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BB of a Water Vapor DIAL Transmitter

Two Parallel Contracts, 600k€ each:

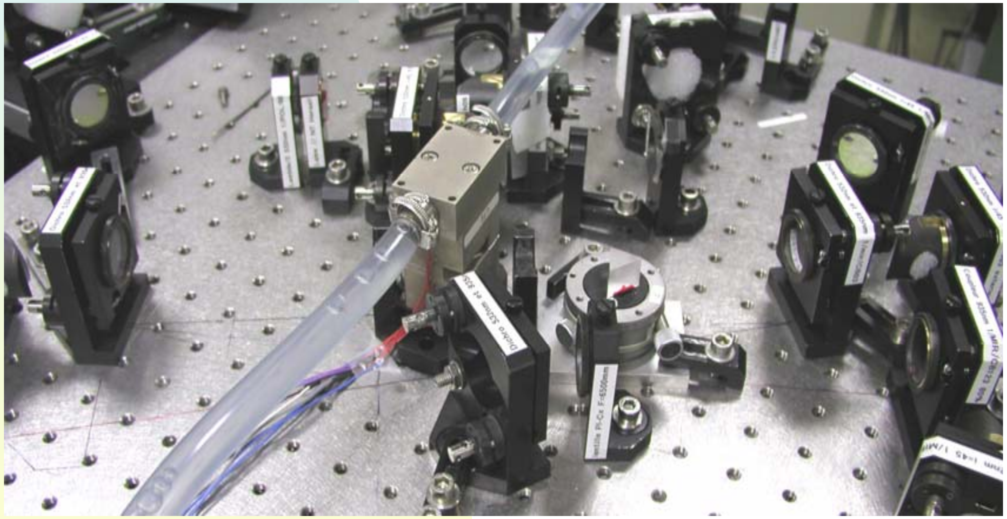
1. **Alcatel-F / Quantel / (Passat) / Poli Milano**
2. **GA / CESI / Poli Milano**

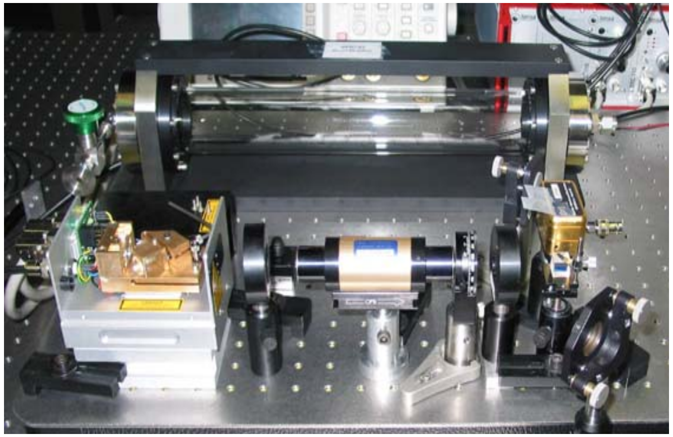
- ***Both Completed***
- ***Both chose Ti:Sapphire after trade-off (*), pumped by Doubled Nd:YAG & seeded by ECLD; frequency reference by water vapor cell***
- ***Both suffered Laser Damage on:***
  - *Mirrors*
  - *Crystals (Ti:Sapphire and Nd:YAG)*
- ***Neither have reached the full set of specifications (Energy!)***

(*) Promising innovative Passat solution with Raman source + OPA considered industrially too risky by the Prime at the time

Quantel Breadboard

Ti:Sapphire oscillator





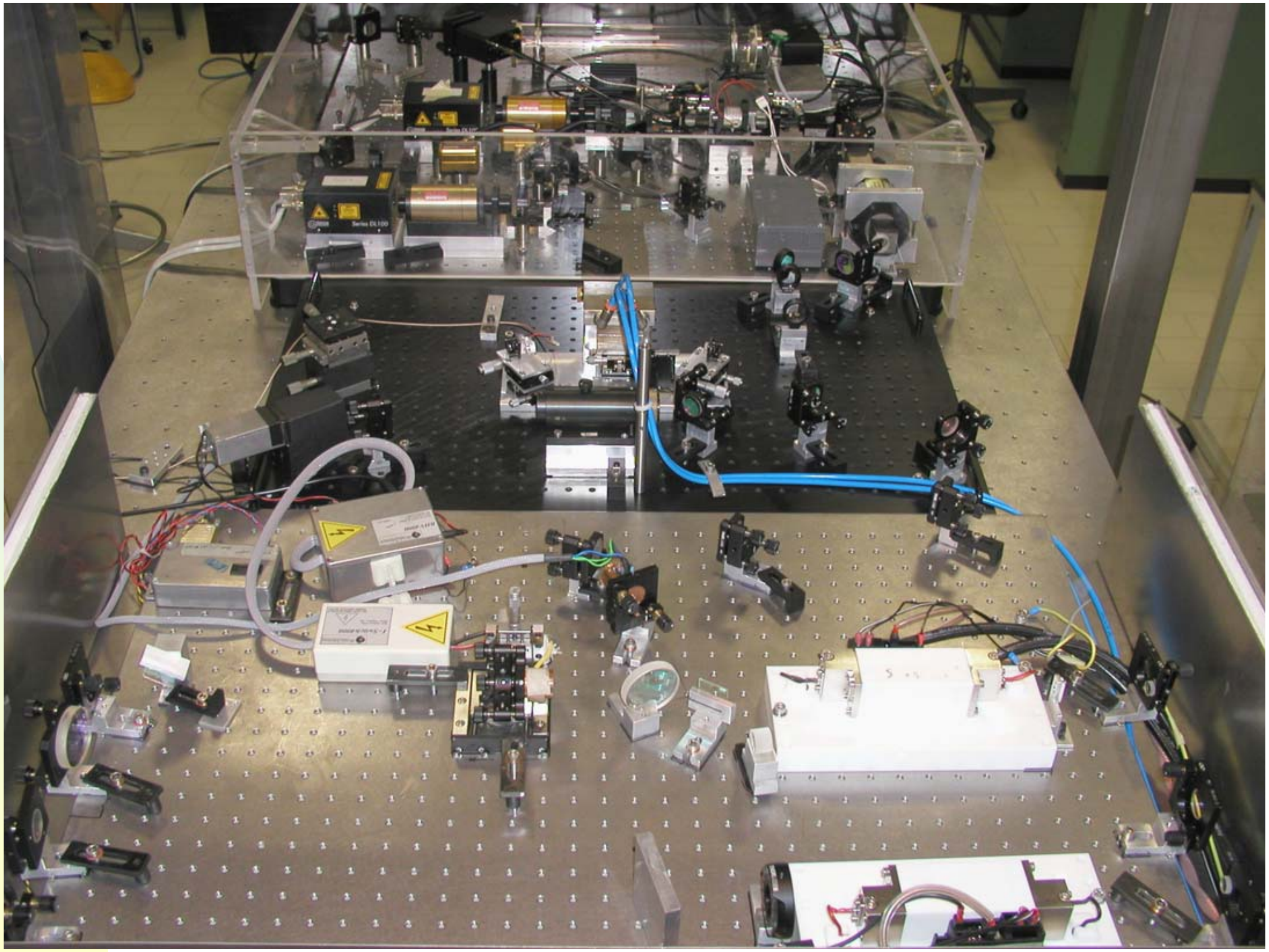
Fiber-coupled Seeder

CESI Breadboard

Seeder →

Ti:Sapphire Laser →

Pump →



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Water Vapor DIAL Transmitter: Results

Parameter	Value	Alcatel / Quantel	GA / CESI
Wavelengths (*vacuum* values)	A minimum of 2 emission λ's out of the first three of either group : I. 935.906, 935.561, 935.684, 935.85 nm II. 943.248, 942.442, 943.083, 940 nm	Group I: (935.561 nm) 935.906 nm	Group I: (935.561 nm) 935.684 nm
Inter-pulse separation within burst (between different λ's)	0 – 200 µsec max.	80 µsec	200 µsec
Energy per pulse	>100 mJ, goal 150 mJ	35 mJ (single-pass Amp)	25 mJ (240 mJ pump)
PRF	> 25 Hz	25 Hz	25 Hz
Energy short term stability	< ±4 %	5.5% (limited by pump stb.)	30% (limited by pump)
Polarization	> 99% Linear	99%	~99.3 %
Spatial beam quality	$M^2 < 2$	< 2	~1.3
Boresight stability	< ±15 µrad	± ~10 µrad	±25 / 40 µrad (pump: 240 µrad !)
Laser Pulse linewidth	< 160 MHz	140 MHz (single-pass Amp)	85 MHz
Spectral purity	99.9% energy within absorption line	99% - meas. Limit.	99.99% TBC
Wavelength accuracy and stability	< ±60 MHz	±33 MHz over 1 sec	±15 MHz over 1 min
Tunability range	±10 GHz	±10 GHz	±15 GHz
Wall-plug efficiency	2% goal	~1 % extrapolated	~1 % extrapolated

L3CCD for Lidar Applications – e2v Technologies

Advanced Demonstrator Activity: 800k€

Objectives

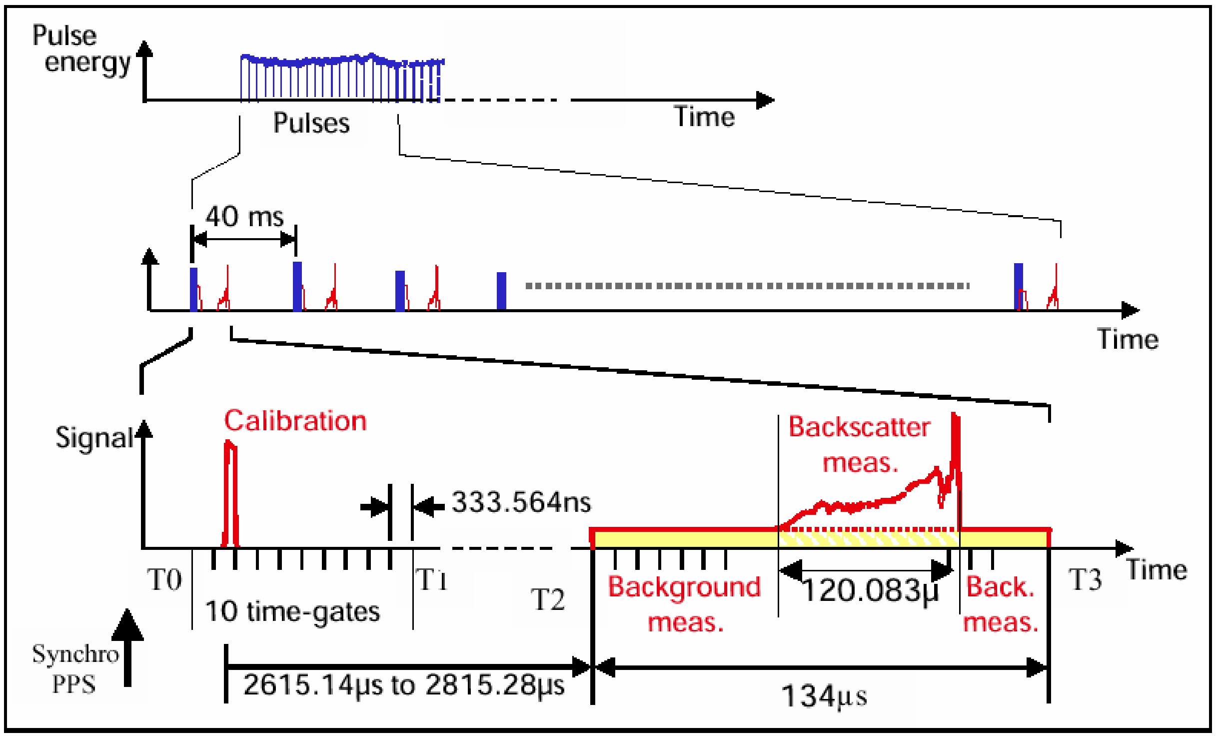
- Develop a representative L3CCD demonstrator of an optimized detector for Lidar applications with the goal to assess its full performance under Lidar-specific operation

- Reduce future risks for the development of this type of detector for future Lidar instrument

Status

- ***Direct Negotiations with e2v Technologies***
- ***Directly driven by EarthCARE***
- ***PDR held 24.10.05 – recommendations under discussion***
- ***Back-illuminated thinned optimized for 355nm; light shield outside sensitive area***

L3CCD – Functional Requirements



Typical Timing Sequence

L3CCD – Operational Requirements

Operating Temperature	As close as possible to 20°C but always within [-50°C to +35°C]	T
Optical spot diameter	20µm	T
Wavelength	355nm	T
Spectral width	Narrowband with δλ typically < 5nm	
Useful signal	1-4000 photons/µs	T
Ground echo (single pulse)	10^4 photons/15ns	T
Quasi-specular reflection (single pulse)	10^5 photons/15ns (TBC)	A/T
High signal at laser emission	TBD	T
Pulse repetition frequency	50-100 Hz typically	T
Number of samples to be acquired	400	T
Time gate	666ns	T
Total Acquisition Repetitiion Period	<7ms	T

L3CCD – Performance Requirements

Quantum efficiency (QE)	>70% at 355nm	T
PRNU (r.m.s. value)	<2% (TBC)	T
Total dark signal (for one read-out time sample of 666ns)	<0.3 electrons	T,
DSNU (rms value)	< 5%	T,
Read-out noise (for one read-out)	< 0.5 e-/pixel	T,
Excess noise factor	$< \sqrt{2}$	T,
Gain value	TBD by the contractor	T,
Gain stability	<1% over 15s	T,
Gain knowledge	<3% over 1hour	T
(Non-)Linearity	< 1% over the useful signal dynamic range	T
Image Charge Handling Capacity	to be sized to accommodate the full dynamic range	T
Memory Charge Handling Capacity	to be sized to accommodate the full dynamic range	T
Serial Register Charge Handling Capacity	to be sized to accommodate the dynamic range	T
Output stage Charge Handling Capacity	> TBD	T
Total allowed fractional charge loss prior to the amplification stage	$< 10^{-3}$ (TBC)	T,
Correlation between consecutive temporal samples	<± 13% (TBC)	T