Status of False Asymmetry Measurement



1.The Set-Up



The Latch Circuit





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¬ gated 60Hz to pre-amp



2.The Algorithm

60 60Hz Gated Signal connected to pre-amp ch-1



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).

 $A_1 = (V_1 - V_2)/20$ $A_2 = (V_3 - V_4)/20$ etc.

Asymmetry, $A = (A_1 + A_2 + A_3 + \dots + A_N)/N$

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. $\Delta A = \sigma / \sqrt{N}$

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.

Testing the script with known asymmetry data:





60Hz Square signal of 4.25V amplitude is connected to pre-amp via 7M Ohm resistor.

So, the output voltage from pre-amp = -4.25 Volt/7M Ohm x 2 M Ohm = -1.21 Volt Expected Asymmetry = $(S_{even} - S_{odd}) / 20$ Volt = -0.0607 From the data analysis using the script, Asymmetry =-0.0616±2.7x10⁻⁷



ADC Count

ADC Count

10

Histogram for individual Asymmetry



3.The Result (from test run)

Test results for 5 minutes of data using ACQ2006
 No Coil used, just bare pre-amp + ADC measurement
 No optical isolator connected.

Gated 60Hz TTL signal fed to pre-amp for reference.

No. of entries considered	No. of T_0 considered	False Asymmtery	Uncertainty
6397300	18278	4.01E-10	2.44E-09
6322400	18064	-8.22E-10	2.34E-09
6275500	17930	-3.45E-09	2.20E-09
6396600	18276	-3.63E-09	2.28E-09
6325200	18072	9.24E-11	2.46E-09
Ave=-1.5E-9±1.1.1E-9			

Next : Thinking of possible scopes for further improvement-

Improve gated 60Hz reference signal using

combination of R and C.

- □ Is it possible NOT to use any reference 60Hz at all ?
- Check how consistent the number of entries/pulse
- over any certain time?
- If the number is very consistent then do the analysis
- without any 60Hz reference signal.
- Improving the grounding and shielding

Gated 60Hz signal for reference using RC



Pre-amp pick up to be analyzed for asymmetry



ACQ164 running at 50KHz, each run has ~ 10° of entries

83<mark>3.10769</mark> 83<mark>2.9761</mark> 83<mark>3.10699</mark> 83<mark>3.6833 833.2005 833.2510</mark>

Fake 60Hz TTL as T0: • Average number of entries per T0

833.02700 833.02701 833.02701 833.02701 833.02666 833.02666 833.02701

Real T0 from accelerator: Average number of entries per T0