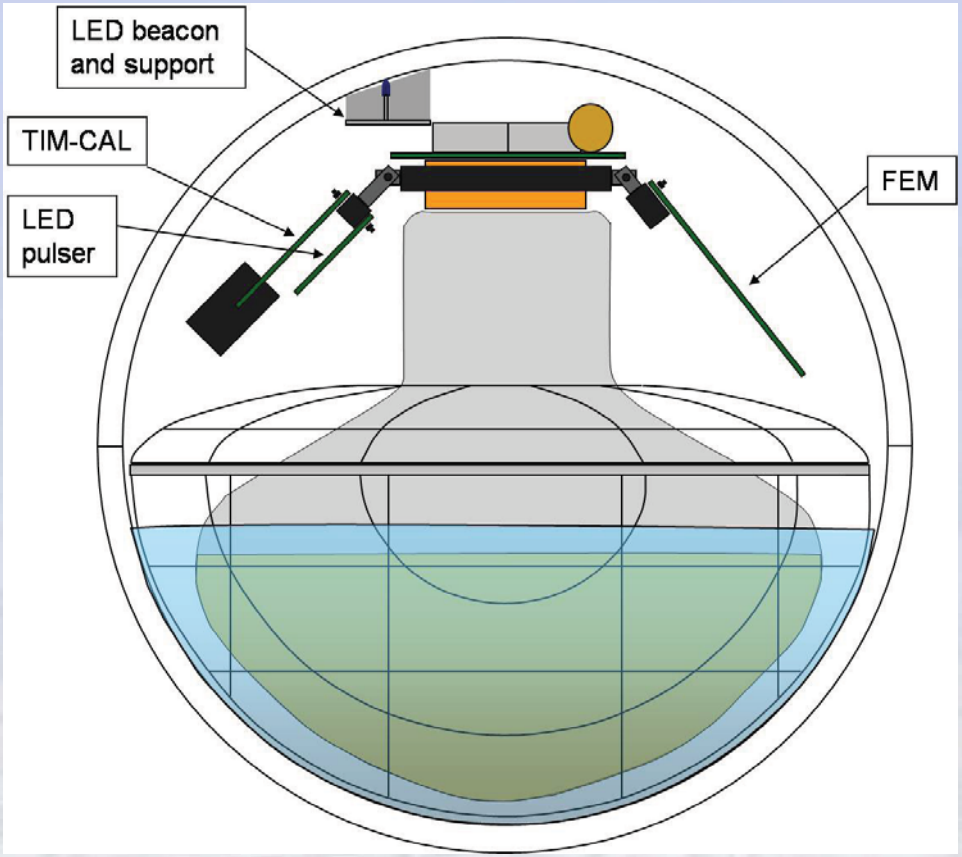
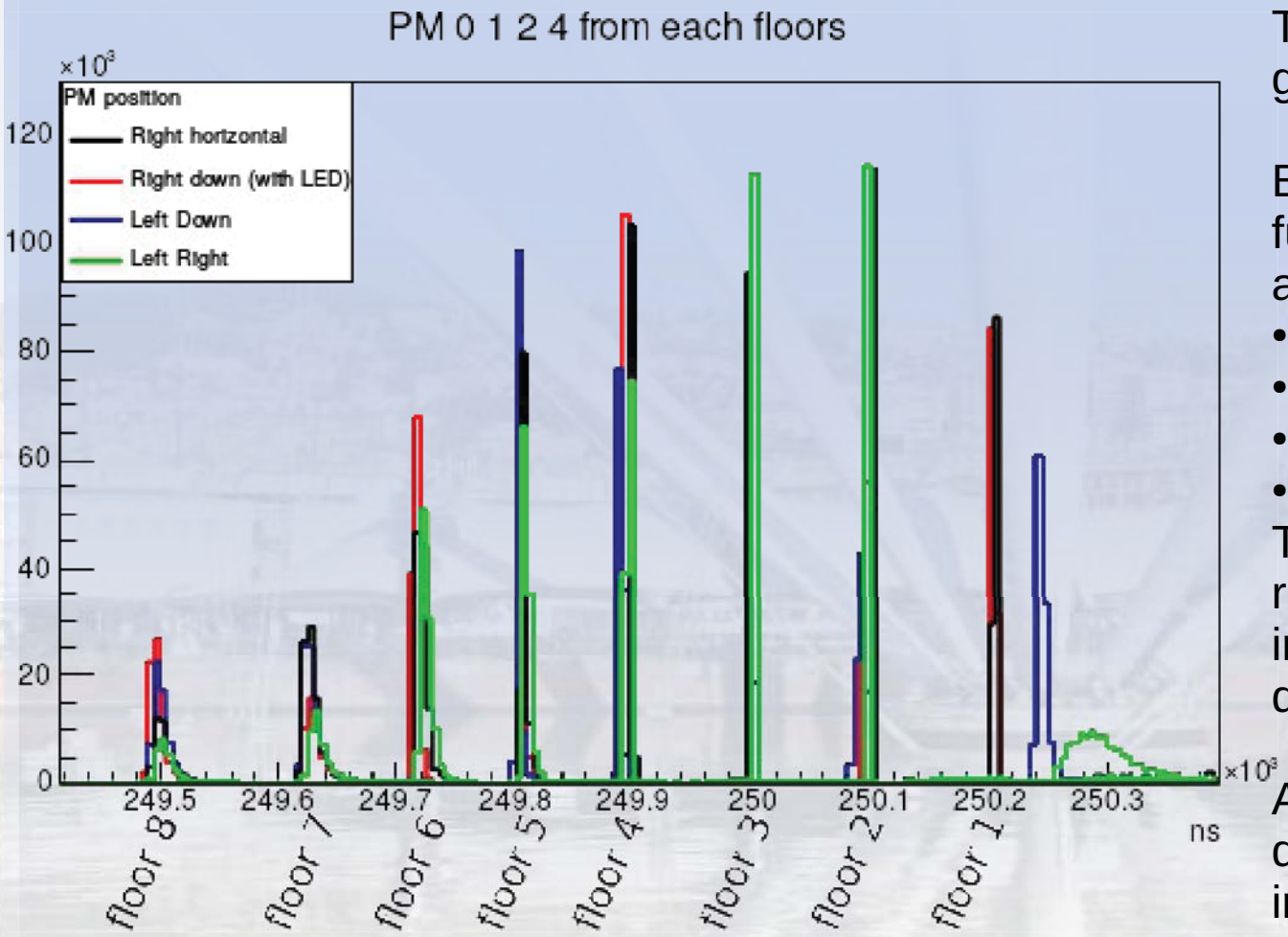
Time calibration, nanobeacon and laser in KM3NeT Italia



Previous results summary



The distribution gives a good time distribution.

But the intensities in function of distance are not as expected

- LED positioning ?
- LED homogeneity ?
- LED used ?
- Different intensities ?

This kind of information is really hard to find and imprecise (in time and duration)

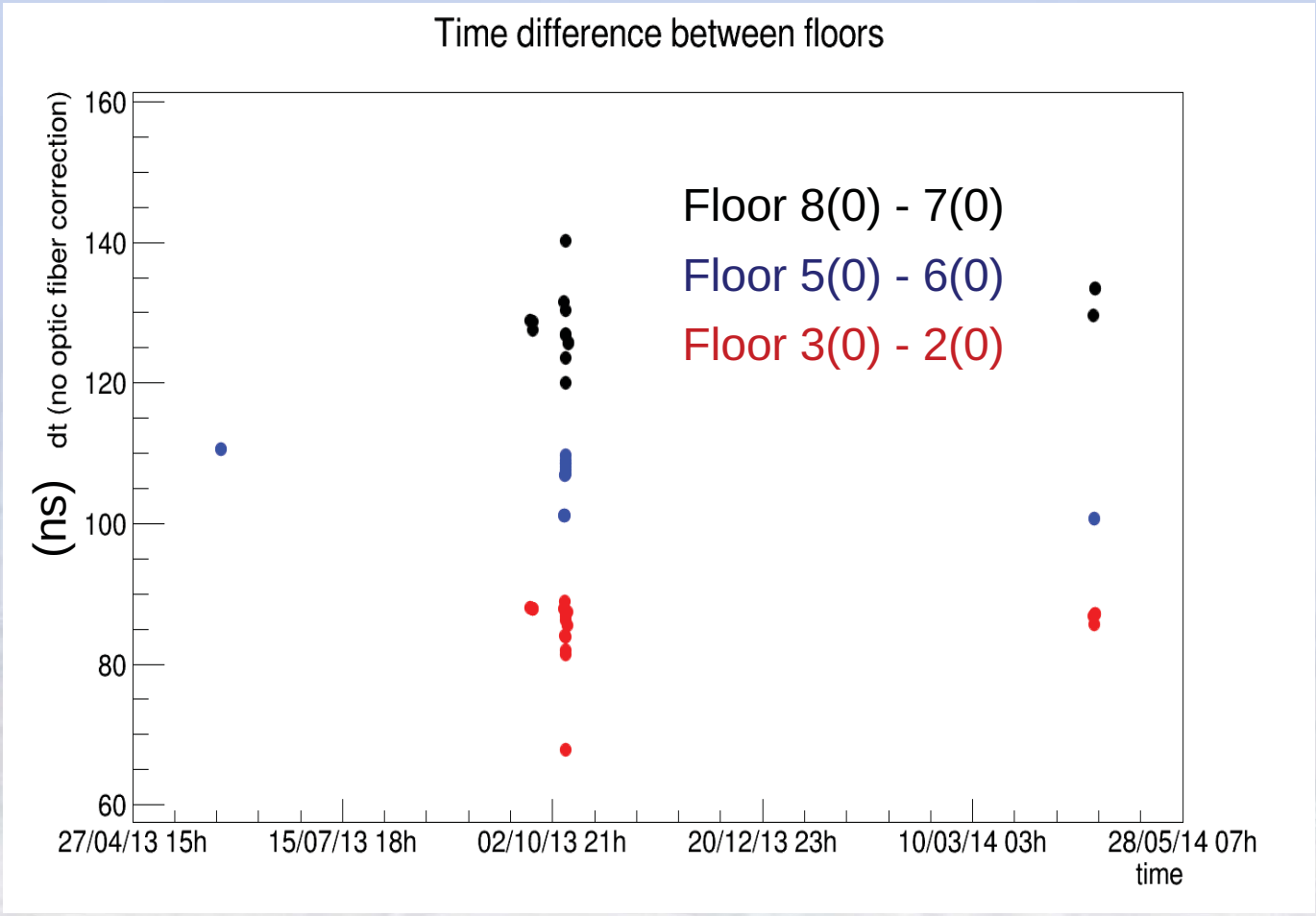
A specific analysis to deduce those informations ?

Timing results

Floor number (N)	Measured propagation time with floor 1 (floor N-1)	Theoretical time with floor 1 (floor N-1)	Differential time with floor 1 (floor N-1)
1	0 +/- 0.5	0	0
2	174 (174) +/- 0.9	186 (186)	12 (12)
3	354 (179) +/- 0.5	371 (185)	17 (5)
4	550 (195) +/- 0.4	558 (187)	8 (-9)
5	740 (189) +/- 0.3	744 (186)	4 (-4)
6	929 (188) +/- 0.5	931 (187)	2 (-2)
7	1113 (182) +/- 0.72	1118 (187)	5 (-6)
8	1302 (175) +/- 0.75	1305 (187)	6 (1)

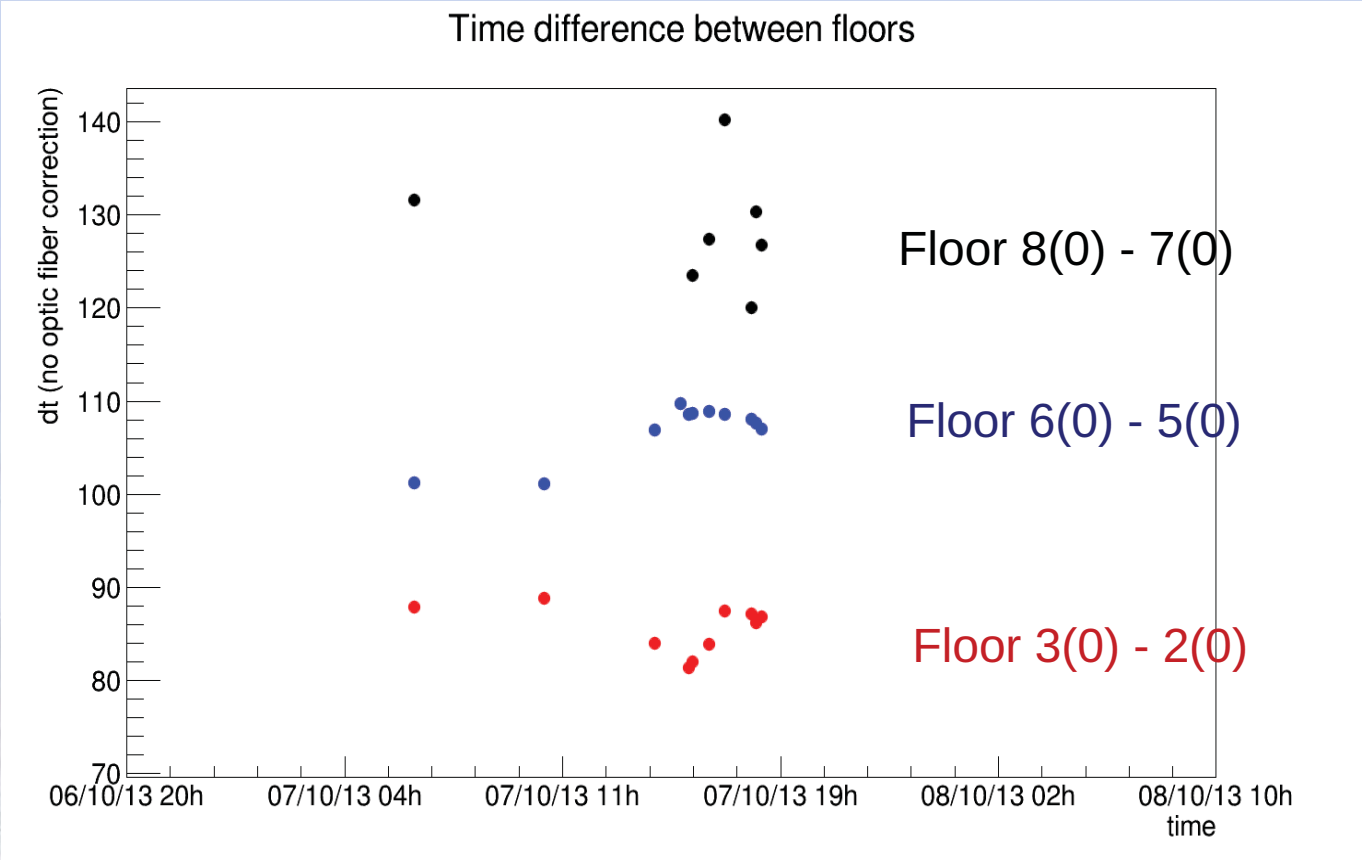
As a cross check a lower intensity run was used for first floors. It correspond to 2.5 ns <=> 20 cm

Some example of the evolution of the timing



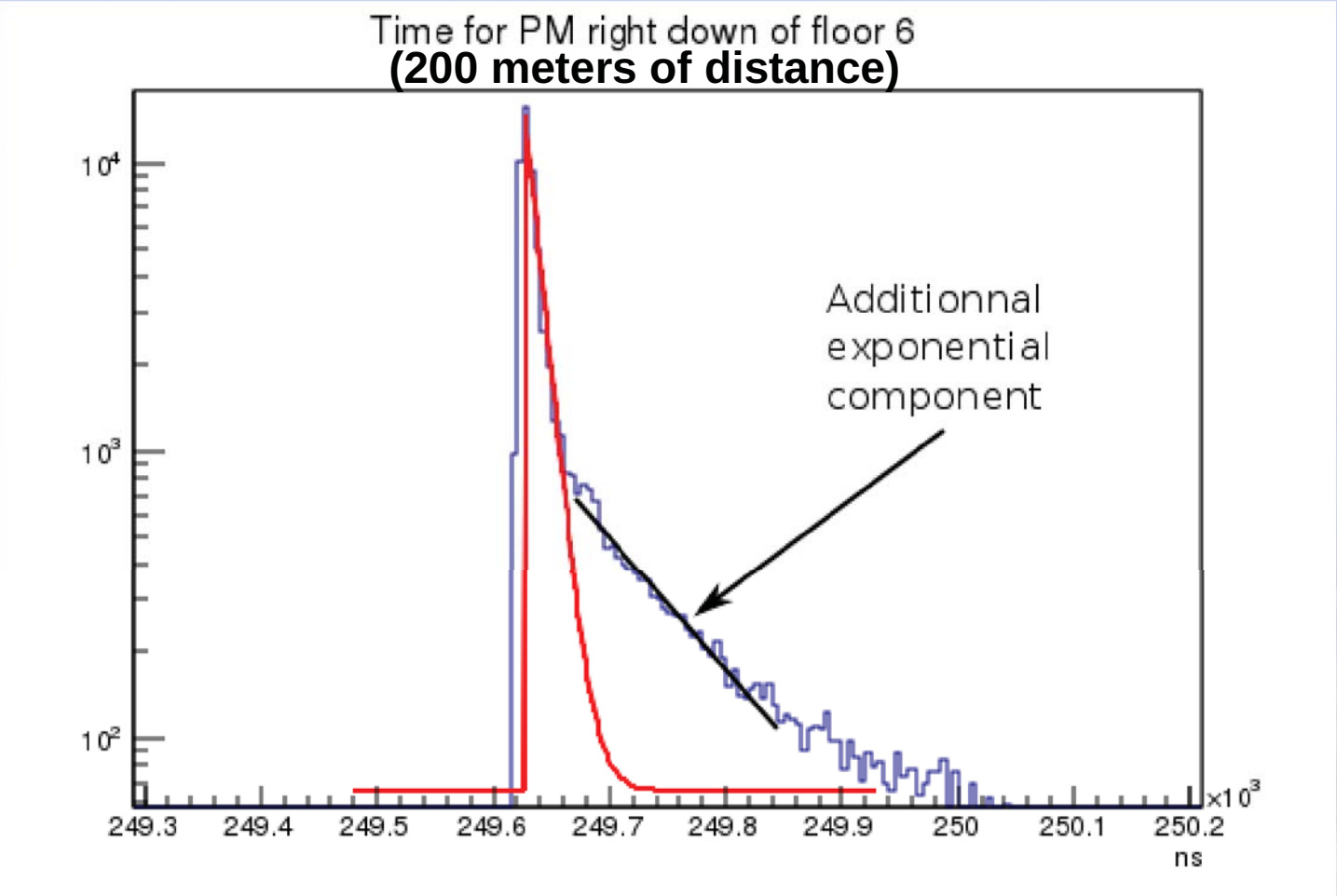
In general, during long period the shifting time is < 10 ns
Compatible expected structure movement

Some example of the evolution of the timing (zoom in)



While the day the OMs position can change by few meters

The water properties



Two components:

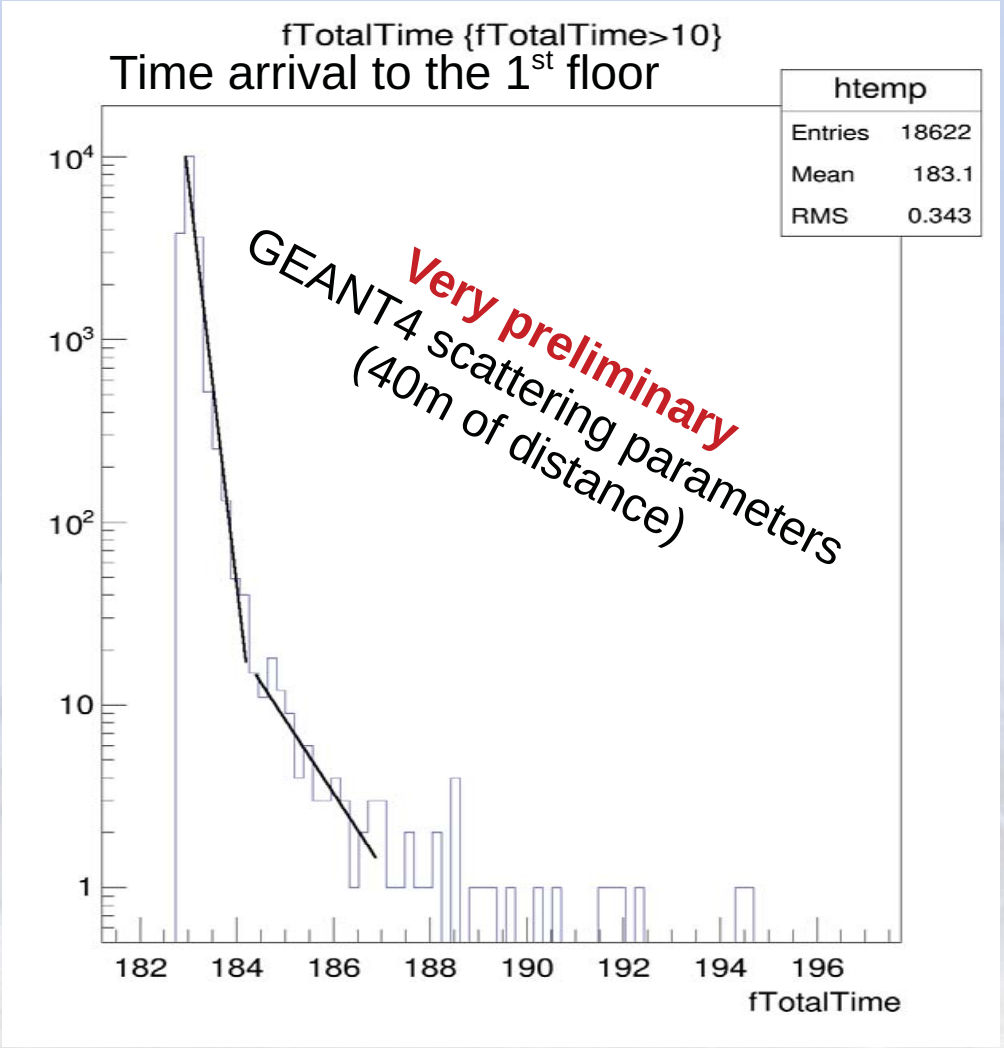
On particules
Small angles, small delay

On molecules
Big angles, big time delay

Those two effects are seen in simulation:

Best fit is on going

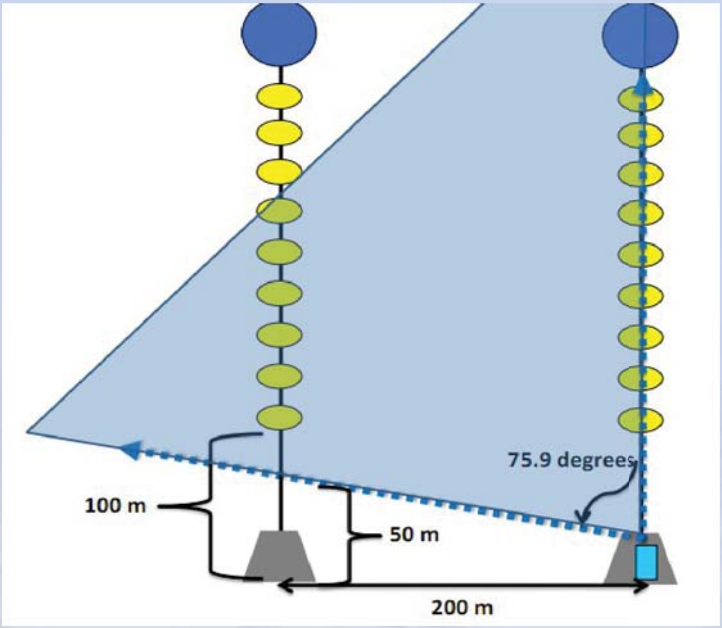
Water properties status



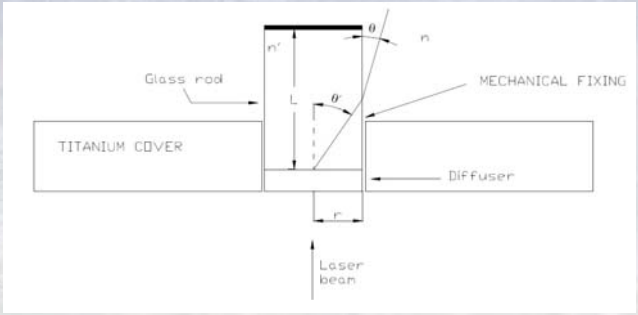
- Concentric detection sphere
  - Separated by the real floor to floor distance
- The source is in the center
- Send photons
- All the photon are kept at each level. Data kept
  - Emission direction (in fact always (0,0,1)
  - Time arrival at each spere
  - Angle arrival
  - Incident angle
- Then the AA is used to put a weigh to the arrival

The goal is to include
- The km3 scattering parameter
- The theoretic implementation to do the best fit with data

Laser setup

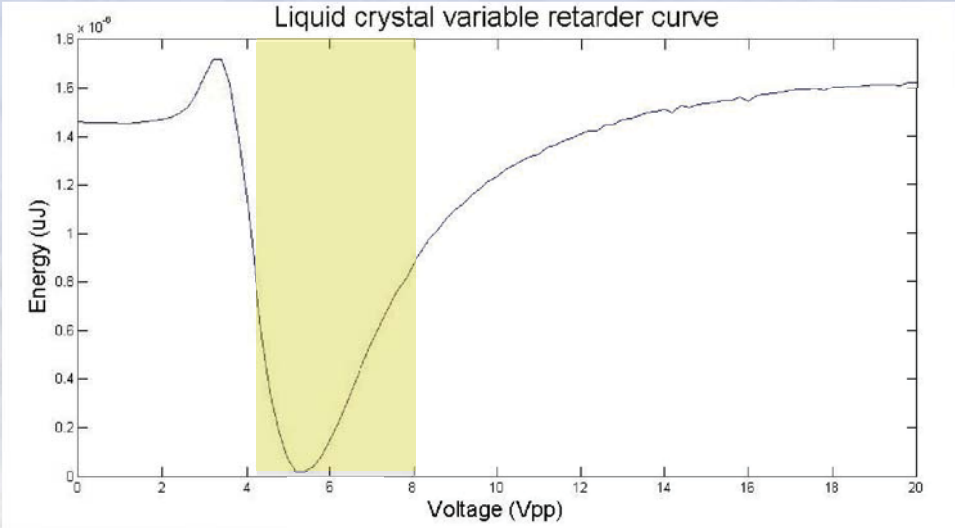


Laser range with the designed glass rod

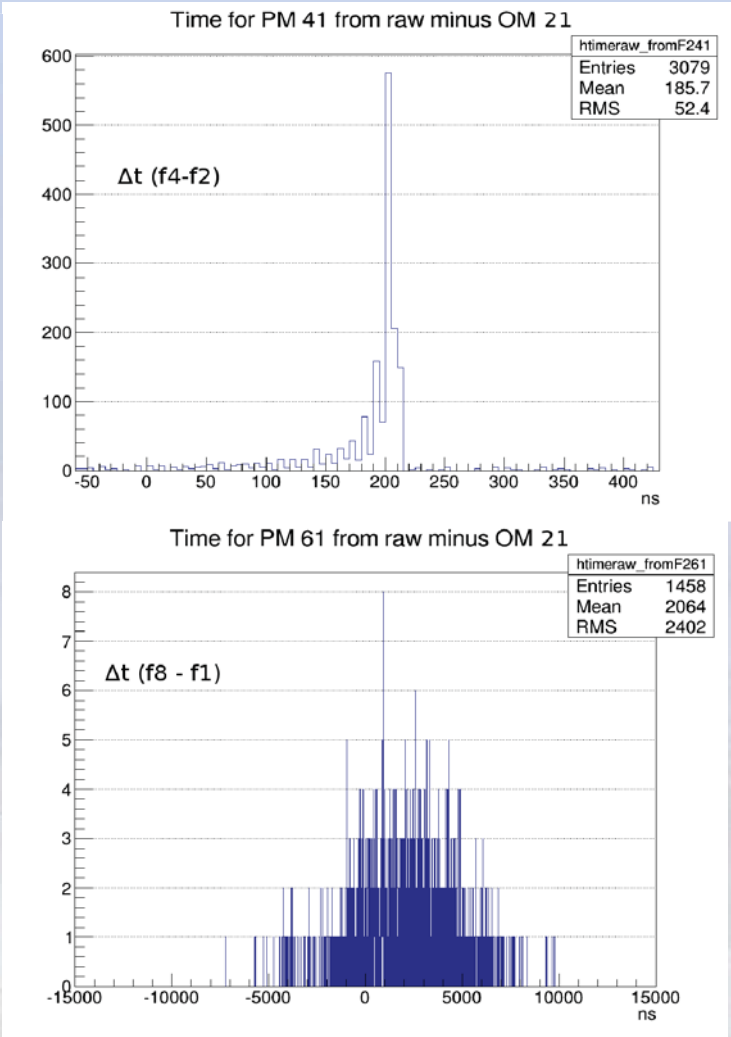


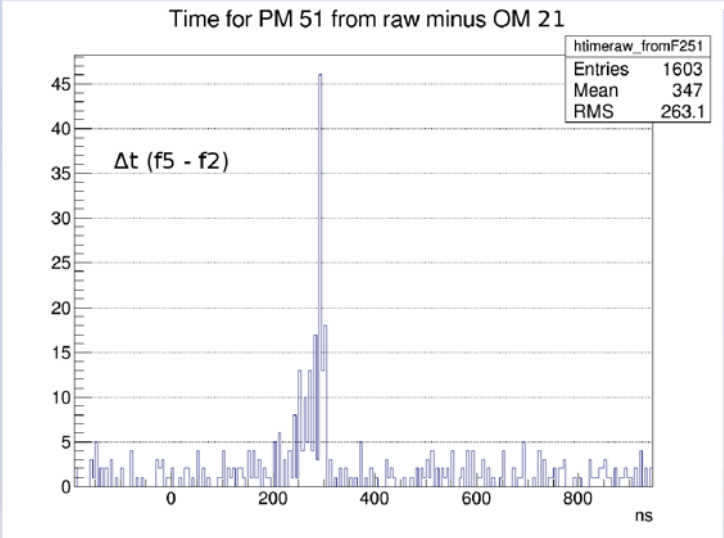
Laser Beacon installed at the base of the NEMO-PhaseII tower

- λ = 532 nm $\lambda_{att}(\lambda=532) \sim 25$ m !!
- no photo-detector close to the laser diode (yes in future)
- light propagation along the vertical not optimal for construction
  - calibrated the optical attenuator
  - measured differences $\Delta t_{1\text{-}n}$: O.K. up to 300m distance



Some results





NOTHING from the 6th floor

- Laser orientation ?