Simulation of optical emission from nanoLED arrays

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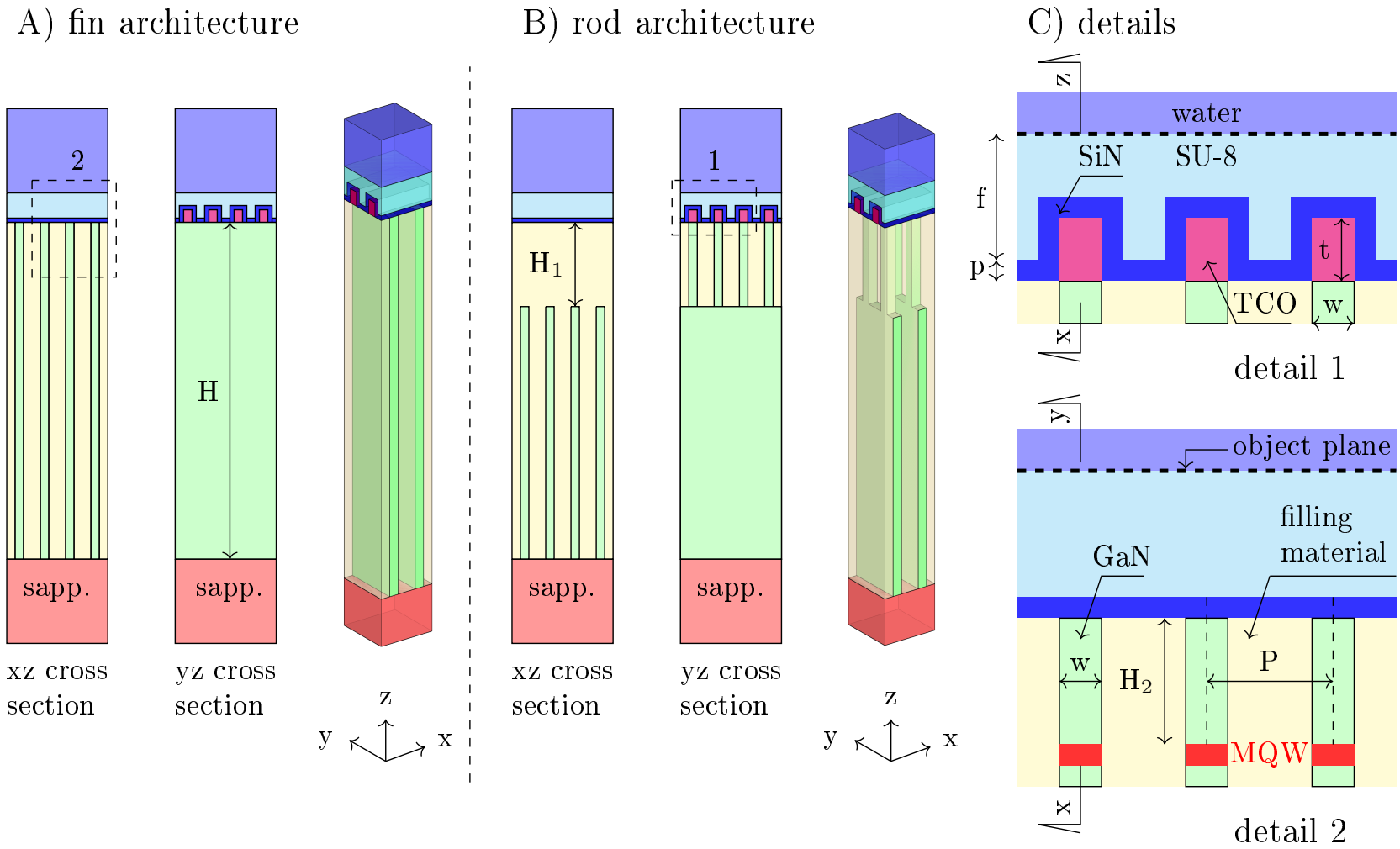
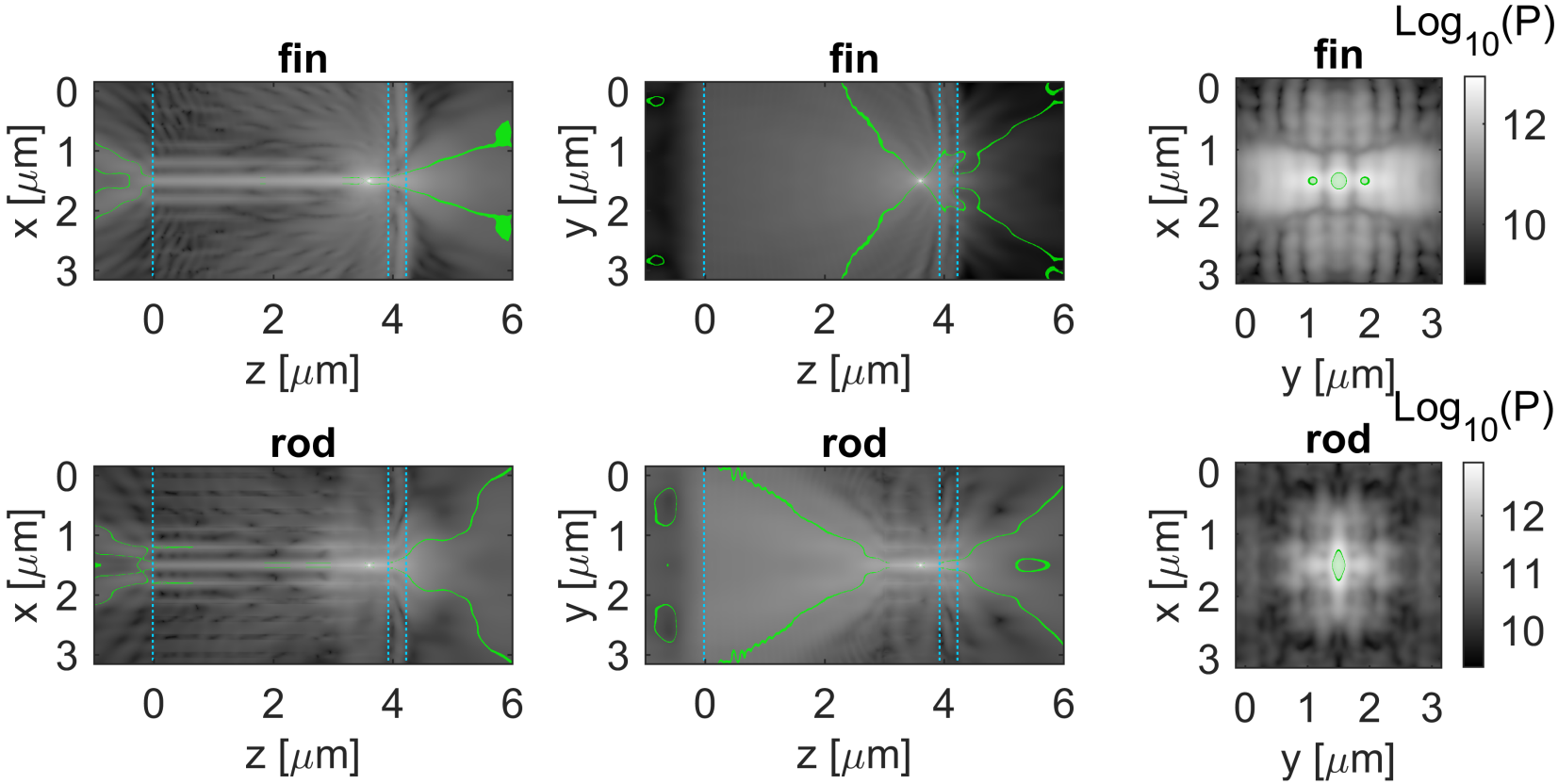
Scheme of the nanoLED array



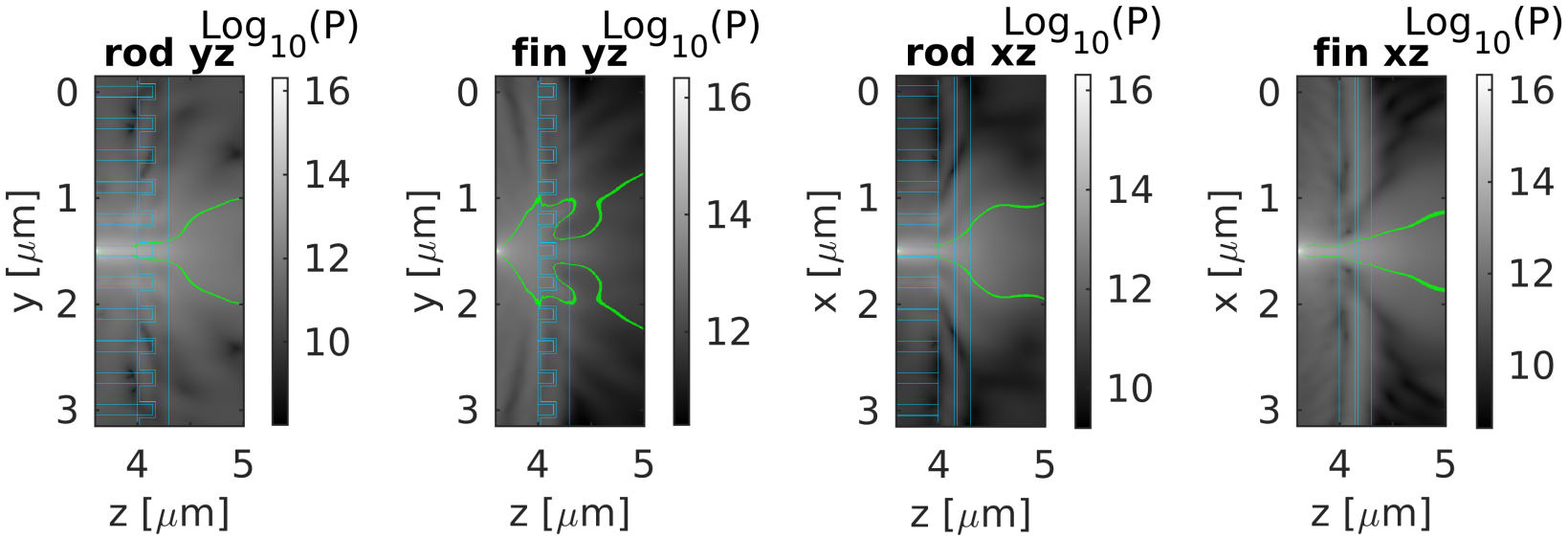
array geometry parameters: type fin or rod, pitch (P), width (W)

Electromagnetic field propagation: fin vs rod



pitch 300 nm, width 100 nm

Electromagnetic field propagation: magnification

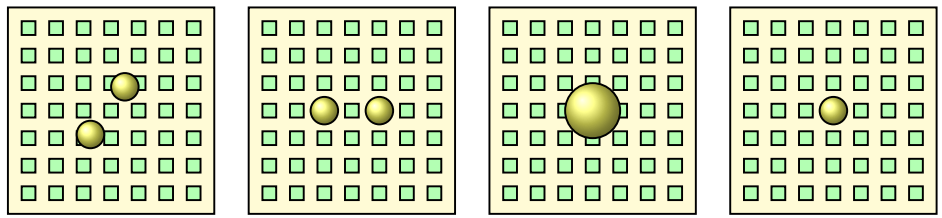


pitch 300 nm, width 100 nm

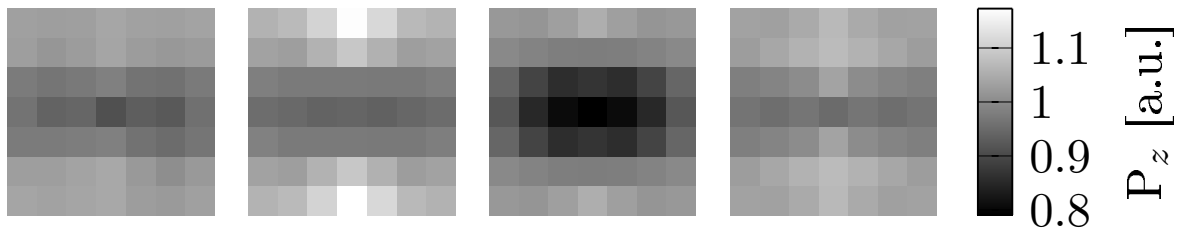
Detection of nanoparticles: what are the limits?

LED system:
rods
W = 50 nm
P = 100 nm
H_2 = 150 nm
distance = 2 pitch

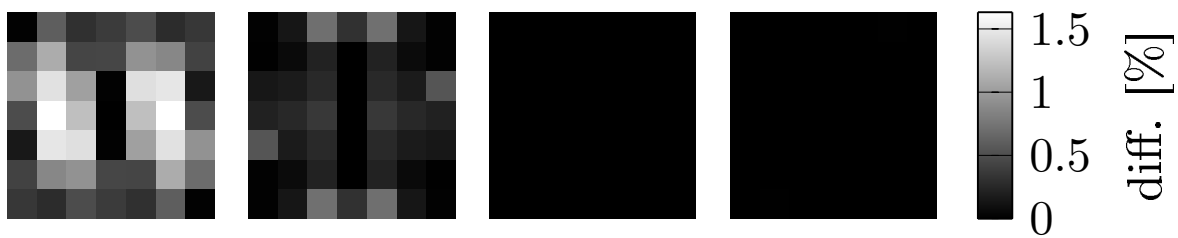
Object: Au spheres
radius=50/100nm



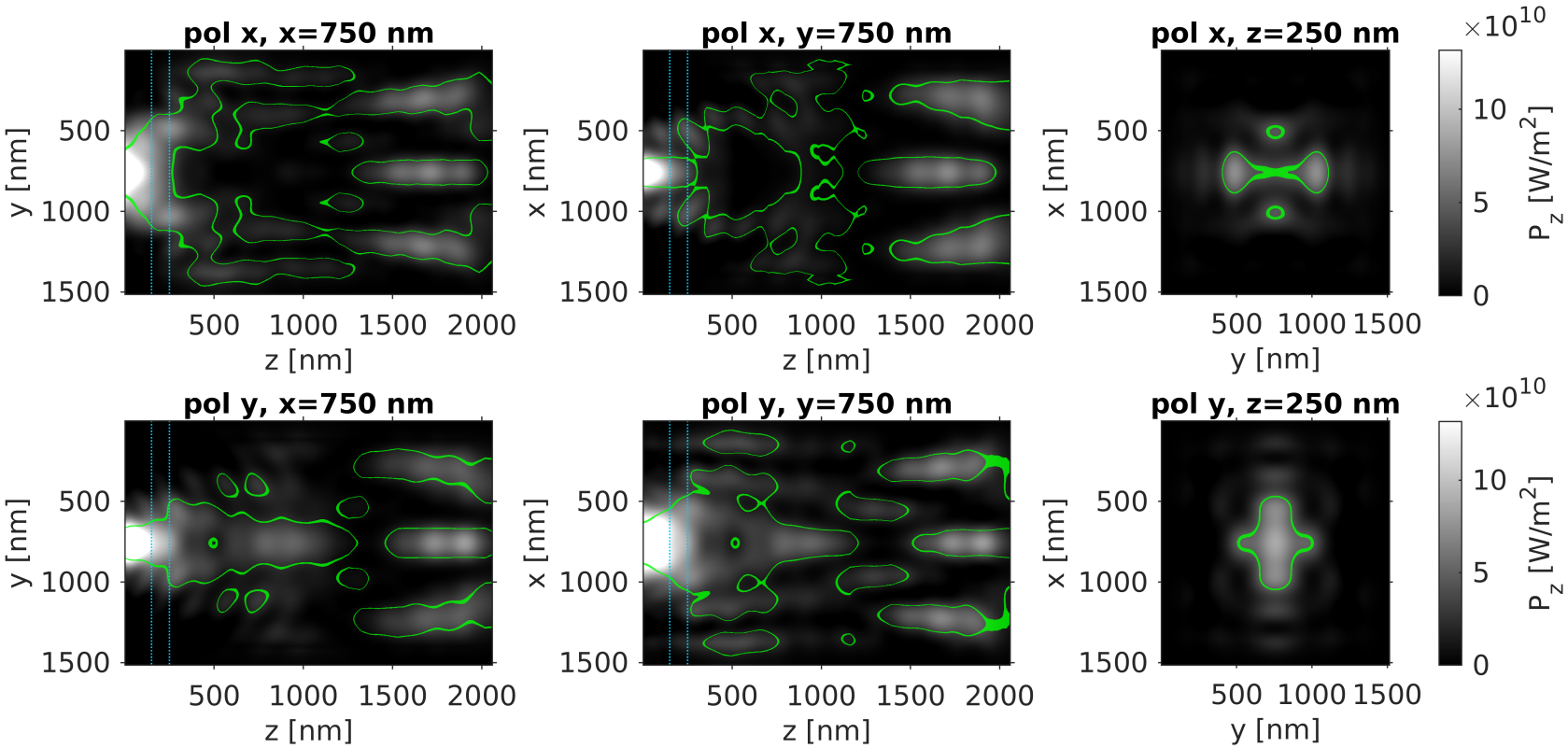
intensity maps, unpolarized light



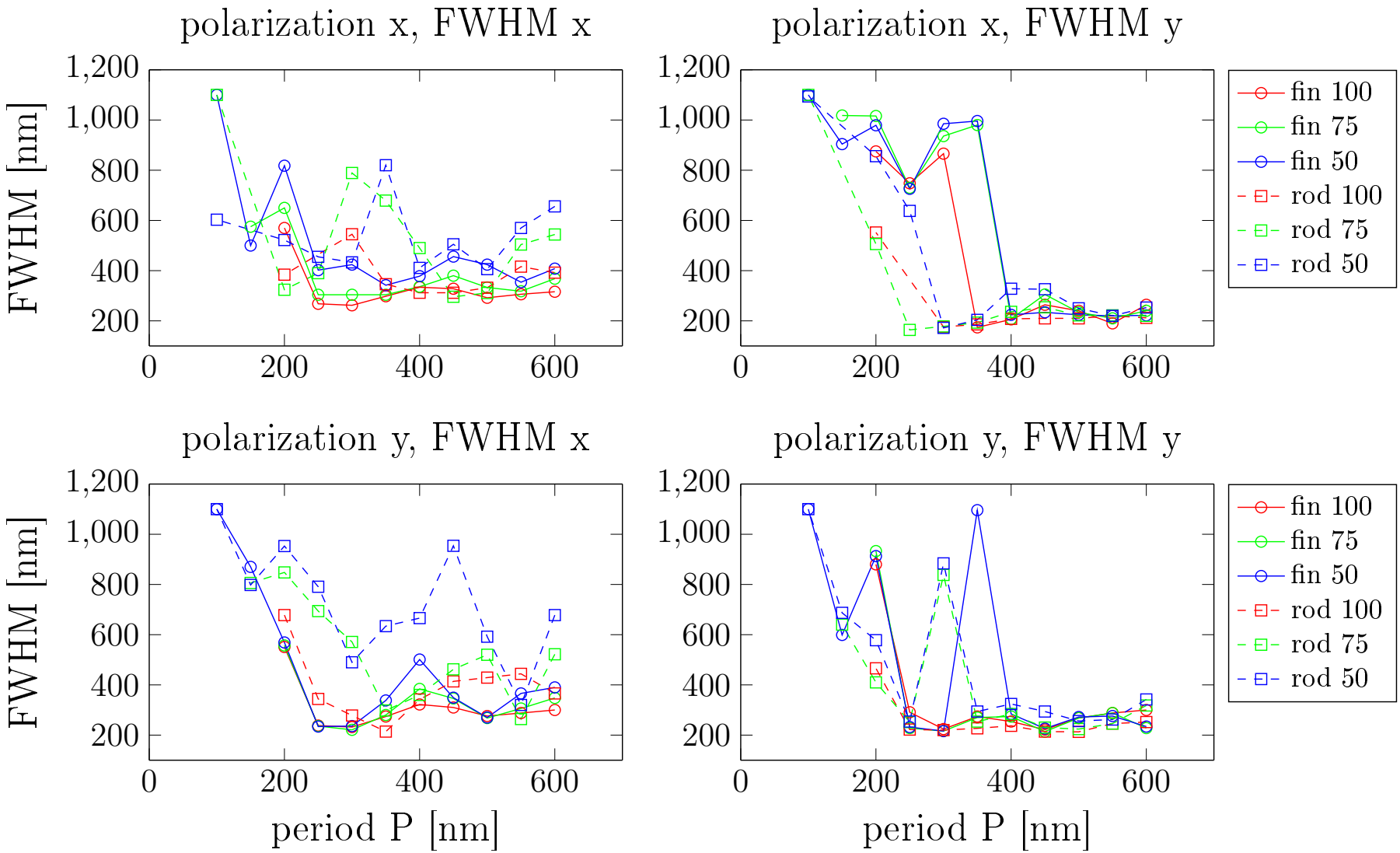
maps of diff. from symmetry along $y = -x$ axis



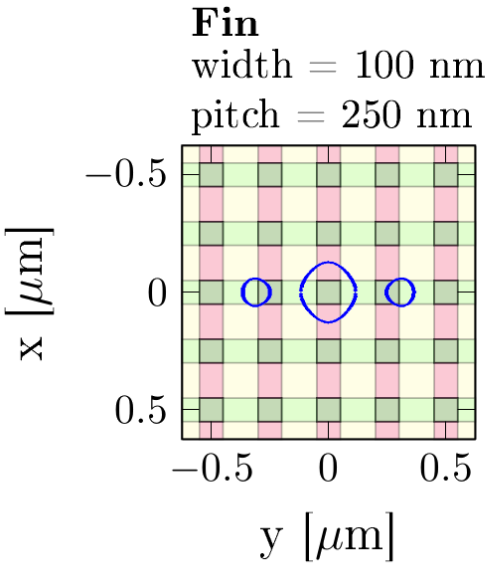
Detection of nanoparticles: electromagnetic field distribution

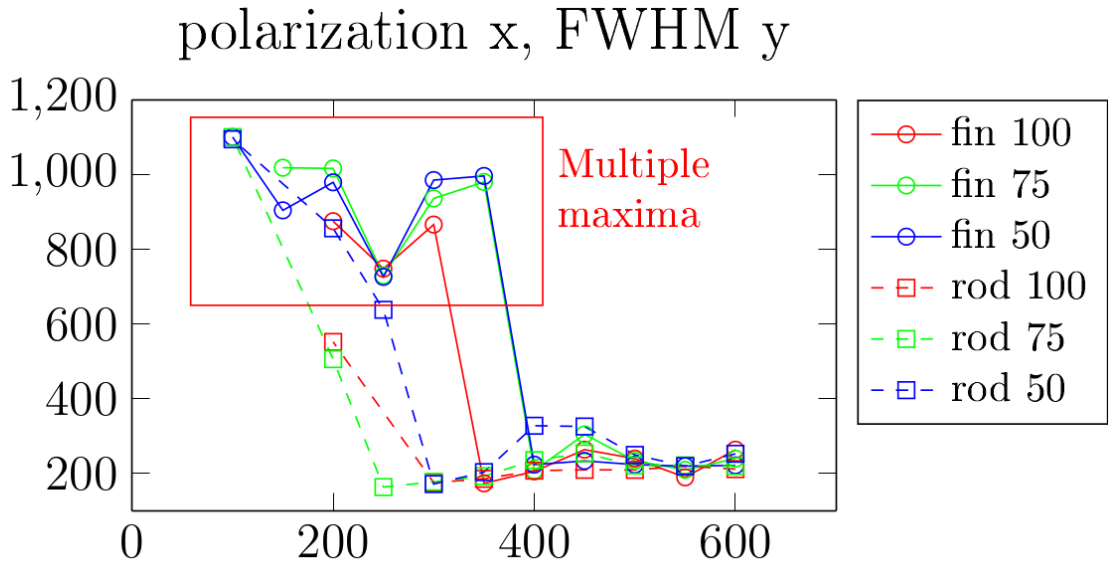


Signal width at the image plane



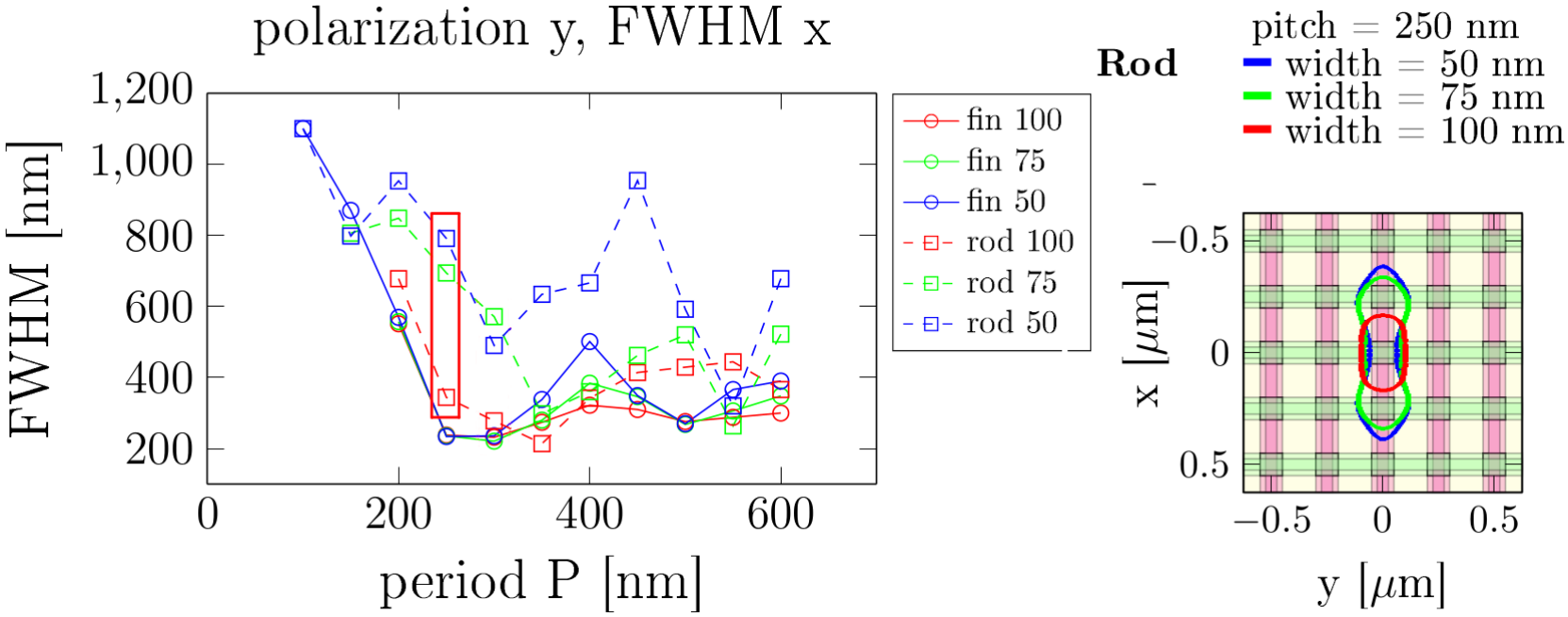
Signal width at the image plane





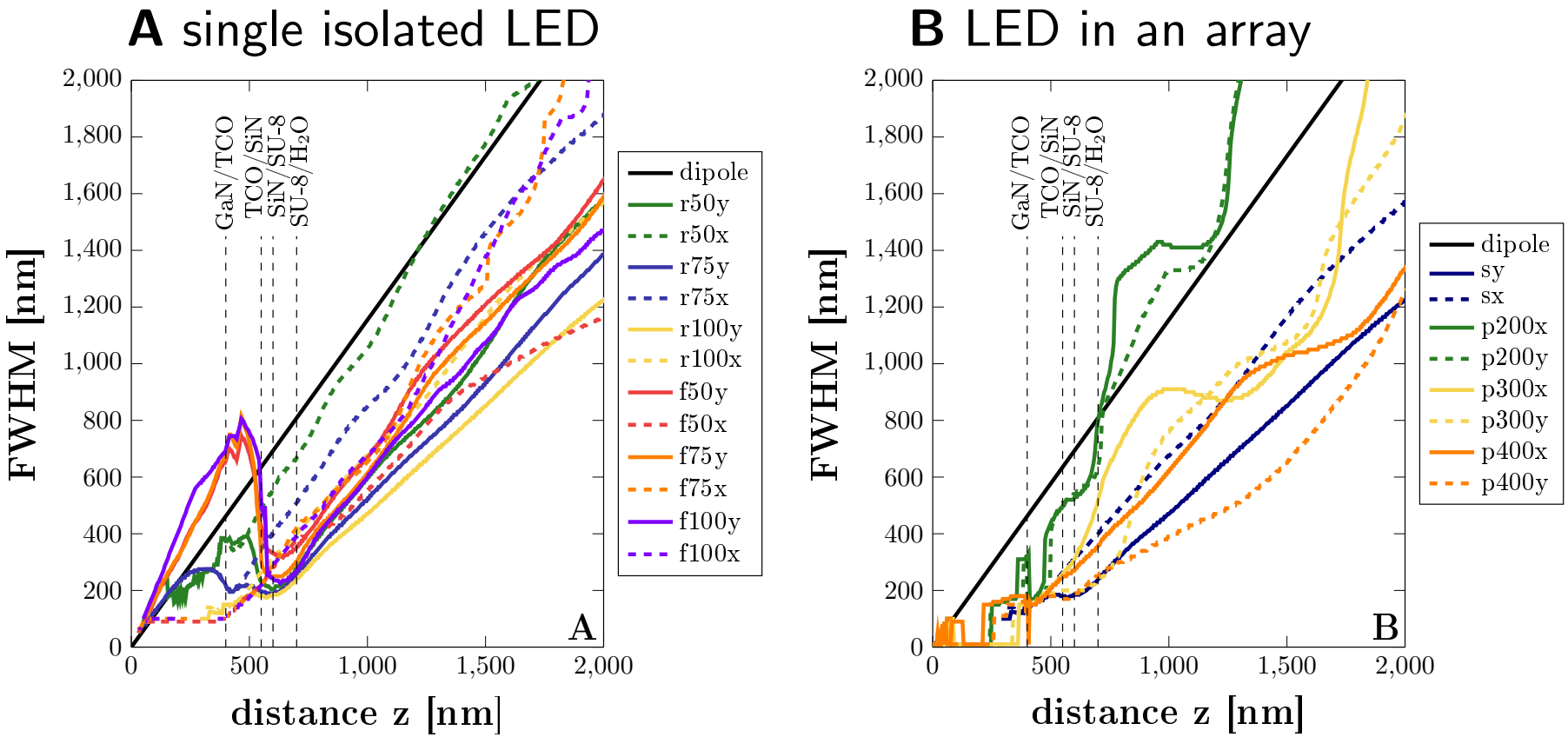
- crosstalk between pixels along the fin plane

Signal width at the image plane



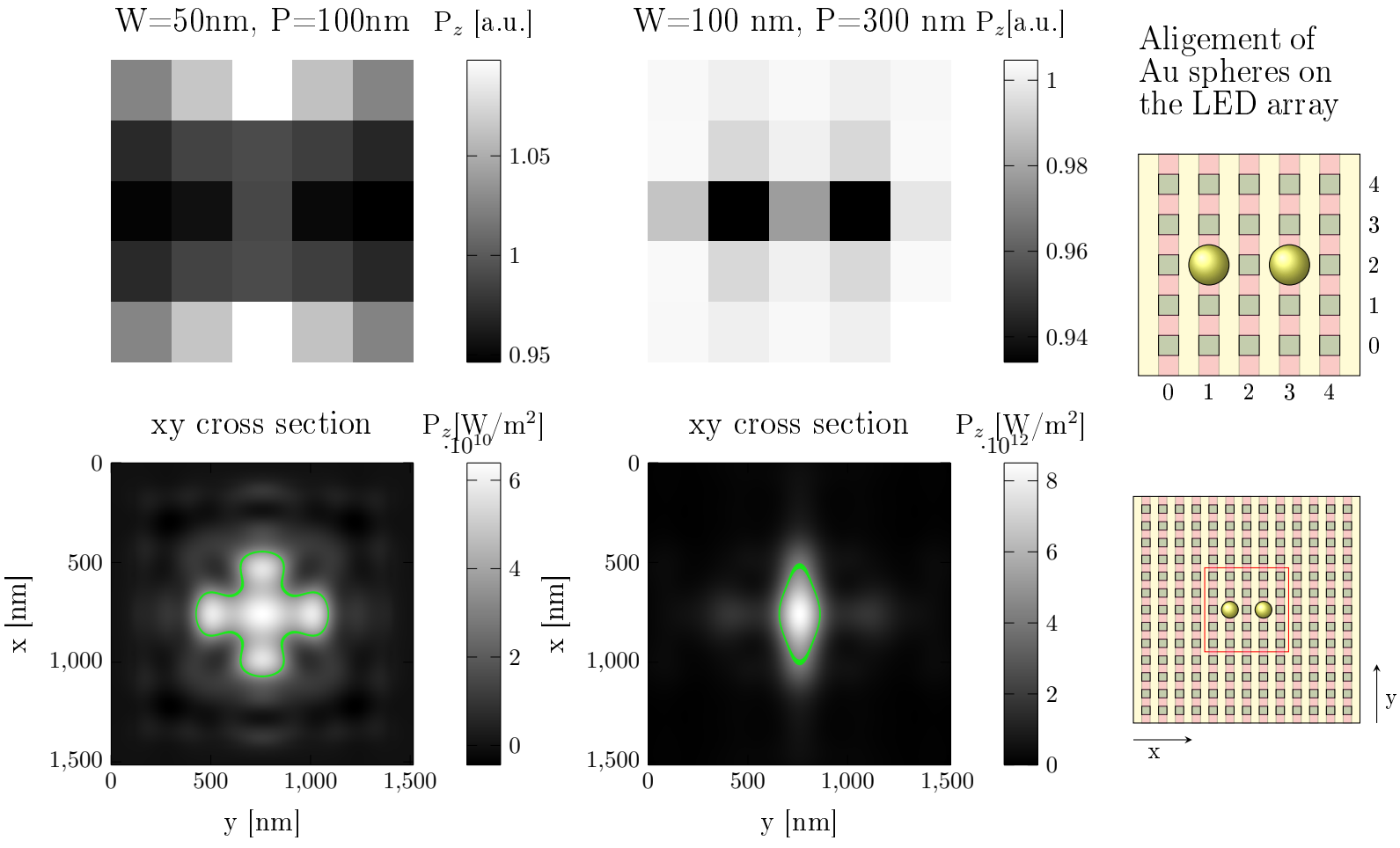
- decrease of the rod/fin width decreases wave confinement inside
- visible elongation of signal in the direction of TCO crossbars

Signal width vs distance form MQW layer



- broadening of the signal width due to the interaction in the array

Detection of nanoparticles: two Au spheres, radius = pitch/2



Summary

- We presented a new concept of a microscope on the chip which use a LED array as an illumination source
- Two designs of LED array was modeled in respect to the pixel size and array pitch
- The key aspect for minimizing light spot size is to confine the light inside the pixel and guide it to the surface
  - Nanorods should be preferred over nanofins
  - The pitch of the array and the width of the fin/rod should be optimized at the same time in order to decrease the crosstalk between the pixels