

Using Finesse for Simulations of Light Behavior in Optical Cavities Code Packet

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Abstract

This packet contains the code for every scenario mentioned in the presentation. It also includes a reference for all of the commands used in the individual simulations.

1 Getting Started

For simulations at home or in the classroom, it is possible to download *Finesse* as it is free software. Versions for all operating systems can be found at <http://gwoptics.org/finesse>.

A Code Reference

Comments:

```
"commented out code  
%commented out code  
#commented out code
```

```
/*  
commented  
out  
code  
*/
```

```
m name R T phi node1 node2  
m1 name T Loss phi node1 node2  
m2 name R Loss phi node1 node2
```

```
s name L [n] node1 node2
```

```
bs name R T phi alpha node1 node2 node3 node4  
bs1 name T Loss phi alpha node1 node2 node3 node4
```

```

bs2 name R Loss phi alpha node1 node2 node3 node4

l name P f [phase] node
pd name node

attr component (Rc[x/y] value) (x/ybeta value)

gauss* name component node q
cav name component1 node1 component2 node2

trace n
startnode node
maxtem order
phase number

xaxis component parameter lin/log min max steps

yaxis [lin/log] abs/deg

put component parameter $variable

pause

```

B A Simple Cavity

```

l l1 1 0 n1
m m1 .99 .01 0 n1 n2
s s1 40 n2 n3
m m2 .99 .01 0 n3 n4
pd loss n1
pd circulating n3
pd OUTPUT n4
xaxis l1 f lin 1.00017e+10 1.0002e+10 1000

```

C Original Code

```

l i1 1.3 0. n7
s s1 1.0 n7 n6

m prm0 0.00005 .99995 0 n6 n6i
s prm_sub .00635 1.45 n6i n5i
m prm1 0.999 .001 0 n5i n5

s s3 0.20 n5 n1

bs bs1 0.5 0.499999 0. 45. n1 n2 n2i n1i

```

```

s subEast 0.0145 1.45 n2i n3i
s subSouth 0.0145 1.45 n1i n4i
bs2 bs2e 1e-4 1.4e-6 0. 45. n3 n3j n3i n3k
bs2 bs2s 1e-4 1.4e-6 0. 45. n4k n4 n4j n4i

s s4 39.800 n2 n8

m1 em1 .000008 .001 0 n8 n8i
attr em1 Rc 75.
s em1_sub 12.7m 1.45 n8i n8ri
m em1r 0.00005 .99995 0 n8ri n8r

# East mirror
m1 em2 .000008 .001 0 n9 n9i
attr em2 Rc 75.
s em2_sub 12.7m 1.45 n9i n9ri
m em2r 0.00005 .99995 0 n9ri n9r

s s6 0.5 n4 nout

pd asp n4
pd PRMout n5
pd northOut n8r

maxtem 4
phase 2

gauss* gl il n7 -1 37.4 # q=z+izr
startnode n7
trace 10

xaxis prml phi lin -1 1 1000 # x-axis: position of prm
yaxis log abs

```

D Changes - xaxis Commands

```

#####
# The following commands
# are used for tuning the DARM.
# One mirror is increased, the other
# is decreased.
#####
xaxis* em1 phi lin -1 1 10000
set tuneNorth em1 phi
func tuneEast = 0-$tuneNorth
noplots tuneEast
put em2 phi $tuneEast

#####

```

```

# The following commands are used
# for changing the power losses in
# the end mirrors.
#####
xaxis em1 T lin 0 0.001 1000
put em2 T $x1

#####
# The following commands are used
# for changing the xbeta (laser
# angular misalignment in the x
# direction).
#####
xaxis* em1 xbeta lin -10e-06 10e-06 10000
put em2 xbeta $x1

#####
# The following commands change the
# radii of curvature of the end mirrors
# this is used to test Gaussian Radius of
# curvature
#####
xaxis em1 Rcx lin 65 85 1000
put em1 Rcy $x1
put em2 Rcx $x1
put em2 Rcy $x1

#####
# The following commands are used to
# change the Rayleigh range of the beam
#####
xaxis gl zrx lin 20 50 1000
put gl zry $x1

#####
# The following commands are used to
# change the z-length of the beam
#####
xaxis gl zx lin -1.75 -0.25 1000
put gl zy $x1

#####
# The following are used for changing the
# individual micropositions of the end
# mirrors. Only one of these can be used
# at a time.
#####
xaxis em1 phi lin -10 10 1000
xaxis em2 phi lin -1 1 1000

```