

The logo for ExCALIBUR 10, featuring the word 'EXCALIBUR' in white uppercase letters above the number '10' in white uppercase letters inside a red circle. The background of the slide is a server room with glowing blue and orange lights.

**EXCALIBUR
10**

BIODAC: BIO-IMAGE PROCESSING AT EXASCALE

Chris Edsall (University of Cambridge)

Engineer's House, 11-12 October 2023

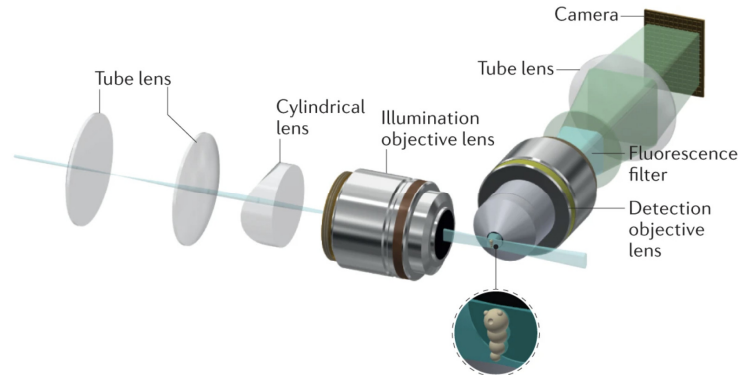


**UK Research
and Innovation**

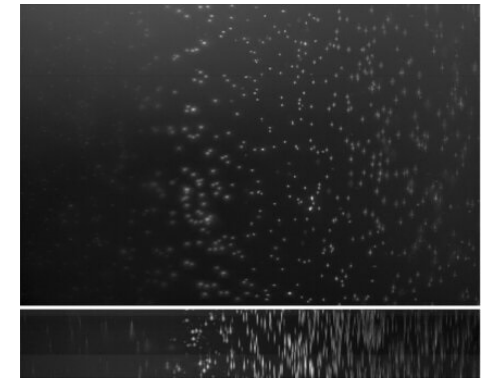


**UK Atomic
Energy
Authority**

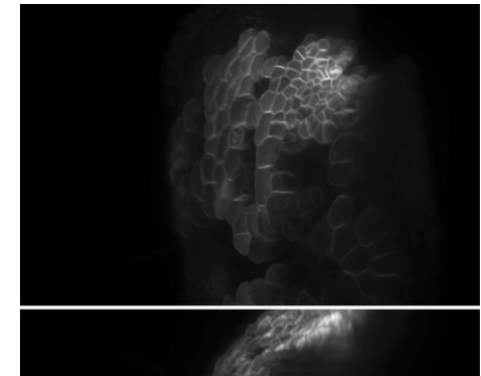
Project Status



- Light sheet microscopy is a gentle, fast imaging technique, able to image large volume samples during long periods of time (e.g. days). The only limitation is the readout speed of the camera.
- Imaging results in big amounts of data.
- Lightsheet image reconstruction relies on specific models.
- The data management and downstream analysis can be easily extended to a broad range of different microscopy techniques.
- Matt Archer (RSE) and Anita Karsa (PDRA) joined the team. Leila Muresan (PI), Chris Edsall and Hugh Robinson (co-I).
- First results:
 - Deep learning 3d segmentation model,
 - image reconstruction is being adapted to HPC.



(a) 0.5µm multi-colour Tetraspeck microspheres (slice)



(b) Membrane labelled Marchantia (maximum intensity projection)

Lightsheet imaging examples

Current Challenges

The amount of data makes image processing and analysis the main bottleneck to fully exploit the technique.

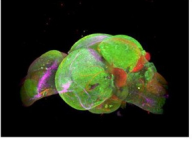
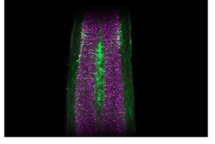
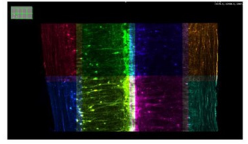
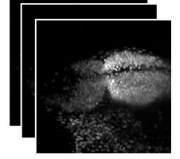

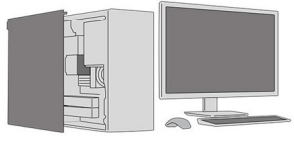


	Few- 10's GB	100's GBs - TBs	100's TBs - PB
Example data			
	single volume, multi-channel PACT cleared adult zebrafish brain	multi-view, multi-channel PACT cleared mouse spinal cord	multi-tiles, views, channels PACT cleared mouse spinal cord
			
			time-lapse zebrafish embryo
Computing environment			
	nominal laptop/desktop	single or multi-socket workstation	local server
	CPU: 4-8 cores, 2-3 GHz RAM: 8-32 GB RAM GPU: onboard or eGPU DISK: 1-2 TB SATA SSD or nMVE TRANSFER: Thunderbolt, ethernet	CPU: 1-4 socket, 8-32 core, 2-4 GHz RAM: 64 GB - 2 TB RAM GPU: 1-4 GPU cards, 5-48 GB (total) DISK: 0.5-40 GB nMVE, 1-144 SATA SSD TRANSFER: 1-200 Gb/s	CPU: 40-80 cores per node, 2.5-3 GHz RAM: 384 GB - 3 TB per node GPU: 2-4 cards per node, 48-80 GB (total) DISK: 5 PB TRANSFER: 100-200 Gb/s
			
			HPC cluster/cloud

Image reconstruction
 Benchmarking
 Optimisation
 Data management
 Big data
 FPGA
 Deep learning
 FAIR Data

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Gibbs Holly C.,...,Perez Lisa M., Frontiers in Cell and Developmental Biology, 9, 2021, 10.3389/fcell.2021.739079