DAQ Status update – May 7, 2014

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System status

- New ACQ2006 ADC daq system with 2 separate ACQ435 modules. Running in “high_res” mode at maximum 64kHz sampling rate

- Have now both HDCI-44 to VHDCI-68 cables from ORNL electronic shop

- First cable mapping has one missing pre-amp twisted pair. One channel has reversed polarity

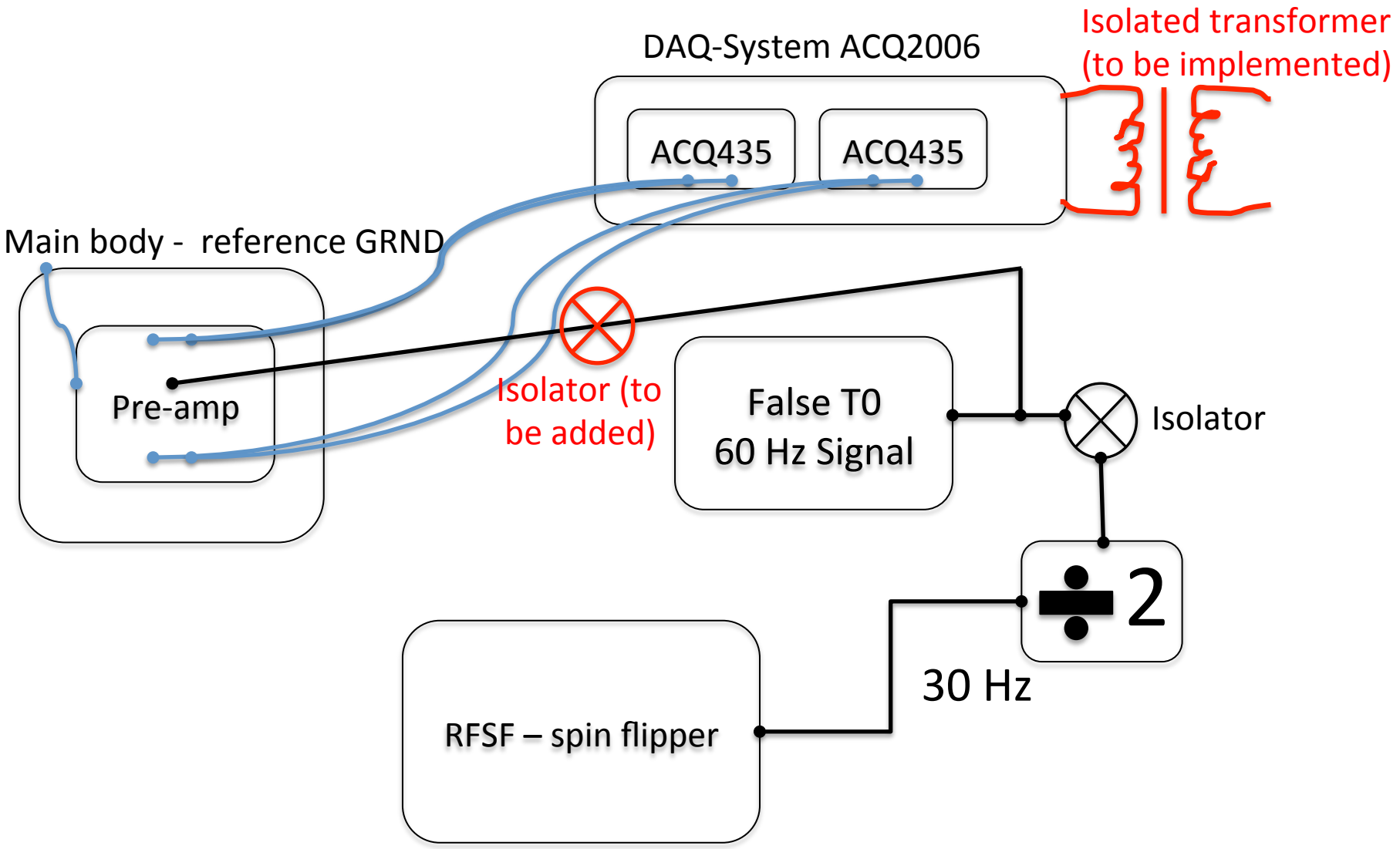
- Second cable is fine. So we are using 34 pre-amps from board.

- 2 pre-amp pins are used for T0 (60 Hz) and 30Hz signals for calculating asymmetry

- Old grounding schemes didn’t work

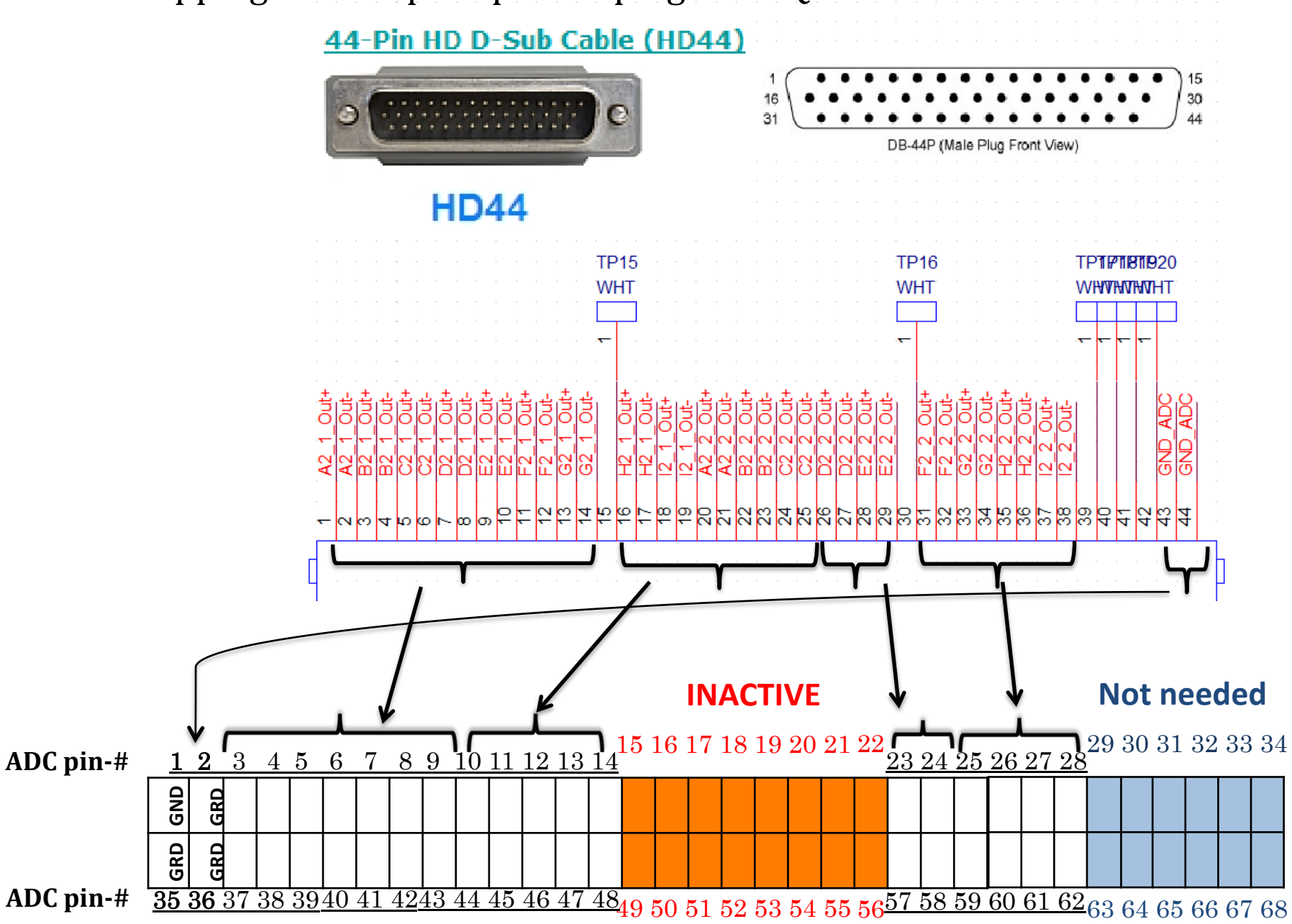
- Using new scheme (next slide) which working well: Each ADC module is connected to the reference (chamber) ground through pre-amp board + cable combination

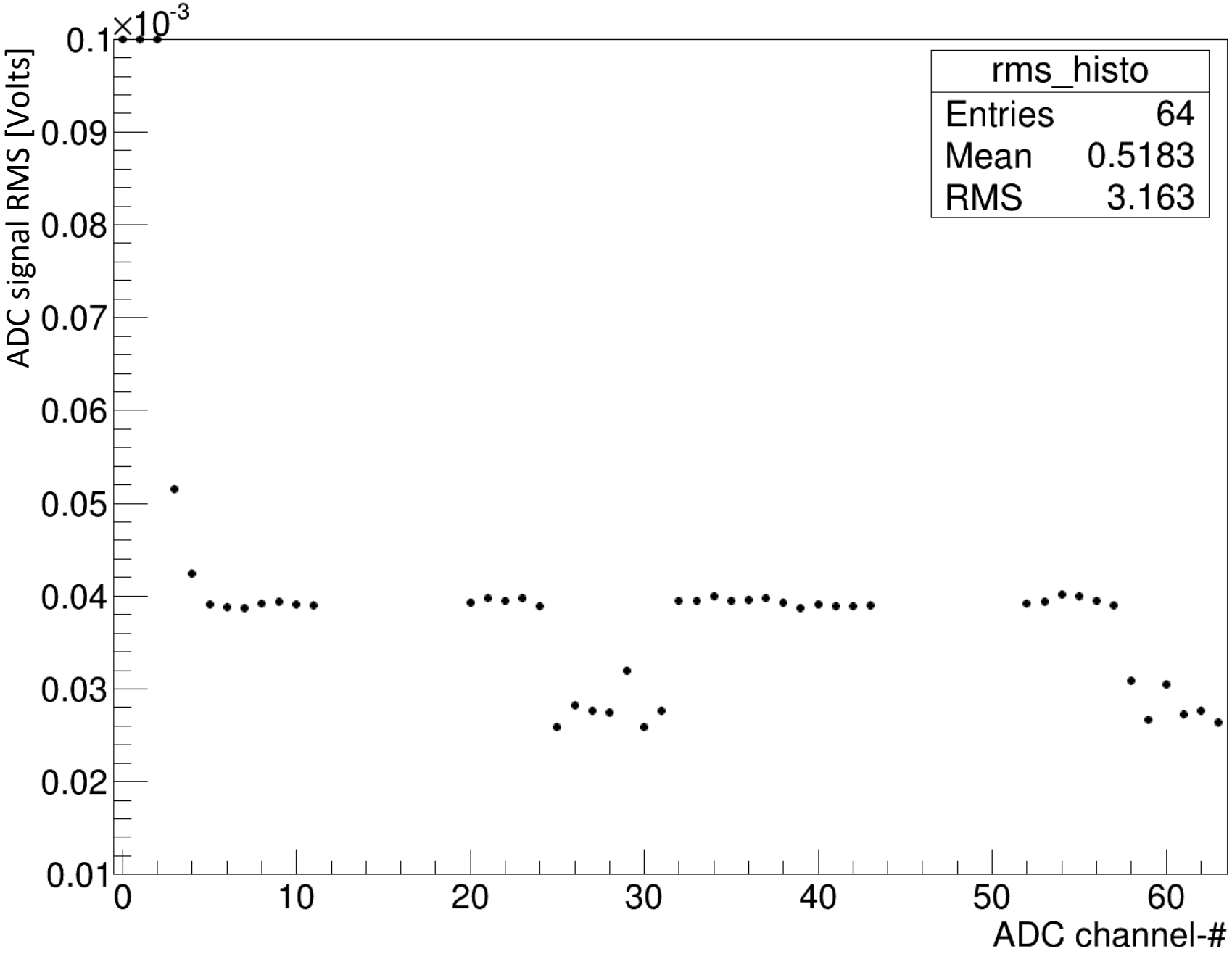
Grounding Scheme (circa D. Bowman)



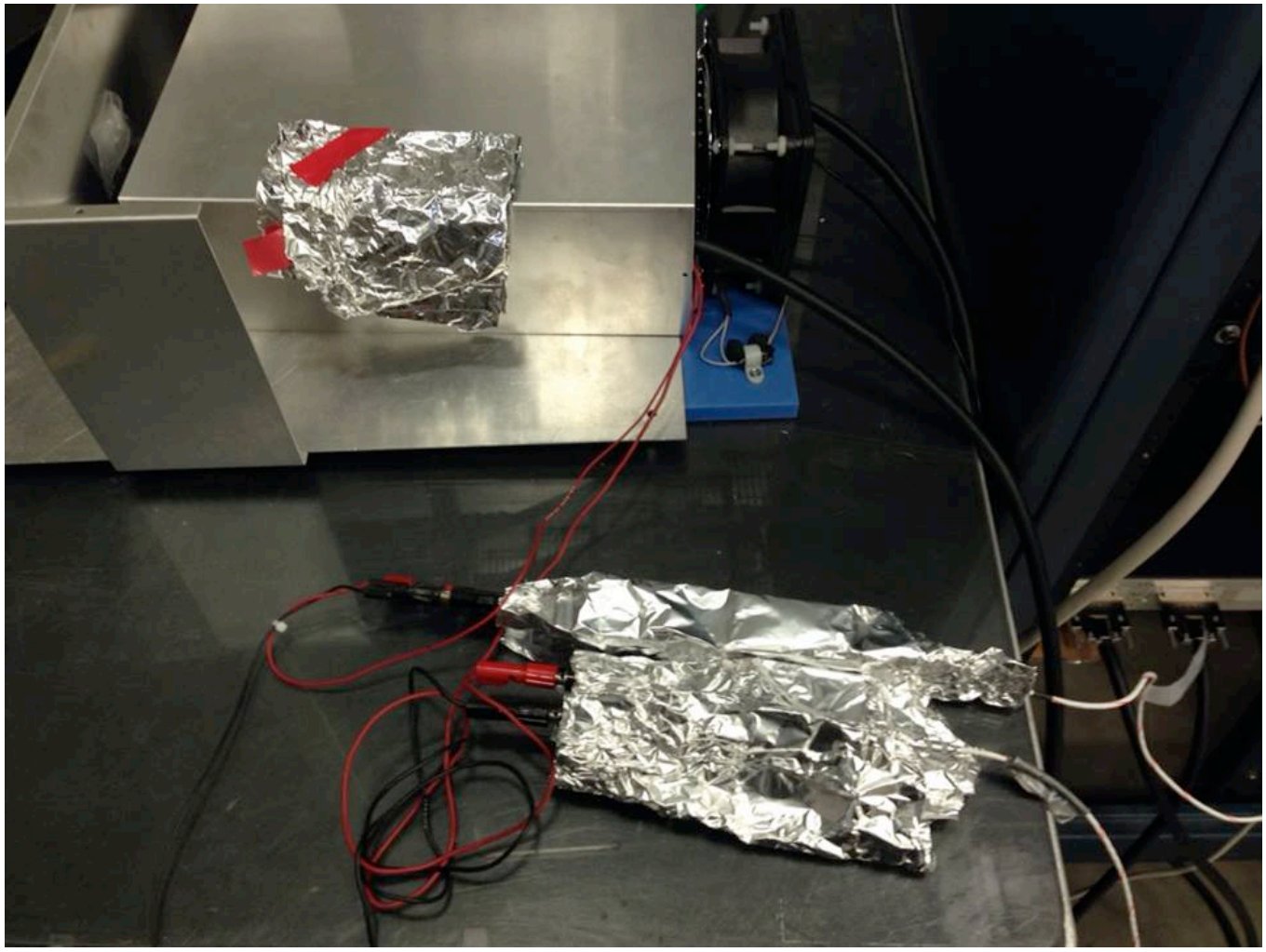
WARNING!: Items in red are not yet implemented in the setup

Mapping: Pre-amp 44-pin HD plug to DAQ 24-ch ADC Pin-out



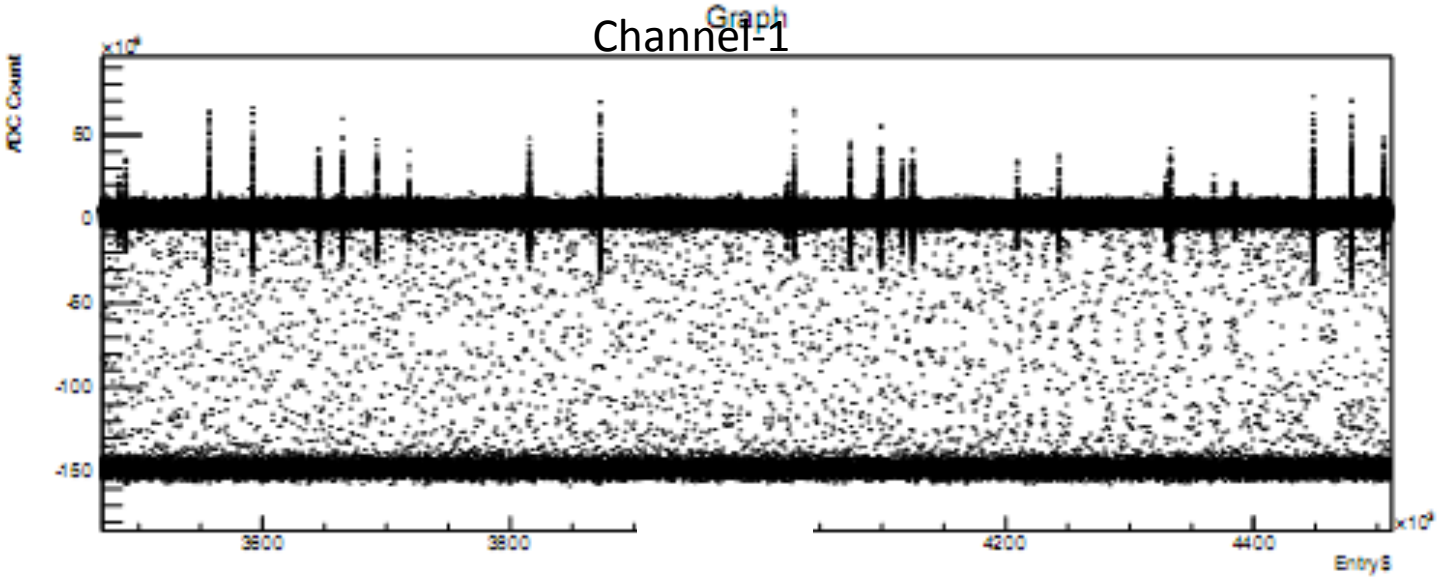

rms_histo
Entries 64
Mean 0.5183
RMS 3.163
×10^-3
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
ADC signal RMS [Volts]
0
10
20
30
40
50
60
ADC channel-#

Aluminum foil goes long way: reduced spurious noise

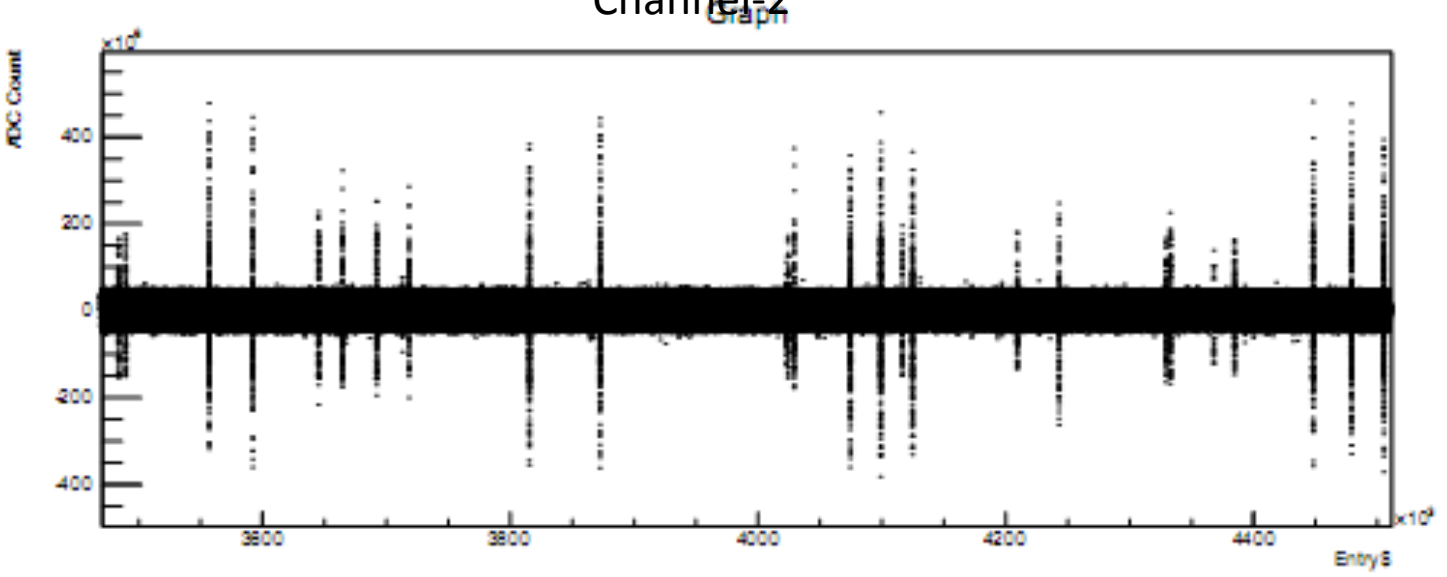


Pickup before additional shielding

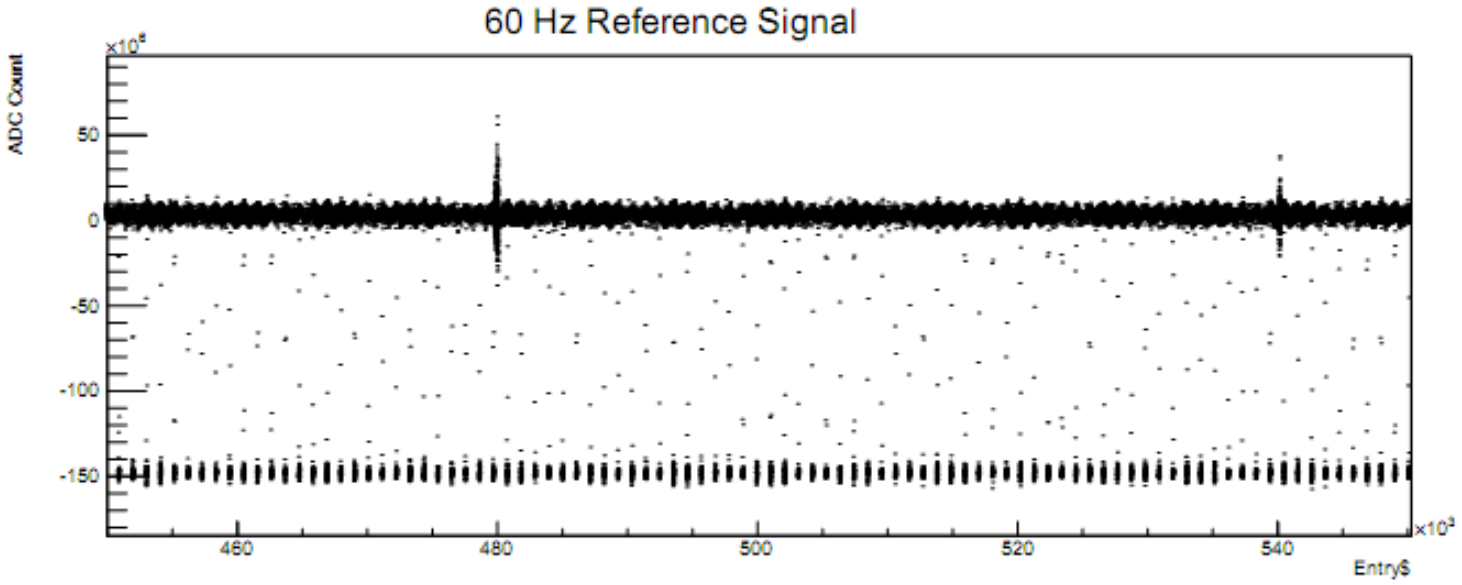
Channel-1

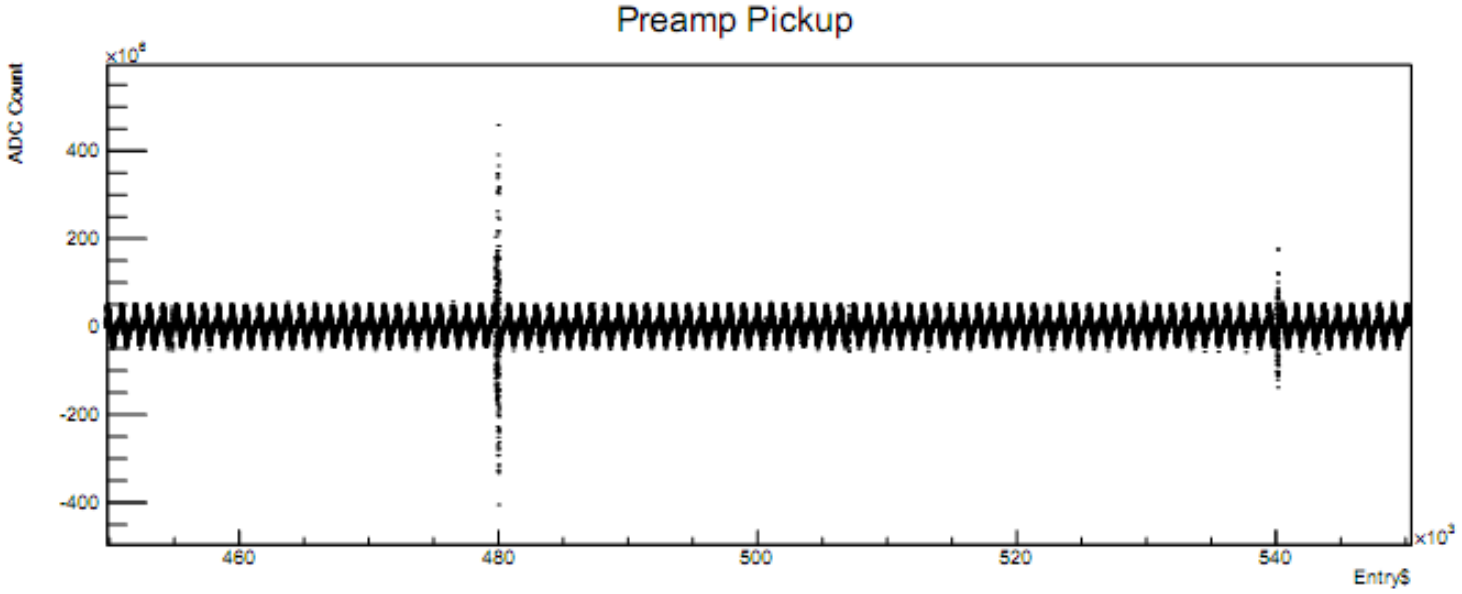


Channel-2

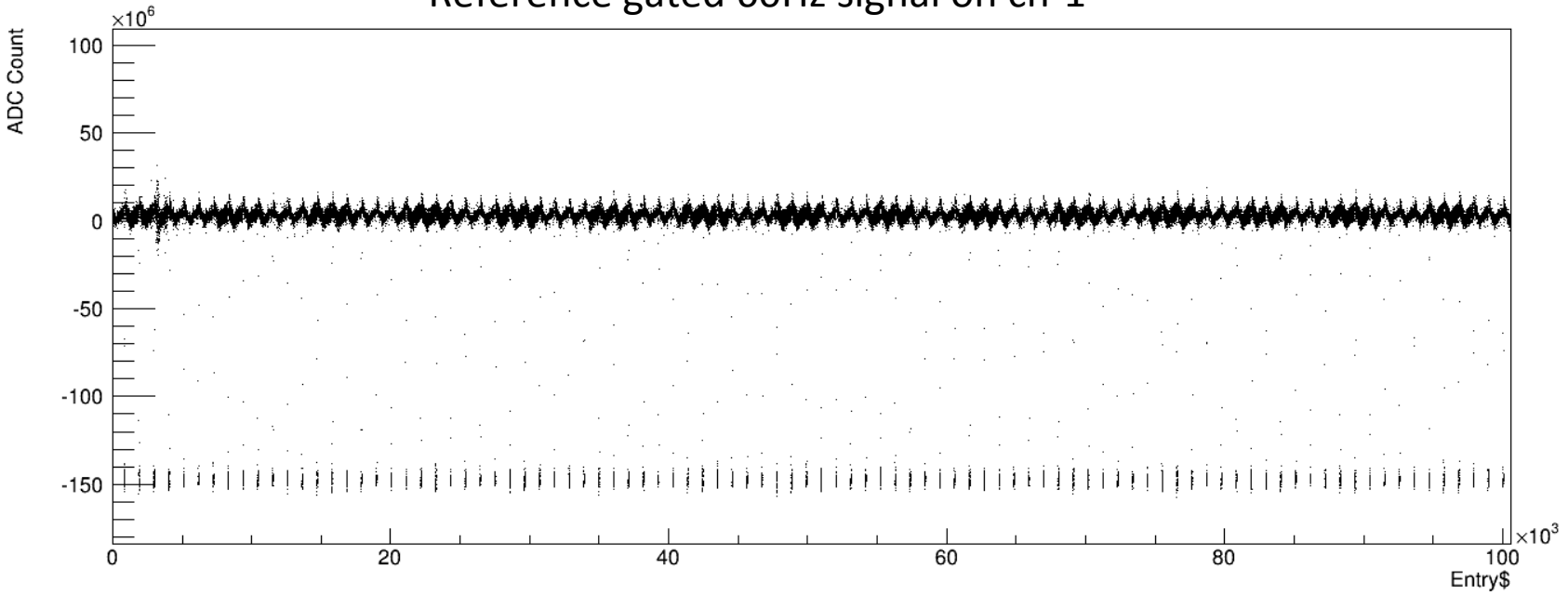


Pickup After additional shielding

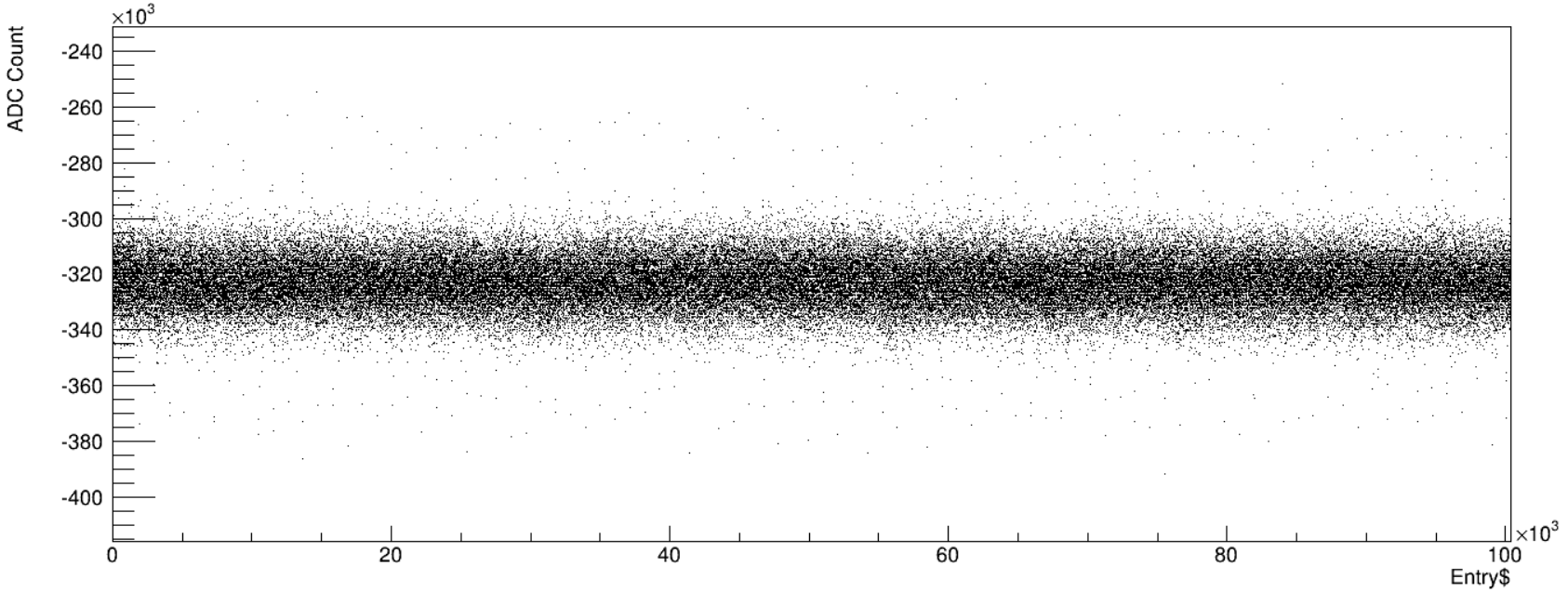




Reference gated 60Hz signal on ch-1

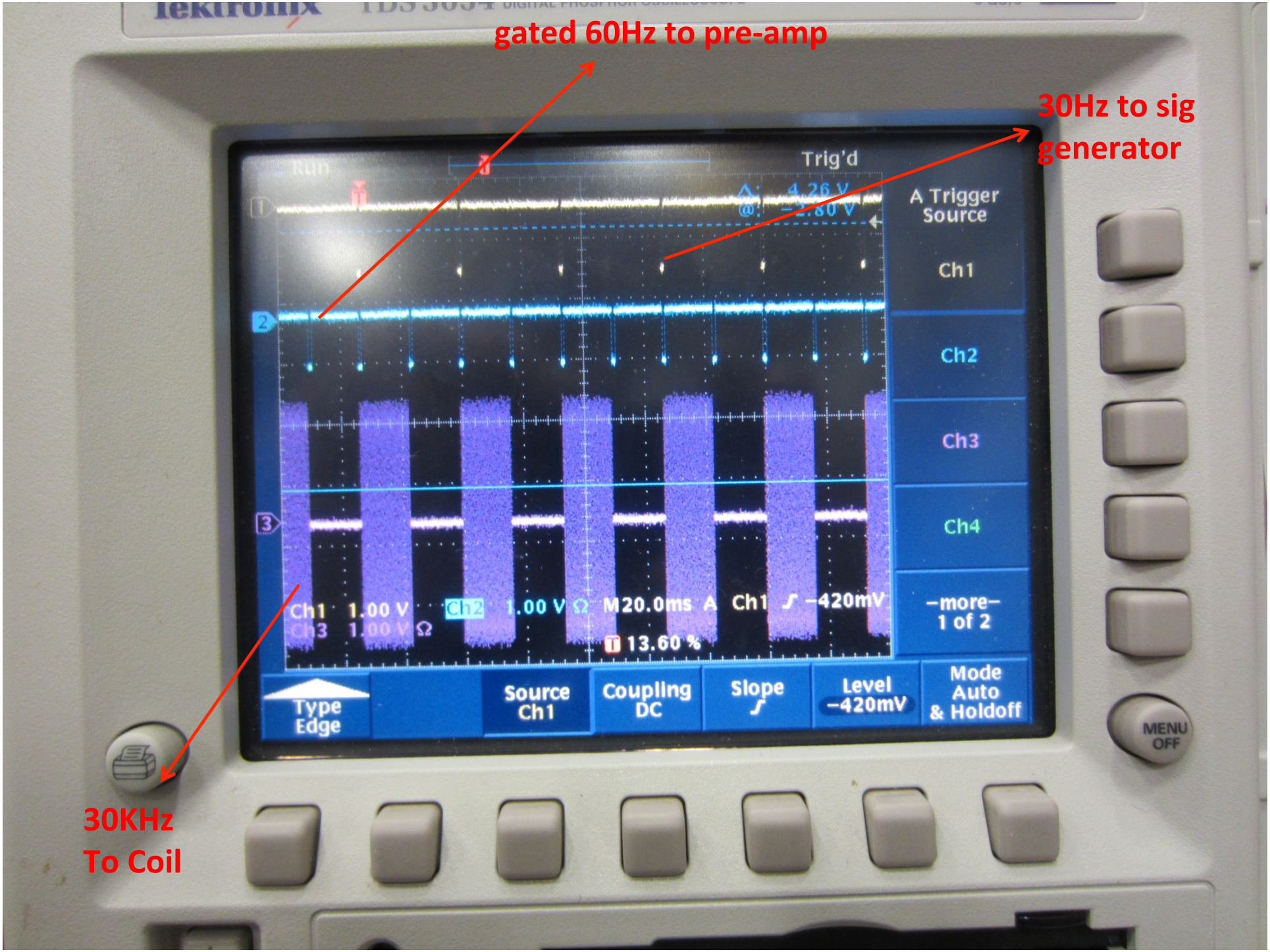


Preamp Pickup on channel 6 to be analyzed

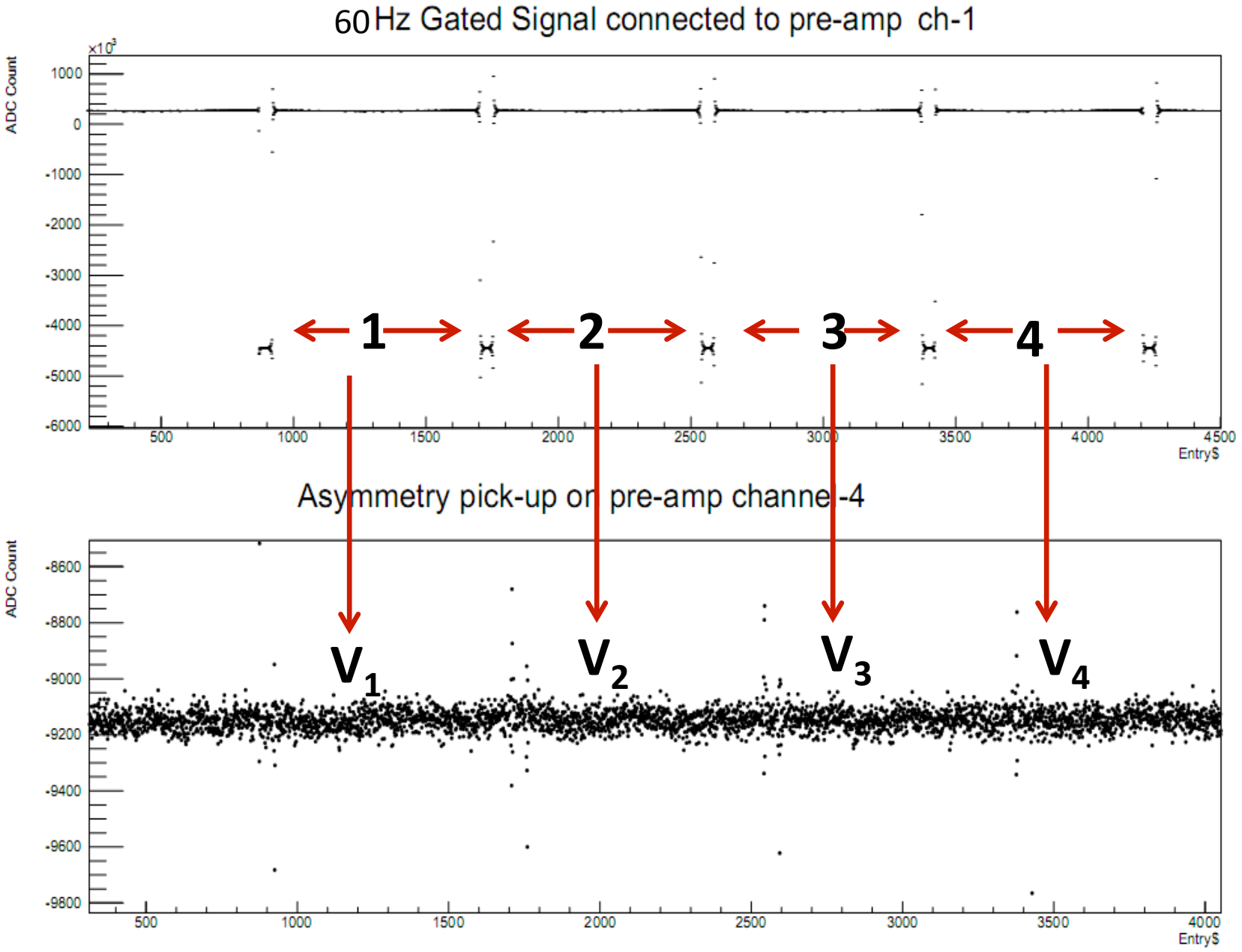


Analyzed Run Configuration

1. ADC sample rate: 64 KHz
2. Resolution mode: Hi
3. Data taking time: 1 Hour
4. No. of preamp channels considered: 32 (14 + 18)
5. No. of ADC modules: Two modules on same board (2 x 24 channels)
6. No. of SF ON/OFF states considered: 216028
7. No. of entries considered: 151219600 (~1.5 x 10^8)
8. Grounding Scheme: See on separate slide


gated 60Hz to pre-amp
30Hz to sig generator
30KHz To Coil
Run
Trig'd
A Trigger Source
Ch1
Ch2
Ch3
Ch4
–more–
1 of 2
Ch1 1.00 V
Ch3 1.00 V Ω
Ch2 1.00 V Ω
M20.0ms A Ch1 –420mV
13.60 %
Type Edge
Source Ch1
Coupling DC
Slope
Level –420mV
Mode Auto & Holdoff
MENU OFF

ALGORITHM


60 Hz Gated Signal connected to pre-amp ch-1
ADC Count
Entry$
1
2
3
4
Asymmetry pick-up on pre-amp channel-4
ADC Count
Entry$
V1
V2
V3
V4

- Take equal number of entries between two T_0 pulses.
- Skip few entries before and after any pulse.
- Subtract two adjacent pulses then, normalize by the full scale of the ADC(20 Volt).
- Skip the very last pulse(T_0).

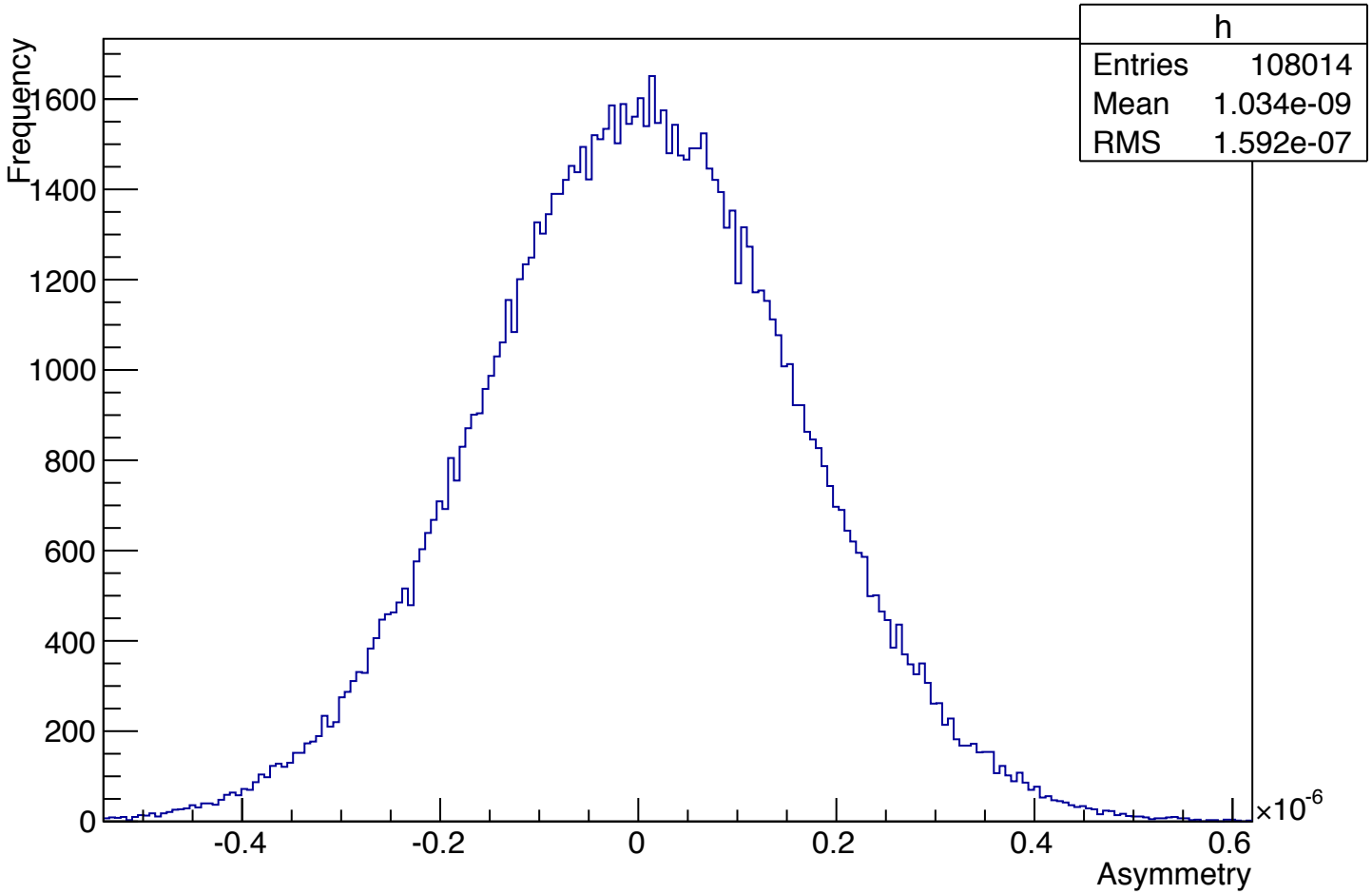
$$A_1=(V_1-V_2)/20$$

$$A_2=(V_3-V_4)/20 \ \ldots.\text{etc.}$$

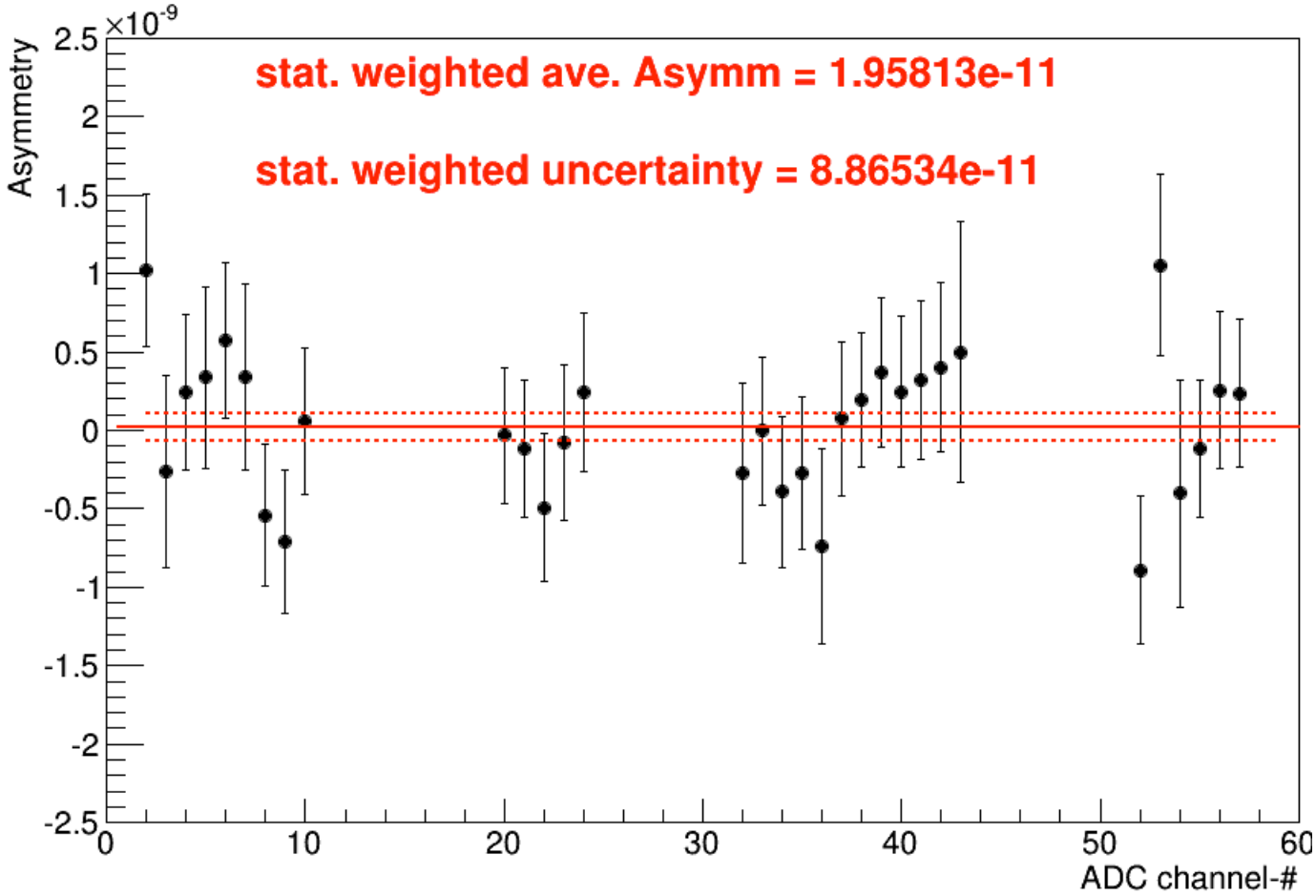
$$\text{Asymmetry, } A=(A_1+A_2+A_3+\ldots\ldots+A_N)/N$$

- To calculate uncertainty in false asymmetry, make a histogram for asymmetry of individual pair, A_k, k-1,2,….N
- Calculate width σ (sigma or RMS) of the histogram.
- Implement the above algorithm in the code/script, check the script with known signal for which the asymmetry is known. Also check changing the number of pairs considered.

False asymmetry per each channel



False asymmetry: all channels



Weighted mean:

$$\bar{x} = \frac{\sum_{i=2}^{\#\ pre-amp} x_i / \sigma_i^2}{\sum_{i=2}^{\#\ pre-amp} 1 / \sigma_i^2}$$

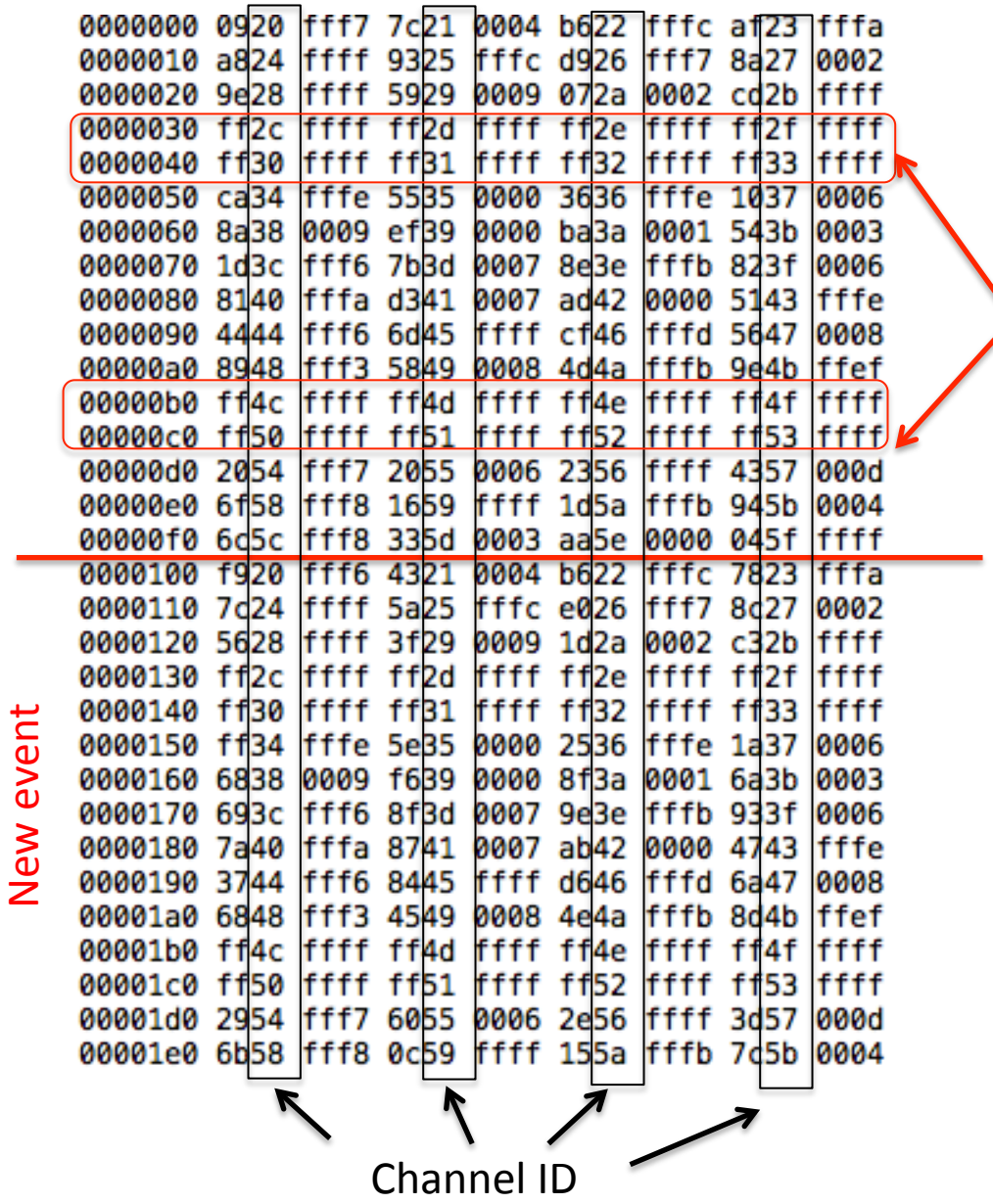
Variance of weighted mean:

$$\sigma_{\bar{x}}^2 = \frac{1}{\sum_{i=2}^{\#\ pre-amp} 1 / \sigma_i^2}$$

Backup

channel - 2 assym +- err 1.02367e-09 +- 4.84329e-10
channel - 3 assym +- err -2.62064e-10 +- 6.13392e-10
channel - 4 assym +- err 2.45177e-10 +- 4.96259e-10
channel - 5 assym +- err 3.38832e-10 +- 5.79534e-10
channel - 6 assym +- err 5.72318e-10 +- 4.93253e-10
channel - 7 assym +- err 3.37608e-10 +- 5.94879e-10
channel - 8 assym +- err -5.39921e-10 +- 4.55369e-10
channel - 9 assym +- err -7.06644e-10 +- 4.5616e-10
channel - 10 assym +- err 6.01397e-11 +- 4.64863e-10
channel - 20 assym +- err -3.38172e-11 +- 4.30205e-10
channel - 21 assym +- err -1.18406e-10 +- 4.36003e-10
channel - 22 assym +- err -4.91311e-10 +- 4.67154e-10
channel - 23 assym +- err -8.00519e-11 +- 4.9769e-10
channel - 24 assym +- err 2.3944e-10 +- 5.0478e-10
channel - 32 assym +- err -2.71598e-10 +- 5.69487e-10
channel - 33 assym +- err -4.50518e-12 +- 4.74571e-10
channel - 34 assym +- err -3.93201e-10 +- 4.81926e-10
channel - 35 assym +- err -2.72225e-10 +- 4.81773e-10
channel - 36 assym +- err -7.40478e-10 +- 6.24964e-10
channel - 37 assym +- err 7.42023e-11 +- 4.92411e-10
channel - 38 assym +- err 1.95165e-10 +- 4.31487e-10
channel - 39 assym +- err 3.69534e-10 +- 4.7236e-10
channel - 40 assym +- err 2.47696e-10 +- 4.81612e-10
channel - 41 assym +- err 3.20441e-10 +- 5.06749e-10
channel - 42 assym +- err 4.03237e-10 +- 5.40083e-10
channel - 43 assym +- err 4.9779e-10 +- 8.3313e-10
channel - 52 assym +- err -8.9173e-10 +- 4.72762e-10
channel - 53 assym +- err 1.05182e-09 +- 5.80361e-10
channel - 54 assym +- err -4.02793e-10 +- 7.19963e-10
channel - 55 assym +- err -1.13358e-10 +- 4.37627e-10
channel - 56 assym +- err 2.5744e-10 +- 5.0203e-10
channel - 57 assym +- err 2.37171e-10 +- 4.67976e-10
 average asymm +- err 1.95813e-11 +- 8.86534e-11

Hexdump of binary data file



- 4 8-character words per line
- 16 lines per event
- Amplitude for channels in rows 4-5 & 11-12 are “ffffff” which is zero in “reverse sampling”? (need correct word)

Next event repeats the same pattern

Conclusion: we have 64 channels in our data stream, 16 of those report zero Amplitudes.

Another confirmation:TTreeBinary Scan

```
Info in <TUnixSystem::ACLiC>: creating shared library /home/daq/n3He_DAQ/n3He_ACQ164/libNPDG/TBranchBinary_cc.so
*****************************************************************************************************************************************************
*    Row   *      d[0] *      d[1] *      d[2] *     d[12] *     d[16] *     d[19] *     d[32] *     d[33] *     d[34] *     d[44] *     d[48] *     d[51] *     d[63] *
*****************************************************************************************************************************************************
*        0 * -16737840 *    320801 *   -205534 *      -212 *      -208 *      -205 *   -349888 *    491841 *     50754 *      -180 *      -176 *      -173 *    -61089 *
*        1 * -16665187 *    322849 *   -202206 *      -212 *      -208 *      -205 *   -346560 *    489793 *     60482 *      -180 *      -176 *      -173 *    -58017 *
*        2 * -16591024 *    312865 *   -208350 *      -212 *      -208 *      -205 *   -348352 *    496193 *     50754 *      -180 *      -176 *      -173 *    -68513 *
*        3 * -16518089 *    318497 *   -213470 *      -212 *      -208 *      -205 *   -340672 *    497473 *     58434 *      -180 *      -176 *      -173 *    -55969 *
*        4 * -16443132 *    325153 *   -208094 *      -212 *      -208 *      -205 *   -343488 *    507713 *     51778 *      -180 *      -176 *      -173 *    -58529 *
*        5 * -16367459 *    320289 *   -208350 *      -212 *      -208 *      -205 *   -343488 *    496961 *     62274 *      -180 *      -176 *      -173 *    -56481 *
*        6 * -16291555 *    324641 *   -207326 *      -212 *      -208 *      -205 *   -348864 *    497729 *     57666 *      -180 *      -176 *      -173 *    -56737 *
*        7 * -16215600 *    321825 *   -202462 *      -212 *      -208 *      -205 *   -346816 *    501825 *     61250 *      -180 *      -176 *      -173 *    -47265 *
*        8 * -16138851 *    334625 *   -209118 *      -212 *      -208 *      -205 *   -351680 *    500289 *     51522 *      -180 *      -176 *      -173 *    -62113 *
*        9 * -16061283 *    327969 *   -202718 *      -212 *      -208 *      -205 *   -353216 *    493633 *     58178 *      -180 *      -176 *      -173 *    -62369 *
*       10 * -15983868 *    319521 *   -206302 *      -212 *      -208 *      -205 *   -349120 *    500033 *     46658 *      -180 *      -176 *      -173 *    -56737 *
*       11 * -15905814 *    324641 *   -208862 *      -212 *      -208 *      -205 *   -352448 *    502081 *     55874 *      -180 *      -176 *      -173 *    -63393 *
*       12 * -15827299 *    326945 *   -211934 *      -212 *      -208 *      -205 *   -355776 *    500545 *     60994 *      -180 *      -176 *      -173 *    -51361 *
*       13 * -15747862 *    326433 *   -212958 *      -212 *      -208 *      -205 *   -347072 *    490561 *     57922 *      -180 *      -176 *      -173 *    -62369 *
*       14 * -15667222 *    325921 *   -202206 *      -212 *      -208 *      -205 *   -357824 *    489281 *     55362 *      -180 *      -176 *      -173 *    -64929 *
*       15 * -15586172 *    326177 *   -198878 *      -212 *      -208 *      -205 *   -357056 *    493377 *     58178 *      -180 *      -176 *      -173 *    -67745 *
*       16 * -15505072 *    337953 *   -213470 *      -212 *      -208 *      -205 *   -346560 *    500033 *     50242 *      -180 *      -176 *      -173 *    -53153 *
*       17 * -15423280 *    328993 *   -200670 *      -212 *      -208 *      -205 *   -354752 *    503617 *     57666 *      -180 *      -176 *      -173 *    -55713 *
*       18 * -15340796 *    329505 *   -210910 *      -212 *      -208 *      -205 *   -359616 *    496449 *     47938 *      -180 *      -176 *      -173 *    -65697 *
*       19 * -15259312 *    338209 *   -203998 *      -212 *      -208 *      -205 *   -347328 *    491841 *     50498 *      -180 *      -176 *      -173 *    -60833 *
*       20 * -15175728 *    334625 *   -200926 *      -212 *      -208 *      -205 *   -353984 *    497217 *     46402 *      -180 *      -176 *      -173 *    -56737 *
*       21 * -15092707 *    335905 *   -193502 *      -212 *      -208 *      -205 *   -354240 *    488513 *     60226 *      -180 *      -176 *      -173 *    -60065 *
*       22 * -15008176 *    331297 *   -208350 *      -212 *      -208 *      -205 *   -361408 *    500033 *     57922 *      -180 *      -176 *      -173 *    -67745 *
*       23 * -14924899 *    332321 *   -209886 *      -212 *      -208 *      -205 *   -345024 *    494657 *     52034 *      -180 *      -176 *      -173 *    -70817 *
```

Some of the empty channels