14-BIT Custom ADC Board Rev. B

The University of Chicago
Same Block Diagram + Readout Memory outside FPGA (32 Mbytes):
- Input Pipeline: ~4us depth (512 samples);
- Two buffers inside FPGA – 4096 words each;
- 40kHz trigger, 100% hit occupancy, 32 samples/trigger (256ns), 32bytes/sample;
- Readout Memory (2 x MT45W8MW16BGX) can store 0.75 second spill.
Shaper/ADC Channel

Revision B Schematic

Noise STDEV Rev. A:
- 2.80 LSB – Dec.’07 FNAL recordings – full chain;
- 2.65 LSB – EShop recordings – ADC Module alone.

**Module SNR ~ 70dB**

Noise STDEV Rev. B (ADC Module alone):
- 1.90 LSB – same signal shape/bandwidth;
- 1.70 LSB – more signal filtering just before A/D chip -> pulse ~5% wider.

**Module SNR ~ 73-74dB**

Note: SNR was calculated as: RMS Full-scale/STDEV Noise.
Crosstalk related Modifications:

- Increase channel spacing by 1mm;
- Use 2 connectors - 8 channels each;
- Fully split power planes between channels from connectors to ADC chips;
- Use smaller size, shielded inductors for the shapers;
- Provide solder pads for individual channel shielding (if needed).
Specifications

• Digital I/Os (non VME)
  Backplane:
  - 16-BIT parallel outputs on P2/J2 – for ET Sum;
  - 4 diff bused lines on P0/J0 - for sampling clock and trigger pulses (VIPA Crate Only!);
  Front Panel:
  - 4 LVDS inputs – optional for sampling clock and trigger pulses;
  - Optical Link – optional;

• Power Requirements:

  +5V – 2A;
  +3.3V – 4.7A;
  -5V – 1.25A (applied on the user defined –V1,V2 pins);
  The +/-12V power pins are not used any more.
Schedule
Self Trigger Method

Implement a block inside FPGA (No Hardware Change):

- Calculate board total energy over last 32 samples, generate “board energy value” every 8 ns.
- Do on-the-fly fitting of each channel, generate a “board fitting accuracy value” every 8 ns.
- The two values produce self trigger. (May trigger at larger that 8ns increments.)
- Create self triggered “board event”.
- Time stamp (8 ns increments) in the header word for each board event.
- Off line, each board event gets associated, and aligned with the others.
- Generate "system event", and discard junk.

How much junk (board events not part of system events) is recorded?

- Simulation may answer that.

This method could be tested during the 100-channel test, and compared with the triggered solution.

- May prove itself useful for other applications.