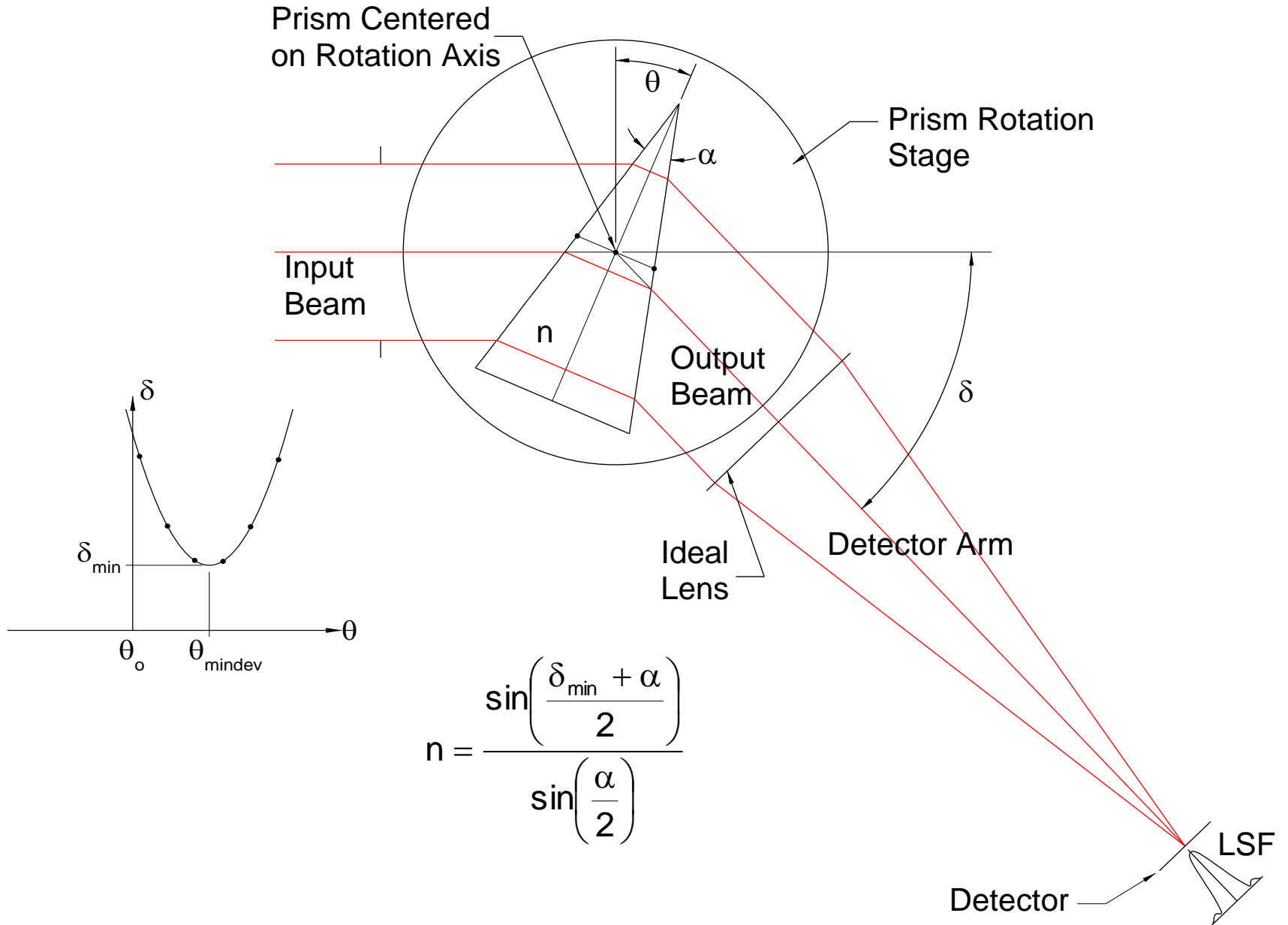


Refractive Index Sample Fab Tolerances

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Refractometer Geometry



Prism Apex Angles

$$\alpha_o = 2 \tan^{-1} \left[\frac{\sin \frac{\delta_o}{2}}{n - \cos \frac{\delta_o}{2}} \right] \quad \delta_o = 58^\circ, \alpha \leq 60^\circ$$

Material	λ_{\min} (μm)	$n(\lambda_{\min})$	α_o (deg)	δ_{\min} (deg)	α (deg)
ALON	0.400	1.812691	54.6612	58.0000	54.0
BaF2	0.270	1.510307	74.6622	37.0969	59.0
CaF2	0.230	1.475755	77.7717	34.2203	59.0
GaAs	1.400	3.419168	21.5744	58.0000	22.0
Ge	2.000	4.104147	17.0747	58.0000	17.0
Si	1.400	3.492307	20.9852	58.0000	21.0
Spinel	0.350	1.748861	58.0210	58.0000	58.0
ZnSe	0.500	2.741340	29.1175	58.0000	29.0
ZnS	0.400	2.558896	32.1163	58.0000	32.0

Prism apex angles are selected to produce approximately 60° of deviation at the shortest wavelength of interest, and rounded to the nearest degree. Apex angle $<60^\circ$.

Prism Tilt at Minimum Deviation

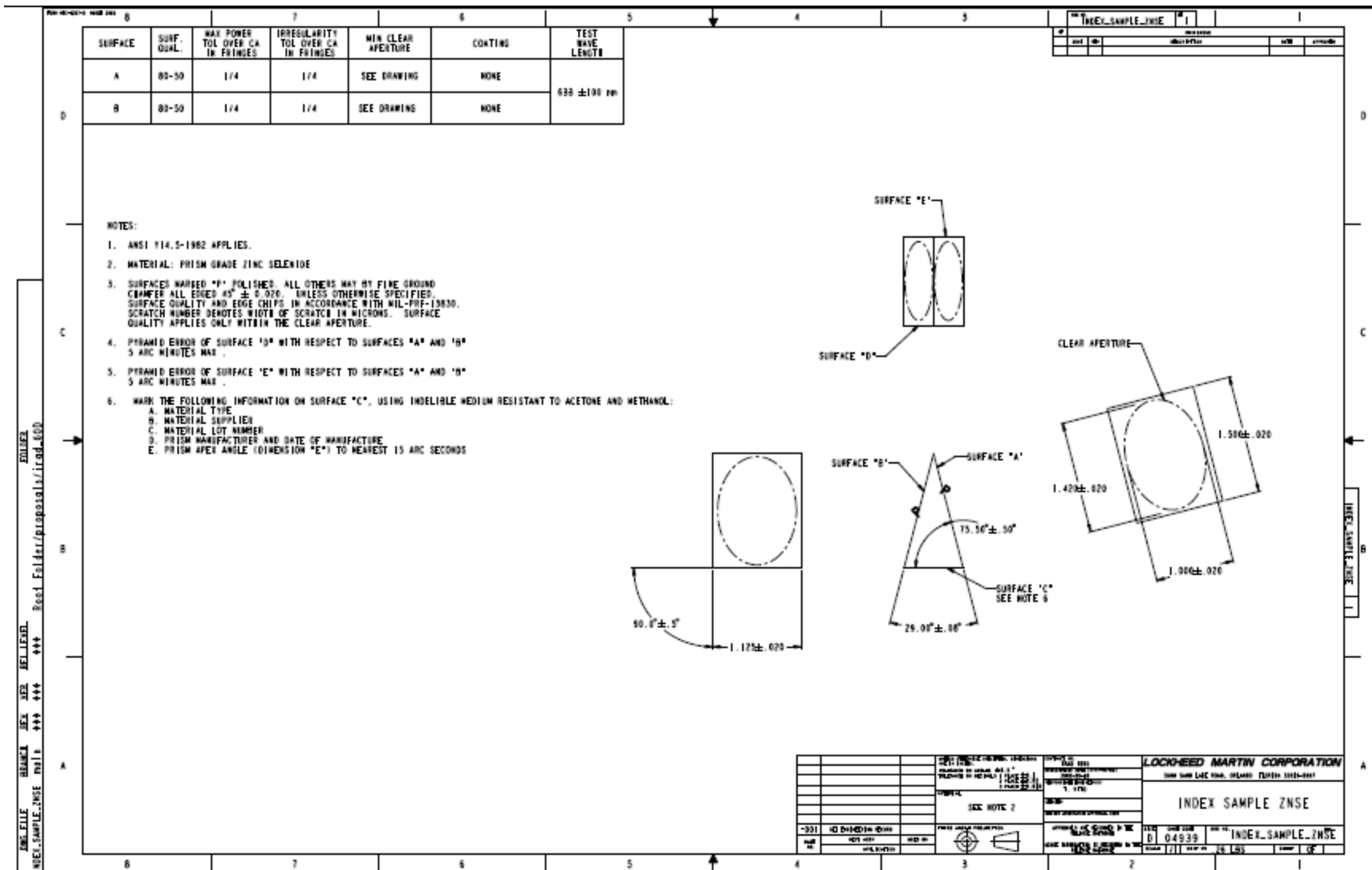
$$\theta_{\text{mindev}} = \sin^{-1}\left(n \sin \frac{\alpha}{2}\right) - \frac{\alpha}{2}$$

Tolerance analysis performed at $\lambda = 3000\text{nm}$

Material	n(3000nm)	α (deg)	δ_{min} (deg)	θ_{mindev} (deg)
ALON	1.738148	54.0	50.2035	25.101754
BaF2	1.461146	59.0	33.0269	16.513440
CaF2	1.417855	59.0	29.5632	14.781600
GaAs	3.316400	22.0	56.5139	28.256933
Ge	4.044808	17.0	56.4337	28.216831
Si	3.432338	21.0	56.4369	28.218446
Spinel	1.667708	58.0	49.9033	24.951660
ZnSe	2.437578	29.0	46.2254	23.112695
ZnS	2.257187	32.0	44.9488	22.474415

Nominal CodeV prescriptions are initialized at minimum deviation.

Prism Dimensions



Fringe Zernike Surface Perturbations

Fringe Zernike Polynomial	CodeV Coefficient
$ZF_1 = 1$	$C_4 = PV$
$ZF_2 = R\cos\theta$	$C_5 = (1/2) \cdot PV$
$ZF_3 = R\sin\theta$	$C_6 = (1/2) \cdot PV$
$ZF_4 = 2R^2 - 1$	$C_7 = (1/2) \cdot PV$
$ZF_5 = R^2\cos(2\theta)$	$C_8 = (1/2) \cdot PV$
$ZF_6 = R^2\sin(2\theta)$	$C_9 = (1/2) \cdot PV$
$ZF_7 = (3R^3 - 2R)\cos\theta$	$C_{10} = (1/2) \cdot PV$
$ZF_8 = (3R^3 - 2R)\sin\theta$	$C_{11} = (1/2) \cdot PV$
$ZF_9 = 6R^4 - 6R^2 + 1$	$C_{12} = (2/3) \cdot PV$

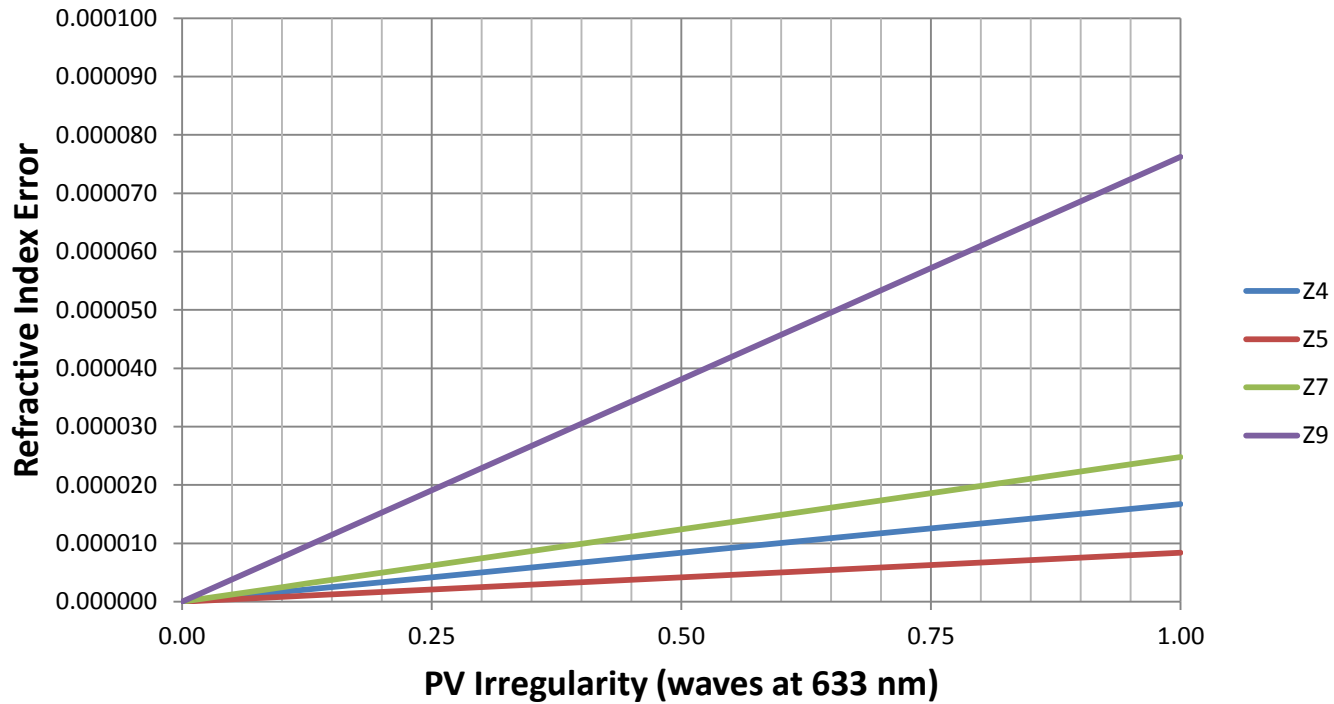
PV in lens units

Zernike Normalization Radius = 0.5 inch

Surface irregularity is in the form of fringe Zernike polynomials.

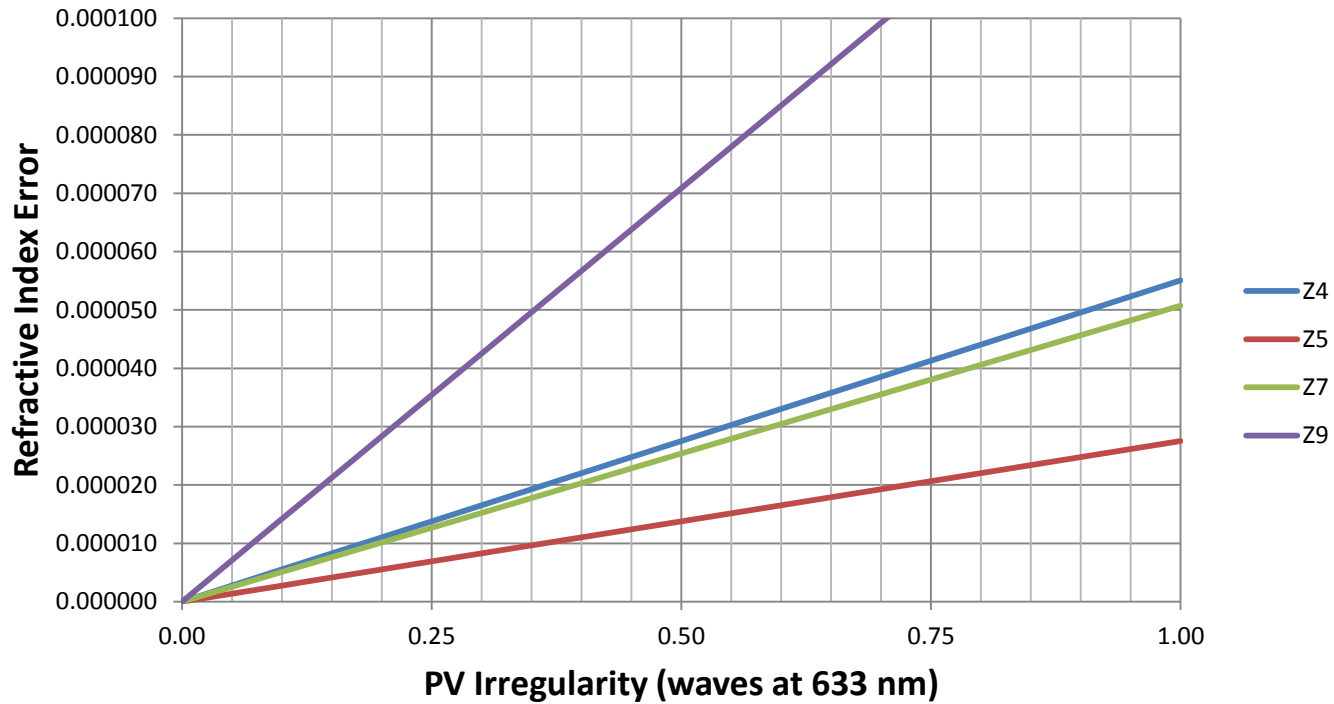
Refractive Index Error vs Irregularity (1/3)

Barium Fluoride



Refractive Index Error vs Irregularity (2/3)

Zinc Selenide



Refractive Index Error vs Irregularity (3/3)

