A final (?!) look at the PPm-DU time calibration

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Beacon runs

No beacon runs in phase 2 data taking (the data with which the PPM-DU paper is written), only phase 1

- Beacon DOM 1: 69 runs distributed on the whole phase 1
- Beacon DOM 2: 7 runs tightly clustered

Time calibration with beacon (the original idea)

Calibrate DOM 2 and 3 using beacon runs where the beacon in the DOM directly below is turned on

Calibrating DOM 3 using beacon in DOM 1

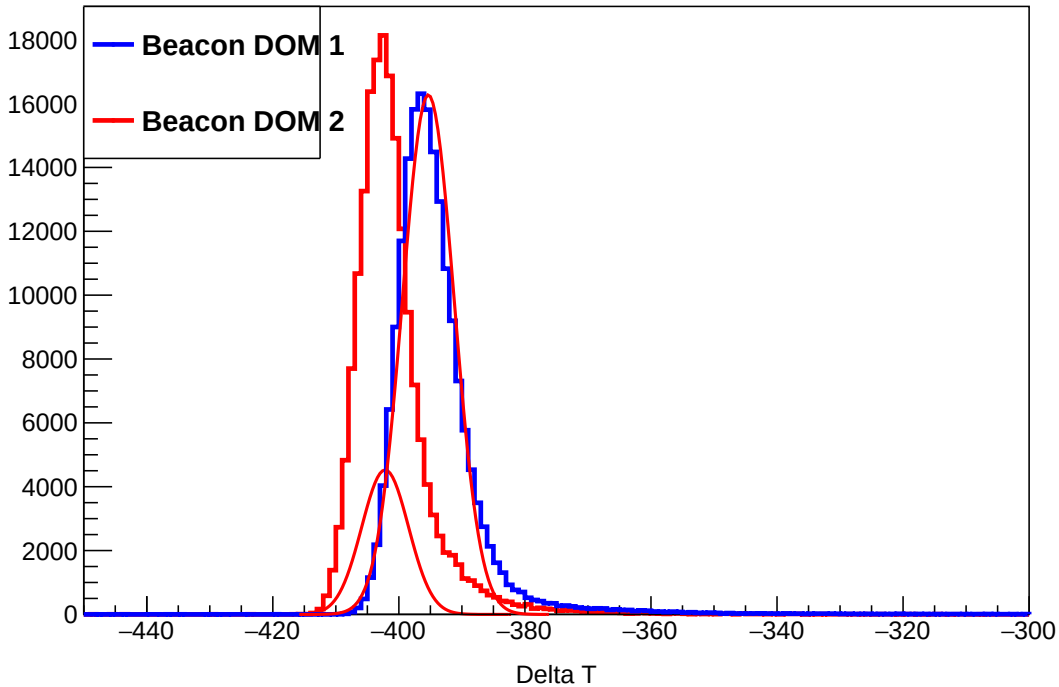

Figure : Obtained time offset for DOM 3 with different beacons

We found a shift for calibrating DOM 3 with the beacon in DOM 1 of $\approx$ 8.5 ns and a spread in width from σ 1.9 ns to σ 5.2 ns

Shifts in time offsets

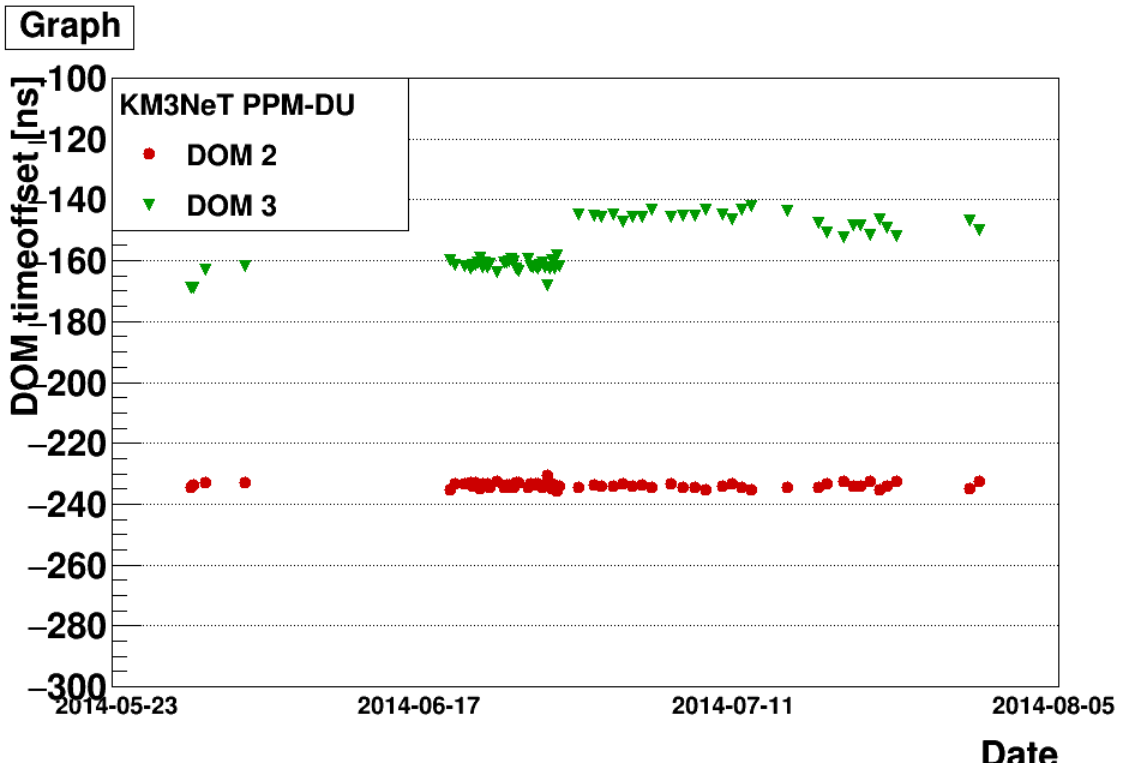

Figure : Time offsets for DOM 2 and DOM 3 in phase 1 determined with beacon in DOM 1

Start and end of periods with different time offsets coincide with power cycles of the DOMs and line

Muon calibration

Method

Fit the agreement between MC and data DOM time difference histograms with a chi square fit
$\rightarrow$ allows to adjust the obtained offsets from beacons with Muons (needs around 12 h of data)

- Phase 1 show good agreement for the 3 different periods (up to 1.5 ns
- Only way to account for shifts in phase 2 data taking (since no beacon runs have been taken)

Muon calibration

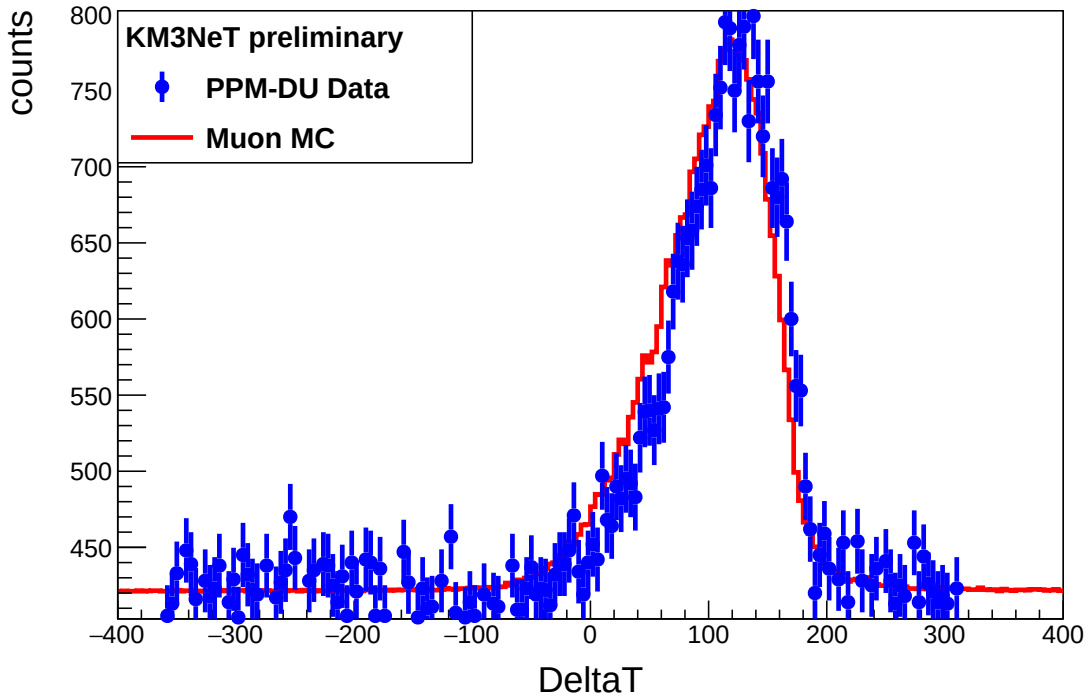

Figure : Delta T distribution between DOM 3 and 2 in phase 1 no muon calibration applied

Muon calibration

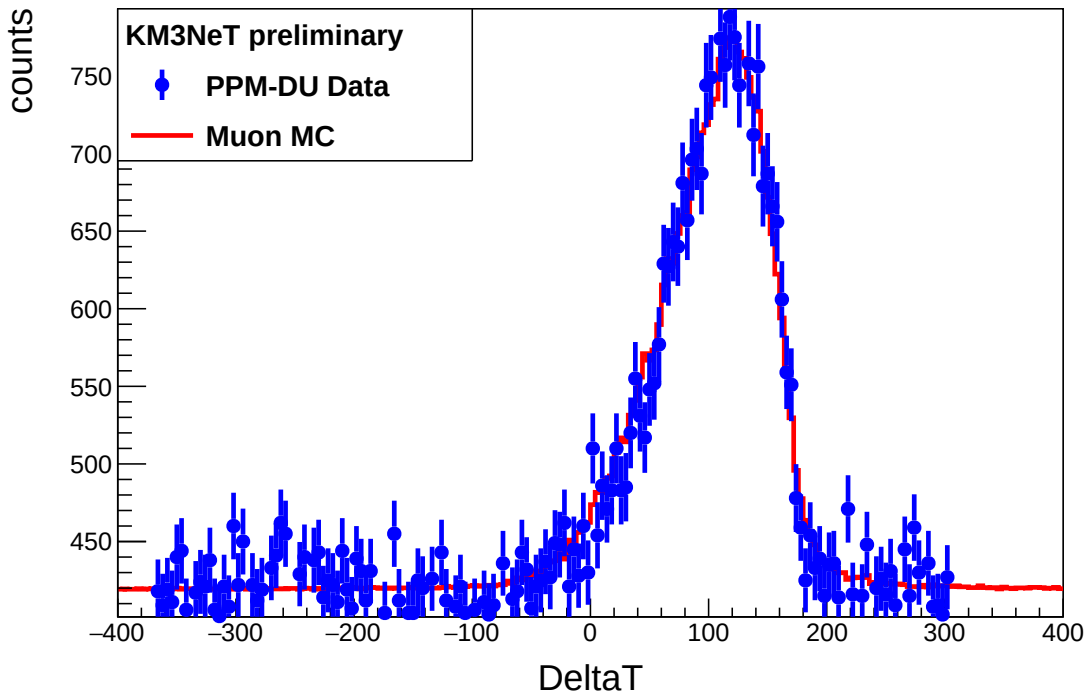

Figure : Delta T distribution between DOM 3 and 2 in phase 1 with muon calibration applied

Time calibration phase 2

All power cycles and found 13 different periods, of which 10 are meaningful (others too short or no runs taken)
↪ Apply Muon time calibration to these and obtain the correct offsets for the different periods

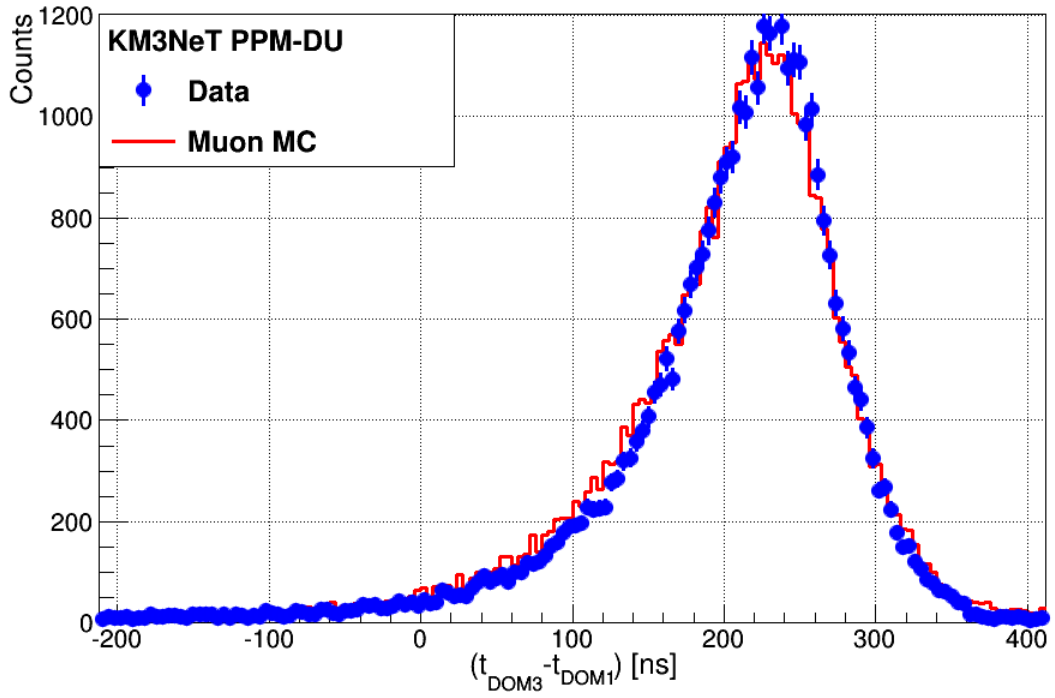

Figure : Delta T distribution between DOM 3 and 1 in phase 1 scaled by entries

Time calibration phase 2

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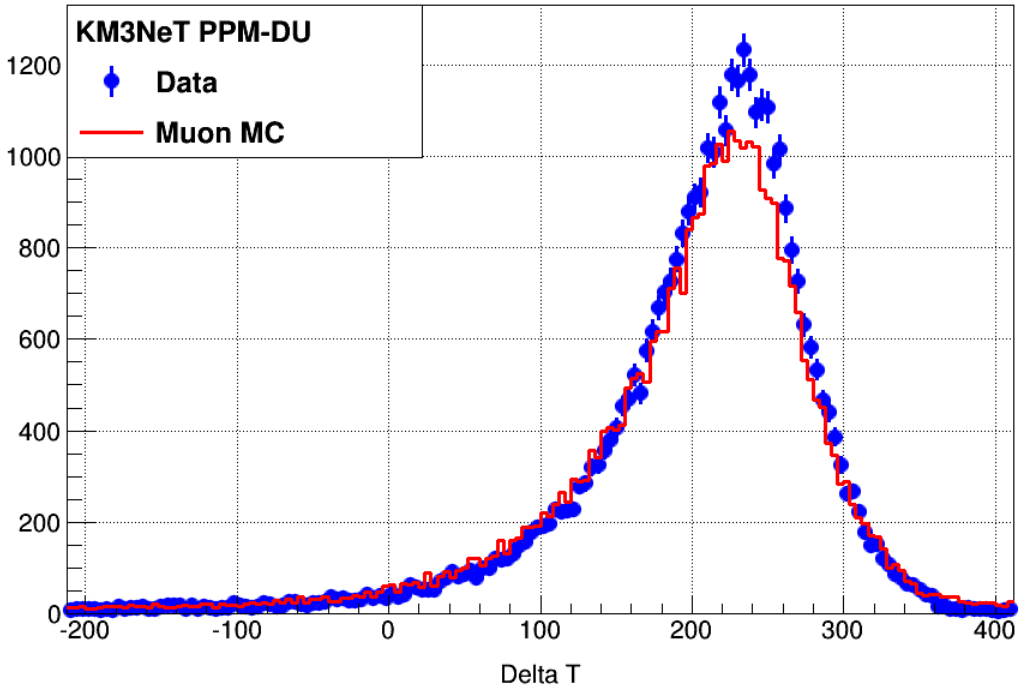

Figure : Delta T distribution between DOM 3 and 1 in phase 1 scaled by life time