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TOF Weekly Meeting
October 5, 2000

TOAD Board Design Status

Outline :

- Current Design of TOAD Board
- Receiver and Discriminator
- Monitor Circuit
- Charge Measurement Circuit
- Timing Measurement Circuit
- Calibration Circuit
- What Next

Current Design of TOAD Board

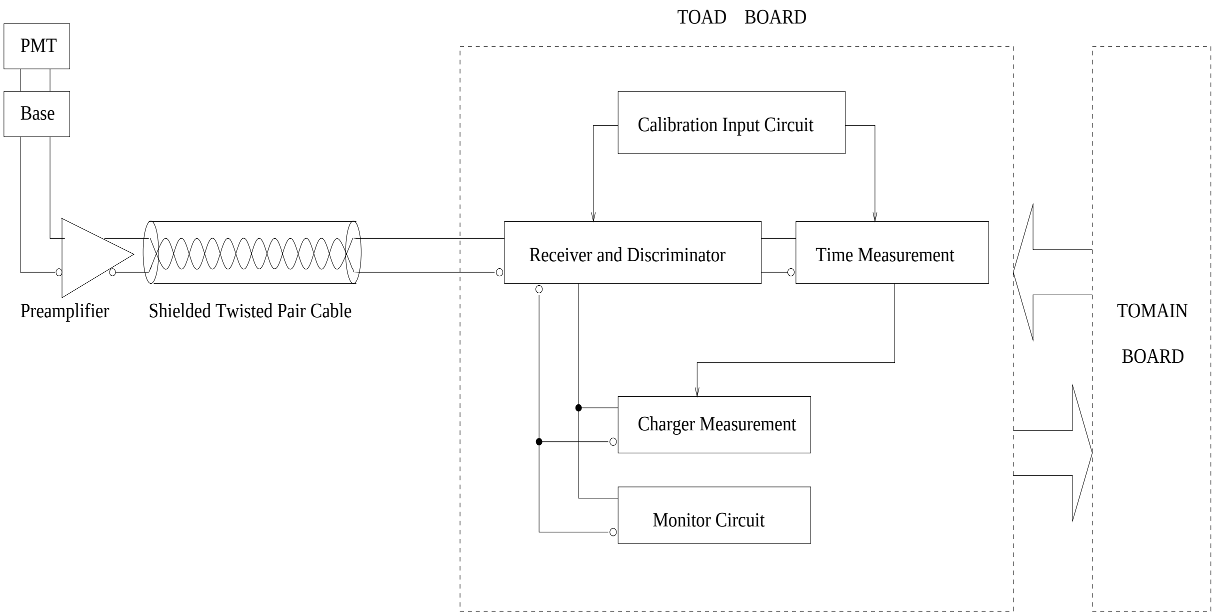


Figure 1: The block diagram of one channel of the TOAD Board.

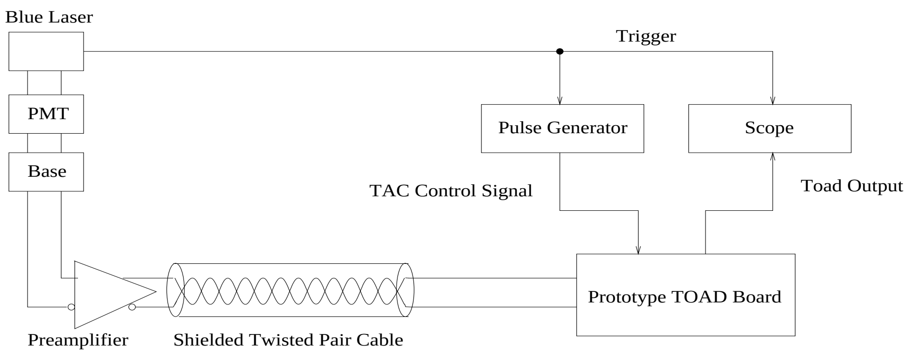
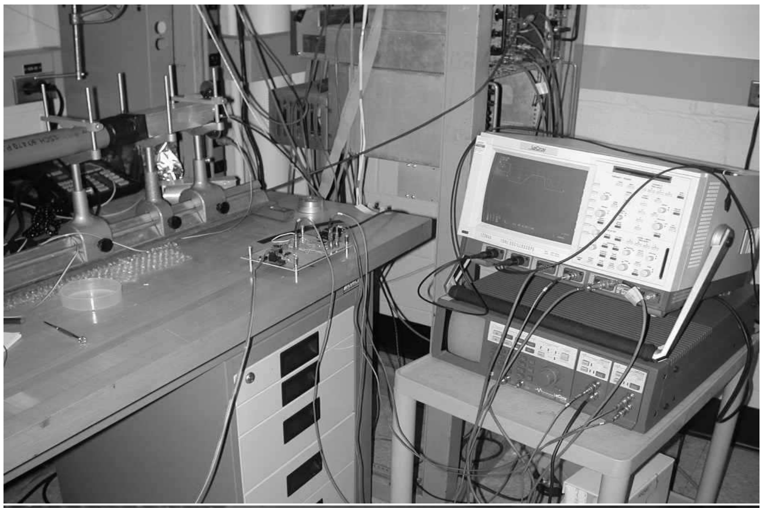
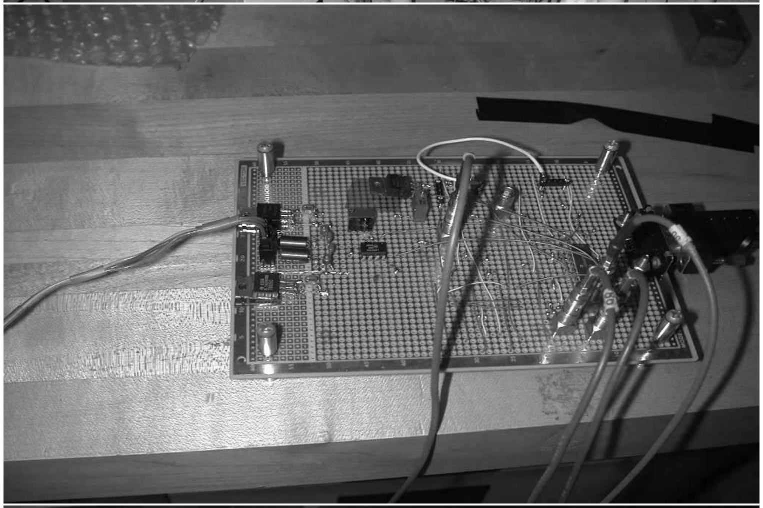
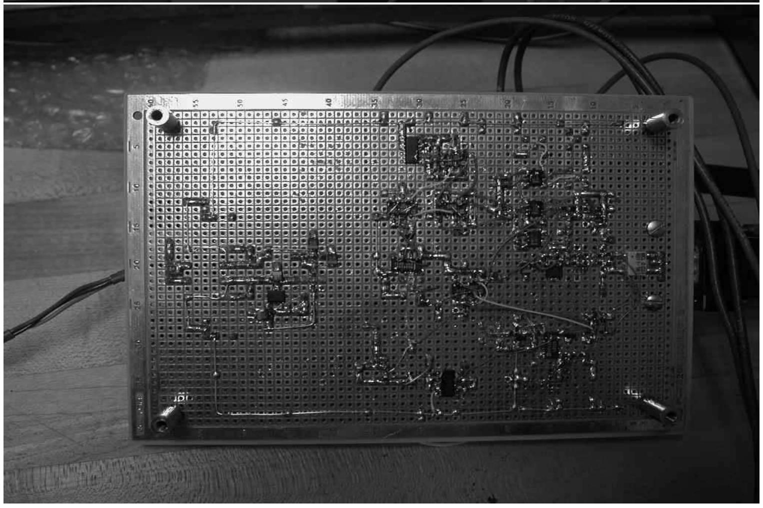


Figure 2: The block diagram of test setup for TOAD prototype at Penn.







Receiver and Discriminator

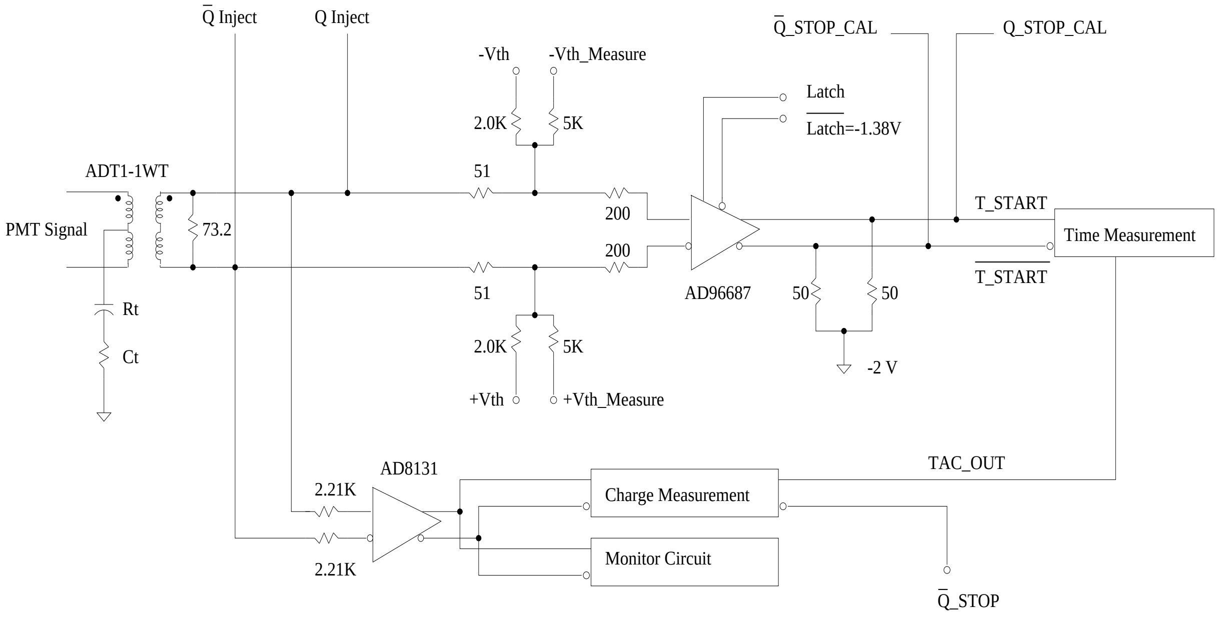


Figure 3: The Schematic of Receiver and Descriminator, only one channel is shown here.

- Terminate the cable with a RF transformer. No rise time degradation introduced by the transformer.
- The cable termination resistor R and C is not used in prototype. Their spaces will be reserved in layout.
- The transformer is DC coupled with a AD96687 comparator.
- The discriminator threshold will be set by TOMAIN board from 0 to 255 mV with 1 mV precision. It can also be measured by TOMAIN board.

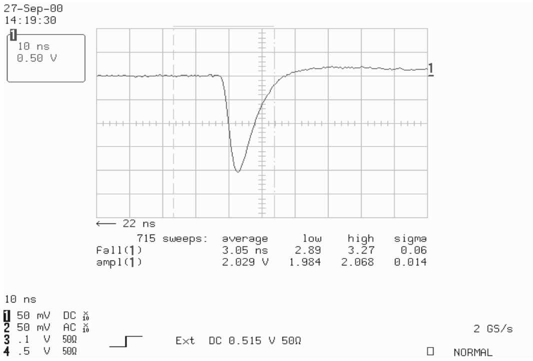


Figure 4: The differential output of the preamplifier at the far end of twisted pair cable terminated with a 73.2 Ω resistor only

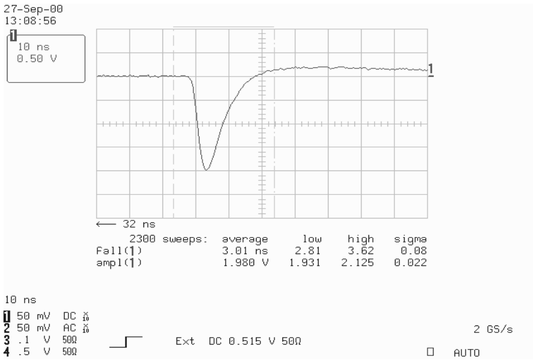


Figure 5: The differential output of the preamplifier across the 73.2 Ω termination resistor which connected with the twisted pair cable through a ADT1-1WT one to one ratio transformer.

- The transfomer is also buffered with a AD8131 differential line driver for charge measurement and monitor circuits.
- No BLR used in prototype. For a 1 V PMT pulse, the overshoot went to a relatively stable value lasting for about 150ns. It is 33 mV at 132 ns and 9.1 mV at 396 ns. However in our test, we use blue laser which gives pulses with fast rise times out of the PMT. On scintillator the rise times range from about 5ns to 10ns depending on which end of the bar the cosmic went through.

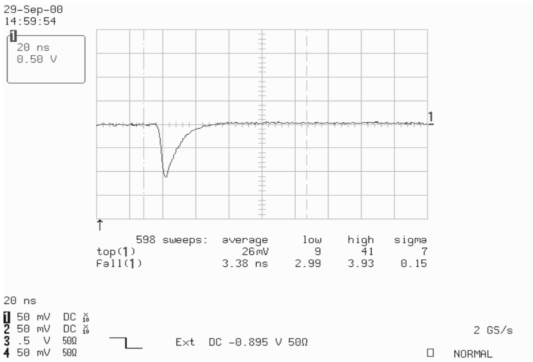


Figure 6: The differential PMT pulse output seen before discriminator.

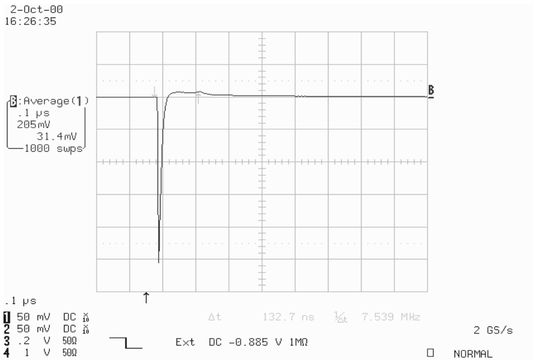


Figure 7: The differential PMT pulse output seen before discriminator.

Monitor Circuit

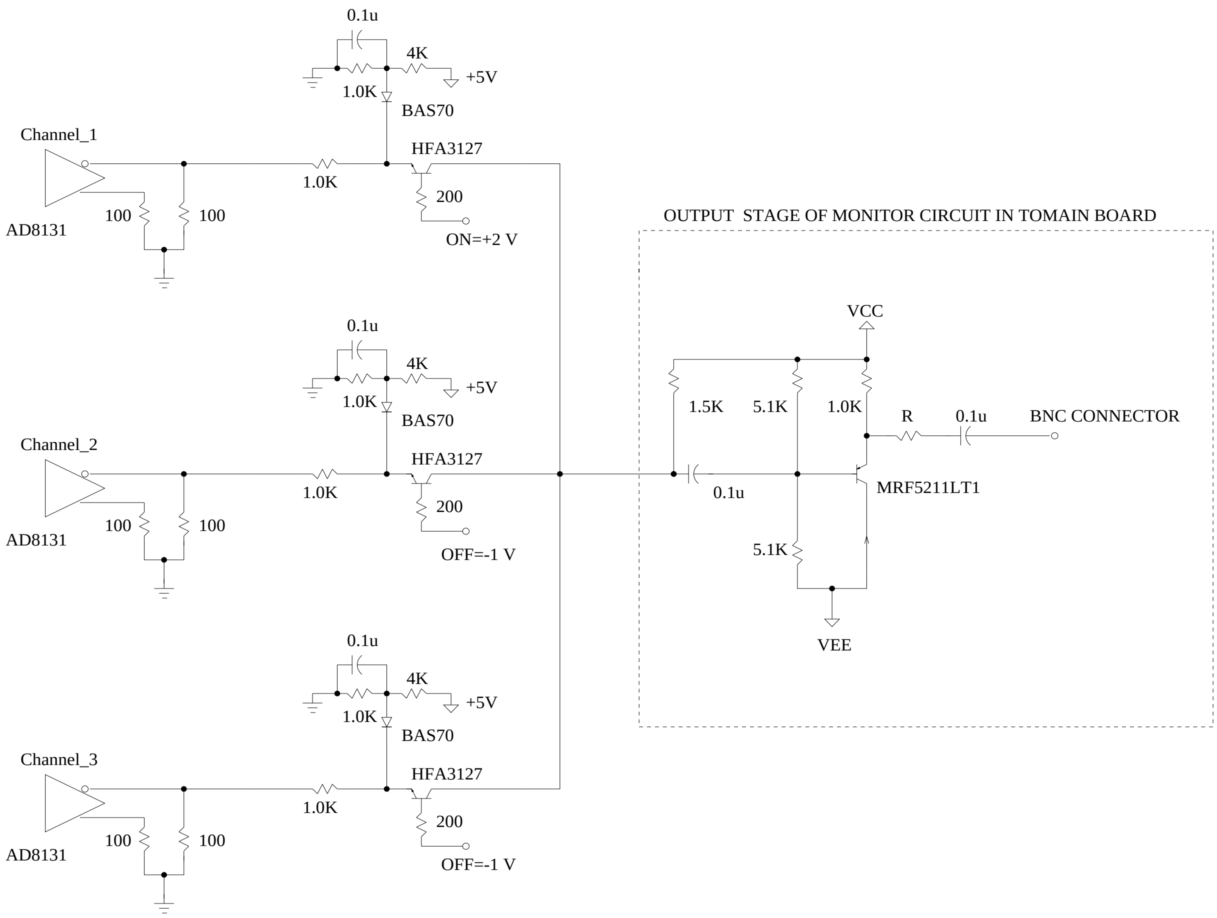


Figure 8: The monitor circuit schematic of TOAD Board.

- All 3 channels' monitor outputs are connected to a common output stage in TOMAIN board, which is also shared by the other two TOAD boards in the same TOMAIN board. Each channel's monitor output can be enabled or disabled through a ON/OFF control voltage from TOMAIN.

- Have the ability to monitor multiple channel at the same time.
- Negligible current draw.

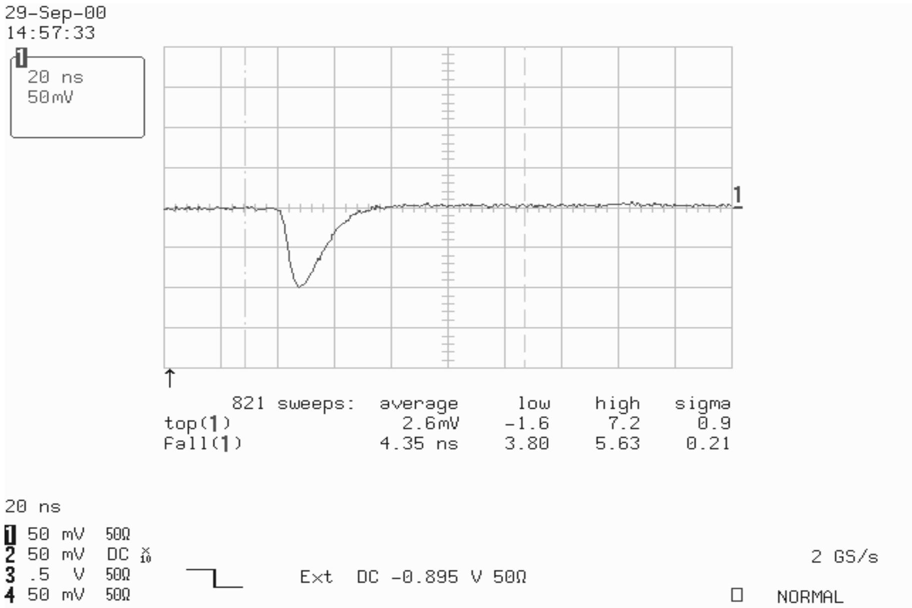


Figure 9: The output signal from monitor circuit board.

Time Measurement Circuit

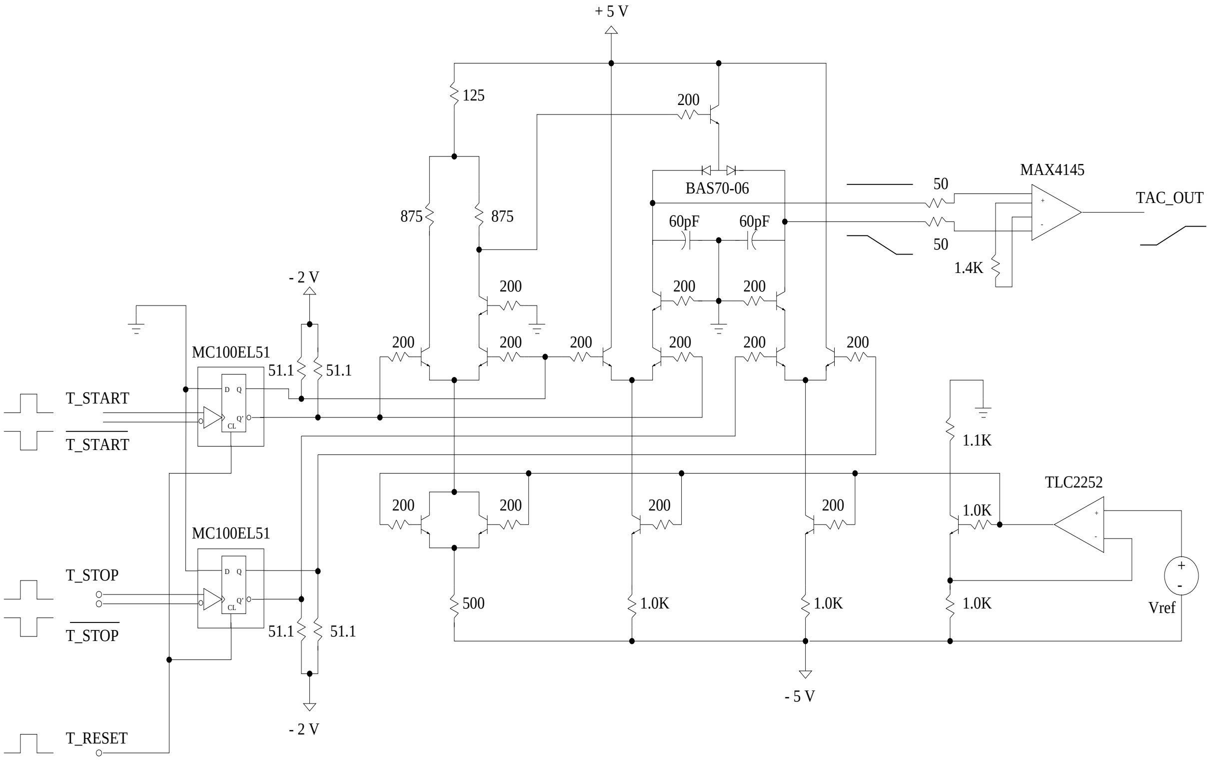


Figure 10: The schematic of time measurement circuit design.

- TAC is buffered by MAX4145, which gain can be adjusted.
- The temperature independent precision voltage source is not implemented in the prototype.

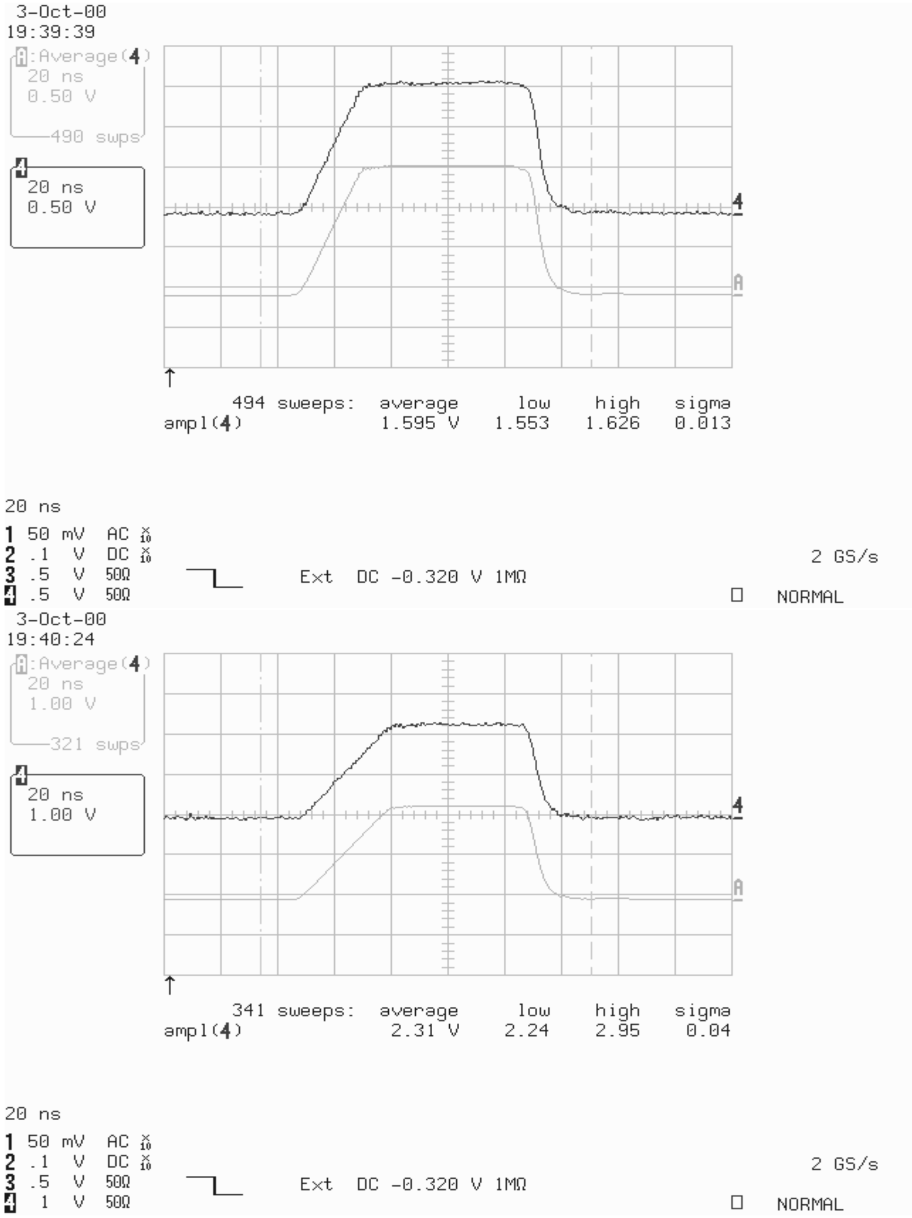


Figure 11: The TAC output.

Charge Measurement Circuit

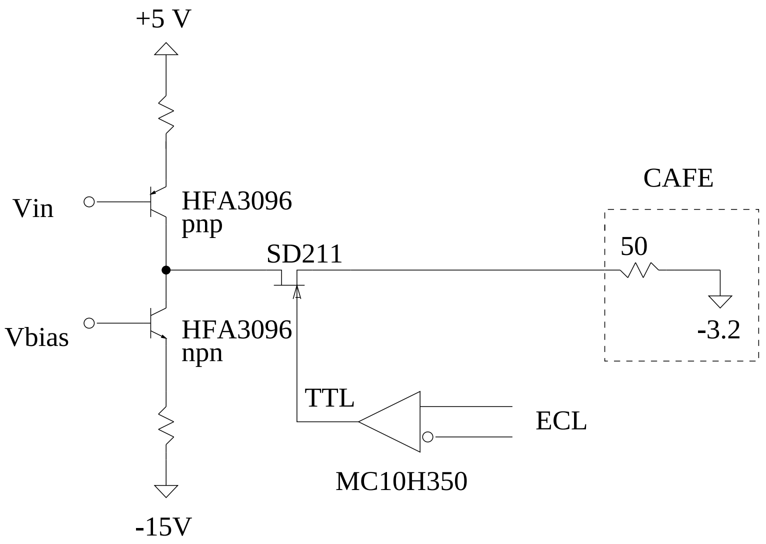


Figure 12: The schematic of old charge measurement circuit design.

The old charge measurement circuit prototype works reasonablely well. However the TTL signal may introduce pick up noise in the toad board.

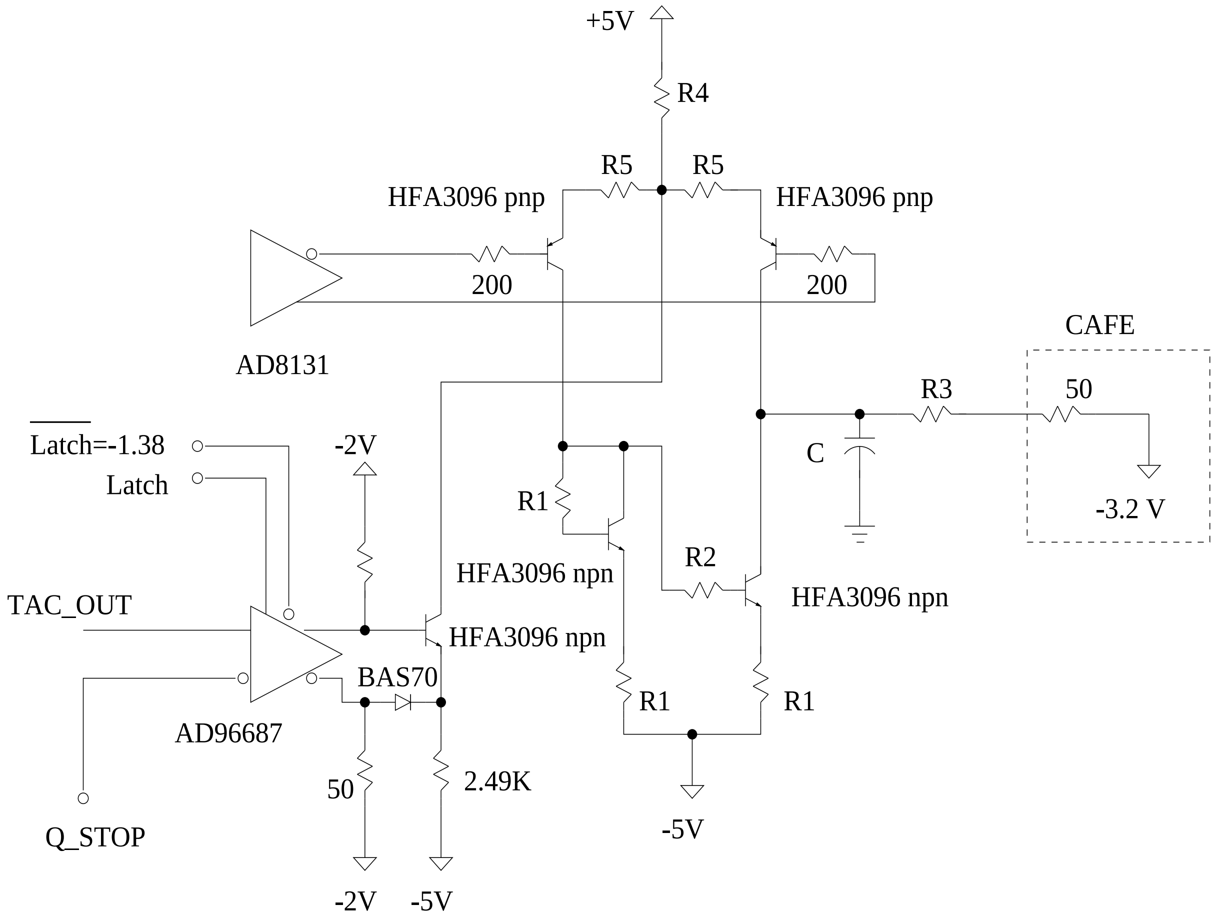


Figure 13: The schematic of current charge measurement circuit design.

- Measure Pulse height for the walk correction.
- The CAFE card expects a current, which full scale is 10mA for 132 ns(1300pC).
- Inplement a self-gated voltage to current convertor, which gate is generated from the linear ramp of TAC output.

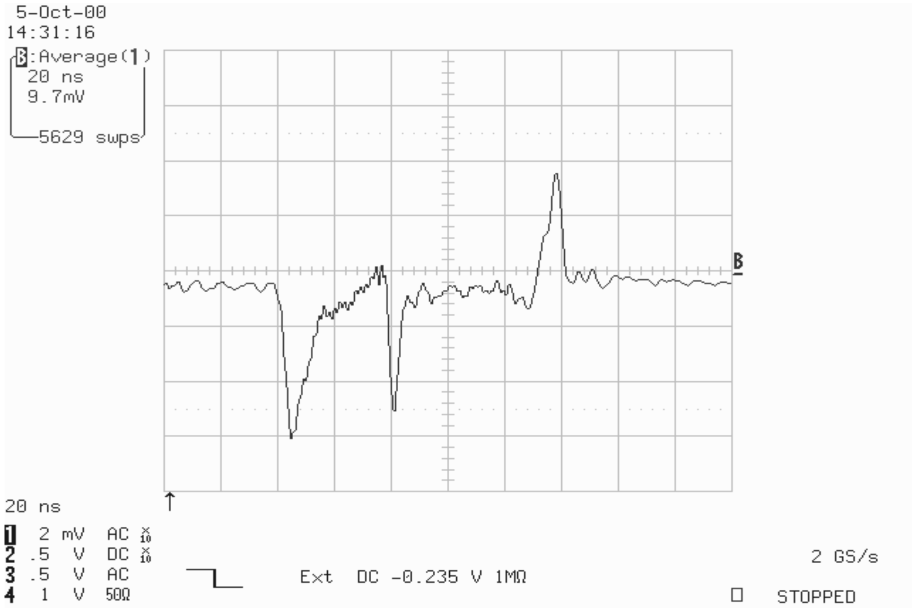


Figure 14: The charge measurement output. Here we choose R1=1.0K, R2=50, R3=0, R4=3.92K, R5=1.0K and C=10 pF.

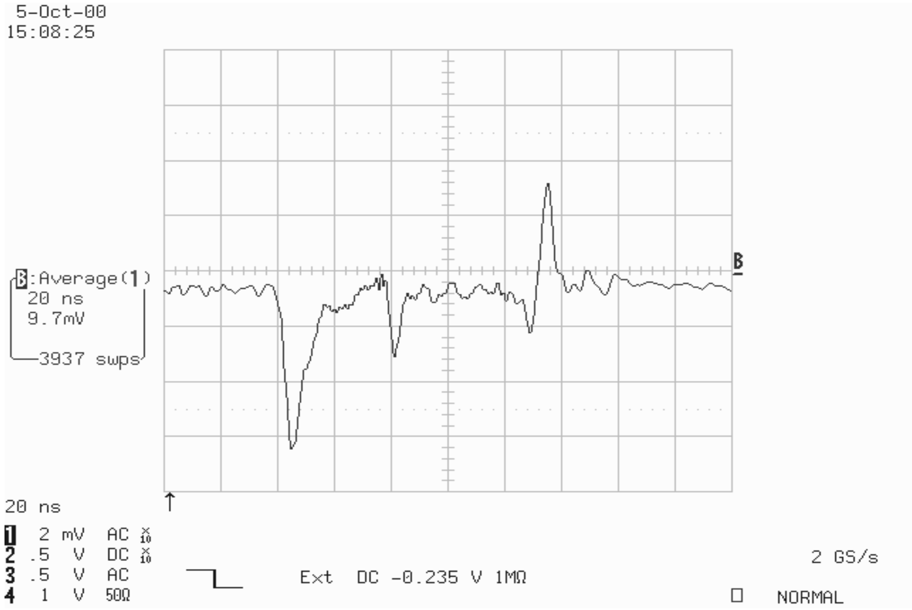


Figure 15: The charge measurement output. Here we choose R1=243, R2=10, R3=0, R4=3.48K, R5=1.0K and C=20 pF.

Calibration Circuit

- Inject a know pulse at the front end of TOAD board for diagnostics and testing. It can be used to calibrate the charge measurement. Its amplitude can be controlled by TOMAIN board.
- Inject a know pulse to start TAC without firing the discriminator. This is used to calibrate the TAC and measure the charge pedestals.

What Next

- Independent study of BLR for TOAD board.
- Optimize the component values in TOAD design.
- Finish the calibration design.