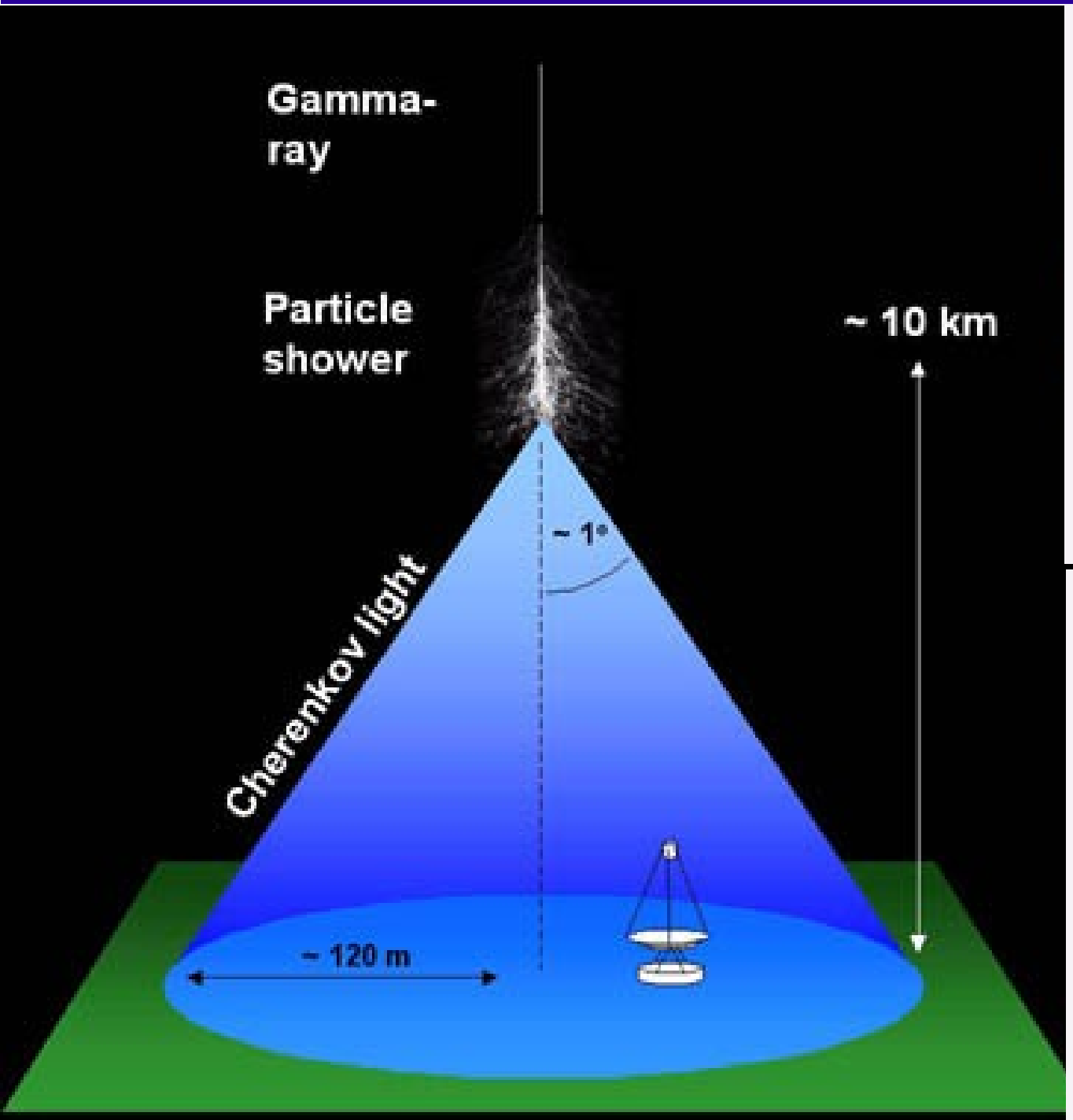
Pizza Seminars
26 March 2014, IFAE

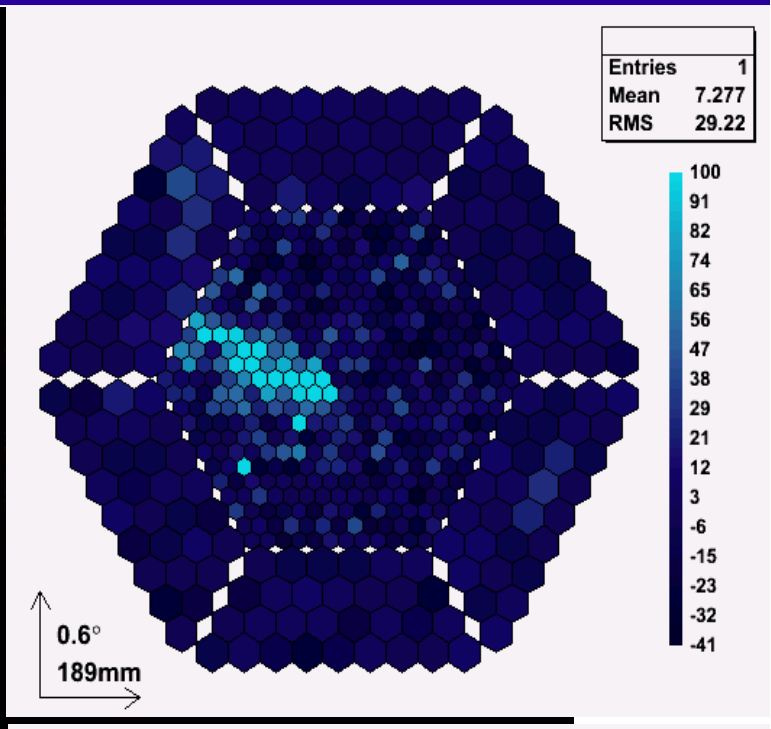
A Raman LIDAR

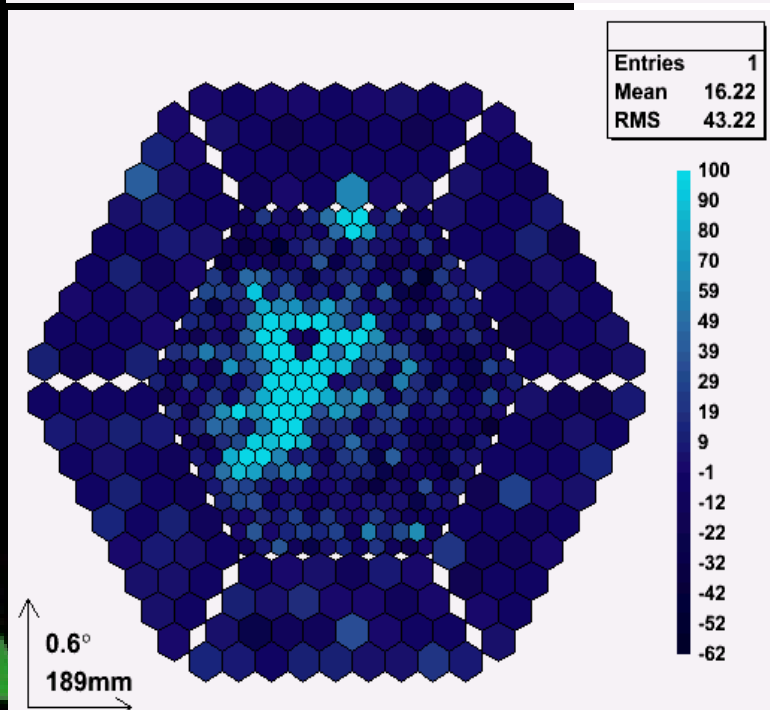
When the atmosphere is part of your detector

Oscar Blanch Bigas

Imaging Atmospheric Cherenkov Technique







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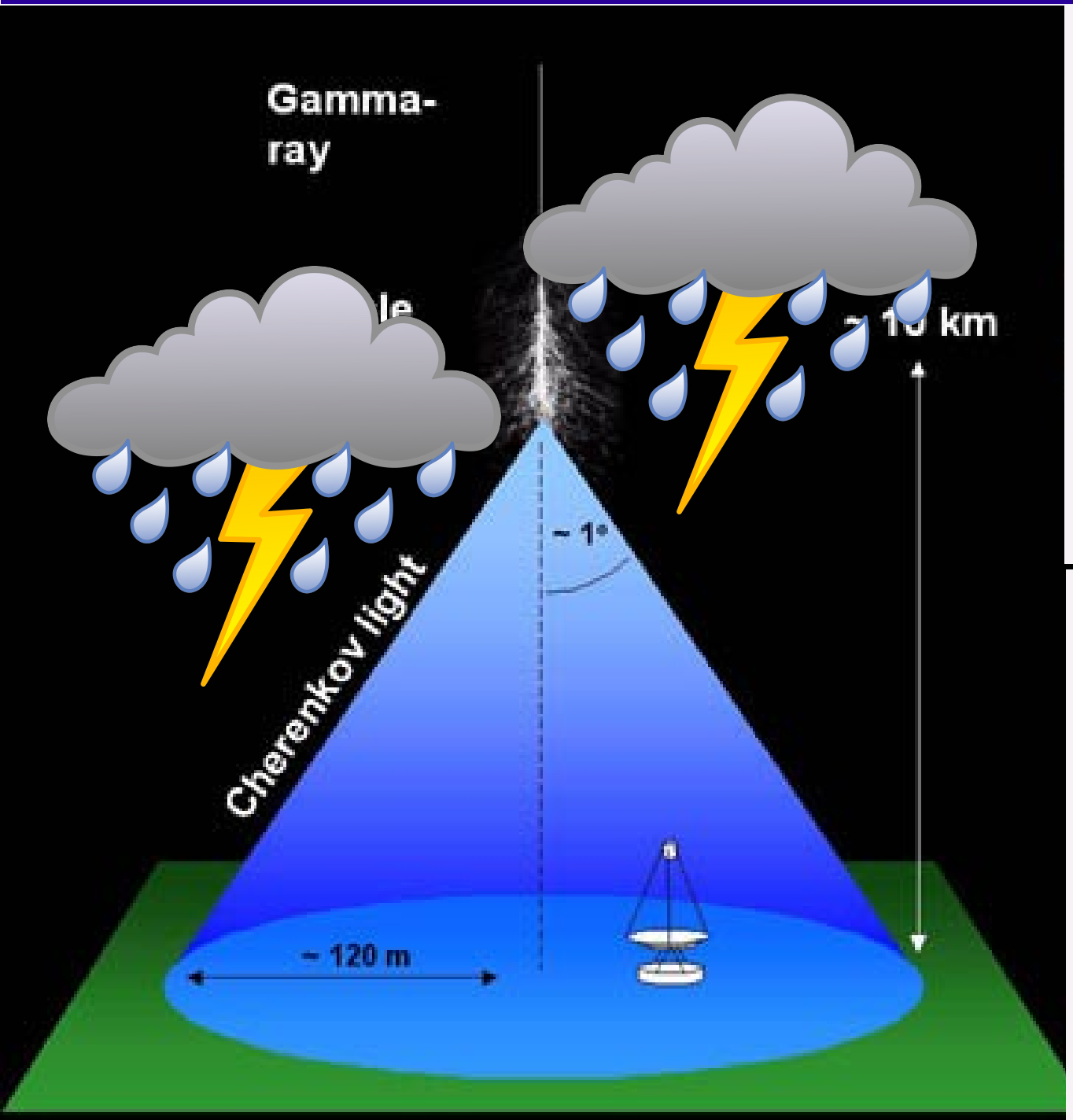

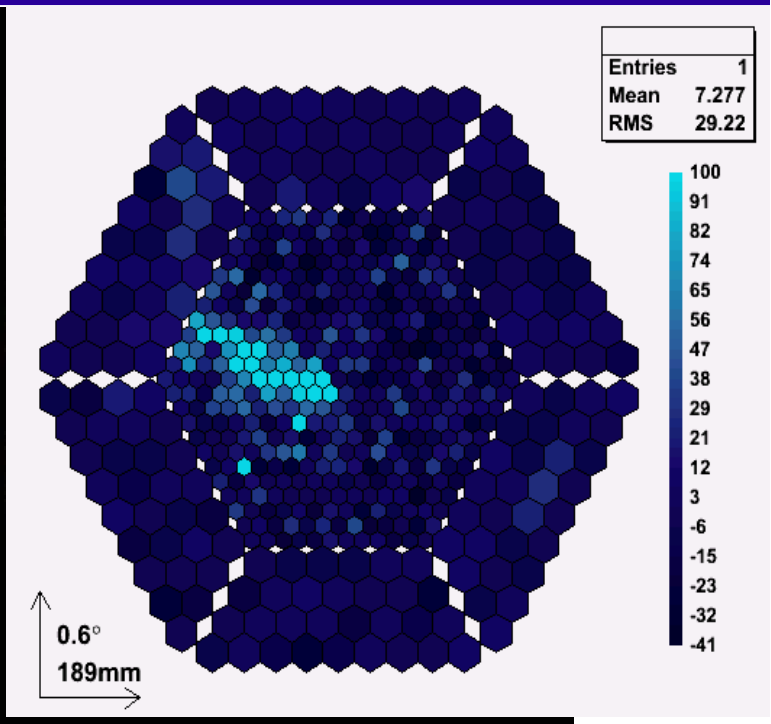

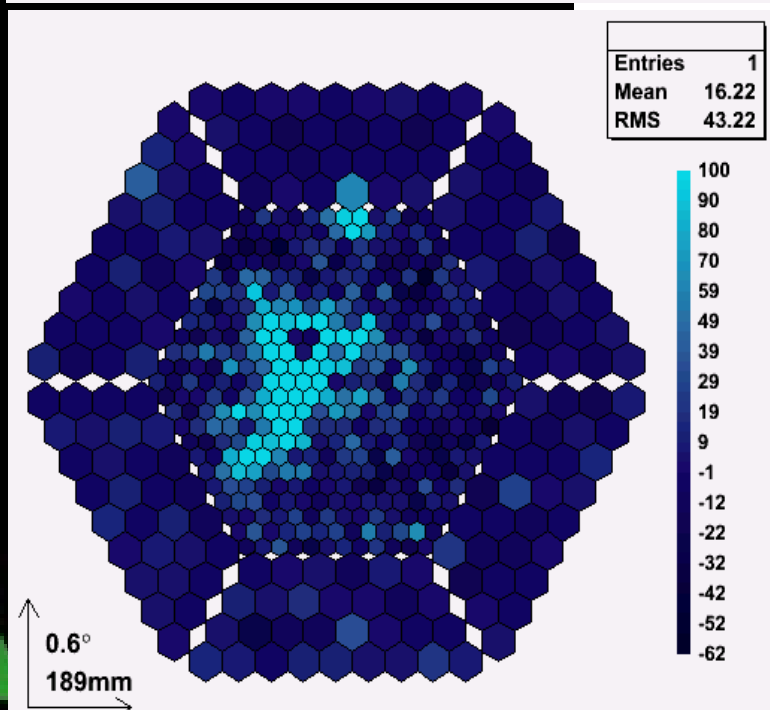

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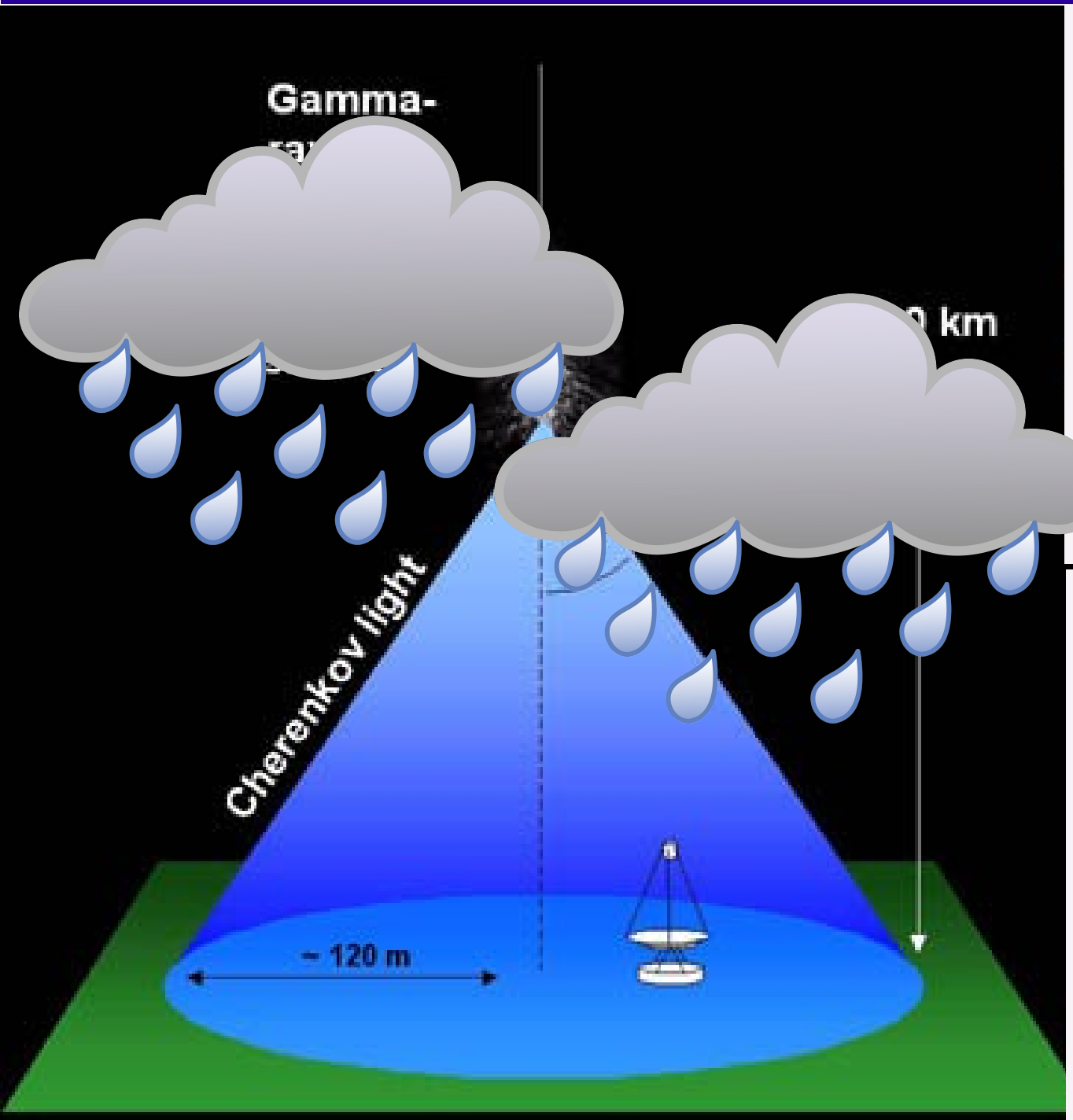

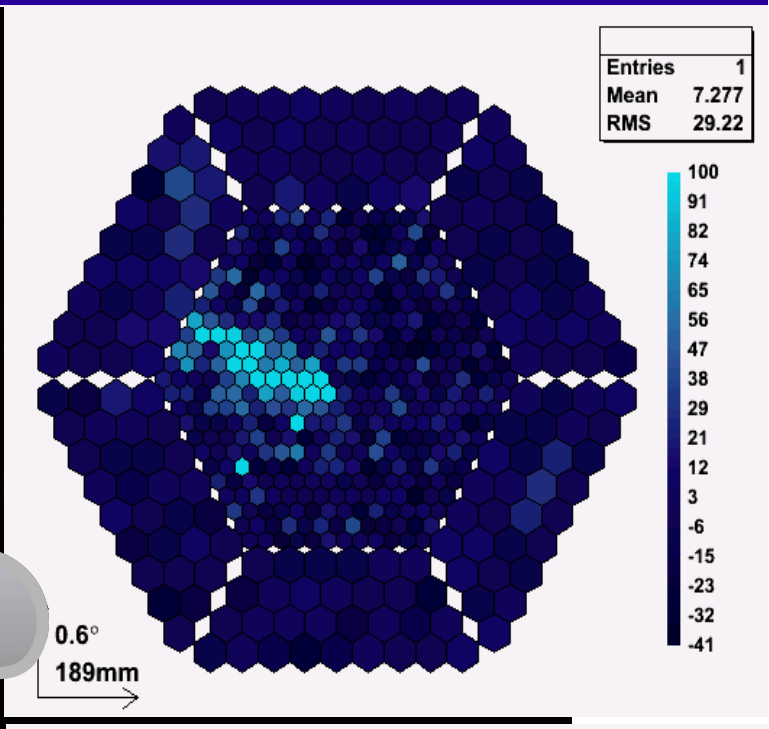

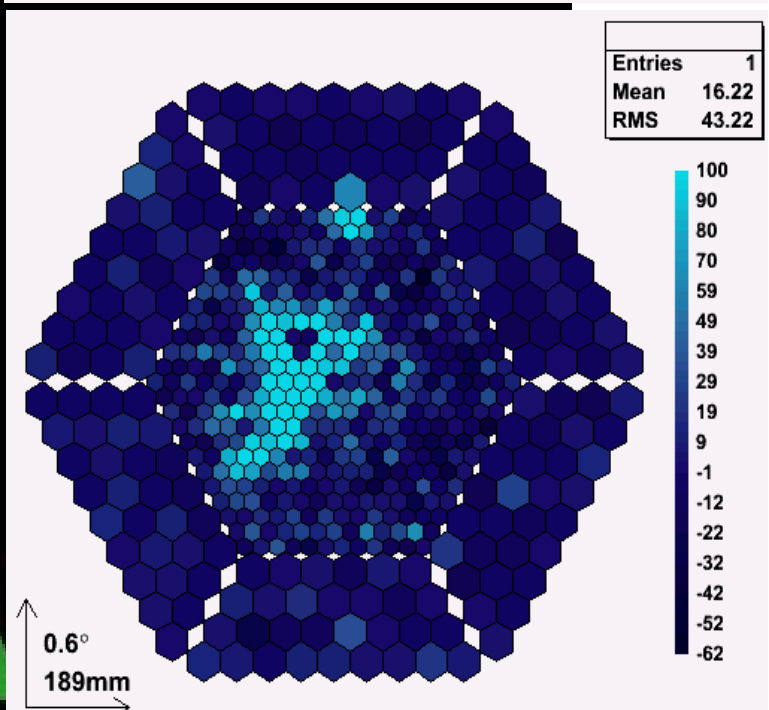

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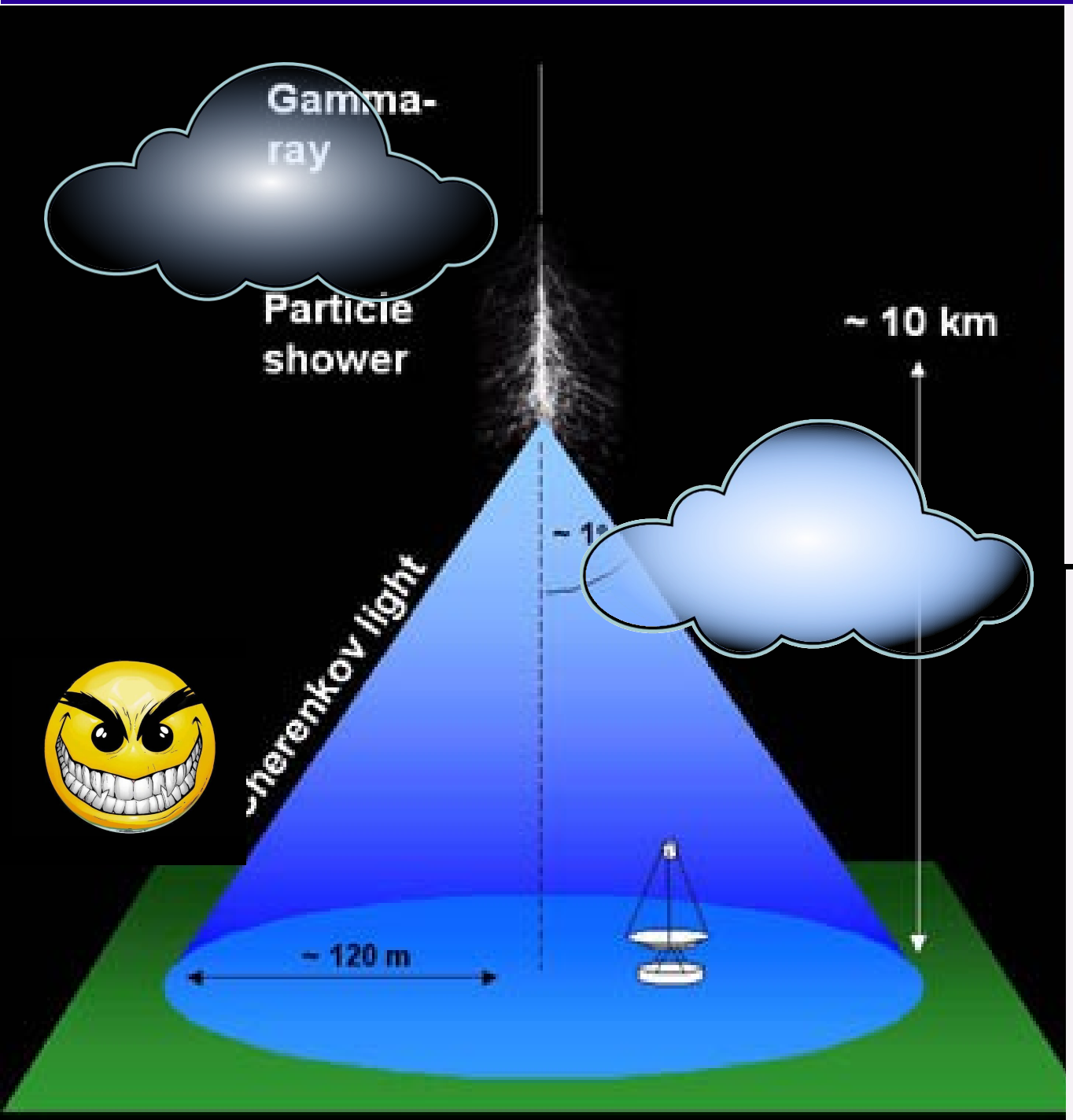
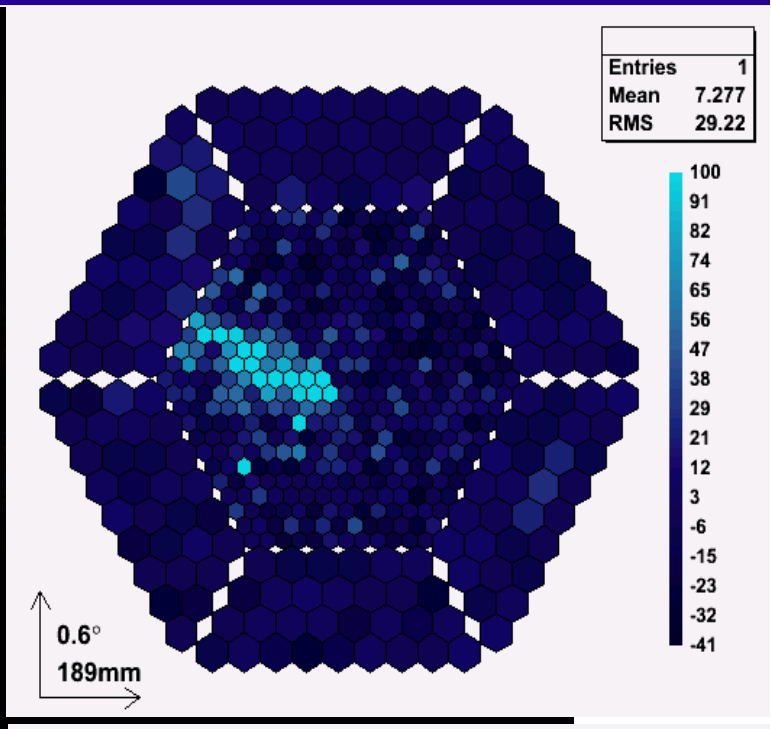
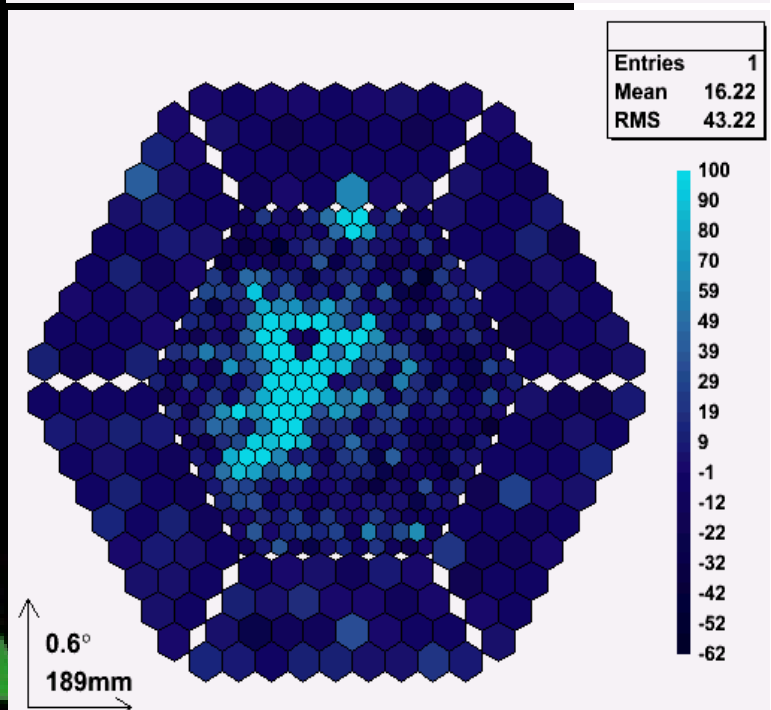
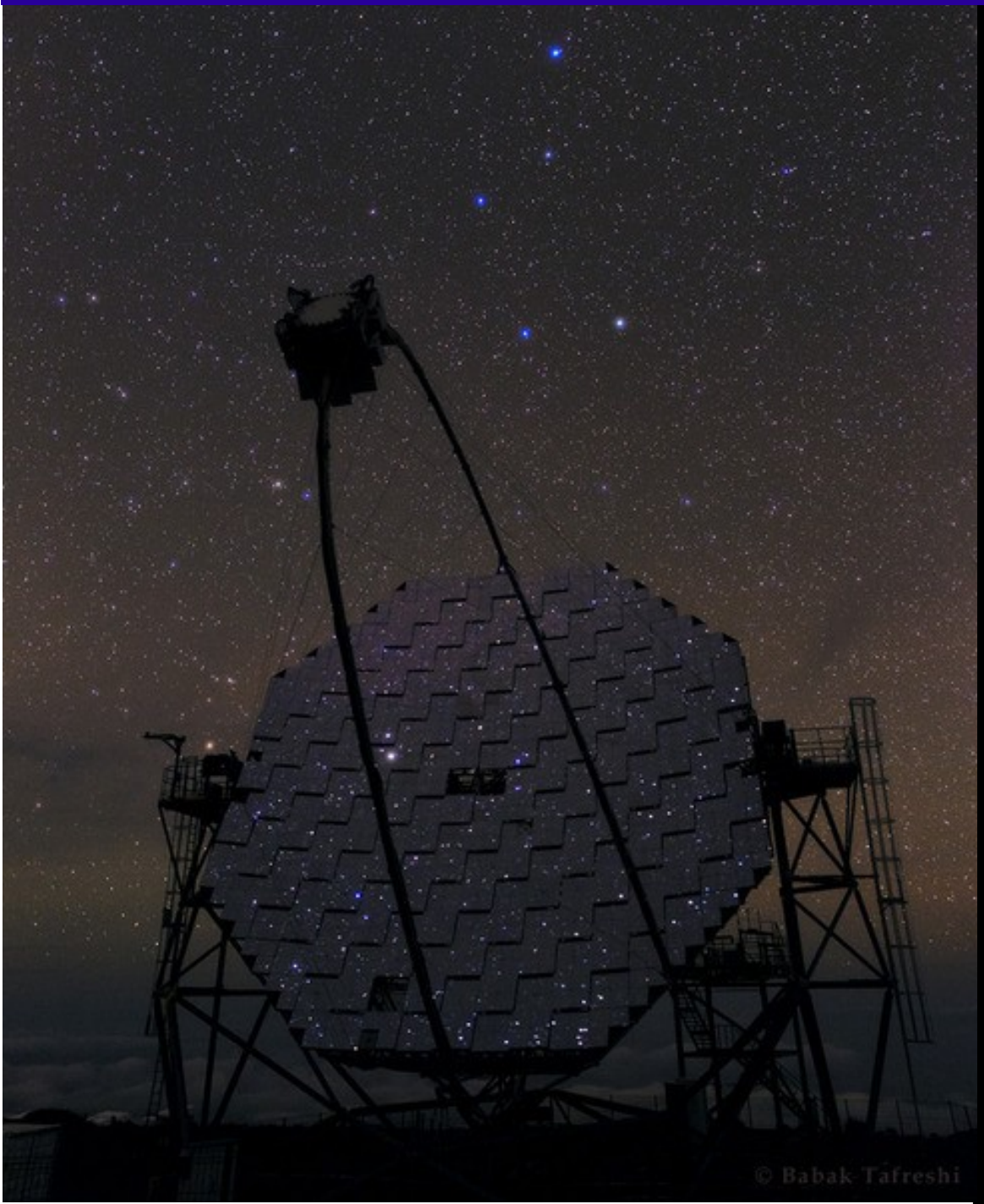
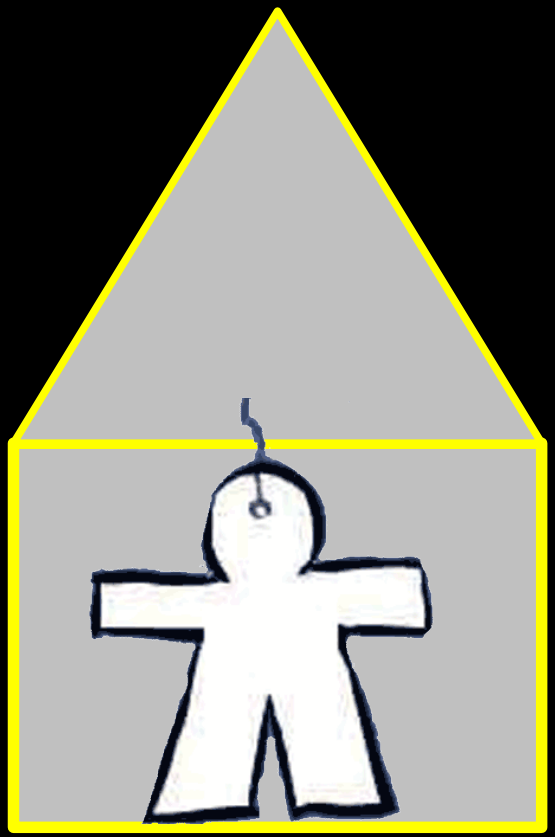






CURRENT CHERENKOV OBSERVATORIES





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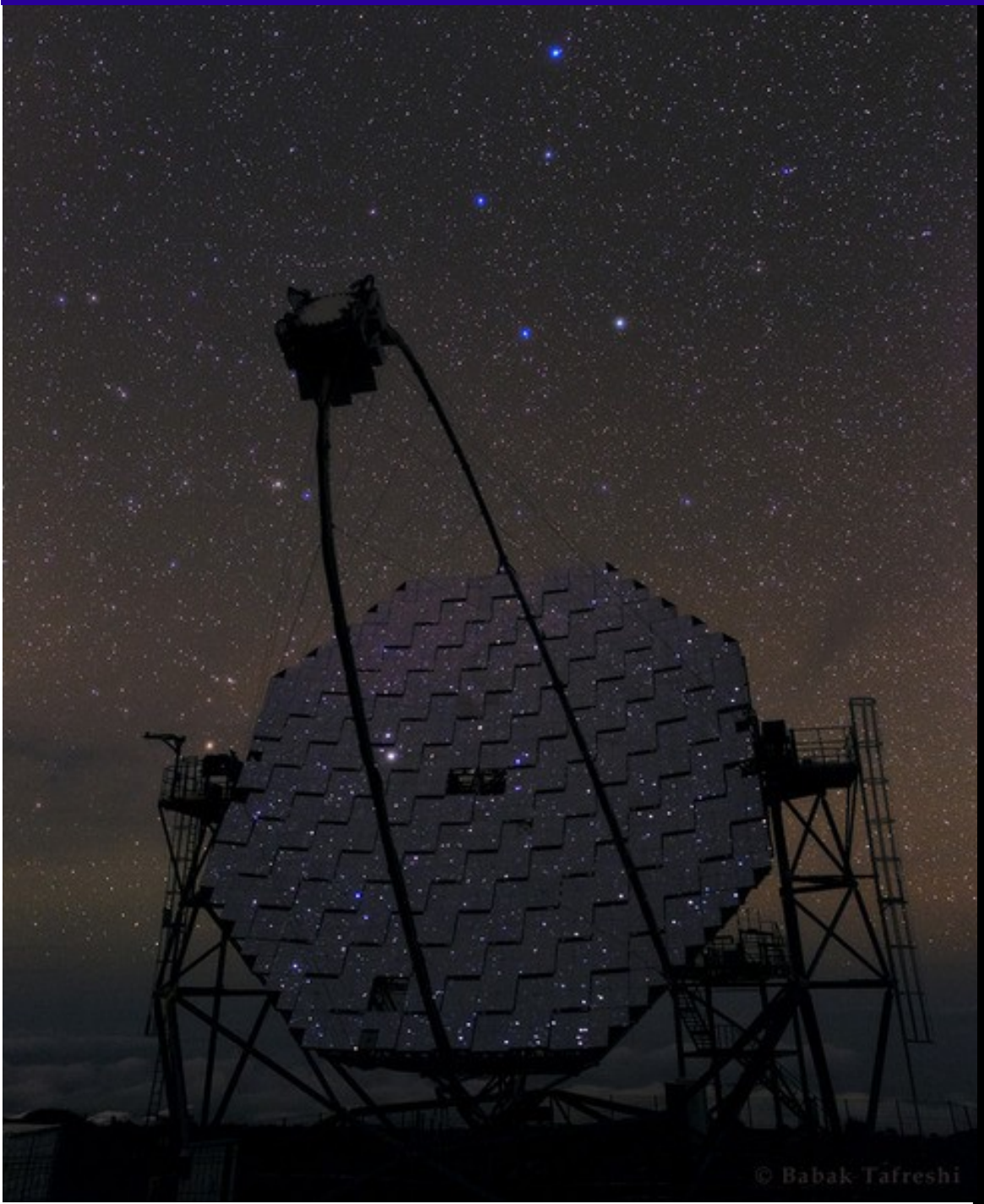

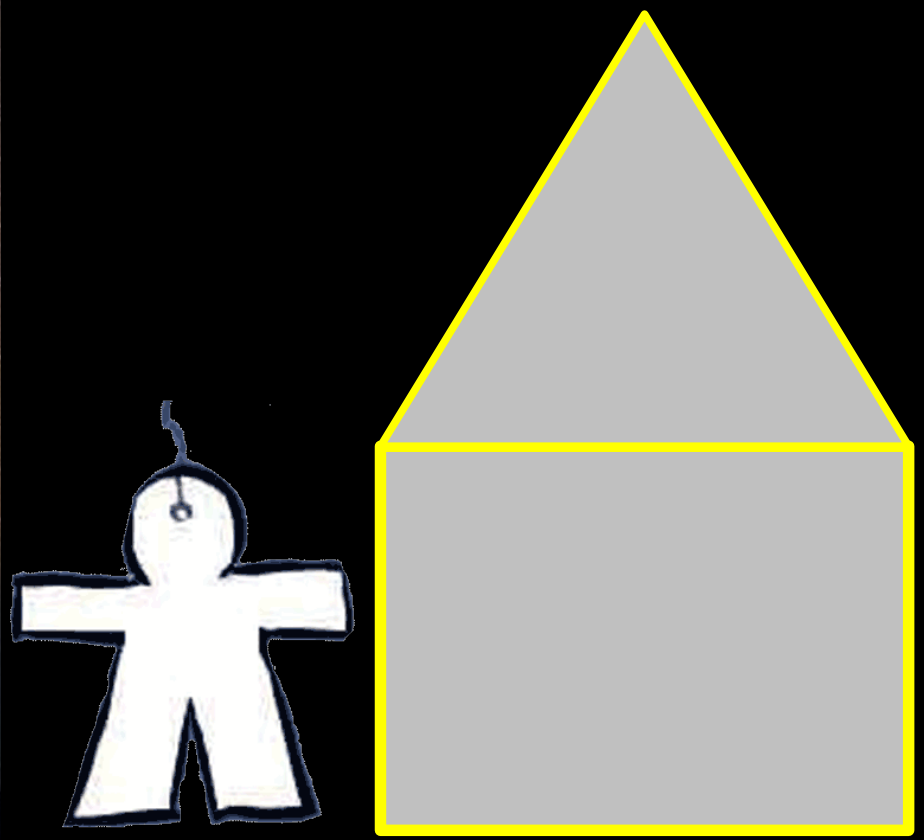

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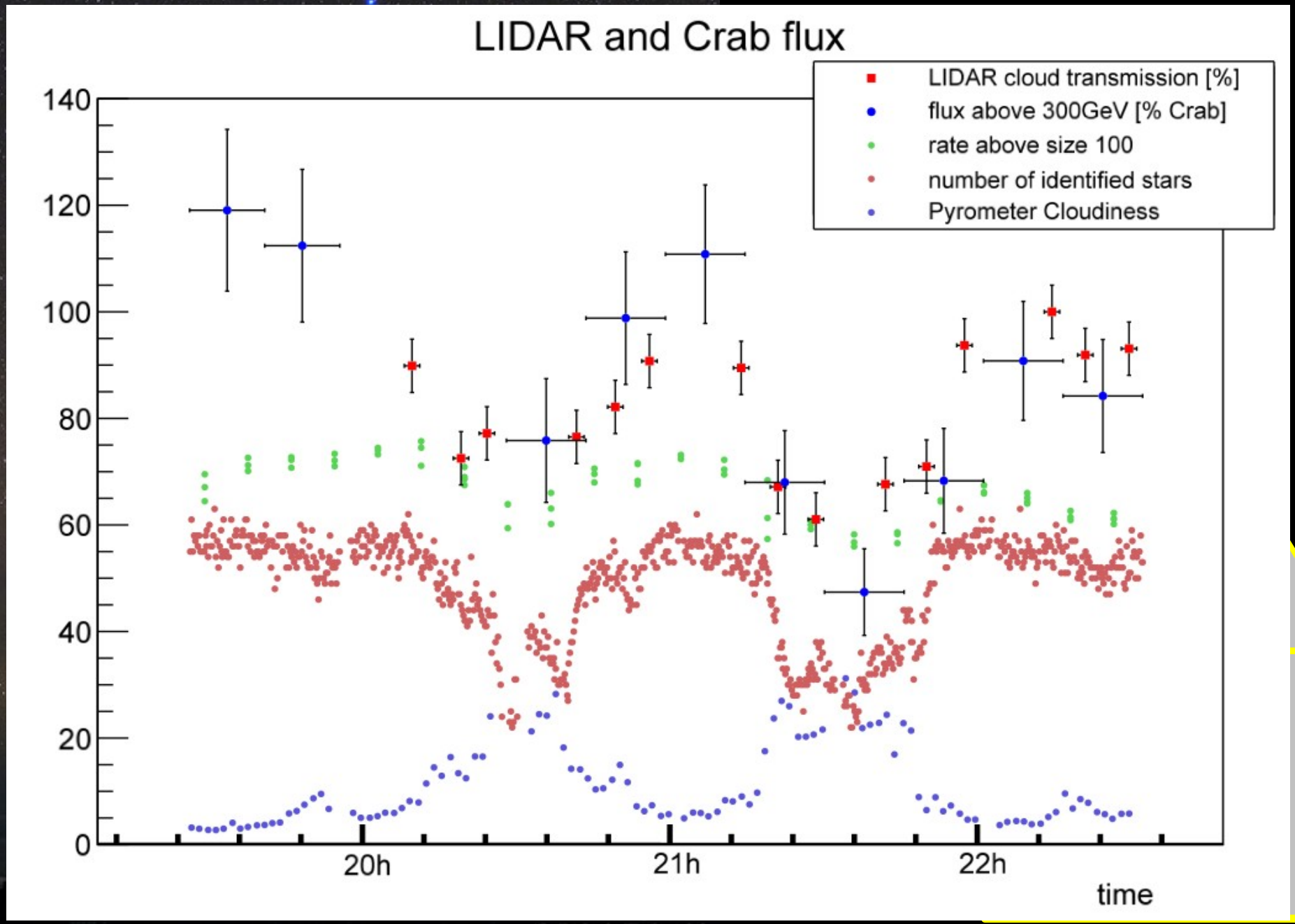
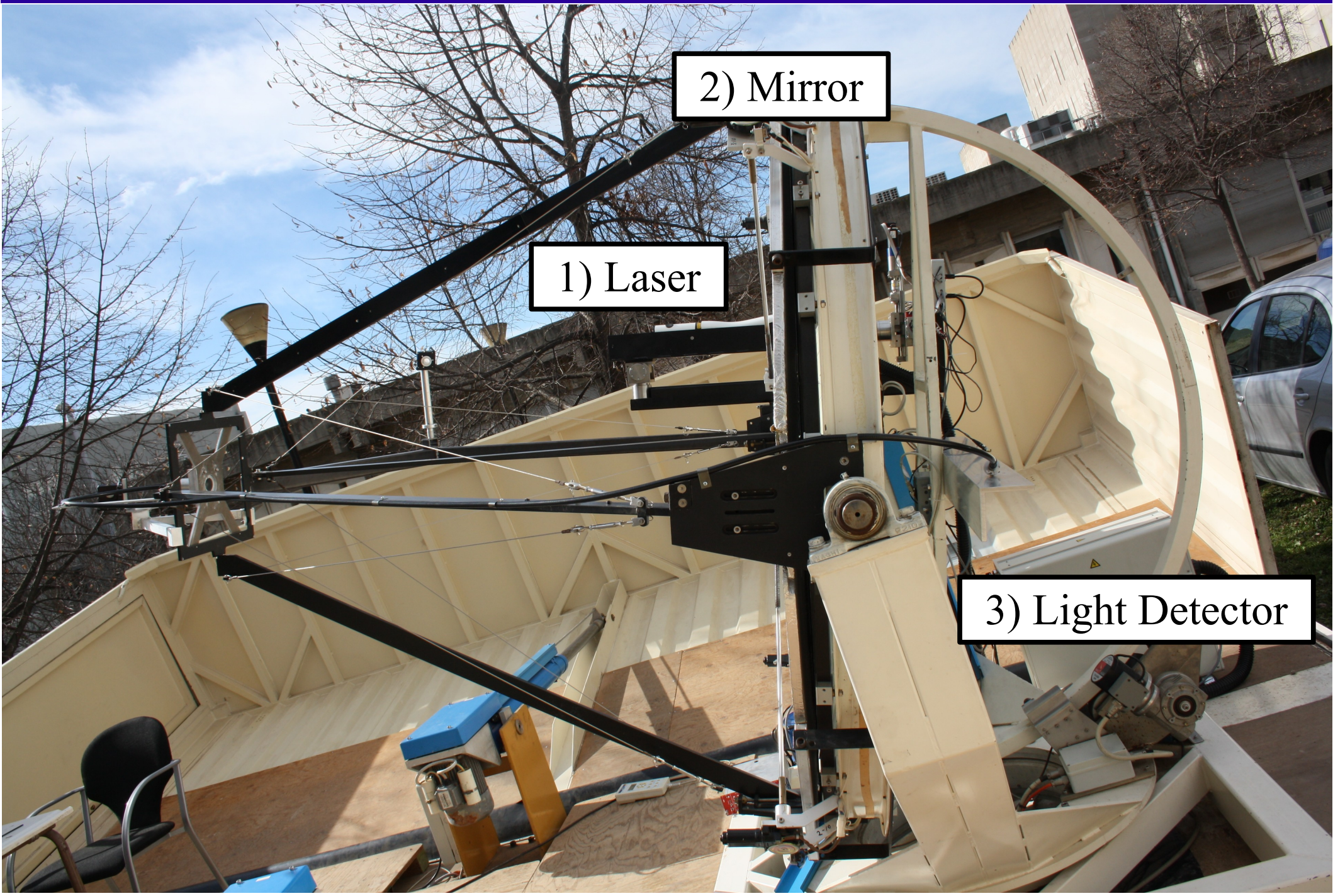


LIght Detection And Ranging



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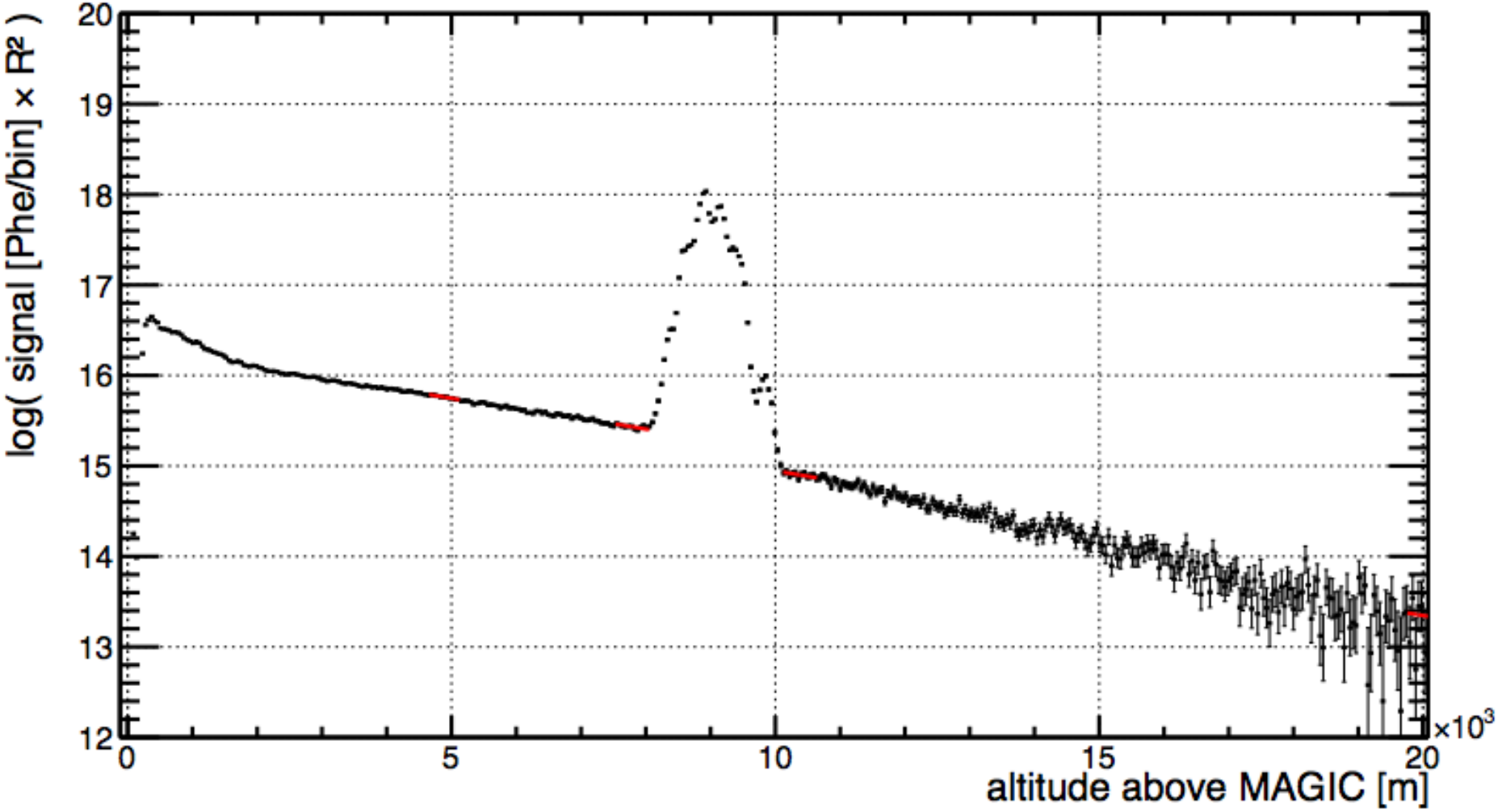
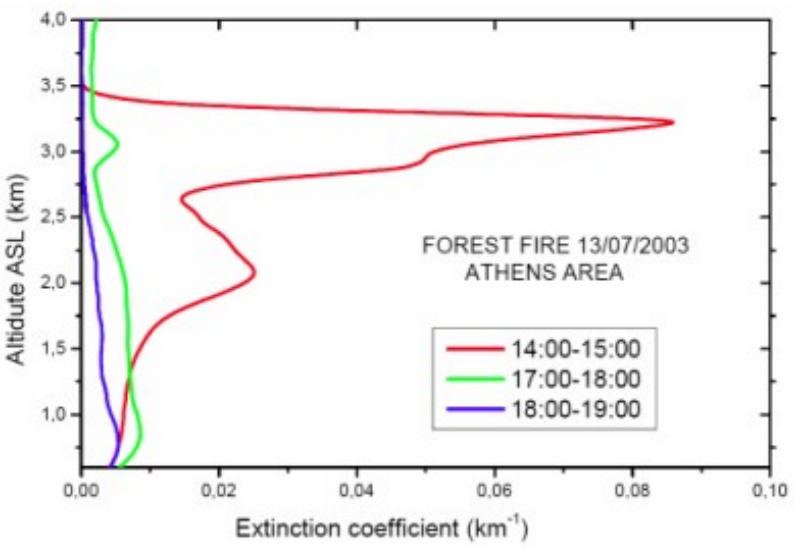


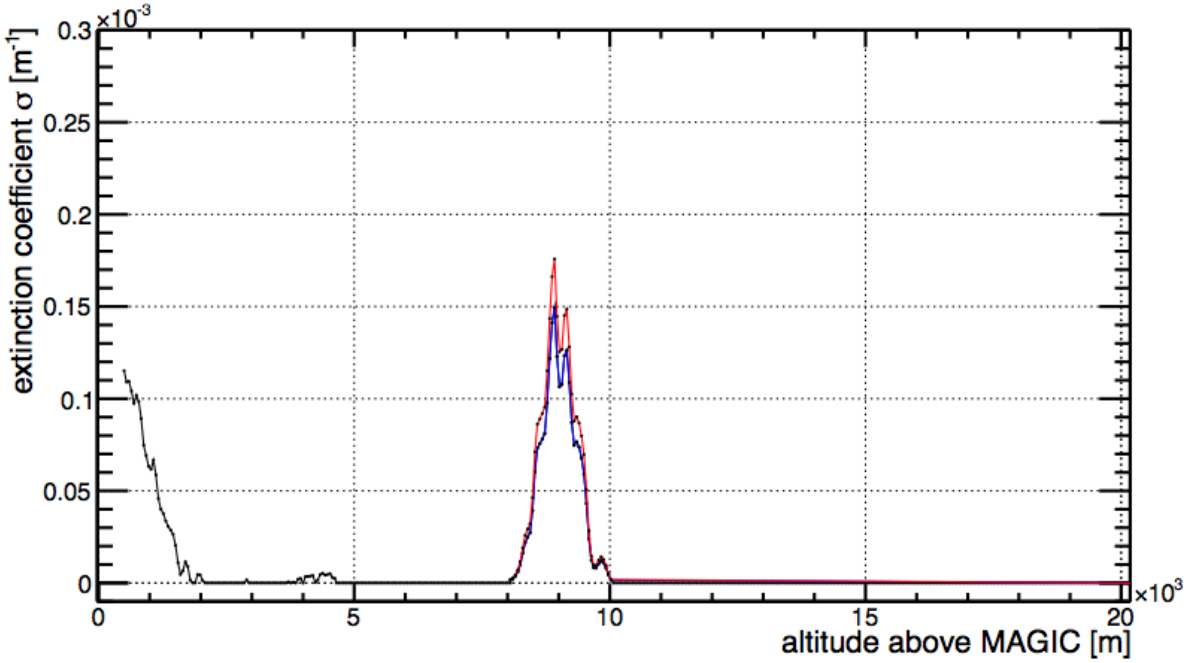
The LIDAR equation

$$P(r,\lambda) = P_0 \frac{ct_0}{2} \beta(r,\lambda) \frac{A}{r^2} e^{-2\tau(r,\lambda)} \qquad (1.1)$$

where P(r,λ) is the radiation scattered by the molecules, P_0 is the initial radiation emitted by the laser, c is the speed of light, t_0 is the time of the transmitted pulse, β(r,λ) is backscatter coefficient, where r is the distance to the molecule and λ is the wavelength. τ(r,λ) represents the optical depth, which could be written in terms of the extinction, α:

$$\tau(r,\lambda) = \int_{r_0}^{r} \alpha(r,\lambda) dr \qquad (1.2)$$





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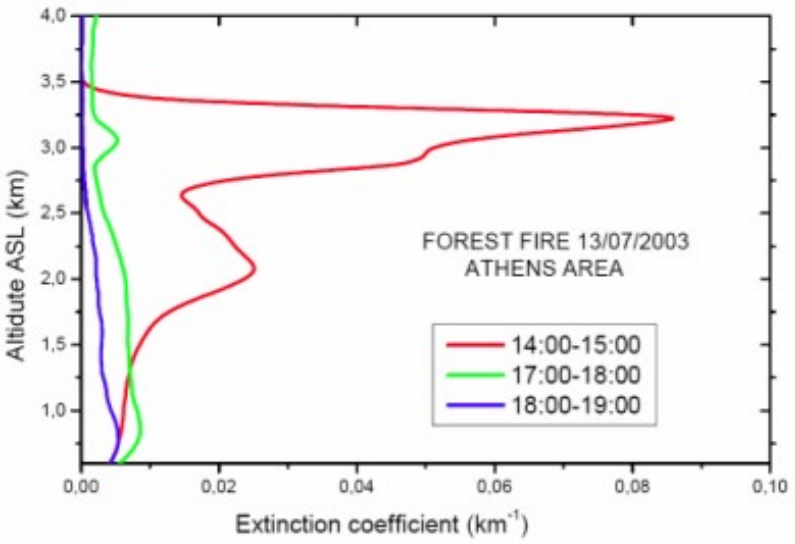
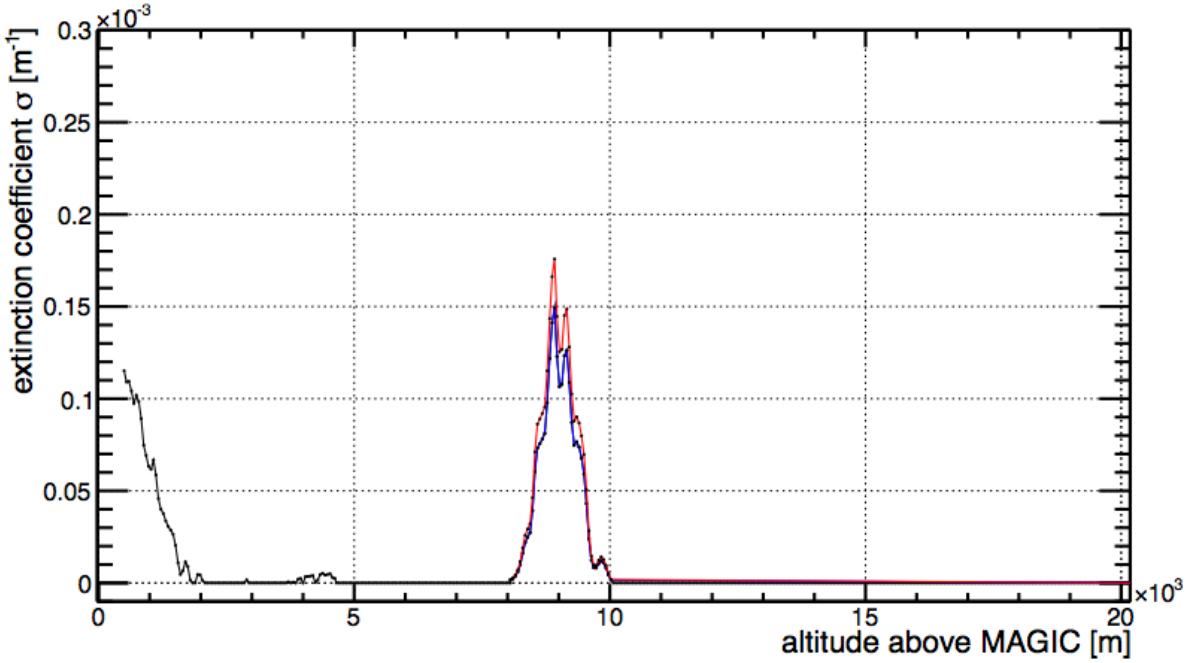
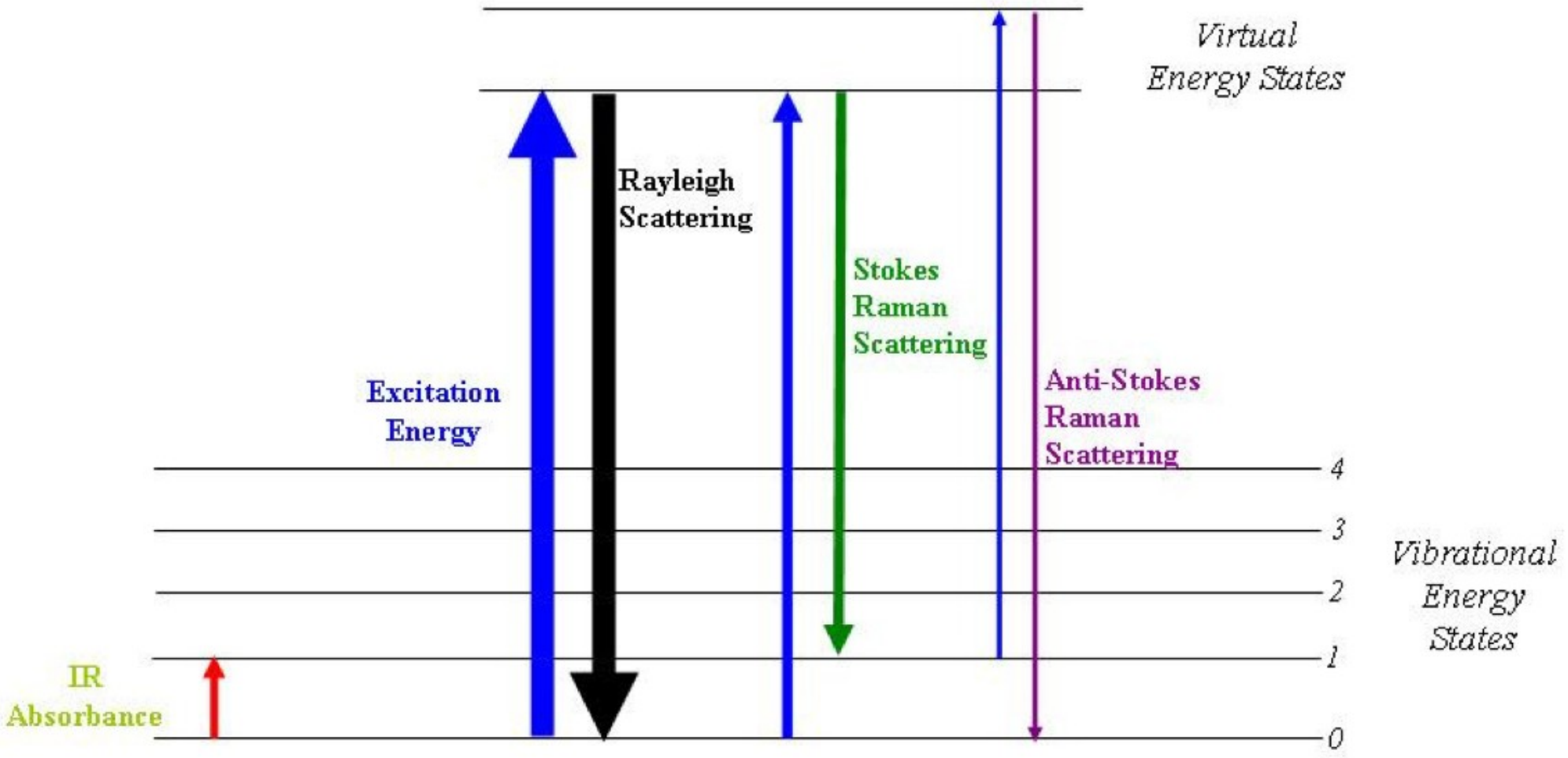




A Raman LIDAR

Inelastic scattering of photons, much smaller than Rayleigh elastic scattering
(V.C. Raman, Nobel prize in 1930)

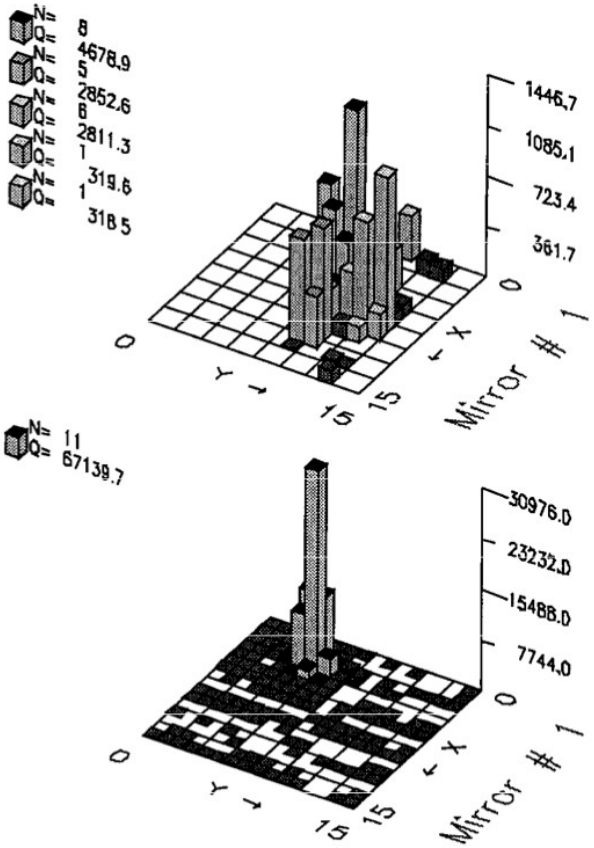


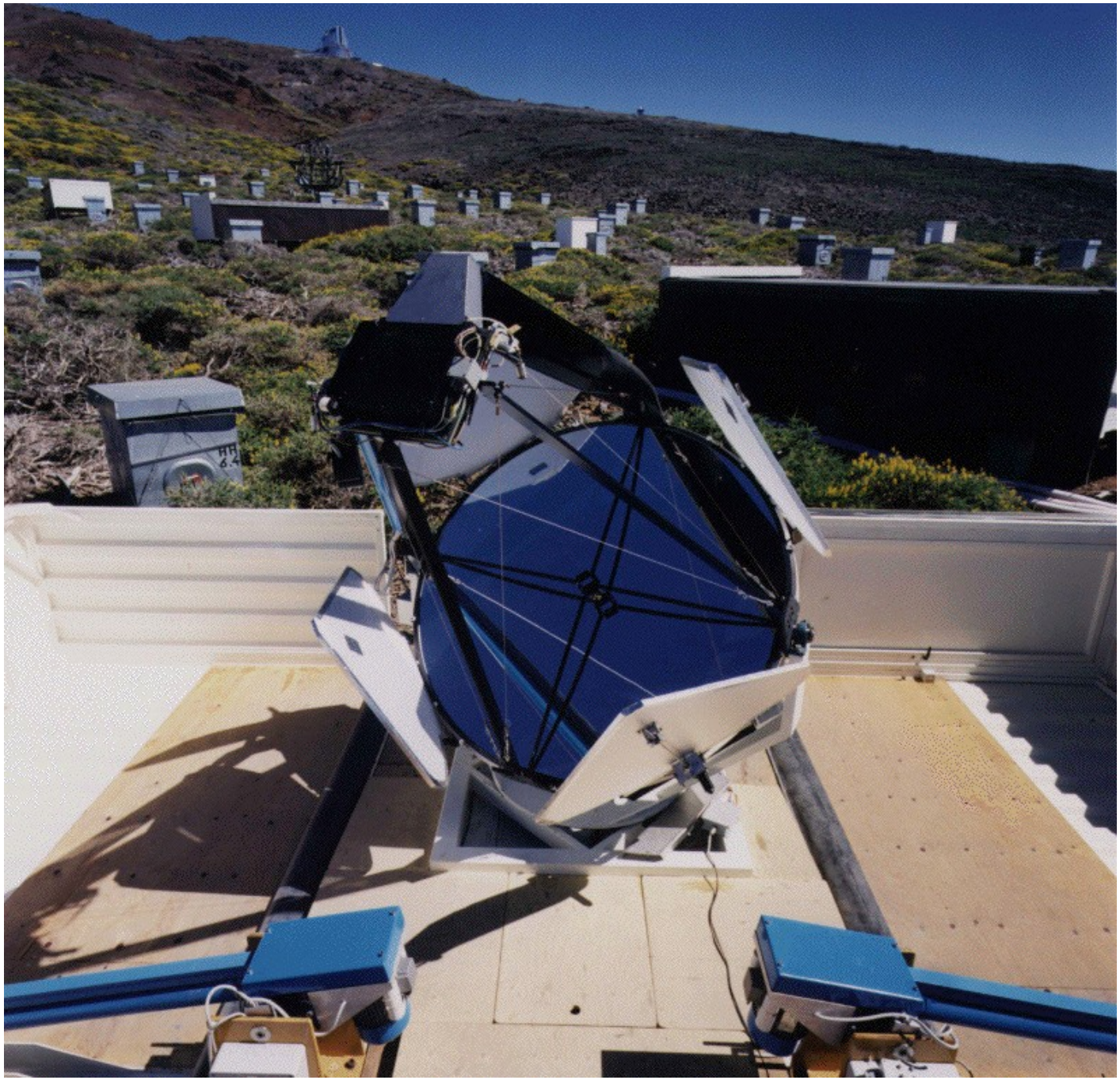
The "Raman wavelength shifts" are characteristic of each molecule
Several backscattered signals to measure both unknowns

IFAE/UAB Raman LIDAR

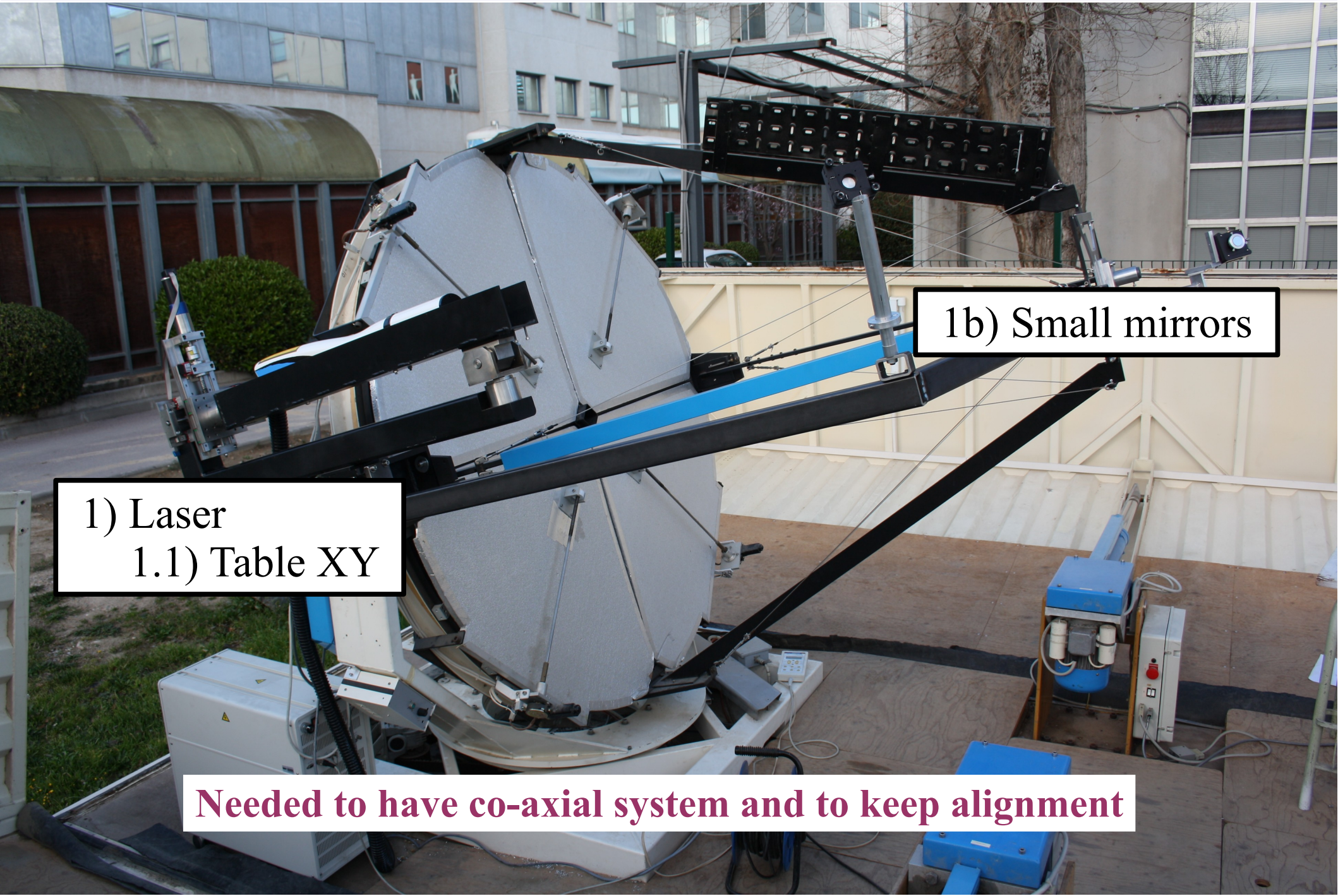
0) CLUE

Cherenkov
Light
Ultraviolet
Experiment





IFAE/UAB Raman LIDAR



IFAE/UAB Raman LIDAR

2) Mirror: Φ = 1.8 m ; f = 1.8 m

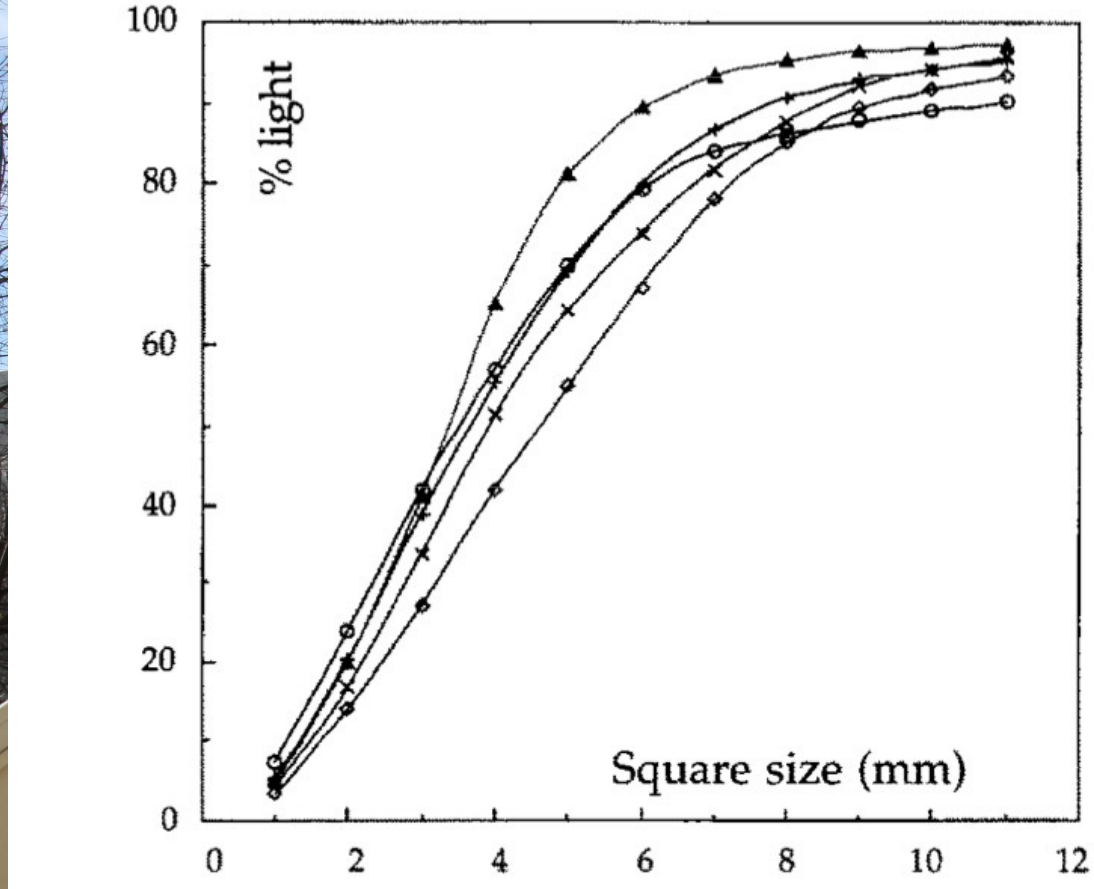
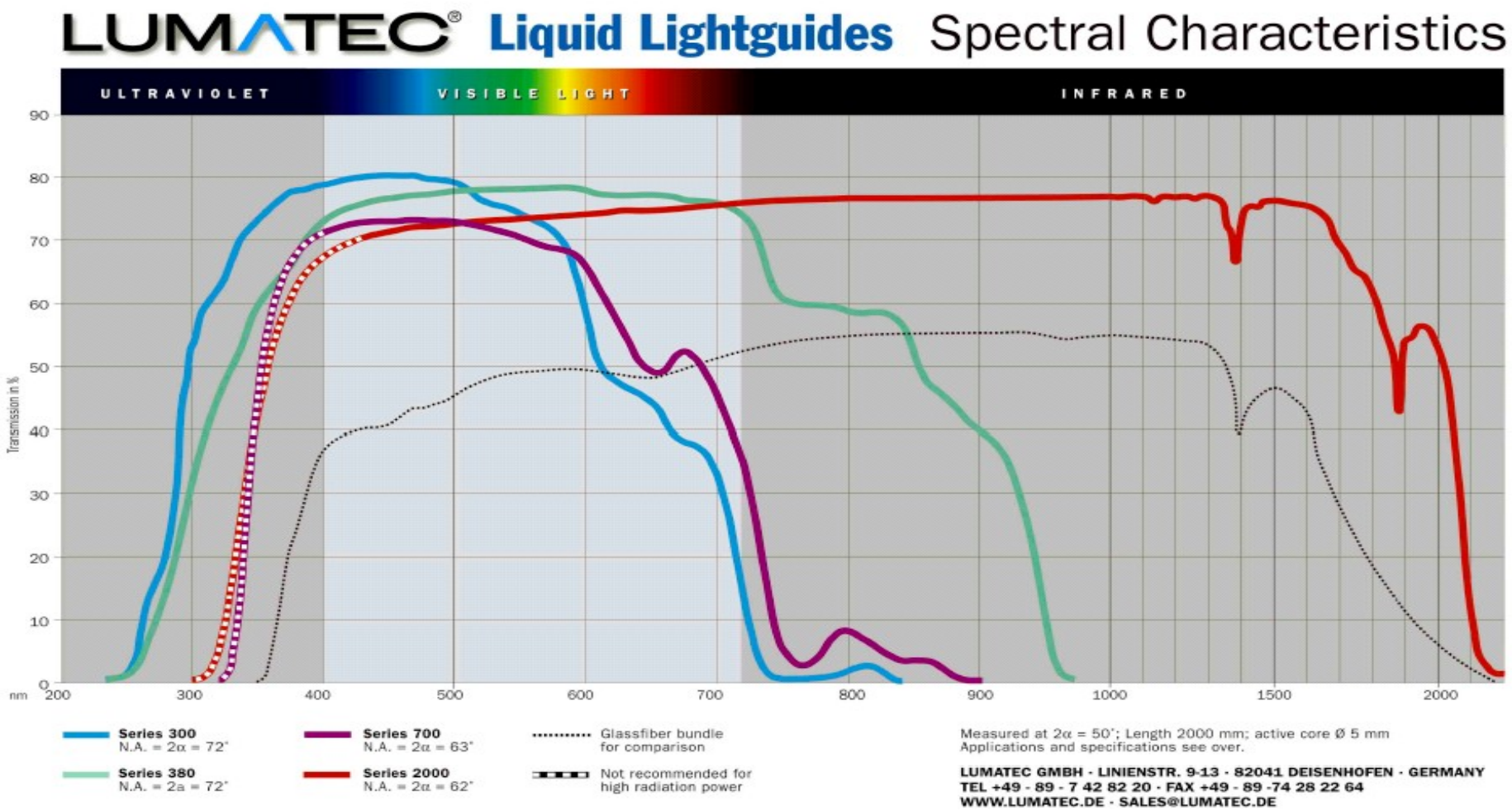
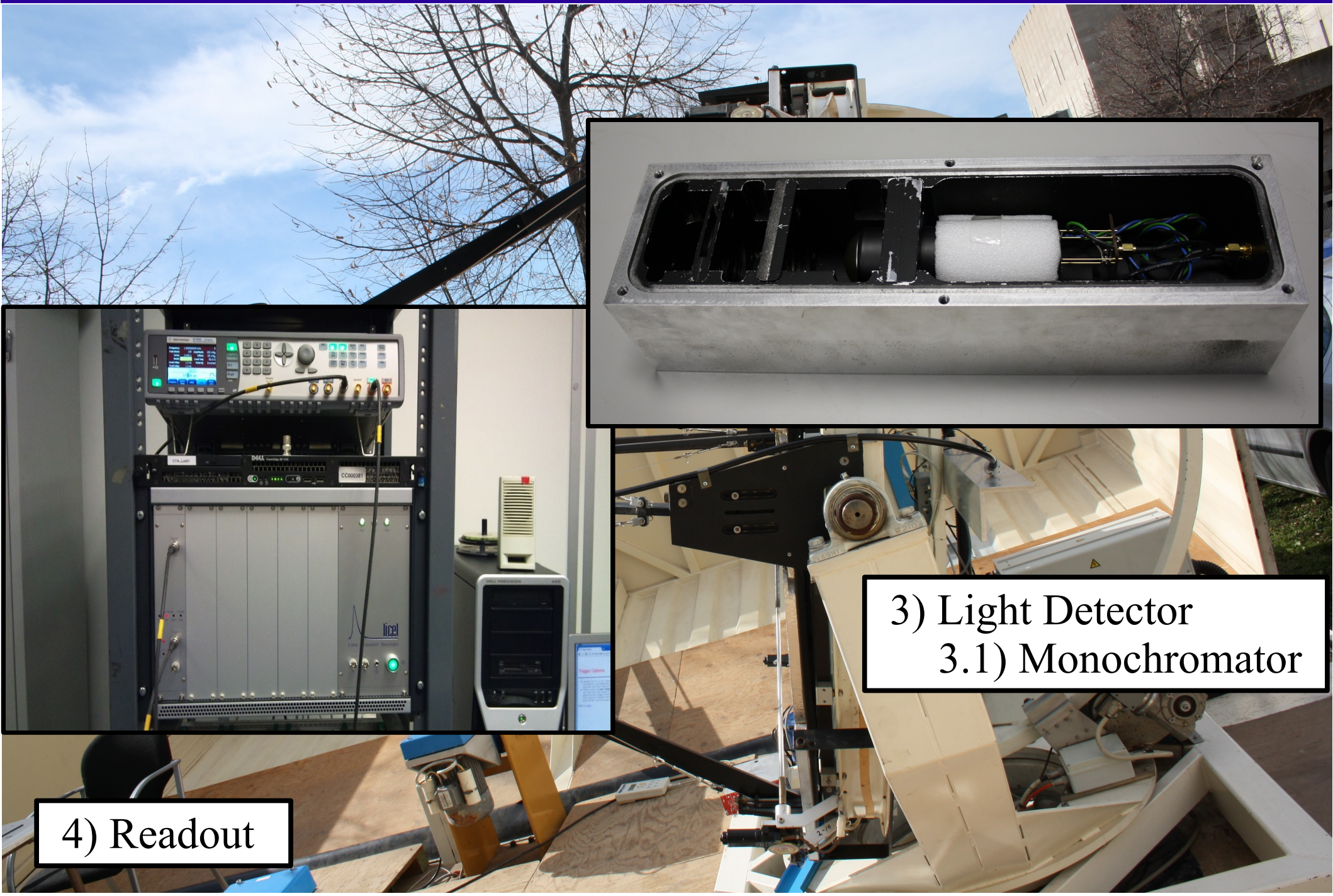


Fig. 2. Percent of reflected light falling within a square of given side for 5 mirrors of production series.

2b) Liquid Light Guide



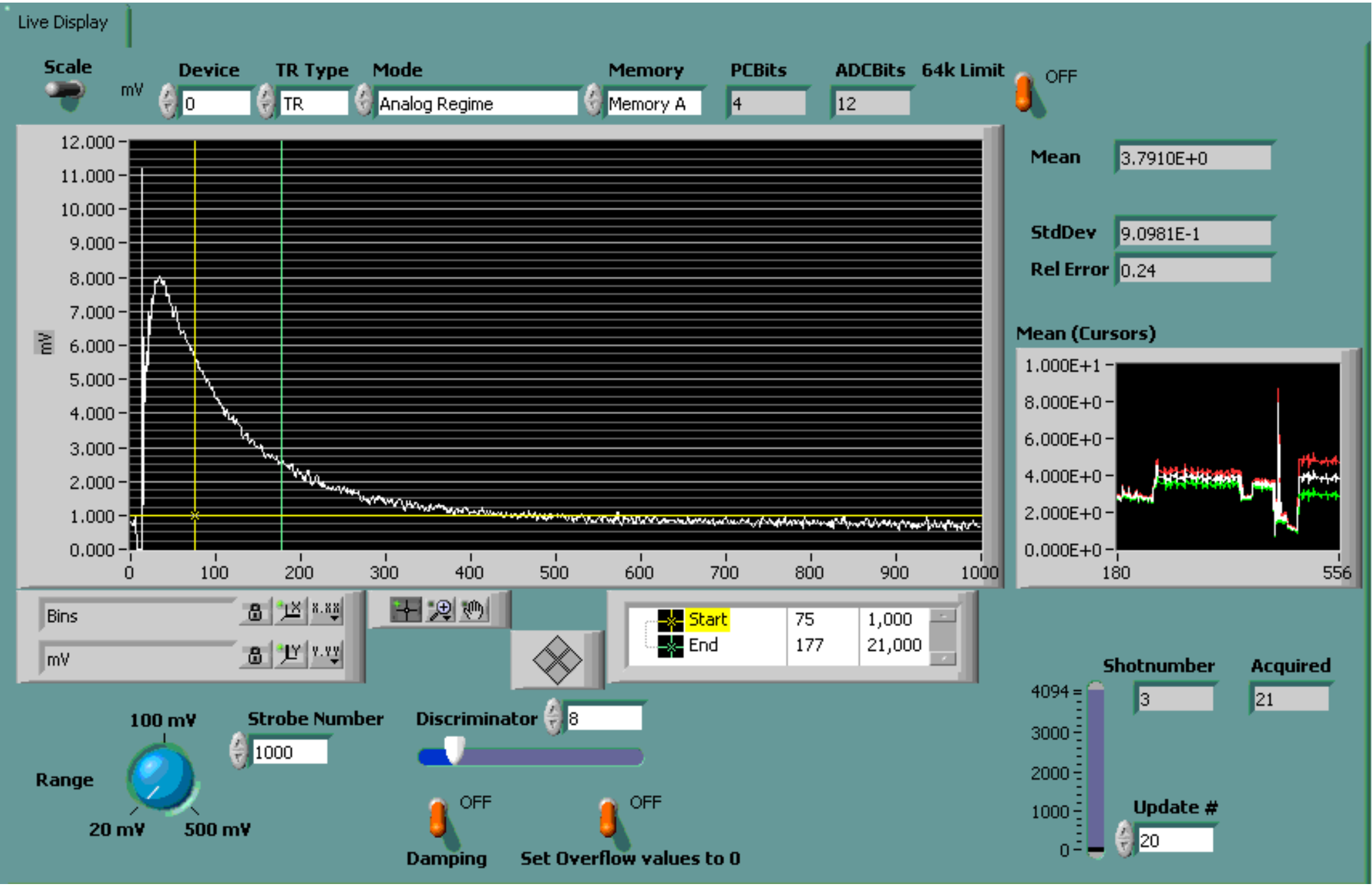
IFAE/UAB Raman LIDAR



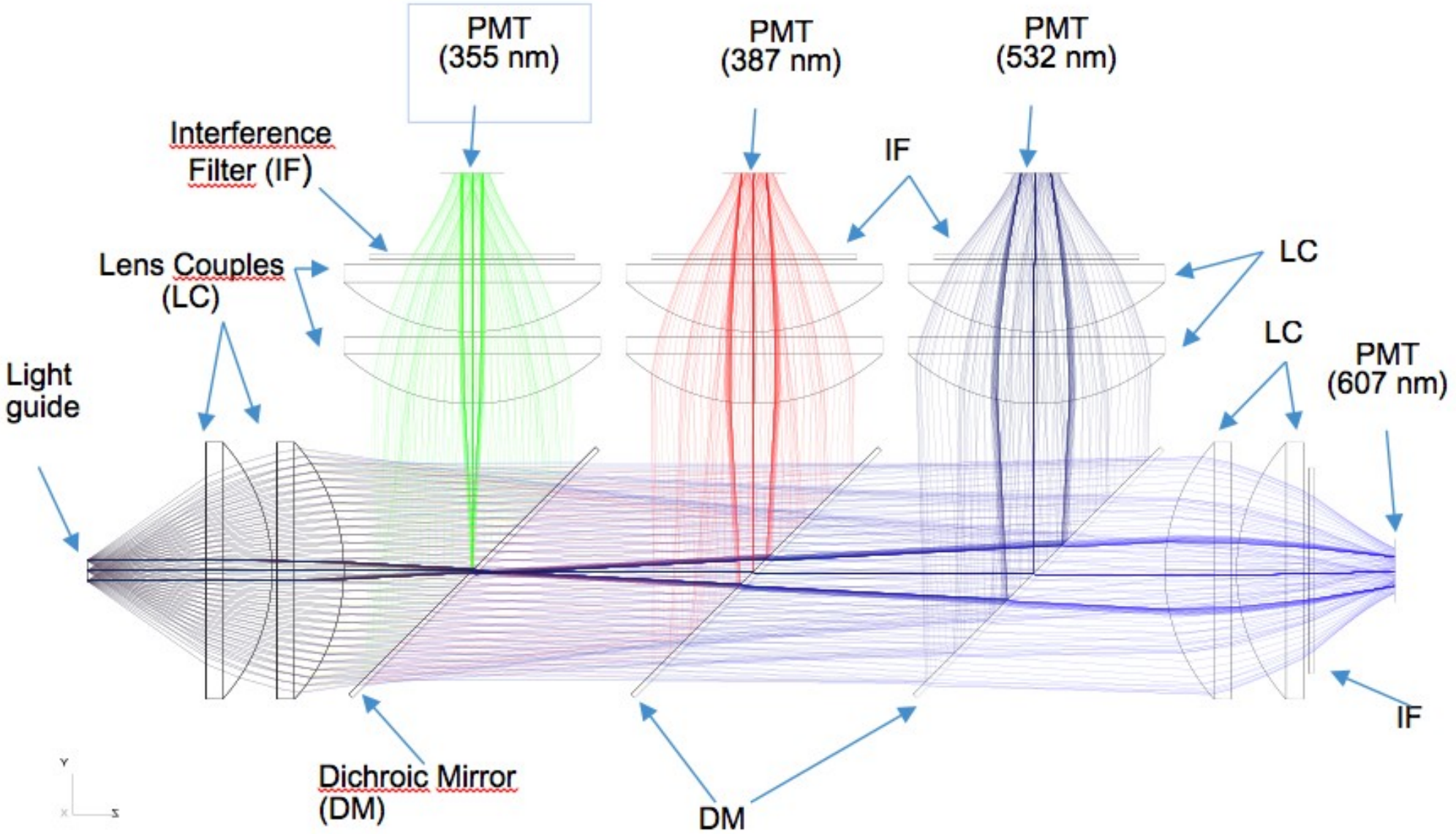
3) Light Detector
3.1) Monochromator

4) Readout

IFAE/UAB Elastic LIDAR



IFAE/UAB Raman LIDAR



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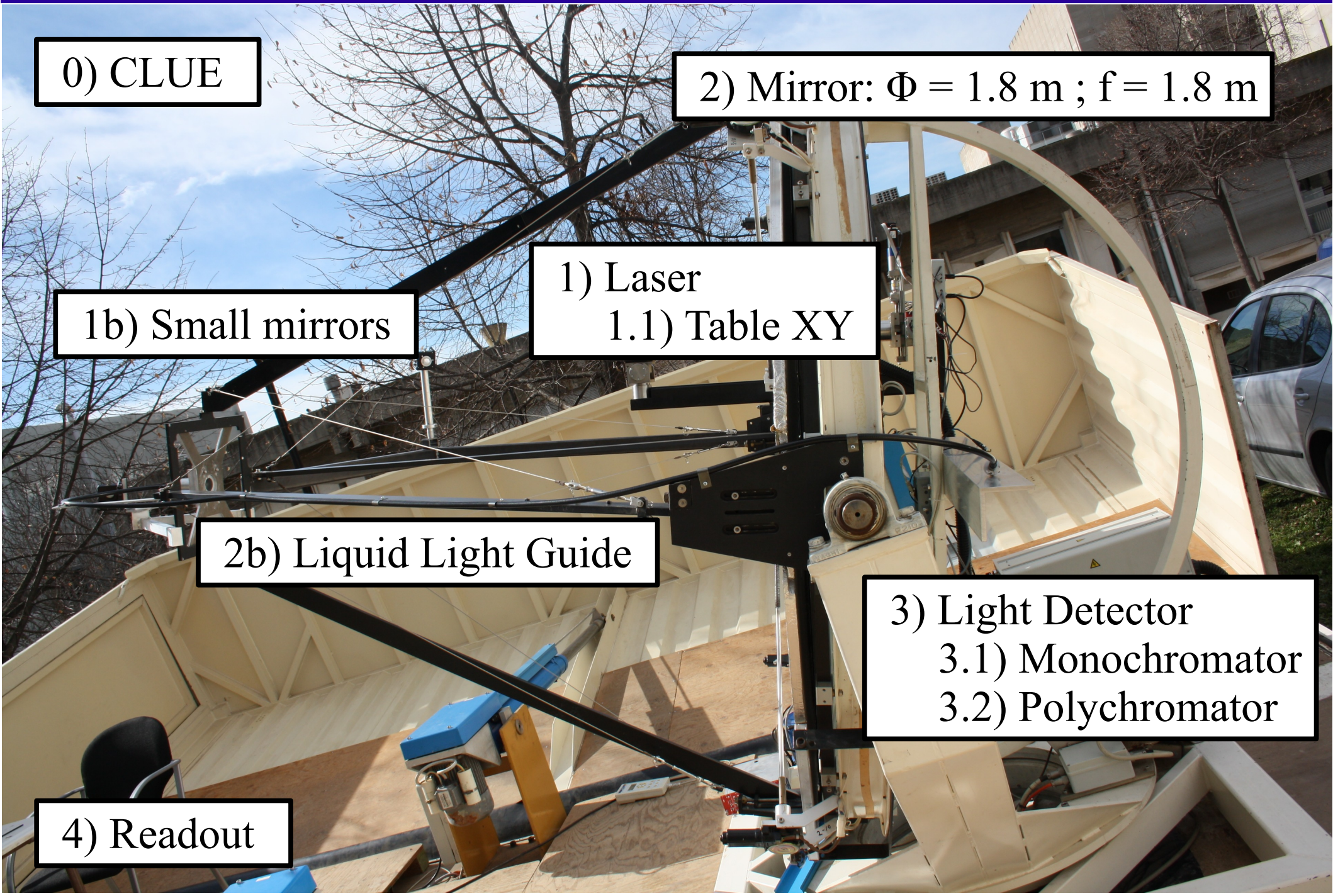

Still a problem to solve ...

The end