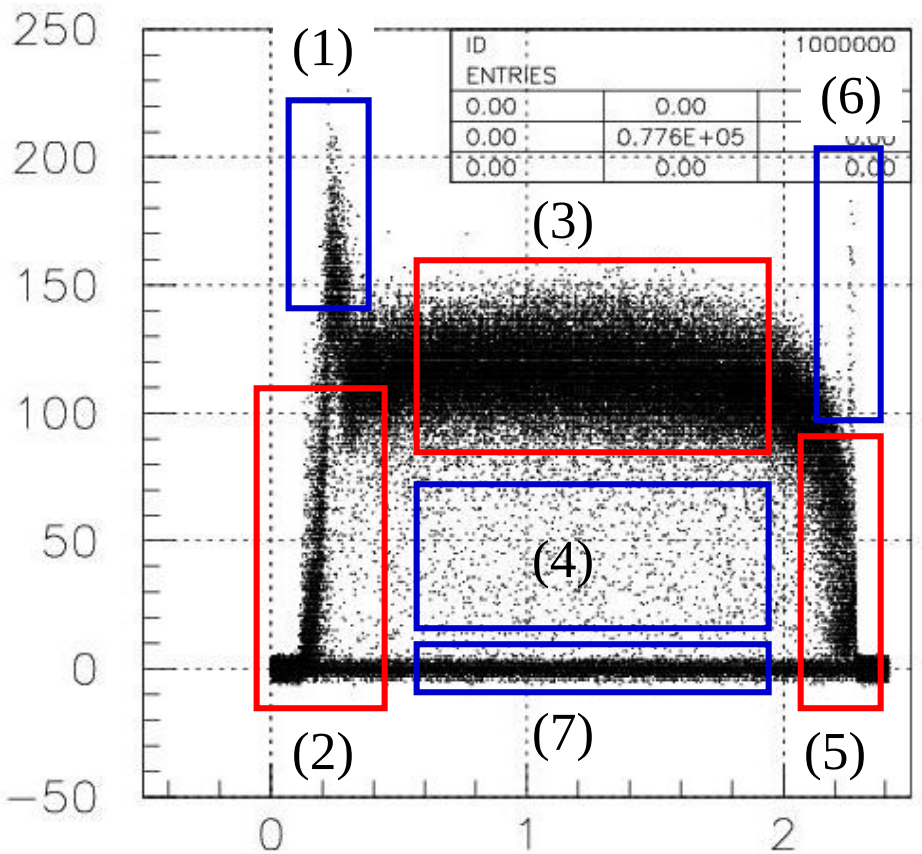
Spill Structure

Divide and Conquer …



RateI(3) vs TIS plane

RUN 49900~50218

7 components:

(1)Horn

(2)Foreleg (Raising edge)

(3)Backbone

(4)Stomach

(5)Hind leg (Trailing edge)

(6)Tail

(7) ground

(1)Horn

What happens when on a rate spike ?

>> Low correlation to the instantaneous rate.

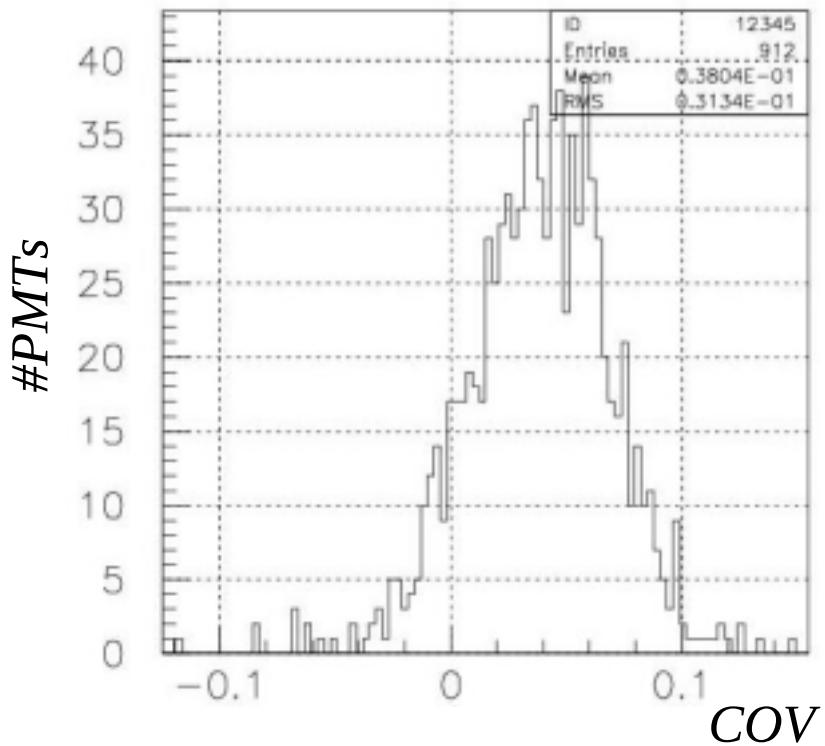
Horn definition :

0.1<TIS<0.4

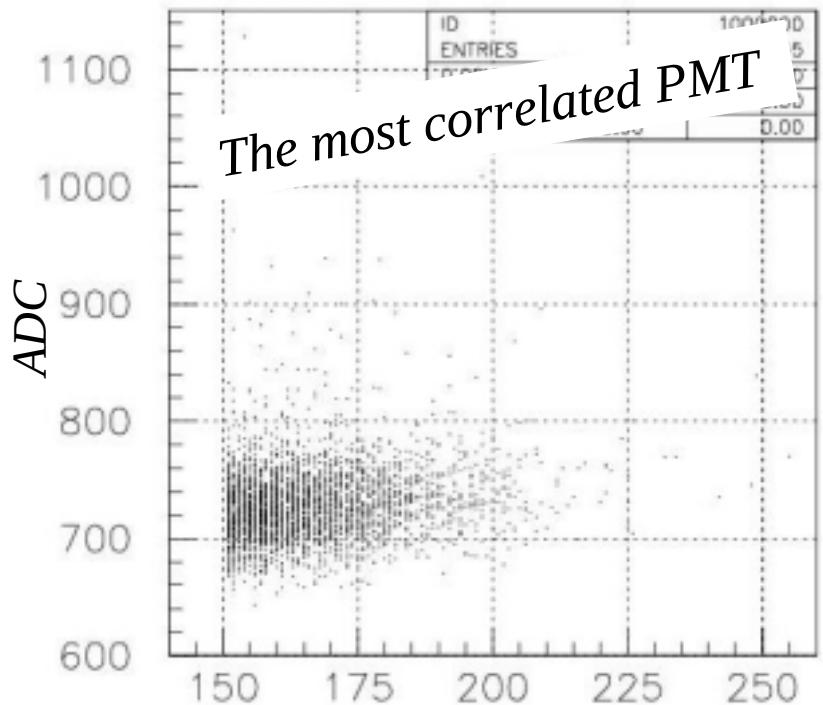
RateI(3)>150

Entries:
3345 / 388506
Ratio 0.86 %

Covariance between ADC and RateI(3) for all PMTs

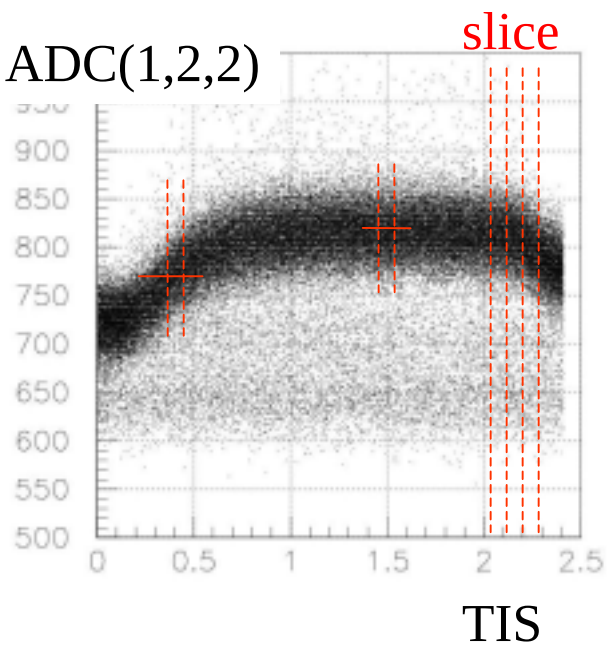


ADC(1,2,11) vs RateI(3)



Boundary

Before the further region-analysis, the boundary between foreleg and backbone (,also the boundary between backbone and hind leg) should be decided somehow reasonably.



Method :

(1)Make a ADC vs TIS scatter plot.
(Note that rate is not used in this method.)

(2) Slice the plot along y-axis and project these slices onto y-axis.

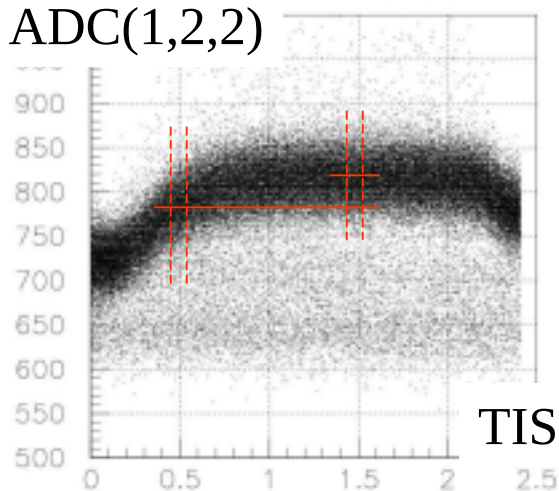
(3)Fit the each slice with gaussian, and find the ADC peak position(Y_i).

(4) Calculate the ratio (Y_i / MAX($Y_{j=1\ldots n}$)) for all slices

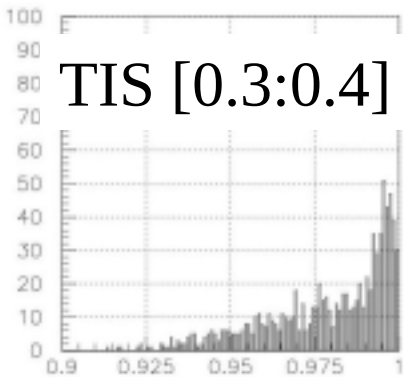
The TIS region where ratios for almost all PMTs are ~1.0 is defined as a “backbone”.

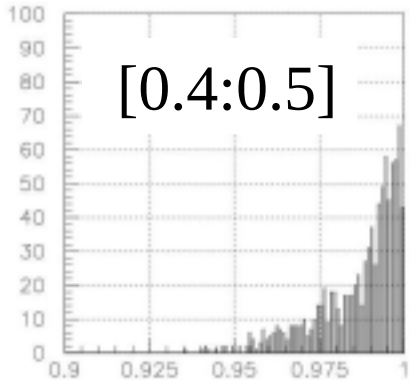
Boundary

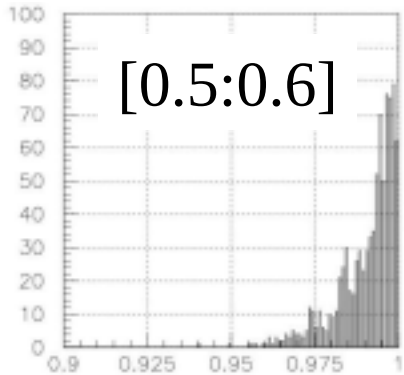
Backbone region is defined as [0.7:2.0].

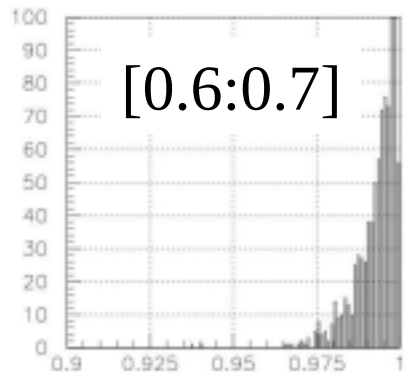


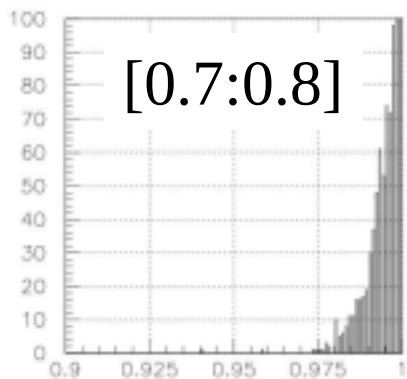
Ratio distribution at various TIS range.
X axis : ratio Y axis : # PMTs

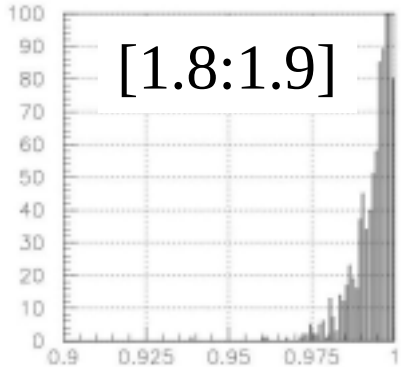


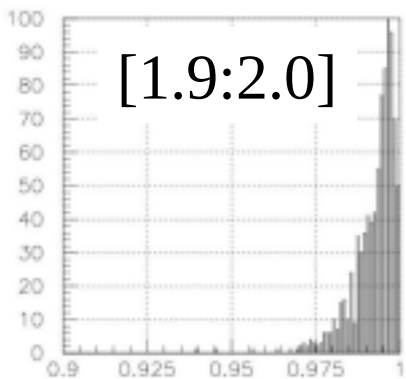


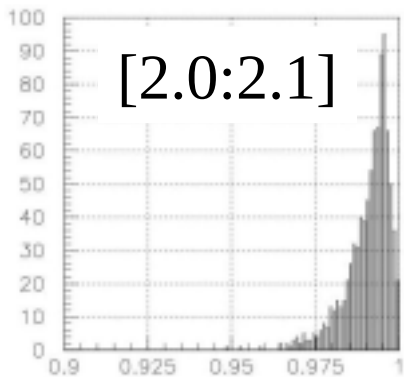












(3)backbone

In backbone region, TIS dependency is much less. Therefore, in this section, rate effect is discussed mainly…

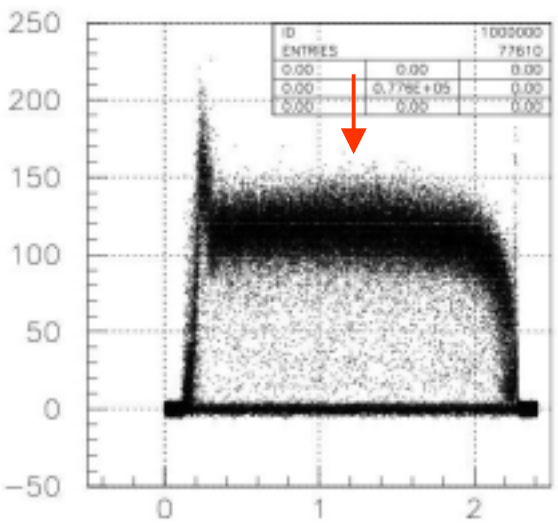
MCSC's rate vs I-Hung's rate

Which is a proper variable, when describing the rate effect.

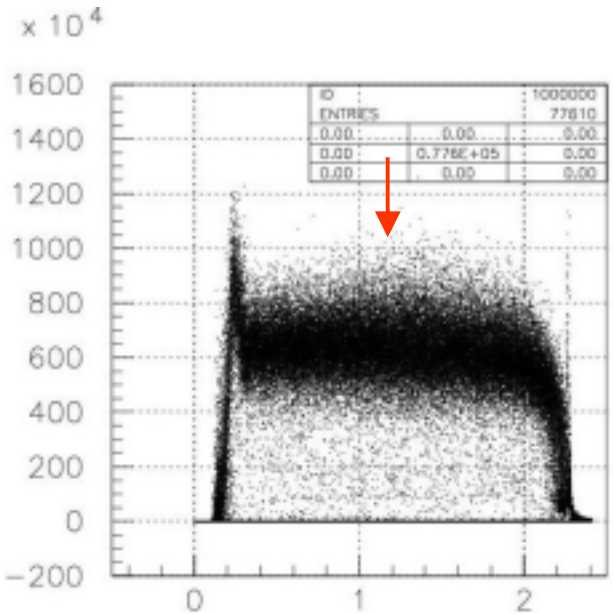
Time constants
RateI(3) : 1.1ms
MCSC Rate : 0.3~0.4ms

Discrepancy can be seen in RateI(3)>80

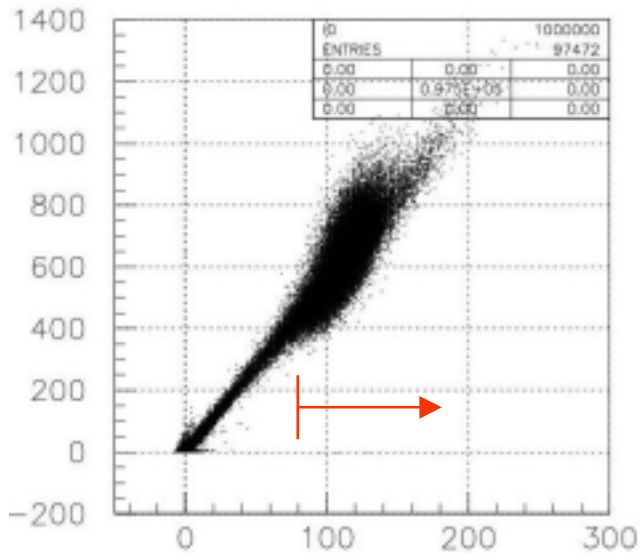
Rate dependency might be different especially in backbone region.



Ratei(3) vs TIS



MCSC Rate vs TIS

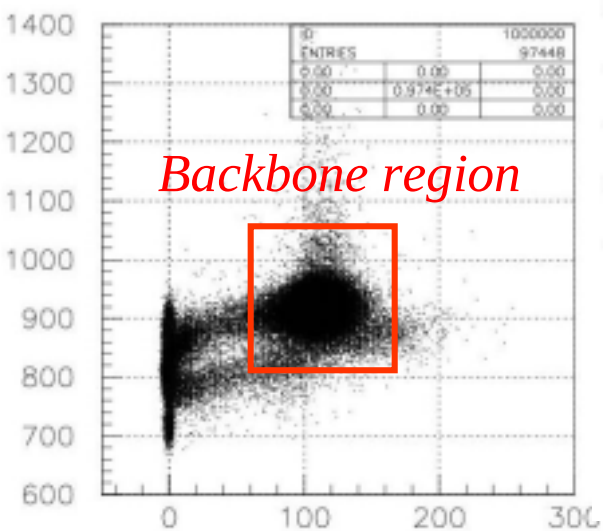


MCSC vs RateI(3)

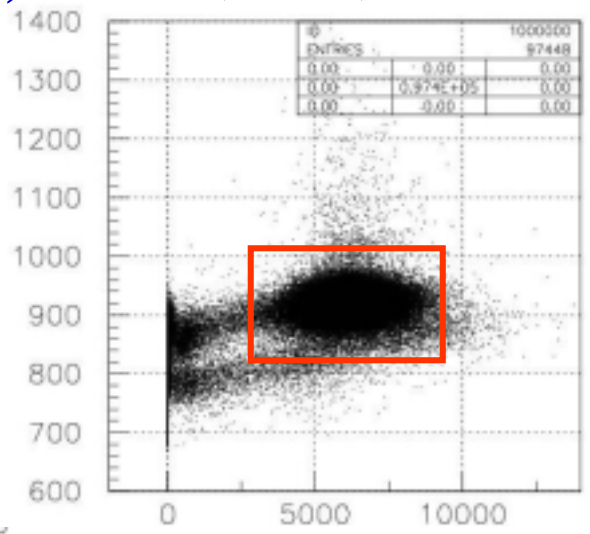
MCSC's rate vs I-Hung's rate

Covariance for ADC and Rate in backbone region.

ADC(1,2,12) vs RateI(3)



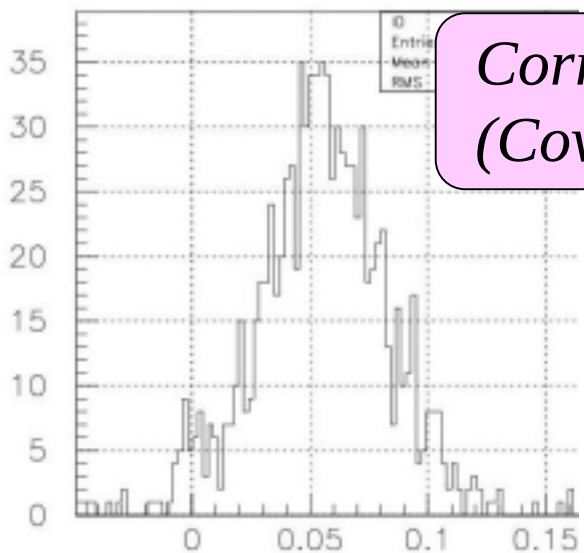
ADC(1,2,12) vs MCSC

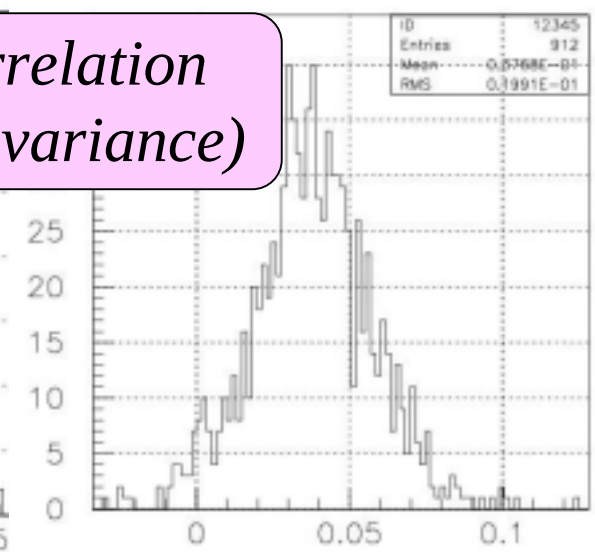


Both of them are less correlated to ADC counts.

But if we dares say, RateI(3) is better…

Correlation (Covariance)





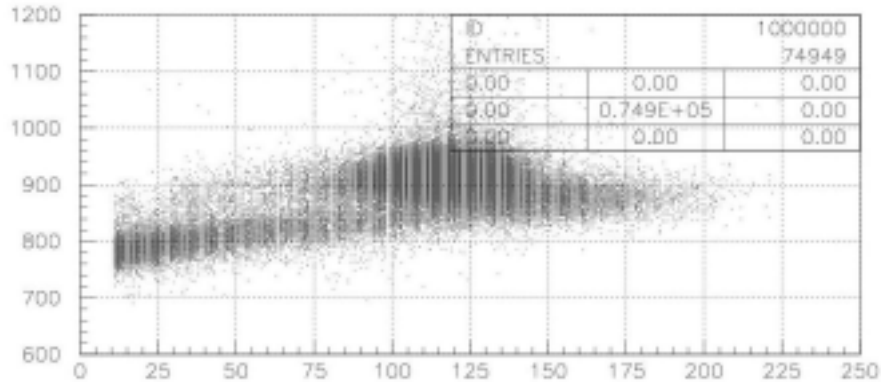
(2)Foreleg

Foreleg part is a good sample to discuss the time constant of a PMT, because rate changes as a function of TIS, and is not flat in this region.

Time Constants

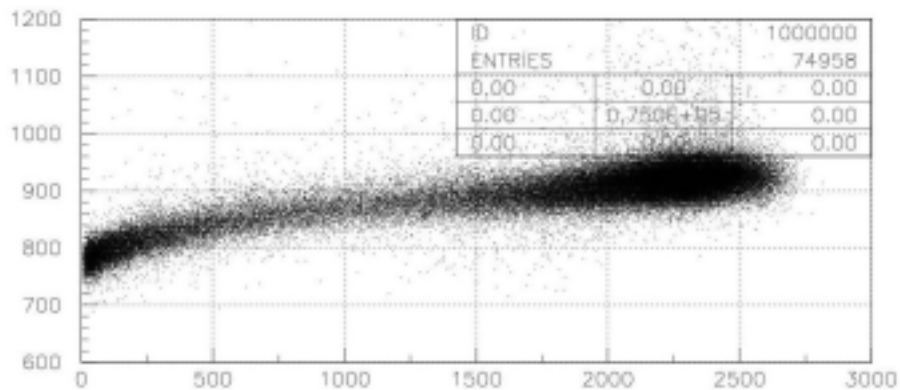
How does the ADC distribution change under the rates of different time constant ?

ADC(1,2,12) VS RateI(3) 1.1ms



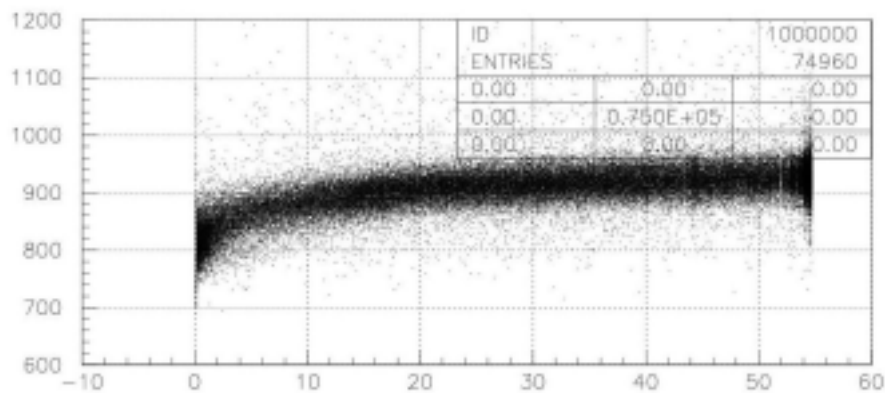
Foreleg + Horn region: TIS < 0.7 RateI(3)>10

ADC(1,2,12) VS RateI(1) 100ms



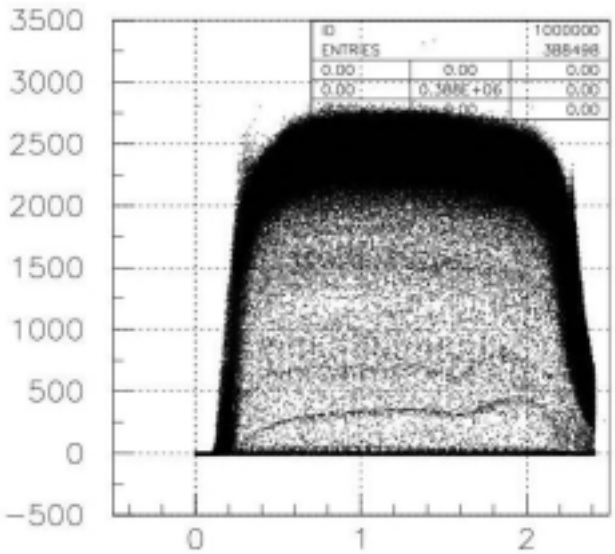
(*) Based on a spill profile (see page 1), estimate the integrated ck rate.

ADC(1,2,12) VS Integral Rate* (450ms)

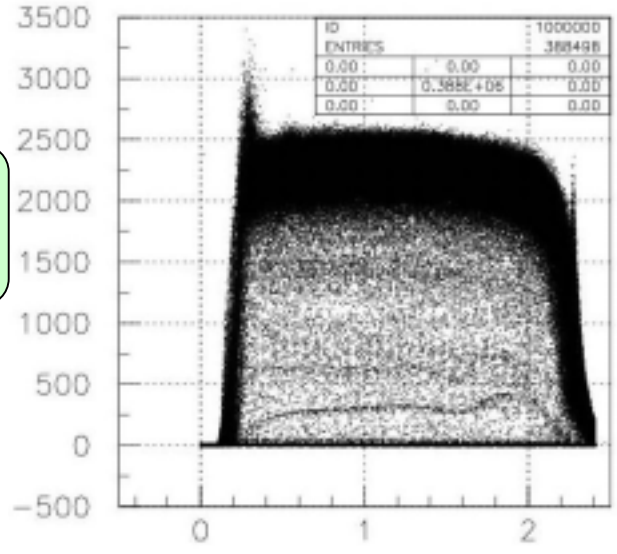


Time Constants (Ref.)

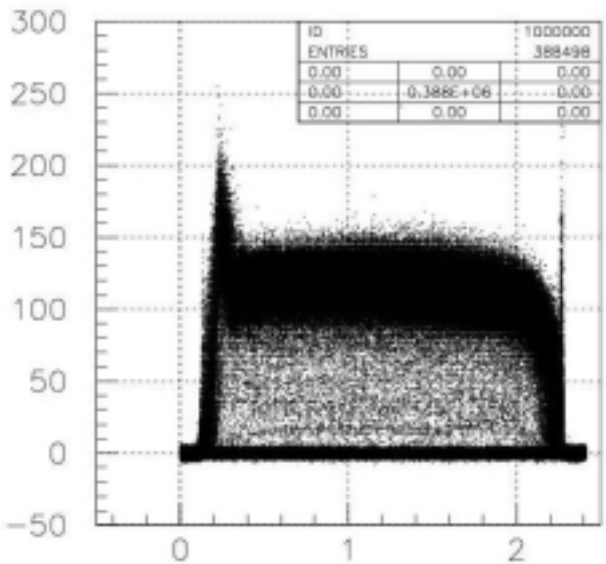
RateI(1)
100ms



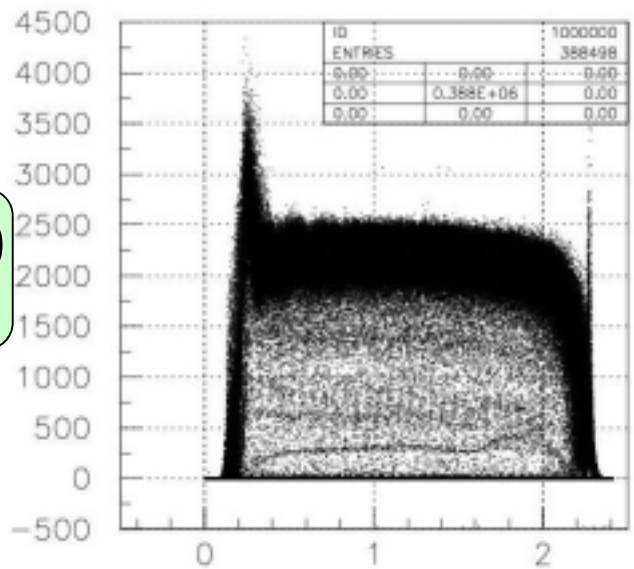
RateI(2)
47ms



RateI(3)
1.1ms



RateI(4)
10ms



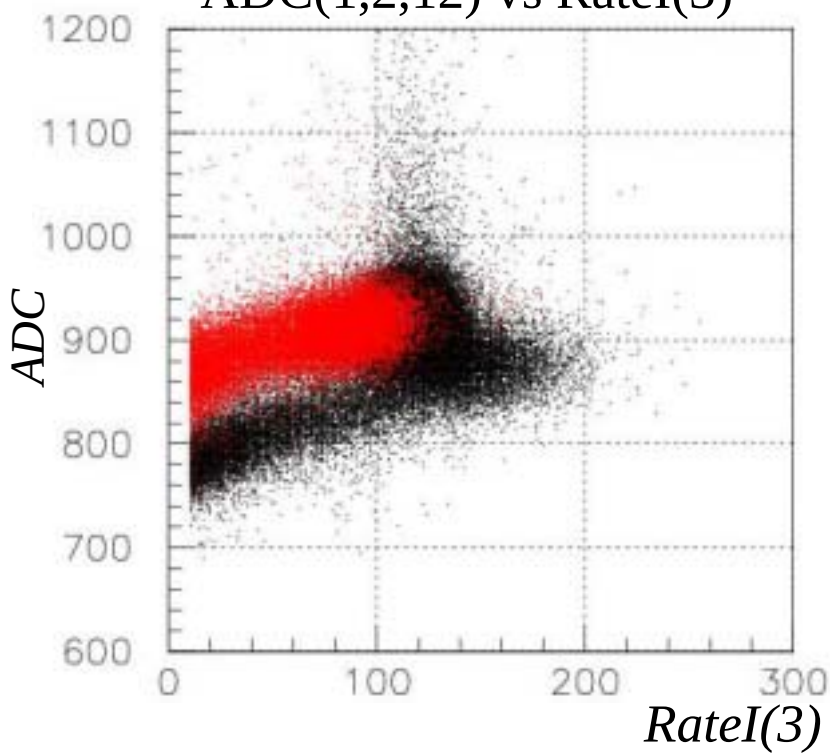
Time Constants

Black dots : foreleg
Red dots : hind leg

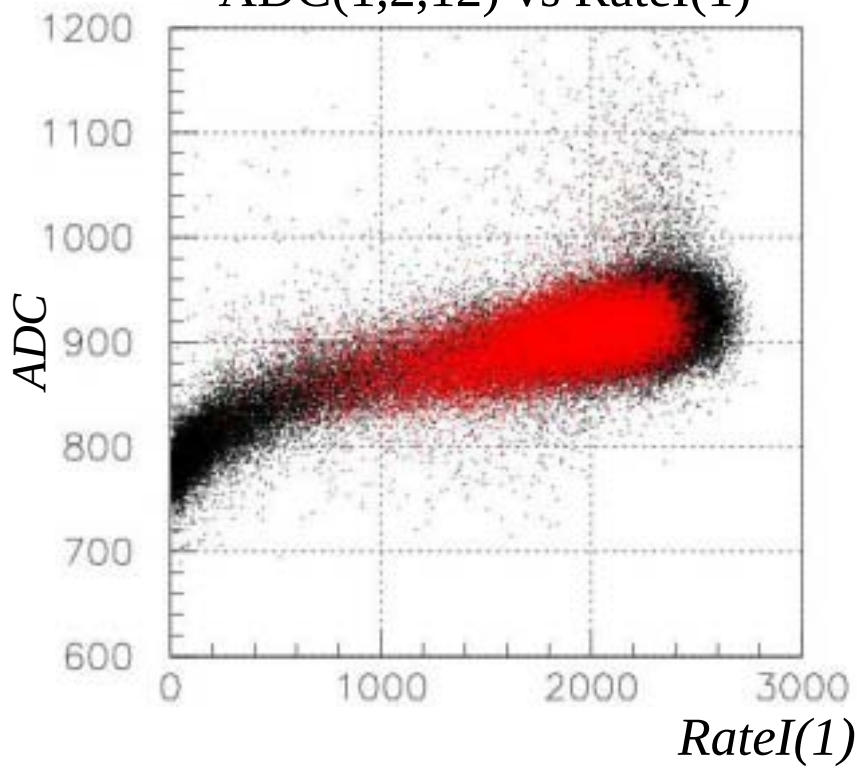
Single variable, RateI(1) which in on a long time constant seems to be able to describe the rate effect for all TIS range.

⟶ need more check for other PMTs

ADC(1,2,12) vs RateI(3)



ADC(1,2,12) vs RateI(1)



(6)Tail

What happens when on a acute rate spike ?

>> Relatively low correlation to the instantaneous rate.

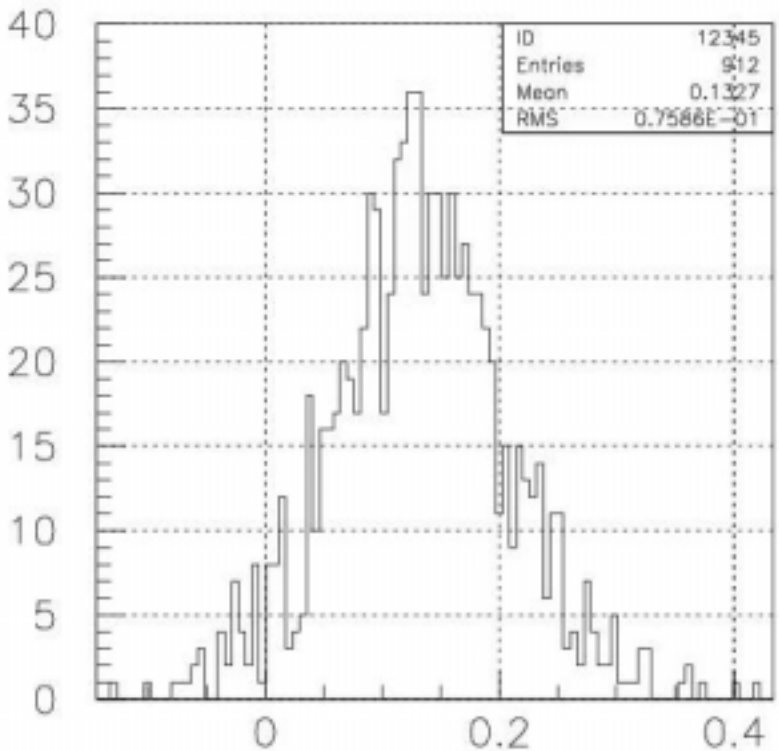
Tail definition :

2.255<TIS<2.3

RateI(3)>80

Entries:
484 / 388506
Ratio 0.12 %

Covariance between ADC and rate for all PMTs



ADC(1,2,9) vs RateI(3)