LIGO

Advanced LIGO

Quad Prototype

Janeen Romie

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- **LIGO LAB**: CIT: H. Armandula, M. Barton, D. Coyne, J. Heefner, J. Romie, C. Torrie, P. Willems. MIT:P. Fritschel, R. Mittleman, D. Ottaway, D.Shoemaker LHO: B. Bland, D. Cook Cook LLO: J. Hanson, J. Kern, H. Overmier, G. Traylor
- **GEO600**: GLASGOW: G. Cagnoli, C. Cantley, D. Crooks, E. Elliffe, A. Grant, A. Heptonstall, Heptonstall, J. Hough, R. Jones, M. Perreur-Lloyd, M. Plissi, D. Robertson, S. Rowan, K. Strain, P. Sneddon, H. Ward UNIVERSITAT HANNOVER: S. Gossler, H. Lueck
- **STANFORD UNIVERSITY**: N. Robertson (also GEO/Glasgow)
- **RUTHERFORD APPLETON LABORATORY**: J. Greenhalgh, I. Wilmut
- **THE UNIVERSITY OF BIRMINGHAM**: S. Aston, M. Cruise, D. Hoyland, C. Speake, A. A. Vecchio
- **STRATHCLYDE UNIVERSITY**: N. Lockerbie

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Quad Prototype

SUS Preliminary Design – 2 MCs & 1 Quad

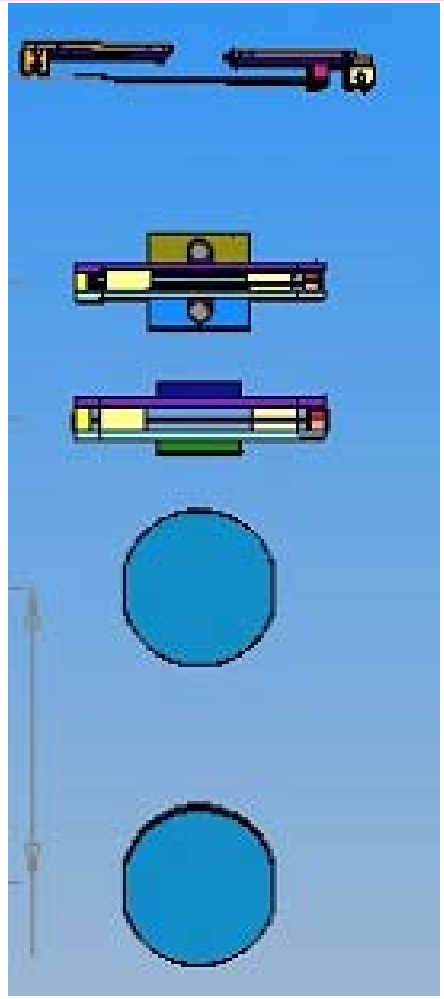
The Quad Prototype – one ETM, assembled at CIT, tested at LASTI.

Controls Prototypes demonstrate mech. & controls requirements – use metal masses and metal suspension wires.

Noise Prototypes set the limits on the thermal and excess noise in Advanced LIGO suspensions

Quad Controls Prototype

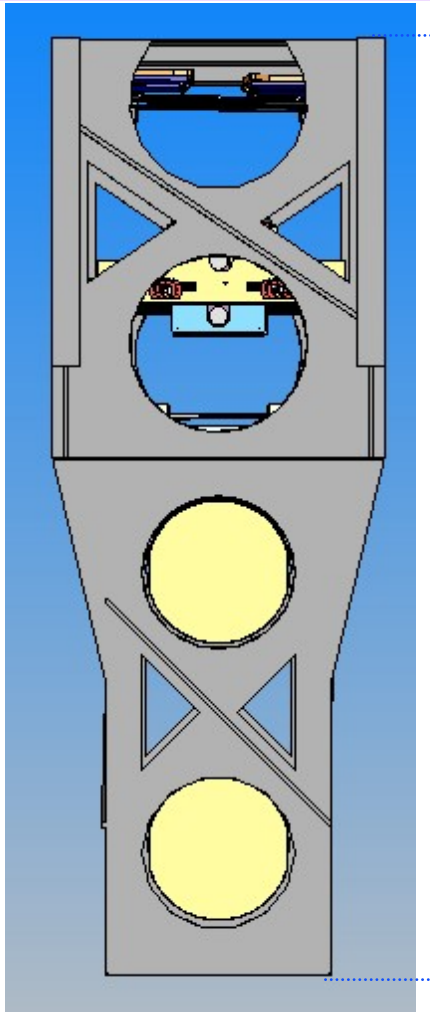
- Quad Prototype Suspension
  - » Optic:
    - – 314mm diameter x 130mm thick
    - – 40 kg
    - – Metal for controls prototype
      - same mass and moment of inertia
      - modeled for FS and sapphire
      - designed for sapphire
  - » Metal wires
  - » Full reaction chain
  - » 20kg, 20kg, 40kg, 40kg (masses from top to bottom)
  - » ETM > ITM



Quad Prototype

- Requirements
  - » 1st mode resonance of support structure 150 Hz or greater – TBD
  - » Total mass of 418 kg with non-suspended mass of 170 kg (including contingency)
  - » Stay clear zones defined by SEI for support tubes and Stage 0 support

Quad Concept Suspension Mass budget



Structure = 66 kg + 25% contingency

Non-Suspended = 70 kg + 25% contingency

@ Top Blades = 24 kg

@ Upper Mass = 13 kg + TBD

@ Upper Int. Mass = 9 kg

@ Penultimate Mass = 7 kg

@ Test Mass = 7 kg

Suspended = 248 kg

2x (22-22-40-40) kg

OVERALL TOTAL = 418 kg

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Quad Progress

- Single, 40kg mass suspended
- Initial modeling and layout complete, including reduction in length – T040028
- Blade Test Facility designed – parts in workshop
- Composite test mass designed, metal parts fabricated
- Layout of eddy current dampers & osems w.r.t. upper mass complete
- Electrostatic HV amplifiers received from Glasgow
- Analog electronics received from Glasgow
- Dspace systems at both sites ready
- Catcher being updated from GEO 600 RM design to quad-size
- FEA of structure

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Quad Fabrication

- Plan
  - » Single Pendulum – 40 kg metal test mass
  - » Double Pendulum – two 40 kg metal masses
  - » Springs [cantilever blades]
  - » Upper Masses
  - » Upper Section
  - » Lower Section

  - » All leading to a **Quad** for Christmas

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Quad Fabrication

- Quad Task List, LIGO-T040016
  - » Overall Assembly
  - » Suspensions
  - » Structure
  - » Jigs (including Catcher)
  - » Glass Concept
  - » Modeling and Software
  - » Springs
  - » Installation Tooling
  - » Electronics
  - » Documents

Suspension Milestones

- MC controls prototype to LASTI June 2004
  - » Installation test, local controls test
- Working quad prototype at CIT Christmas 2004
  - » Local controls test, global controls functioning, ECDs, electrostatic
- Quad to LASTI end of January 2005
  - » Installation test
- LASTI cavity test start June 2005

SUS Interface

- Every Monday, 8am Pacific – Design Meeting
  - http://www.ligo.caltech.edu/~ctorrie/ (Design)
- Every Tuesday, 9am Pacific – Technical Meeting
  - http://www.ligo.caltech.edu/SUS.html
- Web-updated MATLAB and Mathematica modeling tools
  - http://www.ligo.caltech.edu/~mbarton/
- PDMWorks secure vault for data management and configuration control, in conjunction with DCC
  - 131.215.115.155
- Common design tools for SolidWorks developed by M. Perreur-Lloyd and C. Torrie
  - http://www.ligo.caltech.edu/docs/D/D030382-04/D030382-04.pdf

Quad Prototype

- Short term challenges
  - Meeting our schedule goals.