# CCP-volumeEM: Making modern computational methods accessible for volume electron microscopy

Martin Jones[1], Michele Darrow[2], Matthew Hartley[3], Gabryel Mason-Williams[2], Joost de Folter[1], Helen Spiers[1], Mariam Demir[6], Agnel Joseph[6], Piper Fowler-Wright[2], Amy Strange[1], Lucy Collinson[1], Leandro Lemgruber-Soares[4], Paul Verkade[5], Martyn Winn[6]

[1]Francis Crick Institute, [2]Rosalind Franklin Institute, [3]EMBL-EBI, [4]University of Glasgow, [5]University of Bristol, [6]STFC Scientific Computing

Volume Electron Microscopy

Volume EM (vEM) is a collection of techniques used to image the structure of cells and tissues through continuous depths of at least one micrometre, at nanometre resolution, based on both transmission electron microscopy (TEM) and scanning electron microscopy (SEM).
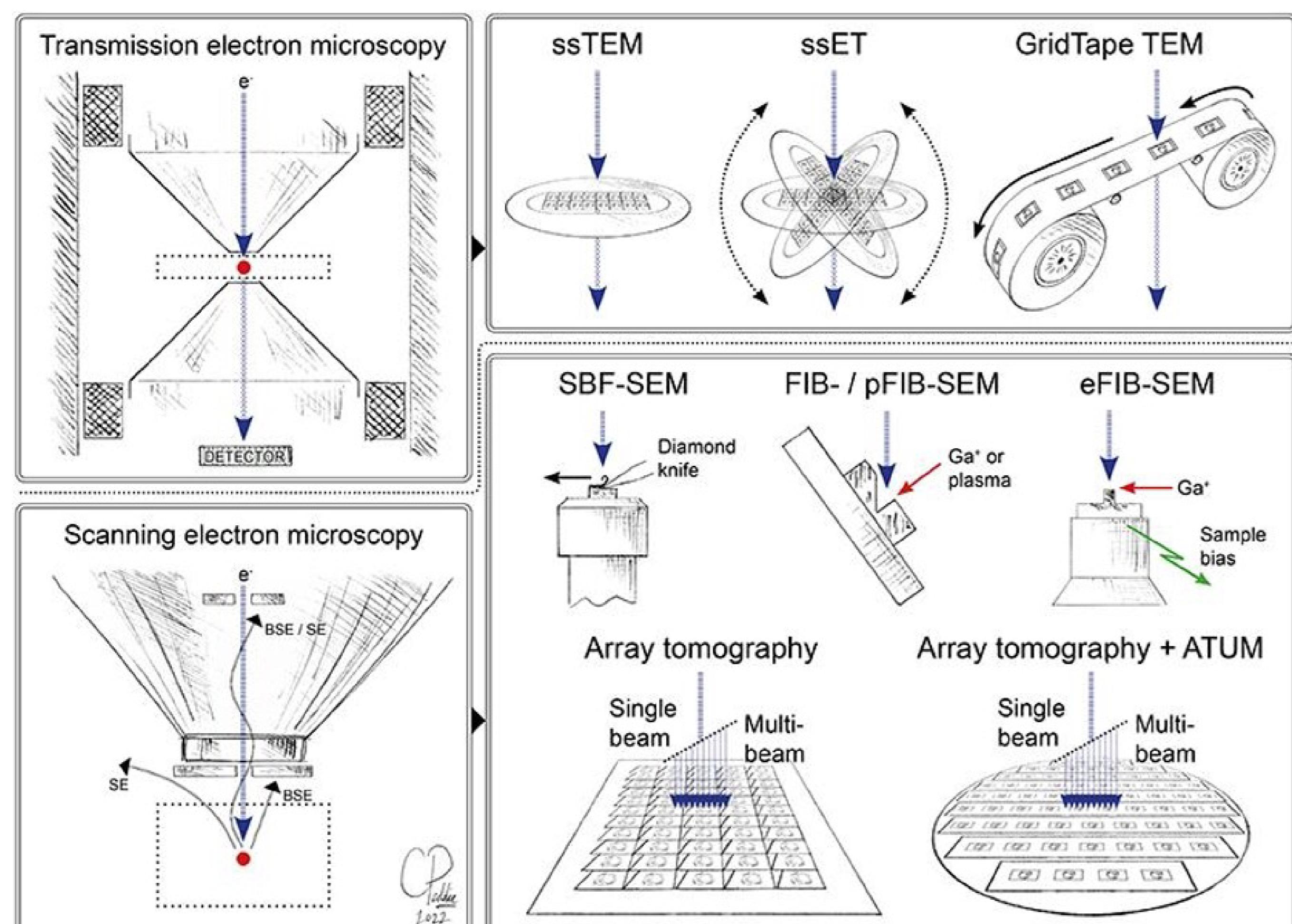

Overview of the diversity of vEM technologies from [1], original artwork by Chris Peddie, Licence CC-BY-4.0

These techniques now routinely generate terabyte scale datasets, which are extremely challenging to analyse, requiring a community of biologists, microscopists, image analysts, and software engineers to coordinate efforts to establish best-practices and ensure a wide range of scientific questions can be accurately and efficiently addressed.

Current activities

Creation of containerised environments for a range of common software tools for vEM analysis.

Deployed on DAaaS platform for training courses.
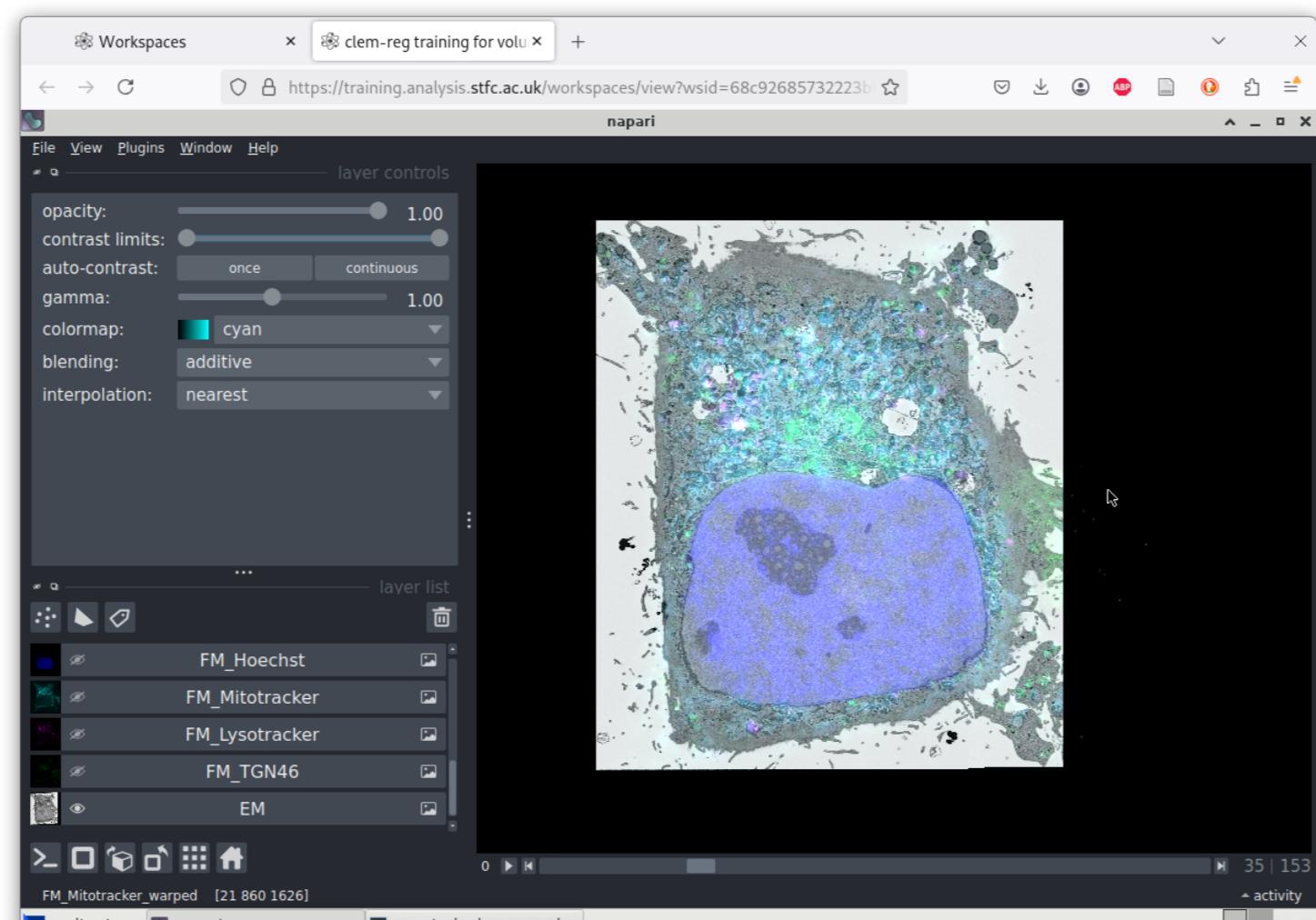
Exemplar workflow for 3D stitching and registration, built upon existing open-source python library.
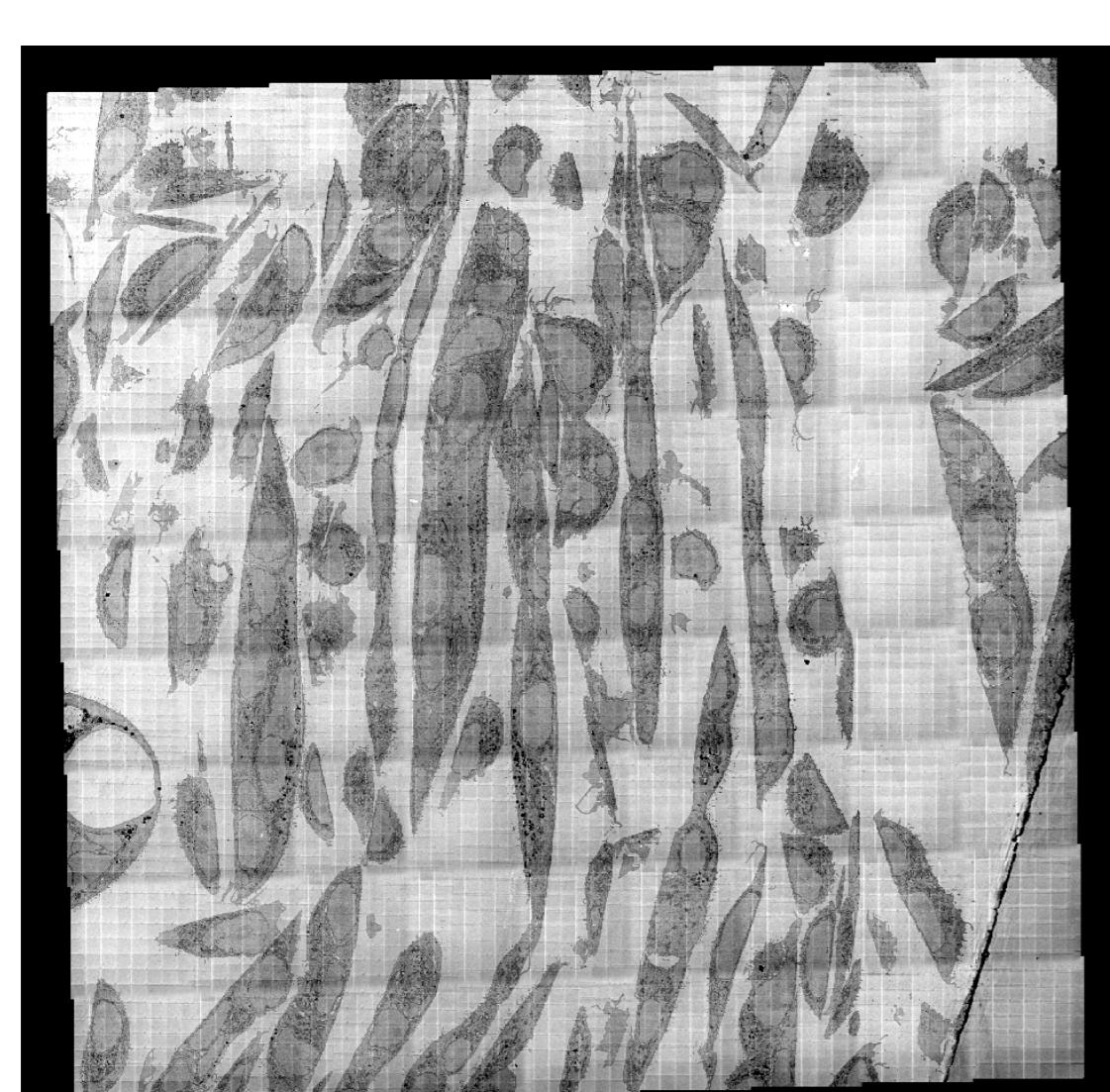
Intended as both a widely useful and well-benchmarked workflow, and as a demonstration of software engineering best-practice, incorporating the latest developments in Next Generation File Formats to aid data management and support FAIR data principles

WP 1: Community Building

There are many stakeholders in the vEM data analysis pipeline, from biologists and microscopists to computer scientists and analysts. A key aim of this project is to ensure all parties get the maximum benefits from a wide range of domains.

A community survey will establish the highest priority goals and guide the long term technical efforts.

A series of community events and hackathons are planned to establish a roadmap for the Collaborative Computational Project (CCP) and to coordinate technical efforts.
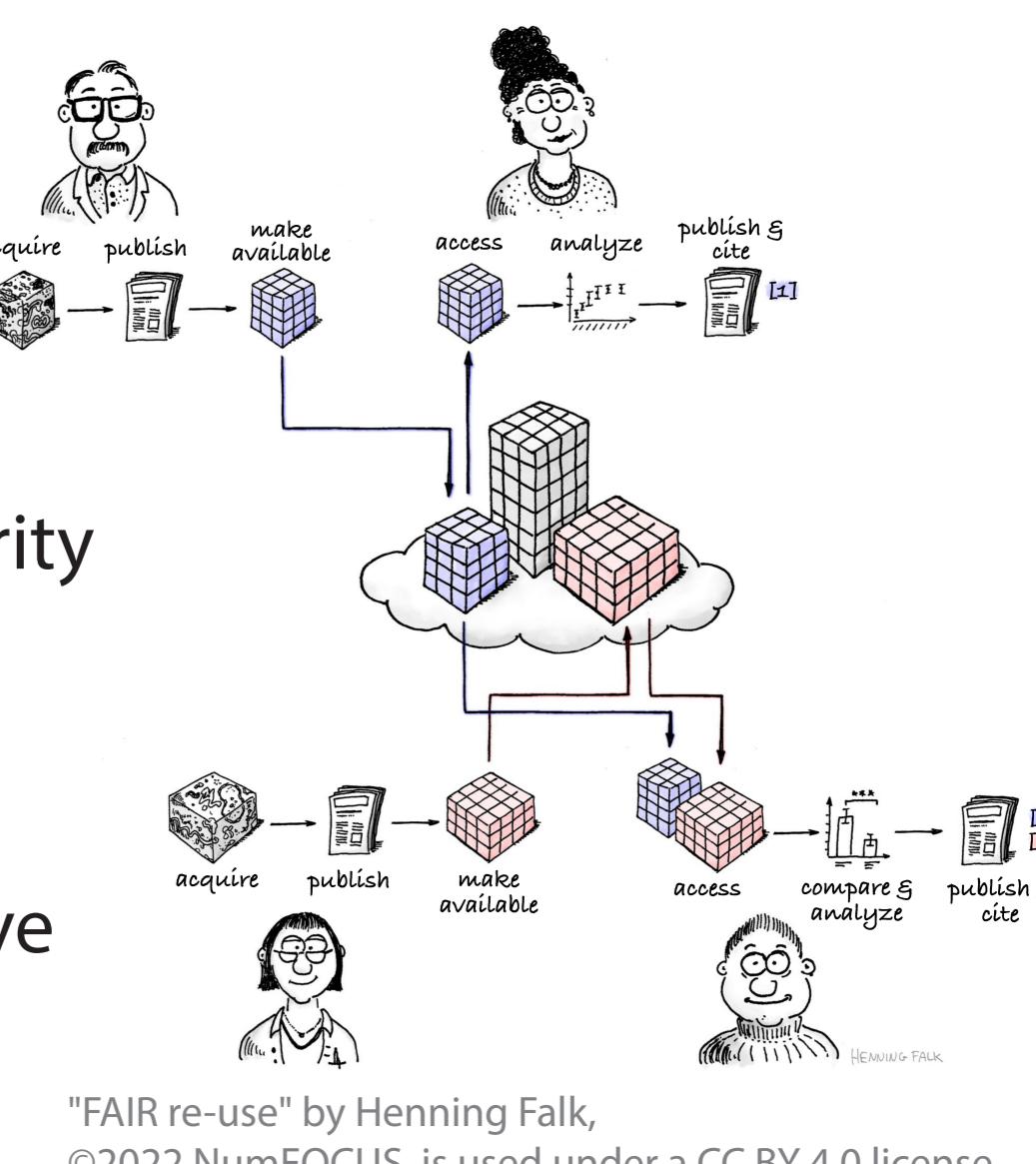
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WP 2: Research Software and Data Managment

As datasets increasingly reach the terabyte scale, efficient handling and processing are critical. Modern tools and techniques, such as Artificial Intelligence (AI), Next Generation File Formats (NGFF) and heterogeneous computing, offer great promise, but require significant RSE effort for robust implementation.

Pilot projects are underway to develop methods to translate technological advancements into sustainable and open solutions that are accessible to all end-users, regardless of their computational background.
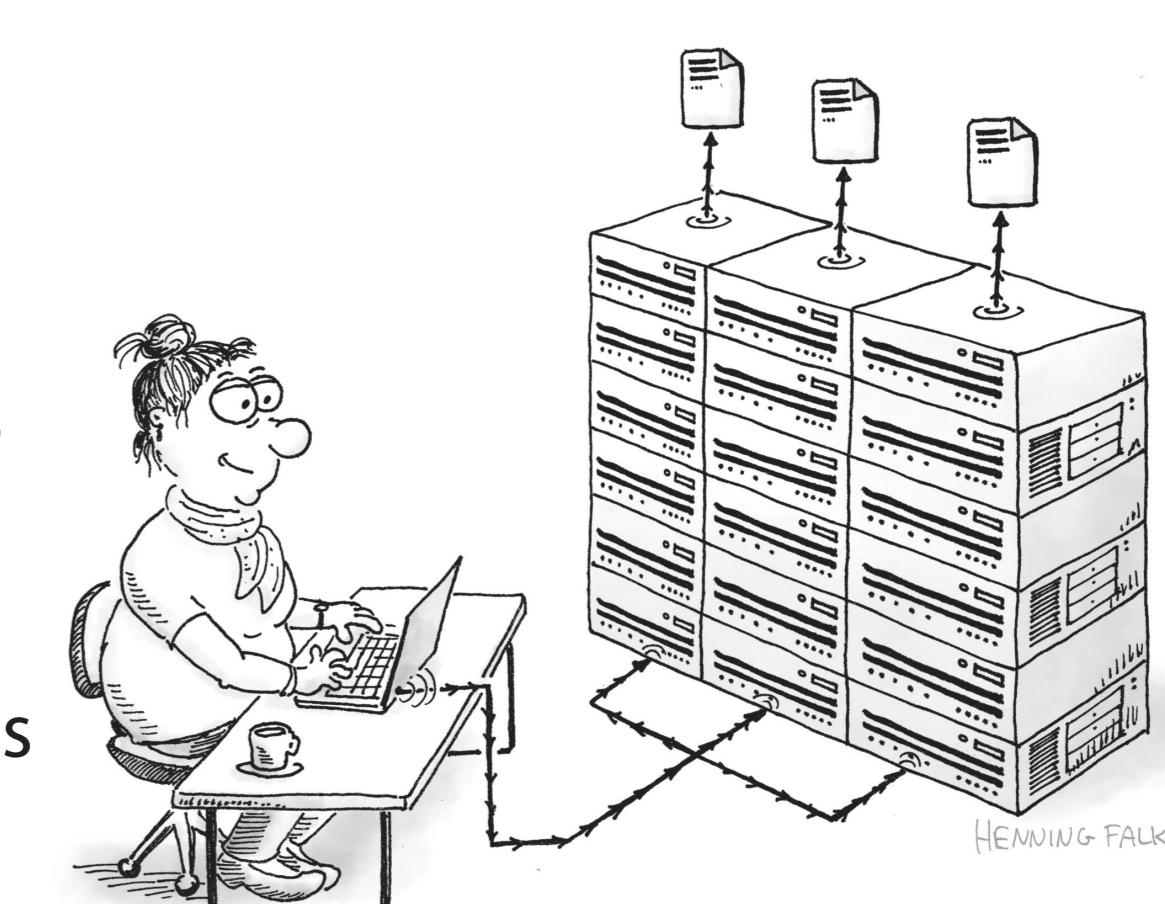
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WP 3: Training and Skills

The rapid advances being made in analysis of vEM data often get stuck in the "developer/super-user" group, never reaching the end-users who need them the most.

In order to disseminate the knowledge to make use of these cutting-edge methods to a broader audience, we will support the community by developing training materials and infrastructure.
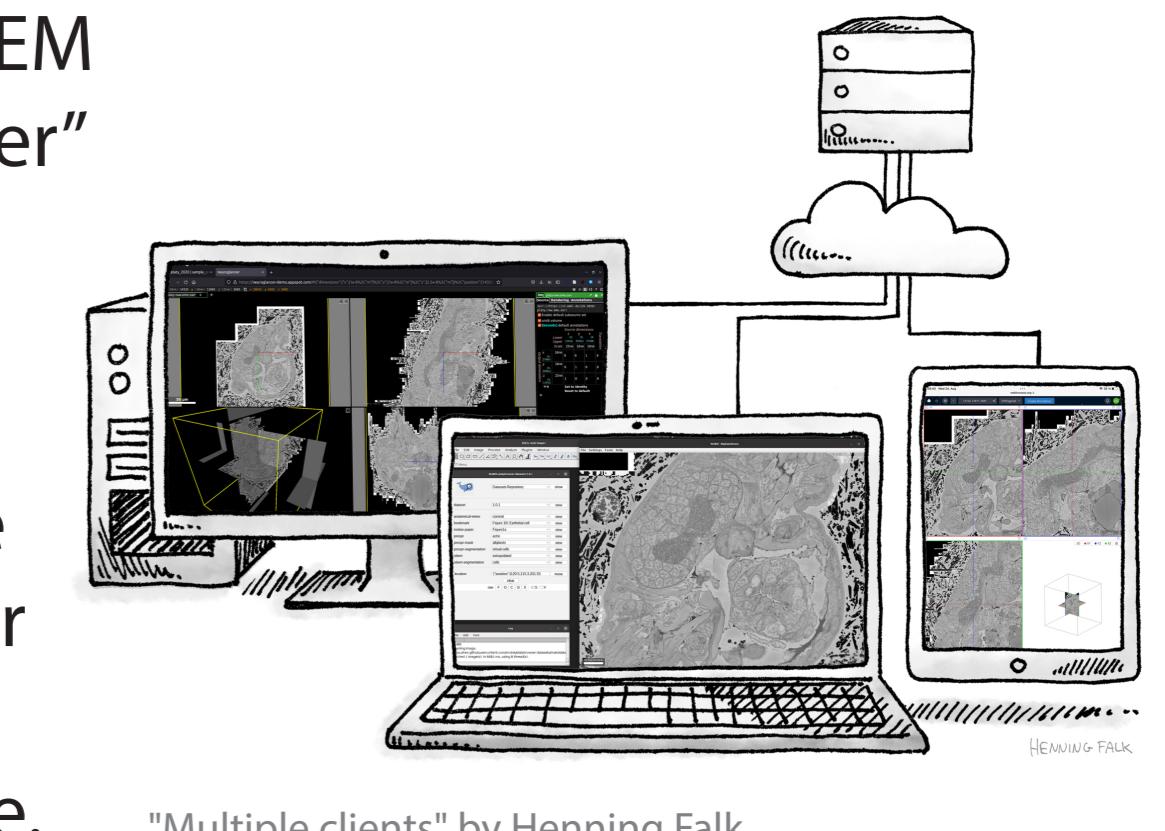
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Materials will be shared openly, allowing development and refinement by the community.

Ensuring data adheres to FAIR principles (Findable, Accessible, Interoperable, Reusable) will be a key message throughout.
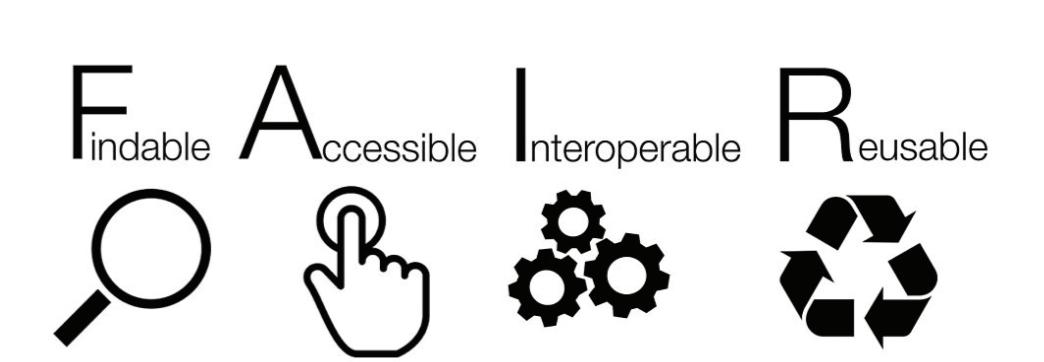
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How to get involved

If you're interested in getting involved, or finding out more, please sign up for our mailing list at https://bit.ly/ccp-volume-em or email ccpvolumeem@gmail.com and look out for upcoming announcements about events and activities!

References:
[1] Collinson, L.M., Bosch, C., Bullen, A. et al. Volume EM: a quiet revolution takes shape. Nat Methods 20, 777–782 (2023). https://doi.org/10.1038/s41592-023-01861-8
[2] Falk, H. zarr-developers/zarr-illustrations-falk-2022 | Zenodo [WWW Document], 2022. URL https://doi.org/10.5281/zenodo.7037367 (accessed 14/4/2025)