

# Discussion on TCT techniques (INTRO)



- TCT – Transient Current Techniques
  - pioneered in RD48/50 communities
  - recent intro/overview: see G.Kramberger [[10.June 2021](#)]
  - wide range of laser induced techniques (TCT, edge TCT, TPA-TCT)
  - ..add ion/electron induced transients techniques (TRIBIC, test beam...)
- TPA-TCT within AIDAInnova: see AIDA kick-off [[13.4.2021](#)]
  - Design of a fiber laser system for TPA-TCT (with Fyla)
  - Development of a turnkey TPA-TCT system
  - Formation of a TPA-TCT user community ... this is an RD50 activity
- This Workshop
  - ‘standard’ TCT is widely used in the community
  - Table-top TPA-TCT is coming into the game, delivering first impressive results
    - beam parameters of  $w_0=0.9\mu\text{m}$  and  $z_0=6\mu\text{m}$  confirmed!
  - IBIC techniques complementing the set of techniques

# Discussion on TCT techniques



- This Workshop
  - 'standard' TCT is widely used in the community
  - Table-top TPA-TCT coming into the game, delivering first results
  - IBIC techniques complementing the set of techniques
- TPA TCT setups – next steps / open questions
  - system development still ongoing
    - Daniel: Do we need a Hexapod for tilt correction?
  - only few institutes using this technique so far (CERN, Santander, Ljubljana, .. NIKHEF(?), Lancaster (updating to latest laser version)
  - initiative to develop a more flexible system based on fibers under way
- TPA-TCT/TCT – experiments to be performed
  - need to fully explore potential and limitations of the new tool
  - ...community starts to explore the new technique
    - depth profiling from top
    - feasibility of performing LGAD mortality studies (next session)
  - **Have a TCT (TPA-TCT) workshop ! 3<sup>rd</sup> edition (Marcos, Gregor, Michael,.....)**
  - Include TPA-TCT charge generation into simulation tools
    - ..work ongoing in Sevilla for integration into Synopsys TCAD
  - Revisiting trapping times ('dead layer' in n+ region)
    - variation of experimental data in literature :  $\tau_e > \tau_h$  and vice versa ... !

# AIDAInnova WP4.4. – TPA-TCT

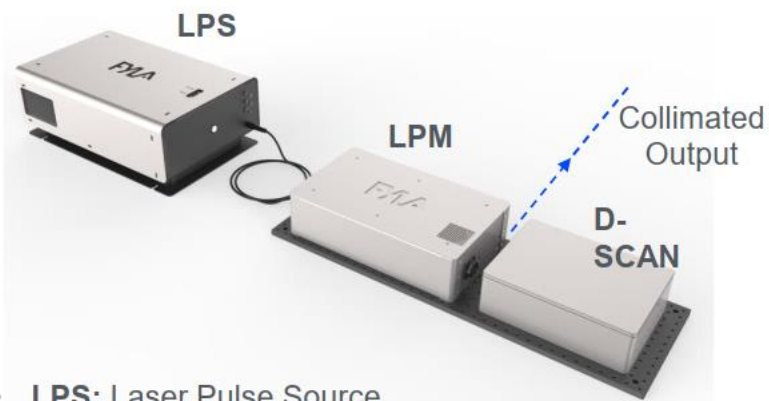


## 1. Design a fiber laser system for TPA-TCT



### CURRENT

LFC1500X commercial model



- **LPS:** Laser Pulse Source
  - All-fiber CPA femtosecond pulses generation
  - Pulse rep rate selection. **Single shot to 8 MHz**
- **LPM:** Laser Pulse Management module
  - Pulse energy modulation: **<10 pJ to > 10 nJ**
  - Synchronized shutter. **rise/fall time < 1 us**
- **D-SCAN:** Dispersion scanning
  - Pulse duration tuning: **300 fs to 600 fs**
  - Pulse temporal properties characterization



**AIDA INNOVA**  
Single box fully all-fiber



- **LPS + LPM + D-SCAN** in single box fully all-fiber
  - Pulse duration goal **< 100 fs**
  - Fiber-based tunable dispersion compensation: **< 100 fs to 1 ps**
  - Fiber-pigtailed AOM functionalities:
    - Energy modulation
    - Pulse rep rate selection
    - Sync shutter
  - Dispersion-less fiber output delivery to TPA-TCT optical sub-system

• for more details: [AIDA-innova kick-off meeting \[WP 4.4.\] link](#)

# AIDAinnova WP4.4. – TPA-TCT



## 2. Development of turnkey TPA-TCT system



- Integrate a fully-fledged, ready-to-use TPA-TCT system.
- Compact and robust optical sub-system providing:
  - Laser beam steering and micro-focusing.
  - TPA-TCT stability monitoring and signal fluctuation real-time compensation.
  - Sampling imaging for beam spot monitoring.
- Sub-micrometer positioning of the sample
  - (tens of nanometers to resolve micron size features).
- Electro-cooling system able to reach -20 Celsius degrees (at least).
- Software integration:
  - DAQ (generic digital scope) and control (positioning stages, cooling).
- Data analysis library (canonical measurements, root based).
- Vertical microscope-like layout inside a black optical enclosure
  - (laser light input via optical fiber)

# AIDAInnova WP4.4. – TPA-TCT



## 3. Form TPA-TCT user community



- Formation of TPA-TCT user community
  - Development of laser and system around it together with laser producer
  - Application of TPA-TCT to various fields of sensor/device characterization
  - Development of analyses techniques and common software
  - Enlarge reach of TPA technology (e.g. defect spectroscopy,.....)
- Next step
  - set up a mailing list
  - organize regular meetings (bi-monthly)
  - ... ramp up activities

• for more details: AIDA-innova kick-off meeting [WP 4.4.] [link](#)