# Mexican Hat developments
## LMA cantilever measurements

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# Mexican Hat status

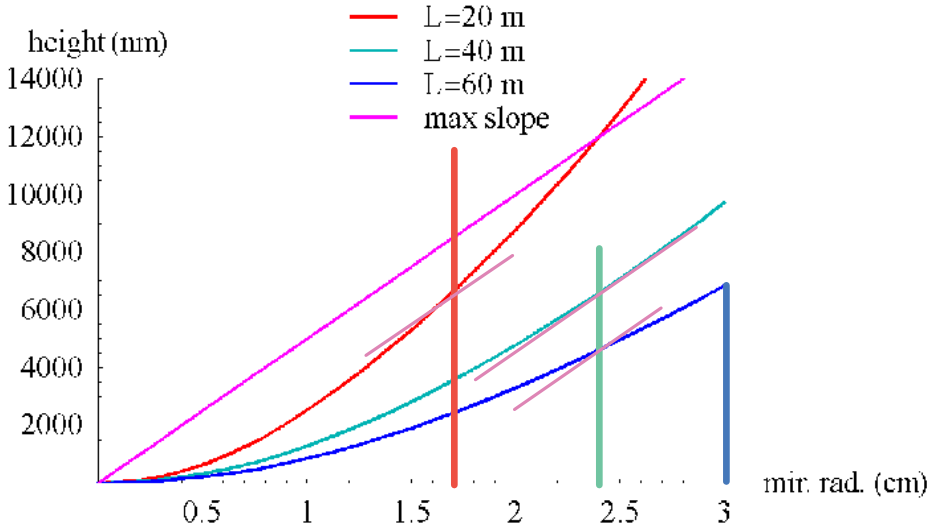
- Marco Tarallo writing result paper
- John Miller to make PhD work on MH continuing development
- Replace waffling flat mirrors
- Compare performance of three MH prototypes
- Establish production specs
- Study angular sensitivity / wavefront sensor requirements

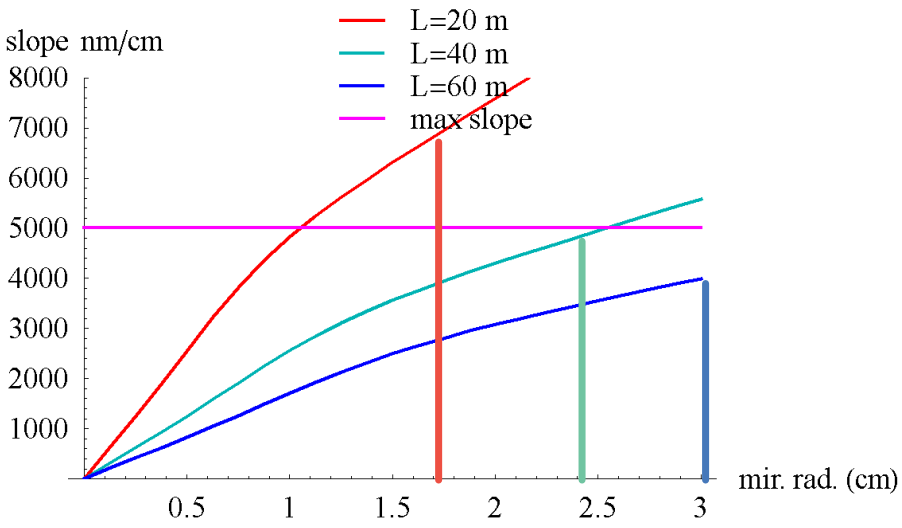
# Mexican Hat status

- Present rigid suspended cavity works with ~flat MH mirror
- Concentric MH mirror cavity required to reduce radiation pressure instabilities
- Concentric MH mirror cavity for present structure is expensive to achieve
  - The max slope measurable in Fizeau interferometer 500 nm/mm
  - Optics tooling necessary to overcome this obstacle is expensive both in terms of money and effort
  - Developing small MH is in any case a dead end or no immediate interest for GW detectors

# Mexican Hat status

- Concentric MH cavity mirrors feasible with present deposition technology if $r_{curvature} \geq 40$ m



# Mexican Hat status

- Cheaper and more effective to build a new suspended interferometer structure
- Need Independently suspended/controlled mirrors
- Roughly as expensive as the present rigid interferometer structure
  - 45-50 m for semi-cavity
  - 90-100 m for full cavity
- Intermediate step towards full scale cavities
- Could be expanded to a MH-TNI with twin cavity

# Mexican Hat status

- Exploring feasibility of new prototype
- John Miller will develop the new interferometer design in parallel with finalizing the characterization of the present MH rigid cavity interferometer

# Coating material measurements at LMA

- The measurement technique:
- Clamped cantilever silica blade ringdown measurements before and after coating
- Measurement improvements:

- Annealed blades (~1000 $^{o}$C) before measurement
- Greatly improved the clamping technique
- Good repetitivity

# Coating material measurements at LMA

- Improved signal/noise Thanks to favorable thickness ratio $(100\,\mu m / \sim 1\mu m)$

$$\phi_{Si} = 1.44 \bullet 10^{-4}$$

$$\phi_{Ta} = 9.0 \bullet 10^{-4}$$

$$\phi_{Ta-Ti(\,form-5)} = 7.8 \bullet 10^{-4}$$

$$stat - relative - error = 15\%$$

- Up to 2 measurements/day

# Coating material measurements at LMA

- Systematic errors to be reviewed.
  - Vincenzo Pierro re-analyzing data / reviewing procedures

- Measurement's precision and repetitivity seem sufficient for optimized coating decision (still work to do)
- Maybe marginal for improved material measurements
- Further improvements/cross checks with reduction of the clamping losses using cantilevers welded to thicker support with Glasgow laser welding
- Sheila's group welded some, on their way to Lyon

# Ta-Ti mirror pathfinder

- Will use MH replacement mirrors
  + TNI mirrors
  as optical absorption formula 5
  (old formula 2)
  path finder