



Remote Determination of OAP Parent Radius of Curvature via Sagittal/Tangential Image Measurements

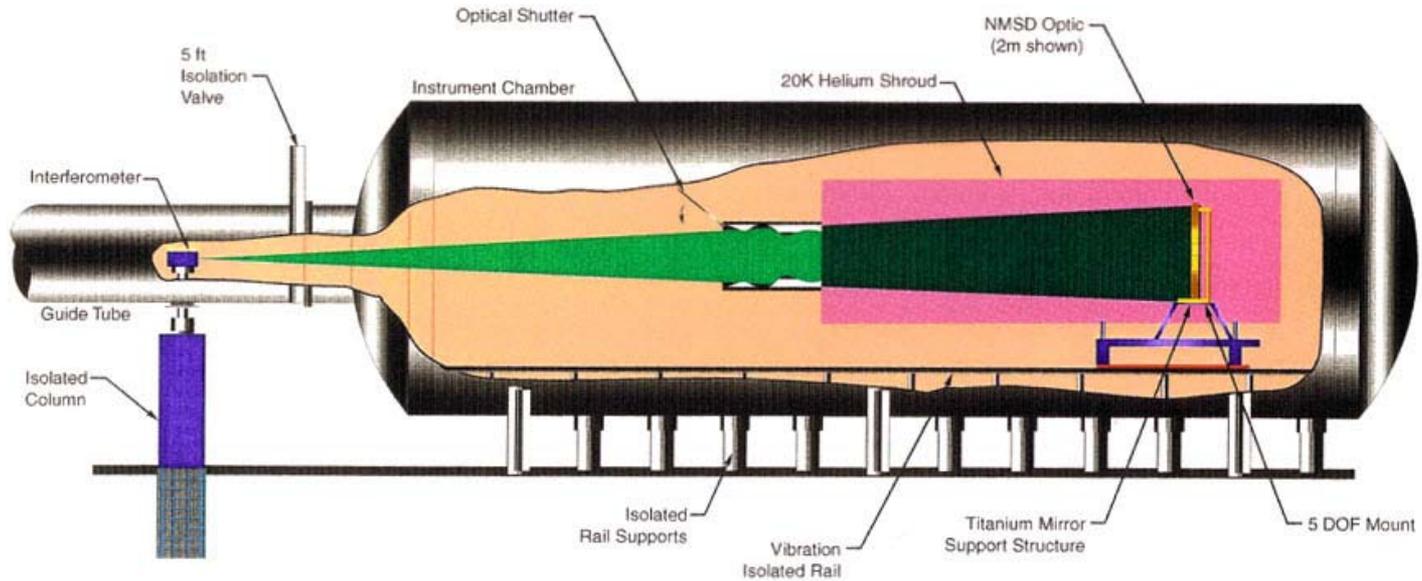
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Sponsored by:
Goddard Space Flight Center
Via Swales Aerospace

NMSD Test Configuration

X-Ray Calibration Facility

Building 4718

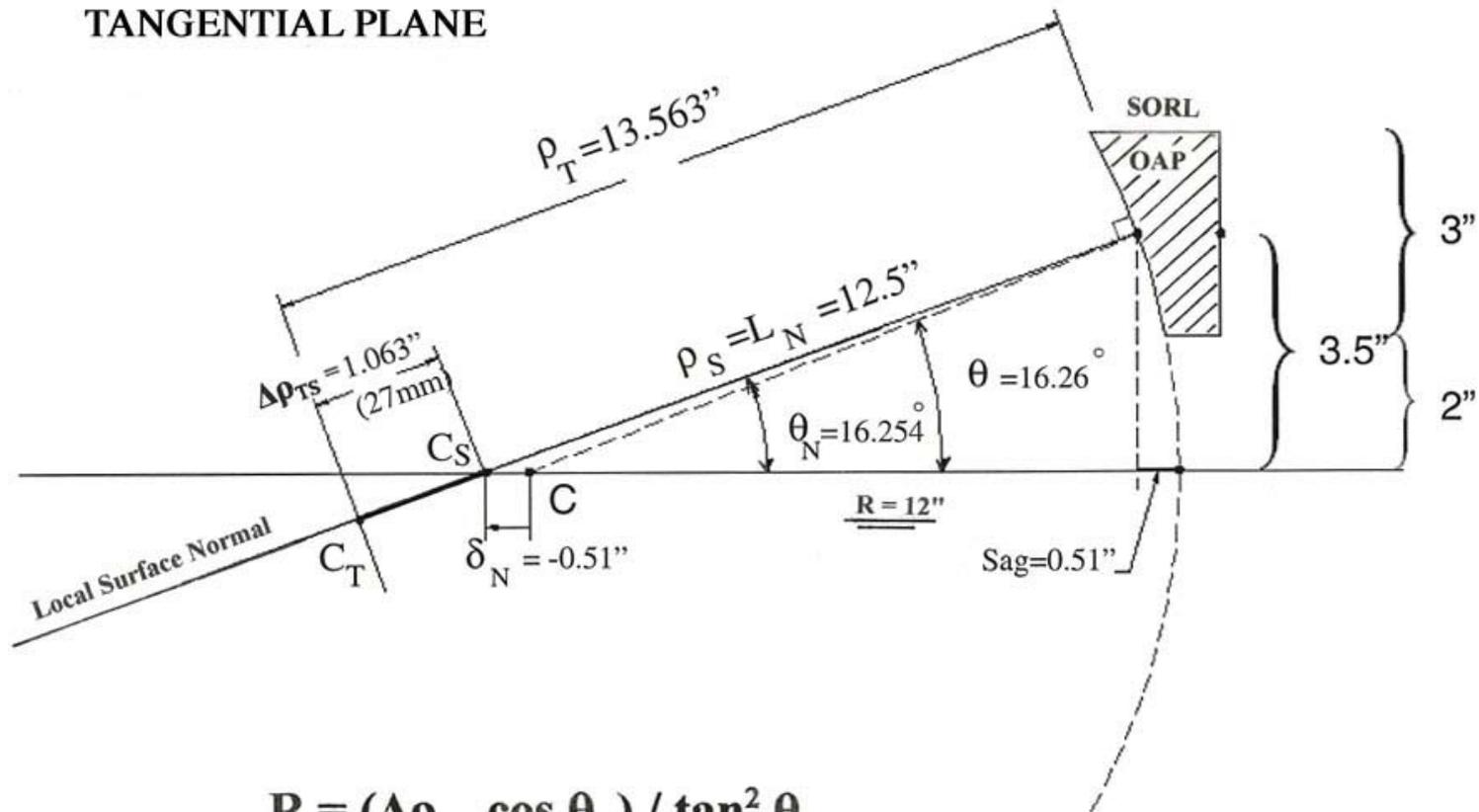


National Aeronautics and
Space Administration

George C. Marshall Space Flight Center

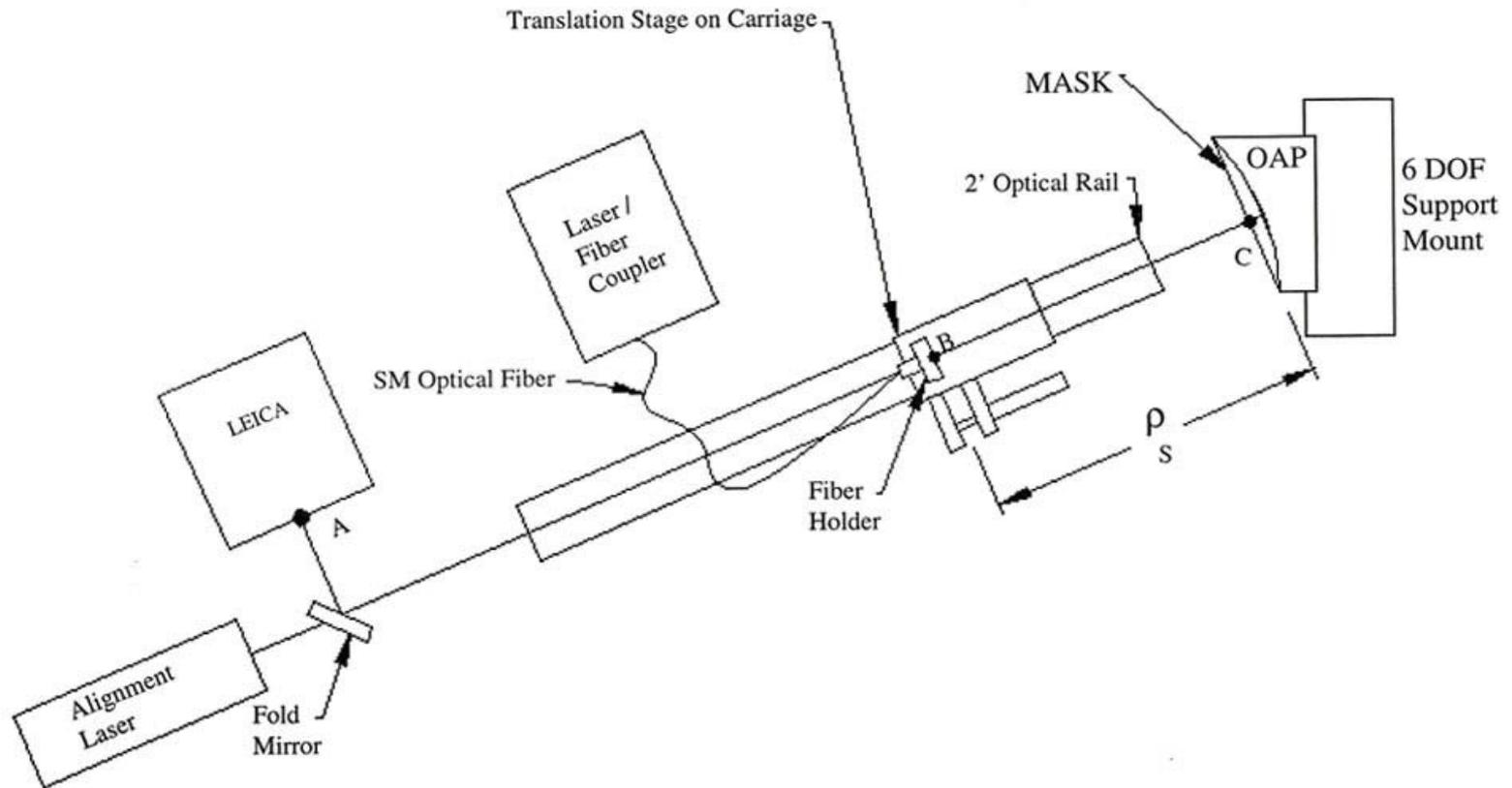
5-32256

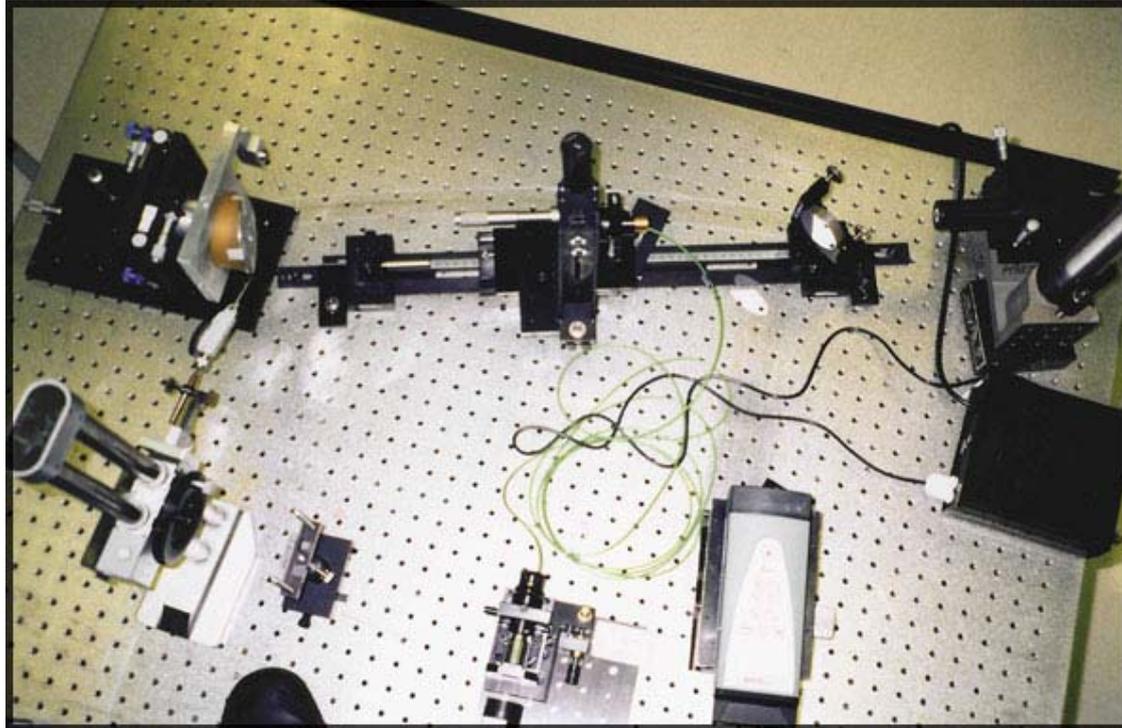
TANGENTIAL PLANE

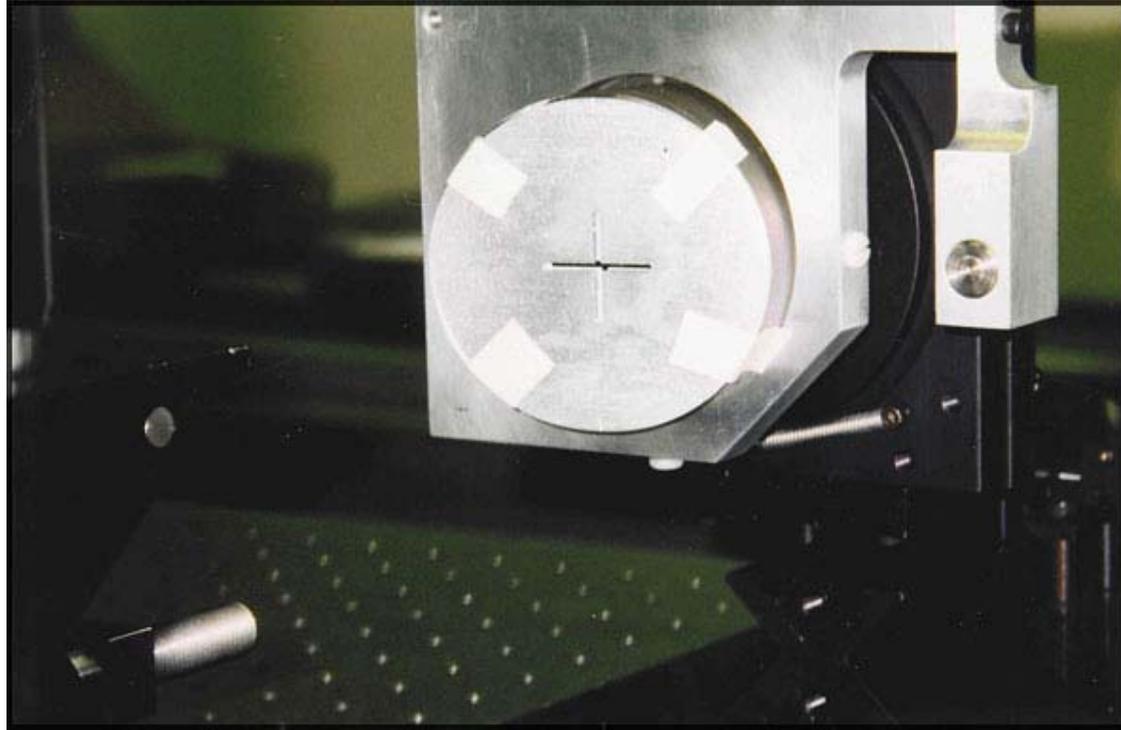


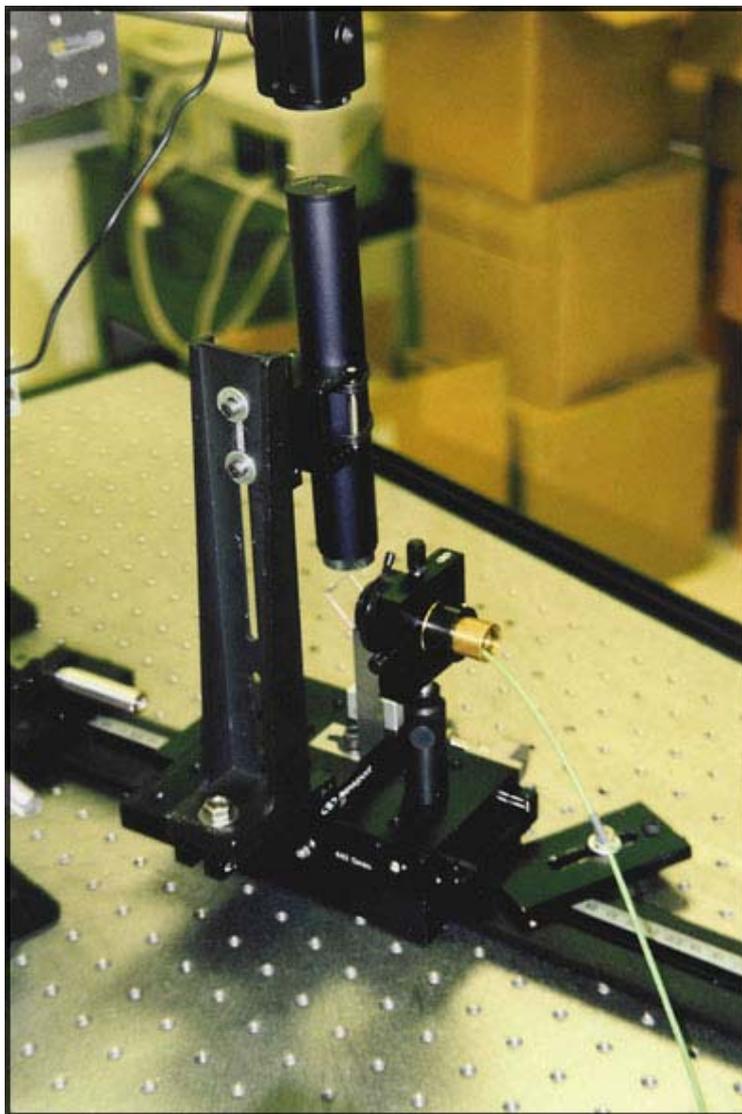
$$R = (\Delta\rho_{TS} \cos \theta_N) / \tan^2 \theta_N$$

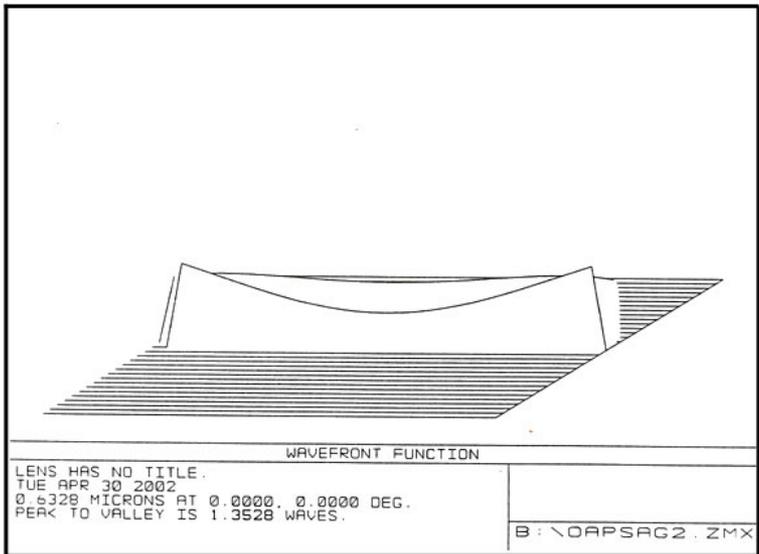
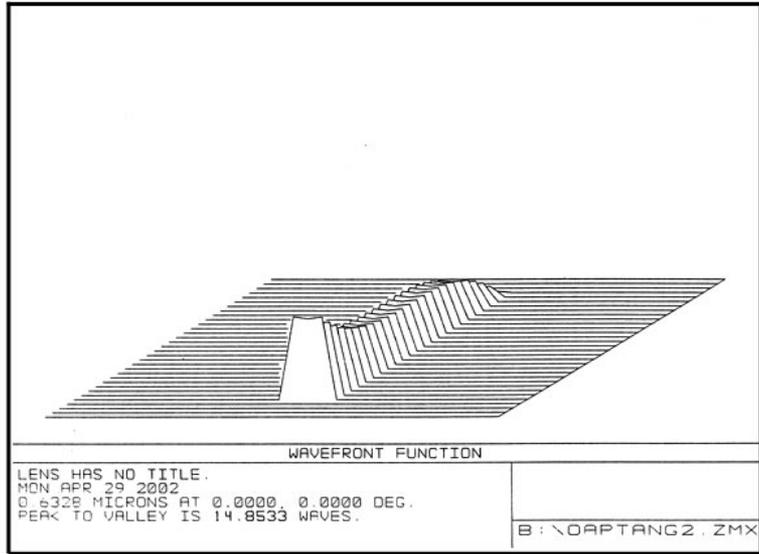
EXPERIMENTAL LAYOUT...TOP (TANGENTIAL) VIEW







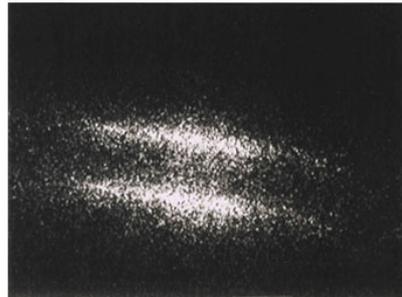
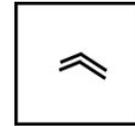




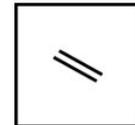
SAGITTAL IMAGE
6/5/02



Sag INSIDE FOCUS $y=32.85$



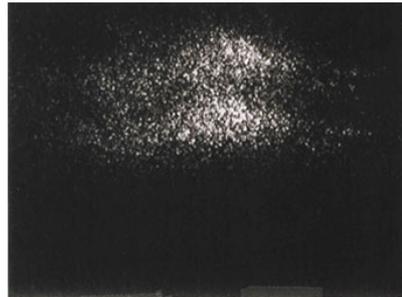
Sag BEST FOCUS $y=31.981$



Sag OUTSIDE FOCUS $y=31.112$



TANGENTIAL IMAGE
6/5/02



Tang INSIDE FOCUS $y=31.64$



Tang BEST FOCUS $y=30.115$



Tang OUTSIDE FOCUS $y=28.60$



Table 1. Test 1

Trial #	Sag reading	Tang reading	ΔST
1	32.085	4.850	27.235
2	31.940	4.487	27.453
3	30.110	4.710	27.222
4	32.065	4.740	27.325
5	32.162	4.680	27.472
6	31.942	4.690	27.252
7	31.925	4.475	27.450
8	31.940	4.862	27.078
9	31.920	4.830	27.090
10	31.900	4.820	27.080
Av	31.981	4.715	27.266
RMS	0.084	0.132	0.148

Table 2. Test 2

Trial #	Sag reading	Tang reading	ΔST
1	32.070	4.755	27.315
2	31.772	4.640	27.132
3	32.150	4.730	27.420
4	32.150	4.760	27.390
5	32.000	4.850	27.150
6	32.130	4.735	27.395
7	32.050	4.755	27.295
8	31.990	4.880	27.110
9	32.050	4.832	27.218
10	31.890	4.890	26.990
Av	32.025	4.784	27.242
RMS	0.114	0.076	0.137

Test #	Δp_{TS}	R	ΔR	% Error
1	27.266 mm	11.971"	0.029"	0.24
2	27.242 mm	11.961"	0.039"	0.32

Sensitivity of R to Errors in $\Delta\rho_{TS}$ & θ_N Measurement

$$dR = [\cos \theta_N / \tan^2 \theta_N] d\Delta\rho_{TS}$$

Let $\theta = 16.254^\circ$, so: $dR = 11.29 d\Delta\rho_{TS}$

Example: RMS from Test 1 = 0.148 mm = $d\Delta\rho_{TS}$

$$dR = 11.29 (0.148 \text{ mm}) = 1.671 \text{ mm}$$

Therefore: $[dR / R] \times 100\% = \mathbf{0.54 \%}$

$$dR = -\Delta\rho_{TS} [(\sin \theta / \tan^2 \theta) + (2 \cos \theta \sec^2 \theta) / \tan^3 \theta] d\theta$$

Let $\theta = 16.254^\circ$, so: $dR = -\Delta\rho_{TS} [87.35] d\theta$

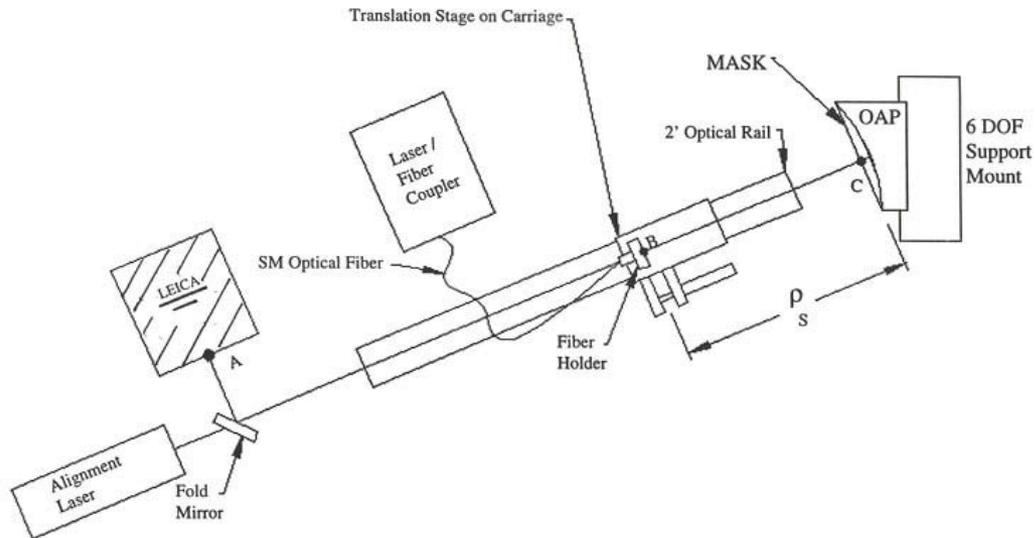
Also let $\Delta\rho_{TS} = 27 \text{ mm}$: $dR = -2358.6 d\theta$

Example: Let $d\theta = \pm 0.00436$ radians (or 0.25°)

$$dR = -2358.6 (\pm 0.00436 \text{ rad}) = \pm 10.29 \text{ mm}$$

Therefore: $[dR / R] \times 100\% = \mathbf{3.38 \%}$

LEICA MEASUREMENT



$$\rho_T = R [1 + (y/R)^2]^{3/2}$$

$$\rho_S = R [1 - \kappa (y/R)^2]^{1/2}$$

Test

1

$-\rho_S$
318.43 mm (or 12.537")

2

318.43

$R = 305.62$ mm (or 12.03")