Gigapixel imaging of fluorescent samples using a light sheet microscope

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Light sheet microscopy is known for its key advantages of increased acquisition speed and very low levels of light exposure to samples. Normally these attributes are used to observe fast dynamic processes or longer developmental processes. Another dimension in which these advantages can be exploited is high throughput imaging of large samples.

As an example, typically imaging an entire early stage chick embryo would require covering an area as large as 8x8mm. If the task is to track cells then the lateral resolution required can be in the region of 0.25µm resulting in a gigapixel image over an 64mm² area. With other microscopy techniques this is simply not feasible and a compromise is made between resolution and area.

Here we show that a light sheet microscope coupled with a high precision large travel translation stage can be used to capture large areas with high resolution, meeting the near gigapixel range. Furthermore the incorporation of SLM-based adaptive optics as well as tunable lenses allows imaging parameters like optical sectioning and penetration depth to be adjusted depending on the sample imaging requirements, which is essential in a multi-user facility.