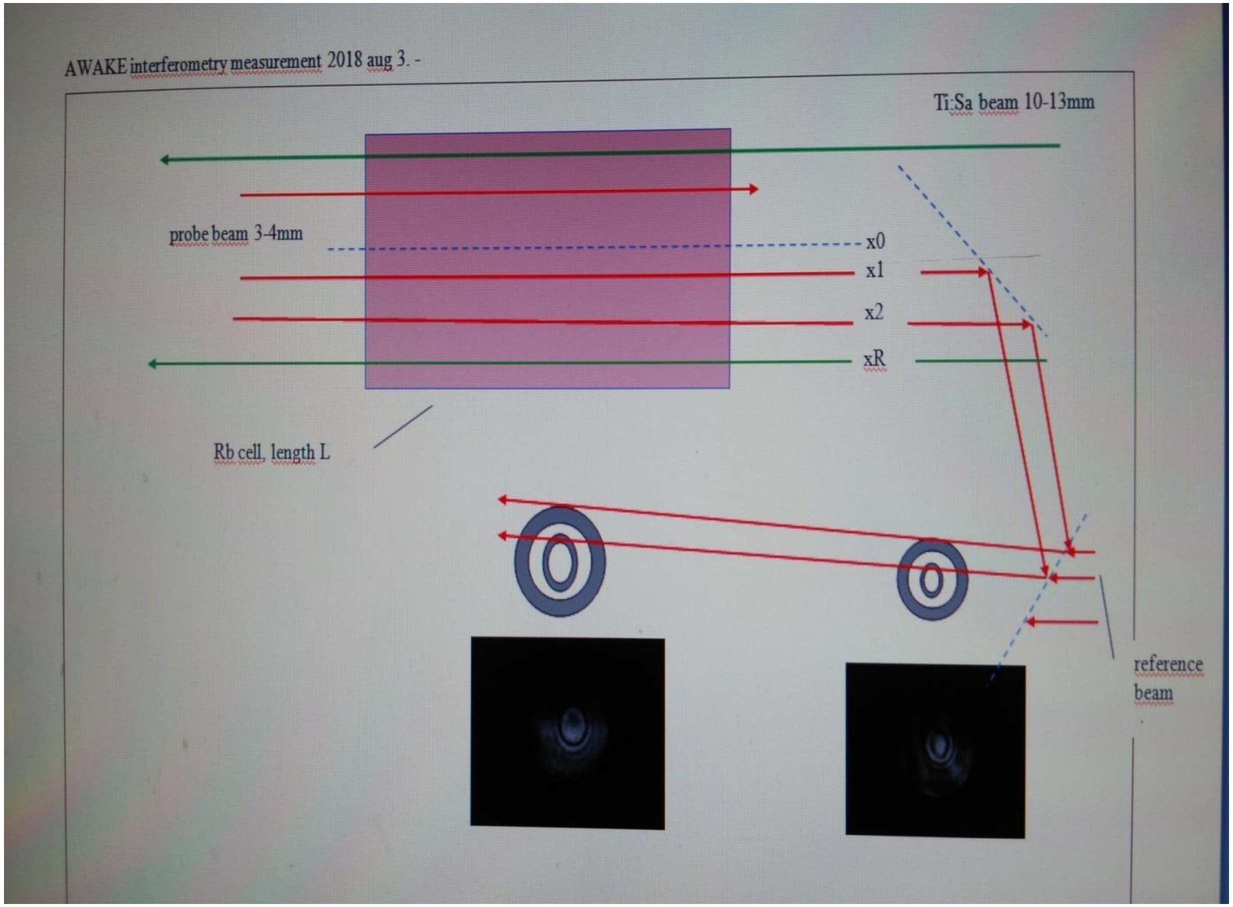
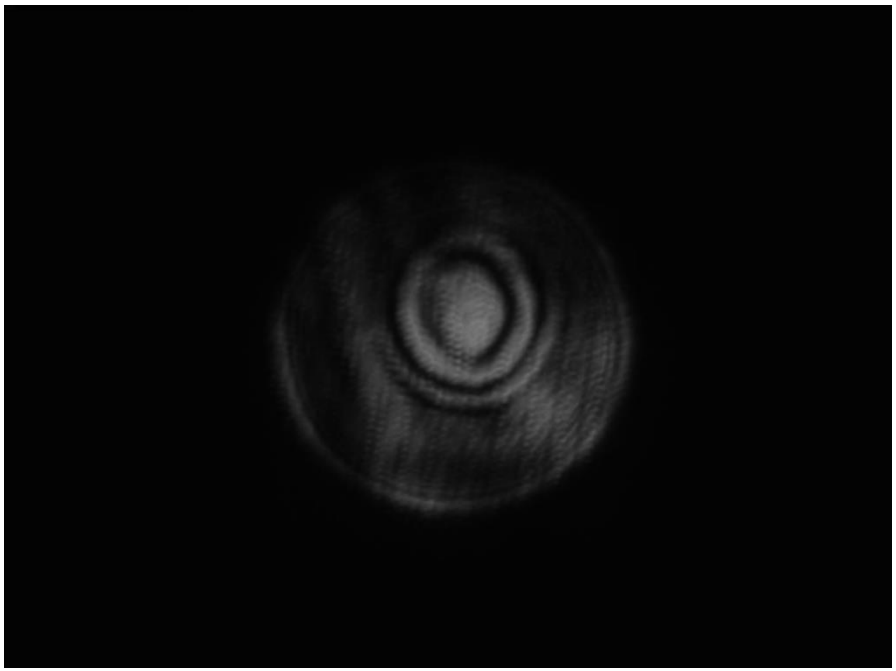
Plasma radial interferometry

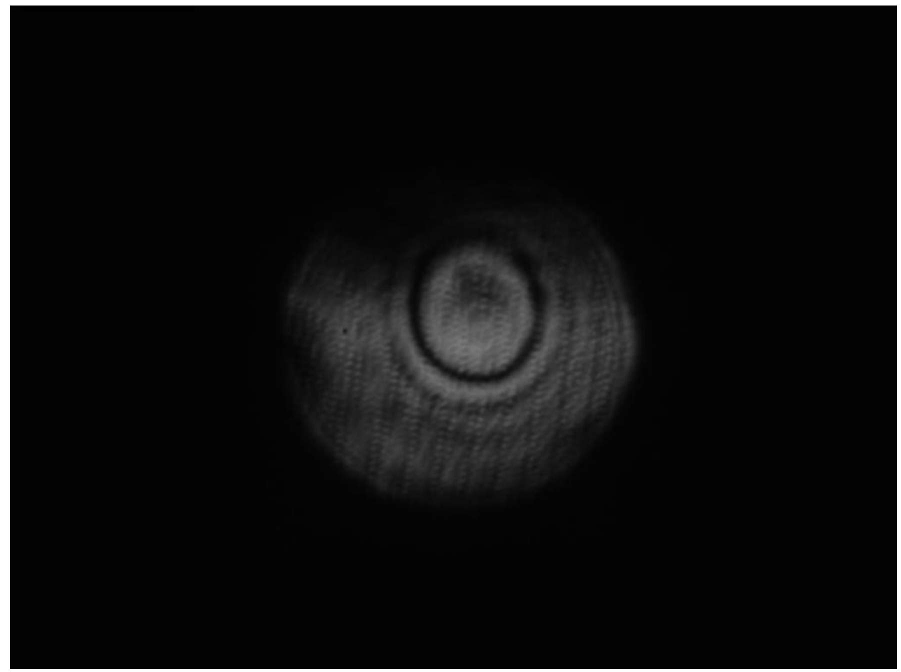
Ti:Sapphirelaser :
800 nm, 40 fs, 2 mJ
$I \approx 5 \cdot 10^{10}\ W/cm^2$



Pictures of the plasma decay experiment



Interferometric fringes in the laser plasma channel after 15 μs decay



Interferometric fringes in the laser plasma channel after 20 μs decay

Results and interpretation

- **$n(x) = n(0)\,(1+g\,x^2)$** ,GRIN lens model, parabolic
- **$\Delta\phi = 2\pi/\lambda\; L\; n(0)\; g\,(x_2{}^2 - x_1{}^2)$** , phase difference,
- **$n(R) = n(0)\,(1+g\,R^2)$** , **R** is plasma column radius
- **$n(R) = 1 - N(R)\pi f e^2 /(2m\,\omega_0\,\Delta\omega) = 1 - N(R)\,\Delta n$** , **N(R)** ground level atom density, **Δn** index change
- **$g = 1/R^2 \;\; [\,n(R) - n(0)\,]/n(0)$** gradient
- **$N(R) - N(0) = 1/\Delta n \;\; \lambda/L \;\; R^2/(x_2{}^2 - x_1{}^2)$** atom density change in plasma tube (edge-centre)

Estimation of the atom density change

$N(R) = 10^{14}$ cm^{-3} , $\Delta\phi = 2\pi$, $\lambda = 7.8\ 10^{-5}$ cm , L = 75 cm
$\Delta\omega = 2\pi\ (-4)\ 10^{9}$ s^{-1}

R = 0.4 cm , x_1 = 0.1 cm , x_2 = 0.25 cm
$N(R) - N(0) = 6.6\ 10^{13}$ cm^{-3} , 66 % plasma density

R = 0.4 cm , x_1 = 0.25 cm , x_2 = 0.35 cm
$N(R) - N(0) = 5.8\ 10^{13}$ cm^{-3} , 58 % plasma density