

# IFO commissioning and Modeling Call

July 17, 2023 T2300280

## Agenda

- Introduction and goals for this set of calls
- Call for interest to contribute
- Cadence and offline communication (chat?)
- First questions to be answered
- A.O.B.

## Actions from the meeting

- Create a git repository to store all minutes, codes, projects and questions to be answered as issue
- Create a mattermost chat for offline communication
- Send an summary to the ifo-modeling and ISC lists, specifying that the ifo-modeling list is the main list for this group
- Meet again in two weeks
- Goals for the next meeting: create and run basic Finesse models of both LHO and LLO to compute: power at all ports, recycling gain, DARM optical gain and cavity pole

## Minutes

- **Introduction and goals for this set of calls**

Goal to talk about O4 commissioning, and maybe extend in to the design of O5. But, no chat about A#, CE, etc.

Meant to be \*collaborative.\* If a paper comes out of it fine, but it's no one person's thing.

Want for collaborators to travel to the sites. Want collaborators to take the initiative and stay engaged.

- **Call for interest to contribute**

Anamaria shares some slides.

LVK wide

Separate people for H1 and L1, because there are different pressing needs for the IFO.

Elenna Capote to Everyone (Jul 17, 2023, 3:09 PM)

Separate modeling is good- how current are details such as distances in the various telescopes at LLO? I just went through the effort of loading these details into the LHO model in finesse, and I imagine we have to do something similar for LLO, especially to get the angular controls right. A better summary of this question: can people at the sites make sure the diagrams of various systems are as up-to-date as possible? This data will be very helpful for getting accurate modeling

Don't care which software is used.

(Other things were mentioned on her slides, maybe she'll post that slide to the DCC.)

- **Cadence and offline communication (chat?)**

Needs to be face-paced and we need offsite folks to be engaged regularly.

Craig Cahillane: "Remote commissioning channel" is a space that we've tried to use to educate new volunteers.

Heard! Just saying it out loud – even though your suggestion comes from the name of channel, this is not about remote commissioning, more focused on \*modelling.\*

Daniel Brown to Everyone (Jul 17, 2023, 3:17 PM)

On a teaching side, we're also trying to run more simulation/modelling workshops now too, we just had one in Nikhef (teaching Virgo commissioners various modelling tools) and we've currently got another workshop going this week in Adelaide to work on thermal modelling issues

- **"First" questions to be answered**

- ❖ (from AE's slide) Reproduce measurement at variety of PSL input power levels / TCS settings by model
  - power in ports
  - Power recycling gain
  - Optical gain and coupled cavity pole
  - Single bounce measurements

[AB]: Could we create a very precise list here? Defining exactly what we mean by each term - e.g. Optical gain vs  $\kappa_C$ . Channels which are proxies for different effects can be confusing when compared to models.

ACTION: Gabriele takes on the action to start a list of activities.

Kissel: You to Everyone (Jul 17, 2023, 3:19 PM)

Please \*don't\* use a google doc for this list. Trello maybe? Some place where we can do a KanBan list and keep track of things

Daniel Brown to Everyone (Jul 17, 2023, 3:19 PM)

That or git issues?

git issues can be easily tied to code which is useful

Gabriele agrees that git is good enough, since we hope to be developing modeling code

Finesse seems to be the most common modeling software used at the moment.

ACTION (to be done by two weeks from now, July 31): Collect a finesse model for H1 and L1, and update it to have the best parameters – and produce the following observables:

- Power at ports
- Power recycling gains
- DARM transfer function (optical gain and cavity pole at least; SRC detuning is icing on the cake)
- Cavity lengths, mirror curvatures
- Mirror transmissions
- Losses

Daniel Brown to Everyone (Jul 17, 2023, 3:30 PM)

We've got a python package already we're aiming to collect these finesse models in too:

<https://git.ligo.org/finesse/finesse-ligo>

Elenna Capote to Everyone (Jul 17, 2023, 3:35 PM)

but IFOSIM has a great tutorial for anyone looking to start using finesse

<https://git.ligo.org/IFOSim/ifosimworkshop2023>

### **There's a LONG list of other things to model**

But, for now we start with the above, in order to start small and gain momentum.

But, in here're folks core-dumps in an unorganized / unprioritized / incomplete list:

- ❖ Understanding the thermal transients in the IFO
  - Change in mode matching
  - Sideband levels
  - SRCL detuning
- ❖ Understanding the OMC mode matching
  - Single bounce vs. full IFO
- ❖ Understanding squeezer mode matching
- ❖ Understanding the low frequency DARM sensing function
  - SRCL detuning
  - Cross-coupling to ASC

- Incorporating suspension dynamics (real stiffness of SUS, rather than assuming a free test mass)
- ❖ ASC plant changes with power, and other odd features.
  - Double peak features
  - RHP poles
  - Optical gain/gouy phase changes in power/TCS changes
- ❖ Replicating contrast defect reduction with RH tuning at LHO
- ❖ Frequency noise coupling
  - Contrast defect correlation with HF coupling?
- ❖ SRCL dither arm power measurement discrepancies
- ❖ Also, instead of Modeling reproducing IFO performance, can we try the other way and suggest IFO changes based on Modeling predictions (even if they make things worse - just to temporarily test the fidelity of a model).

**Use this mailing list to coordinate over email:** [ifosim@ligo.org](mailto:ifosim@ligo.org)

**Need to find a person on site, and a person who's out in the LVK at large to coordinate activities**

L1? Anamaria agrees to be the point of contact.

H1? To be determined

LVK at large: Dan Brown agrees.

Updates (like slides or tech notes) should be exported and put in the DCC (\*not\* left in a random google doc / slides, \*not\* on a git lab wiki pages)

**Folks who're interested in actually doing work:**

Dan Brown  
 Huy Tuong Cao  
 Jennie Wright  
 Craig Cahillane  
 Elenna Capote  
 Louis Dartez  
 Jacques Ding  
 Carl Blair  
 Shreejit Jadhav

- A.O.B.

## Attendance

Aaron Jones

Jeff Kissel  
Gabriele Vajente  
Bram Slagmolen  
Hiroaki Yamamoto  
Haoyu Wang  
Jameson Rollins  
Louis Dartez  
Craig Cahillane  
Keita Kawabe  
Garilynn Billingsley  
Anamaria Effler  
Aidan Brooks  
Sheila Dwyer  
Jacques Ding  
Karla Ramirez  
Valera Frolov  
Georgia Mansell  
Adam Mullavey  
Keiko Kokeyama  
Wenxuan Jia  
Daniel Brown  
Elenna Capote  
Jennie Wright  
Kevin Kuns  
Yuta Michimura