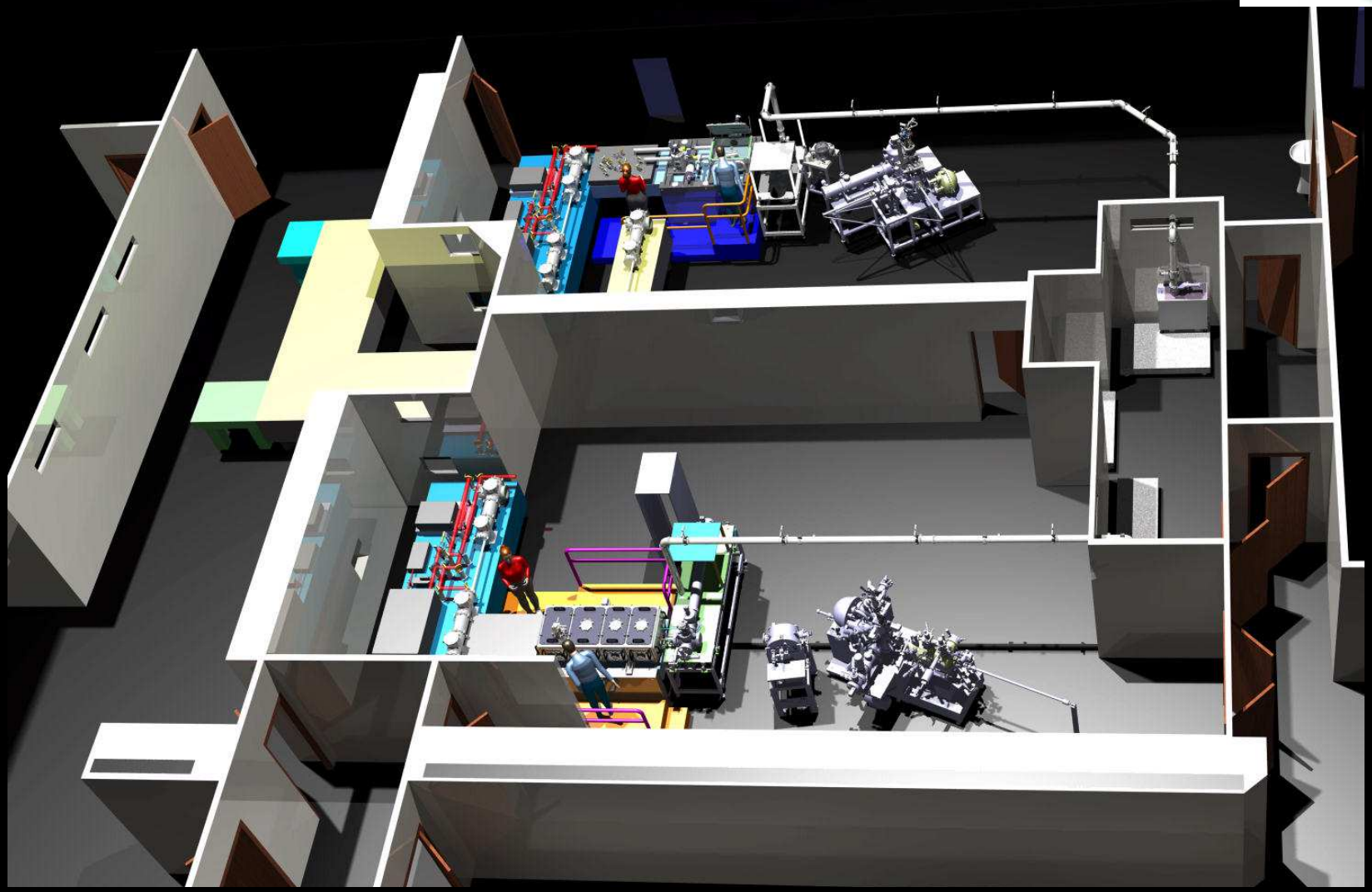
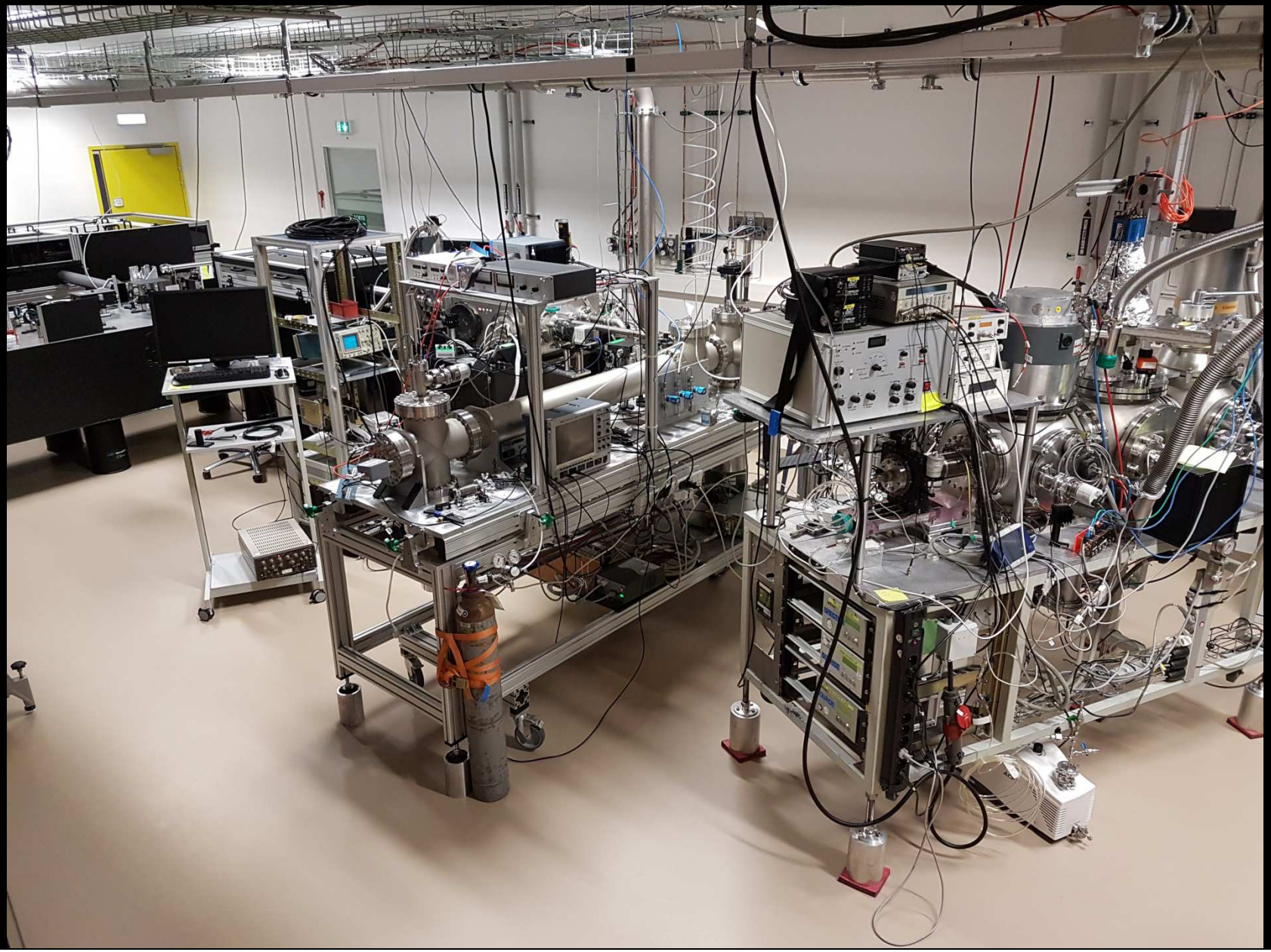
FAB1 XUV: A high-energy flexible atto beamline

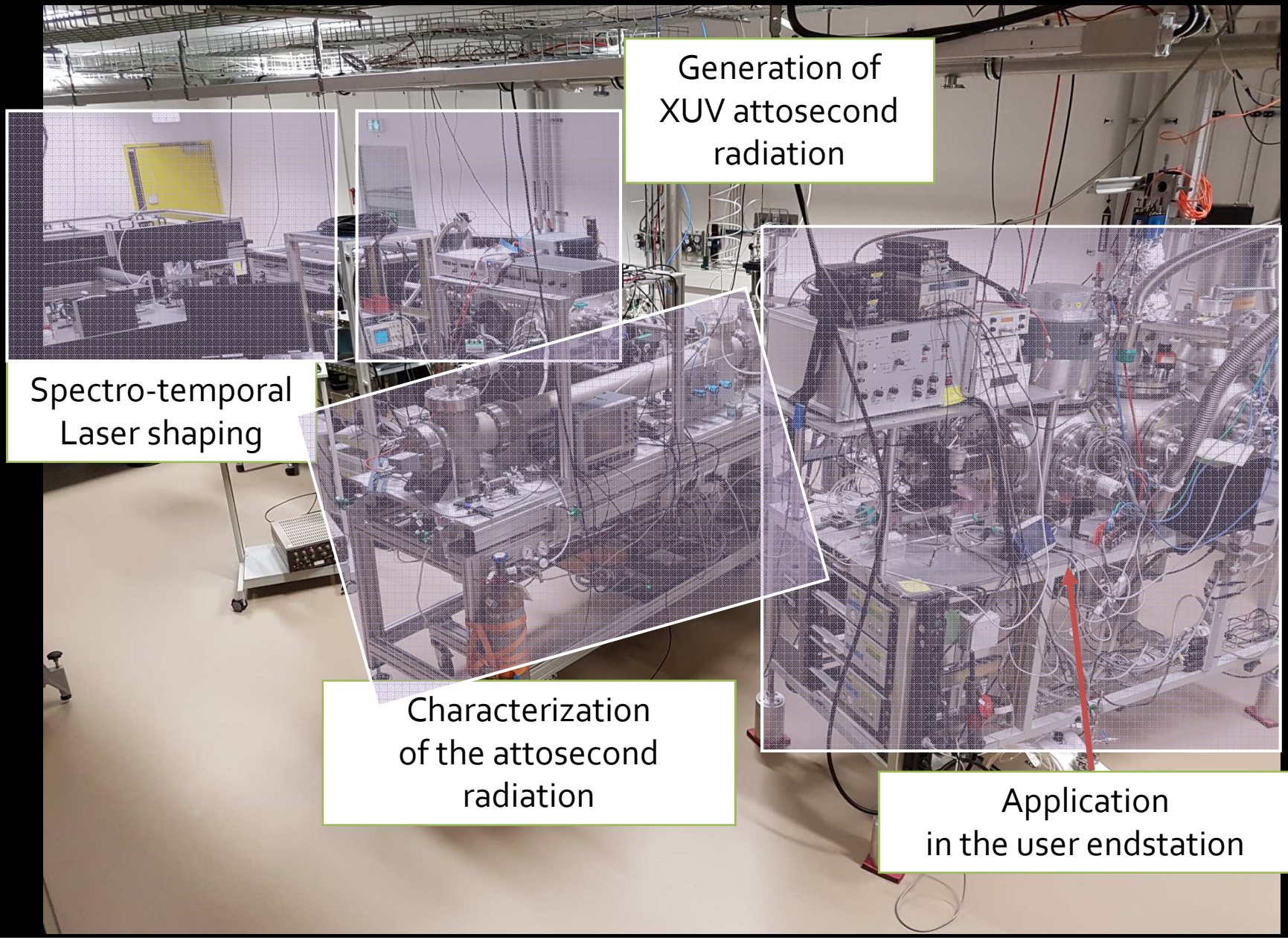
D. Platzer, M. Turconi, A. Borot, C. Alexandridi, M. Lejman,
A. Autuori, D. Bresteau, P. Salières *et al.*



FAB1 atto beamline: 4 blocks

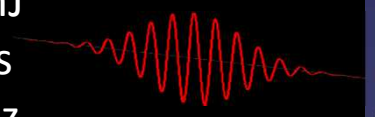


FAB1 atto beamline: 4 blocks

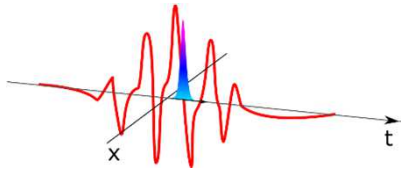


Block 1: Spectro-temporal laser shaping

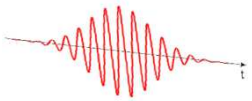
15 mJ
24 fs
1 kHz



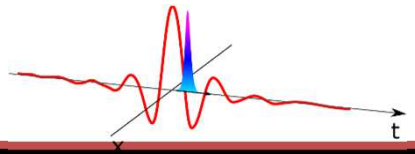
Line 3: OPA + IR
2-color waveform synthesis

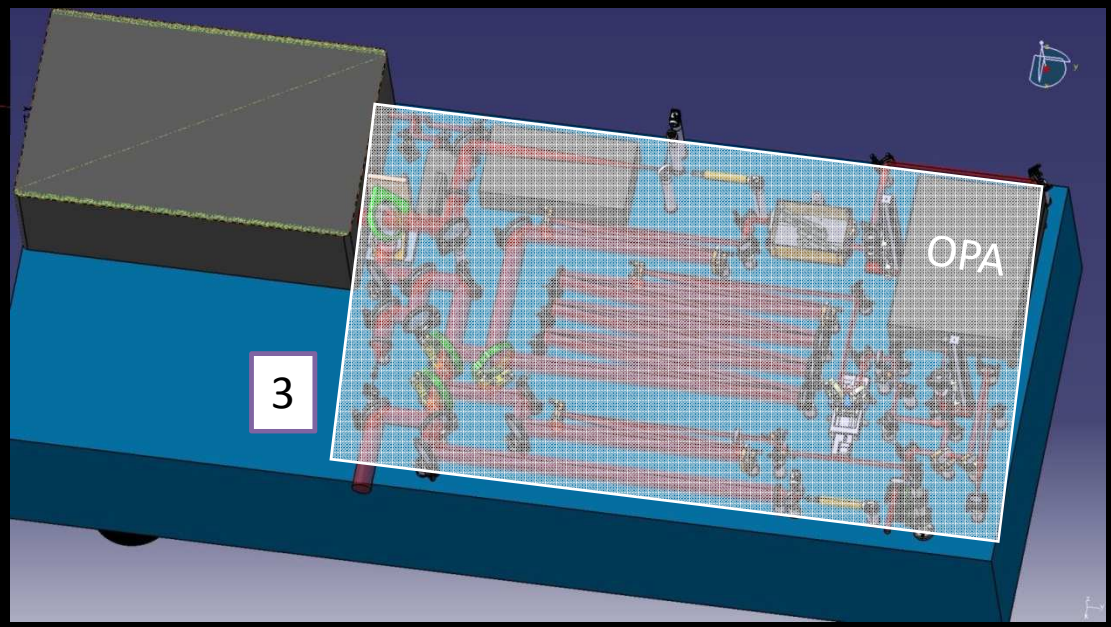


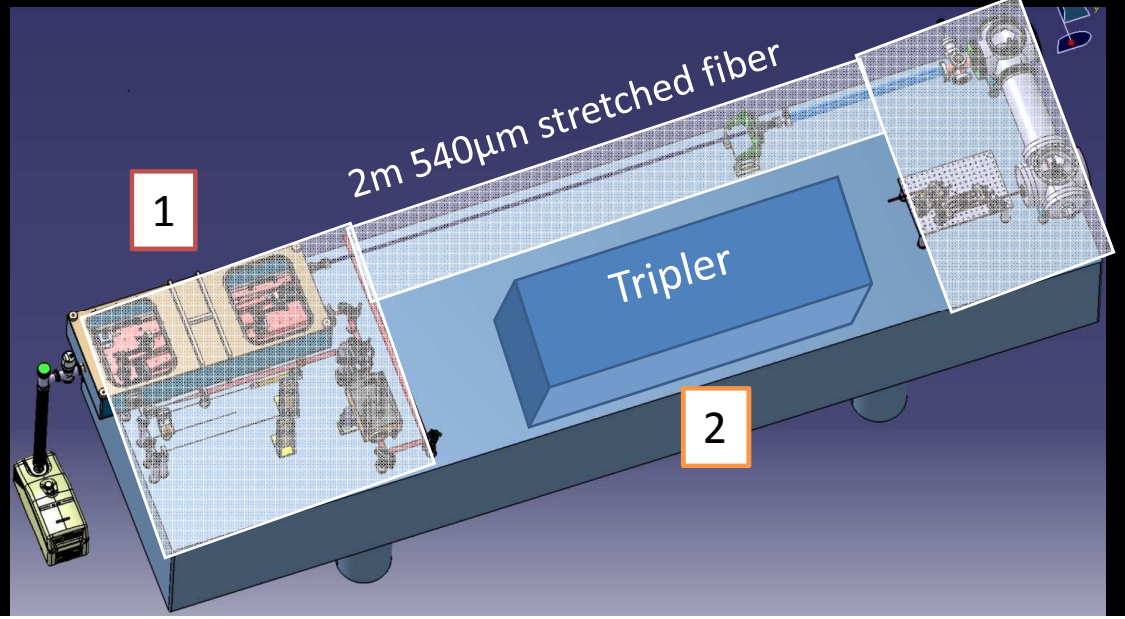
Line 2- 3w
Tripler



Line 1
quasi-monocycle IR pulse

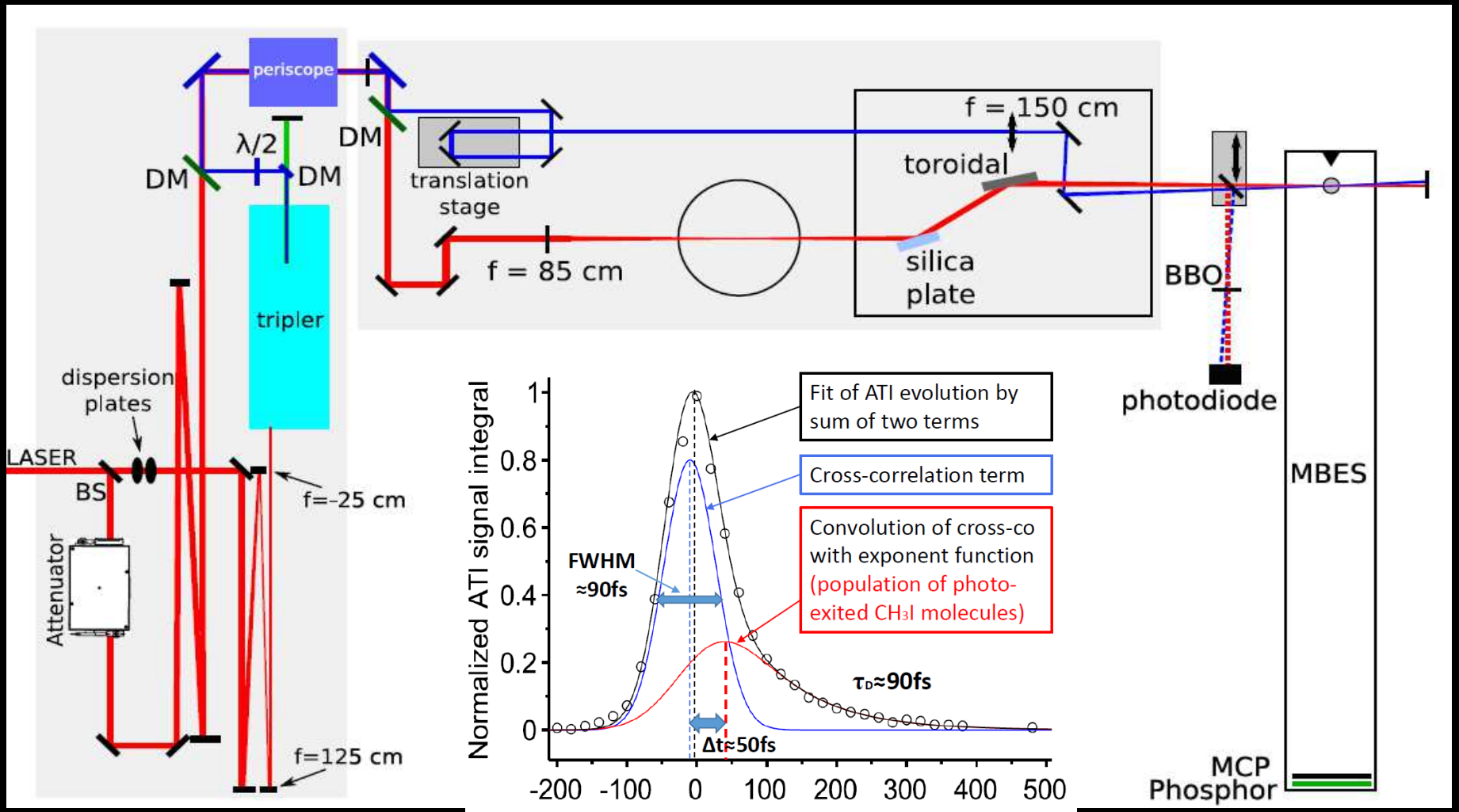






Tripler installation for 3ω+IR/XUV pump-probe studies

O. Gobert et al.

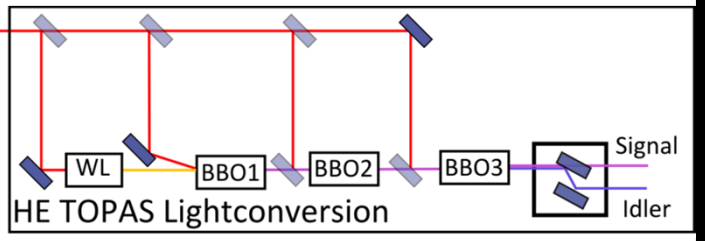


$CH_3I + 3\omega \longrightarrow CH_3I^* \longrightarrow CH_3 + I$

=> M. Lejman talk

Optical Parametric Amplifier

FAB 1
1 kHz
5 mJ

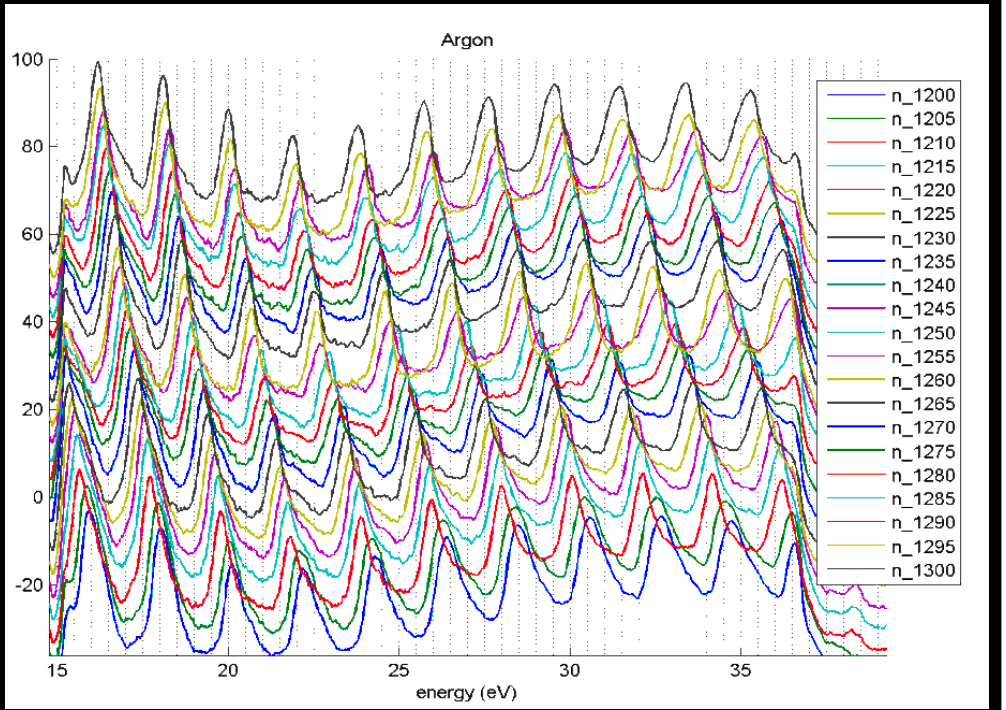


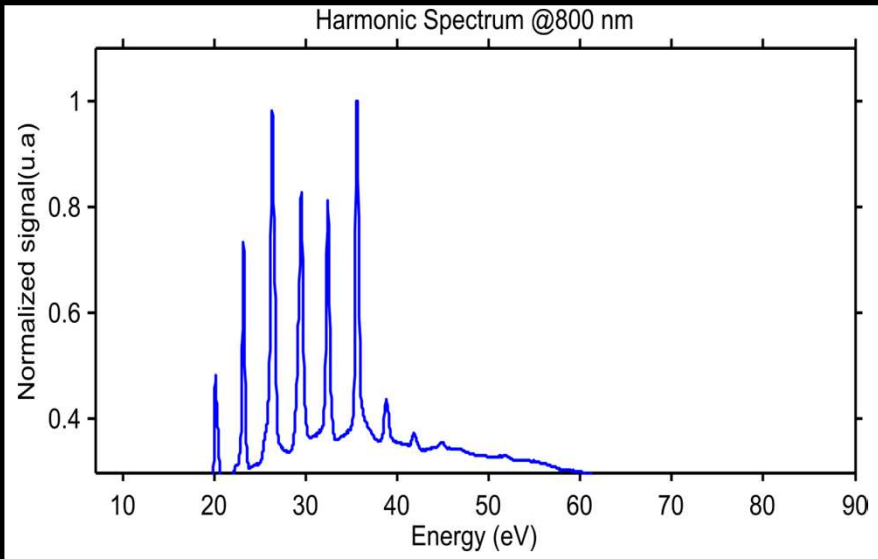
Signal+idler: [1.1-2.2] µm
1 mJ max energy

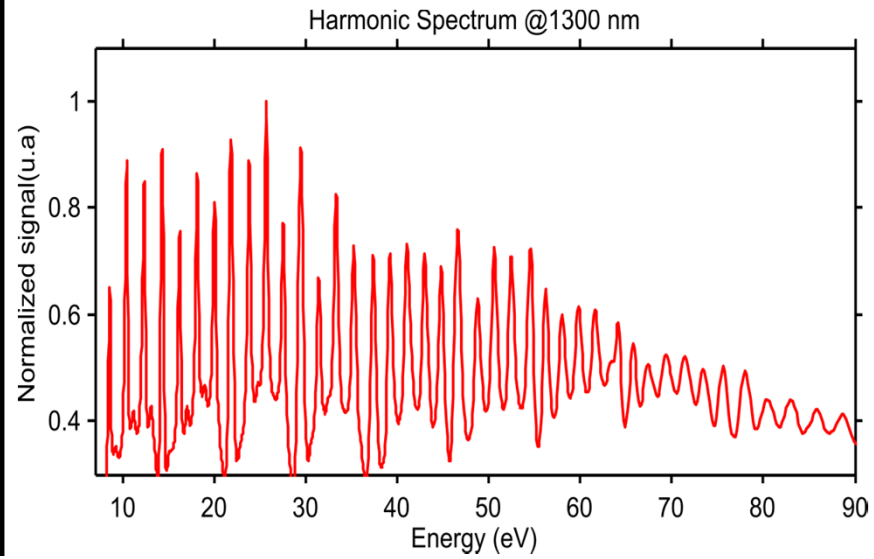
Harmonic spectrum increase:

$h\nu_{cutoff} \sim Ip + \alpha\ I\ \lambda^2$

XUV harmonic tunability: λ

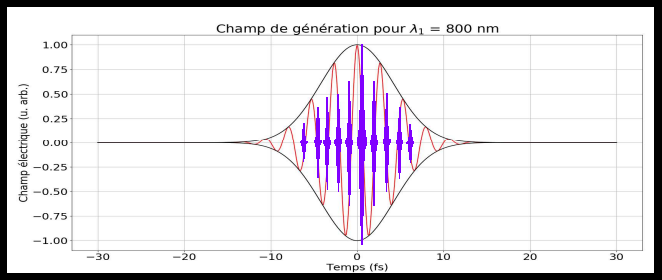






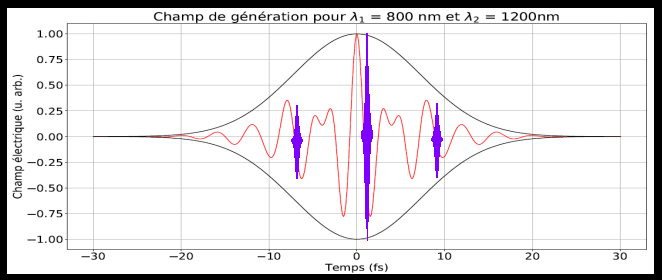
Generation of isolated atto pulses by waveform synthesis

Generation with laser at 800 nm



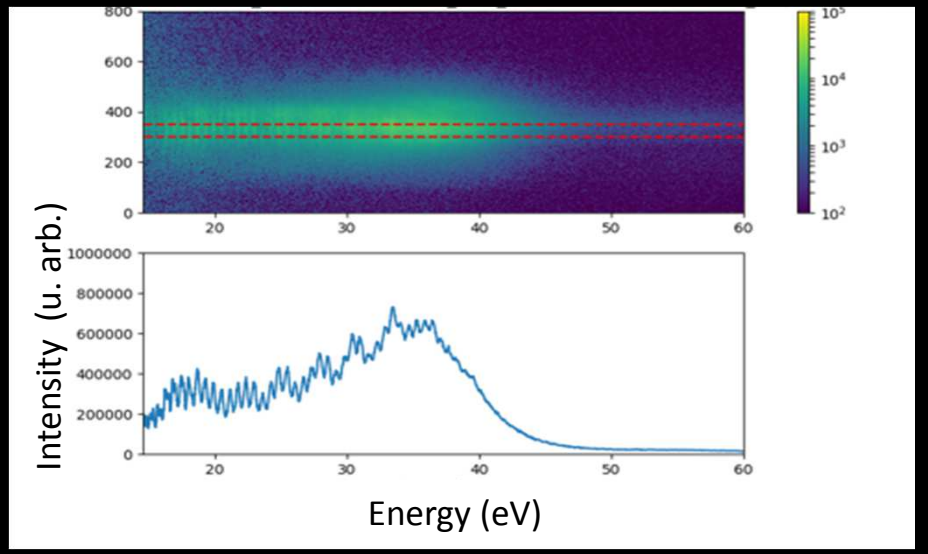
=> 1 atto pulse every ½ cycle: atto pulse train

Generation by frequency mixing of 800 nm with OPA at 1200 nm



=> 1 main atto pulse at the envelope maximum

Spectrum generated by 800+1200 mixing (data of 2018)



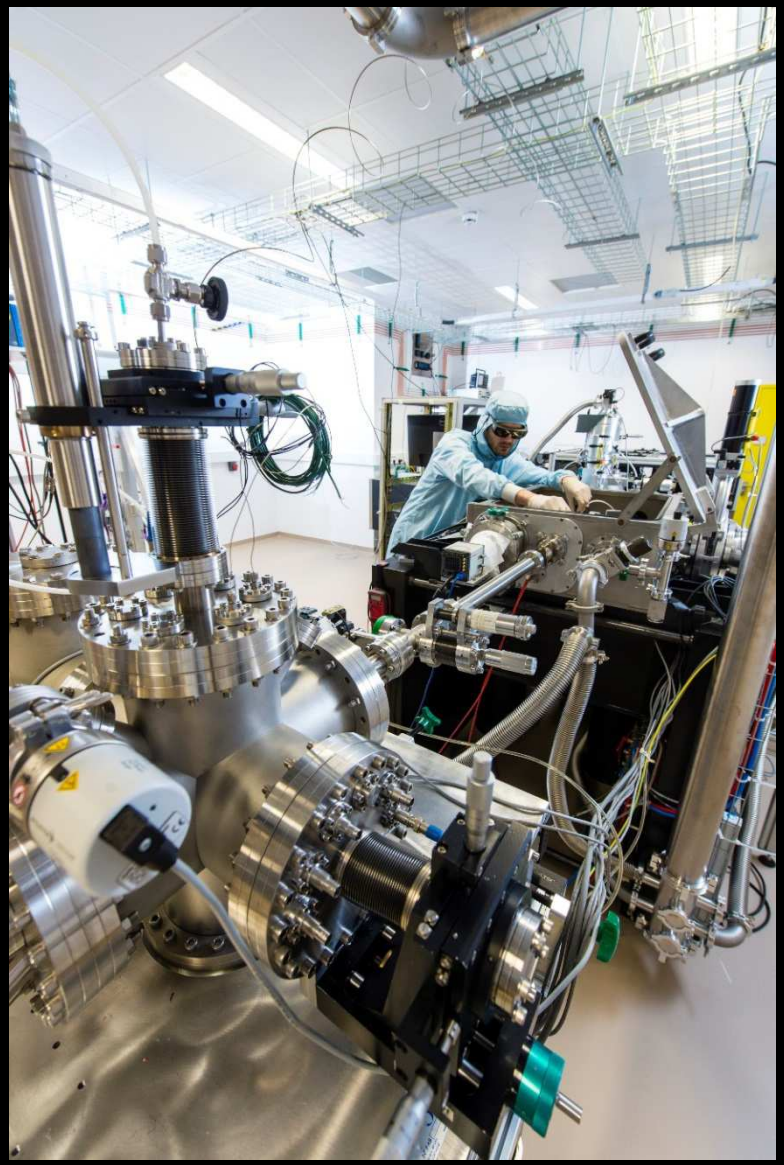
=> Fast beatings at low energies: new period ~9 fs due to secondary

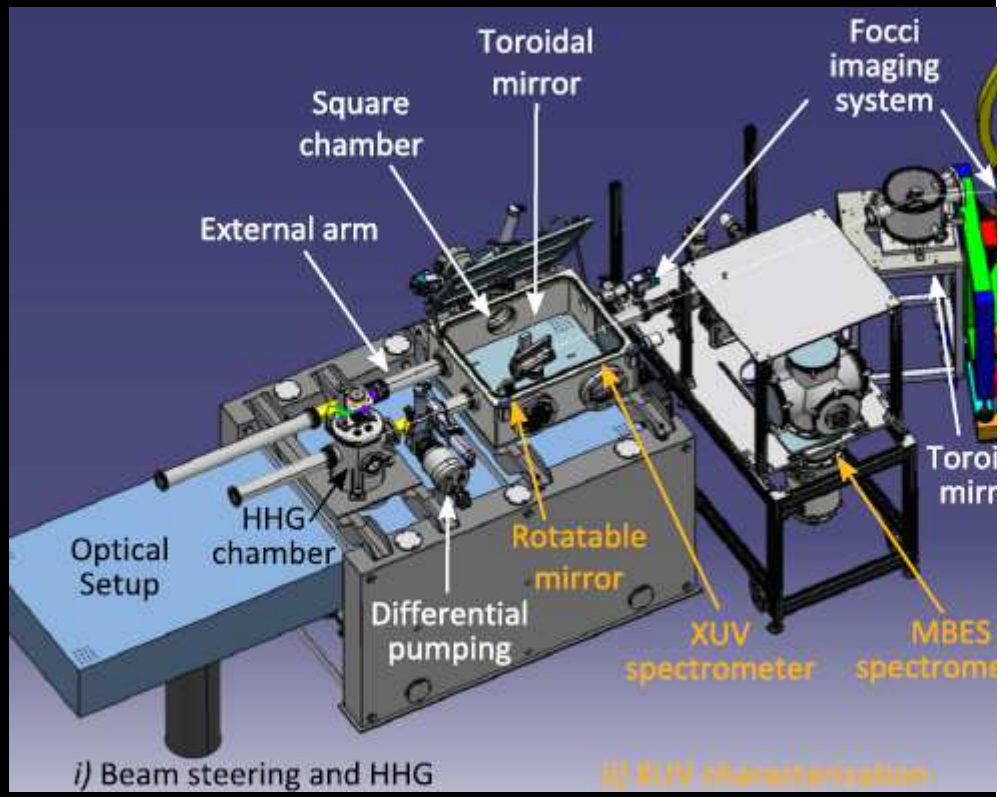
=> Continuum at high energies: **suggests an isolated pulse**

Future work:

- Stabilization the OPA-laser delay and laser CEP
- Temporal characterization of the generated pulses

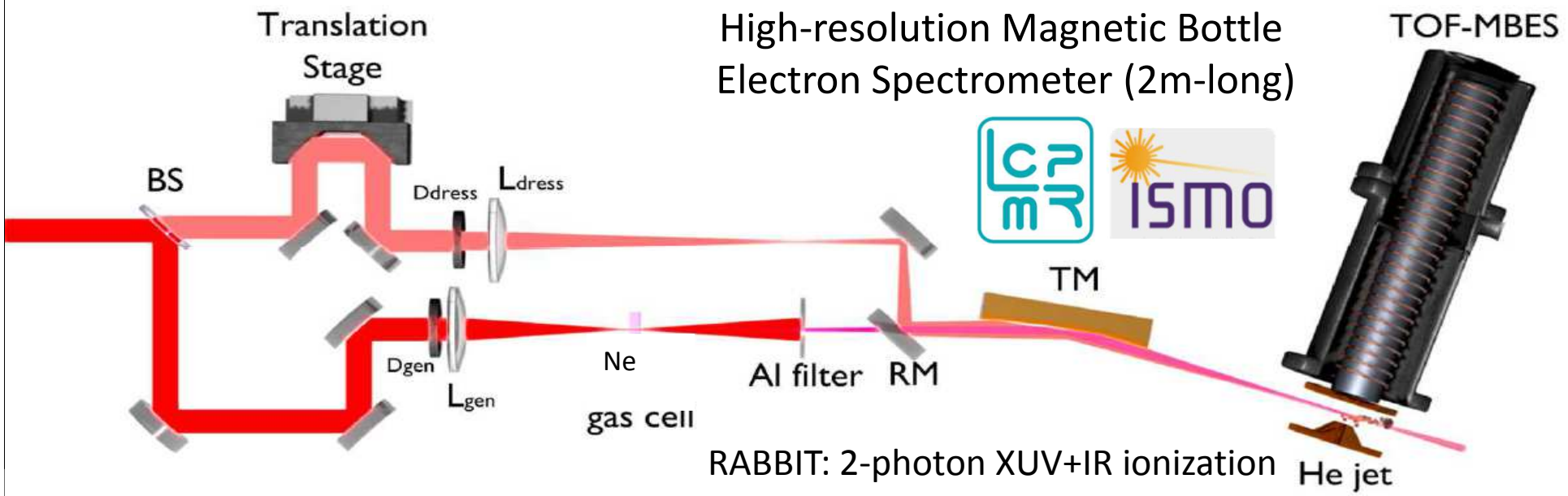
Block 2: Generation of XUV attosecond radiation





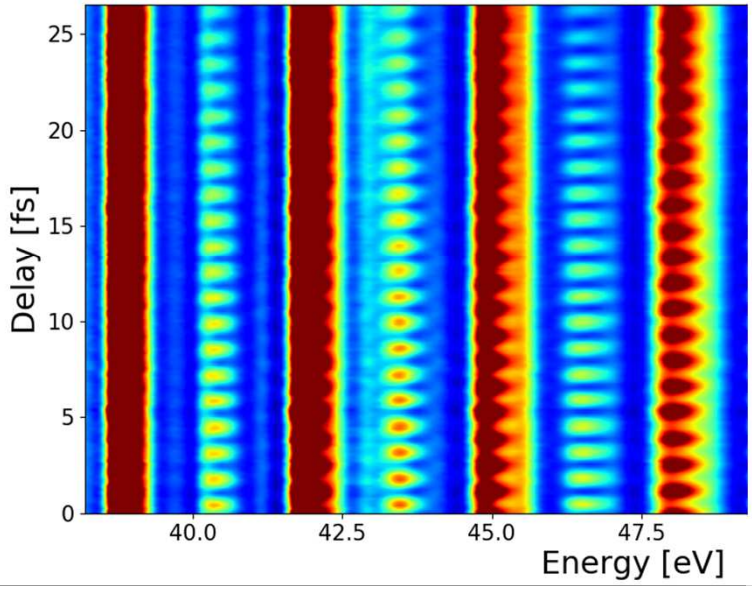
Operational in February 2017 with spectral and temporal characterization

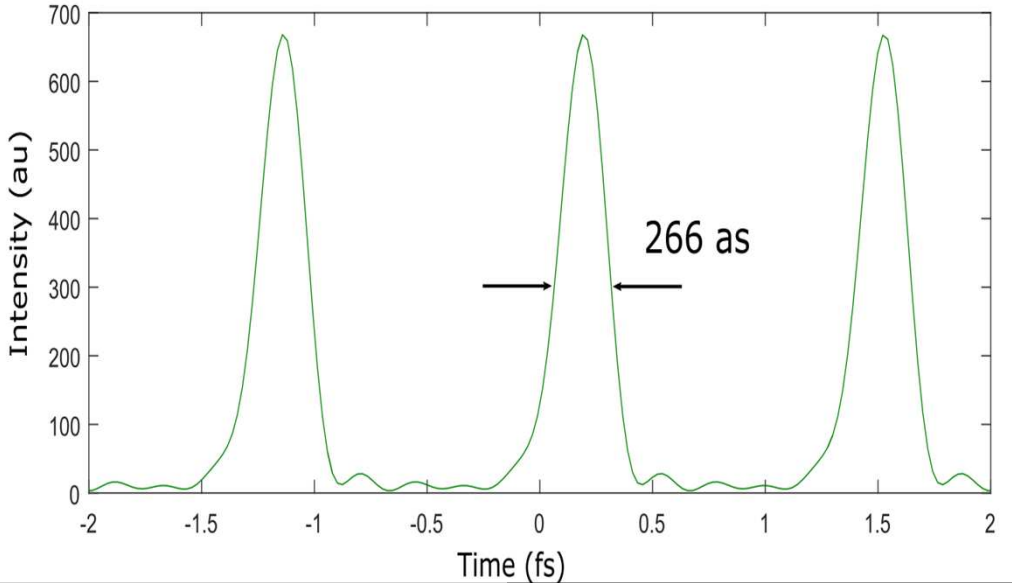
Block 3: Temporal characterization with RABBIT



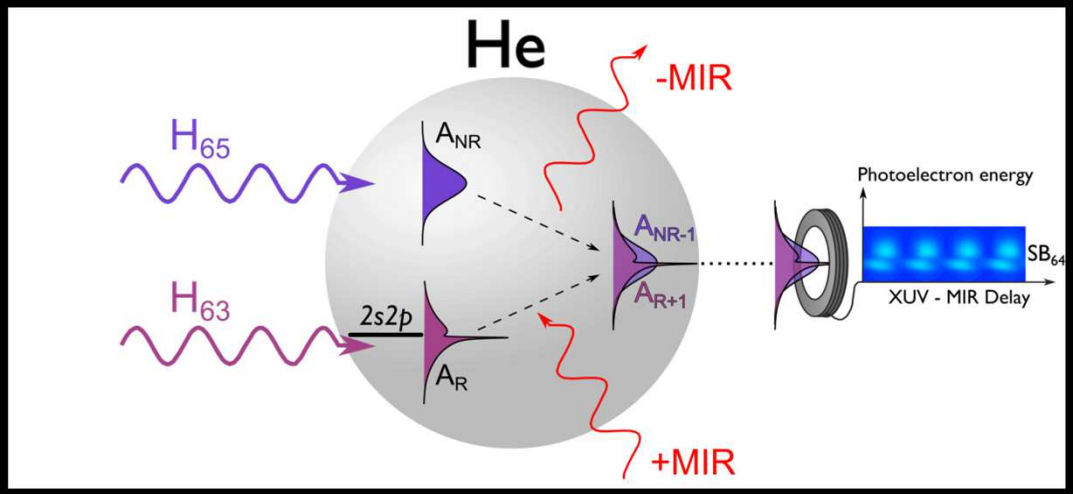
High-resolution Magnetic Bottle Electron Spectrometer (2m-long)

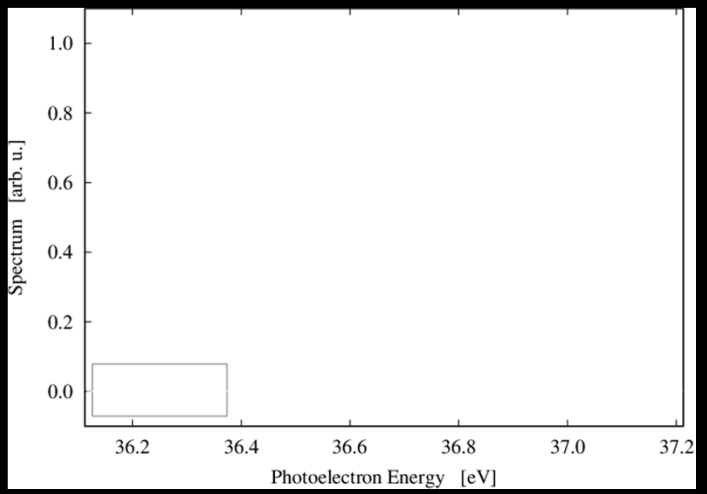
RABBIT: 2-photon XUV+IR ionization





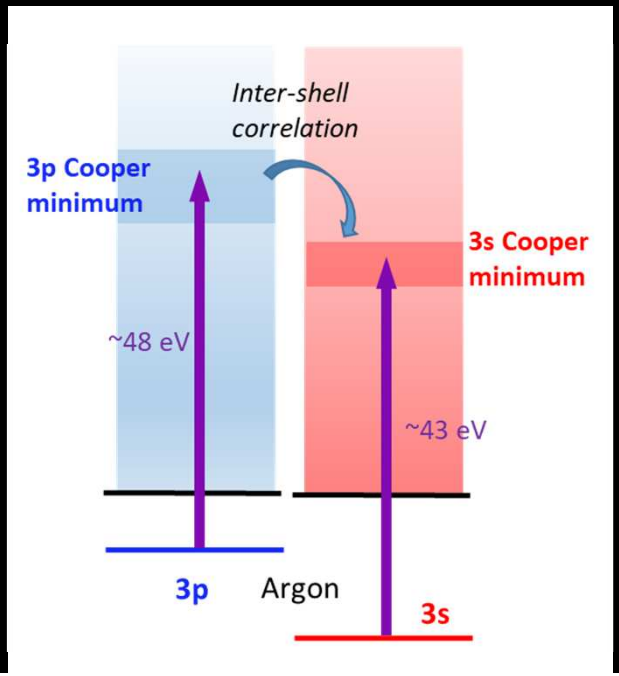
Block 3: Attosecond spectroscopy

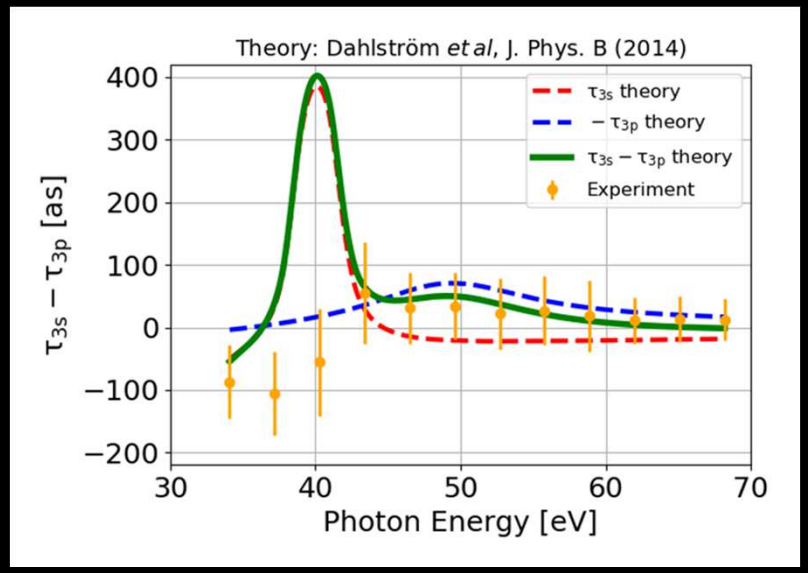




Rainbow RABBIT => Reconstruction of the resonance buildup with attosecond resolution

V. Gruson, et al. Science (2016)

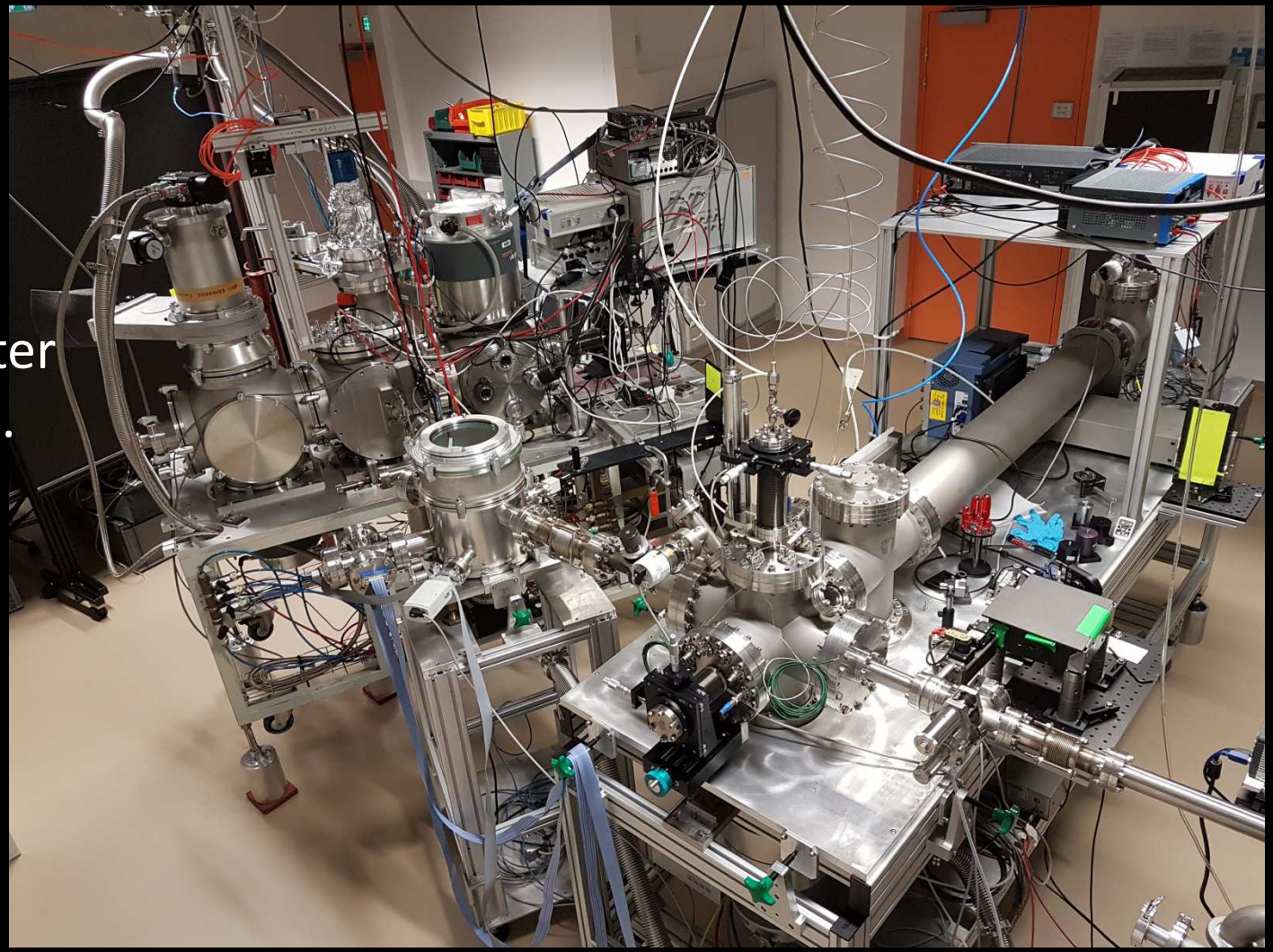




=> D. Platzer talk

Block 4: User endstation

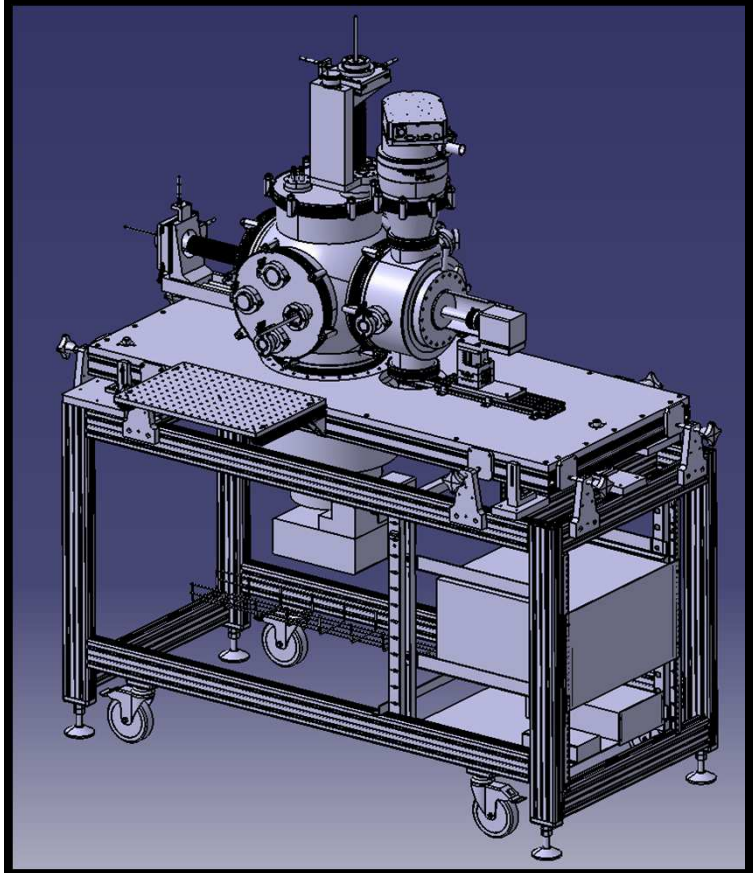
VMI spectrometer
L. Poisson et al.



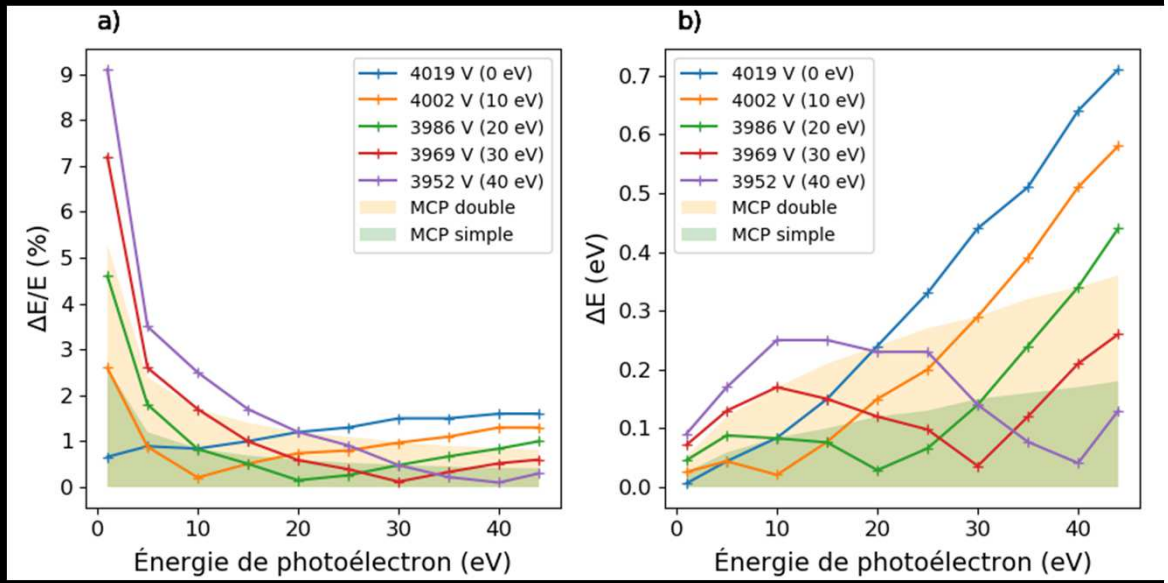
Measurement of angularly-resolved attosecond photoionization delays

Block 4: Development of a high resolution VMI

D. Platzer, C. Pothier, L. Poisson and P. Salières



New lens design



- Up to 50 eV photoelectron energy
- High resolution in order to perform Rainbow Rabbit

FAB1 XUV: A high-energy flexible atto beamline

=> Many possibilities of spectro-temporal shaping

=> pump-probe spectroscopy using MIR/IR/UV/XUV photons

=> multi-beam experiments: alignment/excitation/probe