# PDV workshop

## Albuquerque (New-Mexico)
## 22-23 october 2012

## IDIL Activities and new PDV system

**David Assous**
**Sales project manager**

IDIL FIBRES OPTIQUES | *System & components for science & industry*

## SUMMARY





Rue Claude Chappe - 22300 Lannion - France - +33(0)2 96 05 40 20 - info@idil.fr www.idil.fr

# 1- Company presentation

- Company founded in 1995
- Team of 23 people
  - 8 engineers
  - 6 technicians
  - 3 sales engineers
- Based in Lannion into 650m² of R&D laboratories
- 2 commercial offices near Paris and Geneva.
- Member of PHOTONICS BRETAGNE




Rue Claude Chappe - 22300 Lannion - France - +33(0)2 96 05 40 20 - info@idil.fr www.idil.fr

# 2- Business field

# 2- Business field

FIBRES OPTICS & COMPONENTS

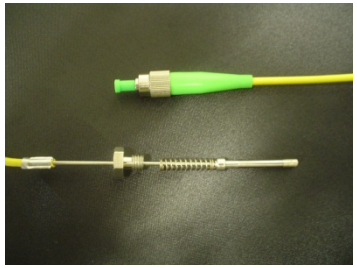
IDIL

- Optical connectors and patchords assembly

# 2- Business field

FIBRES OPTICS & COMPONENTS

IDIL



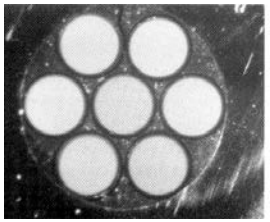
- Optical connectors and patchords assembly

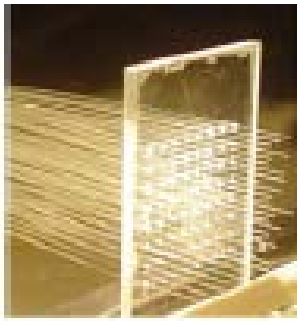
- Optical fiber sensor conception
  - Strain
  - Deformation
  - Temperature
  - Pressure
  - Chimical
  - Based on fiber  Bragg grating or Brillouin

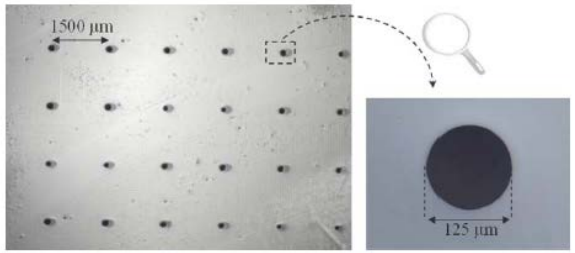
IDIL FIBRES OPTIQUES | *System & components for science & industry*

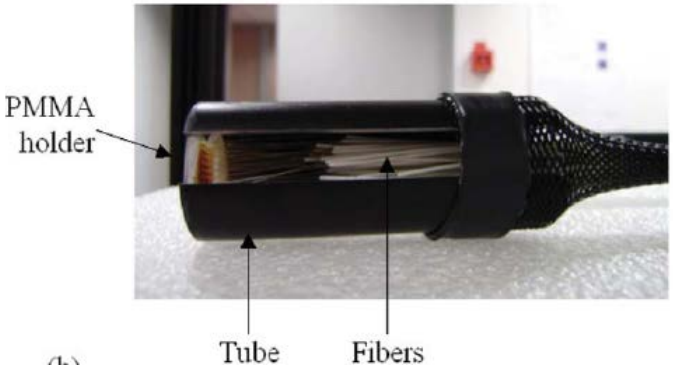
# 2- Business field

- Optical connectors and patchords assembly
- Optical fiber sensor conception
- Customized fiber optic component realization
  - Fibered Variable attenuator
  - Collimator, Focuser
  - Fiber extremity polishing
  - Fiber matrix
  - Bundle
  - Fiber spool







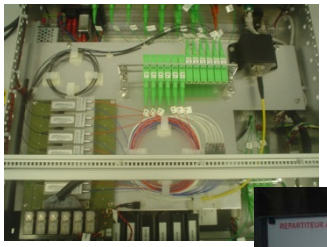

IDIL FIBRES OPTIQUES | *System & components for science & industry*

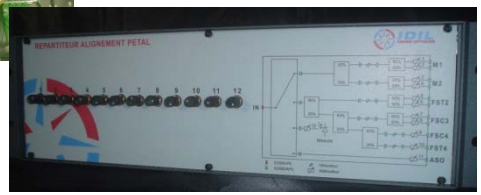
# 2- Business field

FIBRES OPTICS & COMPONENTS

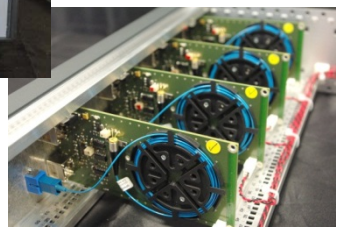
IDIL

- Optical connectors and patchords assembly
- Optical fiber sensor conception
- Customized fiber optic component realization
- Customized optical integration






Laser management for PETAL alignement

Electrical-optical synchronisation converter

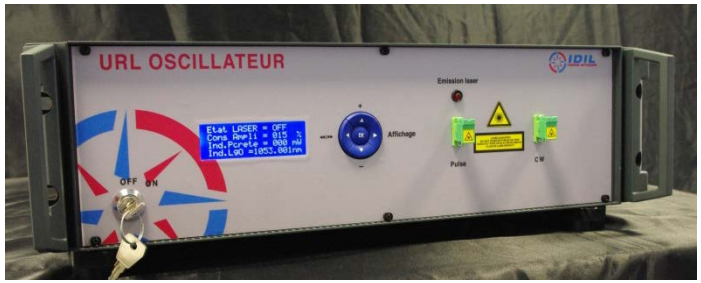
IDIL FIBRES OPTIQUES | *System & components for science & industry*

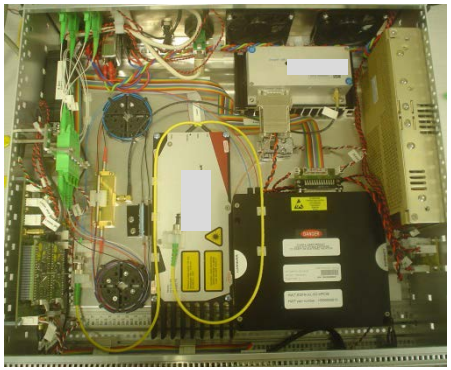
# 2- Business field

LASERS & AMPLIFIERS

IDIL

- Conception and fabrication :
  - Fiber lasers
  - Fibers amplifiers
  - ASE optical source
  - Customized laser (fs, ps, ns)





Rue Claude Chappe - 22300 Lannion - France - +33(0)2 96 05 40 20 - info@idil.fr www.idil.fr

# 2- Business field

SPECTROSCOPY & SYSTEMS

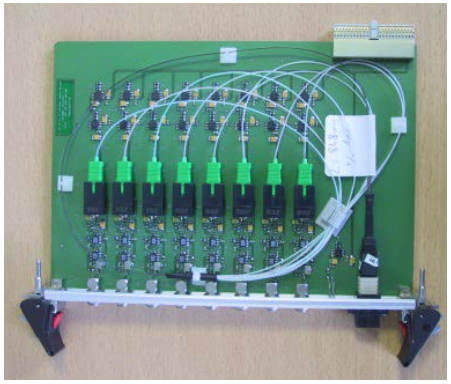
IDIL

- Instrumentation :

- High speed instrumentation
- Photonic Doppler velocimetry system
- Customized measurement system

CUSTOM & NEW PRODUCTS

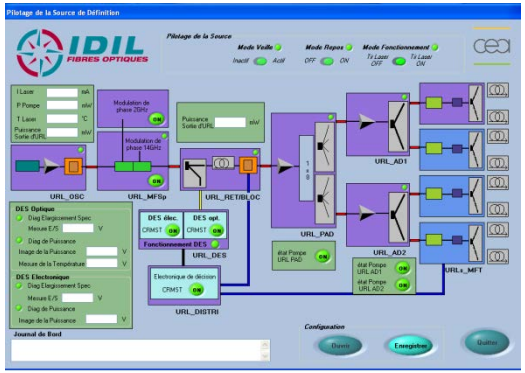
IDIL



IDIL FIBRES OPTIQUES | System & components for science & industry

# 2- Business field


- Design of electronic board for optoelectronic applications :
  - Current and temperature driver
  - Optoelectronic converter
  - High speed detection
  - Embedded software, micro - controller
  - …
- GUI conception for optoelectronic applications



# 4- IDIL CEA PDV collaboration

- 2009 : Beginning of the collaboration with the CEA to develop an industrial PDV system
- System integrated into a 29U cabinet
- 4 measurement channels system
- 12 systems installed into the differents CEA laboratories.
- PDV system commercialize under CEA license
- Development of a treatment software based on Fourier transform algorithm by the CEA team
- Price for a 4 channels PDV cabinet ~ 160 K€

cea
energie atomique • energies alternative

IDIL FIBRES OPTIQUES | System & components for science & industry

# 5- IDIL New PDV system


- Low size. Only 5U height
- Modular (1 to 4 channels)
- Attractive initial cost (75K€)
- Extra channel (~22K€)
- Unique Ethernet interface
- Enhance specifications
  - Sensitivity 1900V/W
  - Linewidth < 15KHz



Rue Claude Chappe - 22300 Lannion - France - +33(0)2 96 05 40 20 - info@idil.fr www.idil.fr

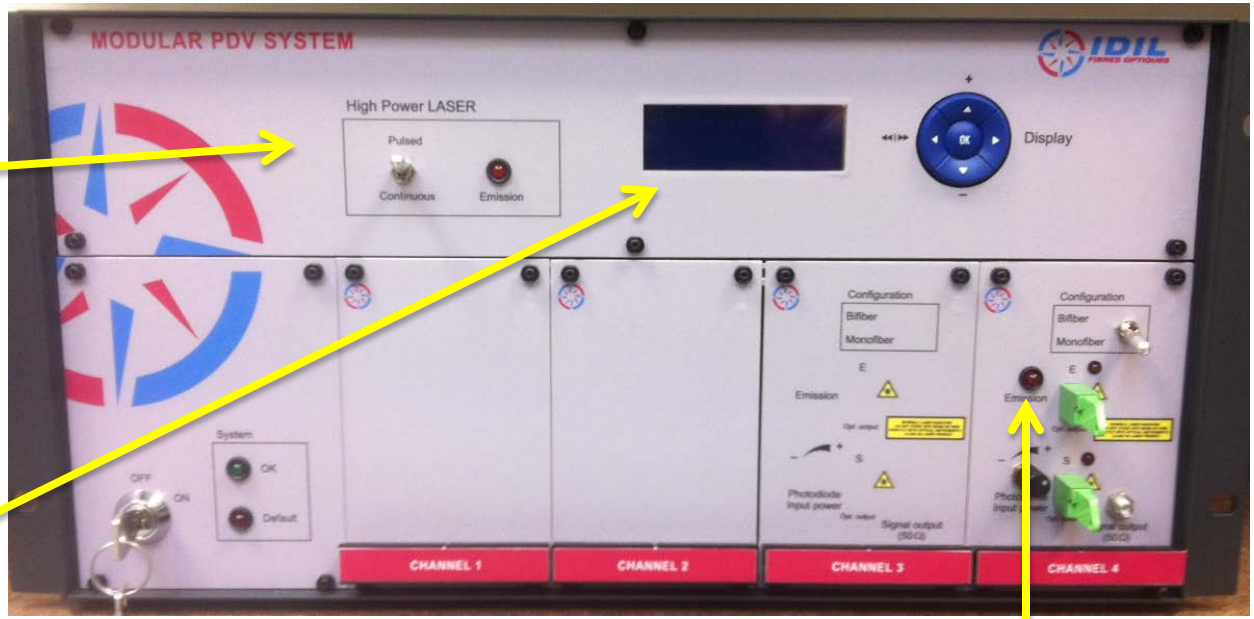
# 5- IDIL New PDV system

✓ Specifications :

- Speed measurement : 0 to 20 km/s
- Speed uncertainty : $\Delta t \, \Delta v = 150 ns.m/s$
- Time uncertainty : 200 ps on the raw signal
  5 ns on velocity after processing
- Minimum reflectance required –60dB
- High sensitivity (>50dB)
- Up to 4 measurement channels
- Ethernet interface
- Continuous or triggered mode
- Low heat deposition on sample
- Eye safety (1.55 µm), all fibered design

# 5- IDIL New PDV system

High power laser de (4W) split in 4 channels




Complete control of the main laser and the different channel by one screen

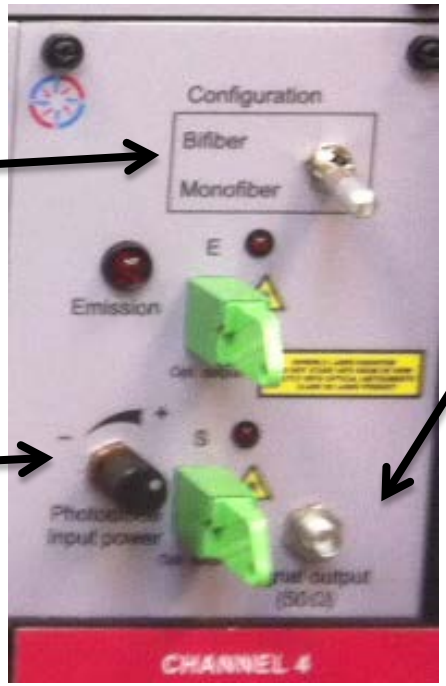
Channel with one laser diode (reference) and all the optical component for detection (circulator, photodiode…)

IDIL FIBRES OPTIQUES | System & components for science & industry

# 5- IDIL New PDV system

Single fiber or mono fiber configuration

Power adjustment of the reflected signal from the target

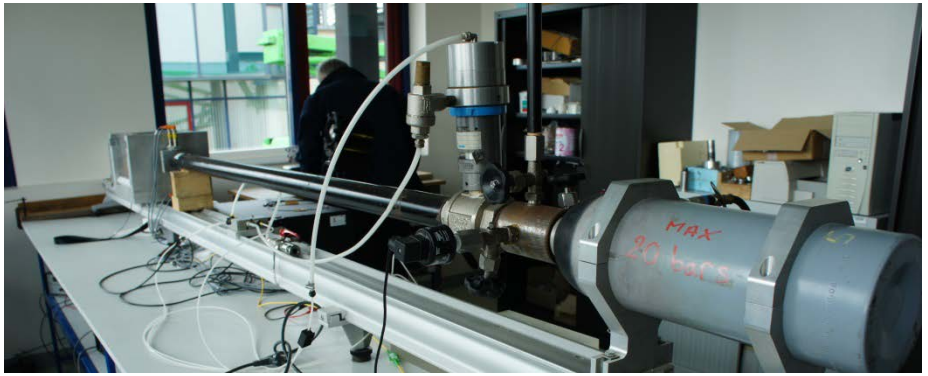



Photodiode output

**Interest of this modular system : frequency multiplexing (4 channels at 4 differents fixed wavelength)**

# 6- Some experiments – Part I

## PDV measurement on composite target under gun shock



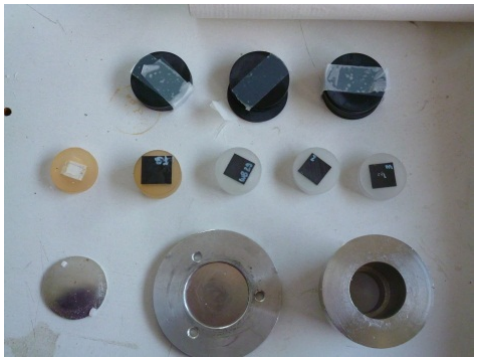

David Assous[1], Romain Ecault[2], Michel Boustie[2] , Nacim Laimeche[2], Pierre-Antoire Frugier[3], Patrick Mercier[3], Laurent Berthe[4], Michel Arrigoni[5]

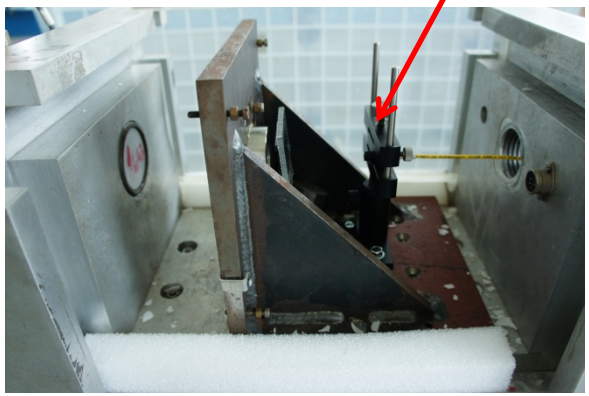
[1]IDIL, Institut PPIME[2], CEA[3], PIMM Arts et Métiers ParisTech[4], ENSTA Bretagne[5]

INSTITUT P' | cnrs | Université de Poitiers | ENSMA | ENSTA Bretagne | DE LA RECHERCHE À L'INDUSTRIE cea | ARTS ET MÉTIERS ParisTech

IDIL FIBRES OPTIQUES | System & components for science & industry

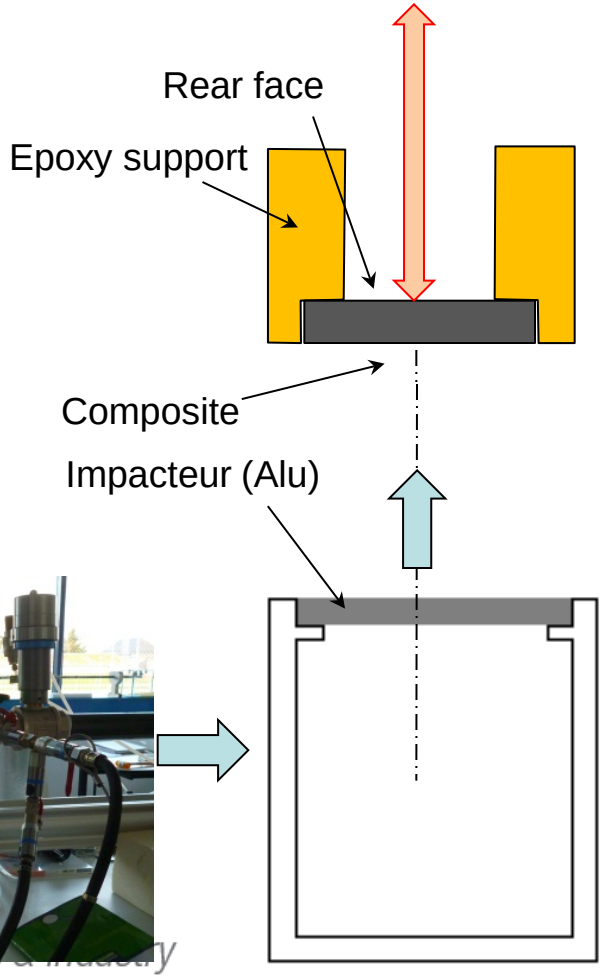
# 6- Some experiments – Part I





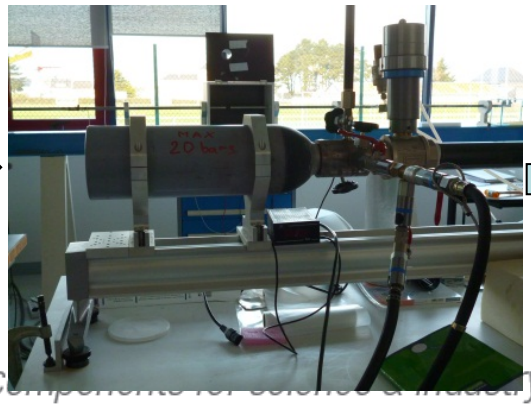
PDV probe

PDV measurement




➢ Séquence de tir

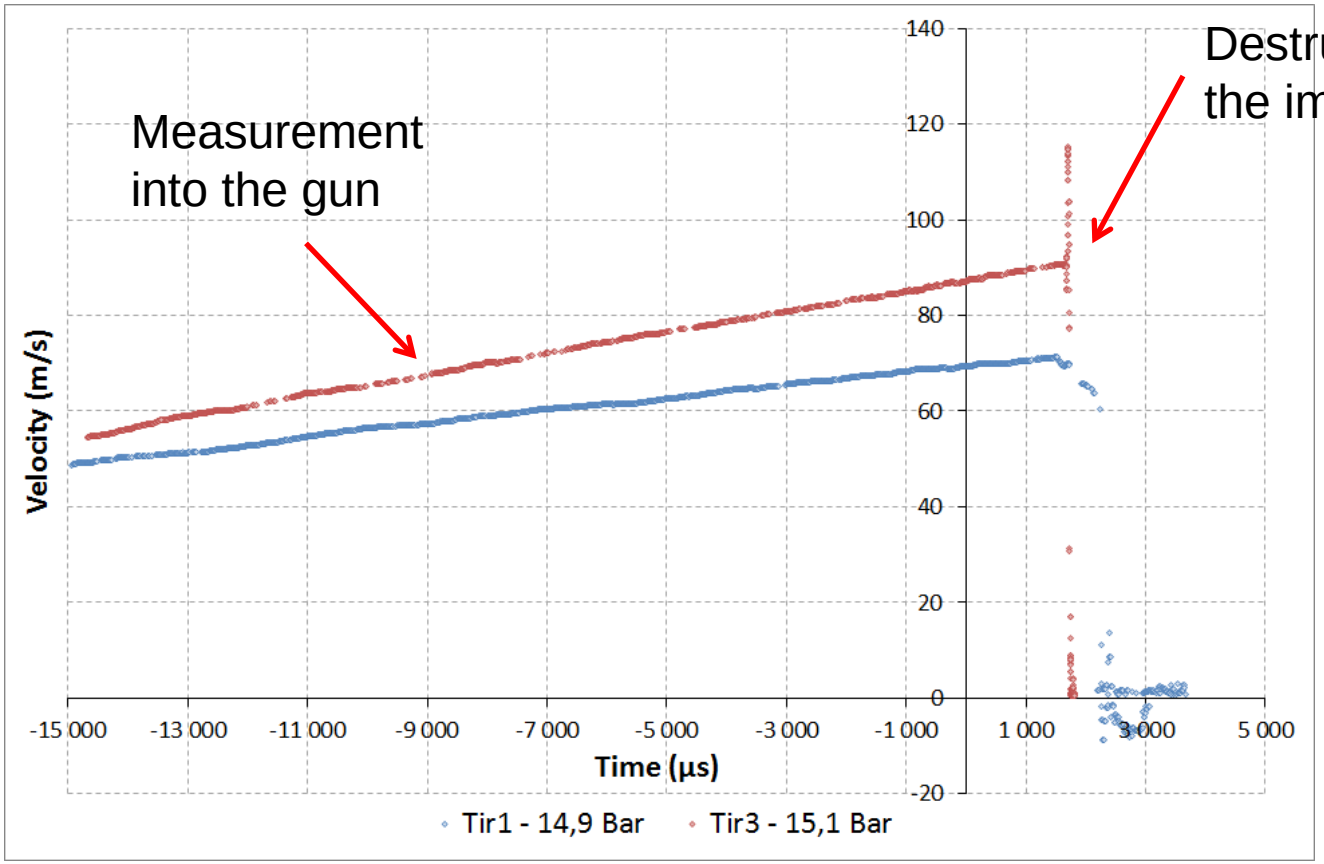
Pression measurement

IDIL FIBRES OPTIQUES | System & components for science & industry

# 6- Some experiments – Part I

✓ **First step : Calibration of the gun (velocity measurement of the impactor)**

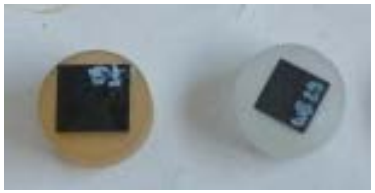


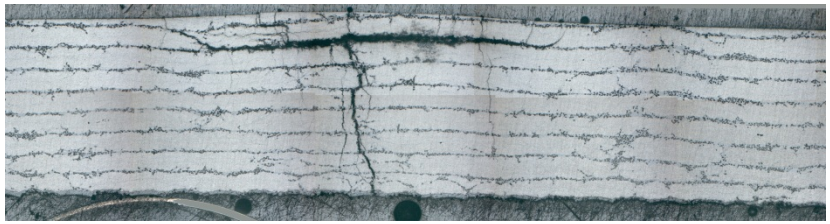
# 6- Some experiments – Part I

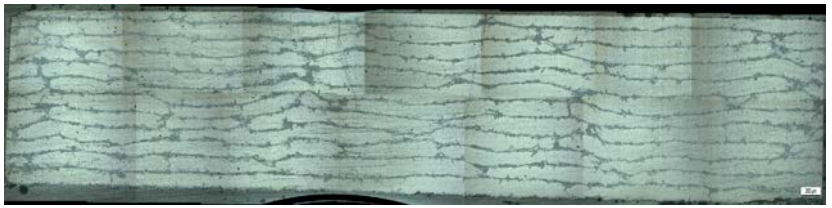
# 6- Some experiments – Part I

## ✓ 2nd step : Measurement on composite material for aeronautic

- Size of sample 10*10 mm
- Thickness : 3mm
- PDV measurement on the rear side



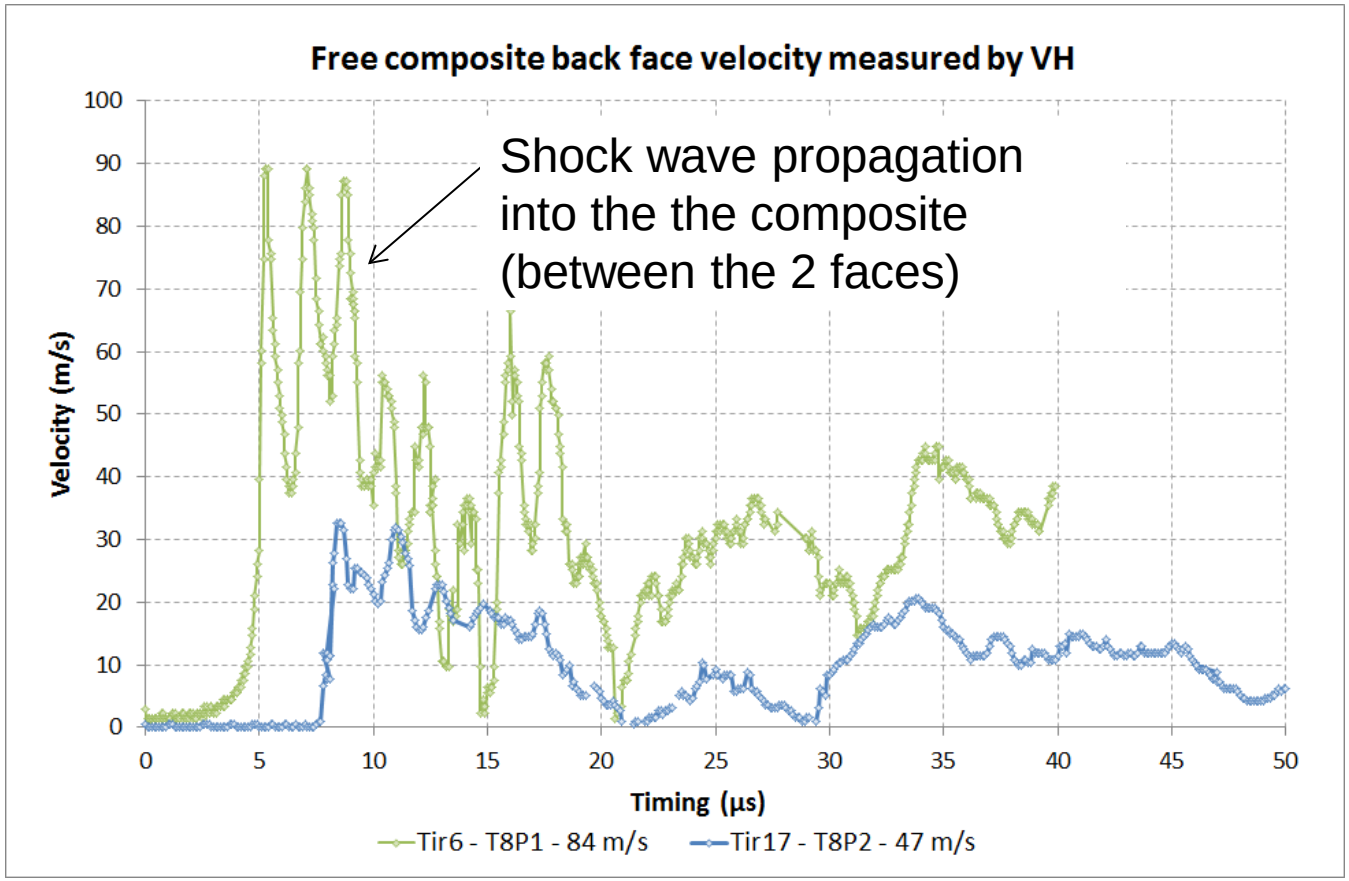




*Section of laminated composite*
*Damaged and non-damaged*

## → Goal : Determination of the damage level by velocity measurement

# 6- Some experiments – Part I

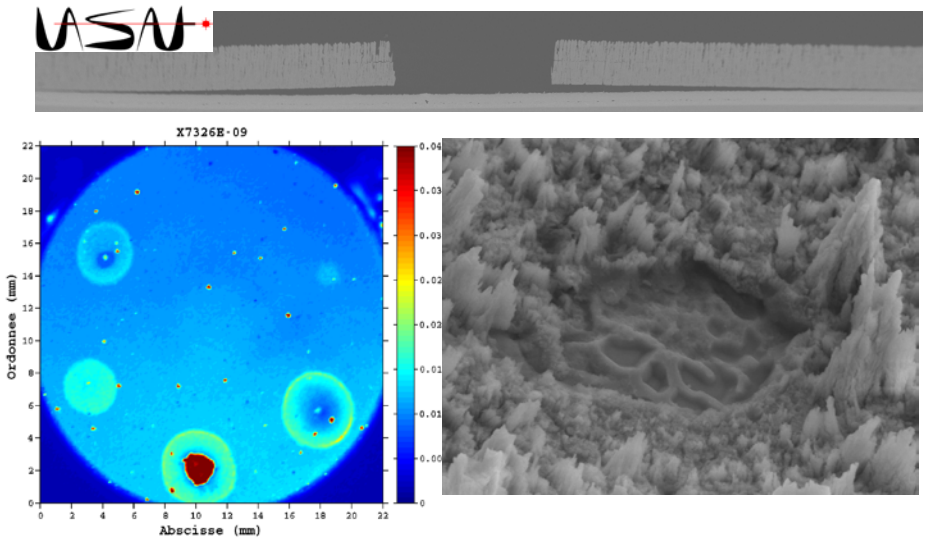


6- Some experiments – Part II

# Laser Shock Adhesion Test (LASAT)

*V.Guipont*[1] *G. Begue*[1]
*D. Assous*[2]

MINES-PARISTECH[1] - IDIL[2]



# 6- Some experiments – Part II

## LASAT tester @ Materials Center of Mines-ParisTech

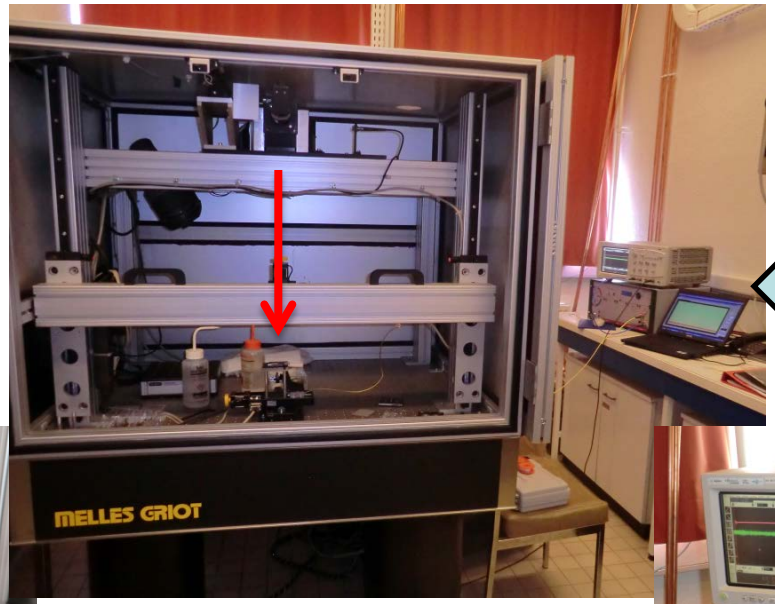
®LASAT

- Saga –Thales Laser :
  - maximum energy: 2J
  - pulse duration: 5.2 ns
  - wavelength: 532 nm
- Two settings parameters are:
  - Irradiated area diameter, m
  - Laser energy, J

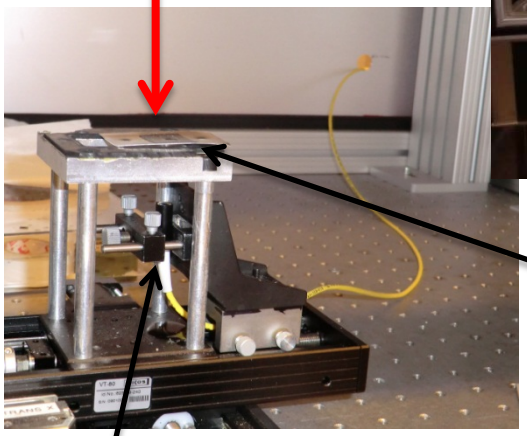
  →laser fluency (power density), W/m²
- Fixed data for each system:
  - Sample thickness
  - Layer thickness

# 6- Some experiments – Part II

Laser beam



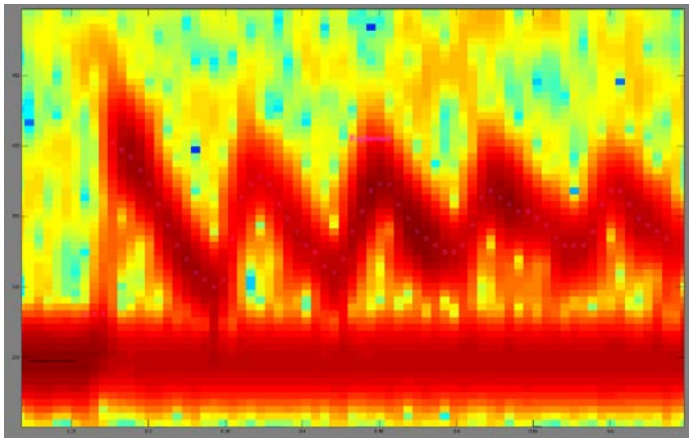

PDV system



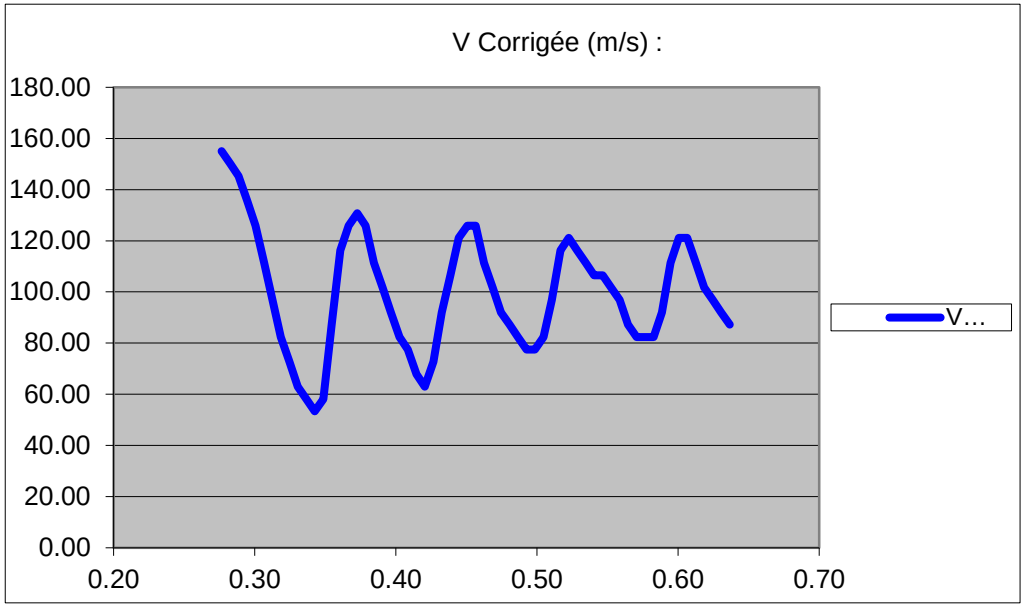
Material under test

PDV Probe

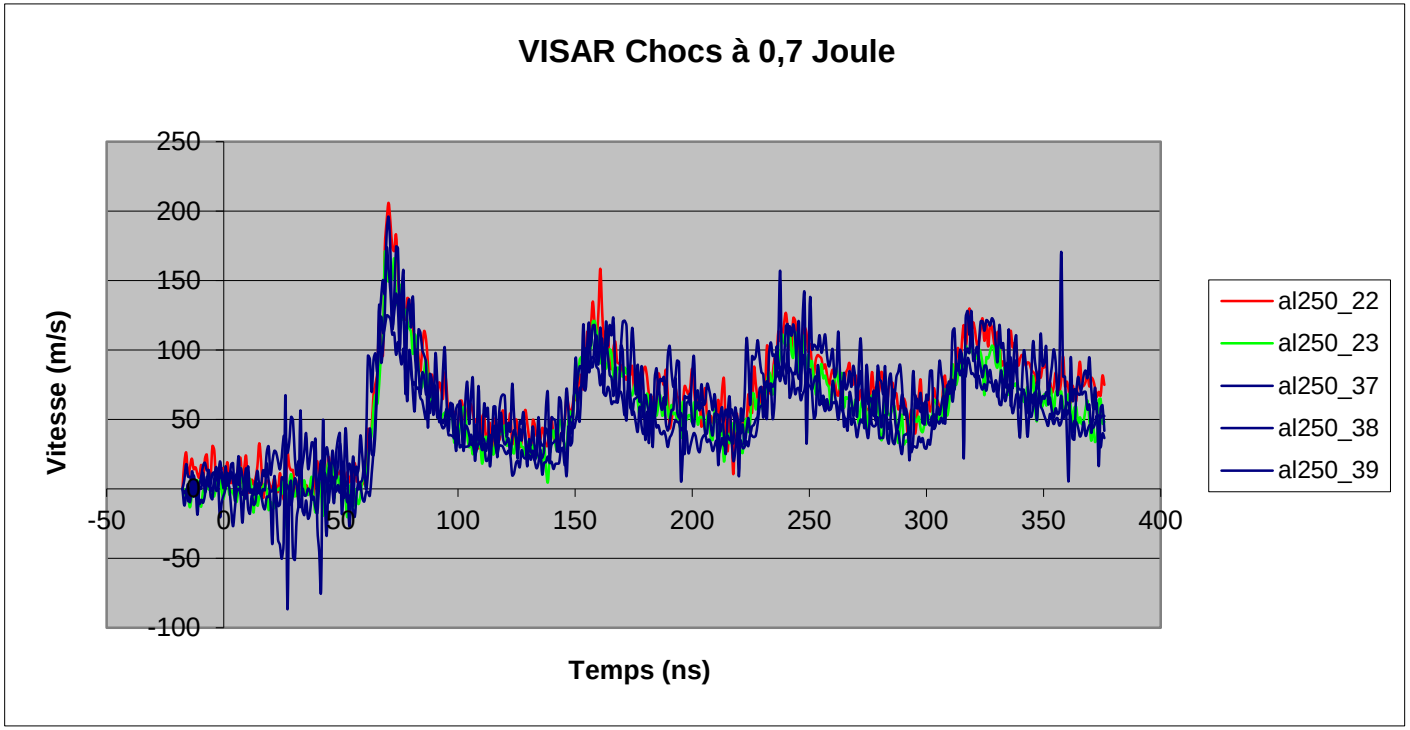
# 6- Some experiments – Part II



Alu 250µm
Shock @ 0,7 Joule

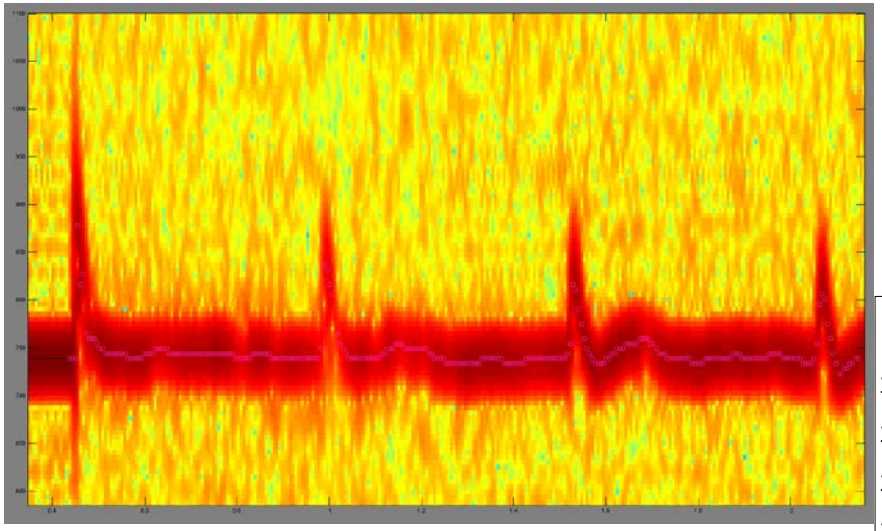


# 6- Some experiments – Part II

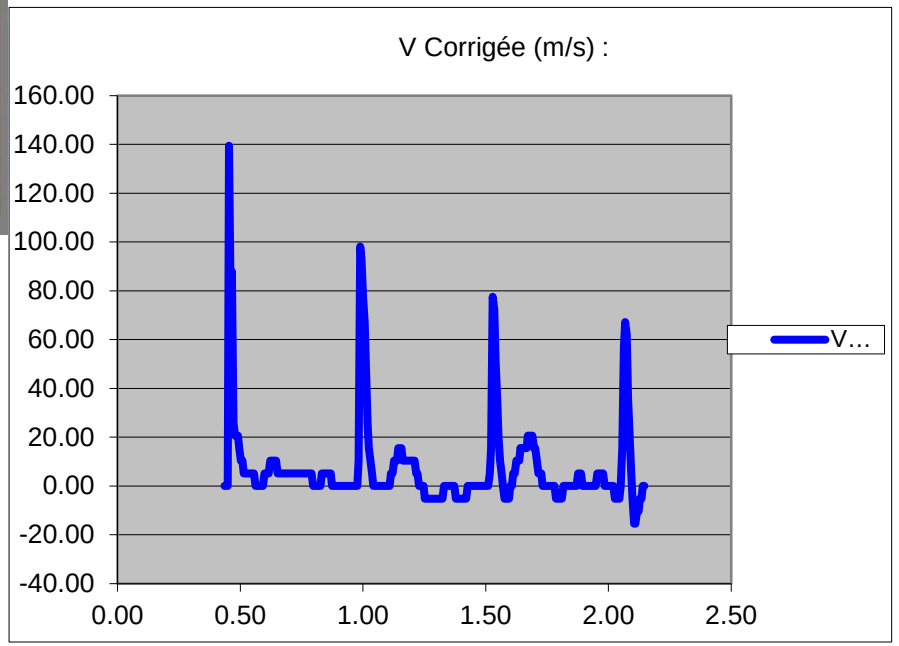



Alu 250µm

# 6- Some experiments – Part II



Nickel 1,5mm
Shock @ 1 Joule



# Thank you for your attention

Contact :

David Assous
Sales project manager

david.assous@idil.fr
www.idil.fr

Tel : +33 2 96 05 40 20

IDIL FIBRES OPTIQUES | System & components for science & industry