LIGO INTERFEROMETERS: DESIGN AND EVOLUTION

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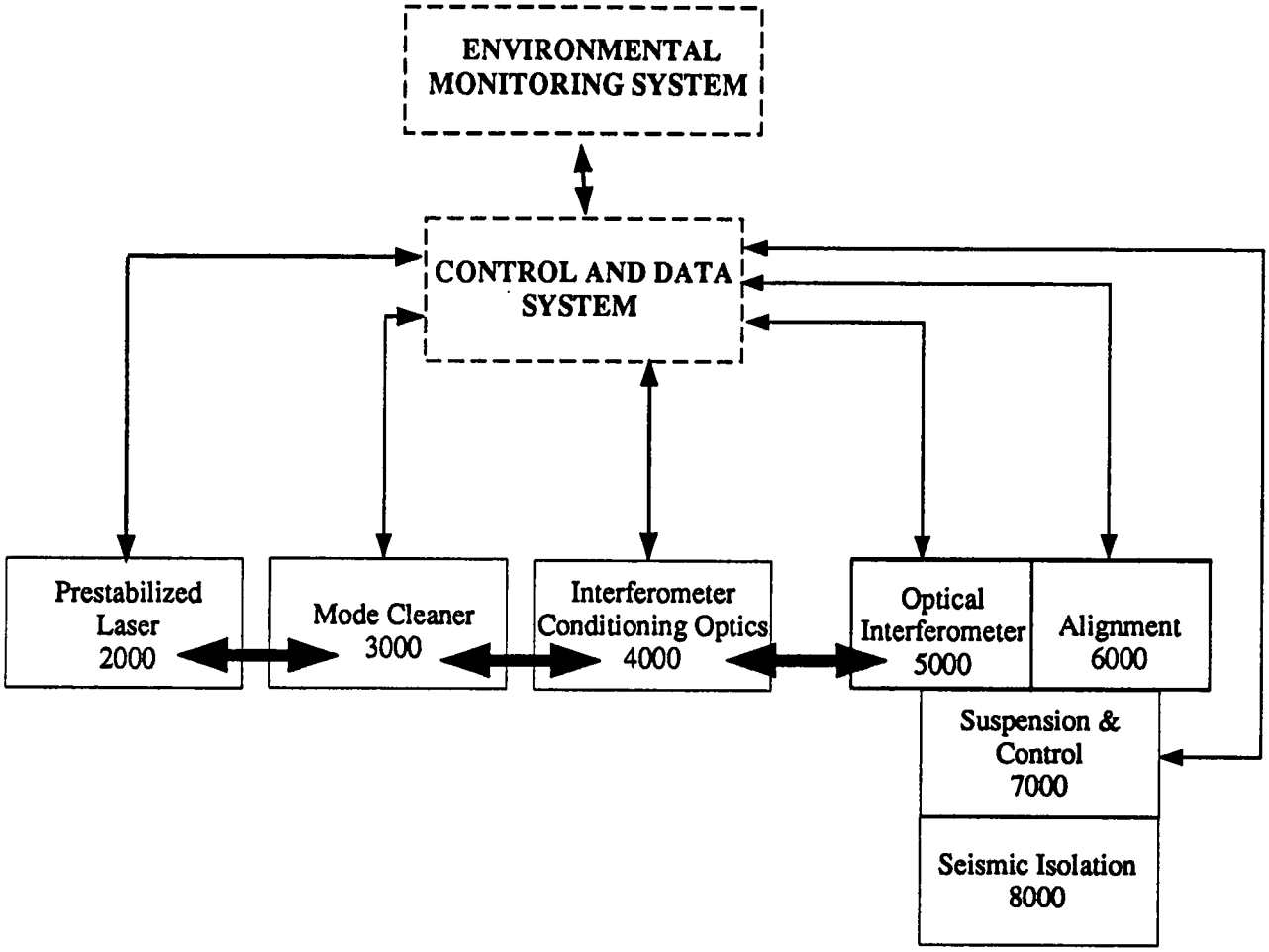
INTERFEROMETER BLOCK DIAGRAM



Initial Interferometers
Status Summary

- LIGO-Scale Subsystem Prototypes Constructed and Tested
  - Prestabilized Laser
  - Vibration Isolation Stack
- LIGO-Scale Subsystem Prototypes Under Active Development
  - Mode Cleaner
  - Test Mass Suspension
  - Large Optical Components (Including Test Masses)
- Smaller Scale Tests Underway
  - Detailed Optical Topology
  - Alignment System
- Not Yet Started
  - Interface to Control/Data System
  - Environmental Monitoring System

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Interferometer Design Process

- Interferometer Conceptual Design Team
  - Responsible for Overall Interferometer Conceptual Design
  - Assigns Subsystem Design Tasks to Working Groups and Reviews Output
  - Maintains Configuration Control through Design Handbook
  - Regular Weekly Meetings, chaired by Deputy Director
- Working Groups Established for:
  - Optical Topology
  - Suspensions and Controls
  - Seismic Isolation
  - Input Optics
- Working Groups Review Existing Design Data, Analyze Alternative Designs and Define Subsystem Requirements, Recommend new Experimental Work When Necessary

Schedule Drivers

- Interferometer "Design Freeze" Required Approximately 2 Years Before Installation of First Interferometer
- Interferometer Design Process Must Accommodate Parallel Design and Research and Must Adapt to Schedule Changes
  - Define Baseline Subsystem Designs with Acceptable Performance for Initial Interferometers as Early as Possible (Existing Technology)
  - Identify and Pursue Promising Improvements for Individual Subsystems for Possible Substitution or Retrofit into Initial Interferometers
- Critical Paths
  - Optical and Servo Topology
  - Large Optical Components (Test Masses)

Major Activities:
Ongoing and Future

- Subsystem Development and Testing on Suspended Interferometers
  - Seismic Isolation
  - Prestabilized Laser and Mode Cleaner
  - Test Mass Suspension
  - Optical Topology at High Power
  - Alignment System
- Define Interface to Vacuum System
- Optical Component Development (Test Masses)
- Design and Test Interface to Control and Data System

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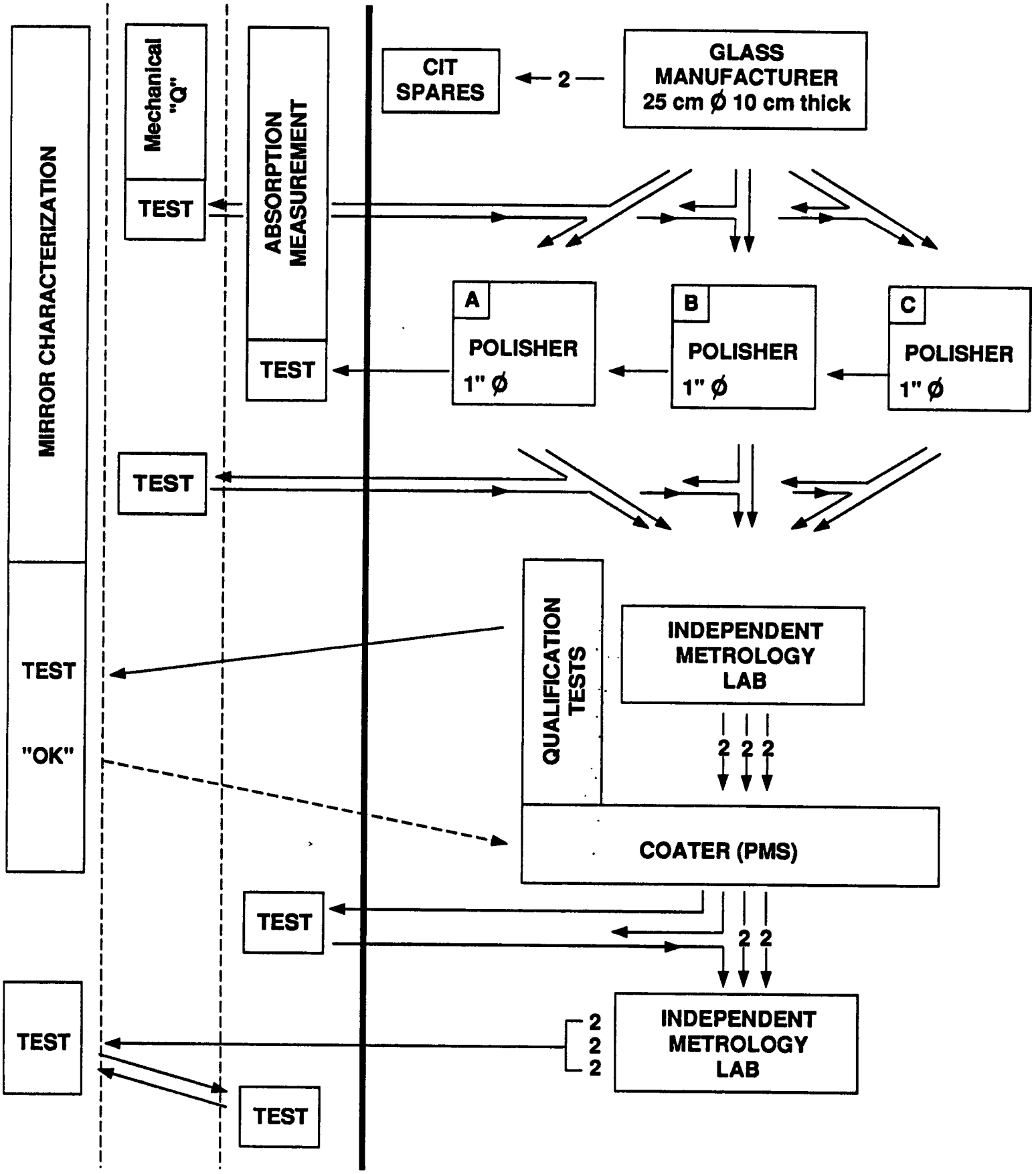
Vacuum System Interface

- Necessary to Define
  - Chamber Dimensions and Locations
  - Port Locations and Sizes
  - Access Requirements
  - Mechanical Interfaces and Adjustment Requirements for Seismic Stacks
  - Etc.
- Requires Definition of "Envelope" for Initial Interferometer Design
  - Requirements for Different Optical Topologies
  - Footprint for Optical Components and Controls
  - Stray Reflections
  - Auxiliary Optical Beams
- Must Anticipate Direction of Future Interferometer Development
  - Future Optical Topologies
  - Improved Low Frequency Isolation
  - Improved Suspensions

Large Optics Development

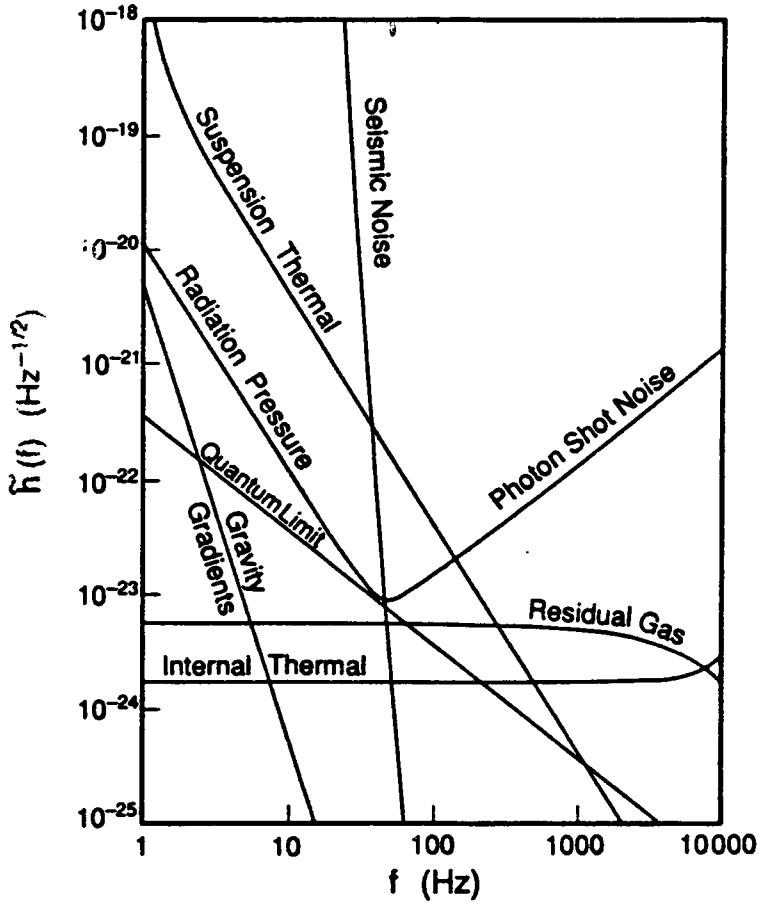
- Have Initiated "Pathfinder" Process to Identify and Develop Appropriate Technologies and Sources
  - Blank Material Specification
  - Blank Vendor
  - Polishing Specification
  - Polishing Vendor
  - Independent Metrology Source
  - Coating Specification
  - Specialized Measurement Techniques
- Pathfinder Process Will Identify and Qualify Vendors and Processes for Full-Scale LIGO Production

OPTICS "PATHFINDER" PLAN

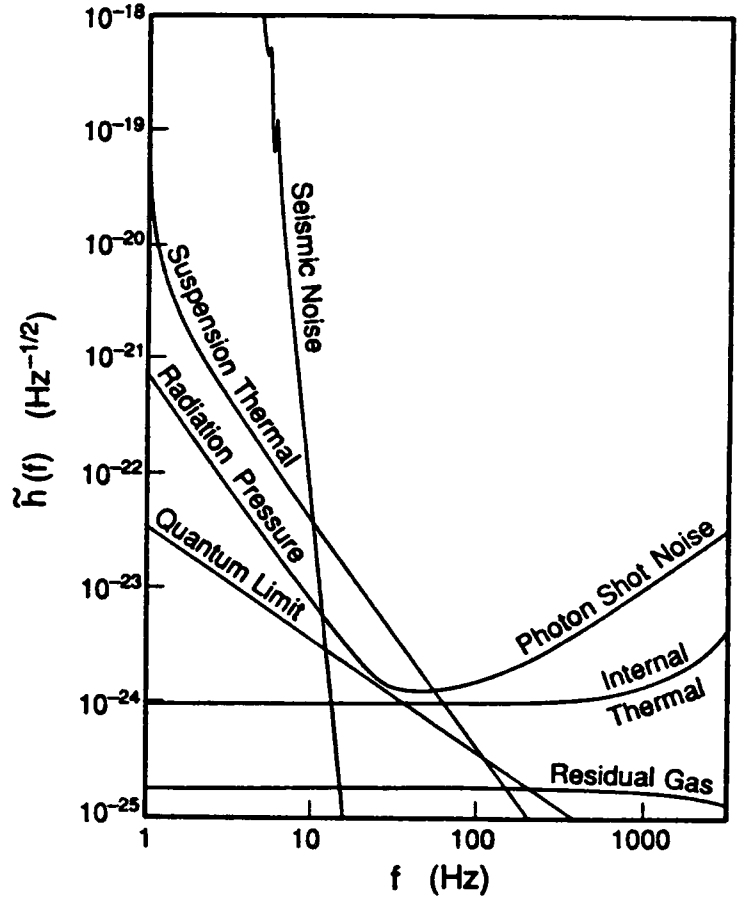


Improvement Toward Advanced Interferometers

Initial Interferometer



Advanced Interferometer



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