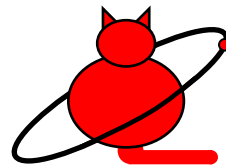




# Application of Selfmixing Laser Vibrometer Technology to Vibrocardiography

Dr. Karl Eugen Meitz

RedCat Devices - Milano



*RedCat Devices*

<http://www.redcatdevices.it> – [k.meitz@redcatdevices.it](mailto:k.meitz@redcatdevices.it)



## The Company: Areas of Activity

- ❑ **RedCat Devices was established in 2006 in Milano (Italy) by:**
  - Cristiano Calligaro PhD in Electronic Engineering, University of Pavia, Italy
  - Karl Eugen Meitz PhD in Mechanical Engineering, TU-Graz, Austria
  
- ❑ **Radiation Hard Electronics, Semiconductor Memories for Aerospace and Critical Environmental Conditions**
  - Research & Development
  - Expertise in OTP, NROM, SRAM and Flash Memories
  - Radiation Hardness by Design and Layout
  
- ❑ **Innovative Laser Systems for the measurement of Physical Properties**
  - Miniaturized Self Mixing Laser Vibrometers
  - GLIST Gas Laser Identification using Selfmixing Technology
    - Transfer of Expertise in Laser Technology, Optoelectronics and Precision Engineering to Practical Solutions for Measuring Problems
    - Joint Development and Distribution



## The Company: Know How and R&D Programs

### Know How

- ❑ RedCat Devices incorporates extensive Know How in Electronic Engineering, Computer Sciences and Mechanical Engineering.
- ❑ RedCat Devices enjoys a strong technological backup from partnerships with universities, research organisations and companies.

### R&D Programs:

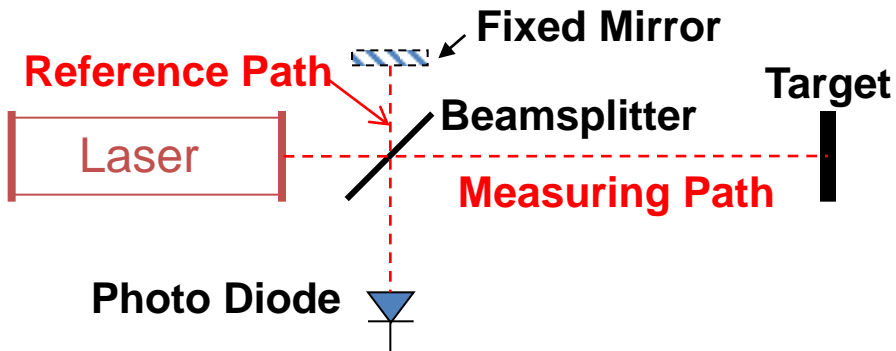
- ❑ Joint Development Program with University of Milano, Department of Physics
- ❑ Italy & Israel Cooperation Program
  - Project “RAMSES” on Radiation Hard Volatile Memories with: Tower Semiconductor Ltd. (IL) - University of Milano (IT) - Calabria University (IT) - University of Padova (IT)
  - Project “RIFLASH” on Radiation Hard Non Volatile Memories with: Tower Semiconductor Ltd. (IL) - University of Milano (IT) - Calabria University (IT) – CNR Catania (IT)
- ❑ GLIST Gas Laser Identification using Selfmixing Technology
  - University of Milano, Department of Physics



# Self Mixing Laser Interferometry

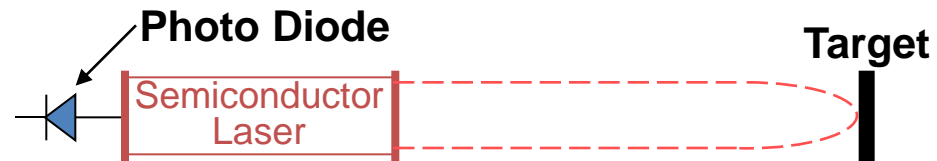
## Conventional Interferometry

- ❑ Conventional techniques are based on external interferometers
- ❑ Interferometer: passive optical system, light generated by a source (coherent or incoherent) is read by a photo diode



## Self-Mixing Interferometry

- ❑ The laser source is part of the interferometer
- ❑ Reference path and beam-splitter removed
- ❑ Light „samples“ the target and is reflected back into the laser cavity



### ADVANTAGES

- Reduced part-count → simpler set-up
- Ultra-compact optical head
- Easy alignment
- High sensitivity on rough surfaces

### MEASUREMENT APPLICATIONS

- Displacement
- Vibration
- Velocity
- Distance



## Self Mixing Laser Interferometry

### Works on all Diffusive Surfaces

Transparent Materials:  
Plexiglass

Human Tissues

Wood, Rubber...



Paper

Metals, hot and cold

Fabrics



## Vibrocardiography

### ❑ Project Idea:

- Application of Laser Vibrometry to Cardiography = **Vibrocardiography**

### ❑ Project Description:

- Development and testing of Selfmixing Laser Vibrometer technology applied to measurement of cardiovascular activities (frequency and amplitude) and / or respiratory activity

### ❑ Advantages:

- Measurement of heartbeat with high resolution and accuracy
- Monitoring and comparison of amplitude and frequency of cardiovascular activity as a diagnostic indicator
- No restriction of patient's space thanks to miniaturized laser technology
- Contactless and non invasive method
- New approach for patients in critical conditions (burns etc.)
- Measurement in cervical/jugular area
- Checking of respiratory activity also possible



## Vibrocardiography

### ❑ Possible Cooperation:

- Joint Development and Testing of Vibrocardiography

### ❑ Possible Partners:

- Universities & Research Centers
- Hospitals & Medical Doctors
- Others



## Other potential cooperation areas

### Radiation Hard Electronics:

- Application of Radiation Hardening Technology to improve robustness of electronic sensors and instruments**
  - Radiology
  - Nuclear medicine
  - ...

### Innovative Laser Systems:

- Application of GLIST Gas Laser Identification using Selfmixing Technology**
  - Environmental Conditions Monitoring
  - ...