SPHERE ULTRAFAST PHOTONICS

- **Address**: Rua do Campo Alegre, 1021, 4169-007, Faculdade de Ciências da Universidade do Porto, Portugal

- **Sphere Head Team**

Rosa Romero (Chief Executive Officer, CEO)
rromero@sphere-photonics.com

Helder Crespo (Chief Technology Officer, CTO)
hcrespo@sphere-photonics.com

- **Links**

https://www.sphere-photonics.com/
https://quatto.eu/

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Sphere Ultrafast Photonics was founded in Porto in September 2013 as a spin-off from the University of Porto (Portugal) and Lund University (Sweden).

Sphere offers a new generation of products and services in the ultrafast pulsed laser regime. It is committed to finding the best solution for measuring various laser systems, providing custom solutions covering different wavelength ranges, pulse durations and repetition rates.

The flagship product is d-scan, an inline, compact and high-performance device for the simultaneous measurement and compression of ultrashort laser pulses.

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ROSA ROMERO (CEO)

Rosa Romero received her Degree (1998) and Master (2001) in Physics from the University of Santiago de Compostela (Spain). During her PhD (2001-2005), at the University of Porto, she developed new optical fiber sensors and nano-devices for telecommunications.

She worked in industry for 7 years designing and developing nanosecond high power pulsed fiber lasers. In 2013, she co-founded Sphere Ultrafast Photonics and received a Master in Business Administration from the Porto Business School.

Currently, she is focused on the development of new solutions for the ultrafast laser market, and promoting the technology developed by Sphere at ultrafast photonics congresses

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HELDER CRESPO (CTO)

Helder Crespo received his Degree and PhD (2006) in Physics from IST (Instituto Superior Técnico, Lisbon). During his thesis he pioneered a technique for generating multicolour ultrafast pulses at LOA (Laboratoire d'Optique Appliquée, Palaiseau, France) and built the first few-cycle femtosecond laser in Portugal.

During his post-doc at MIT (Massachusetts Institute of Technology, USA), he designed and built CEP-stable sub-two-cycle lasers. He co-founded the Ultrashort Pulse Laboratory of the University of Porto and Sphere Ultrafast Photonics.

Currently, he also works at the Central Laser Facility (Didcot, England) as a Senior Ultrafast Laser Scientist.

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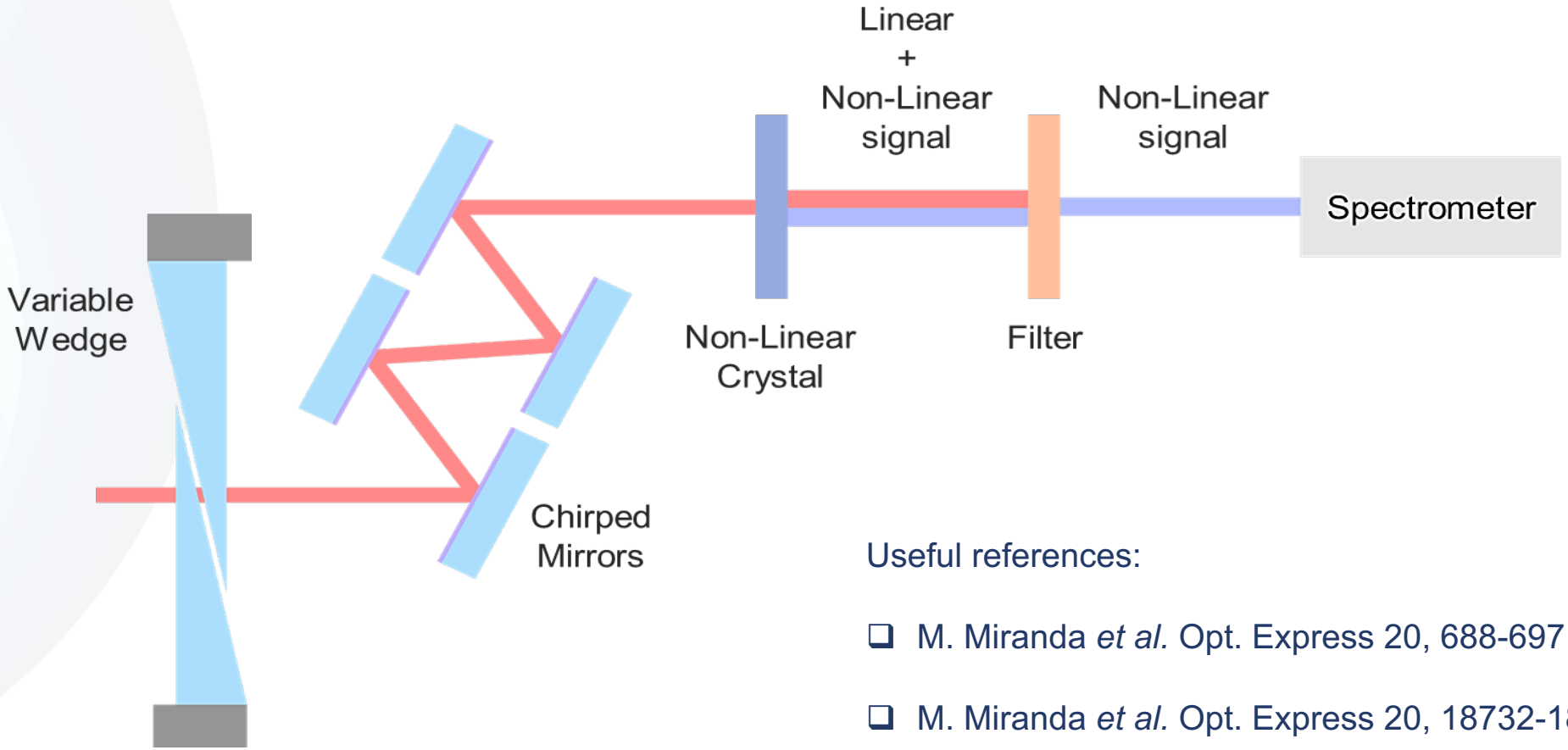
SPHERE IS SPECIALIZED IN THE D-SCAN METHOD

Developed during the PhD of Miguel Miranda, d-scan is a laser pulse characterization technique that involves a variable compression stage (typically a pair of glass wedges and chirped mirrors) and a non-linear process (usually second harmonic generation).

It requires no pulse splitting, no interferometric precision and no time delay.



Useful references:

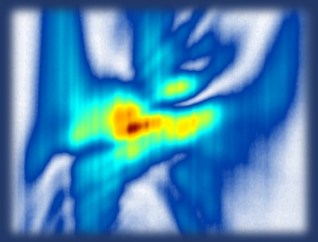
- M. Miranda *et al.* Opt. Express 20, 688-697 (2012)
- M. Miranda *et al.* Opt. Express 20, 18732-18743 (2012)

SPHERE IS SPECIALIZED IN THE D-SCAN METHOD

d-scan measures the non-linear spectrum as a function of wavelength and dispersion, giving rise to a graph called the d-scan trace, which is strongly correlated with the spectrum and phase of the pulse that originated it.

A specialized algorithm reconstructs the measured trace by adapting an initial guess laser field. This allows to retrieve the spectrum, the phase and the time intensity profile of the fundamental laser pulse, i.e., a full characterization is achieved.

Measure d-scan trace in the lab



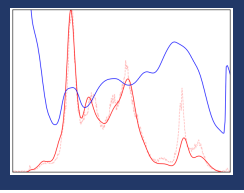
Set an initial guess laser field (spectrum + phase)

Simulate d-scan trace from the initial guess

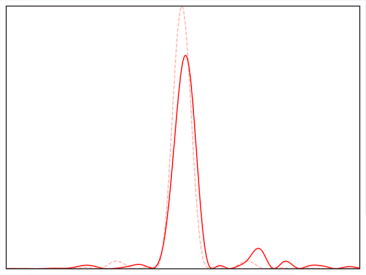
Calculate the error between measured and simulated trace

Run specialized algorithm *N* times to minimize the error by adapting the initial guess

Obtain the spectrum and phase that minimized the error



Reconstruct the time domain laser pulse



D-SCAN DEVICE DEVELOPED BY SPHERE CHARACTERIZES A LASER PULSE IN A SIMPLE AND FAST WAY (alignment and retrieval can be done in less than 1.5 minutes!)

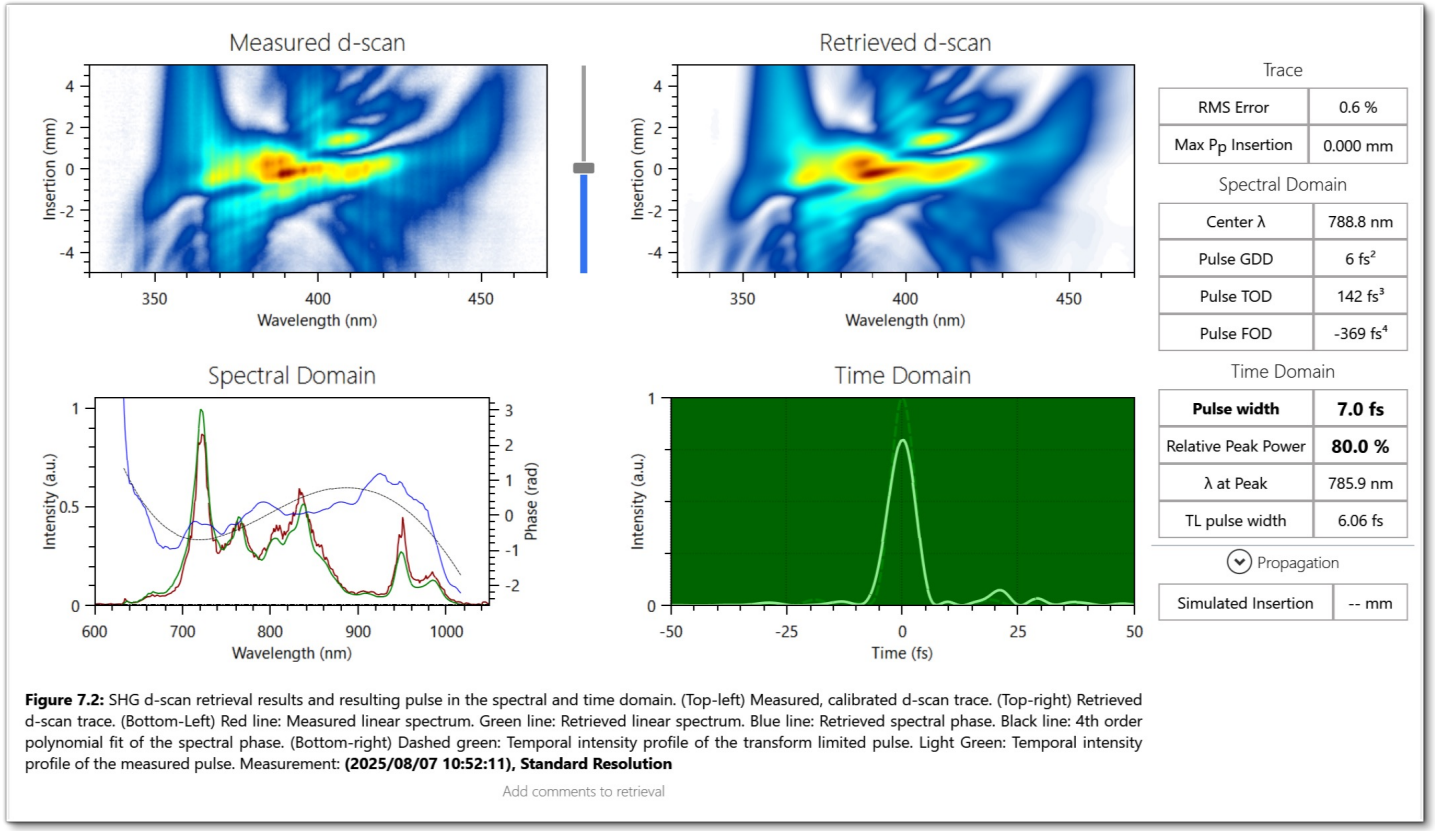


Figure 7.2: SHG d-scan retrieval results and resulting pulse in the spectral and time domain. (Top-left) Measured, calibrated d-scan trace. (Top-right) Retrieved d-scan trace. (Bottom-Left) Red line: Measured linear spectrum. Green line: Retrieved linear spectrum. Blue line: Retrieved spectral phase. Black line: 4th order polynomial fit of the spectral phase. (Bottom-right) Dashed green: Temporal intensity profile of the transform limited pulse. Light Green: Temporal intensity profile of the measured pulse. Measurement: **(2025/08/07 10:52:11), Standard Resolution**

Add comments to retrieval

SOLUTIONS DEVELOPED BY SPHERE

Applications

d·micro

Instrumentation

d·vision

Laser Systems

d·shot

d·scan

d·cycle

CEP·tag

More information at https://www.sphere-photonics.com/

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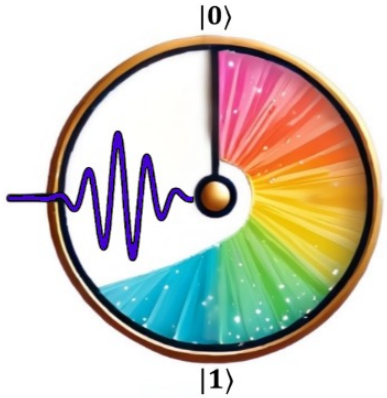

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