ARCADE status

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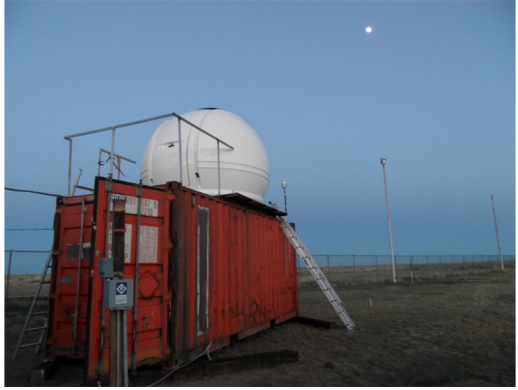
CCF Meeting – Barcellona, October 3rd 2017

The ARCADE Raman Lidar for CTA



TARGET :

The ARCADE Lidar will operate at the CTA sites with the goal of making **a first survey of the aerosol conditions of the selected site** and to use it as **a calibrated benchmark for the other Lidars that will be installed on site**.

groups involved :

- INFN Napoli → L. Valore, C. Aramo
- INFN / CETEMPS L'Aquila → V. Rizi, M. Iarlori, E. Pietropaolo
- INFN Torino → P. Vallania, G. Dughera, M. Marengo

It will measure the aerosol extinction **α(h)** and backscattering coefficient **β(h)** profiles as well as the **water vapour mixing ratio** : all information will help to characterize the optical properties of aerosols on site.

Completed steps & present status

UPGRADE COMPLETED (June 2016)

- water vapour Raman channel added to the elastic and N2 channels
- New DAQ system (Isocomp APCv26 modules)
- new PMTs : Electron Tubes 9829B

ARCADE LIDAR TRANSFERRED TO L'AQUILA (July 2016)

- Once in L'Aquila, the telescope has been reassembled in L'Aquila / CETEMPS laboratory to be tested.

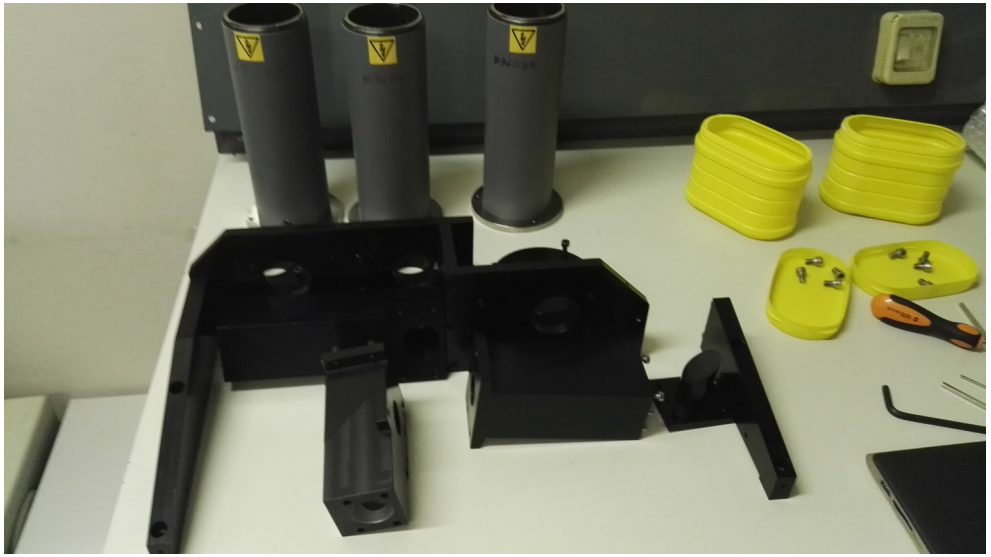
- In the reassembling procedure, we found out that some optical elements need to be renewed (damaged or missing…)

Reassembling in L'Aquila

The laser bench

The steering mechanism and the telescope

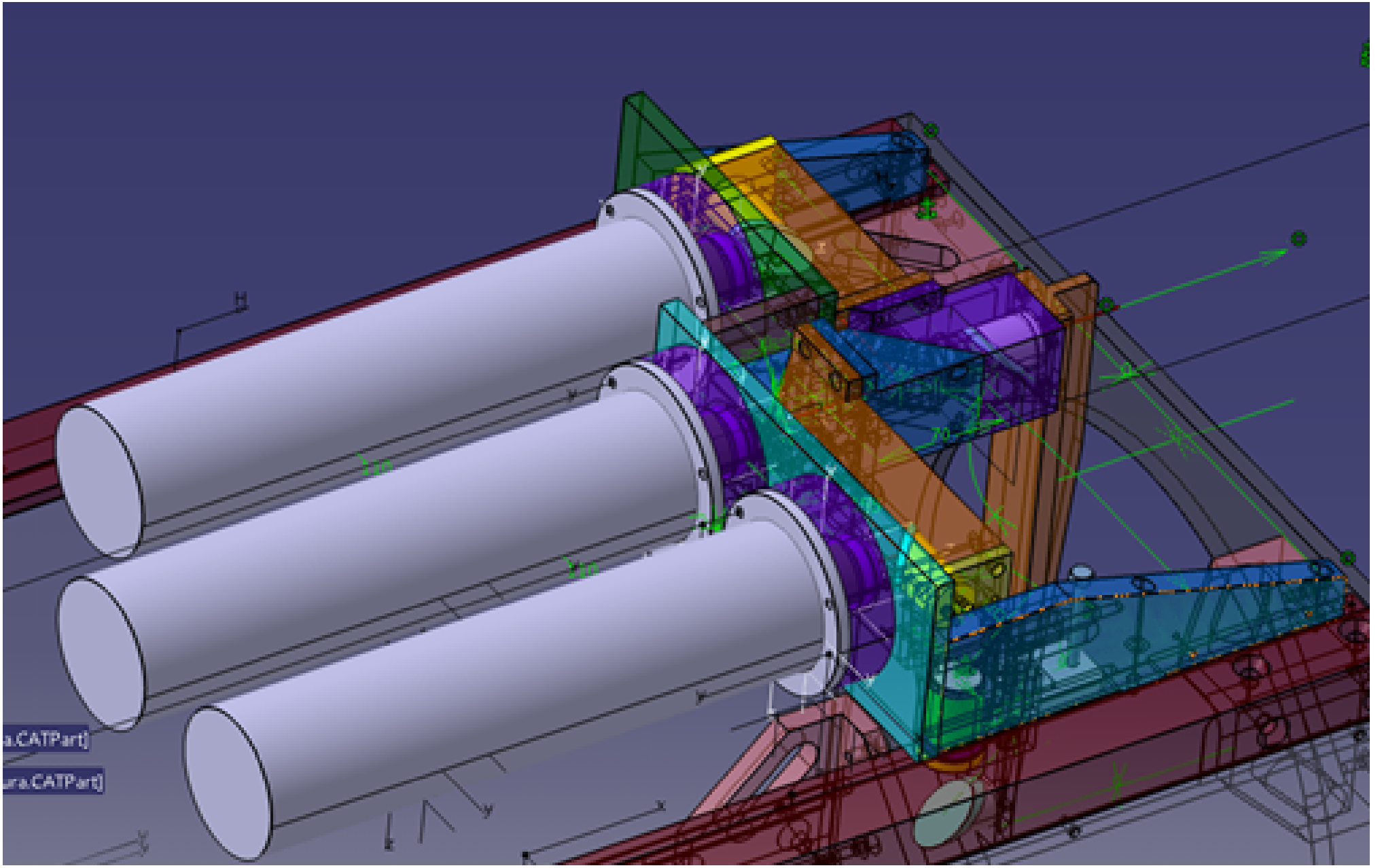
Reassembling in L'Aquila



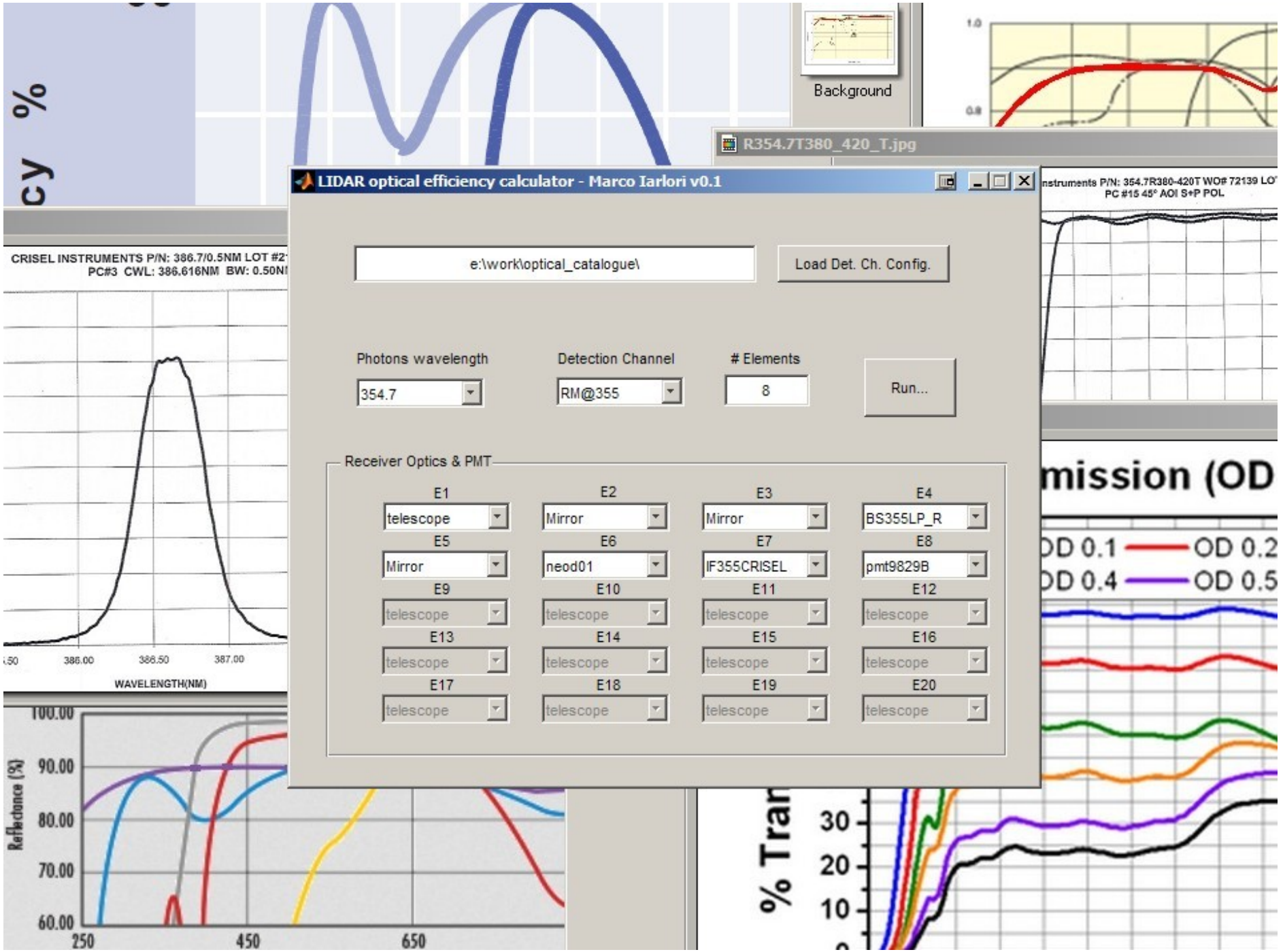
Reassembling the receiver (with all the optical elements)

First light of the Centurion Laser

Spectra efficiencies simulation of the receiver



Spectra efficiencies simulation of the receiver

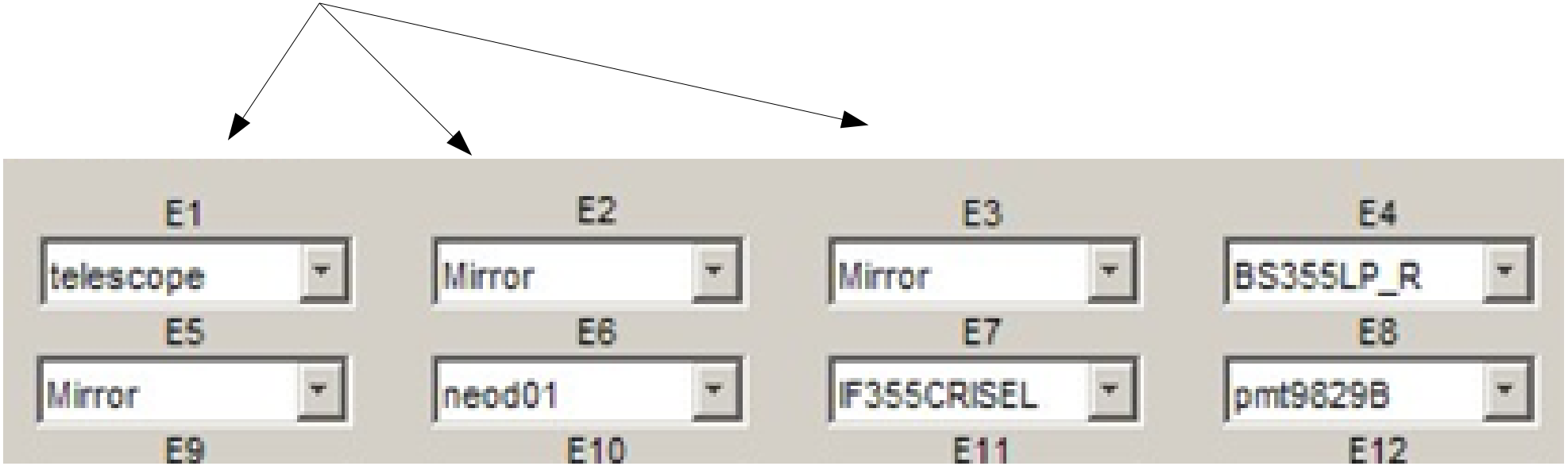


Spectra efficiencies simulation of the receiver

Example:

evaluation of the overall optical transmission of air/aerosol elastic channel

Accounting for all the elements involved in the propagation into the receiver (trasmission and reflection curves from the manufacturers)

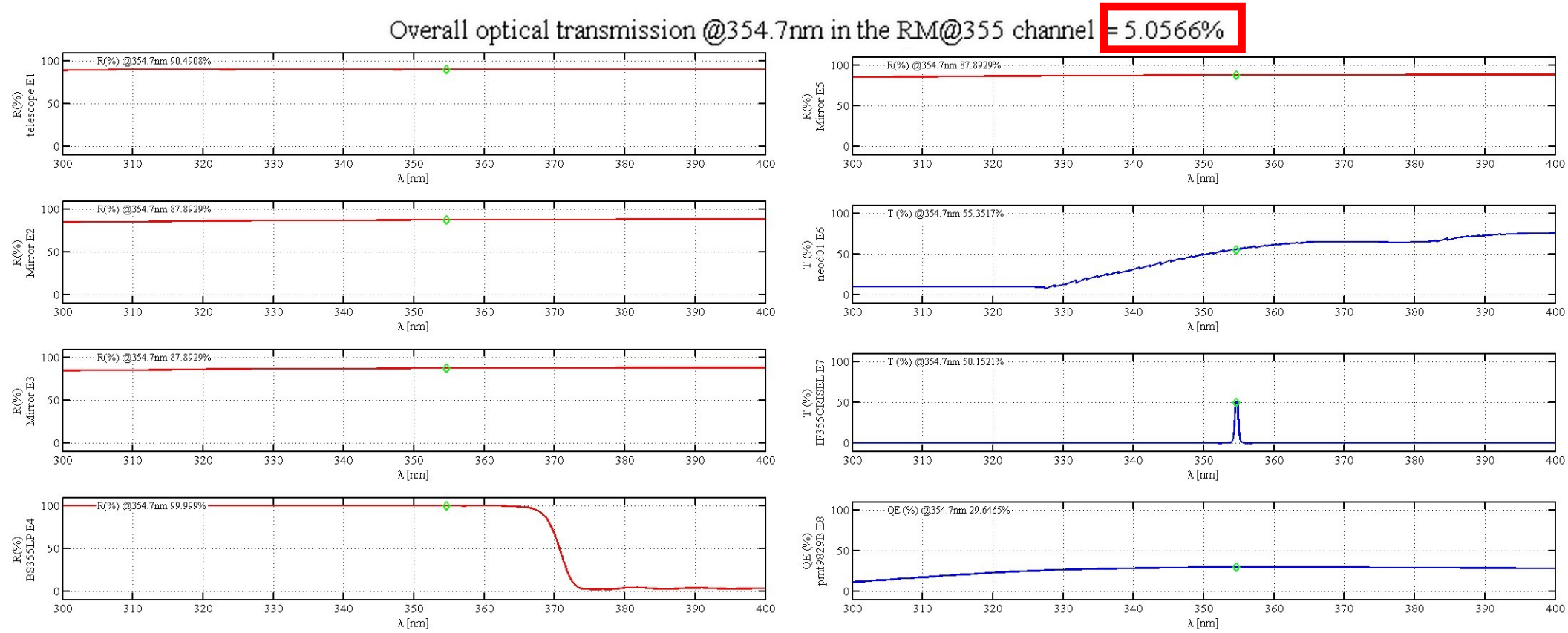


Spectra efficiencies simulation of the receiver

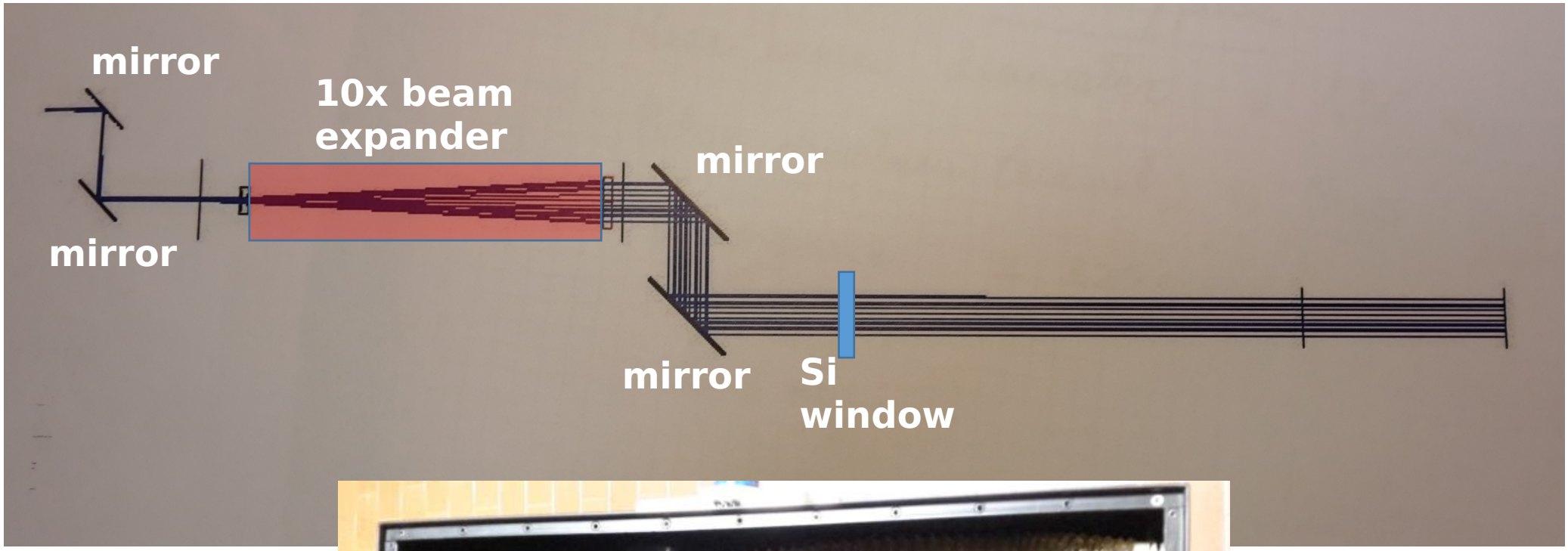
Example:

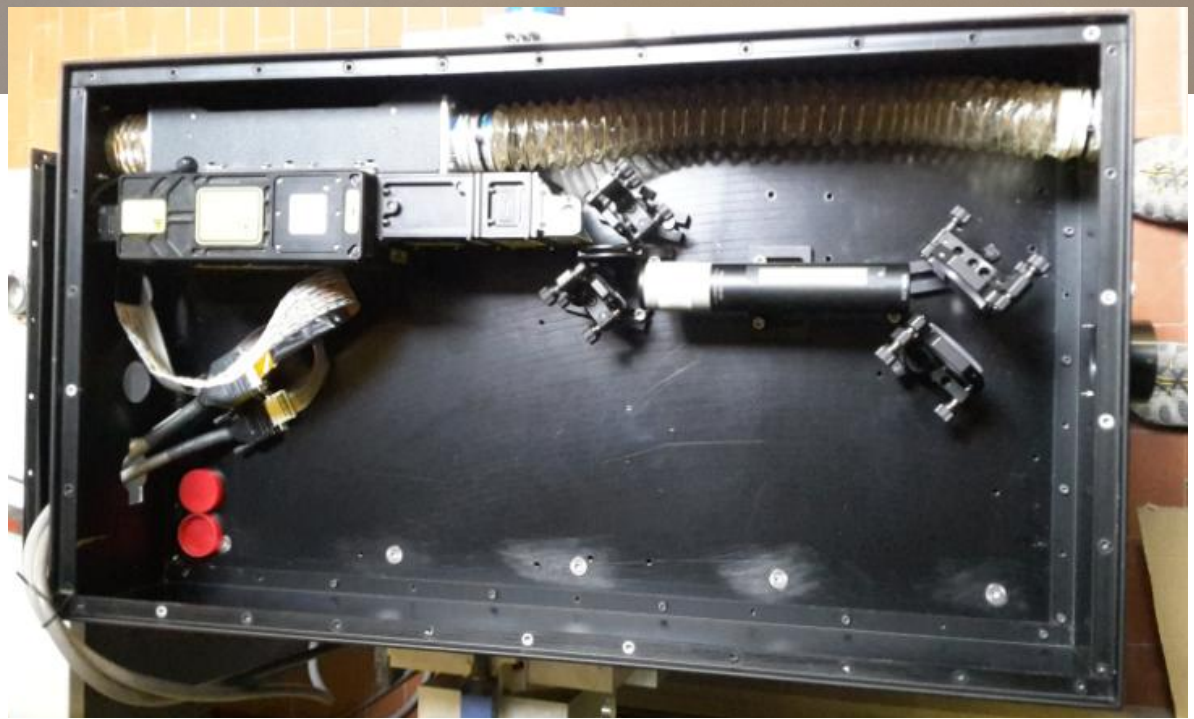
overall optical transmission of air/aerosol elastic channel

All the channel can be simulated and their interference, if any, can be evaluated; i.e. elastic photons in Raman (anelastic channels).

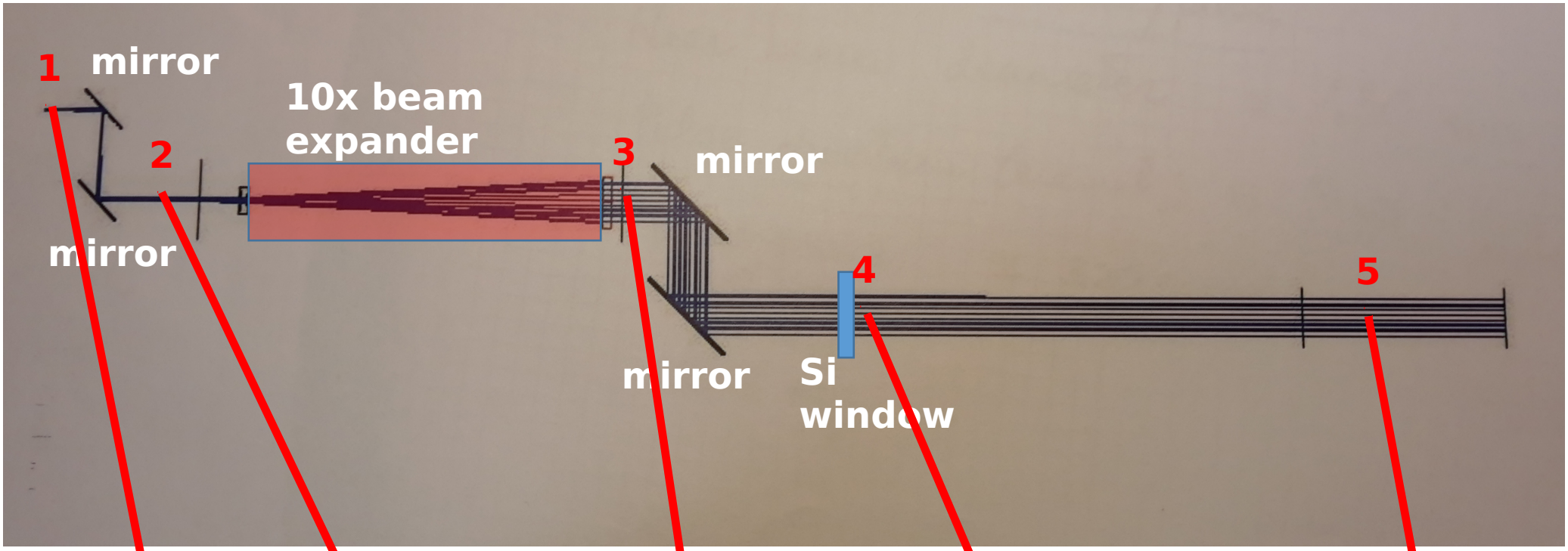


Laser optical bench ZEMAX© simulation



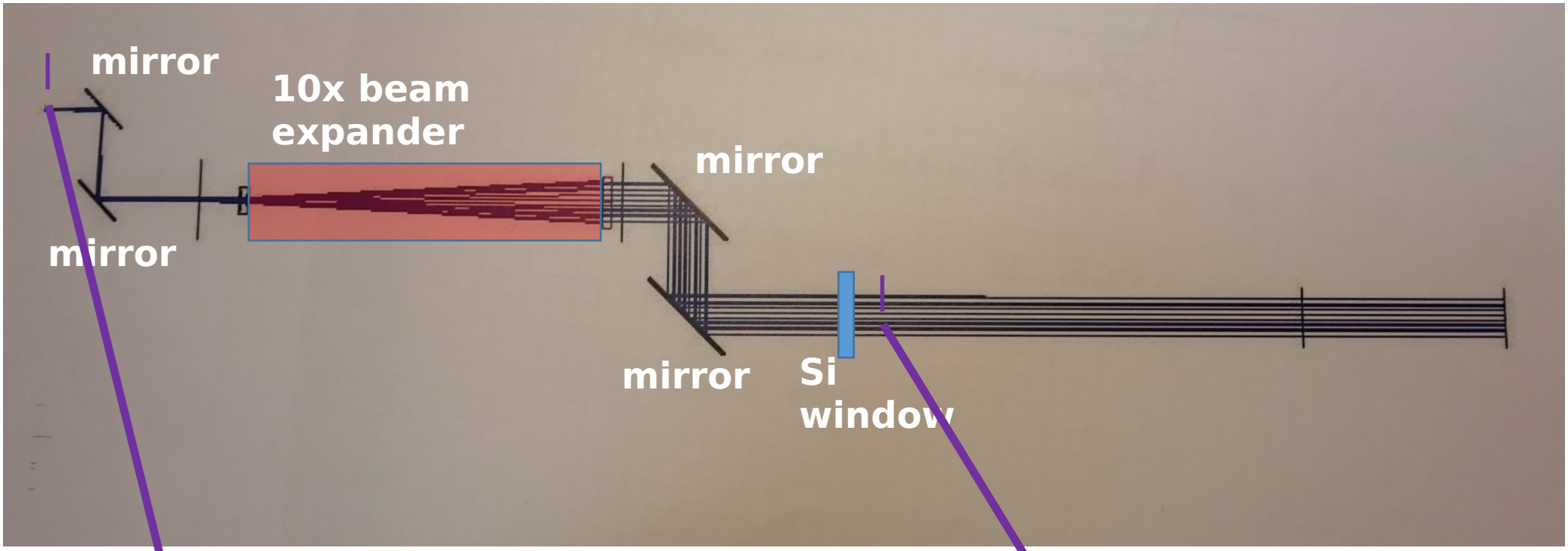


Laser beam footprint



Overall laser beam half angle divergence ~ 0.32±0.05 rad

Laser single pulse energy

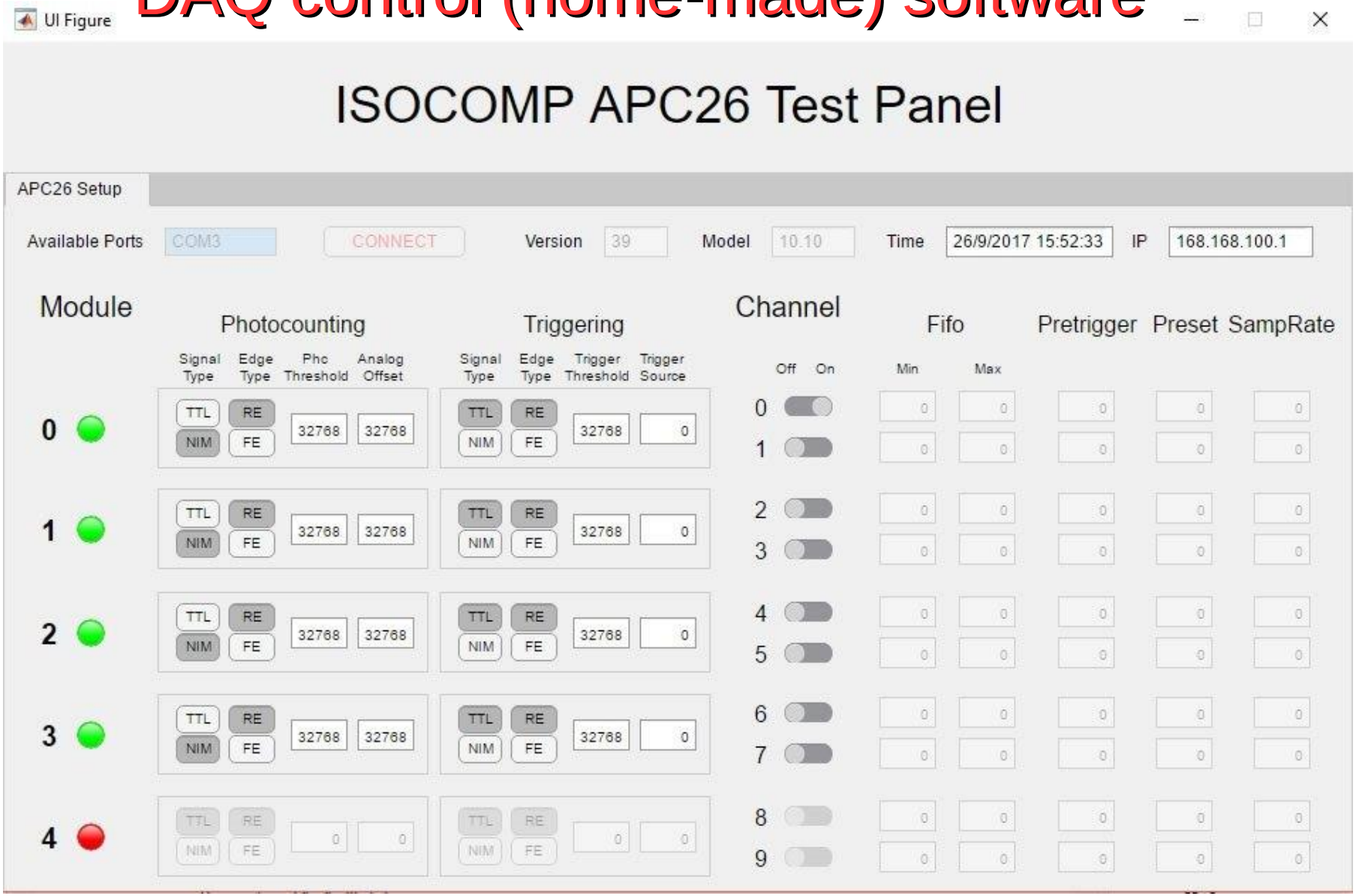


5.8 ± 0.1mJ

3.0 ± 0.1mJ

With new beam expander and high energy mirrors the output energy can be increased up to 4.1 ± 0.1 mJ.

DAQ control (home-made) software



This program has been designed to be used on site (locally).

For the remote acquisition, shell commands will be developed.

Acquired signals will be stored in the PC on site and transferred to Italy every day.

DAQ control (home-made) software

Photon-counting and analog detection of:

- air/aerosol elastic signal
- N2 Raman signal
- H2O Raman signal

Max count rate 250 Mhz

Time resolution 100 ns (15 m vertical resolution)

expected time to acquire a good signal : 10 min

Future installation in La Palma

Trip to ORM in La Palma from 17 to 21 October 2016 (C. Aramo, V. Rizi and L. Valore)

Visit to Observatorio Roque de Los Muchachos to look for a possible location for the ARCADE Lidar

Technical document for the installation of ARCADE Lidar at ORM prepared for SUCOSIP meeting (presented by L. Valore on 27th October 2016 via skype)

Approved from the CCI on October 28th 2016

ARCADE Lidar

Technical Documentation

for construction at ORM, La Palma

INFN Naples, L'Aquila, Torino for CTA
L. Valore, V. Rizi, C. Aramo, M. Iarlori,
P. Vallania, M. Marengo, G. Dughera

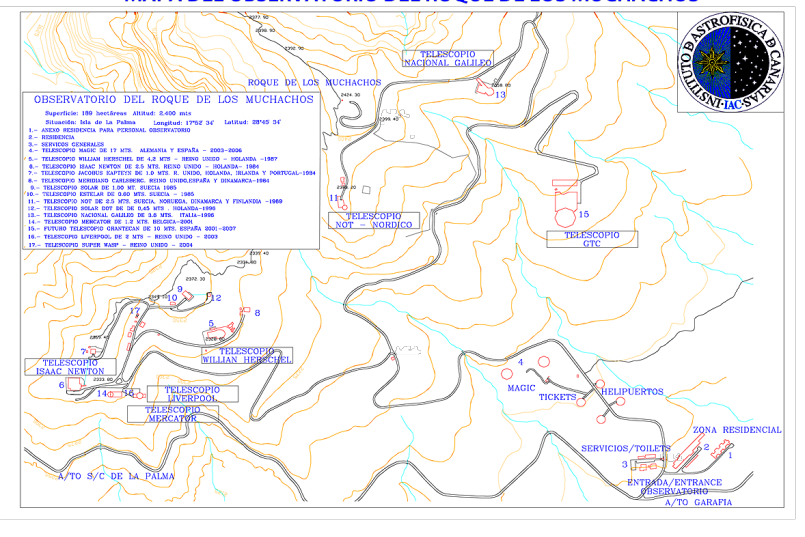
contact emails : laura.valore@na.infn.it, vincenzo.rizi@aquila.infn.it, carla.aramo@na.infn.it

Ready to ship the Lidar by the end of this year → we need to establish the location!!

Installation in La Palma

- Need for power and internet connection
- Need for a flat location - we can avoid a concrete pad as basement, railroad ties will work that will have less impact on the environment
- We can completely avoid inferference with the (many) existing telescopes, running the Lidar 15 minutes before (sunset) and after (sunrise) astronomical twilights
- It is a temporary installation (no more than 2 years)
- The ARCADE Raman lidar, before the deployment in the field will pass hardware and software quality checks according to the well established procedures adopted in EARLINET

MAPA DEL OBSERVATORIO DEL ROQUE DE LOS MUCHACHOS



Arcade In-kind INFN cost

WBS-Nr.	Description	# of items	Official CTA Cost Estimate per item		Own estimate (if different)		Comments
			Equipment [EUR]	Labour [FTE]	Equipment [EUR]	Labour [FTE]	
3.10.3.4.2.5	ARCADE LIDAR	1	46.400 €	3,56	80.000 €		Funded

Firb-Miur Arcade cost = 100 keuro

Until now:

- Upgrade: 41 keuro
- Shipments and container: 27 keuro
- Travel costs: 2 keuro

Total 70

From now

- Travel costs to install
- Local installation costs