# Squeezed light injection in GEO600

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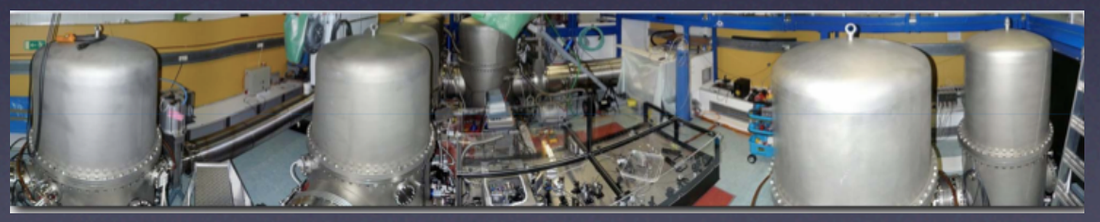
LIGO-G080525-00-Z

# Outline

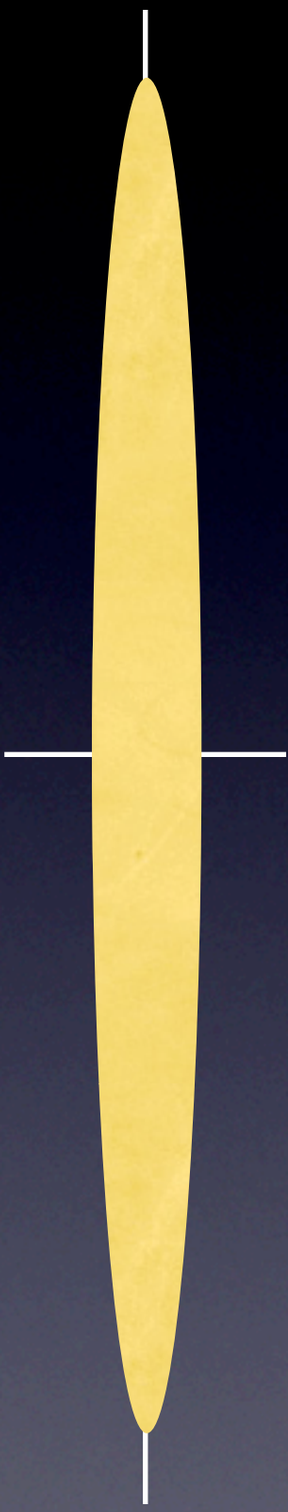
- Generation of strongly squeezed states

- Generation and coherent control of squeezed vacuum states in the audio band

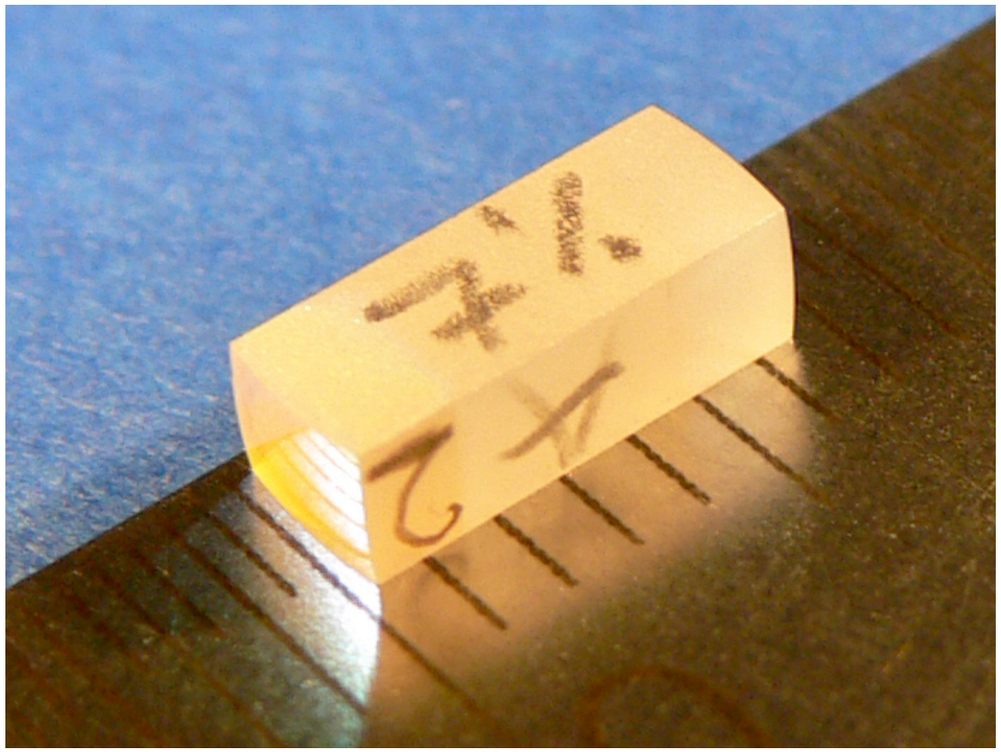
- GEO-Squeezer design



# Generation of strongly squeezed vacuum states

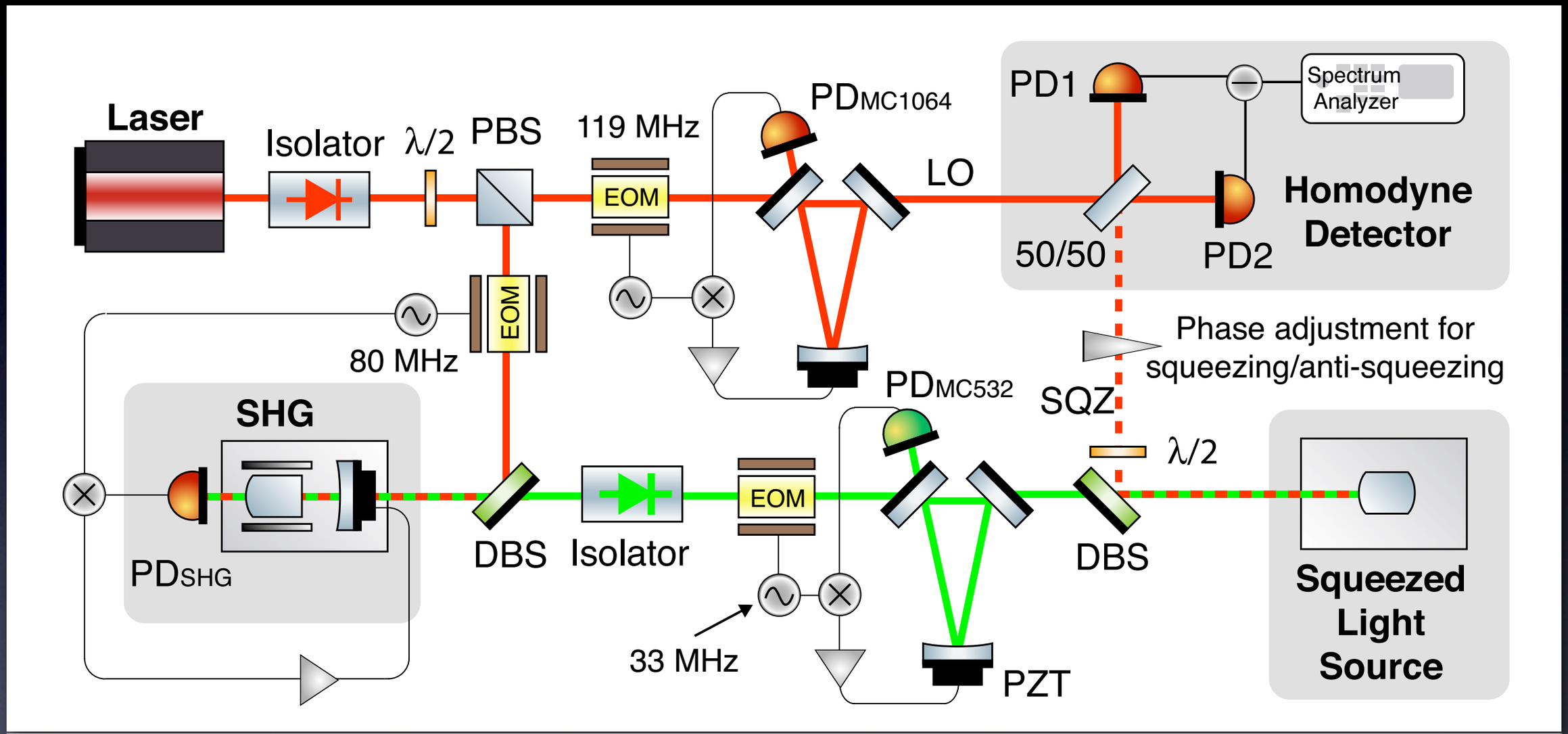


# Monolithic squeezed light source

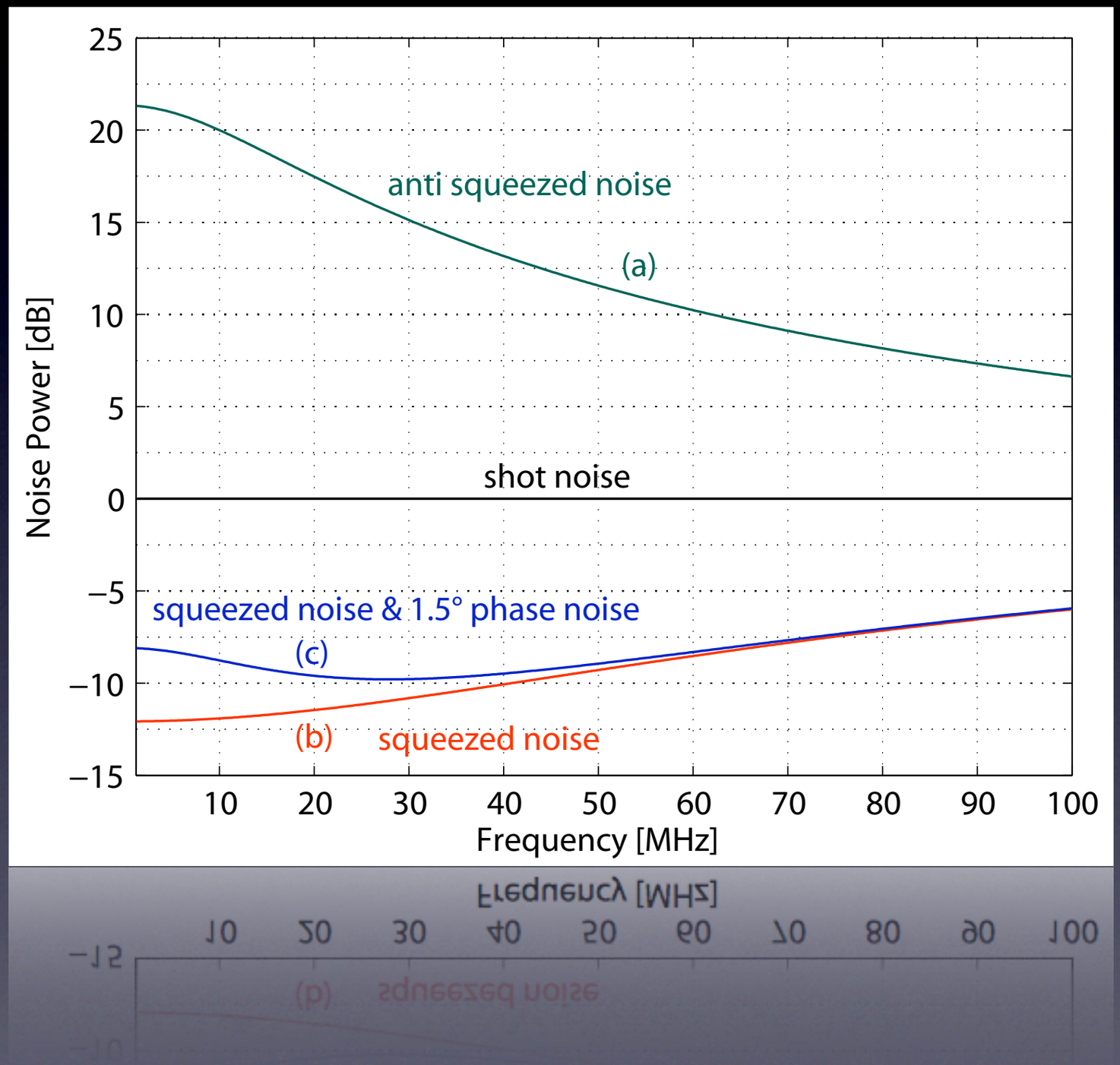


- Monolithic cavity made from $MgO:LiNbO_3$
- 2.0 x 2.5 x 6.5 mm
- Finesse of 50 @ 1064nm
- High escape efficiency
- Free spectral range=11 GHz

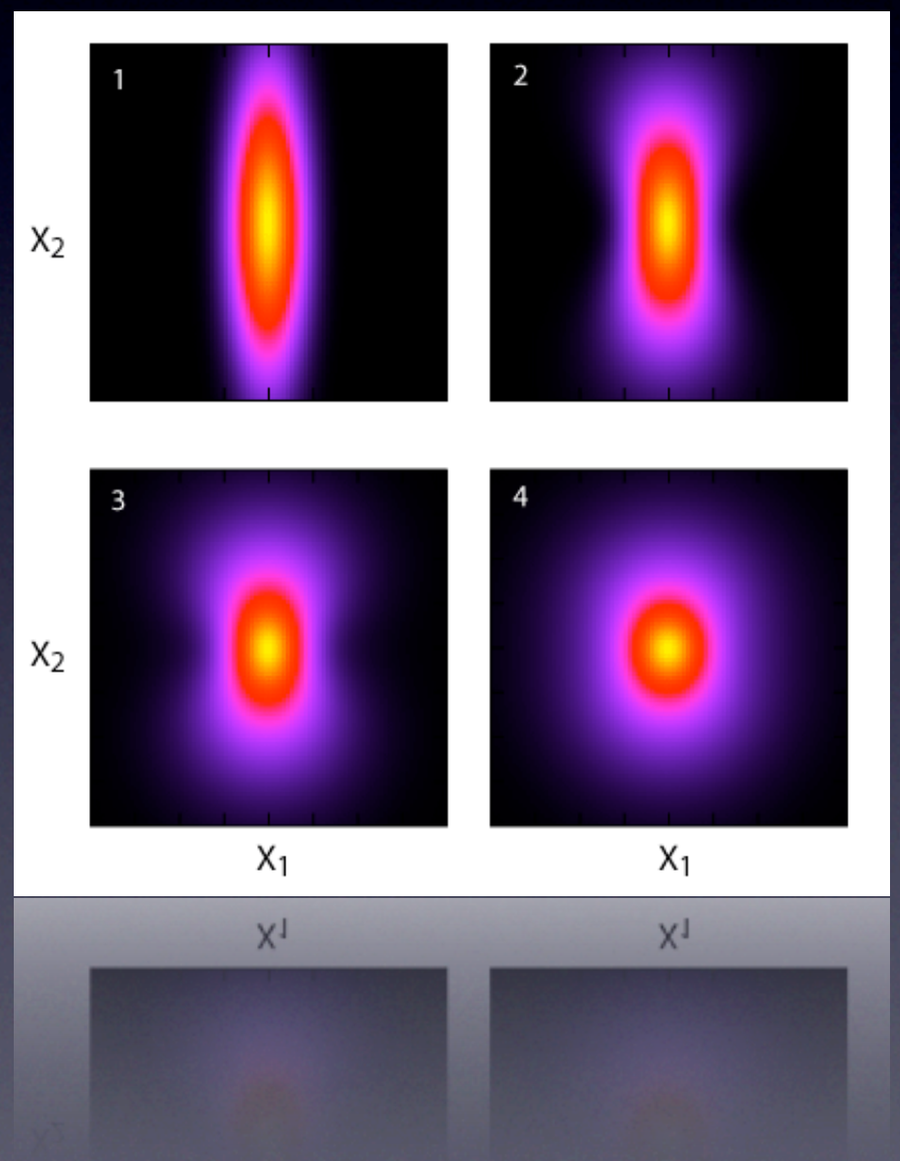
# Experimental setup



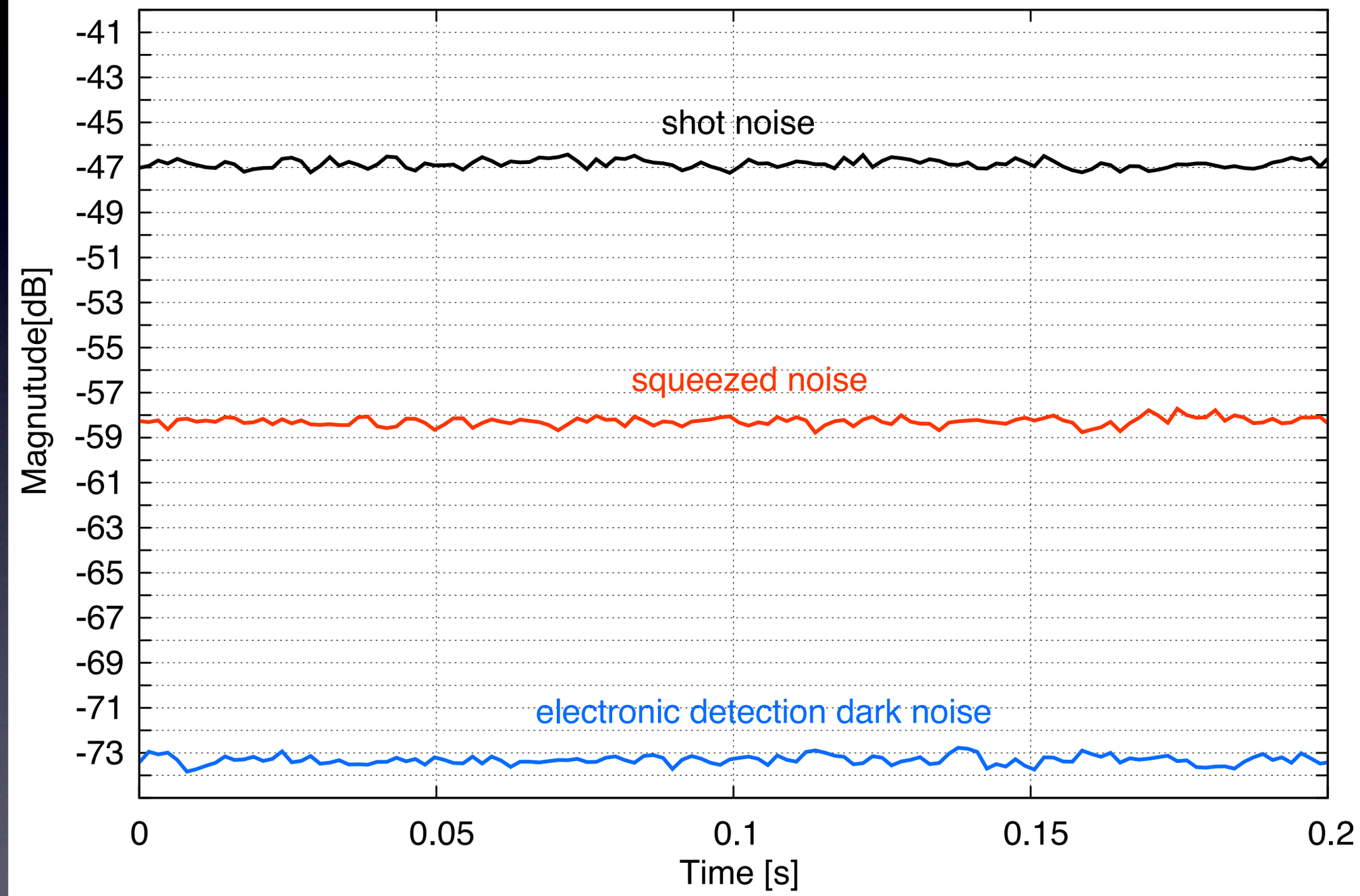
# Technical improvements




- Low phase noise!



# 11.5 dB squeezing @ 5 MHz



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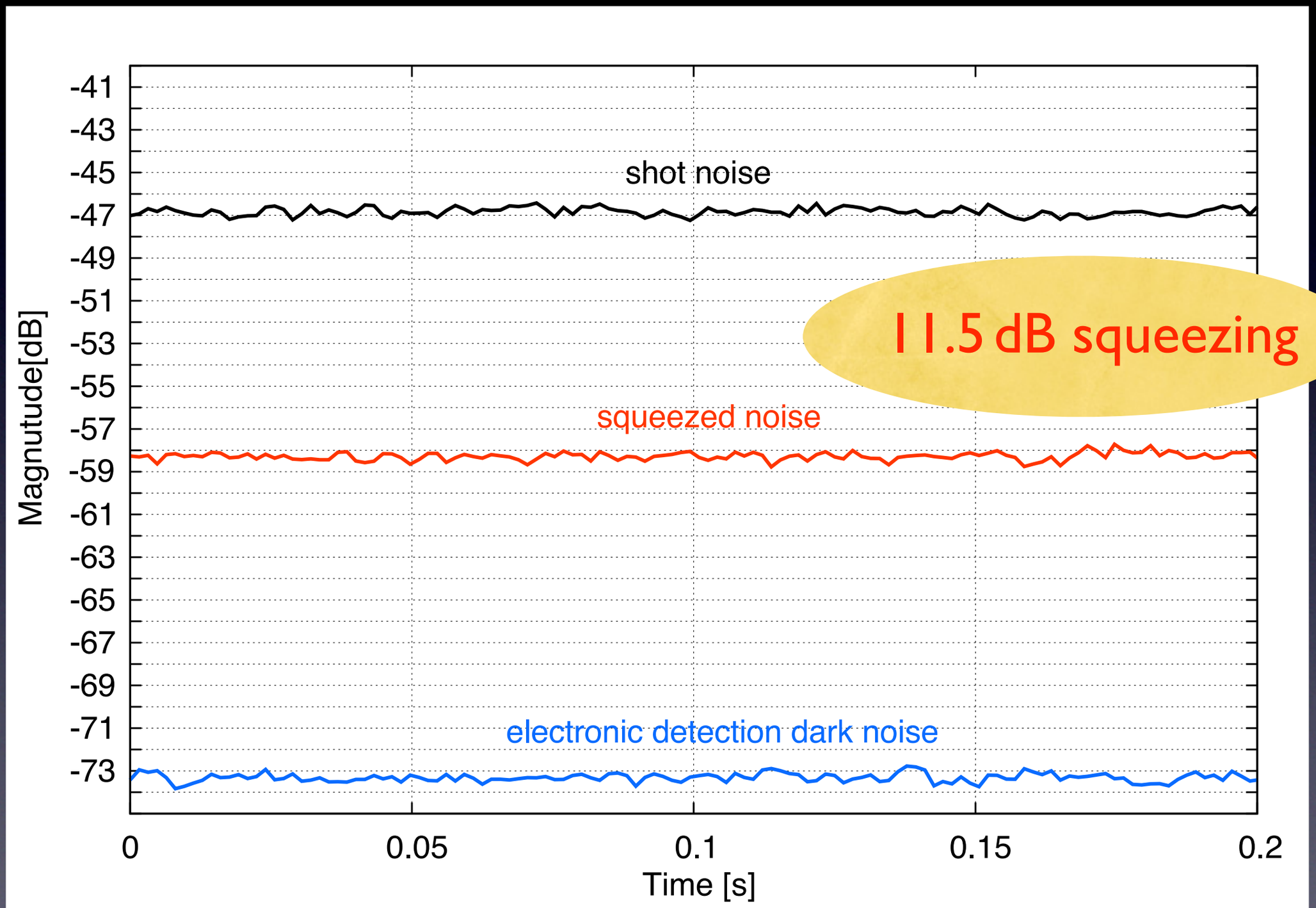
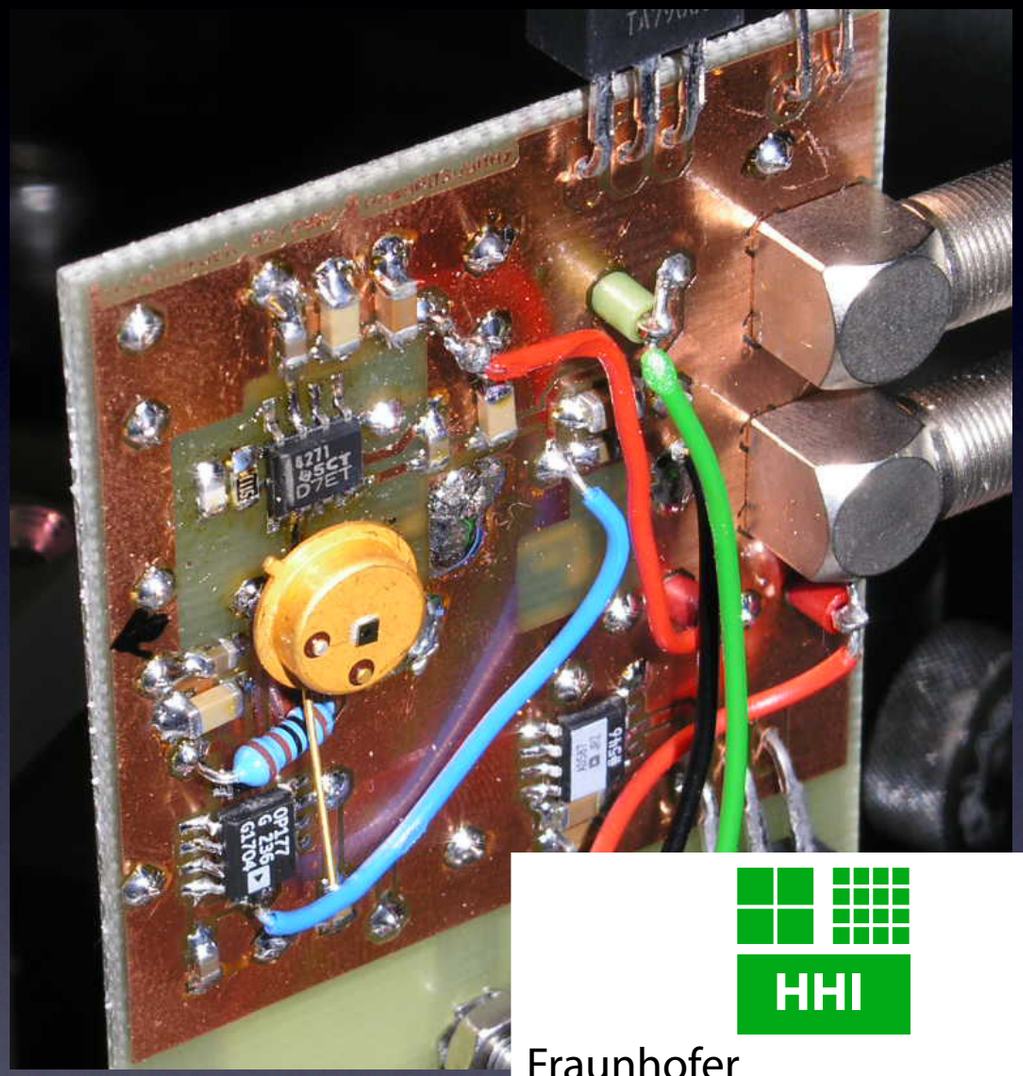


# Low loss photodetector



- New custom made PD´s
- QE = 99% @ 1064nm
- 2% better than Epitaxx

- Task : compare PD´s to anadigics...

Fraunhofer
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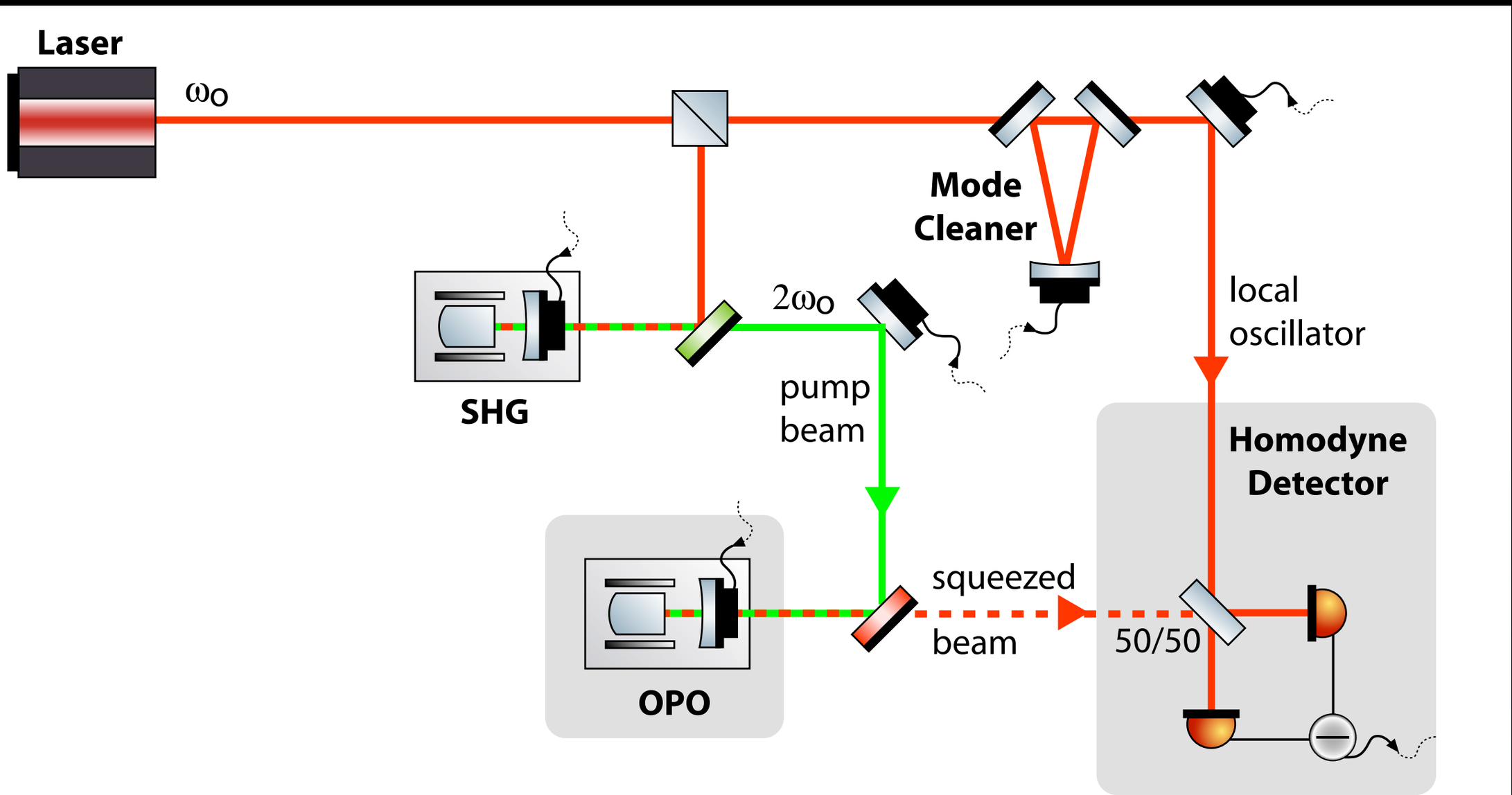
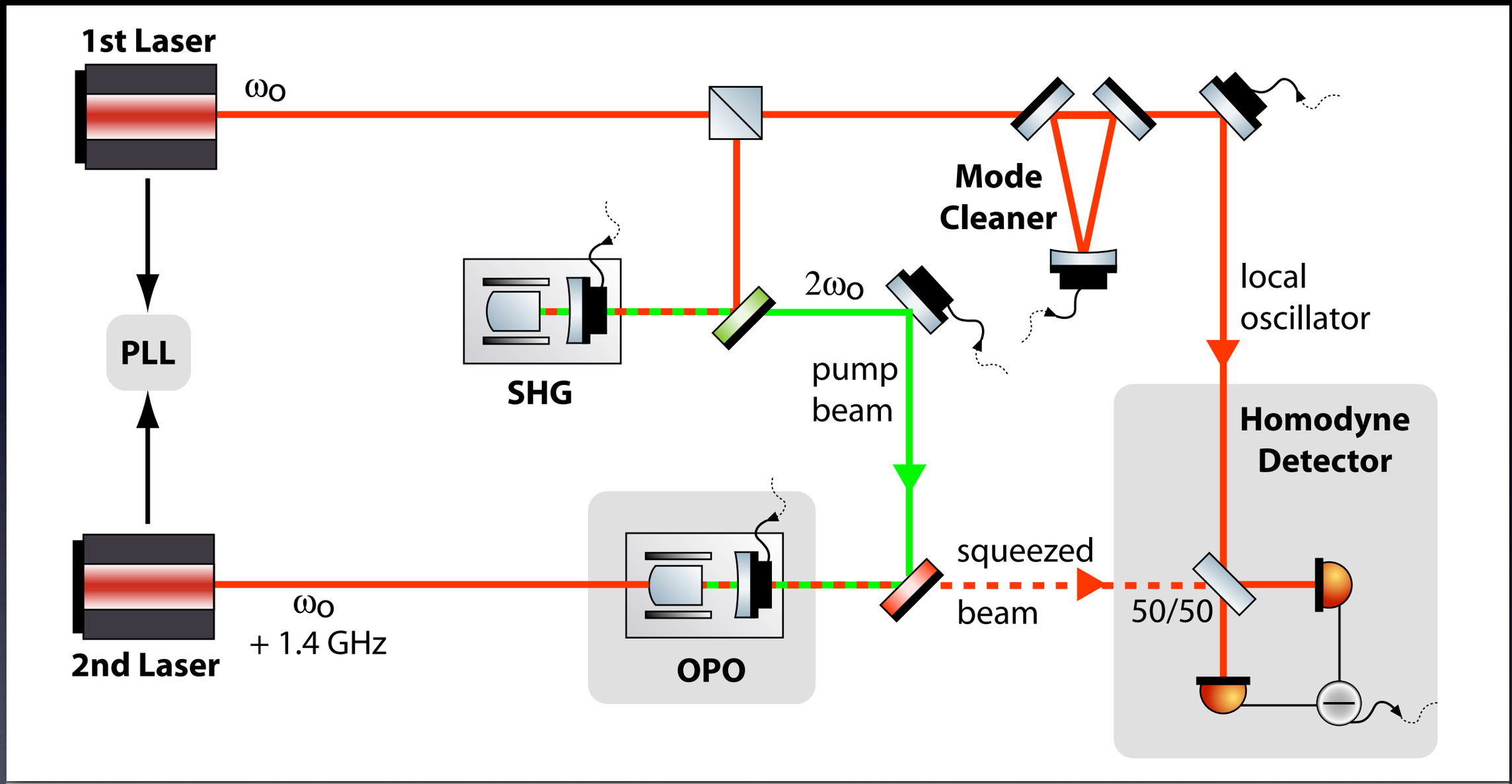
# Generation of squeezed vacuum states in the audio band

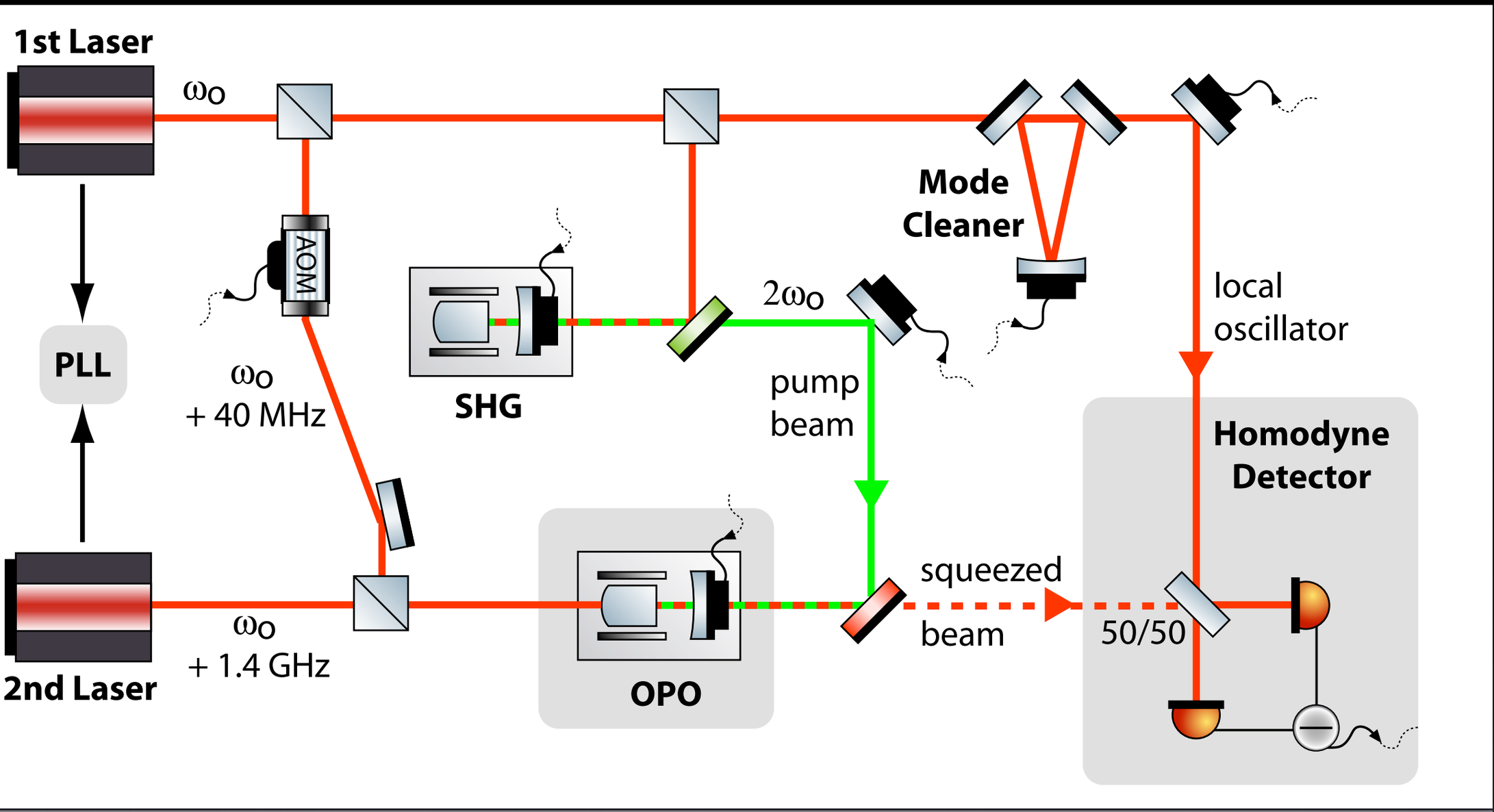
# Experimental setup I



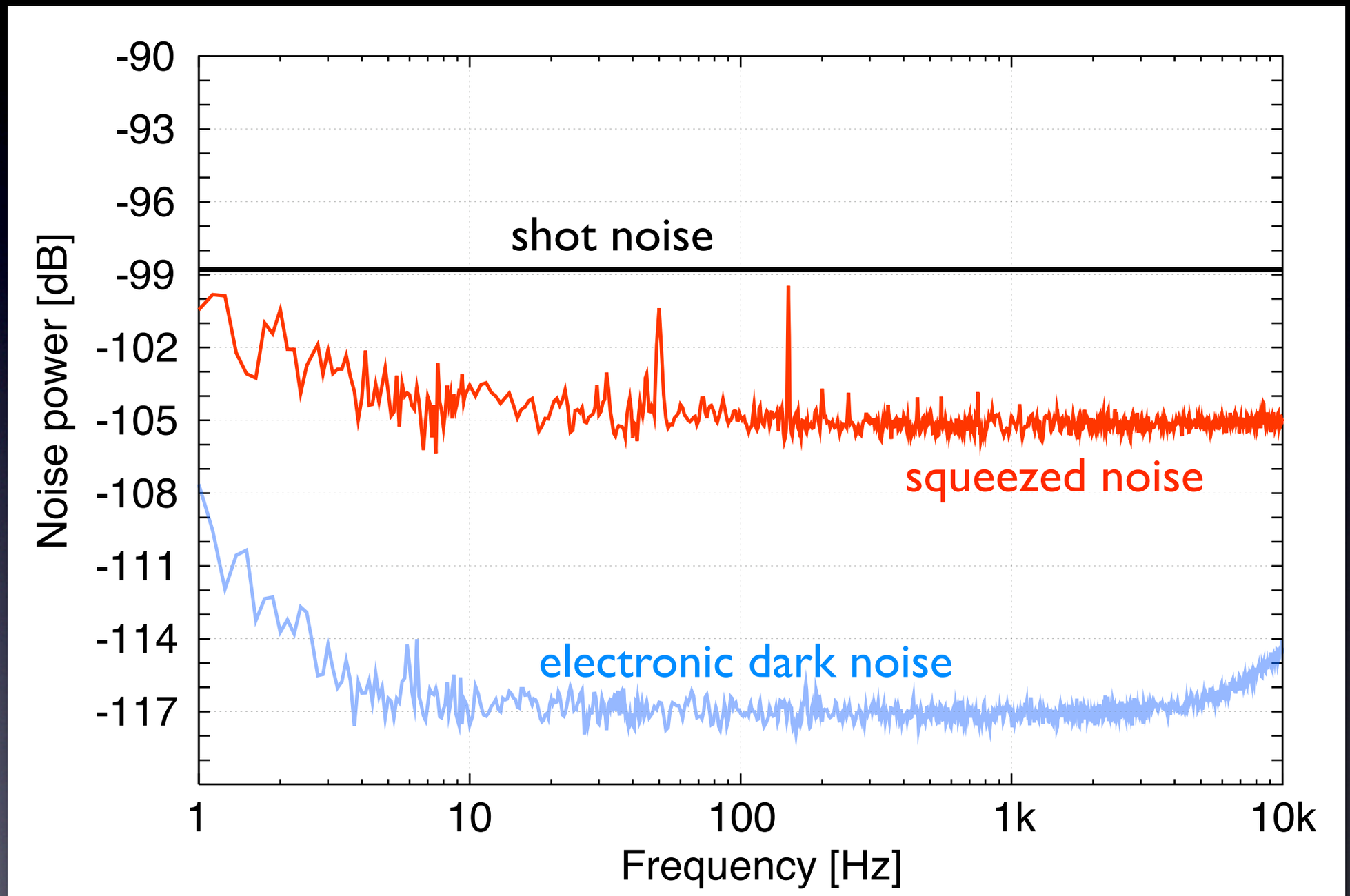
# Experimental setup II



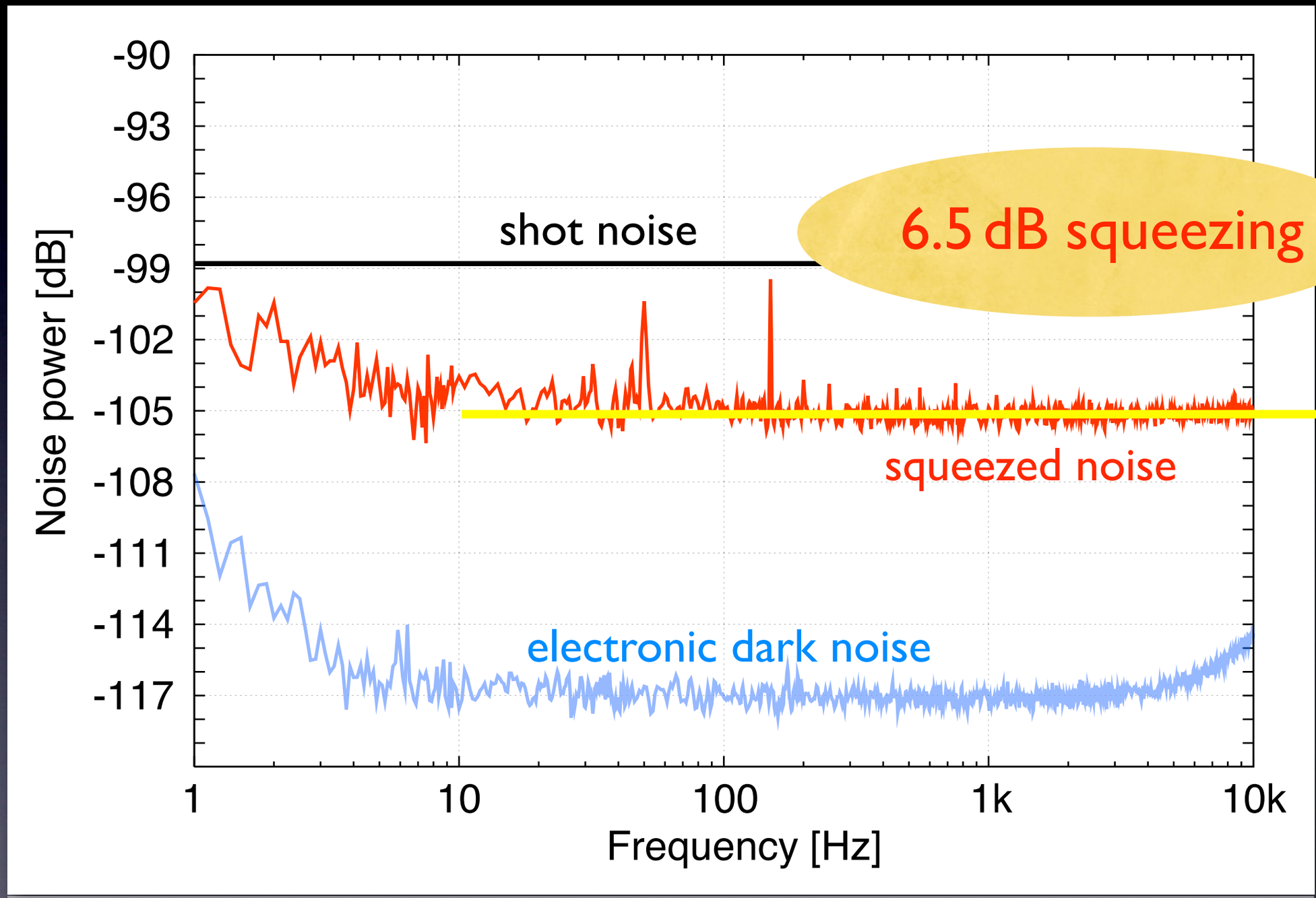
# Experimental setup III



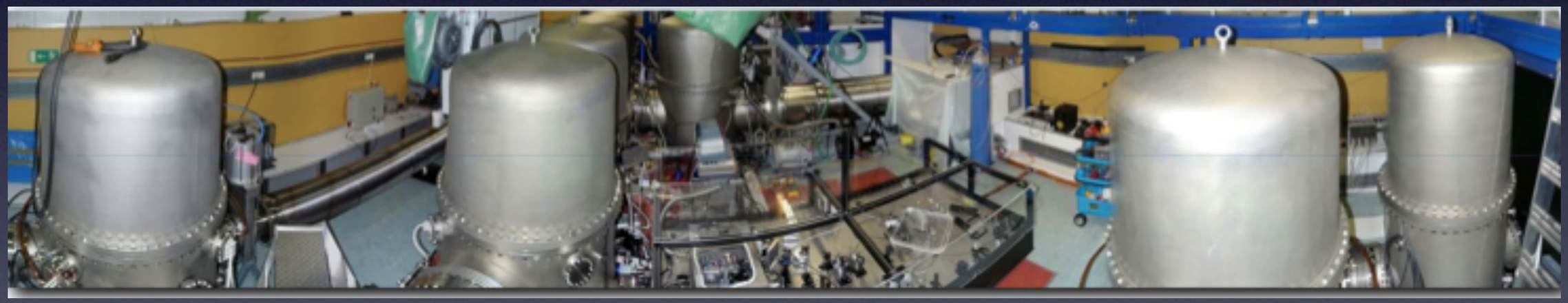
# Detection of squeezed noise down to 1 Hz



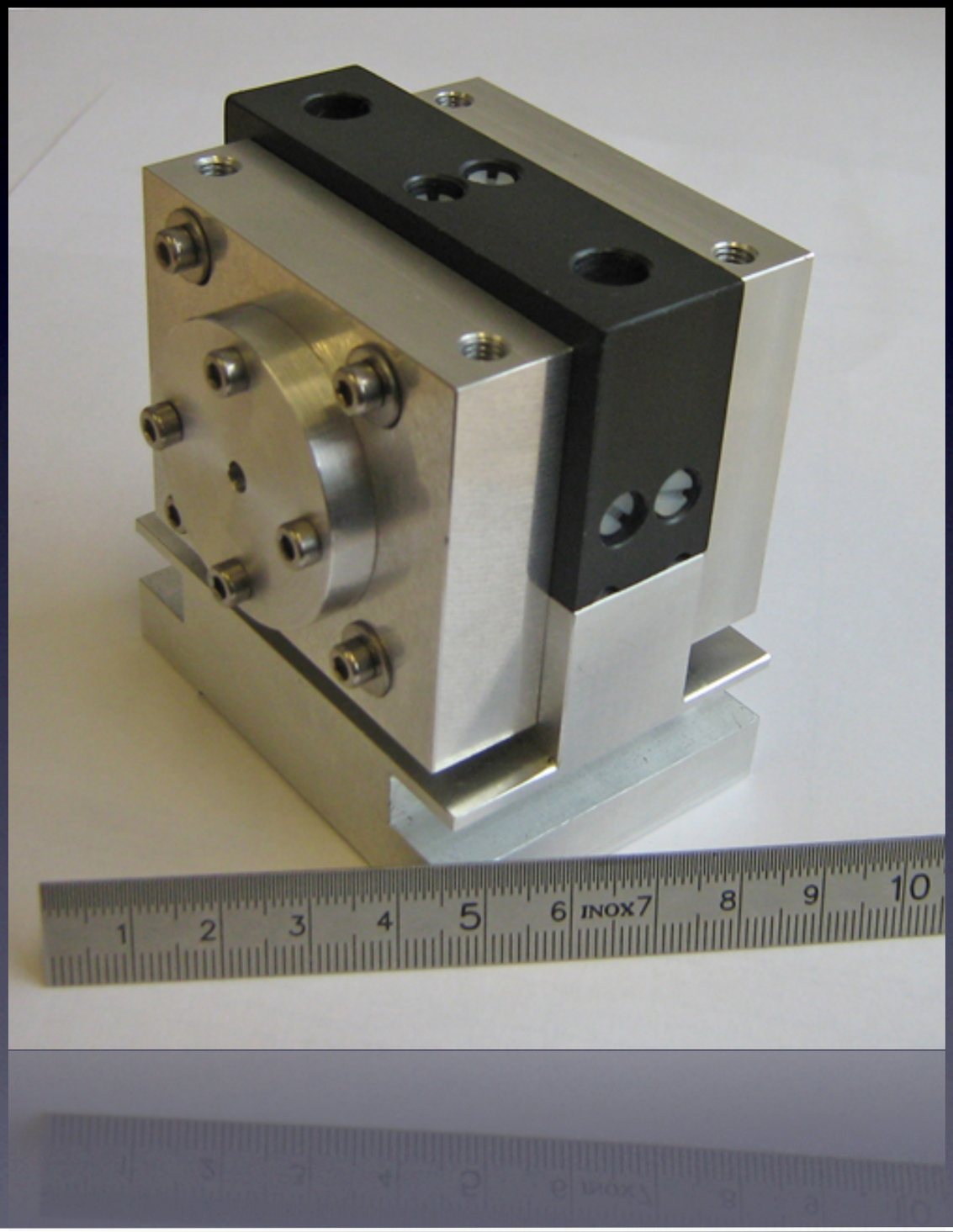
# Detection of squeezed noise down to 1 Hz



# GEO-Squeezer design

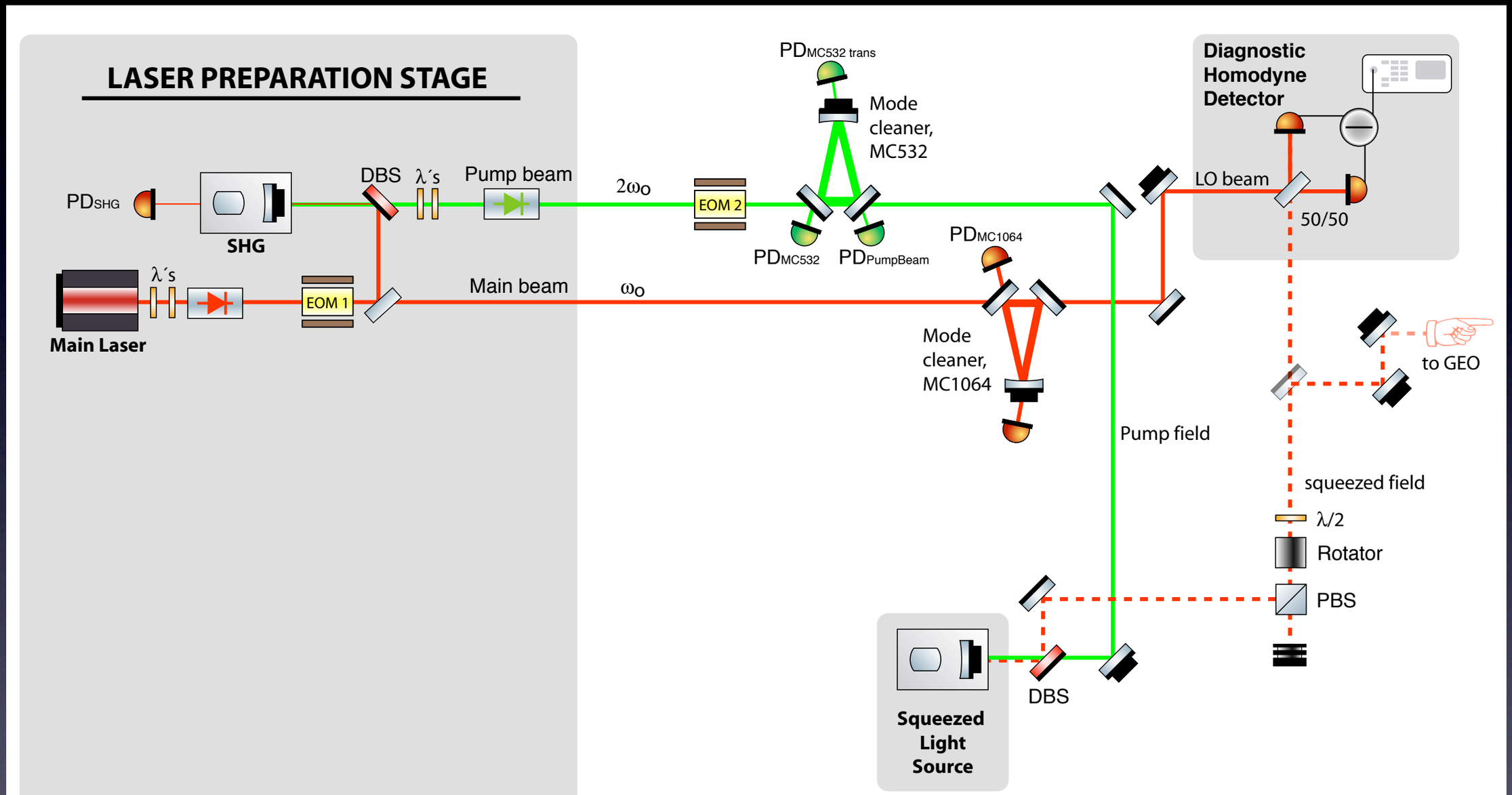


# GEO-Squeezer cavity design

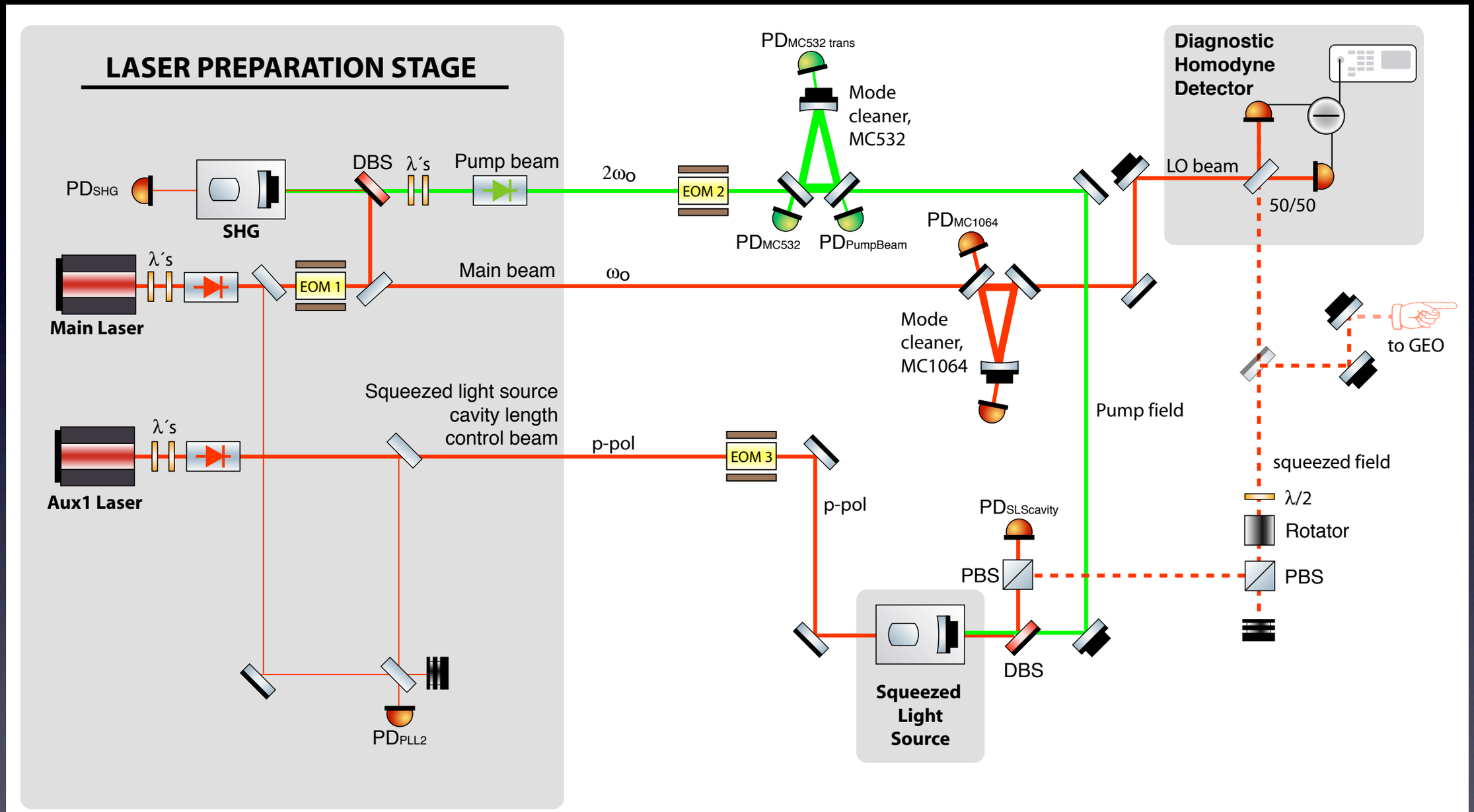



- Hemilithic cavity (linear) made from MgO:$LiNbO_3$ or PPKTP
- High escape efficiency, internal loss only 5 %
- Compact design
- Single resonant at 1064nm

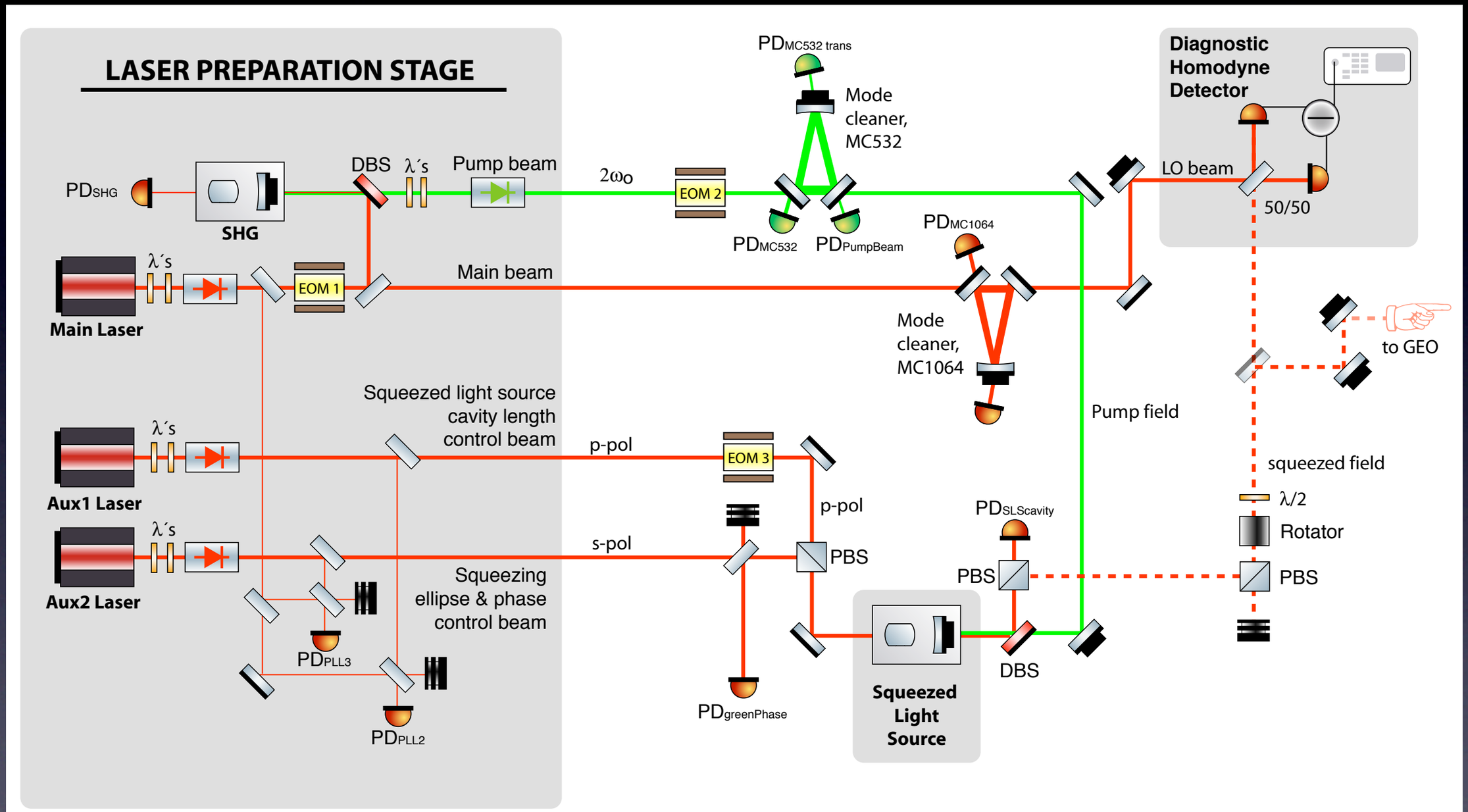
# GEO-Squeezer: Optical layout I



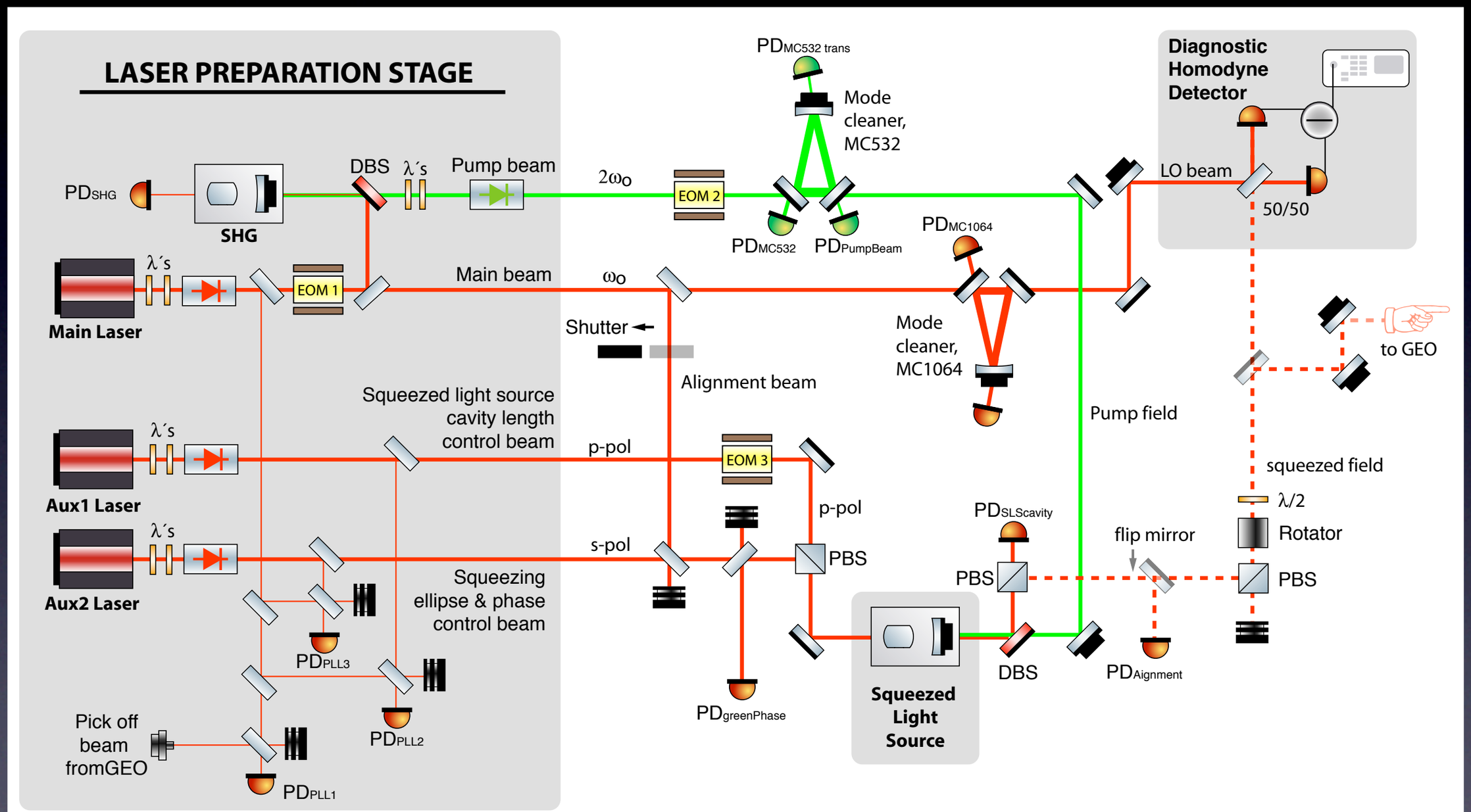
# GEO-Squeezer: Optical layout II



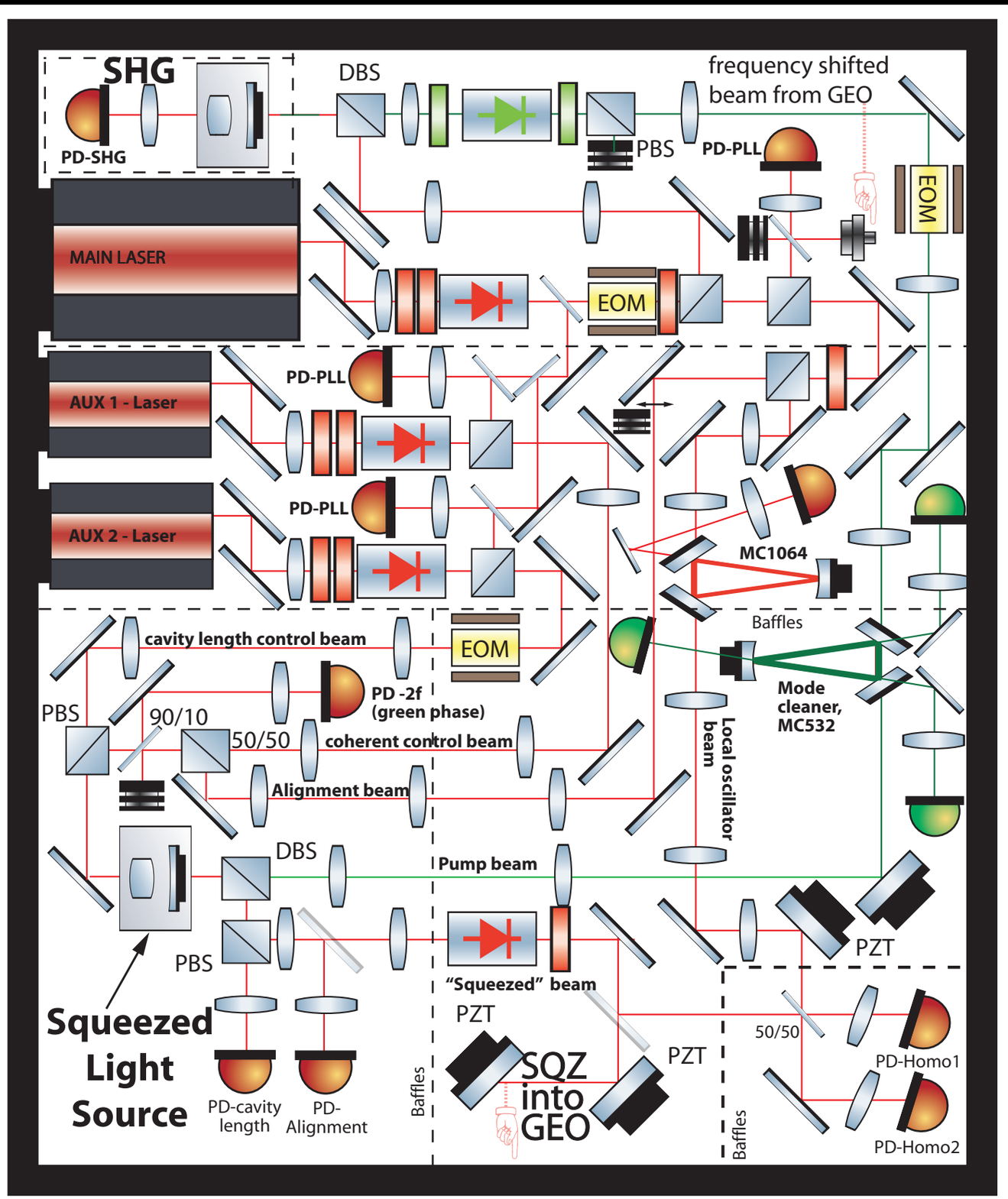
# GEO-Squeezer: Optical layout III



# GEO-Squeezer: Optical layout IV



# GEO-Squeezer: Breadboard layout

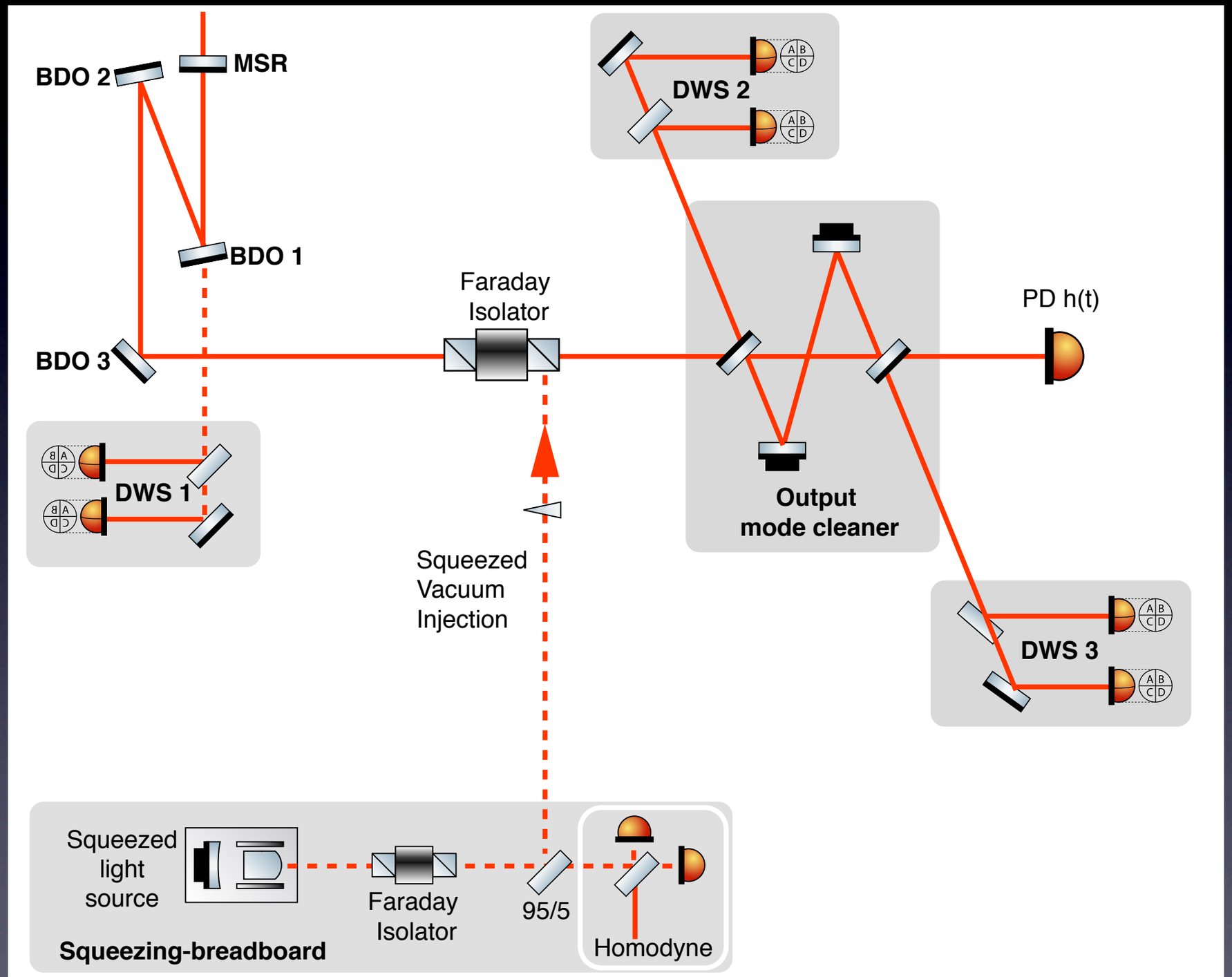



- Custom made breadboard
- Dimensions: 1,35m x 1,15m
- Weight: approx. 150kg

# GEO-Squeezer: Electronic control

- Analog electronics for high bandwidth control loops
- Digitally interfaced
- Real time Linux System / EPICS

# GEO-Squeezer: Loss budget



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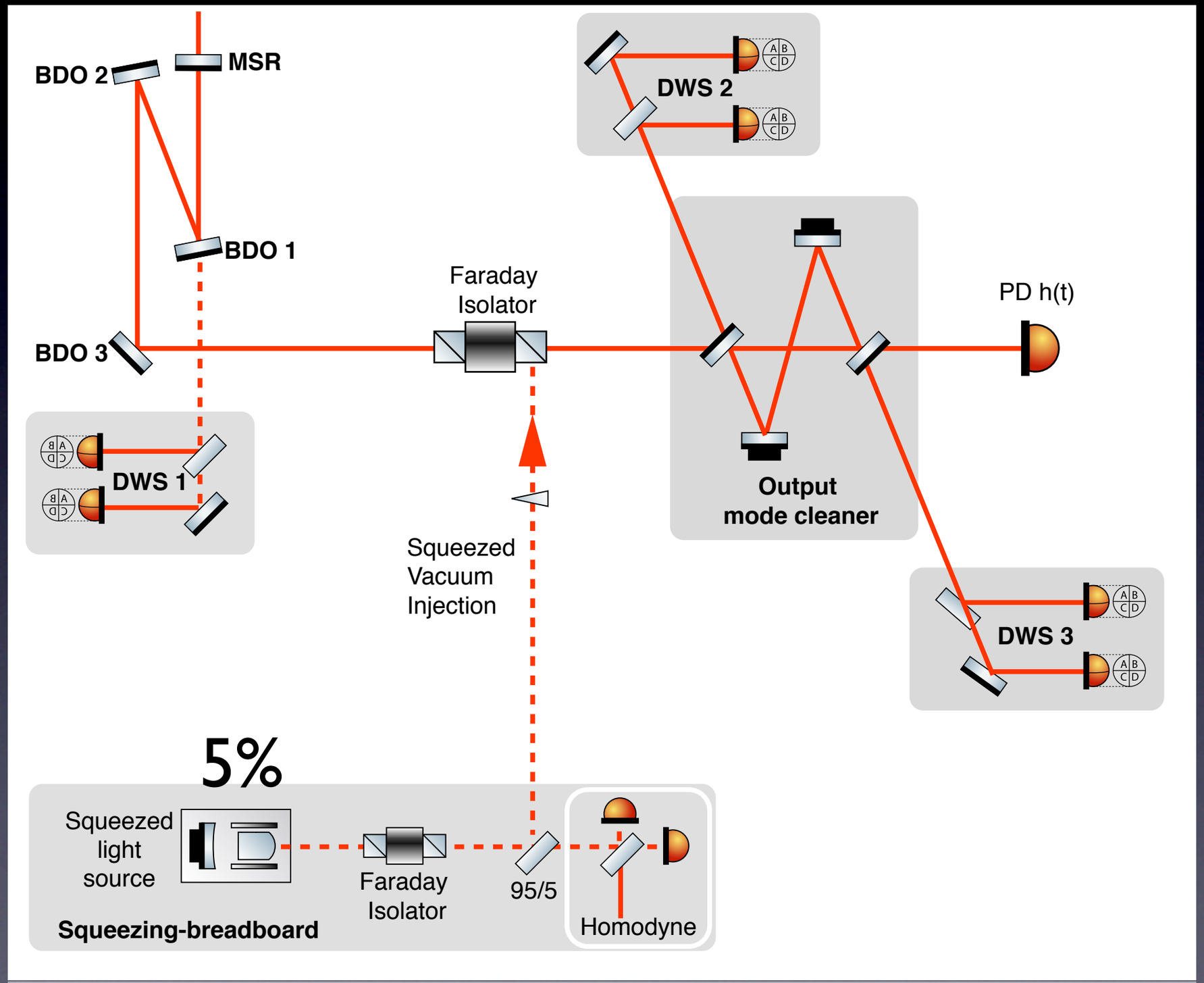

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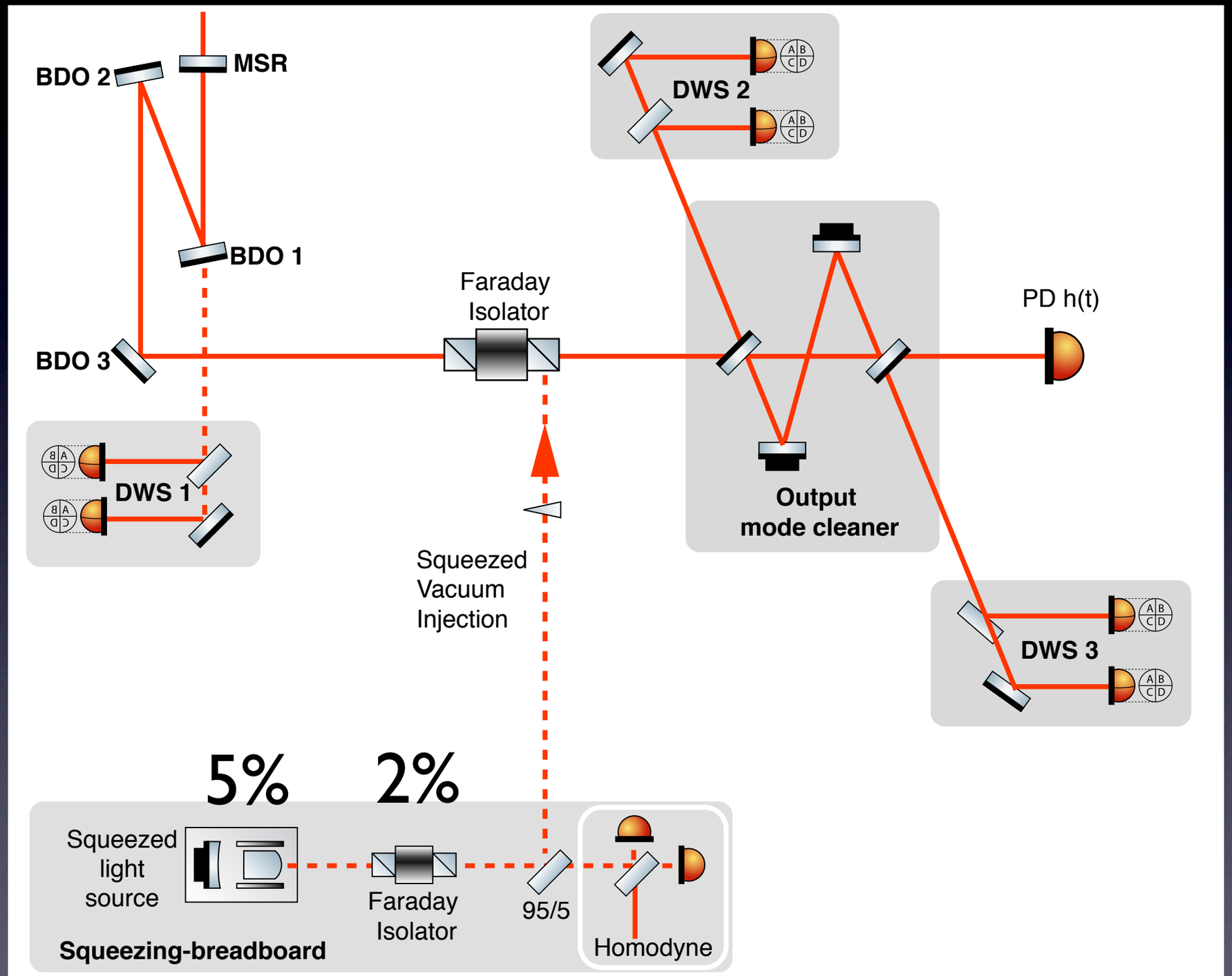

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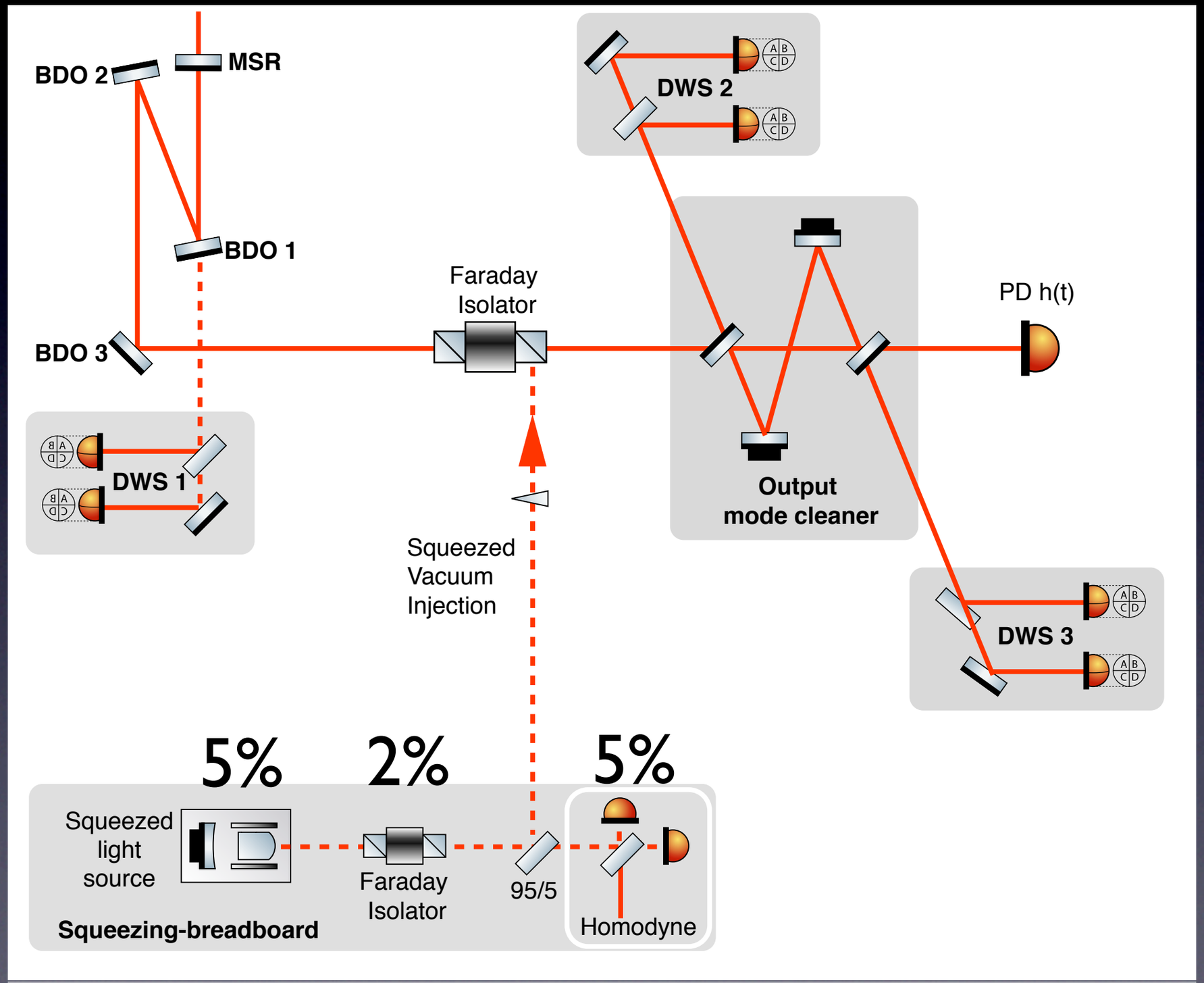

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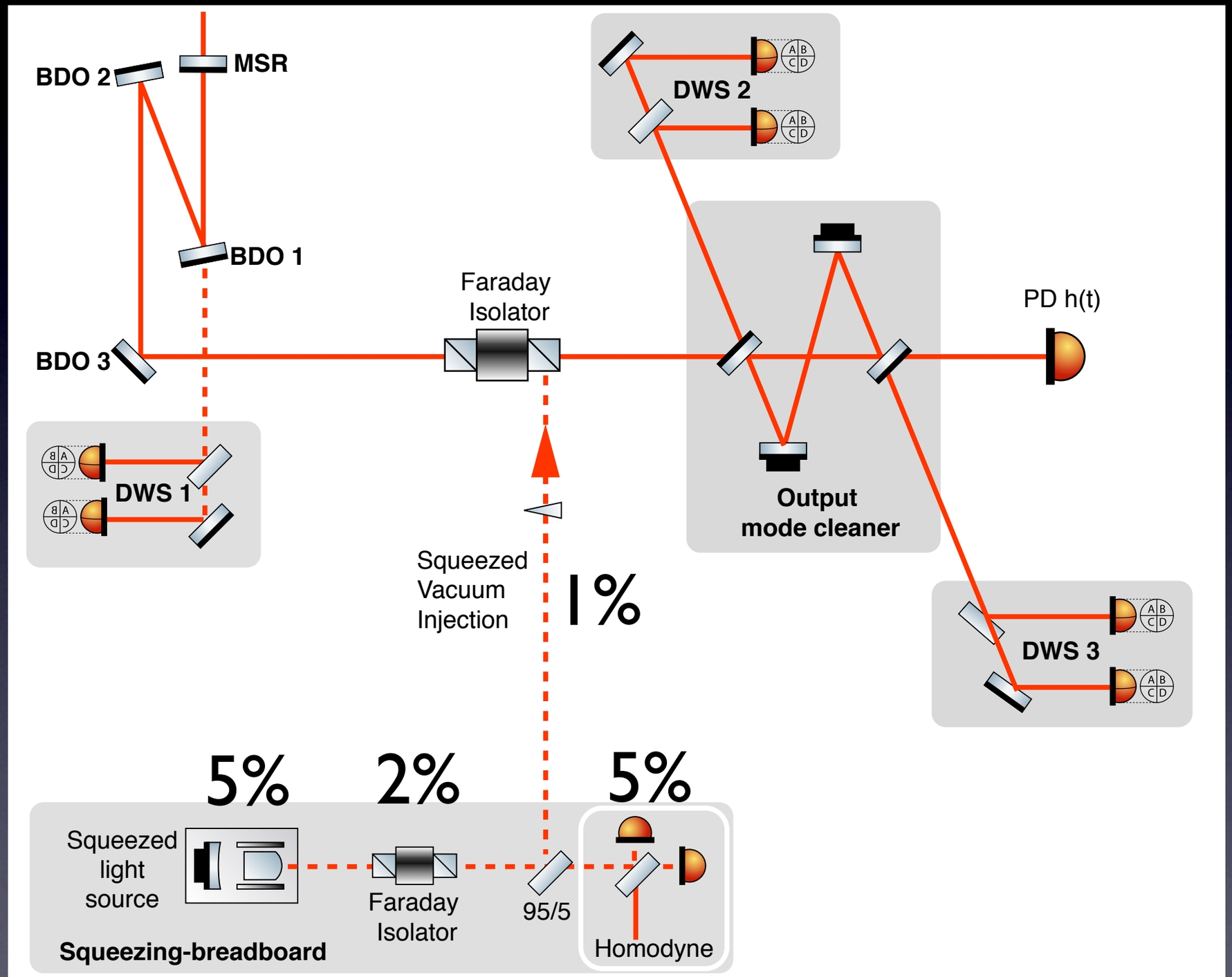

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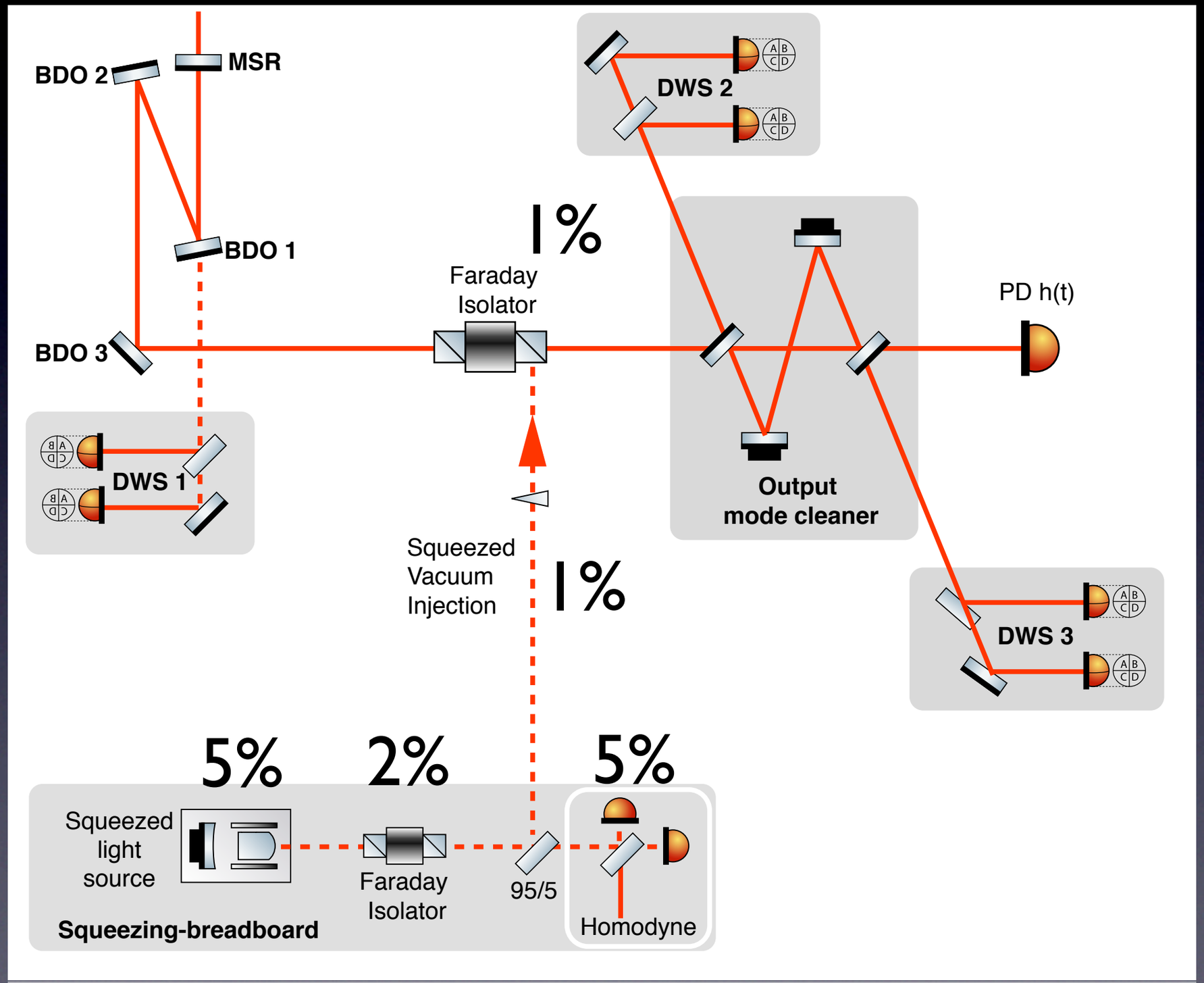

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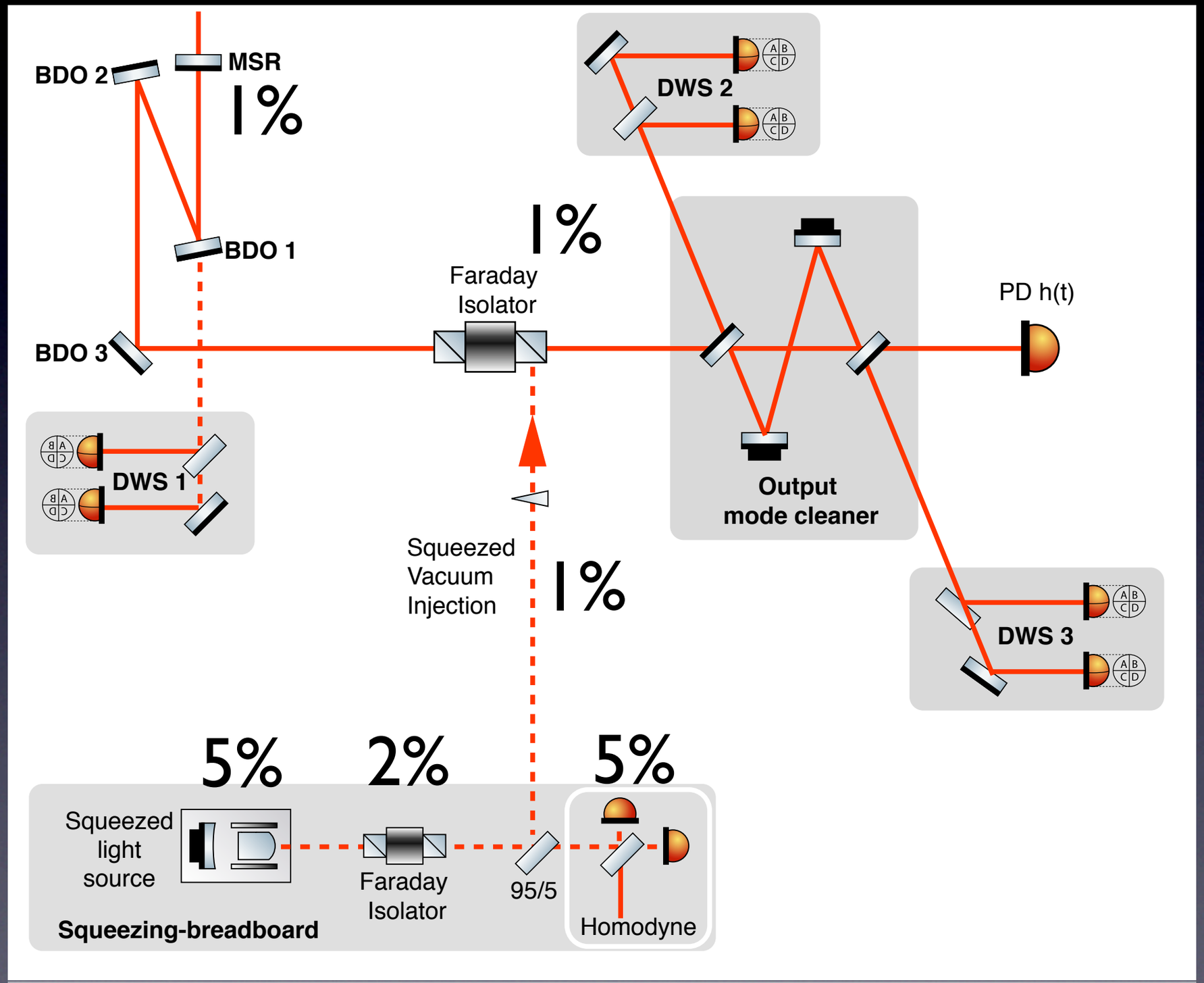

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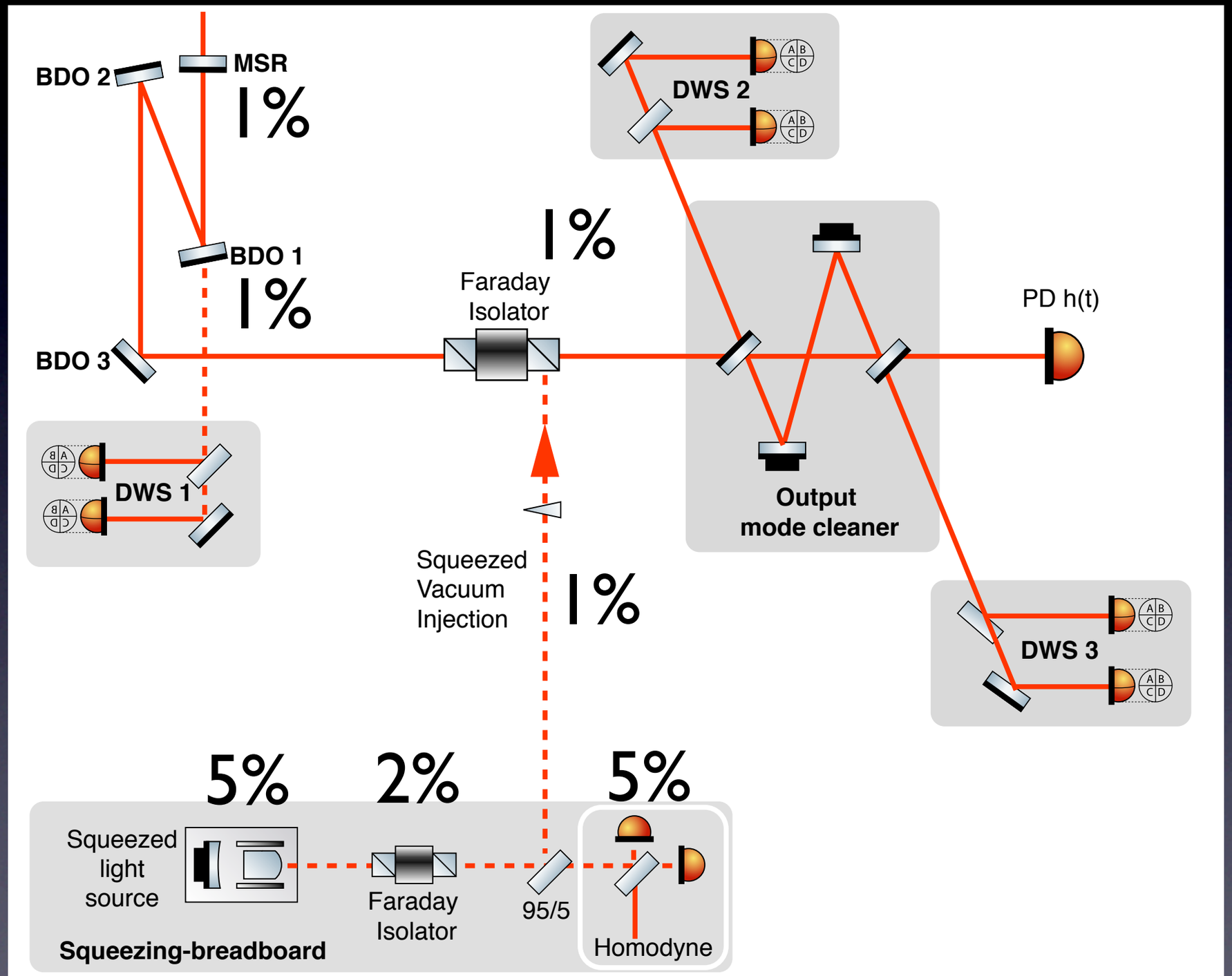

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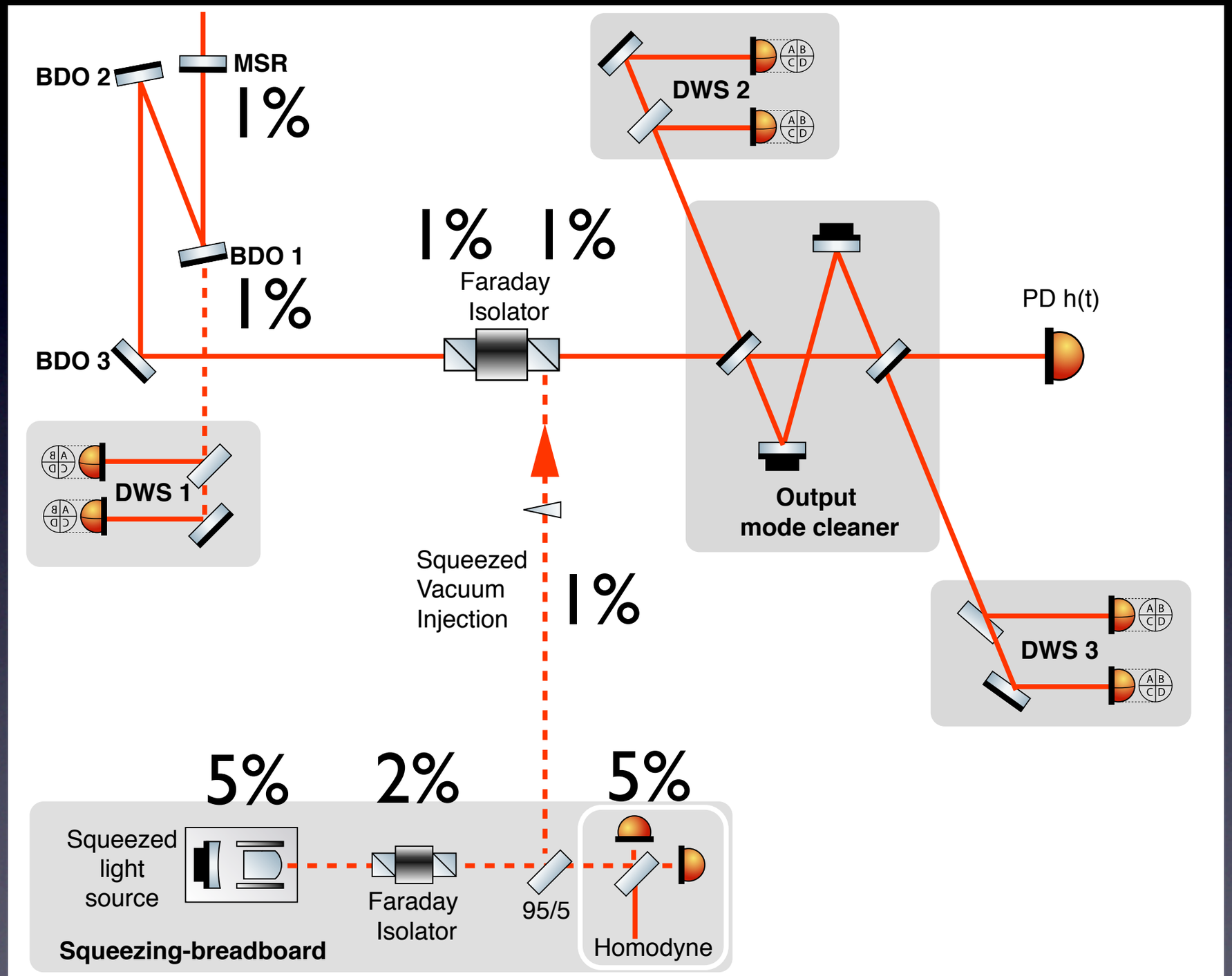

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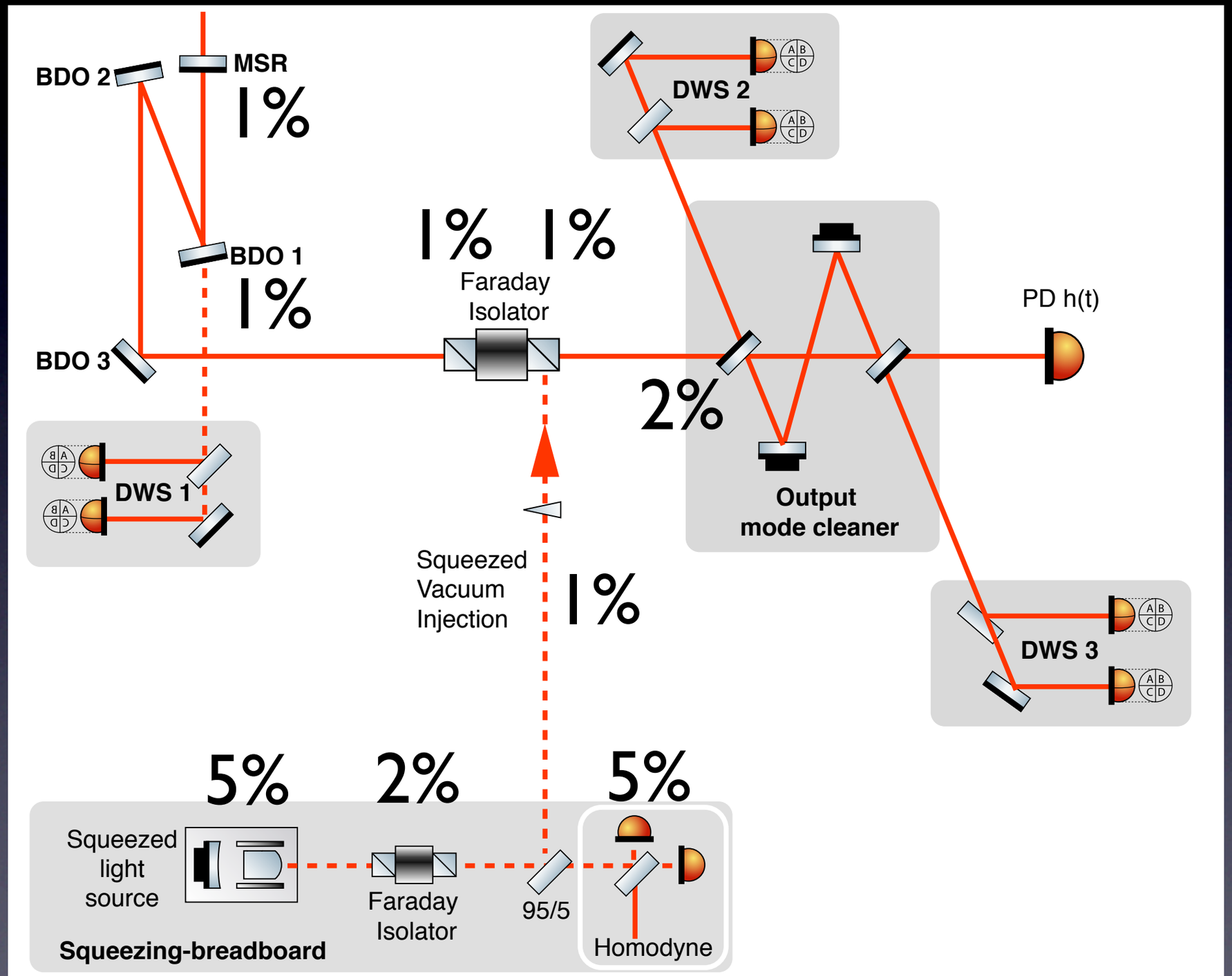

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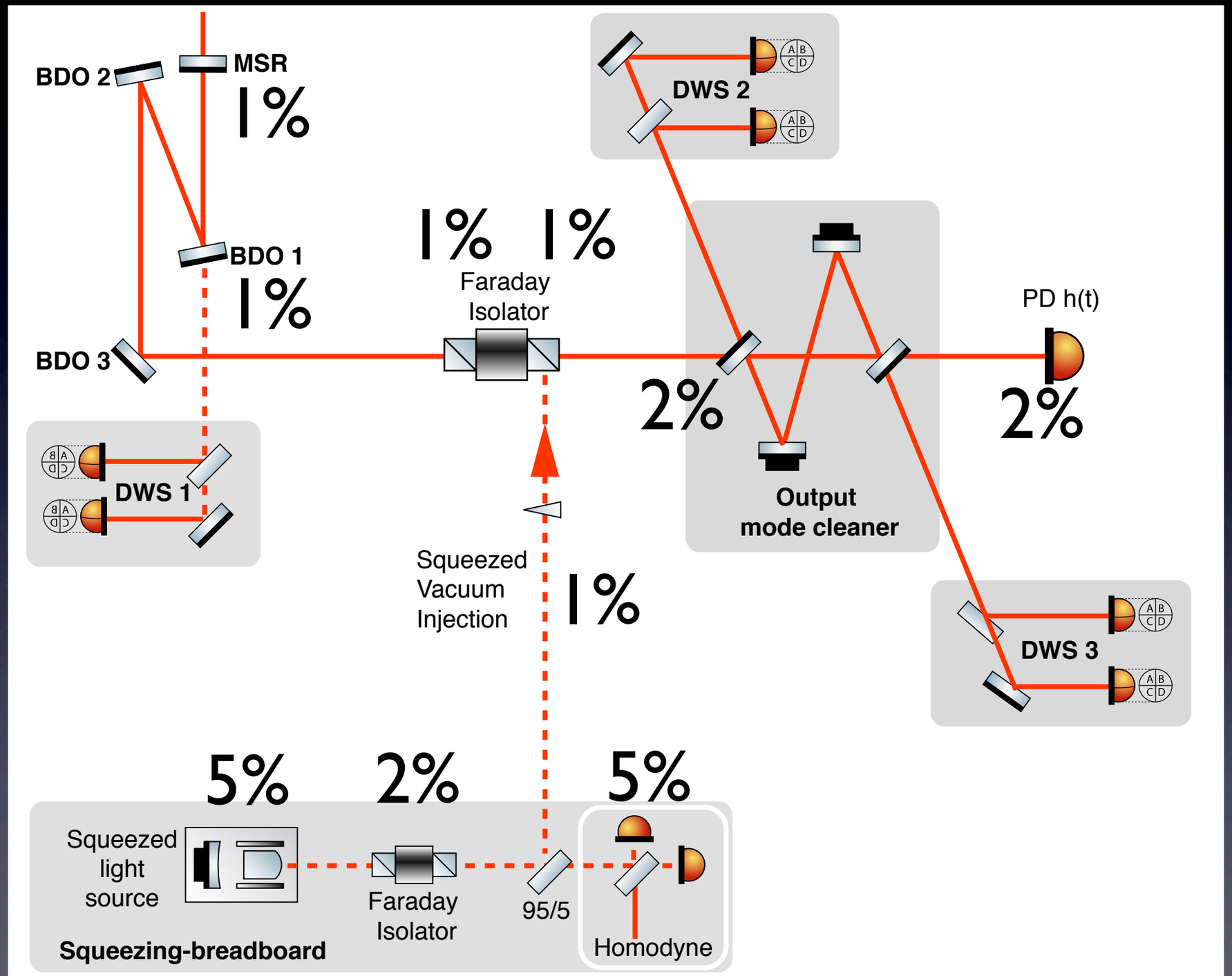

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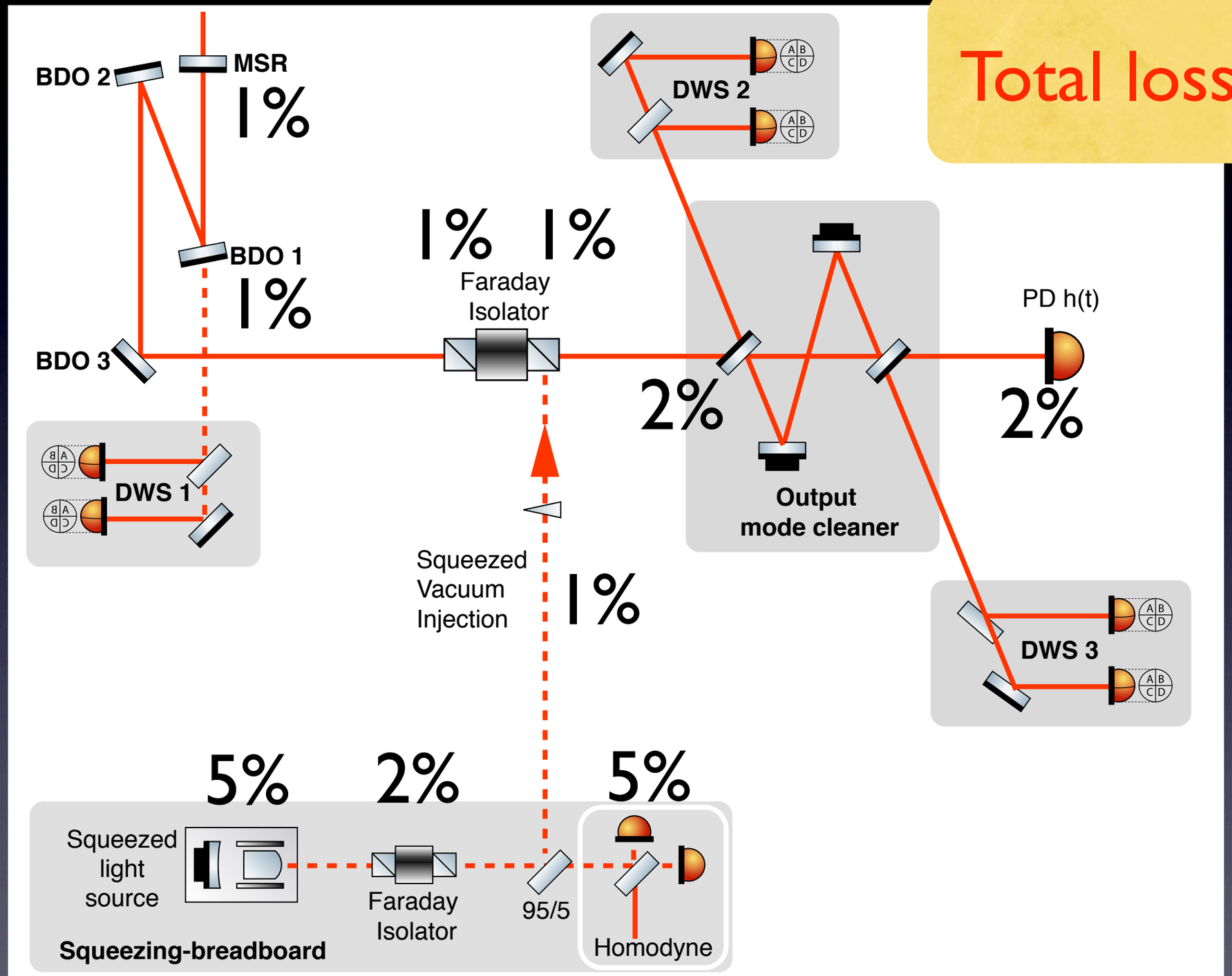
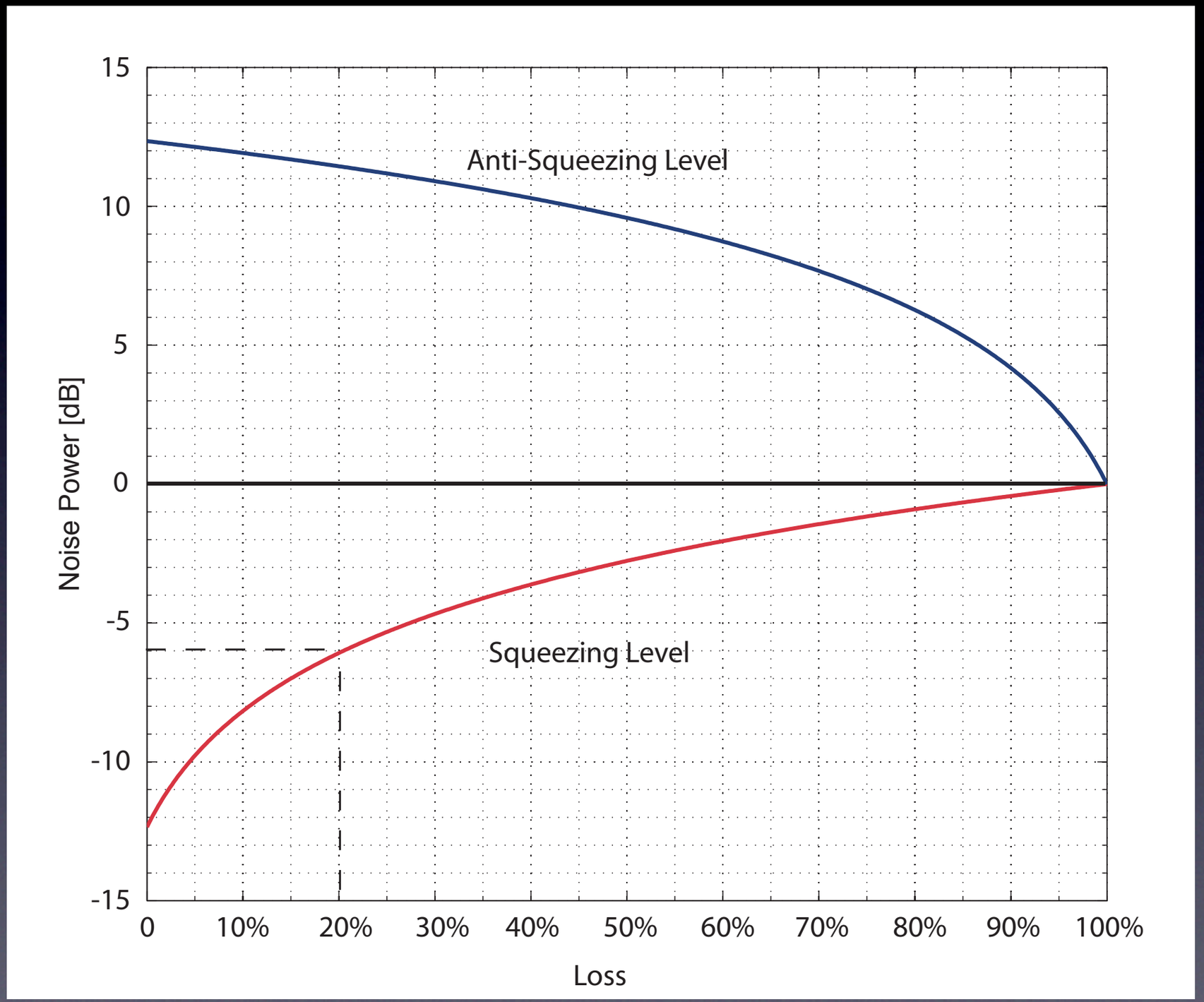
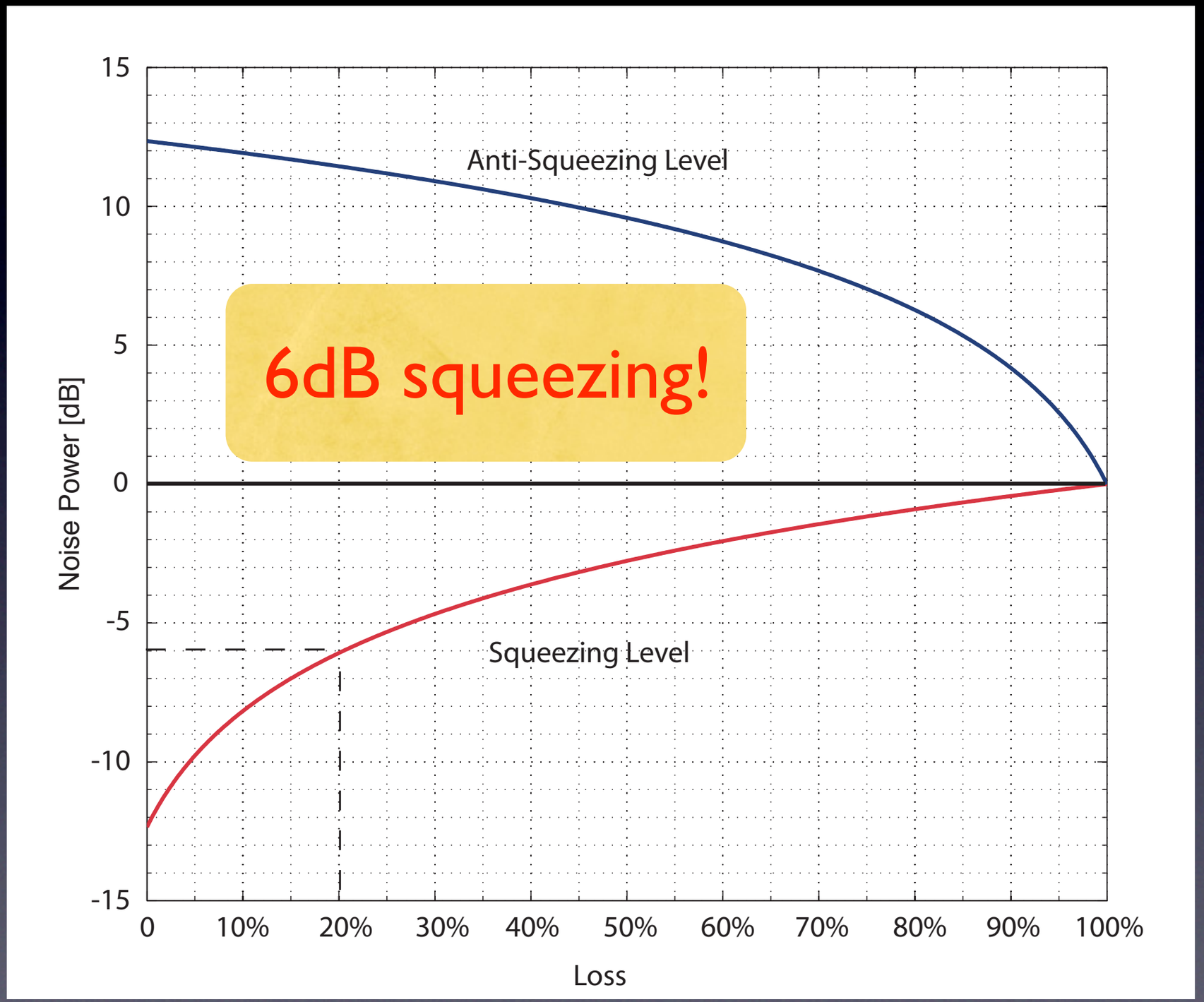


# GEO-Squeezer: Loss budget II



# GEO-Squeezer: Loss budget II



# Timeline / Summary

- Assembling of the squeezing breadboard starts now!
- Spring 2009: GEO OMC & Faraday Isolator will be installed
- Spring 2009: Squeezed light injection into GEO