Optics Compatibility Validation

DHS

August 29, 1994

Optics Compatibility Validation
Outline

- description of the generic initial interferometer
- beam raytracing layout
- auxiliary alignment layout
- conclusions from the layout exercise

Optics Compatibility Validation
Generic Ifo: configuration

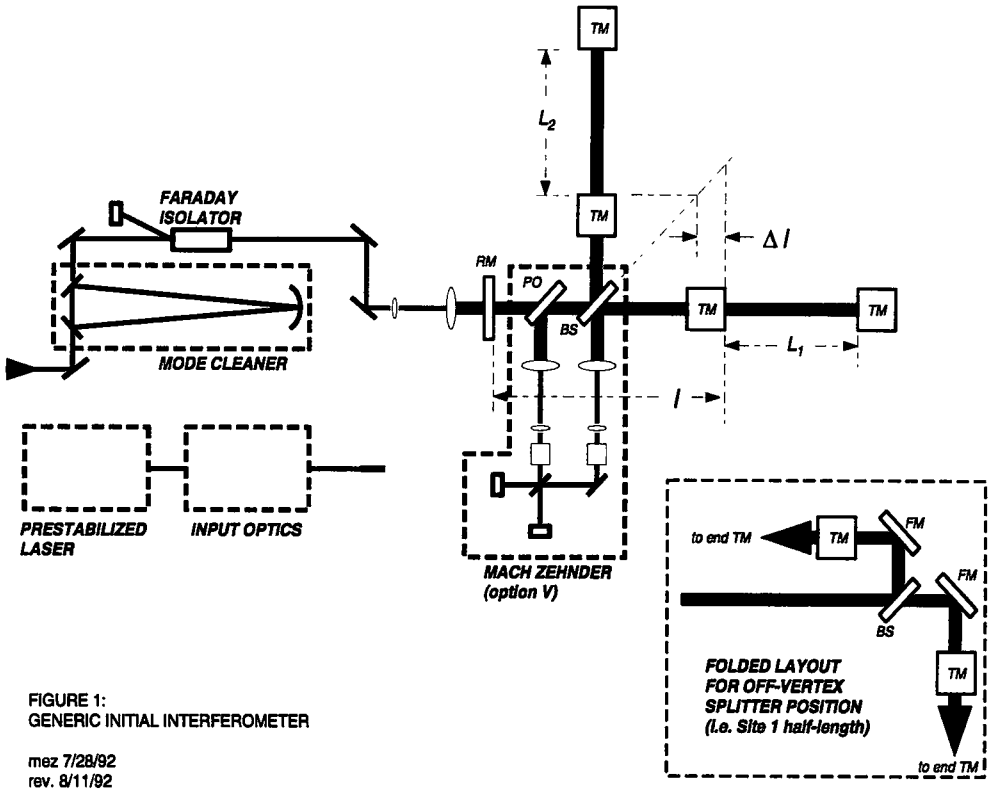

FIGURE 1:
GENERIC INITIAL INTERFEROMETER

mez 7/28/92
rev. 8/11/92

- wish to exercise flexibility, available space
- select superset of initial Ifo configurations
  - power recycled Michelson with Fabry-Perot arm cavities
  - triangular mode cleaner
  - configured for full– and half-length positions
- redundant GW readout systems
  - Mach-Zehnder post-modulation
  - Schnupp asymmetry pre-modulation
- redundant readout of other degrees of freedom
  - sums/differences of carrier modulation
  - two frequency (carrier/subcarrier) system

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Generic Ifo: Length constraints

- 2:1 mode cleaner to recycling cavity length chosen
- RF phase modulation wavelengths must be resonant
  - in mode cleaner (12m length means 12.7 MHz FSR)
  - in recycling cavity (6m length gives 'FSRs' at 12.7, 37.5, ...)
- 15 cm near mirror asymmetry chosen
  - optimal value function of mirror imperfections
  - conservative (i.e., large) asymmetry
  -

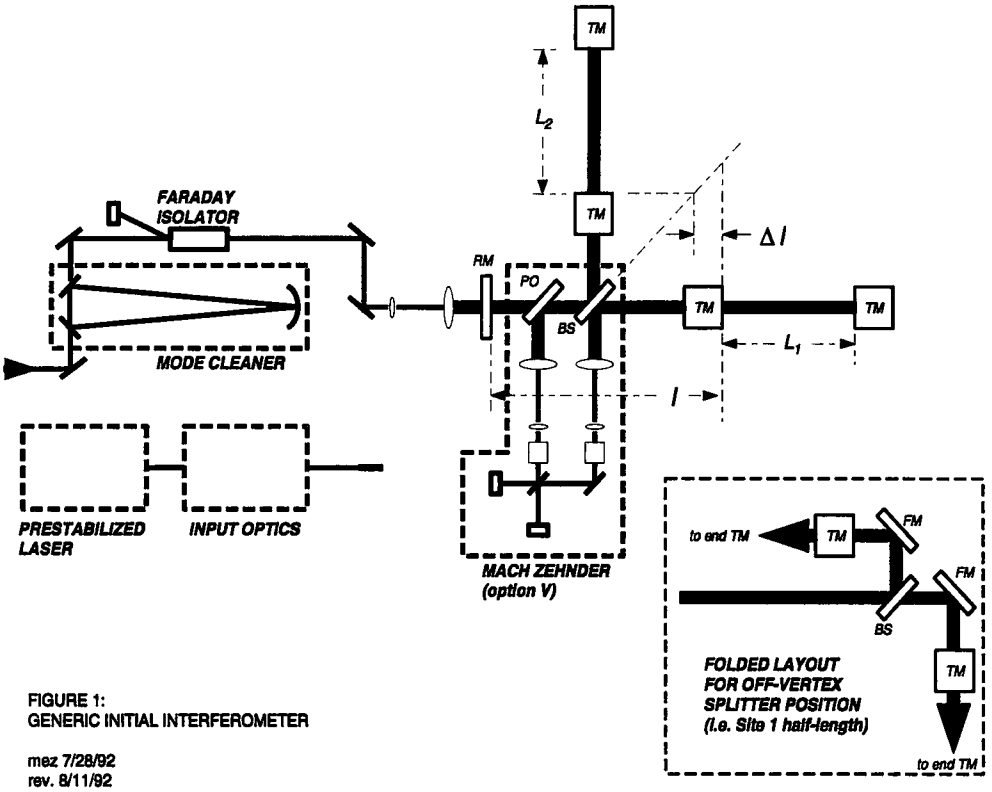

FIGURE 1:
GENERIC INITIAL INTERFEROMETER

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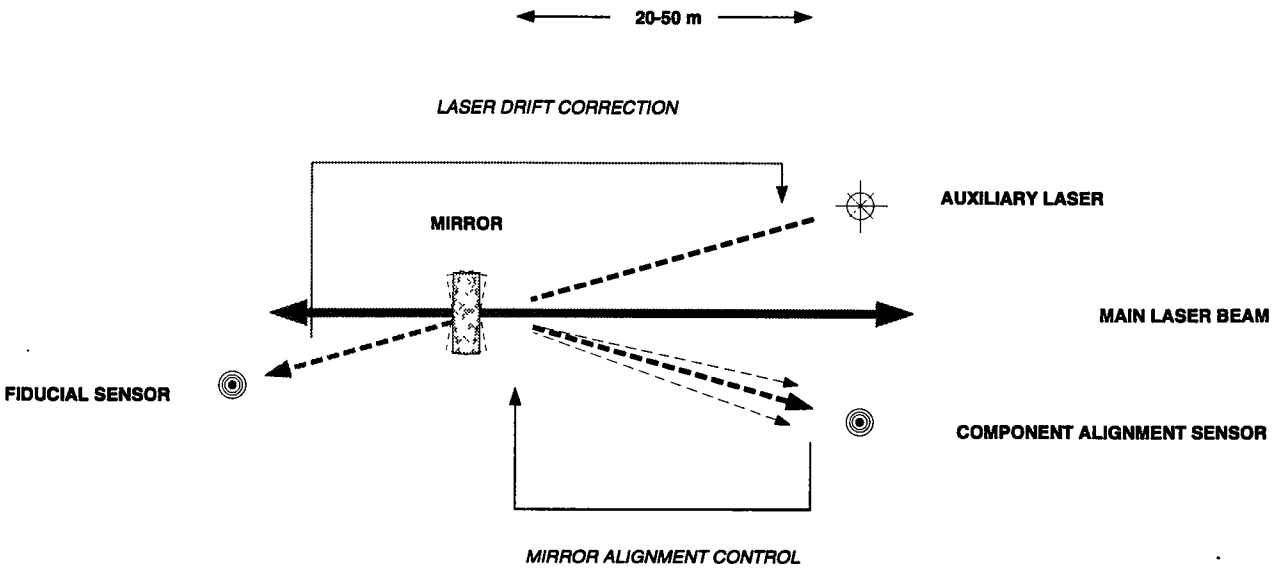
Generic Ifo: Auxiliary pointing



adoption of auxiliary pointing scenario

- **system must be short-term (minutes) operable with 40m-like pointing system**
- **conservative (expect operation with automated alignment system)**
- **creates significant requirement for clearance of ports, paths**

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Generic Ifo: Stray Beam and Scattered Light control

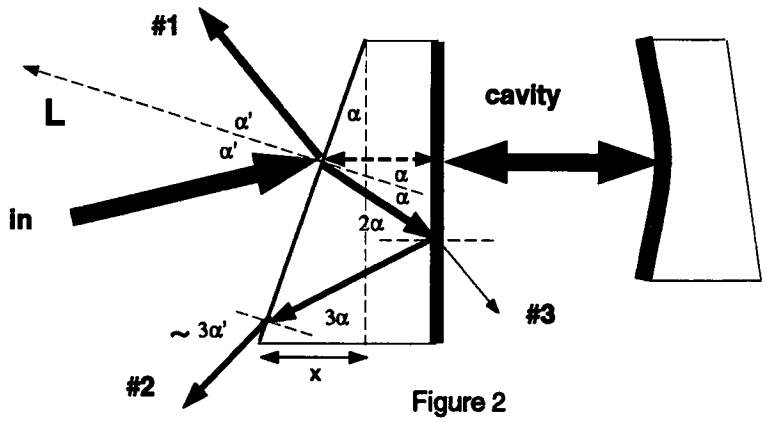

Figure 2

optical components wedged to avoid accidental interference

- **explicit calculation of beams**
- **adopt requirement for minimum intensity, clearance**
- **assume present-day Anti-Reflection coatings (10^{-3} – 10^{-4} reflection)**
- **some beams 'useful' (information led out through ports)**
- **others not (fed into beamstops)**

substrates and surfaces scatter light

- **substrates scatter 5–10 ppm/cm or 50–100 ppm per optic**
- **surface scatter 10–100 ppm/surface**
- **have assumed availability of a black baffling, vacuum compatible**