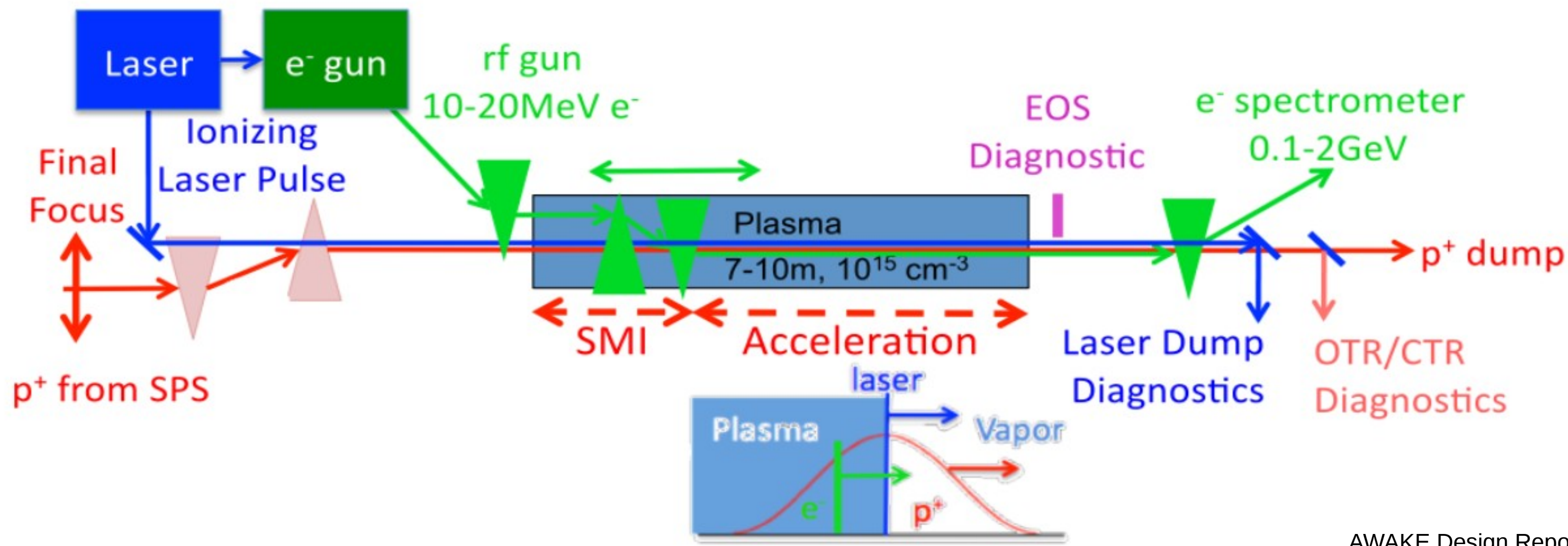


Advanced Wakefield Experiment (AWAKE) at CERN

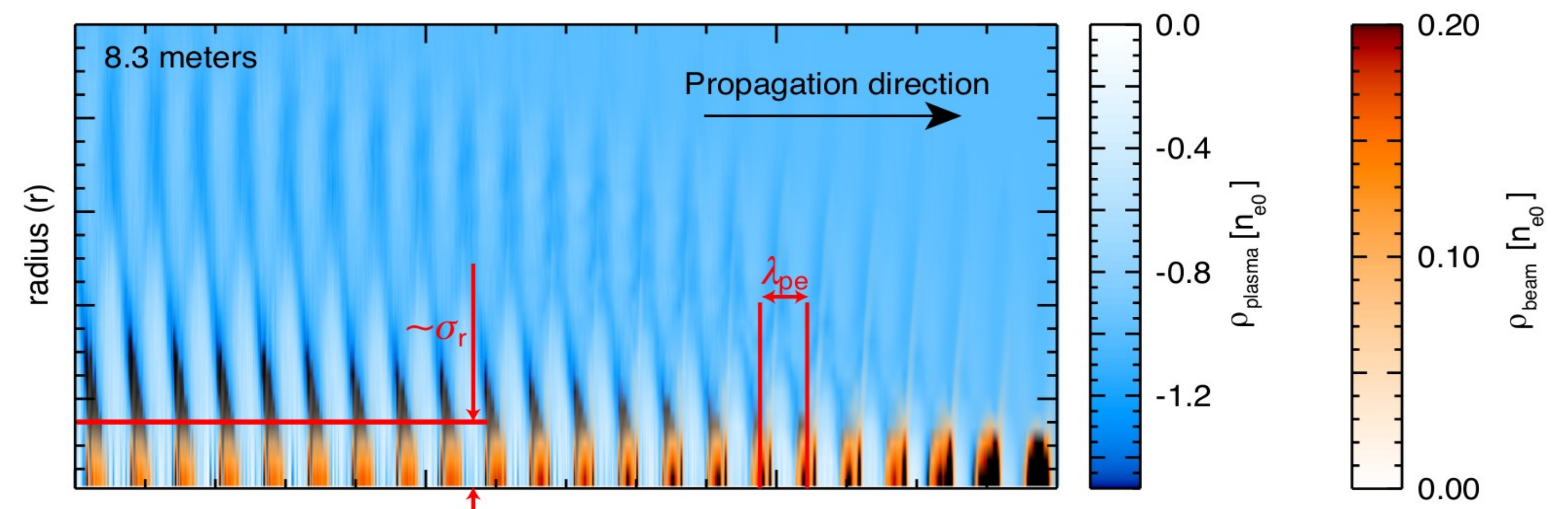


AWAKE Design Report

Plasma based Acceleration

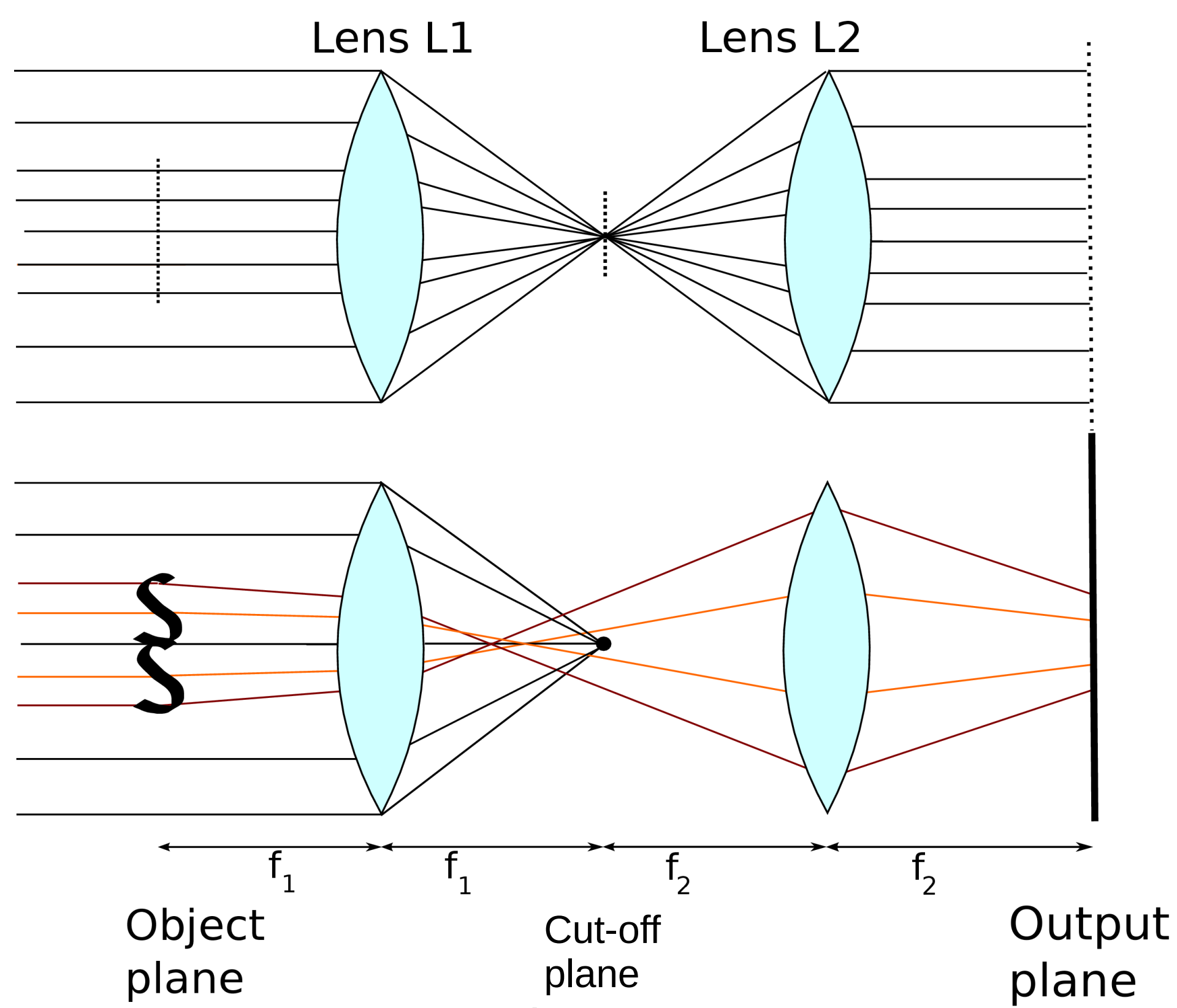
- Proton beam propagates through the Rubidium Plasma
- Co-propagating laser seeds self-modulation instability (SMI) → Generation of the Wakefield
- Acceleration of injected electrons

Formation of Micro Bunches through SMI



AWAKE Design Report

Schlieren Imaging

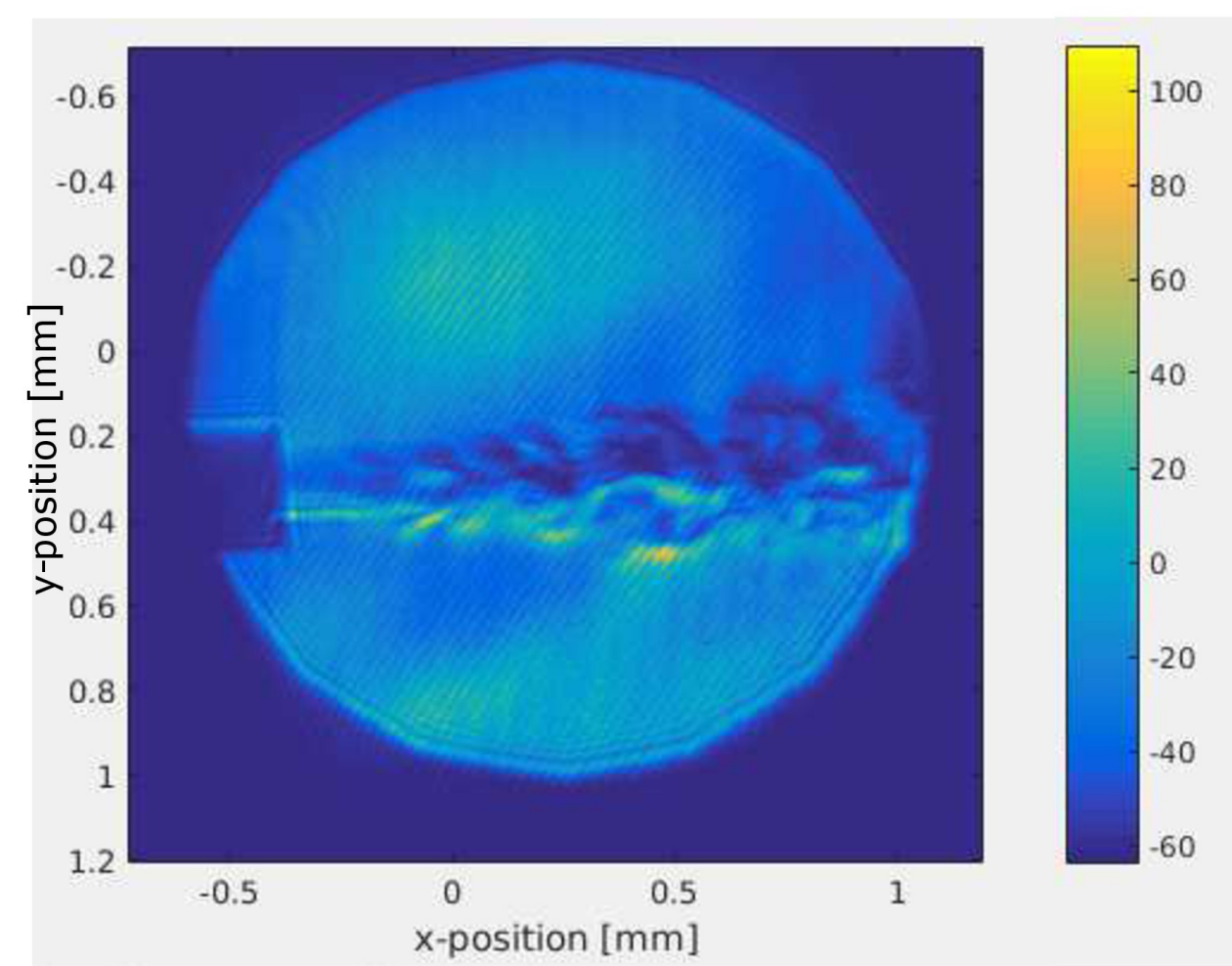


Basic Principle

- Blocking of non-deflected rays
- Imaging of deflected rays

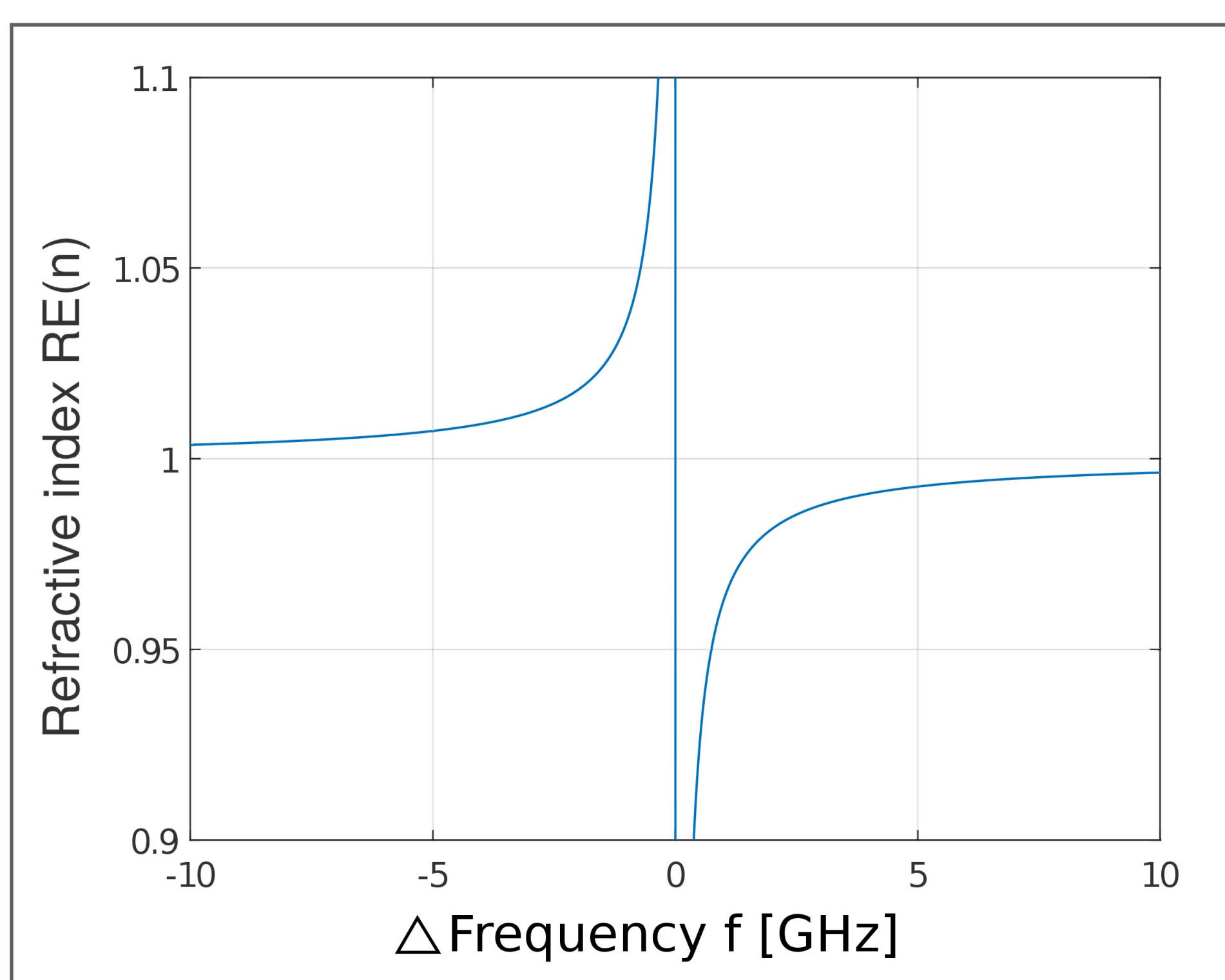
Visualization of Density Perturbations

Imaging transparent objects by making the strength of bending visible using Schlieren imaging



Plasma Radius Measurement

Refractive Index of Rb close to Transition Line D2



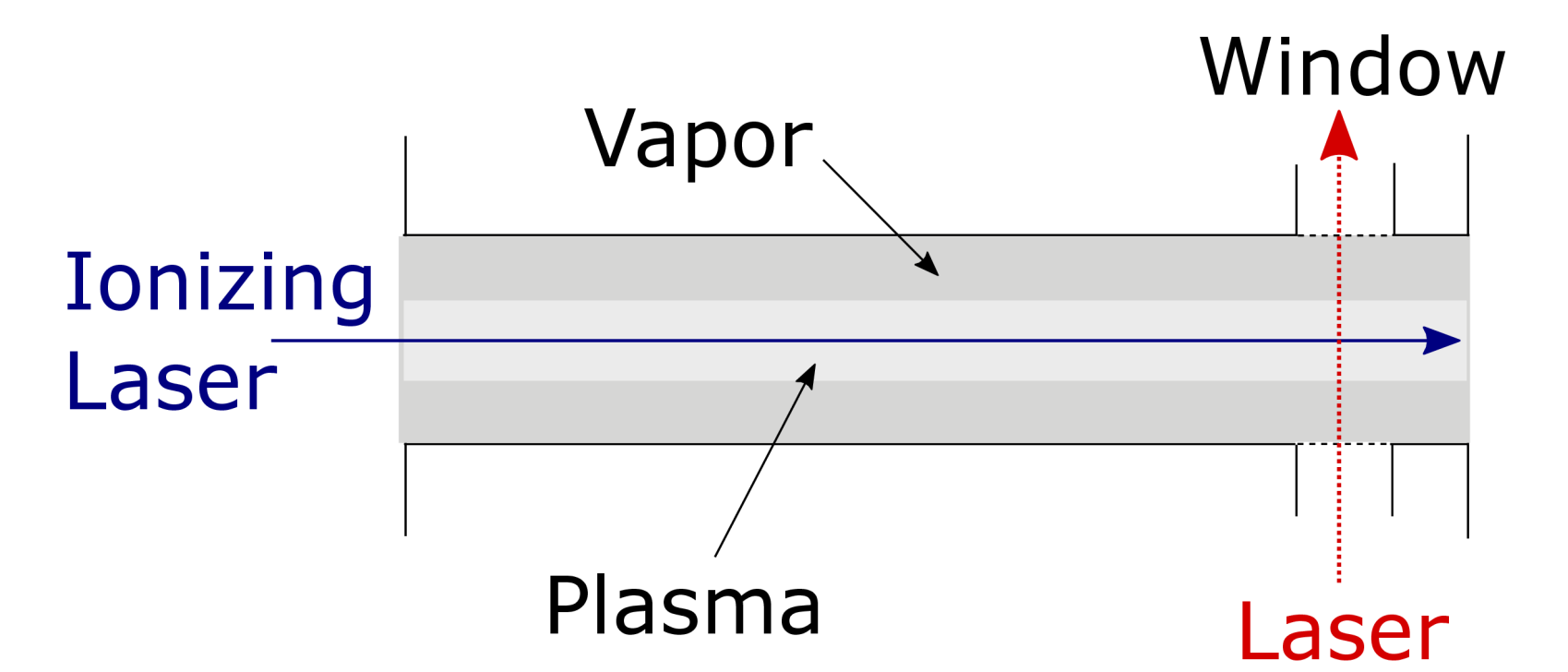
Difference in refractive index determines the strength of bending of the rays

- for vapor

$$RE \left(\sqrt{1 + \frac{N_i(r) e^2}{\epsilon_0 m_e} \sum_{j \neq i} \frac{f_{ij}}{(\omega_{ij}^2 - \omega^2 - \frac{i\omega}{\tau_{ij}})}} \right)$$
- for plasma

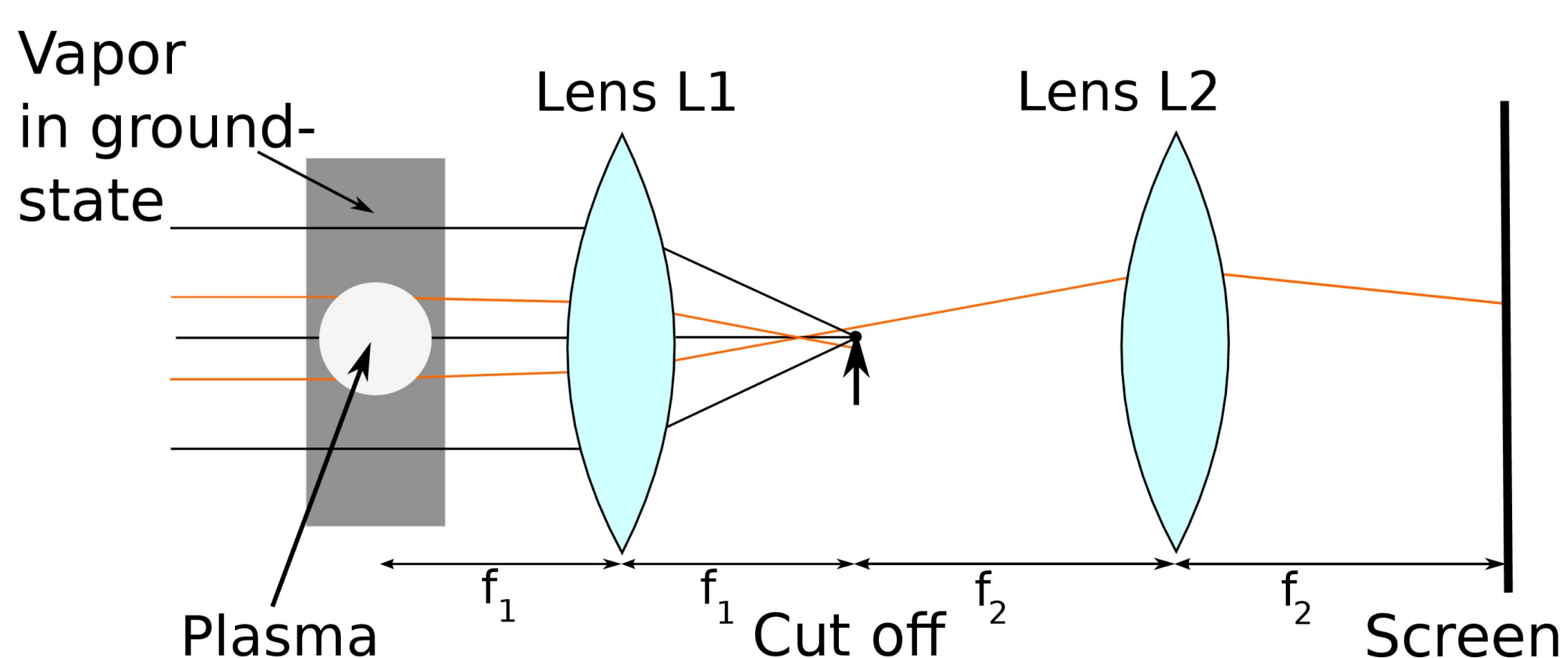
$$n = \sqrt{1 - \frac{\omega_{pe}^2}{\omega^2}}$$

10m Plasma Cell at CERN



- Ionizing laser (blue): Creates Rb plasma in the cell's center
- Imaging laser (red): Transverse image of the plasma column

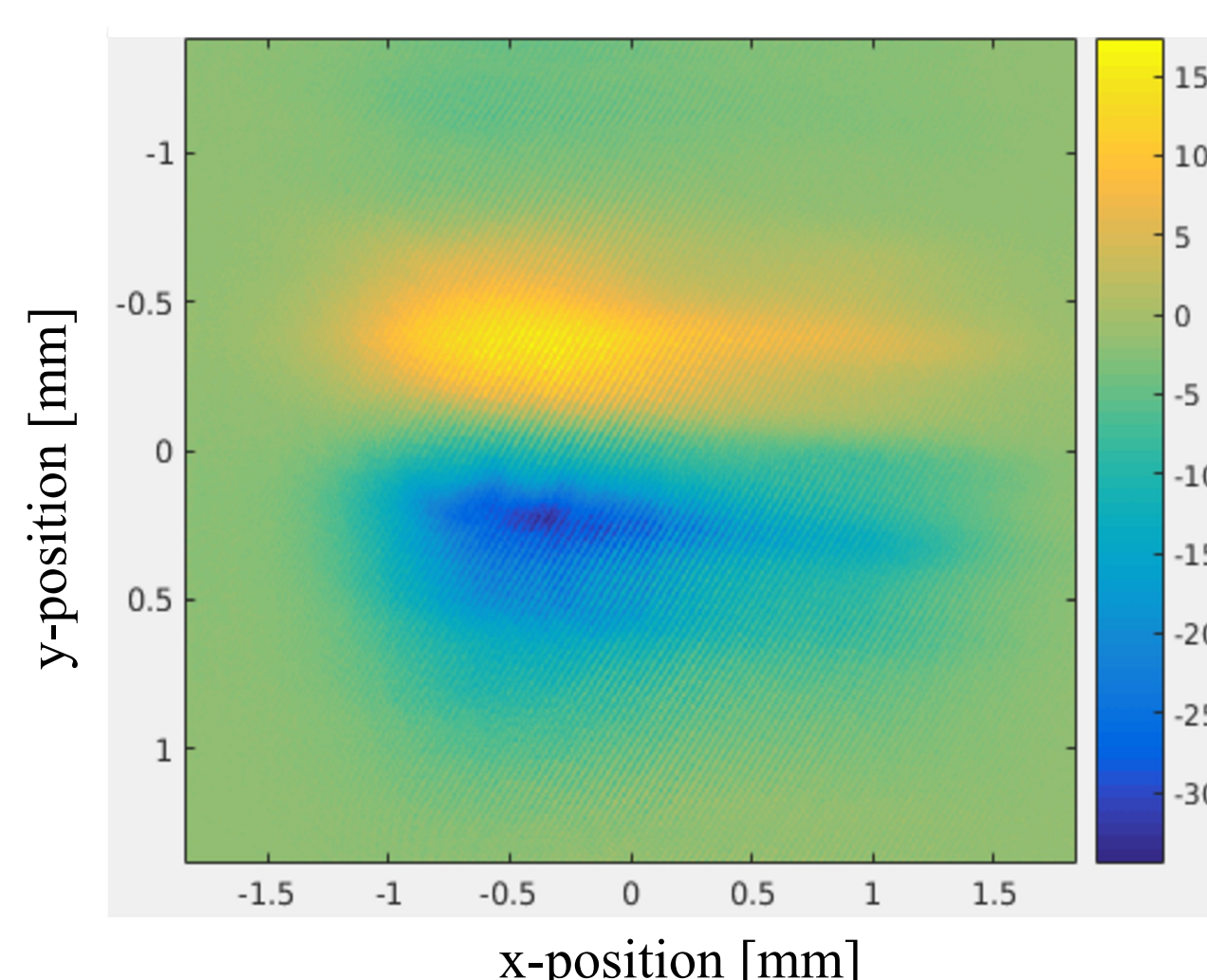
Schlieren Set Up for Plasma Radius Determination



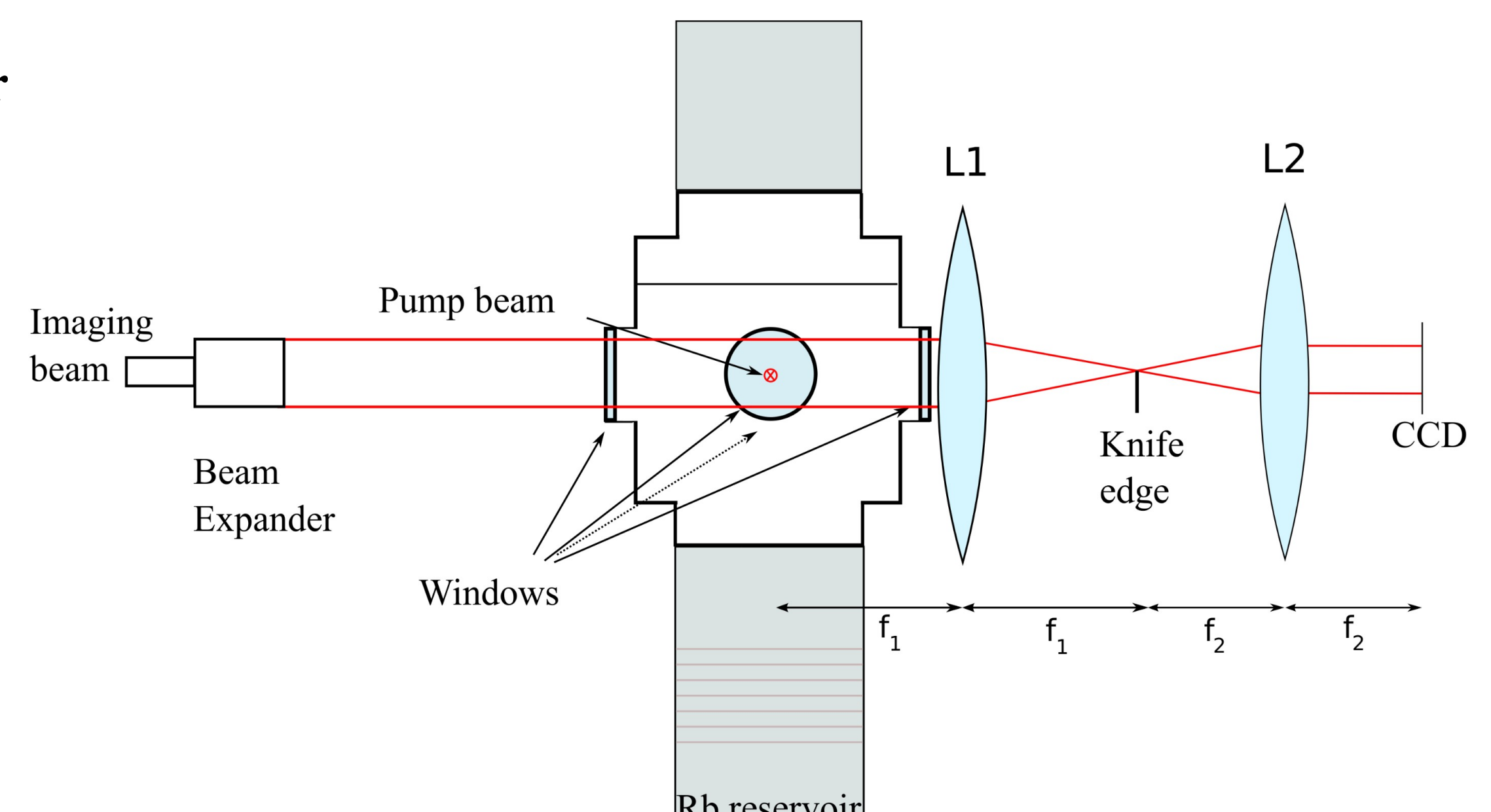
Laser wavelength close to transition line D2:

- refractive index of vapor in the ground state >1 (or <1)
- refractive index of plasma ~1
- Plasma column as transparent object with different refractive index
- Bending of the rays which propagate through the object

Schlieren Image of Column of Excited Vapor



Current Set Up at MPP



- Pump beam: Creating column of excited atoms in the center of the cell
- Imaging beam: Used for Schlieren imaging of the column of excited atoms
- Knife edge: Razor blade as cut off in the focal plane of lens L1