Reproducing SRC alignment at LHO in Zemax

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aLIGO LHO Logbook

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We don't have any 'before' measurements to compare to, but at least we now have some amount of information of where we are on these optics after the big move.

I'm pretty sure that these new A2L values can only be good, so I've accepted them in both safe and observe snaps for SR2 and SRM (see first and second attachments, only 2 rows per SDF table are accepted). These A2L gains for non-test mass suspensions are not under guardian control, so this should be good enough to keep them in place.

In the table below, the Cal-Delta line reduction factor ends up really just being the ratio of the peak height in DARM before I started doing anything to that dof, and the noise level. To do a better job of measuring this, I would have had to increase my excitation amplitude, but that didn't seem important enough to do given the limited commissioning time we had.

	ampl [counts] of line at 30.5 Hz	A2L gain step size when minimizing	CAL-DELTAL line reduction factor	Final A2L gain	Inferred spot position [mm
SR2 P2L	0.1	0.1	50x	+5.5	11.1
SR2 Y2L	0.1	0.3	45x	-4.5	-9.1
SRM P2L	0.7	0.1	100x	-3.4	-6.8
SRM Y2L	0.7	0.1	50x	+3.6	7.2

I don't have time right now to think through the whole left-vs-right sign convention (it's discussed in alog 31402), but it does look like we're rather 'diagonal' in the SR now, since the signs of the spot positions are opposite for SR2 vs SRM (eg one positive P2L and one negative P2L means the beam is on opposite sides of center).

Images attached to this report

Comments related to this report

sheila.dwyer@LIGO.ORG - 16:13, Monday 29 April 2024 (77497)   Link

Anamaria, Sheila

About sign conventions:

- negative P2L gain means the spot is below the actuation node of the optic (more negative is lower)
- negative Y2L gain moves the spot to the right, if we are facing from the AR surface toward the HR surface

This means that on SR2 the spot is 11mm above the rotation center and 9 mm in the negative X direction from the center. On SRM the spot is 6.8mm below the center of rotation, and 7.2mm in the negative x direction.

https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=77443

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Reverting to before April 24th alignment using the slider valuer to see where "the bad spot is"

H1 ISC   Link

jenne.driggers@LIGO.ORG - posted 15:17, Wednesday 24 April 2024 - last comment - 12:51, Friday 26 April 2024(77388)

Can un-clip at AS port with *massive* SR3 and SR2 moves

We're still working to understand why we've got problems, but we've at least found *an* alignment of SR3 and SR2 that seems to prevent clipping at the AS port when we're centered on AS_C. To get here, I had to move SR3 and SR2 by very large amounts, much more than they ever drift. In order to more accurately see changes in power levels on the AS WFS, I had the DC centering loops engaged in this single bounce off of ITMY configuration.

In the attached plot, the bottom row is the slider values for SR2 yaw and SR3 yaw (so, in microradians). As a reminder, folks have been checking all day and there is no indication from suspension sliders, OSEMs, or where applicable oplevs, that any of our optics have moved nearly this much, so this should not have been necessary. That said, we've often found that (normally at least) we have lots of leeway clipping-wise when chosing SR3 and SR2 positions. There's no reason a priori that I can think of that would prevent us from locking with these SR2 and SR3 positions, but TJ and Camilla point out that having moved SR3 this much may make it challenging to also have the HWS paths aligned. These moves are basically my moving SR3, then moving SR2 to re-center on AS_C.

The top row of the attached plot is the centering on AS_C. So, we would like to only evaluate the amount of power on AS_A or AS_C (middle row) when the beam is centered on AS_C. It turns out that it's the low-ish part of the power curves that are the values when AS_C is centered.

I have highlighted using a blue line on the AS_A curve (middle row right side) roughly the trend. When we started (at about -42 mins) the power on AS_A when AS_C is centered is at about 1.64 units on this y-axis, and as we move SR3 and SR2 in yaw, I can increase the power on AS_A to about 1.85 units. Jennie found that a time of equivalent single bounce configuration from a week ago, we had 1.87 units on this y-axis. (This y-axis is just AS_A_NSUM * 0.001). I didn't take the time to go to the 'other side', but the trend of power on AS_A seems to show that we're into the plateau region, and at the same time the AS AIR camera looked much more normal and unclipped.

EDIT to note that part of the reason it's helpful to wait to evaluate AS_A power until AS_C was centered, is that that also gave time for the DC centering loops to catch up to my big SR3 moves. I think that the reason AS_A sometimes is higher than the blue marker curve, is that the beam was clipping on AS_A while the DC centering loops were catching up.

Images attached to this report

Comments related to this report

sheila.dwyer@LIGO.ORG - 12:51, Friday 26 April 2024 (77446)   Link

slider changes:

- SR2 P + 60 urad SR2 Y +1786 urad
- SRM P didn't move much compared to it's usual drift SRM Y - 148 urad
- SR3 P no change SR3 yaw +269 urad

https://alog.ligo-wa.caltech.edu/aLOG/index.php?callRep=77388

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Measured position on SR2, SRM

Last night and today we are in a different spot through the OFI. See Sheila's alog 78096 for the move that was made.

Overall, SR2 and SRM yaw are much closer to center in this position, however SRM pitch is farther from center. I did a quick double check of the SRM pit, and indeed this is where it wants to be.

The previous spots (with the previous SR3 alignment) are recorded in alog 77443.

	ampl [cts] of line at 31.0 Hz	A2L gain step size when minimizing	CAL-DELTAL line reduction factor	Final A2L gain	Inferred new spot position [mm]	Change from alog 77443 position
SR2 P2L	1.0	0.1	100x	-1.0	-2.0	13.1 mm other side of center
SR2 Y2L	1.0	0.1	100x	+0.3	0.6	9.7 mm other side of center
SRM P2L	2.0	0.1	50x	-5.5	-11.1	4.3 mm farther from center
SRM Y2L	2.0	0.1	30x	+1.85	3.7	3.5 mm closer to center

Attached are the saved SDF diffs for both Observe and Safe snap files.
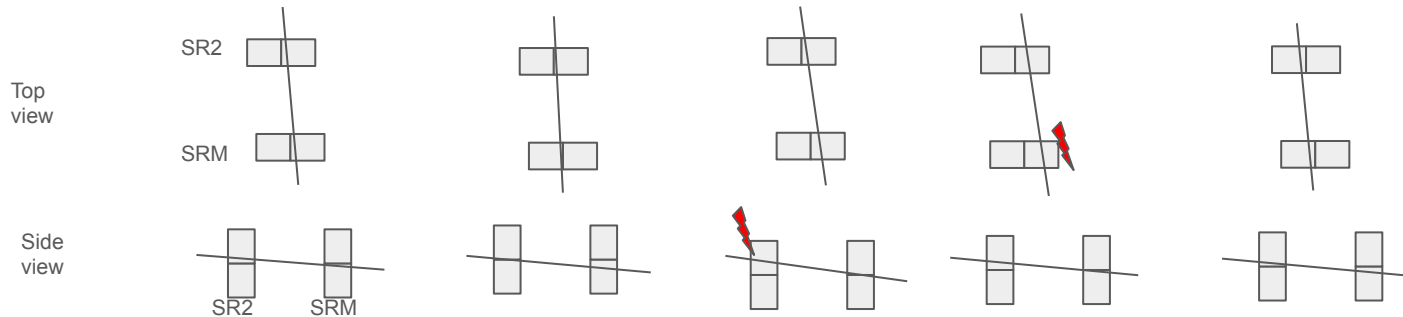
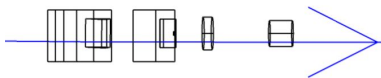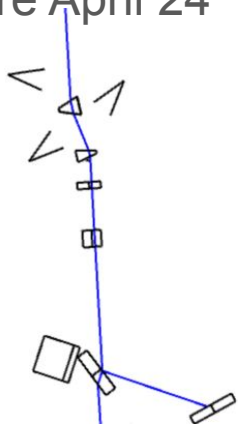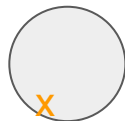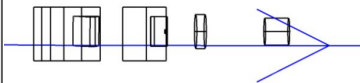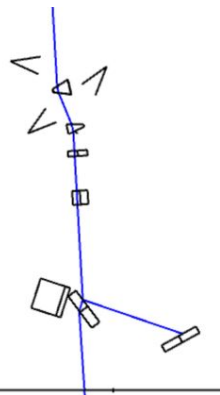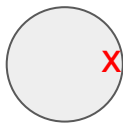|	Pre April 24, mm X	May 07 -P move, mm X	May 07 +P move, mm X	May 07 -Y move, mm X	Post April 24, +Y move, mm X
SR2 v	11.1 (high)	2.0	25	12	11.1
SR2 h	2 (+X)	0.6 (+X)	3.0 (+X)	22 (+X)	9.1 (-X)
SRM v	-6.2 (low)	-11.1	1.6	-3.4	-6.8
SRM h	3.5 (+X)	3.7 (-X)	-13 (+X)	-25 (+X)	7.2 (-X)

Spot measured

Spot measured

OFI aperture if you look from HAM6

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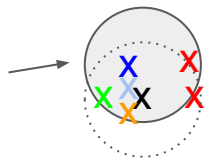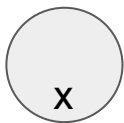
Pre April 24

-P

+P
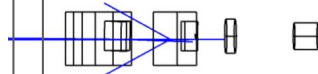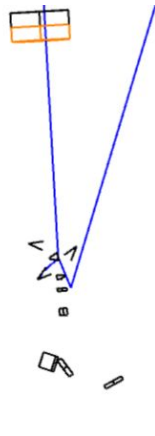
-Y
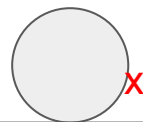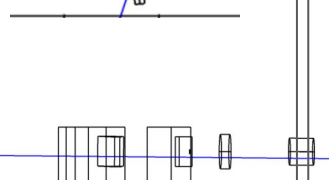
Post April 24
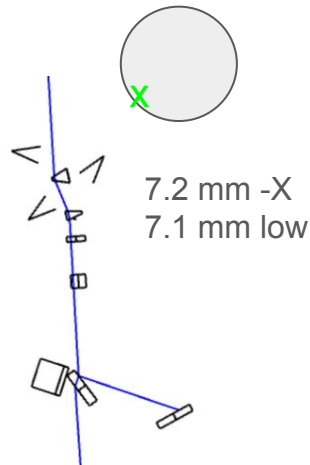
7.2 mm -X
7.1 mm low
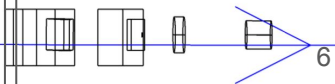
OFI aperture
if you look
from HAM6

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Proposed spot #1
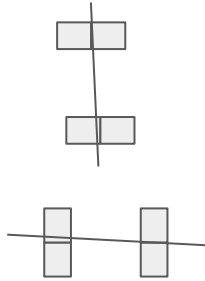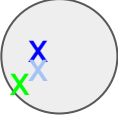
SR3 pitch -292 urad (osem)
SR2 pitch +800 urad (osem)

SR3 yaw -592 (osem)
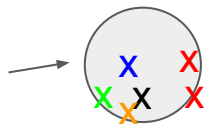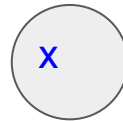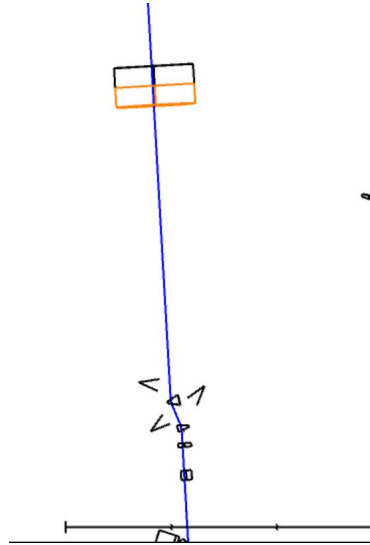SR2 yaw +34 (osem)

	Pre April 24	May 07 10:39	May 07 11:03	May 07 11:39	Post April 24
	Start	-P move	+P move	-Y move	+Y move
SR3 P slider value	438	81.9	798	438	438
SR3 Y slider value	-148.8	-148.8	-148.8	-686.3	120
SR3 P M1 osem	-290	-674	112	-263	-292
SR3 Y M1 osem	-616	-592	-640	-1018	-405
SR2 P M1 osem	-570	3040	-1955	503	596
SR2 Y M1 osem	11	34	28	-2164	1160

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Alternatives to the blue X spot

	The blue X, mm X	The blue X, mm X	The blue X, mm X	Light blue X, mm X	Light blue X, mm X	Light blue X, mm X	Post April 24, +Y move, mm X
SR2 v	11 (high)	15 (high)	20(high)	20(high)	15 (high)	11 (high)	11.1
SR2 h	0.6 (+X)	0.6 (+X)	0.6 (+X)	0.6 (+X)	0.6 (+X)	0.6 (+X)	9.1 (-X)
SRM v	0.2 (high)	0.2 (high)	0.2 (high)	-4 (low)	-4 (low)	-4(low)	-6.8
SRM h	3.7 (-X)	3.7 (-X)	3.7 (-X)	3.7 (-X)	3.7 (-X)	3.7 (-X)	7.2 (-X)

OFI

SR3 pitch -292 SR2 pitch +800	SR3 pitch -170 SR2 pitch -15	SR3 pitch -27 SR2 pitch -968	SR3 pitch -27 SR2 pitch -1090	SR3 pitch -170 SR2 pitch -140	SR3 pitch -292 SR2 pitch +680	SR3 pitch -292 SR2 pitch +596
SR3 yaw -592 SR2 yaw +34	SR3 yaw -592 SR2 yaw +34	SR3 yaw -592 SR2 yaw +34	SR3 yaw -592 SR2 yaw +34	SR3 yaw -592 SR2 yaw +34	SR3 yaw -592 SR2 yaw +34	SR3 yaw -405 SR2 yaw -1160

thomas.shaffer@LIGO.ORG - 16:30, Wednesday 08 May 2024 (77719)

Here are some trends with SR2 and SR3 M1 osems during these moves.

EDIT: Added a revamped table with the SR2 and SR3 OSEM changes. The deltas from these could all be values.

	Pre April 24	May 07 10:39	May 07 11:03	May 07 11:39	Post April 24
	Start	-P move	+P move	-Y move	+Y move
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SR3 Y slider value	-148.8	-148.8	-148.8	-686.3	120
SR3 P M1 osem	-290	-674	112	-263	-292
SR3 Y M1 osem	-616	-592	-640	-1018	-405
SR2 P M1 osem	-570	3040	-1955	503	596
SR2 Y M1 osem	11	34	28	-2164	1160

Images attached to this comment

A possible typo in the aLog? Pitch should be the same for post and pre april 24 alignement Assumed +570 for this work