# COMPARISON BETWEEN THE PERFORMANCES OF THE NEMO DETECTOR FOR TWO TOWERS DISTANCES

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The behaviour of two detectors which differ only for the tower distances have been studied.

The tower structure is the standard one: 16 crossed arms 20 m long, each with 4 PMT, with a distance of 40 m from each other; the number of towers is 64. The distance between towers has been fixed at 200 m and 150 m.

The trigger requires at least 1 signal larger or equal to 3 photoelectrons.
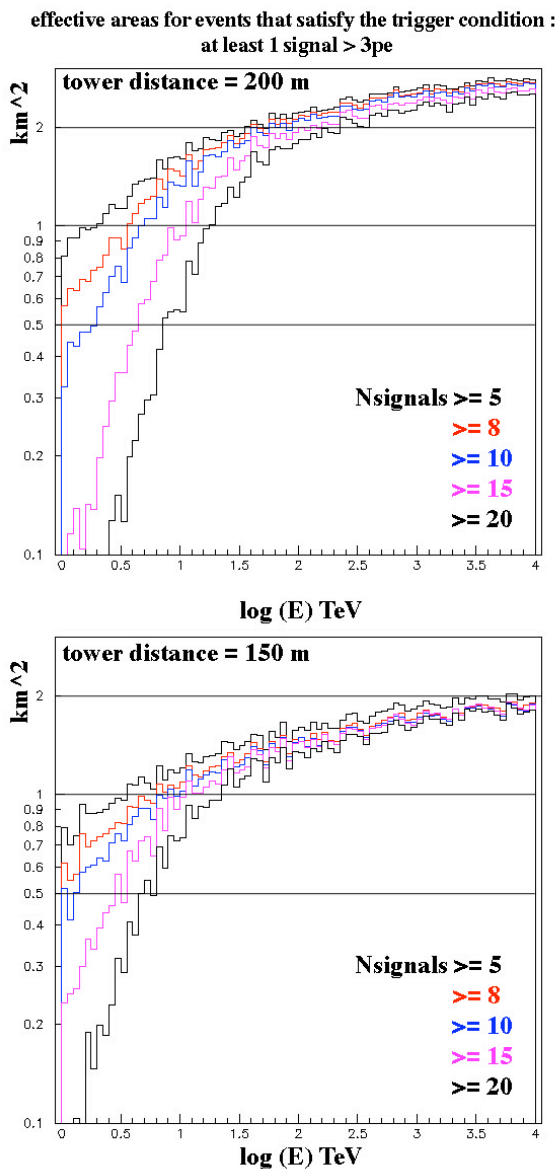
In Figure 1 are reported the effective areas in the two cases for different cuts in the number of signals.

For energies larger than 10 TeV, when the event is widely spread in the detector, the reduction of the instrumented volume is the prevalent effect.

For lower energies the compactness of the detector helps to have more signals.

Figure 1

At this stage I applied a causality cut to the events with at least 3 signals: the starting hit is the main signal (i.e. the signal with the maximum amplitude) and the accepting time windows were ± 300 ns wide. When the number of signals goes below 3 the event is lost.

The efficiencies of the causality cut are reported in Figure 2a.

Subsequently, my standard filtering based on the dimensions of the signal clusters have been applied. Again when the number of signals goes below 3 the event is lost.

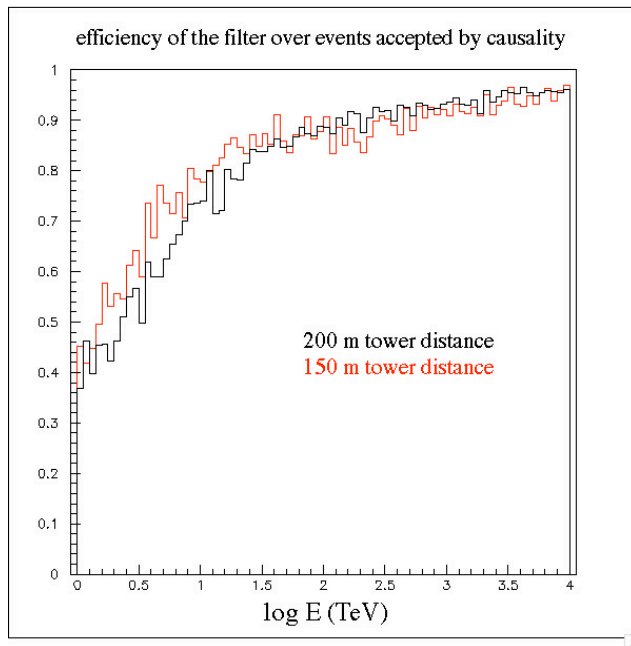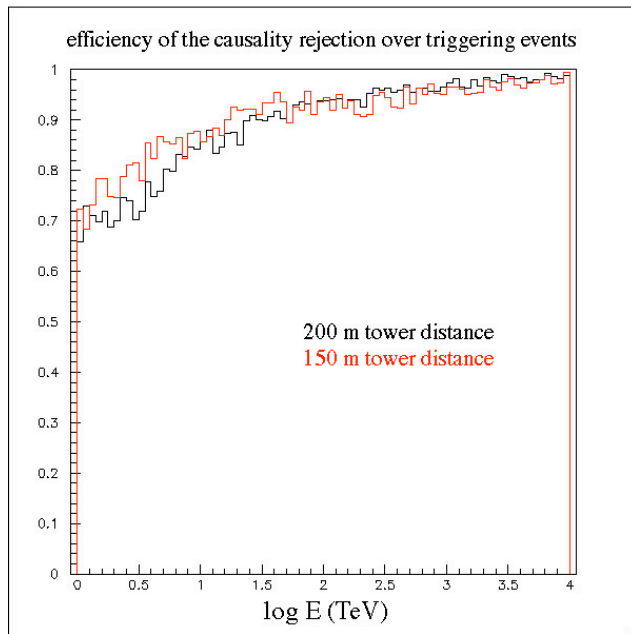The efficiencies of the filtering are reported in Figure 2b.

efficiency of the causality rejection over triggering events

200 m tower distance
150 m tower distance

log E (TeV)

Figure 2 a, 2b

efficiency of the filter over events accepted by causality

200 m tower distance
150 m tower distance

log E (TeV)

The two efficiencies do not differ very much between the two detectors: we can see that for a more compact detector the time spread is slightly less at lower energies, Figure 2a, the same occurs for the clustering of the signals, Figure 2b.

Analogous conclusions can be derived from Figures 3a and 3b where the effective areas after the two processes, causality and filtering, are shown.

The detector with lower tower distance recuperates something in the low energy region but it is clear the reduction of effective areas at higher energies.
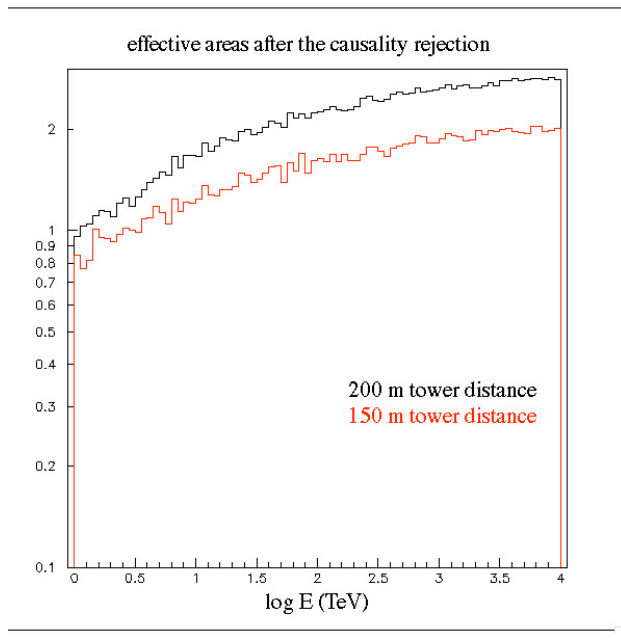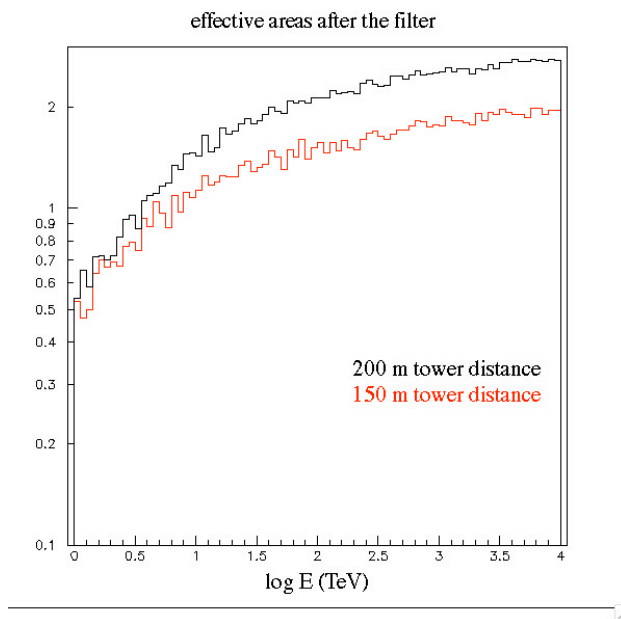
effective areas after the causality rejection

200 m tower distance
150 m tower distance

log E (TeV)

Figure 3a, 3b

effective areas after the filter

200 m tower distance
150 m tower distance

log E (TeV)

As the last comparison, the signal distributions after the 3 steps: trigger, causality and filtering, are shown in Figure 4.

Taking into account that the results refer to the whole energy interval (it means that the low energy part weights less), all the distributions are very similar.

It is also evident that the severe reduction of hits made from the cluster method is responsible of the loss of about 30% in the effective areas at lower energies.

Introducing now the 40K background, we can discuss this argument.

The severe reduction in the signals number could be justified, at least as a first approach, from the fact that after the filter the number of spurious hits (from ^{40}K) in the event becomes negligible as can be seen in Figure 5. In this way it seems possible that the reconstruction procedure will have a high efficiency and a good accuracy.
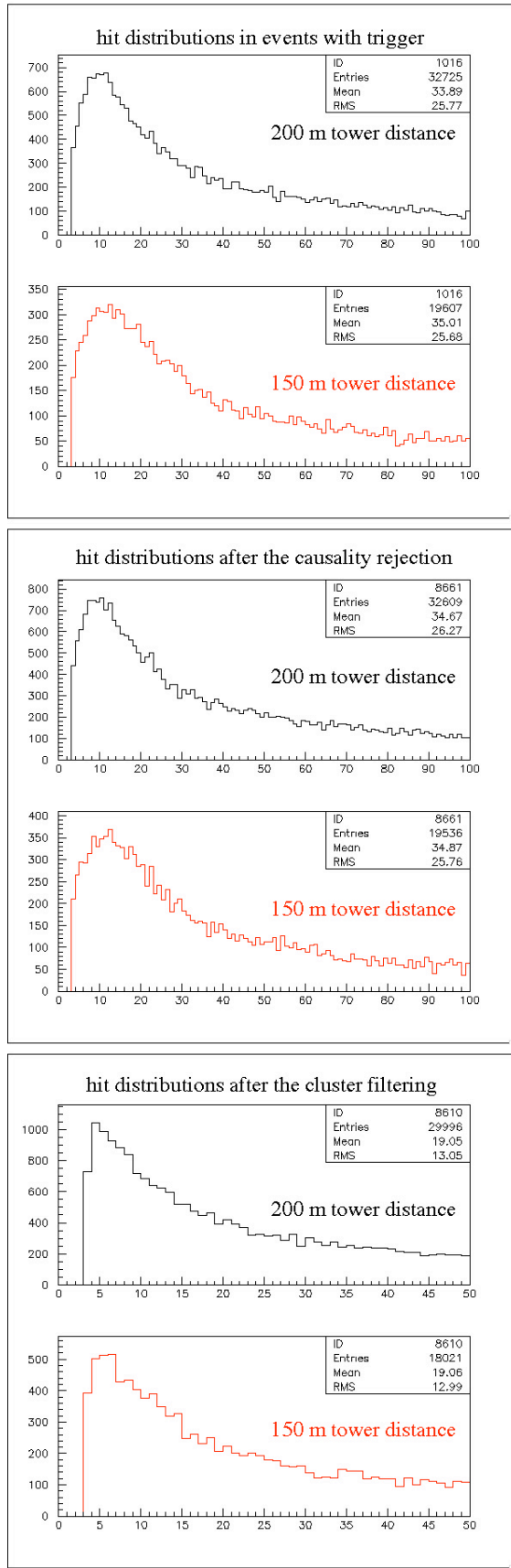
hit distributions in events with trigger

ID	1016
Entries	32725
Mean	33.89
RMS	25.77

200 m tower distance

ID	1016
Entries	19607
Mean	35.01
RMS	25.68

150 m tower distance

hit distributions after the causality rejection

ID	8661
Entries	32609
Mean	34.67
RMS	26.27

200 m tower distance

ID	8661
Entries	19536
Mean	34.87
RMS	25.76

150 m tower distance

hit distributions after the cluster filtering

ID	8610
Entries	29996
Mean	19.05
RMS	13.05

200 m tower distance

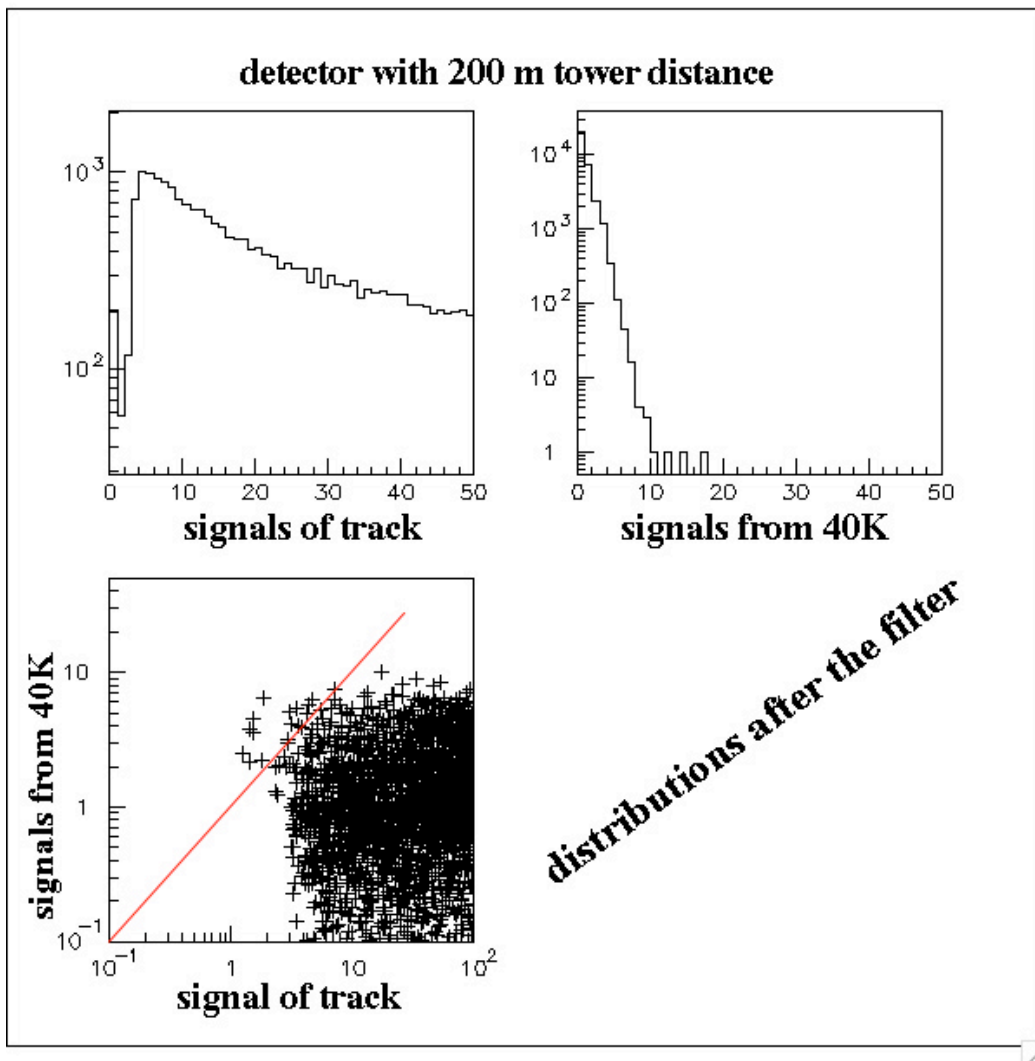| ID	8610
Entries	18021
Mean	19.06
RMS	12.99

150 m tower distance

Figure 4

4

Figure 5

The situation for the 150 m detector is absolutely similar.

PERSONAL CONCLUSIONS:
    if the reported results will be confirmed and no clear contradictions will come from a reconstruction procedure, the reduction of the towers distance from 200 to 150!m is useless.