shower channels should have good PMTs and for now are preferred to be chosen from central region (vertically) of the focal plane, though we may shift to regions on the edge that are not blocked by the HAPPEX detector later this year.
- A scaler-based counting DAQ will be setup in the test area, using mostly NIM-based electronics and visual scalers;
- The trigger generated by the scaler DAQ will be sent back to the HRS-R detector hut, and included in the regular HRS and scaler DAQs. The trigger+scaler DAQ thus provides a scaler-based counting DAQ;
- It is desired to setup a scaler-based DAQ with regular ADCs to check the discriminator levels, signal shape etc;

2 List of instruments to be provided by Hall A.

- for scaler DAQ:
 1. At least 2 (ideally 4) scalers from the scaler DAQ;

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- for electron counters:
 1. $1 \times 428F$ (linear fan-in/fan-out);
 2. 1×465 or $365AL$ (≥ 4 inputs logic units);
 3. $1 \times 623B$ or $4608C$ or 2×821 (discriminators);
- for pion counters:
 1. 1×465 or $365AL$ (≥ 4 inputs logic units);
 2. additional logic unit for reversing ($\times 3$);
- for fanning out lead glass signals (in the hut):
 1. $2 \times 428F$ (linear fan-in/fan-out);
 2. 50Ω terminators ($\times 18$ optimal);
 3. 6Ω high-pass RC filters;
- for cabling/checking etc.:
 1. $1 \times$ multimeter;
 2. 50Ω terminators ($\times 10$ minimum, $\times 20$ best);
 3. $1 \times$ function generator;
 4. $1-2 \times$ high frequency pulser;
 5. short cables for setting up electronics;
 6. $1 \times$ scope;
 7. Though the regular scaler DAQ will be used, some visual scalers are desired to check signals in the test cage;

3 List of instruments borrowed from DAQ group.

The DAQ group has provided a VME-based 8-channel 12-bit 100MHz FADC module and associate (standard) software for readout.

Figure 1: Schematic diagram for setup in the HRS-R detector hut. To optimize the output of fan-in/fan-out, the unused outputs will be terminated by 50Ω terminators. The four channels from the Preshower should consist adjacent two blocks from the left column and two opposing blocks from the right column; The two channels from the Shower should be both from the central column and are right behind the chosen Preshower blocks. All six channels should have good PMTs and are preferred to be chosen from central region of the focal plane. The setup should be non-invasive.

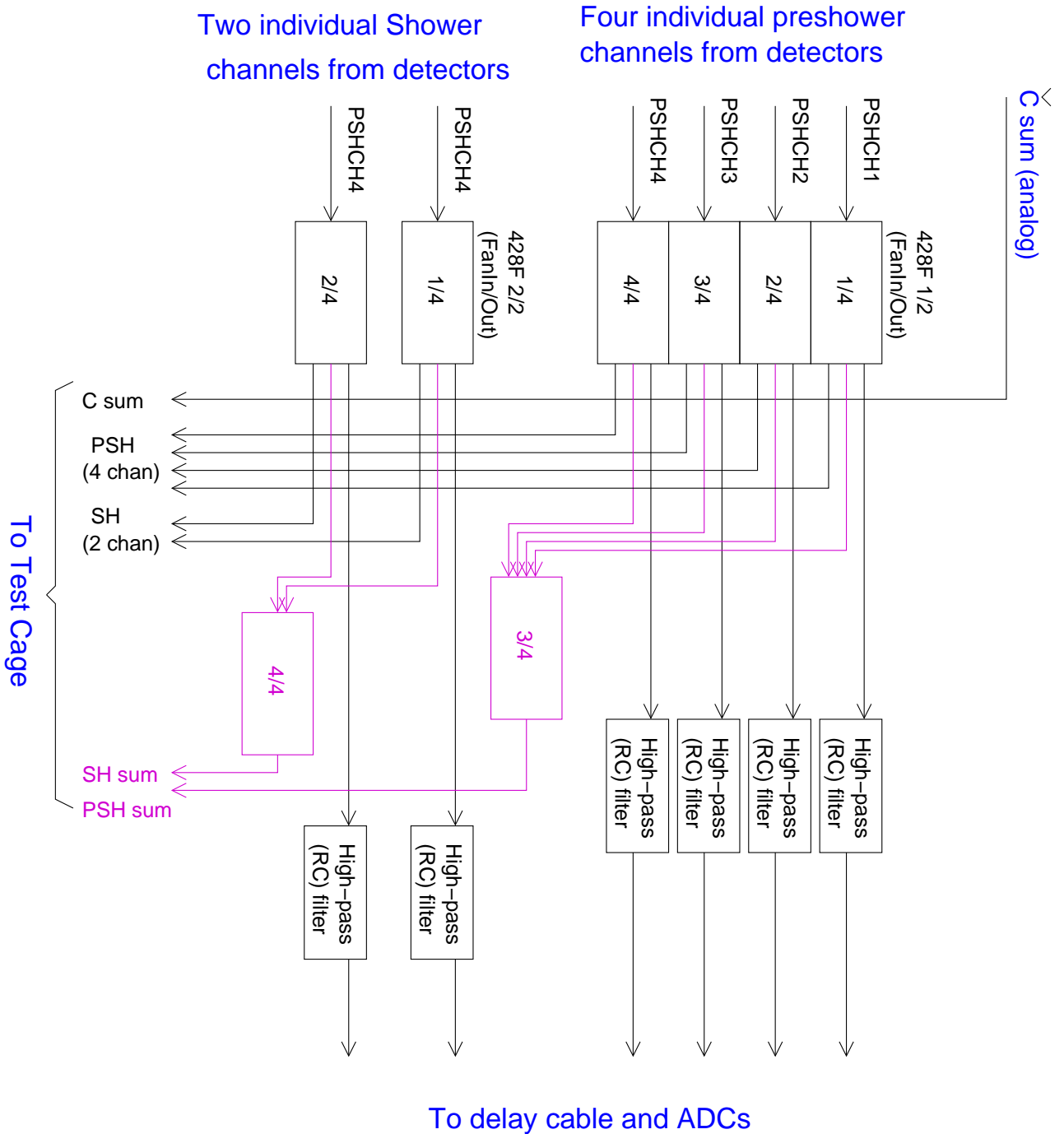
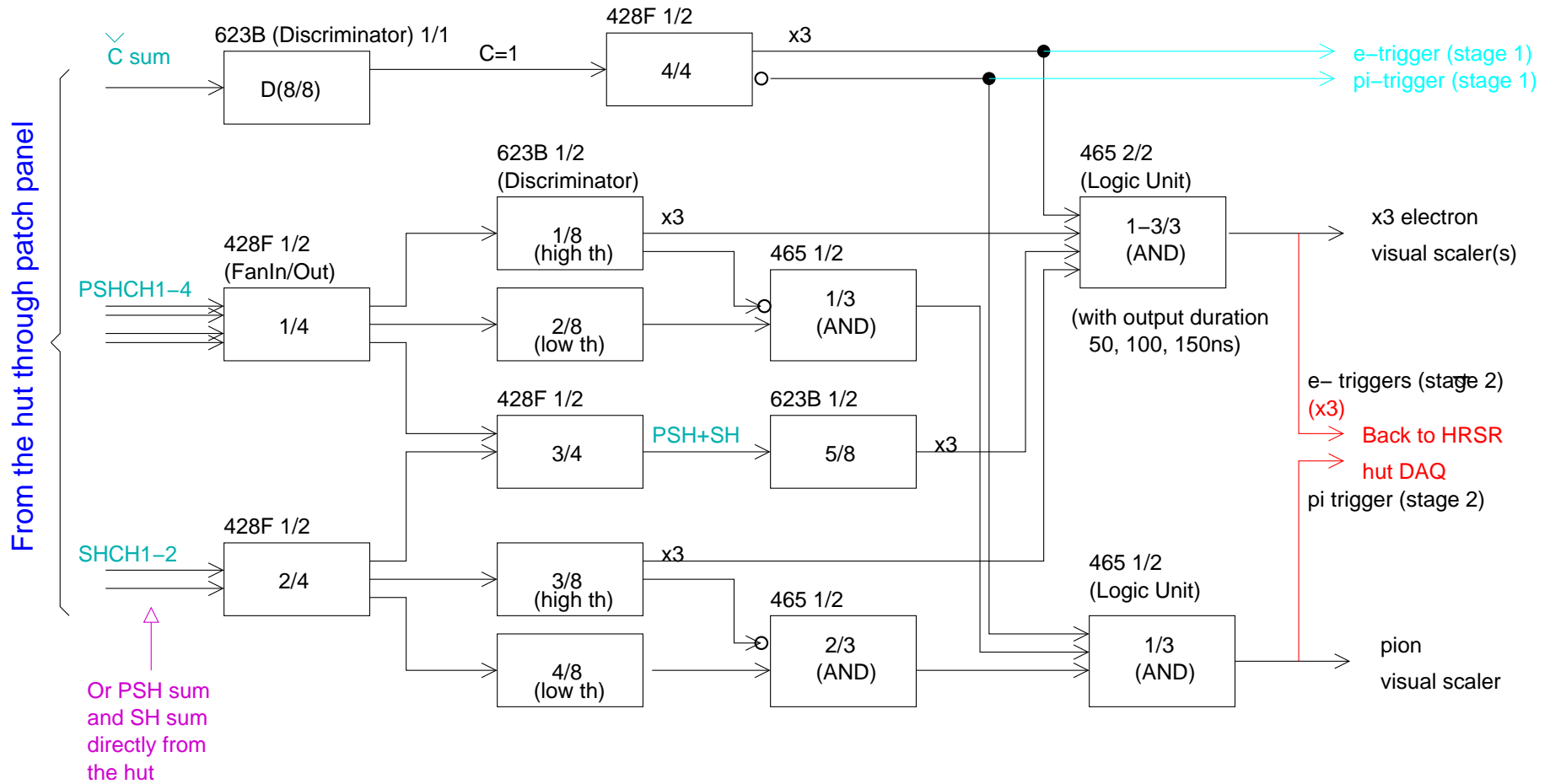


Figure 2: Schematic diagram for setup in the test area (2nd floor counting house).



4 The Test

- Setting up triggers:
 1. Setup electronics as described in section 1 and Fig.2;
 2. Make sure triggers from the test cage can be synchronized with the HRS, the scaler, and the FADC DAQ (*how??*).
- Before setting up Pre/Shower signals (using \check{C} -sum only, to be done using cosmic runs and w/ beam during Hyper-nuclear commissioning):
 1. Set discriminator for \check{C} -sum (test cage), send two triggers: e ($\check{C} \text{ sum} > \check{C} \text{ sum}_{th}$) and π ($\check{C} \text{ sum} < \check{C} \text{ sum}_{th}$), as shown by the cyan lines in Fig.2, to HRS DAQ in the hut;
 2. Send \check{C} -sum to FADC and readout through CODA (*can it be synchronized with the HRS CODA?*).
 3. Take data (cosmic or w/ beam) with scaler, HRS and FADC DAQs;
 4. Compare counts from scalers (direct output), HRS DAQ (data with software cut on \check{C} -sum), and FADC DAQ (data with some kind of patten recognition);
- After Pre/Shower signals are split from the hut, using both \check{C} -sum and (Pre)Shower signals, w/ beam, at low rate:
 1. Send two sets of triggers e (x3) and π , as shown by the red lines in Fig.2, to HRS DAQ in the hut;
 2. Send \check{C} -sum, Preshower and Shower signals (6 individual channels and 3 sums) to FADC and readout through CODA.
 3. Take data (cosmic or w/ beam, at least one good run with beam and lot of electrons is required) with scaler, HRS and FADC DAQs;
 4. Compare counts from scalers (direct output), HRS DAQ (data with software cut on \check{C} -sum), and FADC DAQ (data with some kind of patten recognition).
- Using both \check{C} -sum and (Pre)Shower signals, w/ beam, at high rate:
 1. Repeat steps above; concentrate on dead time and pile-up's.

5 List of contact persons/tasks

- Eugene will setup and provide (or supervise the setup) for shower counters in the detector hut (Fig.1). The two summed signals are optional if space is limited. This is to be done during commissioning of the Hypernuclear experiment;
- Bob and Bogdan will provide electronic modules as given in section 2 (week of May 2-6);
- Xiaochao/Bob will setup the electronics in the test cage, will coordinate with Sirish and Bogdan (week of May 9-13);
- Bob will help to setup the scaler-based DAQ and synchronization among HRS, scaler and FADC DAQs (week of May 16-20);
- Xiaochao/Bob will perform cosmic runs (week of May 23-27);

- Xiaochao will contact Hypernuclear people to make sure they are okay with our setup in the Pre/Shower signals; Bob will make sure the regular DAQ will not be affected (before May 20);
- Xiaochao/Bob will perform tests w/ beam (early June);
- All collaborators are welcome to help for any task listed above.