

LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY
- LIGO -
CALIFORNIA INSTITUTE OF TECHNOLOGY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

| | | | |
|------------------------------------|---------------------------|---------------|-------------|
| | LIGO-T952013 -00-D | | 5/16/95 |
| <i>Document Type</i> | <i>Doc Number</i> | <i>Group-</i> | <i>Date</i> |
| Alignment Design Interfaces | | | |
| <i>Title</i> | | | |
| David Shoemaker | | | |
| <i>Author(s)</i> | | | |

DRAFT

*This is an internal working note
of the LIGO Project*

Massachusetts Institute of Technology
LIGO Project - MS 20B145
Cambridge, MA 02139
Phone 617 253 4824
Fax 617 253 7014
E-mail: info@ligo.mit.edu
WWW: <http://www.ligo.caltech.edu>

Table 1: Detector Alignment System (ASC) Interfaces

| | | |
|---|---------------------------|--|
| | | |
| Top Level ASC (organizational structure for the ASC) | | |
| Requirements flowdown TO ASC | Source | |
| GW sensitivity | SysInt | |
| max shotnoise degrad. due to misalign | SYS | |
| max degrad. due to beam jitter+ misalign | SYS | |
| align req. for MC and IO pointing | SYS | |
| Environmental inputs, other subsystem requirements impacting ASC | | |
| length sensing configuration | SysInt | |
| commissioning scenario | SYS | |
| operations scenario | SYS | |
| foundation slab distortions, oper. | FAC | |
| foundation slab distortions, non-oper. | FAC | |
| stack angular drift | SEI | |
| stack mode Qs and frequencies | SEI | |
| optic axis motion of susp. masses | SUS | |
| tilt, twist seismic motion | SUS | |
| transf. funct. of angular susp. actu. | SUS | |
| deviation from ideal operating point | LSC | |
| curvature mismatch of arms | COC or SYS | |
| power scattered out of TEM ₀₀ | COC or SYS | |
| Refl., uniformity of AR coatings | COC or SYS | |
| reflectivity of AR at Optlev lambda | COC or SYS | |
| Requirements impacted by ASC | impacted subsystem | |
| beam jitter at input to interf. | IOO | |
| suspension controller dynamic range | SUS | |

Table 1: Detector Alignment System (ASC) Interfaces

| | | |
|--|---------|------------------|
| | | |
| stack drift compensation: | | |
| degrees of freedom | SEI | |
| resolution | SEI | |
| noise in operation | SEI | |
| dynamic range | SEI | |
| acceleration in operation | SEI | |
| Electrical interfaces for all of the subsystems; repeated below for each individual subsystem | | |
| laser intensity control | to | PSL |
| input beam ready | from | IOO, PSL |
| input beam intensity | from | IOO |
| input beam modulations | from | IOO |
| coarse acquisition alignment achieved | to | LSC |
| losing coarse acquisition alignment | to | LSC |
| length error, control signals | from | LSC |
| length servos locked | from | LSC |
| length servos lock broken | from | LSC |
| misalign as part of lock sequence | from | LSC |
| losing operational alignment | to | LSC |
| losing optical lever control | to | SUS, PSL |
| angular control signals | to | SUS, SEI, IOO |
| translational control signals | to | SEI |
| suspension sensor signals | from | SUS |
| monitor photodiode signals | from | COC |
| gains, states, status, power | to/from | CDS backbone |
| | | |

Table 1: Detector Alignment System (ASC) Interfaces

| | | |
|---|---------|------------------|
| | | |
| Initial Alignment (mixed manual/automated model) | | |
| * Mechanical interfaces: demands on other systems | | |
| movable targets in vacuum | VEQ | |
| viewports | VEQ | |
| monuments | FAC | |
| * Optical interfaces (where the Green beam is contacted) | | |
| movable targets | SYS | |
| beam position sensors | SYS | |
| * Electrical interfaces | | |
| laser intensity control | to | PSL |
| input beam ready | from | IOO, PSL |
| input beam intensity | from | IOO |
| input beam modulations | from | IOO |
| coarse acquisition alignment achieved | to | LSC |
| losing coarse acquisition alignment | to | LSC |
| length servos lock broken | from | LSC |
| misalign as part of lock sequence | from | LSC |
| losing optical lever control | to | SUS, PSL |
| angular control signals | to | SUS, SEI, IOO |
| translational control signals | to | SEI |
| suspension sensor signals | from | SUS |
| monitor photodiode signals | from | COC |
| gains, states, status, power | to/from | CDS backbone |
| | | |
| | | |
| | | |

Table 1: Detector Alignment System (ASC) Interfaces

| | | |
|---|-----------------------|------------------|
| | | |
| Optical Lever (~50m lever model) | | |
| * Mechanical interfaces: demands on other systems | | |
| monuments | FAC | |
| tables and stay-clear zones | FAC | |
| viewports | VEQ | |
| Optlev beam space (stay-clear in vac.) | SYS, COC, SUS, SEI | |
| relay mirrors in-vacuum | VEQ, SUS, SEI | |
| suspension actuators | SUS | |
| * Mechanical interfaces: | | |
| inaccessible paths (stay-clear in vac). SYS, COC, SUS, SEI | | |
| * Optical interfaces: | | |
| no direct interfaces with green beam (stay clear zones) | | |
| TM reflectivity at Optlev wavelength | from | COC |
| * Electrical interfaces: | | |
| coarse acquisition alignment achieved | to | LSC |
| losing coarse acquisition alignment | to | LSC |
| length servos locked | from | LSC |
| length servos lock broken | from | LSC |
| losing operational alignment | to | LSC |
| losing optical lever control | to | SUS, PSL |
| angular control signals | to | SUS, SEI, IOO |
| suspension sensor signals | from | SUS |
| gains, states, status, power | to/from | CDS backbone |

Table 1: Detector Alignment System (ASC) Interfaces

| | | |
|--|------------------|------------------|
| | | |
| Wavefront sensor | | |
| * Mechanical interfaces: demands on other systems | | |
| optical tables and supports | FAC | |
| viewports | FAC | |
| relay mirrors | FAC, SEI, SUS | |
| shared table space | LSC | |
| * Optical interfaces | | |
| green beam at sampled ports | COC, LSC | |
| * Electrical interfaces: | | |
| input beam intensity | from | IOO |
| input beam modulations | from | IOO |
| length error, control signals | from | LSC |
| length servos locked | from | LSC |
| length servos lock broken | from | LSC |
| losing operational alignment | to | LSC |
| losing optical lever control | to | SUS, PSL |
| angular control signals | to | SUS, SEI, IOO |
| translational control signals | to | SEI |
| suspension sensor signals | from | SUS |
| monitor photodiode signals | from | COC |
| gains, states, status, power | to/from | CDS backbone |
| | | |
| | | |
| | | |
| | | |

Table 1: Detector Alignment System (ASC) Interfaces

| | | |
|--|---------|-----------------|
| | | |
| Centering (periodic dither model) | | |
| * Physical interfaces | | |
| none | | |
| * Optical interfaces | | |
| none | | |
| * Electrical interfaces: | | |
| input beam intensity | from | IOO |
| input beam modulations | from | IOO |
| length error, control signals | from | LSC |
| length servos locked | from | LSC |
| length servos lock broken | from | LSC |
| translational control signals | to | SEI |
| suspension sensor signals | from | SUS |
| monitor photodiode signals | from | COC |
| gains, states, status, power | to/from | CDS backbone |