

TMSY Telescope focal tuning results

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LIGO-G1101254

TMS Telescope

- Folded off-axis parabolic telescope
- Primary – 9” diameter (228.6 mm)
 - Front telescope aperture 8.5”
- Secondary – 1.5” diameter (38.1 mm)
- Folding mirror 1 – 6” diameter
- Folding mirror 2 – 3.5” diameter (with flat mods)

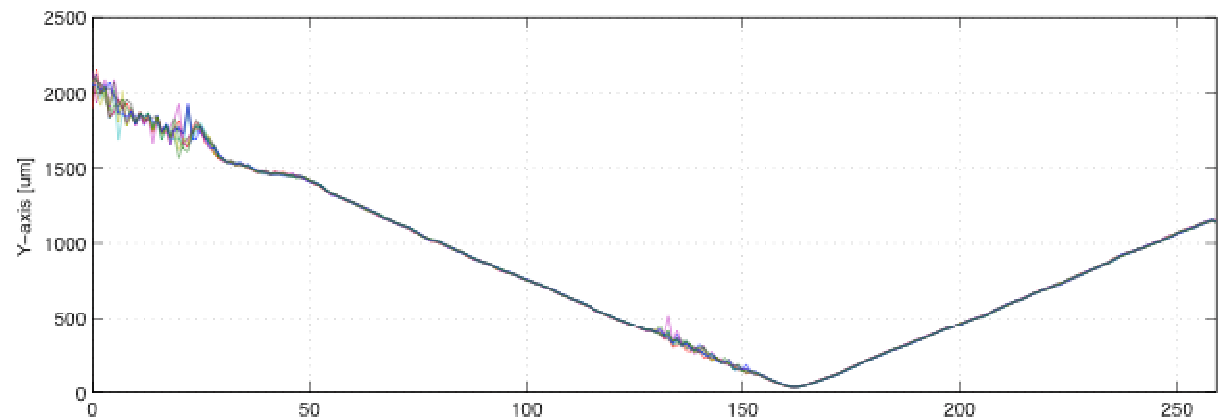
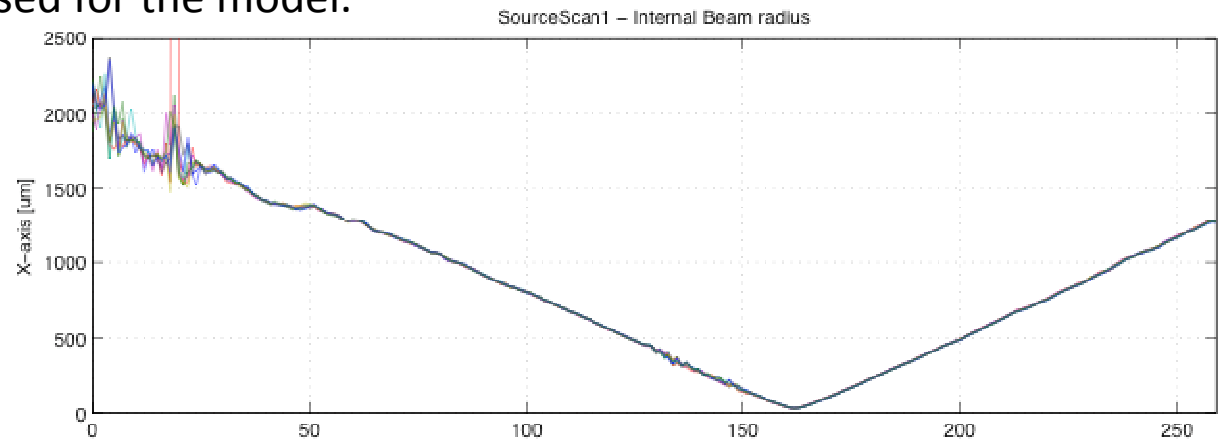
Source Parameters (MM results)

1. IR beam retro reflected using the last steering mirror on the Pedestal breadboard. MM to Retro mirror is 47cm.
2. The RED marked values are used for the model.

[EXTERNAL RESULTS]

	Min	Max	Mean	Std Dev	Dim
M≤x	0.97	0.99	0.98	0.007	-
M≤y	1.03	1.06	1.04	0.007	-
M≤r	1.00	1.02	1.01	0.006	-
2Wox	5.529	5.717	5.658	0.0637	mm
2Woy	5.728	5.879	5.821	0.0494	mm
2Wor	5.652	5.799	5.741	0.0540	mm
2Wex	5.754	5.790	5.777	0.0110	mm
2Wey	5.889	5.911	5.898	0.0066	mm
2Wer	5.826	5.843	5.838	0.0058	mm
Zox	6.911	3.317	4.813	-1.1608	m
Zoy	5.592	2.476	3.778	-1.0532	m
Zor	5.937	2.918	4.279	-1.0849	m
Zrx	23.059	24.669	24.038	0.5409	mm
Zry	23.326	24.371	23.961	0.3954	mm
Zrr	23.237	24.518	24.005	0.4566	mm
Divergence-x	0.23	0.24	0.24	0.003	mr
Divergence-y	0.24	0.25	0.24	0.002	mr
Divergence-r	0.24	0.24	0.24	0.003	mr

Astigmatism(Zoy-Zox)/Zrr -8.6 -3.0 -4.3 1.96 %
 Waist Asymmetry(2Woy/2Wox) 1.025 1.042 1.029 0.0058
 Divergence Asymmetry Thetay/Thetax 1.024 1.041 1.032 0.0056



Tele Measurement - 3 (Single Lens)

1. IR beam from the Pedestal breadboard into the Tele, retro-reflected by the 8" flat ETM, back to the breadboard into the MM.
2. The RED marked values are used in the model are return values.

[EXTERNAL RESULTS]

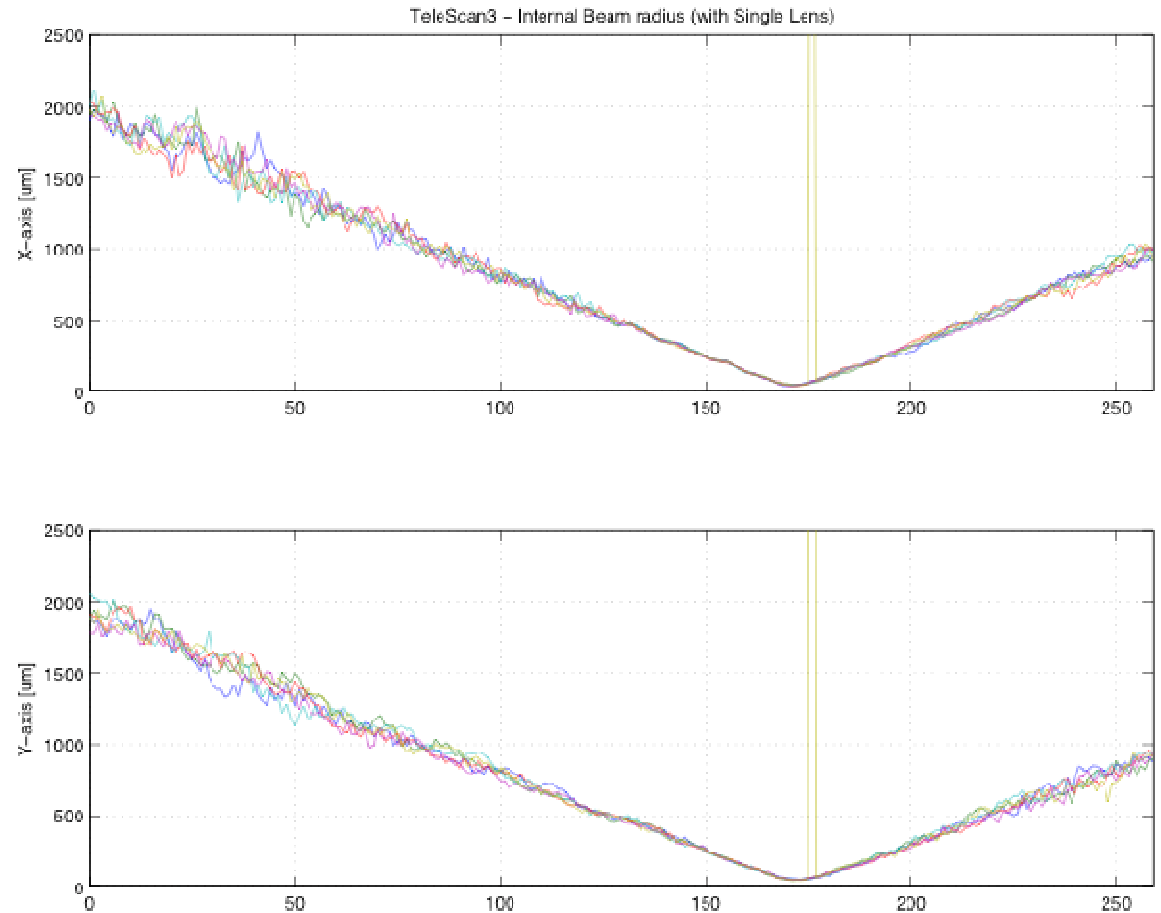
Min Max Mean Std Dev Dim

	Min	Max	Mean	Std Dev	Dim
M≤x	1.27	1.36	1.32	0.036	-
M≤y	1.25	1.39	1.32	0.046	-
M≤r	1.29	1.39	1.33	0.037	-
2Wox	0.608	0.675	0.638	0.0249	mm
2Woy	0.625	0.665	0.639	0.0163	mm
2Wor	0.632	0.665	0.645	0.0140	mm
2Wex	3.028	3.191	3.081	0.0641	mm
2Wey	2.740	3.009	2.926	0.0989	mm
2Wer	2.932	3.060	3.005	0.0475	mm
Zox	-1.048	-1.098	-1.076	-0.0163	m
Zoy	-0.992	-1.044	-1.022	-0.0198	m
Zor	-1.039	-1.055	-1.049	-0.0058	m
Zrx	0.215	0.246	0.228	0.0123	mm
Zry	0.218	0.236	0.229	0.0075	mm
Zrr	0.224	0.238	0.230	0.0051	mm
Divergence-x	2.74	2.85	2.80	0.047	mr
Divergence-y	2.69	2.87	2.79	0.064	mr
Divergence-r	2.76	2.84	2.80	0.034	mr

Astigmatism(Zoy-Zox)/Zrr 1.5 39.7 23.7 14.47 %

Waist Asymmetry(2Woy/2Wox) 0.934 1.058 1.003 0.0515

Divergence Asymmetry Thetay/Thetax 0.953 1.046 0.998 0.0316



Tele Measurement – 4 (Single Lens)

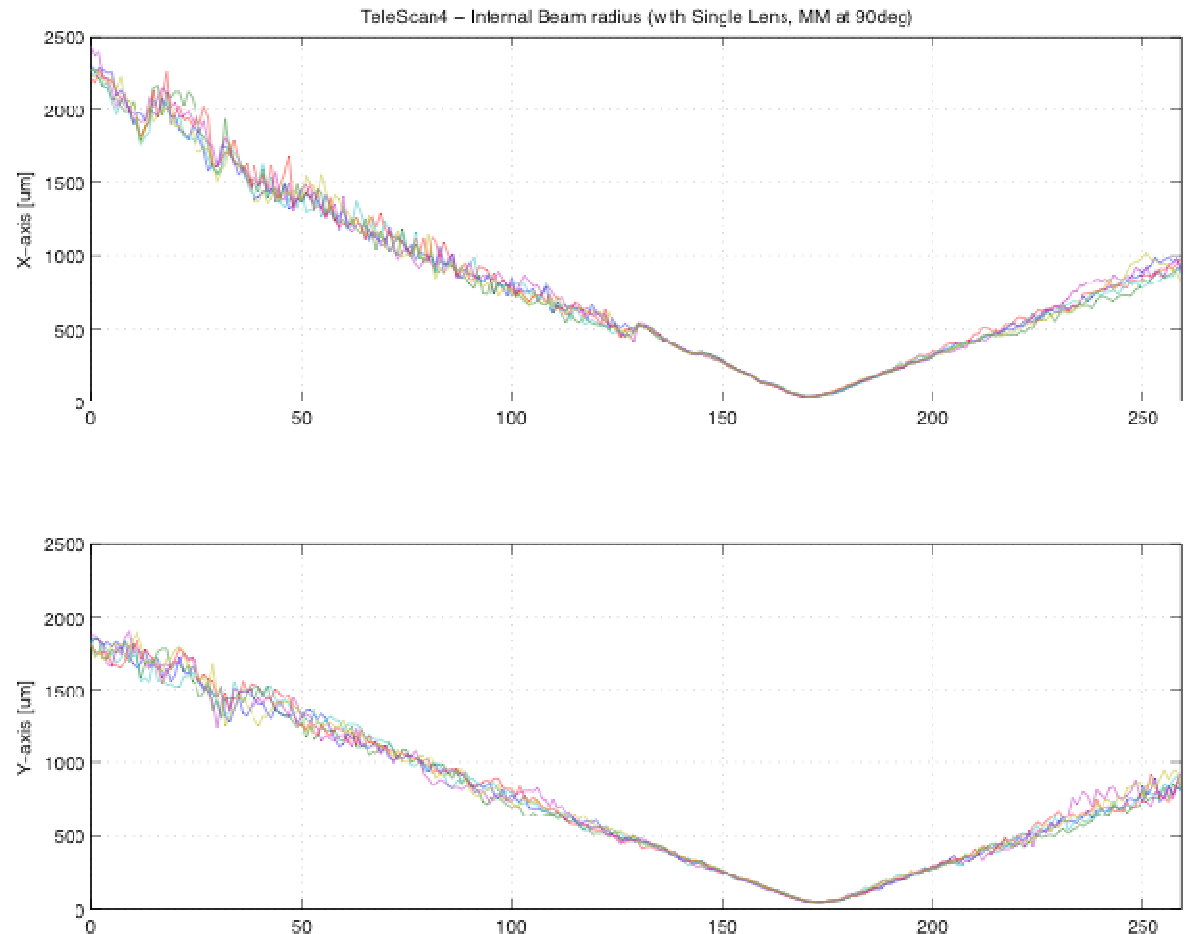
1. Same as ‘Tele Measurement – 3’, but with the ModeMaster rotated (roll) by 45 degrees, to sample the beam differently.
2. The RED marked values are used as the return values.

[EXTERNAL RESULTS]

Min Max Mean Std Dev Dim

	Min	Max	Mean	Std Dev	Dim
M≤x	1.16	1.21	1.17	0.020	-
M≤y	1.17	1.21	1.19	0.014	-
M≤r	1.21	1.25	1.23	0.015	-
2Wox	0.560	0.605	0.577	0.0163	mm
2Woy	0.575	0.594	0.585	0.0076	mm
2Wor	0.593	0.621	0.603	0.0092	mm
2Wex	3.027	3.218	3.100	0.0732	mm
2Wey	2.711	2.878	2.788	0.0600	mm
2Wer	2.882	3.053	2.949	0.0615	mm
Zox	-1.081	-1.132	-1.103	-0.0190	m
Zoy	-0.968	-1.003	-0.986	-0.0147	m
Zor	-1.025	-1.062	-1.044	-0.0147	m
Zrx	0.200	0.224	0.209	0.0083	mm
Zry	0.203	0.217	0.211	0.0051	mm
Zrr	0.213	0.228	0.218	0.0052	mm
Divergence-x	2.70	2.80	2.76	0.033	mr
Divergence-y	2.73	2.84	2.77	0.039	mr
Divergence-r	2.73	2.82	2.76	0.031	mr

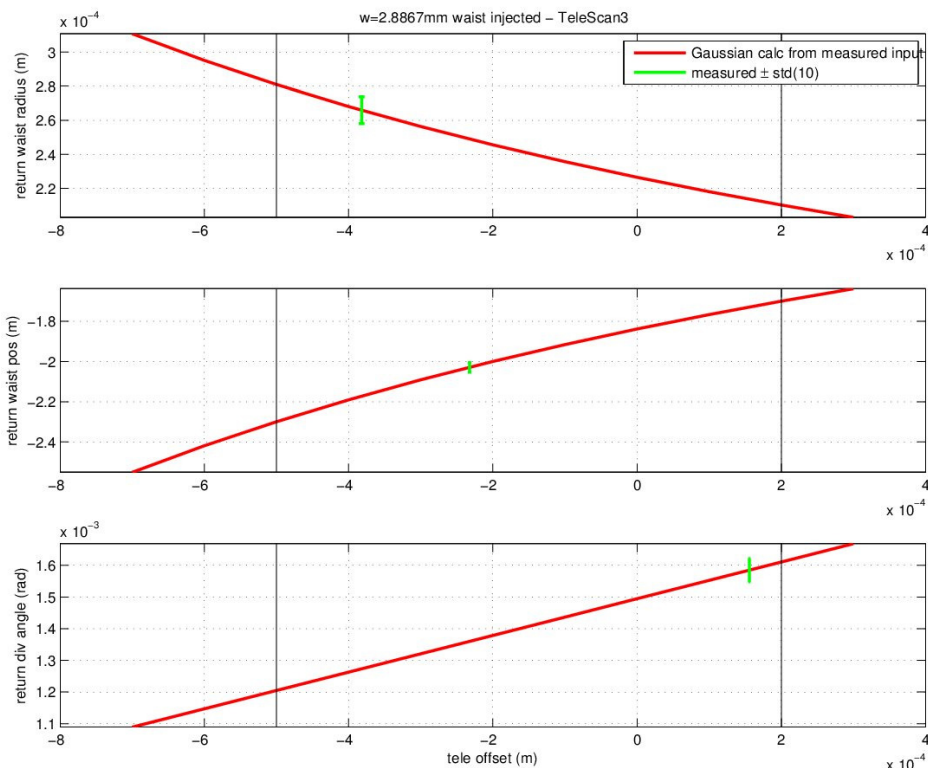
Astigmatism(Zoy-Zox)/Zrr 42.1 64.8 53.7 7.85 %
 Waist Asymmetry(2Woy/2Wox) 0.982 1.039 1.014 0.0227
 Divergence Asymmetry Thetay/Thetax 0.988 1.017 1.002 0.0128



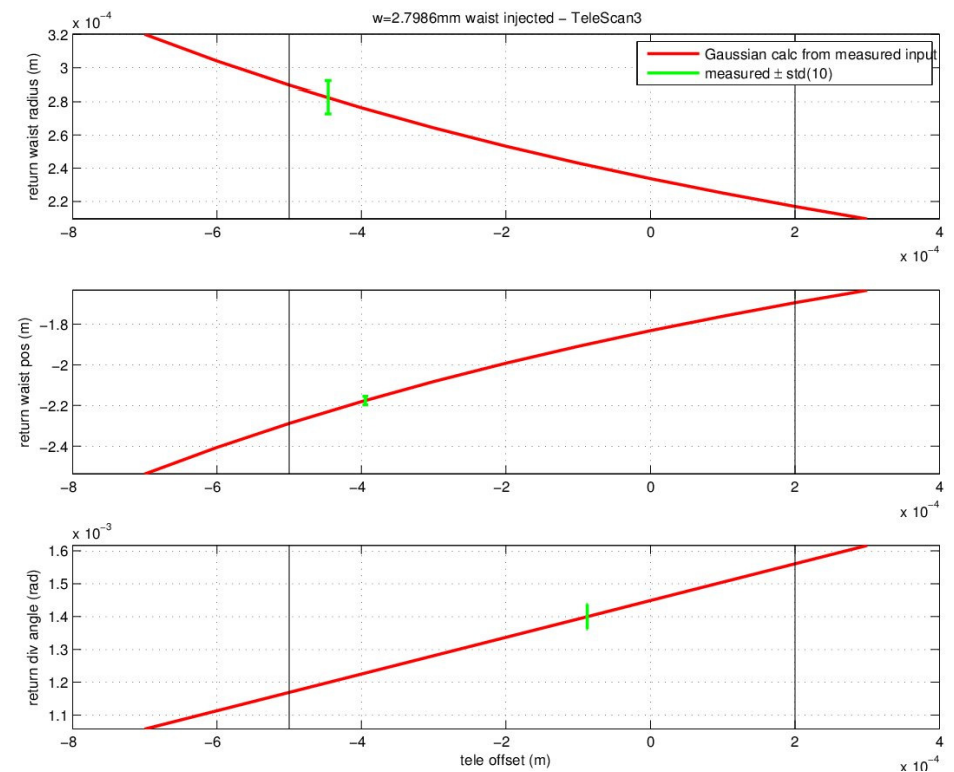
Telescope de-tuning Results (using TeleScan3 measurements)

1. Input into the TeleModel are the measured Source Parameters from the ModeMaster.
2. The GREEN markers are from the measured ModeMaster results from 'Tele Measurement 3' (they should be crossing the red calculated line).
3. The vertical lines indicate the tolerance.

X-axis



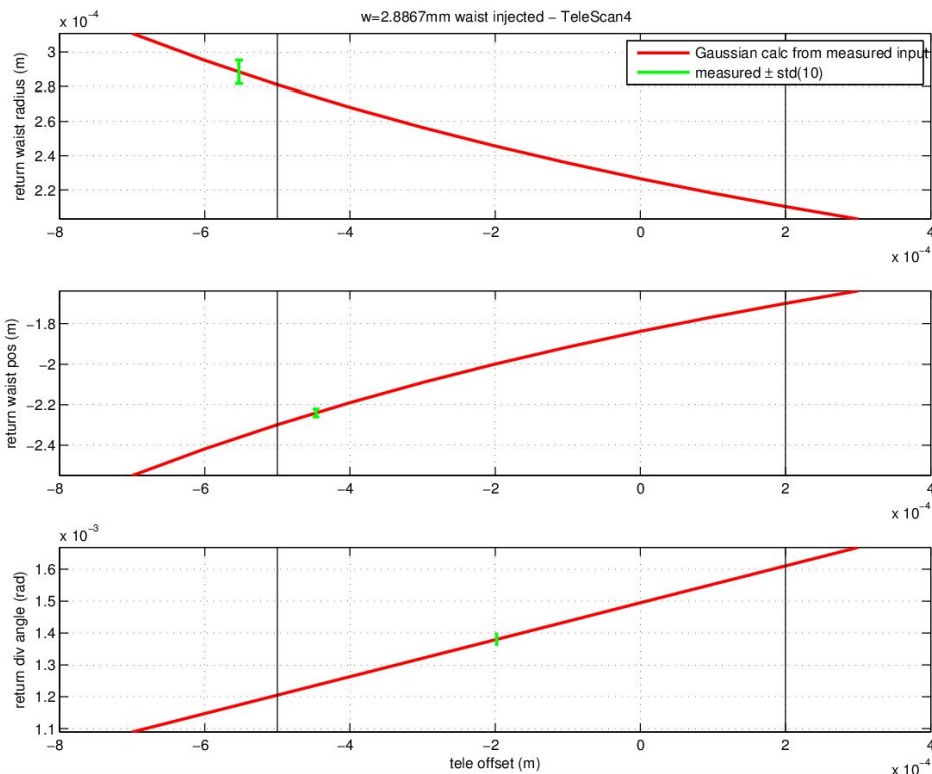
Y-axis



Telescope de-tuning Results (using TeleScan4 measurements)

1. Input into the TeleModel are the measured Source Parameters from the ModeMaster.
2. The GREEN markers are from the measured ModeMaster results from 'Tele Measurement 4' (they should be crossing the red calculated line).
3. The vertical lines indicate the tolerance.

X-axis



Y-axis

