

An update of « low cost » commercially  
Available lidar systems  
For  
Improved cloud detection

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Eye safety Requirement → Two solutions depending on wavelength operation

1) Visible wavelength operation (532/523 nm typ)

Micro Joule laser sources operating at high rep rate

→ **Microlidar**

High SNR : Low field of view required

2) UV-IR operation

Large energy lasers possible (mJ range)

UV preferred to have better sensitivity and allow for an

External reference using Rayleigh scattering (355 nm typ)

→ **Minilidar**

Eye safety : Large field of view required

# EXISTING LOW COST LIDAR ?

## Requirements

- High detection sensitivity :  $\text{SNR} \gg 1$  at 10 km for 60 m resolution and 30s
- Compact and transportable
- Eye safe
- Automated operation
- Cost ~100 k€(or less!)

# MICROPULSE LIDAR Update

→ new company : Sigma Space USA ([www.sigmaspace.com](http://www.sigmaspace.com))

## *Transmitter*

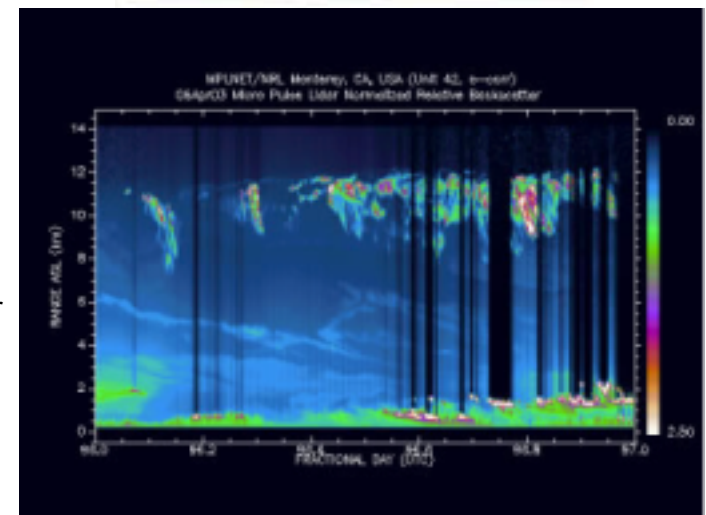
Laser Wavelength	523.5 nm Nd:YLF or 532 nm Nd:YAG
Pulse Repetition Frequency	2500 Hz
Pulse Energy	8 $\mu$ J
Eye Safety	ANSI Z136.1 2000 Compliant

## *Receiver*

Telescope Type	Maksutov Cassegrain
Focal Length	2400 mm
Diameter	178 mm
Field of view	100 $\mu$ rad

## *Detection*

Detector	Avalanche APD, photon counting mode
Range Resolution	15 m, 30 m, 75 m (programmable)
Maximum Range	60 km
Multichannel Scaler	Two-channel photon counting, A/D converters for temperature and energy monitors, USB interface to computer.



*Micro-Lidar system developed by Sigma (USA), and example of observations.*

## CIMEL : CAML development



Similar to Sigma system but

Plug and use

Fiber assembled system

Outside operation with  
telescope only (10 m fiber)

Limited range :

**New Laser source : 8  $\mu$ J 5 kHz**

**To be tested at CIMEL**

**(first prototype using 3  $\mu$ J)**

**Availability : summer 2005**

## Mini-Lidar : UV Lidar (355 nm)

→ Development at CEA/CNRS/LSCE  
(comparable performance to LMD/LIMAG minilidar but eyesafe)

→ Commercialized by LEOSPHERE (June 2005)

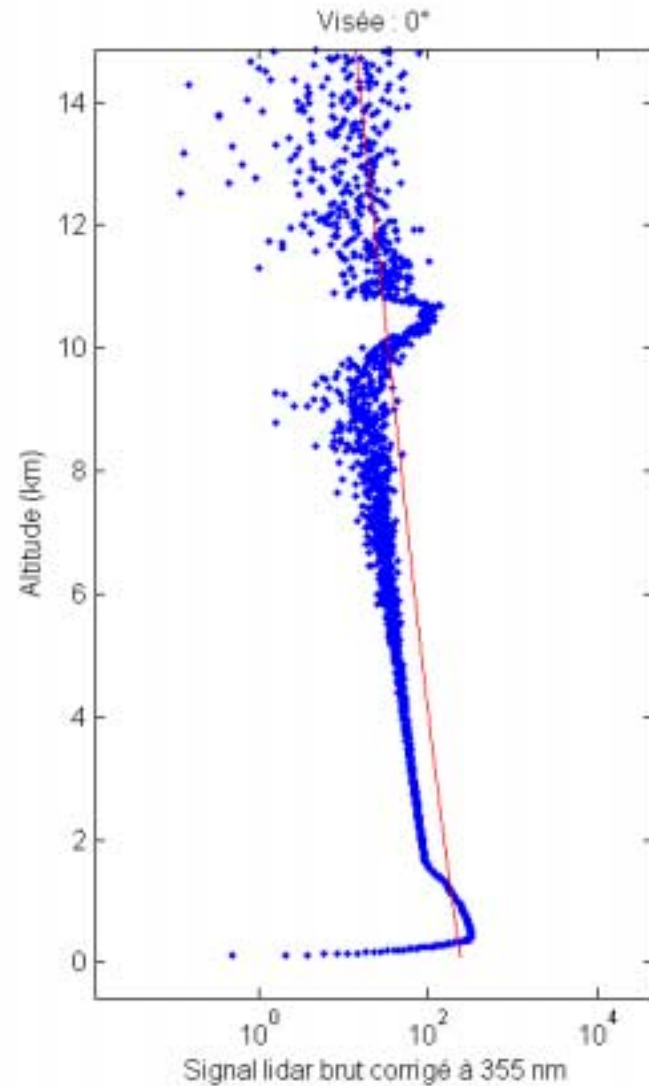
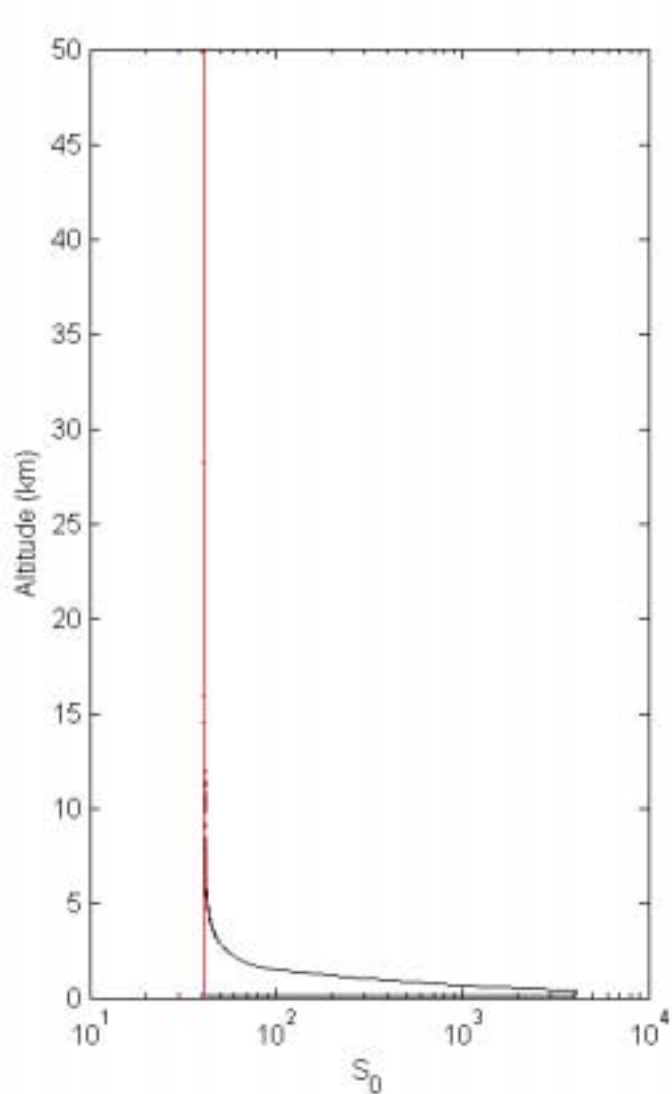
<http://www.leosphere.com>



Pictures : courtesy of Leosphere

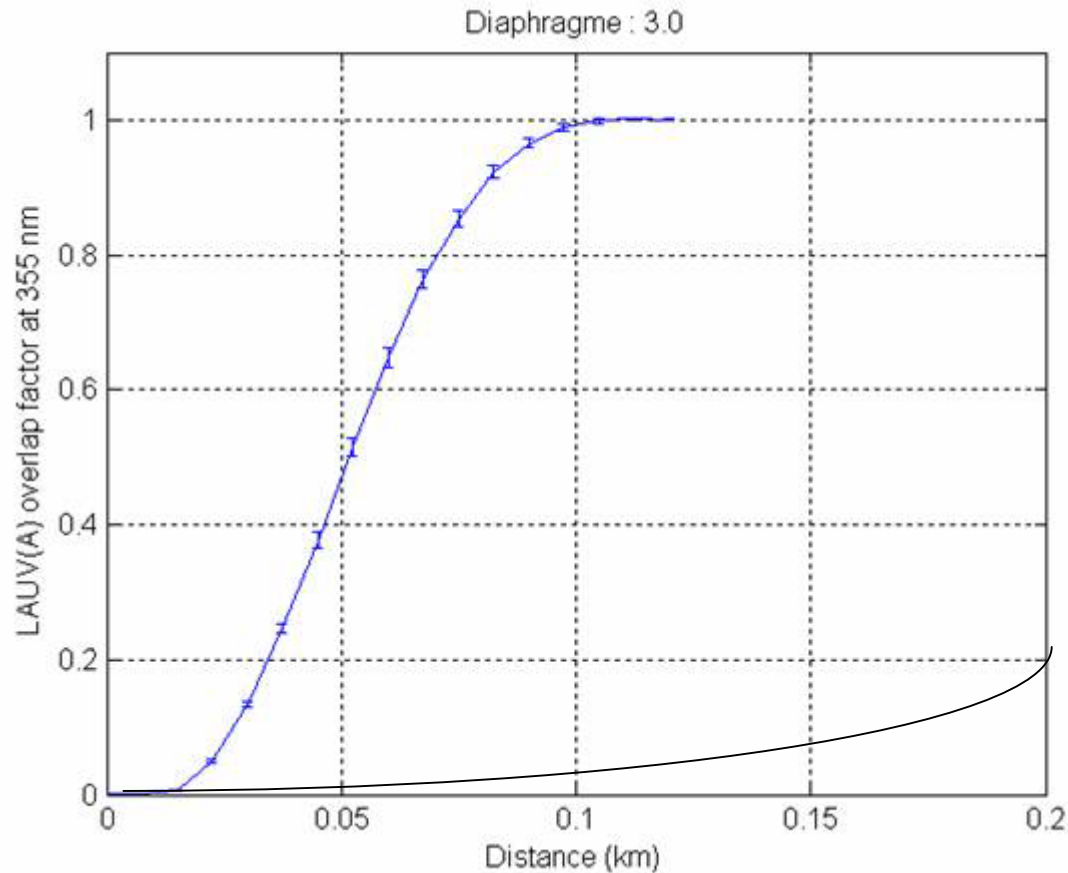
→ Low cost flashlamp replacement

# Example of results : Daytime 120 s acquisition time



Courtesy of P. Chazette, LSCE

Large field of view allows fast signal recovery; narrow one  
Reduces signal dynamics



Wide field

Narrow field  
(estimated)

New systems to come :

- micropulse systems : Degreane ?
- minilidar from Raymetrics (2005-2006)

Issues

- Alignment control
- Continuous operation (laser source lifetime ~1 year)
- operation cost and reliability

→ Positive evolution, solutions to come !