



| The European Synchrotron

PROJECTS STATUS: SOME NEWS FROM THE ESRF



ESRF-EBS

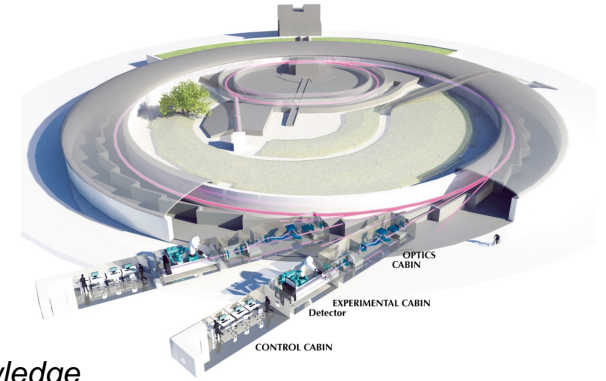
Extremely Brilliant Source

first-of-a-kind, low-emittance, high-energy
synchrotron light source

N. Leclercq on behalf of the ESRF Software Group

- **European Synchrotron Radiation Facility**

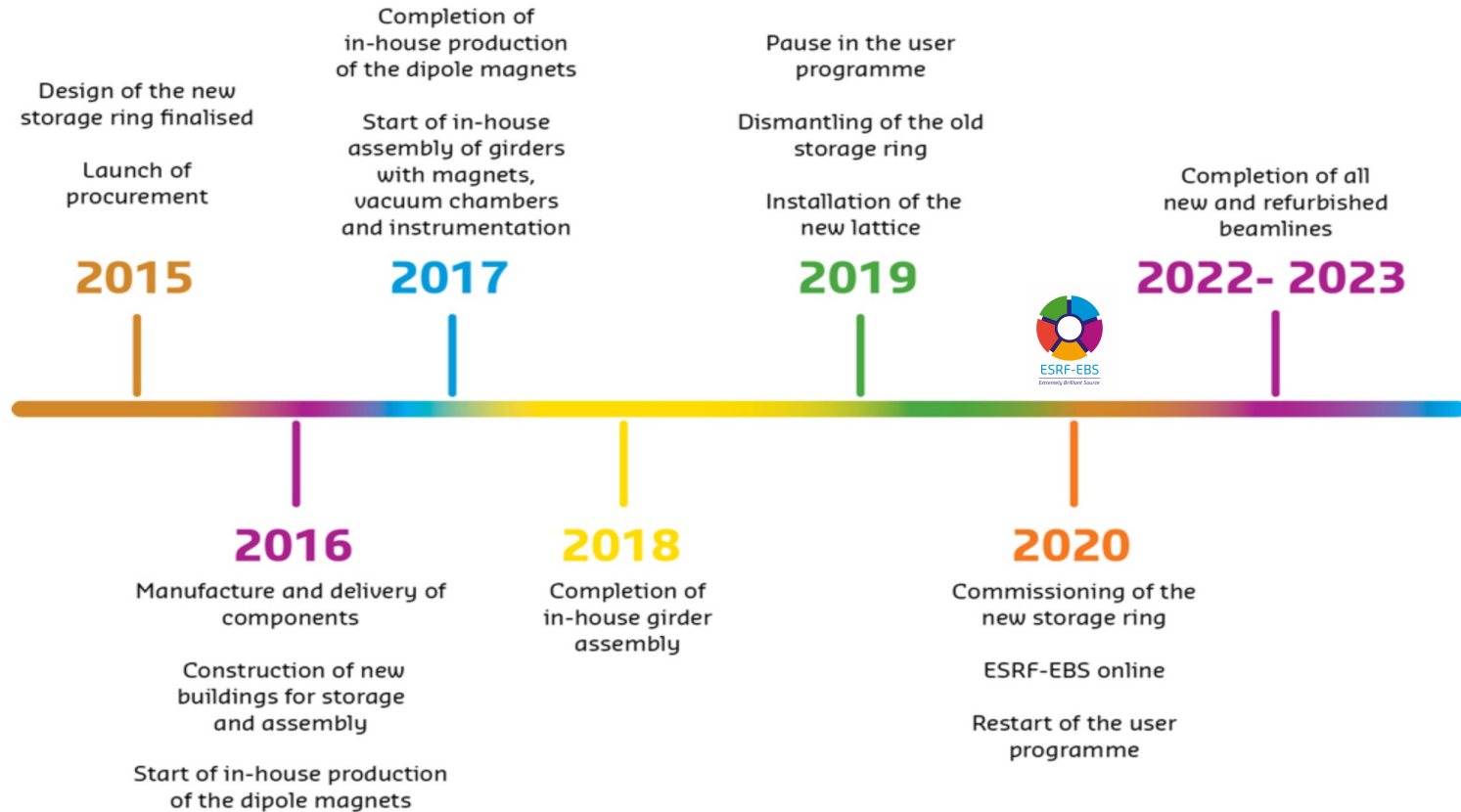
- A photon factory from science (matter studies)
 - *light/matter interaction* → *knowledge (i.e., light as a probe)*
 - *photon source* → (44) *beamlines* → *experiments* → *data* → *knowledge*



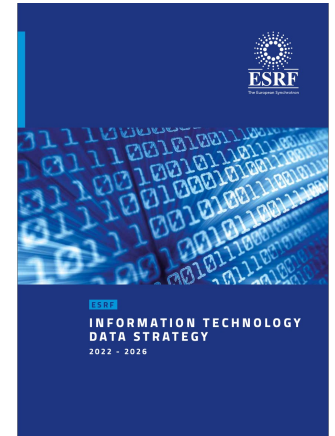
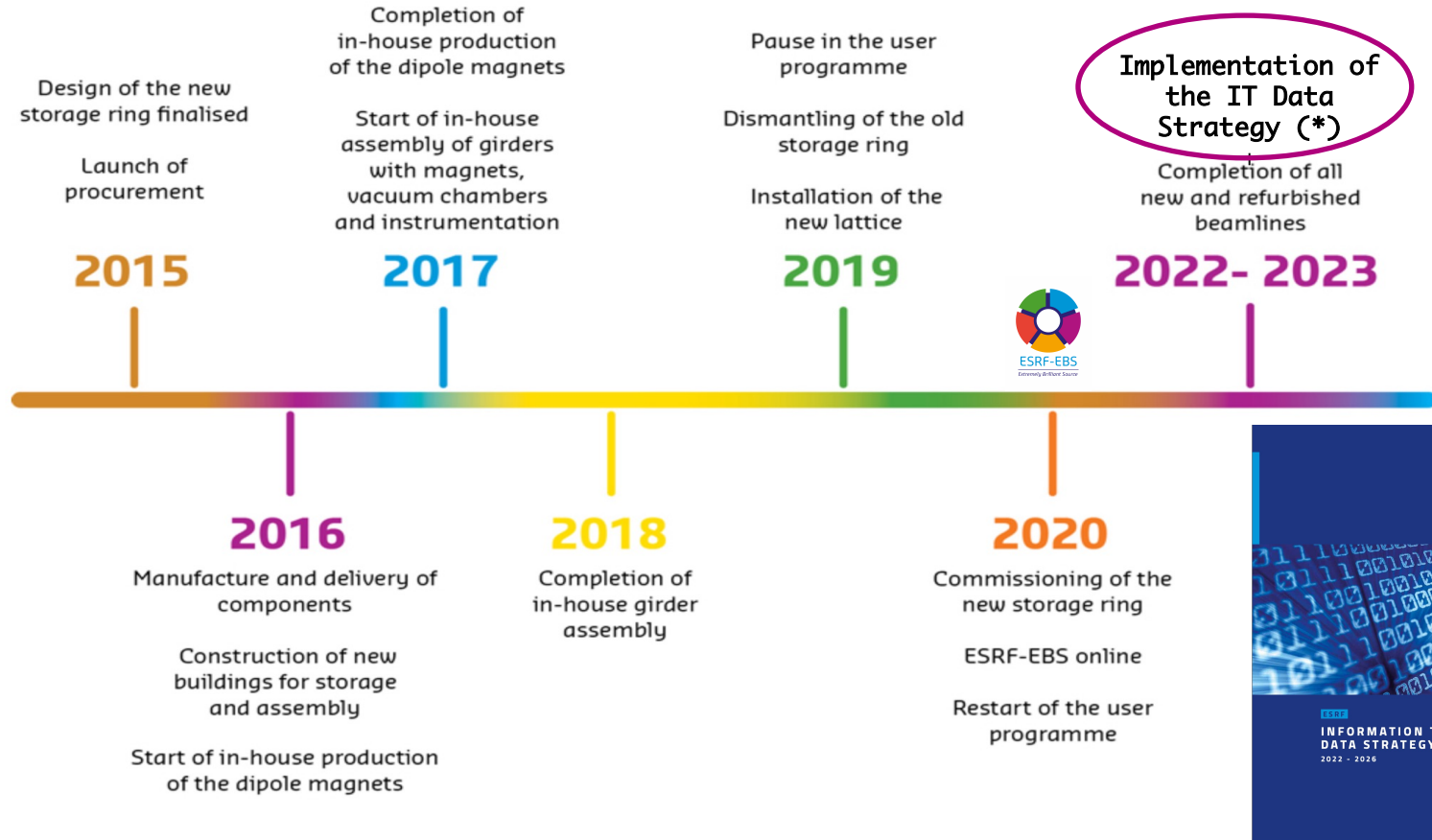
- EBS: a new machine to tackle global challenges
 - *ESRF: 30 years of state-of-the-art X-ray experimental science*
 - *answer new scientific needs* → ***new machine (4th generation storage ring)***
 - *part of an end-to-end upgrade started in 2009!*
 - *ERSF-EBS is running in user service mode since August 2020*



THE ESRF UPGRADE PROGRAM – BEYOND THE PHOTON SOURCE...



THE ESRF UPGRADE PROGRAM – BEYOND THE PHOTON SOURCE



(*) 2022-2026 - see <https://www.esrf.fr/files/live/sites/www/files/about/information-material/it-strategy-brochure>

- **an end-to-end program**
 - 150 M€ spread over **4 components** from 2015 to 2023
 - *following the 180 M€ invested from 2009-2015*
 - **a new machine (EBS)**
 - *new SR + adapted transfer line & booster – open to users in 2020*
 - **4 new (flagship) beamlines + 14 refurbished + 29 unchanged**
 - *47 beamlines in 2023 – (some on hold for budget constraint)*
 - *3 of the new beamlines on hold due the budget constraint*
 - **a new X-ray detectors program**
 - *faster readout + higher resolution → data deluge (tens of TB/day)*
- **data management & processing**
 - we are changing the scale at which we address the related offer & services
 - digital transformation of the institute (data-oriented services)

- industrialization of experimental data engineering and processing



- **industrialization of experimental data engineering and processing**
 - on premises cloud infrastructure (data center) – data storage, access & processing
 - *online & offline data processing*
 - *domain-specific web applications + jupyter notebooks as user interface*



- (data center construction postponed to 2025 + opening of some dedicated positions on hold)

- **IT@ESRF: 6 teams involved**
 - Infrastructure Division – IT Services Group – **Network Unit** (5 FTE)
 - Infrastructure Division – IT Services Group – **Unix Systems Unit** (10 FTE)
 - Engineering Division – Software Group – **Accelerator Control Unit** (10 FTE)
 - Engineering Division – Software Group – **Beamlines Control Unit** (20 FTE)
 - Engineering Division – Software Group – **Data Automation Unit** (11 FTE)
 - Scientific Division – **Algorithms & (Scientific) Data Analysis Group** (10 FTE)

- **constant enhancement of the EBS control system**
 - the EBS operation is our priority (24/7 operation)
 - +500 *Tango* classes, +110 *Java* GUIs for the control room
 - +26000 *Tango* devices running in +3000 *Tango* device-servers on +360 hosts (mostly *KVM* instances)
 - new features & refurbishments
 - e.g., rewrote the magnets/power-supplies ecosystem (22% of the CS in terms of num. of devices)
- **new CI/CD platform**
 - keeping the code catalog under control – enhance its life-cycle management
 - innovative way to compose the device-servers
 - see *Damien Lacoste's* talk on Wednesday afternoon

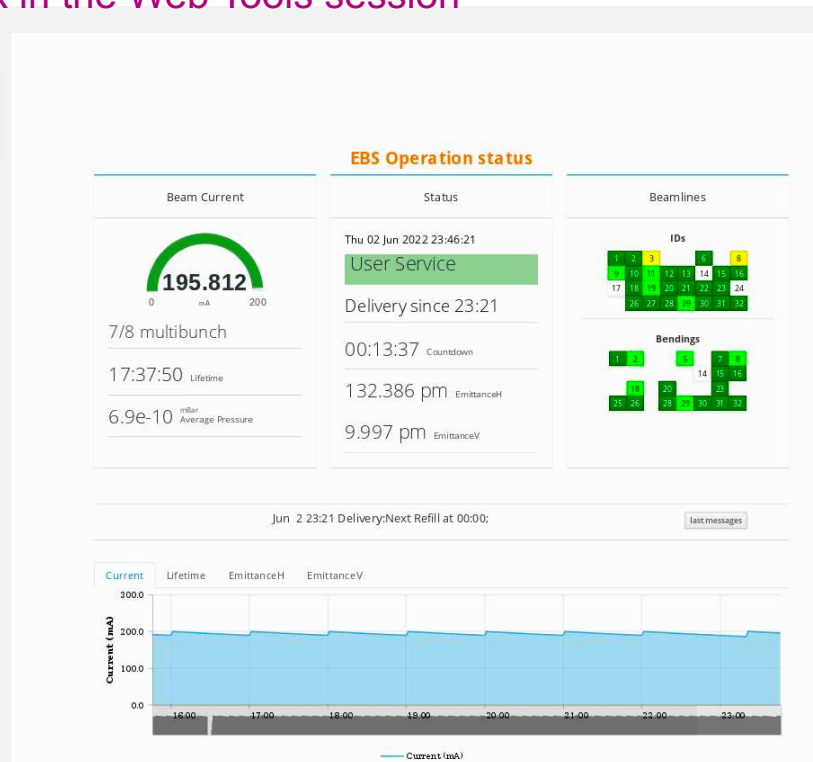
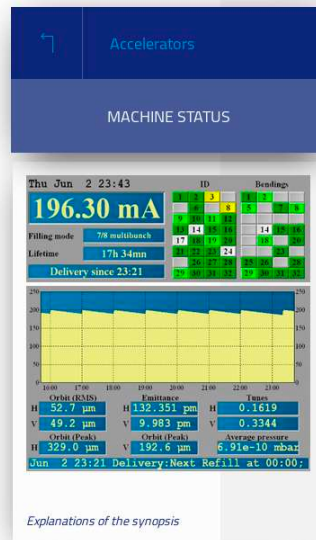
- **enhanced Storage Ring simulator**

- pyAT-based (<https://atcollab.github.io/at/index.html>)
 - *accelerator toolbox (implemented in python)*
 - *python for beam dynamics aspects*
- even closer to the “real” machine
 - *same Tango devices, same GUIs*
- off-line developments/testing
 - *commissioning booster*
- 4 instances
 - *including one in production with high availability constraints (standby)*
- ultimate version: an **EBS digital twin**
 - *bi-directional interactions between the machine and its virtual counterpart*

- **contributions to Tango**

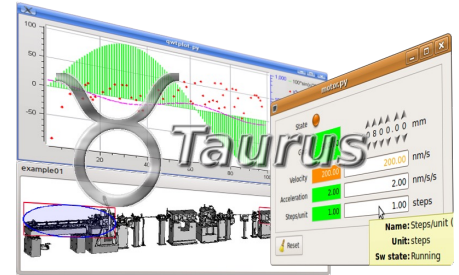
- **4 staff members involved in the project:** Andy G., Damien L., Reynald B. and myself
- project management, subcontractors' activity follow-up, MRs impl. & reviews (kernel & more)

- replacing the EBS operation status page
 - currently base on an obsolete technology (Jyse)
 - new impl: ESRF C++ backend (by JLP) + dedicated frontend (by AB + ALM)
 - see Axel Bocciarelli's talk in the Web Tools session



- adopting **TAURUS** for GUIs

- refocus on cppTango-based solutions (beyond GUIs dev.)
 - *promote Python in the Team, join a community*
 - *java/swing now considered as legacy in most institutes*



- what about the +110 GUIs apps currently based on ATK (Java/Swing)?
 - *Java/Swing will allow LTS for (at least) a decade*
 - *new apps or major refurbishments will be developed with TAURUS*
- what about web-based solutions?
 - *seen as a complementary offer, notably for dashboards*
 - *TAURUS is a more “natural” transition due to {local culture, developers’ skills, operators’ habits}*
 - *restricted application domain (GUIs only) compared to Python (GUIs, devices, scripts)*

- **control & data acquisition on the 44 beamlines**



- **BLISS**

- *in-house solution similar to Sardarna or Bluesky – see <https://bliss.gitlab-pages.esrf.fr/bliss/master/>*
- *deployed on 23 beamlines, 10 in progress (2023-2024)*

- **LIMA**

- *in house solution for the integration of 2D x-ray detectors (or simple cameras)*
- *C++ with Python binding*

- **DAIQUIRI**

- *web-based framework for beamlines control and data acquisition*
- *see <https://ui.gitlab-pages.esrf.fr/daiquiri/>*

BCU HIGHLIGHTS



Daiquiri UR ID21

Front End RUNNERG Front End RUNNERG FSS Prelock OPEN Absorber 1 OPEN Absorber 2 OPEN

BV1 BV2 BV3 BV4

Veg1 Veg2 Veg3 Veg4

Pen Pen Pen Pen

Front End RUNNERG Front End RUNNERG FSS Prelock OPEN Absorber 1 OPEN Absorber 2 OPEN

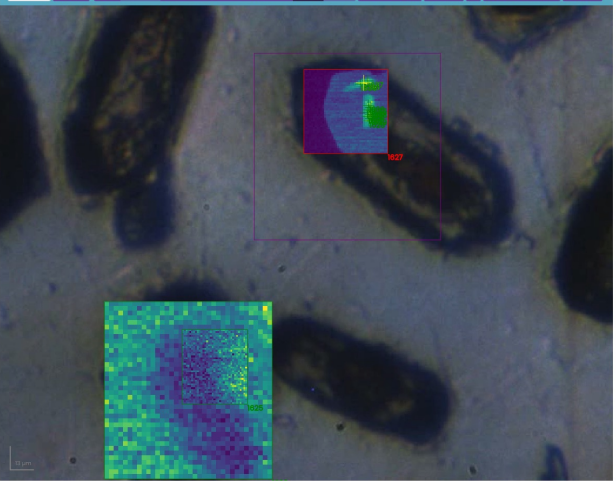
View_H2_MF View_H2_MF View_H2_MF View_H2_MF

Move Move Move Move

Daiquiri UR ID21

Ring Current: 100.0% Front End RUNNERG FSS Prelock OPEN Absorber 1 OPEN Absorber 2 OPEN HUG2

Turn Snap Off Mask FDI ROI ID Measure Pan Move Clamp FE Centre Save Comets Images



MB-14-AMT-03-inc13

#	Type	Size		
1825	ROI	35x40 μm	Color B	↑
1826	ROI	90x95 μm	Color B	↑
1827	ROI	45x45 μm	Color B	↑
1828	ROI		Color B	↑
1829	ROI		Color B	↑
1830	ROI		Color B	↑
1831	ROI		Color B	↑
1832	ROI		Color B	↑
1833	ROI		Color B	↑
1834	ROI		Color B	↑
1835	ROI		Color B	↑

Data Collections

Id	Start	Took	Status	Type
1512	08-10-2020 10:16:51	4 min	OK	XRF map

Maps

Id	DC	ROI	Px	Py
<input type="checkbox"/>	779	1512	S-Kal	45 45
<input type="checkbox"/>	780	1512	P-Kal	45 45
<input type="checkbox"/>	781	1512	Si-Kal	45 45

Id Red ROI Green ROI Blue ROI

No composite maps for this object

Zoom: 100%

Daiquiri UR ID21

Ring Current: 100.0%

Scans

Title	Start	End
zaprtoqund enetraq 2.8 2.9 400 0.1	08-10-2020 05:51:03	08-10-2020 05:51:56
zaprtoqund enetraq 2.8 2.9 400 0.1	08-10-2020 05:49:22	08-10-2020 05:50:14
zaprtoqund enetraq 2.8 2.9 400 0.1	08-10-2020 05:44:05	08-10-2020 05:44:58
zaprtoqund enetraq 2.8 2.9 400 0.1	08-10-2020 05:31:44	08-10-2020 05:32:35

QScan samy 10.753951 10.8839500000000000 08-10-2020 20:14:39

160 samx 20.580000000000000005 20.958 189 0.05

QScan samy 5.401990000000000005 5.709191 08-10-2020 12:15:48

zaprtoqund enetraq 2.8 2.9 400 0.1 08-10-2020 05:49:45

zaprtoqund enetraq 2.8 2.9 400 0.1 04-10-2020 03:05:18

QScan samy 22.832000000000000008 28-09-2020 09:57:23

Spectra Plot

Point: 6499

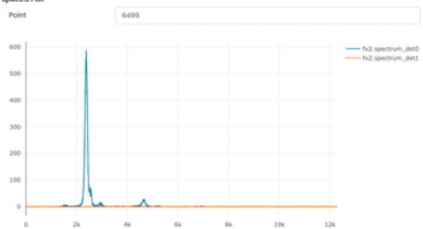
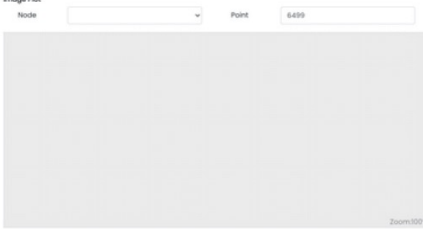


Image Plot

Node: Point: 6499



- **data-oriented tools & services**

- web-based UI tools for scientific data processing & management
 - visit <https://data.esrf.fr>

Visualize your data with H5Web
Visualize your HDF5 files from the data portal with H5Web (Hibou)

Find, browse and download your data
Access to your experiment's data and metadata, access to open data

Electronic logbook
Keep track of the experiment, so the data and metadata can be better understood and reused

• The Human Organ Atlas

Human Organ Atlas
EXPLORE
SEARCH
3D RECONSTRUCTIONS
HELP

Welcome to the Human Organ Atlas

The Human Organ Atlas uses **Hierarchical Phase-Contrast Tomography** to span a previously poorly explored scale in our understanding of human anatomy, the micron to whole intact organ scale.

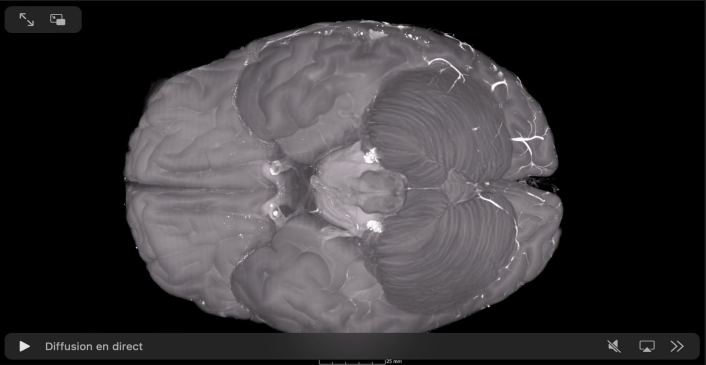
Histology using optical and electron microscopy images cells and other structures with sub-micron accuracy but only on small biopsies of tissue from an organ, while clinical CT and MRI scans can image whole organs, but with a resolution only down to just below a millimetre. **HiP-CT** bridges these scales in 3D, imaging intact organs with ca. 20 micron voxels, and locally down to microns.

We hope this open access Atlas, enabled by the ESRF-EBS, will act as a reference to provide new insights into our biological makeup in health and disease. To stay up to date, follow [@HiP-CT](https://twitter.com/HiP-CT)

Funding

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- The [European Synchrotron Radiation Facility \(ESRF\)](#) — funding proposal MD-1252
- The [Chan Zuckerberg Initiative](#), a donor-advised fund of the Silicon Valley Community Foundation
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- The Royal Academy of Engineering, UK
- The UK Medical Research Council
- The Wellcome Trust



HIP-CT imaging and 3D reconstruction of a **complete brain** from the body donor LADAF-2020-31. More videos can be viewed on the [HiP-CT YouTube channel](#).

Collaborators

- [UCL](#), London, England: **Peter D Lee, Claire Walsh, Simon Walker-Samuel, Rebecca Shipley, Sebastian Marussi, Joseph Jacob, David Long, Daniyal Jafree, Ryo Torii, Charlotte Hagen**
- [ESRF](#), Grenoble, France: **Paul Tafforeau, Elodie Boller**
- Medizinische Hochschule Hannover, Germany: **Danny D Jonigk, Christopher Werlein, Mark Kuehnel**
- Universitätsmedizin der Johannes Gutenberg-Universität Mainz, Germany: **M Ackermann**
- University Hospital of Heidelberg, Germany: **Willi Wagner**
- Grenoble Alpes University, Department of Anatomy, French National Center for Scientific Research: **A Bellier**
- [Diamond Light Source](#), Harwell, UK: **Andy Bodey, Robert C Atwood**
- Imperial College London, UK: **JL Robertus**



ESRF HIGHLIGHTS

Tafforeau / ESRF 2022 UCL, CZI, LADAF



THANKS!

