Nexus optics, aperture sizes, image sizes, and beam divergence. **S. Oas 1/11/2006**

IR source: Consider the source a .16" square with a .032 - .041 " slit halfway up the middle. The top width of the source is 0.061". For image sizes consider the source .16" square or .21" (5.3mm) across its widest part.
The IR source runs between 1175 –1250 degrees C (1398 – 1523 degrees K).

White light: The white light source is a filament about .12" diameter and about .375" long. For a symmetric shape consider the image as .12" dia. (3mm dia.). This source normally runs at about 2327 – 2527 degrees C (2600 – 2800 degrees K).

Source ellipse mirror: 30 degrees, 6.00" FL and 3.42"FL, 2.0" dia. (P/N 160-709803). This focuses the image of the source onto the iris aperture. The image of the IR source (5.3mm) is magnified by 6/3.42 or 1.75. Thus, the image of the source on the iris is 5.3mm x 1.75 = 9.3mm. Note that 9.3mm corresponds to an aperture setting of APT=115. Aperture sizes greater than 115 do not give much more signal and the energy is coming from the heated material next to the source (insulation in the source assembly).

Iris: The variable iris is controlled by Omnic software. The approximate size of the iris is listed below.

Iris setting	Iris dia.	Theoretical dia. in sample compartment	Image size at detector	Half angle Beam divergence	TGS Interferogram Volts p-p
APT=150	10.7mm	10.7mm	1.98mm	2.0 degrees	12.15
APT=115	9.3mm	9.3mm	1.72mm	1.75 degrees	11.70
APT=100	8.75mm	8.75mm	1.61mm	1.6 degrees	11.46
APT=75	7.52mm	7.52mm	1.38mm		10.62
APT=50	6.27mm	6.27mm	1.15mm		9.33
APT=32	5.08mm	5.08mm	0.94mm	0.95 degrees	7.57
APT=25	4.50mm	4.50mm	0.85mm		6.72
APT=9	3.00mm	3.00mm	0.55mm		3.73
APT=6	2.50mm	2.50mm	0.46mm	0.47 degrees	2.70
APT=4	2.00mm	2.00mm	0.37mm		1.96
APT=1	1.30mm	1.30mm	0.24mm	0.25 degrees	0.72
APT=0	0.75mm	0.75mm	0.14mm	0.14 degrees	0.26

Source collimation mirror: The beam goes through the iris to a 6.00" FL, 90 degree, 2.5" dia. parabolic mirror (P/N 160-709903). This collimates the beam into the interferometer (with some beam divergence due to the iris size).

Beam divergence: The beam divergence can be approximated by using the angle generated by the iris size to a point 6.00" away (the distance between the iris and the center of the 6" FL parabolic mirror). Some angles for certain iris settings are listed above (Note this is half angle beam divergence usually used for calculations. Total beam divergence is twice the half angle divergence). Note that the beam divergence is slightly greater on the short focal length side of the mirror and slightly smaller on the longer focal length side of the mirror.

Interferometer: The mirrors in the interferometer are 1.5" dia. Thus, the beam coming out of the interferometer is 1.5" dia.

Sample compartment mirror: This mirror is a 6.00" FL, 90 degree, 2.5" dia. parabolic mirror (P/N 160-709903). Because this mirror is the same as the source collimation mirror, the image size in the sample compartment is the same as the iris size (with some distortion due to the off axis parabolics).

Detector mirror: 1.66" FL, 8.97" FL, 80 degree ellipse, 2.25" dia. (P/N 160-710006). This mirror takes the beam image in the sample compartment and focuses it onto the detector. The image in the sample compartment is reduced by a factor of 5.4 (8.97/1.66 = 5.4). Detector mirror image sizes for different aperture sizes are listed above.

Detector element sizes:

DLaTGS	1.3mm dia.
Polyethylene window TGS	1.5mm dia.
MCTA, MCTB	1mm x 1mm
InSb	2mm dia.
PbSe	1mm x 1mm
PbS	2mm x 2mm
InGaAs, 1.7um	1mm x 1mm
InGaAs, 2.6um	1mm dia. and 2mm dia.
LiTaO3	1.5mm dia.
Silicon	2.5mm dia.

For reference, the DLaTGS detector signal amplitude for different apertures is listed above.

For 470 or 4700 benches:

IR source: Assume the source is 0.16” square or 0.21” (5.3mm) across its widest part.

Source Mirror: 160-722601, 2.66” focal length parabolic, 60 degrees. Collimates beam into the Interferometer.

Sample compartment mirror: This mirror is a 6.00” FL, 90 degree, 2.5” dia. parabolic mirror (P/N 160-709903).

Sample compartment image: If the largest source image is 5.3mm, the beam image size in the sample compartment will be 6.00/2.66 x 5.3mm or 11.9mm.

Detector mirror: 1.66” FL, 8.97” FL, 80 degree ellipse, 2.25” dia. (P/N 160-710006). This mirror takes the beam image in the sample compartment and focuses it onto the detector. The image in the sample compartment is reduced by a factor of 5.4 (8.97/1.66 = 5.4).

Detector image size: Since the detector mirror reduces the image in the sample compartment by a factor of 5.4, the largest image size at the detector will be 11.9mm/5.4 or 2.2mm.

For Avatar type benches:
IR source: Again, consider the source to be 5.3mm across its widest part.
Source Mirror: 160-715800, 3.11”, 90 deg parabolic.
Interferometer: 1” mirrors, so beam coming out is about 1” dia.
Sample compartment mirror: 160-715901, 5.44”, 90 deg parabolic.
Sample compartment image: 5.3mm x 5.44/3.11 = 9.27mm at widest part
Detector mirror: 160-715700, ellipse 1.18”, 7.37”, 90 deg.
Image at detector: 9.27mm x 1.18/7.37 = 1.48mm at widest part.