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# Status of the H1 Squeezer Experiment

8<sup>th</sup> EDOARDO AMALDI CONFERENCE,  
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ANU, AEI, MIT, CIT and LHO collaboration

# Motivation

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- High power operation in future detectors
  - Maybe the biggest remaining technical risk
  - Squeezing allows for lower laser power
- Squeezer technology now ready
  - 7 dB of squeezing down to 10 Hz
  - Has been demonstrated on a bench and on interferometers (40M)

## **Missing: Low frequency noise demonstration**

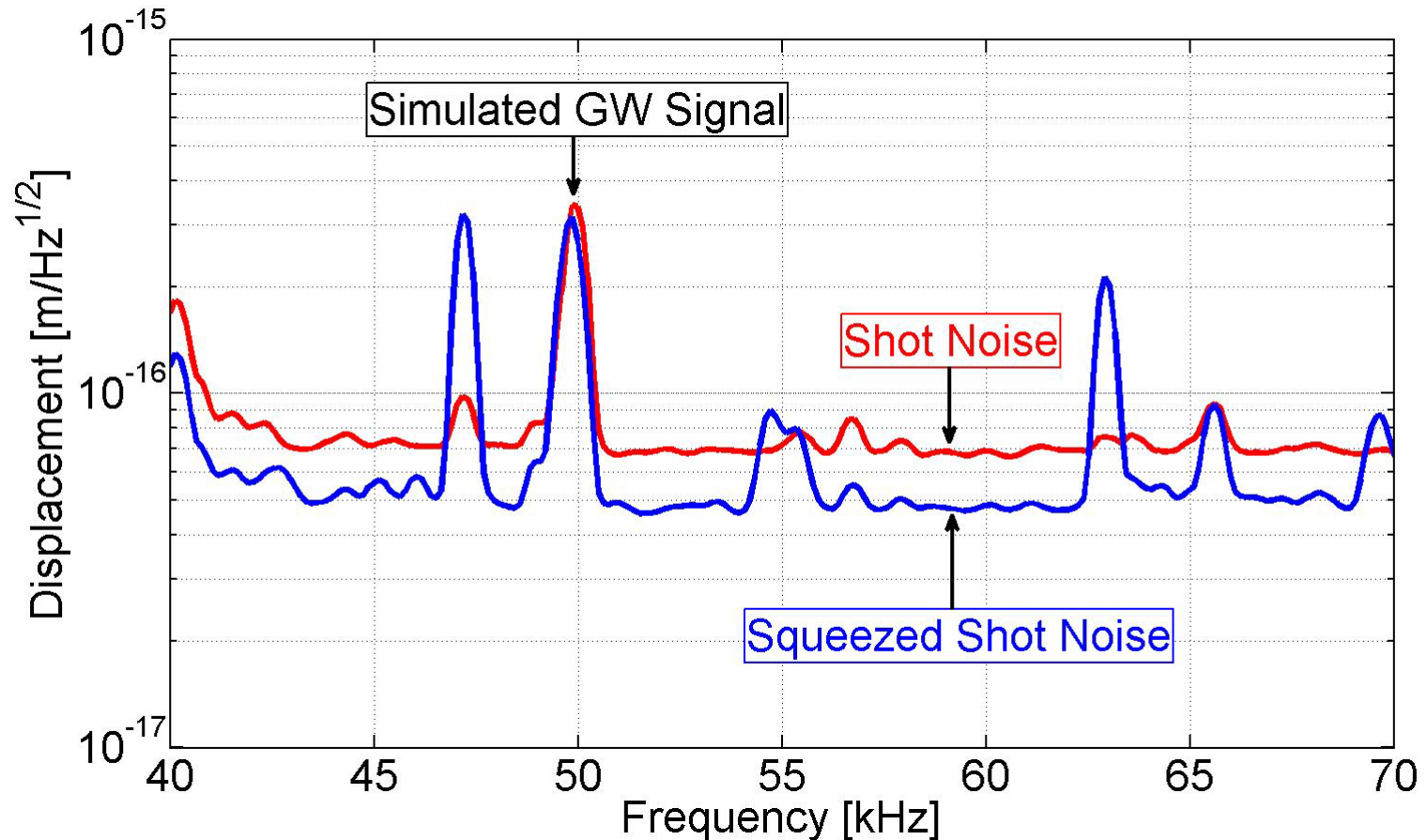
- Planned Experiments
  - GEO600: prototype for long baseline interferometers
  - Hanford: low noise at low frequency

# Goal of the H1 Squeezer Experiment

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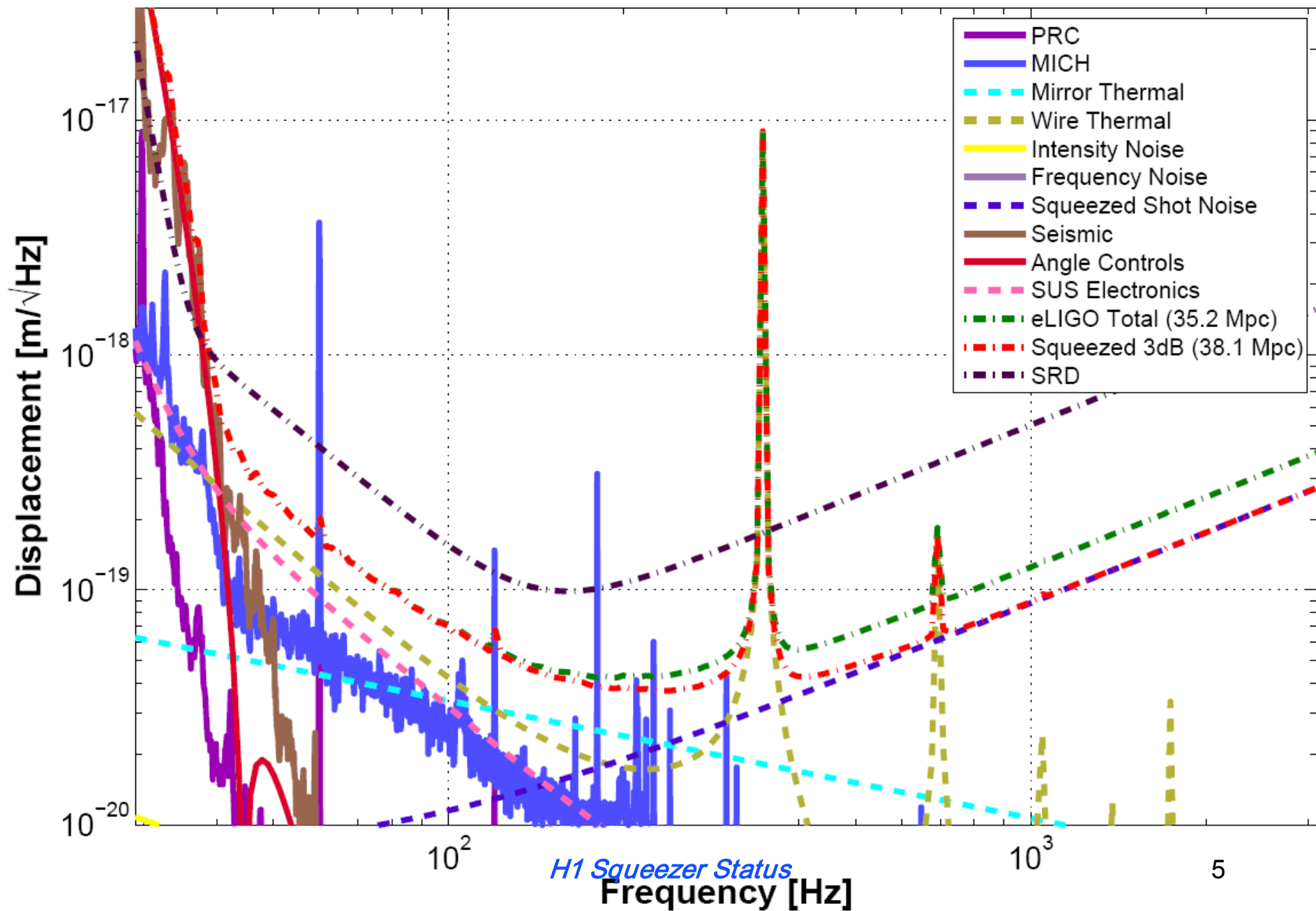
- ❑ Demonstrate squeezing at low frequency with a highly sensitive long baseline interferometer
  - Demonstrate 3 dB of squeezing at frequencies where we are shot noise limited
  - Do not introduce noise at other frequencies!
- ❑ Build a squeezer which could be readily turned into an advanced LIGO upgrade
- ❑ Be ready for a test in Hanford after next science run
- ❑ We got the OK to build it

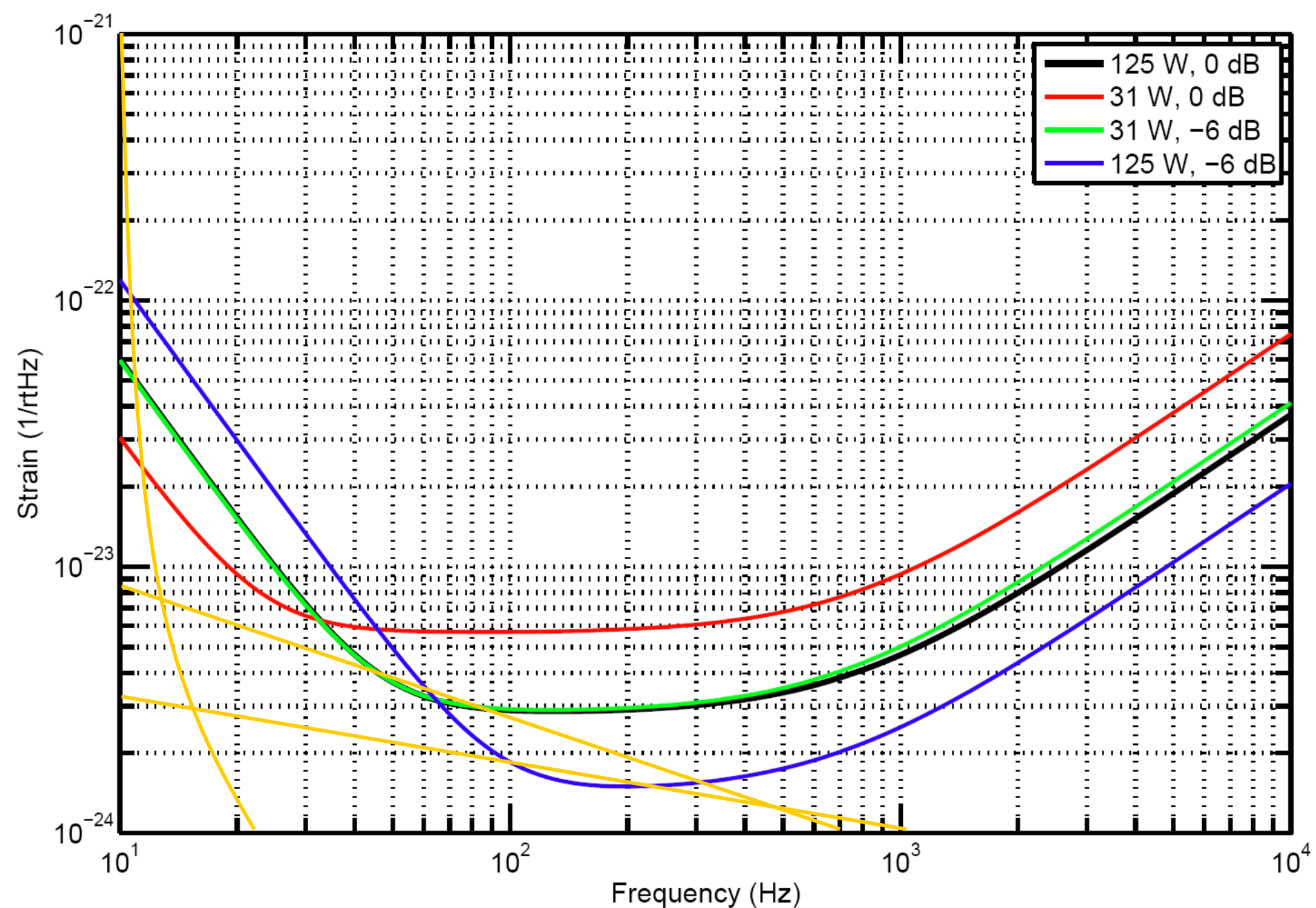
## 40M squeezing



*K. Goda, O. Miyakawa, E. E. Mikhailov, S. Saraf, R. Adhikari, K. McKenzie, R. Ward, S. Vass, A. J. Weinstein, and N. Mavalvala, Nature Physics 4, 472 (2008)*

# Squeezed Enhanced LIGO, 30 W



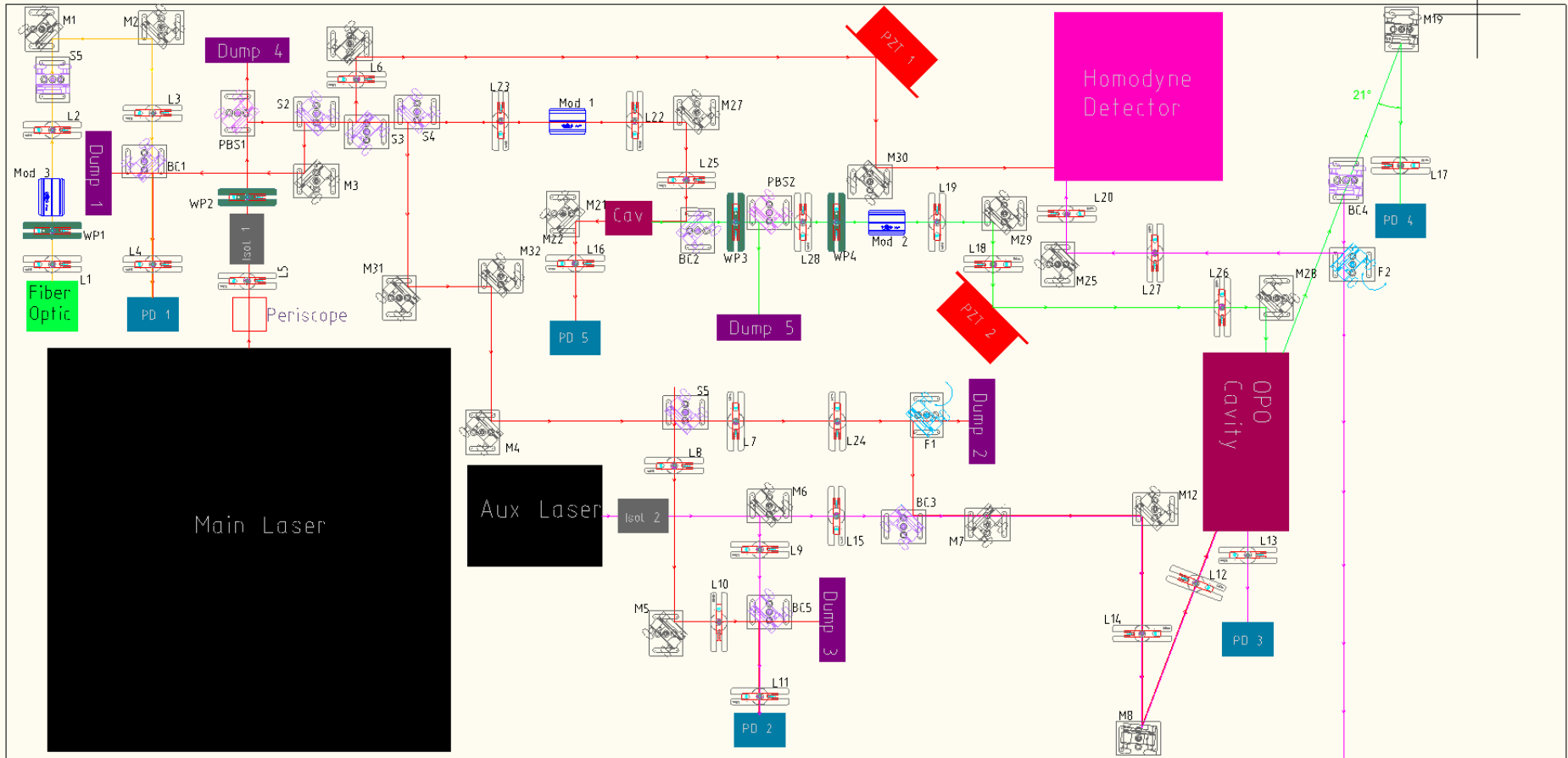


# Baseline Design

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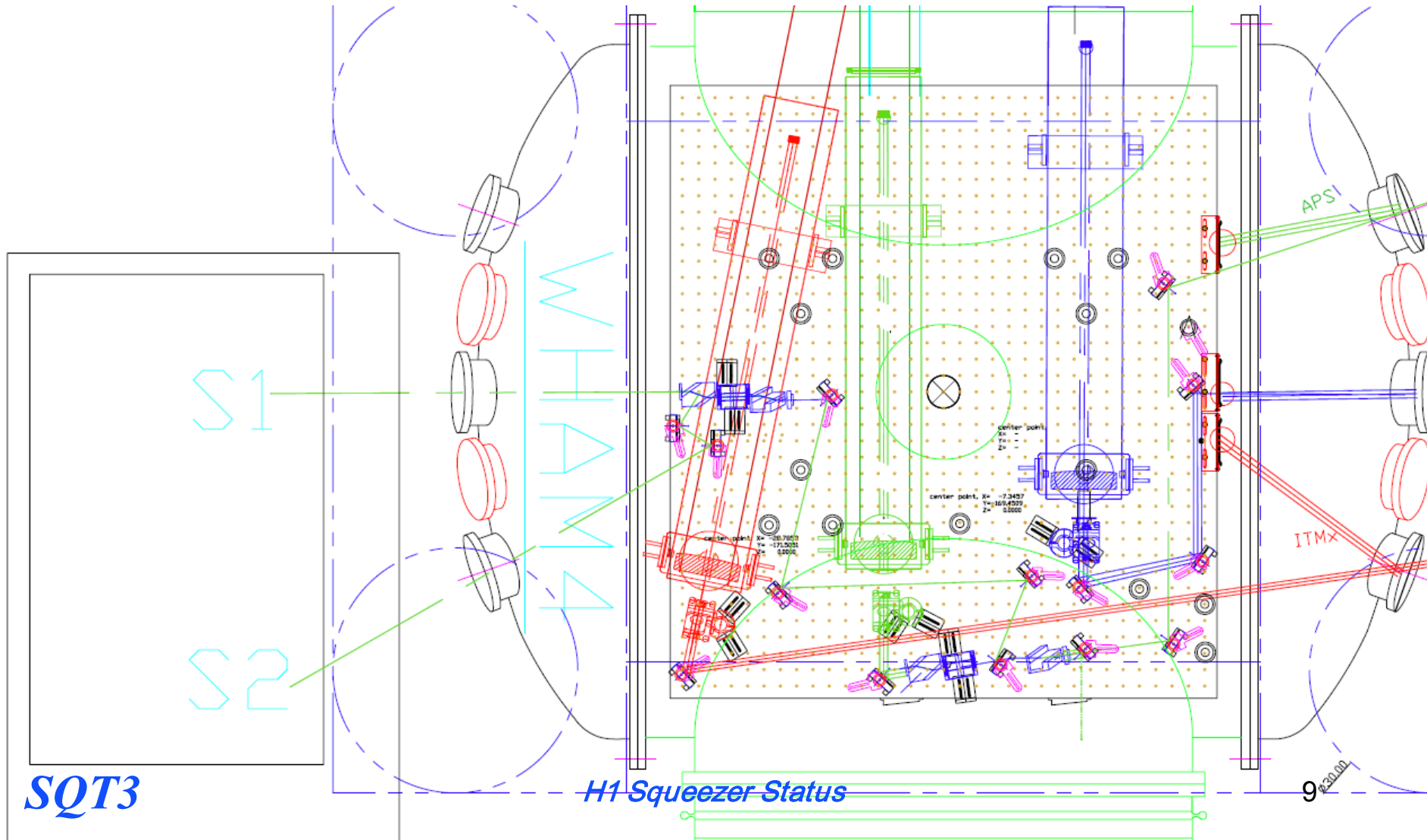
- ❑ Inject into anti-symmetric port
  - New optics table required (8' x 3')
  - New Faraday isolator design required
- ❑ Reuse initial LIGO Nd:YAG laser (10W)
  - Second-harmonic generator (SHG) uses AEI design
  - Locked to interferometer laser by fiber
  - Frequency locked auxiliary laser for frequency shifted subcarrier
- ❑ Optical parametric oscillator (OPO)
  - ANU design: Doubly resonant
  - Bowtie configuration: Less backscattering
  - Non-linear crystal: PPKTP
- ❑ Homodyne Detector from AEI
- ❑ Use advanced LIGO electronics where possible (Hanford)
- ❑ Assembly and testing at MIT

# Optical Layout





# HAM4 Layout



# H1 Squeezer Time Line



- ❑ Fixed start date for H1 experiment: 2/15/2011
  - ❑ Fixed end date for H1 experiment: 10/3/2011
- Better be ready!