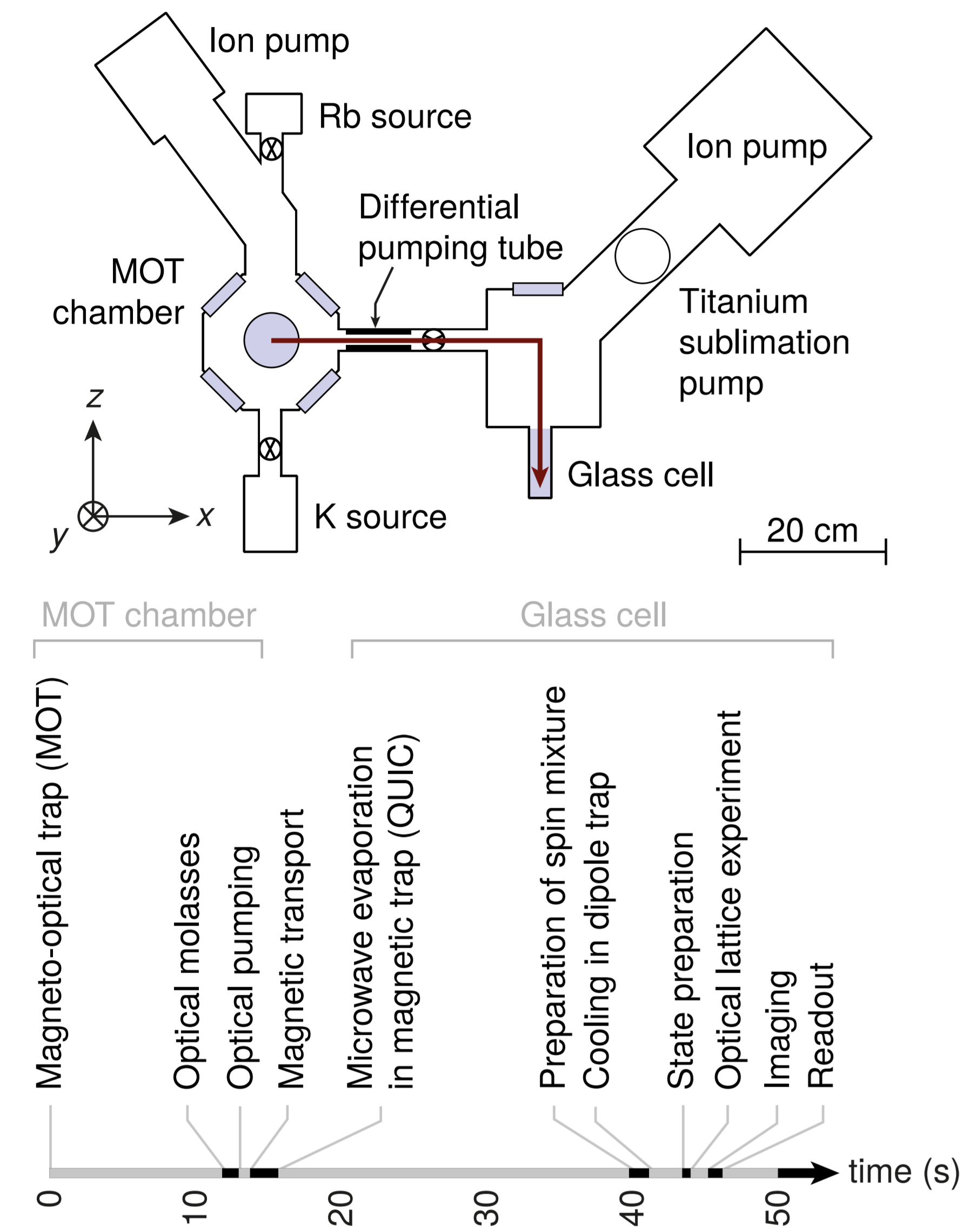


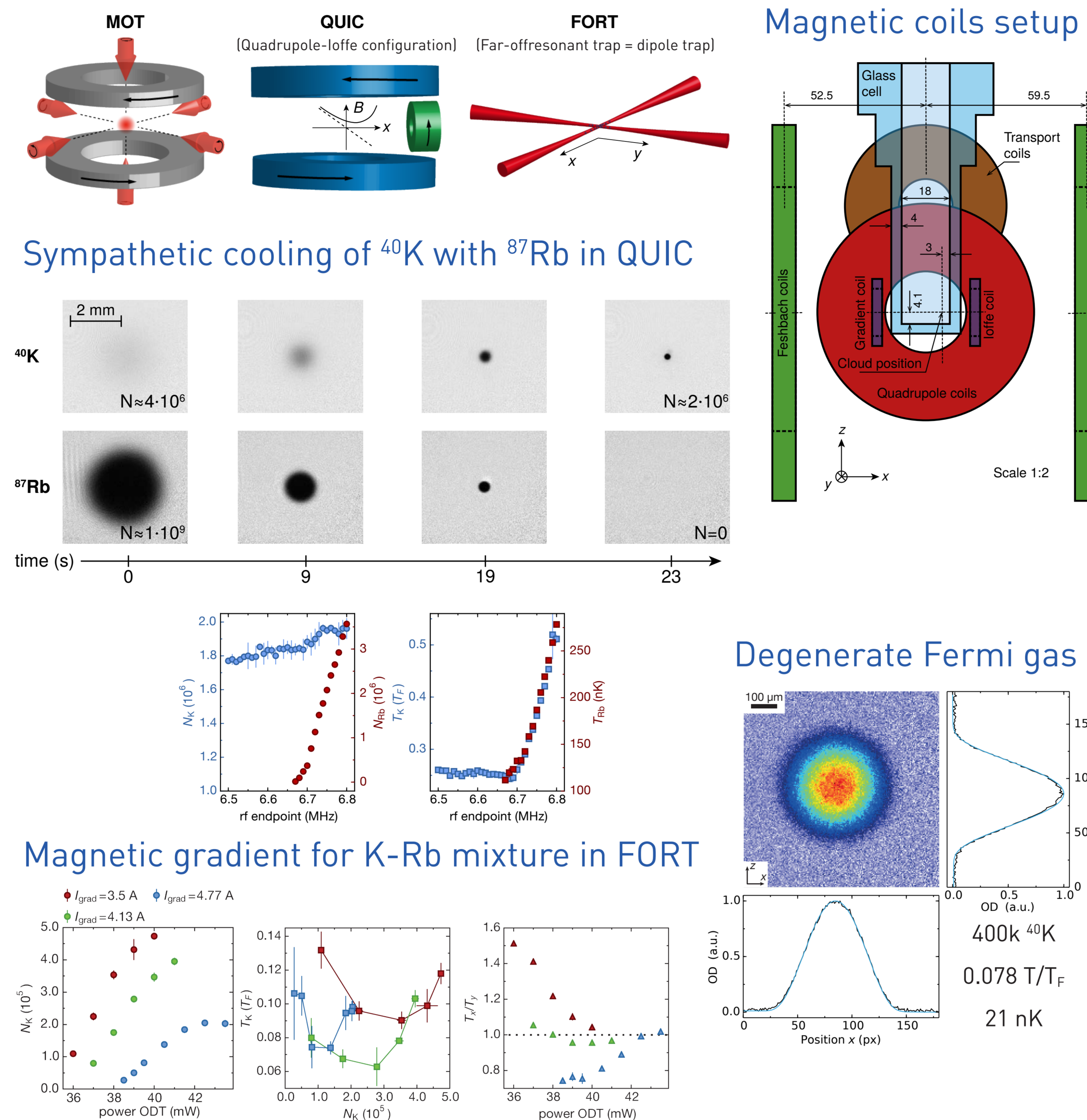
# Strongly-correlated fermions in optical lattices - apparatus

Lattice team: Kilian Sandholzer, Joaquín Minguzzi, Anne-Sophie Walter, Konrad Viebahn, and Tilman Esslinger  
 Institute for Quantum Electronics, ETH Zurich

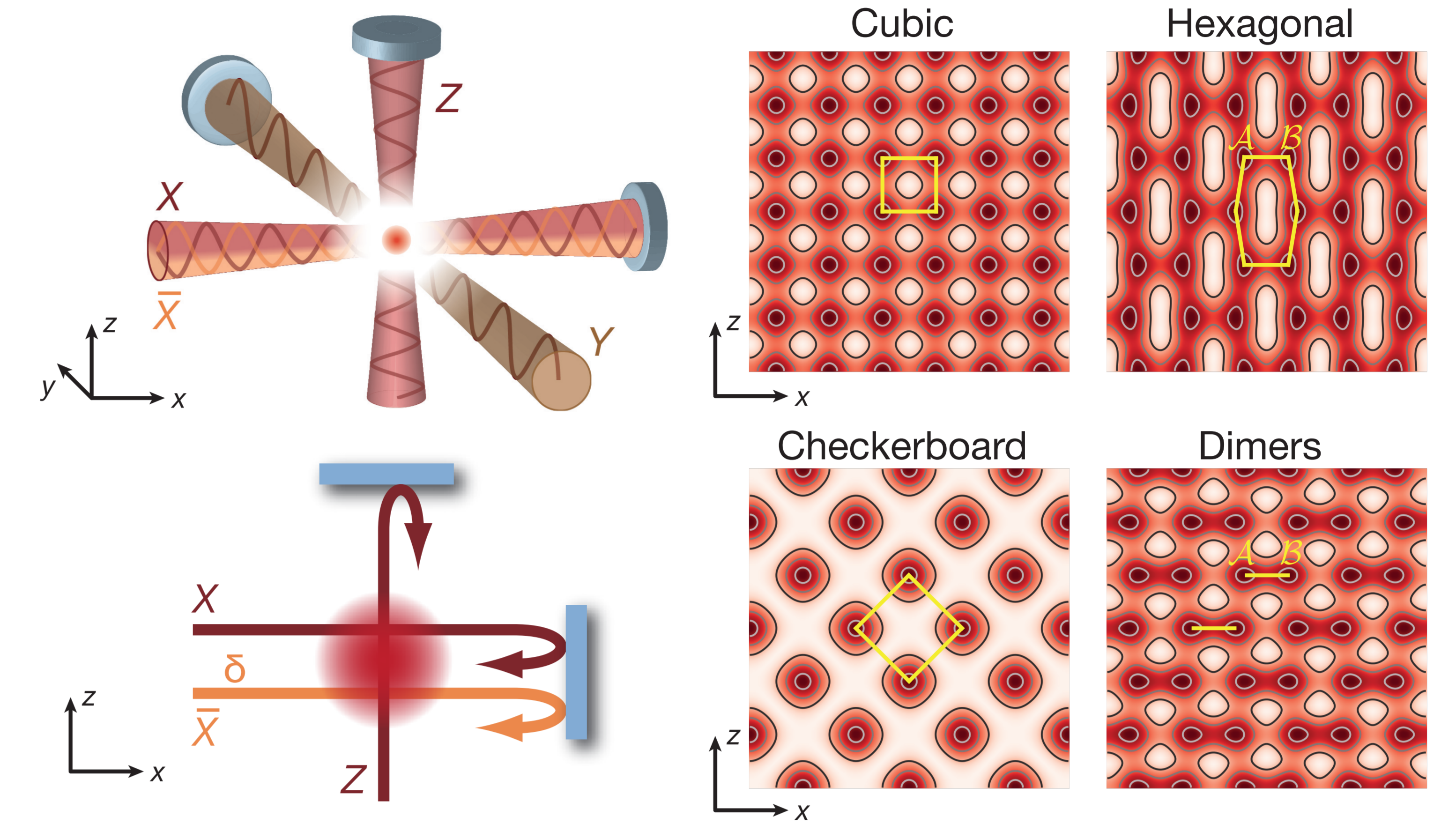
## Apparatus and sequence overview



## Ultracold <sup>40</sup>K and <sup>87</sup>Rb



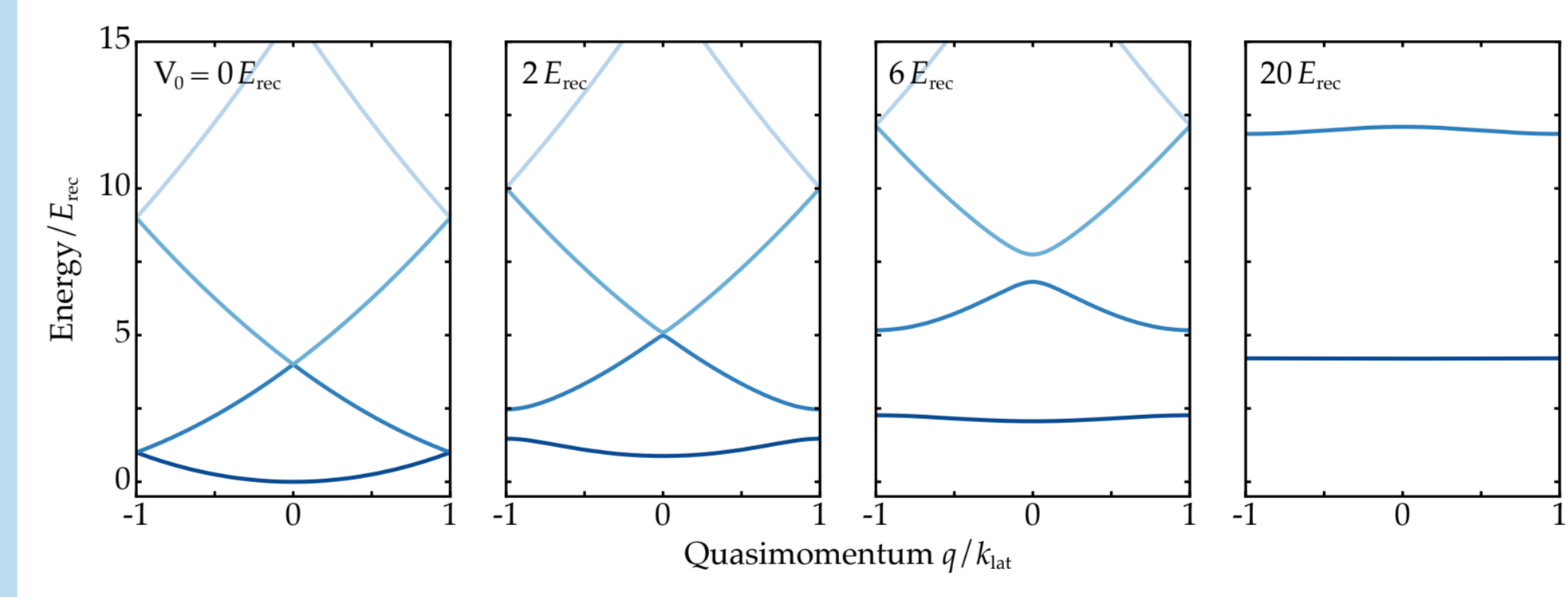
## Optical lattice with tuneable geometry



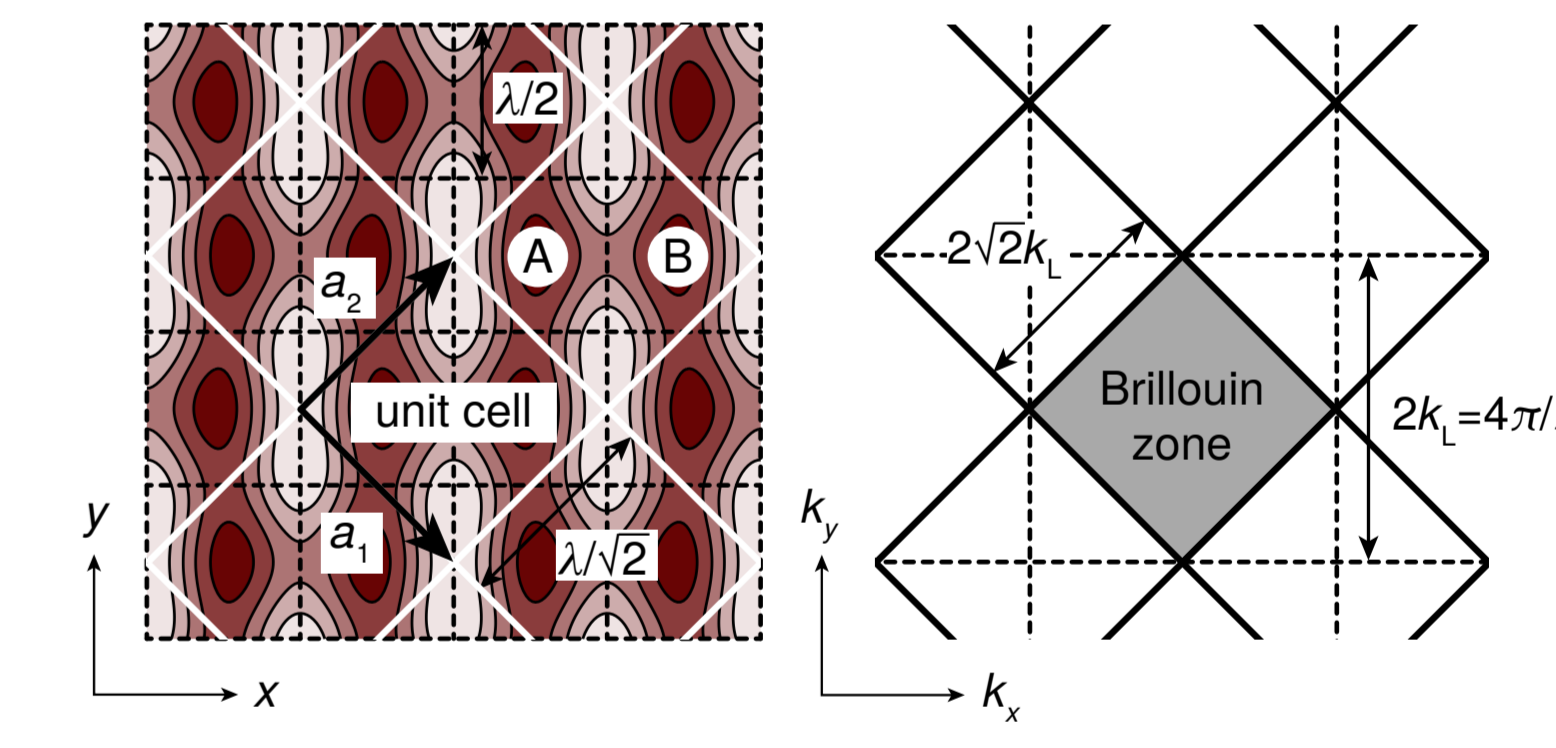
Potential  $V_{\text{lat}}(x, y, z) = -V_X \cos^2(kx + \theta/2) - V_X \cos^2(kx) - V_Y \cos^2(ky) - V_Z \cos^2(kz) - 2\alpha \sqrt{V_X V_Z} \cos(kx) \cos(kz) \cos(\varphi)$

$\theta =$  symmetry phase  
 $\varphi =$  superlattice phase

## Optical lattice: 1D bandstructure



## 2D unit cell and Brillouin zone

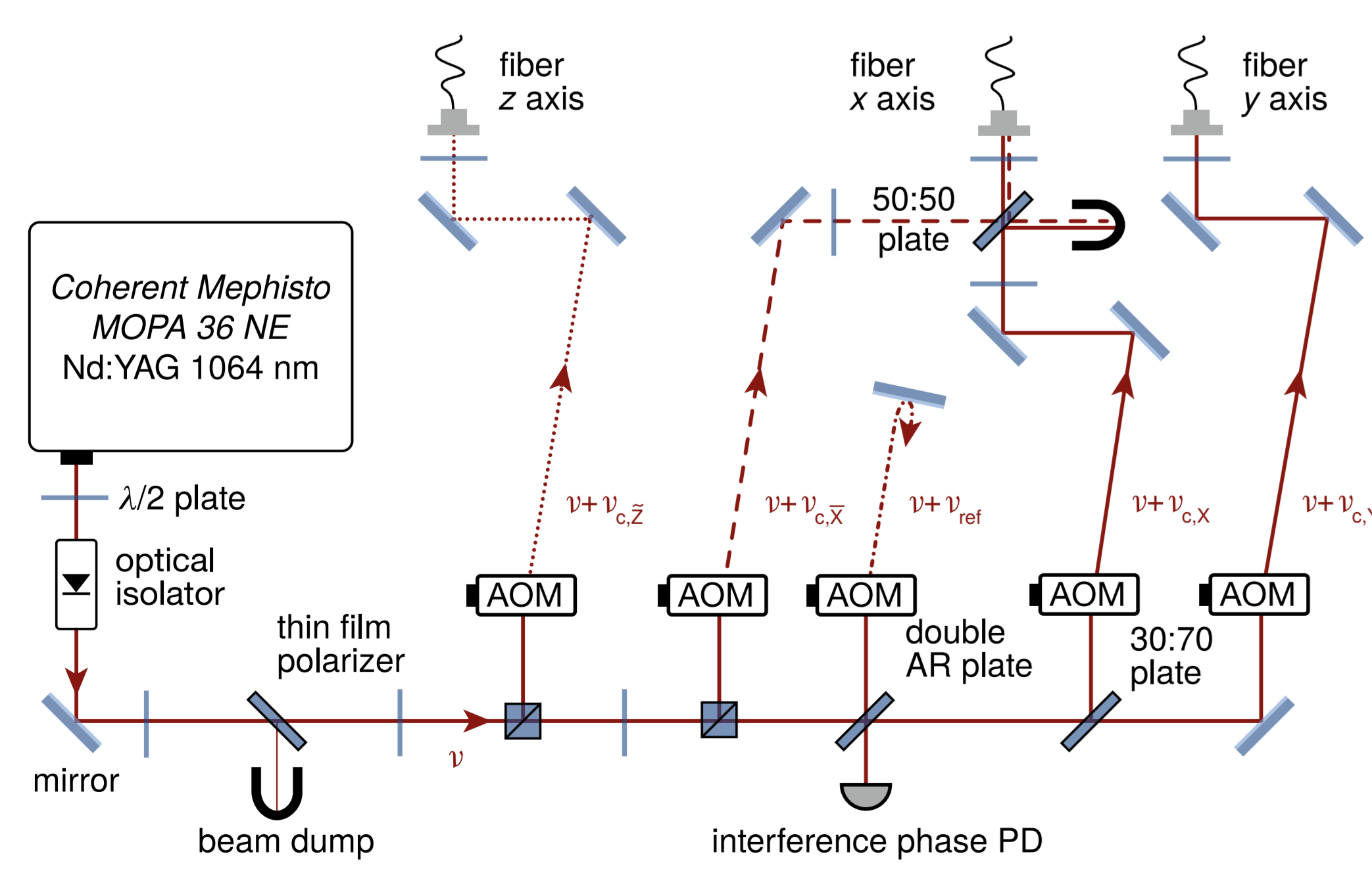


## Team members 2001-2016

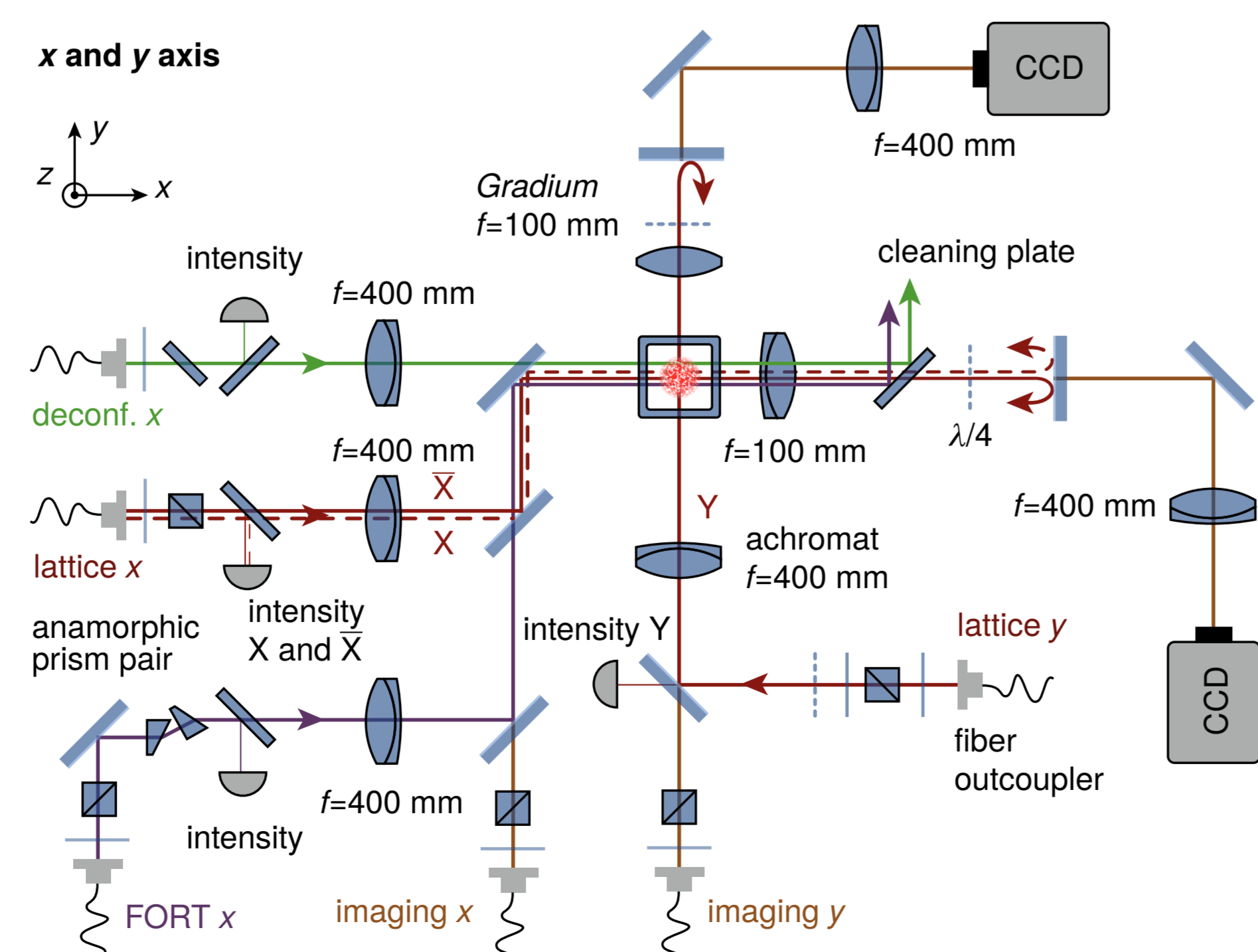
Thilo Stöferle, Henning Moritz, Michael Köhl, Christian Schori, Kenneth Günter, Niels Strohmaier, Robert Jördens, Leticia Tarruell, Daniel Greif, Thomas Uehlinger, Gregor Jotzu, Michael Messer, Rémi Desbuquois, Frederik Görg

## Interferometer setup for superlattice

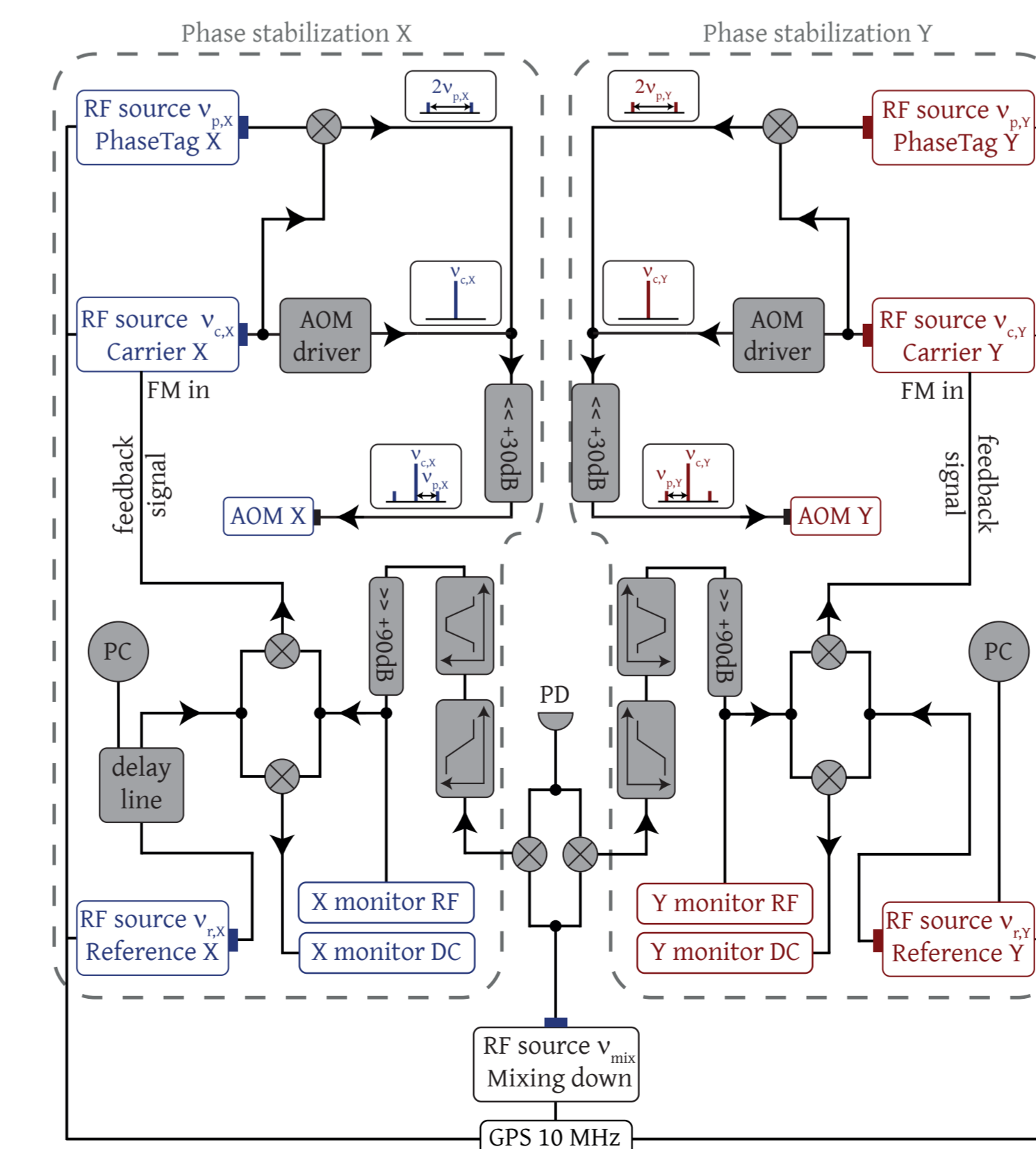
### Superlattice: optical setup on laser table



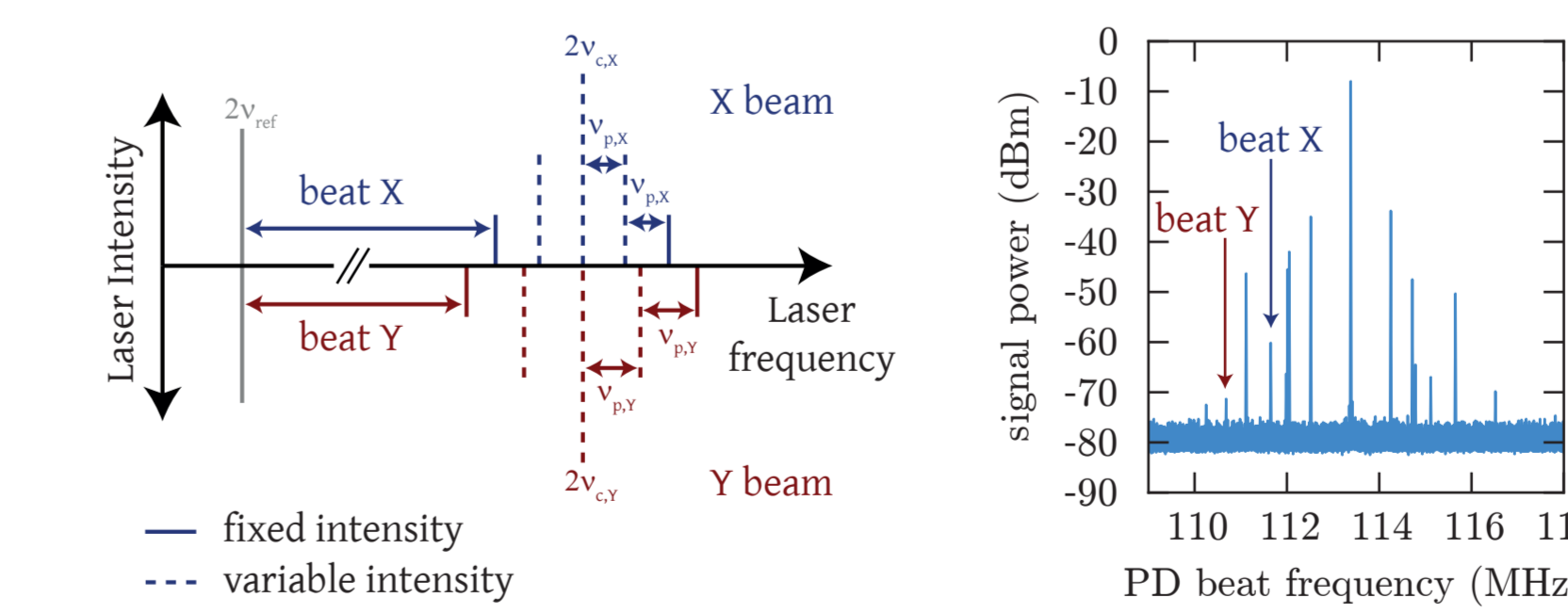
### Optical setup on experiment table



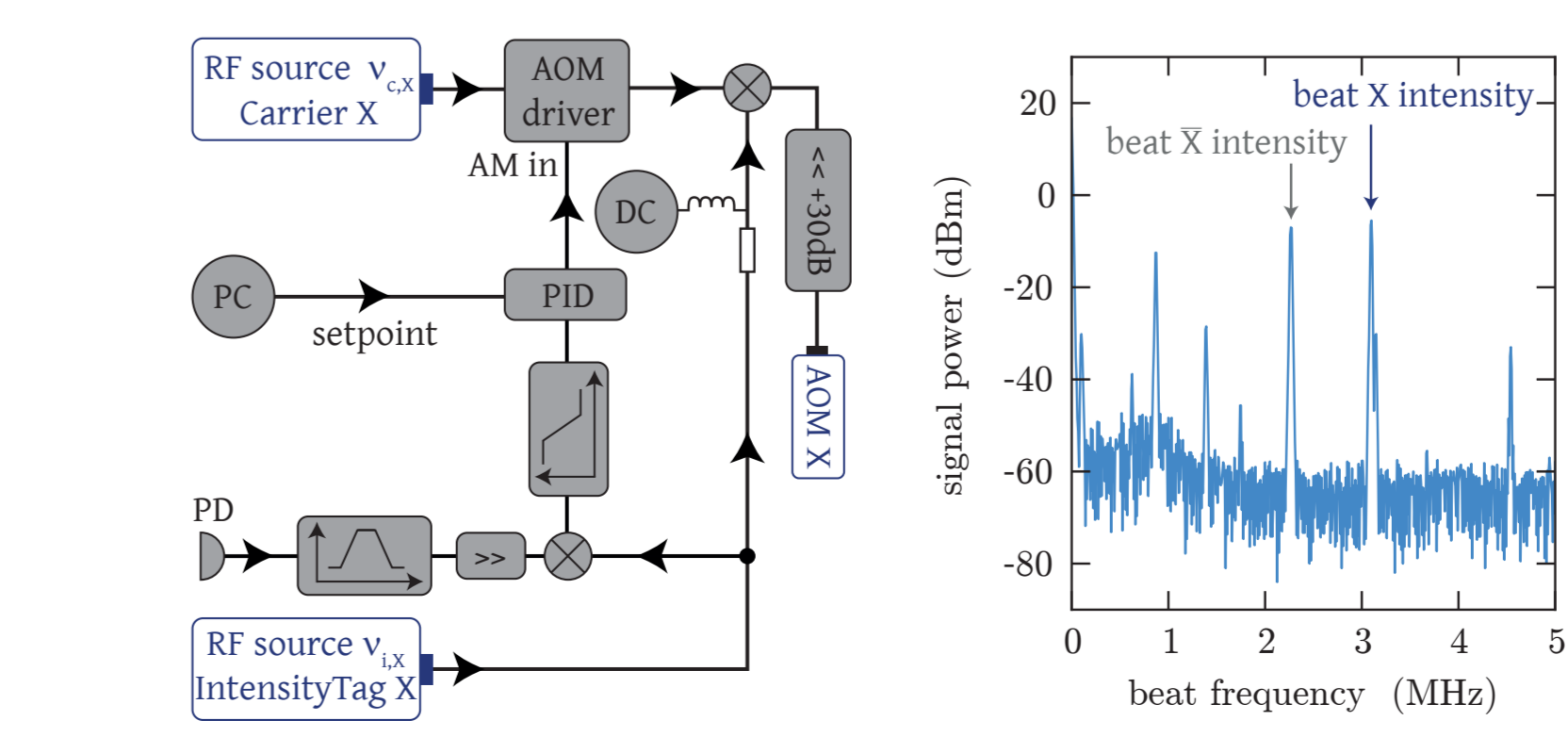
### Phase lock: RF electronics



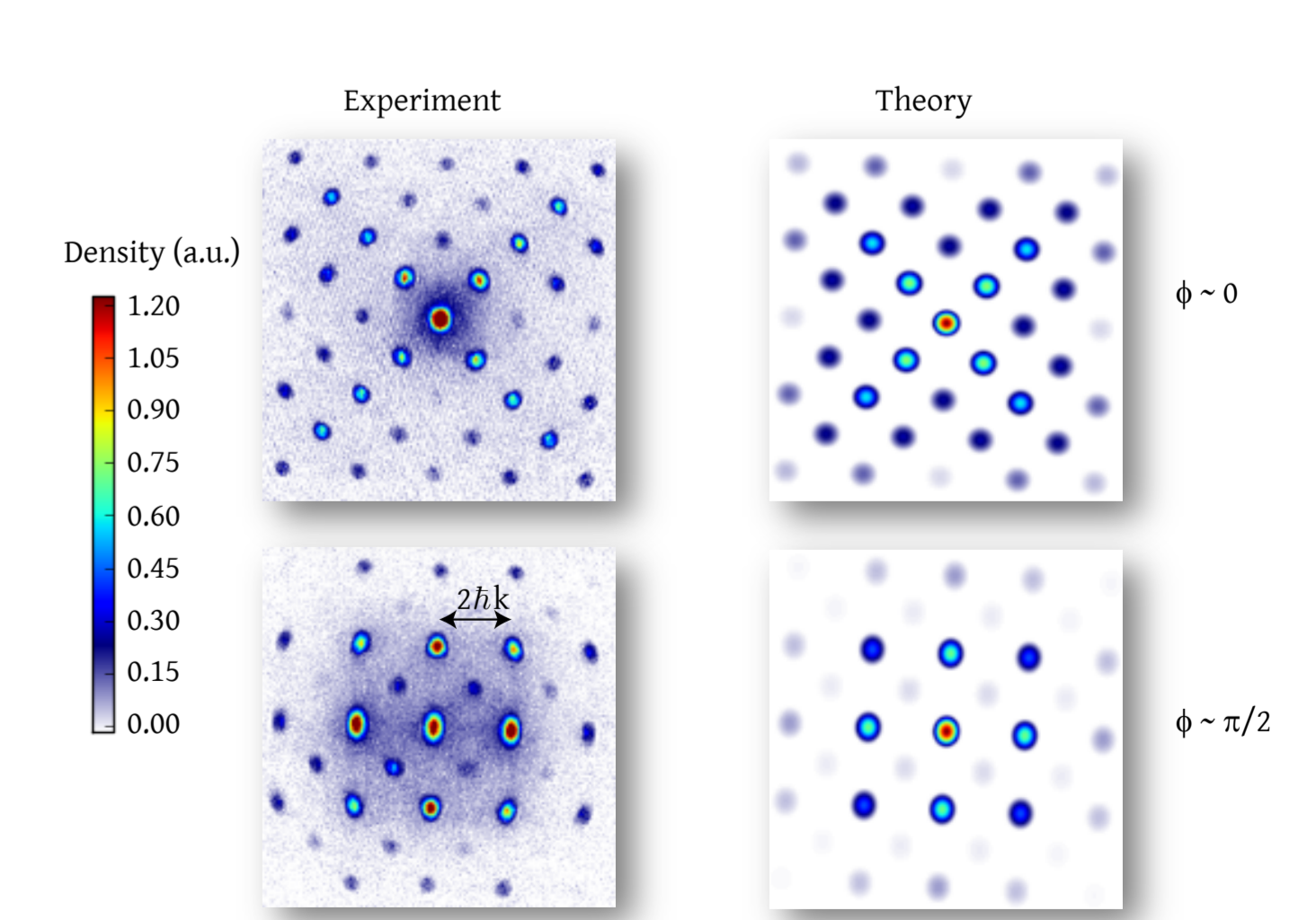
### Beat notes on photodiode



### Intensity stabilisation



### Superlattice phase calibration



Raman-Nath/Kapitza-Dirac diffraction on <sup>87</sup>Rb BEC