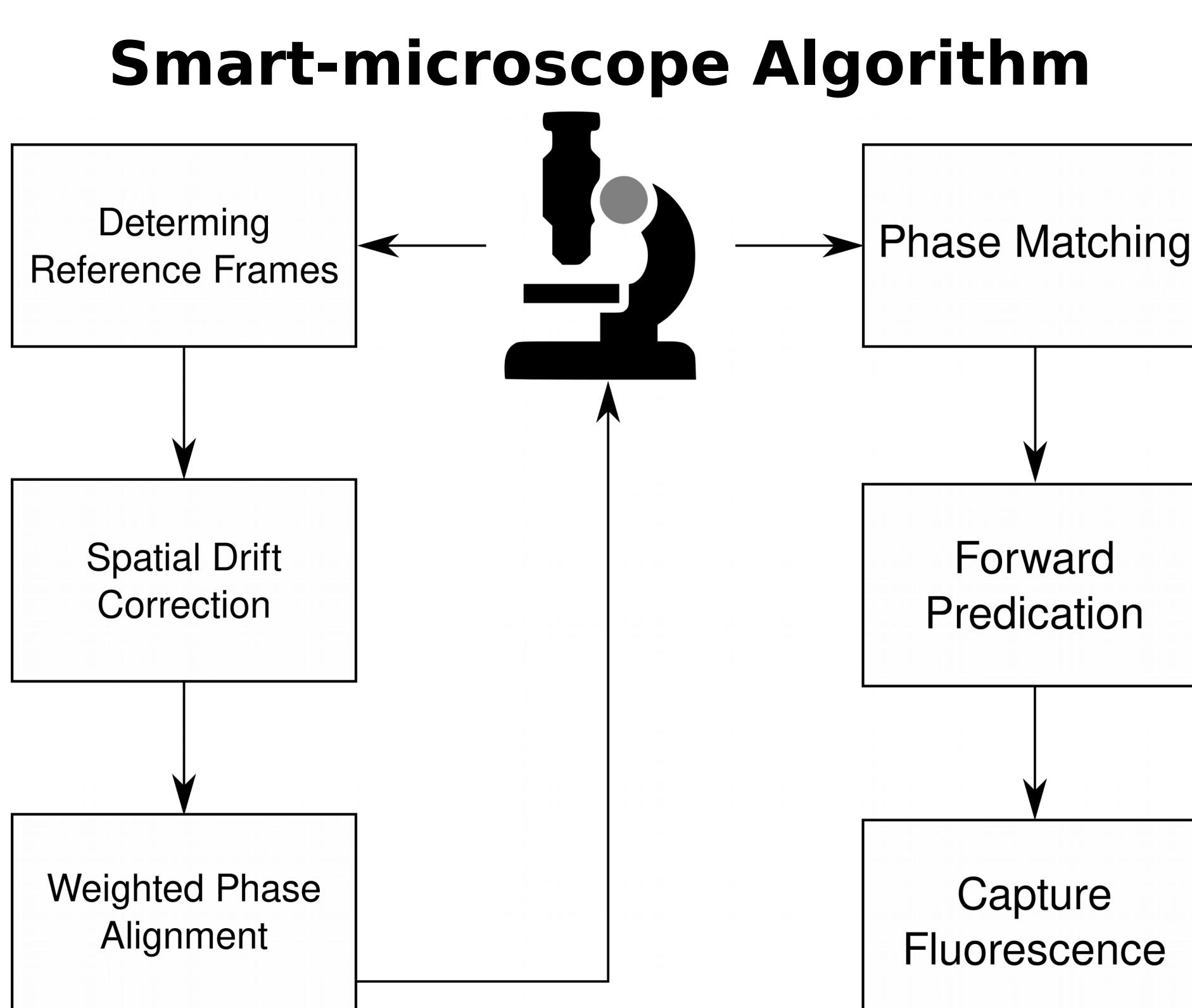


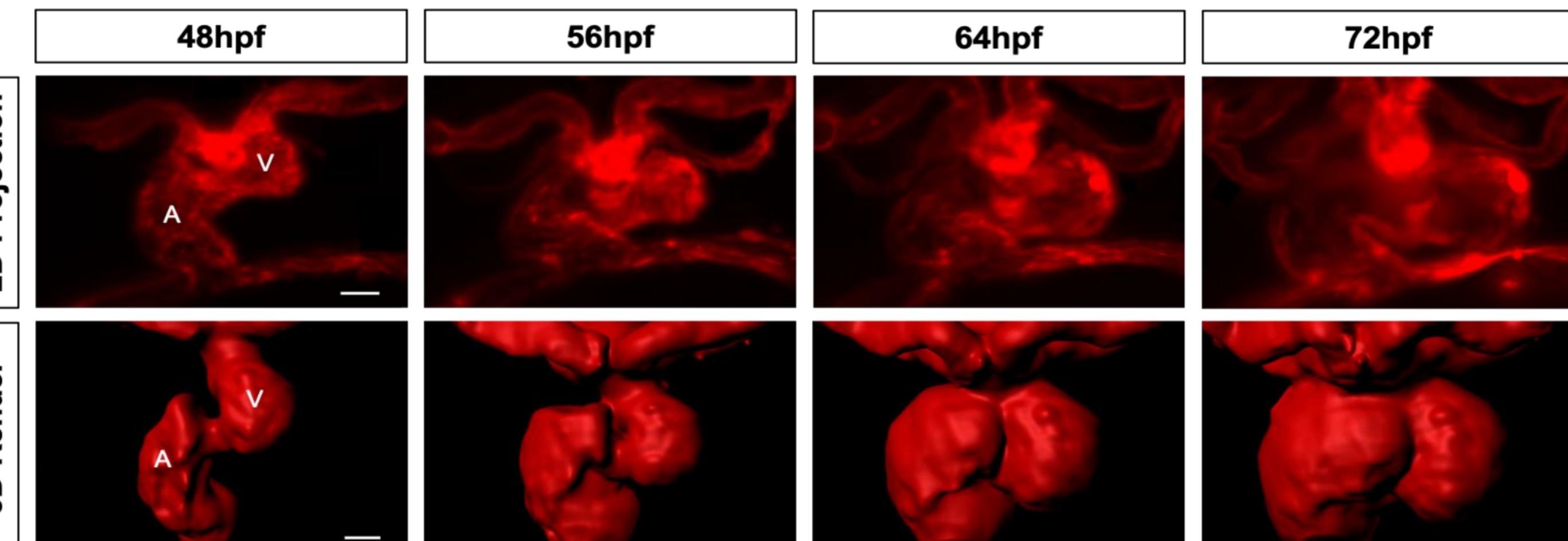
A Smart Microscope for *In Vivo* Day-Long 3D Time-lapse Imaging of the Beating Zebrafish Heart

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Finn Bruton, Aryan Baghbadrani, Charlotte Buckley, Carl Tucker,
Adriano Rossi, John Mullins, and Martin A. Denvir; University of Edinburgh

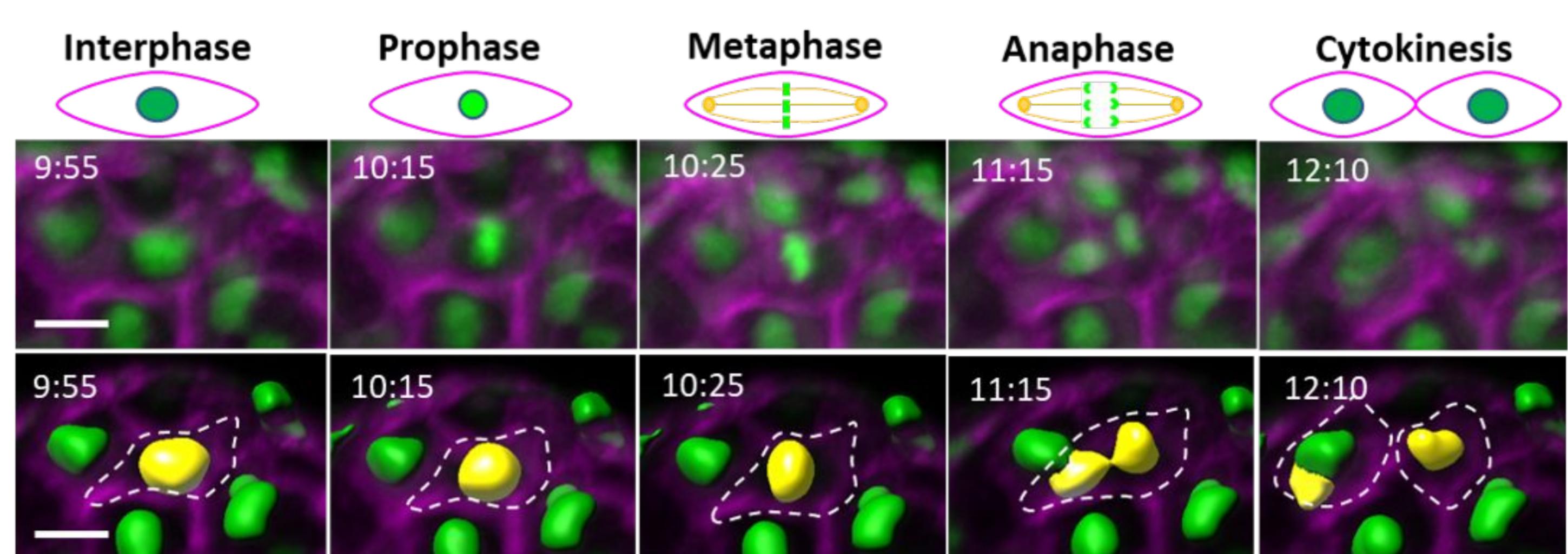
- 3D imaging of the heart is *challenging*:
- Constant, *high-speed beating*
- *Shape and size changes* during development
- *Existing methods* have major drawbacks:
 - Pausing heart with *drugs* affects *physiology*
 - Retrospective gating causes *phototoxic damage*
- We developed a **smart microscope** capable of:
 - **Virtual freezing** of the heart without drugs
 - **Reduced phototoxic** effects
 - Provide **phase-locked, day-long** imaging with human-level precision



Day-long, 3D, Time-lapse Heart Imaging...



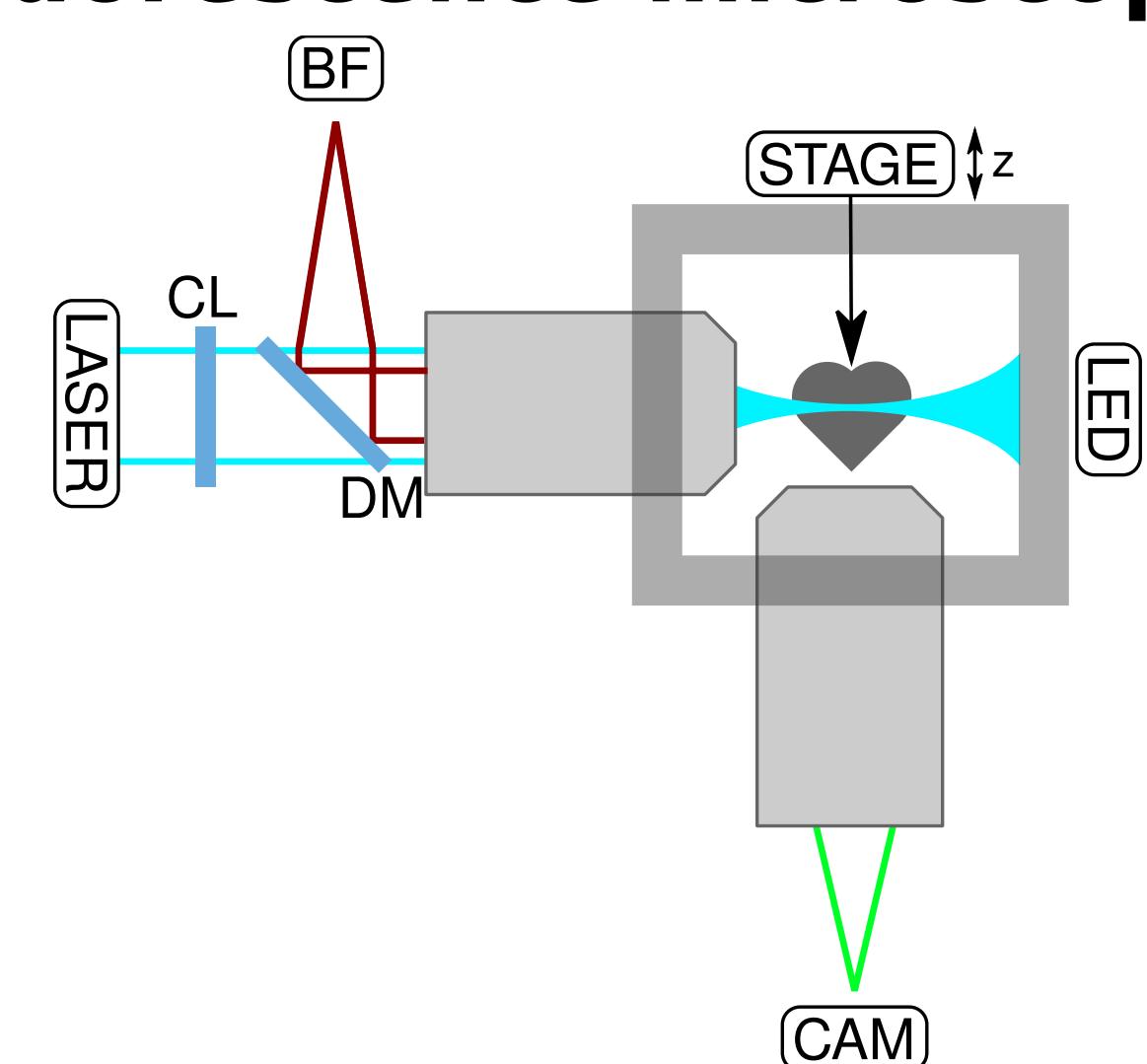
... with high spatial and temporal resolution.



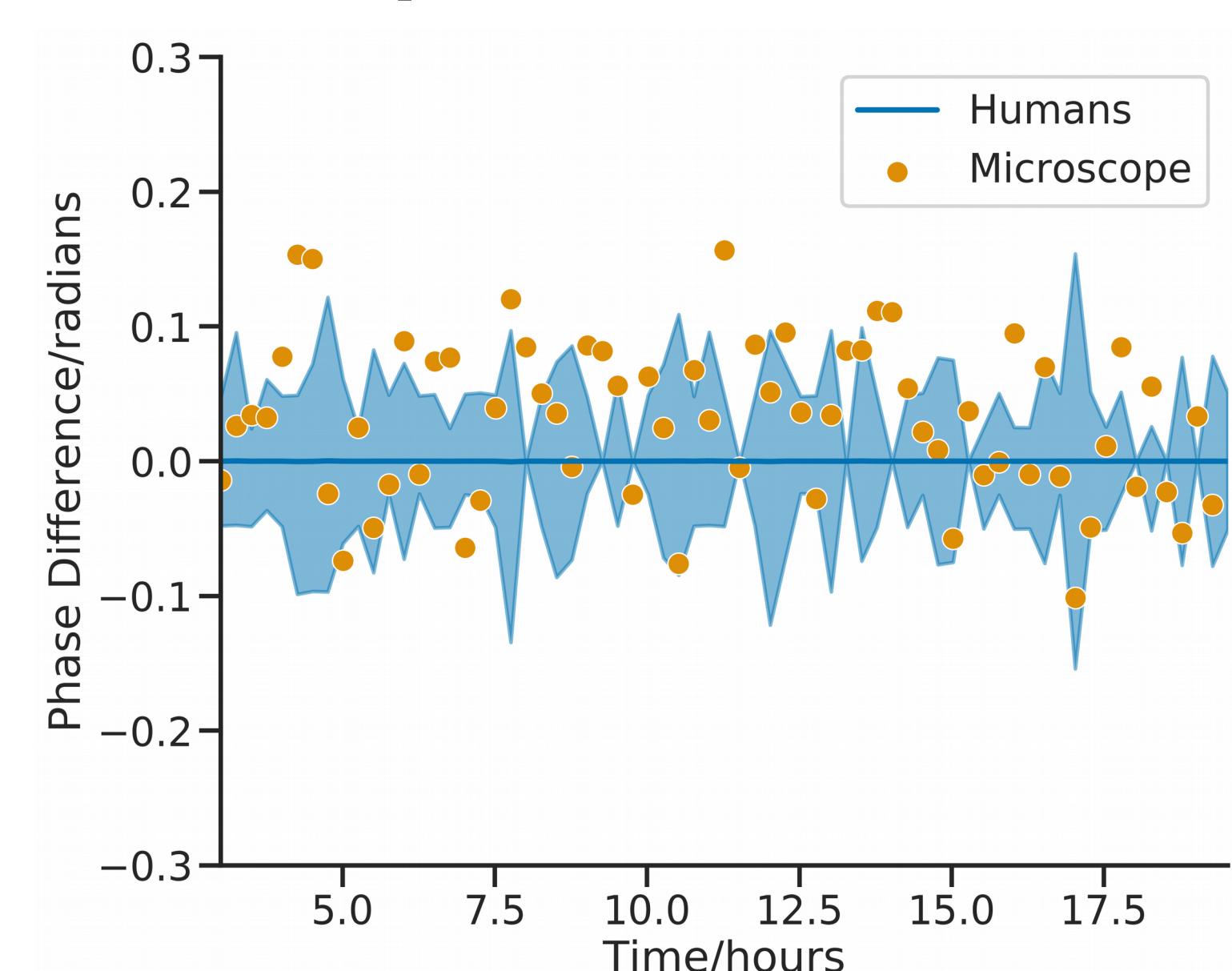
With this microscope we have:

- Observed detailed 3D structure during periods of *massive developmental changes* (heart looping)
- Tracked the 4D behaviour of macrophages and neutrophils during *cardiac injury response*
- Witnessed *never before seen cell division events* that contradict the established literature of cardiac trabeculation

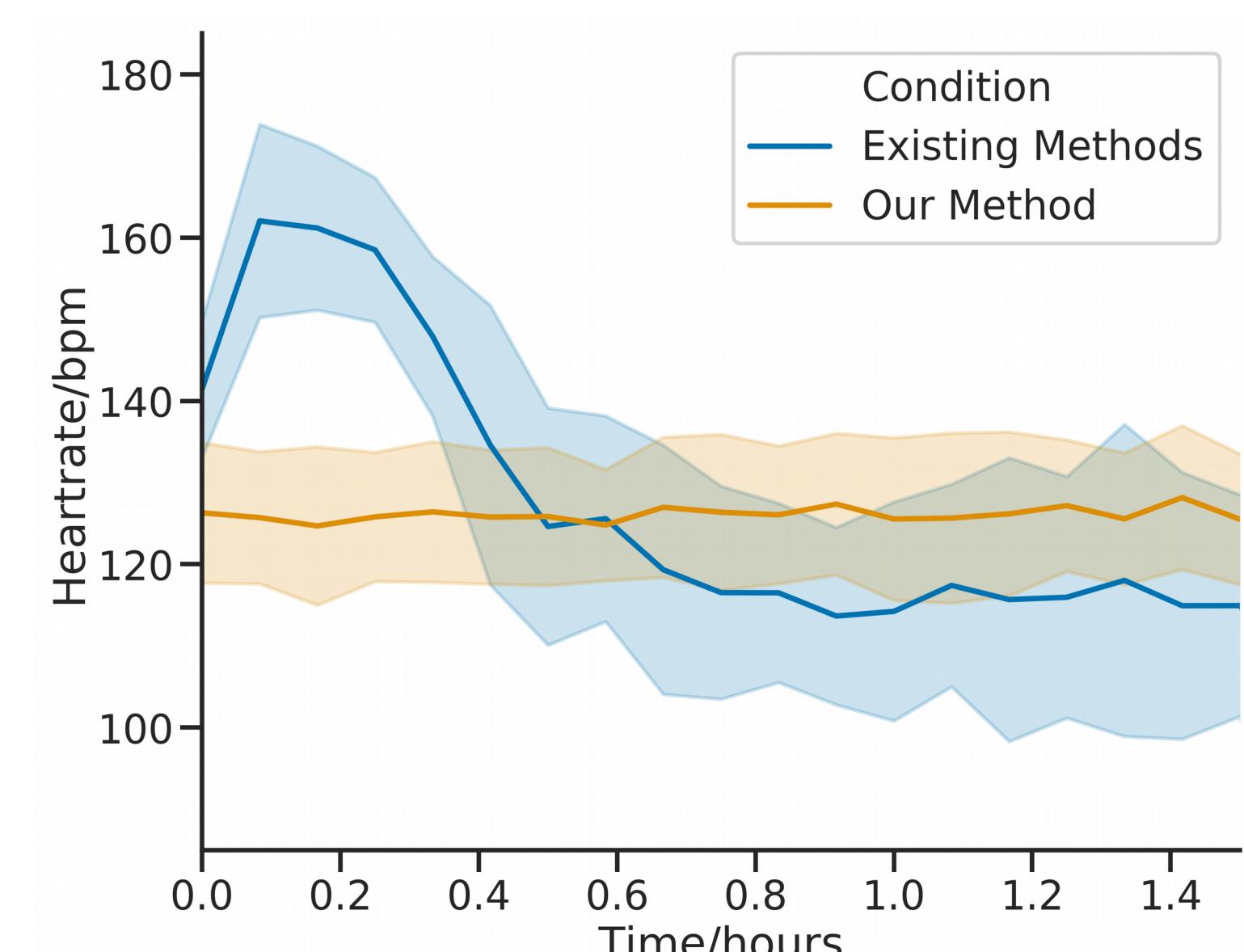
A schematic of the light-sheet fluorescence microscope.



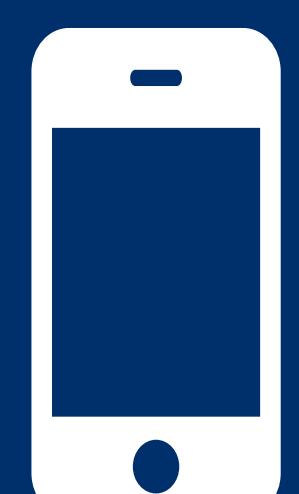
Stable phase-locking over hours compared to humans



Zebrafish heart-rate response to imaging is stable during imaging



University
of Glasgow



Take a picture
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British Heart
Foundation