Particle Image Velocimetry of Optically Stretched Cells
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**Background**

**Optical Stretcher**
Traps the cells, then stretches them along the axis of the beam.

 Tells us about cell dynamics and structure.

 Specifically, are cancer cells "stretchier?"

**The Cells**
Human Mammary Epithelial Cells (HMECs)  
**GFP** are less cancerous. **TWIST** are more cancerous

 Blebbistatin loosens the cytoskeleton  
 ML7 locks the cytoskeleton

 Cytoskeleton of a cell, with actin in red, and microtubules in green. Does not include tubulin (Wikimedia commons).

**Goal: Adapt and Apply PIV to Analyze Cell Interiors**

**Particle Image Velocimetry (PIV)**
PIV tracks boxes of pixels, producing a series of velocity vector fields.

 Adjusted PIV Code:  
• Threshold to single out the cell
• Accounting for cell movement by subtracting average velocity

**Applications**
Unexplained “Shoulder” of contraction in HMEC-TWIST ML7

 General differences between GFP and TWIST

**Results**

**ML7 “Shoulder”**
Position vs. Horizontal component of velocity for ML7 without the shoulder and ML7 with the shoulder. The former is stretching, while the latter is contracting.

 Results only confirmed the observation

**GFP and TWIST**
Position vs. horizontal velocities for a GFP and a TWIST cell.  
GFP generally had fewer but stronger stretches. TWIST generally had more but weaker stretches.

**Conclusions:**
GFP and TWIST could correlate to a viscoelastic model of the cytoskeleton where GFP is more elastic and TWIST is more viscous.

PIV on the recoil stages, however, proved inconclusive.

Primary finding is that PIV is, in fact, a viable method of analysis for optical stretcher data.