DU-2 nanobeacon analysis

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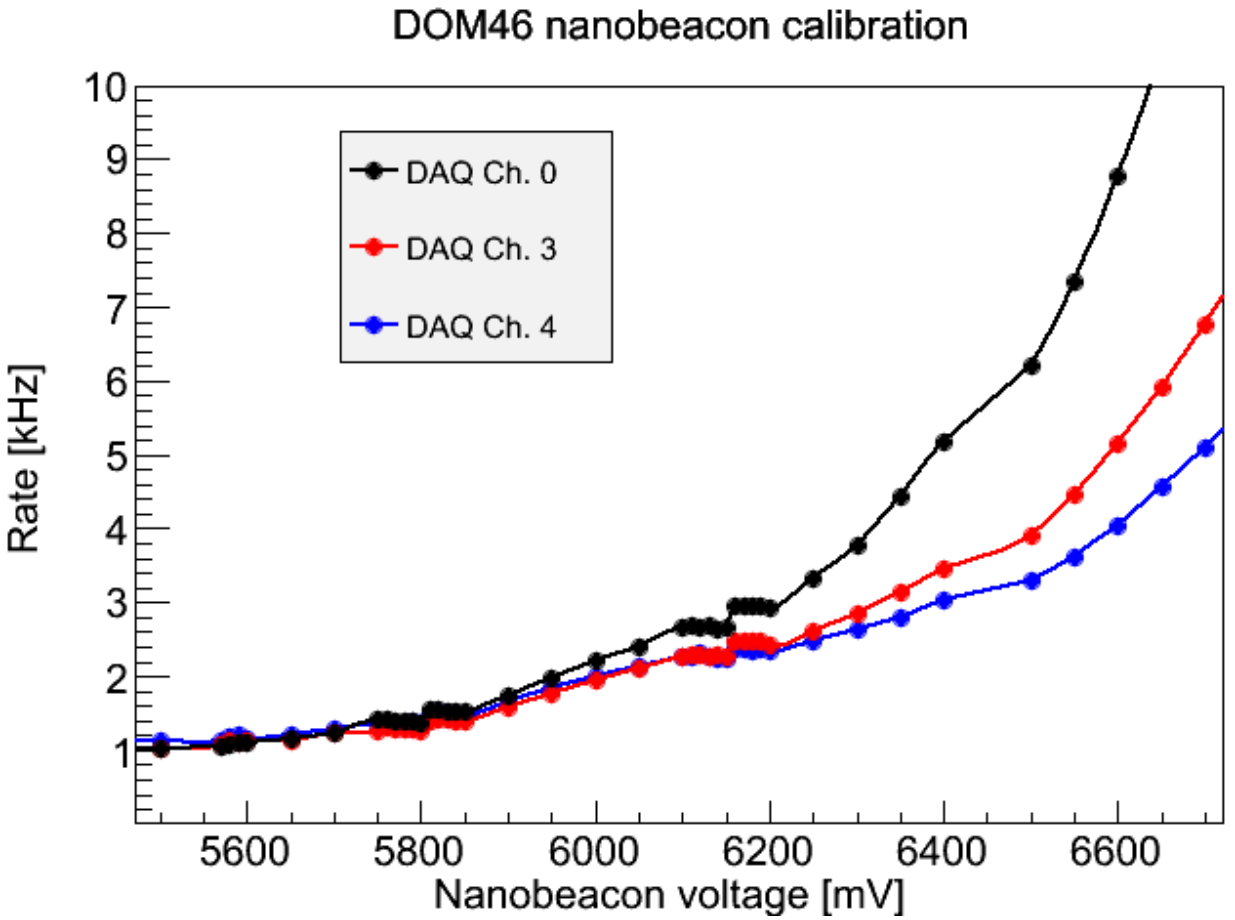
ANTARES/KM3NeT group meeting
16 Feb 2016

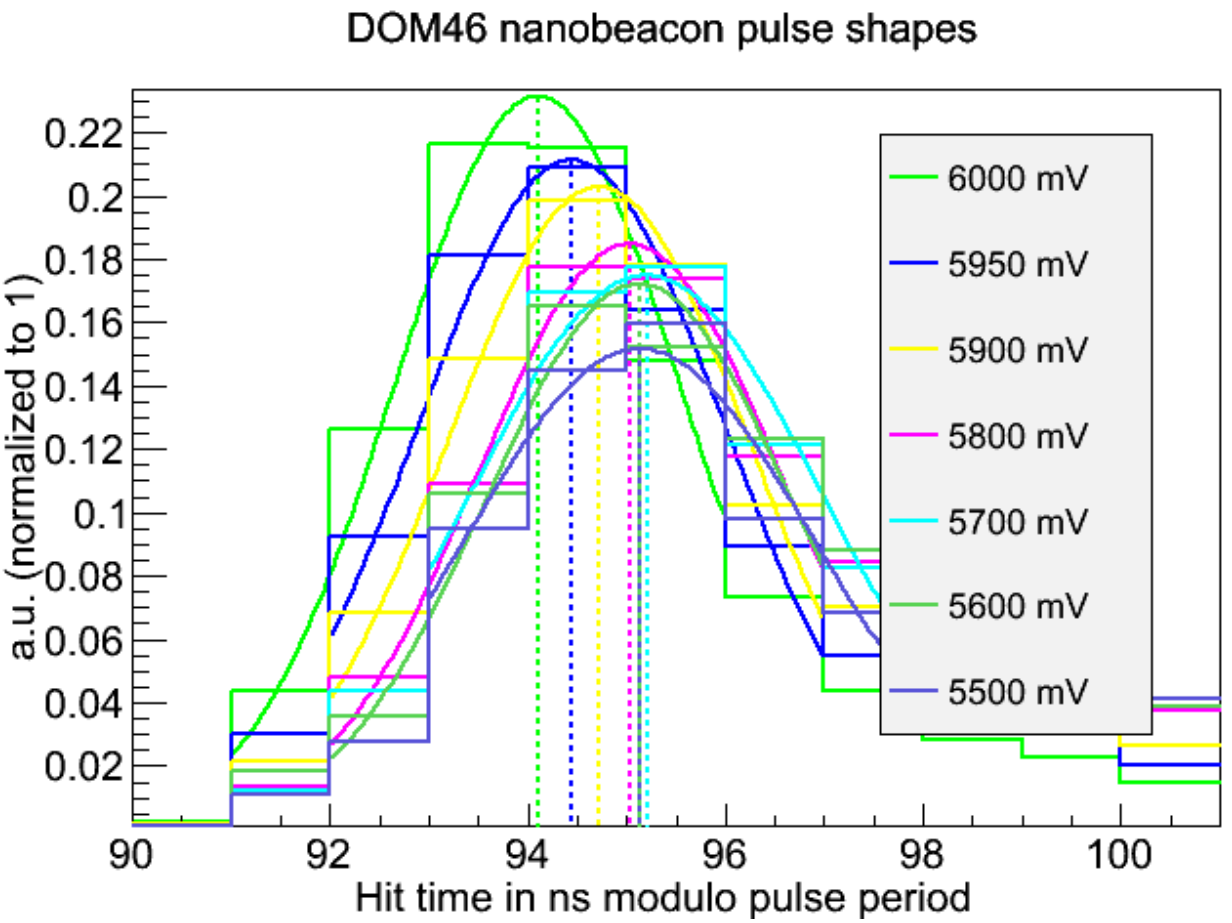
PMT response to NB



Based on 30s runs taken with DOM46 in the Nikhef dark box

NB brightness nonlinear.

PMT response to NB

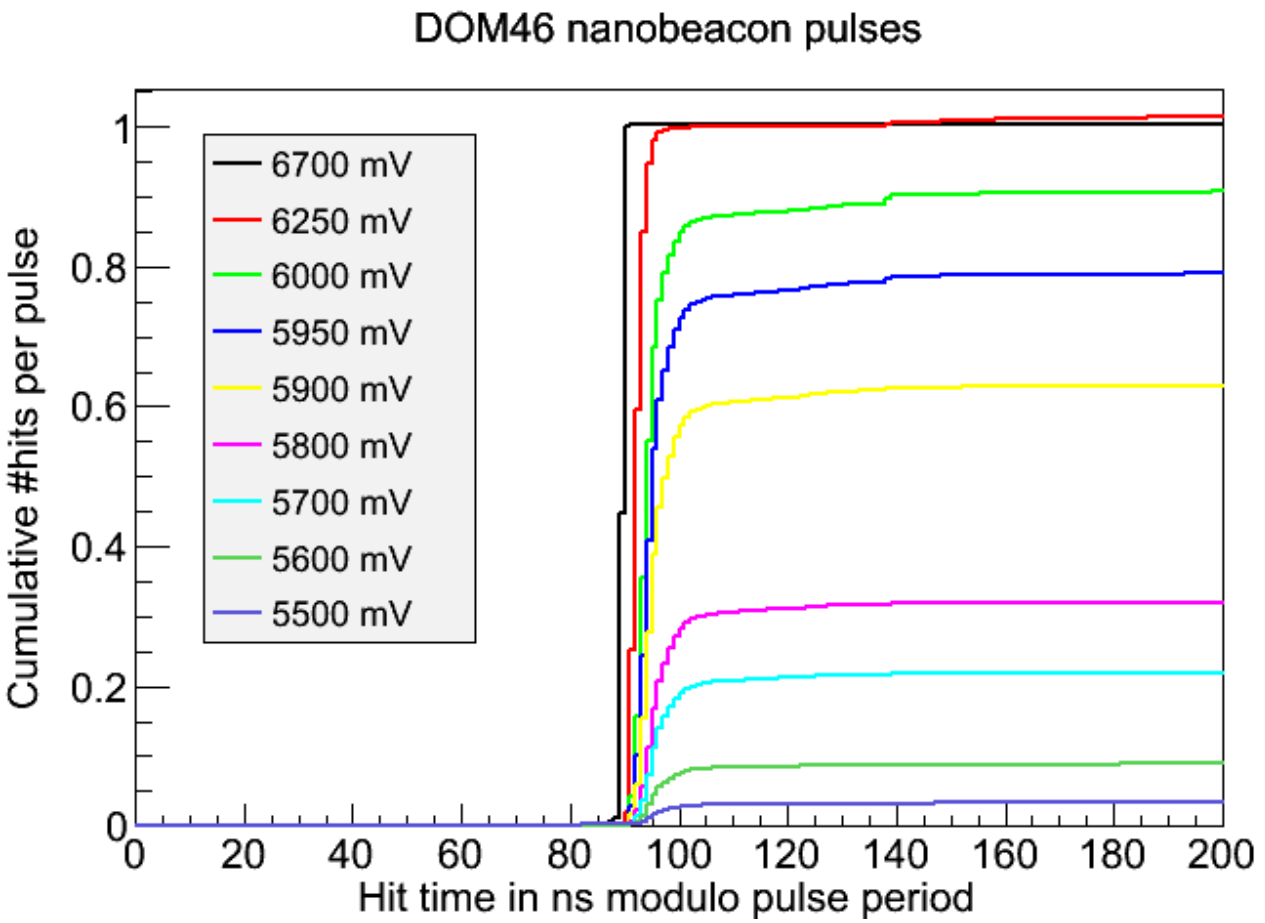


Based on 30s runs taken with DOM46 in the Nikhef dark box

Peak position shifts with brightness.

But only ~1 ns in 'reasonable' brightness range.

PMT response to NB

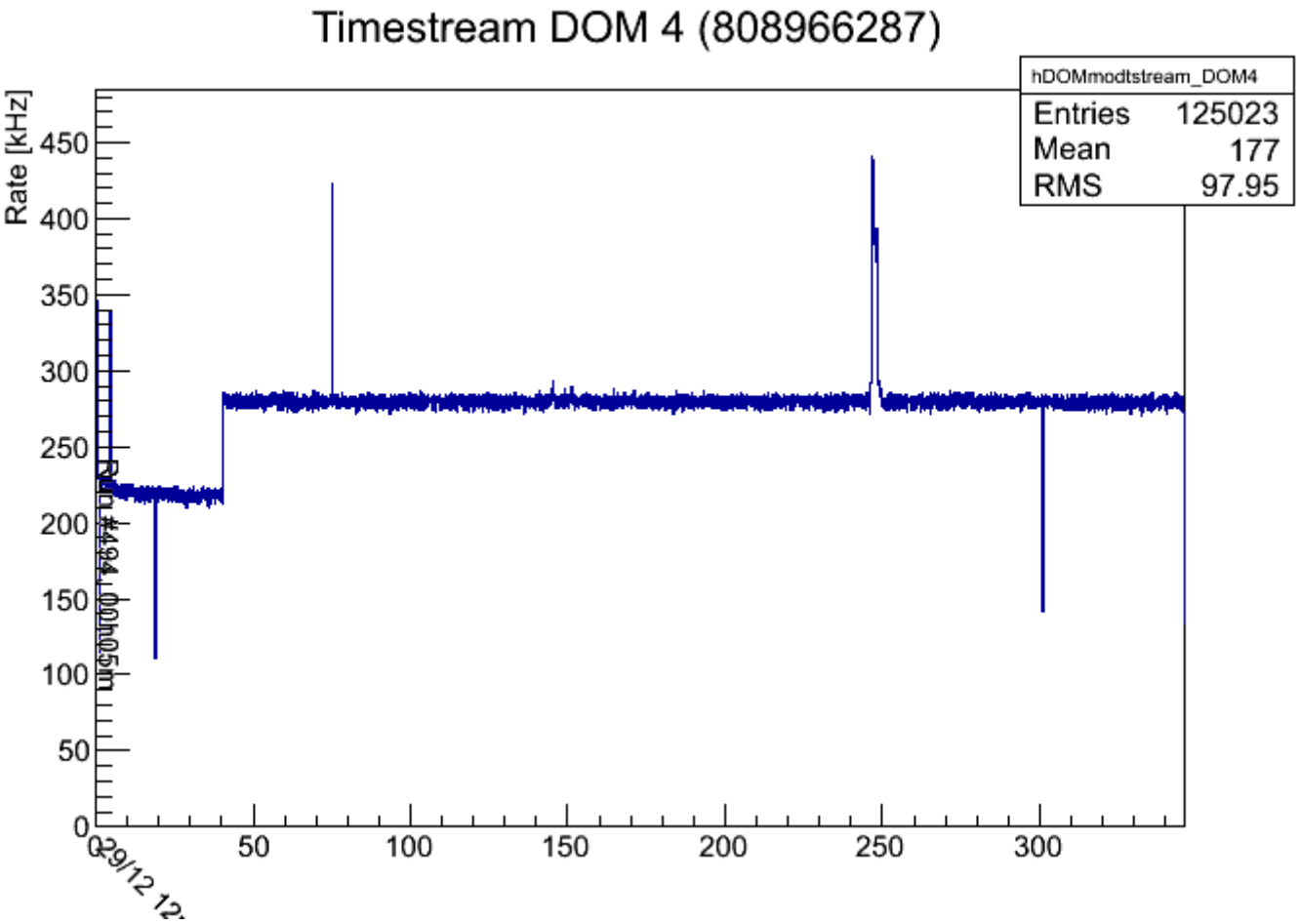


Based on 30s runs taken with DOM46 in the Nikhef dark box

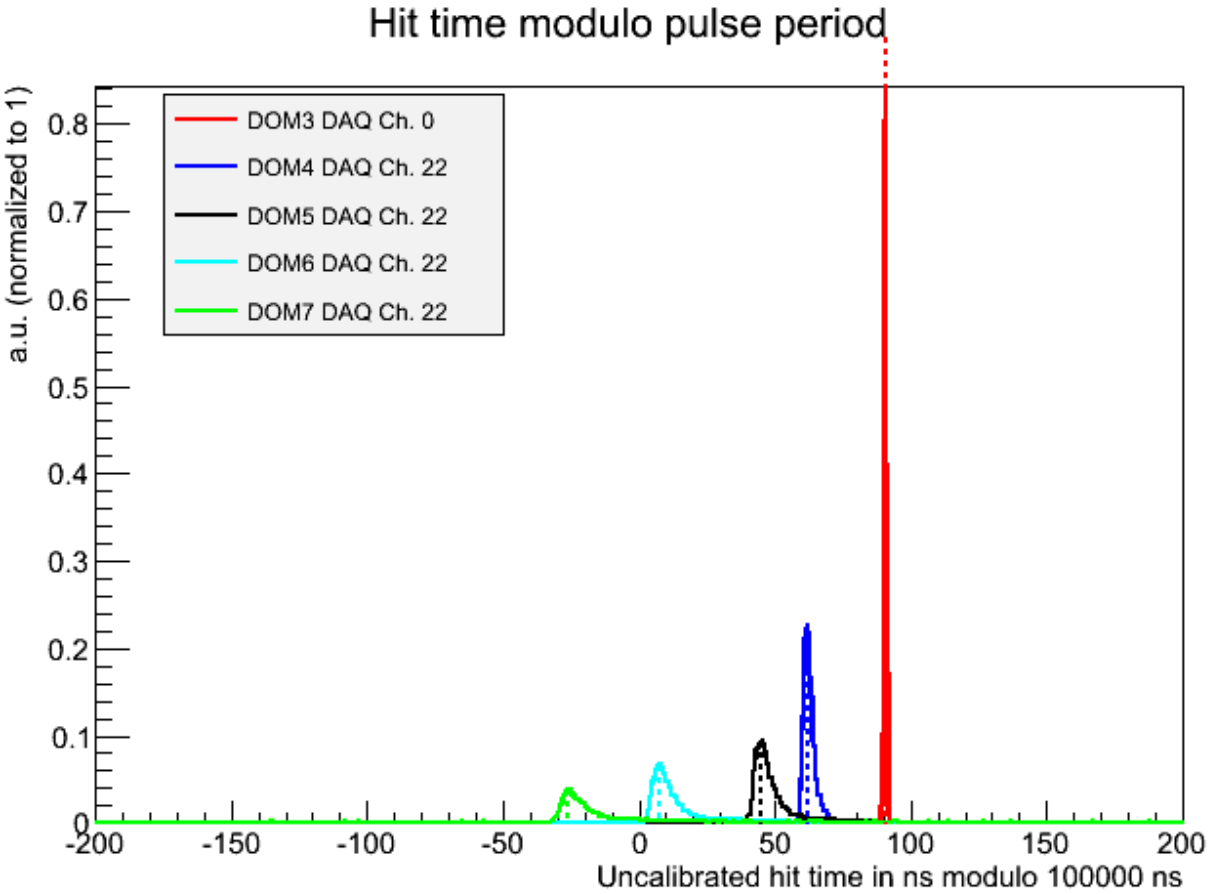
PMT response saturates at 1 hit per pulse.
Only leading edge of bright NB pulses is seen.

Run selection

- Only a few nanobeacon runs
- Not all useable
- Nanobeacon voltages changed through run
- Beacon too bright or too faint
- Only 3 runs with L0 data
- Rest L1 data
- Events unusable because of trigger
- Often, DOMs are off
- Made run-by-run selection of useful parts

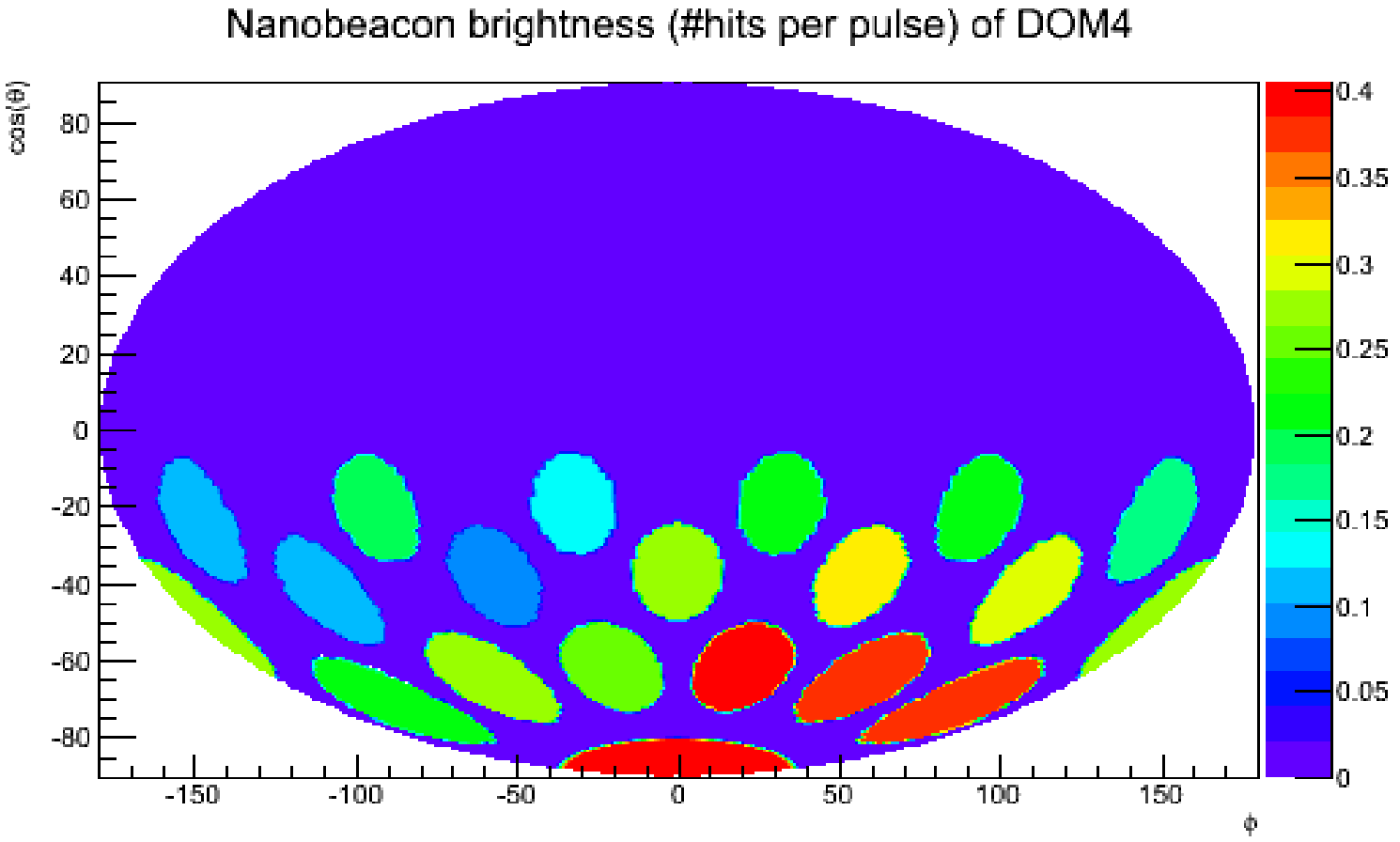


Example of pulse shapes



Run 494 (L0 run)
Nanobeacon much brighter than what we normally use (overilluminating DOM3)

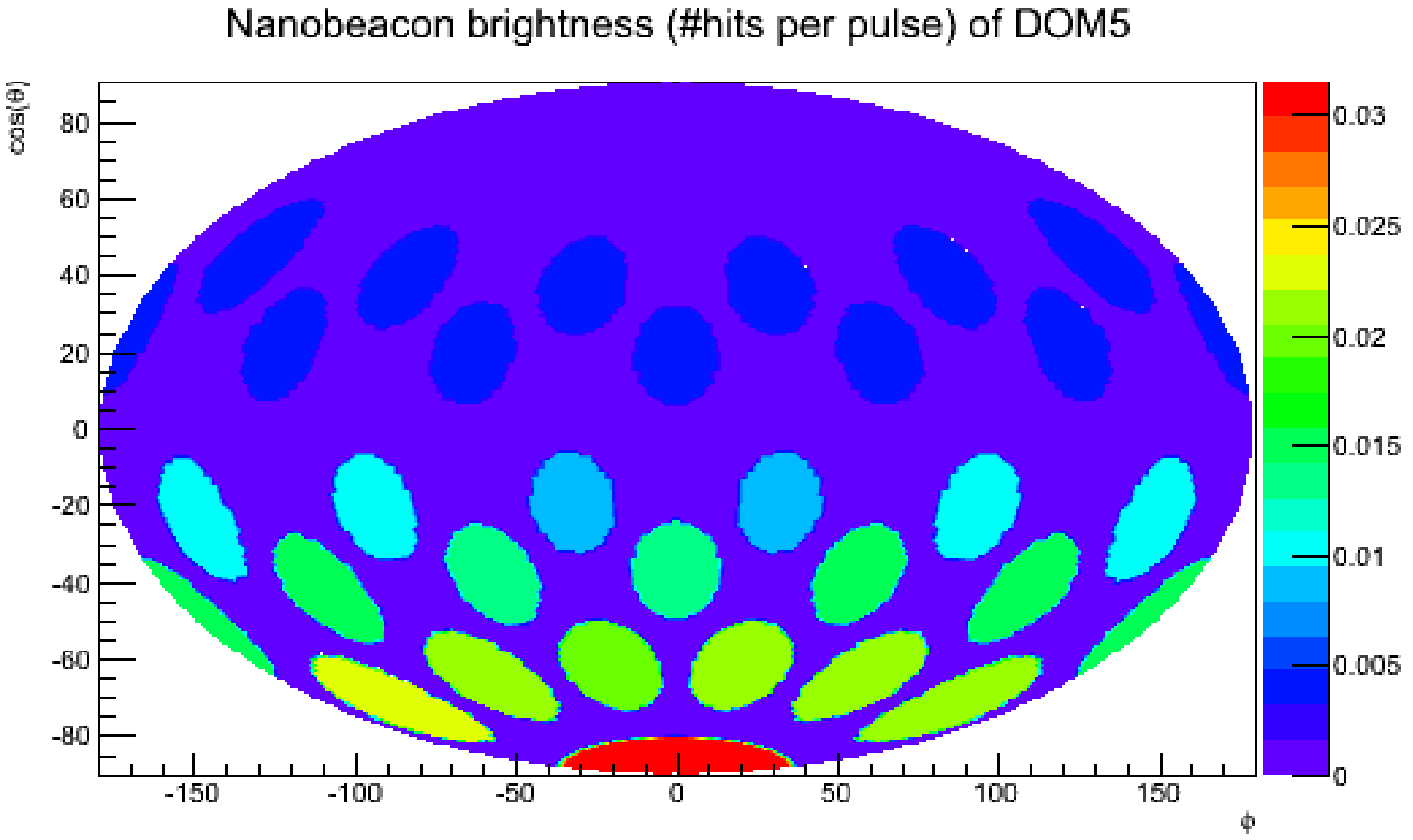
Nanobeacon brightness



Brightness = integrated number of hits per nanobeacon pulse

Run 494

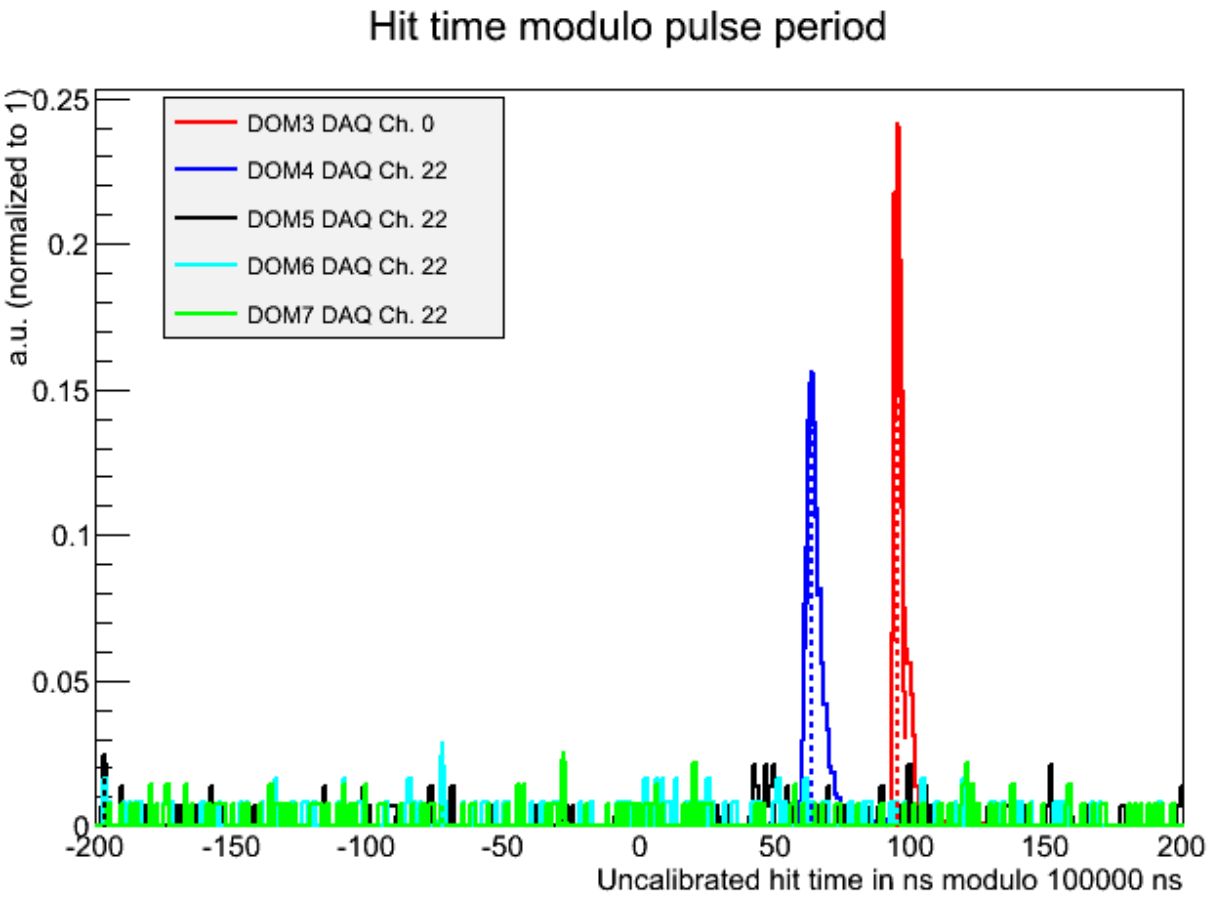
Nanobeacon brightness



Not showing DOM3 for this run, it looks bad due to the HRV

Run 494

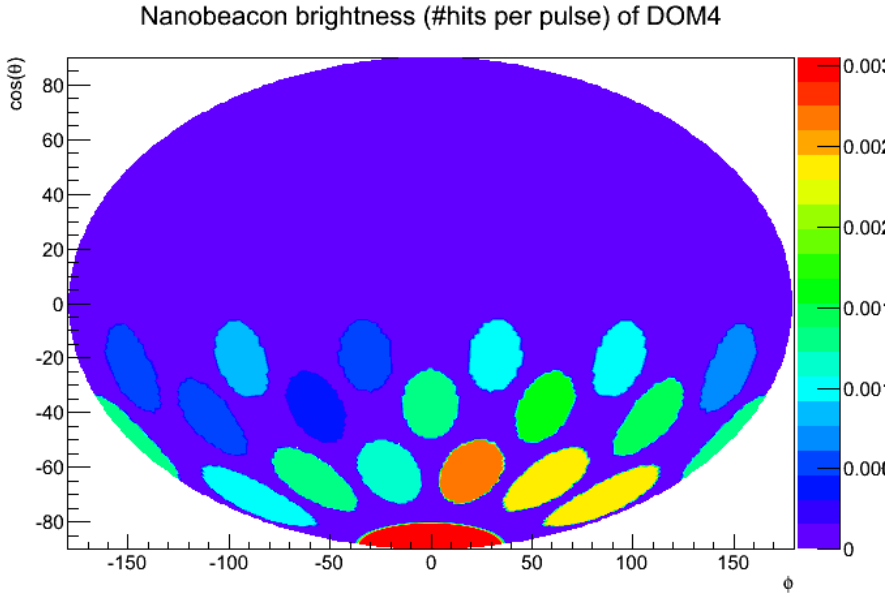
Example of pulse shapes

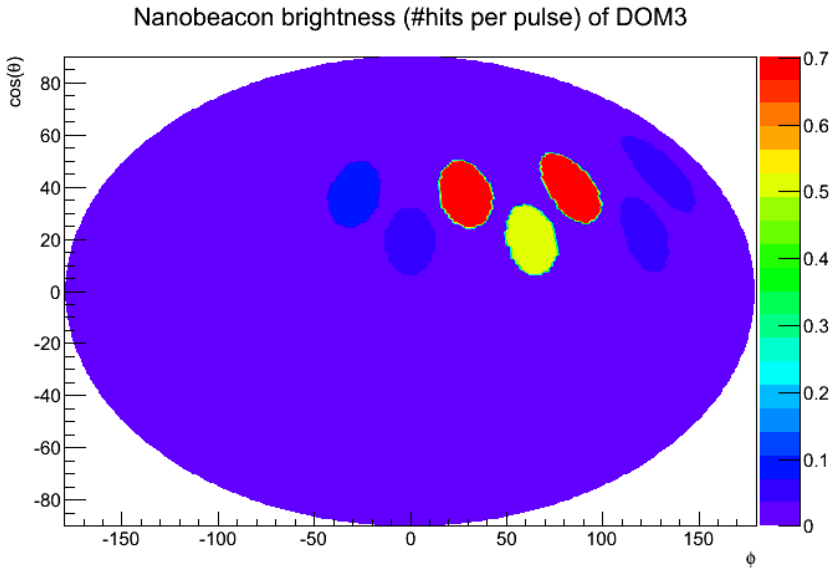


Run 1649 (L1 run)

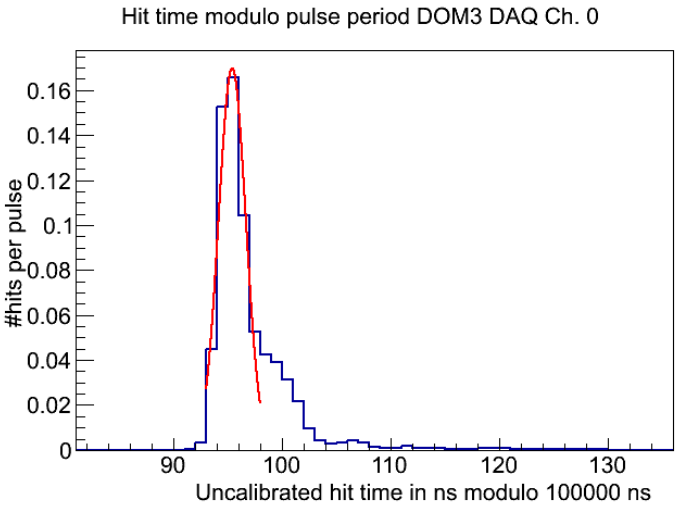
Nanobeacon brightness

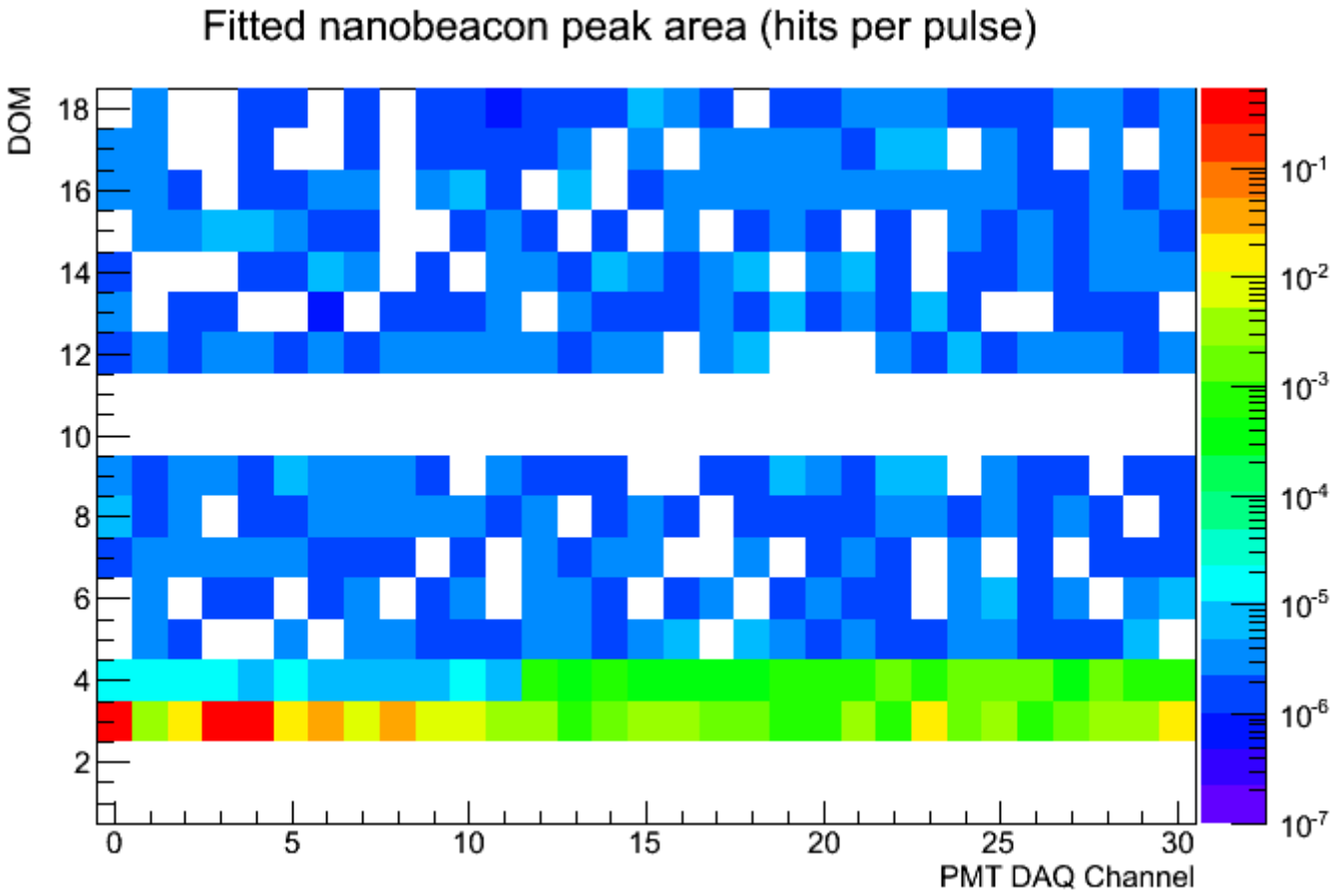
Run 1649





Nanobeacon brightness

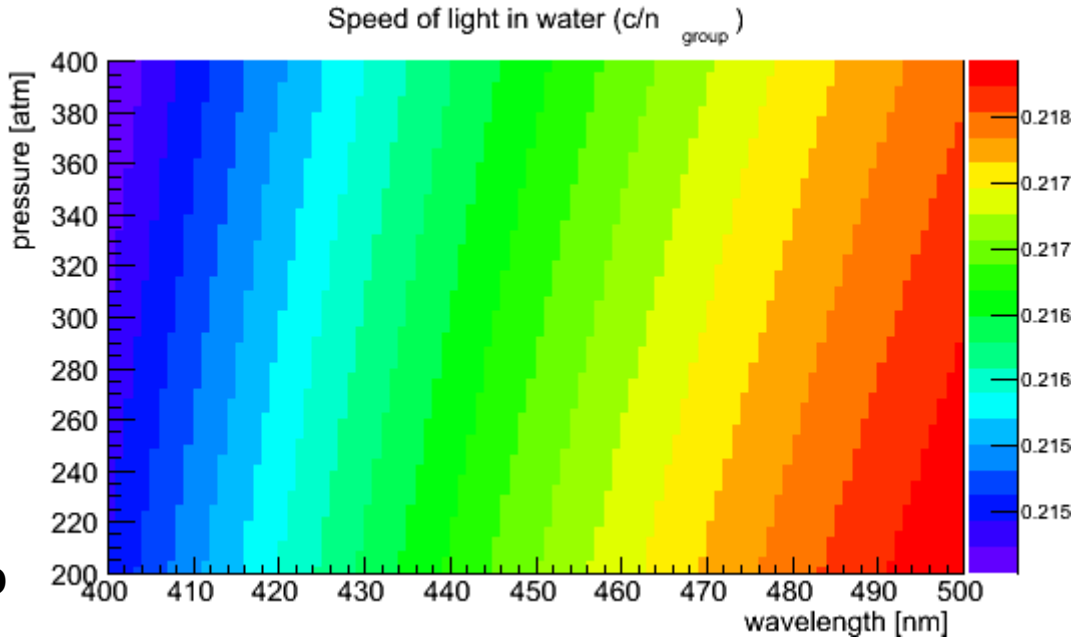




Run 1649

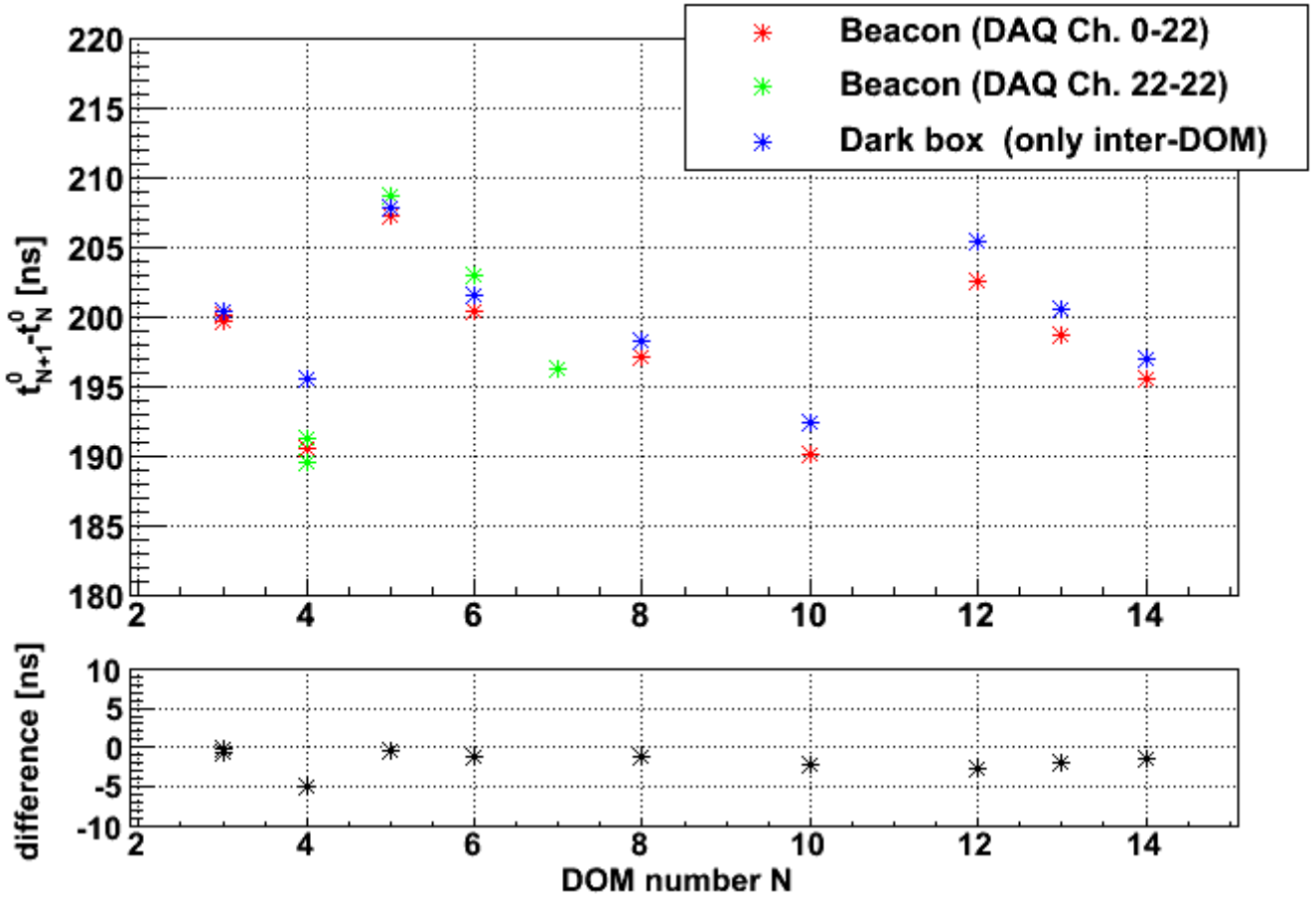
Systematics

- Using JDispersion, 470 nm, 300 atm pressure
  → c_w = 0.217449 m/ns
- Diego Réal: LED model is HLMP_CB1A_XY0DD with 470 nm with a width of 20 nm FWHM
- Systematic uncertainties:
  - NB spectrum
  - water properties
  - line length
- Light travel time ~160 ns
  - 1% uncertainty = 1.6 ns
  - ~1.6 ns per 100 atm pressure
  - ~1.6 ns per 10 nm wavelength
  - ~1 ns per 20 cm spacing



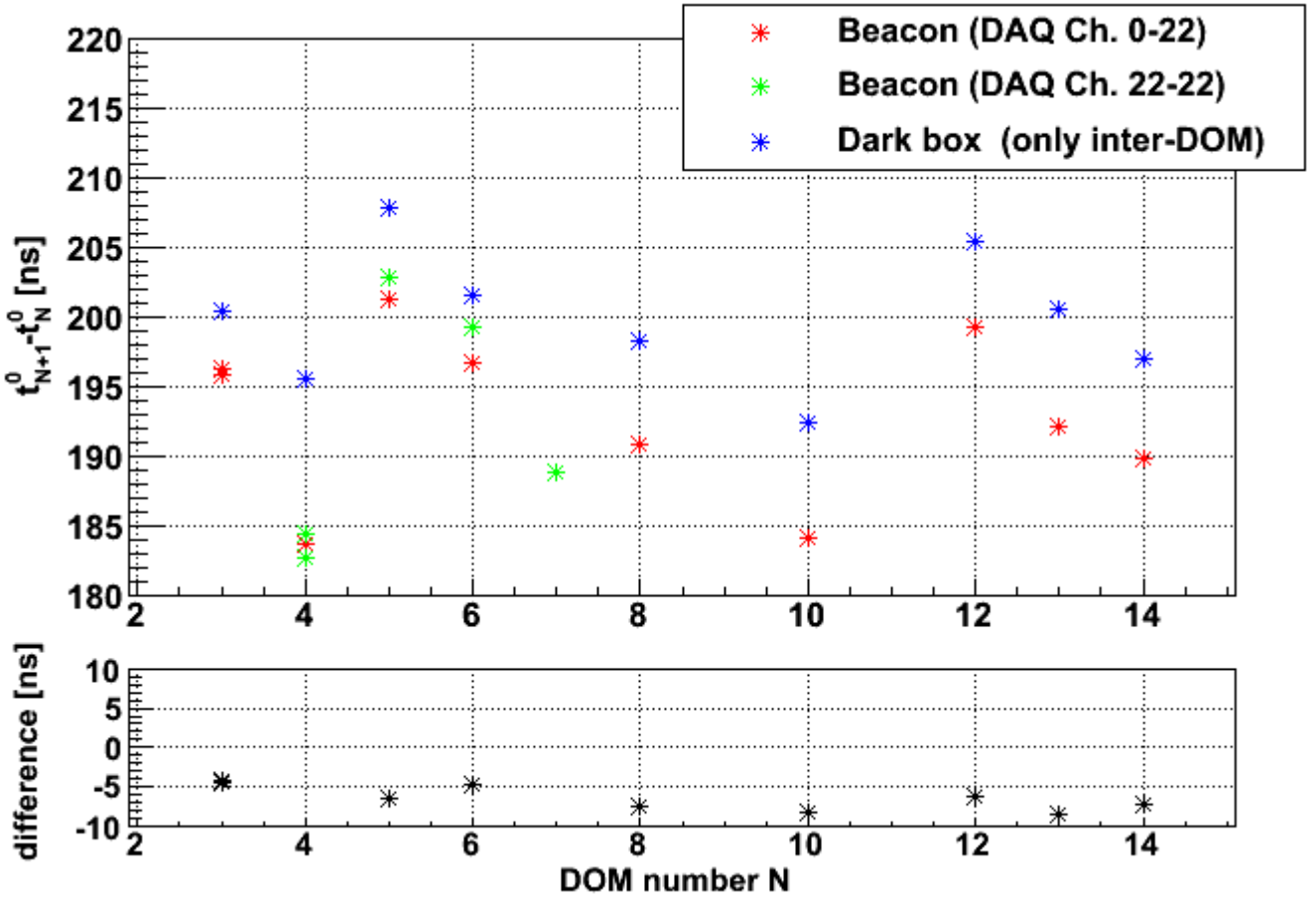
Systematics probably limit the accuracy to more than 1 ns

Preliminary Result



Detector file

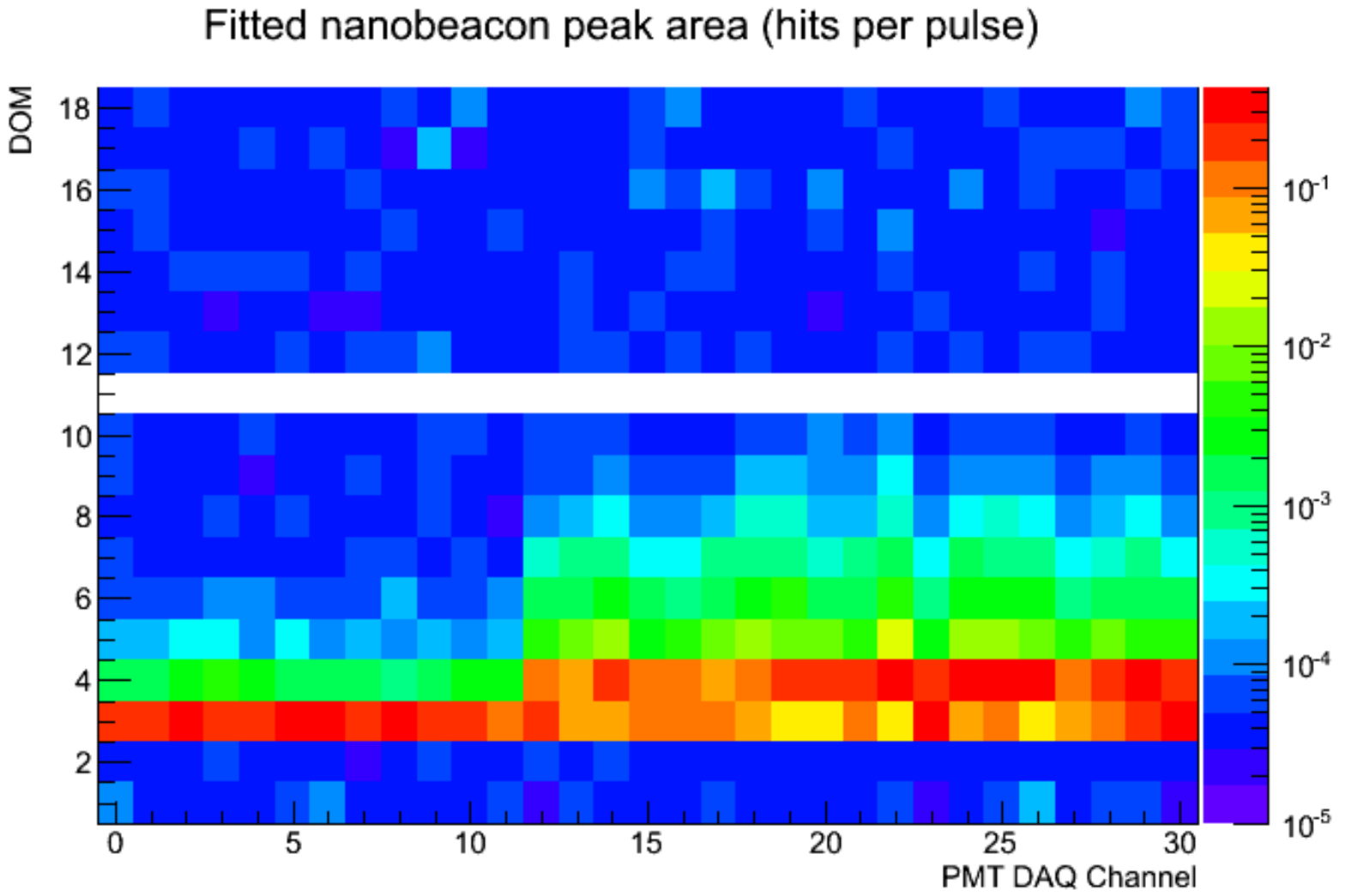
- DOM heights as measured with the ROV
- Average inter-DOM spacing 37.2 m instead of 36 m



The time calibration results if we use the 36 m detector file

Backup

Run 494


Fitted nanobeacon peak area (hits per pulse)
DOM
18
16
14
12
10
8
6
4
2
0
5
10
15
20
25
30
PMT DAQ Channel
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}