

# INTERFEROMETRY WITH A FAST GATED ICCD CAMERA AT BESSY II

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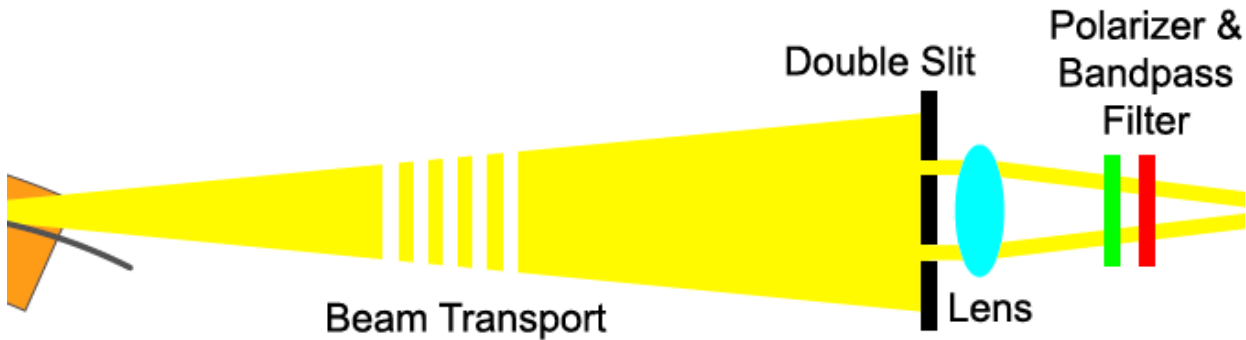
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DEELS

2024

# Interferometric beam size measurement

The usual set-up for the beam size measurement with the IBSM:



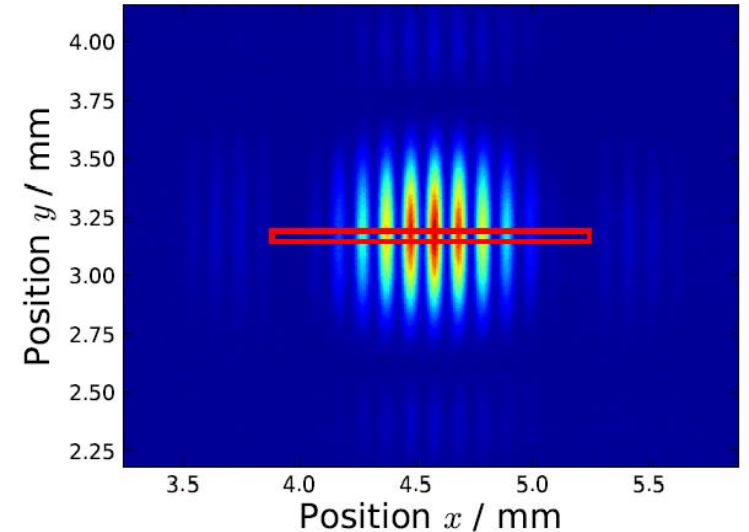
1) Fitting received Intensity with eq.1 to get visibility  $V$

$$I(x) = I_0 \operatorname{sinc}^2 \left( \frac{a}{\lambda f} (x - x_0) \right) \left[ 1 + V \cos \left( \frac{2\pi d}{\lambda f} (x - x_0) + \psi \right) \right]$$

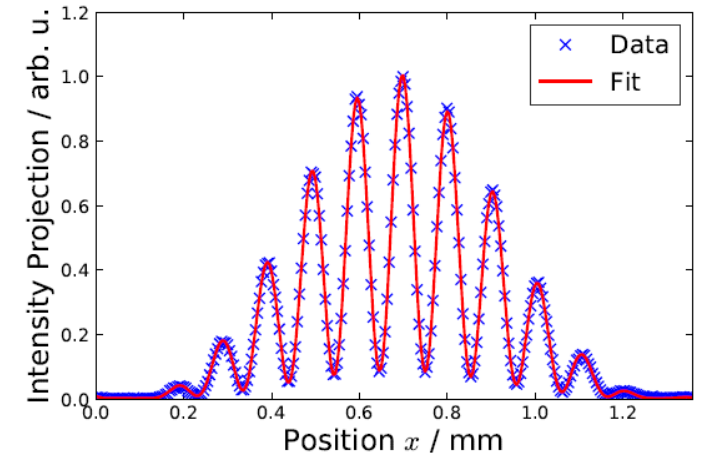
2) Calculate beam size  $\sigma$  (for Gaussian beam) using the visibility  $V$

$$\sigma = \frac{\lambda L}{\pi d} \sqrt{\frac{1}{2} \ln \left( \frac{1}{V} \right)}$$

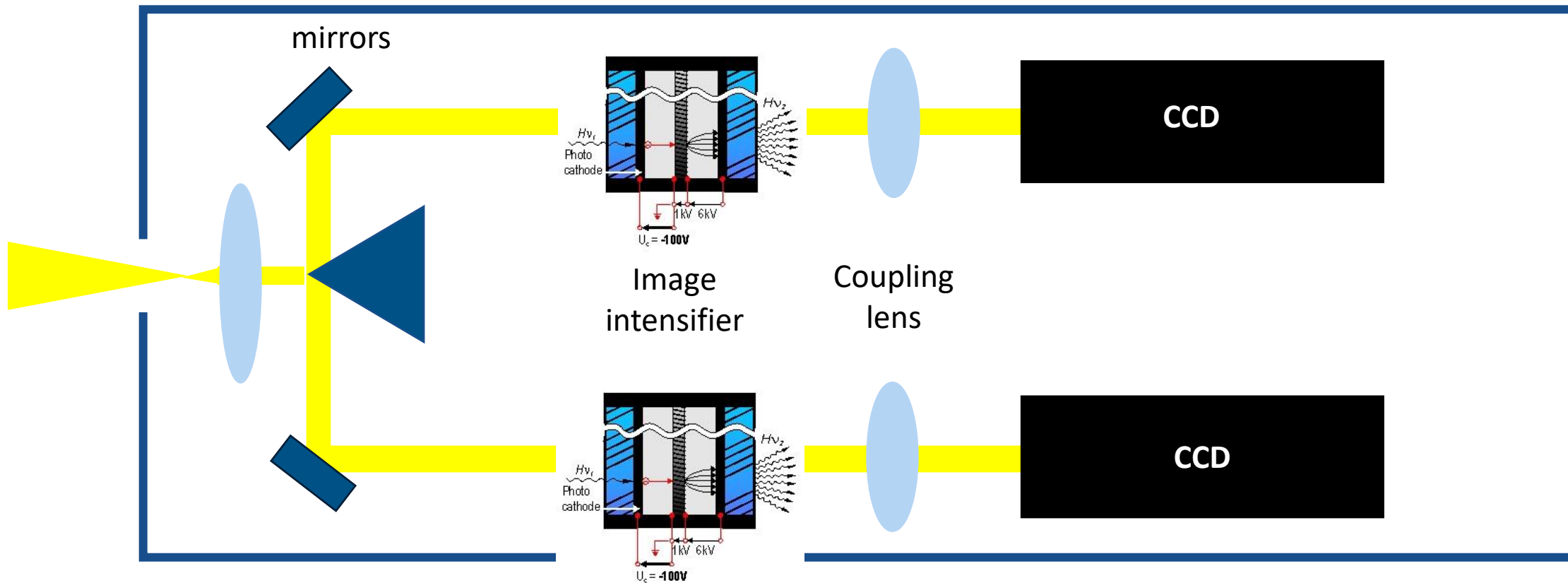
Interference pattern at the CCD camera



Fitted intensity in the region of interest



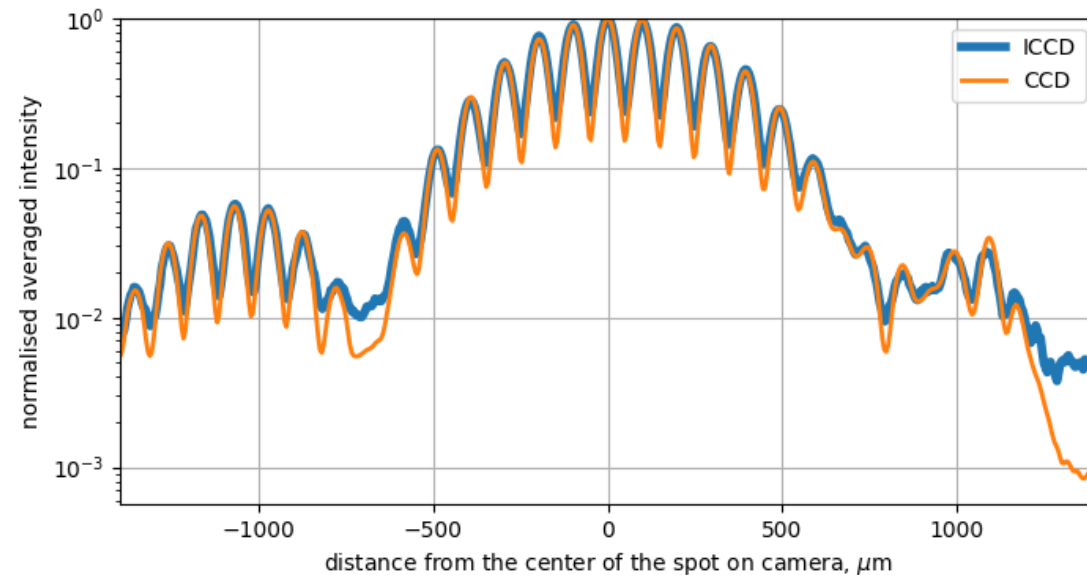
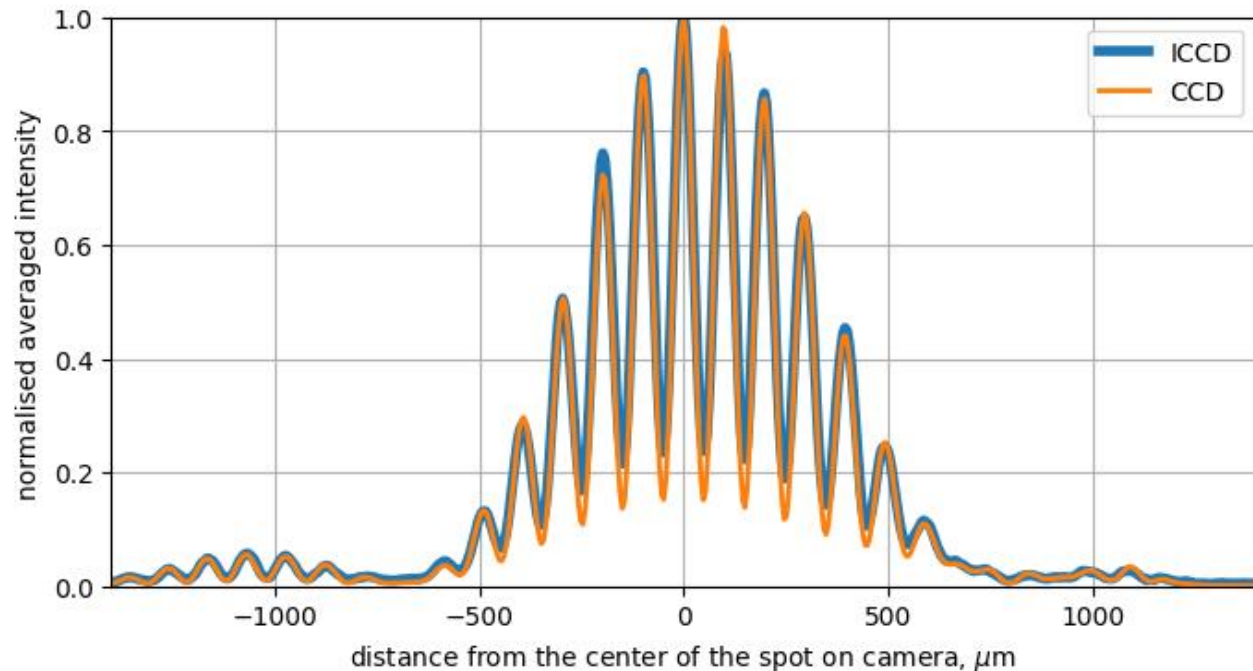
# Fast-gated ICCD camera



XXRapidFrame from Stanford Computer Optics

# IBSM with fast-gated ICCD

**Problem:** measured with ICCD visibility is lower than expected



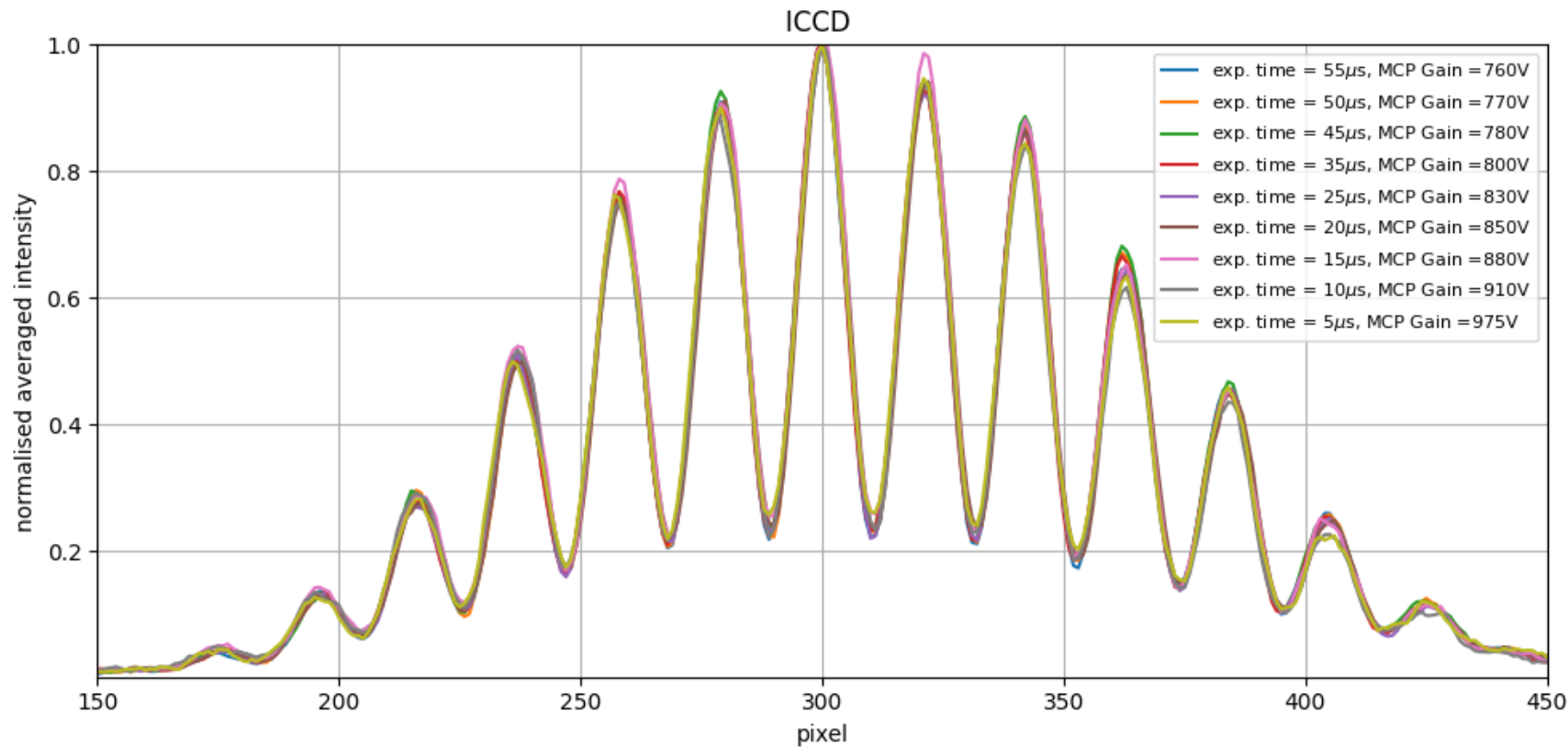
**Difference in received visibility is  $\sim 13\%$   $\rightarrow$  difference in measured beam size  $\sim 37\%$**

# Exploring non-linear behaviour of ICCD

## Possible reasons:

- Dependence of the received intensity on the MCP Gain

Measurement SR and double slit



No significant  
dependence

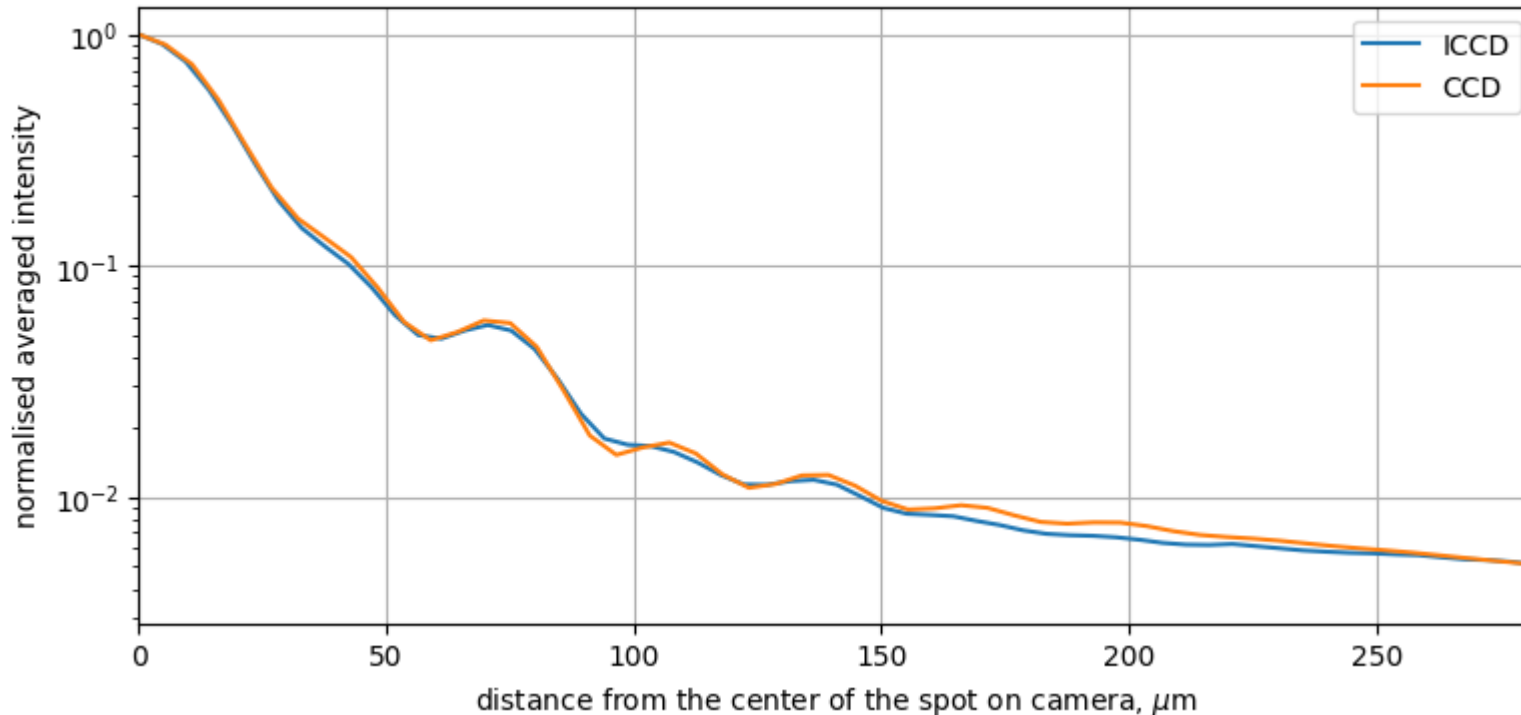
# Exploring non-linear behaviour of ICCD

## Possible reasons:

- ~~Dependence of the received intensity on the MCP Gain~~
- Dependence on the maximal light intensity

Measurement with laser and pinhole

averaged curves



No difference between  
CCD and ICCD results!

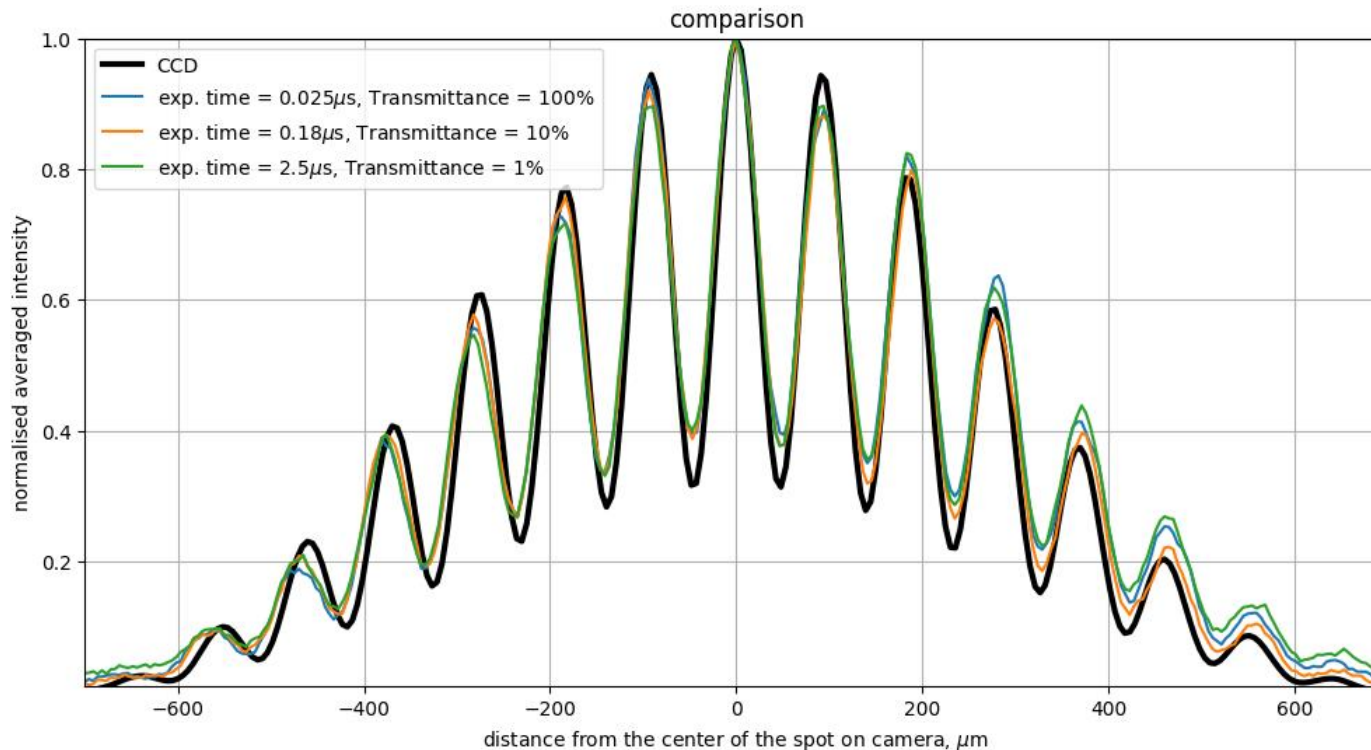
Continuous light of low intensity

# Exploring non-linear behaviour of ICCD

## Possible reasons:

- ~~Dependence of the received intensity on the MCP Gain~~
- Dependence on the maximal light intensity

## Measurement SR and double slit



Almost no difference  
despite 100 times lower  
peak intensity

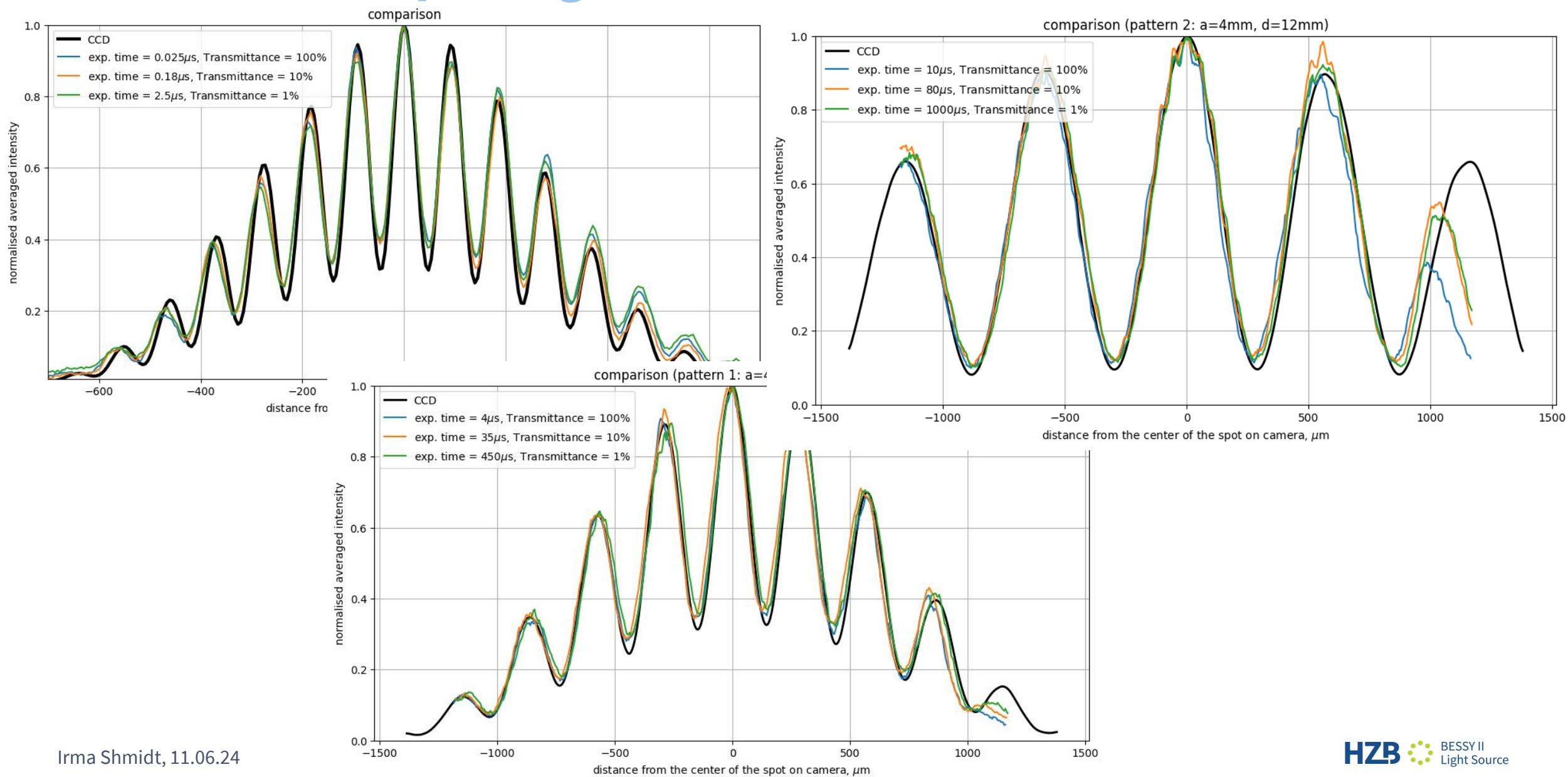
# Exploring non-linear behaviour of ICCD

## Possible reasons:

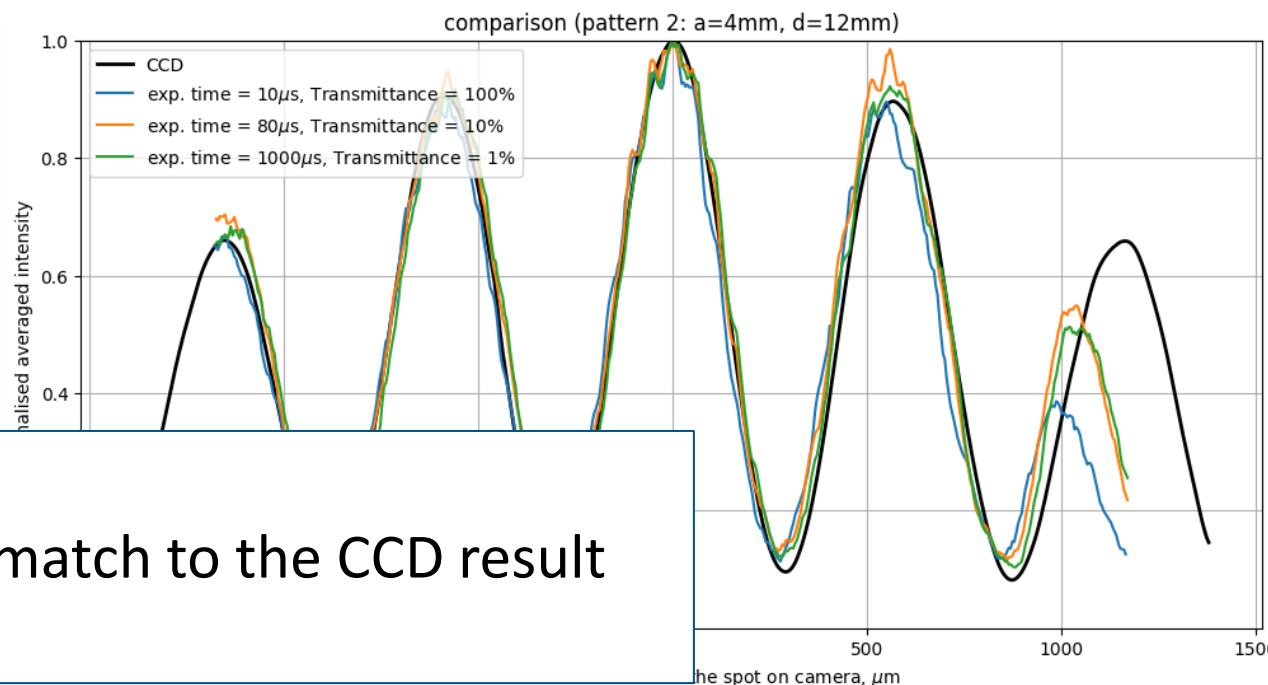
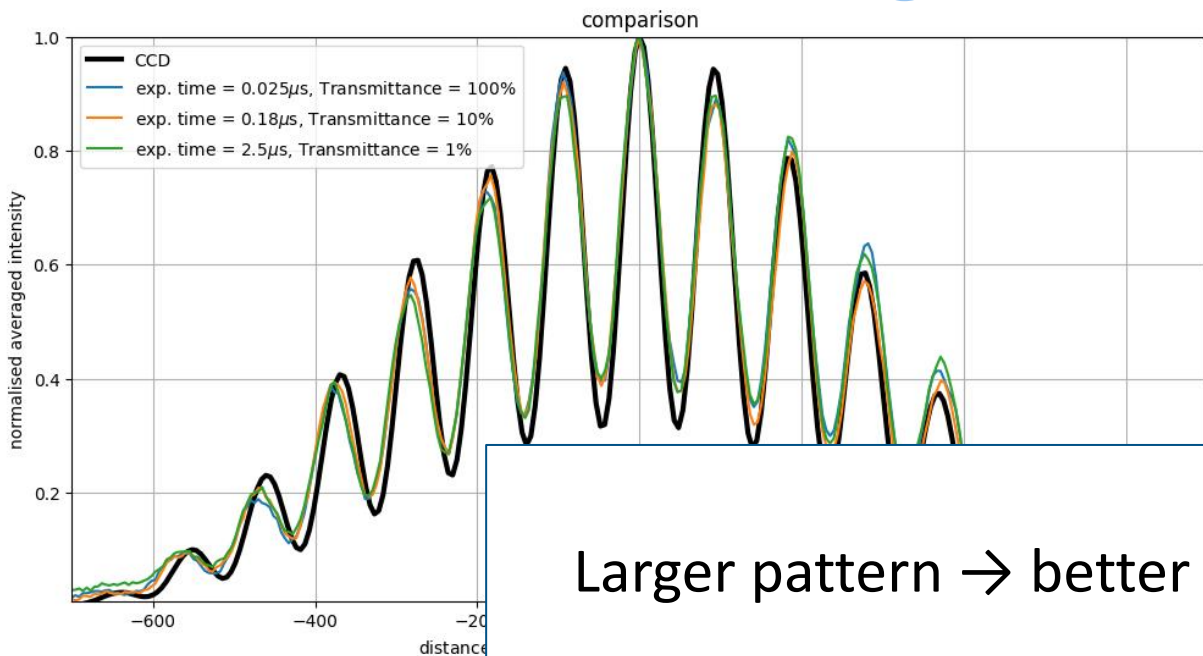
- ~~Dependence of the received intensity on the MCP Gain~~
- ~~Dependence on the maximal light intensity~~
- Dependence on the magnification (distances between peaks in the interference pattern)



# Exploring non-linear behaviour of ICCD



# Exploring non-linear behaviour of ICCD



Larger pattern  $\rightarrow$  better match to the CCD result

