

## Light Beads Microscopy (LBM)

### **Application:**

- a) *Cellular resolution in mammalian brain tissue*
  - Cortex-wide and multiregional high-speed volumetric calcium imaging in the mouse brain at cellular resolution
  - Large-scale cellular resolution volumetric imaging in NHP (marmoset) brain
- b) *Sub-cellular resolution in mammalian brain, whole-brain imaging in invertebrates and zebrafish*
  - High speed whole brain imaging in zebrafish at larval and juvenile stage
  - Volumetric synaptic resolution functional imaging in mammalian brains
  - Large-scale / whole brain imaging in invertebrates
- c) *Non-neuronal imaging*

### **Example technical parameters:**

- a) *Cellular resolution / large volume:*  $\sim 5 \times 5 \times 0.5$  mm 30 planes at  $< 3$  Hz; voxel sampling / resolution:  $\sigma_{x,y} \sim 5 \mu\text{m}$ ,  $\sigma_z \sim 15 \mu\text{m}$
- b) *High resolution / small volume:*  $\sim 1 \times 1 \times 0.5$  mm 30 planes at  $< 5$  Hz; voxel sampling / resolution  $\sigma_{x,y} < 1 \mu\text{m}$ ,  $\sigma_z < 10 \mu\text{m}$
- c) Other configurations and tradeoffs of the spatial and temporal resolution and volume size within the same voxel sampling rate of  $\sim 150 \times 10^6$  voxels per second possible

## Optimized three-photon imaging

### **Application:**

- Deep ( $> 1$ mm), sub-cortical imaging at cellular / sub-cellular resolution
- Imaging in gut
- Imaging through skull / dura invertebrate cuticles
- Spinal cord imaging

### **Example technical parameters:**

$\sim 0.3 \times 0.3$  mm at  $\sim 1.0 - 1.3$  mm depth in mammalian brain at  $\sim 10$  Hz; voxel sampling / resolution:  $\sigma_{x,y} < 1 \mu\text{m}$ ,  $\sigma_z < 10 \mu\text{m}$

### **Approach:**

- LBM will be integrated optionally into a standard 2p microscope or a mesoscope
- The 2p microscope equipped also with optimized volumetric 3p imaging modality