To create a camera lens using the Tunable Acoustic Gradient (TAG) lens to achieve the following advantages:
- No moving parts in the lens to avoid mechanical wear
- Large focal range to be able to take pictures of objects at any distance
- Large depth of field with a large aperture opening to allow much better photos in low light settings

The TAG lens is a liquid-based lens that uses acoustics to change its index of refraction in sub-microseconds. If a camera lens is designed correctly, a slight change in the TAG lens’ index of refraction will produce a large change in the focal distance.

Challenge #1: Aberrations
Chromatic Aberrations – need to use achromatic lenses
Field Curvature/Spherical/Distortion – all lenses experience this to some degree – need right combination of lenses

Aperture 4:
large opening
Aperture 8:
medium opening
Aperture 22:
“pin-hole”

To design the lens was done using Zemax, a professional ray-tracing program. While designing, two major challenges appeared: aberrations and aperture limitations of the TAG lens. Many models were created to try to fix these challenges, and at the end the best models were combined together.

Physical limitations of the TAG lens - small opening and long body
Aberrations - the larger the aperture, the greater the aberrations

Though an aberration-free lens was not created, the challenges of using the TAG lens in commercial optical applications were explored, and it was shown that using the TAG lens leads to a larger depth of field.

Graph of aberrations in different surfaces

- Experiment with different lenses to reduce aberrations
- Explore variations in the 4f system to overcome the physical limitations of the TAG lens
- Build and shorten the setup

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