Recent Quartz Irradiations

May 25, 2021

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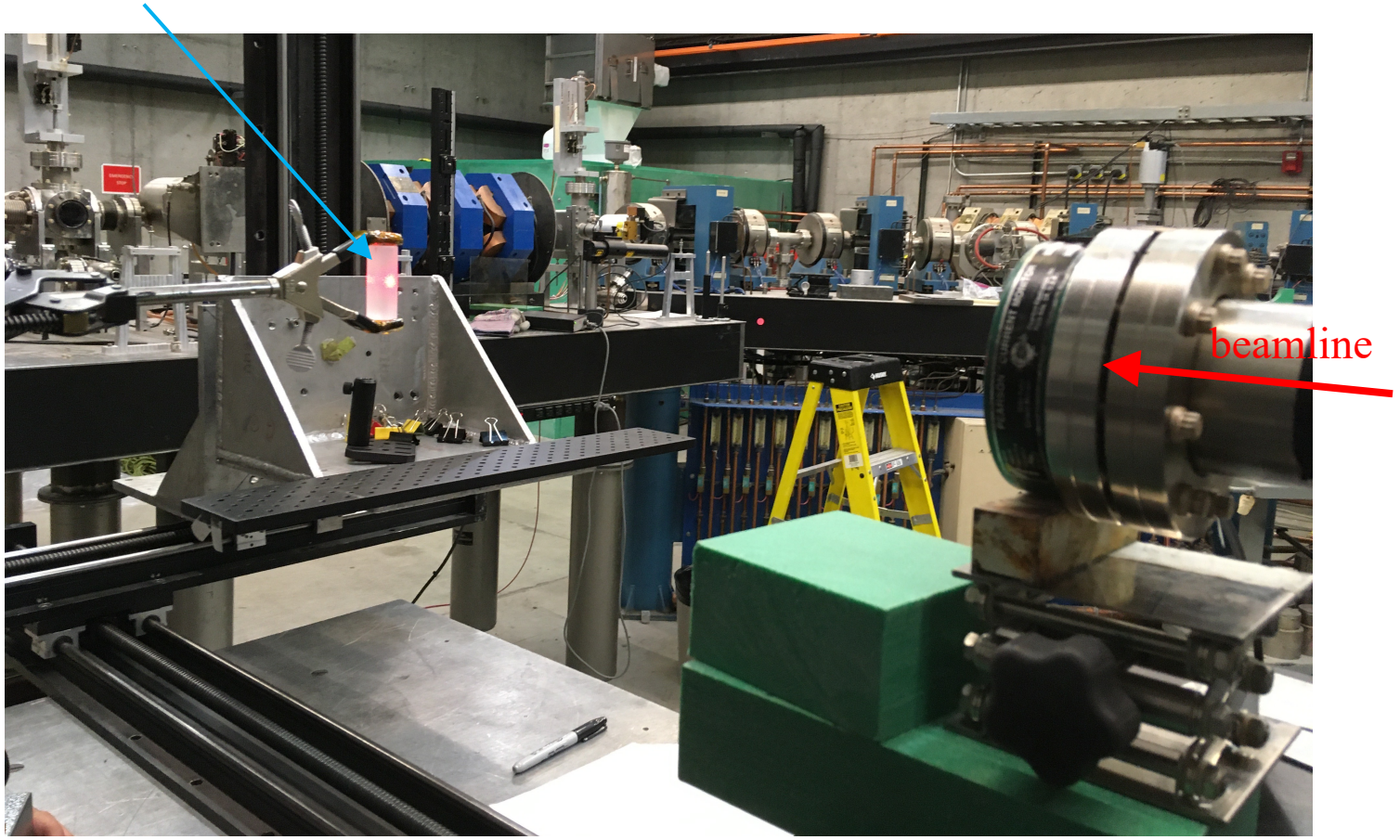
Outline

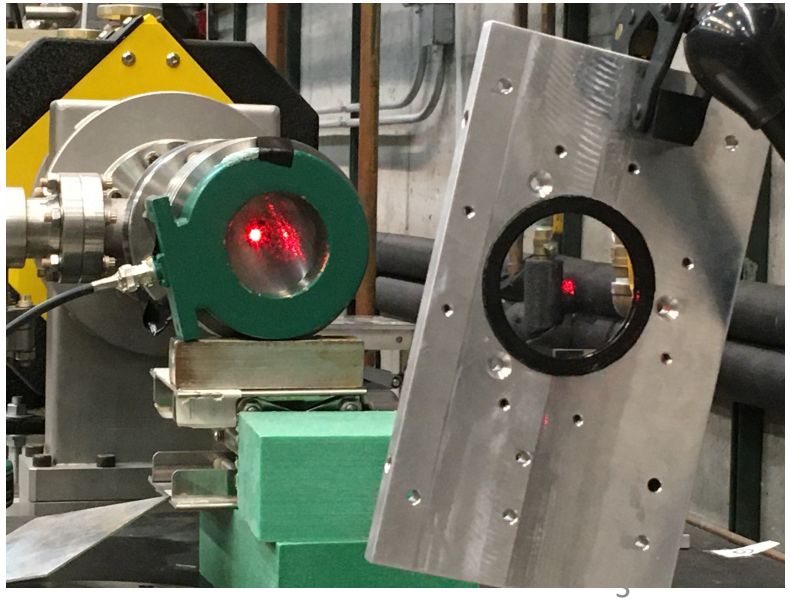
- Beam setup and dose estimate
- Transmission apparatus
- Preliminary Results (relative transmission loss and syst errors)
  - Three Corning samples: 7980 UV Grade F, Eximer, and SK-1300
  - Fused silica LP filter (400 nm)
- Summary and upcoming tests

Beam and Sample Setup

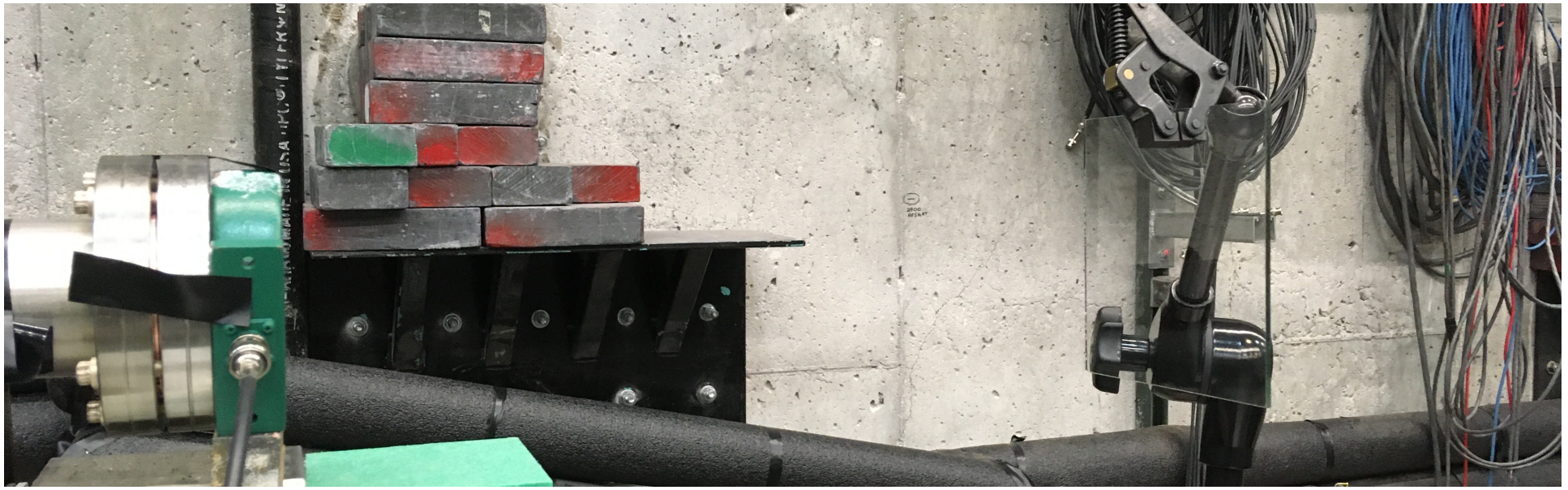
- Very preliminary results from May 19, 2021 quartz irradiation run at Idaho Accel. Center
- Used 25 MeV machine 0 deg port with: 8 MeV peak energy, ~40 mA peak current, 700 ns pulse width and 200 Hz rep rate.
- Corning samples: 2 cm diameter by 5 cm long; polished on flat ends only
  - Samples are 50 cm from beam exit window



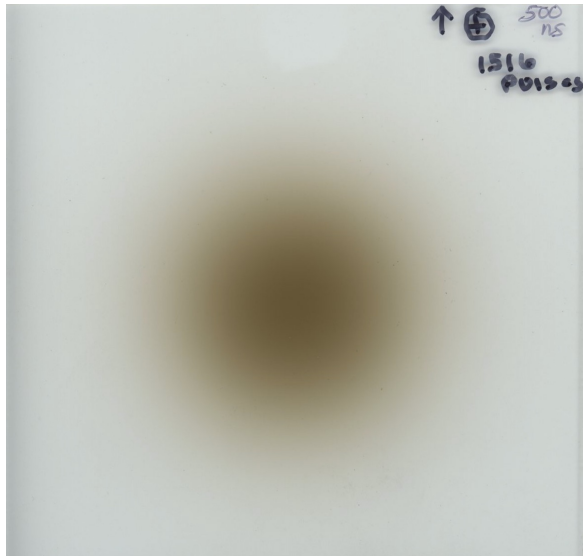
Longpass filter dose test



Beam spot size at sample



Glass slide



6 in

- Analysis ongoing
- Will use this to benchmark G4 simulated beamspot for more precise dose calibration

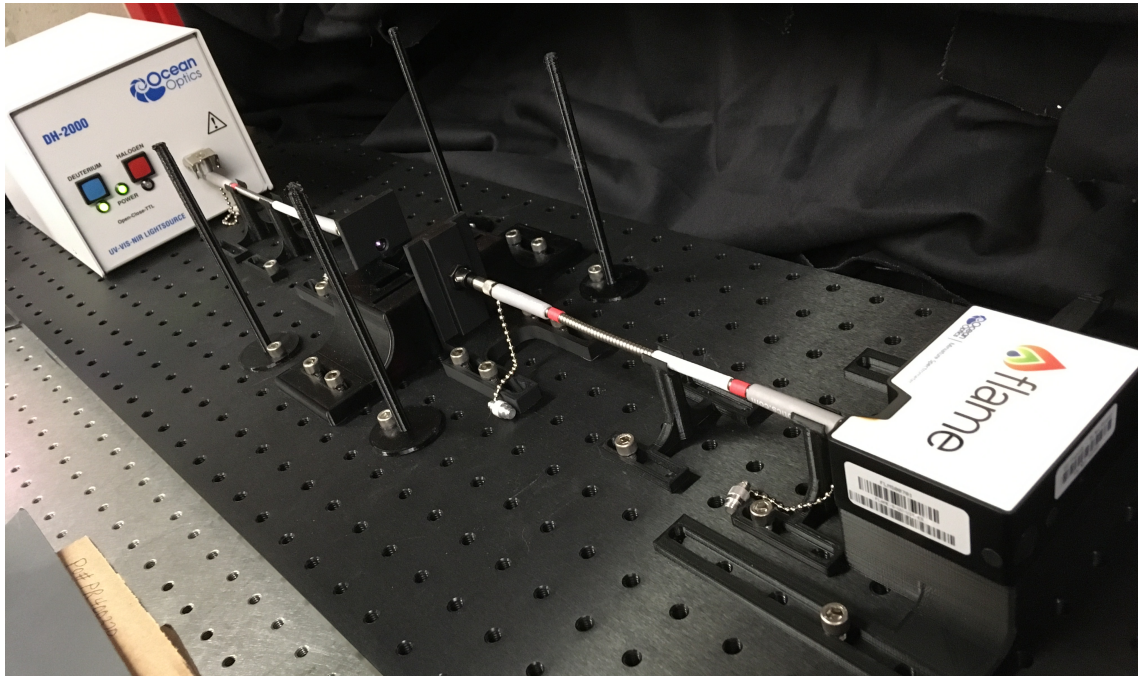
Beam dose measurements

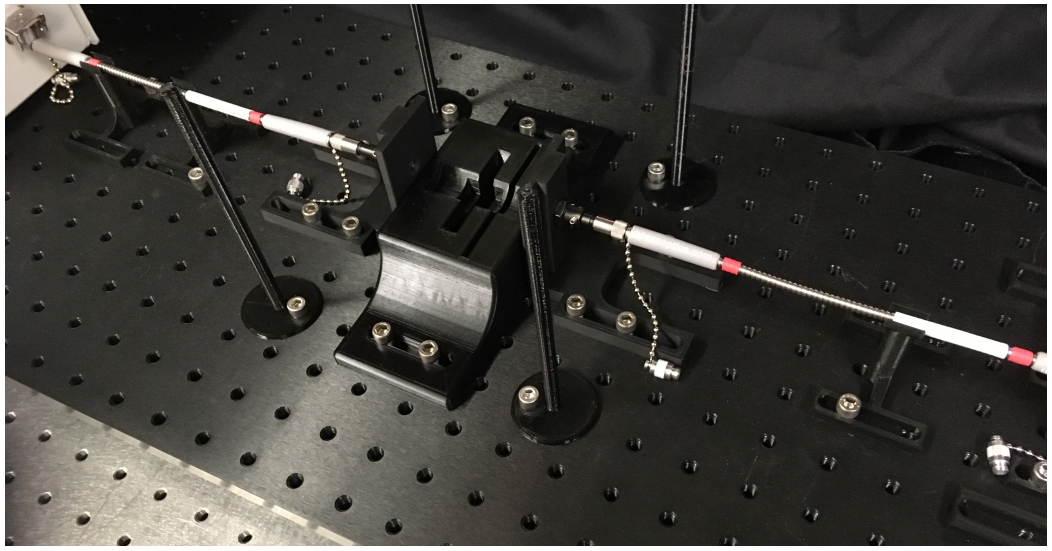
Sample 4x4 OSL array measurement (5 beam pulses)

120 rad/pulse	**137 rad/pulse**	**113 rad/pulse**	**86 rad/pulse**
144 rad/pulse	224 rad/pulse	212 rad/pulse	120 rad/pulse
207 rad/pulse	271 rad/pulse	248 rad/pulse	161 rad/pulse
155 rad/pulse	188 rad/pulse	179 rad/pulse	123 rad/pulse

- Use Optical Stimulated Luminescence (OSL) dosimeters
- Setup 3x3 and 4x4 OSL arrays to map-out incident radiation field
- Use microStar Reader to measure dose to OSLs
- And use these measurements to benchmark G4 sim

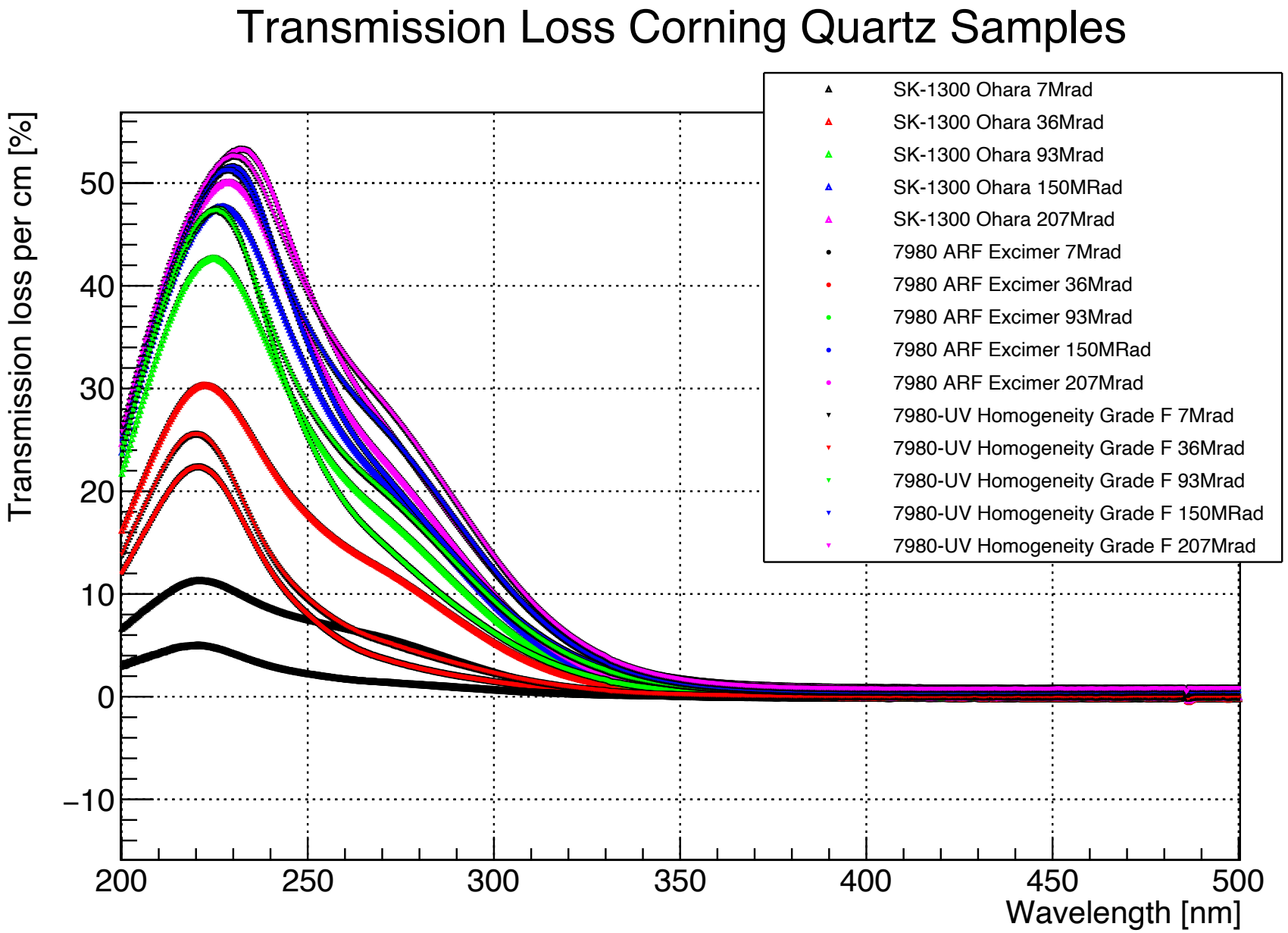
Transmission Apparatus



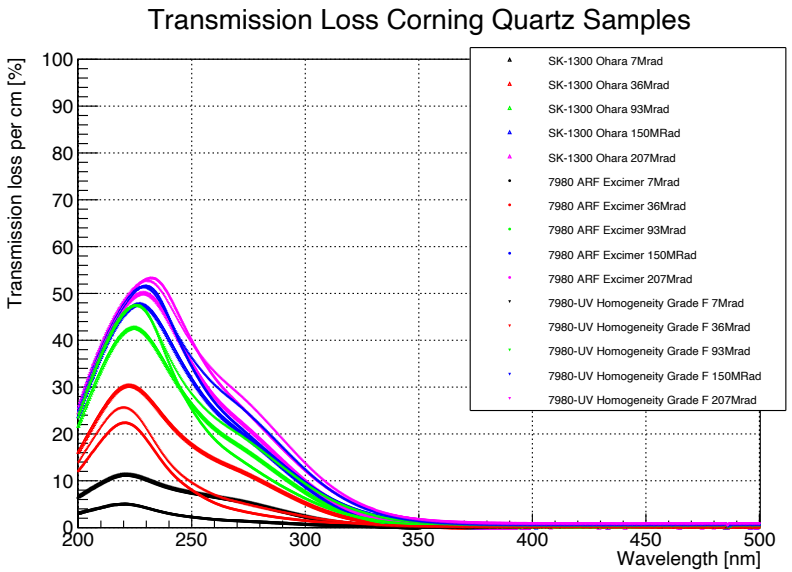


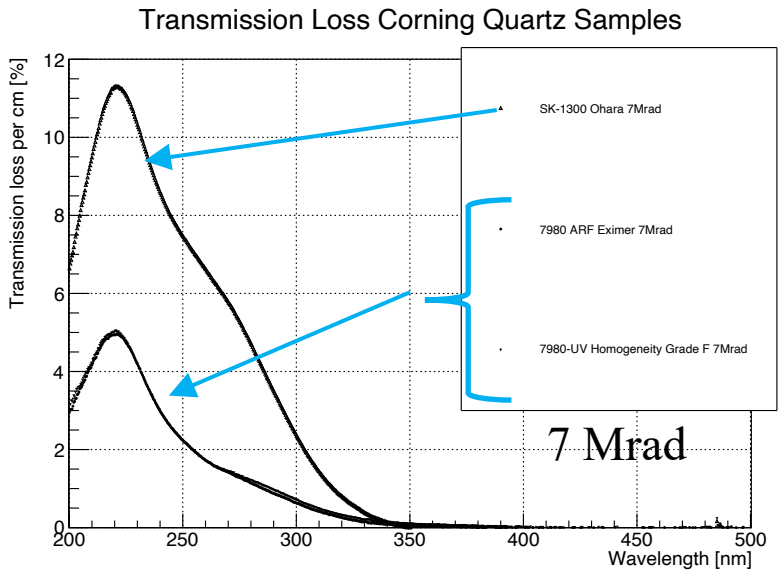
- Ocean Optics Deuterium UV light source
- USB spectrometer
- Straight fiber optics; static arrangement for reduced systematics
- 3D printed nylon sample holder; accommodates all tested samples; also static
- More details in future talks

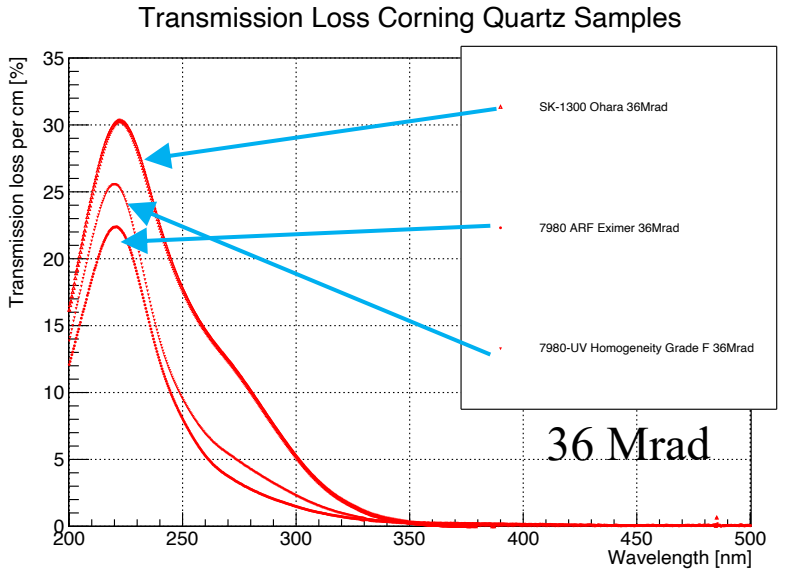
Preliminary Results for Corning samples

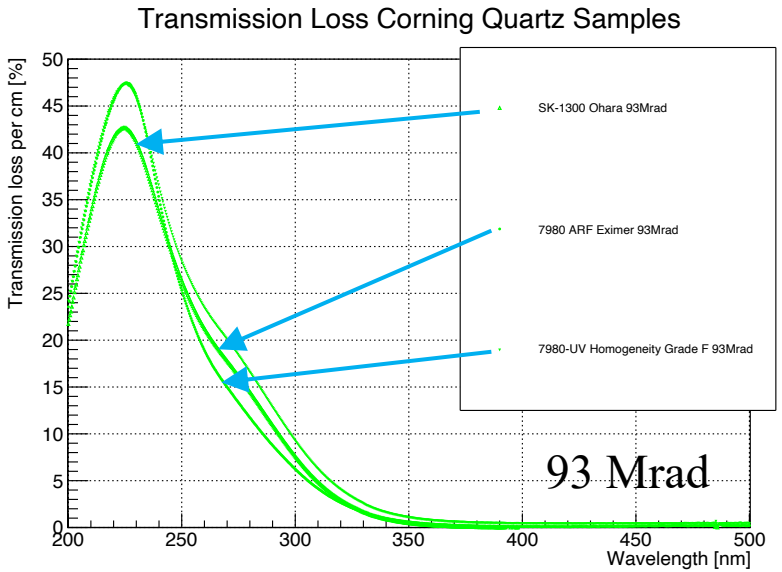


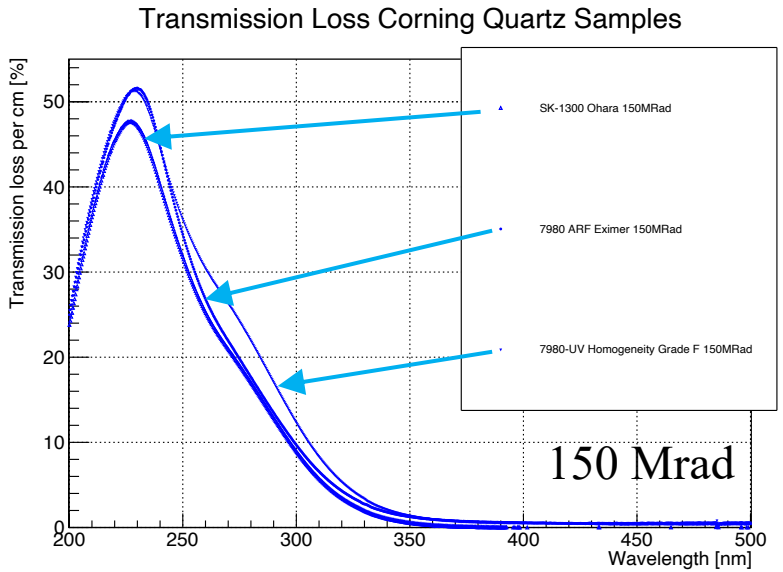
Preliminary Results for Corning samples

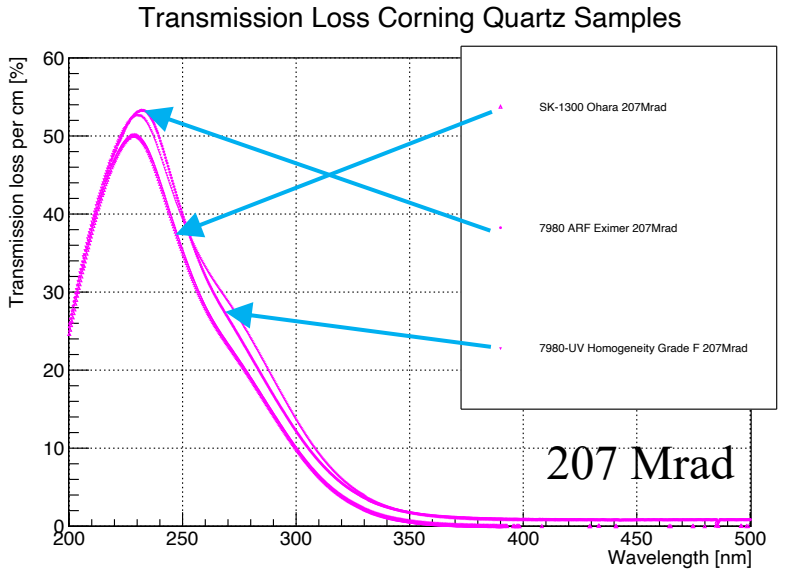




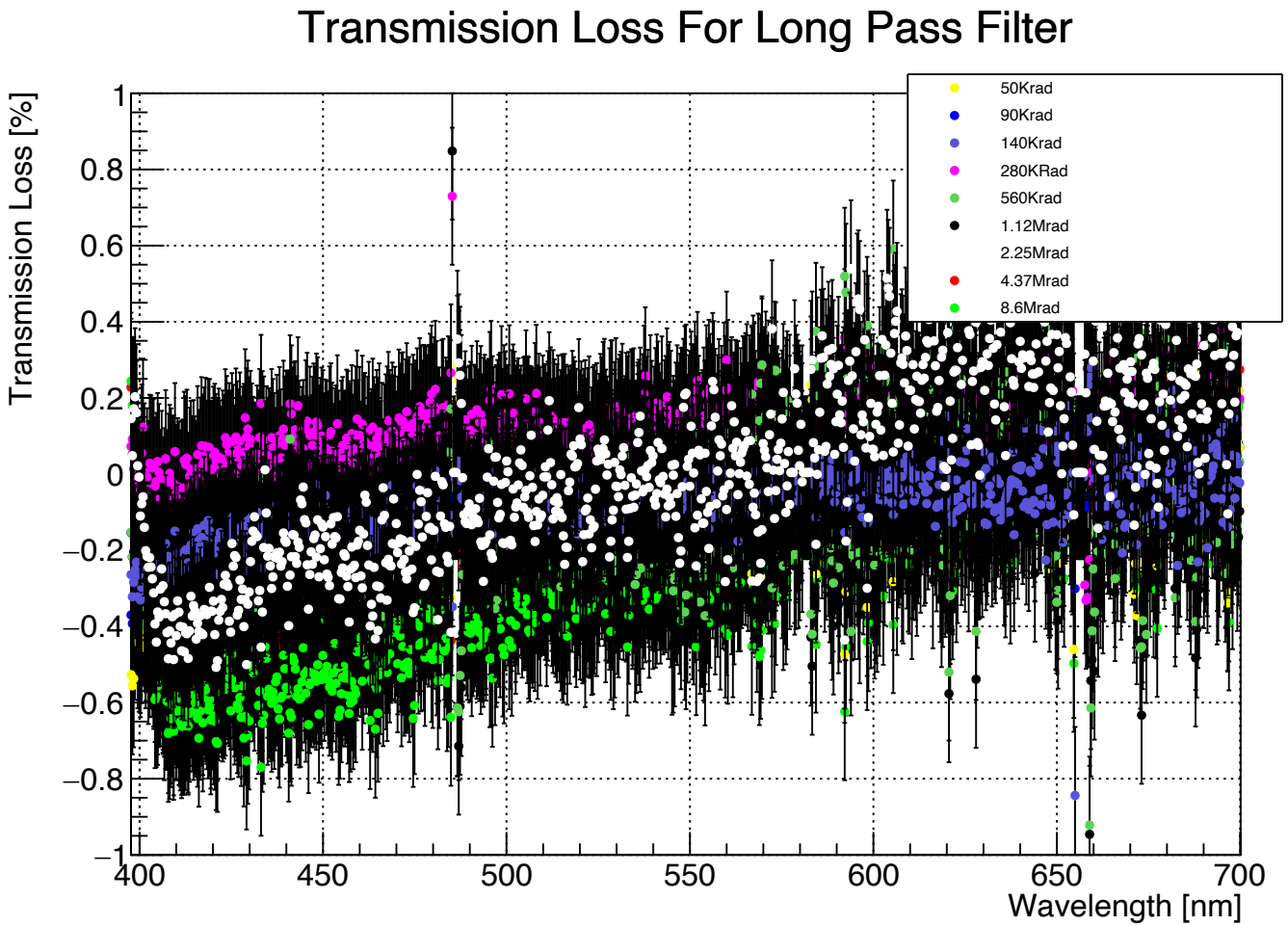




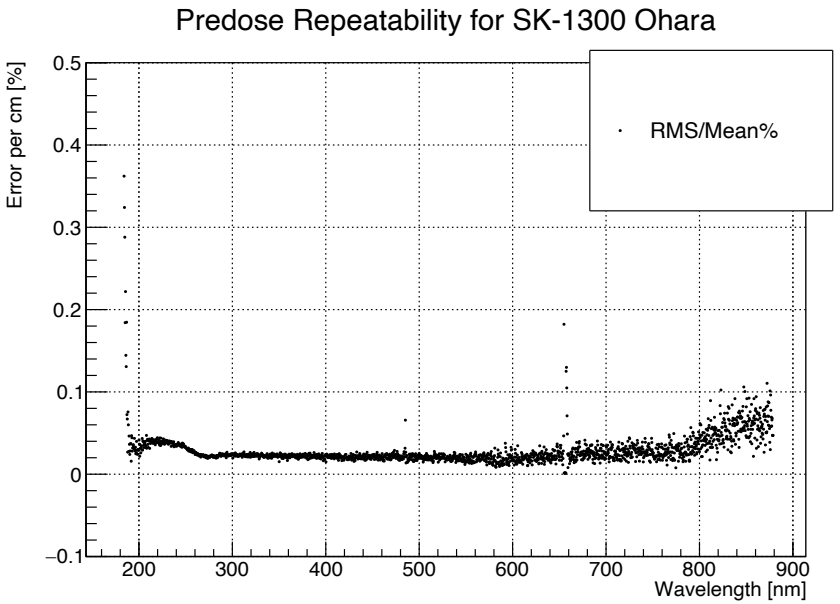


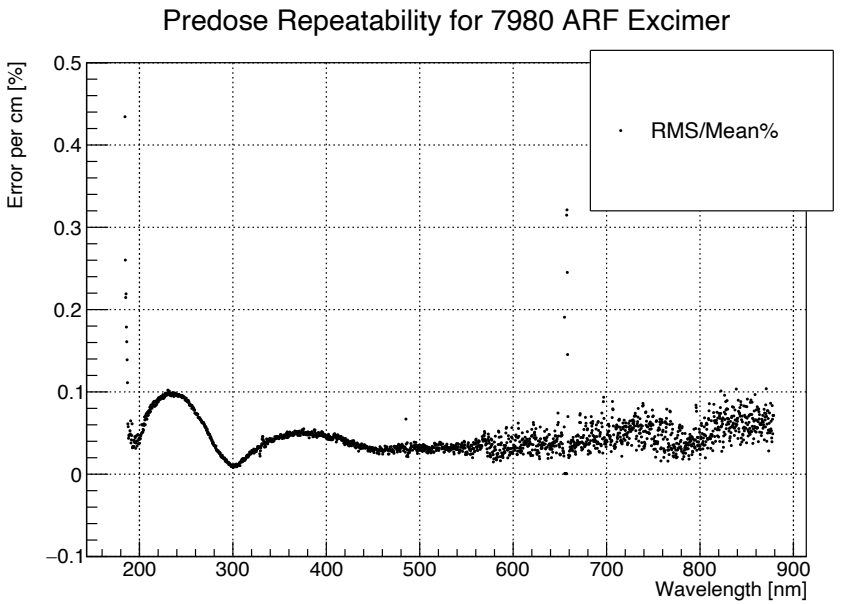


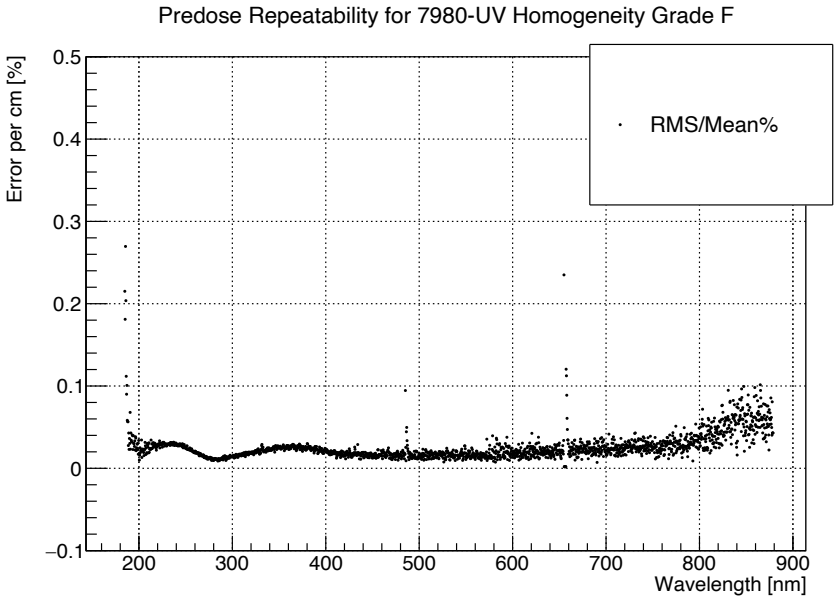
Preliminary Results for LP filter (400 nm)

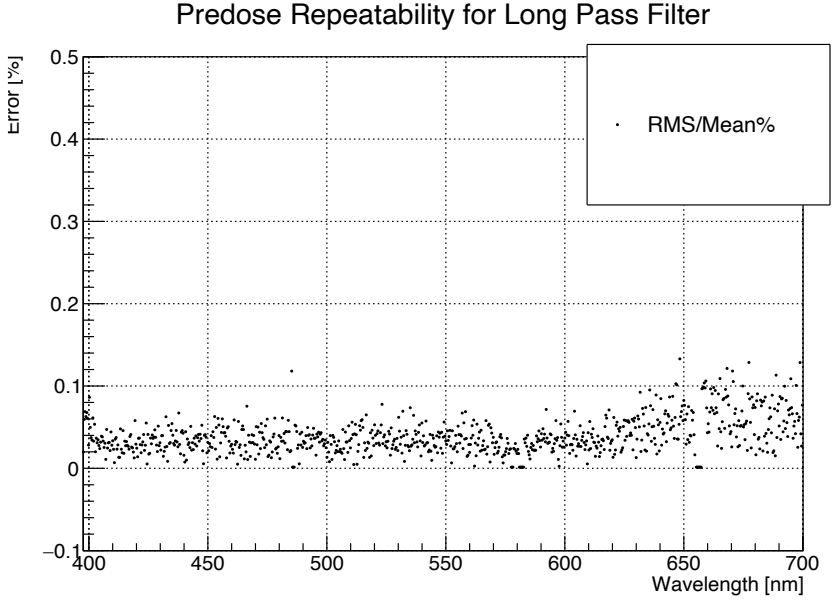


Reproducibility Tests (not dominant error)









Summary

- Light source drift error (dominant) and possible correction are under investigation, but expected to be at ~0.1 % level
- New apparatus (static arrangement) has greatly reduced repeatability systematics
- Corning transmission losses all fairly similar, but at higher doses SK-1300 was best and at lower doses, Eximer is best, and UV Homogenity Grade F is closest to Eximer; Note SK-1300 worst performer at low (~10 Mrad) dose; SK-1300 becomes better at ~100 Mrad
- Edmund Optics 2” longpass filter did not show any signs of losses up to the max tested which was ~10 Mrad (~3 Mrad peak/5x5mm^2)
- Future dedicated dose calibration run is coming soon; recent measurements will be simulated to get better dose/pulse estimate for this data.