

Suspensions/Isolation Working Group

LSC 11 March 98
David Shoemaker

January '97 Aspen workshop: Formation of Ad-Hoc Working Group

- notes on LIGO, JILA Web Sites

Subsequent and future gatherings:

- Spring APS, 1997
- LSC Livingston, August 97
- Thermal Noise Weekend, Stanford November 97
- This meeting: LSC Hanford, March 98
- Perugia: Thermal Noise and low-frequency noise sources, 4-6 June 98
- LSC JILA, August (11-12 August: workshop on isolation issues)

Common activities focussed around LIGO interferometer evolution

- '2003' LIGO II advanced subsystems
 - > double pendulum explicit path
 - > moderate improvements in Q
 - > associated control changes (e.g., external active system)
- '2007' LIGO III advanced LIGO
 - > large masses, high Qs, low F seismic isolation
 - > too early for conceptual designs
 - > 'what is crossover frequency with gravity gradient limit?'

Meeting Goals

Exchange of technical advances

- ACIGA preisolation and sapphire test mass and suspension (JU Li)
- multi-stage passive designs for LIGO (Riccardo Desalvo)
- brief overview of recent design progress for the GEO suspension:
 - advances in silicate bonding of the lowest stage (Sheila Rowan)
 - earlier parts of the suspension (Ken Strain/Jim Hough)
- subsystem dynamic model compatibility (Joe Giaime)
- ideas for models of suspensions in interferometer (Gabriela Gonzalez)
- cryogenic suspensions (Warren Johnson)
- roadmap for Advanced Seismic Isolation (Tuck Stebbins)
- progress report on magnetic suspension work (Ron Drever)
- progress on measurement of anelasticity and on calculation on coating losses; setting goals for performance improvements (Peter Saulson)
- active isolation: near term plans in LIGO (David Shoemaker)

Development of a shared 'timeline'

- > linked schedules, joint activities
- > division of effort
- > ultimately, a combined cost, schedule, and technical plan

Development of a decision-making process

- > not all paths can be followed (people, money, time)
- > choices needed: need to say 'no' to some activities
- > how to do this?

Suspensions/Isolation Working Group

LSC 15 August 97

David Shoemaker

January '97 Aspen workshop: Formation of Ad-Hoc Working Group

- meeting of interested parties
- discussions of present/nearterm activities
 - > LIGO: LIGO I; requirements; plans for thermal noise measurements
 - > GEO double pendulum design: final design
 - > JILA: ambitious active seismic isolation system: 6 dof, 2 stages
 - > Stanford: fiber development, bonding techniques, control systems
 - > Syracuse substrate material losses through squeeze/relax
 - > Moscow: substrate and pendulum losses through Q measurements
 - > Penn. State: sensor, actuator and servo studies
 - > Caltech/Drever: magnetic suspensions
- notes on LIGO, JILA Web Sites

Working Group Goals

Common activities focussed around LIGO interferometer evolution

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Interest in coupling activities more tightly

- > linked schedules, joint activities
- > division of effort
- > exchanges/visits

Spring APS: Second meeting

Side session in stolen moments (two long mornings)

- ~25 persons, some there just for Suspension discussions
- technical discussions rather than organizational issues
- presentations: gravity gradient noise, ground noise at LIGO sites, point design spreadsheets, low-frequency limit to interferometry, control analysis of the JILA active isolation system, design considerations for LIGO suspensions, notes from visits to GEO lab, detailed transfer function modeling, status of the GEO600 suspension design, materials for suspensions, and experiment to make a direct measurement of substrate thermal noise and excesses, magnetic suspensions, silicon and sapphire bonding methods
 - > notes on LIGO Web site
- basic plan outlined in Adv R&D proposal supported
- action items developed, to be reported here

This meeting: rough agenda

Thermal Noise

- Ken Libbrecht: The Thermal Noise Interferometer
- Roger Route: Flexures, sapphire resonators, silicate bonding, creep
- Peter Saulson:
 - > Latest results of fused silica Q measurements at Syracuse
 - > Time-domain dissipation measurements
 - > Wire dissipation measurements
- Sheila Rowan: Thermal noise: progress and plans for GEO 600

GEO600 Suspension

- Ken Strain: Double pendulum system with active and passive stages
- Matt Husman: Work with GWO 600 on the double pendulum transfer function

LIGO I

- Gabriela Gonzalez: Seismic isolation in initial LIGO: how we deal with it
- David Shoemaker: LIGO I documentation for suspensions and isolation

Test Facilities

- Eric Gustafson: what the Stanford Engineering Test Facility is and how it might be managed
- Jonathan How: Experiments planned for the ETF
- David Shoemaker: MIT LIGO Lab Suspension test facility plans

Where are we going next

- Warren Johnson: Thoughts on the organization of suspension research; critical issues

Jesper Munch

Ingredients for a 2003 suspension

requirements

- All

environment and interfaces

- LIGO, PSU

characterization of present system

- LIGO, PSU, JILA, LSU

test mass material selection

- Syracuse, LIGO-ACIGA-VIRGO, Moscow, Stanford

suspension fiber selection, attachment/assembly techniques

- Stanford, GEO, Syracuse, Moscow

modeling, configuration choices

- PSU, LIGO, Stanford

sensor/actuator development

- PSU, JILA, GEO

moderately active external system

- LIGO, JILA

high-sensitivity prototype testing

- Stanford, LIGO (east/west), GEO (with all)

final testing

- LIGO (with all)

Challenge: choose

- enough ingredients, recipes, and kitchenaids for several designs
- only need (and can only support) one final design
- need to plan the 'triage'