



# Squeezing GEO600

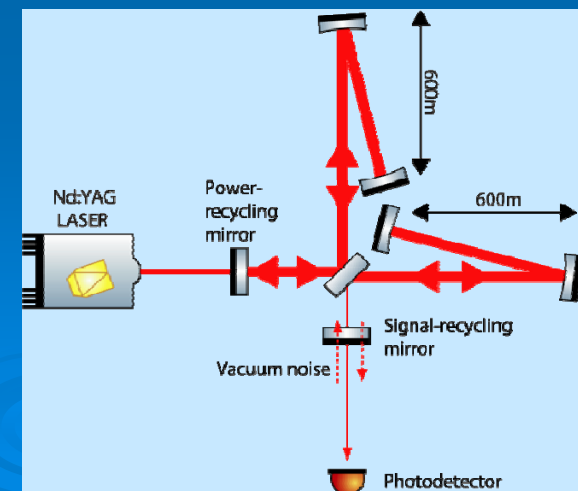
Harald Lück



# Current GEO600 operation mode



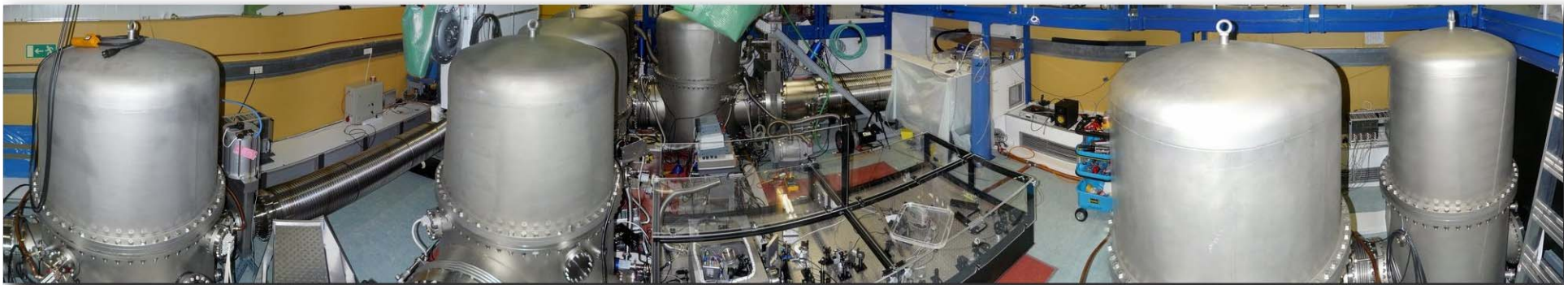
- Dual recycling; detuned to 550Hz
- SR transmission 2%
- Heterodyne read-out 15MHz
- 3 kW inside PR cavity



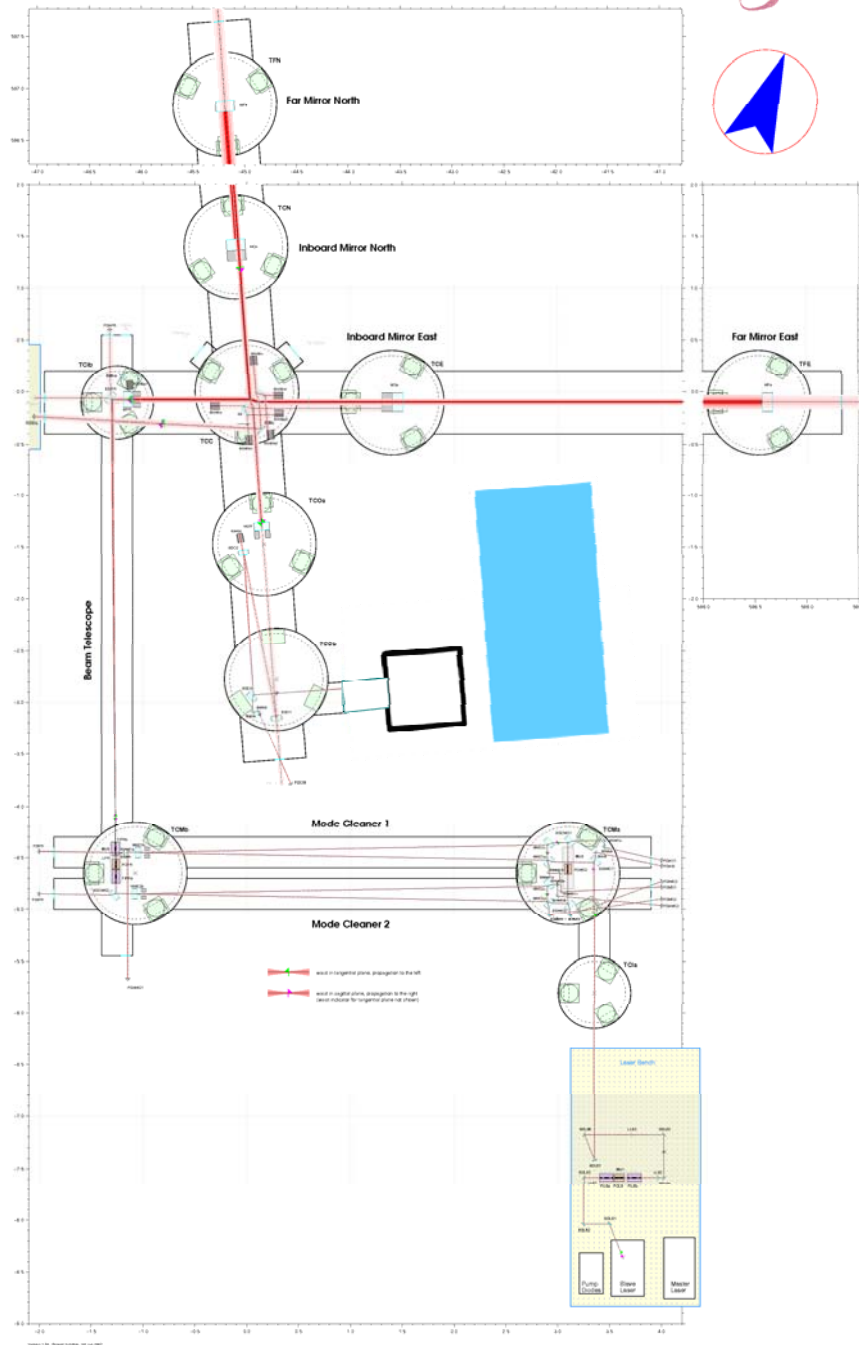
# Plans



- Astrowatch + low-risk commissioning until 'Enhanced' IFOs come online (spring 2009 )
- Keywords: DC readout, squeezing, OMC, higher power, thermal comp., tuned SR, lower SR factor, extended digital control...
- Goal: demonstration of long term stable operation of GEO-HF with squeezed light @ improved sensitivity



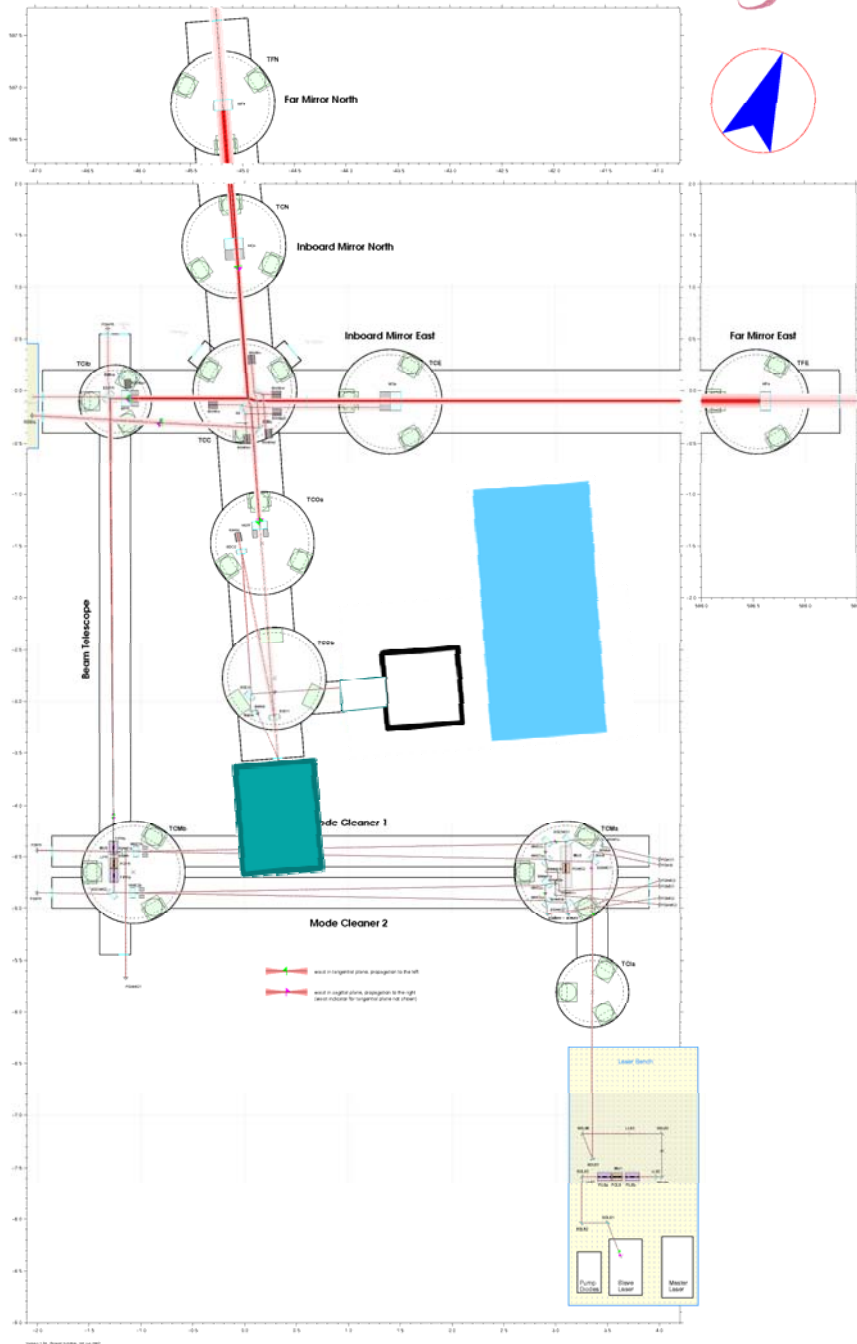
## GEO 600 optical layout



Now:

- Auto Alignment on detection bench
- Main photo detector on detection bench outside vacuum system

## GEO 600 optical layout

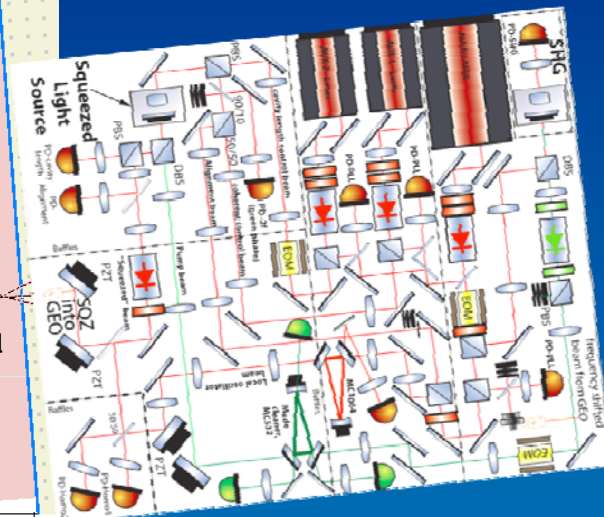
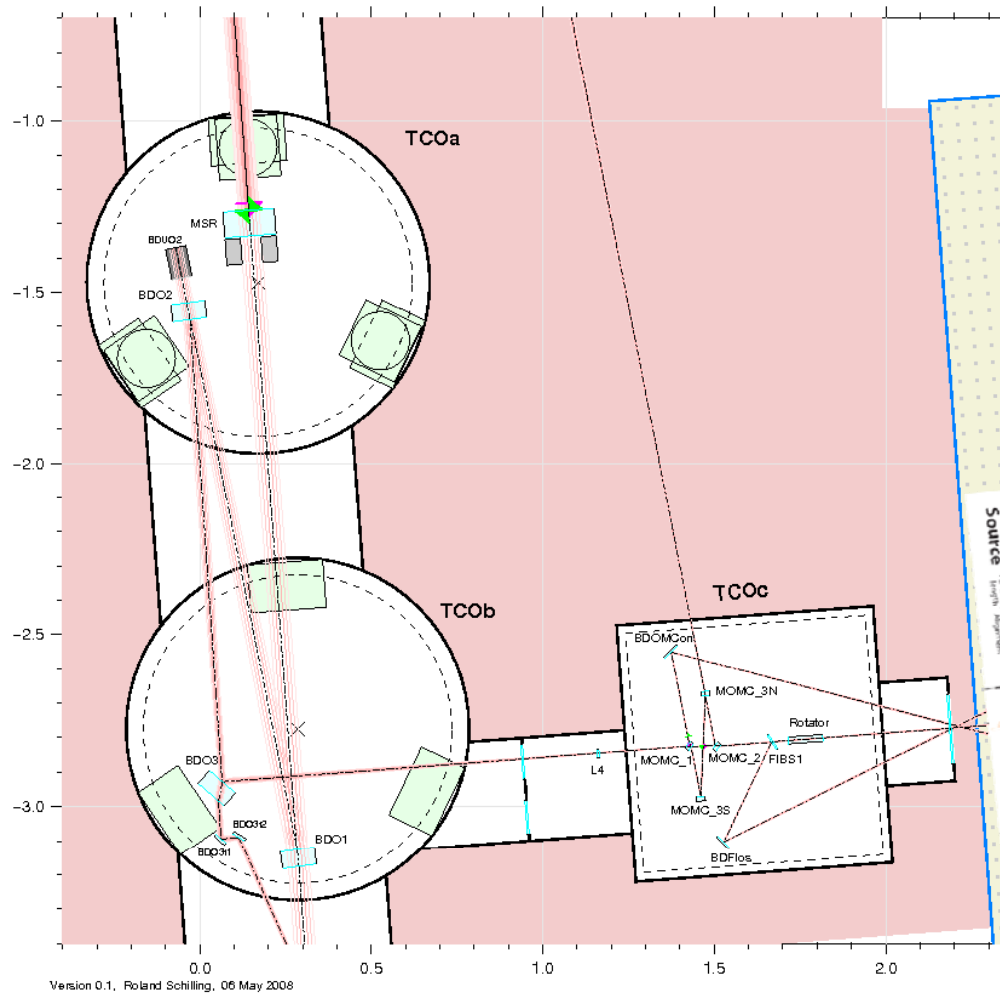


Then:

- Auto Alignment on new AA bench
- Main photo detector in additional vacuum tank
- OMC to reduce higher order TEM mode contributions to detected light
- > less technical problems with PD @ higher light levels

# GEO HF layout

## Output section

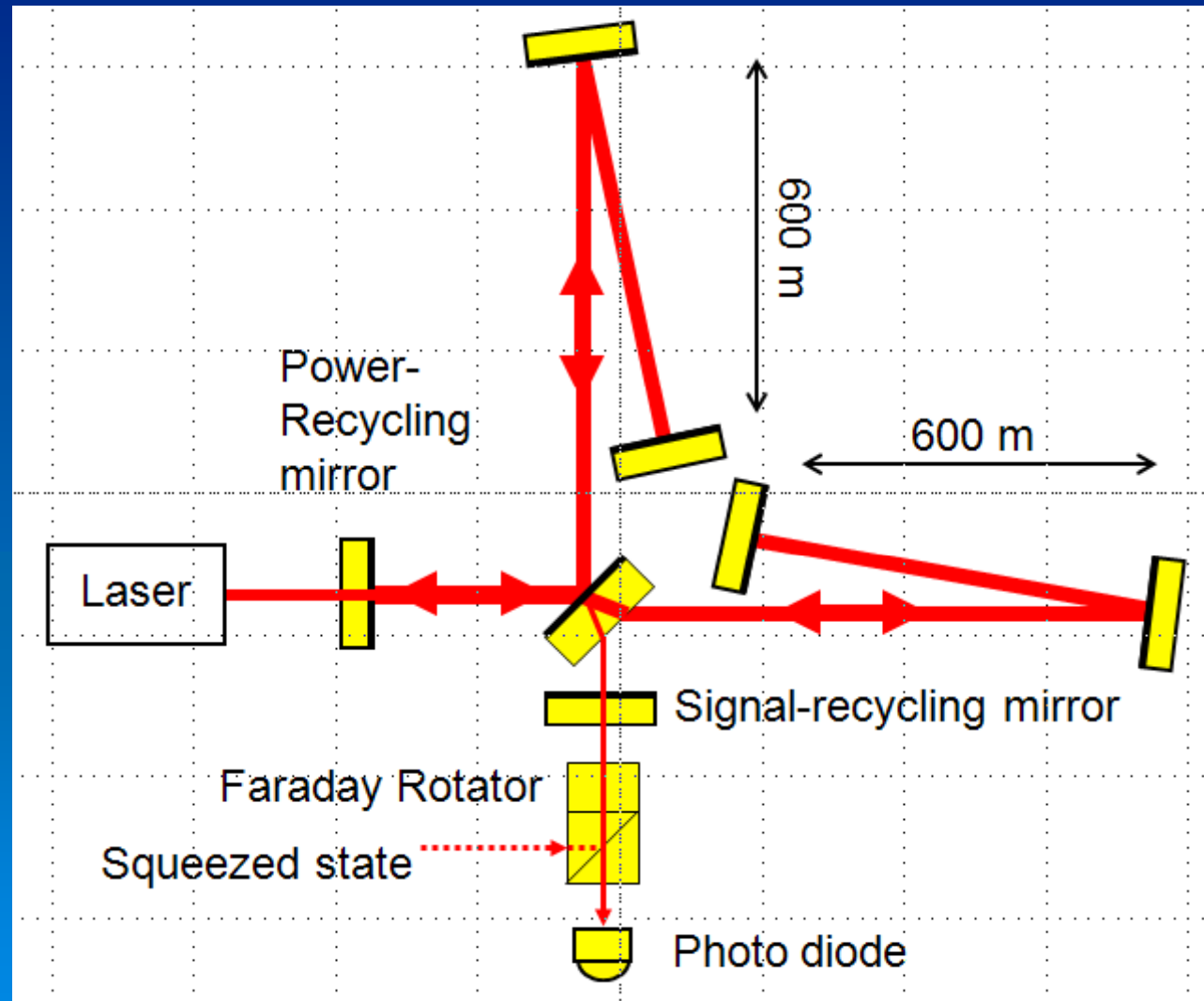


Inject squeezed light  
to lower shot noise

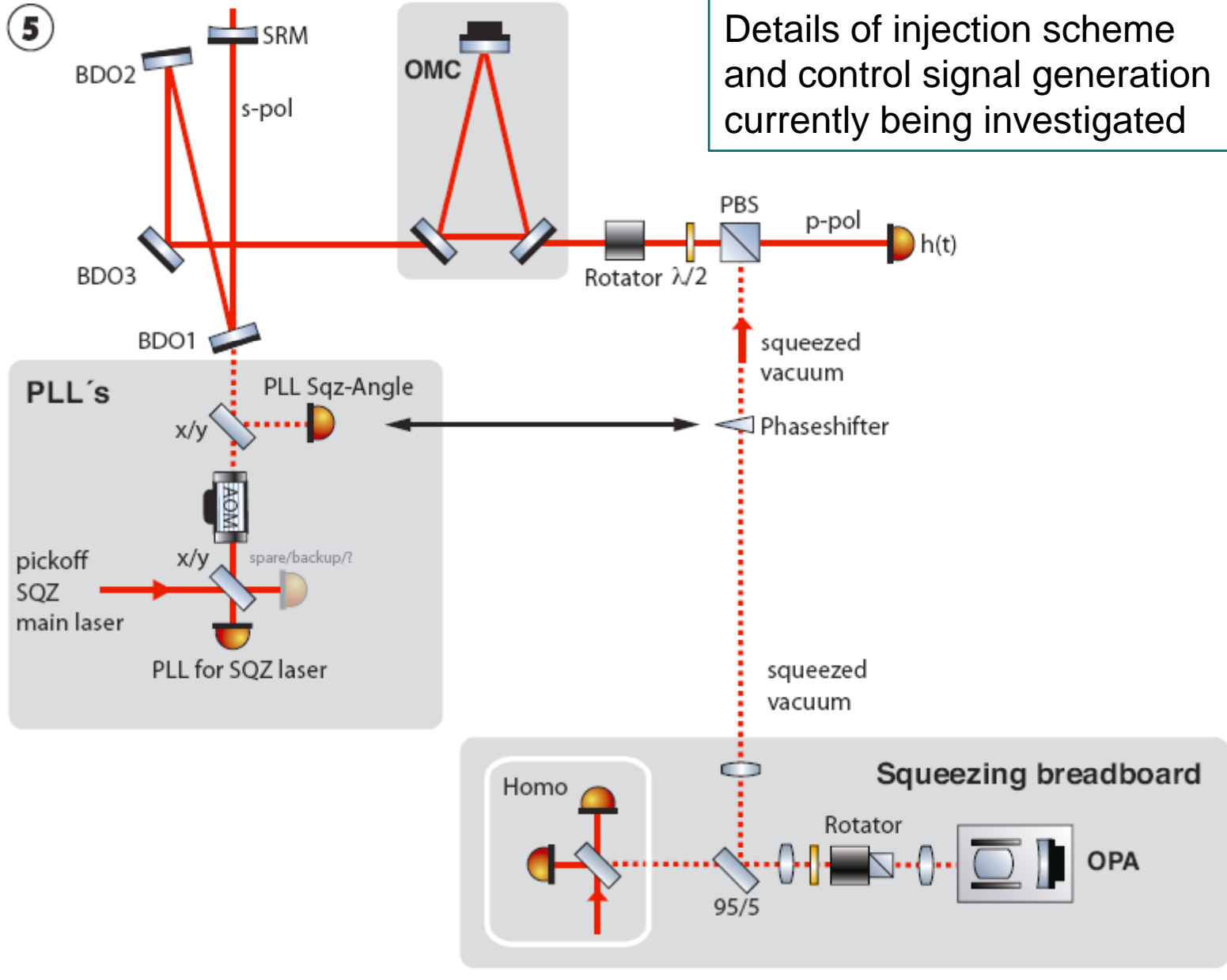
AA

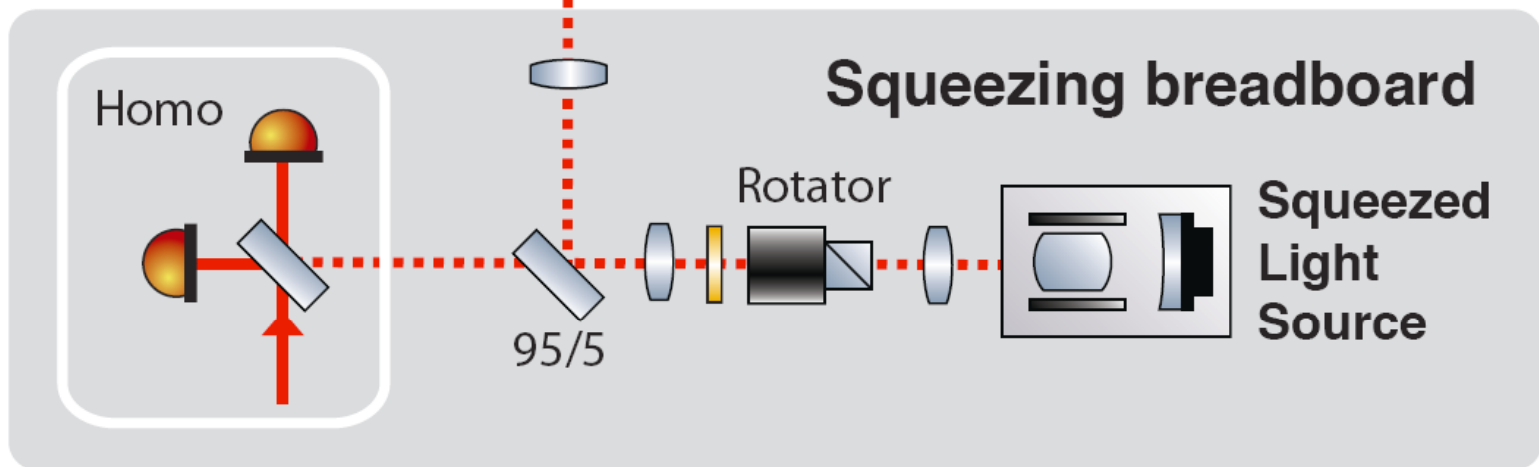
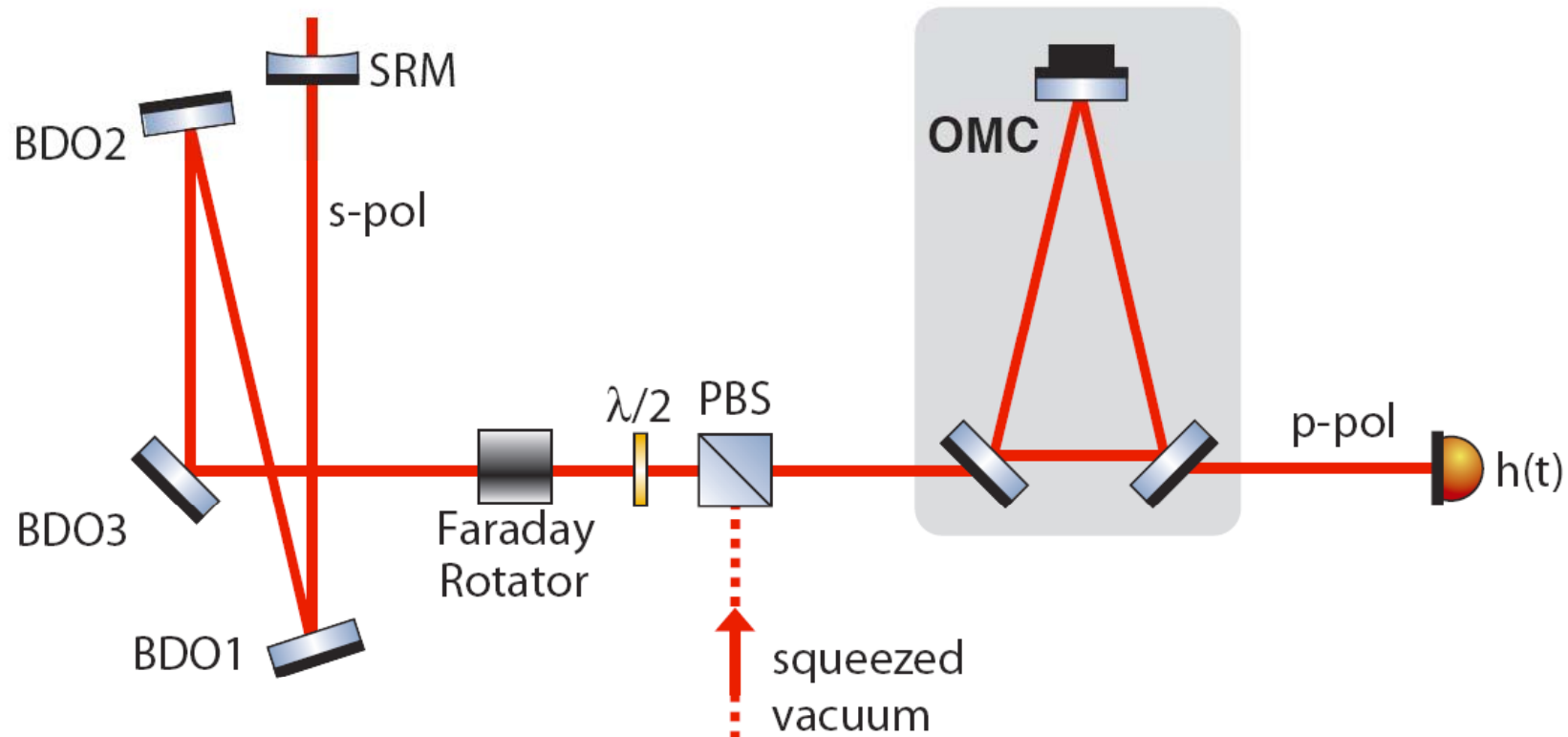
Cleaner 1

# Schematics of injecting squeezed light

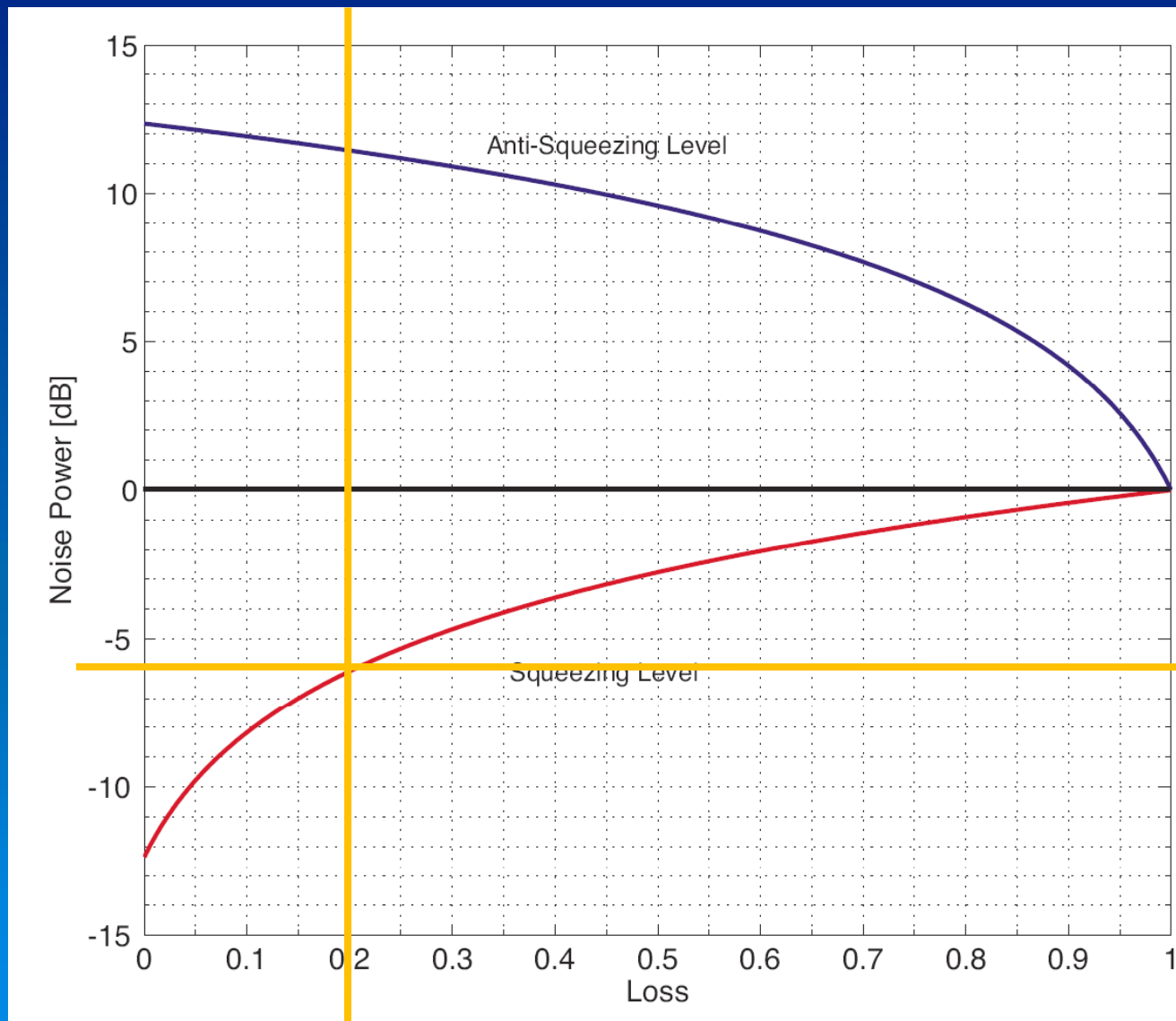


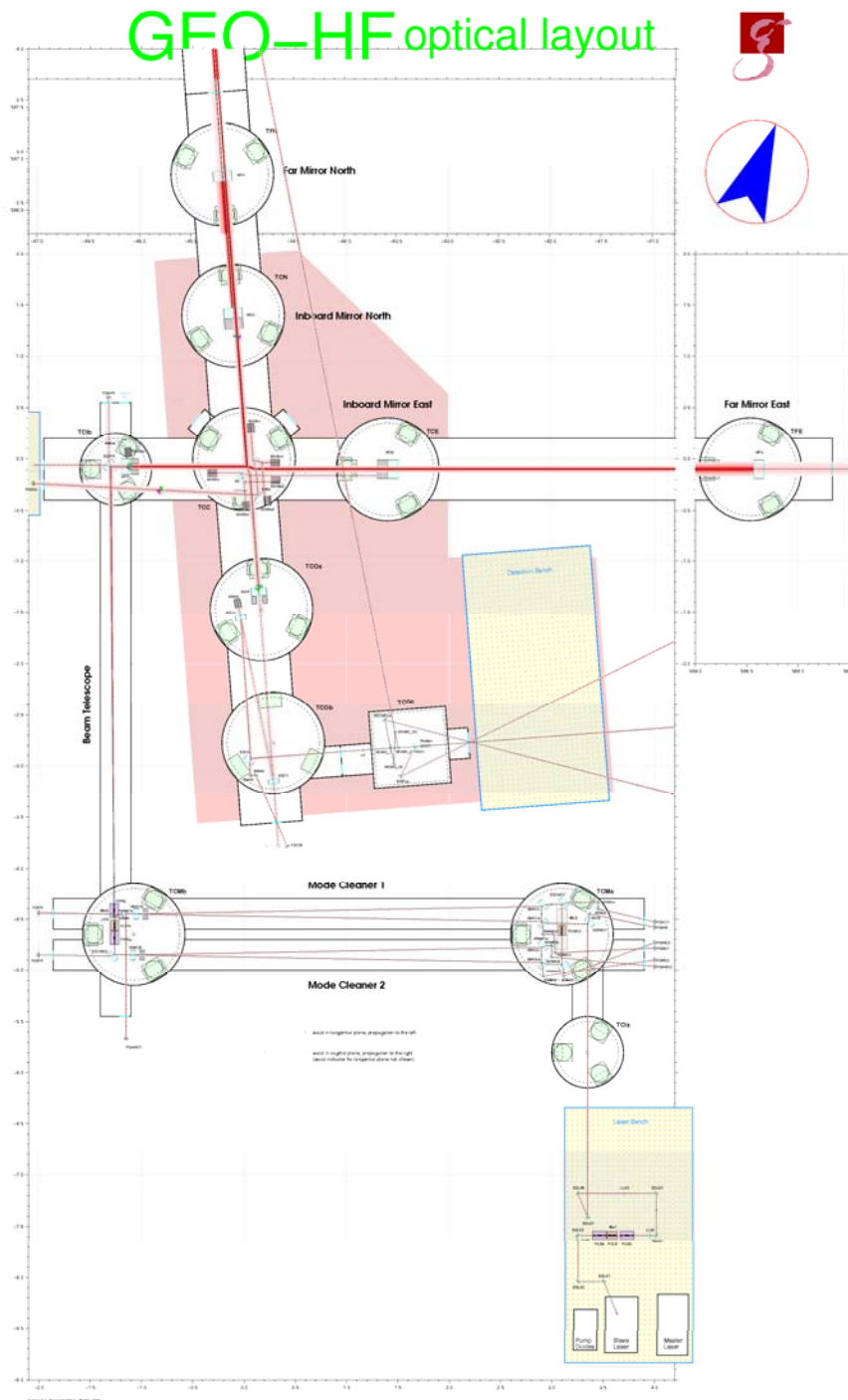
5





# Squeezed light and optical losses

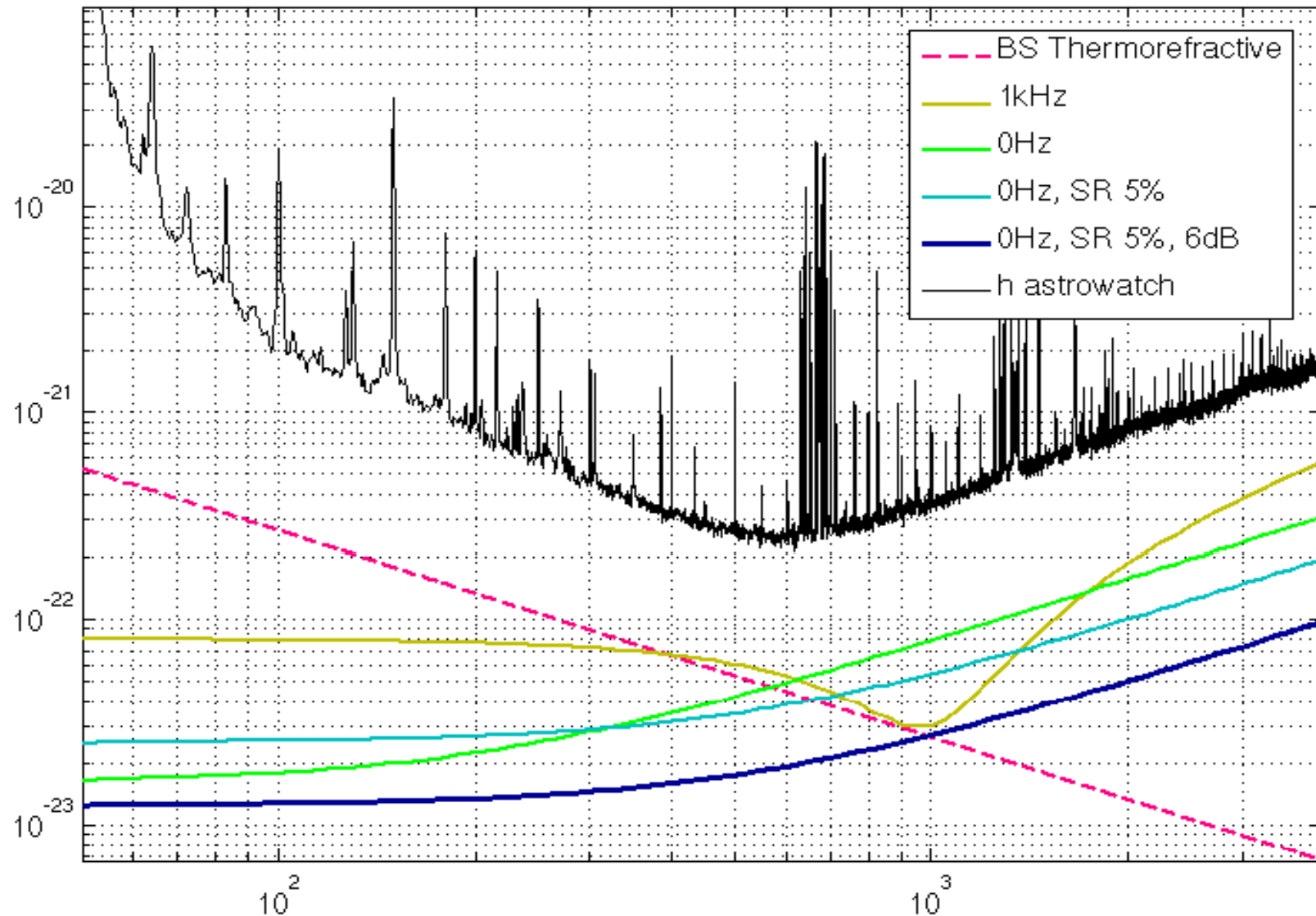




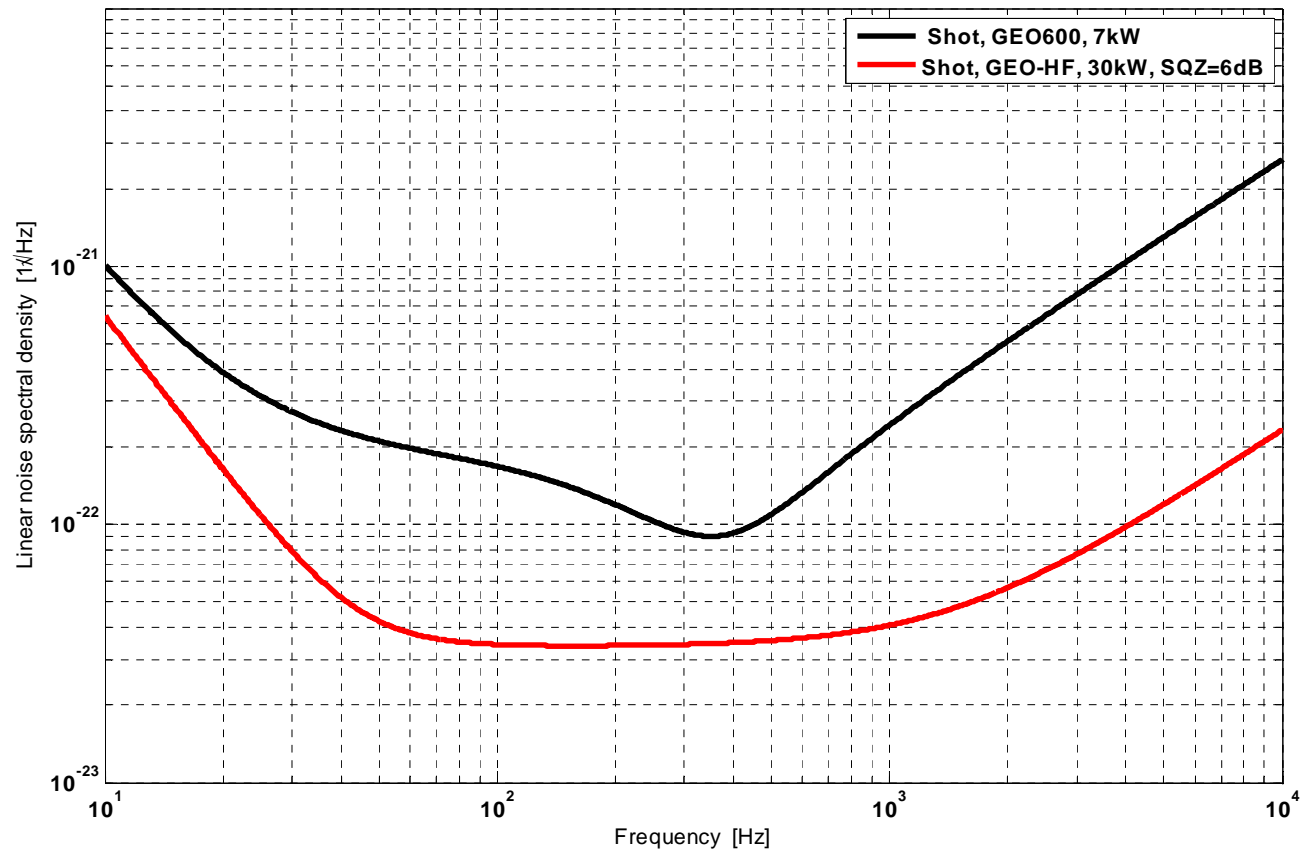
# Power increase

- Currently **3.5kW @ MPR**
- Increase laser power  
10 W (6 W) -> 35 W
- Exchange MC mirrors  
-> increase throughput 2x  
**-> 30kW @ MPR**

# Options Towards GEO-HF

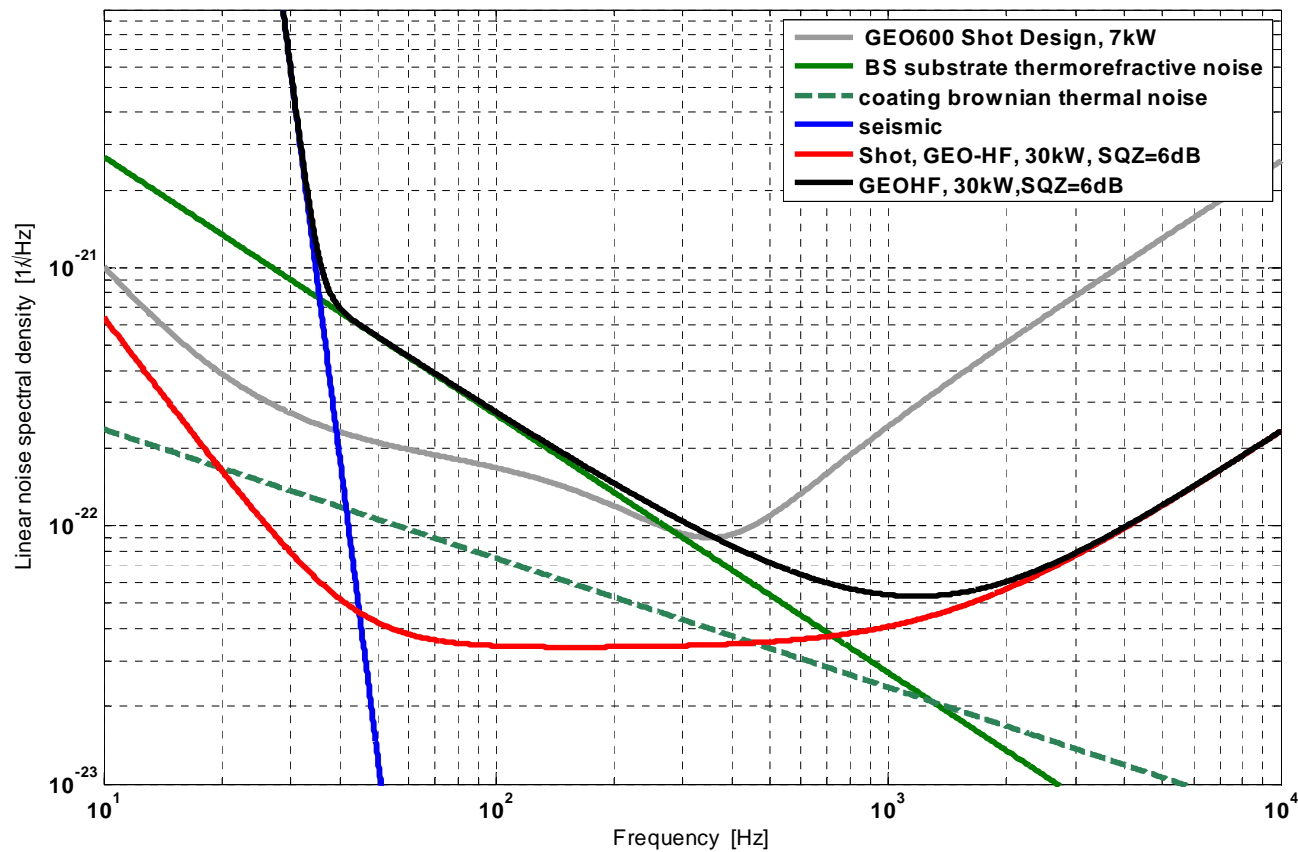


# Quantum Noise GEO600 vs. GEO-HF



GEO600: 7kW, Schnupp Modulation, 550Hz detuning  
GEO-HF: 30kW, DC Readout, OMC, Tuned, broadband

# GEO HF Noises



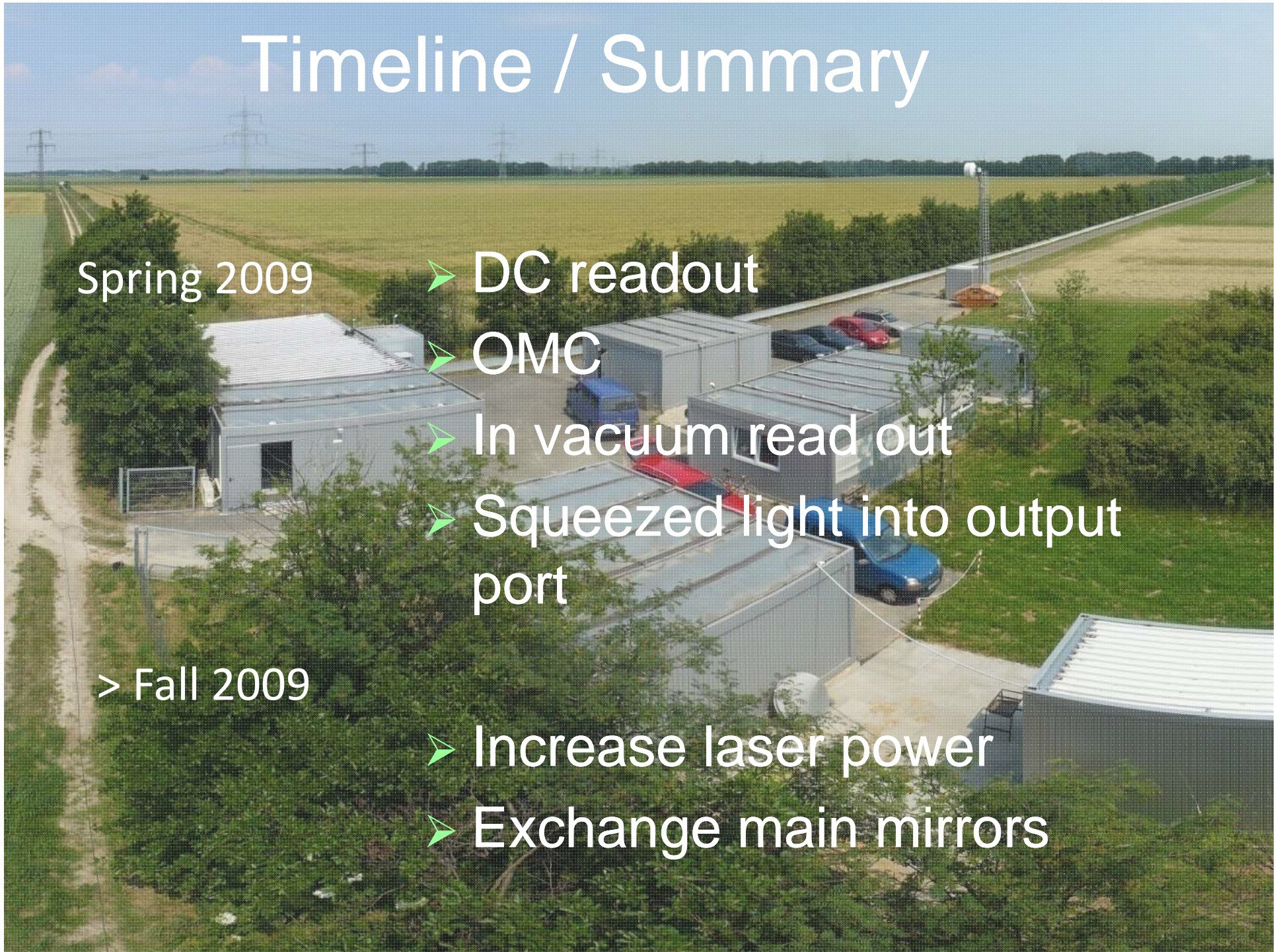
# Timeline / Summary

Spring 2009

- DC readout
- OMC
- In vacuum read out
- Squeezed light into output port

> Fall 2009

- Increase laser power
- Exchange main mirrors



# Additional vacuum tank TCOc

- $75^3 \text{ cm}^3$
- Viton gaskets ( $10^{-6}$  mbar)
- Viewport between TCOb and TCOc  
(Will it be a problem?)  
So far we do not see any  
Isolated platform inside

