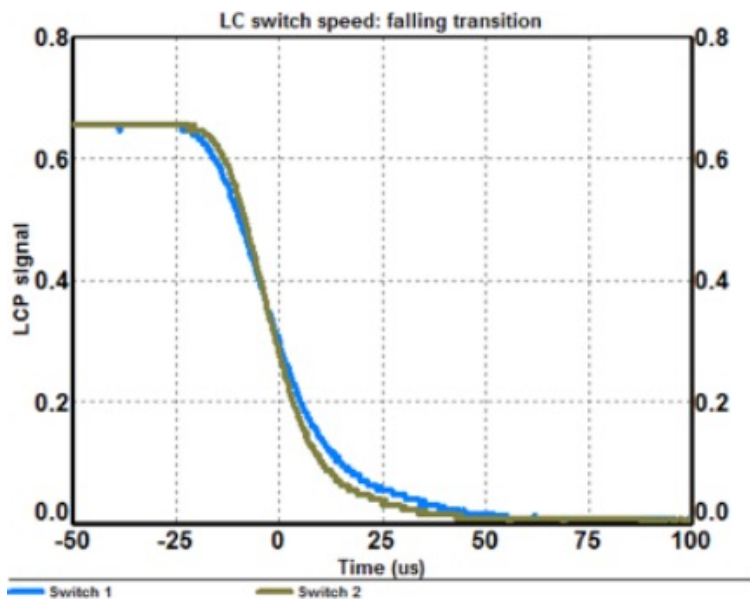


# Liquid Crystal Polarization Grating Lenses

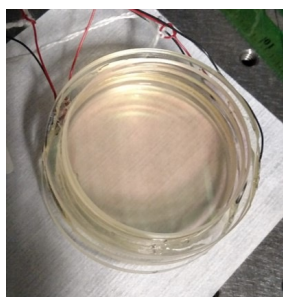
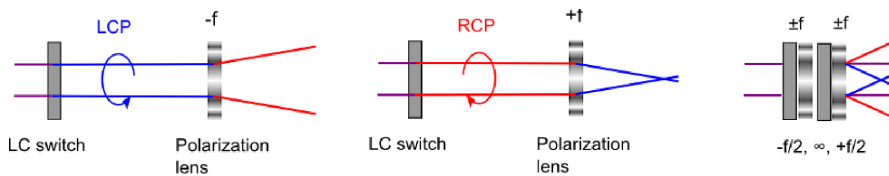
Fast • Non-mechanical • Remote Focusing

Liquid Crystal Polarization Gratings utilize spatially varying birefringence to create highly efficient polarization-sensitive gratings. Circularly polarized light will see a positive or negative lens depending on the handedness of the incident light. By using an alternating stack of LCPGs and half-waveplate switches, we can produce large discrete focus changes in  $<40 \mu\text{s}$ .

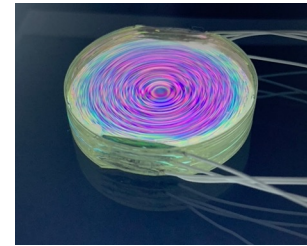
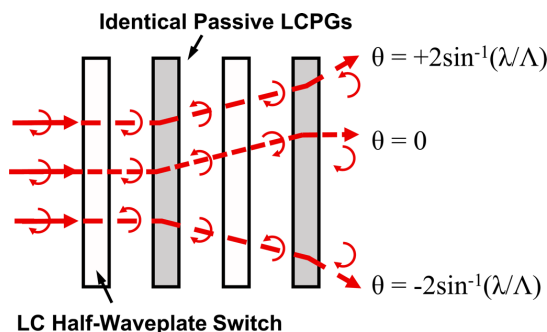
## Fast, Discrete Refocusing ( $>500 \mu\text{m}$ in $<40 \mu\text{s}$ )



## Stackable for access to many focal planes



## LCPG Lens Stack Schematic



## Benefits of LCPG Lens Remote Focusing

- • •
- Low size, weight, and power
- $<40 \mu\text{s}$  fast direction
- $<3 \text{ ms}$  slow direction
- Robust non-mechanical operation
- Large apertures possible ( $>5 \text{ cm}$ )
- High diffraction efficiency ( $>99\%$ )
- Simple microscope integration
- Demonstrated in VIS to MWIR
- Broadband systems possible

## Liquid Crystal Suite

- • •
- Variable Retarders
  - Liquid Crystal Variable Retarder
  - UV Variable Retarder
  - MWIR Variable Retarder
  - OEM LCVR

- Rotators
  - Achromatic High-Speed Rotator
  - Binary Rotator
  - Polarization Rotator

- Shutters / Attenuators
  - Achromatic High-Speed Shutter
  - High Contrast Shutter
  - Variable Attenuator

- Controllers
  - Analog Controller
  - FLC Controller
  - LC Digital Interface Controller
  - Temperature Controller
  - Two Channel High Voltage Controller

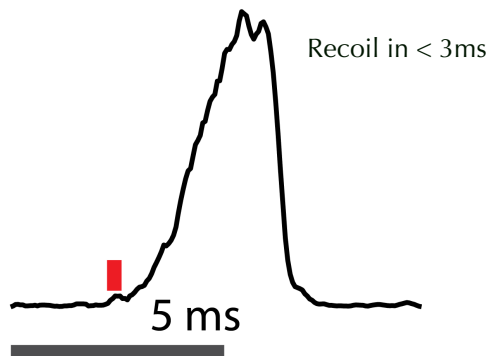
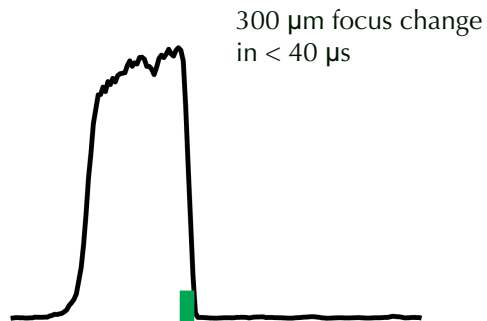
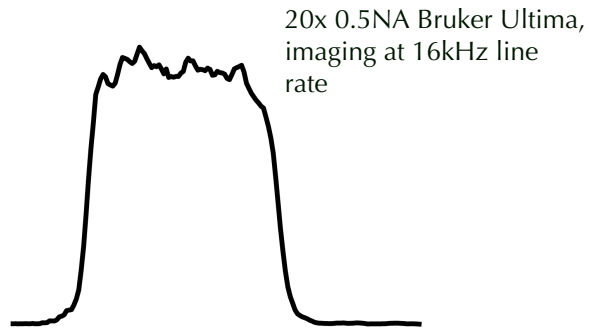
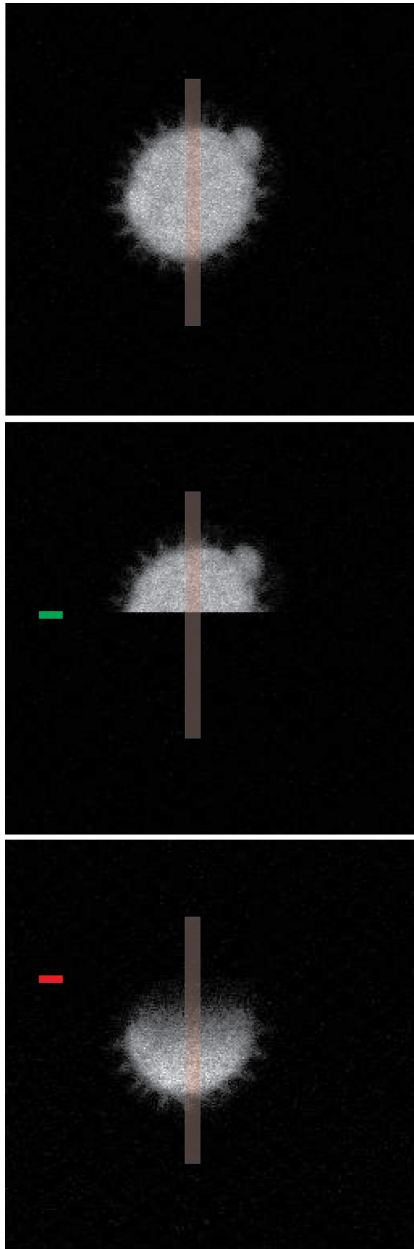


ORDERING INFORMATION

Meadowlark can provide custom systems to meet your needs using the patented liquid crystal polarization grating (LCPG) beam steering technology. When contacting us for a quote, please provide:

- Nominal Focal Lengths and/or Focal Plane Shifts (mm)
- Tolerance Requirements
- Response Time (ms)
- Wavelength (nm)
- Diameter (mm)
- Description of Application & Additional Details

*Remote focusing in a two-photon microscope*



2P microscope images courtesy of Darcy Peterka, Columbia University