

ID01 Status

ID01 team
(Steven Leake)



	Nanodiffraction	Coherent Diffraction Imaging	Full Field Diffraction Microscopy
FoV(μm)	100 x 100	< 1	>> 100 x 100
Spatial res. (nm)	35-1000	< 10 **	<100
Beam size (nm)	35-1000	35 < 1500	100 000 x 100 000
Flux (ph/s)	1E10 *40	4E9 *40	1E12
Energy (keV)	7 – 12, 19 – 30	7 – 12, 19 – 30	19 – 40

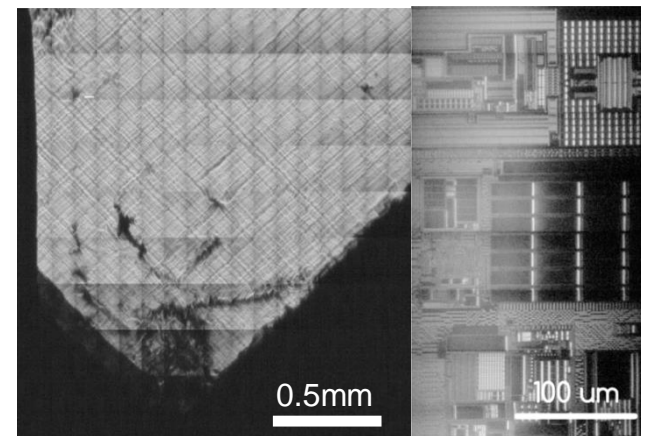
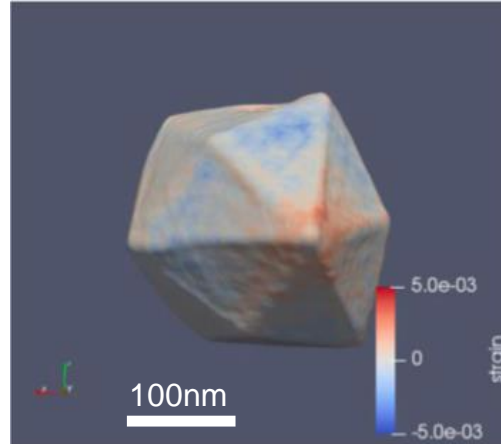
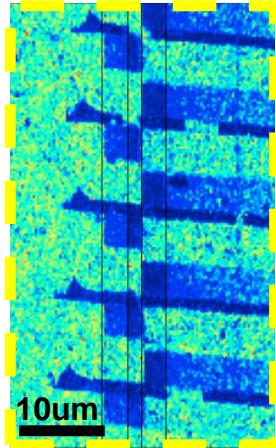
operando, ex/in-situ



Nanodiffraction

Coherent Diffraction Imaging

Full Field Diffraction Microscopy



2018-II | 11%

55%

25%

Nano-focus @ ID01, ESRF

56nm x 141nm

200nm



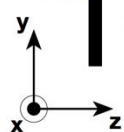
double crystal monochromator

slit selects coherent beam

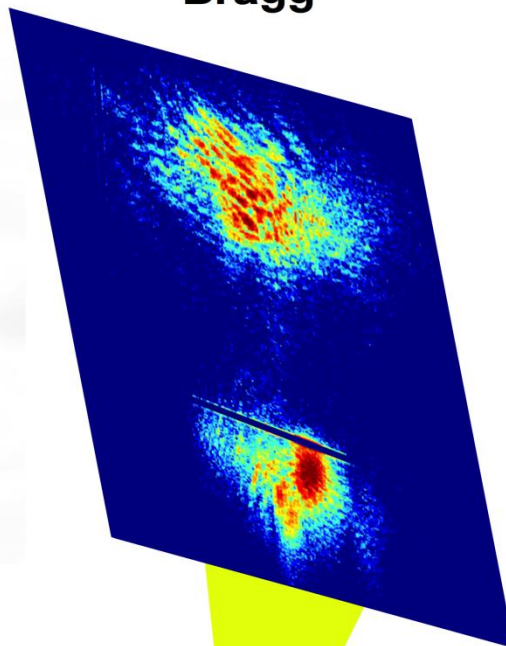
Fresnel Zone Plate

central stop

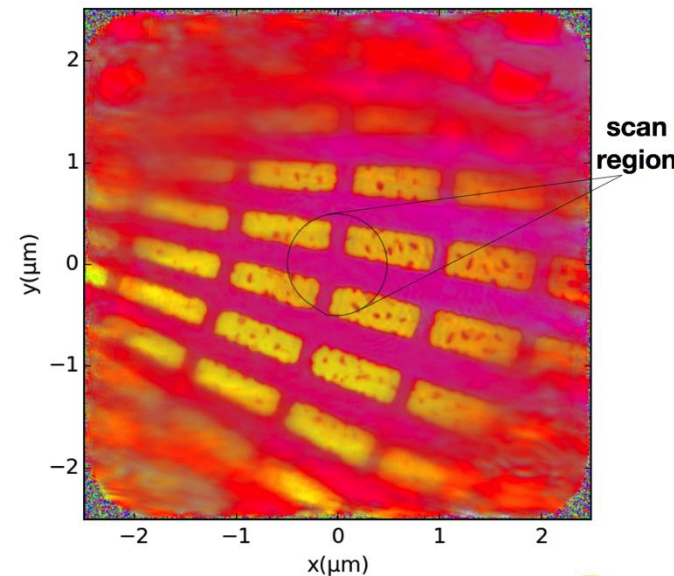
order sorting aperture



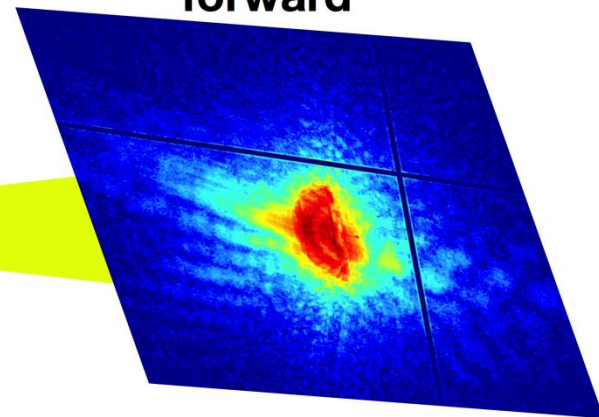
Bragg



Reconstructed reference object



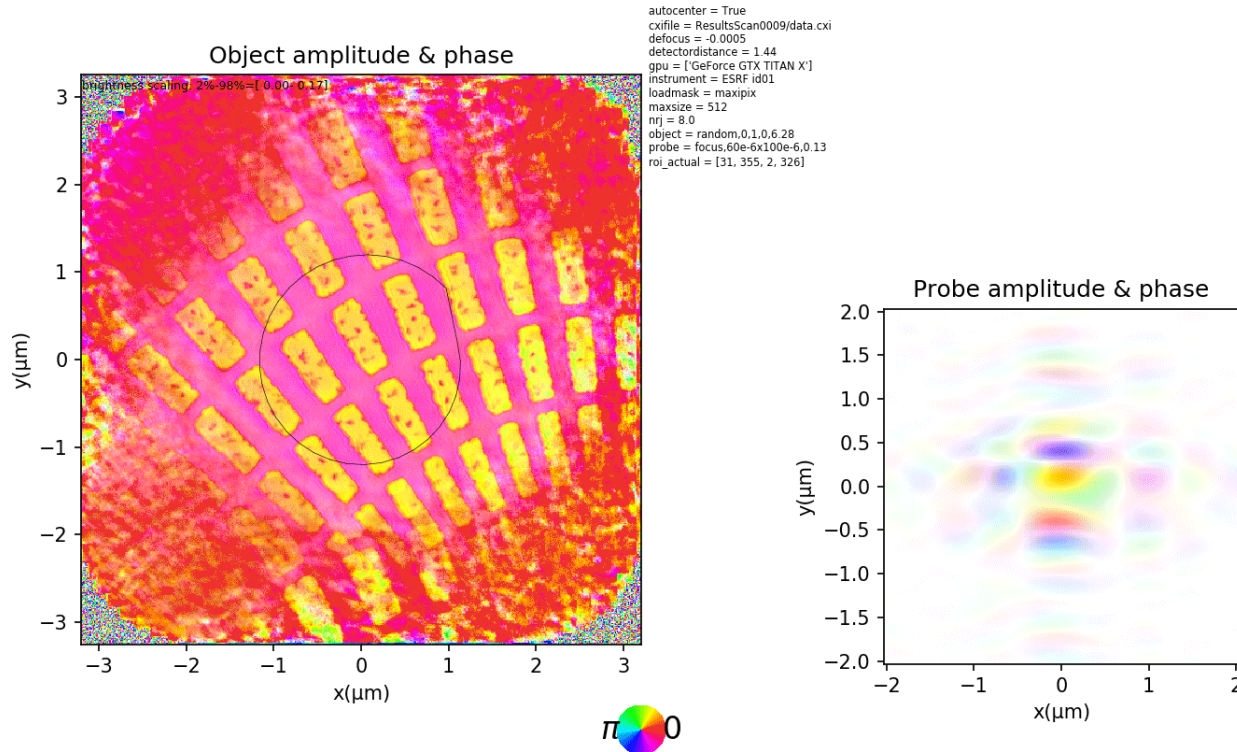
forward



PyNX python library,
<https://gitlab.esrf.fr/favre/PyNX>

Leake et al. JMADE express 2017

Scan #9, 128 frames, pixelsize= 12.5nm, LLK= 5.963
algo=20DM,probe=1,100DM,100APs,100ML,analyze,nbprobe=3,100DM,100AP,100ML



PyNX v3.3.3, finished at 2017/10/26 11:19:07

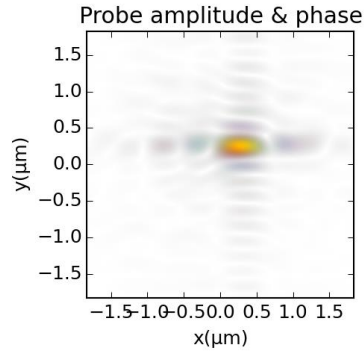
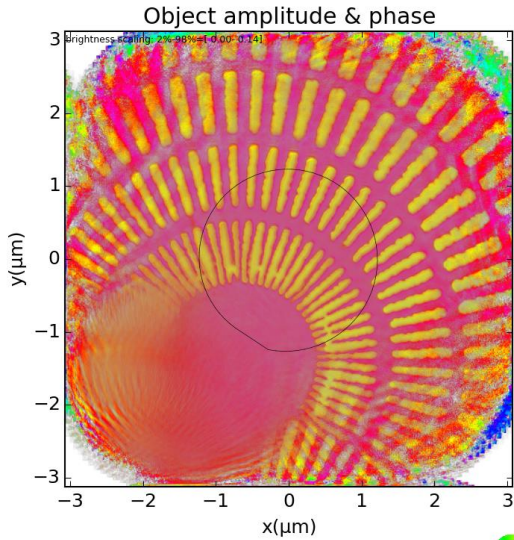
PyNX python library for CDI data treatment
<https://gitlab.esrf.fr/favre/PyNX>

Silx for data visualisation
<https://github.com/silx-kit/silx>

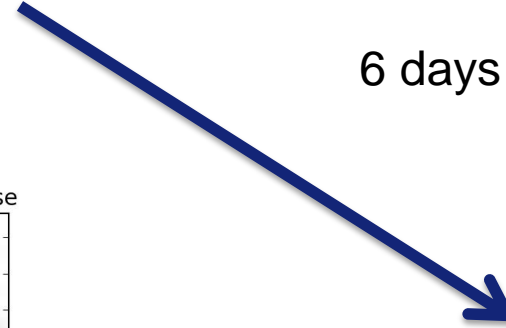
KB BEAM EVOLUTION

Scan #14, 513 frames, pixelsize= 12.7nm, LLK= 2.439
algo=50DM,probe=0,object=1,AP200,probe=1,200AP,200ML,nbprobe=3,200AP,ortho,200ML

```
autocenter = True
cxfile = ResultsScan0014\data.cxi
detectorDistance = 1.2958
gpu = ['GeForce GTX TITAN X']
instrument = ESRF ID01
load = ResultsScan0014/Run0002-05.npz
maxsize = 512
nI = 8.0
object = random.0.1.0.6.28
roi_actual = [3, 291, 13, 301]
```

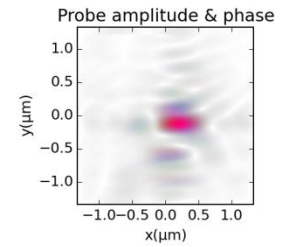
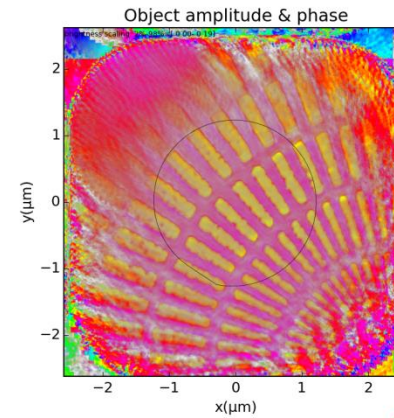


6 days



Scan #1170, 513 frames, pixelsize= 9.5nm, LLK= 18.286
algo=50DM,probe=0,object=1,AP200,probe=1,200AP,200ML,nbprobe=3,200AP,ortho,200ML

```
autocenter = True
cxfile = ResultsScan1170\data.cxi
detectorDistance = 0.9404
gpu = ['GeForce GTX TITAN X']
instrument = ESRF ID01
load = ResultsScan1170/Run0002-05.npz
maxsize = 512
nI = 8.0
object = random.0.1.0.6.28
roi_actual = [0, 280, 85, 365]
```



PyNX v2.7.0, finished at 2017/02/07 23:46:18

PYNX: FEATURES & DEVELOPMENT

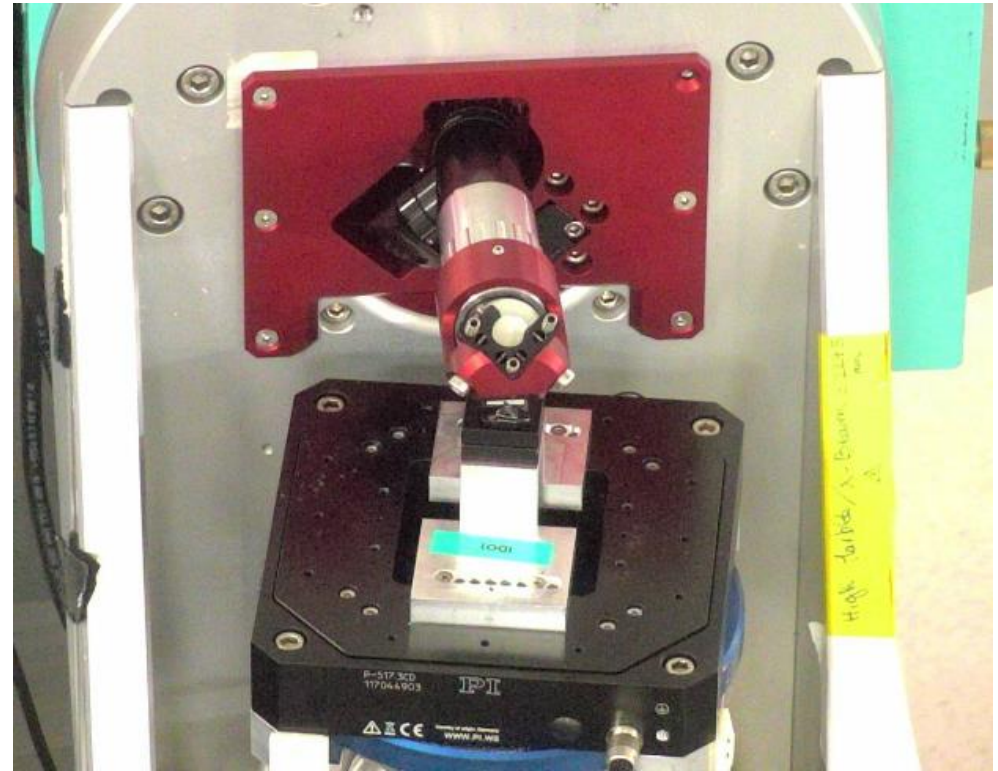
Status: **user-ready** / **testing** / **development** / **early development**

	CDI	Ptycho (far field)	Ptycho (near field)	Ptycho (Bragg)	Phase contrast
GPU	CUDA OpenCL	CUDA OpenCL	CUDA OpenCL	OpenCL	(OpenCL)
Python API	Operators	Operators	Operators	Operators	Operators
User scripts	✓	✓			
GUI	Notebooks, silx	Notebooks, silx	Notebooks, silx	Notebooks	
Features	<ul style="list-style-type: none"> • HIO, RAAR, ER, ML, CF, GPS • Partial coherence • Bragg & small-angle • Mask • Free LLK • Eigen-solutions • CXI/NeXus output 	<ul style="list-style-type: none"> • DM, ML, AP • Multiple modes • Bragg & small-angle • Mask • Probe analysis • Extended probe • (Floating intensities) • CXI/NeXus output 	<ul style="list-style-type: none"> • DM, ML, AP • Multiple modes • Small-angle • Mask • Probe analysis • Object-space mask • Serialised (tomography) • CXI/NeXus output 	<ul style="list-style-type: none"> • DM, ML, AP • 3D • 2D back-projection • Mask • Multiple 2D angles 	<ul style="list-style-type: none"> • Propagation • Paganin
TODO	<ul style="list-style-type: none"> • Genetic optimisation • Lower memory requirements 	<ul style="list-style-type: none"> • Position correction • Larger datasets • Transparent beamstop • Other algorithms 	<ul style="list-style-type: none"> • Position correction • Other algorithms 	<ul style="list-style-type: none"> • Position correction • Memory footprint • Fly-scans 	<ul style="list-style-type: none"> • Holo-tomo data • Illumination, object and flatfield optimisation

Automation and Data pipelines

Instrumentation News

EYES ON THE SAMPLE



Retractable – 2 μ m reproducibility

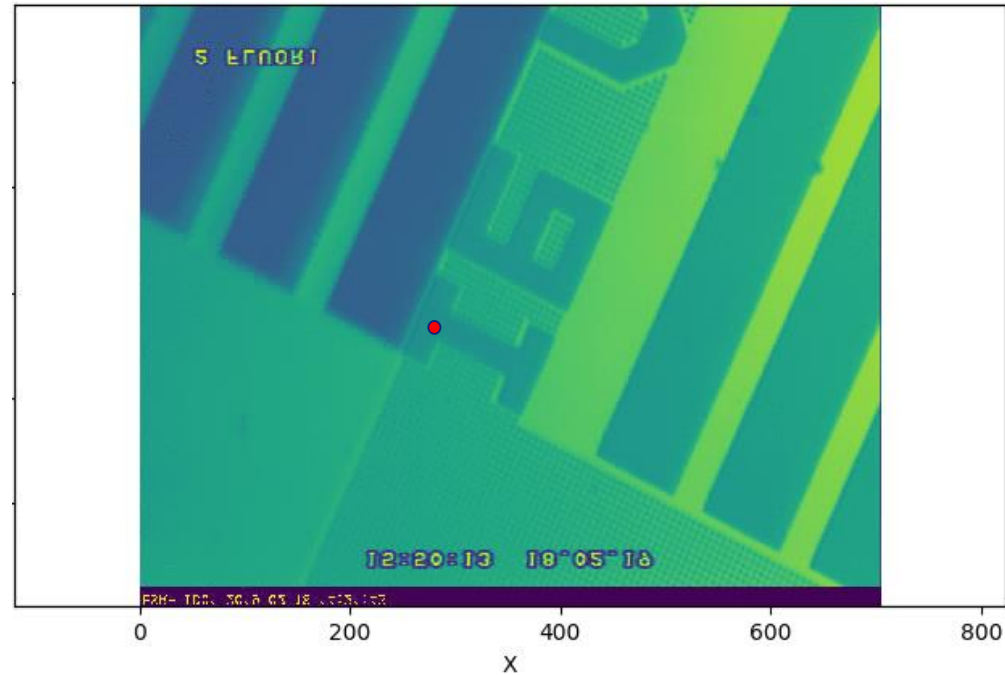
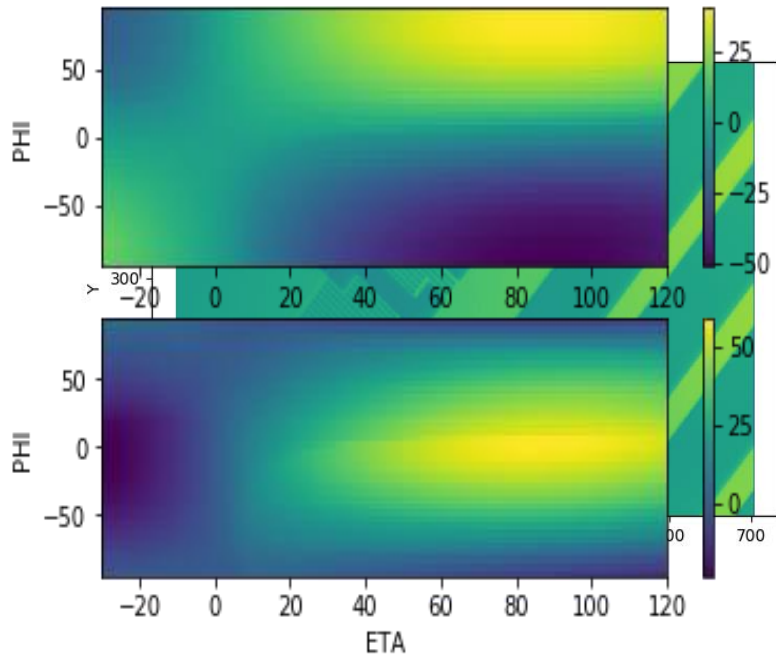
Stable over large eta

Permanent installation

Only 10x

Sample courtesy of J. Eymery (CEA)

LUT

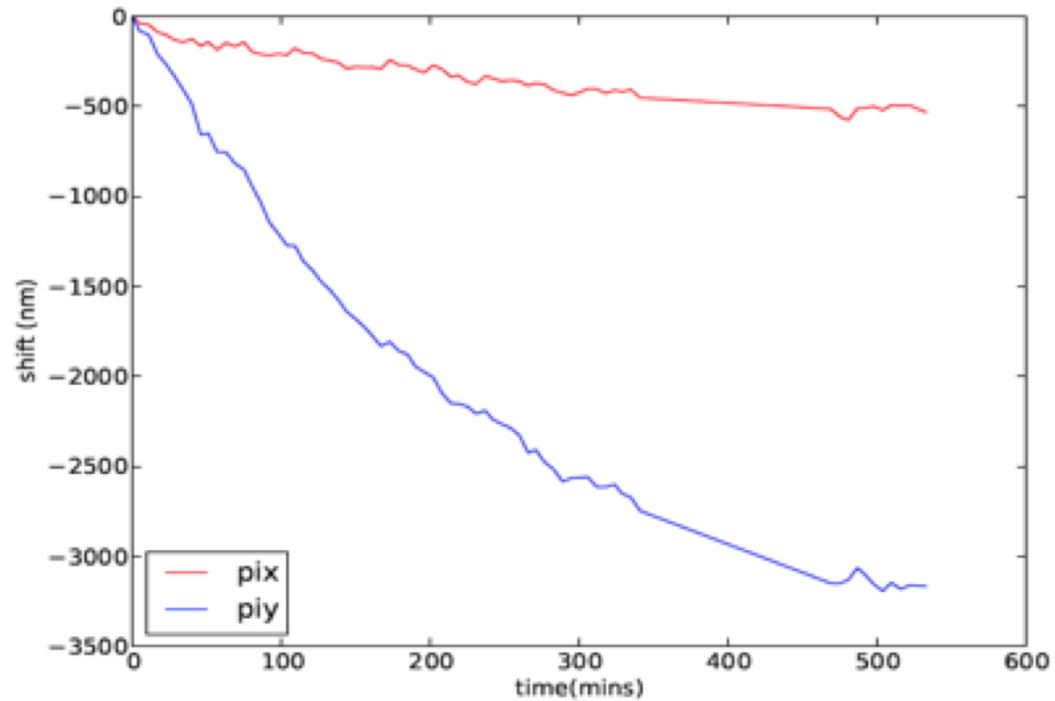


$-60 < \text{phi} < 60$; $0 < \text{eta} < 80$

Improves reliability (nanopositioning)

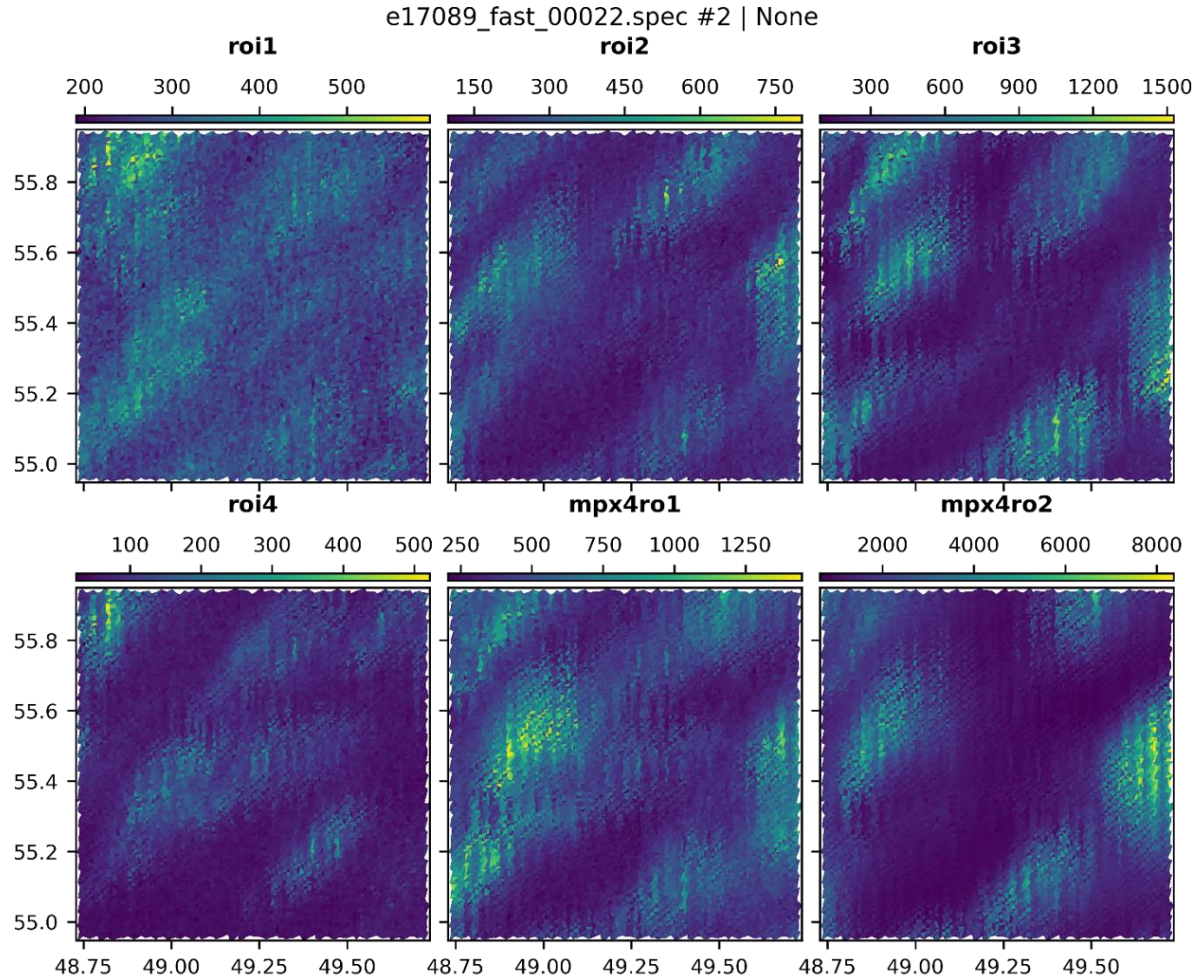
Multiple Bragg peaks faster

ONCE YOU CLOSE THE HUTCH....



after settling: 60-100nm/hr

Estimates from indirect measurements 20-30nm level

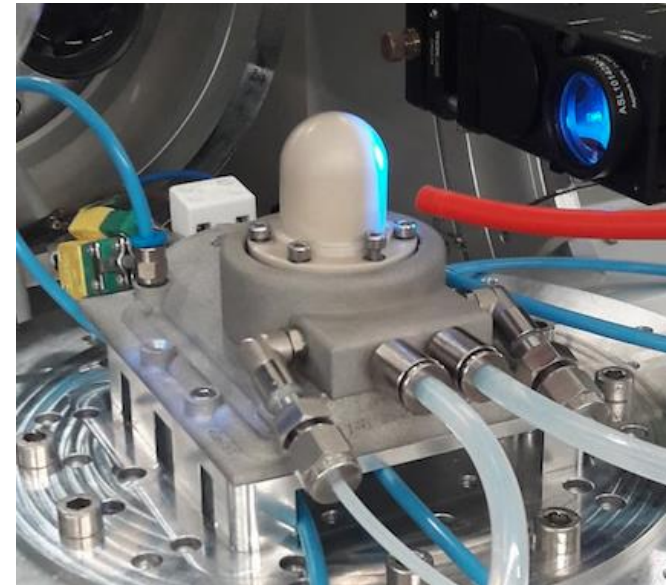


eta=22.53; del=45.6; phi=5.710125
 thx=-0.9206, thy=1.8984
 Wed 2018/10/17 21:27:30

Courtesy of E. Zatterin

- Cryo needs to be refurbished really
 - science case required, interest?
- Furnaces up to 1000C, water cooled - available
- Gas panel for catalysis (Richard collab.)
- Electrochemical cell (Richard collab.)
- AFM/ indenter (Cornelius collab.)
- Offline/ online nanomanipulation, interest?
- Battery cells coming soon (TEESMAT)

New furnace



Water cooled
(Y. Watier + ID01)

We are open to your suggestions!!!!

EBS Day

- Eiger 2M (500Hz cont.), 500K (8kHz cont.) (22kHz burst) 1
- GaAs timepix for high energies (300Hz cont.) 1
- Use of secondary source (< remove optics issues from source) 1

ID01 team

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Roberto Homs
Herve Gonzalez
Gilbert Chahine
Jan Hilhorst
Sara Fernandez
Filippo Cianciosi
Gaetan Girard



We are optimised for BCDI
but we can always do better
tell us what you need
see you at the EBS!