

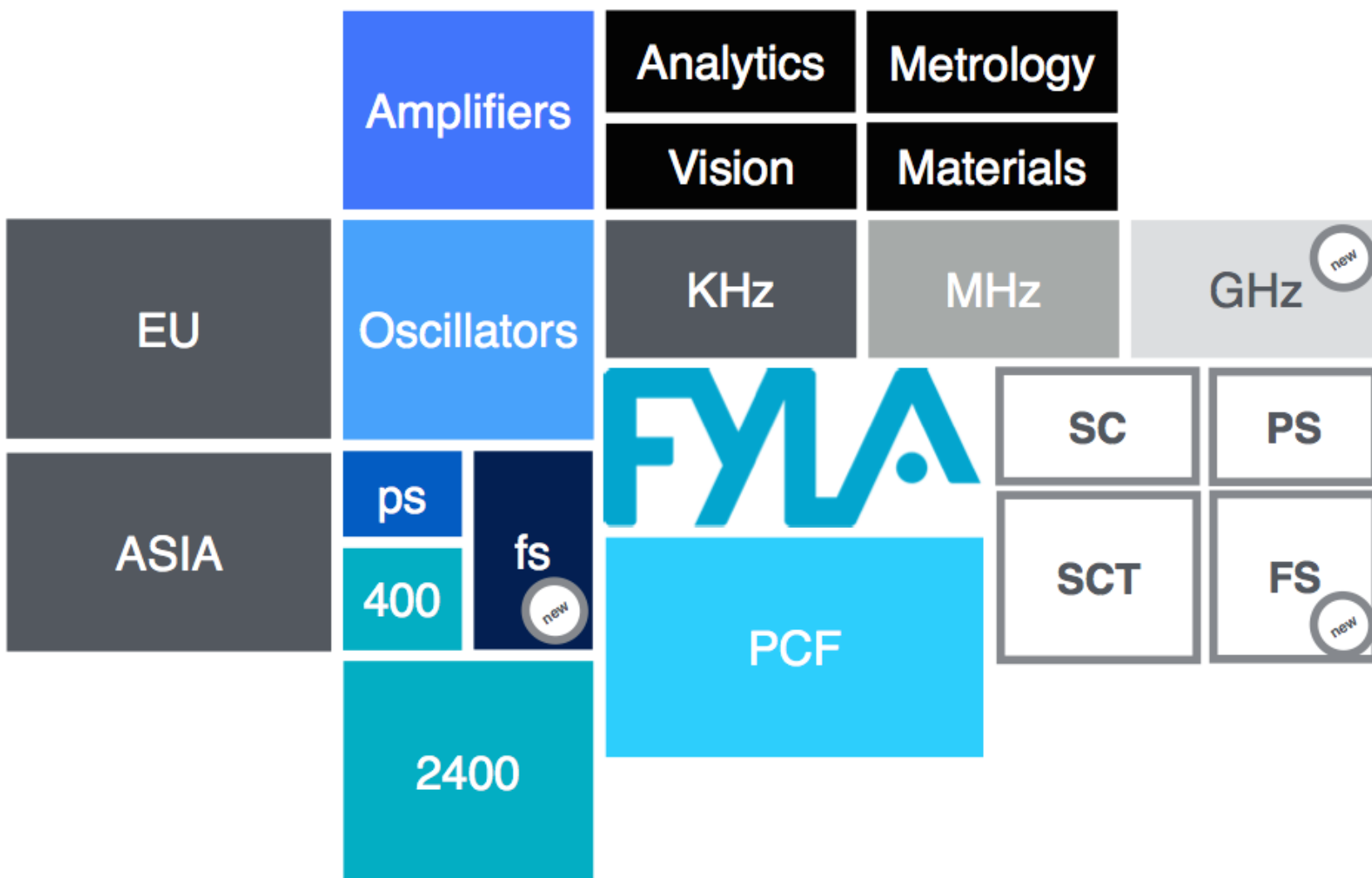
# Fiber Lasers. Focused on Customer R+D Needs and Perspectives

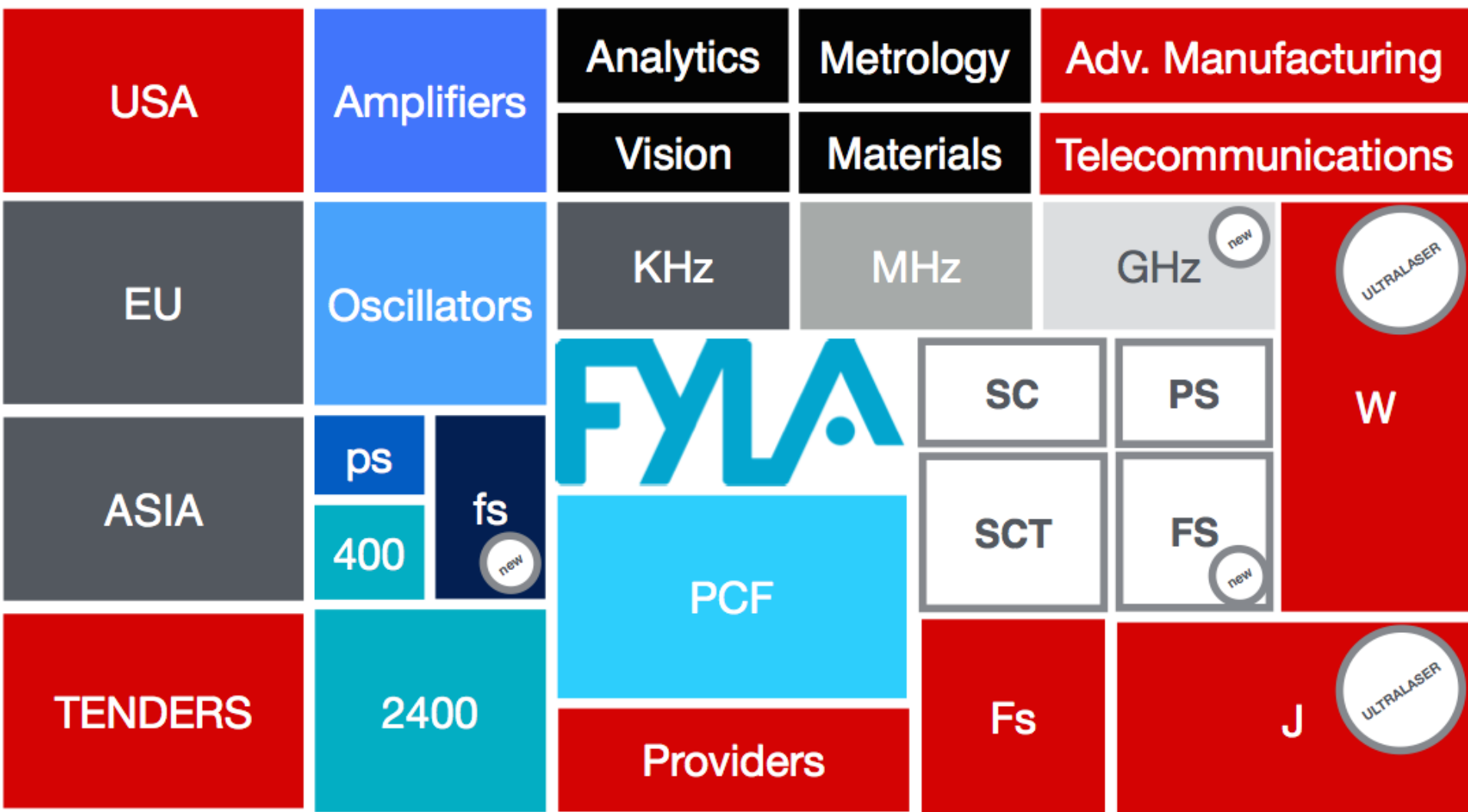
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COST MP1401 Annual Conference and 2<sup>nd</sup> MC Meeting, Zadar, 12-15 April 2016  
**SIG1 - Special Interest Group**

# Overview

- FYLA
- Customer Focused R+D Needs and Perspectives
  1. Supercontinuum Fiber Lasers
    - Microscopy, Inspection, Sorting
  2. 1.5  $\mu\text{m}$  Fiber Laser Frequency Combs
    - Communications and Radar
  3. 1.0  $\mu\text{m}$  Ultrafast Fiber Lasers
    - Advanced Manufacturing
- Conclusions





## PRODUCT / TECHNOLOGY

SC LASERS

## MARKET / SECTOR

MICROSCOPY - SCIENTIFIC

## CUSTOMER NEEDS

- Temporally Coherent White Light
- Higher Spectral Power Density in VIS Range
- Pulse Shaping and Spectral Conformation Tools
  - Fast, Versatile and Broadband

## R+D ACTIONS - COST PARTNERS – STSMs

- PCF designing: manufacturable ANDi fibers
- Programmable Amplitude/Phase Shaping Modules:
  - High resolution, broadband and efficient (low losses)

## PRODUCT / TECHNOLOGY

### SC LASERS

## MARKET / SECTOR

### MICROSCOPY - INDUSTRY

## CUSTOMER NEEDS

- Ease of manufacture
- Compactness
- Lifetime > 10.000 hours typ.
- Light managing Tools
  - More relaxed performance (eg 4 fixed lines for fluorophore excitation), affordable

## R+D ACTIONS - COST PARTNERS – STSMs

- Simpler SC structures (e.g: simplify MOPA n° of stages)
- Increase robustness of fiber components: pigtailed diodes, splices protection, SESAM integration - reliability

## PRODUCT / TECHNOLOGY

### SC LASERS

## MARKET / SECTOR

### INSPECTION - SORTING

## CUSTOMER NEEDS

- Stability: short and long term.
  - Full Spectrum Power Stability  $< 0.1\%$  (Std. Dev.)
  - Spectral Stability  $< 0.1$  dB (Min-Max hold) over different spectral bands
- Spectral Flatness.
  - $< 3$  dB variation over full VIS band,  $< 3$  dB variation over full VIS band

## R+D ACTIONS - COST PARTNERS – STSMs

- Nonlinear fiber optics:
  - Beyond fundamental limits on stability of solitons, dispersive waves, etc?
- Ultrastable fiber laser seeds and amplifiers:
  - $< 0.01\%$  peak power RMS,  $< -120$  dB/Hz @ 100 Hz phase noise

## **PRODUCT / TECHNOLOGY**

### FIBER LASER FREQUENCY

COMBS

## **MARKET / SECTOR**

### COMMUNICATIONS -

RADAR

## **CUSTOMER NEEDS**

- Higher fundamental FSR (5G and beyond): > 60 GHz
- Introduce and process independent data to carriers
  - Elastic superchannels, Multiprotocol Hybrid Wireless Networks, Photonic Radar

## **R+D ACTIONS - COST PARTNERS – STSMs**

- Smart independent modulation and interleaving solutions
- Frequency multiplication of fundamental FSRs of MLLs
  - E.g: Éthalon fiber filters with high tolerance to temperature fluctuations



## PRODUCT / TECHNOLOGY

1  $\mu\text{m}$  ULTRAFast FIBER LASERS

## MARKET / SECTOR

ADVANCED  
MANUFACTURING

## CUSTOMER NEEDS

- Reliable and compact high power amplification
- Higher pulse repetition rates
- Pulse timewidth tuning

## R+D ACTIONS - COST PARTNERS – STSMs

- High Power Amplification Tests
  - Pulse Timewidth: 0.4 ps (1 ns stretched) PRR > 1 MHz
  - Aimed Pulse Energy > 50  $\mu\text{J}$

# Conclusions

- Strong Potential of Fiber Laser Technology in Industry
- Industry to cross Barrier of Confidence
- SMEs to perform R+D Focused on Industry Needs
- COST Fiber Laser Community Knowledge and Resources to Boost Fiber Laser SMEs to Fulfill Industry Expectations

# Questions