A general look at the DU2 data

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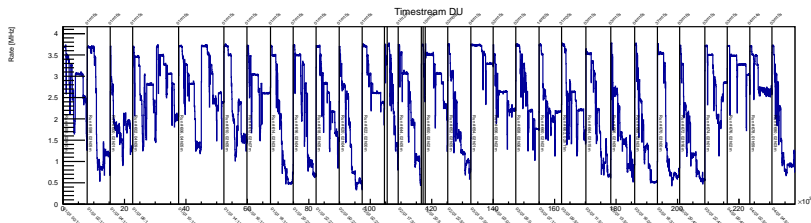DU2 data analysis meeting 11/01/2016

KM3NeT
Opens a new window on our universe

Introduction

▶ Not looking at physics (see e.g. Karel's talk for that)
▶ But general data integrity
▶ Some problems in the data

Summed rate of the whole DU for the first days of January.

Technical

- Data is copied daily to Lyon, retrievable using IRODS
  `/in2p3/km3net/data/raw/sea/KM3NeT_00000007/`
- Reading data with JPP
- Mostly look at *JDAQSummarySlices*
  $\Rightarrow$ Give PMT rates and DOM status every 0.1s.

Problem 1: We slowly lose DOMs during the runs
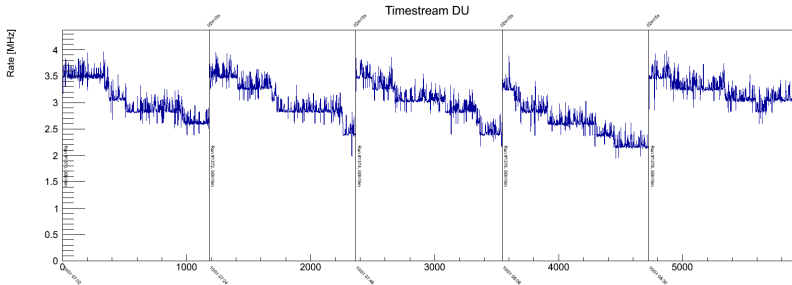
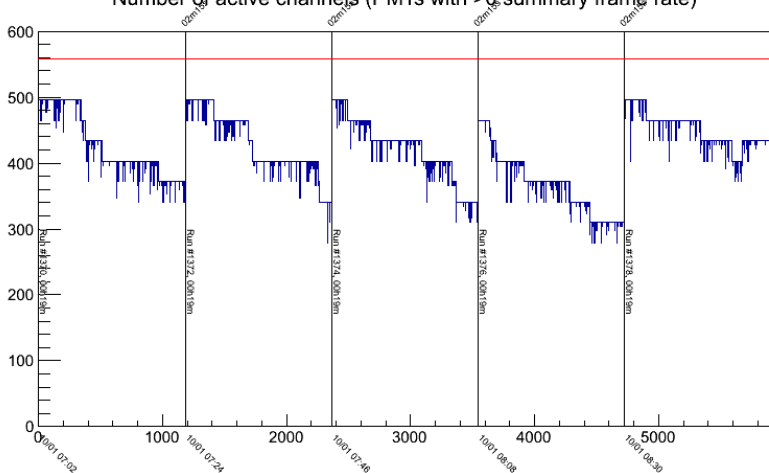
Rates as a function of time for five runs taken last Sunday.
This is the summed rate over all PMTs in the DU.

▶ Rate drops in steps
▶ The unreadably small labels show
  ▶ Run numbers (1370, 1372, ..., 1378)
  ▶ Run duration (19 mins)
  ▶ Time between runs (2m15s)
  ▶ Date and time (first run 10/01/2016 07:02AM)
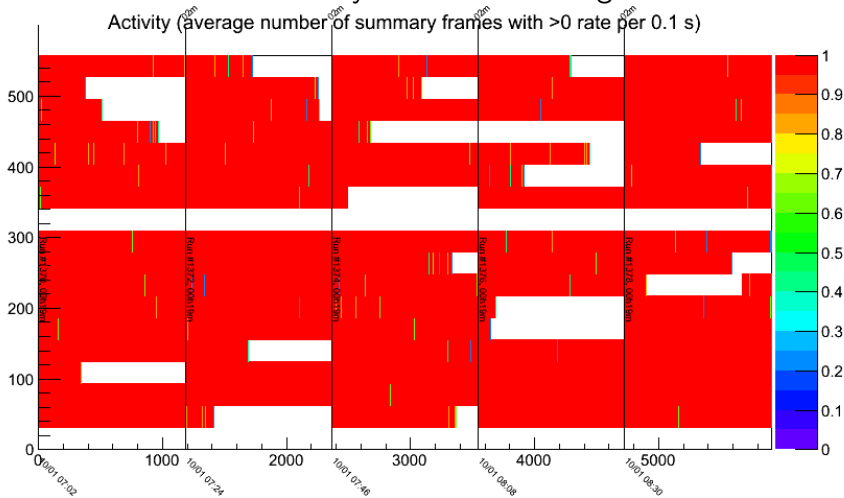
Problem 1: We slowly lose DOMs during the runs

Number of 'active channels'
(number of PMTs for which there is data + the rate is more than 0)
for the same five runs.

Problem 1: We slowly lose DOMs during the runs

Activity (average number of summary frames with >0 rate per 0.1 s)

Number of active channels split out by PMT.
The y-axis shows 31*DOMnr+PMTnr with numbering starting from 0, and the DOMs ordered from low to high.

Problem 1: We slowly lose DOMs during the runs

- DOMs themselves are not off (we do get summary data)
- Starting a new run temporarily fixes the problem
- Current hypothesis: CLBs go into a strange state, sending lots of data and overloading the DataFilters.
- No solution yet.
- Taking short (20 min) runs to minimize the loss of data.

Problem 2: Periodic behaviour in time streams

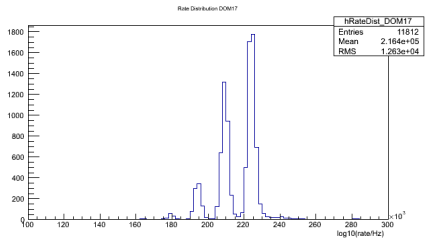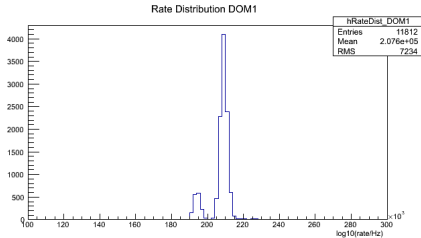
Timestream DOM 1 (808974928)
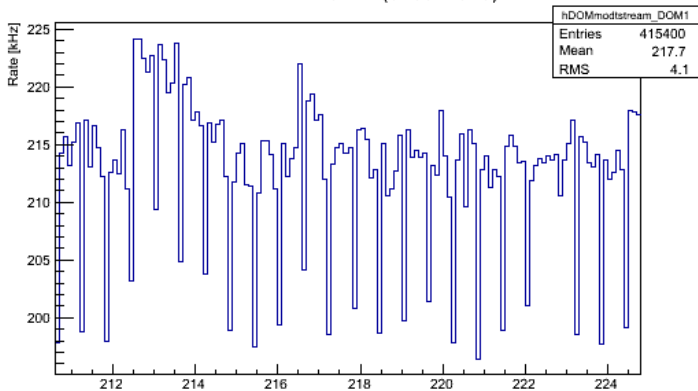
Rate versus time for DOM2, run 1160. Each data point is 0.1s.

▶ Note the periodic downward fluctuation
▶ This feature is seen in all DOMs and all runs until 1162

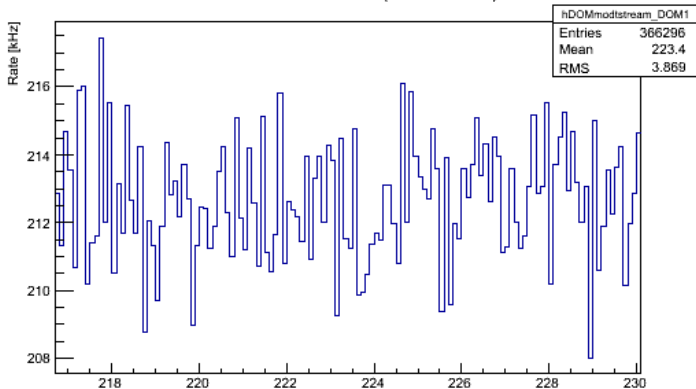## Problem 2: Periodic behaviour in time streams

Rate distribution for run 860. DOM2 (left) and DOM18 (right).

▶ Note the multiple peaks.
▶ Caused by the same feature.

Problem 2: Periodic behaviour in time streams

Rate versus time for DOM2, run 1164.

- ▶ Problem mysteriously vanished since run 1162 (08/01/2016 16:00)
- ▶ After unrelated expert intervention: Update of DQ to version 3.6 and Control Unit upgrade

Problem 3: Slice splitting

- Some slices have the same UTC starting time and frameIndex
- Happens in most (if not all) runs
- One of the slices usually contains 1 DOM, while the other contains the rest

Problem 4: DOM status

▶ The *status* is 32 bits of data stored in each JDAQSummaryFrame (i.e. once for each DOM in each time slice).

  ▶ bit 0: whether timing is okay
  ▶ bits 1-31: whether HRV was activated for each PMT

▶ Looks okay in the monitoring data.

▶ But always 0 in the stored data.

▶ Problem with writing or reading?

▶ I read it with JDAQSummaryFrame::getStatus().

Frame index and UTC time

I checked that the timing of these matches as it should:

$$(n_i - n_0) \times 0.1\mathsf{s} = t^{\mathsf{UTC}} - t_0^{\mathsf{UTC}}$$

where '0' index denotes the first slice in the run.

MRunAnalyzer plots

▶ Also looking at some more advanced plots with MRunAnalyzer
▶ Relatively slow (reading in *JDAQTimeslices*)
▶ Not very accurate when DOMs start dropping out
▶ Program is under constant construction
▶ Following plots are all based on run 1507

MRunAnalyzer plots
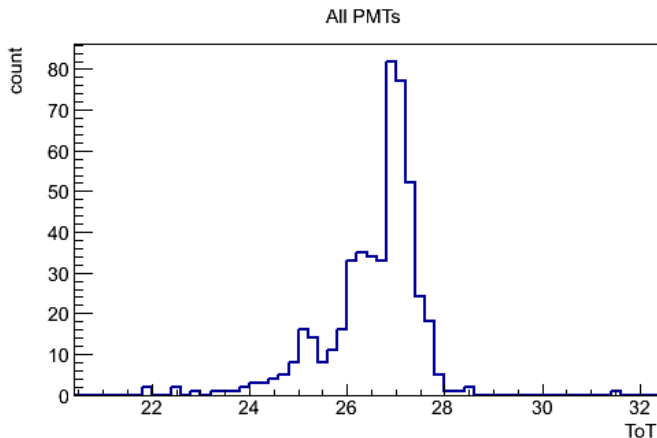
ToTs of all the PMTs, based on Gaussian fits (run 1507).

MRunAnalyzer plots


Relative Hit Times DOM 1, PMTS 0 (F4) and 1 (E5)
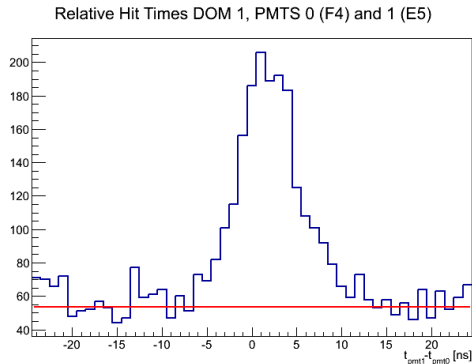
Example of a relative hit time histogram. It shows the time differences between hits on a given pair of PMTs. The red line indicates the expectation for uncorrelated channels.

The 'Rate of correlated hits' or 'correlation' is the integral of the curve minus the area under the red line.
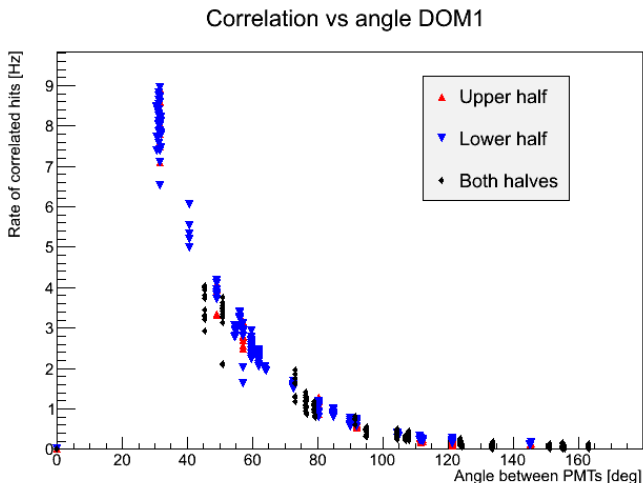
MRunAnalyzer plots

DOM1 correlations (rate of correlated hits [Hz])
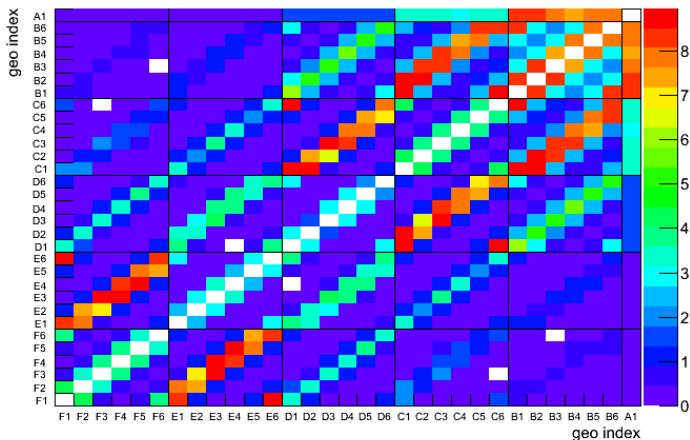
Inter-PMT correlation for each PMT pair. (DOM2, run 1507).

MRunAnalyzer plots

Correlation vs angle DOM1

Inter-PMT correlations as a function of the angle between PMTs (DOM2, run 1507).