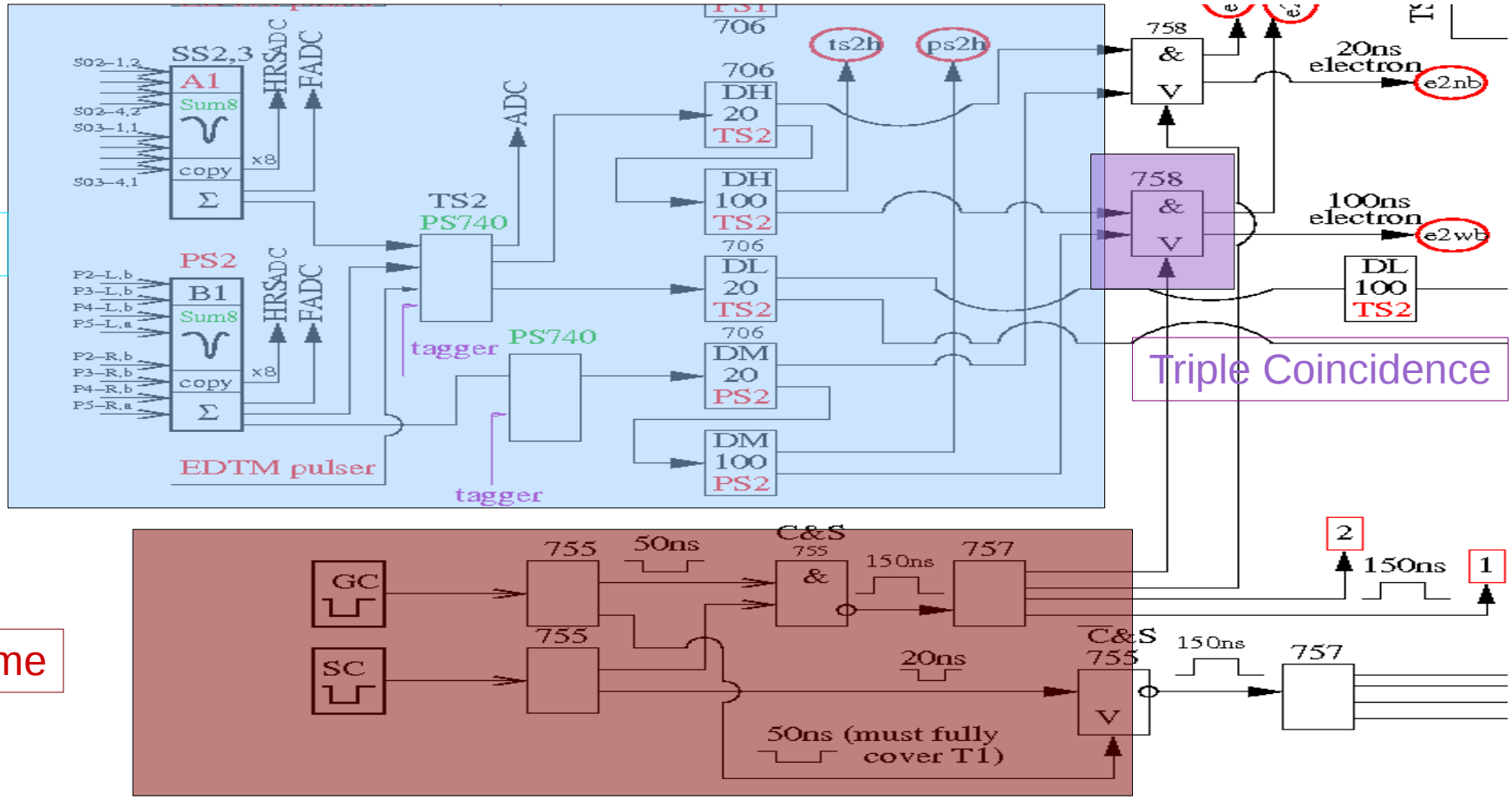
Trigger Simulation: Veto Deadtime

Overview

Path Deadtime

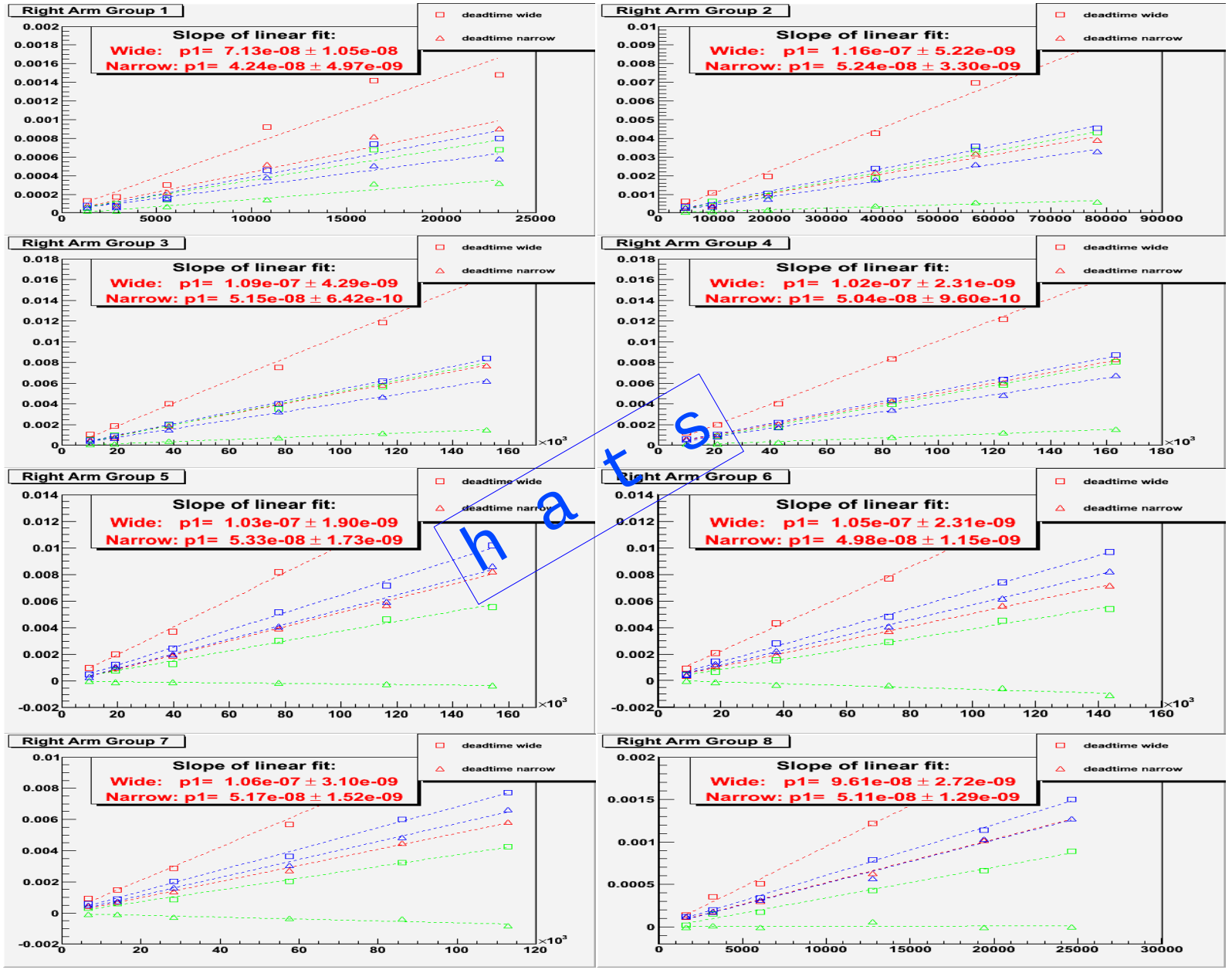
Veto Deadtime



Total Deadtime = Path Deadtime + Veto Deadtime

- Path Deadtime: very well understood, Theory = Data = Simulation.
- Veto Deadtime: still trying to understand, seems to be dominating.

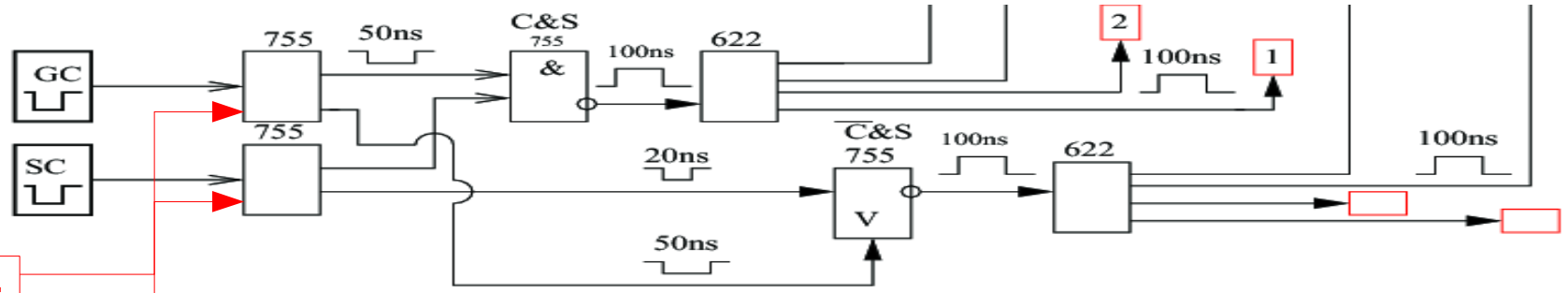
Path Deadtime (Simulation)



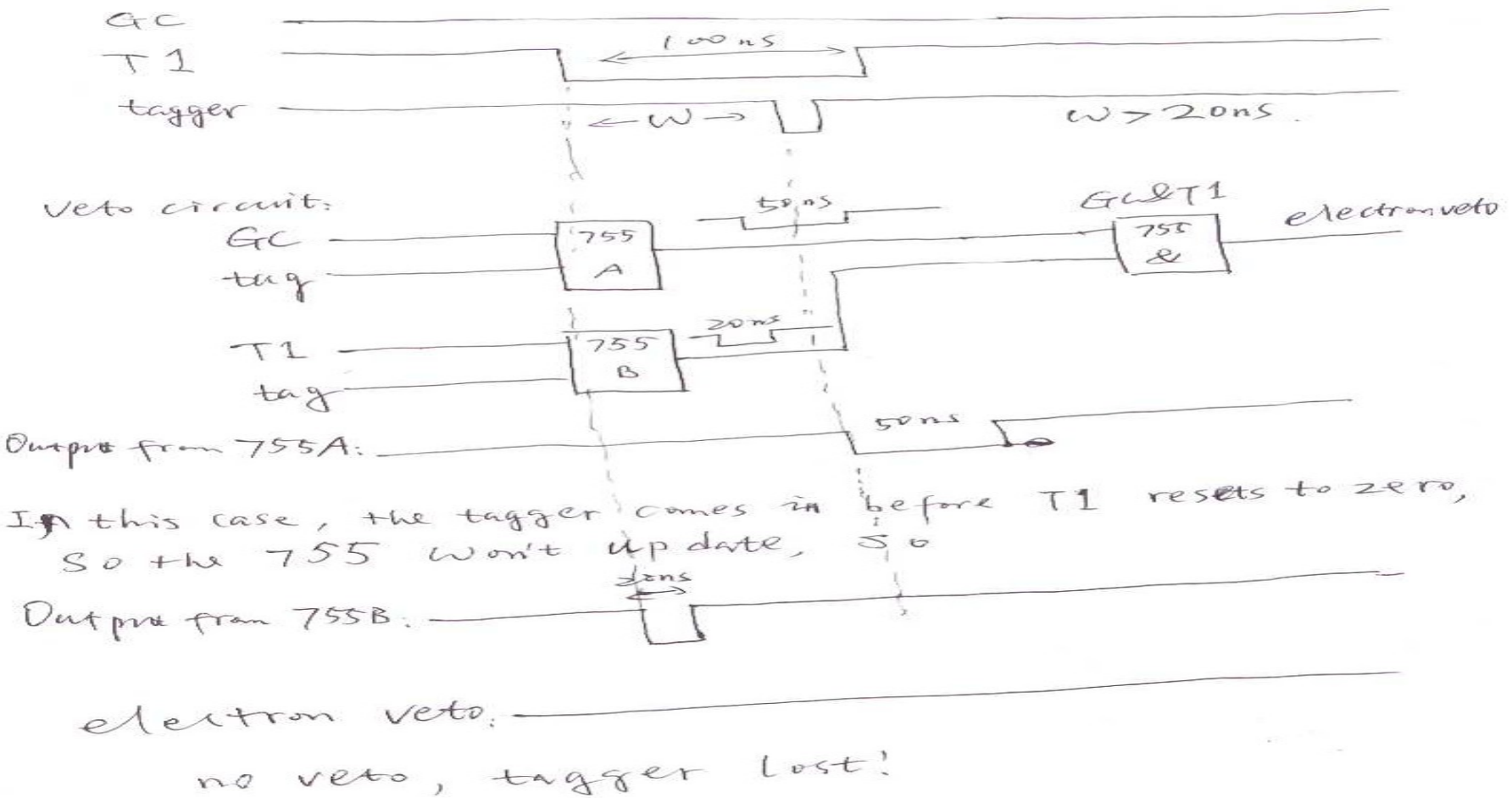
The mistake:

```
dtnar[j][i] = tlnar[j][i] + punar[j][i];
dtwid[j][i] = tlwid[j][i] + tlwid[j][i];
```

Veto Deadtime: Problem Revisited

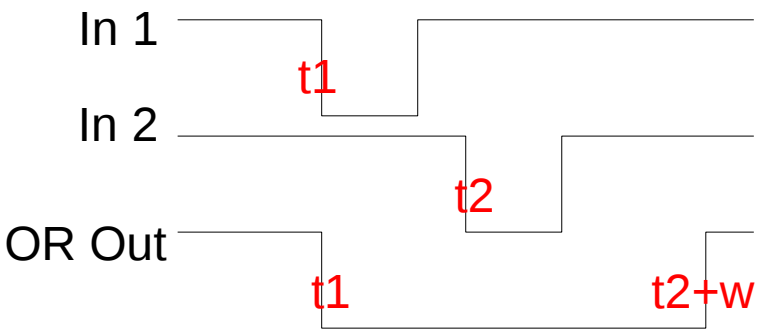


Tagger

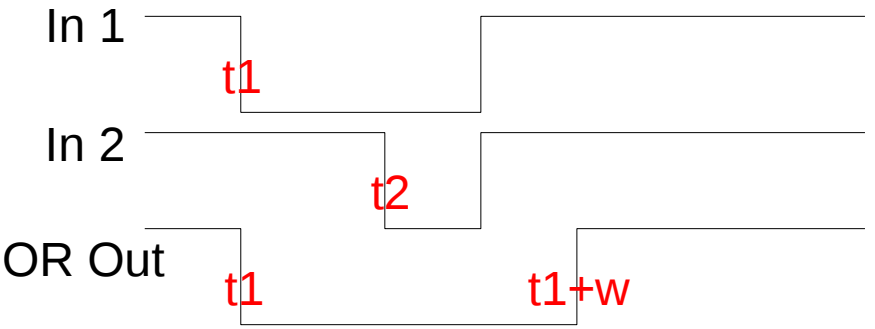


Phillips 755 not always updating

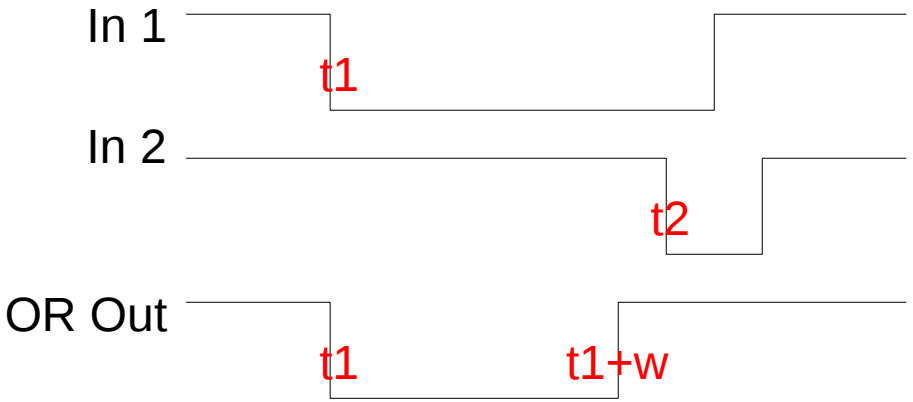
Senario A:



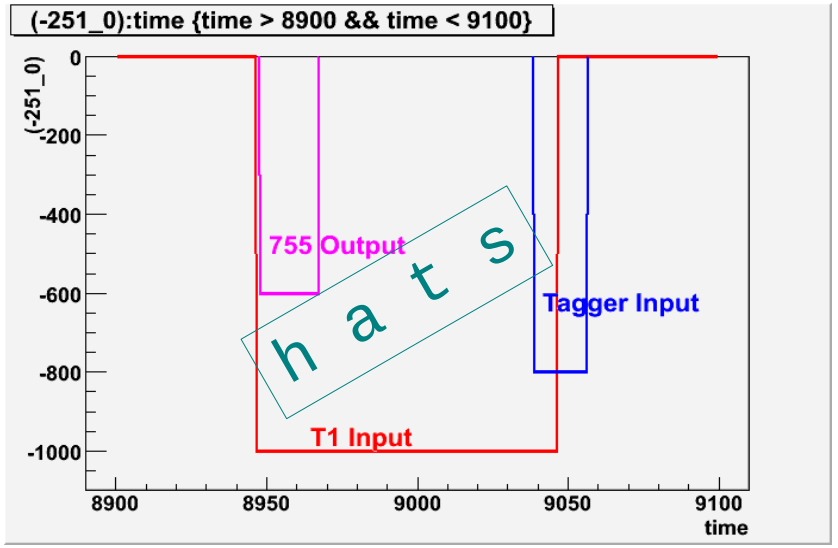
Senario B:



Senario C:

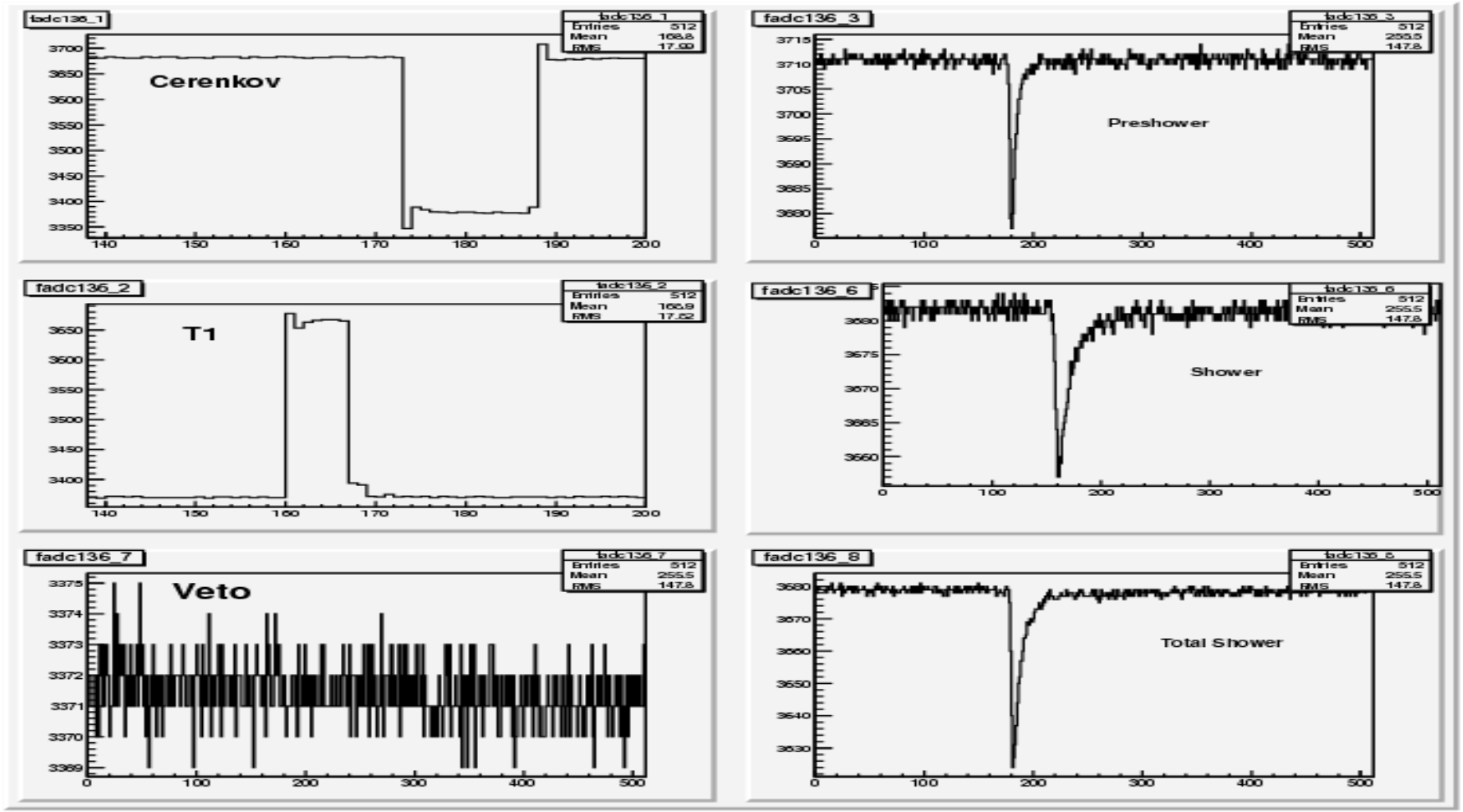


Simulation:



More Explanation for Physics signals

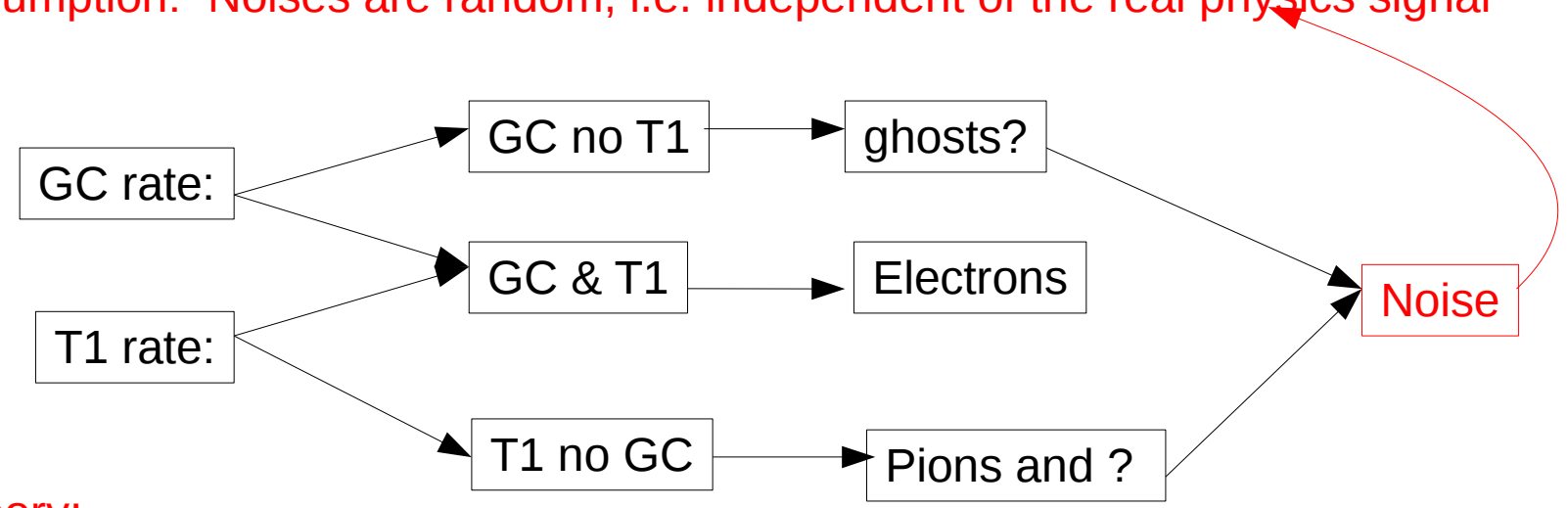
Evidence from FADC



FADC Analysis almost impossible due to low statistics

The Theory

Assumption: Noises are random, i.e. independent of the real physics signal



Theory:

$$Deadtime(group) = R_{T1.no.GC} \times (W_{T1in} - W_{T1out}) + R_{GC.no.T1} \times (W_{GCin} - W_{GCout}) + R_{group} \times W_{path}$$

W_T1in means the width of T1 signal as the input of 755.
etc.....

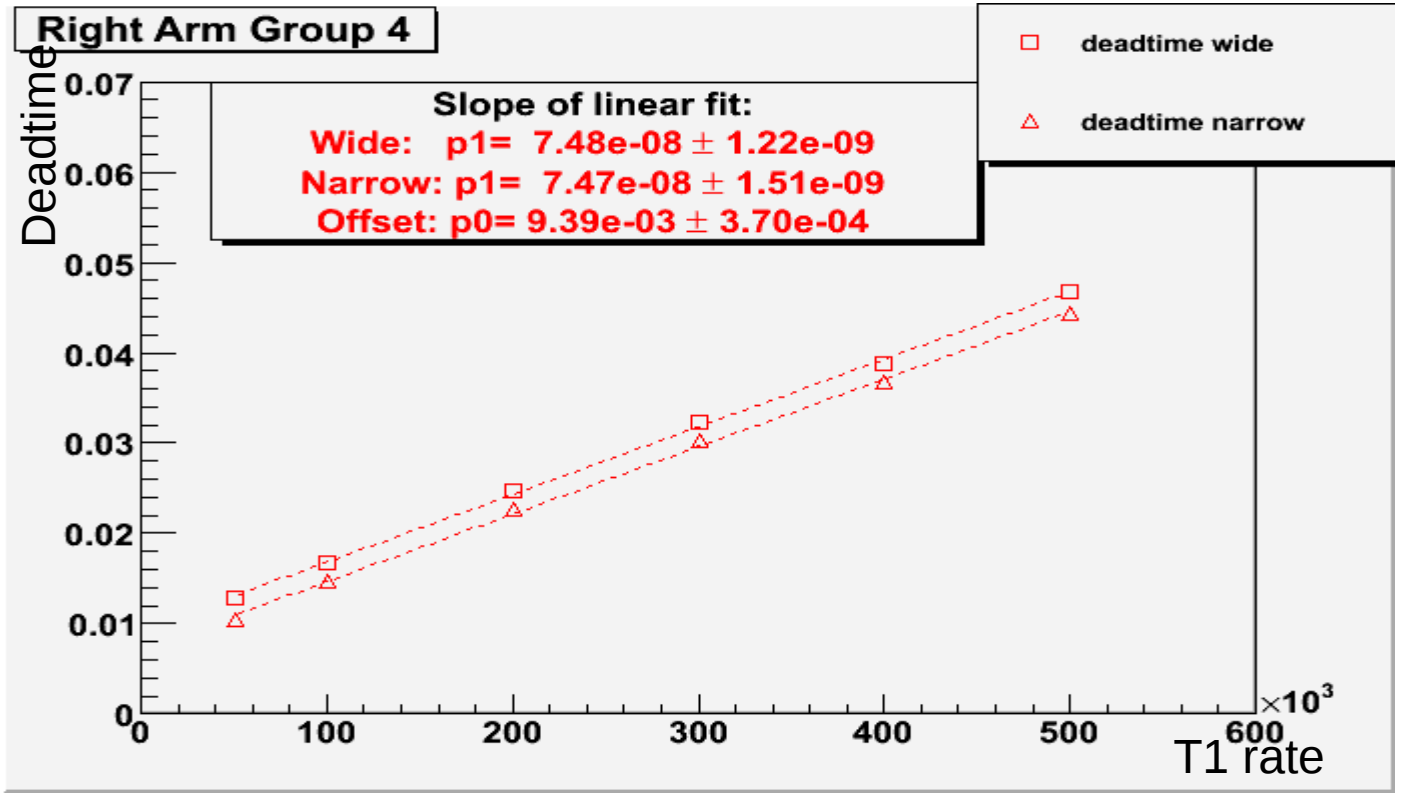
Methodology: Study the deadtime with only one parameter variable.

Deadtime dependence on T1 rate (1)

Electron rate: 200K

GC rate: 100K, input width 100ns, output width 55ns

T1 (T1.no.GC) rate: variable, input width 100ns, output width 20ns.



Theory:

Slope = 100 – 20 = 80 ns;

Offset = 100K x (100 – 55)ns + 0.004
= 0.0085

Simulation:

Slope = 75 ns

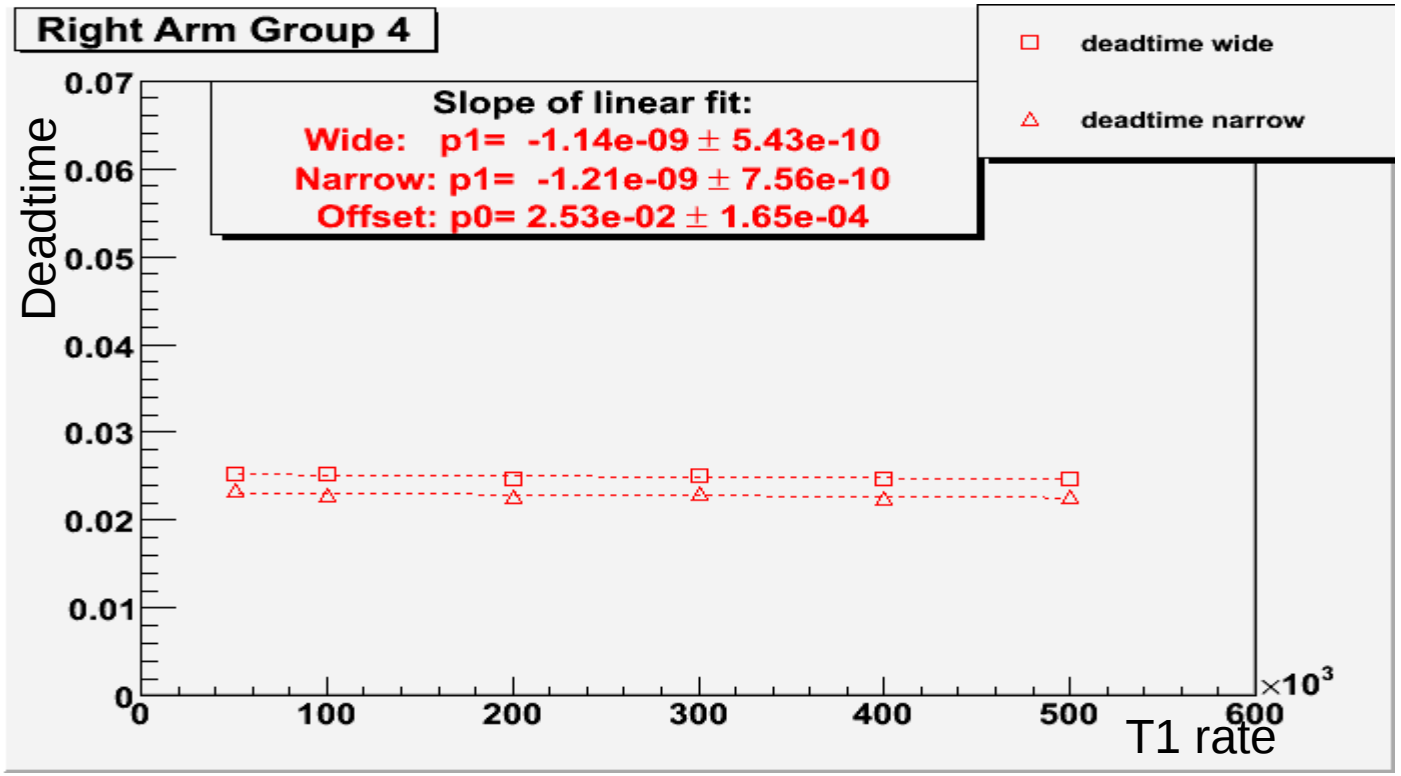
Offset = 0.0094

Deadtime dependence on T1 rate (2)

Electron rate: 200K

GC rate: 500K, input width 100ns, output width 55ns

T1 (T1.no.GC) rate: variable, input width 30ns, output width 35 ns



Theory:

Slope = 0 ns;

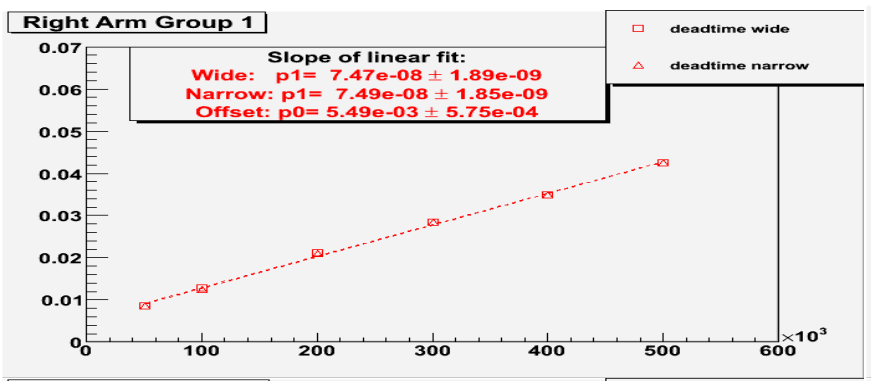
Offset = 500K x (100 – 55)ns + 0.004
= 0.0265

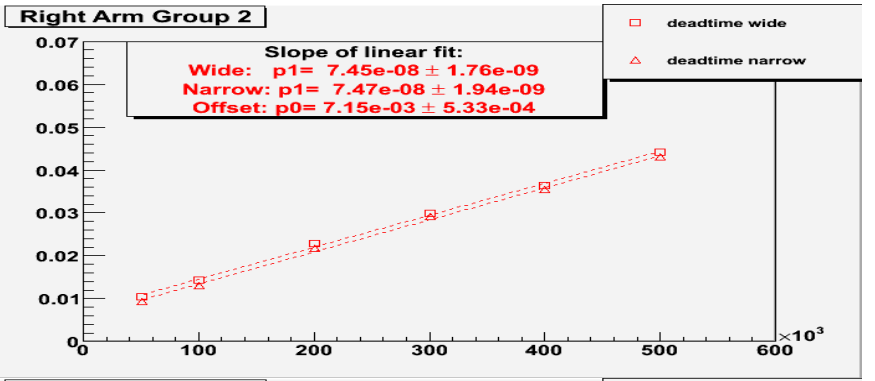
Simulation:

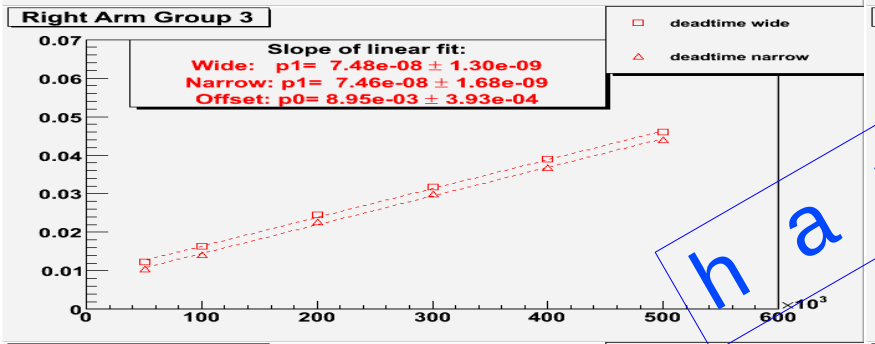
Slope = -1.1 ns

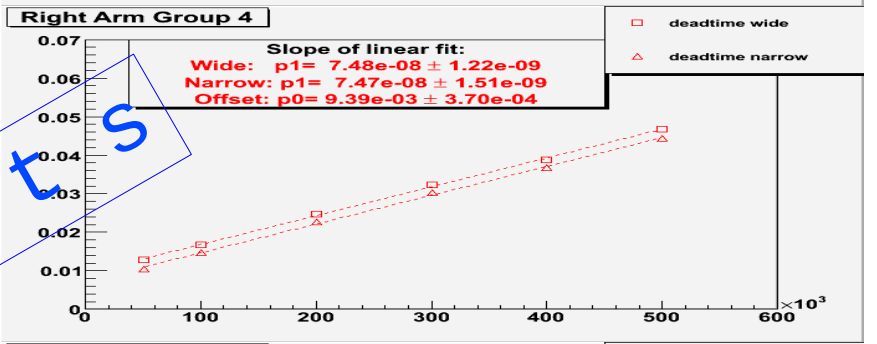
Offset = 0.0253

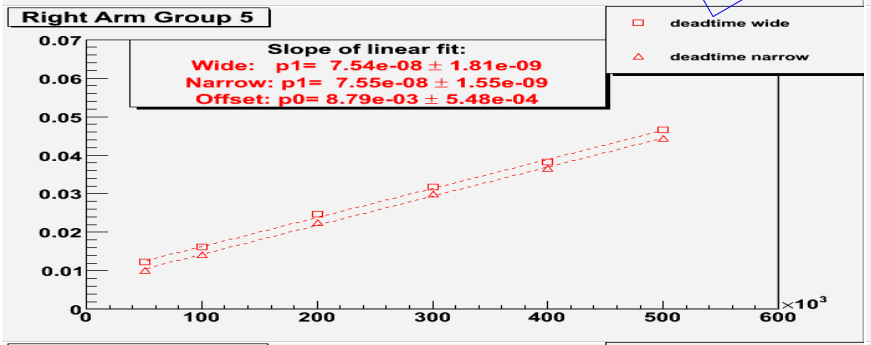
Deadtime dependence on T1 rate (3)

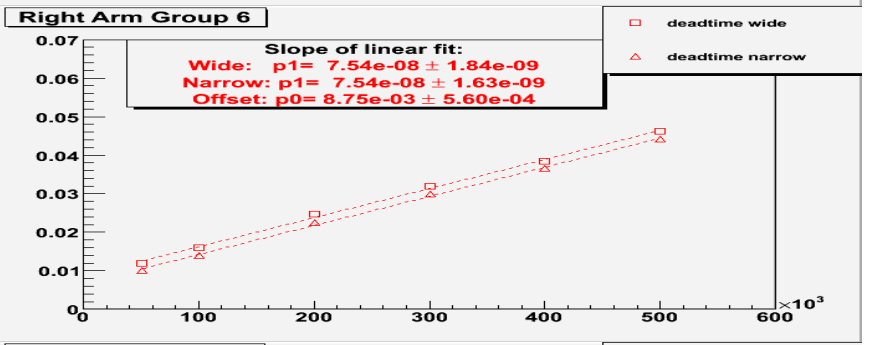


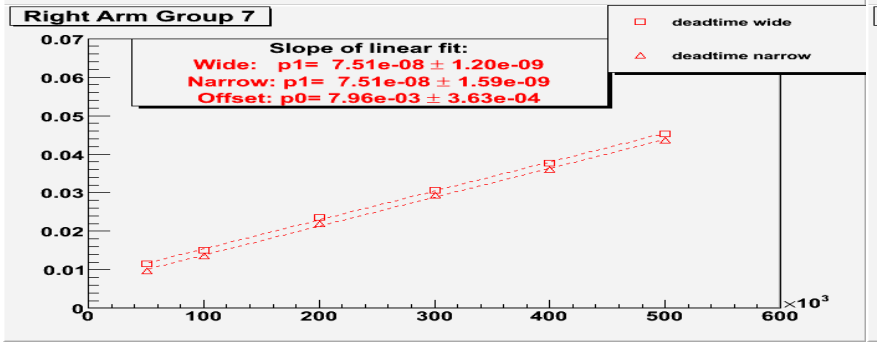


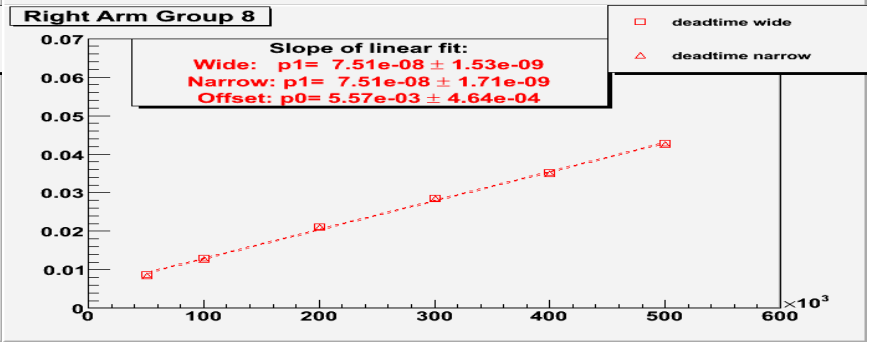




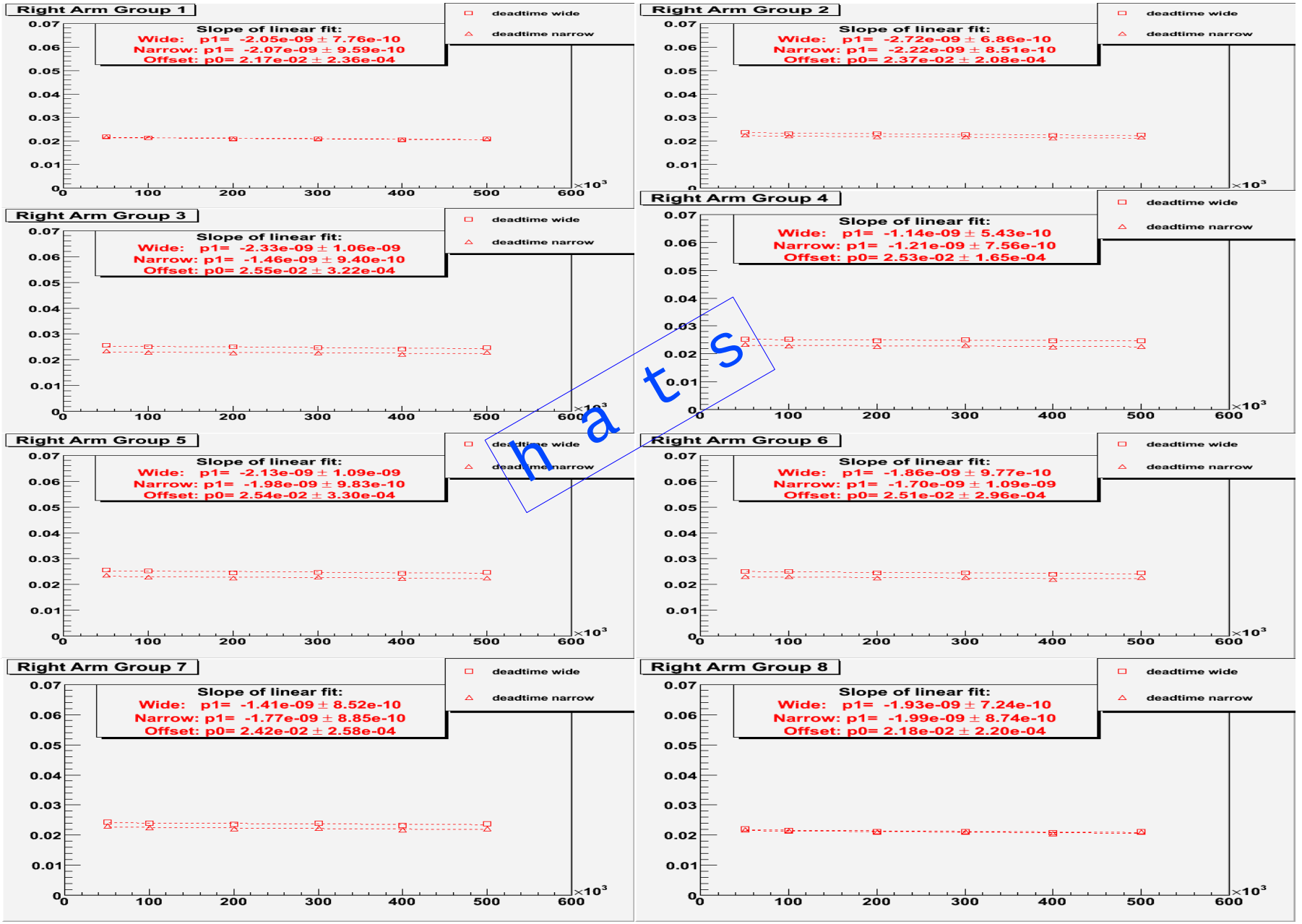








Deadtime dependence on T1 rate (4)



Questions

Question 1: Is our assumption valid ?

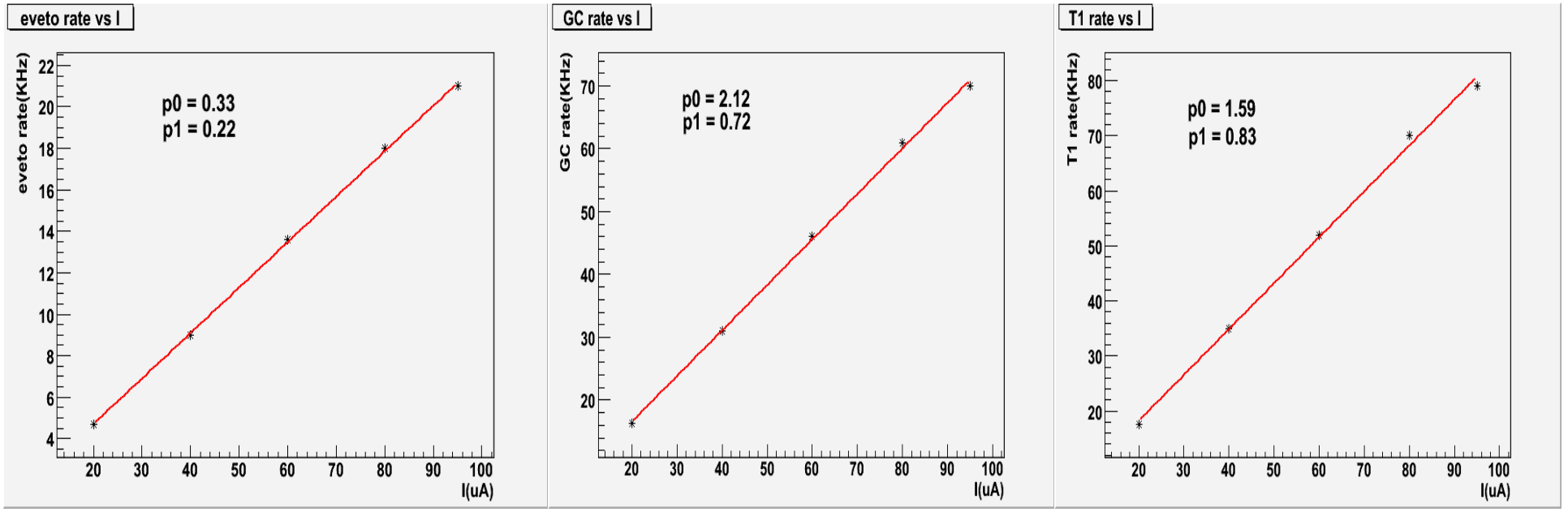
Simple thoughts: Electron rate ~ Eveto rate ~ k1 x I

GC rate ~ k1 x I + k2 x I + k3

Random???

physical signal induced noise

Electronics, Background??



Runs: 14087, 14088, 14089, 14091, 14092, the first attempt of deadtime measurement

Question 2: What is the upstream deadtime (exactly) ?

History

Change of veto circuits took place on November 26th, 2009, reference of “Before” and “After”

	GC Intrinsic	T1 Intrinsic	GC 755 in	GC 755 out	T1 755 in	T1 755 out	results
Before	100ns?	100ns?	100ns	55ns	100ns?	20ns	~100 ns deadtime w.r.p.t. T1 rate
After	100ns?	100ns?	60ns	70ns	30ns	32ns	Normal path deadtime

eg. run 14087, right arm, rough comparison:

Data:

Deadtime ~ 79K x 100ns = 0.0079

Theory:

Deadtime ~ (79 - 21)K x (100 – 20)ns
+ (70 - 21)K x (100 – 55)ns
+ small amount
= 0.0068

hatsModule: Signal Processing

Example: hatsPhi755

```
void hatsPhi755::Process()
{

  Int_t numtrig = 0;
  for (Int_t i = 0; i < N_input; i++) {
    if ((*(Input[i])) > 10.0)
      numtrig ++;
  }
  if (numtrig >= coinc_lvl)  //coincidence level
    trigged = true;
  else
    trigged = false;

  //if veto == 0, process the trigger logic, else
doesn't care
  if ((!veto_connected) || (veto_connected &&
((*veto) < 10.0)))
    {
      if(sig_reset && trigged) {
        sig_reset = false;
        output_status = true;
        output_idx = (Int_t) width;

      }
    }
  else {
    //do nothing??
  }
```

```
  ////outputing signal
  if (output_status) {
    Buffer[idx] = 1000.0;
    output_idx --;
    if (output_idx < 0)
      output_idx = 0;
  }
  else
    Buffer[idx] = 0;

  /////check if input signals reset
  Int_t numreset = 0;
  for (Int_t i = 0; i < N_input; i++) {
    if ((*(Input[i])) < 10.0)
      numreset++;
  }
  if (numreset == N_input)
    sig_reset = true;

  /////end of outputing
  if (output_idx <= 0)
    output_status = false;

  Update();

}
```