# PMT Signal Droop for Extended Pulses

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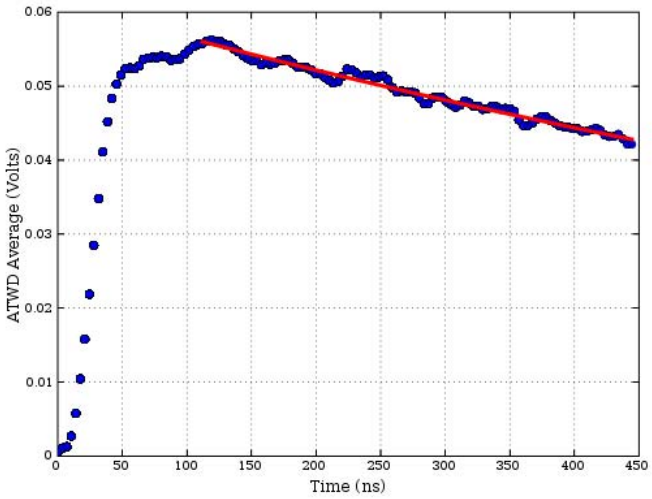
IceCube – In-Ice Devices

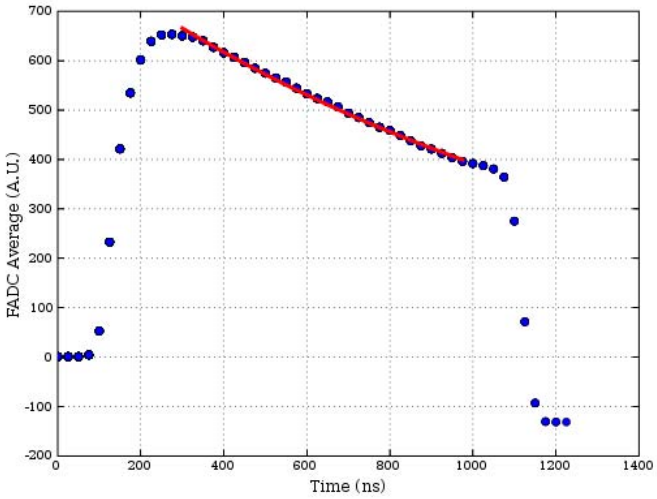
MBID: 78d52c98293c
Run: UWDAQ1-4390
Temp: -45 °C

ATWD Ch0




Exponential decay fit to time constant of 1.24 µs.

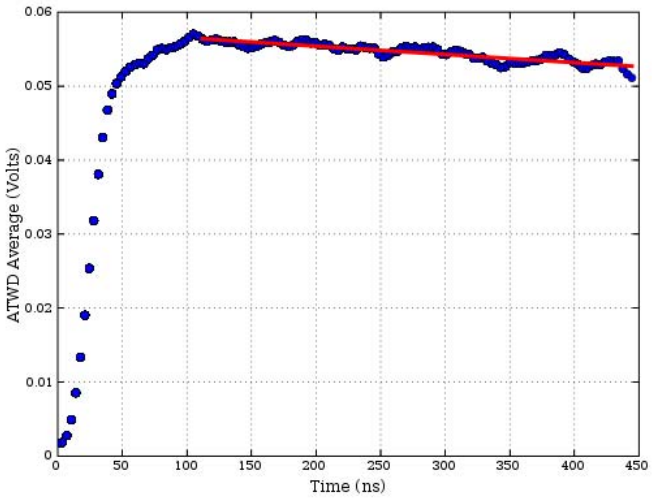
FADC




Exponential decay fit to time constant of 1.32 µs.

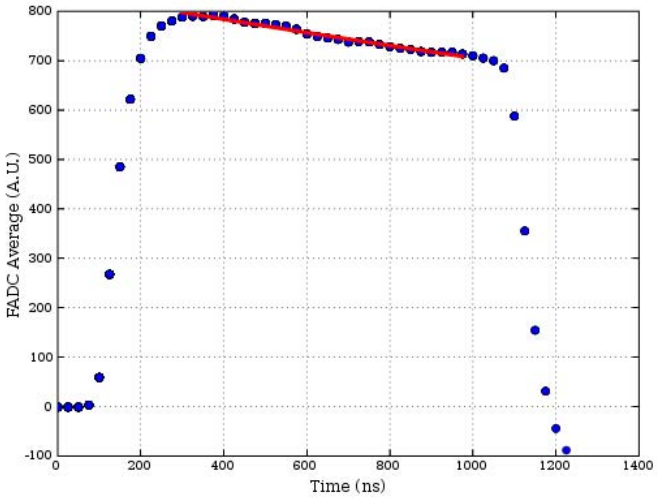
MBID: 78d52c98293c
Run: UWDAQ1-4517
Temp: +25 °C

ATWD Ch0




Exponential decay fit to time constant of 4.9 µs.

FADC




Exponential decay fit to time constant of 5.7 µs.

Analysis Code

```
import sys
from icecube.domtest.util import getHits
from icecube.domtest.domcal import calibrator, regression
from Numeric import *
from pylab import *

filename = sys.argv.pop(1)
f = file(filename, 'rb')
hd = getHits(f, 25000)

mbid        = sys.argv.pop(1)
cal         = calibrator('domcal ' + mbid + '.xml')
fadc avg    = zeros(50, 'd')
atwd avg    = zeros(128, 'd')
nsel        = 0
ch          = 0

for x in hd[mbid]:
    fadc = array(x.fadc[0:50], 'd') - 131
    v    = cal.recoATWD(x.atwd[ch], ch, 2.6)
    if sum(v) > 5:
        fadc avg += fadc
        atwd avg += v
        nsel += 1

fadc avg /= float(nsel)
atwd avg /= float(nsel)

########## FADC Plotting ##########
x0 = 12
x1 = 40
x = arange(x0, x1) * 25             # Set the x range for FADC droop fit
y = log(fadc avg[x0:x1])            # Set domain
slope, inter, r = regression(x, y)  # Do linear regression
print "FADC:", 1.0 / slope
plot(
    arange(50)*25, fadc avg, 'o',
    x, exp(slope*x+inter), 'r-', linewidth=3,
    hold=False
    )
grid()
xlabel('Time (ns)')
ylabel('FADC Average (A.U.)')
savefig('fadc.png', dpi=72)

x0 = 32
x1 = 128
x = arange(x0, x1) * 3.5
y = log(atwd avg[x0:x1])
slope, inter, r = regression(x, y)
print "ATWD:", 1.0 / slope
plot(
    arange(128)*3.5, atwd avg, 'o',
    x, exp(slope*x+inter), 'r-', linewidth=3,
    hold=False
    )
grid()
xlabel('Time (ns)')
ylabel('ATWD Average (Volts)')
savefig('atwd.png', dpi=72)
```