OMC work

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ISC meeting

G110175

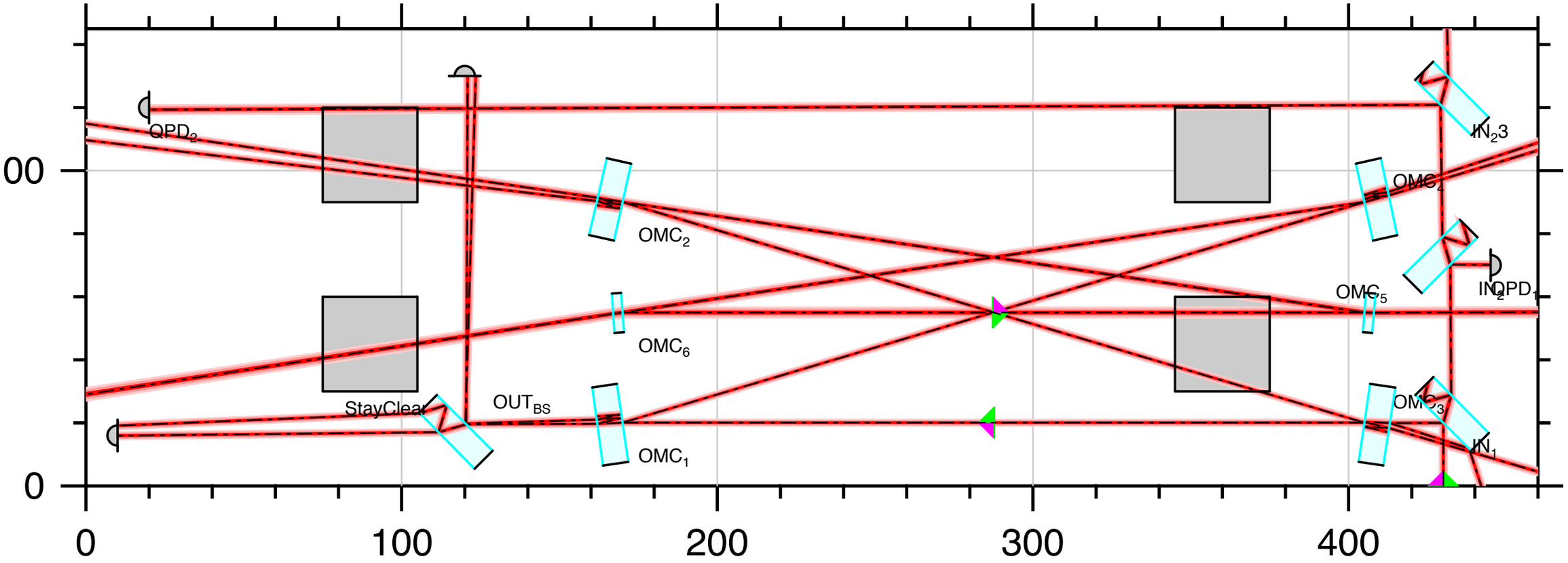
Output mode cleaner

- Optical cavity and photodiodes to read out the anti-symmetric port
- Filter 9 MHz and 45 MHz RF sidebands
- Filter higher-order spatial modes from
  - junk modes
  - mode mismatches

OMC initial layout

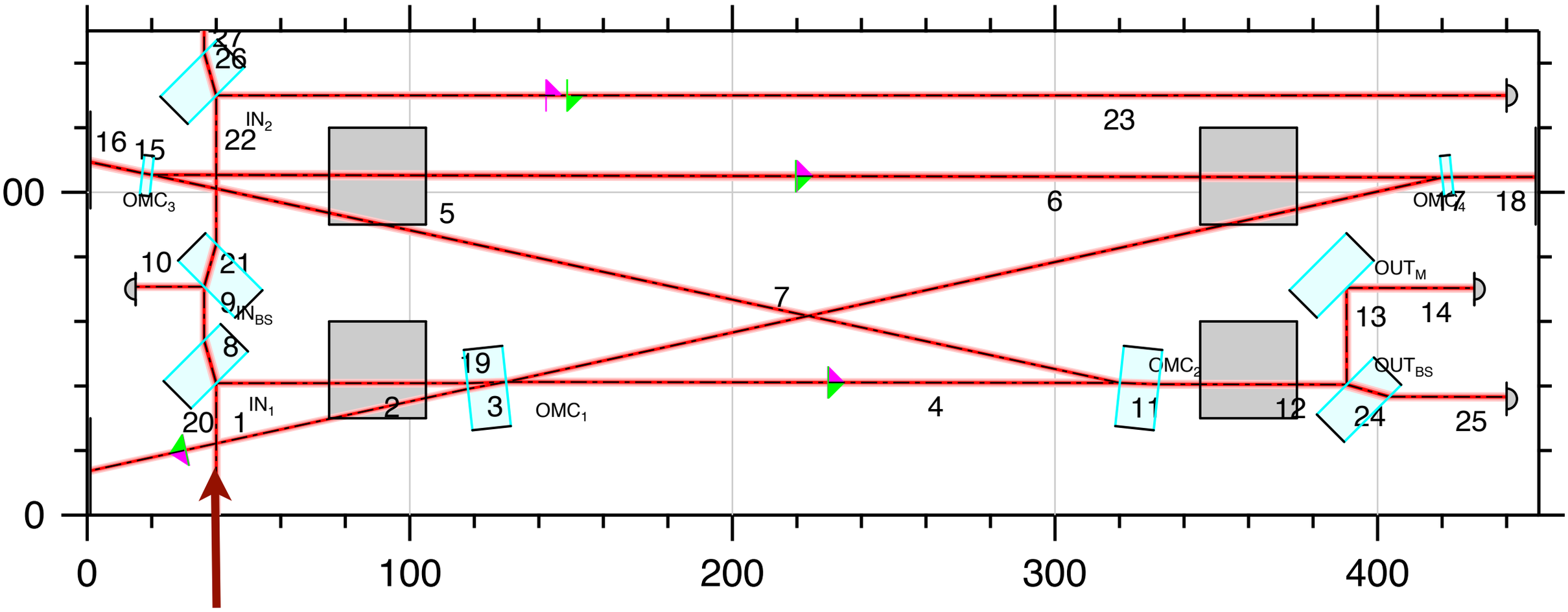
- Must match eLIGO suspension -- same weight (8kg) and size
- Developed in Optocad
- Tried a variety of designs
- Maximize cavity length for the given footprint

“6 Shooter”



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

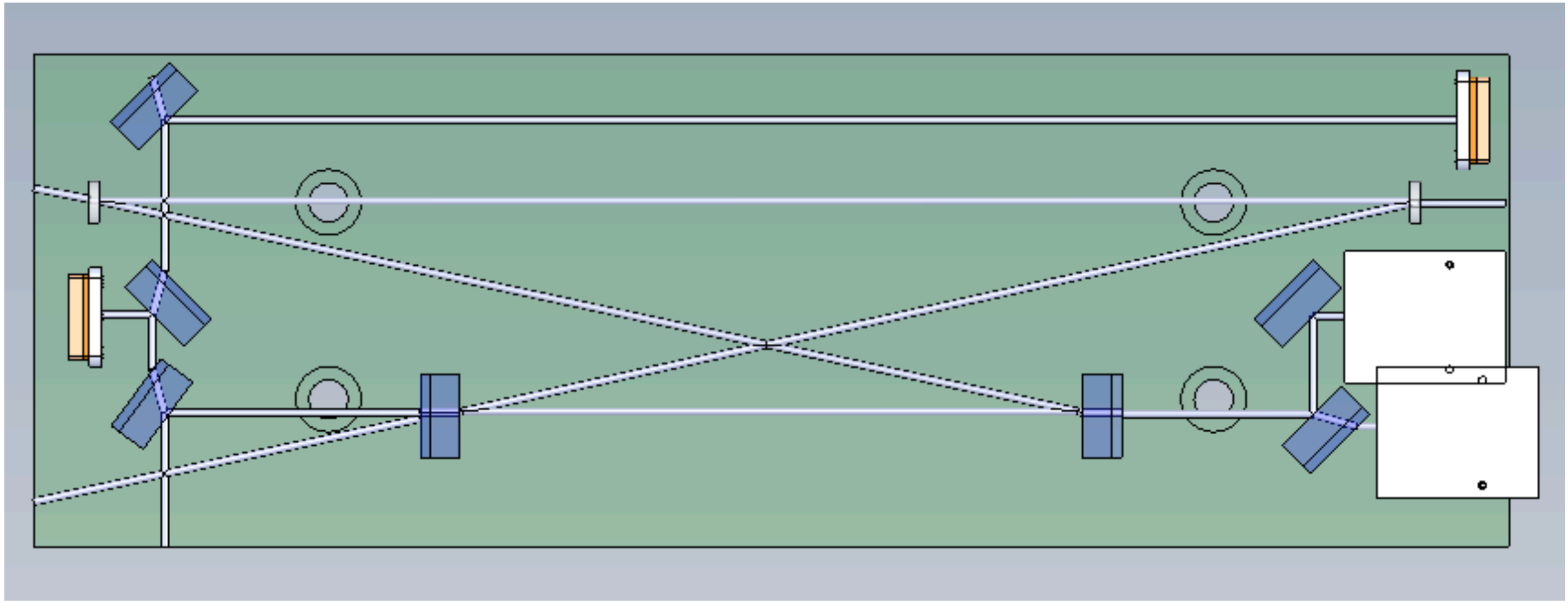
“Bowtie”



- 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

LIGO

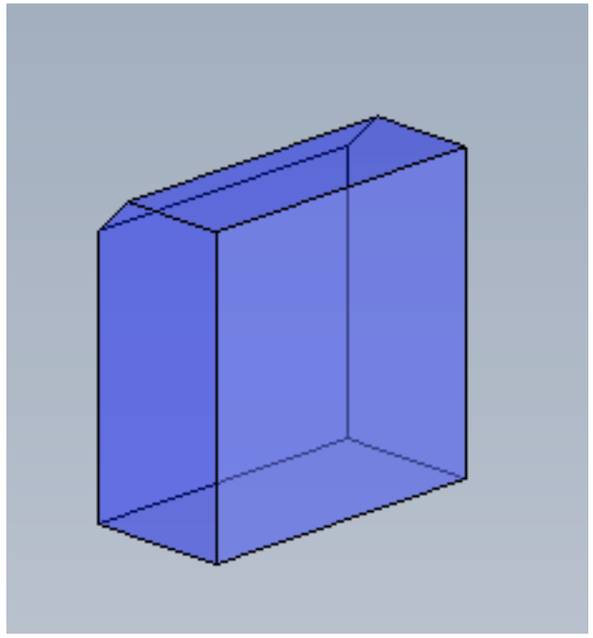
Into solid works



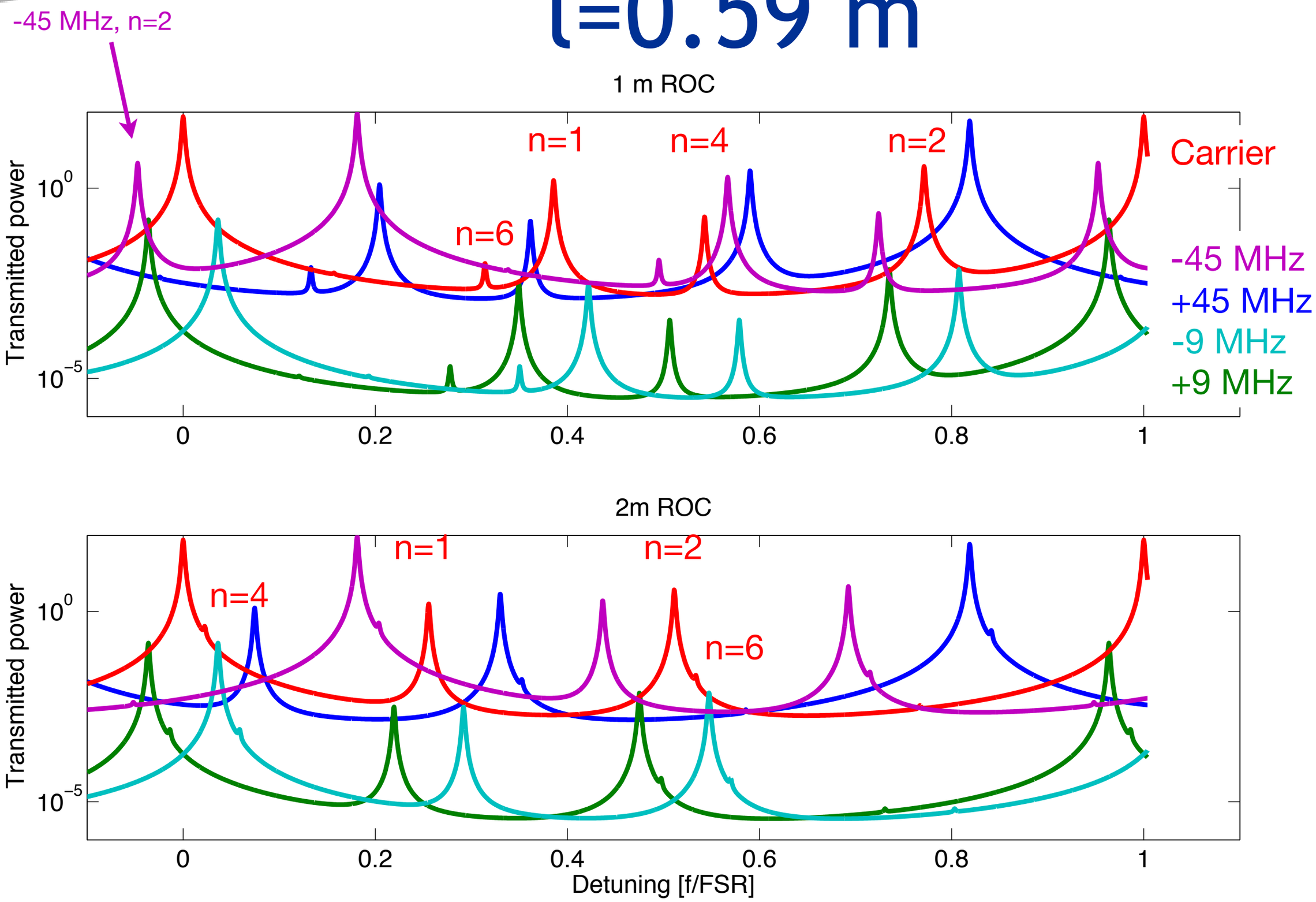
- New macros for importing geometry from a text file (VBA program)

Tombstone Mirrors

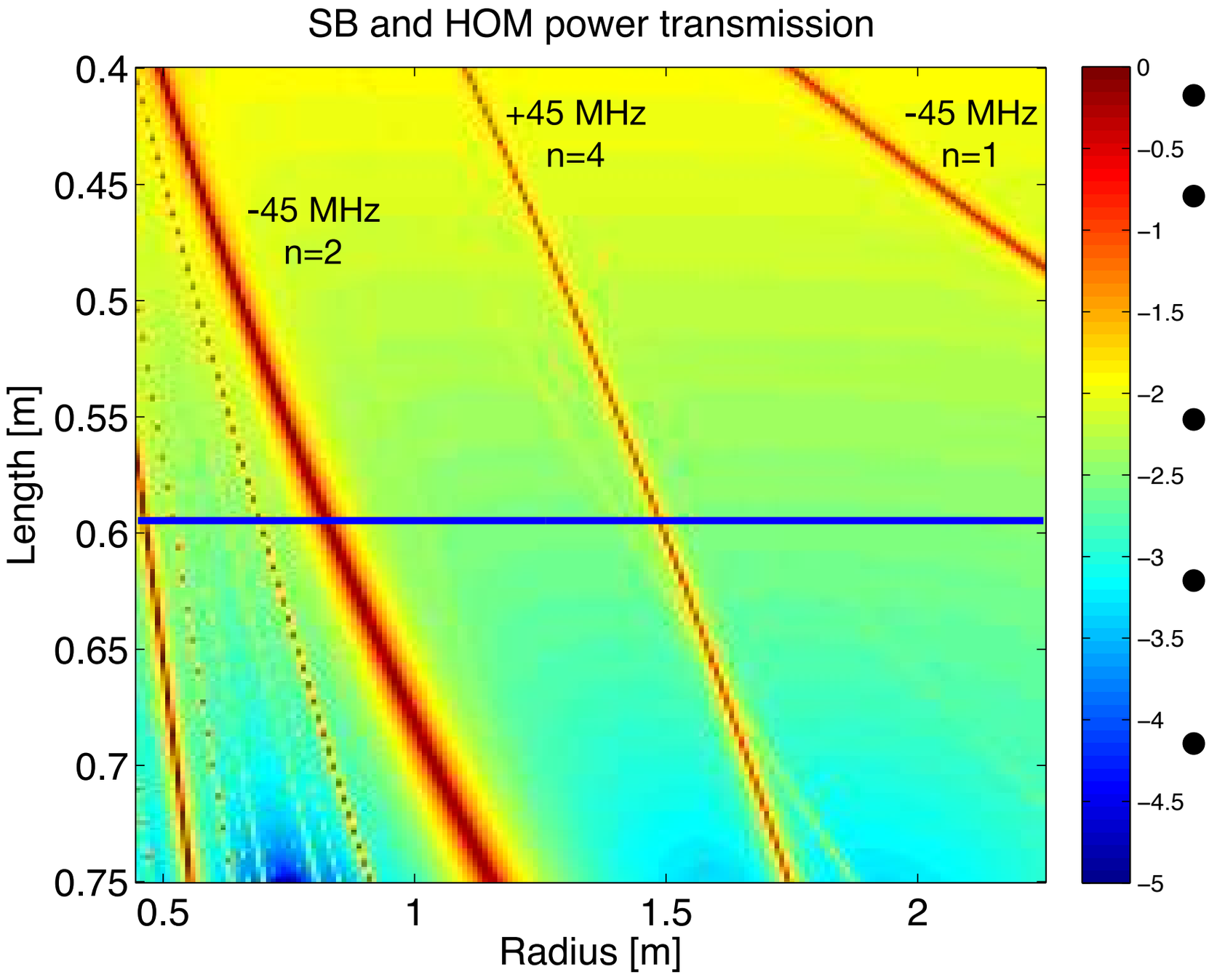
- More rigid design
- 2cm beam height
- chamfer to indicate AR surface
- Fewer epoxy bonds and assembly steps
- Pitch tolerance tight but not tragic (see LIGO-T0900647-v2: Ray optics calculations of alignment matrices)
- Requires 3 coatings:
  - High reflector (at 6 deg and 45 deg)
  - Partial reflector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



Mode transmissivity
l=0.59 m



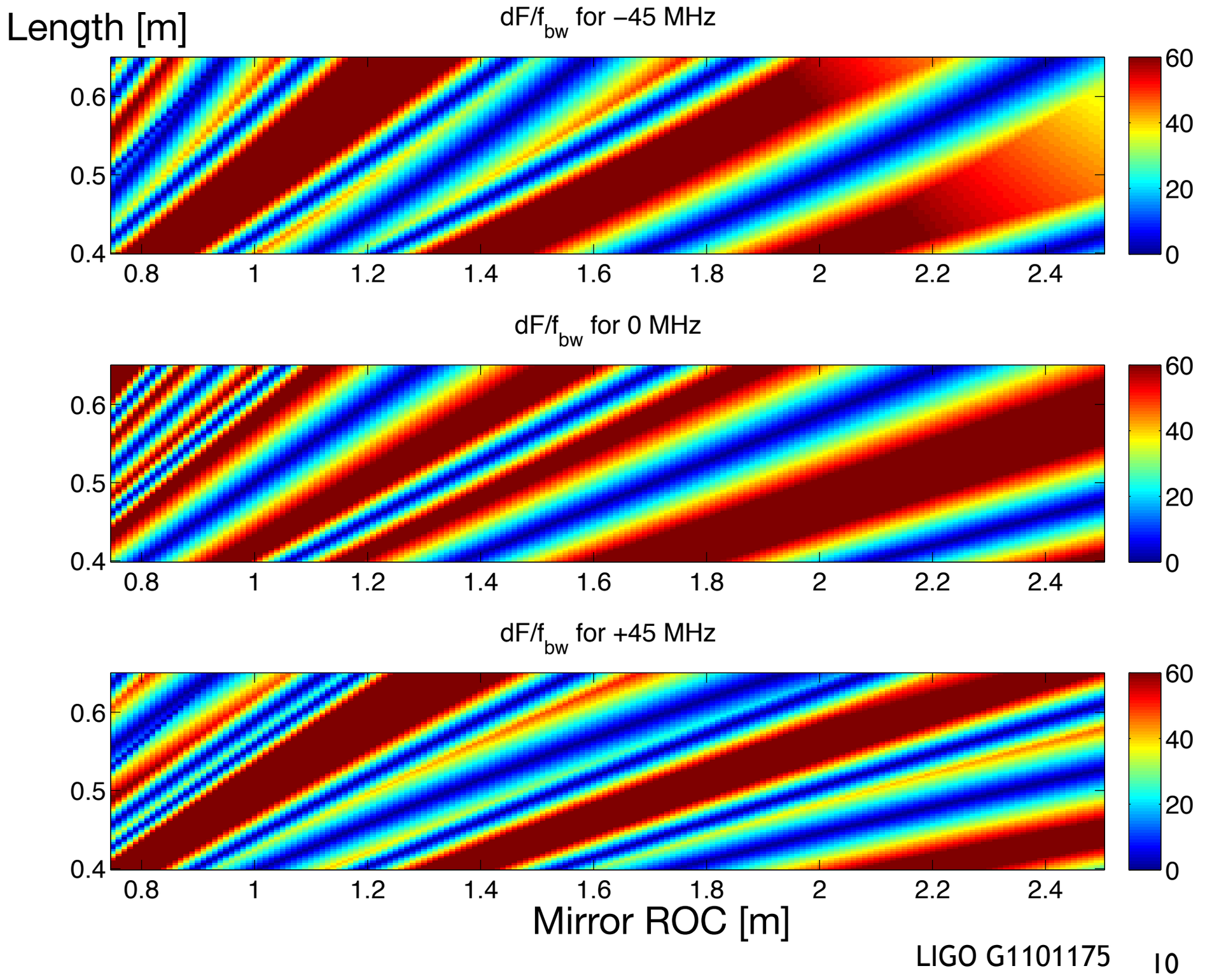
Excess power transmission



- Logarithmic scale
- Plot power excess relative to the minimum
- Trends are constant g-factor
- Implies R=2 more forgiving than R=1
- But dominated by constant 45 MHz power

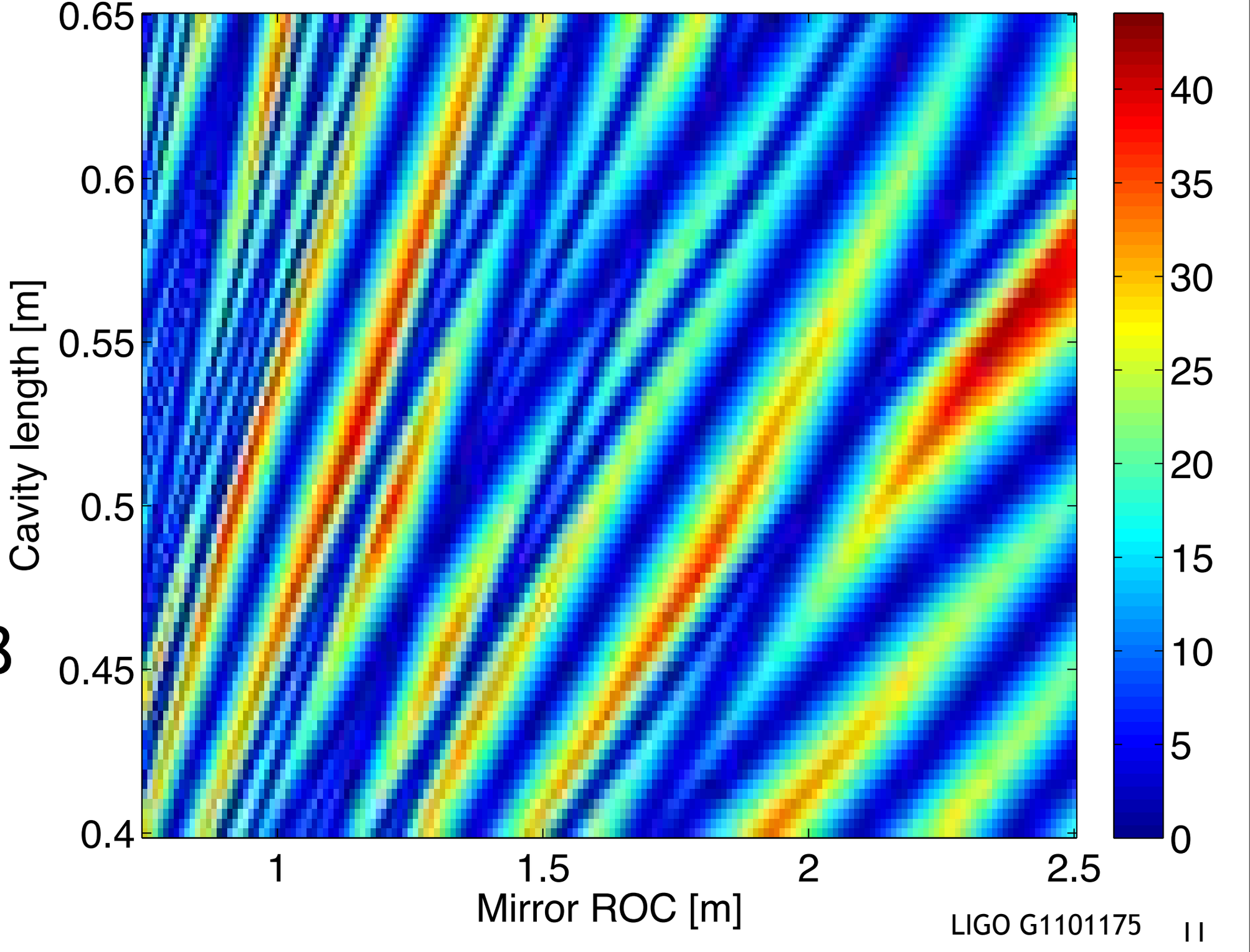
Better: mode spacing

- Calculate the distance to the closest mode
- Normalized by the cavity bandwidth



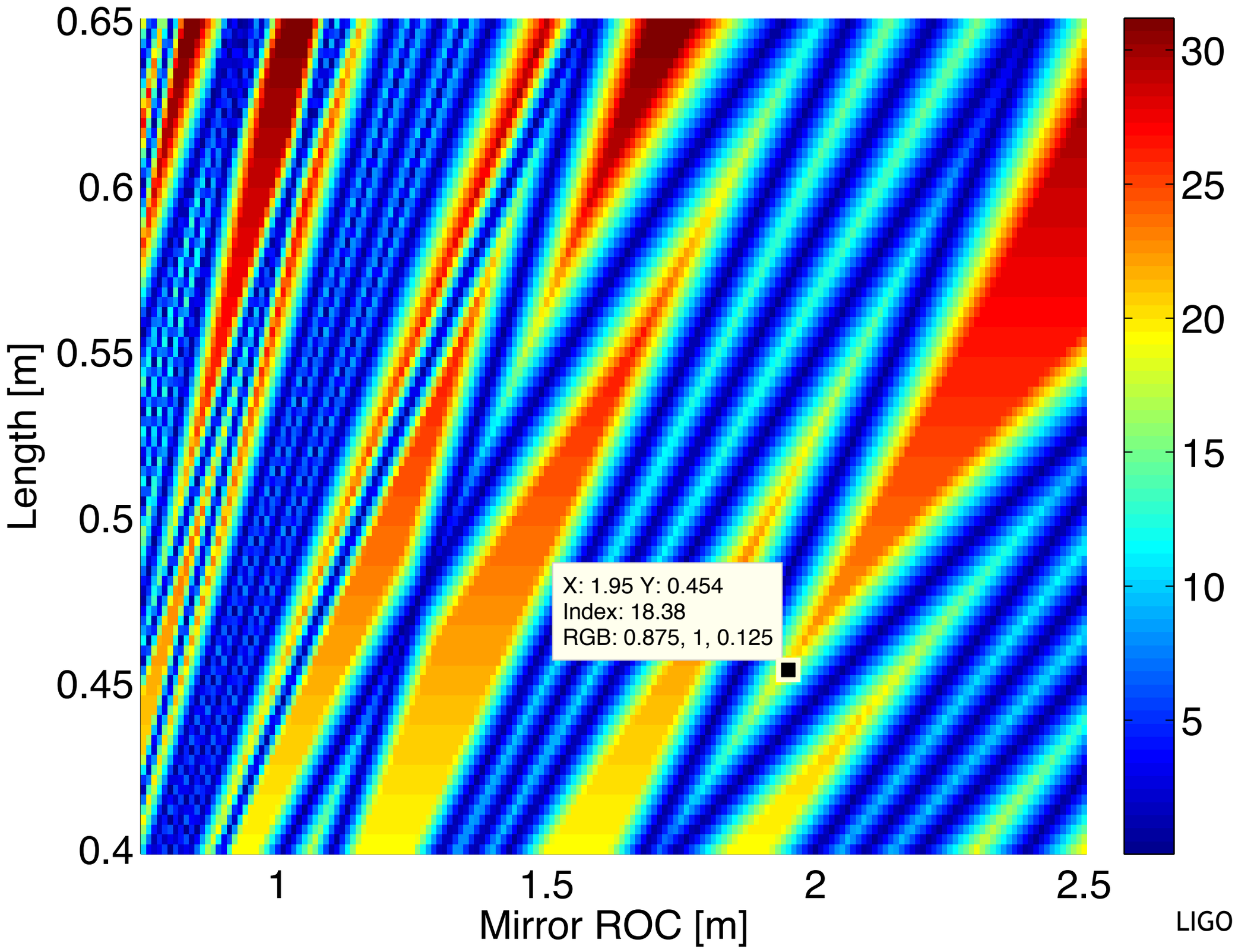
3 frequencies

- Minimum distance
- Up to N=8



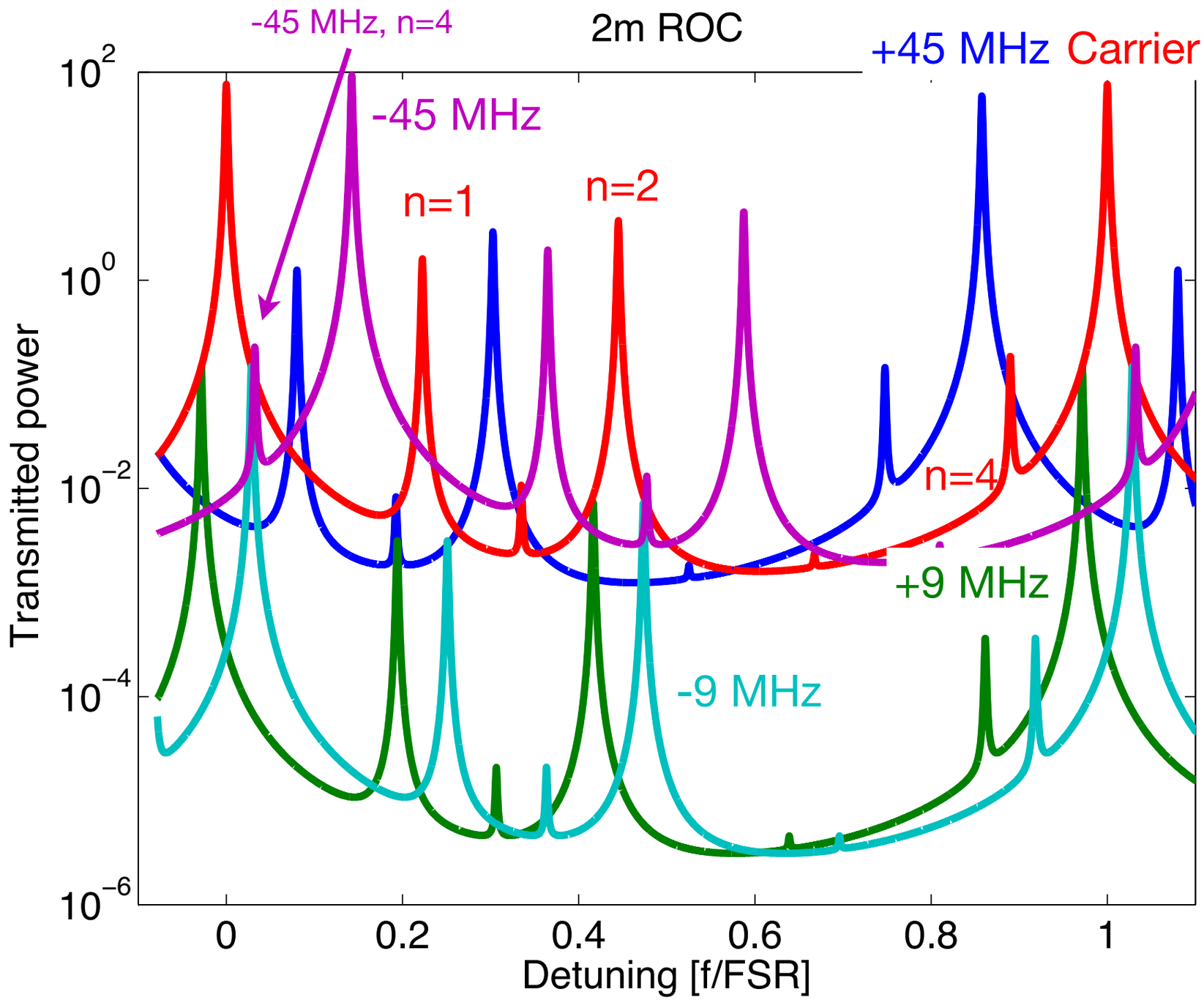
All frequencies

df/ f_{bw} for 0, ± 9, ± 45 MHz, N≤6



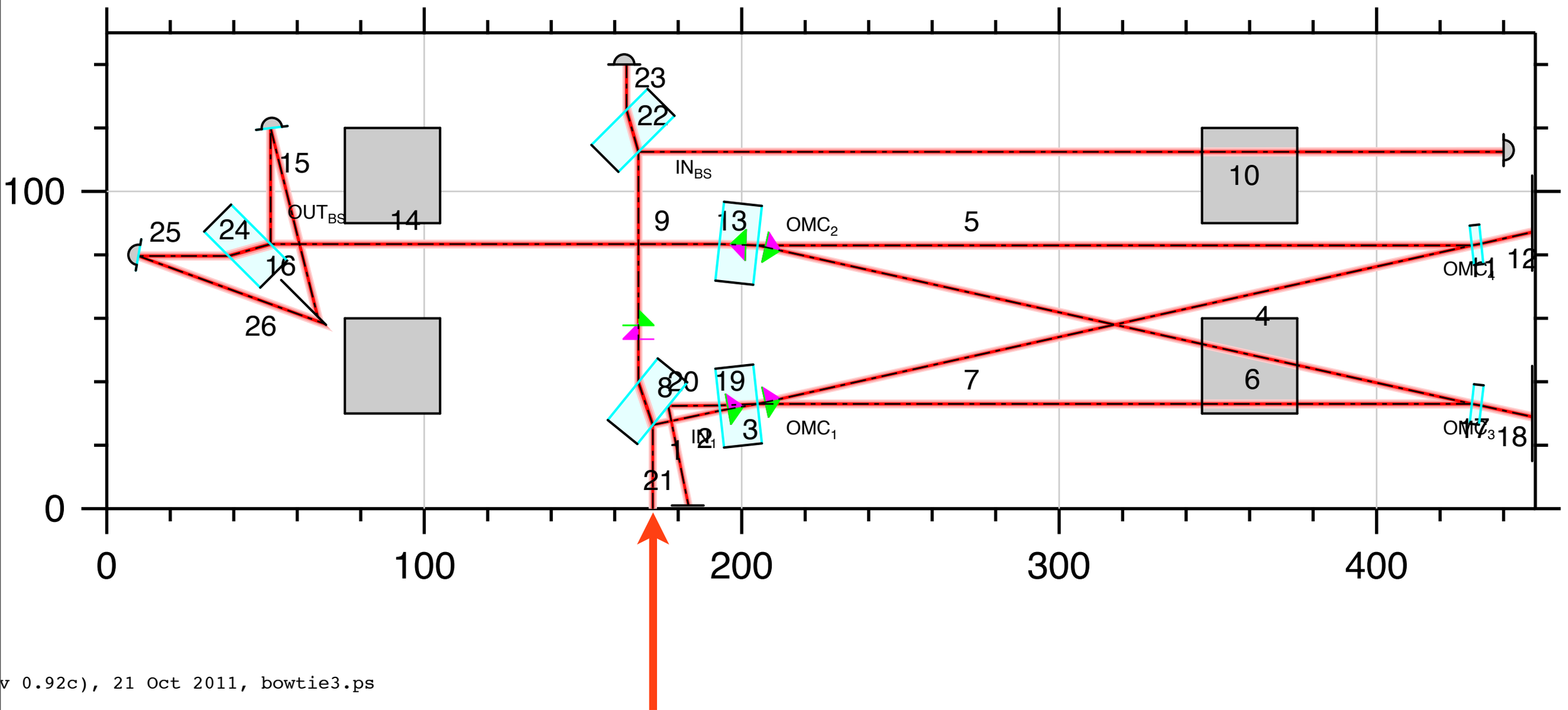
Optimum

ROC	2m
Roundtrip length	938mm
Roundtrip Φ_G	80.1deg



Layout

- Working out design details



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