FADC Asymmetry Measurement Testing

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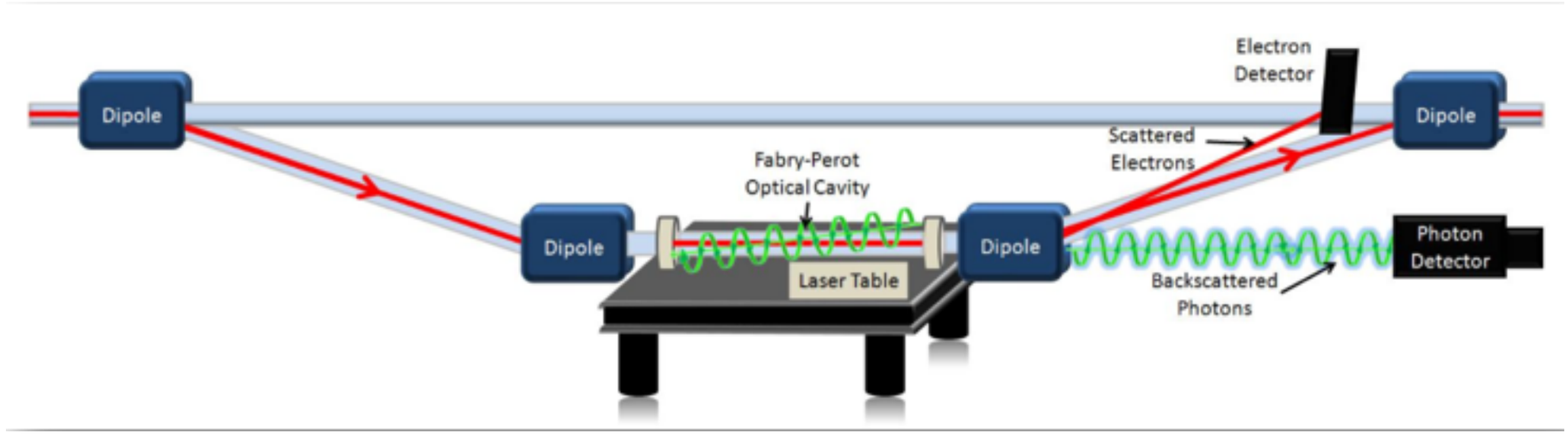
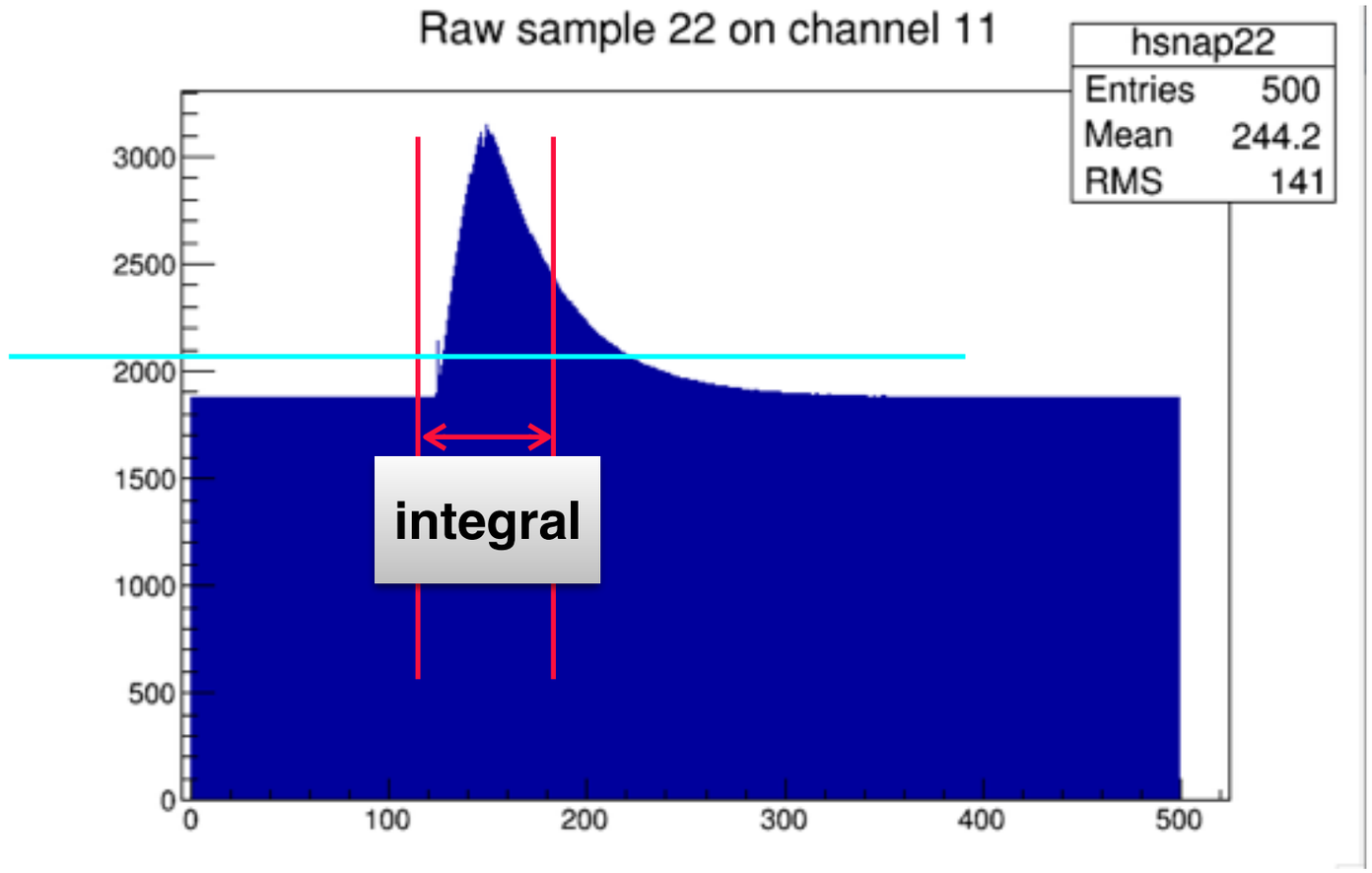
Compton asymmetry

$$A_{\exp} = \frac{N^+ - N^-}{N^+ + N^-} = P_e A_{theory}$$

$$P_e = \frac{A_{\exp}}{A_{theory}}$$

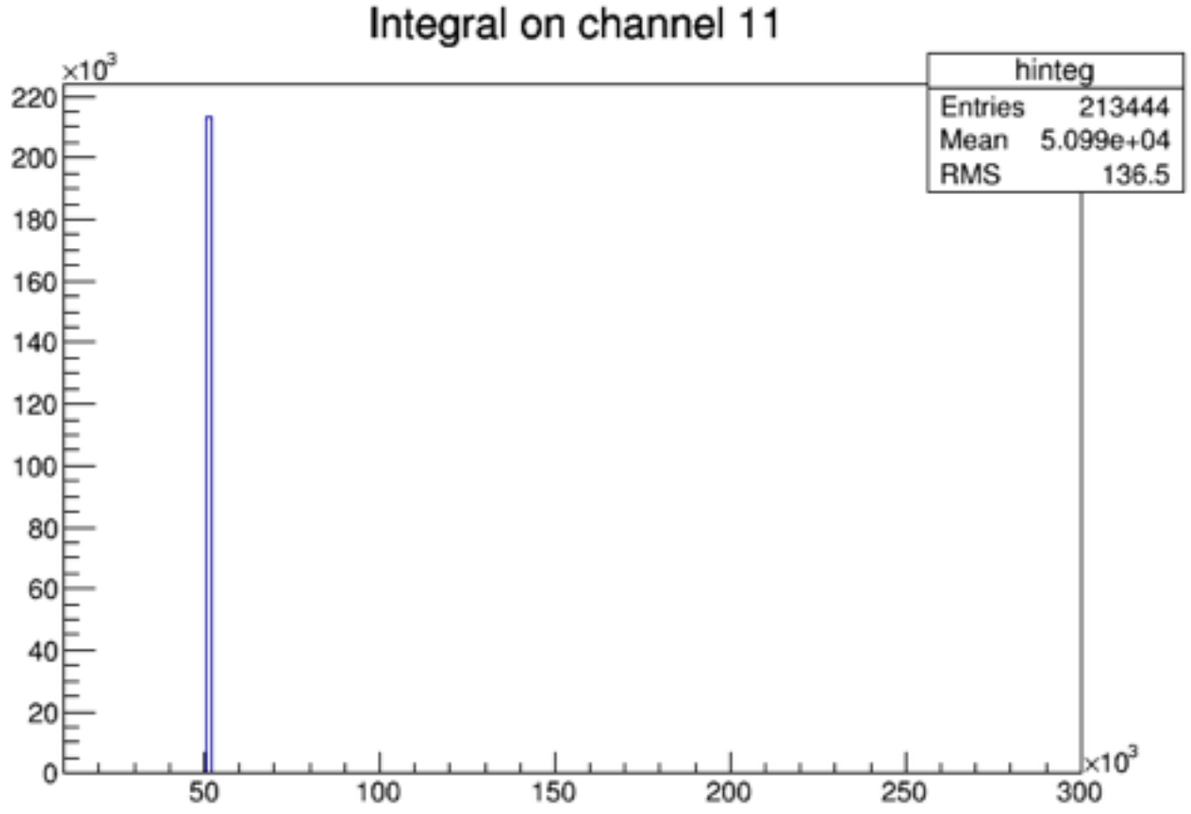


FADC integral mode



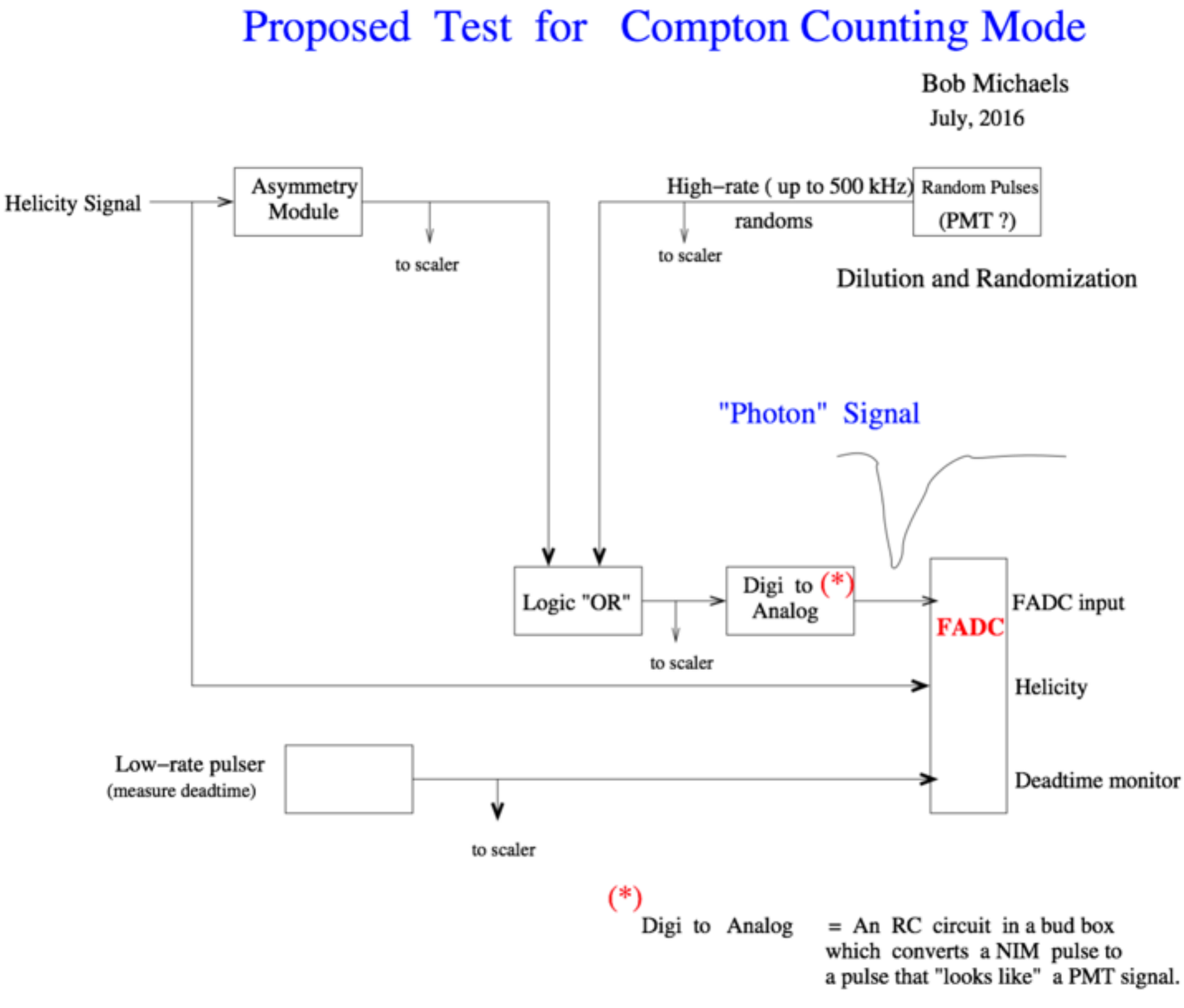
Pulse integral mode

- integral number
- time begin to integrate

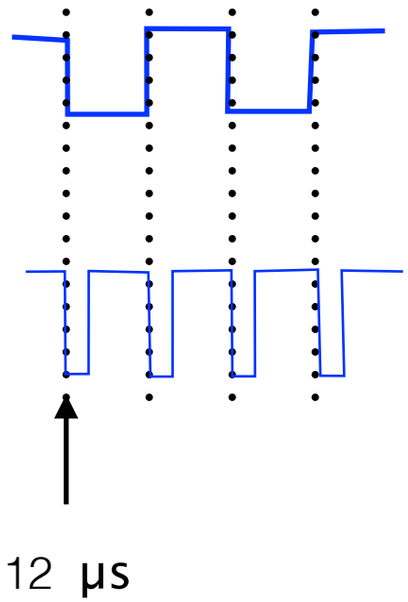


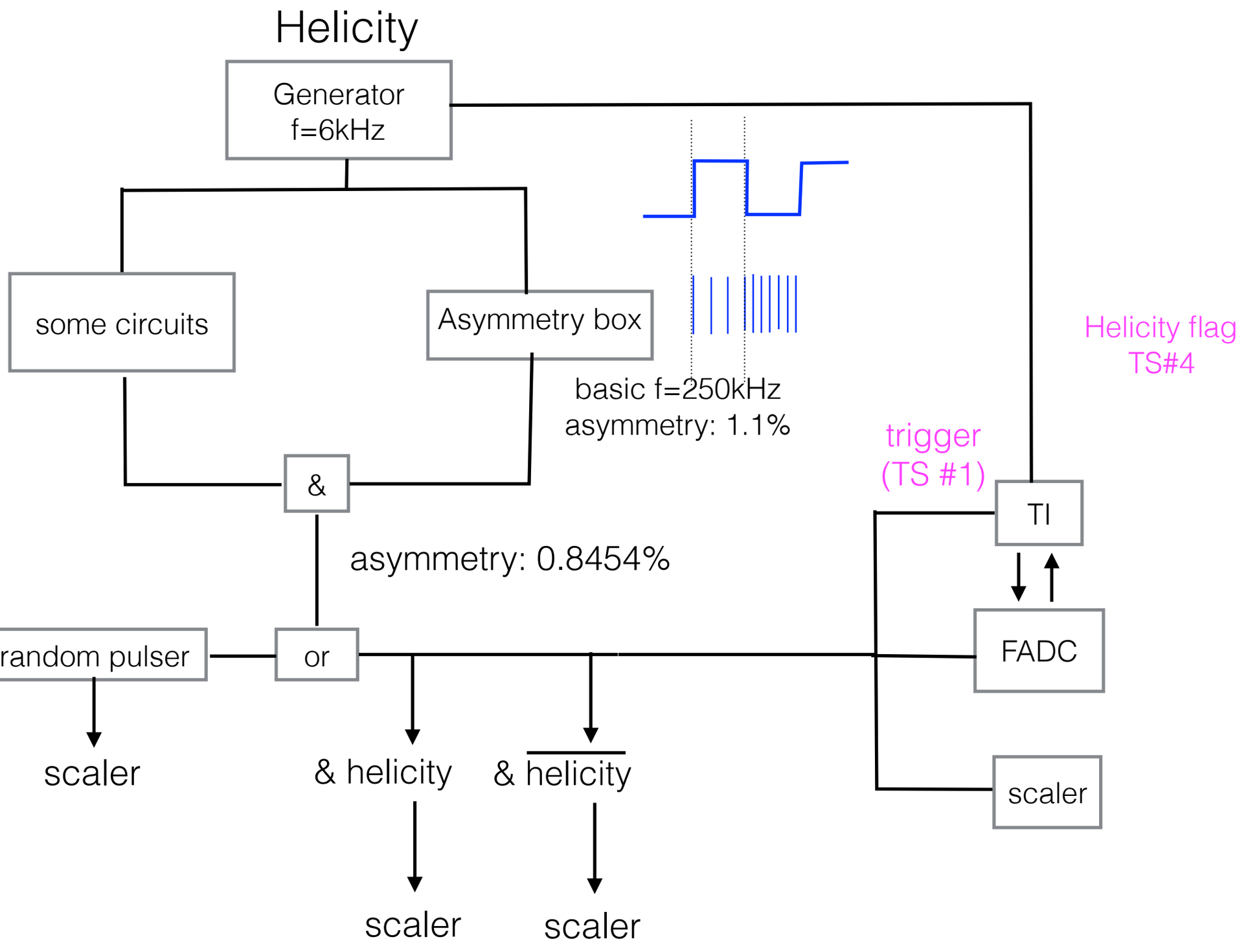
Purpose:

- measure DAQ dead time
- measure an asymmetry by FADC



Circuits

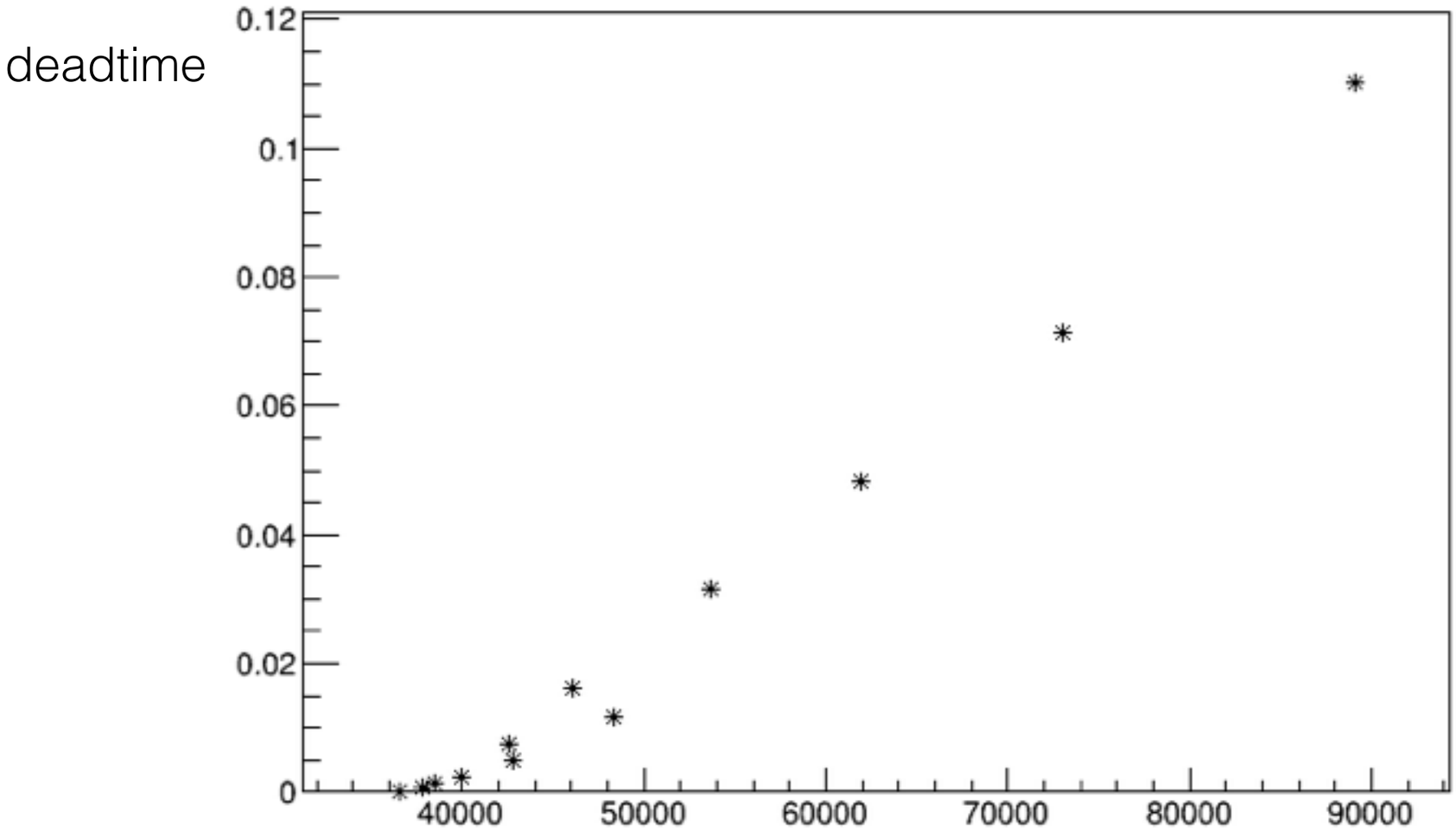




- dead time = 1- FADC counts/scaler counts
- calculate asymmetry from scaler and FADC respectively
- change the frequency of random pulser

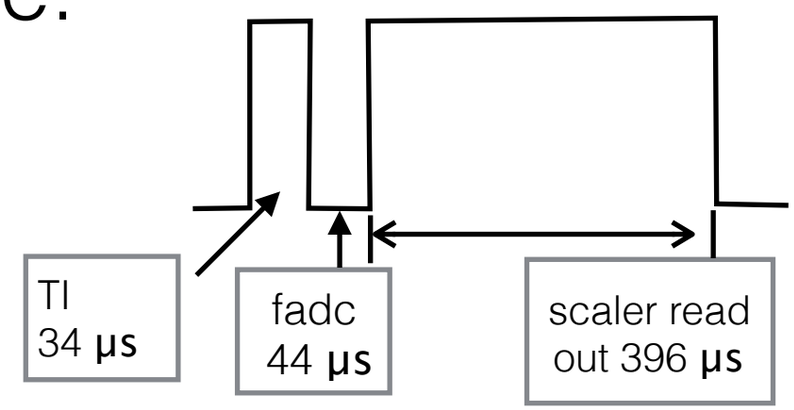
DAQ dead time

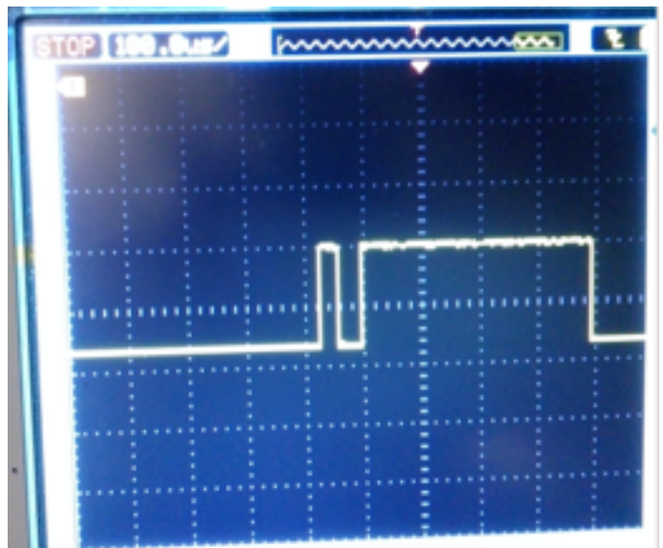
DAQ deadtime = 1-total counts from FADC/counts from scaler



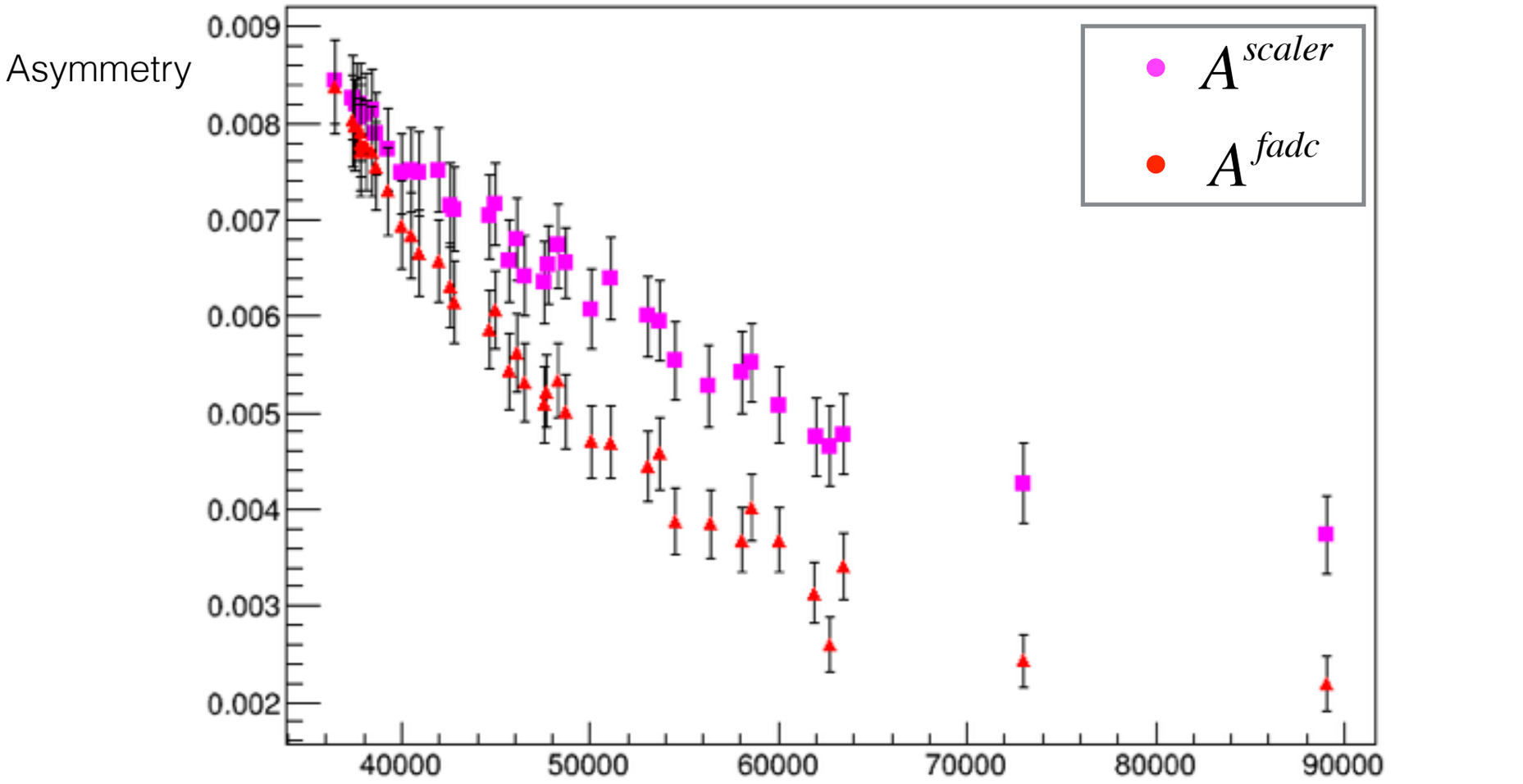
DAQ deadtime vs. frequency

scope:





Asymmetry vs. frequency



Asymmetry vs. frequency

$$A = \frac{N^+ - N^-}{N^+ + N^-} = \frac{(N^+_{con} + N^+_{rdm}) - (N^-_{con} + N^-_{rdm})}{(N^+_{con} + N^+_{rdm}) + (N^-_{con} + N^-_{rdm})}$$

$$A = \frac{N^+_{con} - N^-_{con}}{N^+_{con} + N^-_{con}} \times (1 - \frac{N_{rdm}}{N_{total}})$$

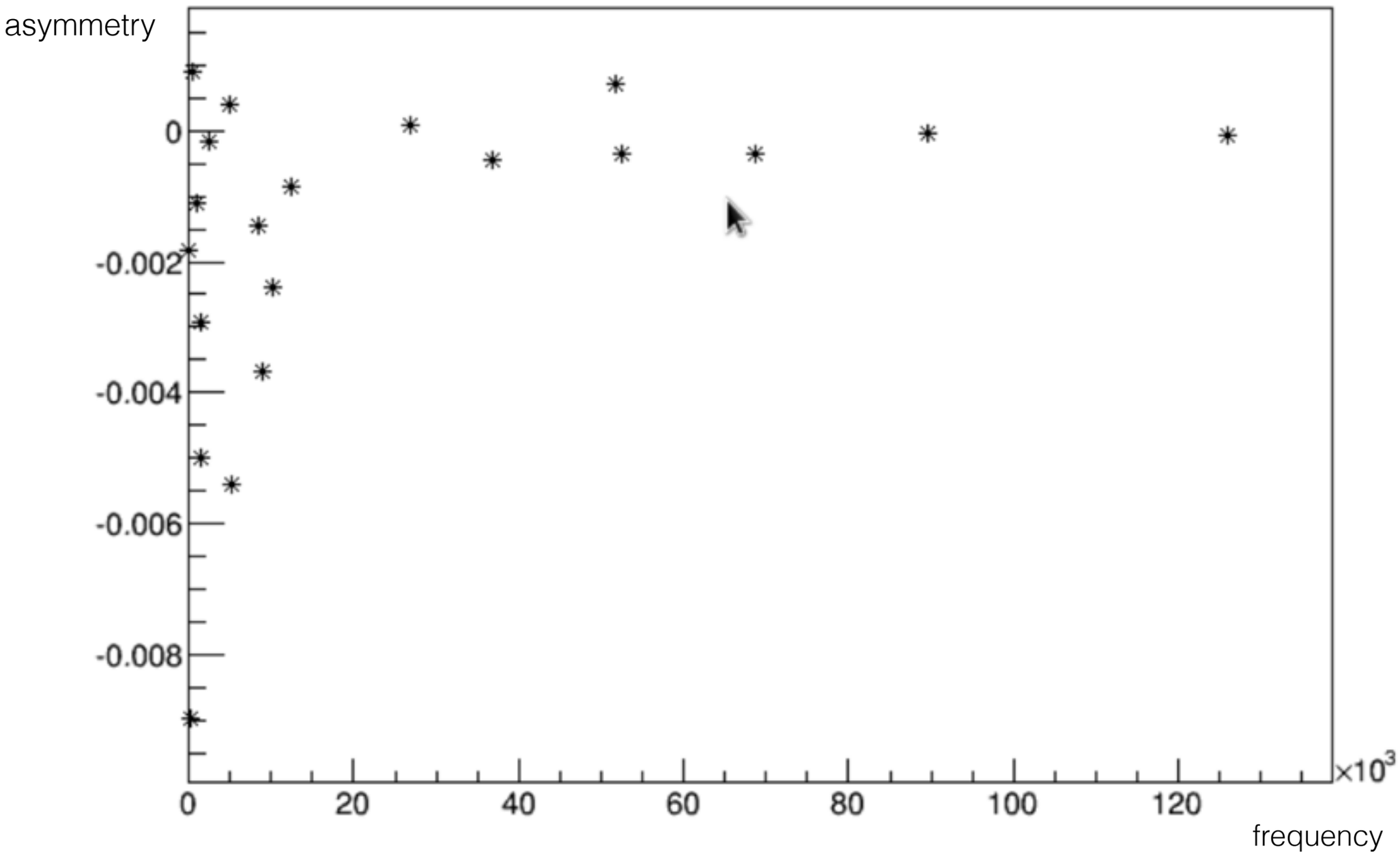
$$A = A_{con} \times (1 - \frac{N_{rdm}}{N_{total}})$$

$$N^+_{rdm} = N^-_{rdm}$$

$$N_{rdm} = N^+_{rdm} + N^-_{rdm}$$

$$N_{total} = N^+_{con} + N^-_{con} + N_{rdm}$$

Random pulser asymmetry vs. frequency

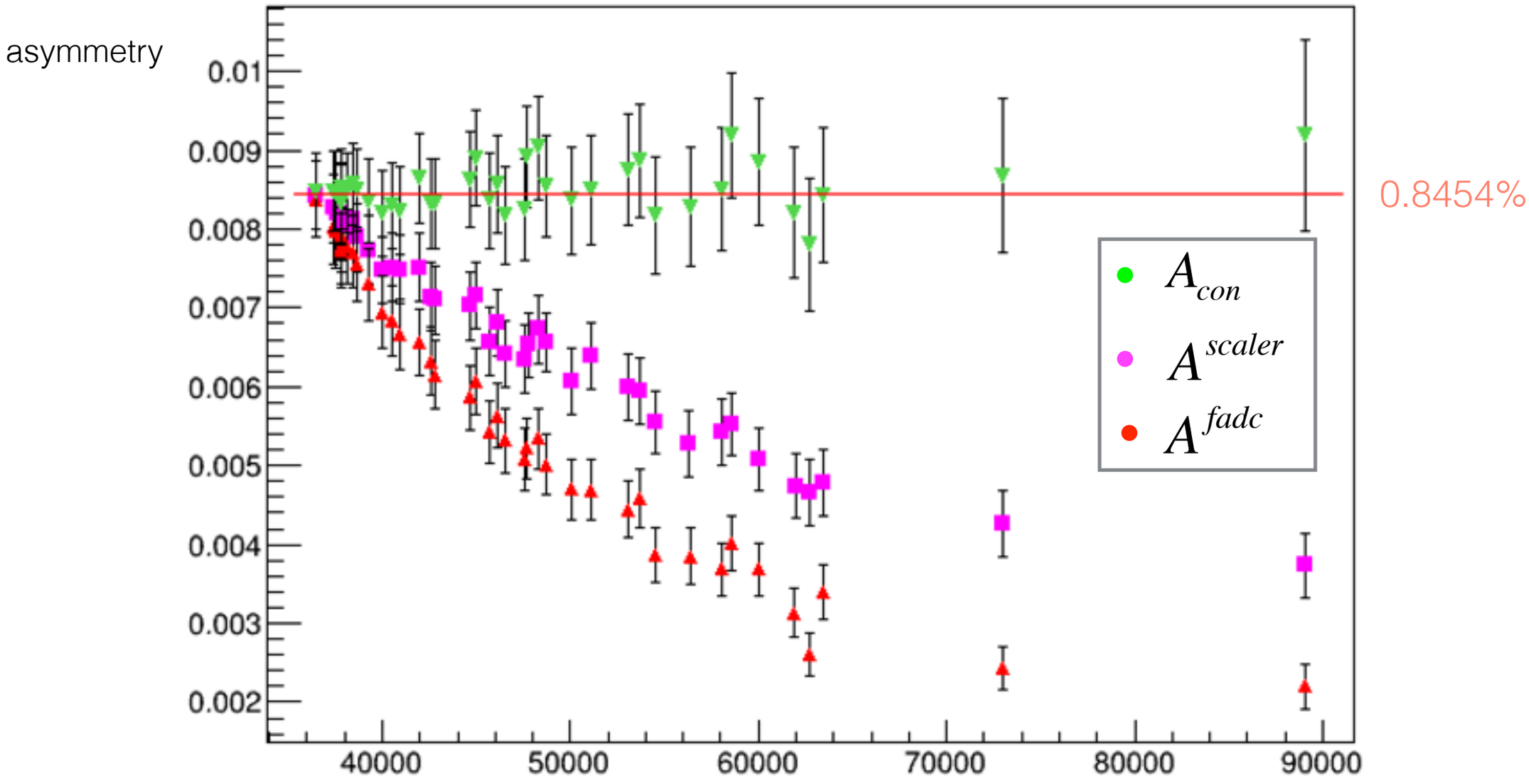


Random pulser asymmetry vs. frequency

Random pulser has no asymmetry

Correction to FADC asymmetry

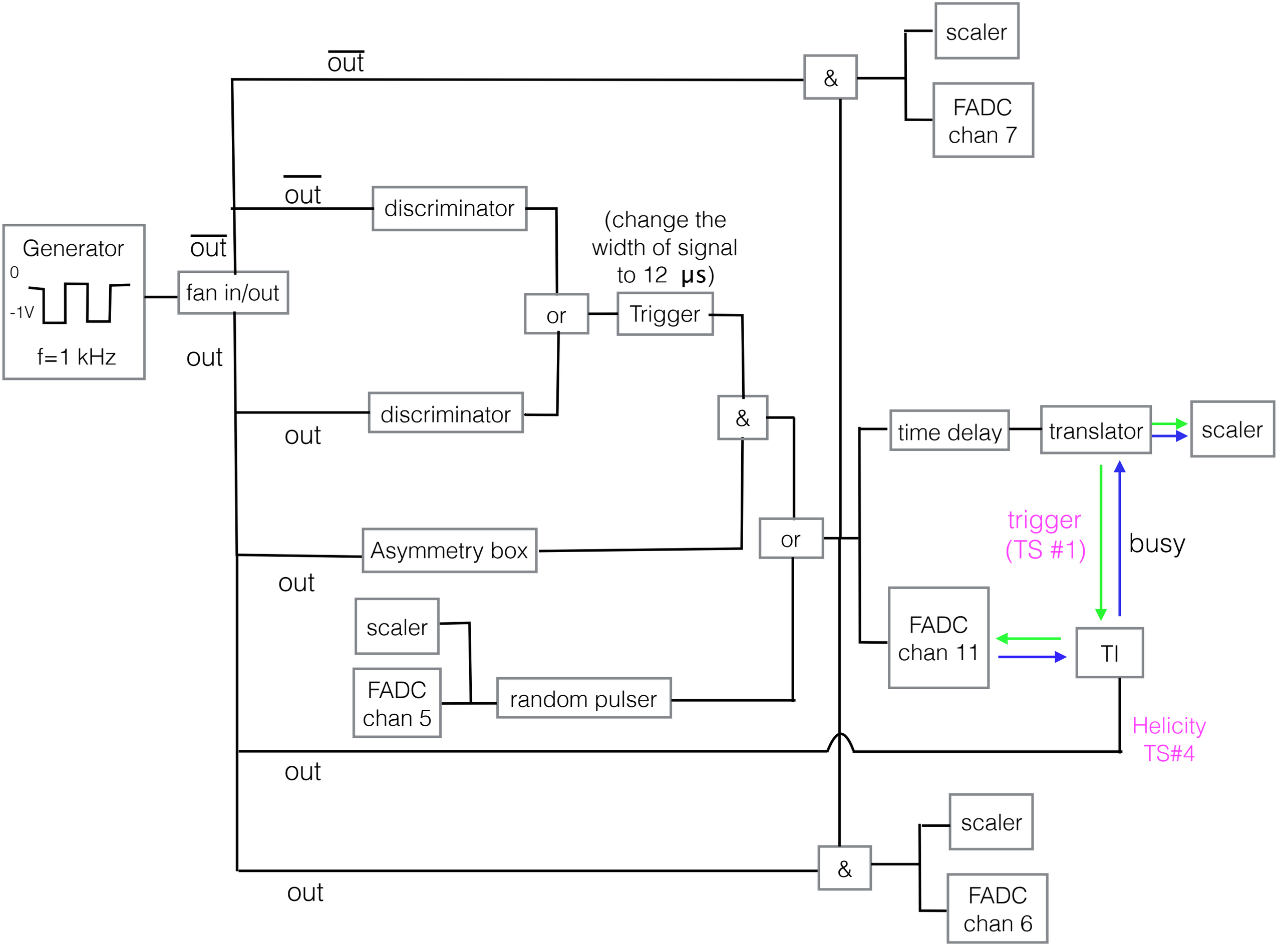
- dead time correction to A_{FADC} , N_{rdm}, N_{total} : using N^{+}_{scaler},N^{-}_{scaler},N^{scaler}_{rdm} ,N^{scaler}_{total}
- dilution: $$A_{con} = \frac{A^{corr}_{FADC}}{1 - \frac{N^{scaler}_{rdm}}{N^{scaler}_{total}}}$$



Asymmetry vs. frequency

Conclusion

- Dead time measurement of Compton DAQ was implemented;
- Setup needs to be improved to reduce the dead time
- Scaler and FADC could be used to measure asymmetry
- After dead time correction and dilution, we can get the expected asymmetry from FADC data


Generator
0
-1V
f=1 kHz
fan in/out
out
out
out
out
out
out
discriminator
discriminator
(change the width of signal to 12 μs)
or
Trigger
&
or
&
scaler
FADC chan 7
time delay
translator
scaler
trigger (TS #1)
busy
FADC chan 11
TI
Helicity TS#4
Asymmetry box
scaler
FADC chan 5
random pulser
scaler
FADC chan 6