

# Compton DAQ

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PREX/CREX Meeting

Dec 2014

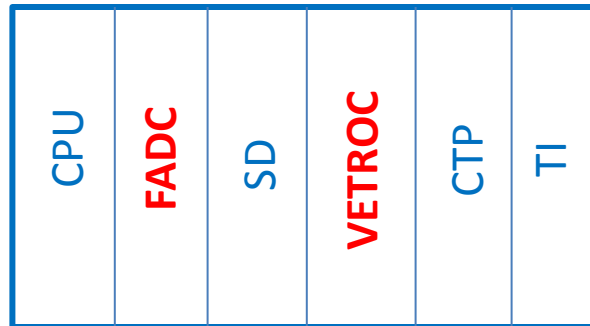
# Outline

- Upgrade plan
  - two modes: counting and integrating
  - using pipelining FADCs and VETROC
- VETROC specification
- Tests of Counting Mode upgrade
- Status of Integrating Mode (CMU DAQ)
- Plans

# Compton DAQ Upgrade Plan \*

**Crate 1:** VXS-based **Pipelining** CODA3 DAQ for high-rate counting

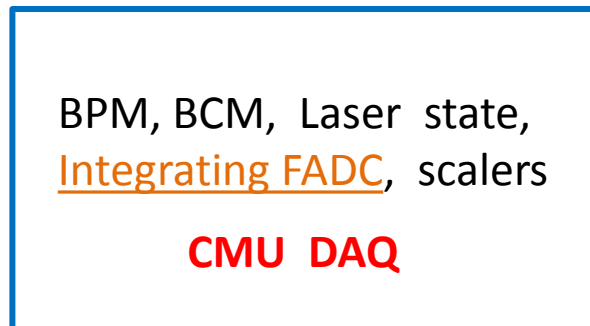
FADC for Photon Detector



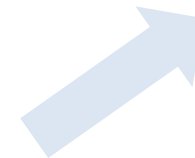
VETROC \*\* for Electron Detector

Prototype VETROC is being developed, final product 1 yr after the prototype.

**Crate 2:** Slow (helicity-based) DAQ



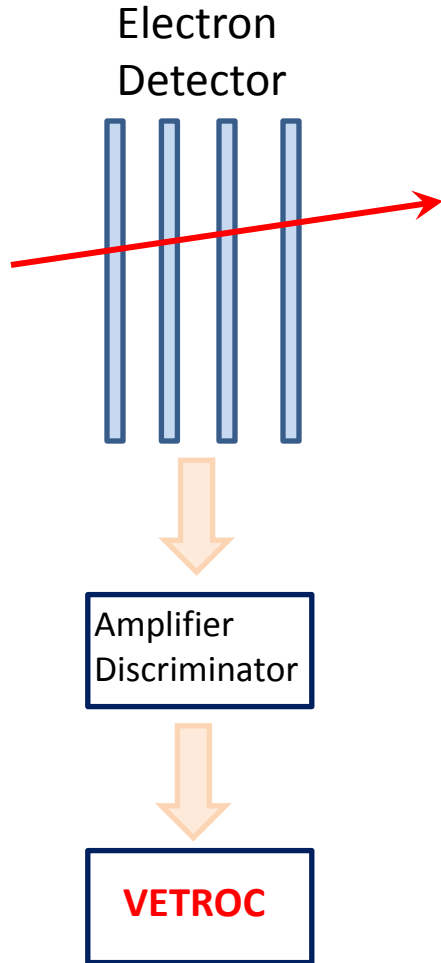
Event Builder



[hallaweb.jlab.org/equipment/daq/compton\\_coda3.pdf](http://hallaweb.jlab.org/equipment/daq/compton_coda3.pdf) \*

[/compton\\_vetroc.pdf](http://hallaweb.jlab.org/equipment/daq/compton_vetroc.pdf) \*\*

# VETROC specification

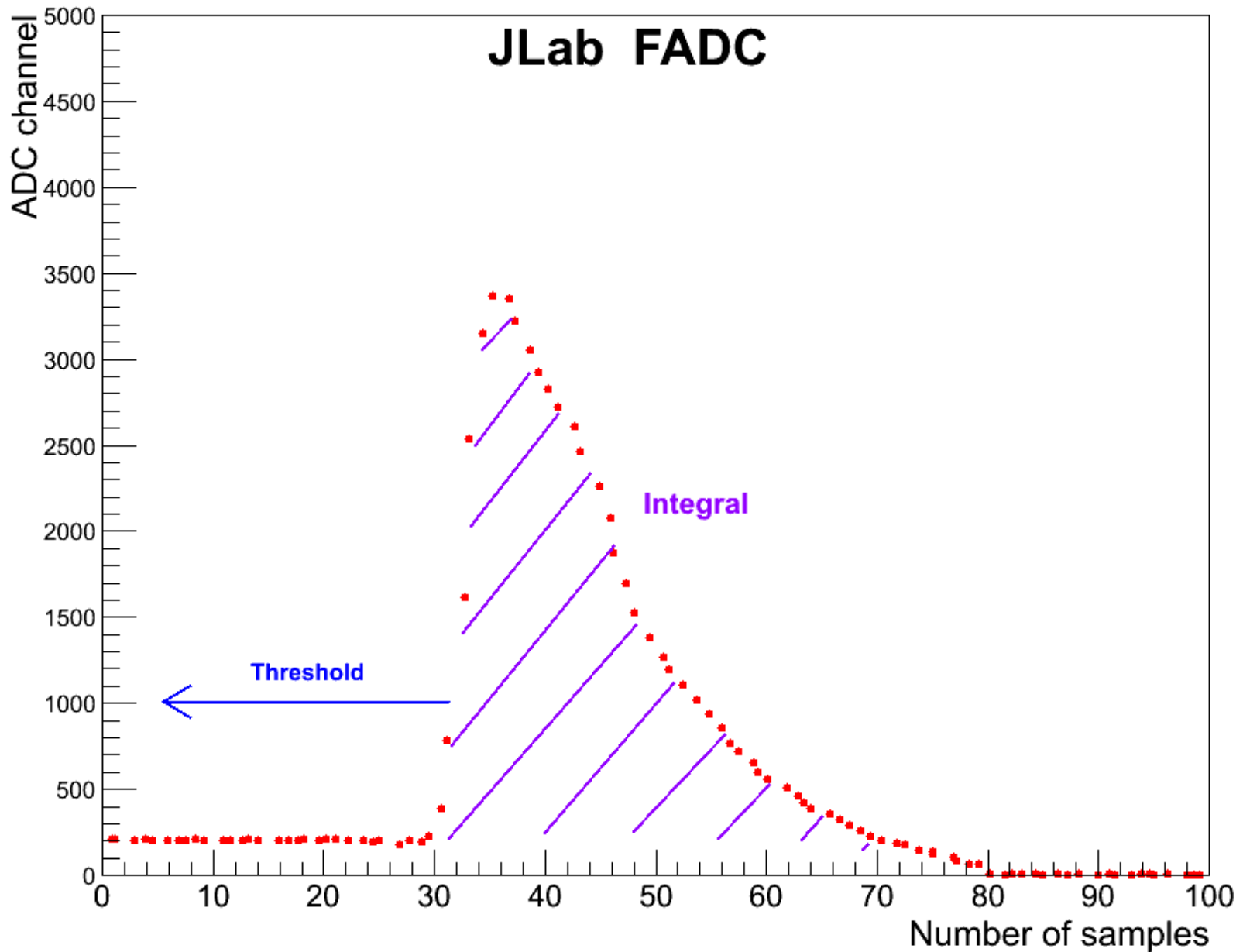


**Purpose:** Generate a trigger based on hits from a track. Read out the strips pertaining to the track at high rate ( $< 1$  MHz)

- JLab-built Pipelining VXS Printed Circuit Board
- Input: discriminator outputs from detector
- Features: trigger logic, scalers, zero suppression, coincidence with photon trigger
- Prototype being developed, final board 1 year after

[hallaweb.jlab.org/equipment/daq/compton\\_vetroc.pdf](http://hallaweb.jlab.org/equipment/daq/compton_vetroc.pdf)

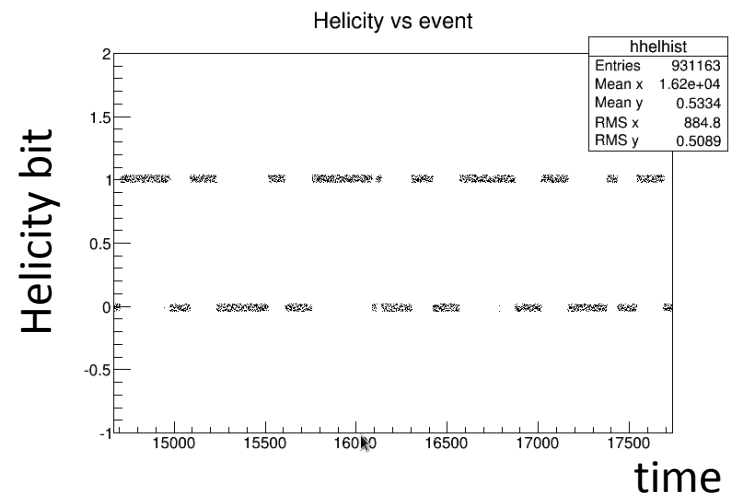
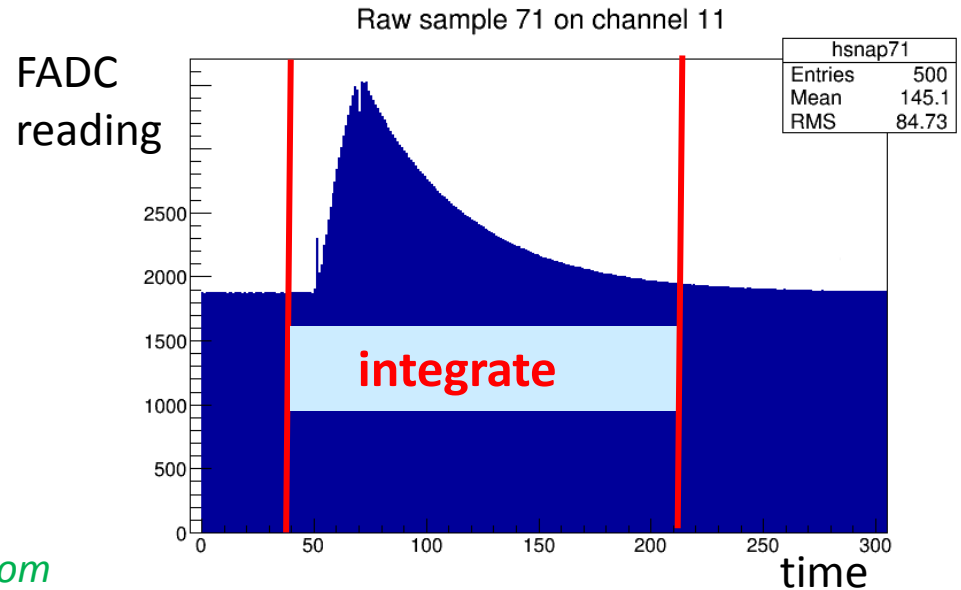
# Counting Mode FADC-based DAQ (to replace Saclay DAQ)



- **FADC** integrates over a threshold
- Extract a helicity-correlated asymmetry of  $\sim 3\%$

*For tests, we compare asymmetries to those from*

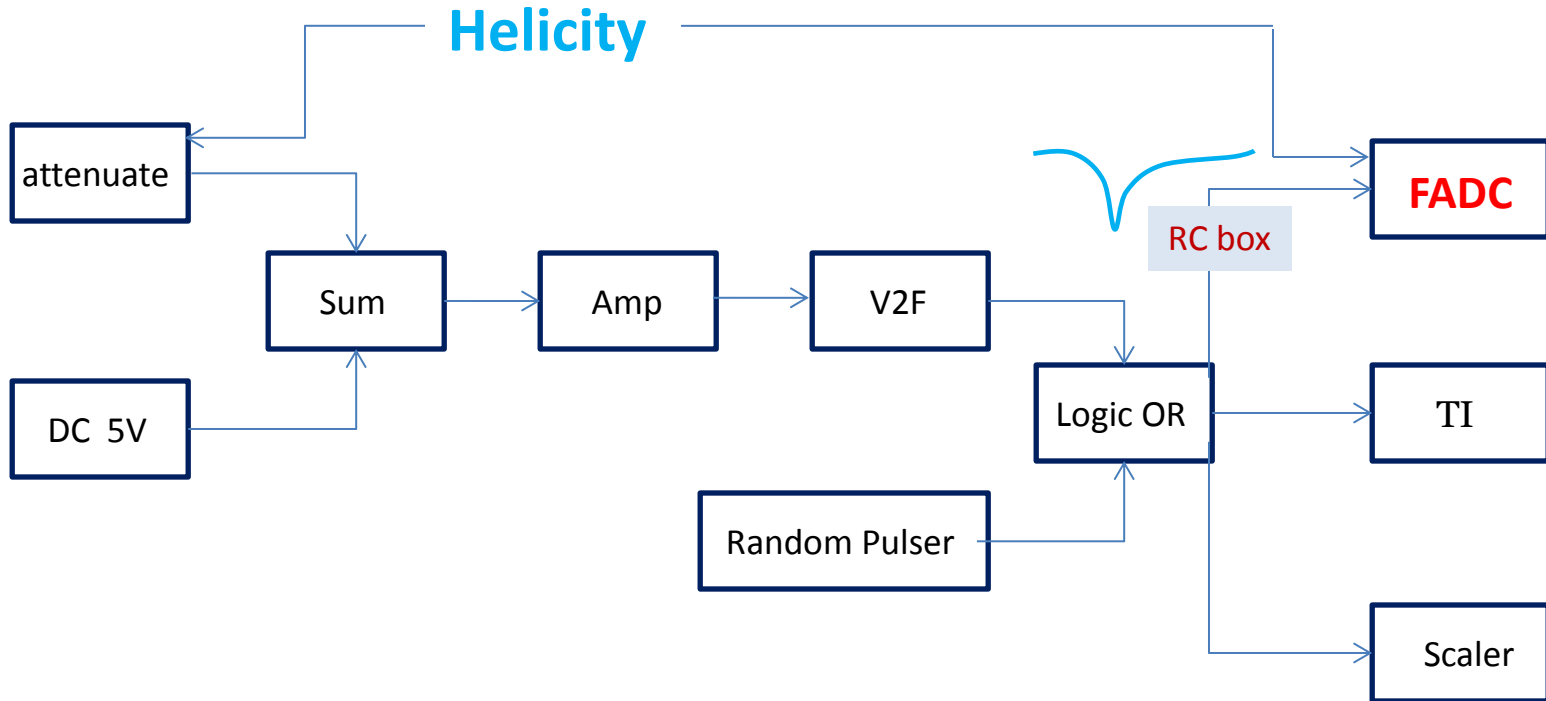
- Scaler using DC helicity levels
- Oscilloscope: a rough check



- **Deadtime** :
  - accuracy needed  $\ll 1\%$
  - using Buffering & multiblock modes  
eliminates DT if frequency  $f < f_{critical}$
  - Observe:  $f_{critical} = 300 \text{ kHz}$  where DT skyrockets
  - 277 kHz DT = zero
  - 410 kHz DT = 20 %
  - $\sim 600 \text{ kHz}$  DT > 30 % and very hard to measure

These are mostly  
random rates

# Tests of Counting-Mode **FADC** DAQ



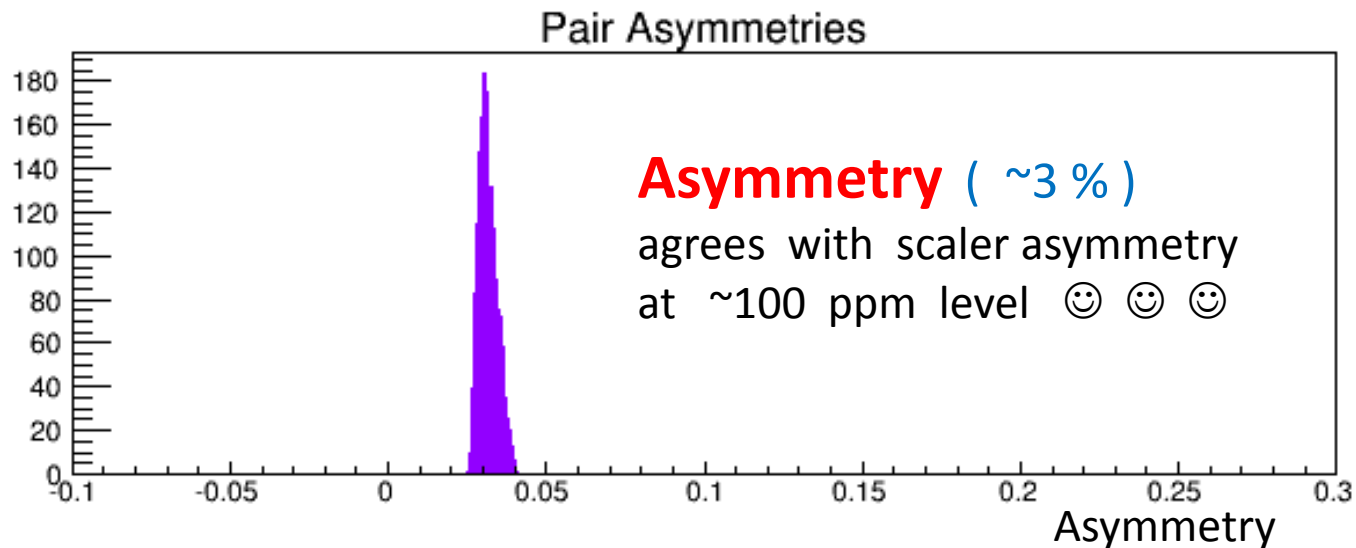
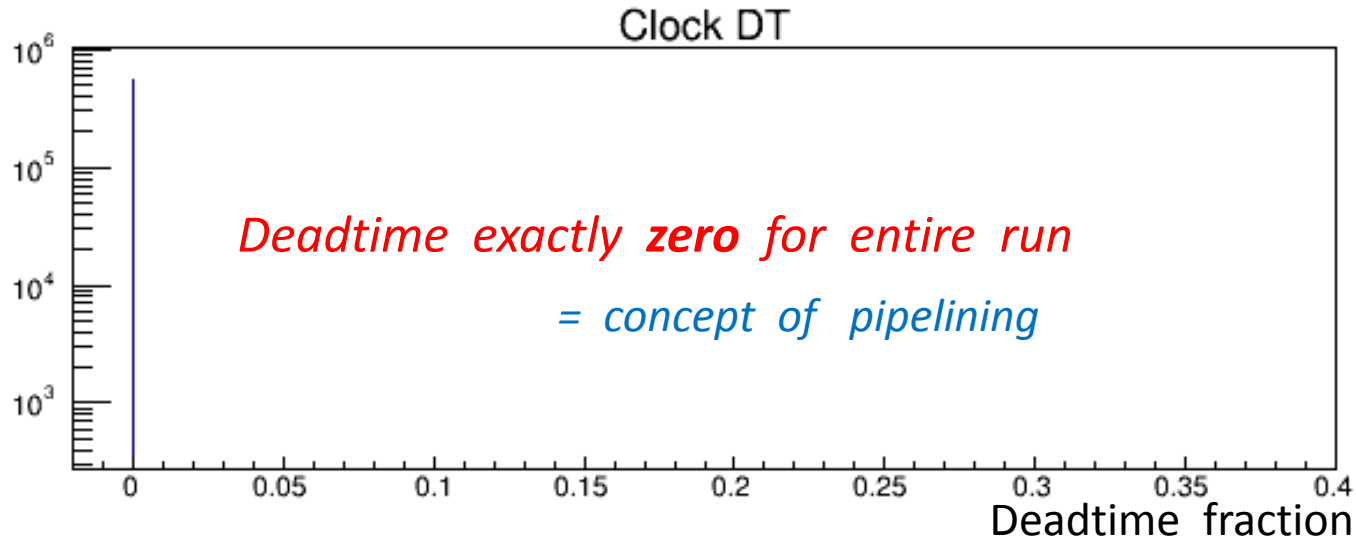
Test Procedure : Trigger with a high-random rate **R**  
which has a helicity – correlated asymmetry **A**

$$0.1\% < A < 5\%$$
$$0 < R < 3 \text{ MHz}$$

[https://hallaweb.jlab.org/wiki/index.php/Compton#Compton\\_Meetings](https://hallaweb.jlab.org/wiki/index.php/Compton#Compton_Meetings)  
See also the 2013 Hall A Annual Report



Run #1590    **Rate = 277 kHz**    **zero deadtime**  
Helicity flip 60 Hz

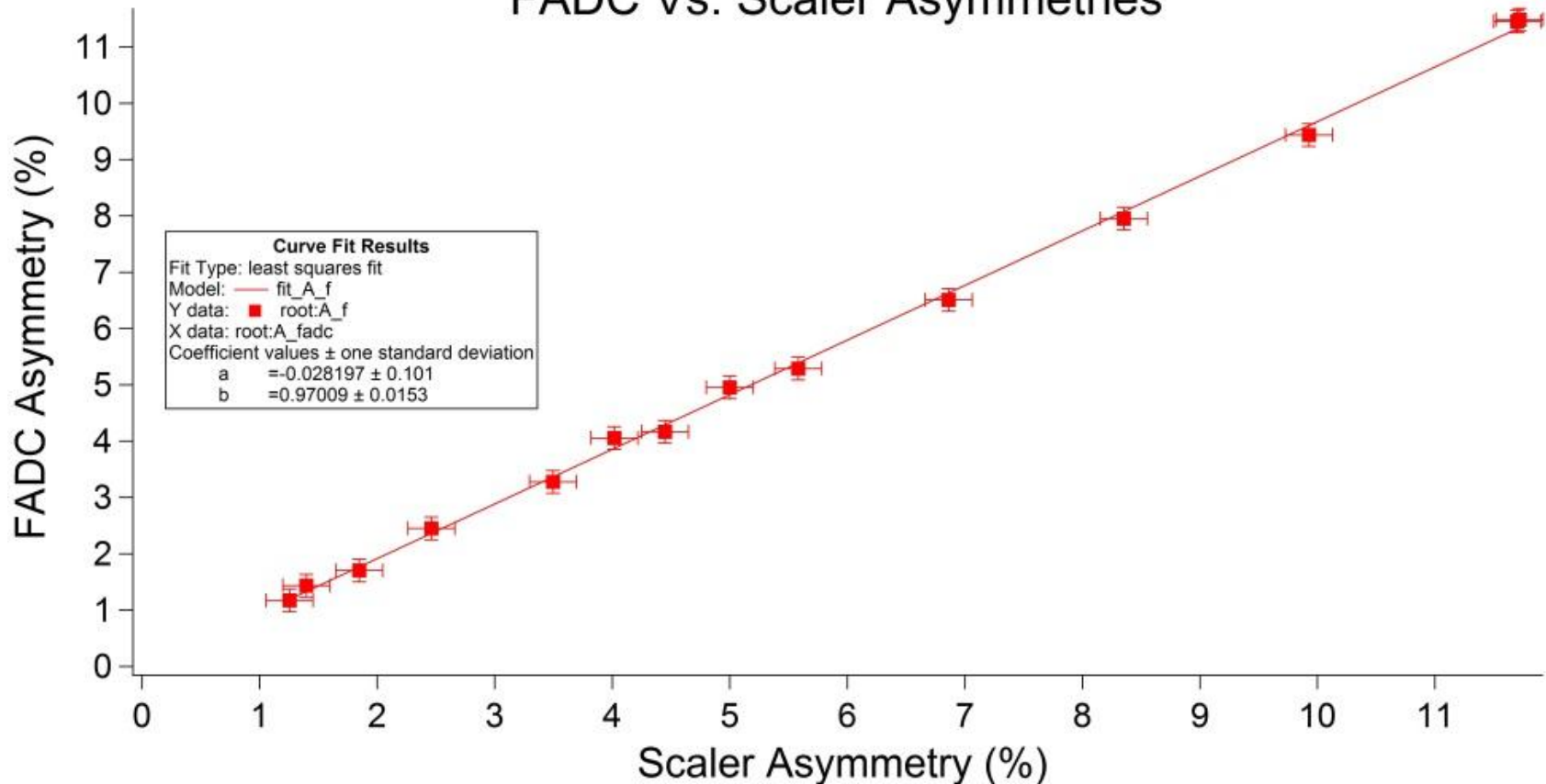


# Asymmetries for $f < f_{\text{critical}}$

$f < 300$  kHz

- “deadtime free” pipelining regime.
- Results from Joshua Hill, W&M summer student

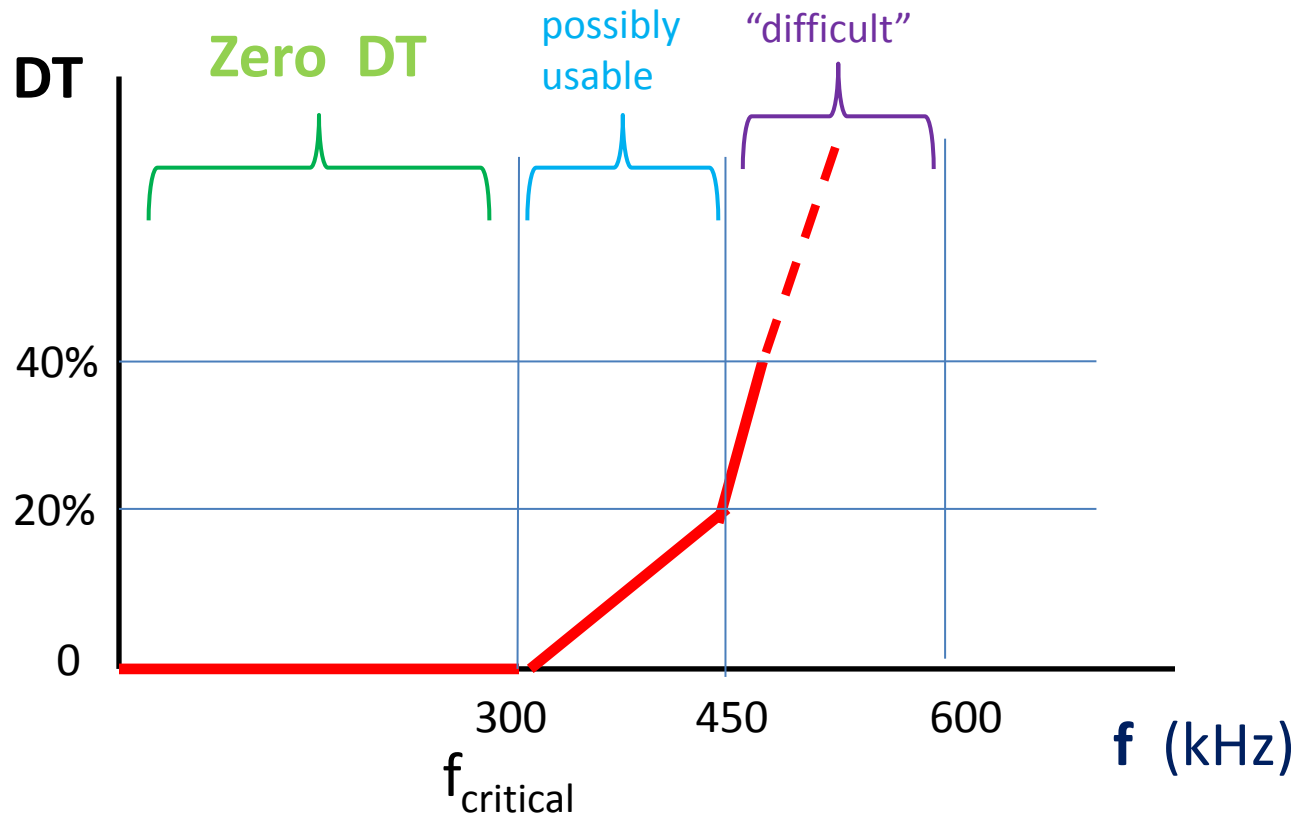
## FADC Vs. Scaler Asymmetries



# Exploring the regime $f > f_{\text{critical}}$

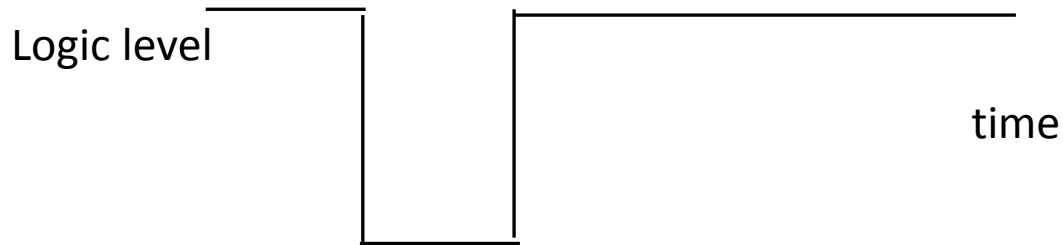
Deadtime vs readout rate.

*Sorry I don't have a proper data plot*

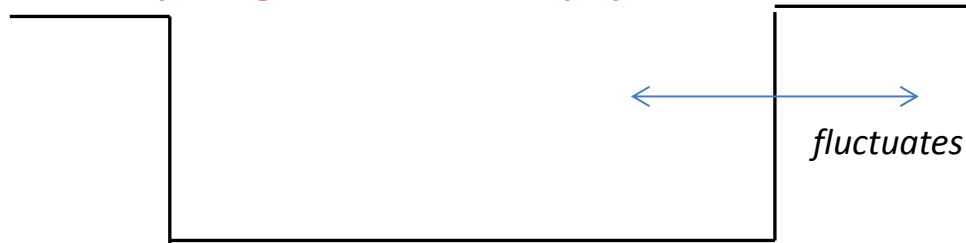




## Normal busy signal (seen on scope)



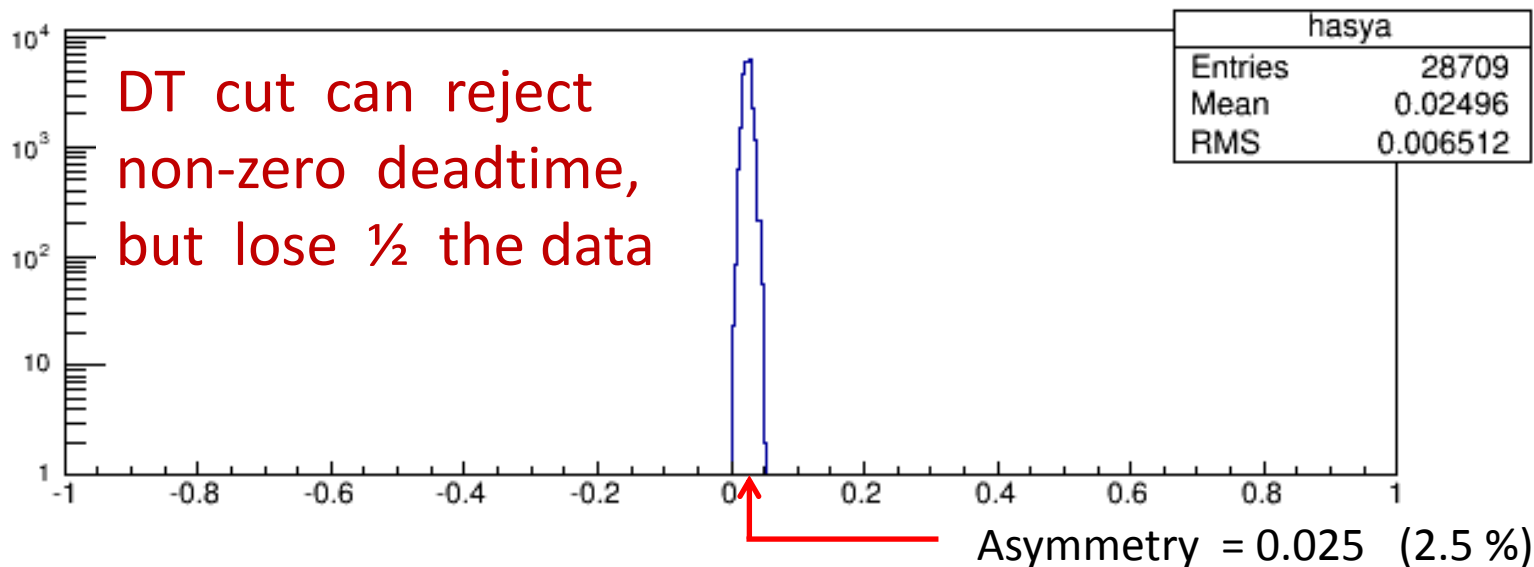
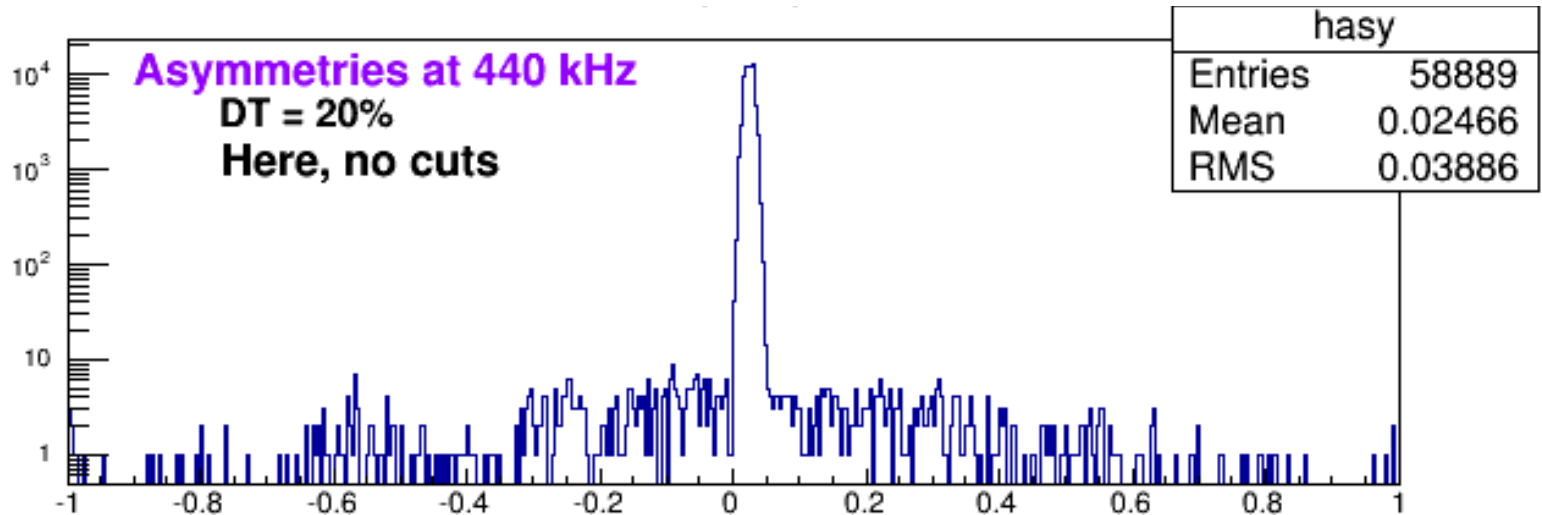
## Busy signal when pipeline overfills



**Deadtime cut** in each helicity window  
on triple coincidence of

*Busy .and. 3 MHz pulse .and. Helicity signal*

# How DT cuts clean the data



# Compton DAQ -- current status and plans

- **Revive CMU Integrating DAQ** -- reversing entropy
  - Spring 2014: successfully ported to CODA 2.6 on a new PC.
  - Not fully working -- I plan to work on it Jan 5 – 31, 2015.
  - Dave Gaskell wants to use it for Spring DVCS run.
- **Awaiting the VETROC prototype**
  - we have a test stand ready for testing it
- **Need to dismantle the old (1998) counting Saclay DAQ**
  - Replace it with counting FADC DAQ – summer 2015 ?