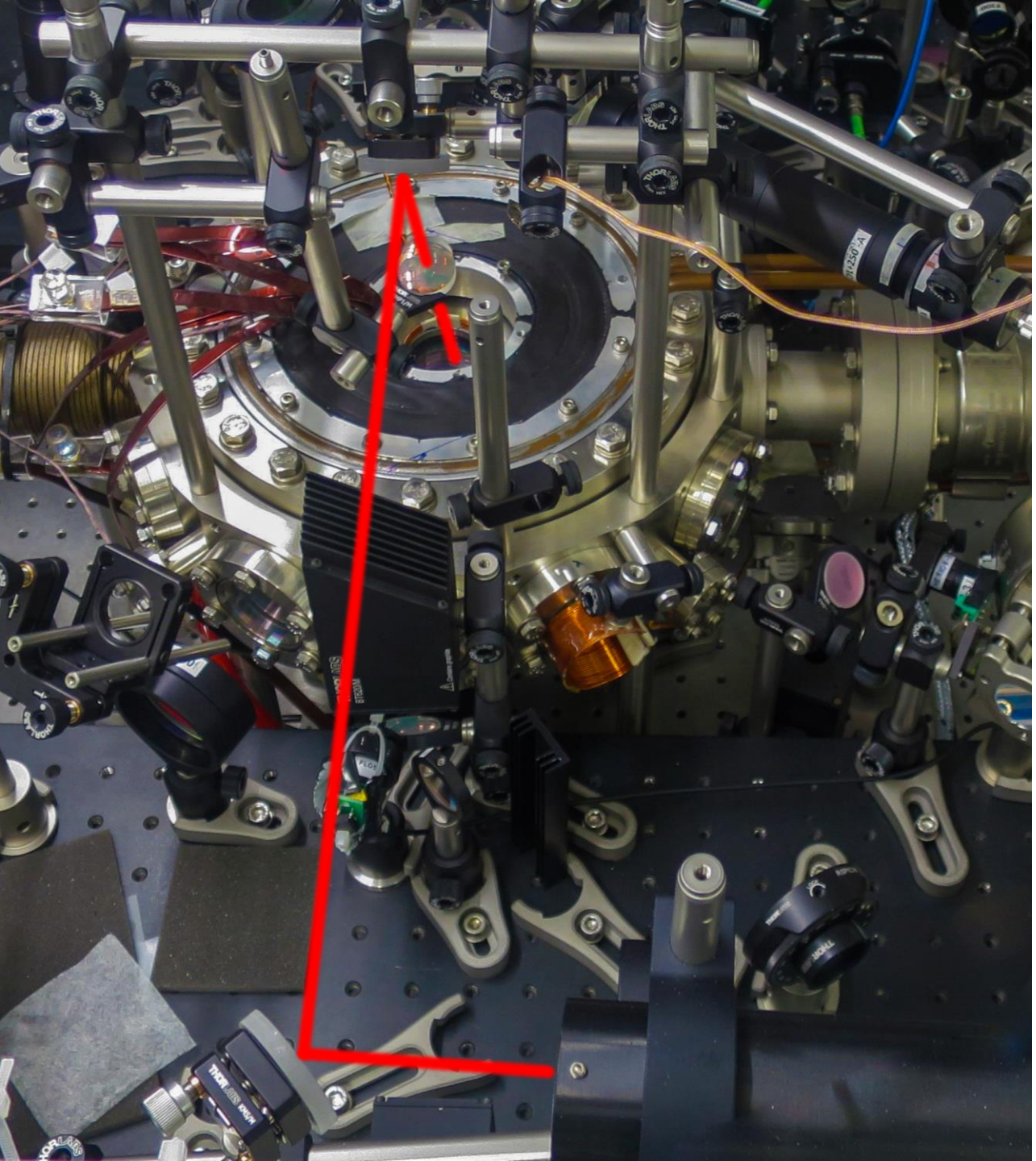


Uporaba optične pincete za eksperimente s hladnimi atomi in Bose-Einsteinovim kondenzatom

Katja Gosar

Mentor: dr. Rok Žitko

Somentor: dr. Peter Jeglič

7. september 2021

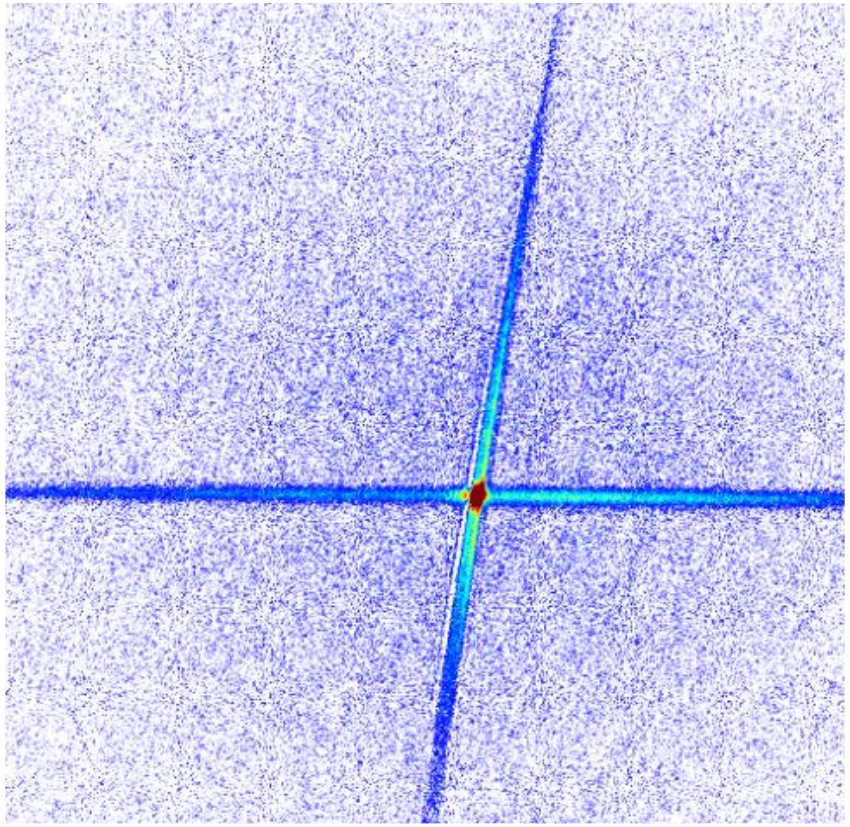
Uvod

hladni atomi in BEC optična pinceta

premikanje, več pasti,
“risanje potenciala” npr. škatlastega

↓

Eksperimenti: Kaj je mogoče?



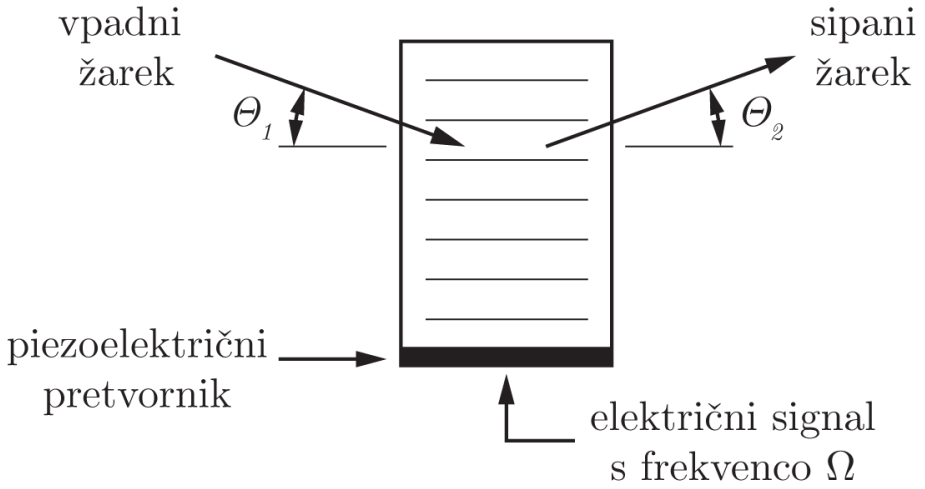
Optične dipolne pasti

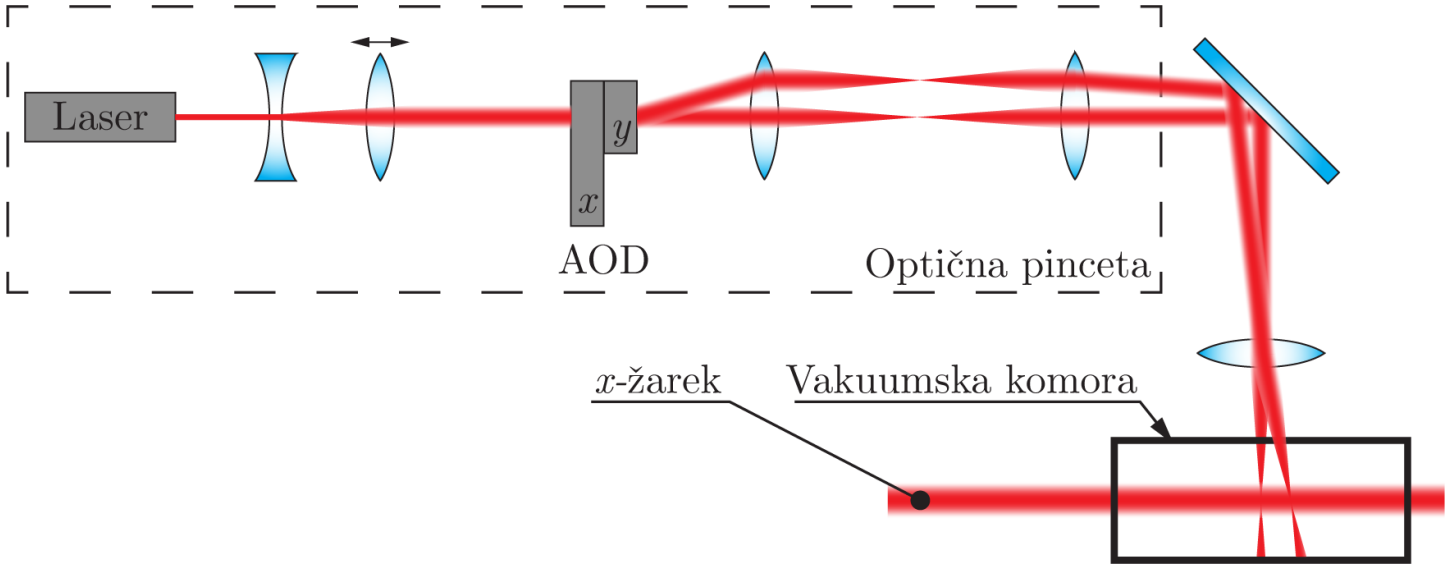
Dipolno polje: $$U_{\mathrm{dip}}(\boldsymbol{r}) = \frac{3\pi\varepsilon_0 c^3}{\omega_0^3}\frac{\Gamma}{\omega-\omega_0} I(\boldsymbol{r}) = \widetilde{U} I(\boldsymbol{r})$$

Gaussov žarek: $$I(\boldsymbol{r}) = I_0 \left(\frac{w_0}{w(z)}\right)^2 \mathrm{e}^{-\frac{2r^2}{w(z)^2}}$$

Radialna frekvenca pasti: $$\omega_r = \sqrt{\frac{4\widetilde{U} I_0}{m}}\frac{1}{w_0}$$

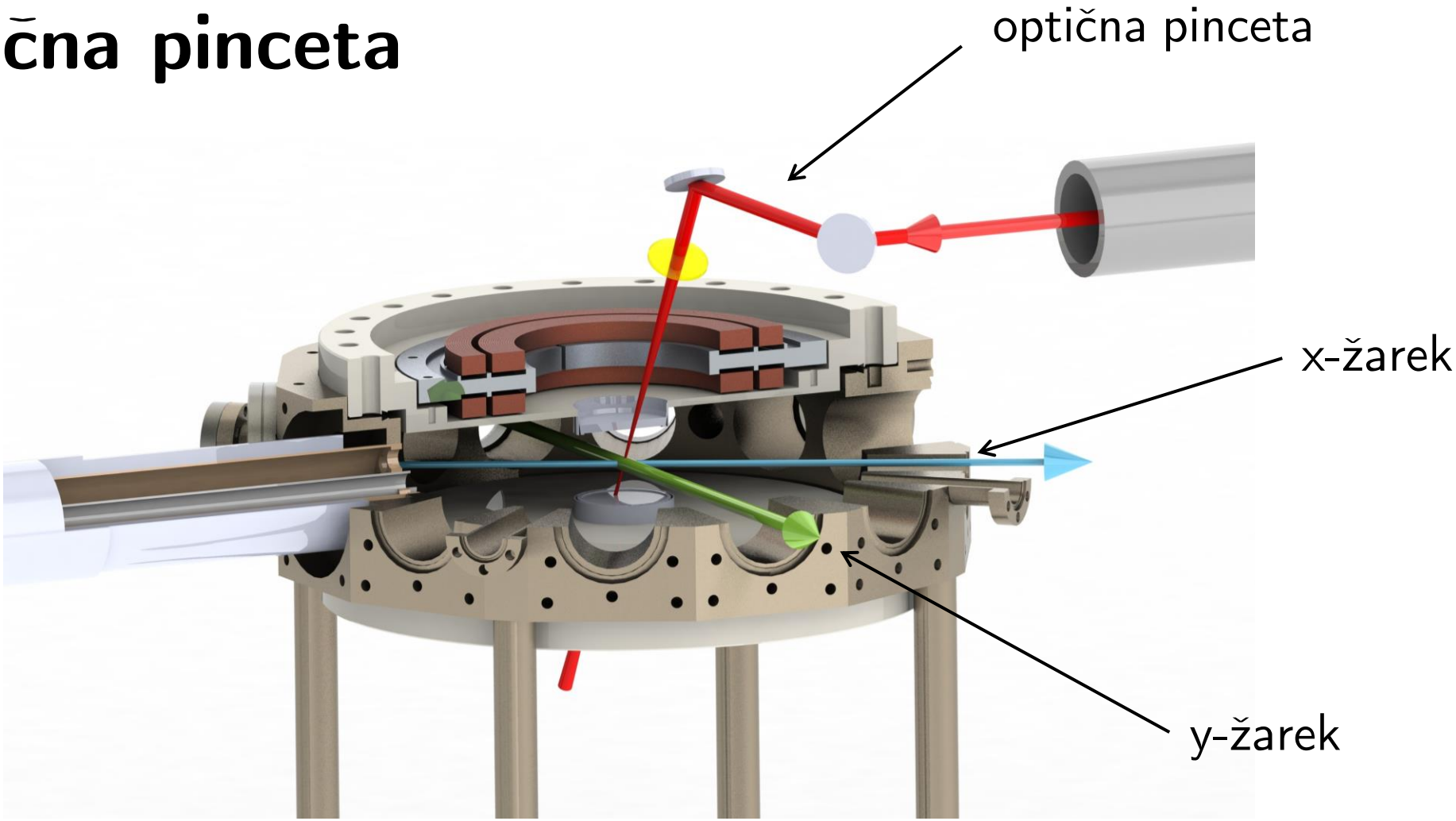
Optična pinceta



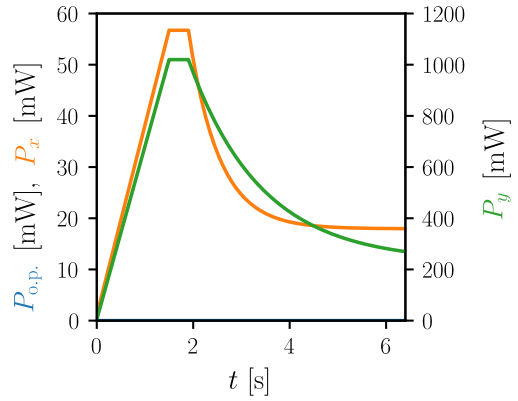


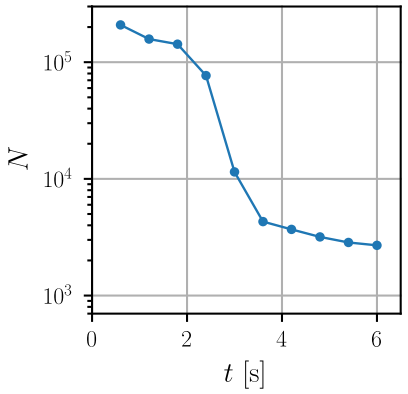
Več pasti:
- multitonski način
- multipleksiranje

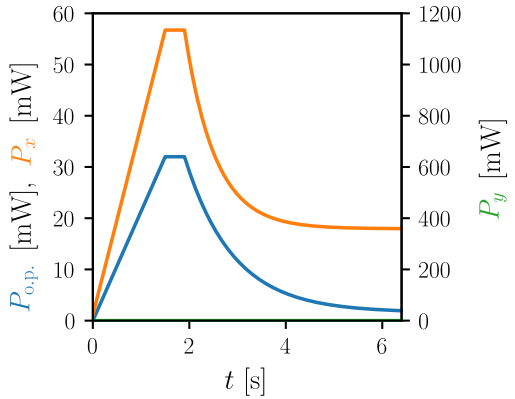
Optična pinceta

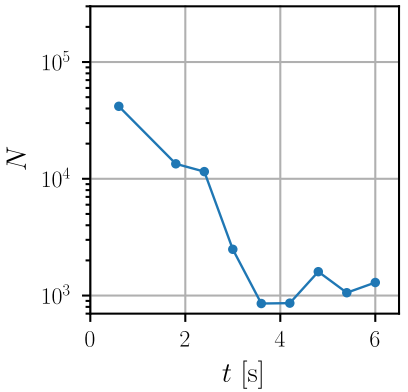


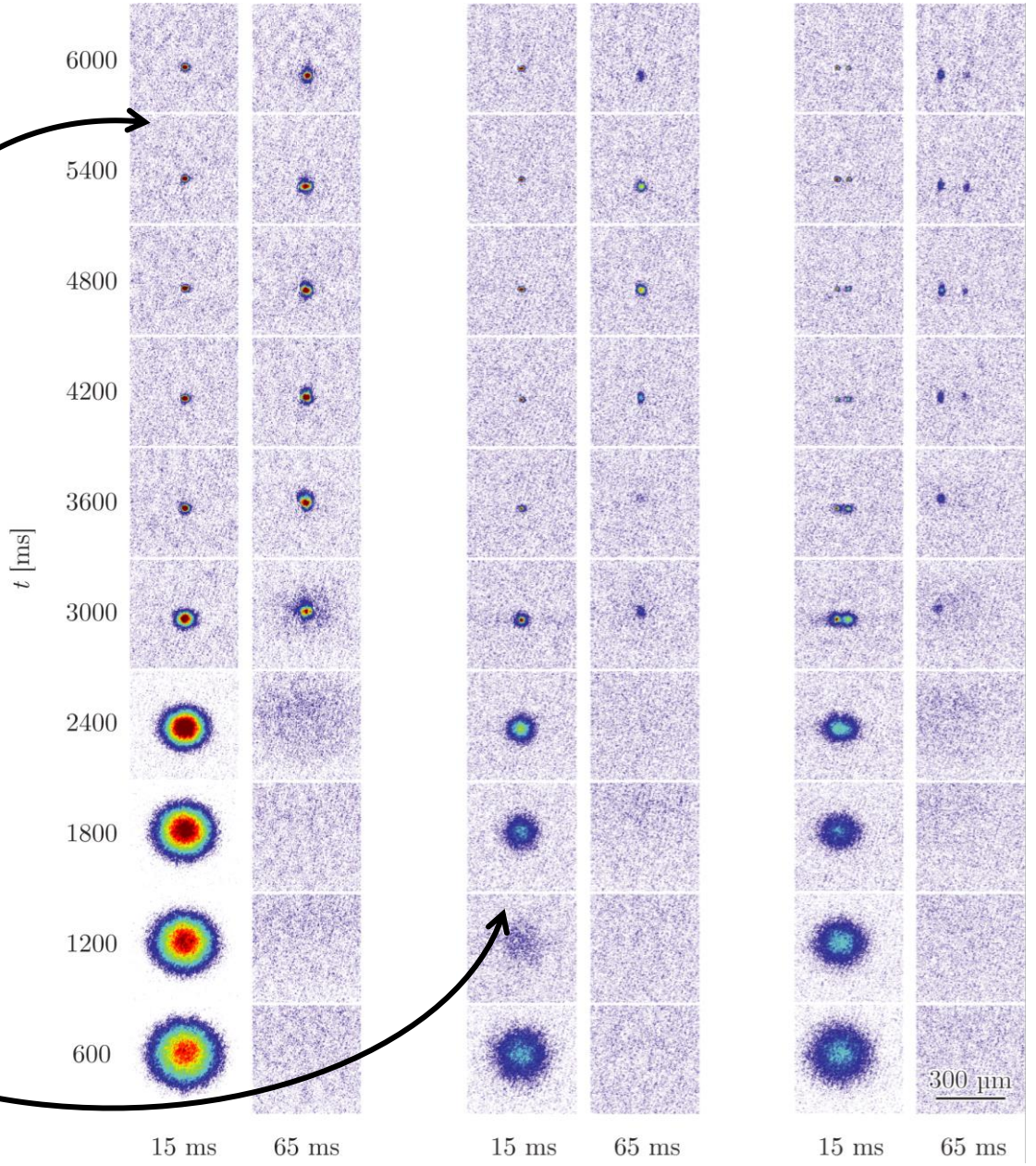
Hlajenje z izhlapevanjem





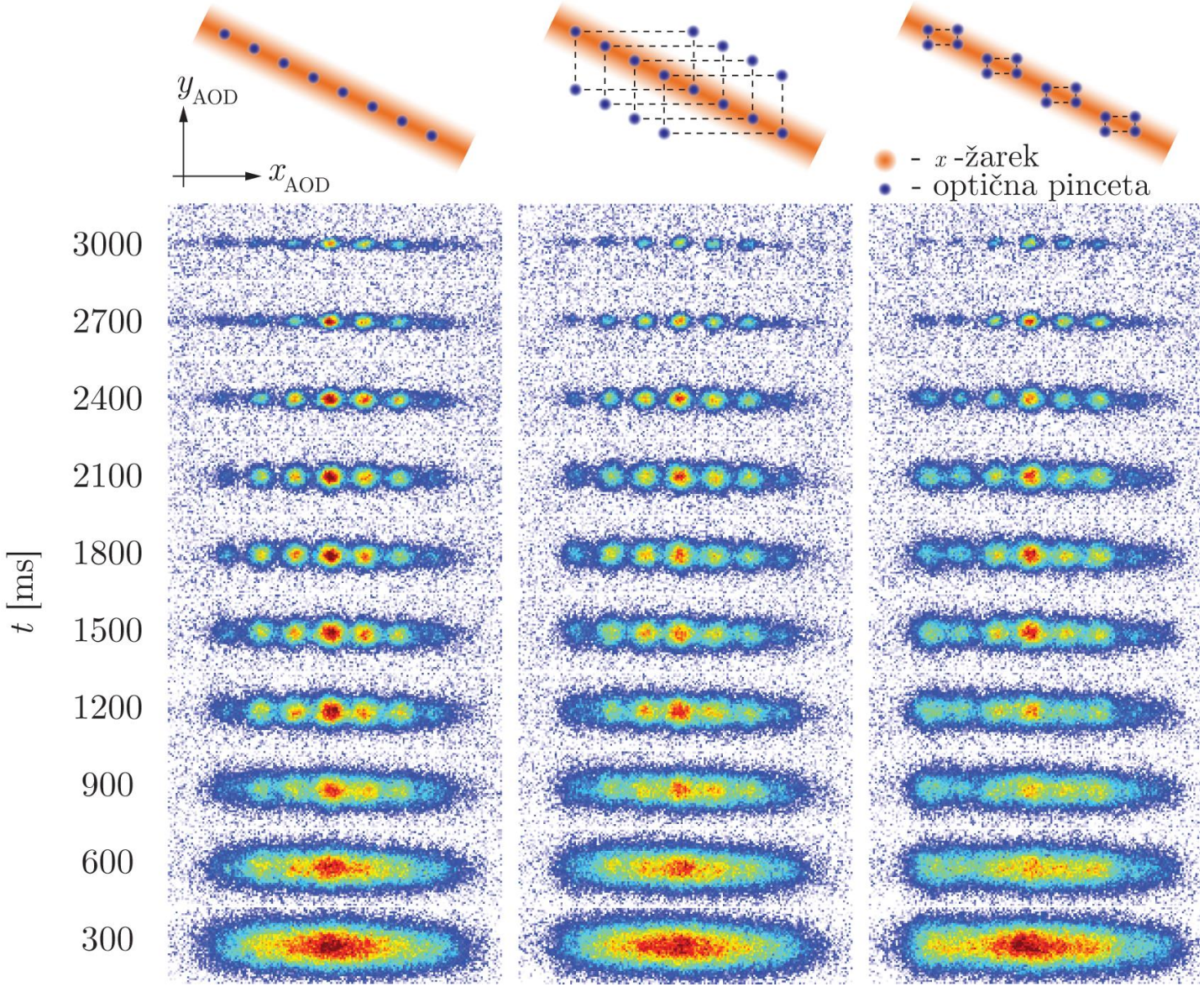






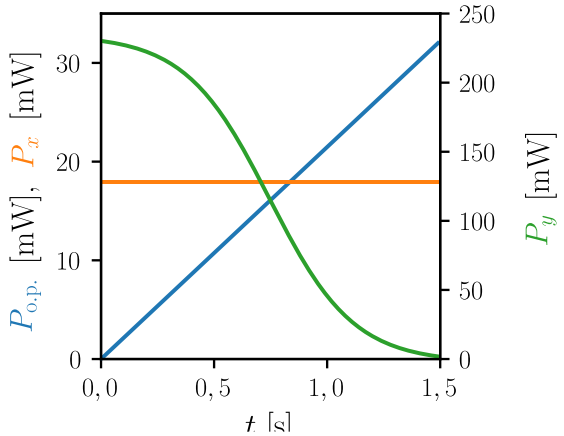
Hlajenje z izhlapevanjem – 8-kratno

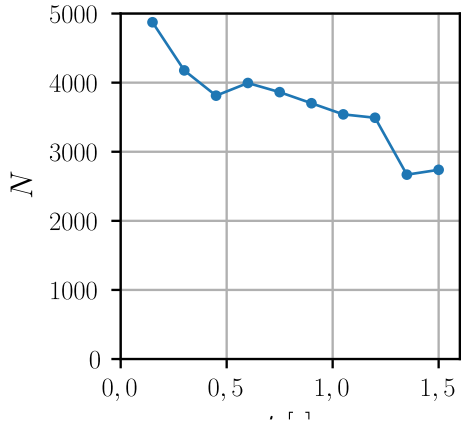
8-kratno multipleksiranje
vs.
4-kratno multipleksiranje po dveh multitonskih pasti (dve različni kombinaciji)

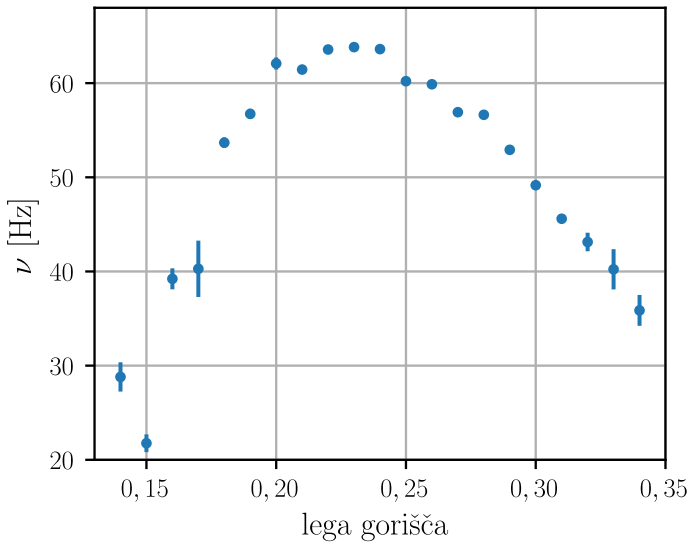


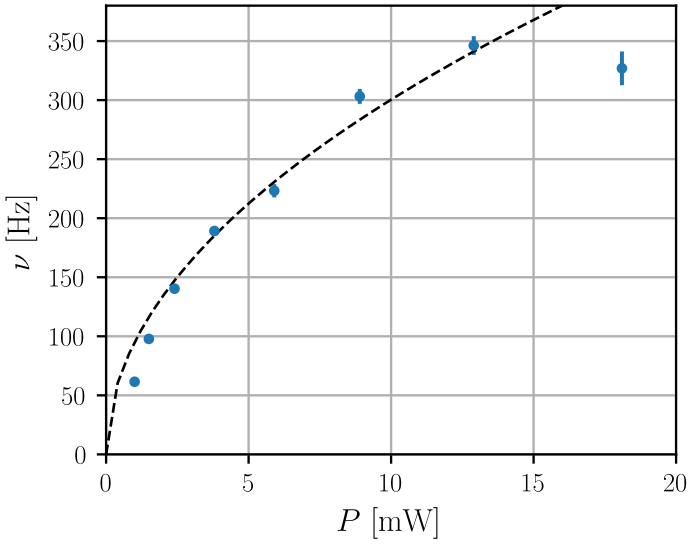
Prenos iz male pasti in meritev frekvence pasti

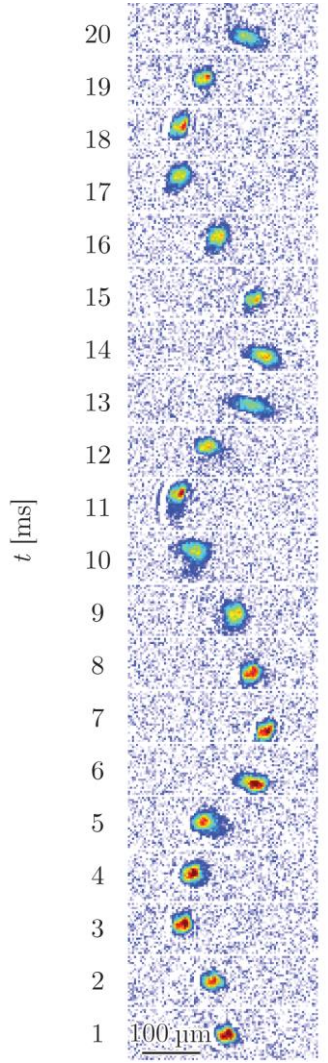
Past v gorišču laserskega snopa optične pincete





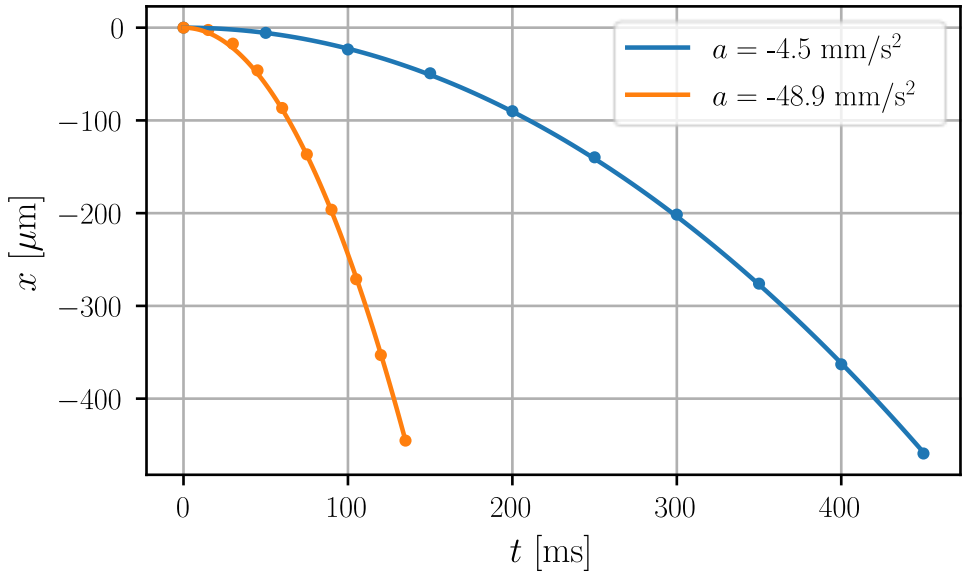


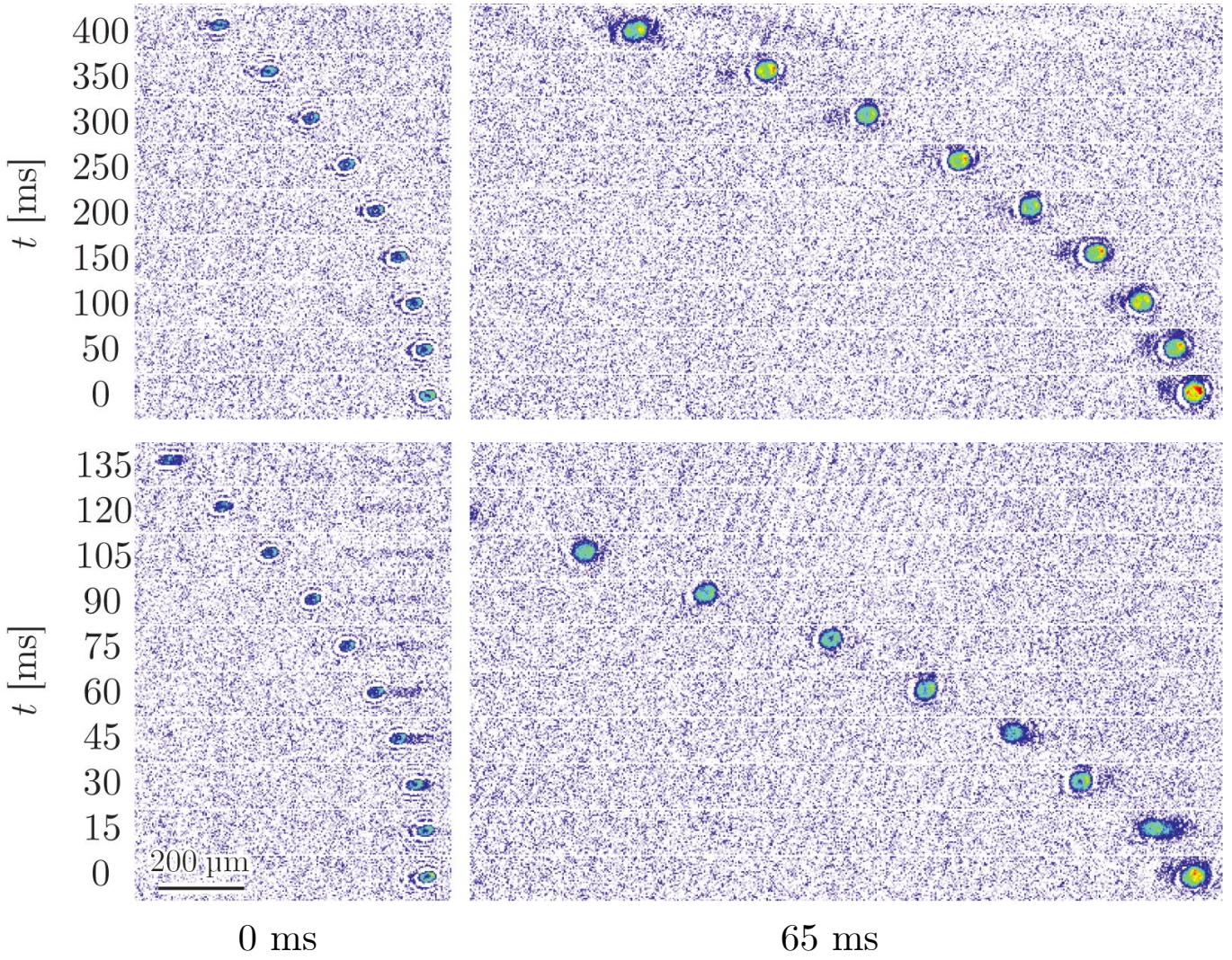




Premik – pospeševanje

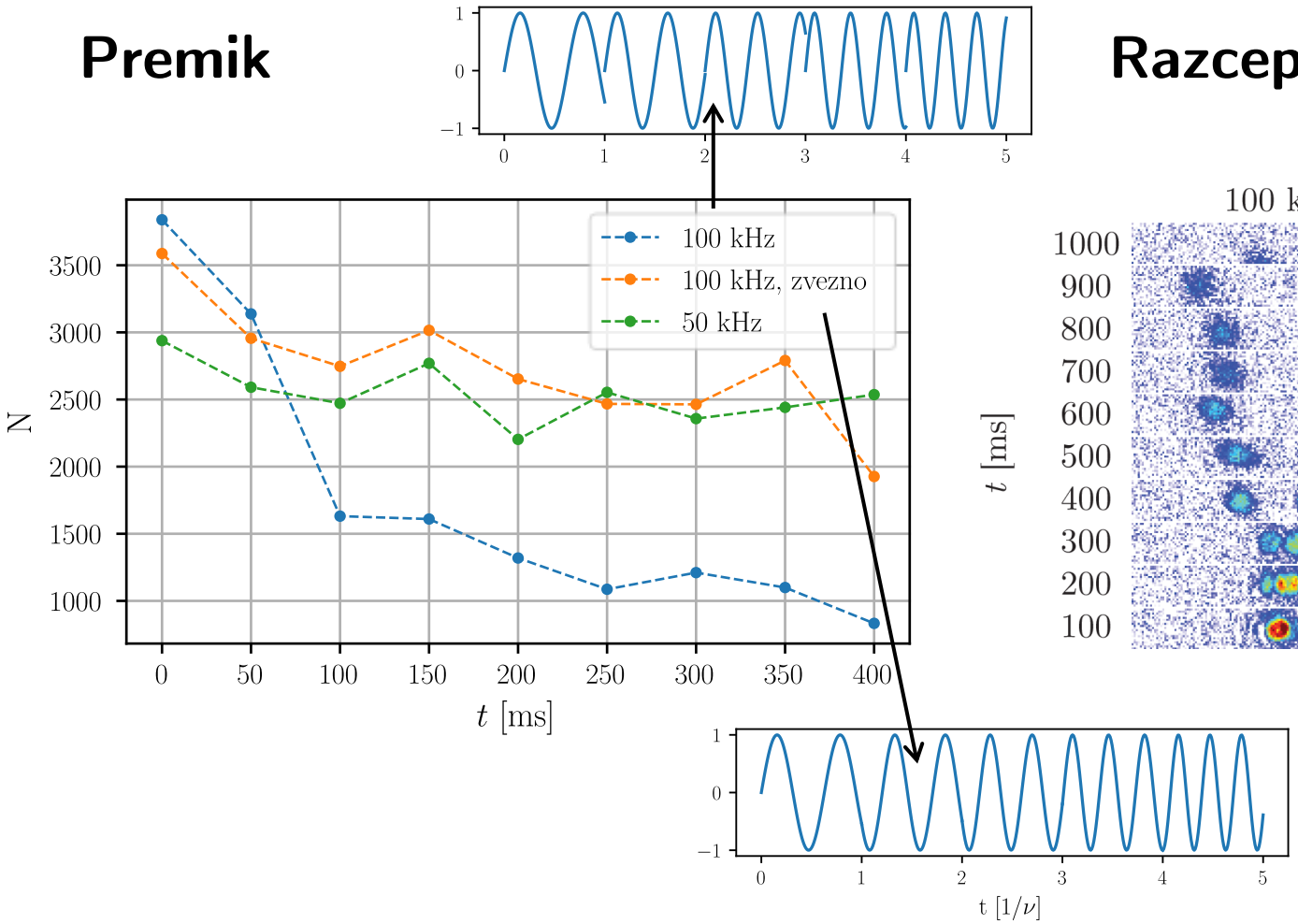
$$x(t) = \frac{1}{2}at^2$$



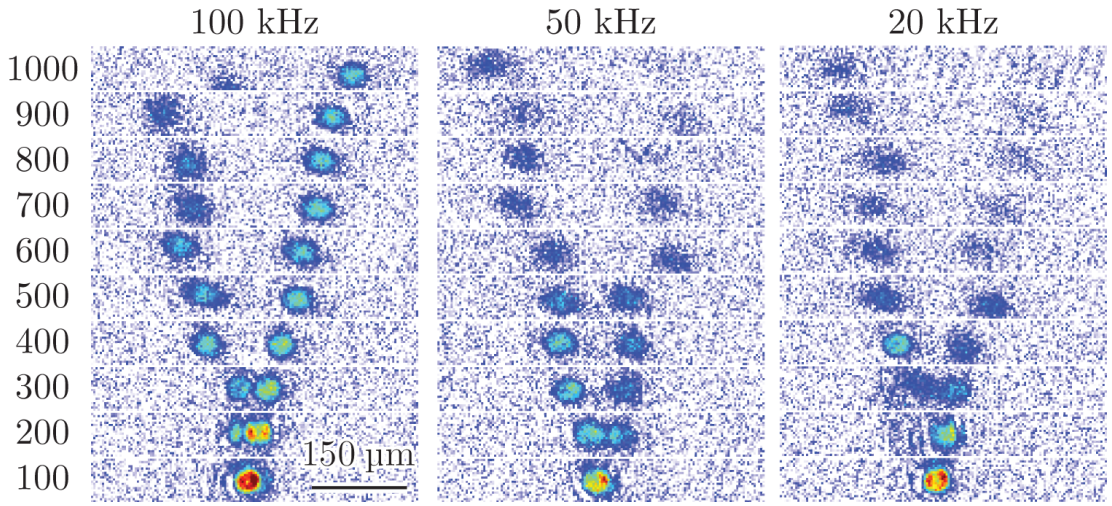


Vpliv frekvence preklapljanja

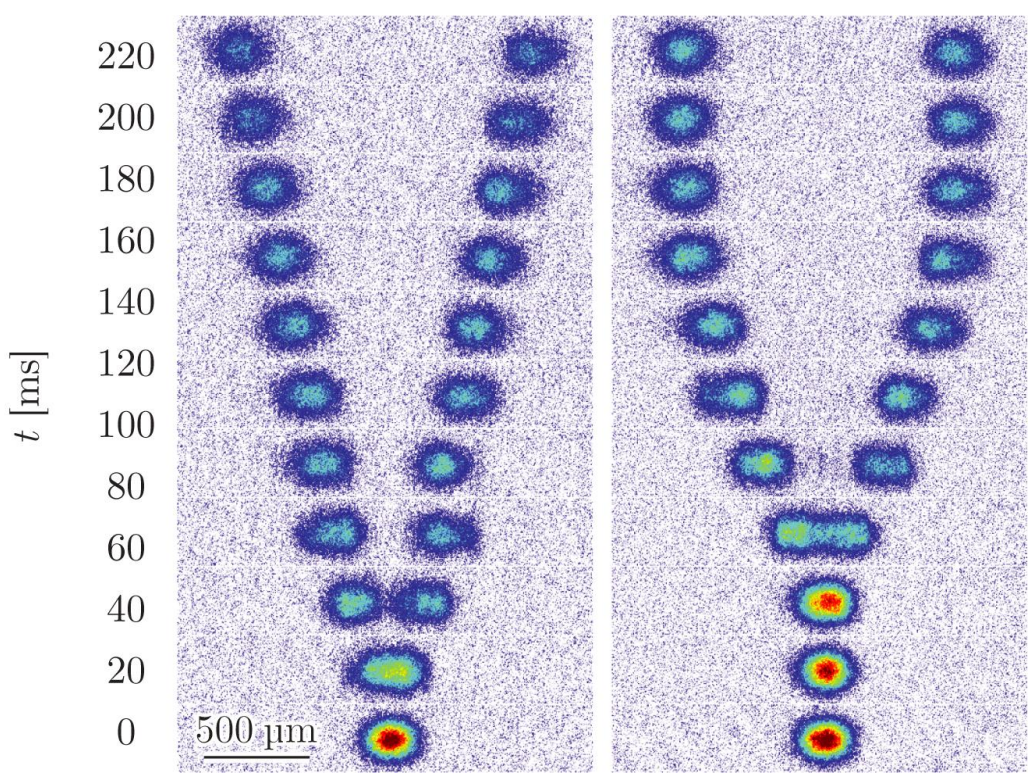
Premik

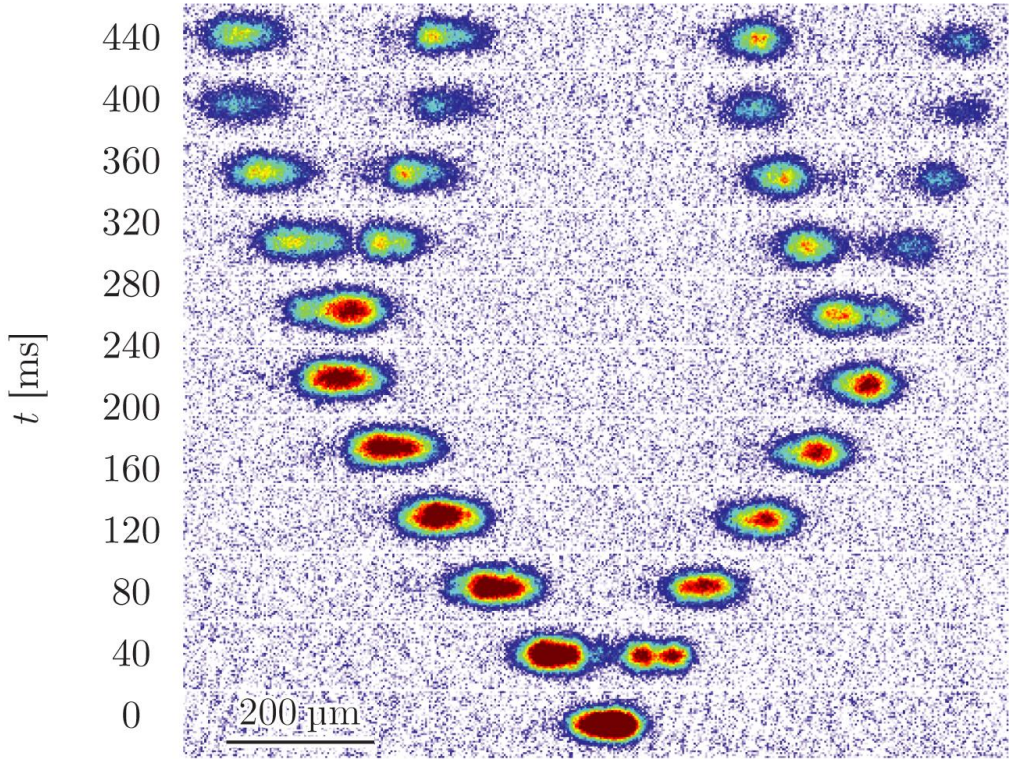


Razcep



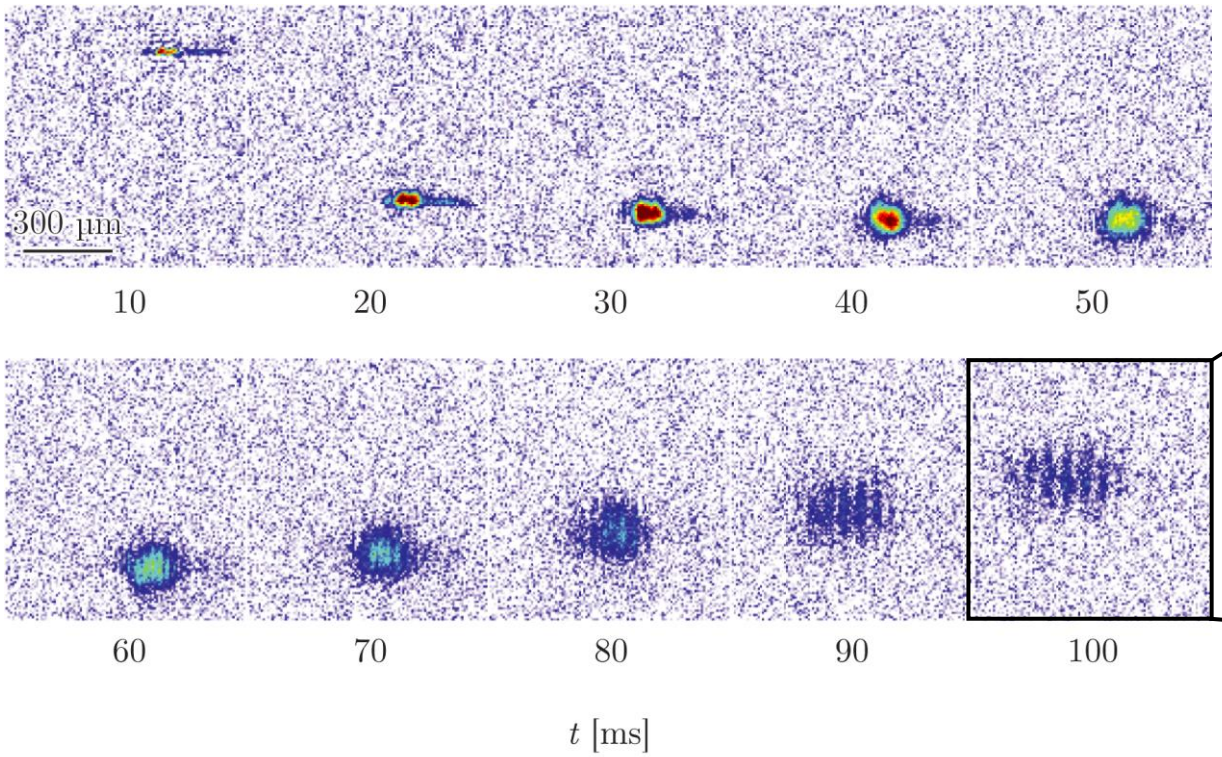
Razcep – hladni atomi

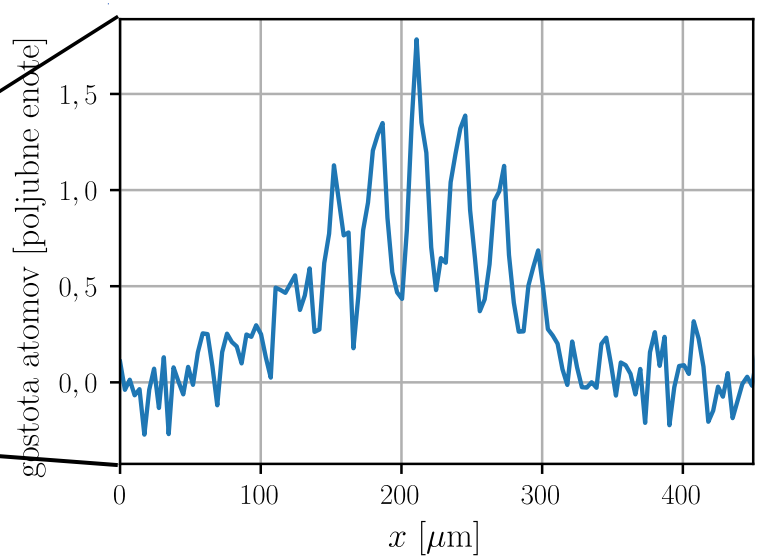




Interferenca dveh Bose-Einsteinovih kondenzatov

$$\lambda = \frac{ht}{md}$$



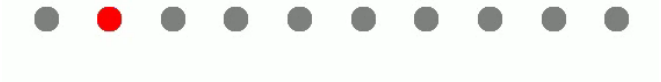


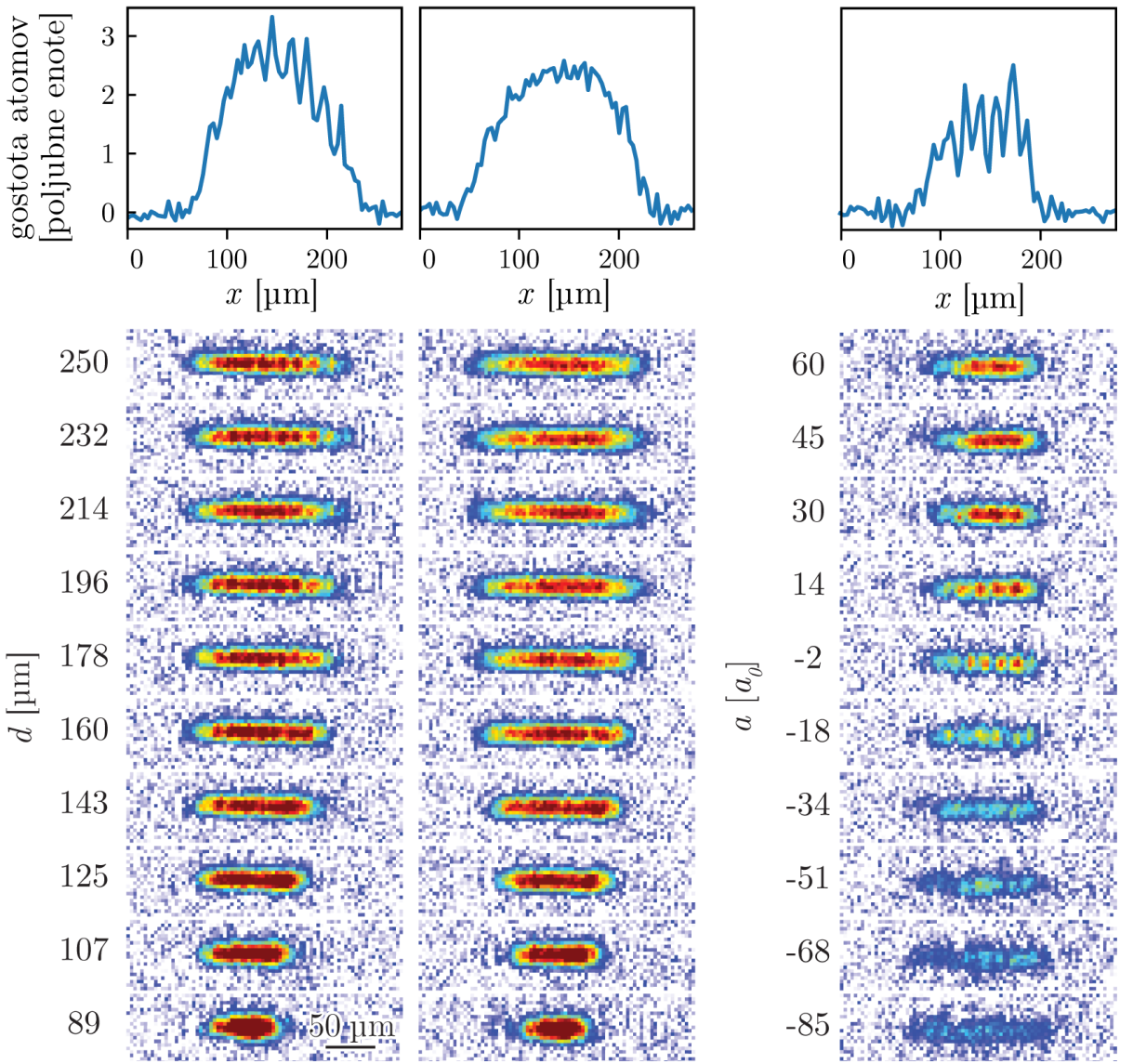
Škatlast potencial

Način multipleksiranja točk za škatlast potencial:

- z leve proti desni

- naključni vrstni red





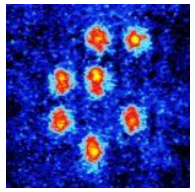
Zaključek

- ✓ evaporacija
- ✓ premikanje
- ✓ razcep
- ✓ škatlast potencial

- ! frekvenca preklapljanja (razcep)
- ! (ne)zvezni signal za AOD (premikanje)
- ! dodatne pasti pri multitonskem načinu (evaporacija)
- ! (ne)periodičnost "risanja" potenciala (škatlast potencial)

- » interferenca
- » solitonski vlaki
- » Faradayevi valovi

IJS



aresis