Parity Violating Deep Inelastic Scattering Experiment: E08-011

"DAQ Status Update"

Ramesh Subedi (UVa)
Xiaoyan Deng (UVa), Diancheng Wang (UVa)

For
Spokespersons: Robert Michaels (JLab), Paul Reimer (ANL), Xiaochao Zheng (UVa)

Introduction

- Focused on understanding deadtime, pileup, and asymmetry of the pvdis-trigger.
- Deadtime is the minimum time interval which must separate two successive events so that these successive events can be recorded as distinct events.
- The events identified as being characteristic of two or more overlapping events give pileup. The pileup results in a data loss and spectrum distortion.
- Its hard to separate pileup from deadtime. The deadtime has a pileup built-in.

Deadtime

- When two or more events occur in a time interval shorter than the gate-width (of the discriminator), they are seen as a single event. The collection of the ignored events make an account of the deadtime-measure.
- Set two different gate widths using discriminators to produce different triggers of dissimilar deadtimes.
- Used TDCs to study pileup.

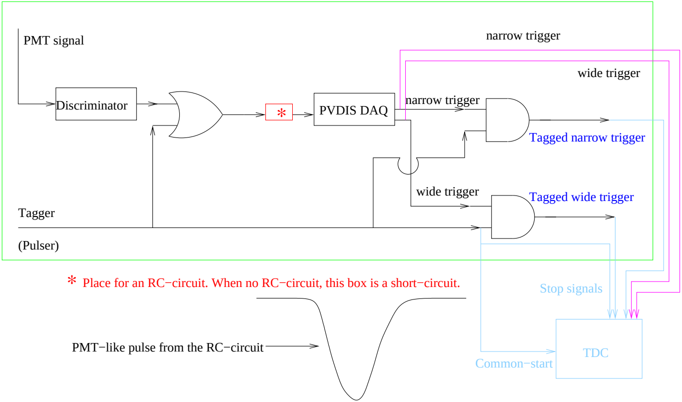
- Three different methods employed to measure deadtime.
  - Method I: Dead-zone observed in TDC-spectrum.
  - Method II: Using the input and output trigger rates.

$$Deadtime = [1 - \frac{output\ trigger\ rate}{input\ trigger\ rate}]$$

  - Method III: Using scaler-data and TDC-data.

$$Deadtime = [1 - \frac{(1 - pileup) * tagged\ trigger\ rate}{tagger\ rate}]$$

Diagram for Method I of deadtime measurement, and for pileup study in Method III.



Result of the deadtime measurement Method I, and pileup using a TDC.

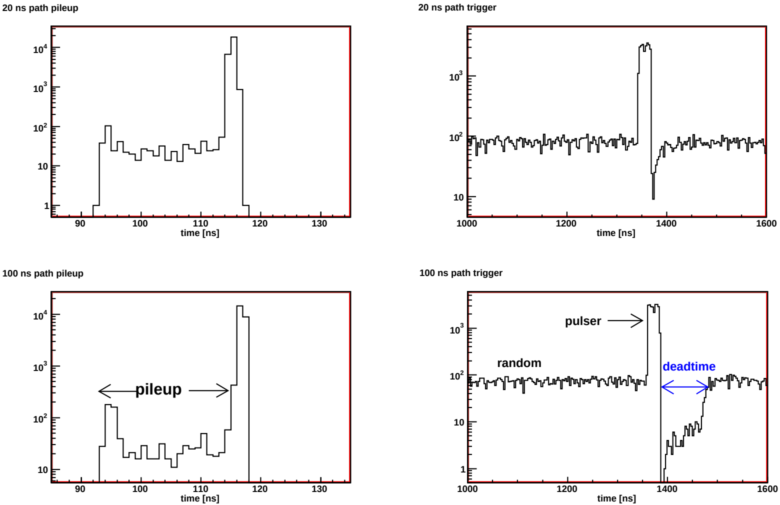
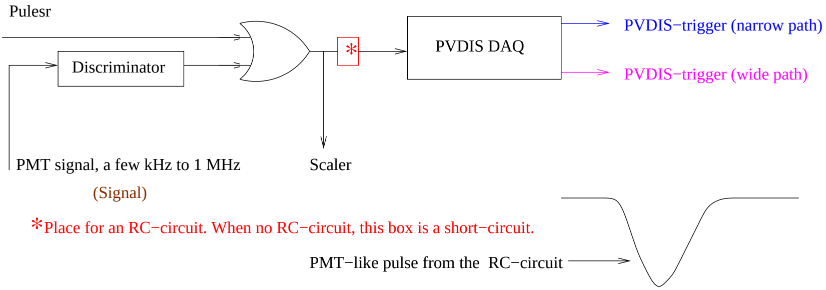


Diagram for the deadtime measurement Method II.



Result of the deadtime measurement Method II using input and output trigger rates.

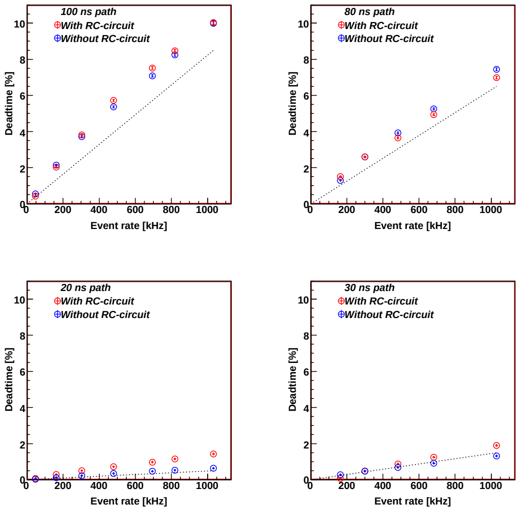
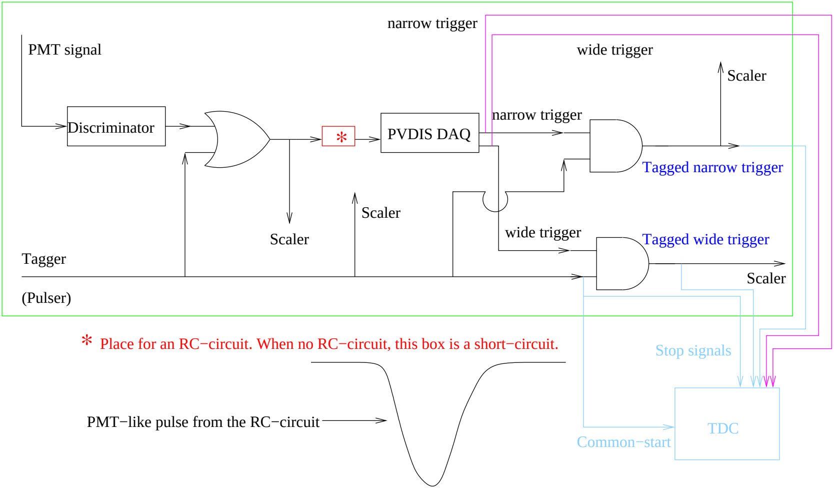
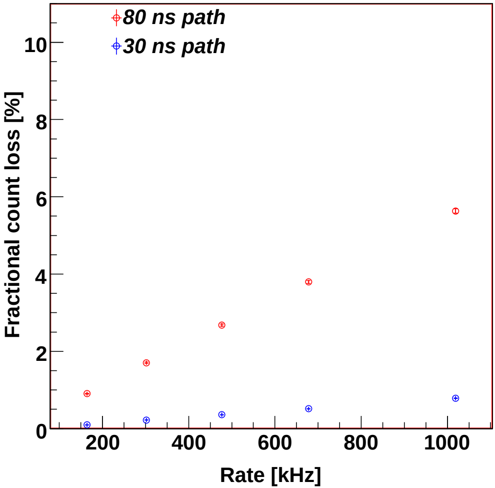


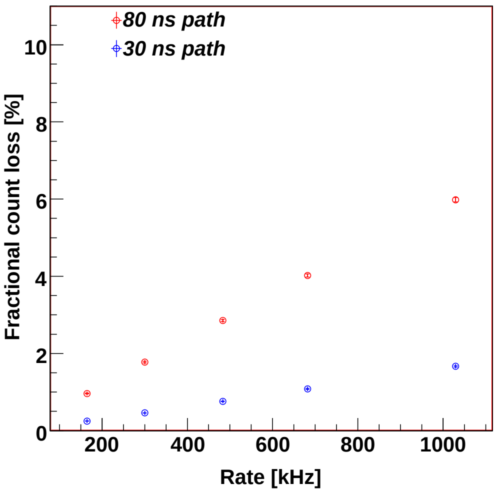
Diagram for the deadtime measurement Method III.



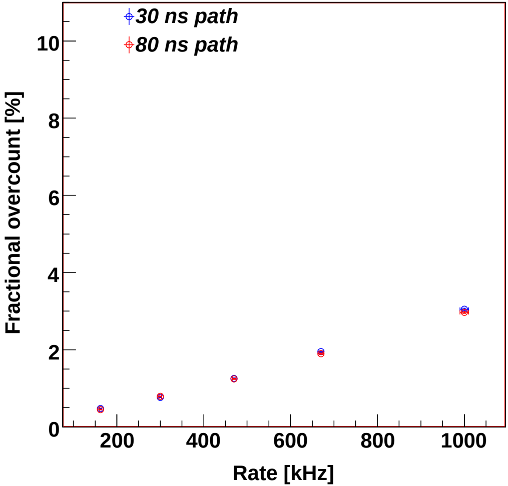
Count loss in scaler-data without RC-circuit.



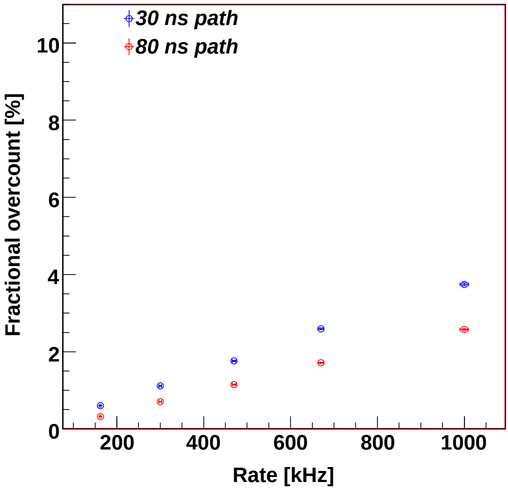
Count loss in scaler-data with RC-circuit.



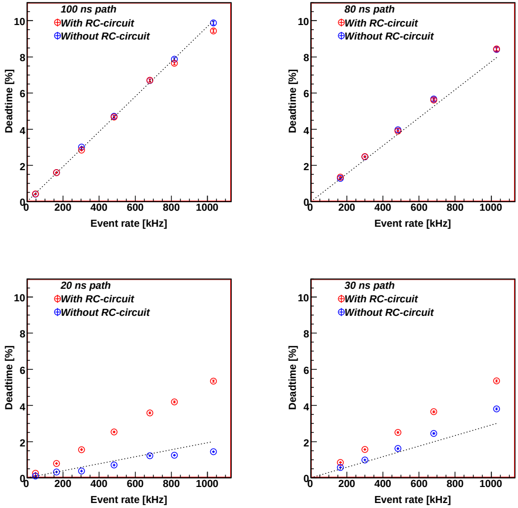
Determining fractional overcount using TDC, without RC-circuit.



Determining fractional overcount using TDC, with RC-circuit.



Deadtime using scaler and TDC.



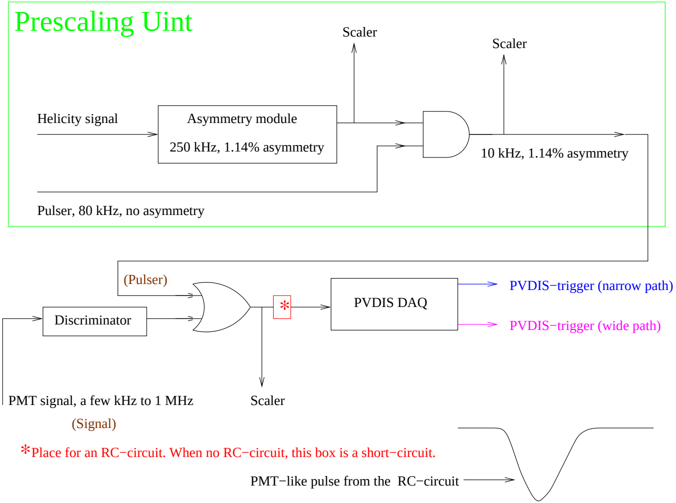
Asymmetry Measurement

- The JLab-made asymmetry module after prescaling is used as the source of input asymmetry (A_{in}), and is about 1.14%. The asmmetry scale of the experiment is about 100 ppm. The asymmytry (A) can be expressed in terms of the input asymmetry, the rate of the input asymmetry R_A after prescaling to a low rate ($\sim$ 10 kHz), and the rate of the final trigger R_{trig}.

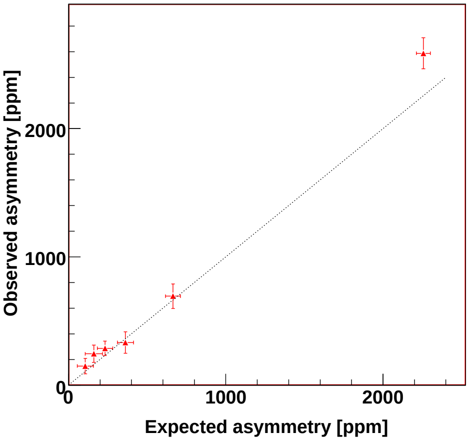
$$A = \frac{A_{in} * R_A}{R_{trig}}$$

A is measured as a function of R_{trig} by keeping A_{in} and R_A fixed.

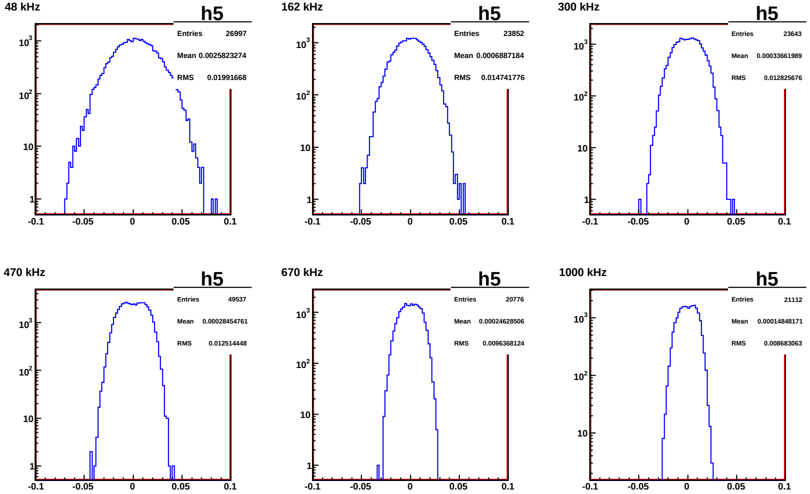
Asymmetry Measurement Diagram



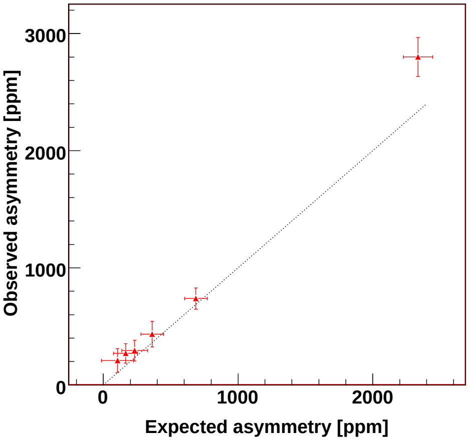
Asymmetry plot without RC-circuit.



Asymmetry plot without RC-circuit.

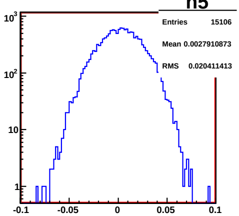


Asymmetry plot with RC-circuit.

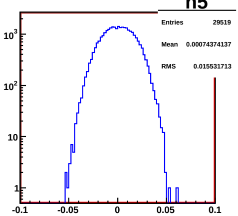


Asymmetry plot with RC-circuit.

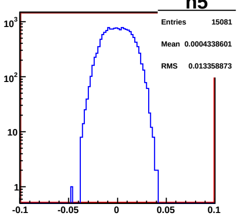
48 kHz



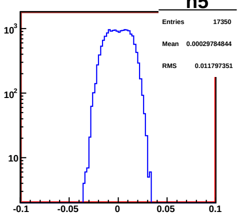
162 kHz



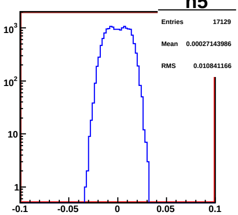
300 kHz



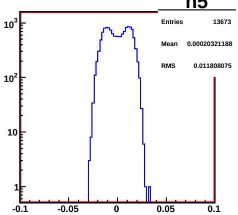
470 kHz



670 kHz



1000 kHz



Future Plans

- Cable up the DAQ in the full form for the right HRS
- Continue testing until moving the setup into the hall next month.
- Use flash ADC to study pileup.