OMERO Implementation at Imperial College London

Imperial College London

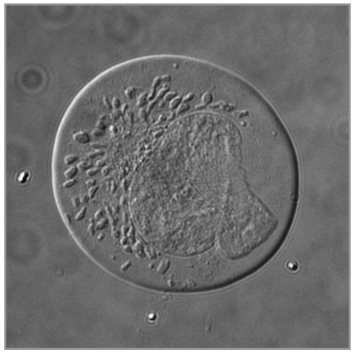
Facility for Imaging by Light Microscopy

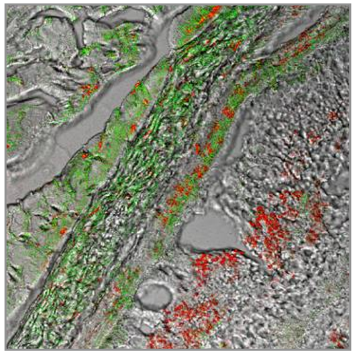
Observing Life As It Happens

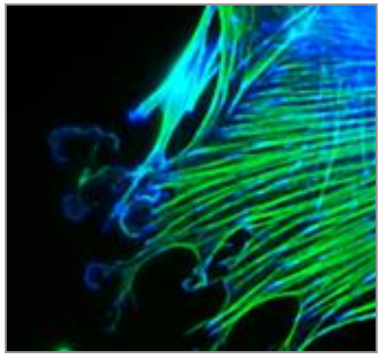
Bioinformatics Support Service

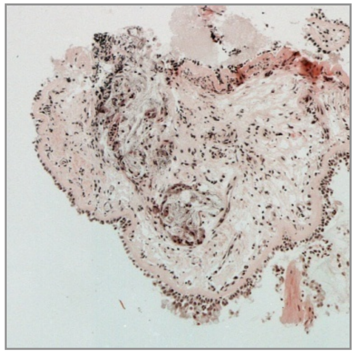
Martin Spitaler

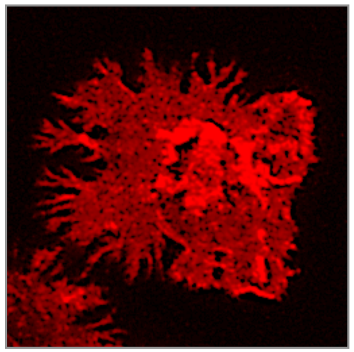
Mark Woodbridge











OMERO Implementation at Imperial College London

- <u>Installation, technical solutions, data integration</u>: Bioinformatics Support Service (Mark Woodbridge, Chris Tomlinson)

- <u>Testing & Users</u>: Facility for Imaging by Light Microscopy (FILM) (Martin Spitaler, Christian Liebig, Steve Rothery), facility users, some non-facility users

- <u>Time scale:</u>
  - first test installation: April 2008
  - large-scale import test and feedback: June 2009
  - first tests with live data: December 2009
  - general roll-out to facility users: from January 2010

Deployment Strategy

- Extensive research
  - Hardware
  - Formats
- Working relationship
  - IT
  - Bioinformatics
  - Imaging
- Candidate Users/Projects
  - Scale
  - Formats
- Expansion
  - Infrastructure
  - Support

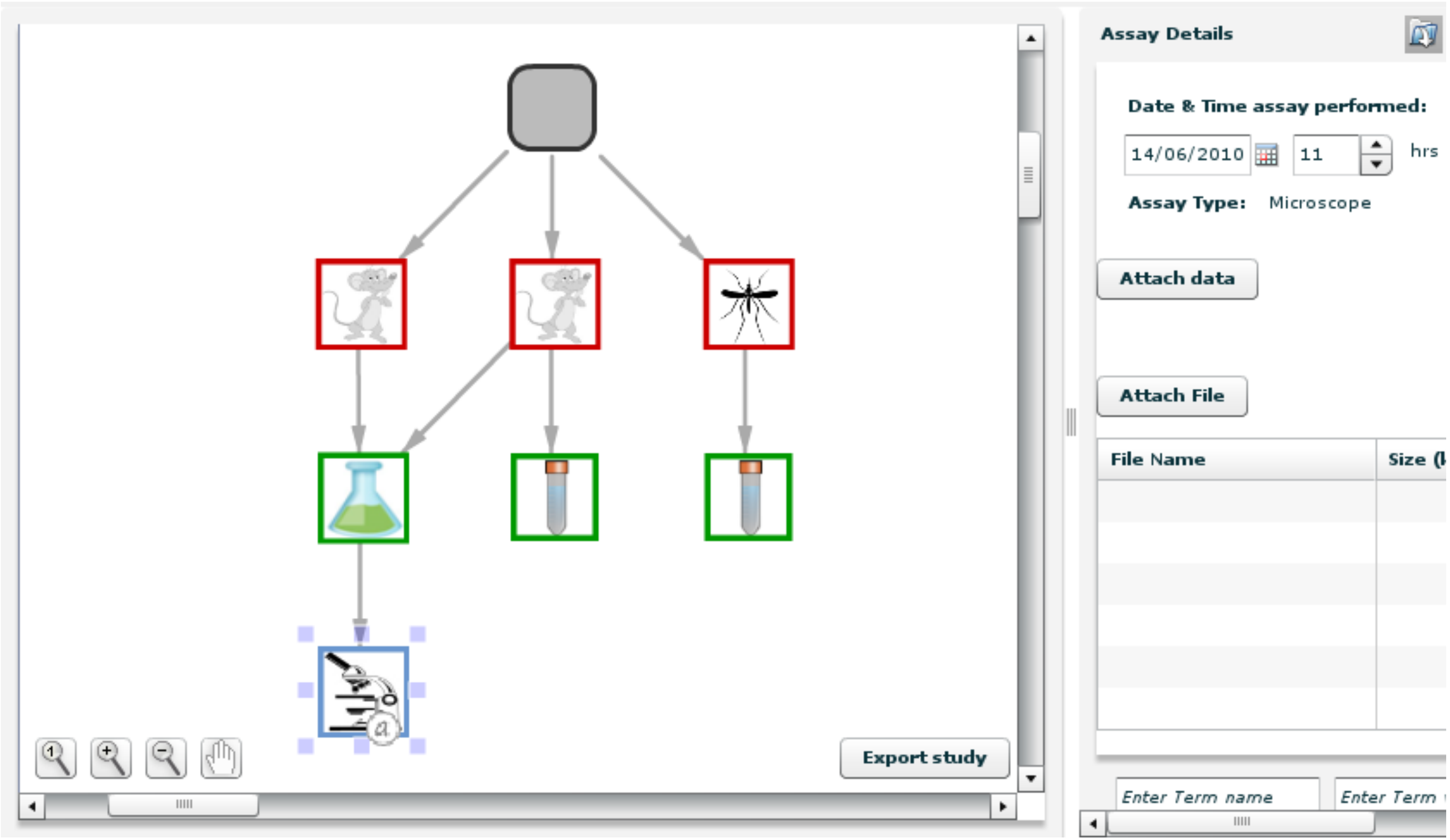
Deployment Issues

- Software upgrades
  - Planning and testing
  - Web Start
- Authentication
  - SSL
  - Directory
  - SSO
- Data in/out
  - Formats
  - Metadata
  - Archival (and integrity)
  - Access
- Onboarding
  - Scalability
  - Tutorials

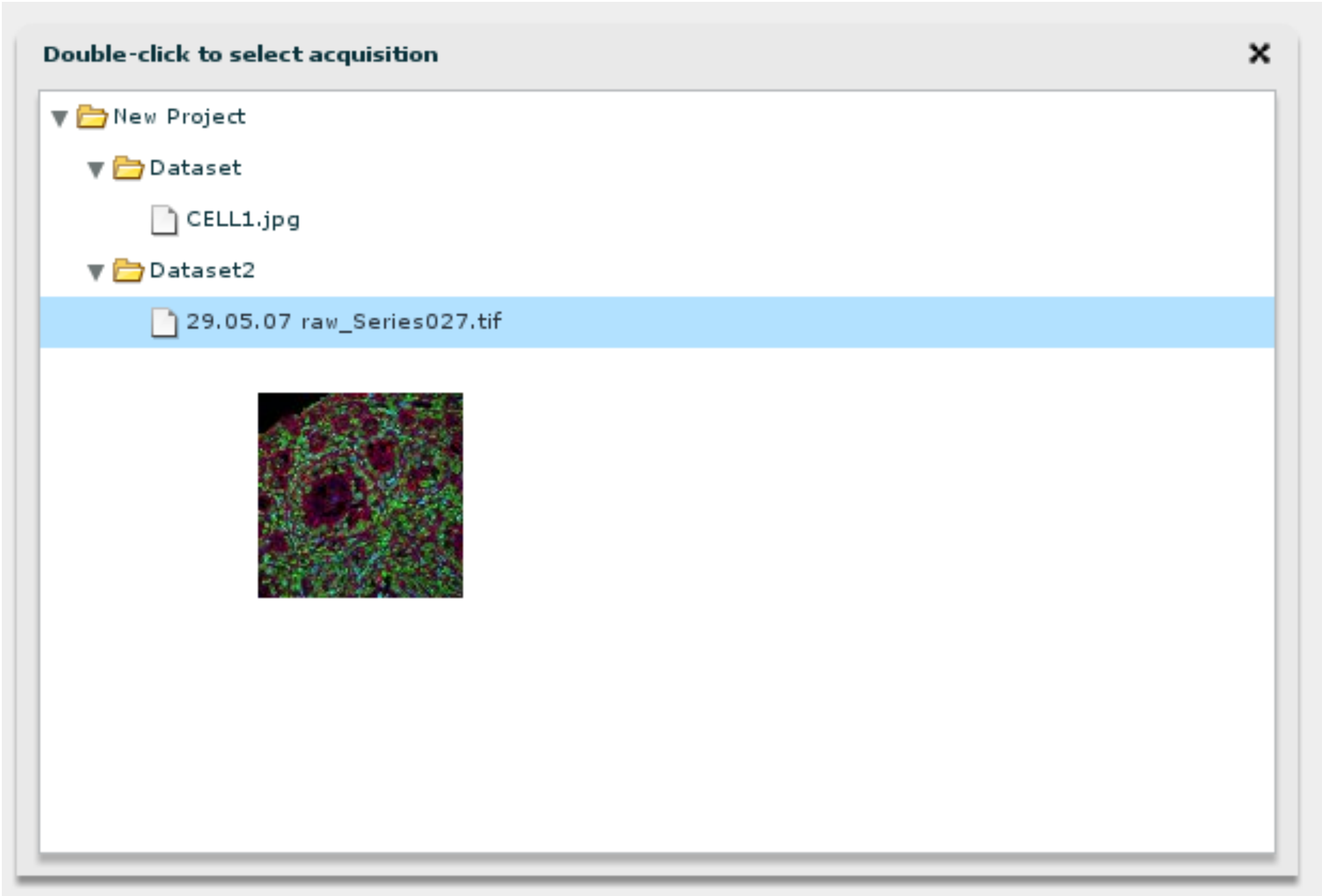
Ongoing Work

- Data management
  - Experimental workflows
  - Long-term storage
- Software pipelines
- Server-side processing
- Institutional integration

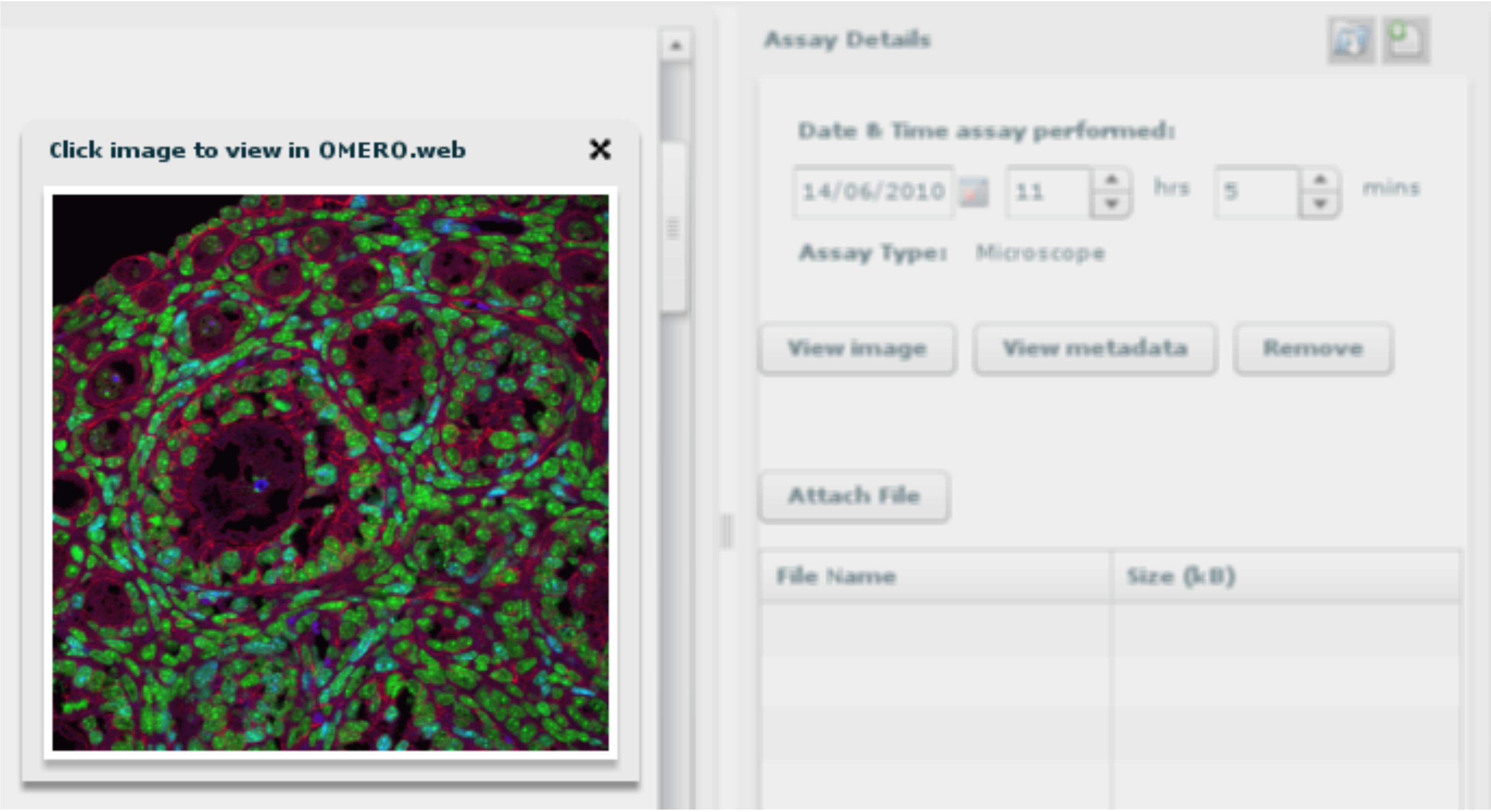
OMERO/XperimentR (Assay)



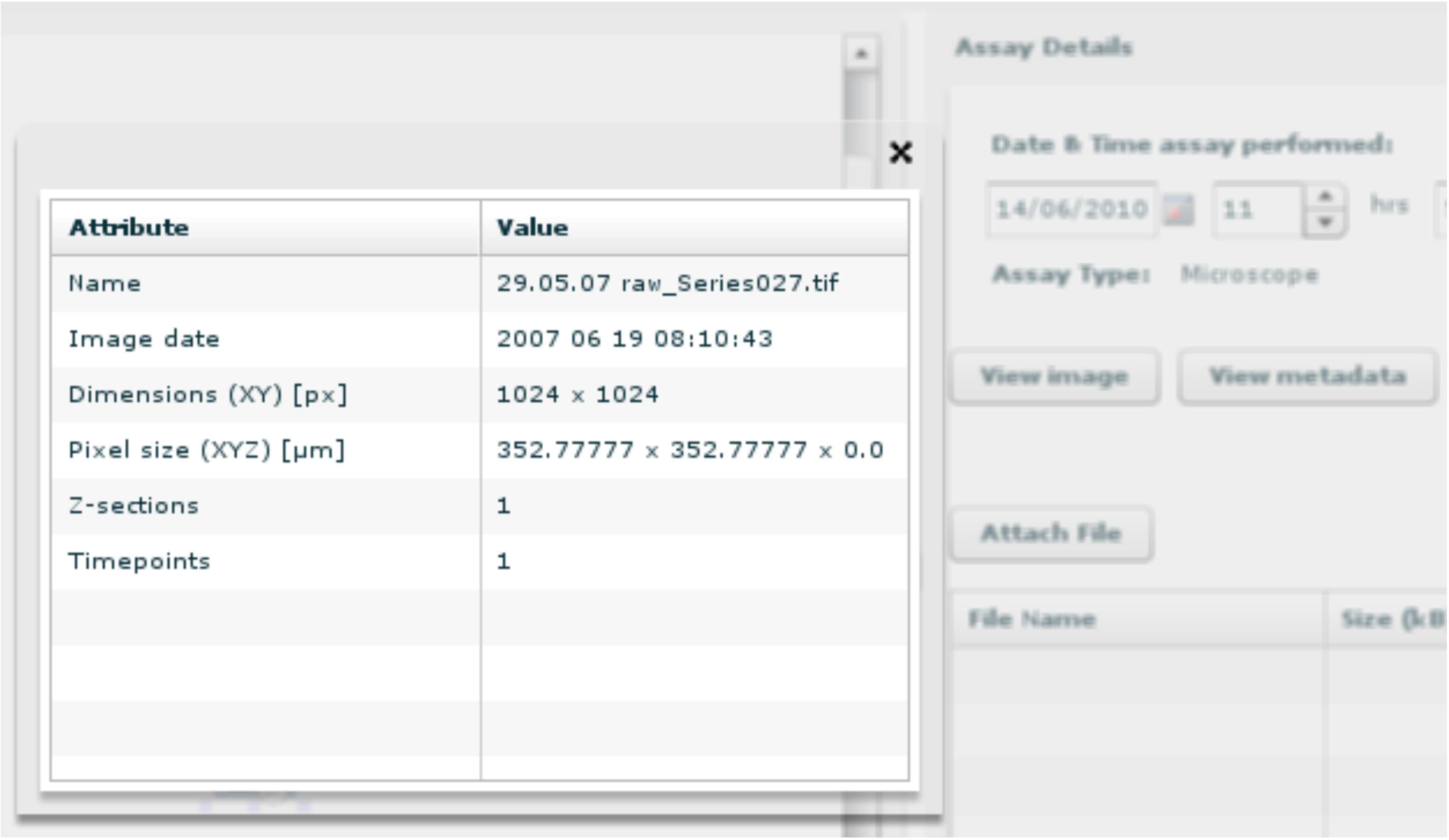
OMERO/XperimentR (Repository)



OMERO/XperimentR (Image)



OMERO/XperimentR (Metadata)



Attribute	Value
Name	29.05.07 raw_Series027.tif
Image date	2007 06 19 08:10:43
Dimensions (XY) [px]	1024 x 1024
Pixel size (XYZ) [µm]	352.77777 x 352.77777 x 0.0
Z-sections	1
Timepoints	1

User overview

- Omero users:
  - FILM:
    - facility staff: microscope tests, user projects
    - researchers currently using OMERO: ~15
    - (potential users: ~380 individual microscopists / ~120 groups)
  - outside FILM:
    - EM (OMERO trial)
    - Photonics (fast Flim, OMERO trial)

- research areas: cell biology, developmental biology, immunolgy, infection biology, physiology, stem cell research, biological engineering

- methodologies: widefield, confocal, two-photon (in vivo), Flim, TIRF, PALM / STORM (in development), high-throughput screening

Microscope overview, file formats

- Widefield:
  - Zeiss Axiovert 200M with **Hamamatsu HCImage (*.TIFF**, *.**CXD**) and **Perkin Elmer Volocity** (**Volocity database format**)
- Confocal:
  - Zeiss LSM-510 (*.**LSM)**
  - Leica SP-2 (**TIFF**, ***.LEI**)
  - Leica-SP5 (**LIF**)
- Flim:
  - Becker-Hickel (***.SPC**)
- HTS:
  - Cellomics (***.C01**)

User experience - file formats

File type	Pixel data	Meta data
Hamamatsu HCImage (*.TIFF, *.CXD)	yes	partially
Perkin Elmer Volocity (Volocity database format)	no	no
Zeiss LSM	yes	yes
Leica SP2 LEI	yes (mostly)	most
Leica SP5 LIF	yes (mostly)	most
Becker-Hickl SPC	no	no
Cellomics	not tested	not tested

User experience - file formats

<u>Remaining issues:</u>

- **Hamamatsu HCImage (*.TIFF, *.CXD):**
  - XY<u>Z</u>T not supported
  - channel information, exposure time, gain, … not detected (time course <u>is</u> detected)
  - metadata are imported in raw format, but not interpreted
- **Volocity:**
  - not supported, indirect via OME-TIFF not possible, apparently due to an export fault
- **Leica SP2 LEI:**
  - lambda-scan imported, but as a time series (metadata not correct)
  - import ‘unstable’
- **Leica SP5 LIF:**
  - lambda-scan as for LEI
  - MP laser settings not detected
- **Becker-Hickl SPC:**
  - not supported

User experience - usability

- **the core functionality of OMERO is seen as extremely useful:**
  - central repository of data from various microscopes
  - easy visualisation
  - easy access from any location
  - sharing (but too limited for routine usage)
  - quick access to archived data and OME-TIFF
- **visualisation:**
  - generally good, many good features (split screen, copy / paste rendering settings, greyscale,
  - rendering limitations limit its usability (visualisation is not quantitative, due to autocontrast, positive and negative controls appear with equal brightness)
  - the problem of side-by-side visualisation of many images is unsolved:
    - zoom too small in thumbnail view
    - split / greyscale visualisation not available
- **data archiving:**
  - in principle great solution for central data archiving
  - main problem: unreliable archiving (easy to forget archive tick box, not option to set it by default)
  - following from this, data duplication (local storage is preferred)

Wish list

Metadata:

- support for missing formats
- confocals: pinhole size as Airy Units (in addition to micrometer)

Data storage:

- it should be possible to make archiving non-optional in the preferences (or by administrator)
- when deleting data, the original image data should be deleted (or quarantined)

Usability:

- rendering!:
  - option to turn it off by default throughout
  - must accept values outside min / max pixel values
- UNDO functions
- user preferences:
  - screen layout
  - default rendering / visualisation (e.g. min / max, greyscale, split, …)
  - data archiving on

Sharing:

- sharing via INSIGHT
- access to archived file via sharing and / or export as OME-TIFF
- hierarchy preserved in shared files (sharing of whole folder / experiments)

Future plans

Improving implementation:

- improved integration in lab workflow (annotation / sharing)
- final data storage solution

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Improving data quality:

- annotation with (compulsory?) experimental metadata on upload
- integration with other data (Systems Biology)

Improving usability:

- integration with image analysis (Definiens, CellProfiler):
    - software should read image data from OMERO, analyse them and write data back into OMERO, together with analysis protocols (logs) and results
    - raw data, analysis logs and results should be automatically linked in OMERO
    - ideally, all data should be visualised in easily accessible form (e.g. multiwell plate layout)

Cooperations - THANKS

- FILM staff: Christian Liebig (now Tübingen), Steve Rothery, Mark Scott
- Bioinformatics Support Service: Mark Woodbridge, Chris Tomlinson, Sarah Butcher
- OMERO team Dundee: Jason Swedlow, Will Moore, …
- Our patient users, first and foremost Marek Cebecauer (Imperial College / University Prague)
- Hamamatsu support, Leica engineers, Definiens Support