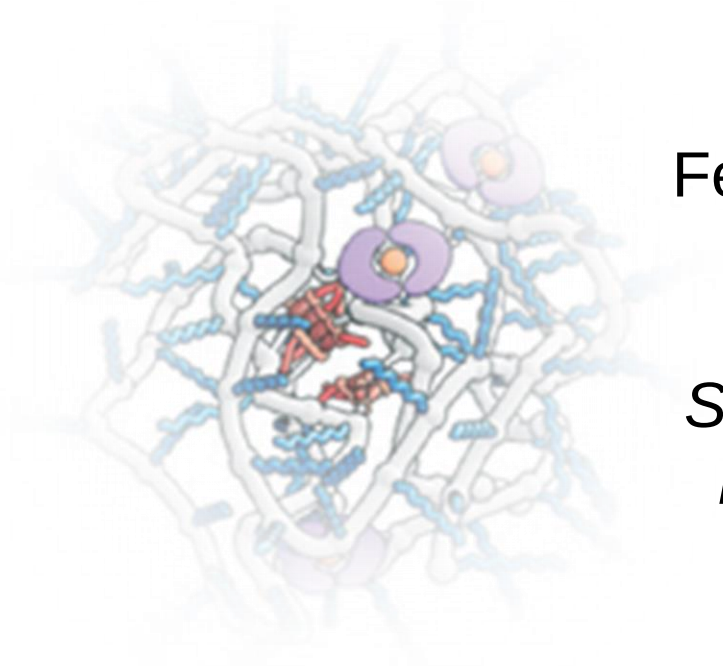
Characterization of Catalytic Nanoparticles using Single-Molecule Microscopy



Fellow: Emmanouil Archontakis
Institution: ICMS, TU/e
Group: Biomedical
Supervisor: Lorenzo Albertazzi
Email: e.archontakis@tue.nl

Meeting 2
Edinburgh, 3rd February 2020

Innovative Training Networks (ITN) – Marie Skłodowska-Curie Actions
H2020-MSCA-ITN-2017 (THERACAT-765497)

Catalytic nanoparticles for cancer therapy

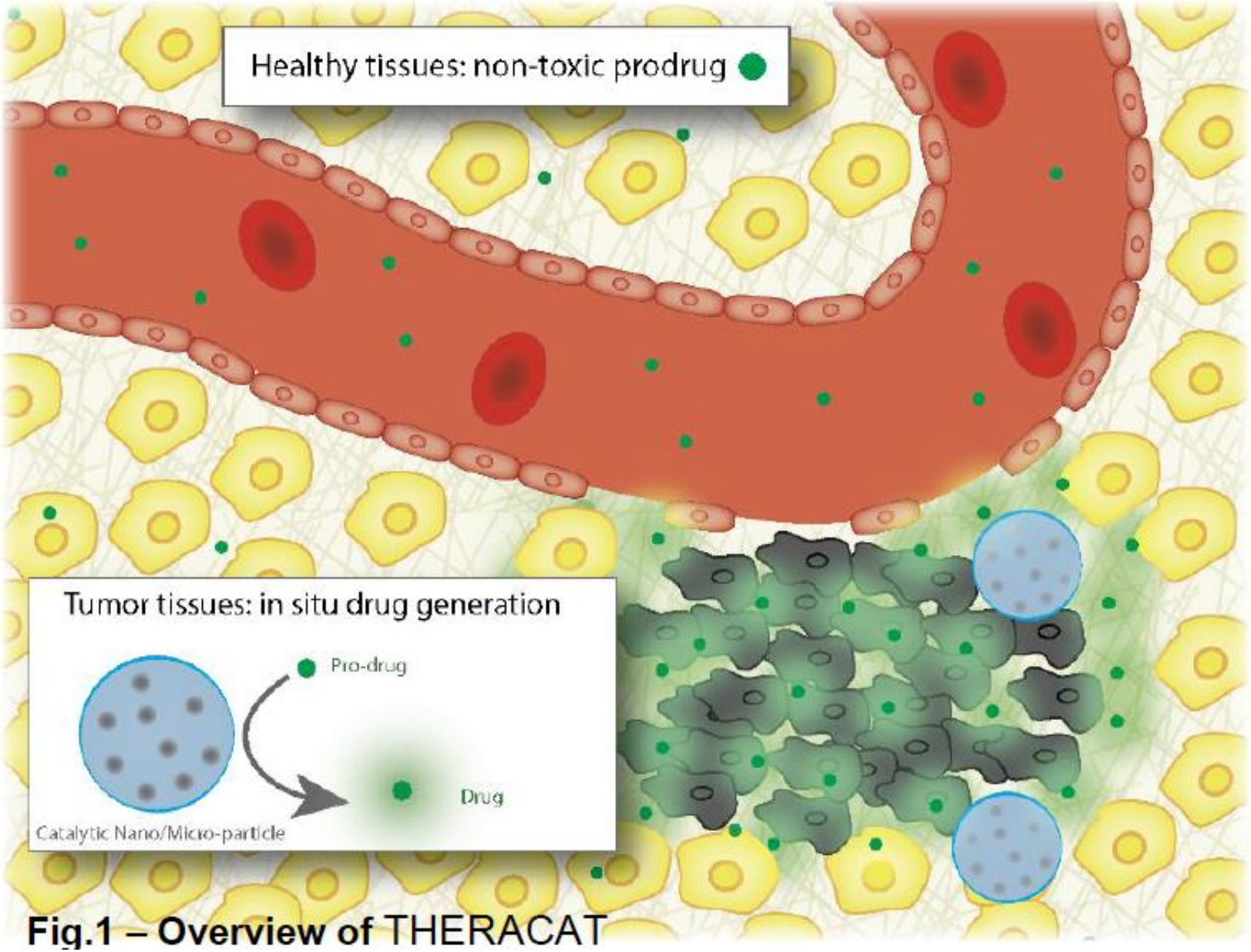
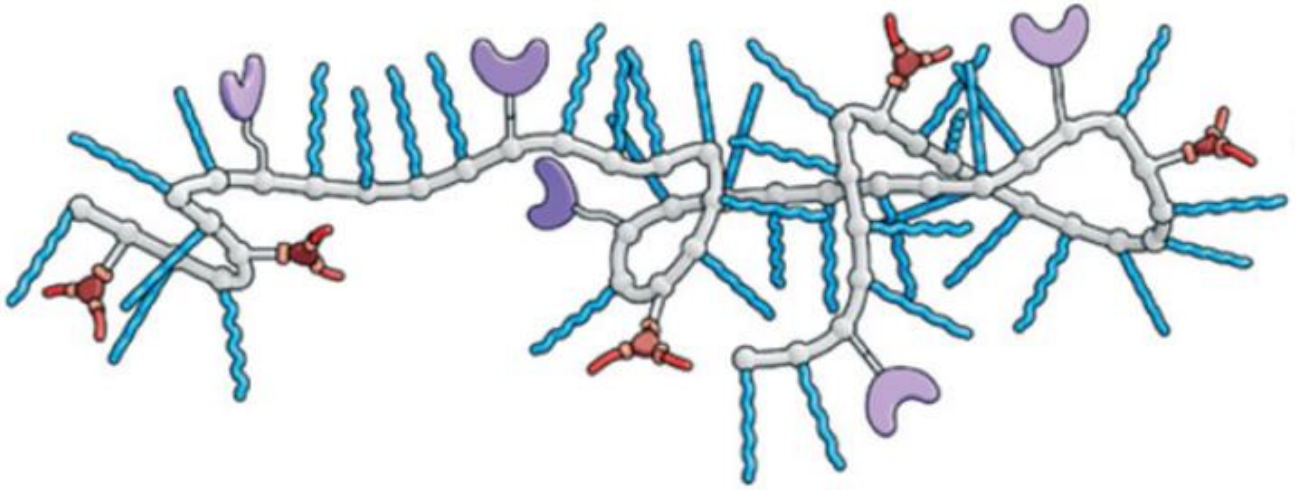
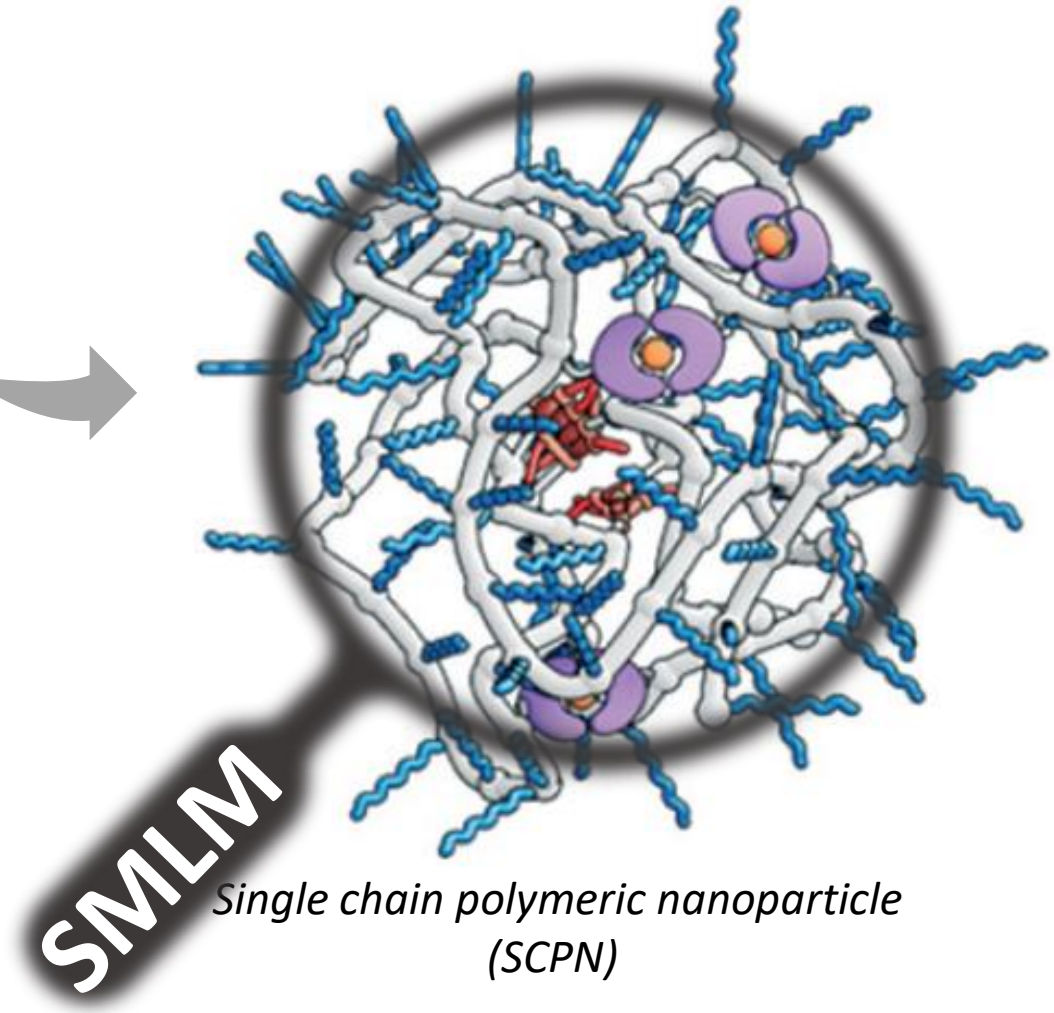


Fig.1 – Overview of THERACAT

Single Chain Polymer Nanoparticles



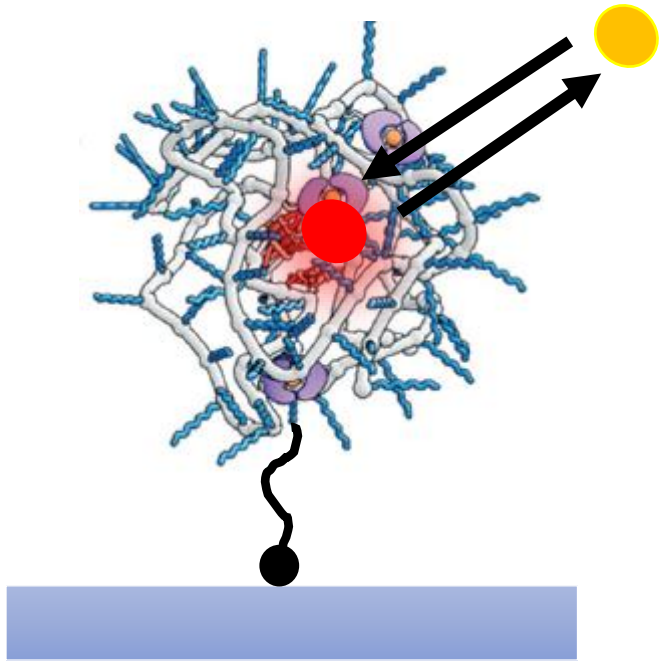
Single chain polymer



Single chain polymeric nanoparticle (SCPN)

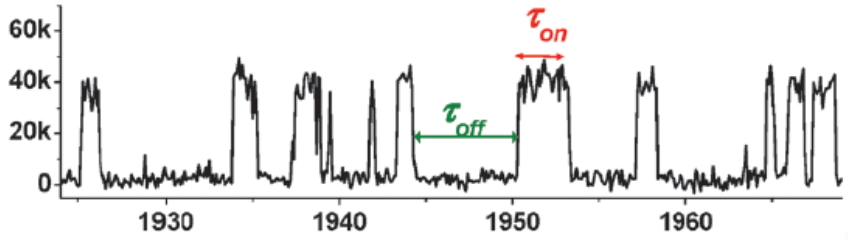
SCPNs are heterogeneous due to the polydispersity on their synthesis

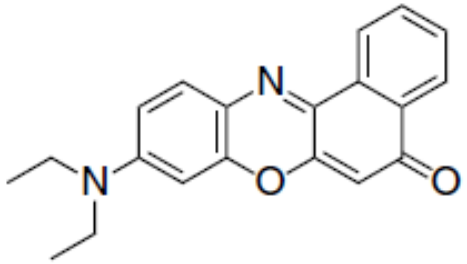
Goal: study SCPN properties and catalytic behavior at SM level



Structure characterization

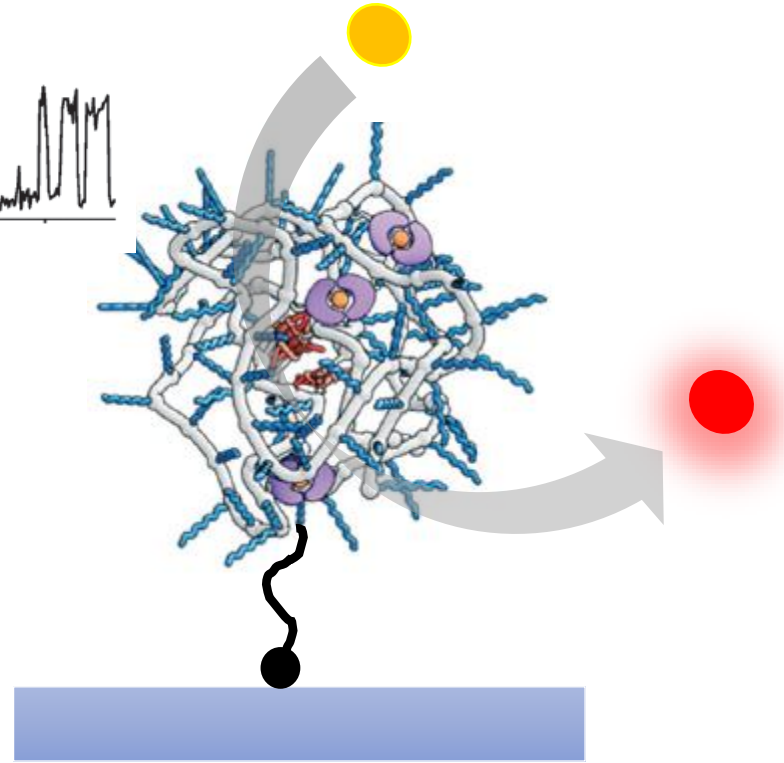
Polarity of the pocket





Fluorescence emission

Increasing hydrophobicity

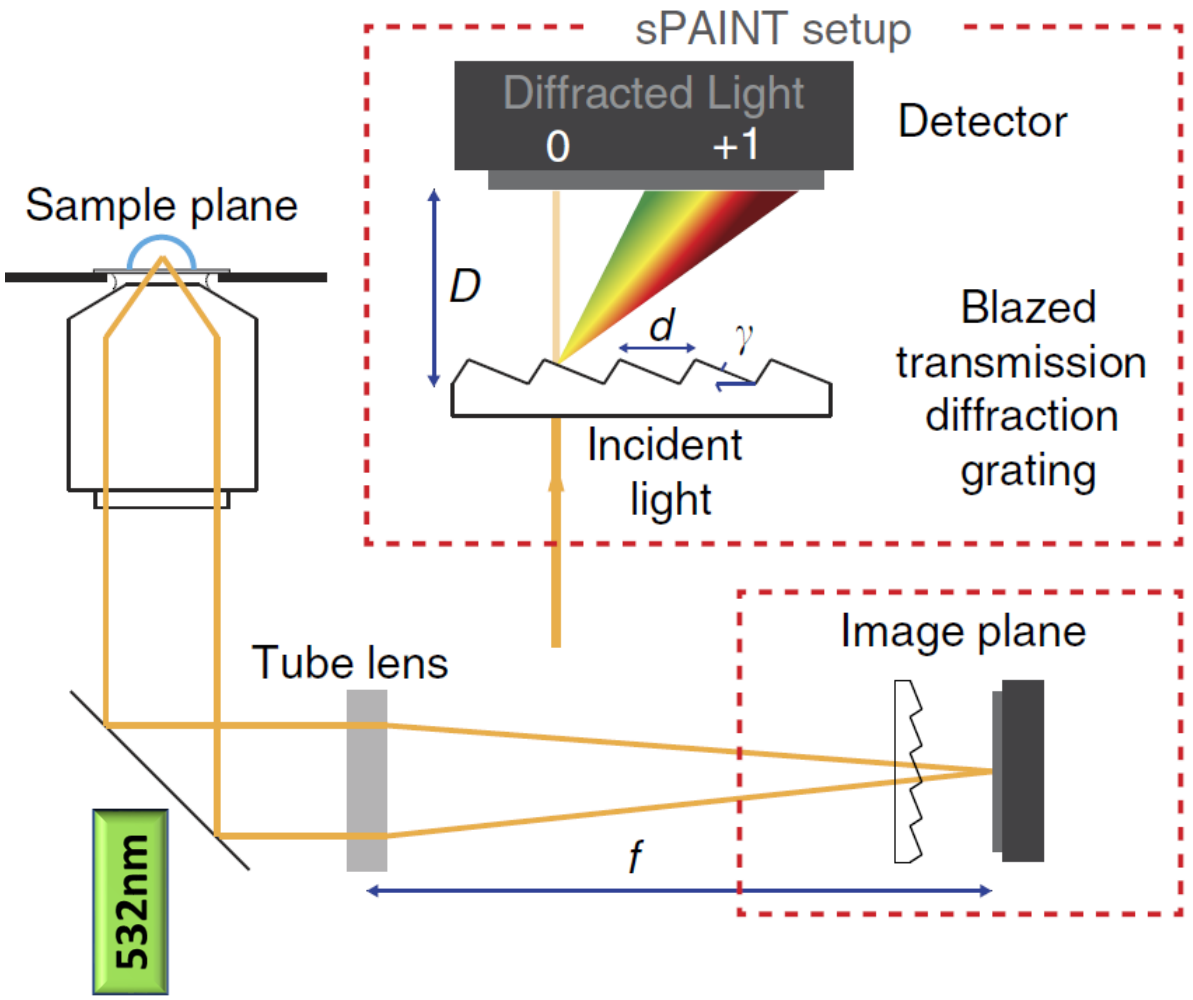


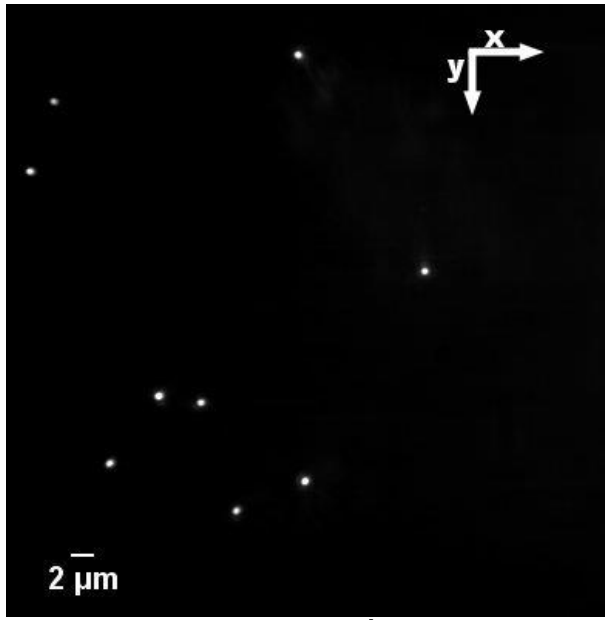
Catalytic characterization

Catalyst stability
Catalytic efficiency

Multi-dimensional super resolution microscopy

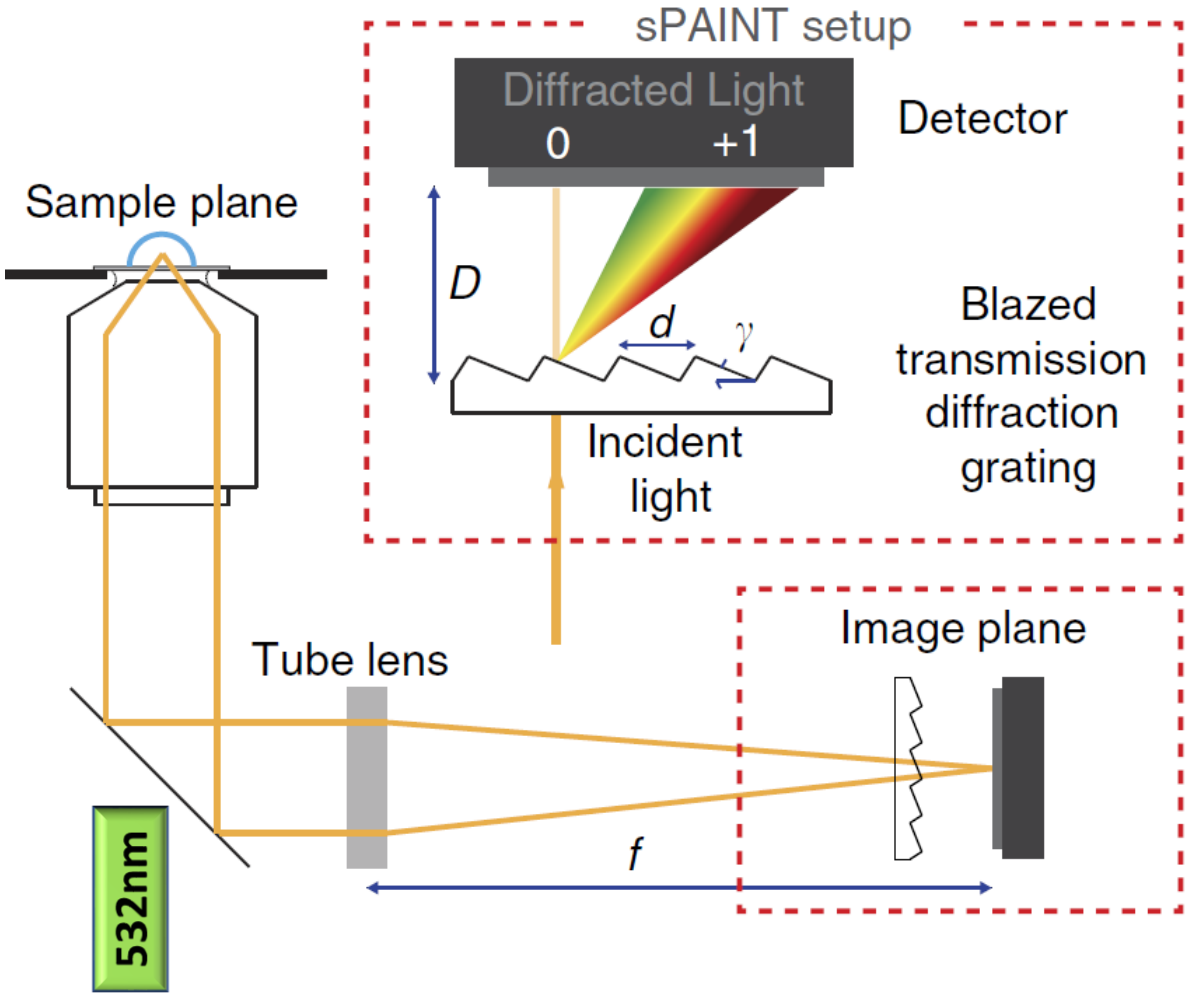
Multi-dimensional super resolution microscopy

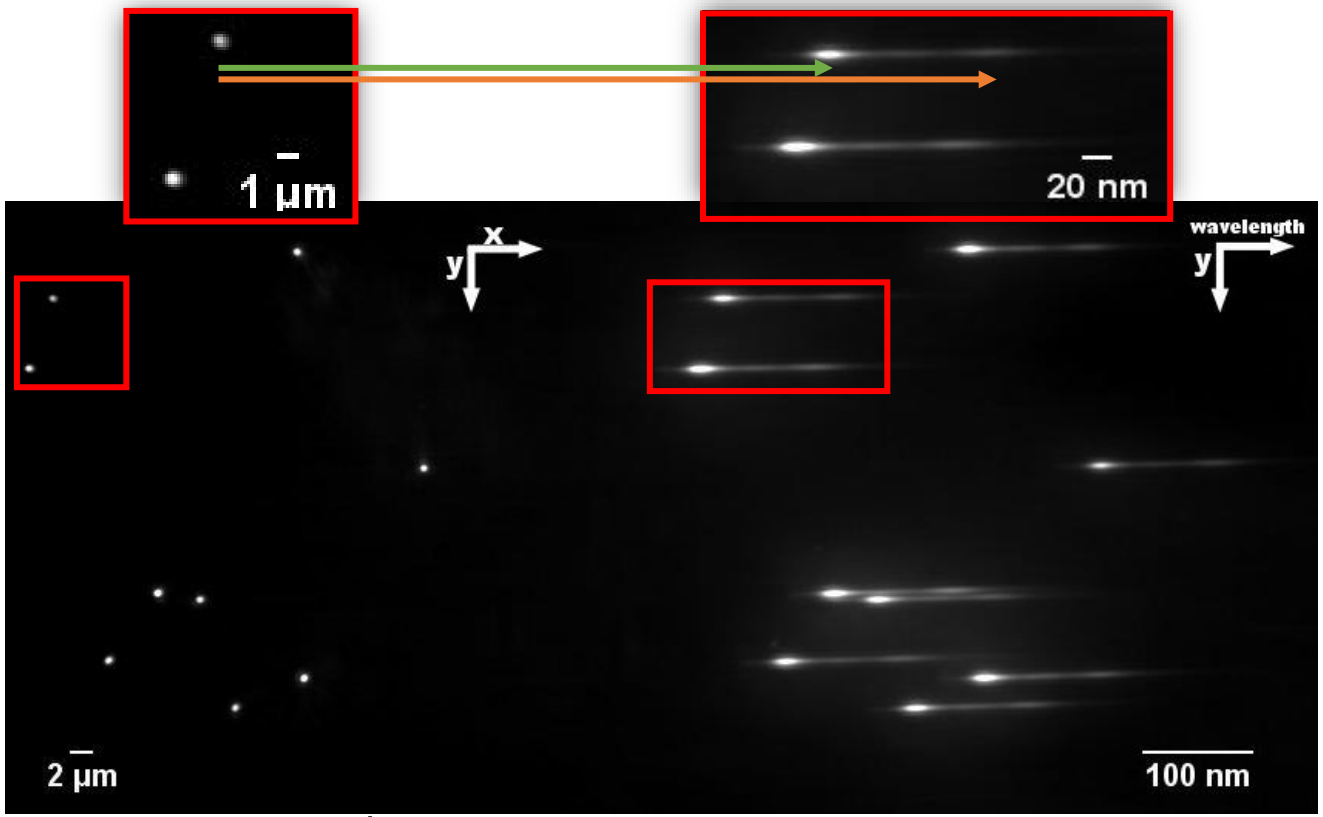




Spatial domain

Multi-dimensional super resolution microscopy

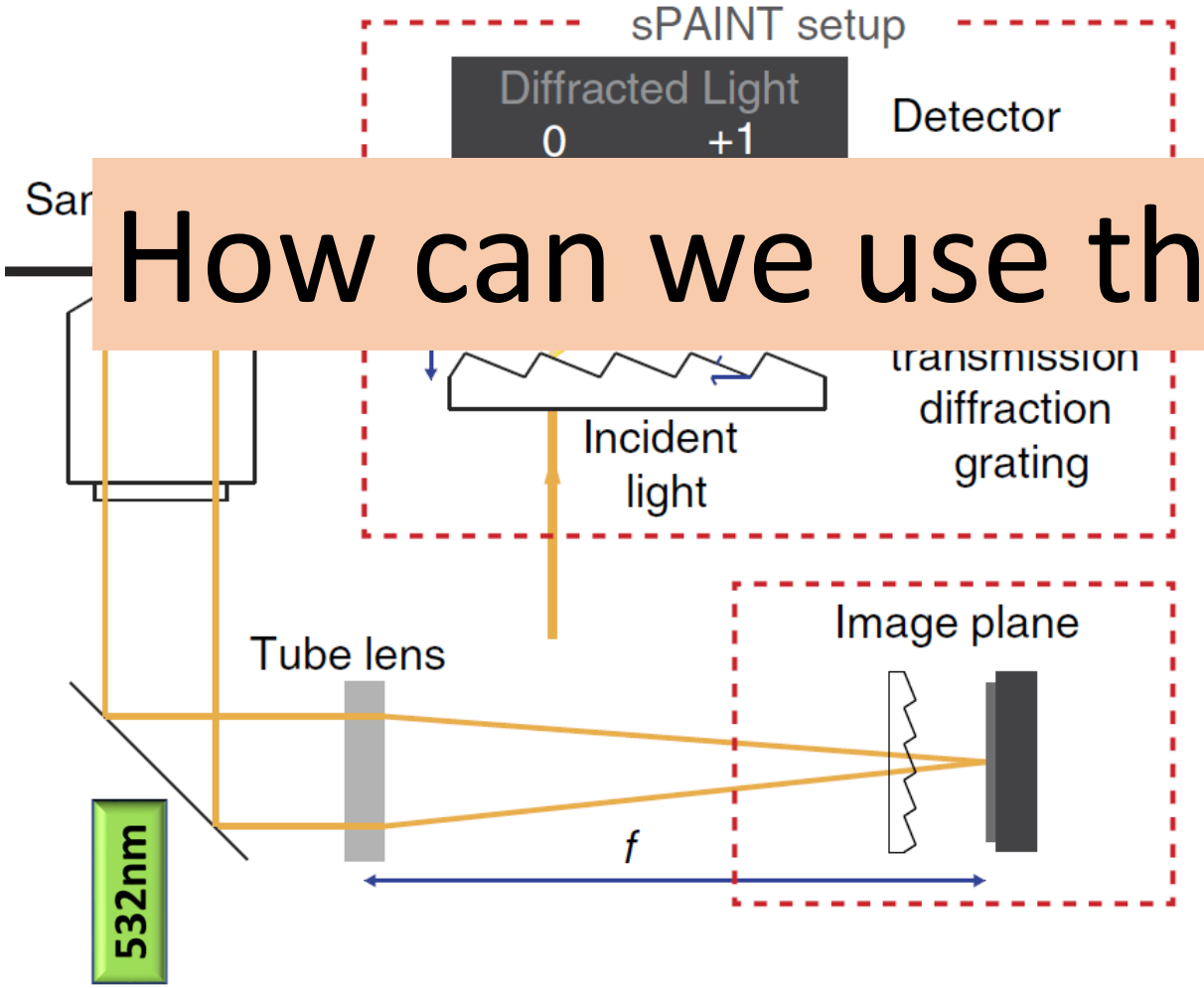




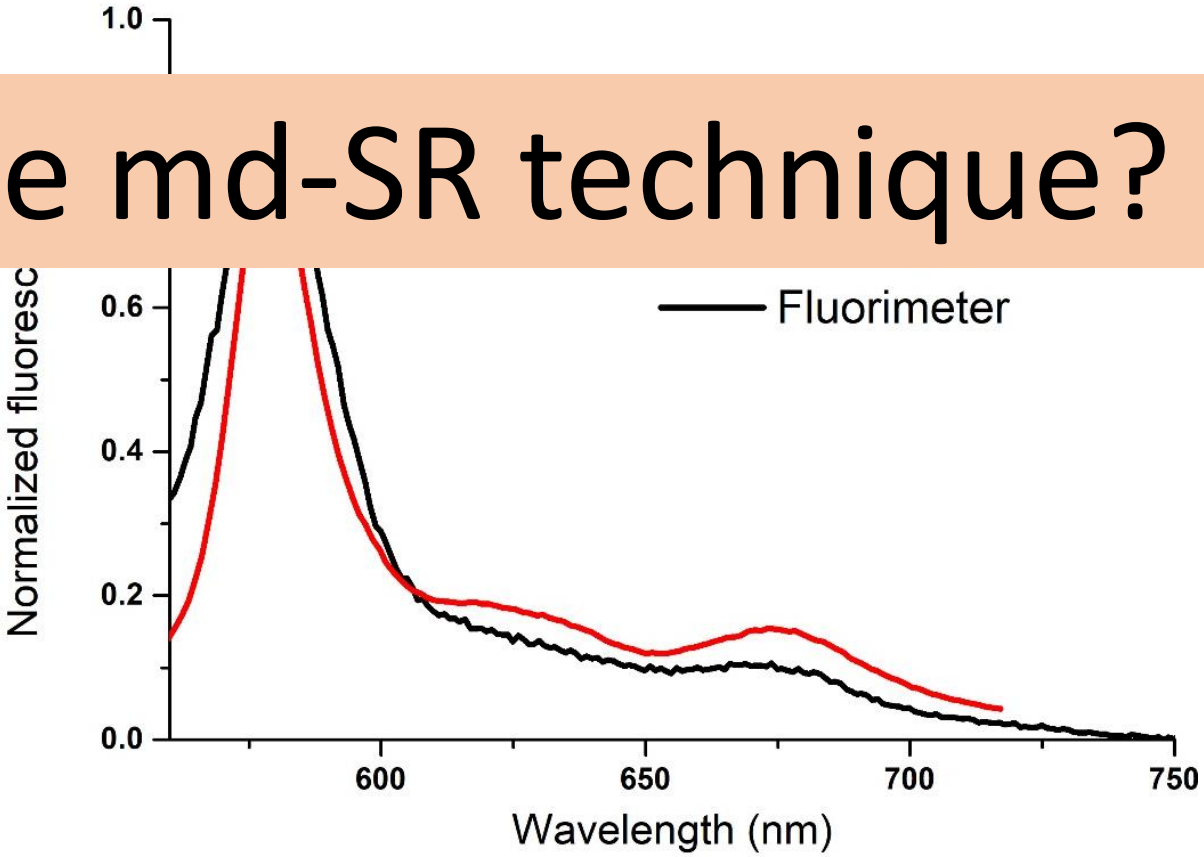
Spatial domain

Spectral domain

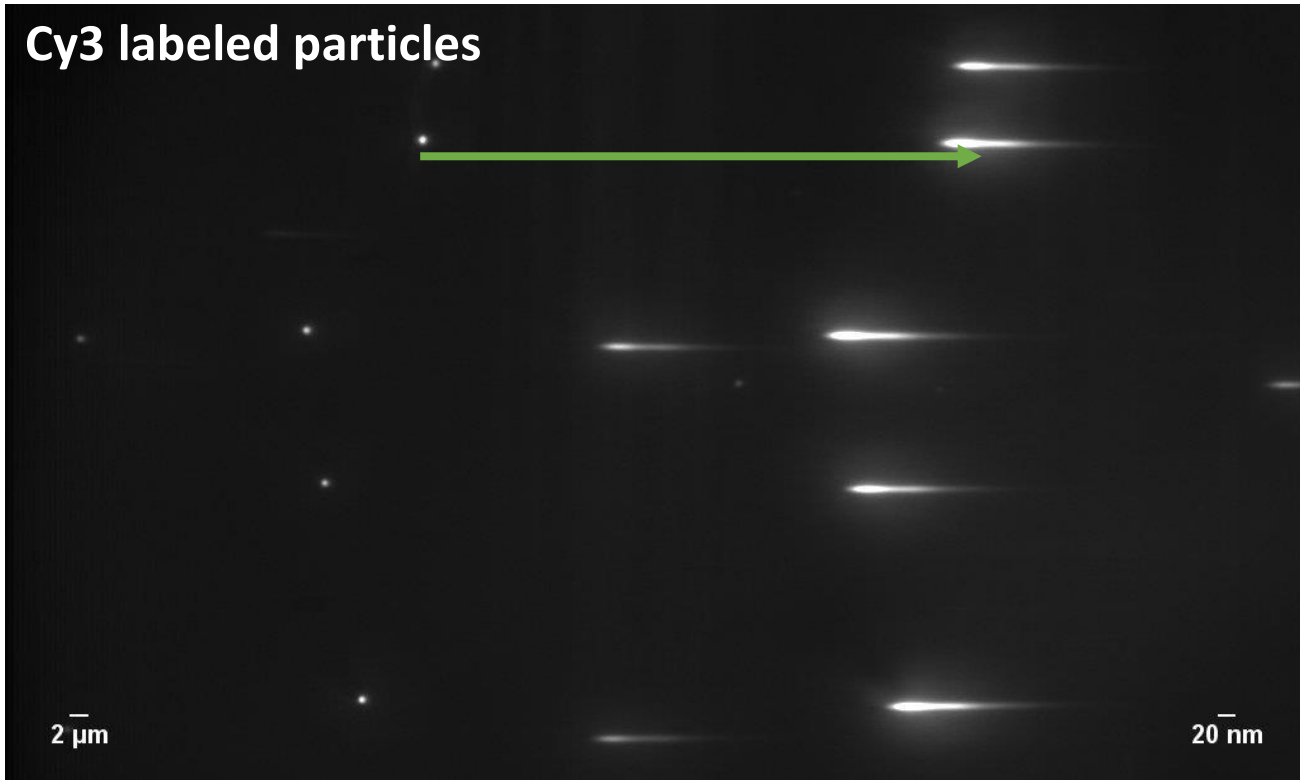
Multi-dimensional super resolution microscopy

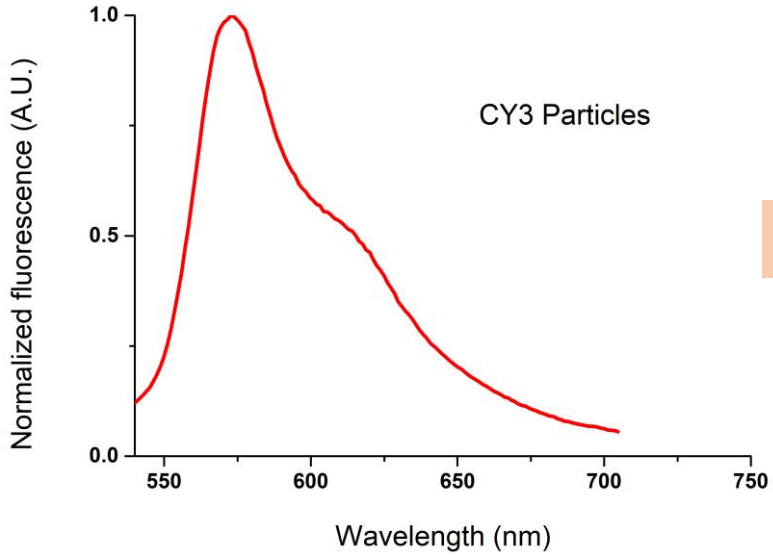


How can we use the md-SR technique?

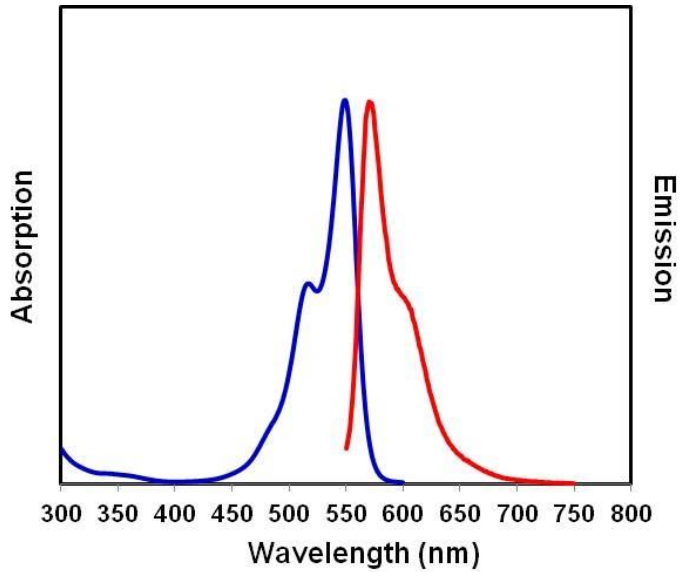


Spectrally resolved single particle microscopy



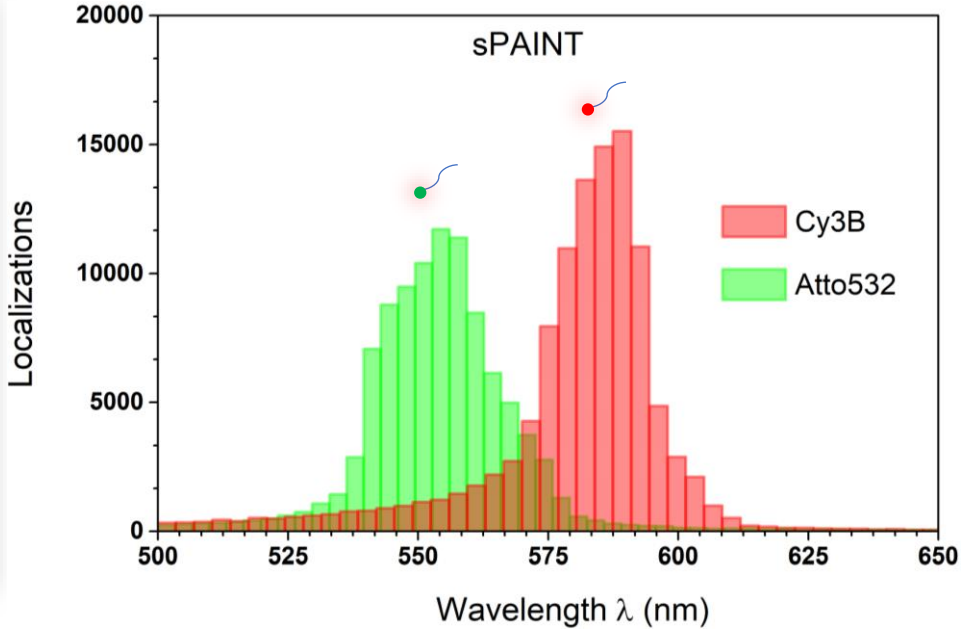


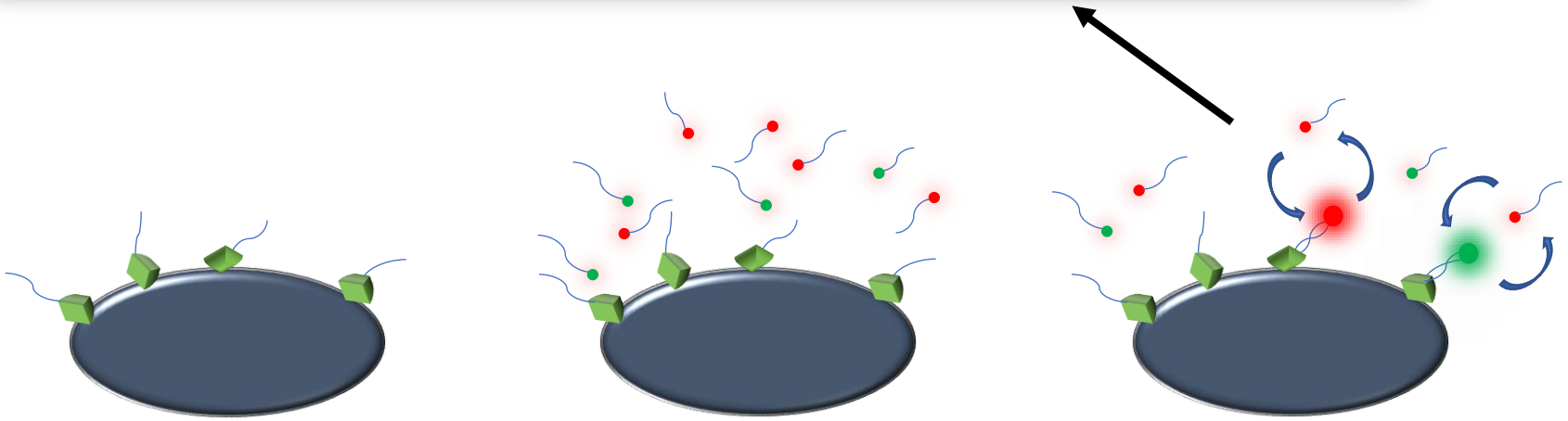
Spectral instrument



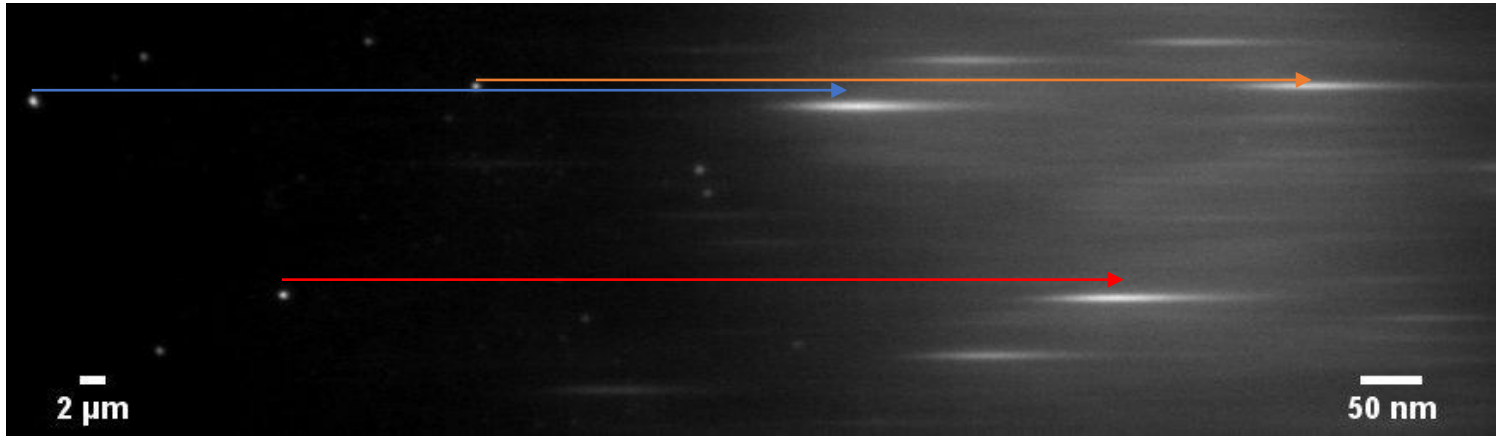
Bulk

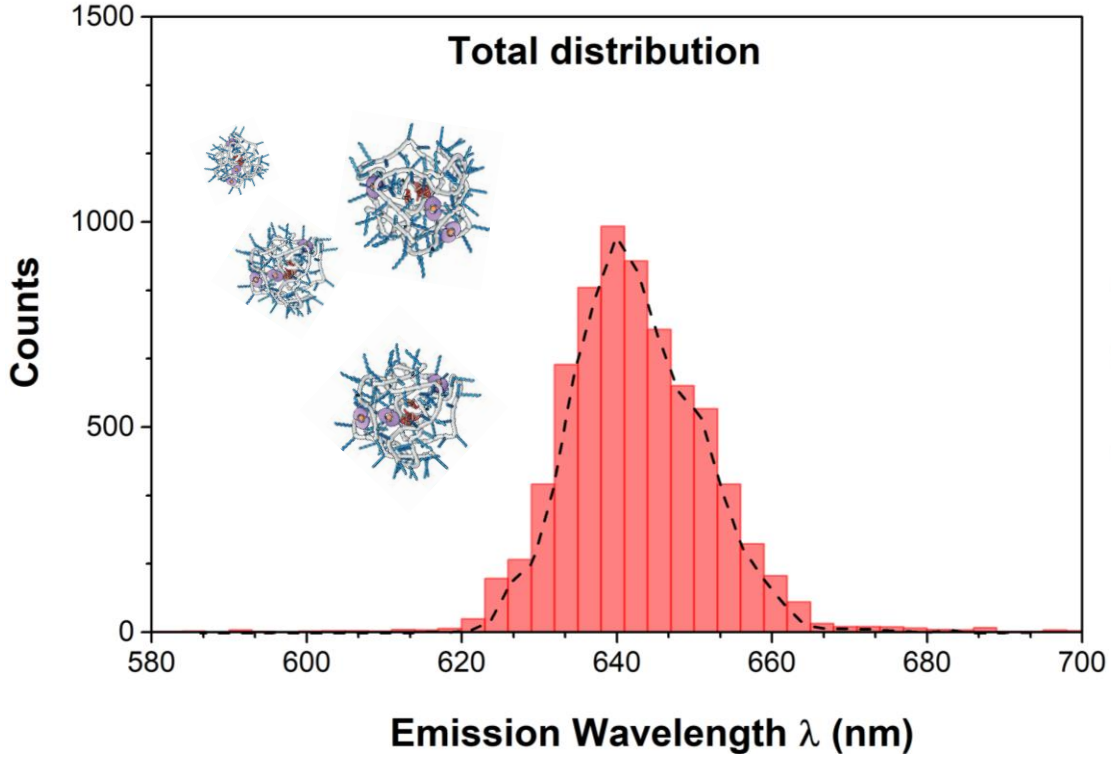
Spectrally resolved single molecule microscopy
One molecule at a time….one wavelength at a time!

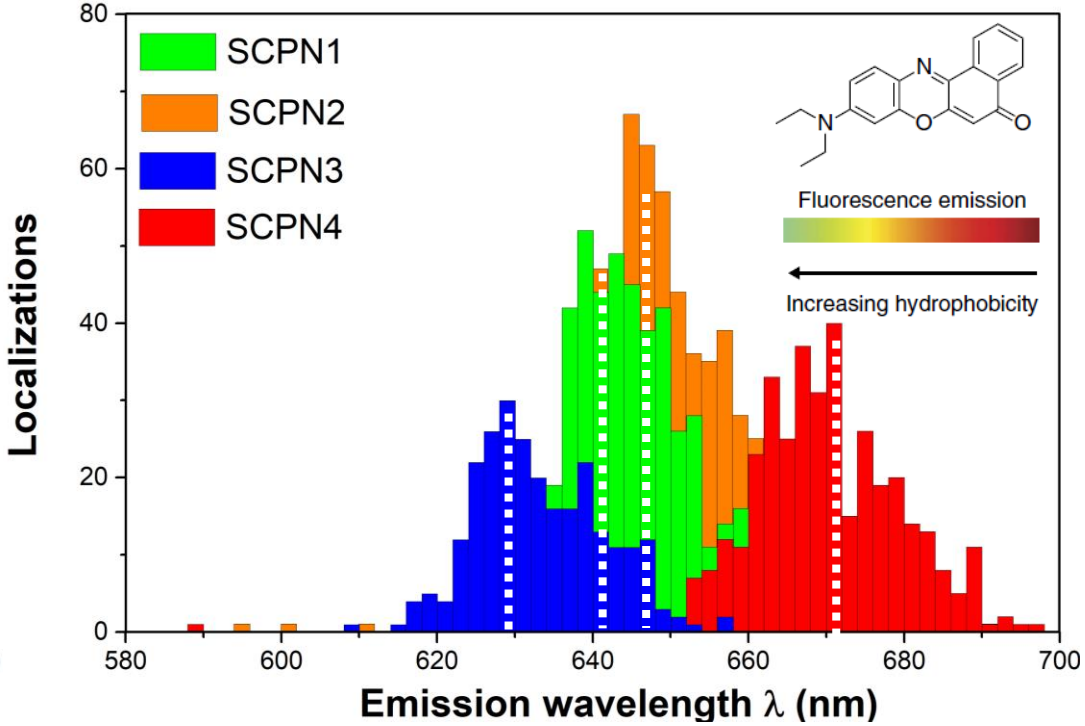




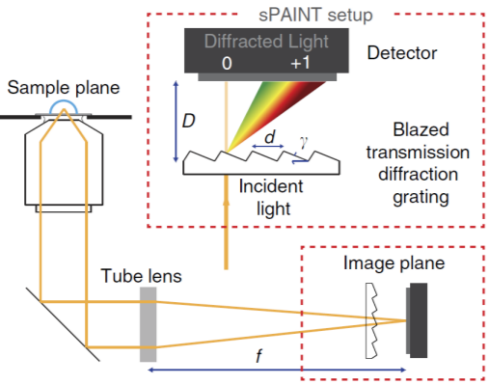
Single SCPN spectra



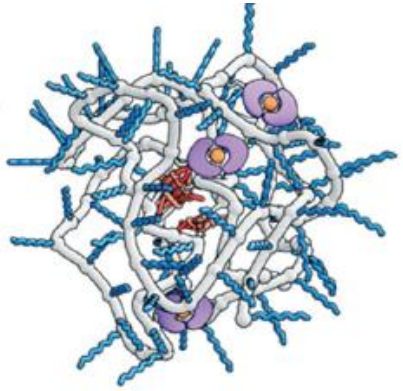




Conclusion



- Md-SR microscopy can be used to spectrally resolve single particles.
- Md-SR microscopy can be used to spectrally resolve single molecules (useful for multicolor imaging and hydrophobicity mapping of dynamic structures) .



- Md-SR microscopy denotes SCPN spectral heterogeneity up to 20 nm.
- Next steps :

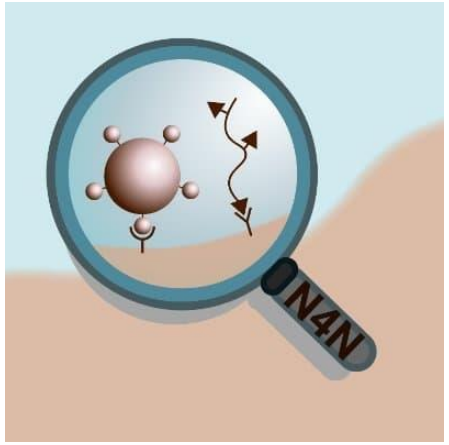
1. sSMLM with environmentally responsive dye
2. Preliminary single molecule catalysis measurements

Scientific and complementary skills training

- Super resolution microscopy (different microscopes)
- Data analysis
- Optical engineering
- Interaction with application and technical experts regarding the microscopes
- Chemicals and sample preparation
- Scientific integrity course
- Supervising master students course
- Presentations
- Attended the biophysics conference in Veldhoven

Thank you!

n4nlab



Innovative Training Networks (ITN) – Marie Skłodowska-Curie Actions
H2020-MSCA-ITN-2017 (THERACAT-765497)