Iron Bending

DCOPS Readout during MTCC
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V1.1
Outline

● Layout
● Hardware Status
● DCOPS readout
● Results
Review of Layout

- The DCOPS laser system as implemented in the MTCC consisted of:
  - 1) 6 half SLM lines at the ME+1 position
  - 2) 3 full SLM lines at each of the ME+2, ME+3, and ME+4 positions
  - 6 partial transfer lines, consisting of 1 laser and DCOPS at the ME+4/3/2/1 and YE+1/+0/-1/-1 positions
Hardware status

• Some DCOPS filters are not quite appropriate, and the signal is weak

• We did not have the opportunity to realign all the lasers precisely, and most of them go off axis sooner or later. Samir et al did a lot of hard work getting them reinstalled and aligned, but he didn't have enough time.

• Two lasers seem not to be working at all (one is broken)
DCOPS Readout

- The Evginny-inspired java-based readout system turned out to be two orders of magnitude too slow, thanks to a quirk in the java implementation on Linux and the fact that the on-board DCOPS fitting was not appropriate.

- The existing system uses two java-based tools for controlling the lasers and one for communicating with DIM.
Why simple averaging doesn't work
The existing system uses two program streams.
The DIM server that creates sentinel files to control the operation of the main readout system. It could in principle be used to monitor the status of the main readout system.
The main readout system is a bash script which reads a configuration file and generates and executes auxiliary scripts to control the lasers, read the DCOPS, and write the information to the database.
grandloop.sh

- Reads (and rereads) control.list, which contains the database information to define which SLM/Transfer lines to read and what they contain and what their database indices are.
- Periodically turns off all the lasers and reads the background levels for each DCOPS, which information is stored in the DCOPS for background subtraction later.
grandloop.sh 2

- Turns off all lasers and processes the information for a single Line (SLM or Transfer)
- Loop over the lasers for a Line, turning on each in turn
- Loop over the DCOPS in a Line, telling the terminal server to tell the DCOPS to read (4 sec) and return the background-subtracted results in hex format (5 sec); at which point it is pre-processed and handed to a C++ routine running under root
grandloop.sh 3

- The output of the C++ routine consists of fit values and an error word: This is formatted into an SQL command
- When done with the DCOPS loop, the command file containing the SQL commands is executed to store the info in the development database and the laser is turned off
Known problems

- The development database is used instead of the online database.
- If you tinker with the sentinel files by hand, the java DIM server gets confused and the program is no longer controllable remotely.
- We don't have a DCOPS account we can all reference.
Unknowns

- How often do we have to redo the background reading?
- Heavy network traffic in the online subnet can DOS the readout by making the readout time exceed the timeout limit. How often will this happen?
- Why are there gaps in the readout?
Results

- The DCOPS readout runs continuously in a loop taking a little over an hour, so if the magnetic field changes during that time the results are likely to be inconsistent.
- We have data from several magnet ramp-ups, and are able to look at displacement vs time and displacement vs current.
DCOPS #71 (ME+3/SLM2) Laser 27

Seconds since 1-Aug

DCOPS 71 (ME+3/SLM2) Laser 27
Interpretation

• As you can see from the previous slide, the center of the laser peak does not return to quite the same place once the magnetic field turns off.

• We also see some long-term drifts, which may be relaxation of the iron.
Transfer lines

Field off

Field on, disks bend and laser changes direction
• In the following slides, the laser (at ME+4) is nearest the upper left. As you go from left to right or down a row you get farther from the laser.

• Plots are omitted if there was no data in that plot. These plots are for stations ME+4/ME+3, ME+2, then ME+1/YE+1/YE+0, then YE-0 and YE-1

• The TP2 stations are less constrained than the TP5 stations

• The horizontal axis is magnet current in amps

• Positions for CCD2 and CCD4 are plotted
Distance along CCD2/4 vs current: TRANSFER-2 L03
Distance along CCD2/4 vs current: TRANSFER-5 L09
Transfer line

- Using the data for ME+3 on Transfer Line 5, I estimate that the laser's mount was bent backward by about 1.4 mradian. Using ME+1 the estimate is 1.1 mradian.
- Using the data for ME+3 on Transfer Line 2, I get about 2.2 mradian bending angle. Using ME+1 this is only .9 mradian, however.
ME+2/SLM2 Laser 22

Z(mm) vs current: ME+2/SLM2 L22
ME+2/SLM2 Laser 22

- There are 10 DCOPS in this laser line. The one nearest the laser is the lower left, and they lie farther from the laser the higher the row is and the farther to the left.
- The laser goes offscale on the upper left DCOPS before the magnet reaches full current.
- The near side of the disk does not bend much relative to the laser line: there's a jump as the laser reaches the other side.
- The deflection at the center must be O(15mm)
HSLM1

Z(mm) vs. current: ME+1/SLM1 L13
HSLM1

- The laser is nearest the upper left DCOPS, and the DCOPS are farther from the laser as you go right and down.
- The deviation is only .5 mm in the farthest DCOPS at 3.7 Tesla. The disk must be bending roughly in the shape of a cone.
ME+3/SLM2 Laser 28

Z(mm) vs current: ME+2/SLM2 L28
ME+3/SLM2 Laser 28

• In this the laser is nearest the bottom left, at TP5

• I do not understand exactly what is going on with the “near side” DCOPS. Station 5 is more constrained than the rest, so perhaps the laser moves less at first, but unless there is some threshold for “give” in the disk mount at high enough force I don't understand the reversal
More plots