

Local Reference Generation Module

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Advanced Techniques in LLRF control for XFEL -
Collaboration Workshop

Kraków, 19.04.2011





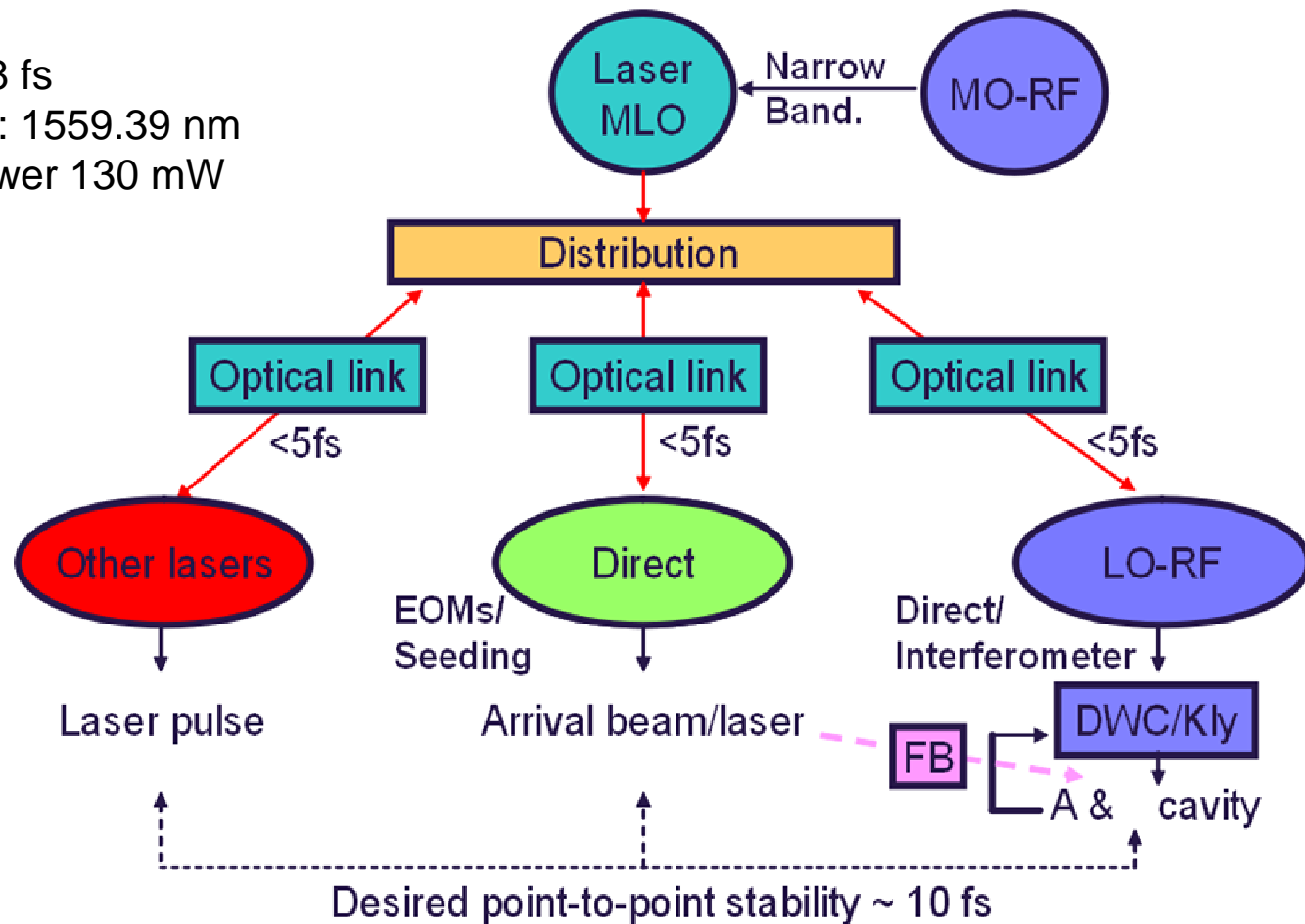
- Optical synchronization system overview
- L2RF - Variety of conversion types
- Direct conversion scheme
- MZI setup

Diagram of the optical synchronization system



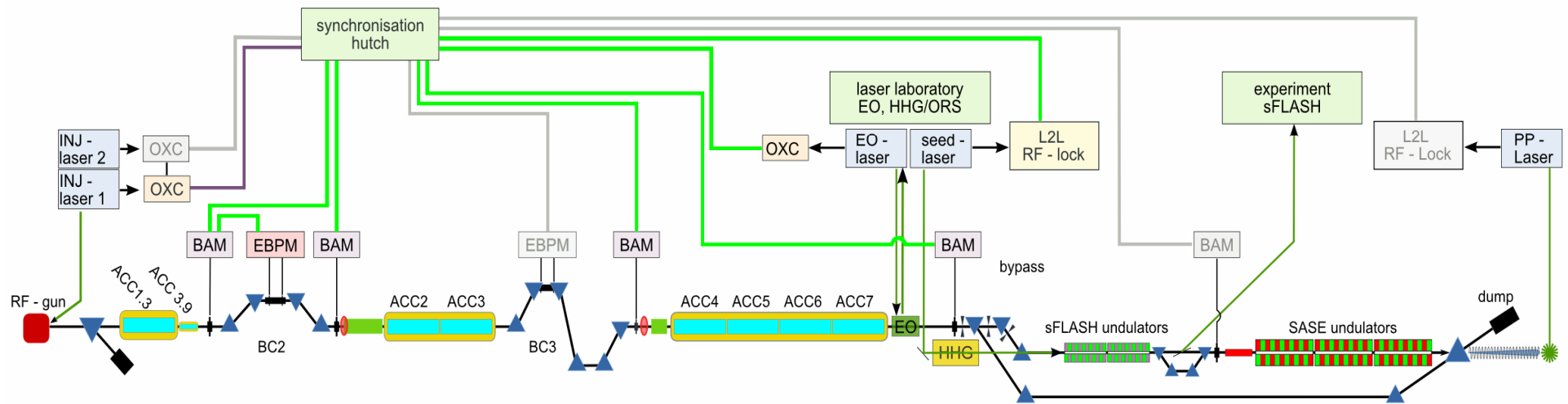
- MLO: laser „Origami”
 - Pulse repetition rate: 216.666667 MHz
 - Pulse duration: 188 fs
 - Center wavelength: 1559.39 nm
 - Average output power 130 mW

- Dispersion-compensated, timing-stabilized fiber links



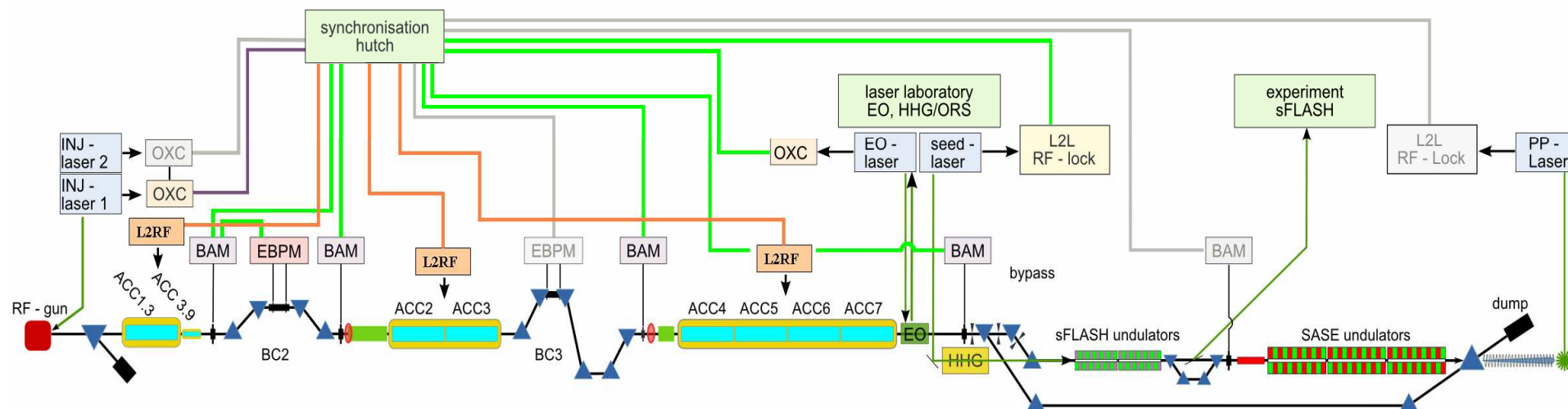
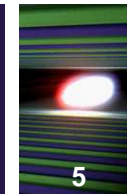
Courtesy of H. Schlarb

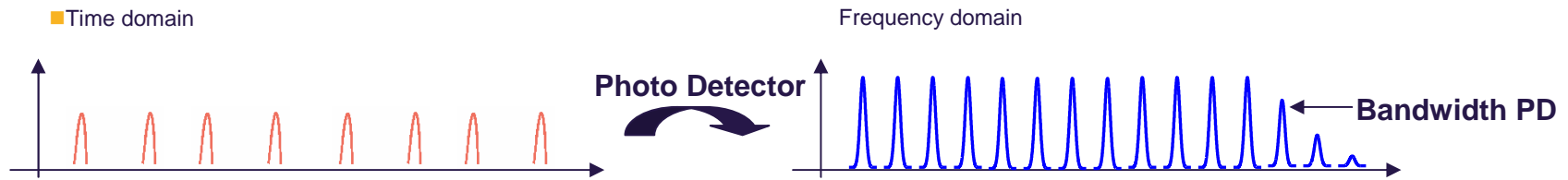
Synchronization system outline



Courtesy of M. Bock

Synchronization system outline

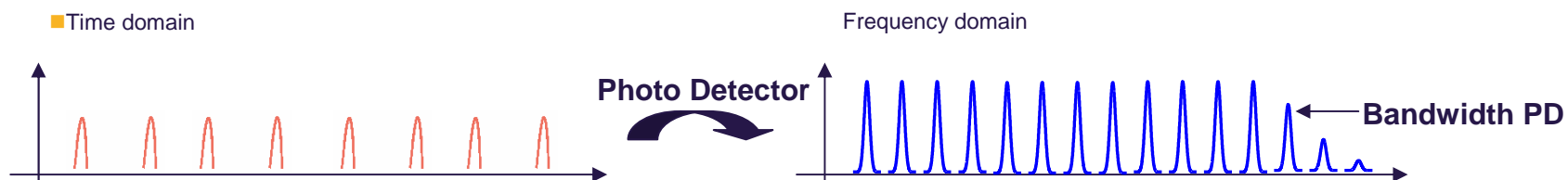
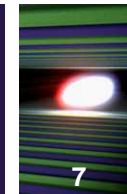




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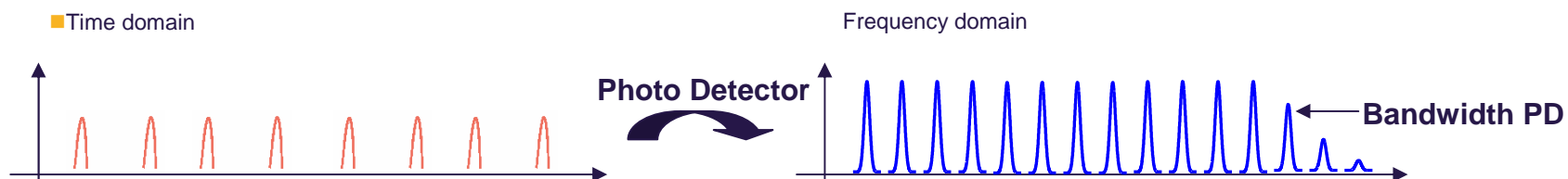
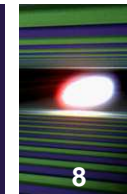
- Direct conversion on the photodiode

Variety of conversion types



Courtesy of: H. Schlarb

- Direct conversion on the photodiode
- Conversion scheme with the Sagnac loop



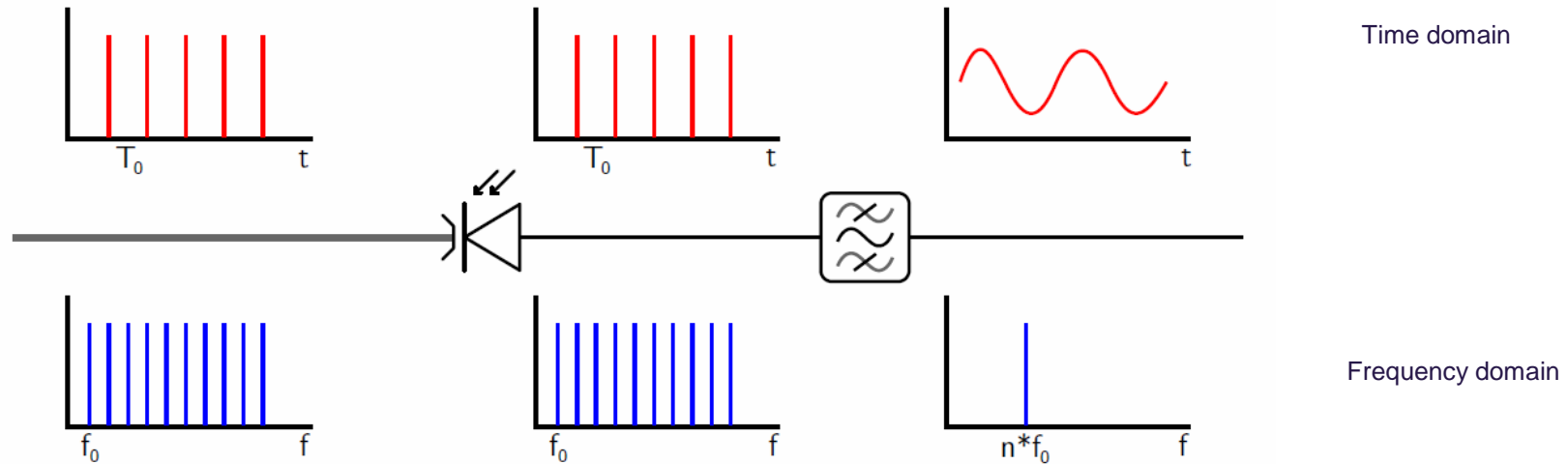
Courtesy of: H. Schlarb

- Direct conversion on the photodiode
- Conversion scheme with the Sagnac loop
- New setup with Mach-Zehnder interferometer

Direct conversion



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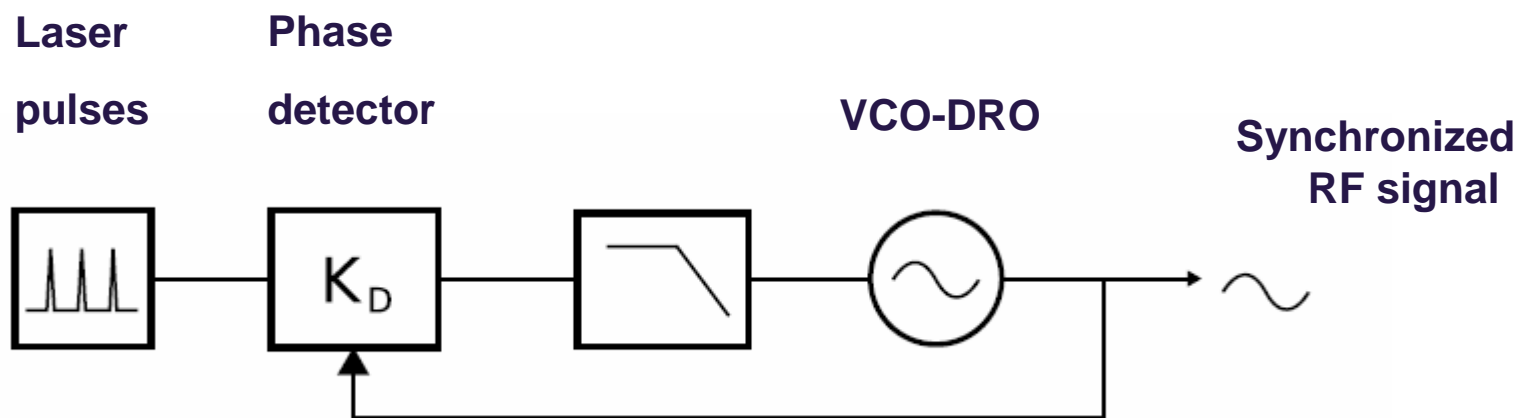
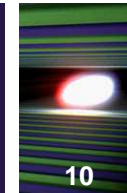
Advantages:

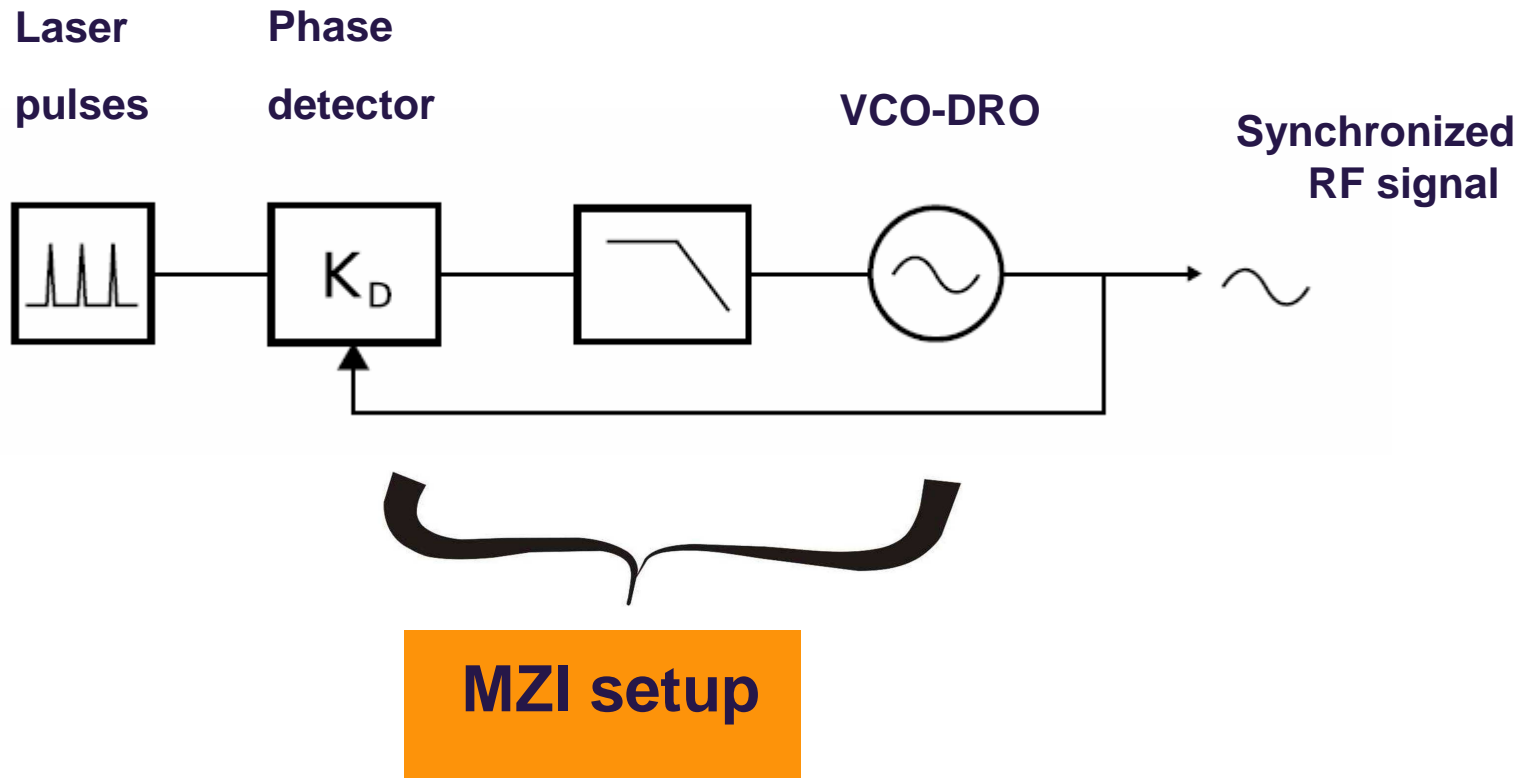
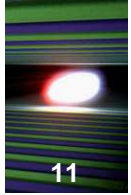
- Simple and robust
- Low cost

Disadvantages:

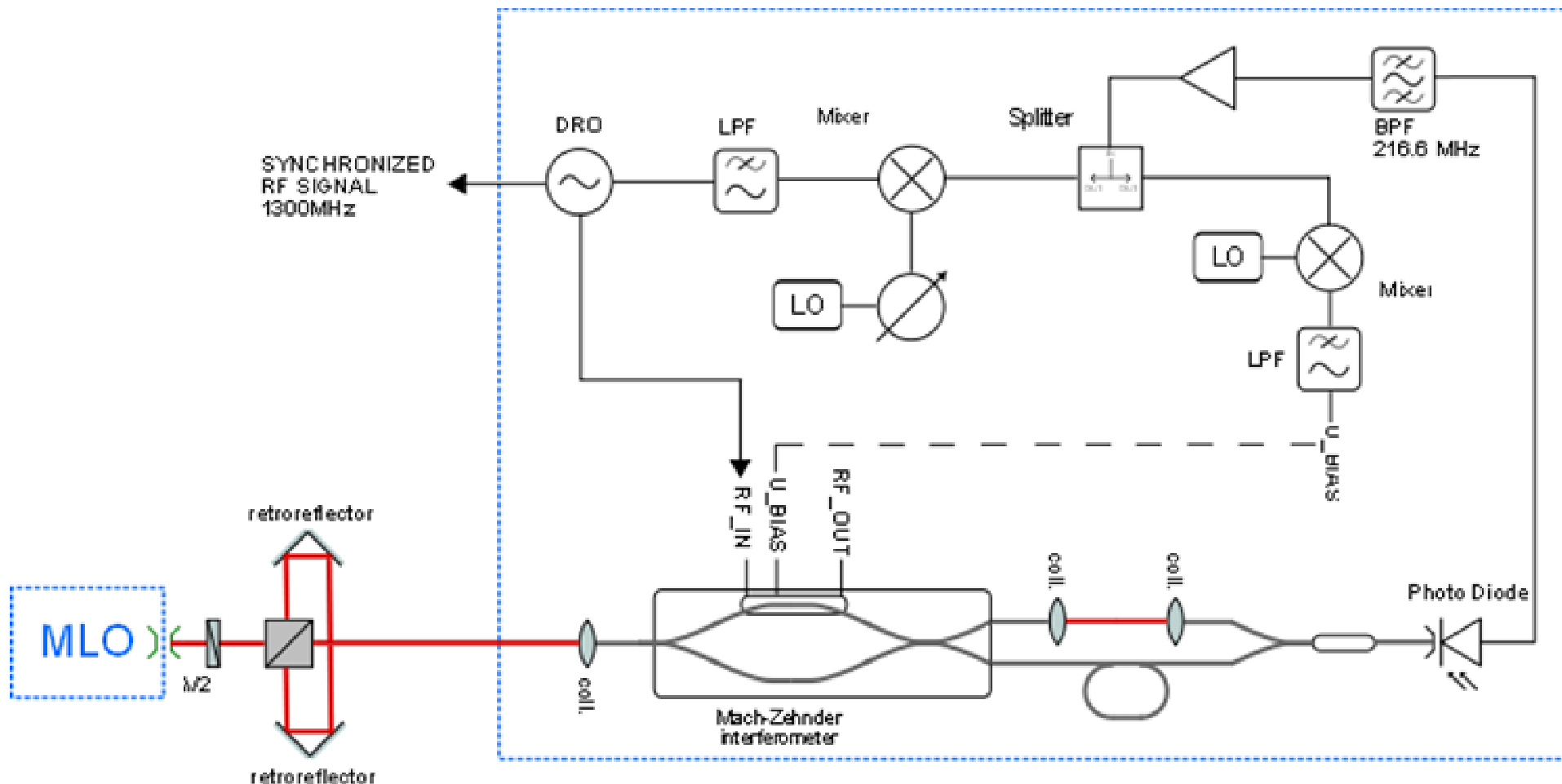
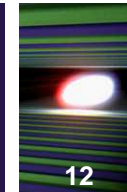
- Temperature drifts
- The limitation is amplitude-to-phase conversion in photodetectors

Optoelectronic PLL

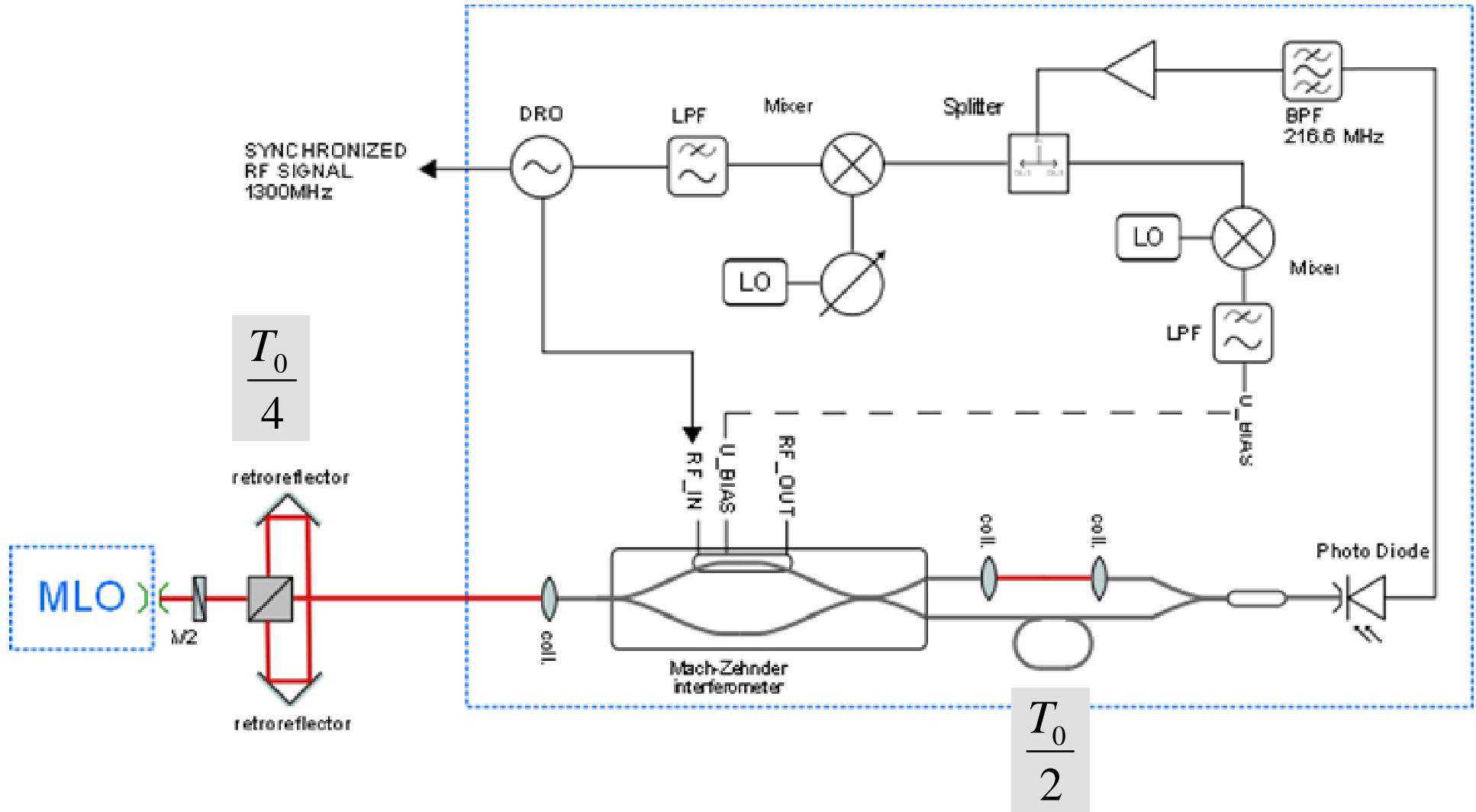




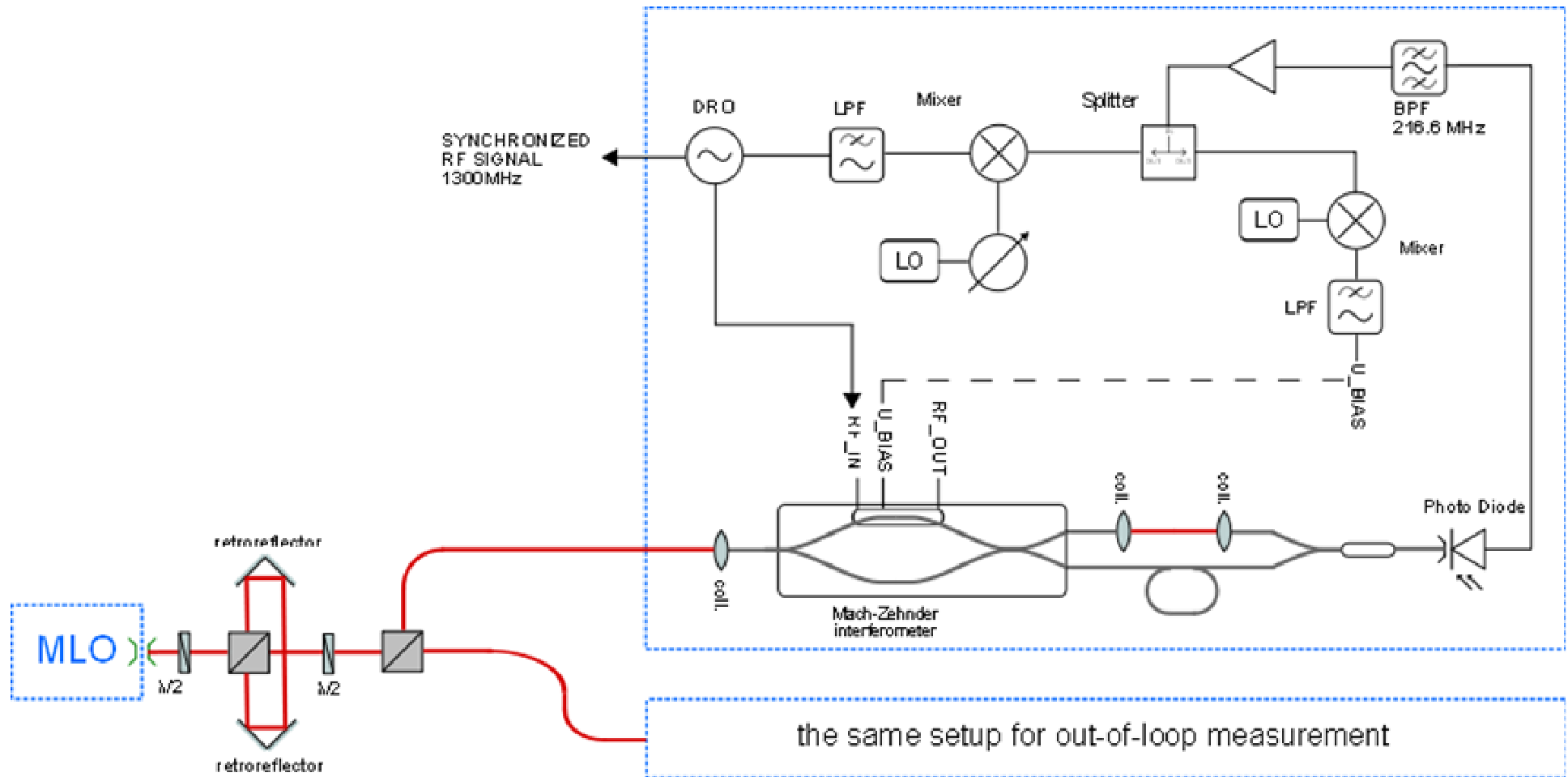
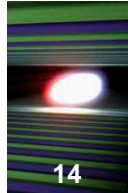
MZI setup



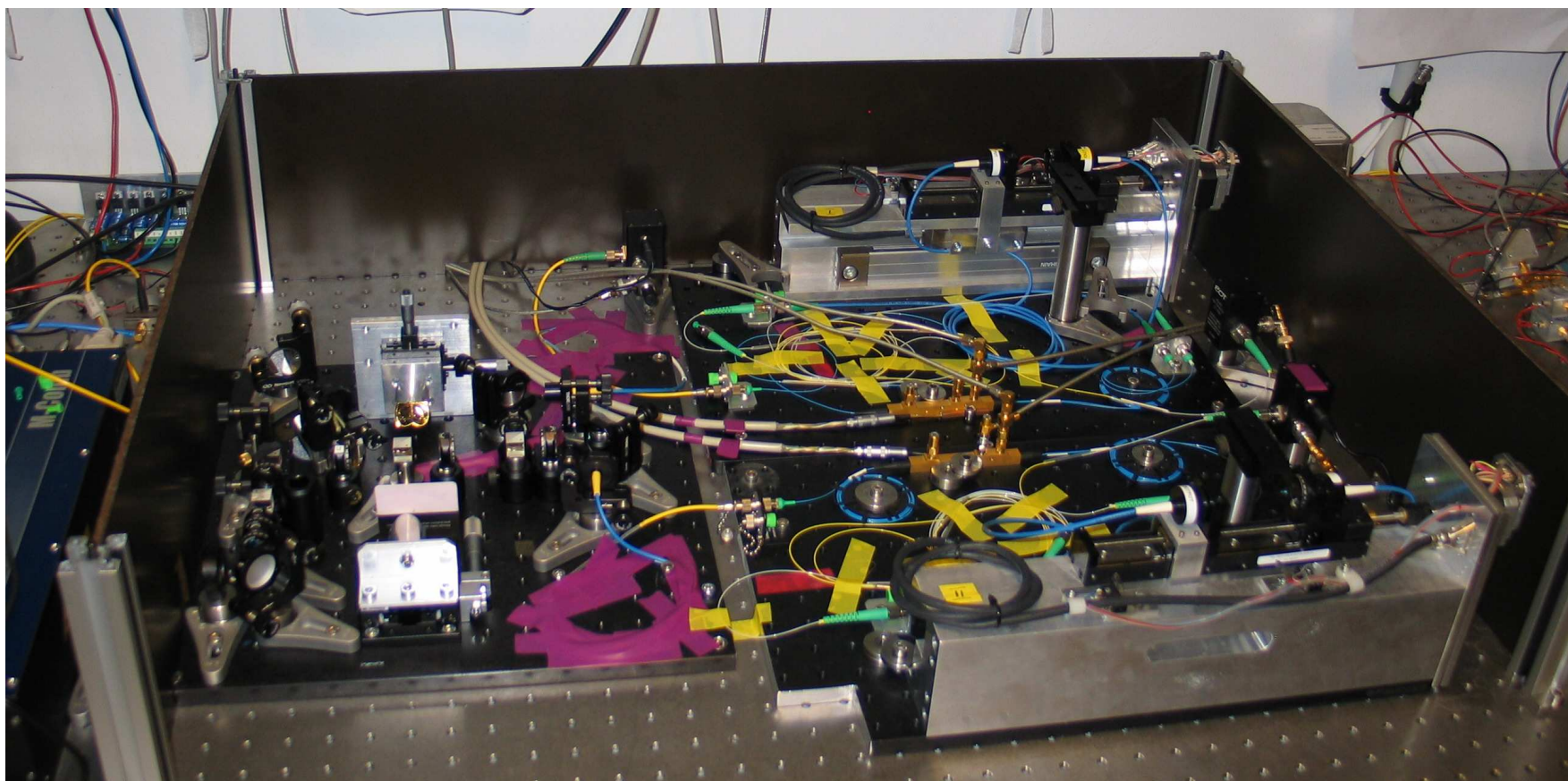
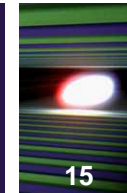
MZI setup



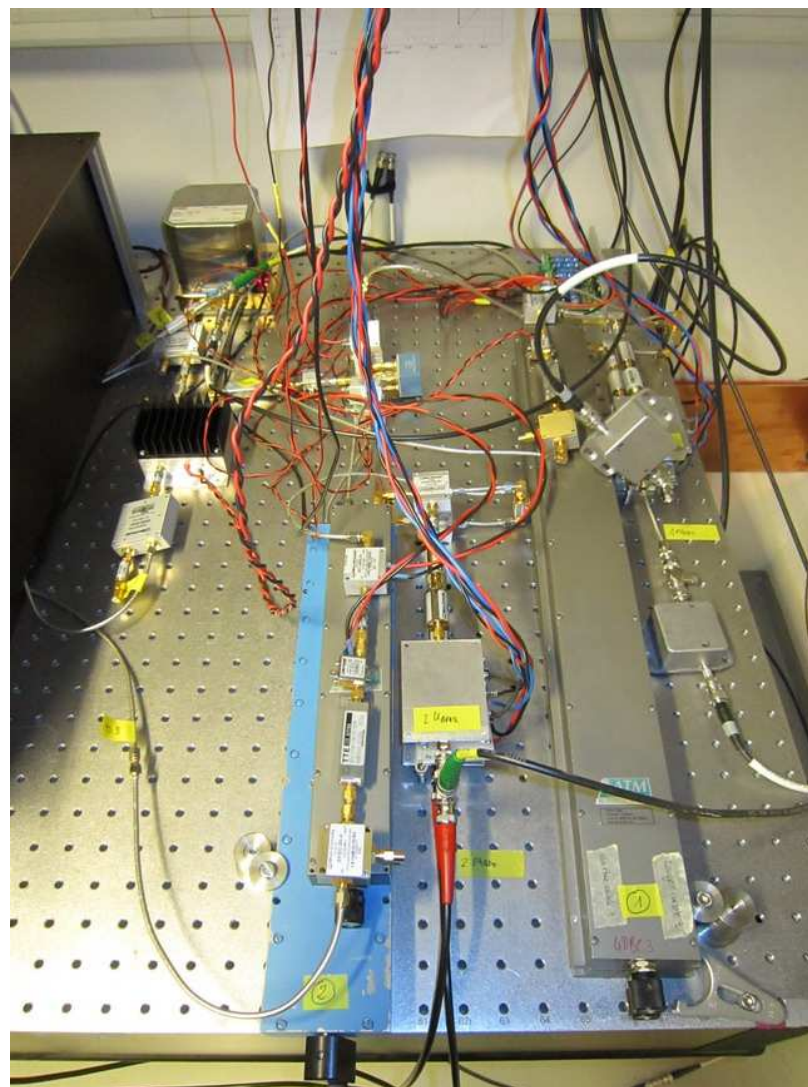
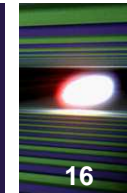
MZI setup



First measurements at the lab - photos



First measurements at the lab - photos





- The new setup shows capability for even better than 10-fs precision performance



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- Tentative end of project is the end of this year



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Thank you for your attention