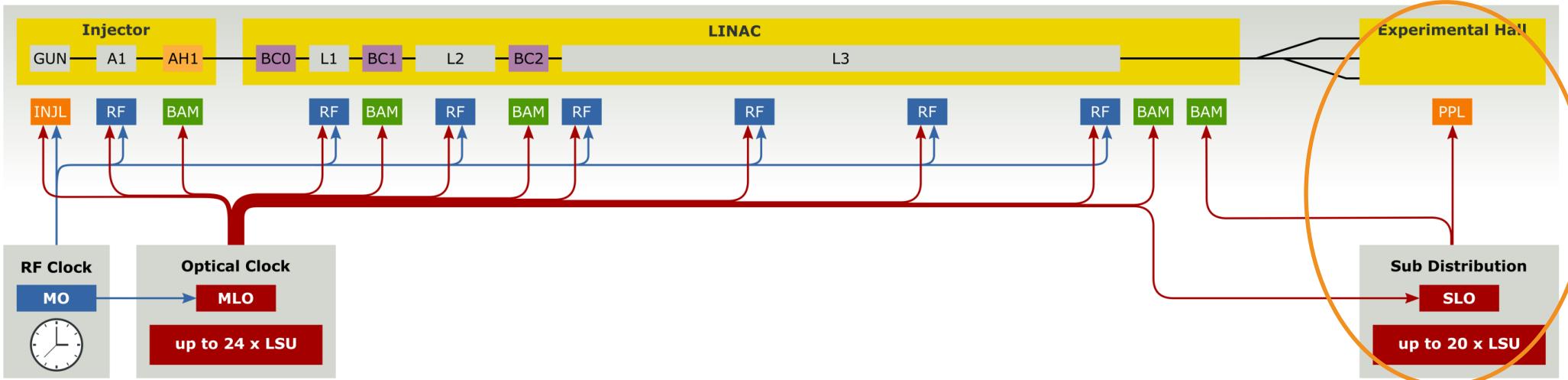


# Laser Arrival Time Monitor for FELs

Anne-Laure Calendron on behalf of LbSync (DESY) and LAS (EuXFEL)  
ARD-ST3, 7<sup>th</sup> to 9<sup>th</sup> September 2022

# Overview FEL Synchronization

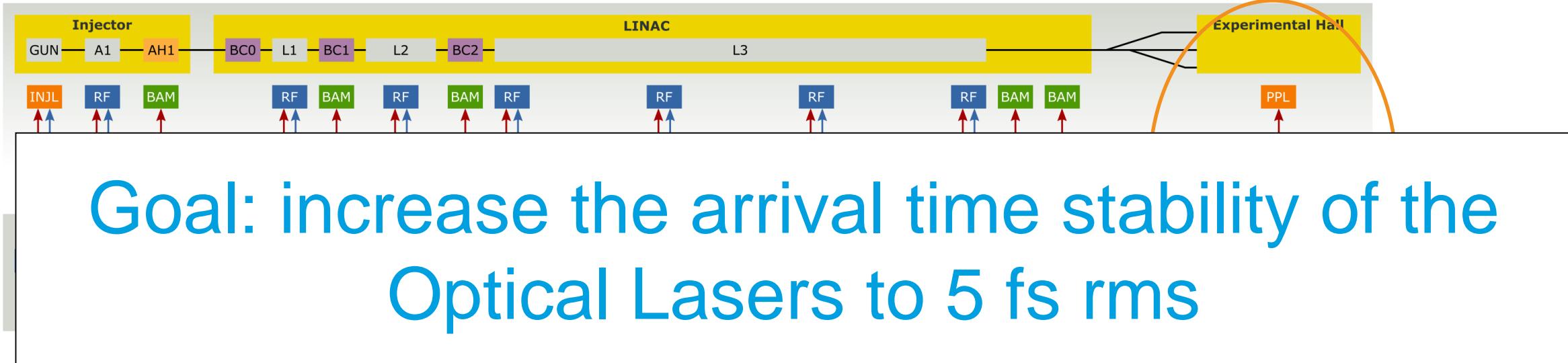
## Example: EuXFEL synchronization



- Length stabilized **fiber link distribution** to bring the optical clock at 33 end stations (RF, BAM, optical Lasers)
- Optical laser against photon (X-ray) **arrival stability**: <15 fs rms uncorrected or <10 fs corrected
- **Electron arrival stability** : 5-10 fs rms

# Overview FEL Synchronization

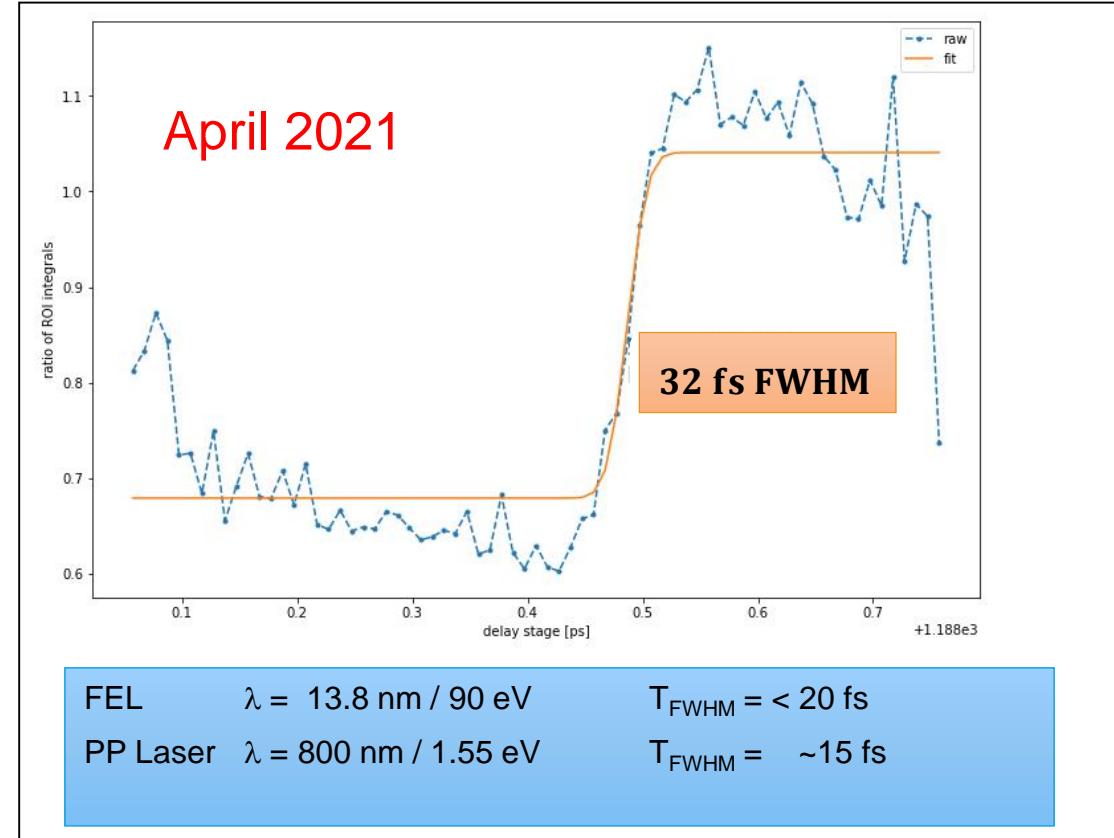
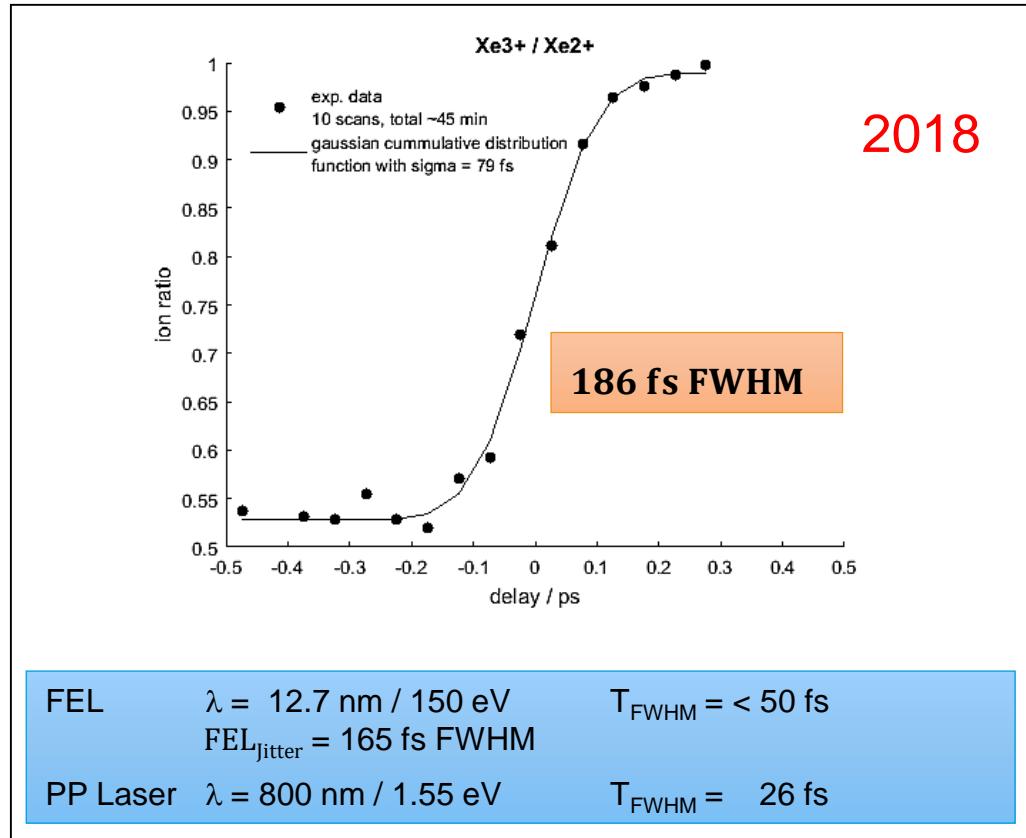
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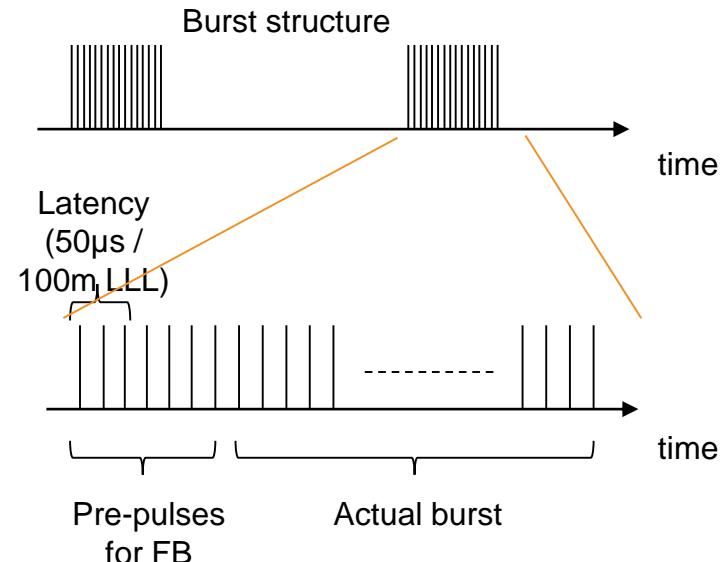
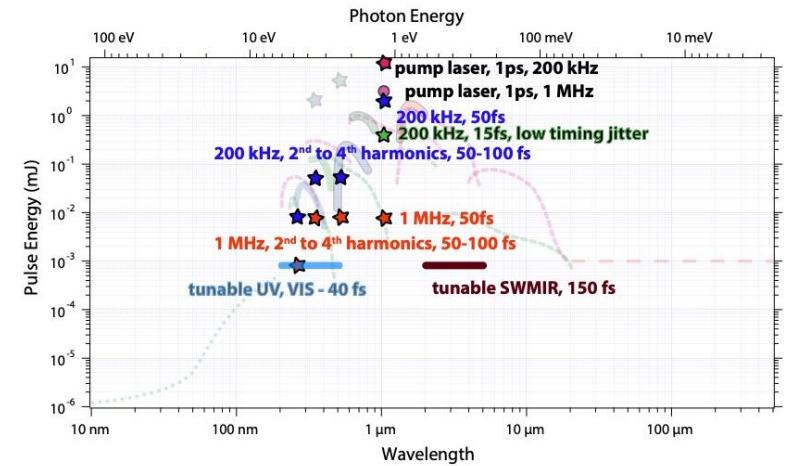
# LAM tested at FLASH: First results

Drastical improvement in the stability of time 0 during the experiments – Users enthusiastic!



# Our device: Challenges ... and solutions!

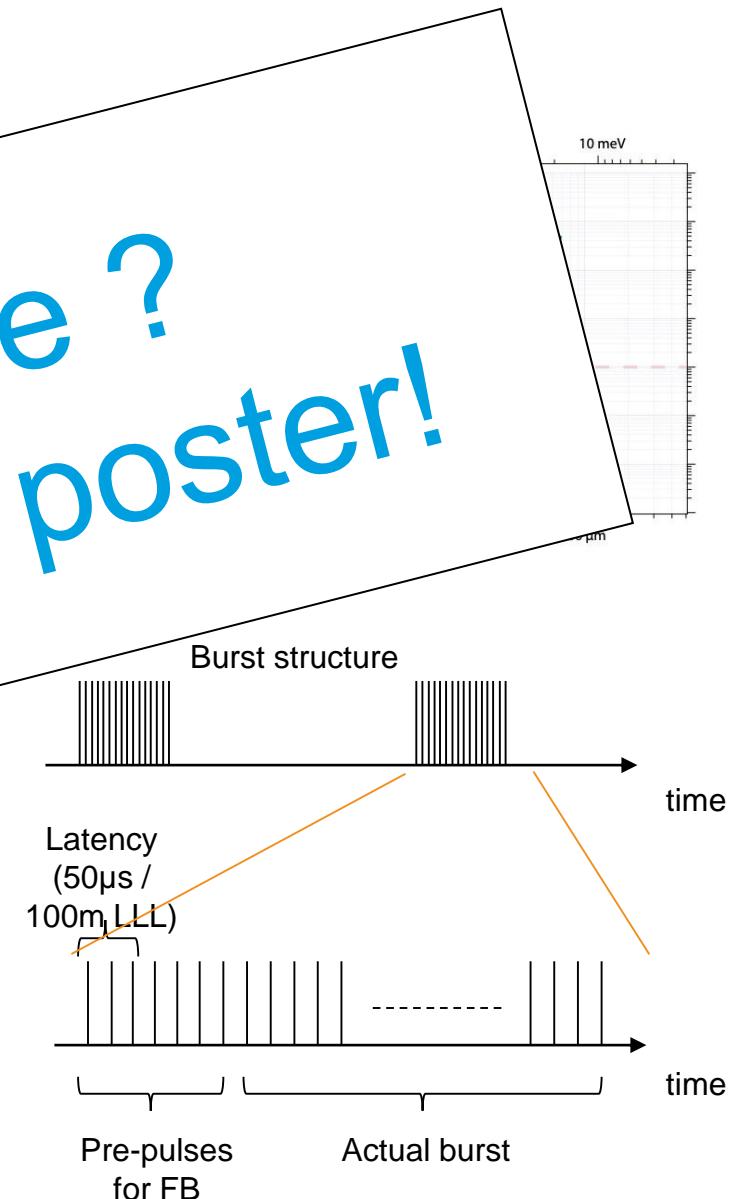
- **Optical**
  - Broad wavelength coverage
  - Ultra-short pulse duration (15fs-xx fs)
  - Pulse-on-demand pattern
  - Large energy variation within a run
- **Controls**
  - 10Hz burst mode with single-pulse detection up to 4.5MHz
  - Slow feedbacks against drifts
  - Fast feedback in the burst / pre-compensation of arrival time
  - User delay
  - Wavelength and energy changes



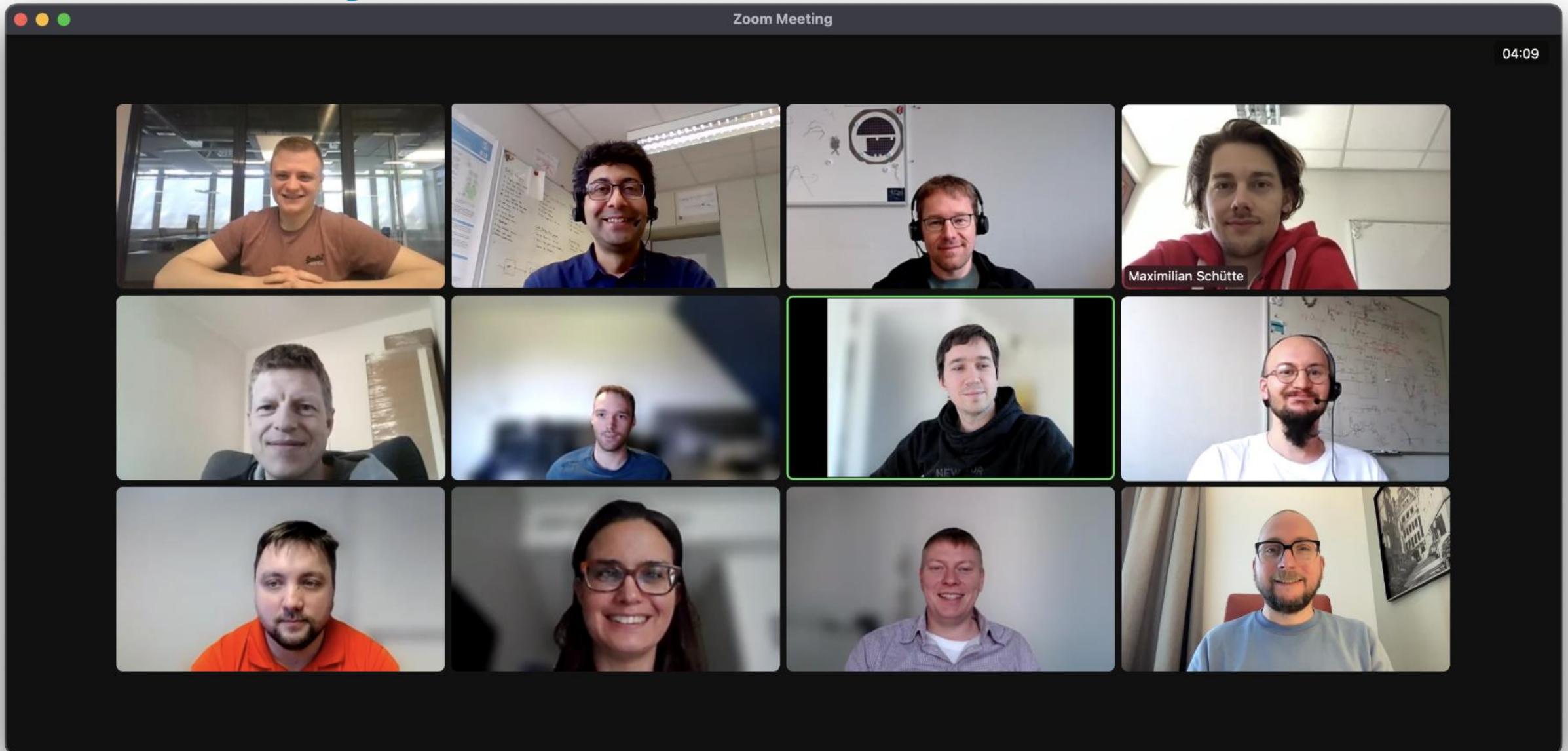
# Our device: Challenges ... and solutions!

- Optical
  - Broad wavelength coverage
  - Ultra-short pulse duration (15fs-xx fs)
  - Pulse-on-demand pattern
  - Large energy variation
- Compensation of arrival time
  - Synchronization
  - Frequency lock
  - Use of fiber
  - Wavelength and energy changes

How to handle these ?  
Some answers on the poster!



# Thank you.



## Contact

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