Introduction to the Control System Working Group (CSWG)

Brett Shapiro

For the CSWG

29 August 2016 – Glasgow, Scotland

Control System Working Group (CSWG)

- Chair: Dennis Coyne.
- Deputy co-chairs: Brett Shapiro, Robert Ward.
- Group charter at M1600033

CSWG Role

The CSWG is unique among working groups

- Feedback control "is pervasive within, and enabling to, the work of many of the other instrument science working groups."

- It's relevance is demonstrated through application to the other working groups.

CSWG Role

- Support of other groups
  - training references: G1600726, G1601640, G1601417, G1600525, G1400557, G1400102
  - support of particular problem areas
  - reviews on the applicability of new controls techniques
- Research into advanced techniques
  - Machine learning
  - Feedback optimization (automated design)
  - etc

5 current focus areas identified

- 5 problem/focus areas identified to support CSWG's role
- Get involved in these focus areas!
  1) IFO lock maintenance with machine learning
  2) Test mass length-to-angle decoupling
  3) Feedback optimization
  4) Transfer function fitting algorithms
  5) IFO earthquake robustness

5 current focus areas identified

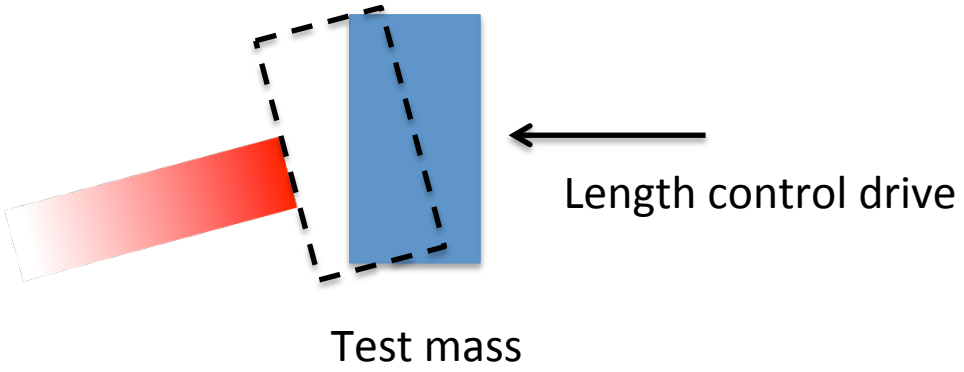
1) Machine Learning for lock maintenance
   - Leader - Rob Ward
   - Use an algorithm to 'learn' the best way to maintain lock
   - See example of acquiring a Bose-Einstein condensate

P. B. Wigley, et al. Fast machine-learning online optimization of ultra-cold-atom experiments. *Scientific Reports*, 2016; 6: 25890

5 current focus areas identified

2) Length to angle decoupling

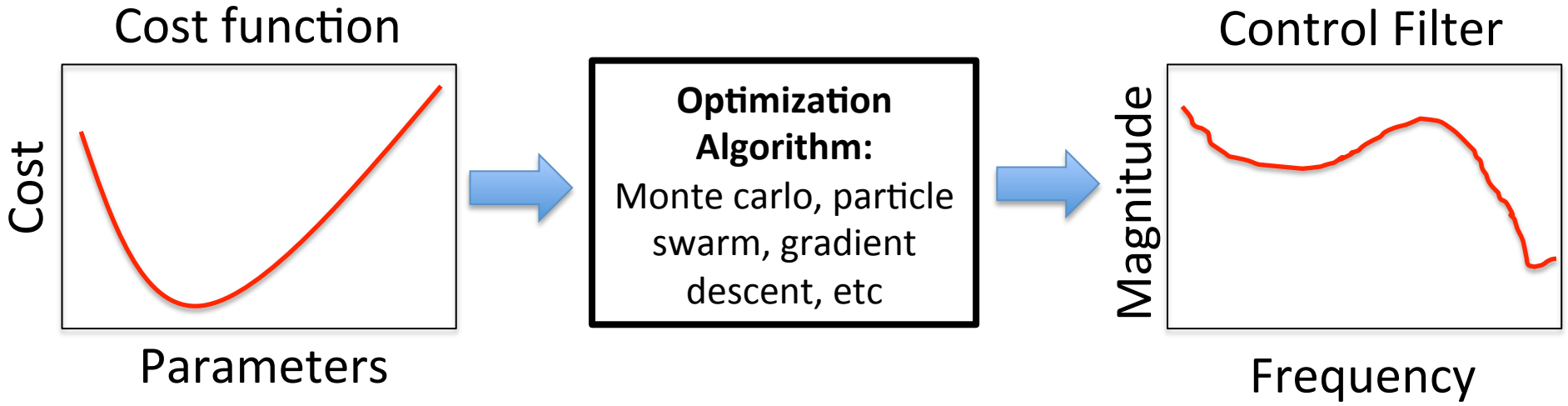
- Leader – TBD
- Separate the problems of controlling cavity length and alignment. Alignment control is currently suboptimal and contributing noise to the IFO.



5 current focus areas identified

3) FB optimization (esp. applied to angular controls)

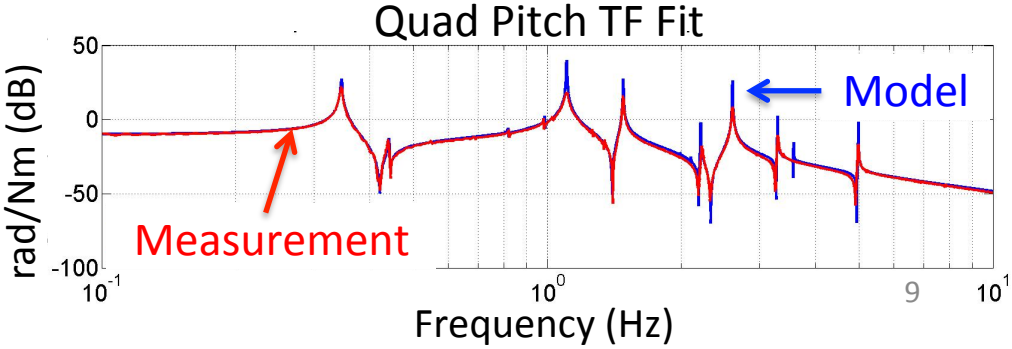
- Leader – TBD
- Collaboration with UC Berkeley and Google



5 current focus areas identified

4) Transfer function fitting algorithms

- Leader – TBD
- Motivation: G1601173 - Hopes and Dreams: One TF Fitting Program to Rule Them All
- Various tools exist: vectfit, n4sid, etc. How to best apply them? Do we need something new?
- Part of a more general topic of experiment design and system identification

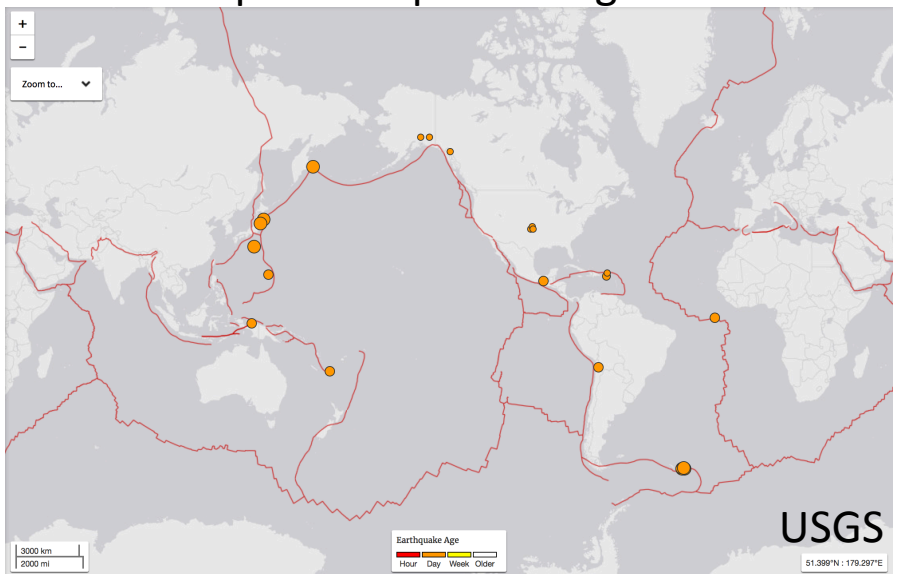


5 current focus areas identified

5) IFO robust configuration for earthquakes

- Leader – Sebastien Biscans
- We already receive early warnings. How best to configure the IFO to not loose lock?

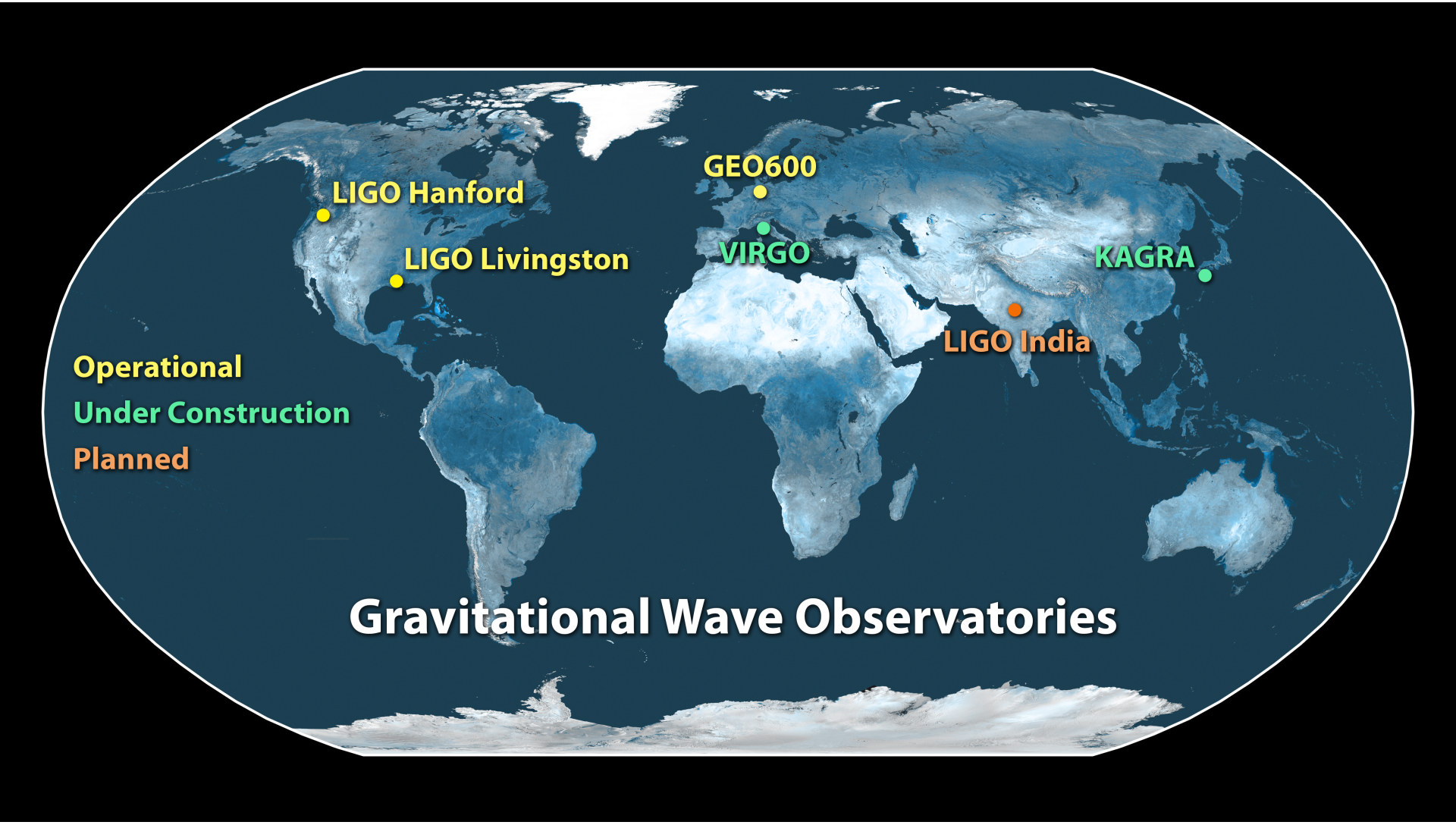
Earthquake map – 22 August 2016



Additional Focus Areas?

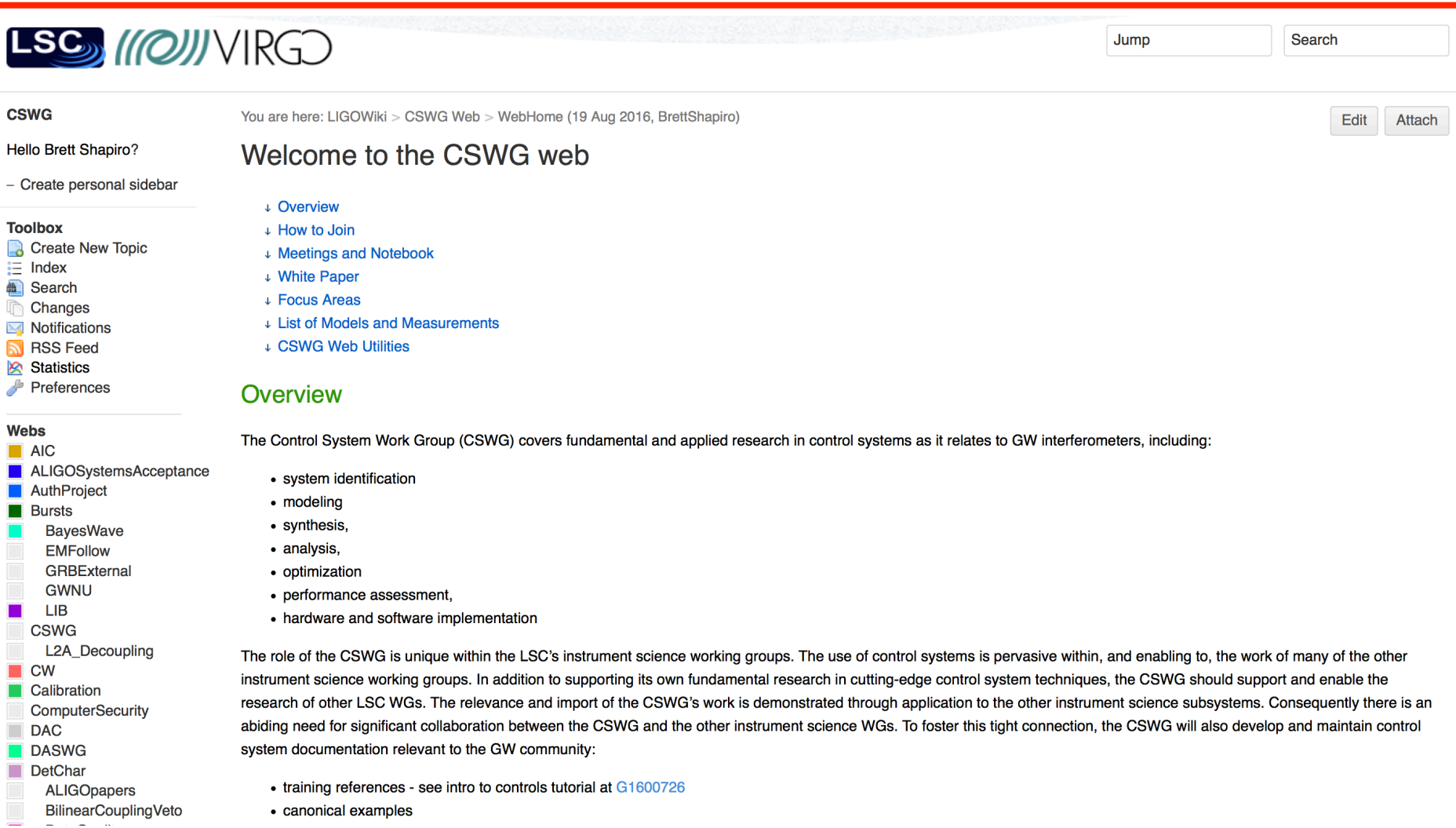
- The CSWG is not restricted to these 5 areas
- Please suggest any other areas the CSWG should prioritize

A Global Working Group



Reference LIGO-G1600275

CSWG Wiki



LSC VIRGO

Jump Search

CSWG

Hello Brett Shapiro?

– Create personal sidebar

Toolbox
- Create New Topic
- Index
- Search
- Changes
- Notifications
- RSS Feed
- Statistics
- Preferences

Webs
- AIC
- ALIGOSystemsAcceptance
- AuthProject
- Bursts
  - BayesWave
  - EMFollow
  - GRBExternal
  - GWNU
  - LIB
- CSWG
  - L2A_Decoupling
- CW
- Calibration
- ComputerSecurity
- DAC
- DASWG
- DetChar
  - ALIGOpapers
  - BilinearCouplingVeto

You are here: LIGOWiki > CSWG Web > WebHome (19 Aug 2016, BrettShapiro)

Edit Attach

Welcome to the CSWG web

- Overview
- How to Join
- Meetings and Notebook
- White Paper
- Focus Areas
- List of Models and Measurements
- CSWG Web Utilities

Overview

The Control System Work Group (CSWG) covers fundamental and applied research in control systems as it relates to GW interferometers, including:

- system identification
- modeling
- synthesis,
- analysis,
- optimization
- performance assessment,
- hardware and software implementation

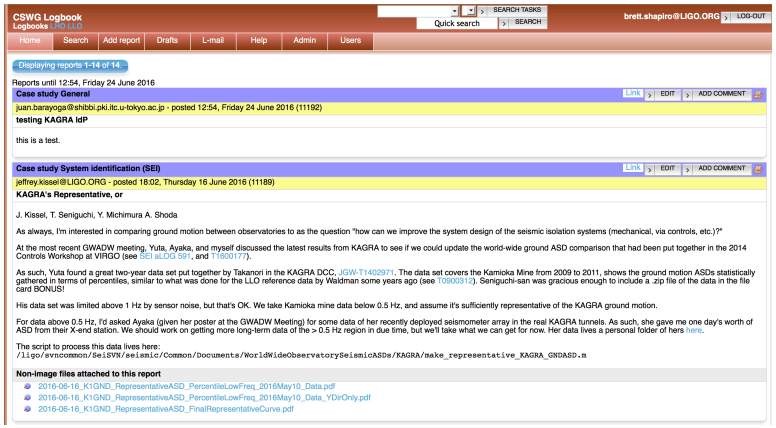
The role of the CSWG is unique within the LSC's instrument science working groups. The use of control systems is pervasive within, and enabling to, the work of many of the other instrument science working groups. In addition to supporting its own fundamental research in cutting-edge control system techniques, the CSWG should support and enable the research of other LSC WGs. The relevance and import of the CSWG's work is demonstrated through application to the other instrument science subsystems. Consequently there is an abiding need for significant collaboration between the CSWG and the other instrument science WGs. To foster this tight connection, the CSWG will also develop and maintain control system documentation relevant to the GW community:

- training references - see intro to controls tutorial at G1600726
- canonical examples

https://wiki.ligo.org/viewauth/CSWG/WebHome

CSWG tools

- alog



https://alog.ligo-la.caltech.edu/CSWG/

- Mailing list: cswg@sympa.ligo.org

  Sign up at https://grouper.ligo.org/mailinglists/cswg

- Teamspeak channel: CSWG

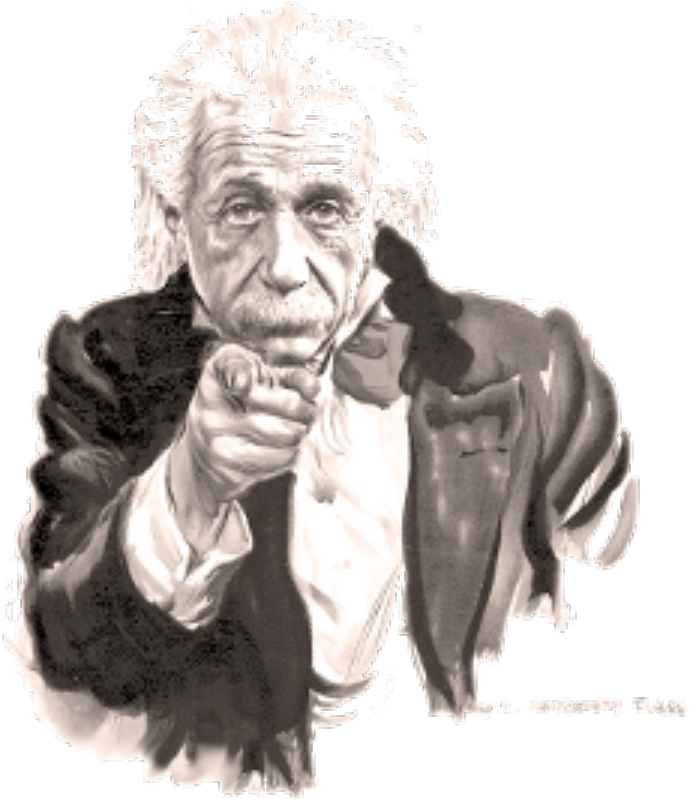
Meetings

Bi-monthly Teamspeak meetings

- US-western hemisphere: 1st Fri of the month, 9am US-PT (6pm CET, 9:30pm IST)

- US-eastern hemisphere: 3rd US Thu of the month, 4pm US-PT (Fri 9am AET, 8am JST, 4:30am IST)

We Need You!



Credit: http://einsteinpostdocs.info/

- Many areas where work is needed
- Get involved!
- Students encouraged to take a controls course
- GW interferometers don't work without controls!