

Program for Summer Workshop 2023

DATE: 21.8. -25.8.

PLACE: Vinicna 7, Prague 2, ROOM B2, 311

FORM: a hybrid form of presentation, (hands-on in-person only)

Image Analysis and Data Processing (not only) in Super-Resolution Microscopy 2023

Program 21.8. – 25.8. 2023

Day 1

Location: VMCF Viničná, Microscopy Center, Viničná 7, Praha 2, room P09

10:00 - 11:00 Registration

**11:00 – 11:15 Welcome note in VMCF (Miroslav Hyliš,Ph.D.,
Martin Schätz,Ph.D., Zuzana Burdikova,Ph.D.)**

**11:20 – 12:00 Introduction to super-resolution microscopy:
methods, principles, theoretical background (Zuzana
Burdíková, Ph.D.)**

- Image Formation in Fluorescence Microscopy
- Resolution and Noise
- Single-molecule localization microscopy (STORM, PALM, DNA-PAINT,...)
- Structured Illumination Microscopy (SIM)

12:00 – 13:20 Lunch

**13:30 – 14:00 Introduction to image processing (Karel
Štěpka, Ph.D., Faculty of Informatics, MUNI)**

14:00 – 14:10 Coffee break

**14:10 – 15:20 Image processing in FIJI, ImageJ
(Karel Štěpka, Ph.D. Faculty of Informatics, MUNI)**

- Two-channel colocalization (mitochondrial and membrane labeling)
- a p-Value of colocalization, data filtering
- Quantitative analysis
- Quantitative data (filtering, thresholding, background separation)
- Filter on photon count
- Data visualization, 3D visualization
- Histogram, measurement of different parameters
- Pseudo-colors, pixel size, rendering mode, multicolor image
- Image export

15:20 – 15:35 Coffee break

**15:35 – 17:00 Optional - ImageJ, Ilastik, Thunderstorm
Installation (Martin Schätz, Jakub Soukup)**

**Optional: Facility tour - KONFMI: Zeiss Elyra
PS, Zeiss Axio Scan, Leica TCS SP8 (Pavel Krist, Jan Paces,
Frantisek Kitzberger)**

Refreshment included

Day 2

Location: VMCF Microscopy Center, Viničná 7, Praha 2, Study room P09

10:00 – 10:40 Matlab Markus Hohle (QBM Munich : “Optical Interferometry Imaging and Artificial Neural Networks for Fast Quality Screening of Cryo-EM Samples”) 30min + Q&A)

10:40 – 10:50 Coffee break

10:50 – 12:00 ThunderSTORM: a comprehensive ImageJ plug-in for SMLM data analysis and super-resolution imaging

(Zdeněk Švindrych, Ph.D., Dartmouth College)

<https://zitmen.github.io/thunderstorm/>

- Single Molecule Localisation (briefly)
- The idea behind ThunderSTORM
- Workflow - localization, filtering, rendering
- Simulation engine
- 3D STORM - astigmatism method

12:00 – 13:00 Lunch

13:00 – 13:40 Scientific lecture: Quantitative super-resolution microscopy reveals nuclear architecture in cells and tissues (Peter Hoboth, Ph.D.)

- Brief summary of SRM and overview of the quantitative approaches.
- Pros and cons of different SRM techniques to quantitatively study the nuclear antigens in cells and tissues.
- Commons and differences in the organization of gene expression compartments between cultured cells and human clinical tissue sections.

13:40 – 14:00 Coffee break

Practical part

14:00 – 16:00 ThunderSTORM hands-on sessions: Individual work with ThunderSTORM software

(Zdeněk Švindrych, Jakub Soukup, Zuzana Burdíková, Martin Schätz, Peter Hoboth, Jan Paces, Frantisek Kitzberger)

Group 1: beginners (Zuzana Burdíková, KONFMI, PŘFUK)

Group 2: intermediate (Ondřej Šebesta, KONFMI, PŘFUK)

Group 3: advanced (Martin Schätz, KONFMI, PŘFUK, Peter Hoboth, KONFMI, PŘFUK)

The coffee break included Refreshments included

16:00 – 16:30 Introduction to Ilastik (Martin Schätz, Jakub Soukup, Jan Paces, Zuzana Burdikova)

19:00 – 22:00 Informal discussion in the Academic Club

Refreshment included

Day 3

Location: VMCF Microscopy Center, Viničná 7, Praha 2, study room B311

10:00 – 11:00 Customizing Fiji/ImageJ with ImageJ Macro with Hands-on (Marcelo Leomil Zoccoler, Ph.D., TU Dresden, Martin Schatz, Jakub Soukup, Jan Paces, Frantisek Kitzberger, Zuzana Burdikova)

11:00 – 12:00 Interactive Design of GPU-accelerated Image Data Flow Graphs in Fiji with Hands-on (Marcelo Leomil Zoccoler, TU Dresden (Marcelo Leomil Zoccoler, Ph.D., TU Dresden, Martin Schatz, Jakub Soukup, Jan Paces, Frantisek Kitzberger)

12:00 – 13:00 Lunch

13:00-13:30 Qupath Anna Klemm (University of Uppsala, Martin Schätz)

13:30- 14:00 Intro to Maker Institute, Prague 3D Printing: From Design to Fabrication (Martin Schätz)

14:00 – 14:30 Coffee break

14:30 – 16:30 Maker Institute, Prague 3D Printing: From Design to Fabrication with Hands-on (Martin Schätz)

16:30 Happy Wednesday Time in National Technical Library

The coffee break included Refreshments included

Day 4

Location: IMCF Microscopy Center, Viničná 7, Praha 2, study room B 311

10:00 – 11:00 Object Detection Using StarDist and Noise2Void (Jakub Soukup, Martin Schätz, Zuzana Burdikova)

11:00 – 11:15 Coffee break

11:00 – 12:15 Introduction to Napari (Marcelo Leomil Zoccoler, Ph.D., UT Dresden, Martin Schätz, Frantisek Kitzberger)

- Bio-Image Processing Using Napari Plugins
- An Image Segmentation Workflow with Napari: from Images to Labels to Surfaces
- Exporting Surfaces to 3D Printers Using napari-stl-exporter Plugin

12:15 – 13:15 Lunch

13:15 – 14:15 Introduction to SIM and UC2 Microscope (Prof. Dr. Rainer Heintzmann, IPHT, Jena)

14:15 – 14:30 Coffee break

14:30 - 16:30 Practical demonstration of UC2 (Benedict Diedetrich, Ph.D., IPHT, Jena)

- practical demonstration of SIM UC2 microscope

The coffee break is included. Refreshments included

Day 5

Zeiss and MesoSPIM WORKSHOP

Location: VMCF Microscopy Center, Viničná 7, Praha 2, study room B 311

9:30 – 10:00 Introduction to Airyscan Microscope (Pavel Krist, Ph.D., Zeiss)

10:00- 10:30 The mesoSPIM and open-hardware microscopy platforms for imaging cleared tissue. (Nikita Vladimirov, Ph.D., UZH Zürich)

10:30 – 10:45 Coffee break

10:45 – 12:15 Handling of data for super-resolution microscopy in ARIVIS - big data, 3D visualization, tracking (Maurizio Abbate, Ph.D., 4D Vision)

12:15 – 13:15 Lunch

13:15 – 14:00 Practical demonstration MesoSPIM (Nikita Vladimirov, Ph.D., UZH Zürich)

- case studies with a practical demonstration of mesoSPIM and mesoSPIM software

Parallel sessions

14:00 – 15:15 Practical demonstration of Airyscan Microscope (Pavel Krist, Ph.D., Zeiss)

14:00 – 15:15 Practical demonstration ARIVIS (Maurizio Abbate, 4D Vision)

15:15 – 15:30 Coffee break

15:30 – 16:45 Practical demonstration of Airyscan Microscope (Pavel Krist, Ph.D. Zeiss)

15:30 – 16:45 Practical demonstration ARIVIS (Maurizio Abbate, Ph.D. 4D Vision)