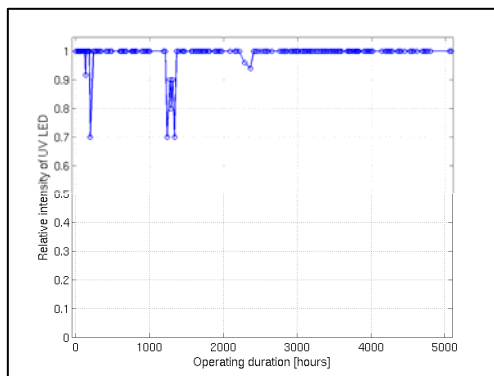
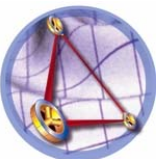


UV LED Charge Management Progress Report



Ke-Xun Sun

LIGO Charging Workgroup Telcon
9:00 am December 11, 2006

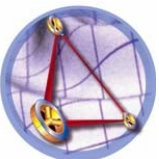
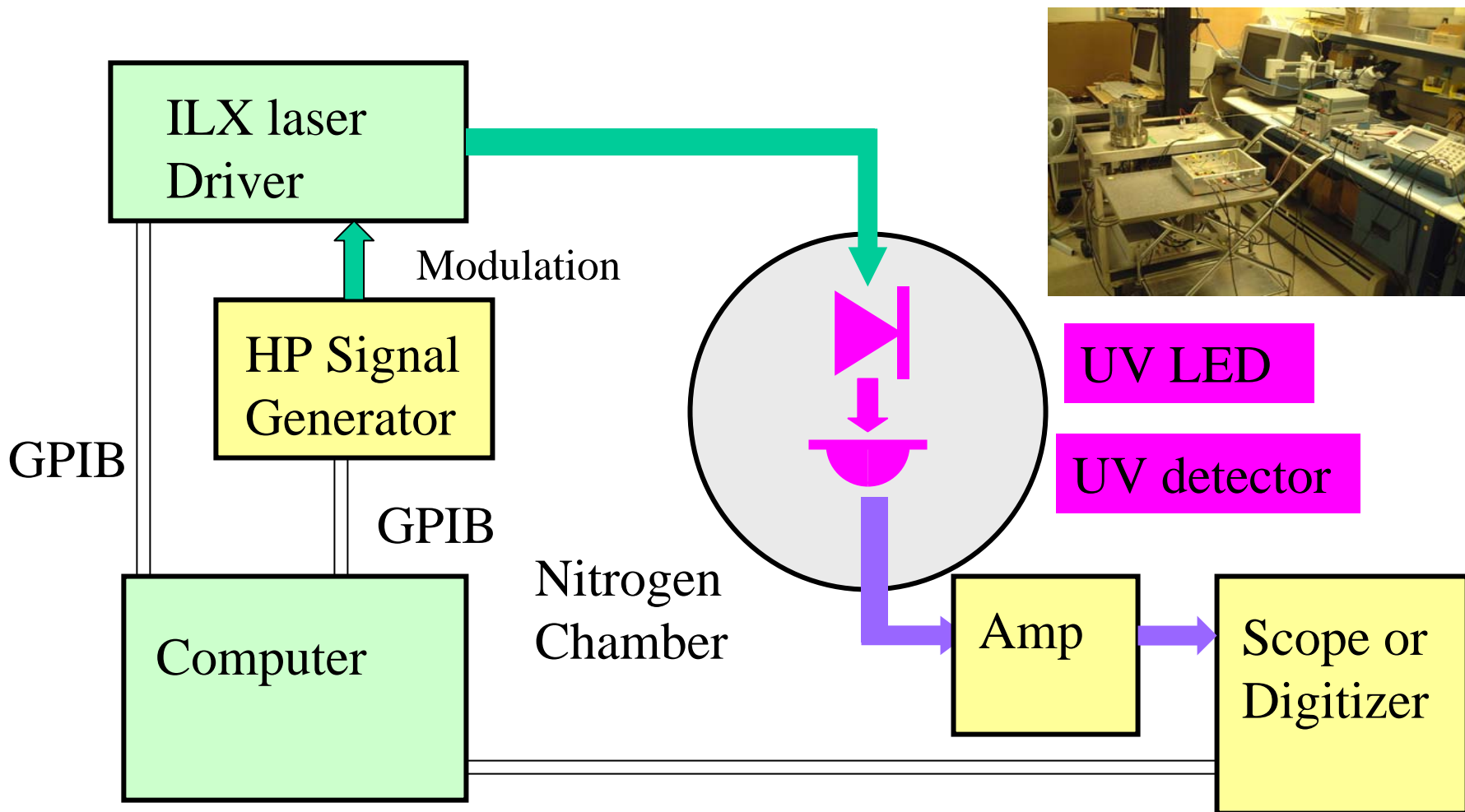


UV LED Lifetime Beats Mercury Lamp

- UV LED Emission Lifetime $> 5,077$ Hours
 - As of Dec. 1, 2006 (5 PM)
 - Power stability within measurement error ($\sim 5\%$)
 - Fast modulation with 10% duty cycle
 - Compared with mercury lamp lifetime of 5000 hrs
- UV LED Spectral Stability
 - Central wavelength ~ 256 nm
 - No spectral shift observed in all three measurements (start, 1000 hrs, and 3000 hrs)

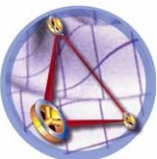
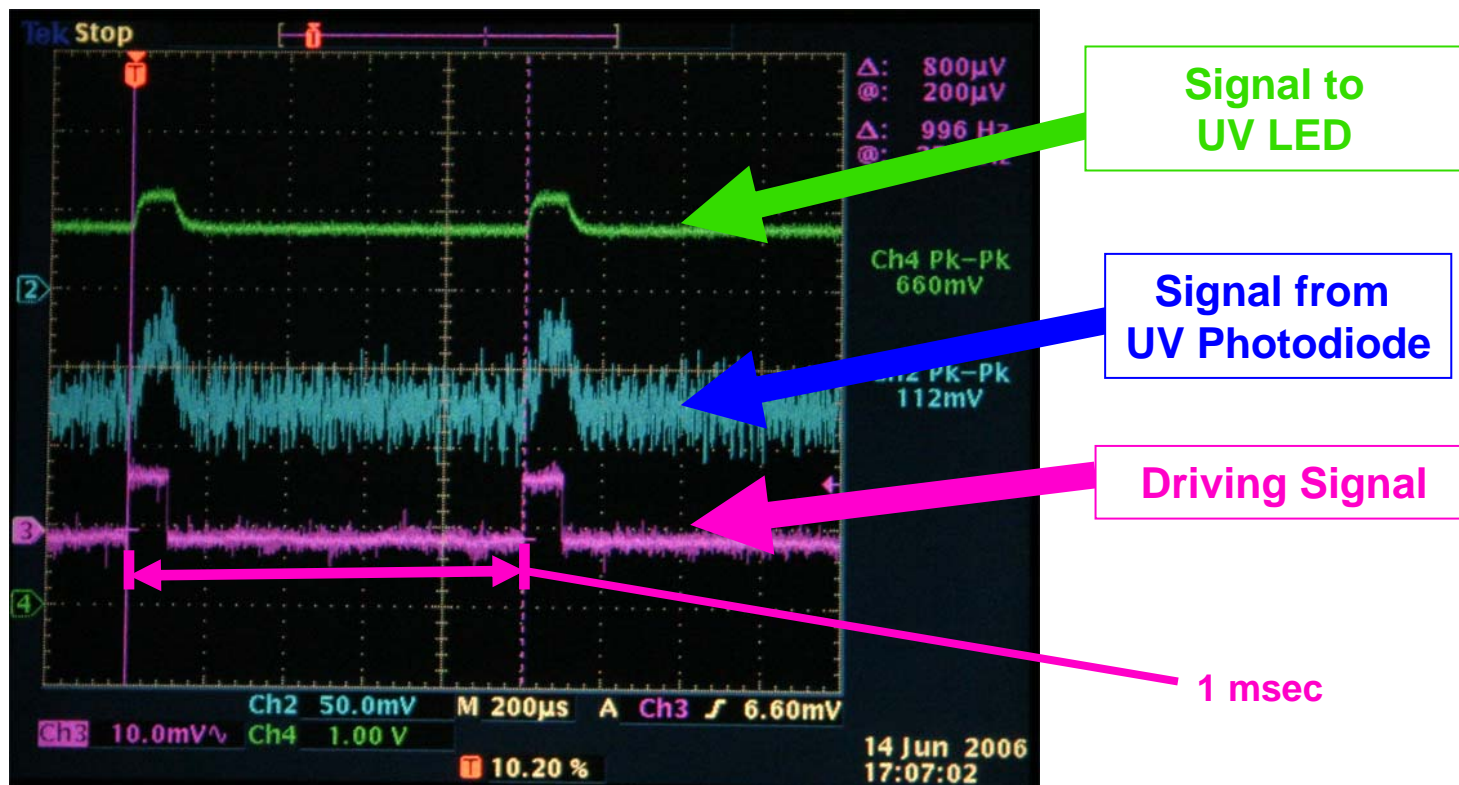


UV LED Lifetime Experiment

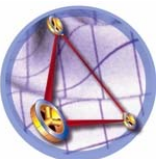
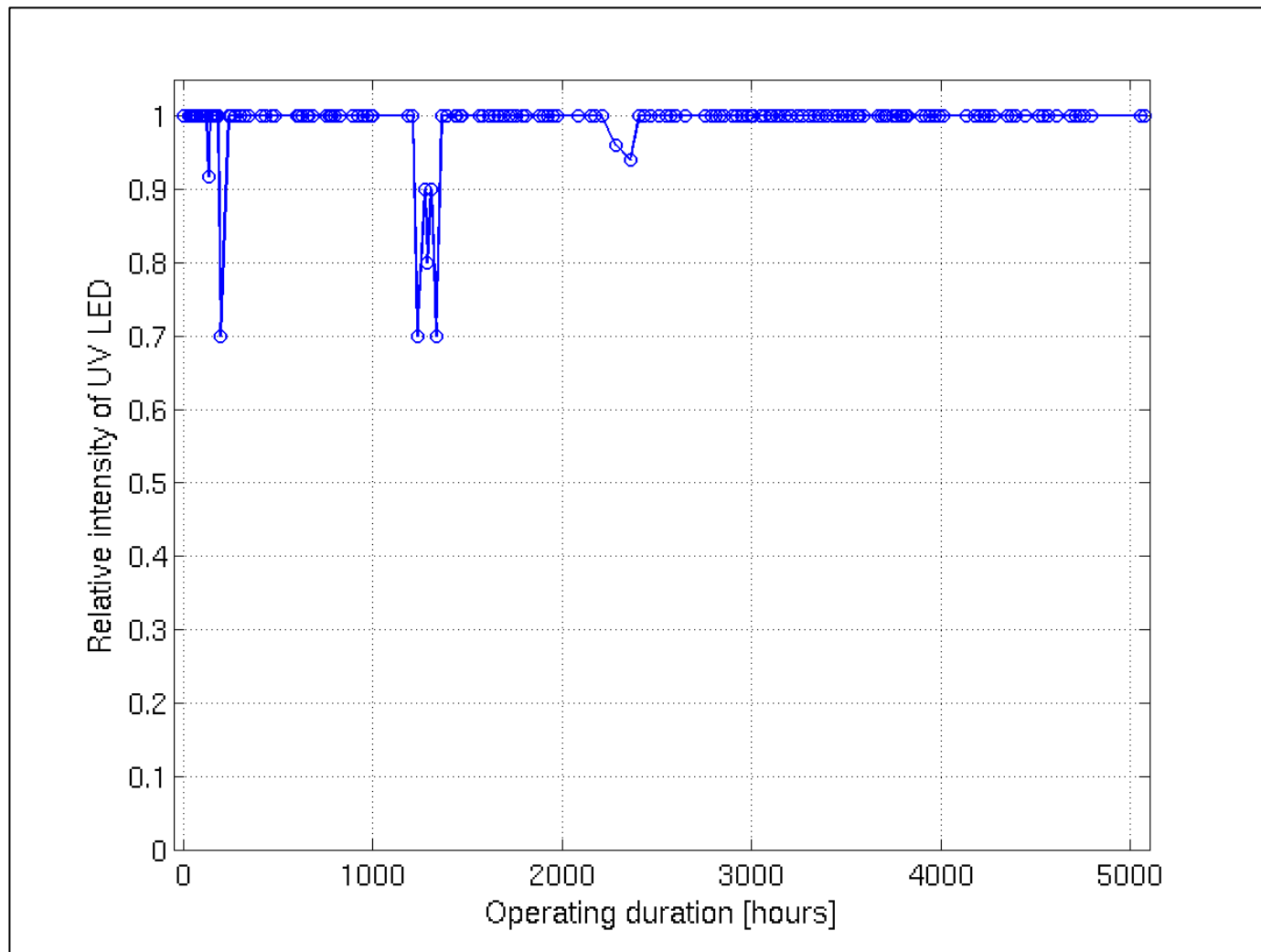


UV LED Operated for AC Charge Management

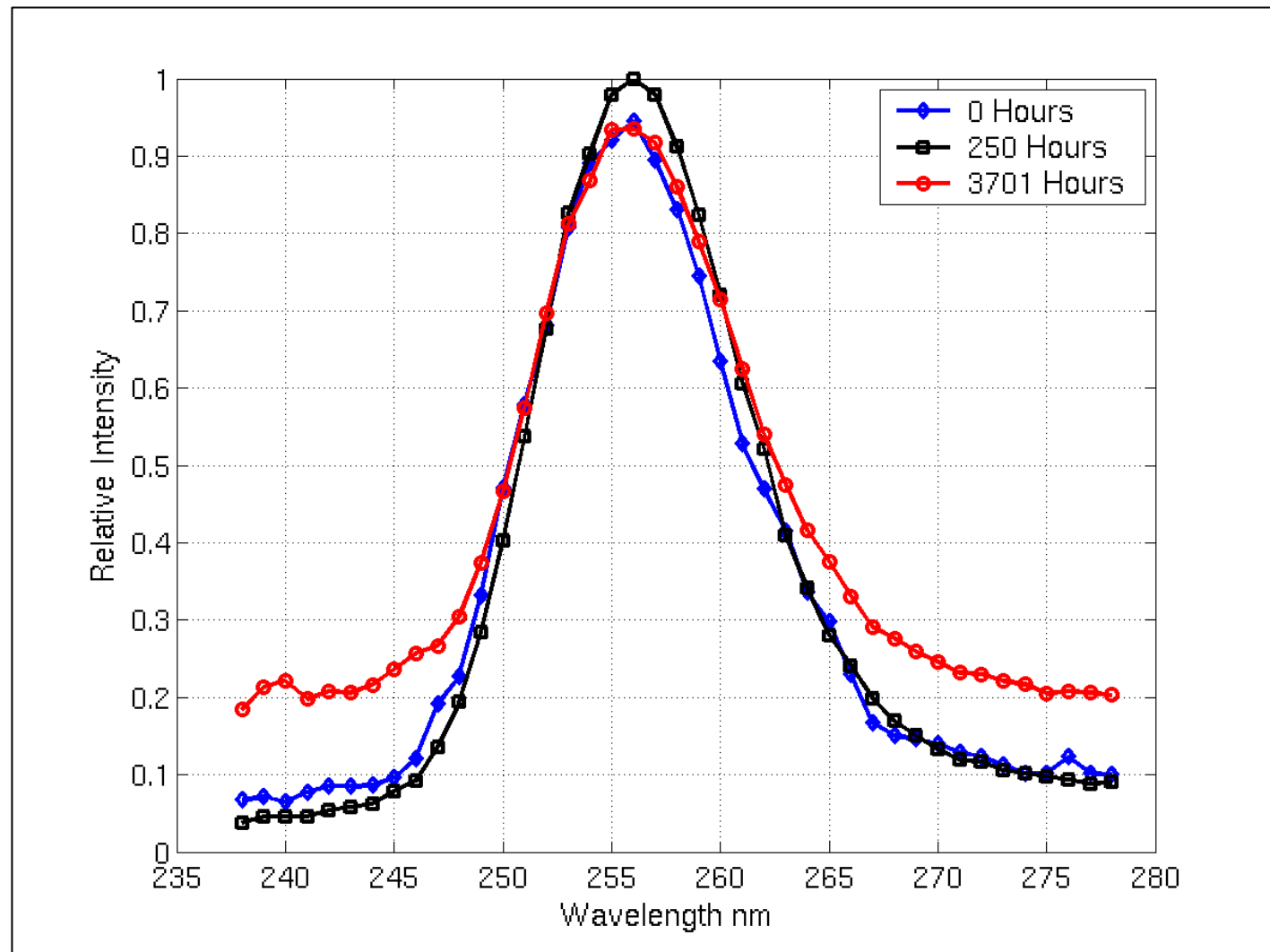
UV LED Direct Readout



Relative Power Stability



Relative Spectral Stability

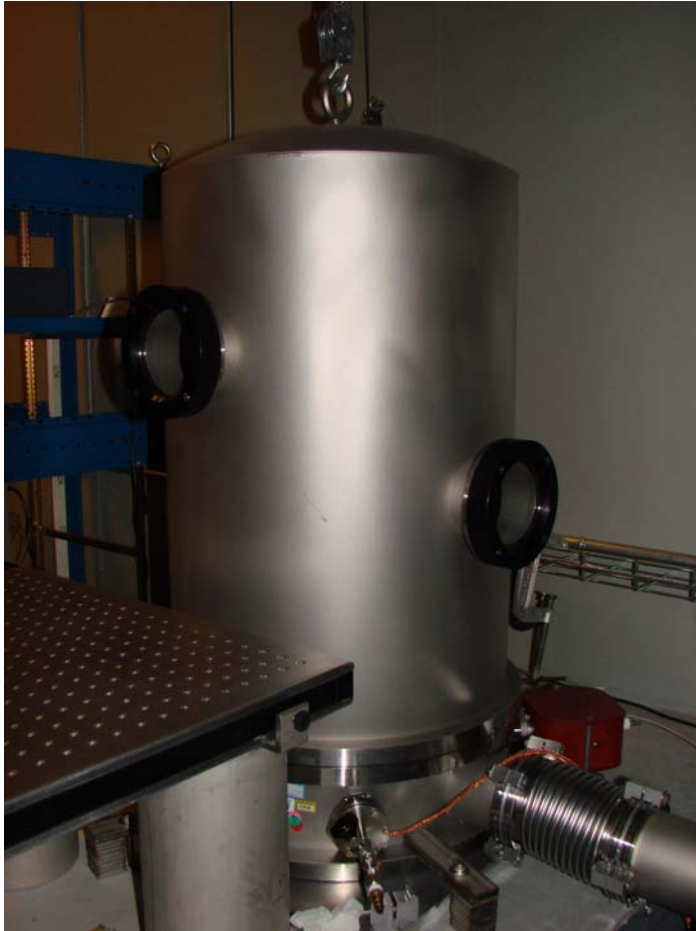


UV LED Charge Management Plan at Stanford

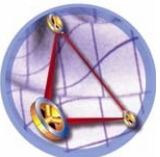
- UV LED system development
 - LISA /LIGO dual use
 - Must have flexible modulation capability
 - High power version for LIGO only
 - Supply the UV LED system to LIGO Labs
- Vacuum chamber commission and renovation
 - UV grade fused silica window
 - Gauges
- AC charge management system for LIGO proof mass charging/discharging
- Remote measurement of surface potential
- Substrate direct charge management
- Conductive coating charge management
- Modeling efforts will parallel



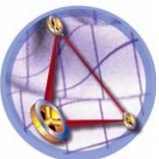
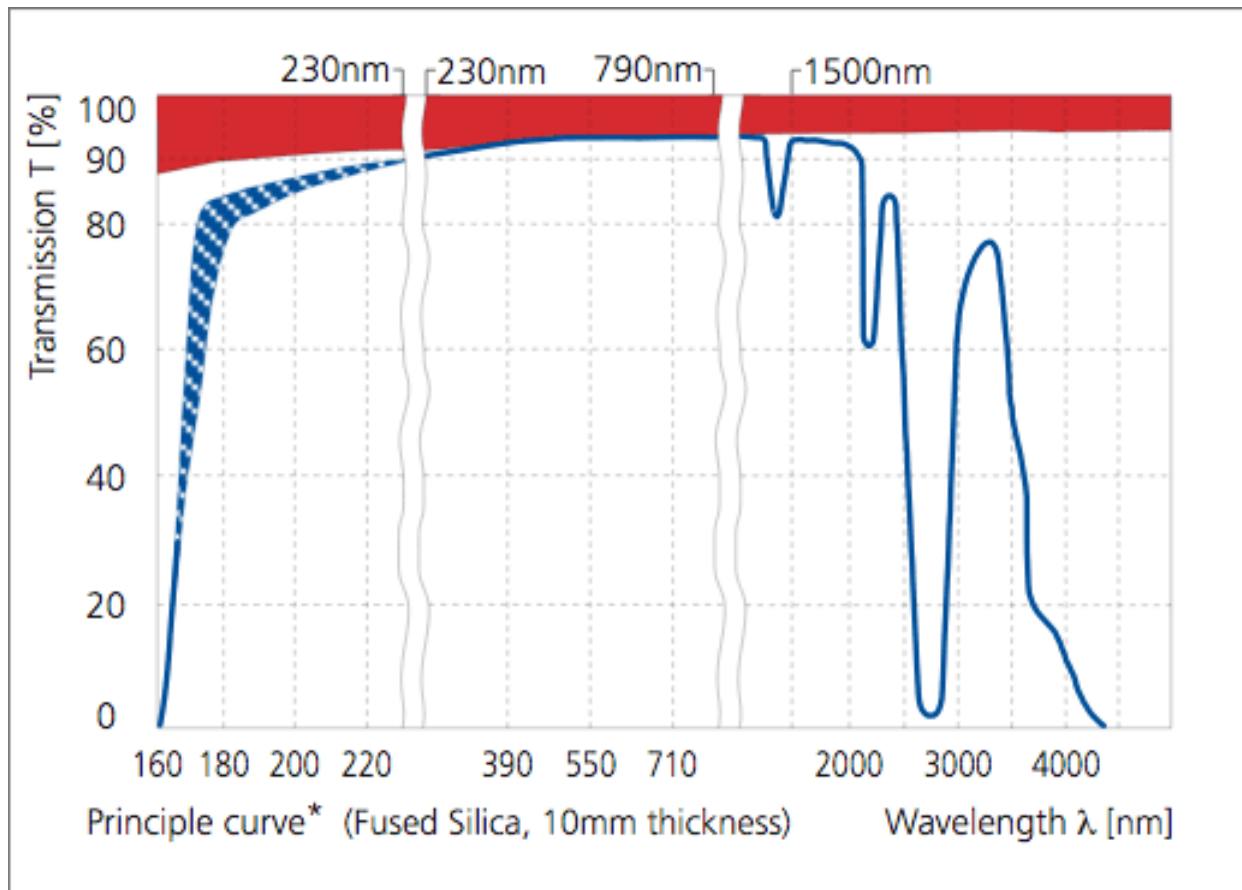
High Vacuum Chamber for LIGO UV Experiment



- Vertical vacuum jar good for suspension
- Ion Pump
- 10^{-7} to 10^{-9} torr

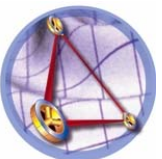
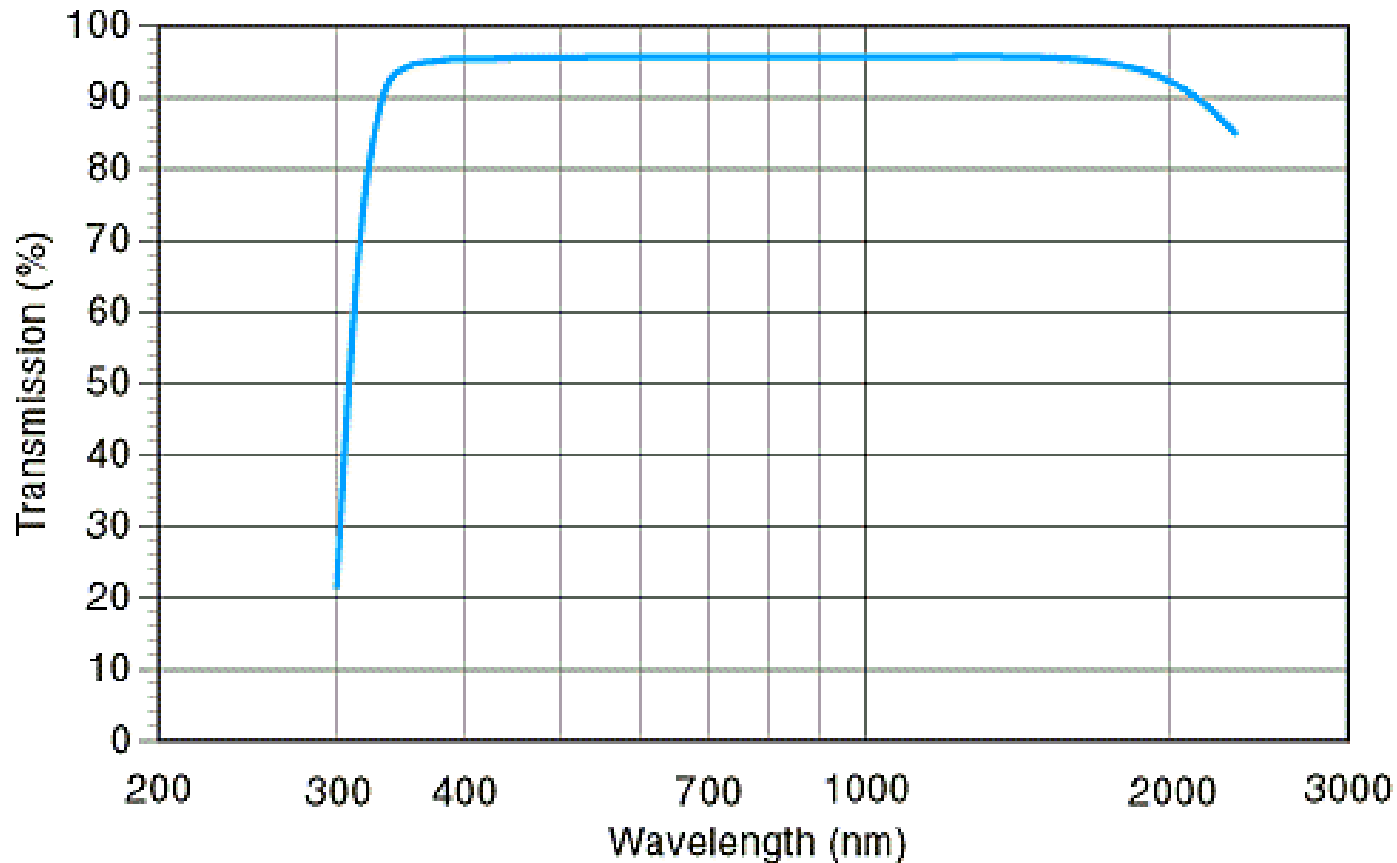


UV Grade Fused Silica Transmission Good for LIGO Chamber Window

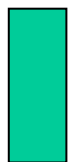


BK7 Glass Transmission Curve

Cutoff at ~330 nm



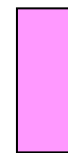
Conductive Coating Patterns



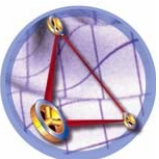
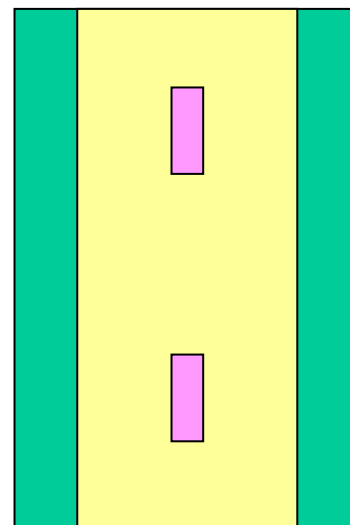
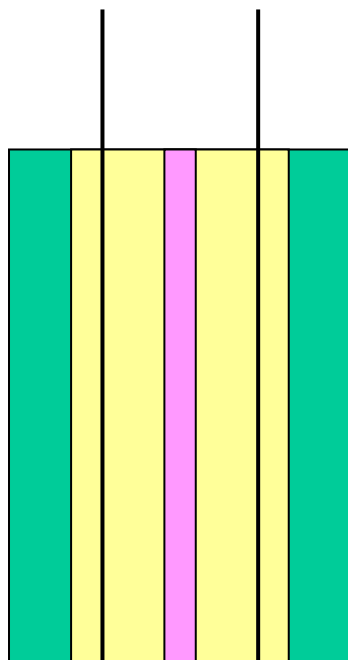
LIGO test mass



UV transparent, weakly conductive coating

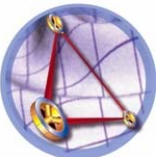
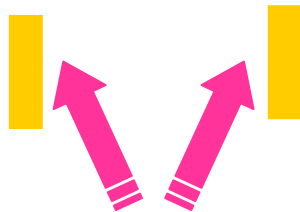
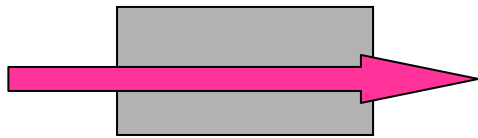


UV transparent photoelectron dot (low work function material)



UV Illumination Schemes for UV AC Charge Management

- Direct illumination
 - UV mercury lamp is routinely used for attachment removal
 - UV LED has sufficient power for cw or pulsed direct illumination
 - Need to make sure no solarization (tanning) effect
- Illumination on coatings
 - Thin Au coating on non-critical portions of test mass and suspension structure
 - Photoelectric effect on thin Au coating is common mechanism for photocathode
 - Higher throughput in charge control



Coordinating with LIGO Project

- Let us know what we can help
 - Gregg's and Charging List's emails very helpful
 - LIGO site configuration info
 - Items needed
 - Requirements
 - Schedule and test plan
 - Some LIGO funds?

