



Pseudo-Random Noise modulation (PRN-cw) lidar for cloud detection in EUSO

- Pseudo-Random Noise modulation lidar (PRN-cw) is an instrument for range-resolved detection of targets, clouds, etc. by continuous wave laser – i.e. **DIODE LASER**
- The use of **DIODE LASER** gives the following advantages:
 - **COMPACT PACKAGE** due to the **SMALL SIZE** and **MASS**
 - **LONG LIFE** due to **ALL SOLID STATE DESIGN**
 - **LOW CONSUMPTION** due to the **HIGHEST POWER EFFICIENCY**
 - **APPROPRIATE WAVELENGTH** for **ATMOSPHERIC PROBING**

Due to these features of the laser source, the lidar sensor unit for cloud detection in EUSO will conform to the requirements for:

CLOUD TOP DETECTION PROBABILITY

SIZE and MASS of the UNIT in EUSO PACKAGE

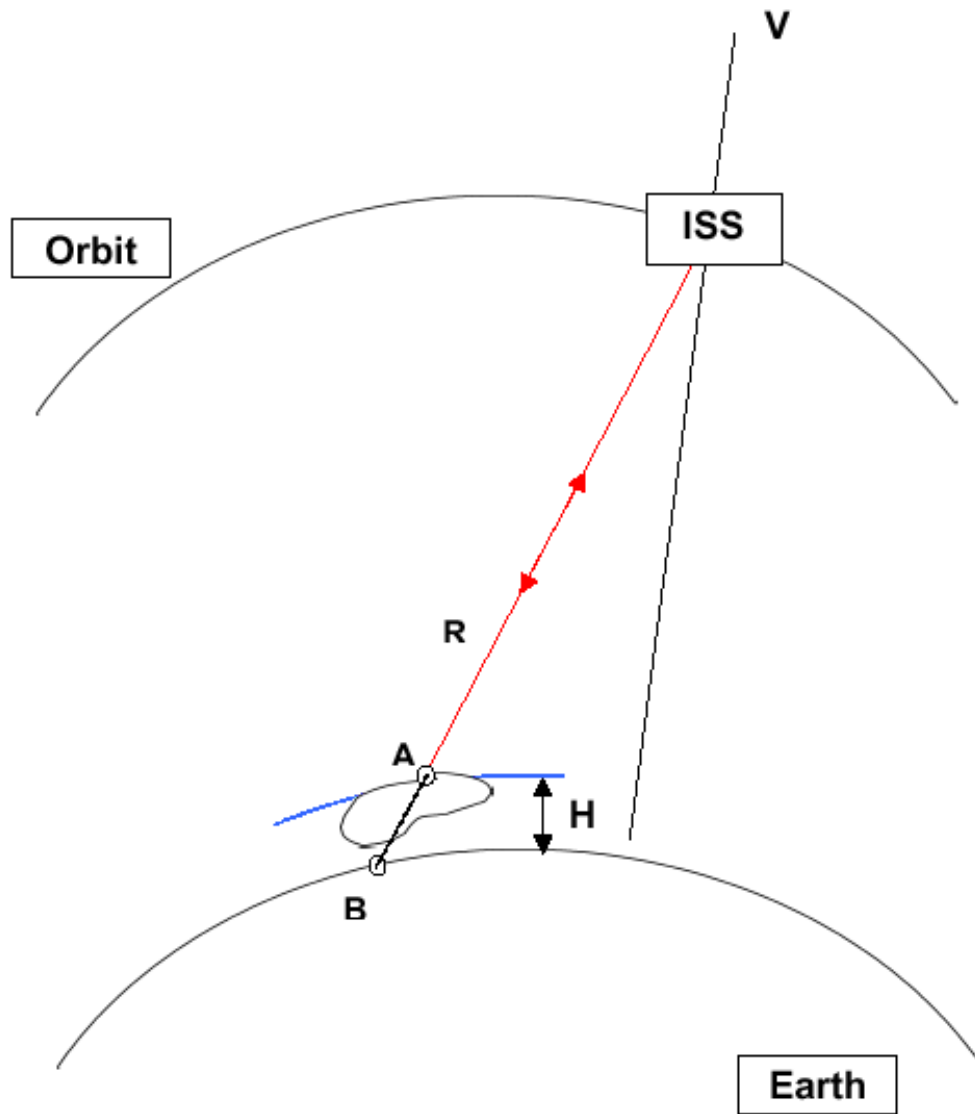
POWER CONSUMPTION of the UNIT



Pseudo-Random Noise modulation (PRN-cw) lidar for cloud detection in EU SO

Geometry of Clouds Probing

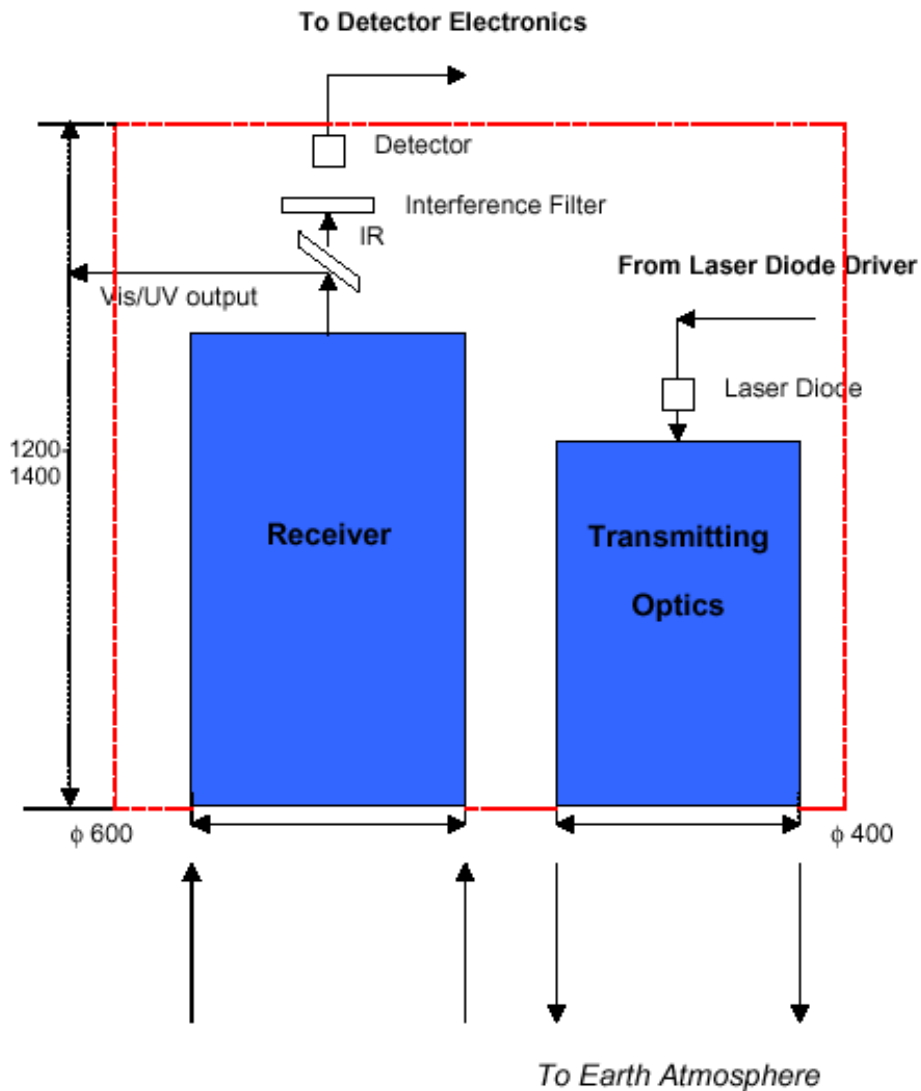
- Distance from ISS to cloud top R – determined by the PRN lidar.
- Cloud top altitude H , determined from R and angular co-ordinates of probing direction with respect to the vertical through ISS.





Pseudo-Random Noise modulation (PRN-cw) lidar for cloud detection in EUSO

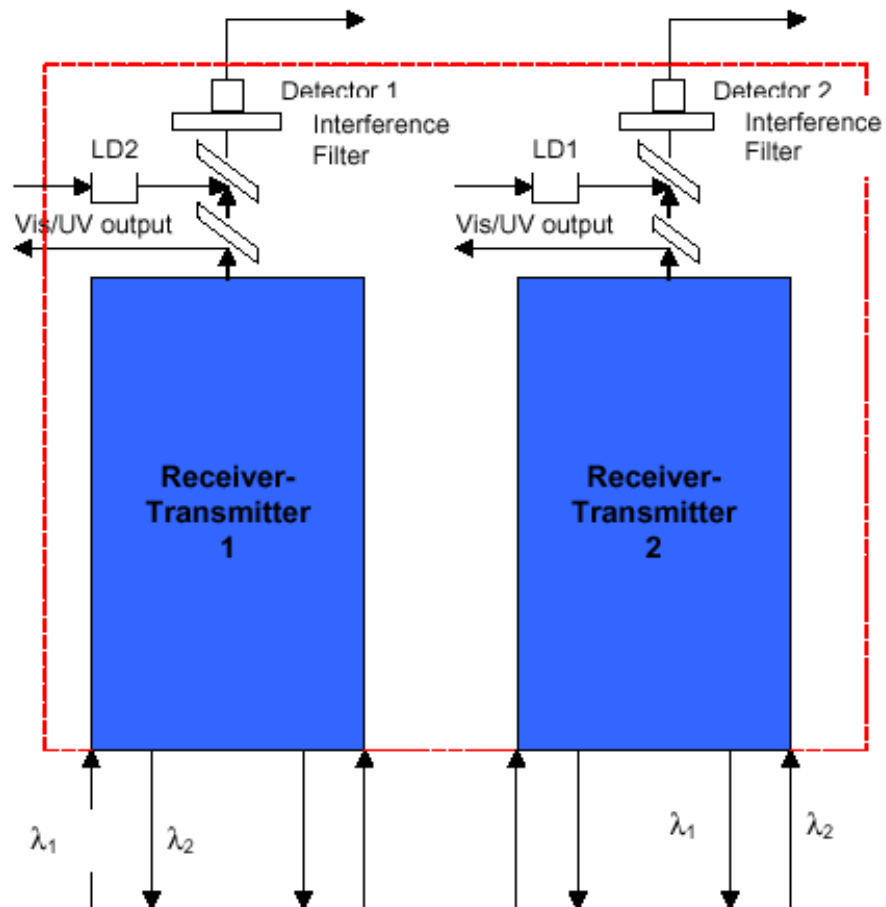
Option 1





Pseudo-Random Noise modulation (PRN-cw) lidar for cloud detection in EUSO

Option 2



To Earth Atmosphere

Pseudo-Random Noise modulation (PRN-cw) lidar for cloud detection in EUSO

Numerical Simulation for cloud top detection.

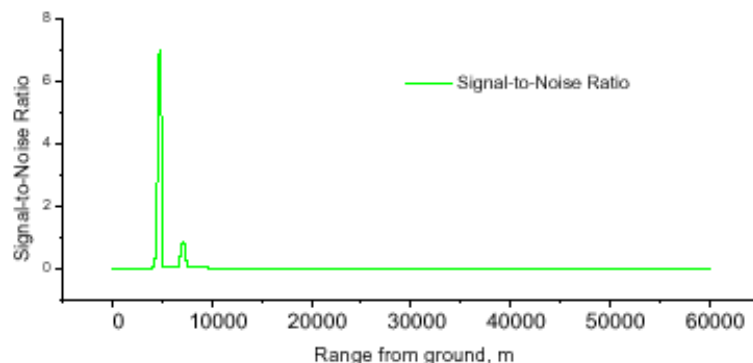
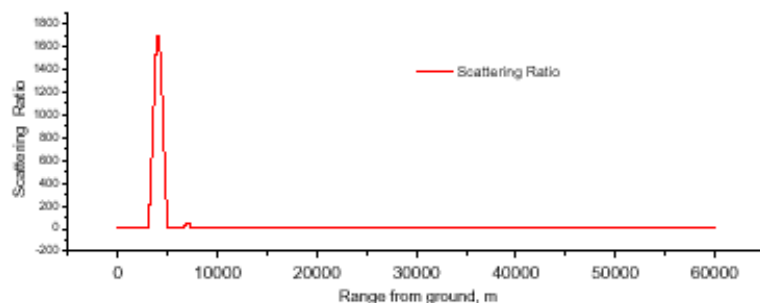
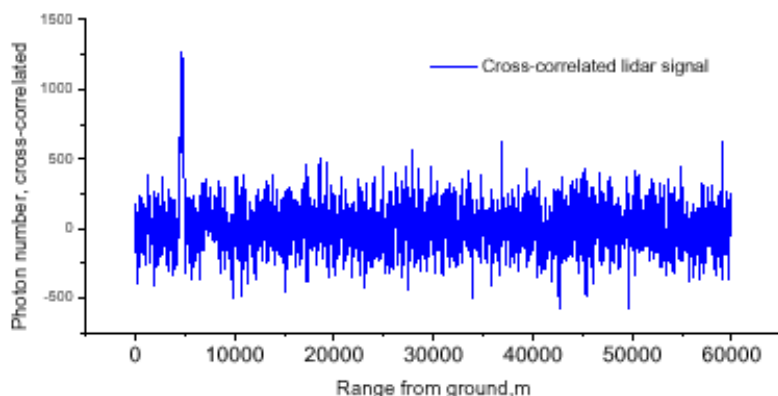
Input Parameters:

Satellite orbit altitude: 380km

Laser Power: 3.0W / Telescope Diam. : 600mm

Range Resolution: 30m / Integration time: 0.1s

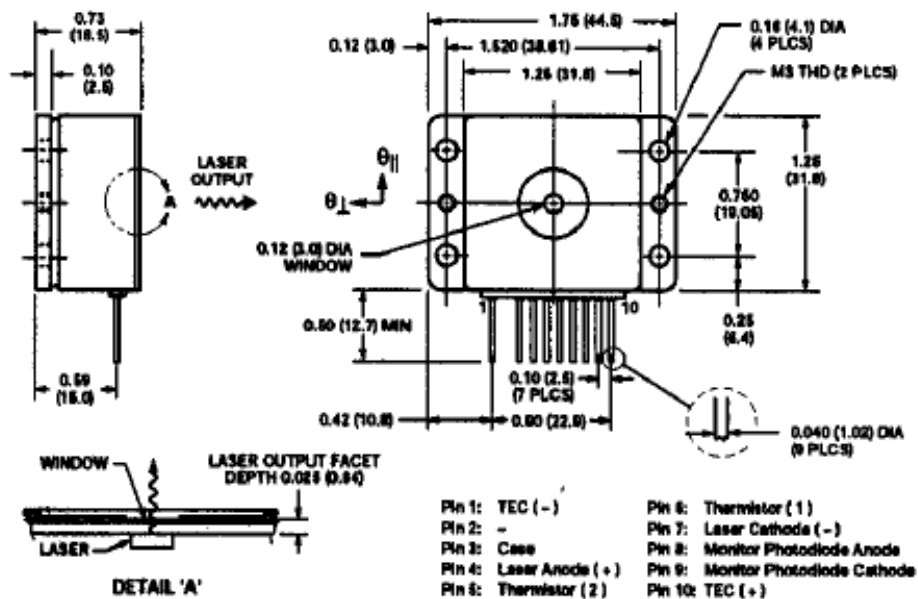
Cloud Scattering Ratio: 1700 / Cloud Top altitude: 5km





Pseudo-Random Noise modulation (PRN-cw) lidar for cloud detection in EUSO

P1 HIGH HEAT LOAD WINDOW PACKAGE



The configuration and dimensions of a high-brightness diode laser (SDL 2400 series, 3.0 W continuous wave output optical power). Such power is considered for the cloud detection in EUSO.

The Discussion:

WHAT SHALL BE THE TASK FOR THE EUSO LIDAR?

OPTION 1: lidar for EUSO only – night-time cloud detection

OR

OPTION 2: lidar for EUSO + cloud climatology – night and day-time cloud detection

OR

OPTION 3: a “full-scale” cloud, aerosol (and ozone?) lidar

OR

OPTION 4: anything else?

???

The Discussion:

WHAT THE LIDAR TEAMS NEED TO KNOW AS INPUTS FOR EUSO LIDAR DEFINITION?

THE CONTRIBUTION TO THE ERROR FROM THE FOLLOWING PHENOMENA, WITH RESPECT TO THE ALTITUDES WHERE THE EVENT TAKES PLACE:

- *Opaque cloud top*
- *Subvisible clouds (aerosol layers): top, base, optical density*
- *Trace gases absorption*

- *Anything else???*

Contract : No. 9099/90/NL/PB, Work Order 07,
CCN 01

***“Advanced Bread Board
of Pseudo Random Noise -
continuous wave total
backscatter lidar”
(ABB of PRN-cw lidar)***

Contractor: Observatoire Cantonal de
Neuchâtel (CH)

Subcontractor: Oerlicon Contraves Space
AG (CH)

ESTEC Technical Officer : Dr. Gerd Ulbrich, TOS-
MMO