Analysis of Tolerances

File : C:\Users\Timothy Coon\Google Drive\AFIT\PhD Research\Telescope Design\Adaptive_optics_final\Adaptive optics final.zmx
Title:
Date : 1/29/2015

Analysis for all 19 configurations.

Units are Millimeters.
All changes are computed using linear differences.

All compensators will be optimized using Orthogonal Descent.

Compensator: Multi-Configuration Operand   4 on Configuration   1, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration   2, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration   3, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration   4, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration   5, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration   6, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration   7, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration   8, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration   9, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration 10, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration 11, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration 12, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration 13, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration 14, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration 15, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration 16, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration 17, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration 18, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   4 on Configuration 19, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration   1, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration   2, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration   3, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration   4, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration   5, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration   6, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration   7, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration   8, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration   9, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration 10, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration 11, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration 12, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration 13, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration 14, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration 15, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration 16, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration 17, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration 18, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   5 on Configuration 19, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration   1, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration   2, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration   3, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration   4, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration   5, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration   6, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration   7, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration   8, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration   9, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration 10, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration 11, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration 12, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration 13, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration 14, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration 15, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration 16, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration 17, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration 18, Min =   0.0000, Max =   0.0000
Compensator: Multi-Configuration Operand   7 on Configuration 19, Min =   0.0000, Max =   0.0000

WARNING: Boundary constraints on compensators will be ignored.

Criterion   : User defined merit function
Optimization Cycles : Automatic mode
Nominal Criterion   : 0.00000000
Test Wavelength   : 0.5500

Fields: User Defined Angle in degrees
 #   X-Field   Y-Field   Weight   VDX   VDY   VCX   VCY
 1   0.000E+000   0.000E+000   1.000E+000   0.000   0.000   0.000   0.000

Monte Carlo Analysis:
Number of trials: 5

Initial Statistics: Normal Distribution

  Trial   Criterion   Change
     1   1.7962E-009   1.7951E-009

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   2     2.1016E-009     2.1005E-009
   3     2.3368E-009     2.3356E-009
   4     2.3664E-009     2.3652E-009
   5     1.8675E-009     1.8663E-009

Number of traceable Monte Carlo files generated: 5

Nominal    1.1651E-012
Best       1.7962E-009     Trial     1
Worst      2.3664E-009     Trial     4
Mean       2.0937E-009
Std Dev    2.3373E-010

Compensator Statistics:
 Multi-configuration Operator 4 Config 1:
Nominal              :          0.000000
Minimum              :         -0.000026
Maximum              :          0.000035
Mean                 :          0.000010
Standard Deviation : :          0.000024

 Multi-configuration Operator 4 Config 2:
Nominal              :          0.000000
Minimum              :         -0.000020
Maximum              :          0.000031
Mean                 :          0.000006
Standard Deviation : :          0.000023

 Multi-configuration Operator 4 Config 3:
Nominal              :          0.000000
Minimum              :         -0.000026
Maximum              :          0.000042
Mean                 :          0.000007
Standard Deviation : :          0.000024

 Multi-configuration Operator 4 Config 4:
Nominal              :          0.000000
Minimum              :         -0.000021
Maximum              :          0.000032
Mean                 :          0.000003
Standard Deviation : :          0.000019

 Multi-configuration Operator 4 Config 5:
Nominal              :          0.000000
Minimum              :         -0.000010
Maximum              :          0.000002
Mean                 :         -0.000004
Standard Deviation : :          0.000005

 Multi-configuration Operator 4 Config 6:
Nominal              :          0.000000
Minimum              :         -0.000020
Maximum              :          0.000043
Mean                 :          0.000005
Standard Deviation : :          0.000023

 Multi-configuration Operator 4 Config 7:
Nominal              :          0.000000
Minimum              :         -0.000020
Maximum              :          0.000045
Mean                 :          0.000011
Standard Deviation : :          0.000022

 Multi-configuration Operator 4 Config 8:
Nominal              :          0.000000
Minimum              :         -0.000092
Maximum              :          0.000099
Mean                 :         -0.000017
Standard Deviation : :          0.000069

 Multi-configuration Operator 4 Config 9:
Nominal              :          0.000000
Minimum              :         -0.000043
Maximum              :          0.000034
Mean                 :         -0.000008
Standard Deviation : :          0.000032

 Multi-configuration Operator 4 Config 10:
Nominal              :          0.000000
Minimum              :         -0.000039
Maximum              :          0.000037
Mean                 :         -0.000005
Standard Deviation : :          0.000026

 Multi-configuration Operator 4 Config 11:
Nominal              :          0.000000
Minimum              :         -0.000038
Maximum              :          0.000054
Mean                 :          0.000001
Standard Deviation : :          0.000031
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 Multi-configuration Operator 4 Config 12:
Nominal            :          0.000000
Minimum            :         -0.000066
Maximum            :          0.000054
Mean               :         -0.000011
Standard Deviation :          0.000040

 Multi-configuration Operator 4 Config 13:
Nominal            :          0.000000
Minimum            :         -0.000067
Maximum            :          0.000017
Mean               :         -0.000019
Standard Deviation :          0.000036

 Multi-configuration Operator 4 Config 14:
Nominal            :          0.000000
Minimum            :         -0.000096
Maximum            :          0.000028
Mean               :         -0.000036
Standard Deviation :          0.000050

 Multi-configuration Operator 4 Config 15:
Nominal            :          0.000000
Minimum            :         -0.000035
Maximum            :          0.000012
Mean               :         -0.000019
Standard Deviation :          0.000016

 Multi-configuration Operator 4 Config 16:
Nominal            :          0.000000
Minimum            :         -0.000056
Maximum            :          0.000039
Mean               :         -0.000008
Standard Deviation :          0.000031

 Multi-configuration Operator 4 Config 17:
Nominal            :          0.000000
Minimum            :         -0.000013
Maximum            :          0.000070
Mean               :          0.000007
Standard Deviation :          0.000032

 Multi-configuration Operator 4 Config 18:
Nominal            :          0.000000
Minimum            :         -0.000055
Maximum            :          0.000061
Mean               :          0.000004
Standard Deviation :          0.000041

 Multi-configuration Operator 4 Config 19:
Nominal            :          0.000000
Minimum            :         -0.000051
Maximum            :          0.000091
Mean               :         -0.000002
Standard Deviation :          0.000049

 Multi-configuration Operator 5 Config 1:
Nominal            :          0.000000
Minimum            :         -0.000066
Maximum            :          0.000069
Mean               :         -0.000008
Standard Deviation :          0.000045

 Multi-configuration Operator 5 Config 2:
Nominal            :          0.000000
Minimum            :         -0.000048
Maximum            :          0.000053
Mean               :         -0.000005
Standard Deviation :          0.000036

 Multi-configuration Operator 5 Config 3:
Nominal            :          0.000000
Minimum            :         -0.000036
Maximum            :          0.000043
Mean               :         -0.000011
Standard Deviation :          0.000029

 Multi-configuration Operator 5 Config 4:
Nominal            :          0.000000
Minimum            :         -0.000047
Maximum            :          0.000027
Mean               :         -0.000016
Standard Deviation :          0.000026

 Multi-configuration Operator 5 Config 5:
Nominal            :          0.000000
Minimum            :         -0.000063
Maximum            :          0.000064
Mean               :         -0.000009
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Standard Deviation :          0.000044

 Multi-configuration Operator 5 Config 6:
Nominal           :          0.000000
Minimum           :         -0.000038
Maximum           :          0.000064
Mean              :          0.000002
Standard Deviation :          0.000038

 Multi-configuration Operator 5 Config 7:
Nominal           :          0.000000
Minimum           :         -0.000043
Maximum           :          0.000036
Mean              :         -0.000000
Standard Deviation :          0.000030

 Multi-configuration Operator 5 Config 8:
Nominal           :          0.000000
Minimum           :         -0.000027
Maximum           :          0.000032
Mean              :         -0.000002
Standard Deviation :          0.000023

 Multi-configuration Operator 5 Config 9:
Nominal           :          0.000000
Minimum           :         -0.000043
Maximum           :          0.000040
Mean              :         -0.000005
Standard Deviation :          0.000031

 Multi-configuration Operator 5 Config 10:
Nominal           :          0.000000
Minimum           :         -0.000044
Maximum           :          0.000075
Mean              :         -0.000009
Standard Deviation :          0.000043

 Multi-configuration Operator 5 Config 11:
Nominal           :          0.000000
Minimum           :         -0.000040
Maximum           :          0.000035
Mean              :         -0.000018
Standard Deviation :          0.000029

 Multi-configuration Operator 5 Config 12:
Nominal           :          0.000000
Minimum           :         -0.000089
Maximum           :          0.000028
Mean              :         -0.000026
Standard Deviation :          0.000044

 Multi-configuration Operator 5 Config 13:
Nominal           :          0.000000
Minimum           :         -0.000046
Maximum           :          0.000029
Mean              :         -0.000021
Standard Deviation :          0.000028

 Multi-configuration Operator 5 Config 14:
Nominal           :          0.000000
Minimum           :         -0.000043
Maximum           :          0.000039
Mean              :         -0.000009
Standard Deviation :          0.000038

 Multi-configuration Operator 5 Config 15:
Nominal           :          0.000000
Minimum           :         -0.000046
Maximum           :          0.000071
Mean              :          0.000004
Standard Deviation :          0.000041

 Multi-configuration Operator 5 Config 16:
Nominal           :          0.000000
Minimum           :         -0.000045
Maximum           :          0.000056
Mean              :          0.000017
Standard Deviation :          0.000038

 Multi-configuration Operator 5 Config 17:
Nominal           :          0.000000
Minimum           :         -0.000031
Maximum           :          0.000052
Mean              :          0.000011
Standard Deviation :          0.000029

 Multi-configuration Operator 5 Config 18:
Nominal           :          0.000000
Minimum           :         -0.000071
Maximum           :          0.000059
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Mean                 :            0.000006
Standard Deviation : :            0.000046

 Multi-configuration Operator 5 Config 19:
Nominal              :            0.000000
Minimum              :           -0.000026
Maximum              :            0.000039
Mean                 :           -0.000001
Standard Deviation :             0.000024

 Multi-configuration Operator 7 Config 1:
Nominal              :            0.000000
Minimum              :           -0.000251
Maximum              :            0.000099
Mean                 :           -0.000084
Standard Deviation :             0.000118

 Multi-configuration Operator 7 Config 2:
Nominal              :            9.112500
Minimum              :            9.112367
Maximum              :            9.112589
Mean                 :            9.112508
Standard Deviation :             0.000089

 Multi-configuration Operator 7 Config 3:
Nominal              :            9.112500
Minimum              :            9.111957
Maximum              :            9.112855
Mean                 :            9.112541
Standard Deviation :             0.000315

 Multi-configuration Operator 7 Config 4:
Nominal              :            9.112500
Minimum              :            9.111684
Maximum              :            9.112996
Mean                 :            9.112479
Standard Deviation :             0.000488

 Multi-configuration Operator 7 Config 5:
Nominal              :            9.112500
Minimum              :            9.112058
Maximum              :            9.112780
Mean                 :            9.112370
Standard Deviation :             0.000268

 Multi-configuration Operator 7 Config 6:
Nominal              :            9.112500
Minimum              :            9.112032
Maximum              :            9.112686
Mean                 :            9.112347
Standard Deviation :             0.000231

 Multi-configuration Operator 7 Config 7:
Nominal              :            9.112500
Minimum              :            9.112008
Maximum              :            9.112862
Mean                 :            9.112438
Standard Deviation :             0.000297

 Multi-configuration Operator 7 Config 8:
Nominal              :           36.450000
Minimum              :           36.449451
Maximum              :           36.450644
Mean                 :           36.449970
Standard Deviation :             0.000407

 Multi-configuration Operator 7 Config 9:
Nominal              :         2037.905803
Minimum              :         2037.905644
Maximum              :         2037.906194
Mean                 :         2037.905856
Standard Deviation :             0.000186

 Multi-configuration Operator 7 Config 10:
Nominal              :           36.450000
Minimum              :           36.449505
Maximum              :           36.450466
Mean                 :           36.450132
Standard Deviation :             0.000349

 Multi-configuration Operator 7 Config 11:
Nominal              :           27.905803
Minimum              :           27.905058
Maximum              :           27.906470
Mean                 :           27.905934
Standard Deviation :             0.000483

 Multi-configuration Operator 7 Config 12:
Nominal              :           36.450000
Minimum              :           36.449498
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Maximum              :       36.450817
Mean                 :       36.450166
Standard Deviation :         0.000541

 Multi-configuration Operator 7 Config 13:
Nominal              :       27.905803
Minimum              :       27.905230
Maximum              :       27.906379
Mean                 :       27.905843
Standard Deviation :         0.000448

 Multi-configuration Operator 7 Config 14:
Nominal              :       36.450000
Minimum              :       36.449898
Maximum              :       36.450211
Mean                 :       36.450038
Standard Deviation :         0.000100

 Multi-configuration Operator 7 Config 15:
Nominal              :       27.905803
Minimum              :       27.905305
Maximum              :       27.905981
Mean                 :       27.905698
Standard Deviation :         0.000238

 Multi-configuration Operator 7 Config 16:
Nominal              :       36.450000
Minimum              :       36.449450
Maximum              :       36.450568
Mean                 :       36.449921
Standard Deviation :         0.000421

 Multi-configuration Operator 7 Config 17:
Nominal              :       27.905803
Minimum              :       27.905182
Maximum              :       27.906298
Mean                 :       27.905739
Standard Deviation :         0.000411

 Multi-configuration Operator 7 Config 18:
Nominal              :       36.450000
Minimum              :       36.449479
Maximum              :       36.450554
Mean                 :       36.450000
Standard Deviation :         0.000408

 Multi-configuration Operator 7 Config 19:
Nominal              :       27.905803
Minimum              :       27.905402
Maximum              :       27.906106
Mean                 :       27.905793
Standard Deviation :         0.000286


End of Run.
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