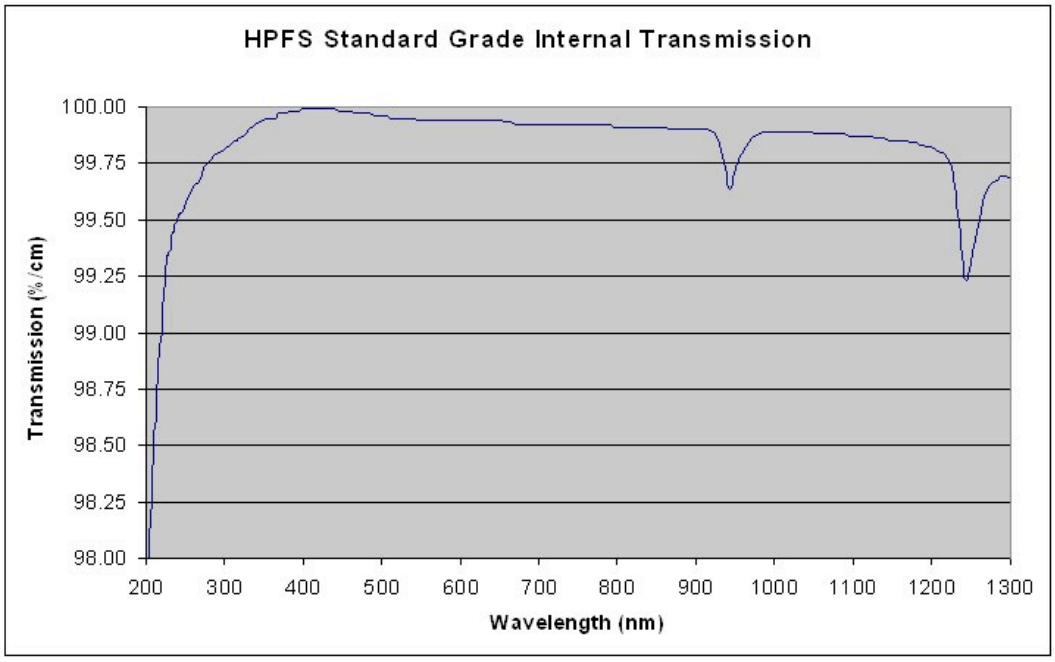
Throughput Estimates

We have been charged by the Review committee to provide throughput estimates using the best values for Solgel coatings and glass transmission available. We have succeeded in obtaining good transmission values for fused silica; the Solgel + MgF2 curves have proven somewhat more problematic.

Fused Silica Transmission:

The following curve for 1cm fused silica was provided by Corning (HPSF Code 7980):



From this, we can estimate the transmission of 70 mm of fused silica:

Wave (microns)	*10mm*	*70mm*
0.30	.998	.986
0.32	.9985	.9895
0.35	.9995	.9965
0.40	.9999	.9993
0.45	.9998	.9986
0.50	.9996	.997
0.60	.9995	.996
0.70	.9993	.995
0.80	.9992	.994
0.90	.9990	.993
0.93	.9963	.974
1.00	.9989	.992
1.10	.9987	.991

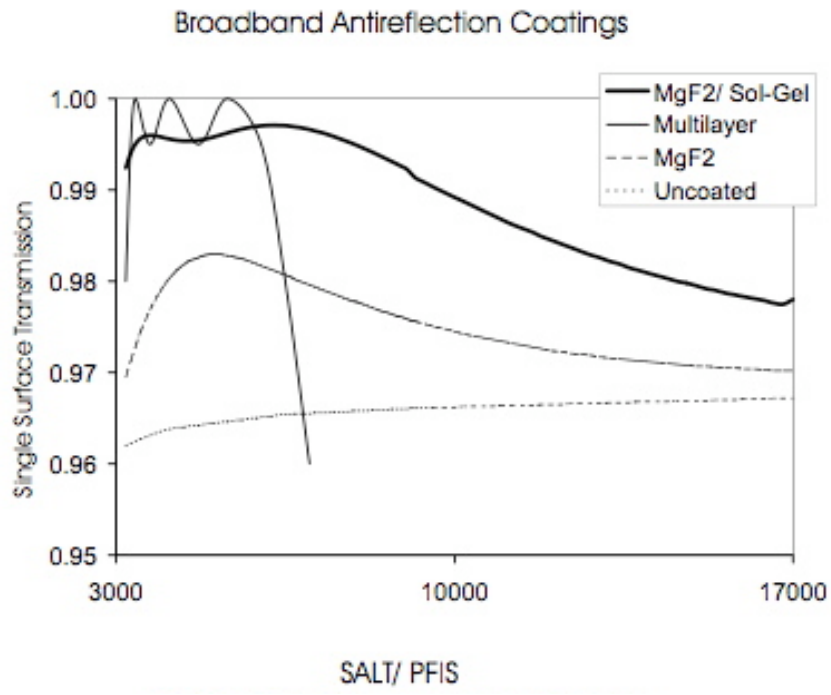
We see that the **total** glass losses are about or less than 1% throughout the range, except for a small dip of 2.6% around 0.93 microns.

Solgel Coatings:

Information on Solgel+MgF2 coatings has been more difficult to obtain. James Stilburn kindly provided information on the measured throughput of the GMOS ADCs, and removing the glass absorption gives us Solgel+MgF2 transmission over 0.4—1.1 microns. (Note that the absorption in the AR coating should be negligible, so the losses can be assumed due to reflectance.) These are summarized here, where "4-surfaces" is calculated from GMOS-S:

Microns	*GMOS-S*	*GMOS-N*	*4-surfaces*
0.40	0.9902	-	0.961
0.45	0.9938	0.9848	0.975
0.55	0.9938	0.9929	0.975
0.65	0.9967	0.9942	0.987
0.75	0.9993	0.9969	0.997
0.85	1.0000	0.9981	1.000
0.90	0.9990	-	0.996
1.00	0.9994	0.9985	0.998
1.10	0.9955	0.9955	0.982

The UV has been harder to assess. Statements in reports for SOAR and the CTIO Blanco Telescope ADC claim Solgel+MgF2 coatings are better than 99% over the full range we are interested in. Throughput measurements(?) for the Blanco ADC at 0.35 and 0.334 microns support the AR coating performance at these levels when adjusted for falling glass transparency, but this depends sensitively on the properties of the glass. The Prime Focus Imaging Spectrograph design for the South African Large Telescope (Nordsieck, http://www.sal.wisc.edu/PFIS/docs/archive/public/talks/asr_05111_vg.pdf; figure below) finds Solgel+MgF2 coatings transmitting at 99% or better over the entire range from 0.32 up to almost 1 micron, falling slowly to about 98.8% around 1.1 microns, but these values appear to be calculated rather than actual measurements. However, "tuning" the coating involves varying the layer thicknesses which should scale closely with the desired wavelengths, and the required scaling (0.31/0.40) does not seem extreme. Note that the peak transmission in their figure does not reach those measured for the GMOS coatings. In summary, we feel confident the UV transmission will be at or better than 99%.



The total throughput of the glass (70mm of HPFS 7980) and AR coatings (values above and assuming 0.99 for a single coating or 0.96 for 4 surfaces for the UV below 0.4 microns) gives:

Wavelength (microns)	*Estimated Total Throughput*
0.30	0.947
0.32	0.951
0.35	0.957
0.40	0.960
0.45	0.974
0.55	0.972
0.65	0.983
0.75	0.992
0.80	0.994
0.90	0.989
0.93	0.971
1.00	0.990
1.10	0.973