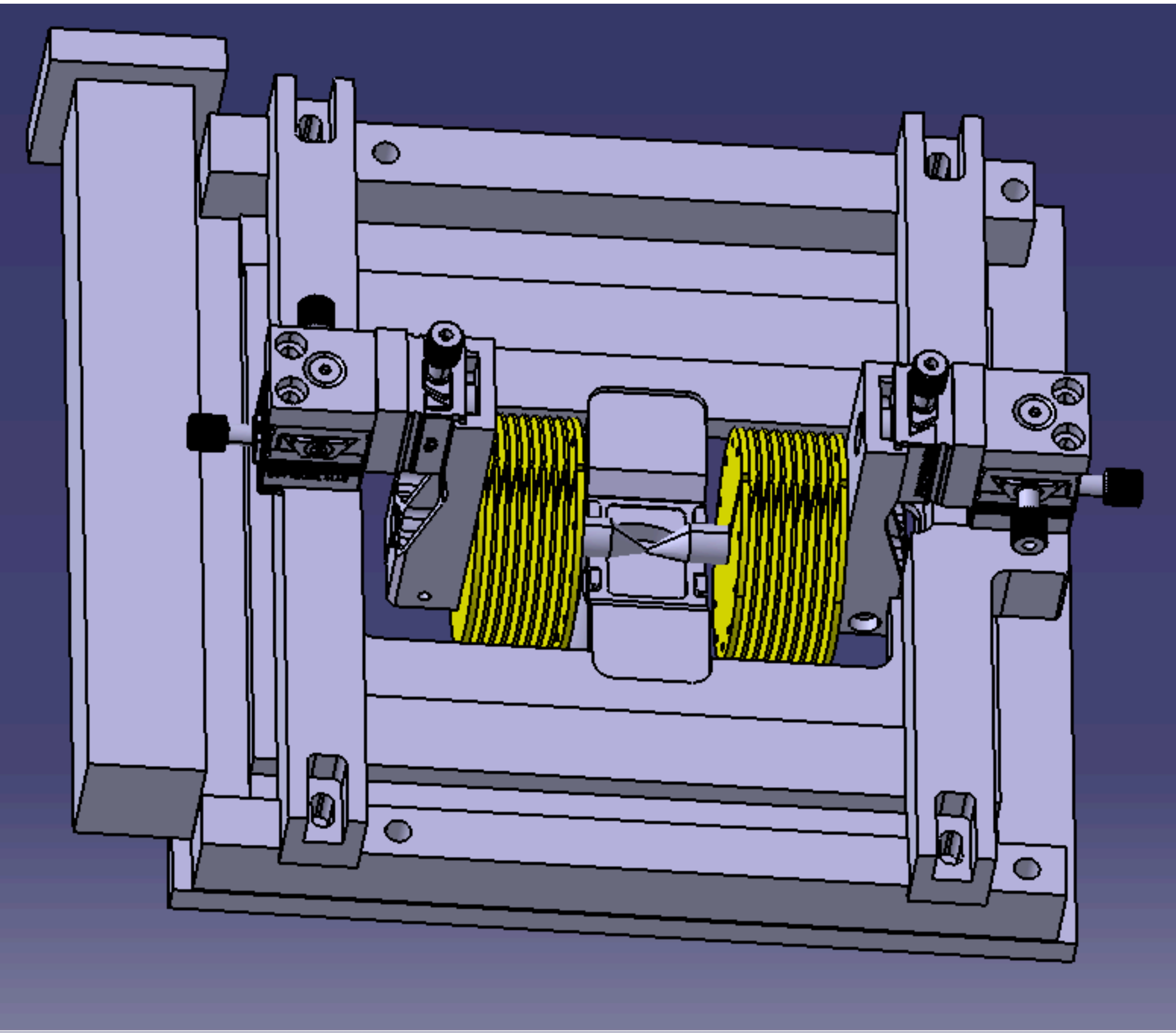
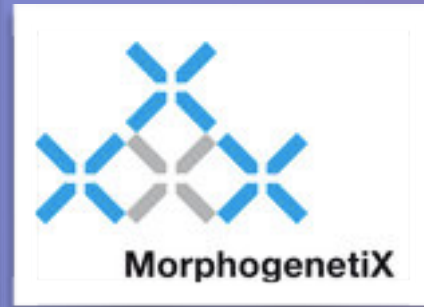


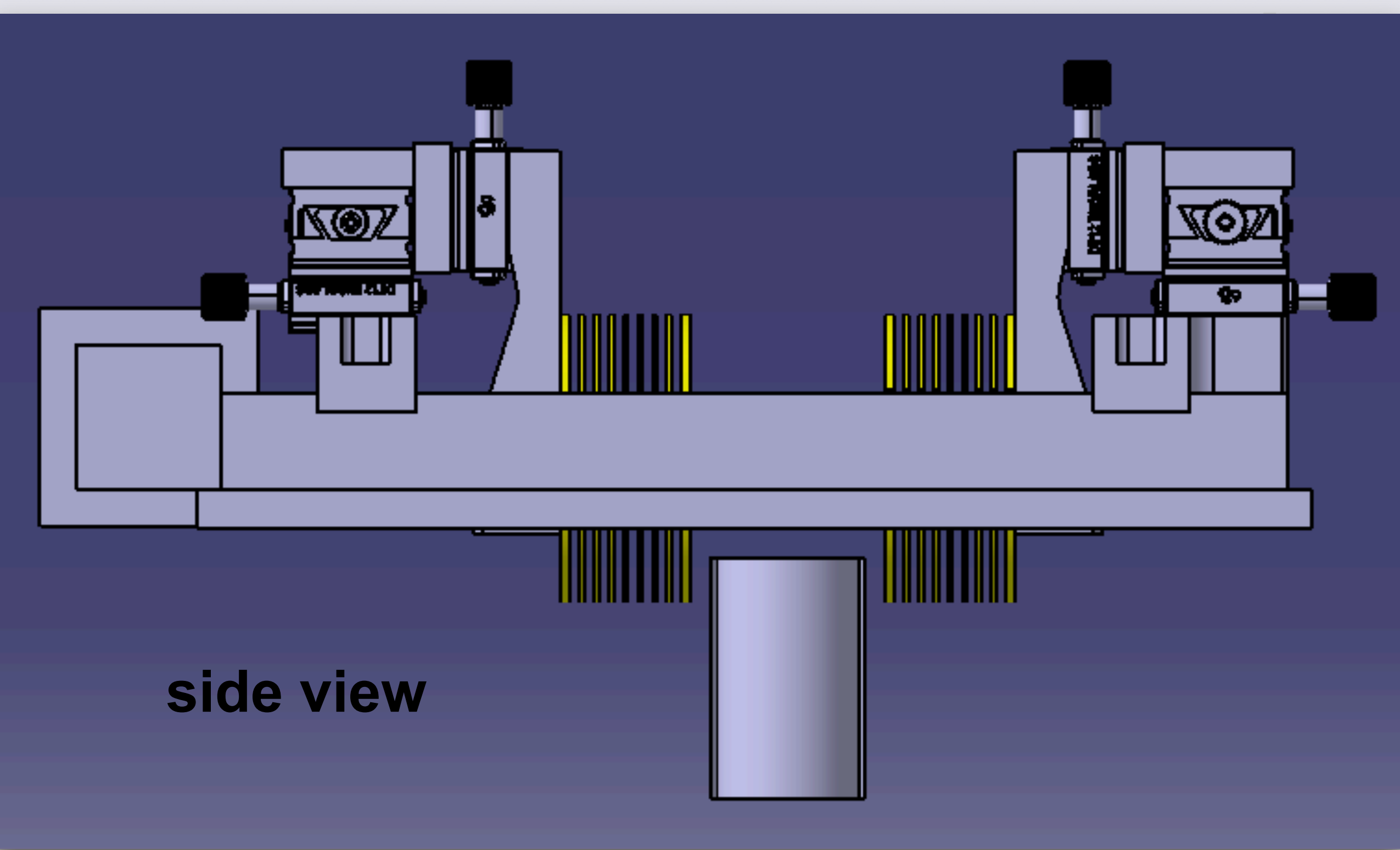
CAARMA: Computer Aided Ample Range Magnetic Apparatus

to study force-regulated processes at cellular and tissue-level.

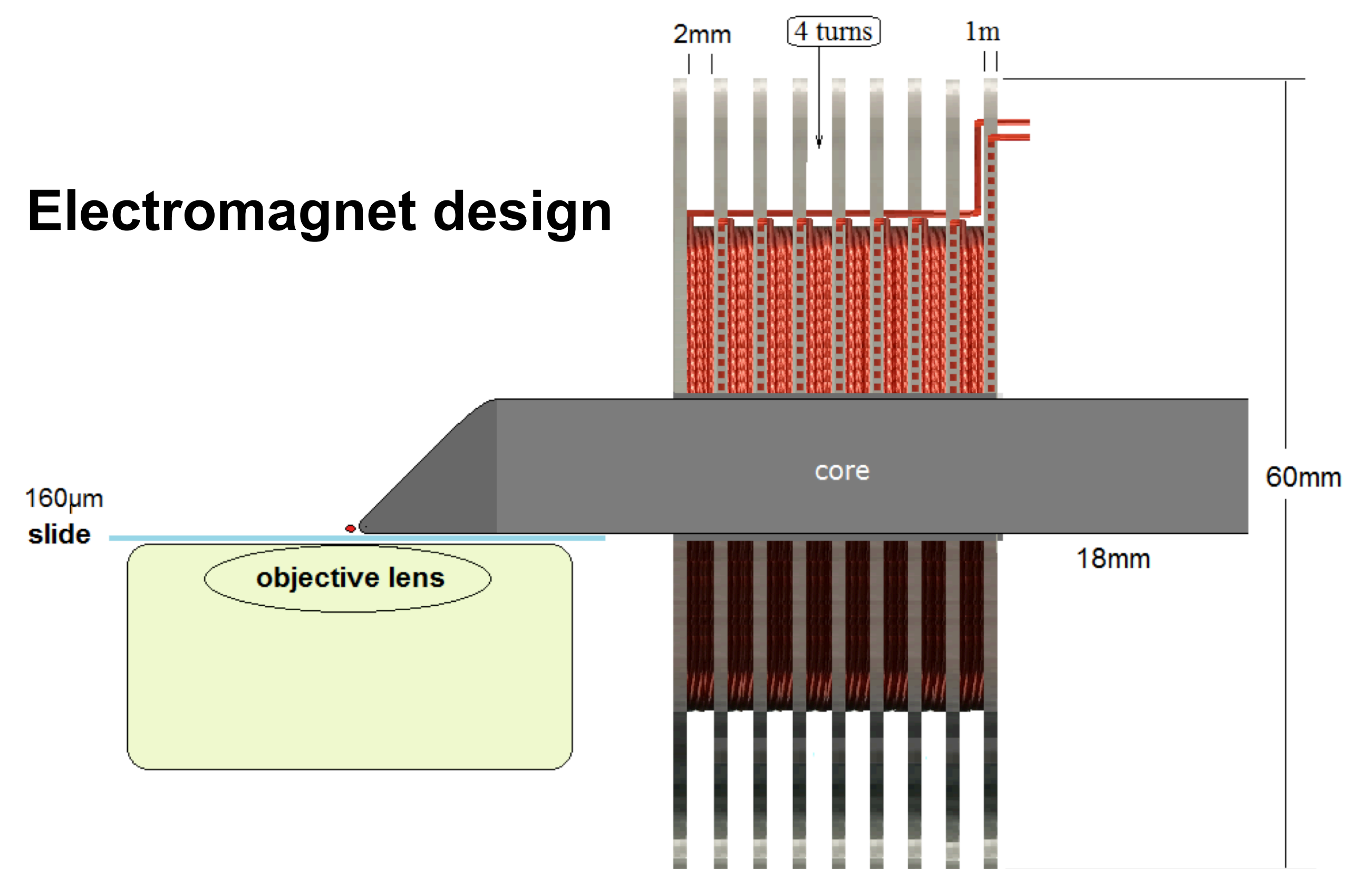
L.Selvaggi, L.Pasakarnis, D.Brunner, C. Aegerter



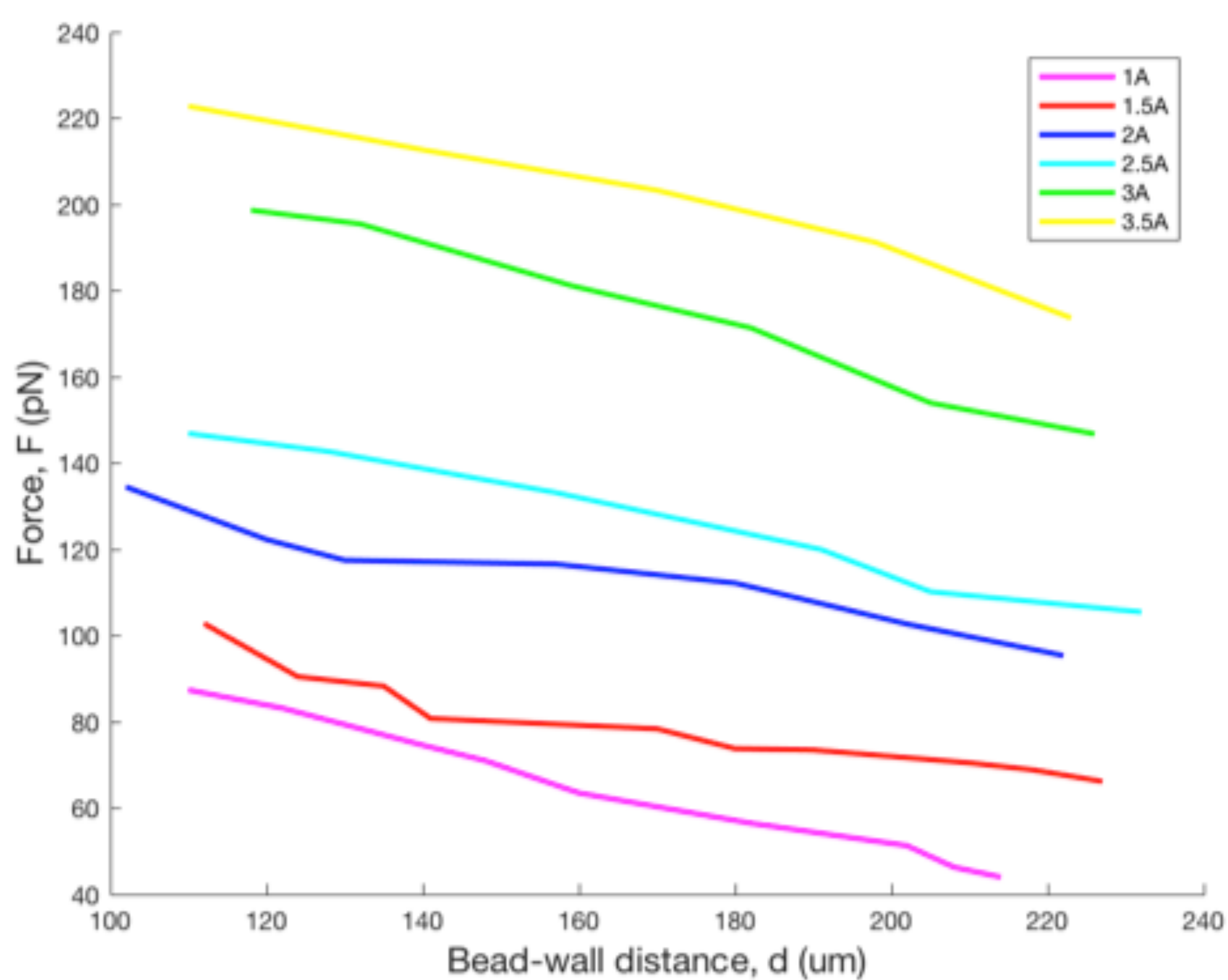
1. Portable magnetic-tweezers device;
2. Microscope-adaptable design;
3. Hundreds of pN, static or pulsed, constant force on micron-sized beads at distance in excess of 100µm from the magnetic tip;
4. Horizontal force, without modifications of the hosting microscope;
5. Use of any objective lens, from immersion up to long working distance;
6. Remanent magnetic field erasing;
7. "Push-and-pull" capability;
8. Dedicated PC software and Control Device for image acquisition, bead tracking and control of the electromagnets (in progress).



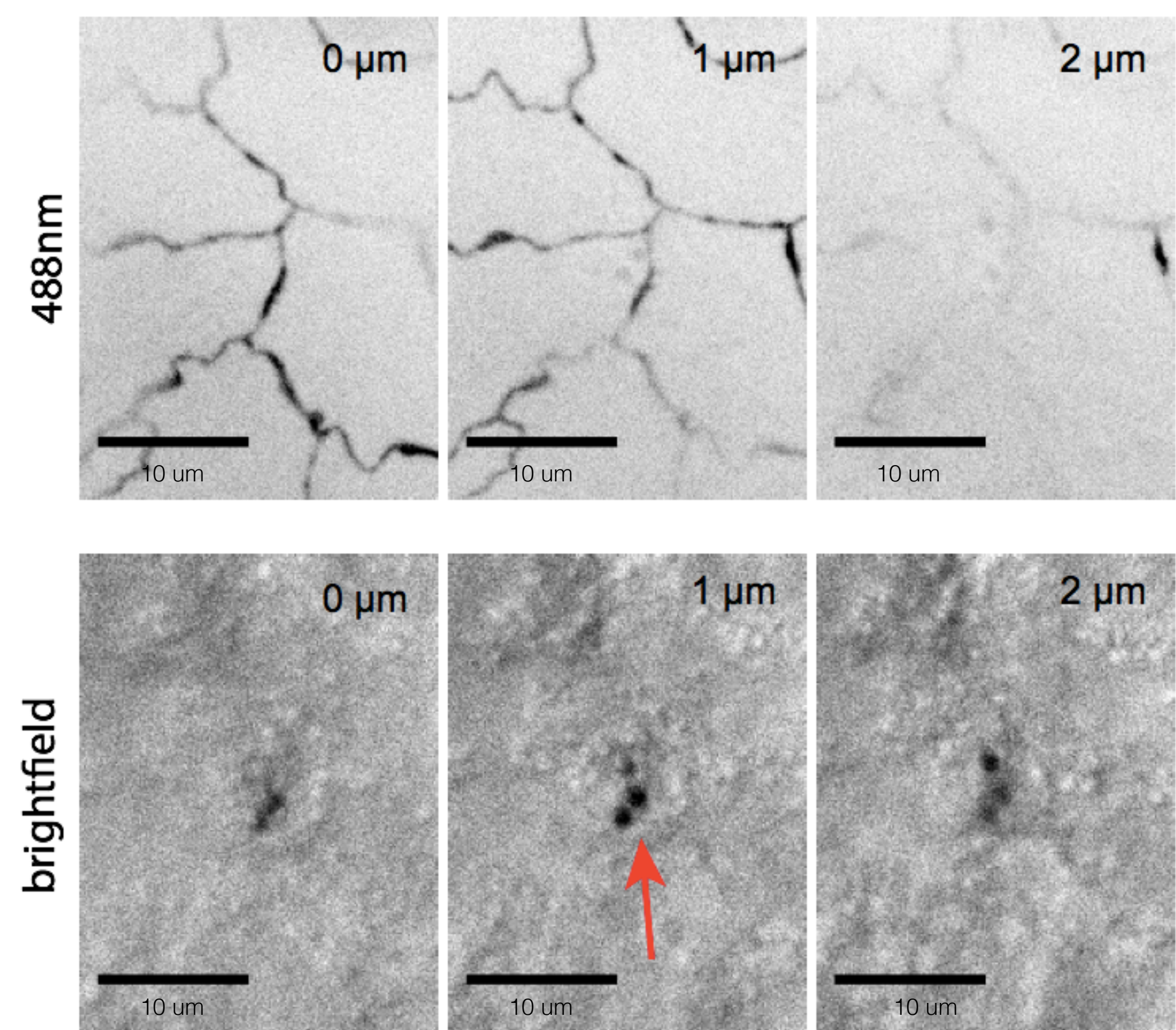
Electromagnet design



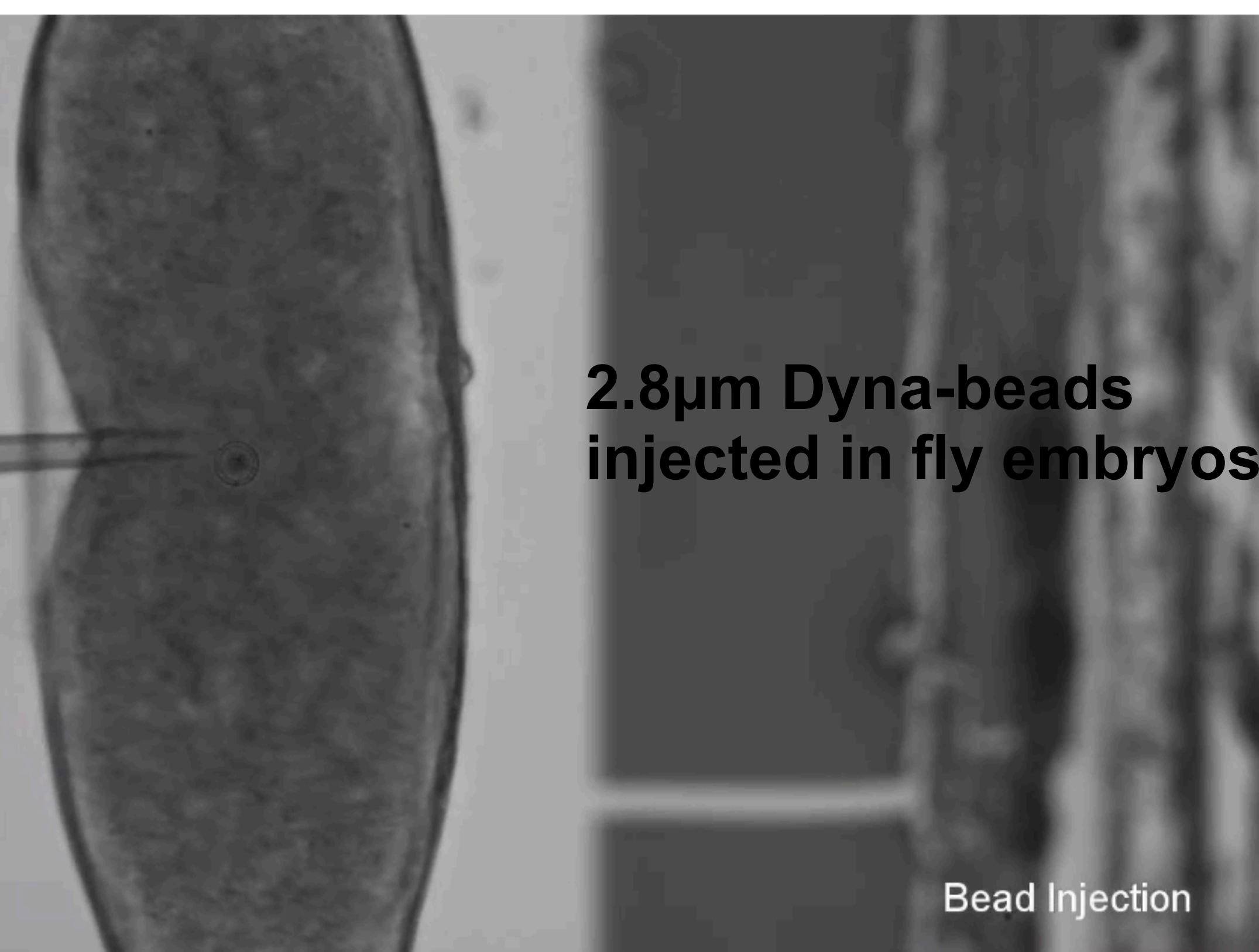
Force Calibration for 2.8µm Dyna-beads



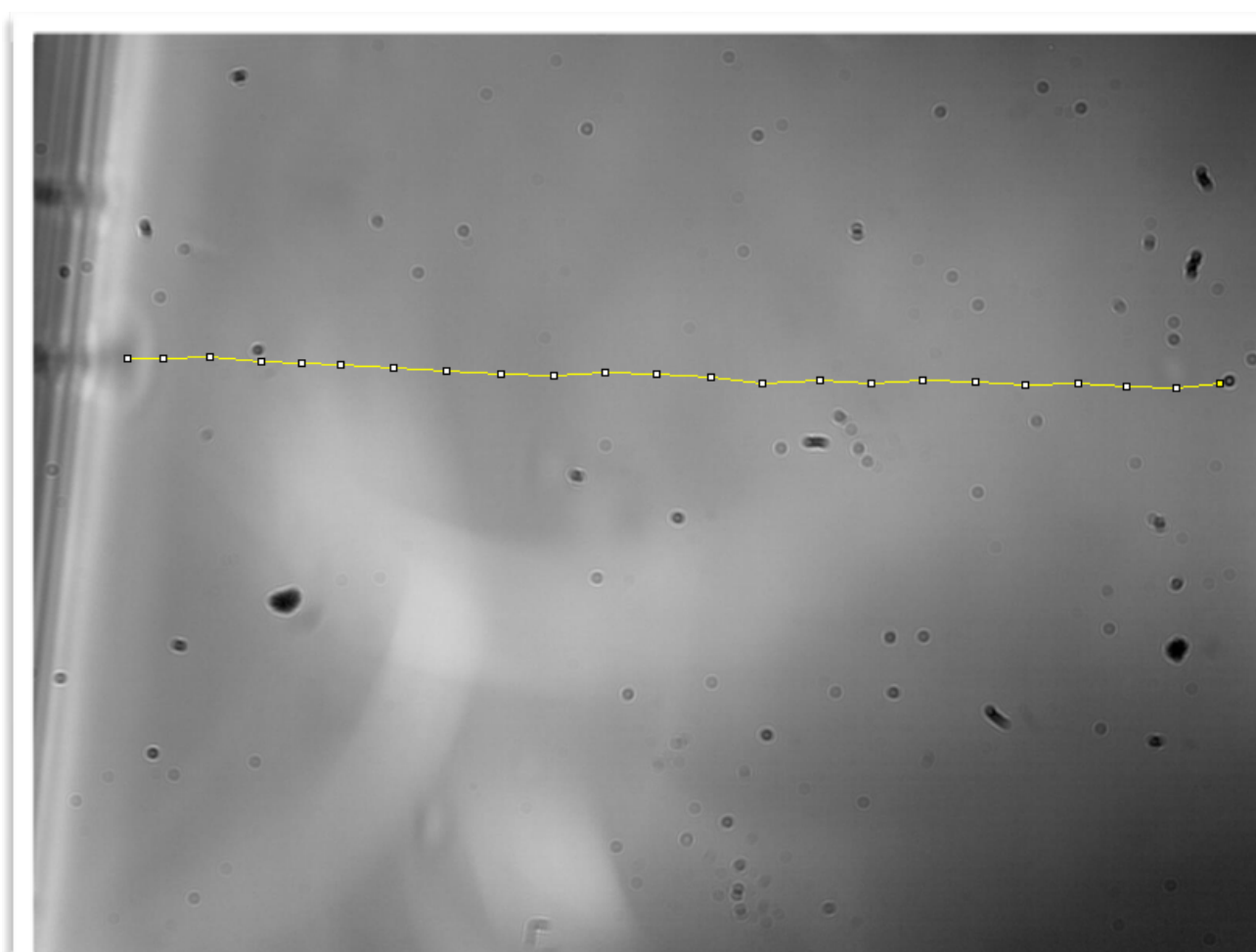
1µm beads inside Amnioserosa cells



Microrheology in early-stage fly embryos



The mean viscosity is:
 0.70 ± 0.1 Pa s center
 0.78 ± 0.12 Pa s center-periphery
 0.79 ± 0.16 Pa s periphery of the embryo.



The interior of the embryo is about three orders of magnitude more viscous than water.

Acknowledgements

The authors would like to thank: Silvio Scherr and the mechanical workshop for the realization of dedicated mechanical parts and Werner Boll for interesting discussion on microscopy.

References

- Kollmannsberger, P., Fabry, B. Review of Scientific Instruments, 78, 114301 (2007).
- Hosu, B.G., Jakab, K., Banki, P., Toth, F.I., Forgacs, G. Review of Scientific Instruments, 74, 9 (2003).
- Yang, Y., Lin, J., Meschewski, R., Watson, E., Valentine, M.T. Reports, 51 (11), 29 (2011).
- Dobrovinskia, K., Swana, M., Polyakova, O., Wieschusa, E.F. PNAS, 114, 1051 (2017).
- Wessel, A.D., Gumalla, M., Grosshans, J., Schmidt, C.F. Biophys. J., 108, 1899 (2015).