Dead time correction factor

Dead time

The dead time correction factor, ***D*** ,was calculated by following the method described in Flaminia's thesis (starting on page 213).

$$D = 1 + \frac{m}{k} = 1 + \frac{T_{Cam} + R_{PMT} \times T_{Window} \times t_{wf}}{T_{Window}}$$

- ***m*** - number of events missed due to the dead time
- ***k*** - number of real events detected by the camera during T_{run} (total duration of a background acquisition run)
- T_{Window} - active time of the light sensors (time where neither the PMT waveforms nor the camera images are being readout) = 300ms (exposure time of the camera) + 184ms (time to activate all sensor rows)
- T_{cam} - effective amount of time it takes for the readout of the camera (30ms)
- t_{wf} - time required for the readout of each set of PMT waveforms (12ms)
- R_{PMT} - PMT trigger rate (the true rate of events is approximated to this value, which is extracted from the trigger module rates).

$$\delta D = \sqrt{(\delta R_{PMT}.t_{wf})^2 + (\delta t_{wf}.R_{PMT})}$$

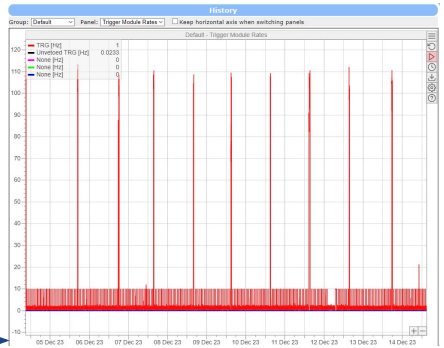
δR_{PMT} - standard deviation of the PMT trigger rate observed during the data taking campaigns

δt_{wf} = 2 ms

Trigger Module Rates

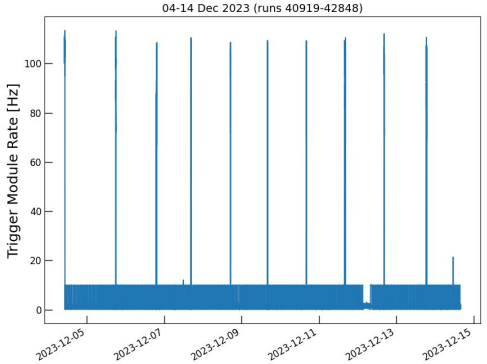
- Example: trigger module rates from 4 to 14 Dec 2023

Plot from MIDAS

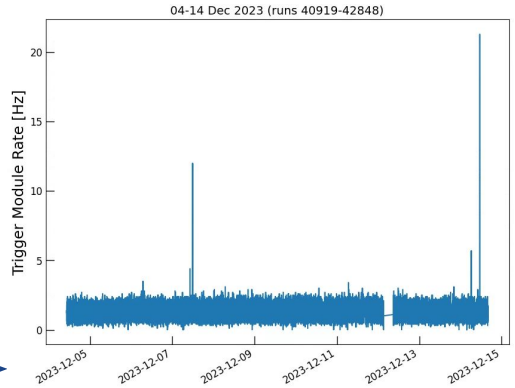


UTC+1 →

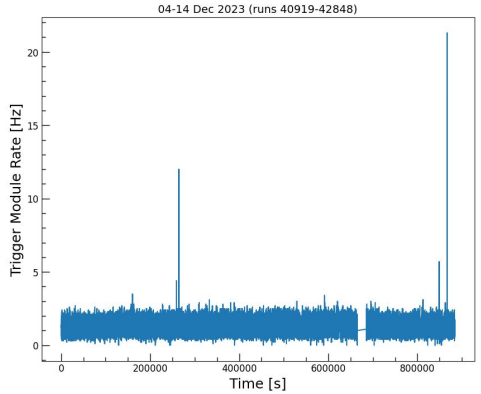
Plot with the data extracted from MIDAS

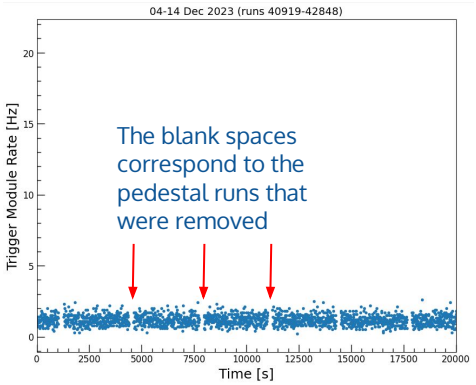


- Pedestal and calibration runs were excluded



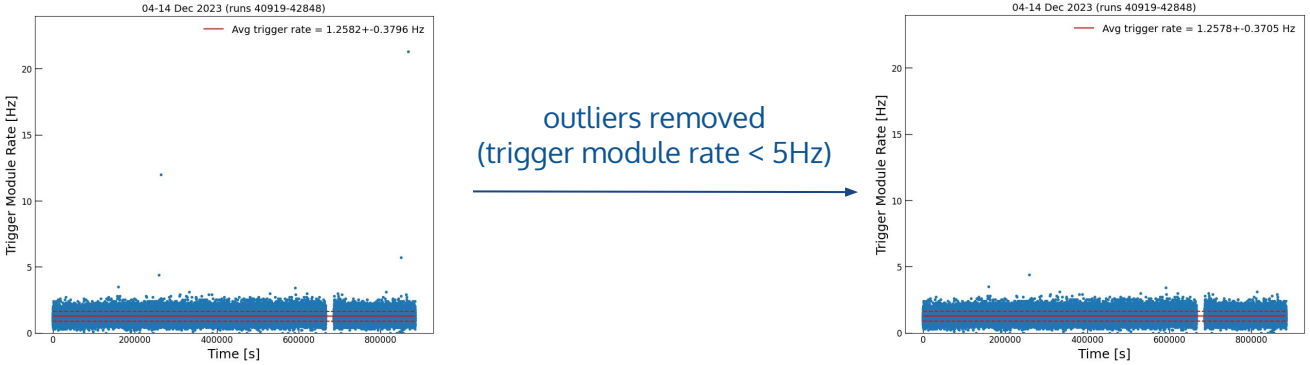
UTC+2 →



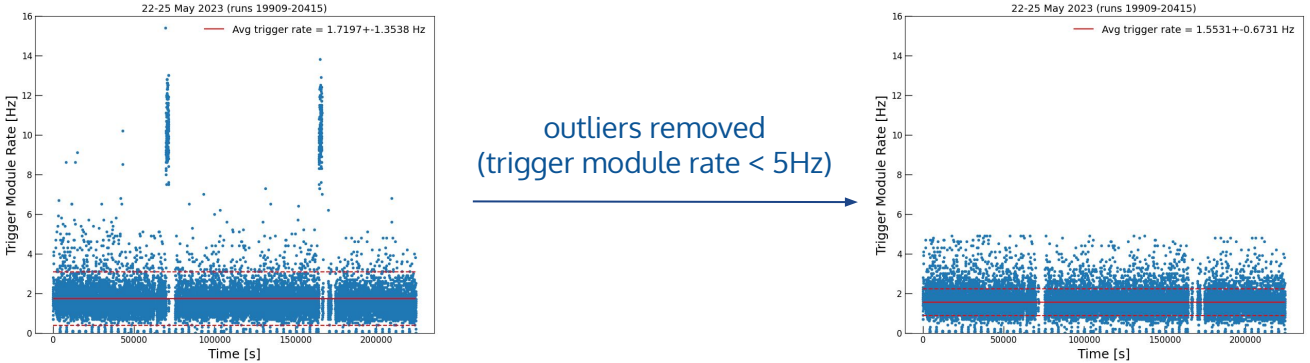


Average Trigger Rate

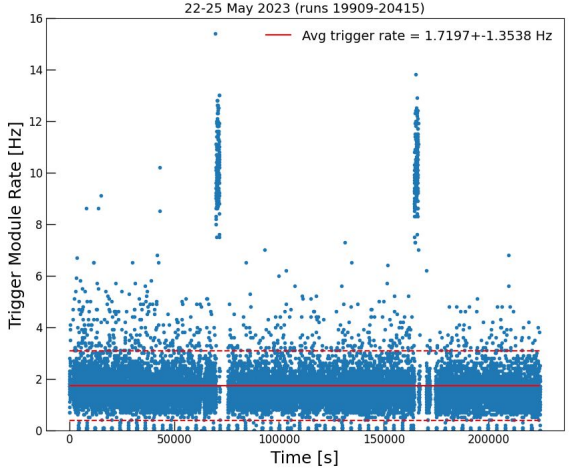
- All the periods of time corresponding to bkg runs, from each different data campaign, were used to calculate the average trigger rate.
- For example, in **runs 40919 to 42848 (December 2023)** we can notice the presence of some outliers.
- However, removing these outliers (considering only trigger module rates < 5Hz) doesn't affect much the avg trigger rate.

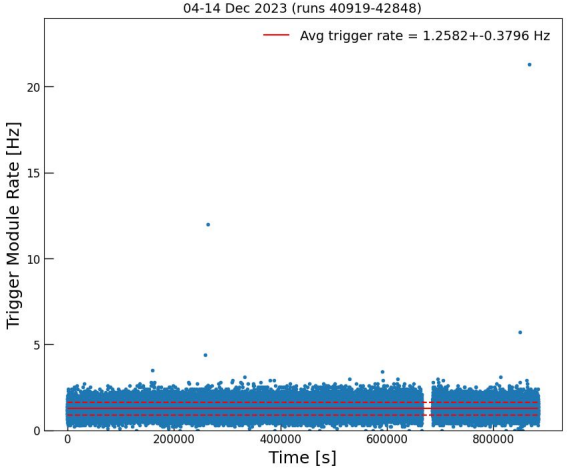


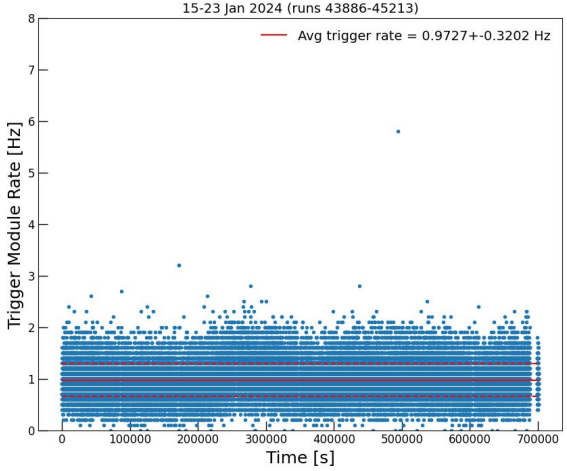
- For **runs 19909-20415 (May 2023)** the avg trigger difference is larger. But, in the end, this doesn't have a substantial impact on the correction factor D.

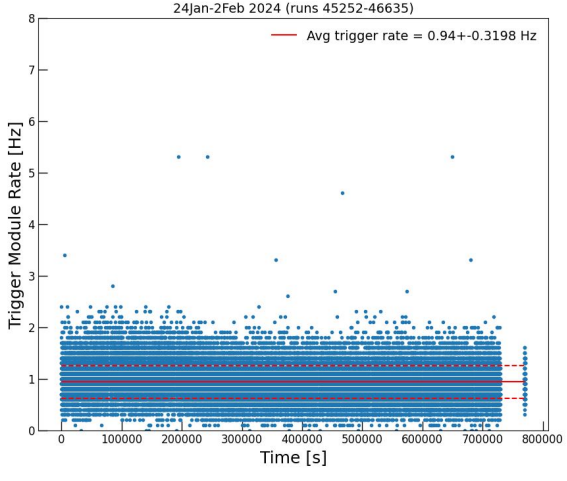


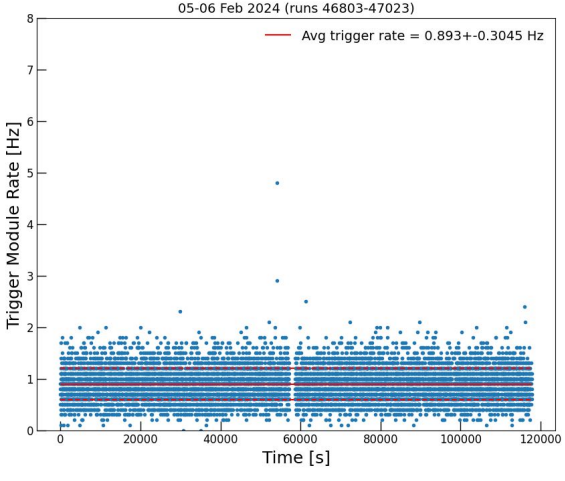
Average Trigger Rate

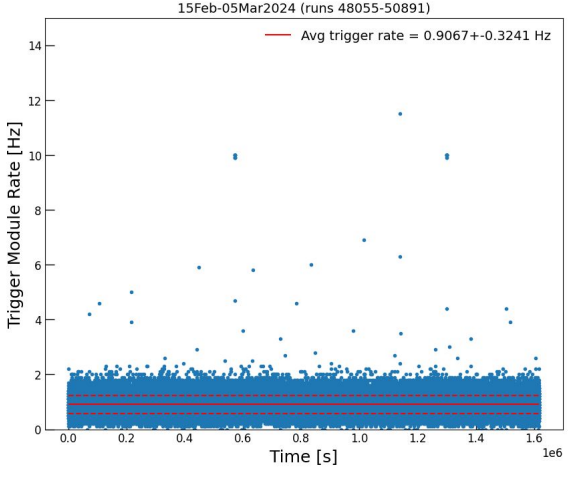




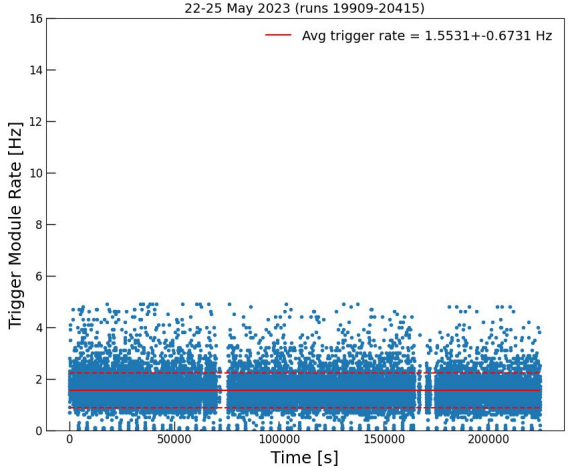


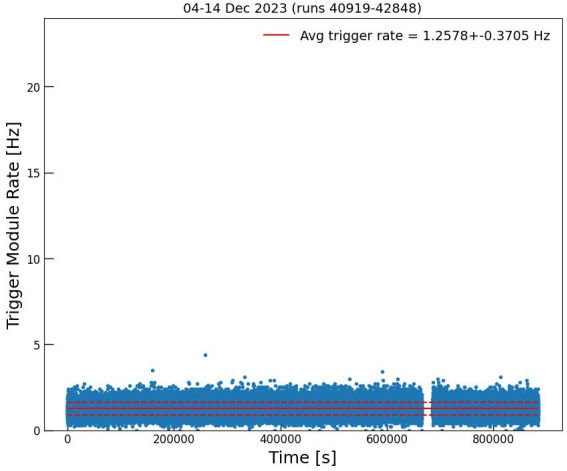


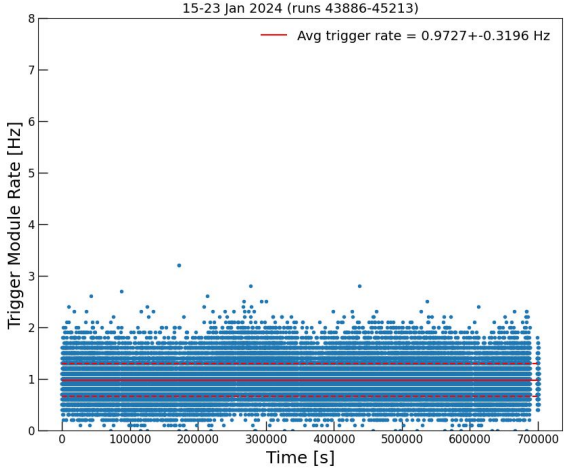


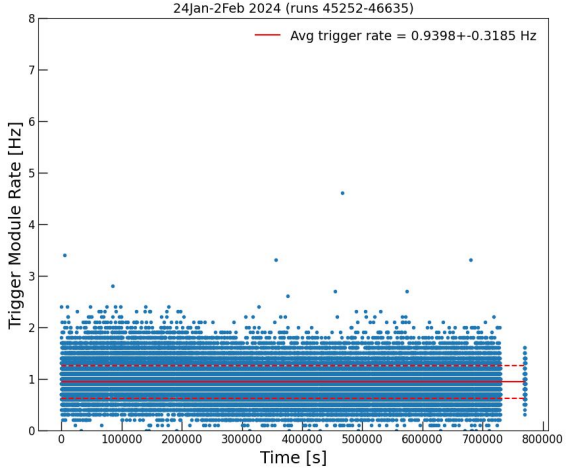


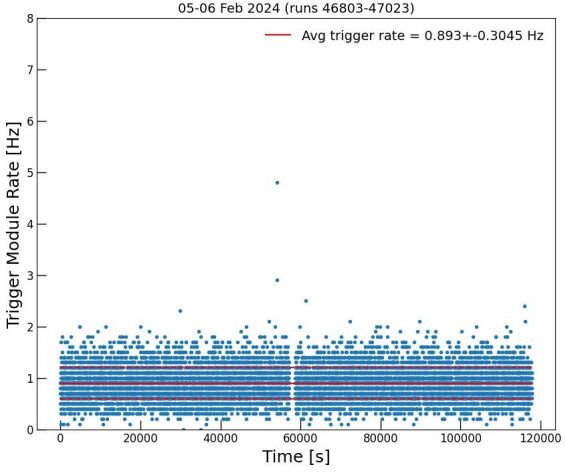
Average Trigger Rate (outliers removed - trigger rate < 5Hz)

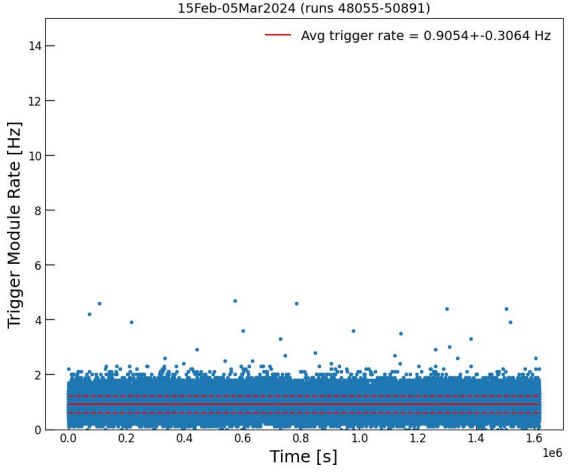












Preliminary Results

	R_{PMT} [Hz]	σ_{RPMT}	D	R_{PMT} [Hz] (trg<5Hz)	σ_{RPMT}	D (trg<5Hz)
Run 3 22-25 May 2023 [19909 - 20415]	1.7197	1.3538	**1.0826 ± 0.0166**	1.5531	0.6731	**1.0806 ± 0.0087**
Run 4 04-14 Dec 2023 [40919 - 42848]	1.2582	0.3796	**1.0771 ± 0.0052**	1.2578	0.3705	**1.0771 ± 0.0051**
Run 4 15-23 Jan 2024 [43886 - 45213]	0.9727	0.3202	**1.0737 ± 0.0043**	0.9727	0.3196	**1.0737 ± 0.0043**
Run 4 24Jan-02Feb 2024 [45252 - 46635]	0.94	0.32	**1.0733 ± 0.0043**	0.9398	0.3185	**1.0733 ± 0.0043**
Run 4 05-06 Feb 2024 [46803-47023]	0.893	0.305	**1.0727 ± 0.0041**	0.893	0.305	**1.0727 ± 0.0041**
Run 4 15Feb - 05Mar2024 [48055-50891]	0.9067	0.3241	**1.0729 ± 0.0043**	0.9054	0.3064	**1.0728 ± 0.0041**

Flaminia's results

Phase	R_{PMT} [Hz]	D
Run 1	30	1.42 ± 0.06
Run 2	3.5	1.104 ± 0.009
Run 3	1.6	1.081 ± 0.007

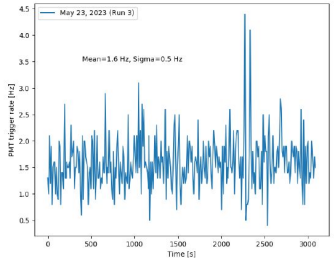


Figure 6.14: Trigger rate monitored during Run 3 in a time of 1 hour. An average rate of 1.6 Hz was measured, with a standard deviation of 0.5 Hz.

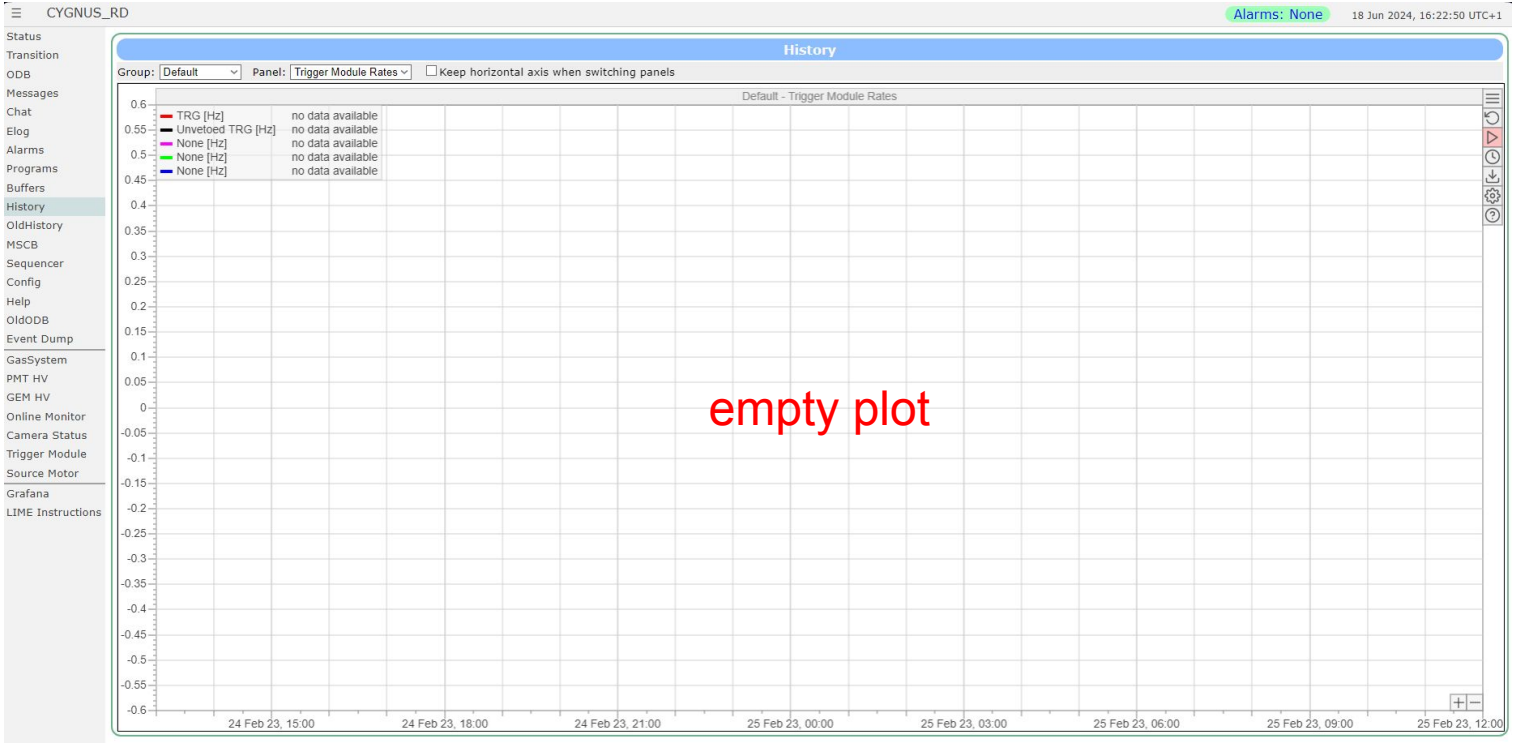
backup

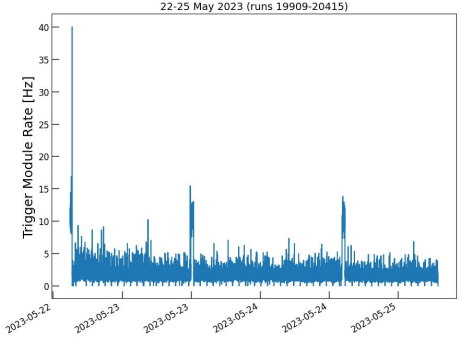
Run2

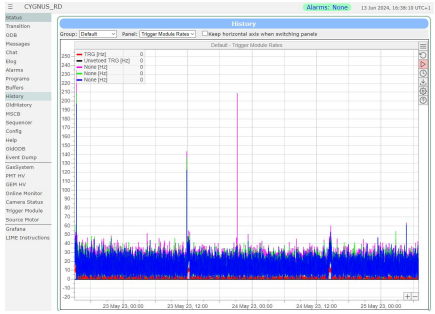
24-25 Fev 2023

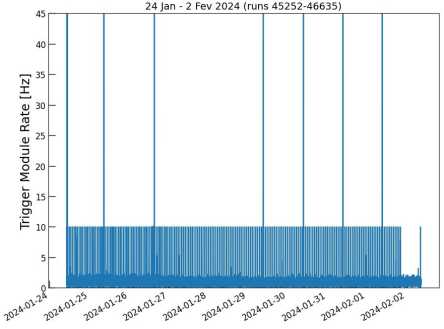
Runs 9888-10131

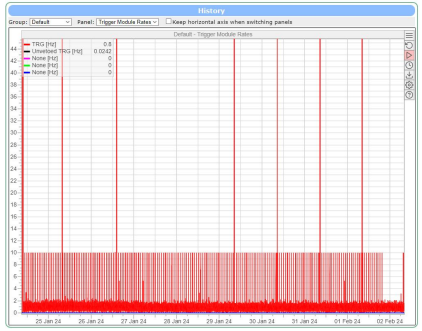
(2023-02-24 14:01:44 2023-02-25 13:55:57)

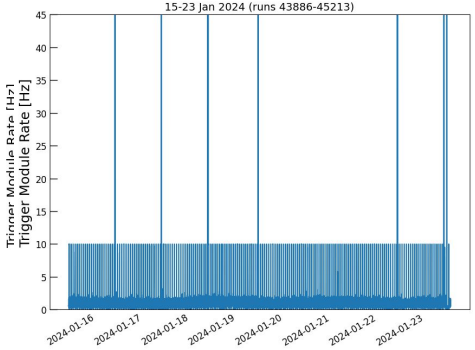


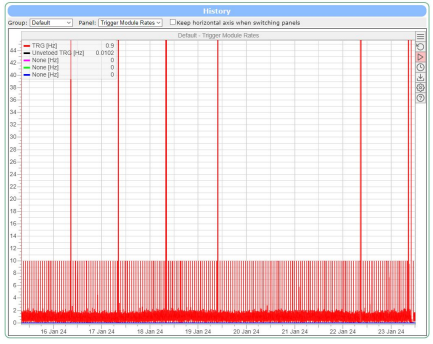

22-25 May 2023 (runs 19909-20415)
Trigger Module Rate [Hz]

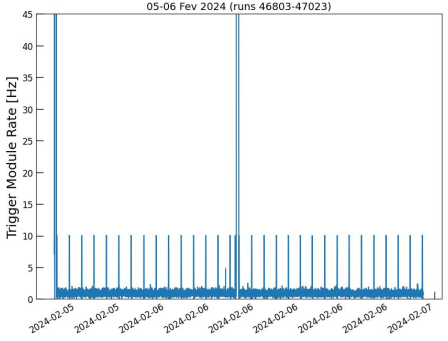

CYGNUS_RD
Alarms: None
History

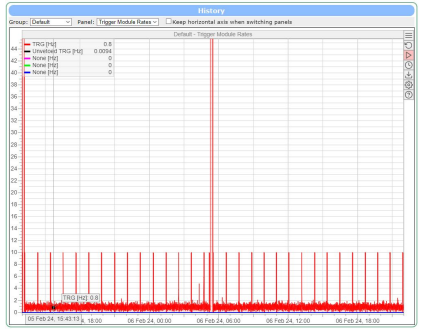

24 Jan - 2 Fev 2024 (runs 45252-46635)
Trigger Module Rate [Hz]

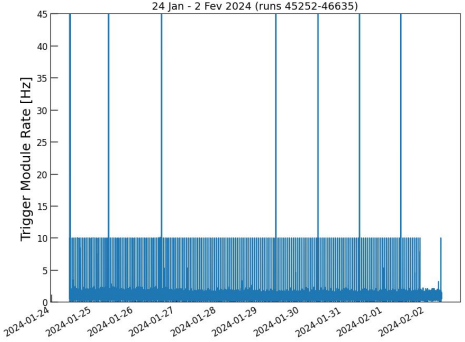

History

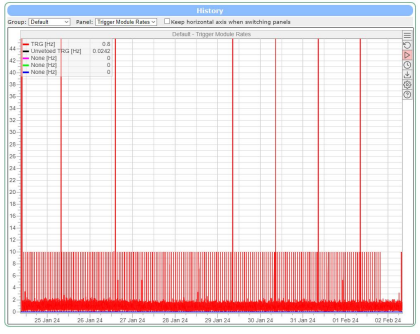

15-23 Jan 2024 (runs 43886-45213)
Trigger Module Rate [Hz]

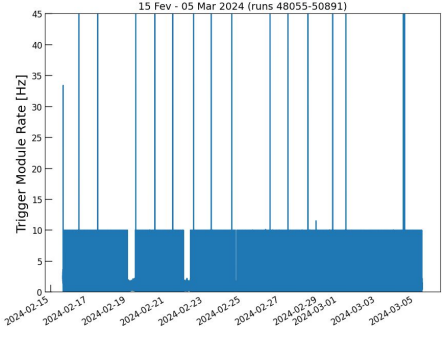

History

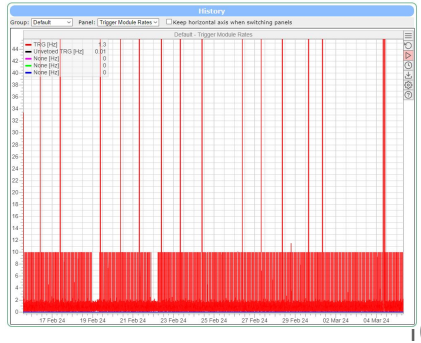

05-06 Fev 2024 (runs 46803-47023)
Trigger Module Rate [Hz]


History


24 Jan - 2 Fev 2024 (runs 45252-46635)
Trigger Module Rate [Hz]


History


15 Fev - 05 Mar 2024 (runs 48055-50891)
Trigger Module Rate [Hz]


History