# Beam diverter and OMC work

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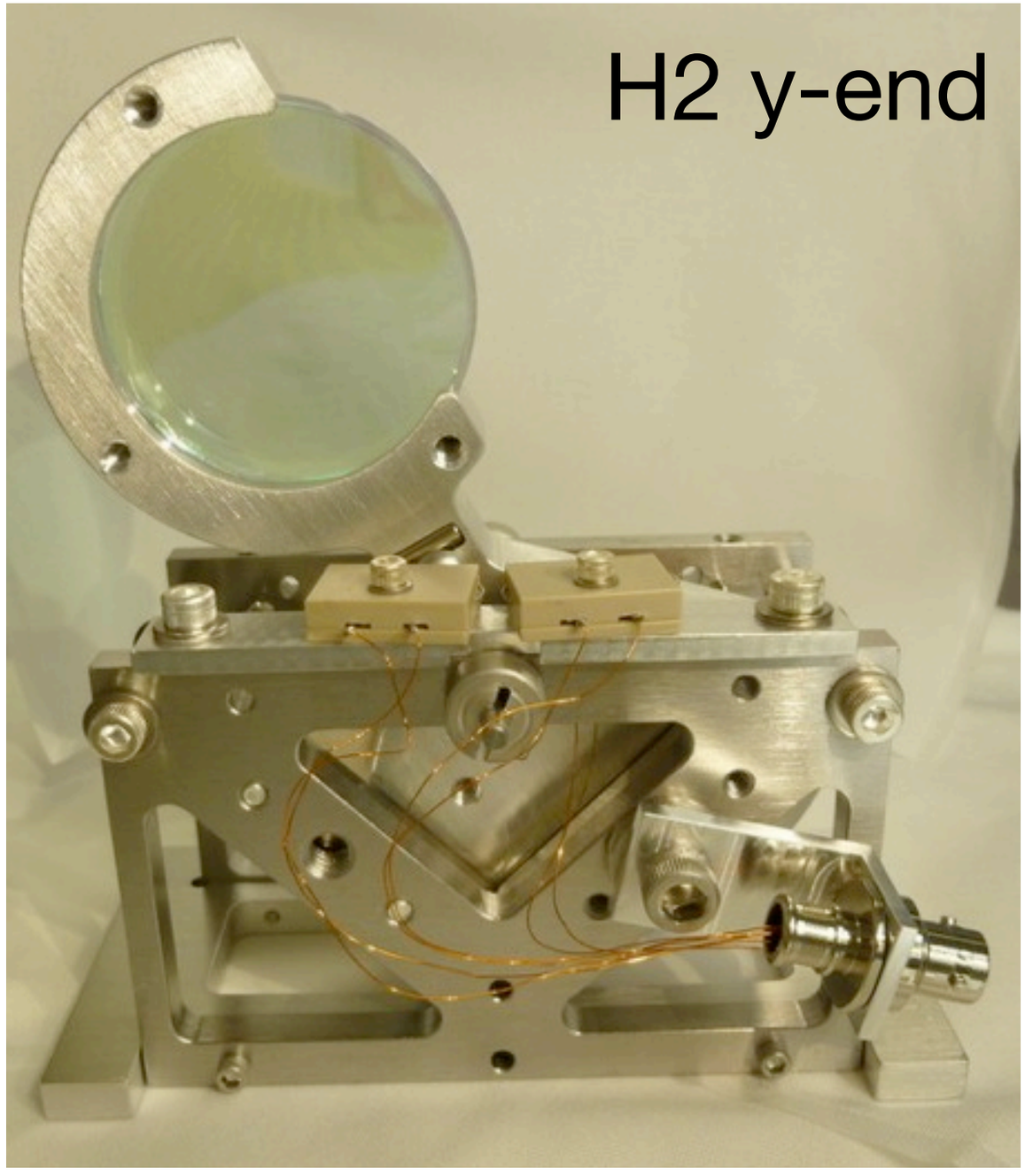
ISC meeting

G1101159

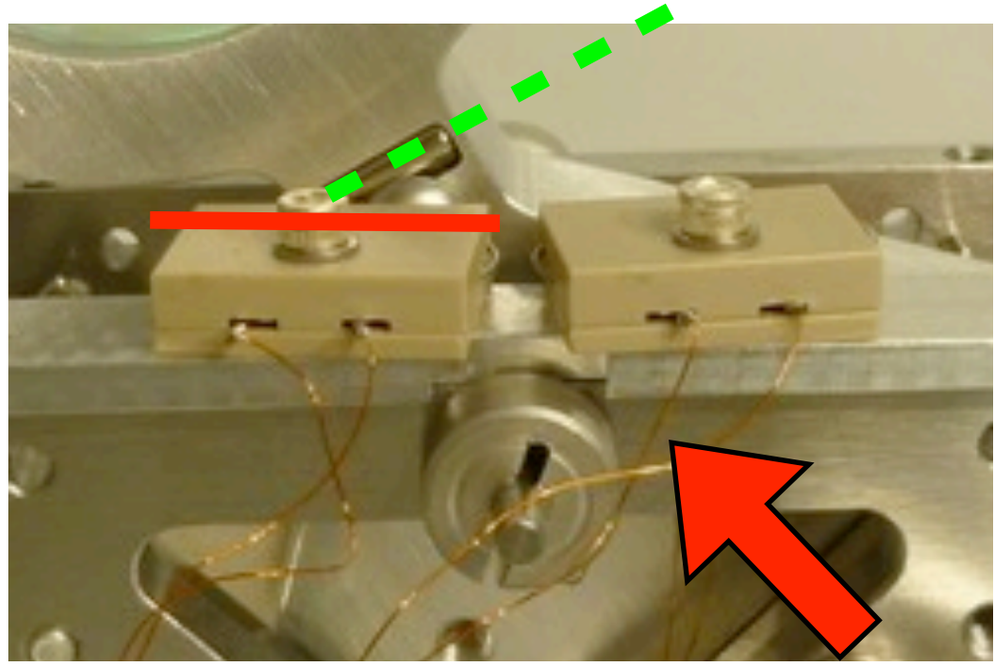
# Beam diverter

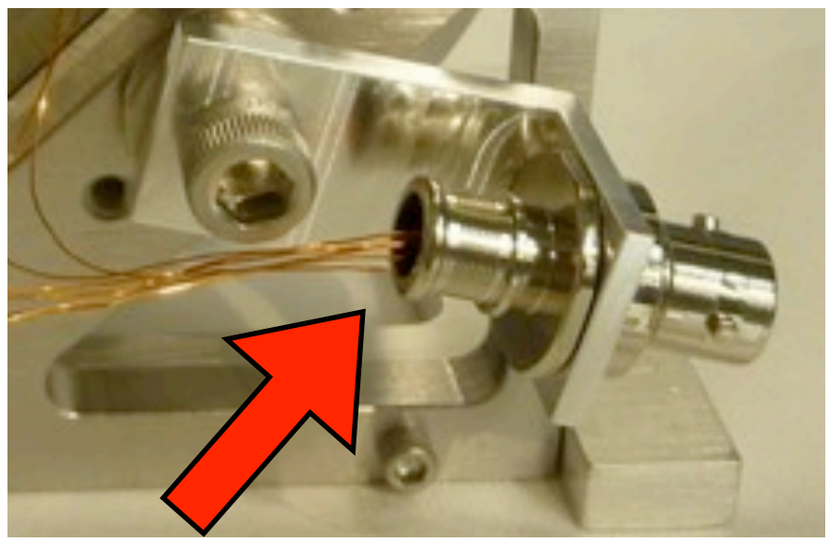
- Design updated based on LHO build
- Many comments from Matt and Bram
- Implemented by Rich and Stephany



# Reed switch mounting

- Interference of shaft collar
- Poor alignment between reed switch and magnet
- Interference between reed switch and moving rotor
- Fine wires very painful in gloves

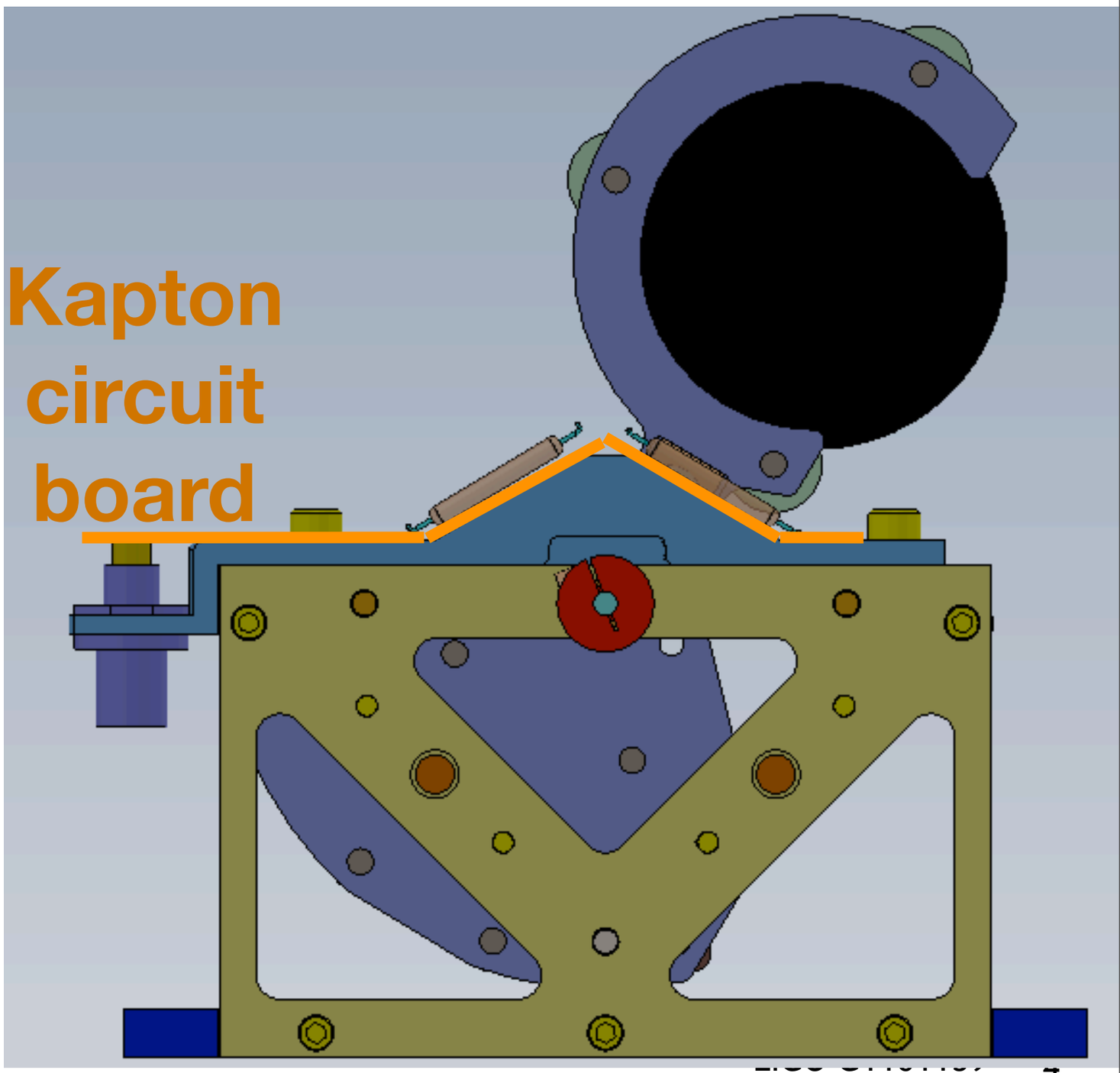




LIGO

# Nirvana

- Single kapton circuit board
- Reed switches and PCB connector soldered to kapton before cleaning
- Solder pads for coil wire connection
- Switches aligned to magnet
- Reduced part count



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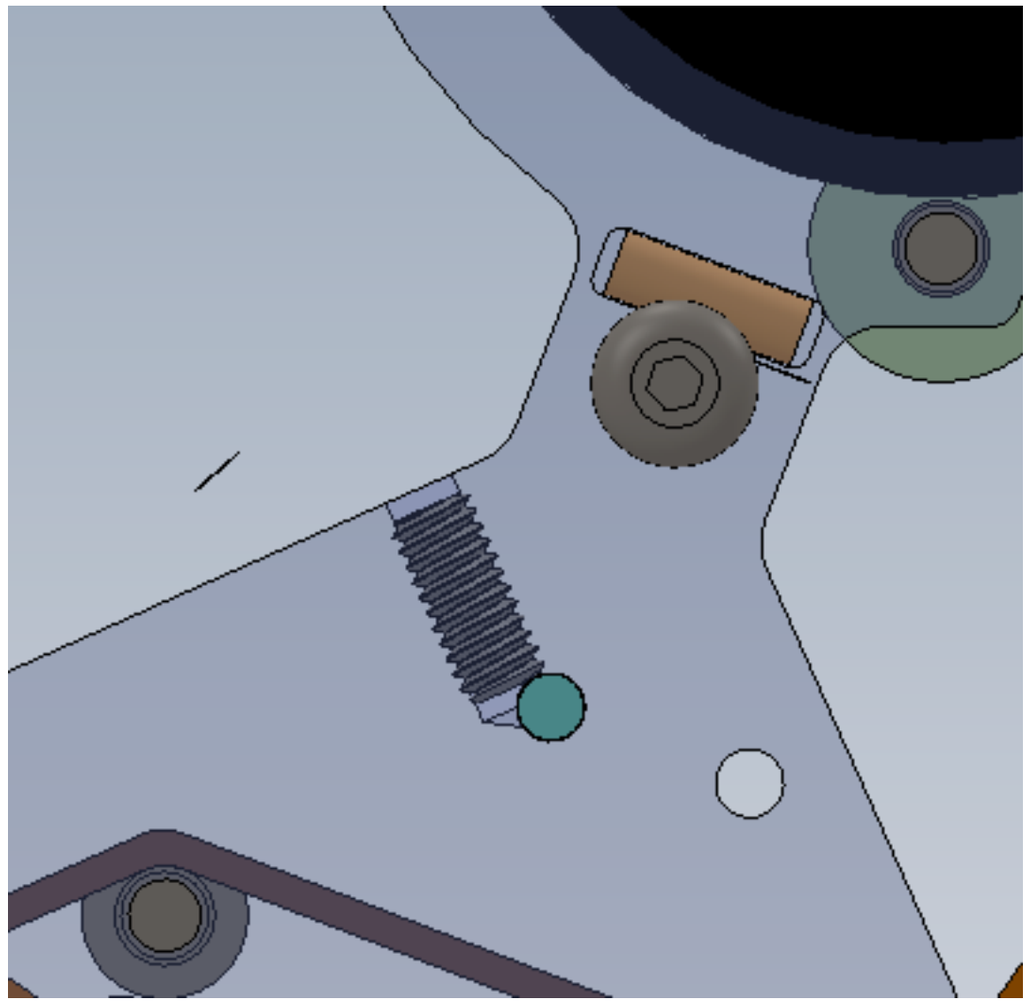
# Axle mounting

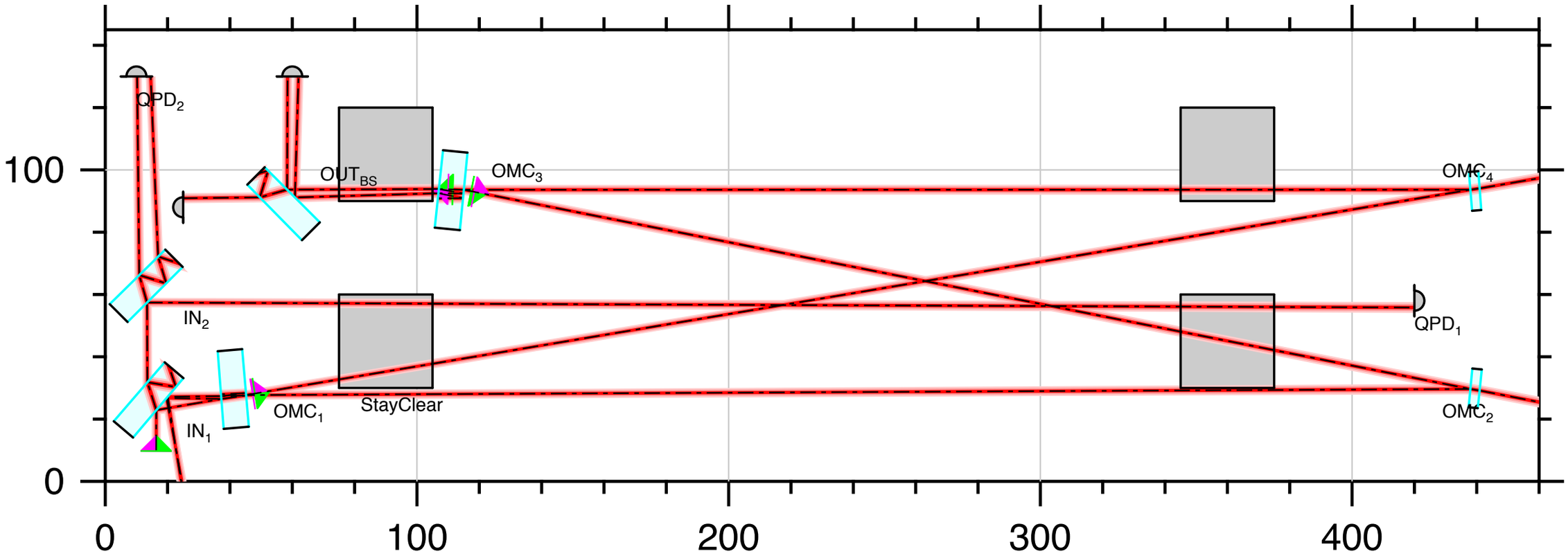
- Slip fit axle mounting with offset set screw
- Allows easy longitudinal positioning
- Eases assembly



# OMC initial layout

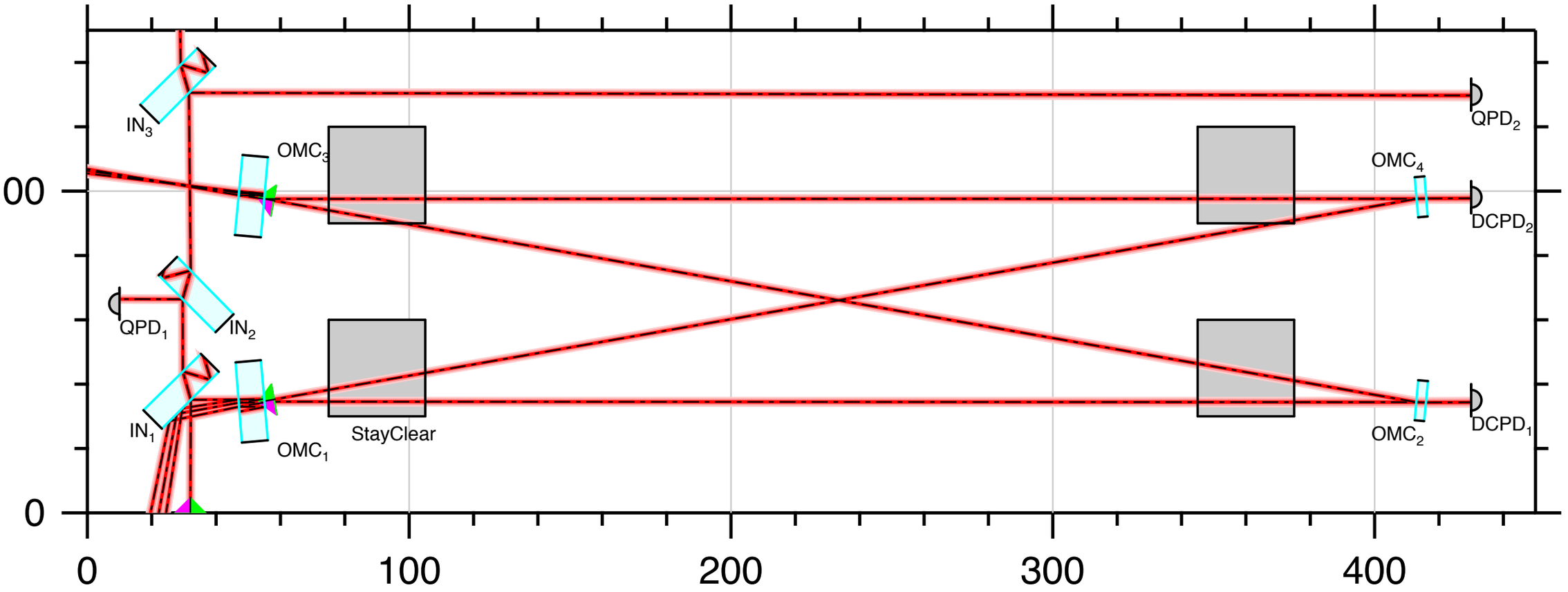
- Must match eLIGO suspension -- same weight and size
- Developed in Optocad
- Tried a variety of designs
- Maximize cavity length for the given footprint

# “Standard”



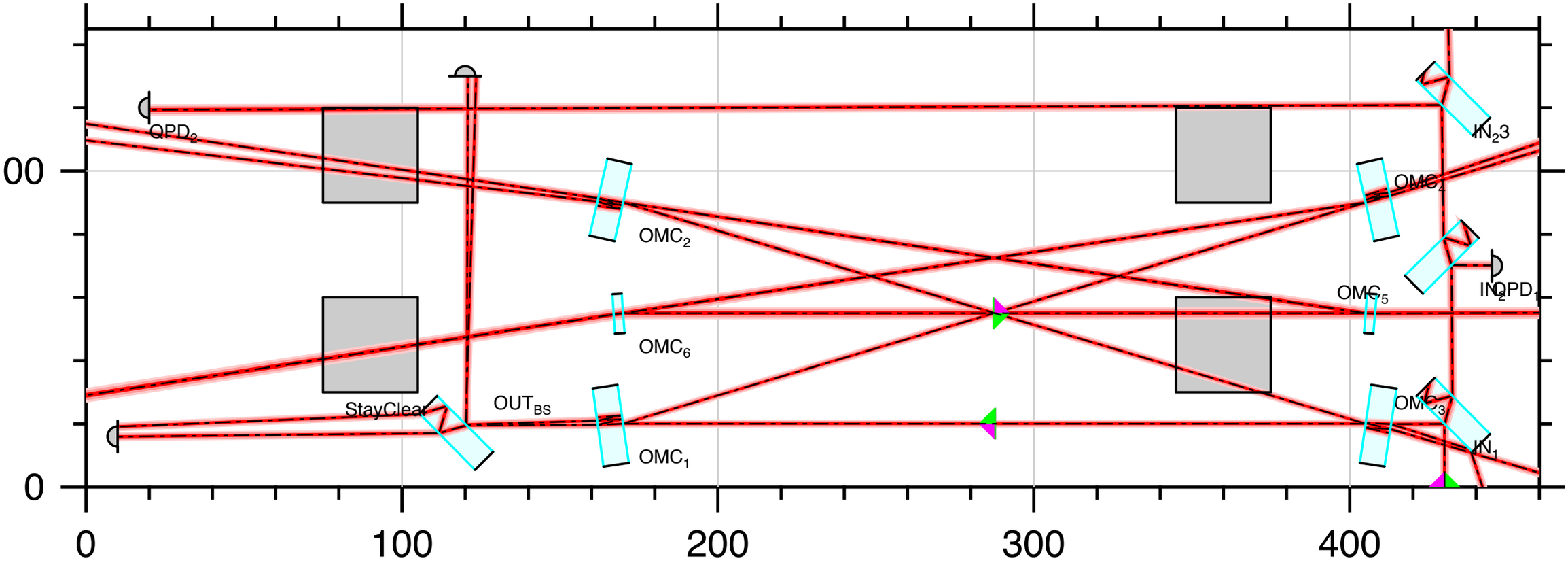

- Same topology as eLIGO w/ exaggerated unequal arms
- Difficult to fit input and output optics (as it was for eLIGO)

# “No BS”



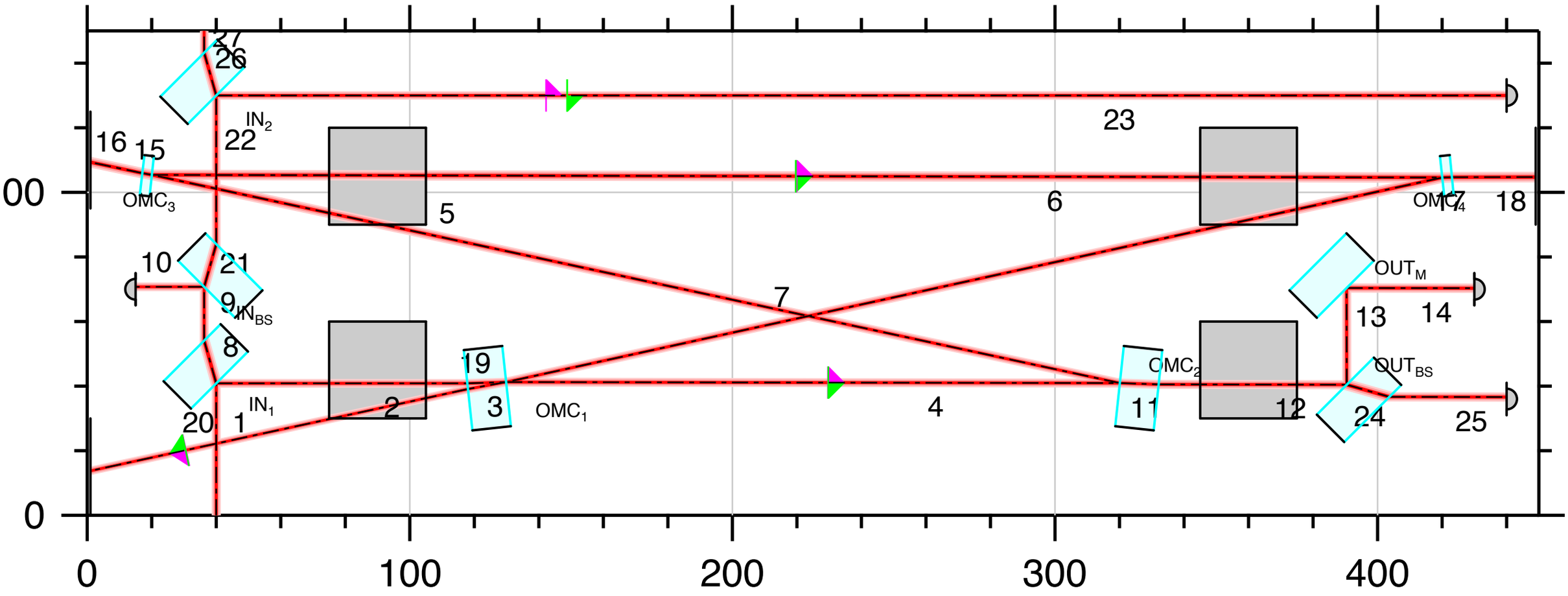

- Pro: Reduces optic count by using the cavity as beam splitter.
- Pro: All PDs are easily accessible
- Con: requires extra coating
- Con: DCPD’s are “different”

# “6 Shooter”




- Pro: Much longer than 4 mirrors
- Pro: More clearance for IO
- Con: Requires more cavity optics

# “Bowtie”




- Reasonable: trade-off between length and I/O access
- Reasonable: good access to PDs
- Poor: REFL beam is tricky
- Poor: one DCPDs has an extra reflection

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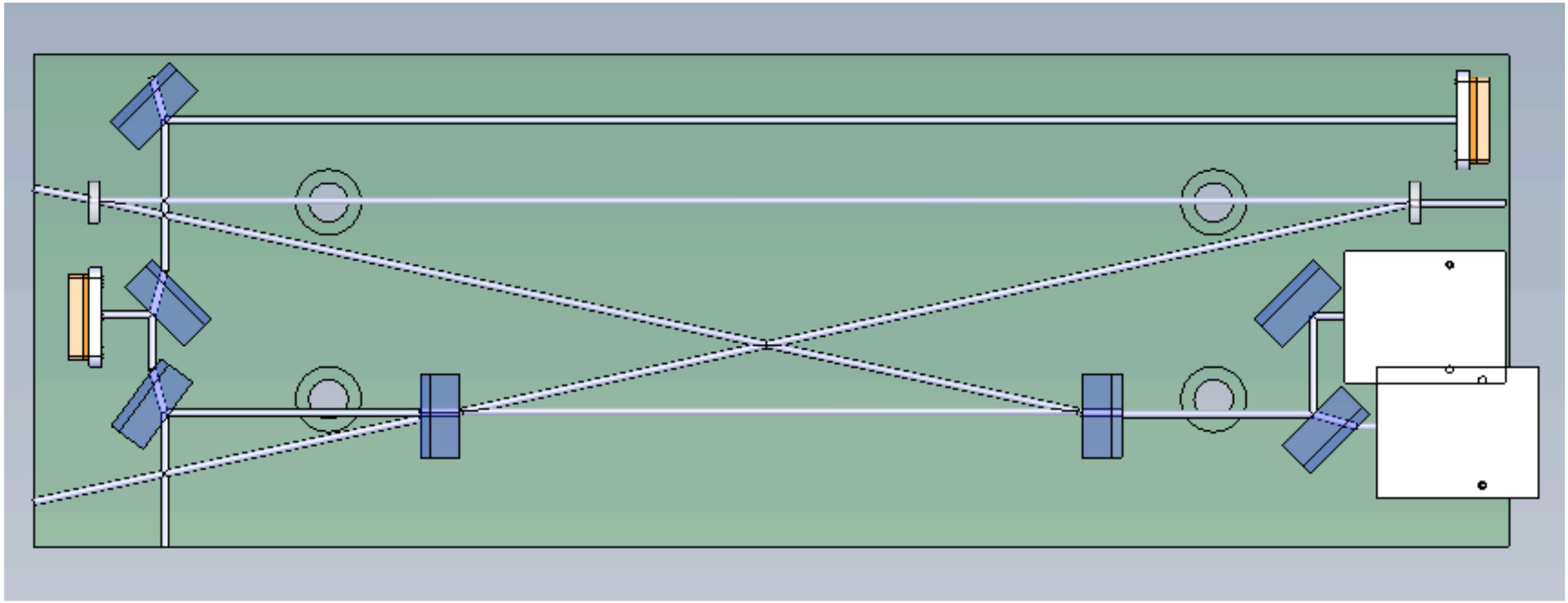
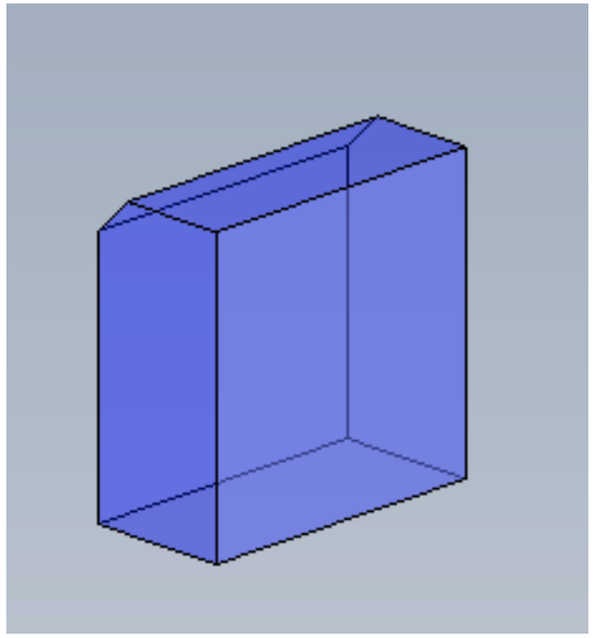
# Into solid works



- New macros for importing geometry (VBA program)

# Tombstone Mirrors

- More rigid design
- 2cm beam height
- chamfer to indicate AR surface
- Fewer epoxy bonds and assembly steps
- Pitch tolerance tight but not tragic (see LIGO-T0900647-v2: Ray optics calculations of alignment matrices)
- Requires 3 coatings:
  - High reflector (at 6 deg and 45 deg)
  - Partial reflector (at 6 deg and 45 deg)
  - 50/50 beam splitter (at 45 deg)



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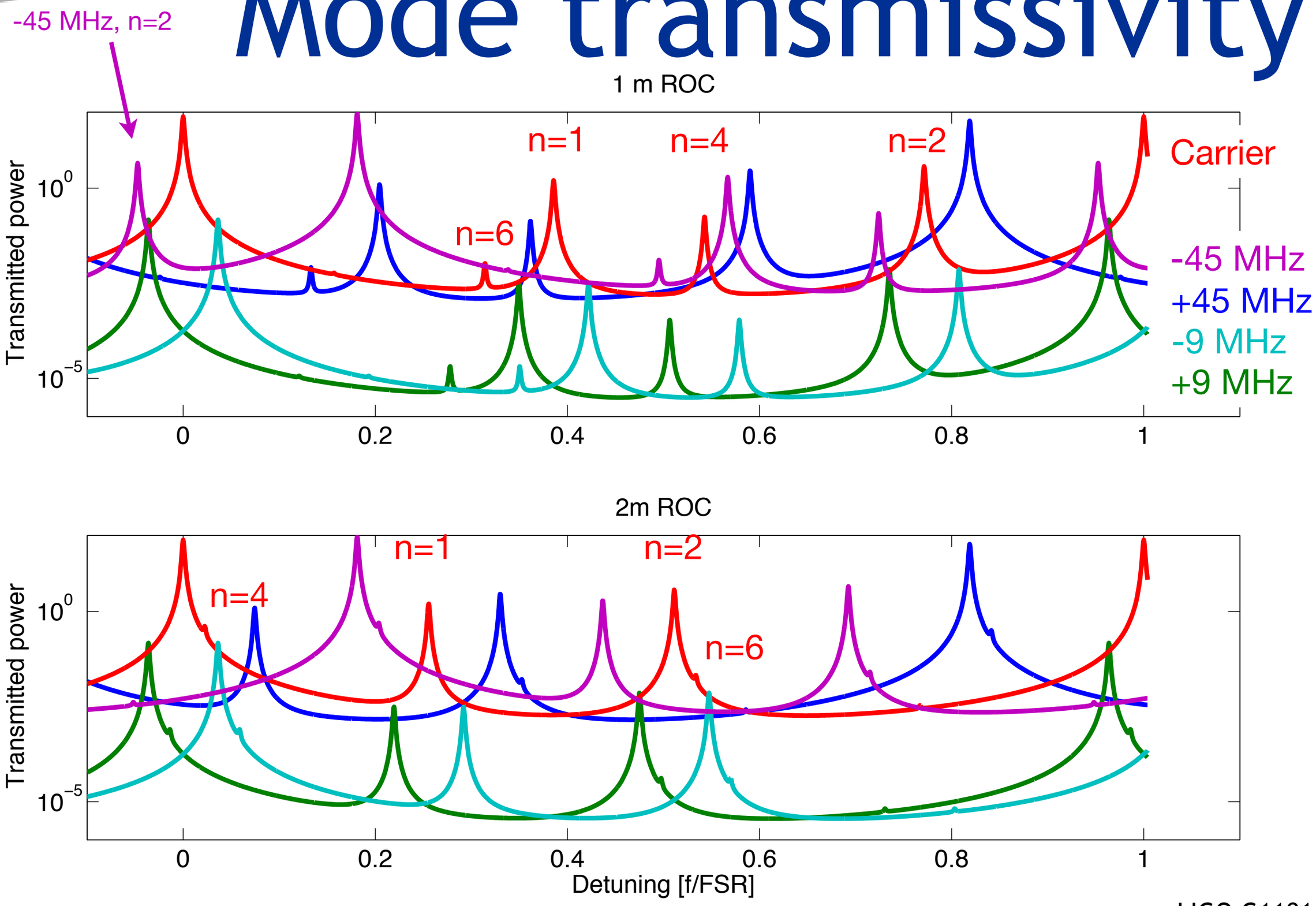
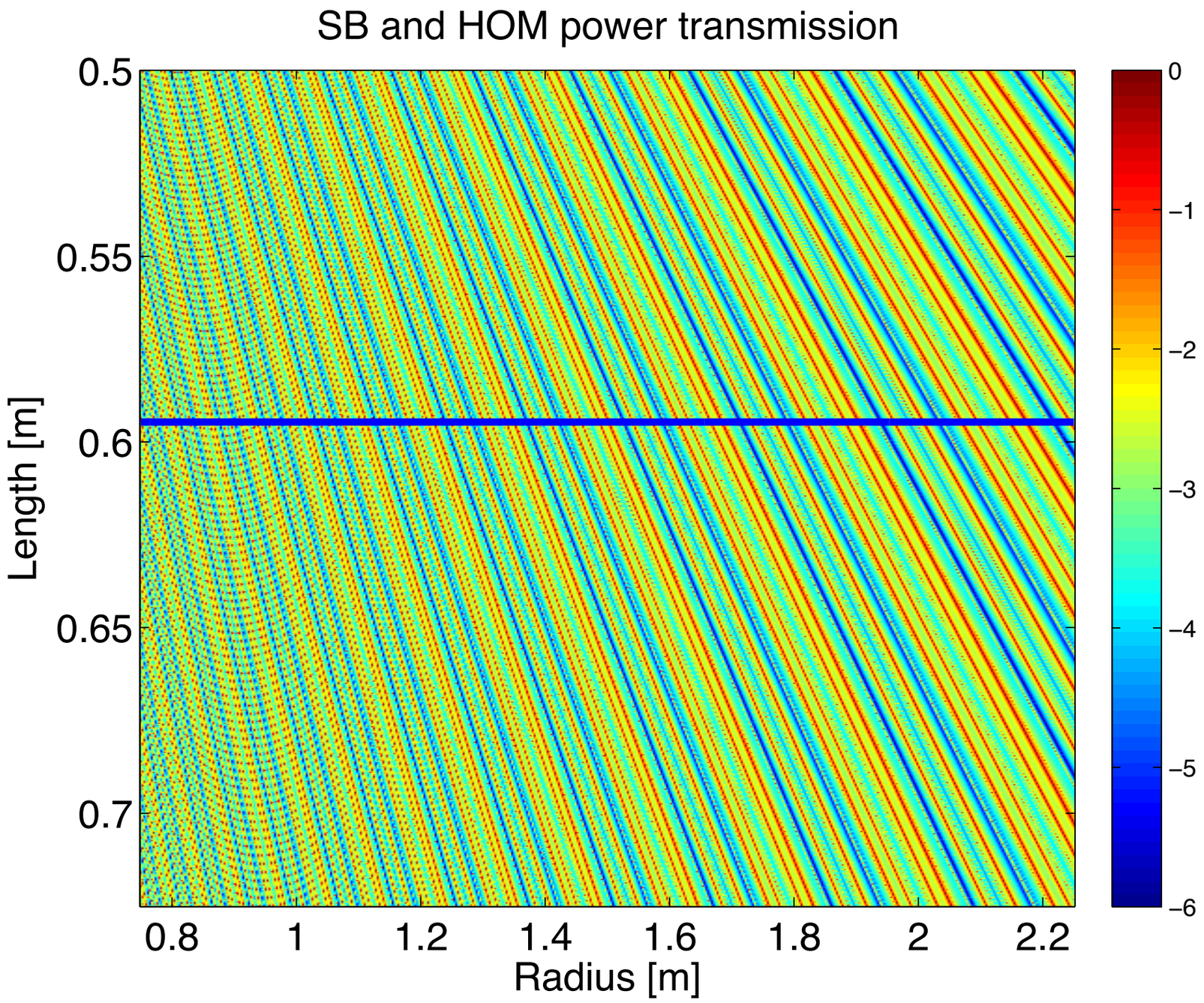
# Mode transmissivity



# Excess power transmission




- Logarithmic scale
- Plot power excess relative to the minimum
- Trends are constant g-factor
- Implies R=2 more forgiving than R=1

# But

- R=2m, L = 0.6 m is the same design as the eLIGO OMC that caused problems
- Should we "be more accurate"? How?
- Should we go for the $\Phi_G$ ~135 instead of $\Phi_G$ ~ 95 (R=1 m)?
- Easy to go shorter, hard to go longer
  - with 1 m ROC: $105 < \Phi_G < 135$
  - with 2 m ROC: $75 < \Phi_G < 95$

# Final mods

- Better diode mounting to make replacement and alignment easier while improving mechanics
- Remove preamps from board to improve stiffness,  mass distribution
- Better cabling and suspension mounting