

Huygens and OMERO

Multi-user batch deconvolution with
web-based HRM via OMERO connection



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Scientific Volume Imaging

Deconvolution – Visualization – Analysis

Huygens Software

Huygens Remote Manager

Huygens Remote Manager v3.4

Help HRM manual Report an issue

vincent Logout

Home

- Start a job**
Create and start restoration and analysis jobs.
- Queue status**
See all jobs.
You have **2 Jobs** in the queue.
- Raw images**
Upload raw images to deconvolve.
- Results**
Inspect and download your restored data and analysis results.
- Statistics**
Summary of your usage statistics.
- Account**
View and change your personal data.

created 2004 by Volker Bäcker and released under the terms of the CeCILL license
extended 2006-2014 by Asheesh Gulati, Alessandra Griffo, José Viña, Daniel Sevilla, Niko Ehrenfeuchter, Torsten Stöter & Aaron Ponti

Open-Source

www.huygens-rm.org

Collaborators:



EPF Lausanne
Biolmaging and
Optics platform



Friedrich Miescher Institute
Facility For Advanced
Imaging and Microscopy



Montpellier RIO
Imaging



ETH Zurich
Single Cell Unit



Scientific Volume
Imaging



Leibniz Institute for
Neurobiology Magdeburg



Biozentrum Basel
University of Basel
The Center for
Molecular Life Sciences



Combinatorial
Neuroimaging
Magdeburg

Multi-user access

Provide easy multi-user access to Huygens deconvolution

Web-based solution

Huygens Remote Manager allows easy access to Huygens deconvolution via the web-browser

Easy user management

Easily add new users, and keep track of the usage

Link to OMERO

Exchange data between HRM and OMERO

High-throughput

Ideally suited for high-throughput deconvolution batch jobs

Visualization & Coloc

Perform Colocalization Analysis in batch mode, and visualize deconvolution results

HRM queue manager & GPU acceleration

Image Processing & Deconvolution

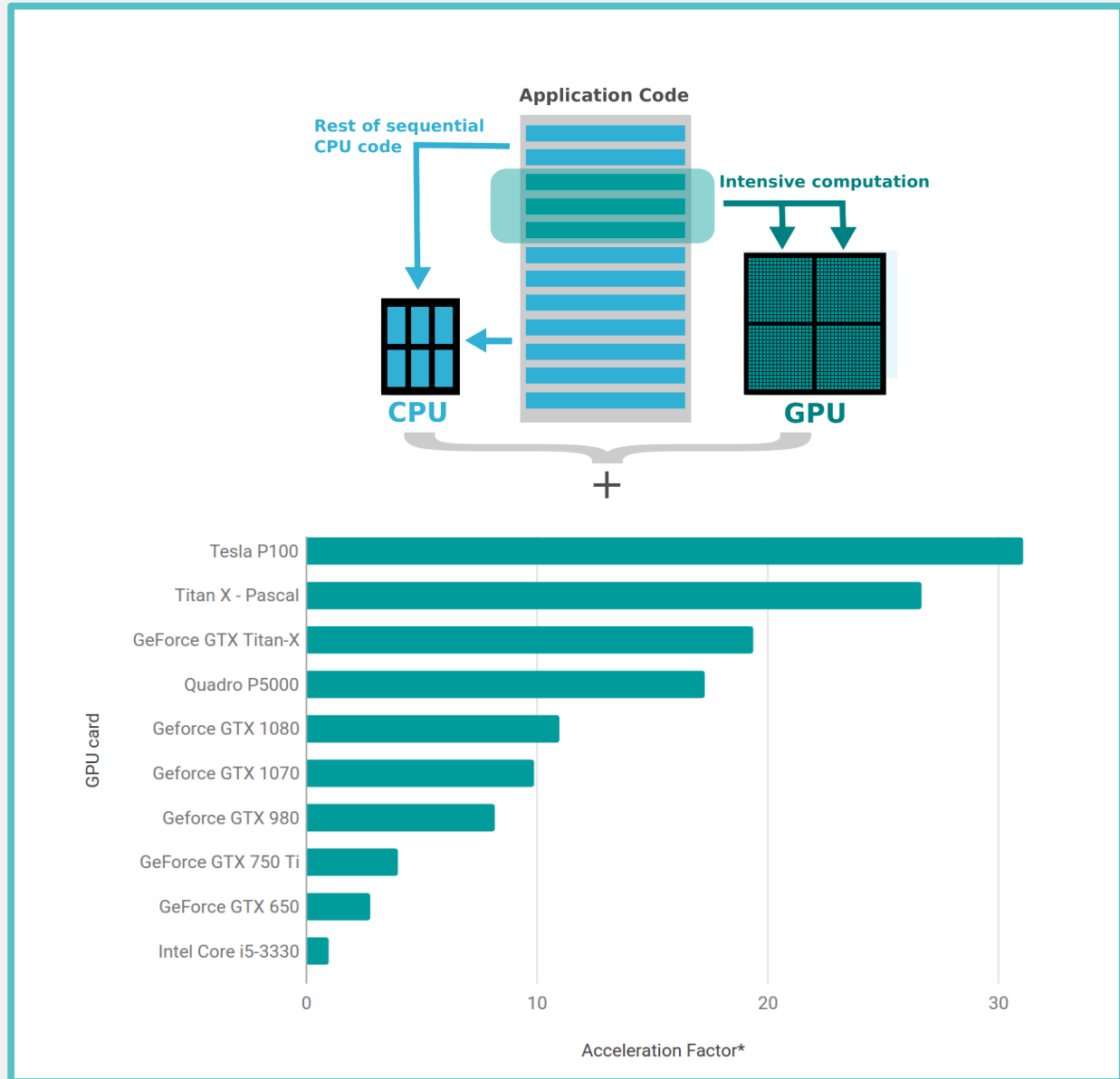
- Powered by Huygens Core
- Theoretical PSF
- Measured PSF

Batch jobs

- Managed by queue manager
- Each user can submit many jobs

Multi-GPU support

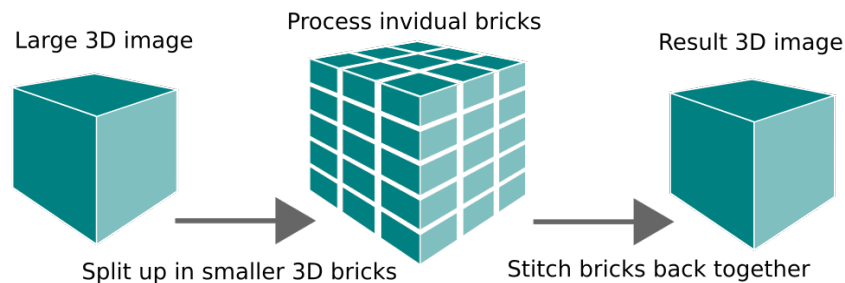
- CUDA GPU acceleration
- Deconvolve jobs on multiple GPU cards in parallel
- <https://svi.nl/HuygensGPU>



Supports many microscope types

- Widefield
- Confocal
- STED (3D)
- Multi-photon
- Spinning-disk
- SPIM/light-sheet

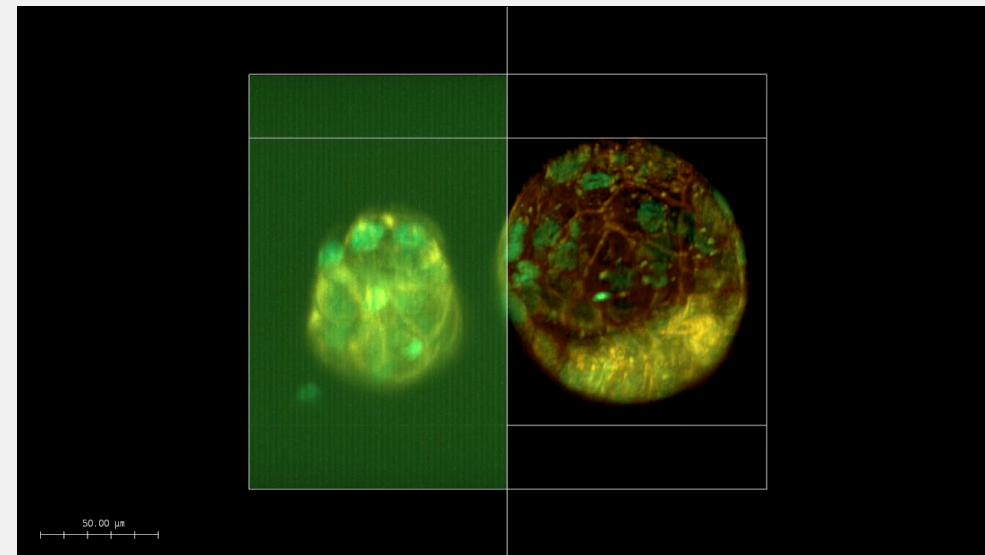
Unique Huygens bricking:



- Image size is not a problem in Huygens
- multi-PSF handling
- GPU deconvolution

Light-sheet Raw

Deconvolved



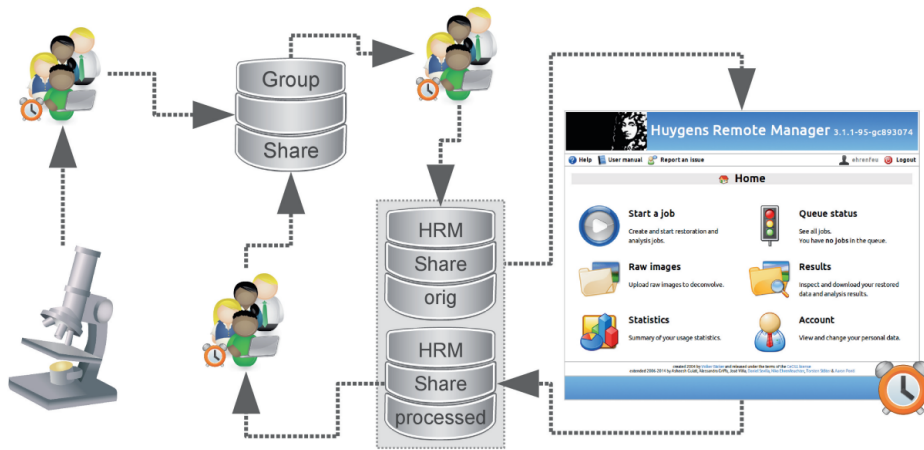
Leica Digital Light Sheet microscope.

Maximum Intensity Projection of a 3D image from mouse blastocyst.

Courtesy of Dr. Marc Duque Ramirez and Dr. Ritsuya Niwayama (Hiiragi group) and Dr. Stefan Terjung (ALMF) from the EMBL Heidelberg, Germany.

OMERO connection

Conventional workflow



Integrated workflow



The screenshot shows the Huygens Remote Manager interface. A dialog box titled 'OMERO login credentials' is open, asking for the user's OMERO username and password. The username is 'omerouser' and the password is masked. A blue arrow points from the dialog box to the right, where a list of raw files and OMERO data is displayed.

Your raw files

```

24hpi wt GFP lamp1 564/.../14.04.24_24hpi wt GFP Lamp1 564 m...
130208_selected_ones_Aurora_B_B6.ome.tif
130208_selected_ones_Aurora_B_B6.ome
BSC1 example.zvi
Bub3 C2 -12_XY1360847581_Z000_T0_C0.ome.tif
Image6.lsm
mitosis1_100nmzstep_2048XYZ_Subset.lsm
sep4_cherryjupiter_20140211_testfile_crop.ics
    
```

Your OMERO data

- ▶ Project: OMX
- ▶ Project: Demo
- ▶ Project: 30Nov2012
- ▶ Project: Copy and paste datasets
- ▶ Project: 121120-OMX
- ▶ Project: 121127-OMX
- ▶ Project: 121207-OMX
- ▶ Project: ImagesUsersOMX
- ▶ Project: 120806-22-Blockkurs
 - ▼ Dataset: 120806-Blockkurs
 - Image: 120806-Rotifer-10X_01-myotf_R3D_D3D.dv
 - Image: 120806-Rotifer-10X_01-myotf_R3D_D3D_PRJ.dv
 - Image: 120806-Rotifer-10X_01-myotf_R3D_D3D_VOL.dv
 - Image: 120806-Rotifer-10X_01_R3D.dv
 - Image: 120806-Rotifer-10X_01_R3D_D3D.dv
 - Image: 120806-Rotifer-10X_01_R3D_D3D_PRJ.dv
 - Image: 120806-Rotifer-10X_01_R3D_PRJ.dv
 - Image: 120806-Rotifer-20X-0120_01_R3D_D3D.dv
- ▶ Dataset: 120822-Blockkurs-cells
- ▶ Project: Test
- ▶ Project: 130201-Mitosis
 - ▼ Dataset: TestBleaching
- ▶ Project: Electron microscopy
- ▶ Project: 130205-AxioPlan2
- ▶ Project: User Data
- ▶ Project: Zebrafish retina
 - ▼ Dataset: ZF adult mGluR6 Zpr1
 - Image: mGluR6-ZPR1_ZF-ad.lsm
 - Image: mGluR6-ZPR1_ZF-ad_decon.lms [mGluR6-ZPR1_ZF-ad_decon.lms Resolution Level 1]
- ▼ Project: Colocalization
 - ▼ Dataset: LSM700 colocal
 - Image: 121123-DAPI_CoilinFITC_HP1a594.lsm

HRM future outlook

- New interface – responsive
- Queue manager for clusters (gc3pie)
- Improved OMERO import/export
- PSF distiller
- Image stabilization (z and/or time)
- Tile stitching
- Fusion (light-sheet)



GC3Pie: A Python framework for high-throughput computing

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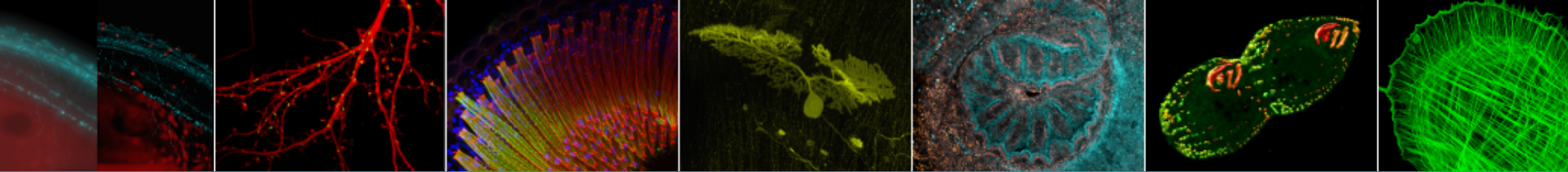
This paper presents GC3Pie [7], a python library to ease the development of scalable and robust High Throughput data analysis tools. Most of the current distributed computing middlewares as well as most of the in-house grown scripts fall short in reaching the scaling and reliability factors required by the ever growing demand of large data analysis. GC3Pie provides mechanisms to automatise the execution and the monitoring of large collection of applications while, at the same time, provides simple data structures and interfaces to steer the behaviour of the underlying system in an application-centric perspective. The goal of GC3Pie is to embody the common execution and monitoring processing part of large data analysis while moving most decision making logic to the application level; like, for example, the reaction of certain types of failures, the validation of the application execution or the brokering of the computing resources driven by application fidelity metrics. This allows to write application specific tools that take full control of the underlying computing and data infrastructure, as opposite of current middleware stacks that are trying to embody the full control of the execution logic thus reducing the flexibility of the entire system as they prevent applications to define their own expected behaviour of the system.

*EG1 Community Forum 2012 / EMI Second Technical Conference
26-30 March, 2012
Munich, Germany*

*Speaker.

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<http://pos.sissa.it/>



Any Questions?

Authors and contributors

Original concept and implementation

Pierre Travo and Volker Bäcker, Montpellier RIO Imaging (CNRS).

Patrick Schwarb, now at Imagic AG, brought the original version of HRM to the Friedrich Miescher Institute (Basel).

Current developers

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Scientific Volume Imaging

Deconvolution – Visualization – Analysis

Free HRM demo:
hrm.svi.nl

More info:

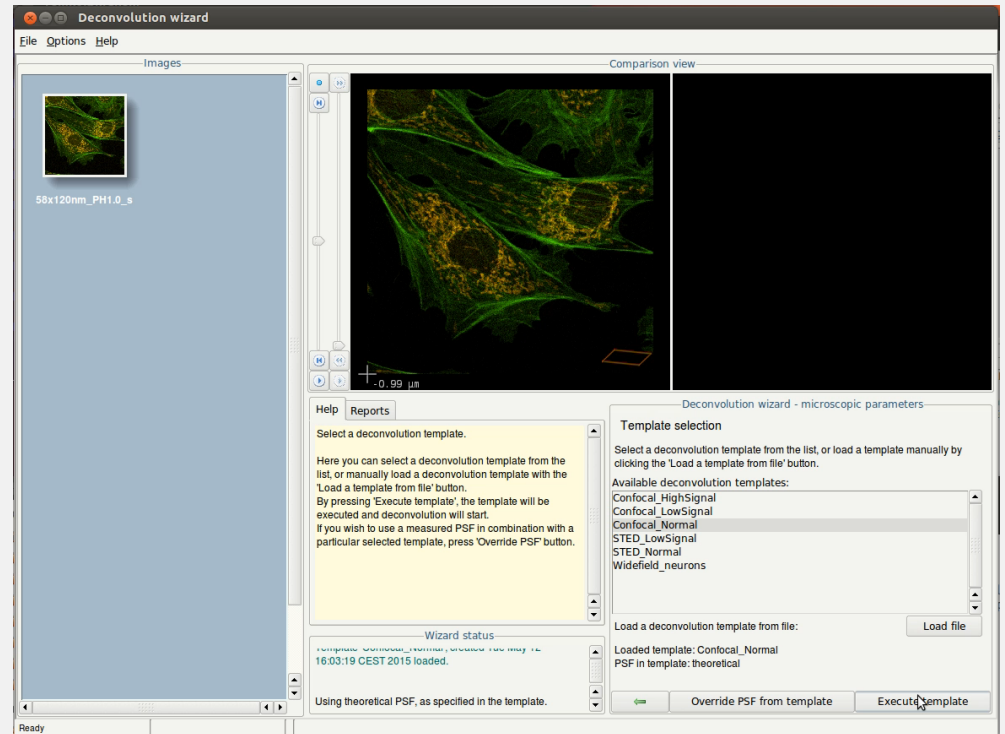
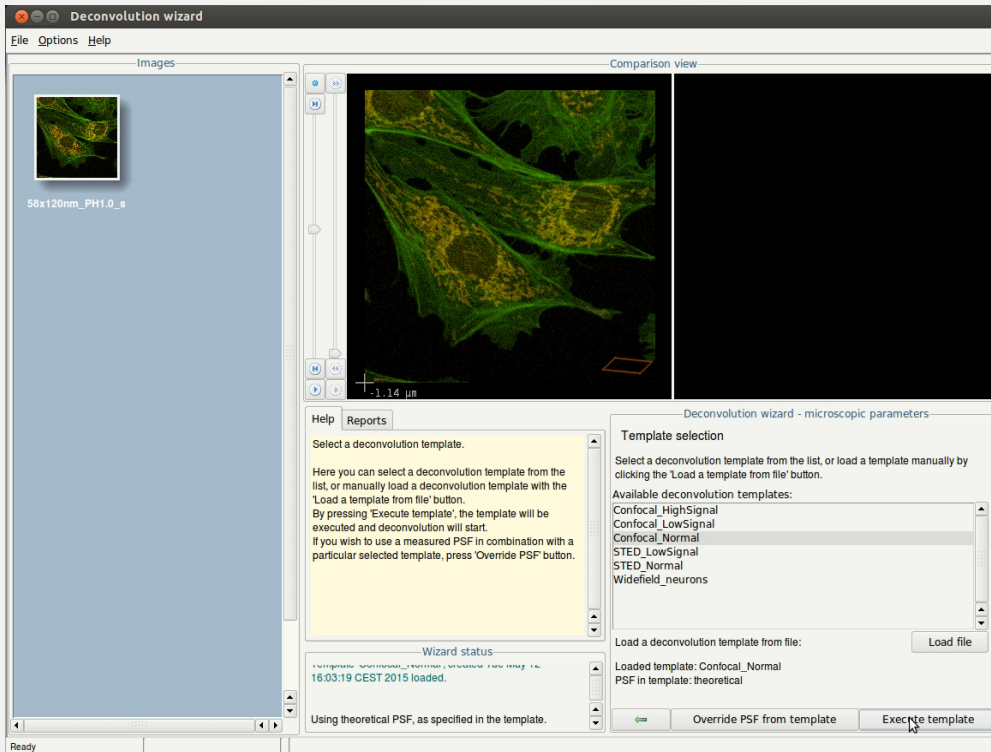
www.huygens-rm.org

<https://svi.nl/HuygensCore>

Huygens Software

Huygens GPU acceleration

Confocal dataset: 2 channels, 1445 * 1439 * 18 (X*Y*Z) pixels



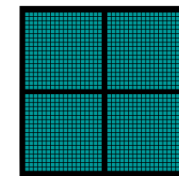
CPU
Multiple Cores

Using CPU:
Intel Xeon E5-2667 v3
(4 cores @ 3.2 GHz)



CPU
Multiple Cores

+



GPU
Thousands of Cores

Geforce GTX Titan-X
3072 CUDA cores
12 GB video-RAM