

# PRIN 2001-Riunione 4 luglio 2014

- Update Unità di Camerino

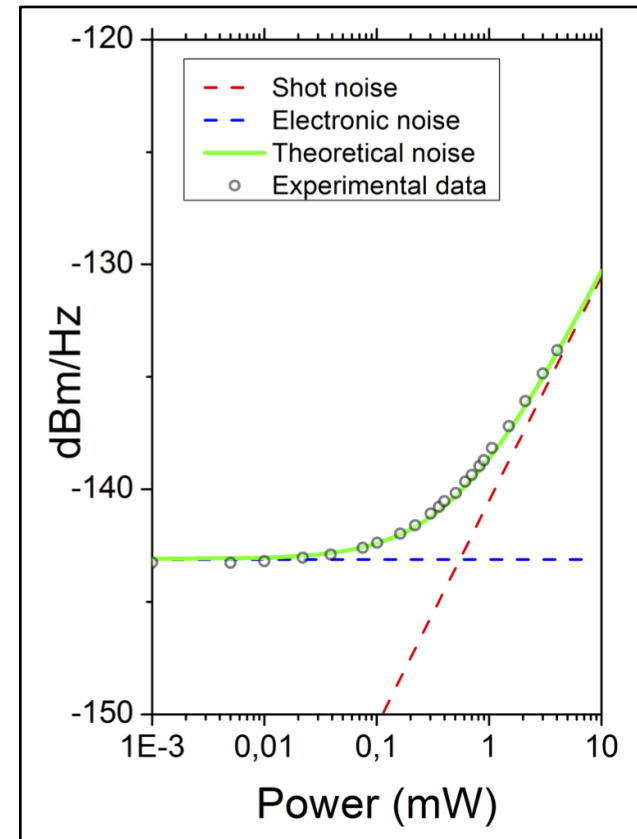
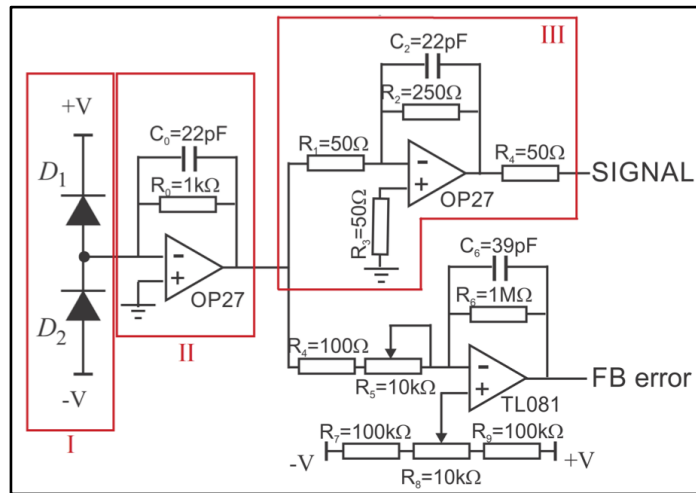
1. Messa a punto rivelazione omodina a 1064 nm



2. Test criogenici a temperature azoto liquido

# Homodyne detection – Low BW

Characterization @1064nm



## ELECTRONIC CIRCUIT – TECH. INFOS

### OP27

- GBW = 8 MHz
- Noise = 3 nV/Hz<sup>-1/2</sup> / 0.4pA/Hz<sup>-1/2</sup>

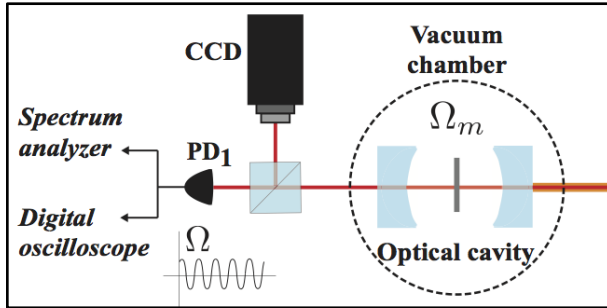
### JDSU ETX1000 (InGaAs)

- R(@850nm) = 0.2 A/W
- R(@1330nm) = 0.9 A/W
- Noise current density = 60 fA/Hz<sup>-1/2</sup>

**NOISE ANALYSIS.** Theoretical electronic noise (blue dashed line) and the theoretical shot noise (red dashed line). The sum of the two theoretical lines gives the green curve. The black circles are the measured experimental noise of the homodyne circuit.

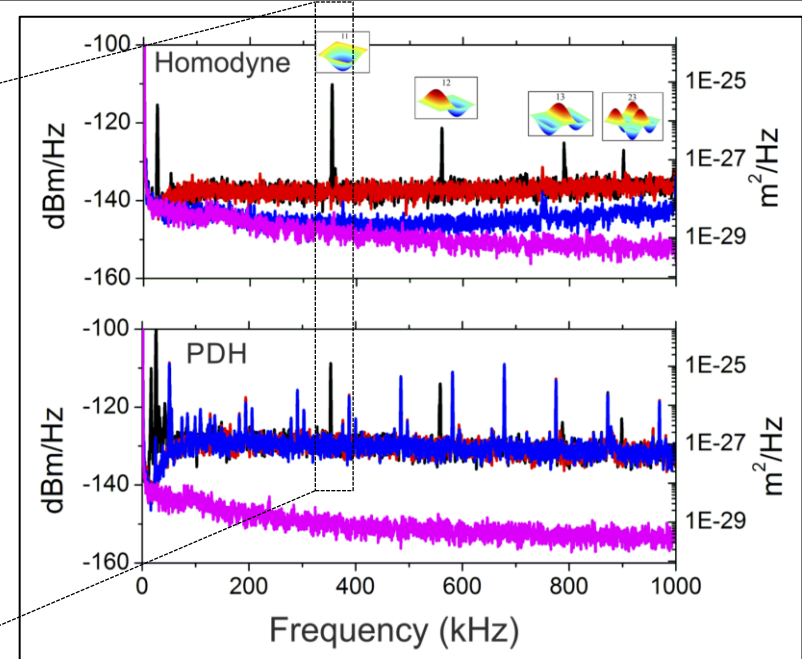
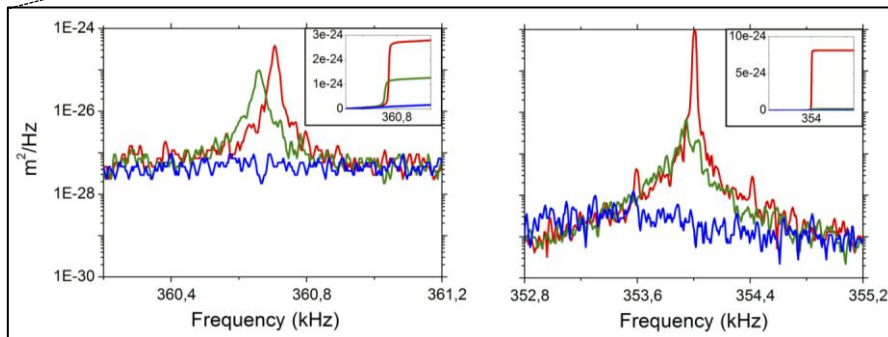
# Homodyne detection – Low BW

## Optomechanical test



**MECHANICAL MODES.** Comparison between the **PDH** noise spectrum (bottom panel) and the **homodyne** noise spectrum (top panel) from 100 Hz to 1 MHz. The magenta line is the spectrum analyzer noise, the blue line is the electronic noise, the red line is the shot noise and the black line is the acquired signal reflected from the cavity.

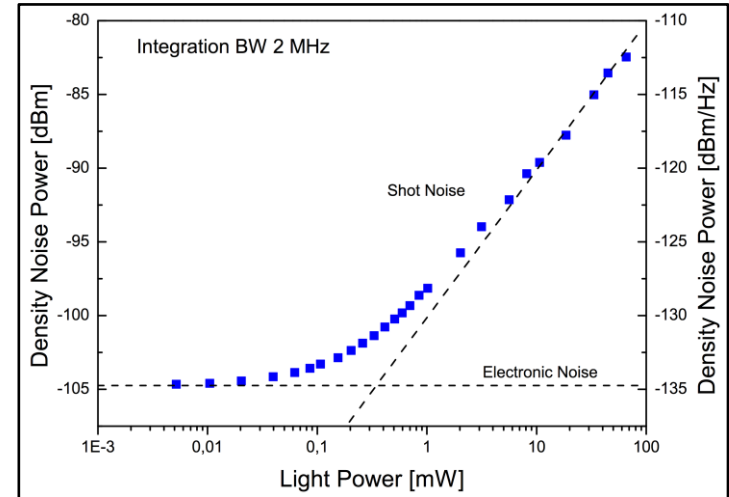
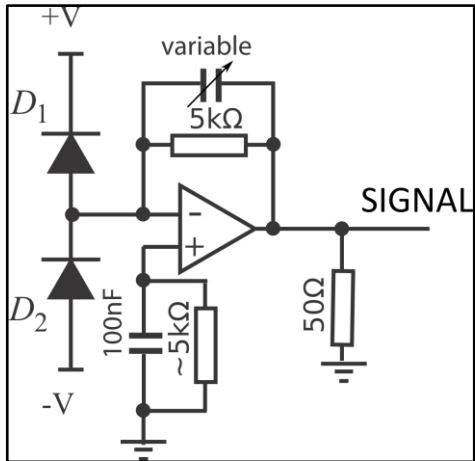
**EXPERIMENTAL SETUP.** Membrane-in-the-middle scheme. A SiN membrane of area  $0.5 \times 0.5 \text{ mm}^2$  and thickness 50nm is placed in a Fabry-Perot cavity, length 9cm and finesse 60000.



**COOLING FUNDAMENTAL MODE.** Comparison between the cooling spectra obtained with **PDH** and **homodyne** techniques. Notes the reduction of a factor around 10 of the background of the homodyne measurements. Inset: cumulative function of density spectra.

# Homodyne detection – High BW

Results @1064nm



## ELECTRONIC CIRCUIT – TECH. INFOS

### OP847

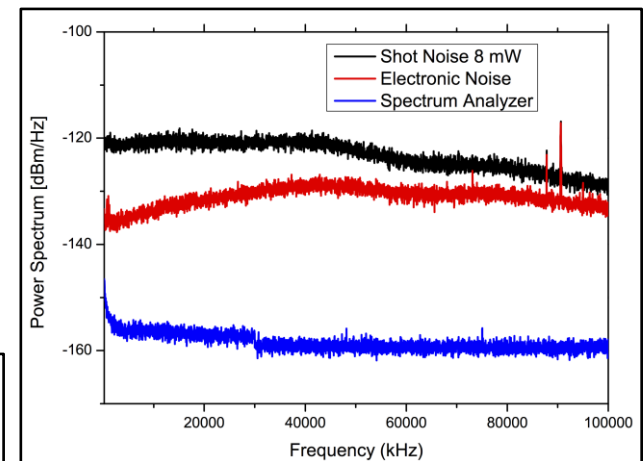
- GBW = 3.9 GHz
- Noise =  $0.85 \text{ nV/Hz}^{-1/2} / 3.5 \text{ pA/Hz}^{-1/2}$

### JDSU ETX1000 (InGaAs)

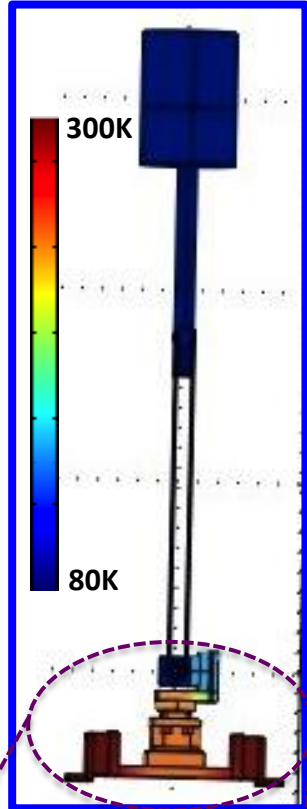
- $R(@850\text{nm}) = 0.2 \text{ A/W}$
- $R(@1330\text{nm}) = 0.9 \text{ A/W}$
- Noise current density =  $60 \text{ fA/Hz}^{-1/2}$

**NOISE ANALYSIS.** Theoretical electronic noise and shot noise. The blue squares are the experimental data.

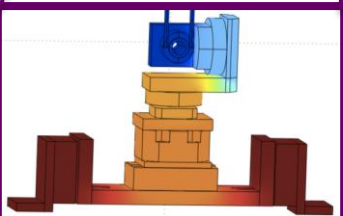
**NOISE SPECTRUM.** Electronic noise (red), shot noise (black), and spectrum analyser noise (blue).



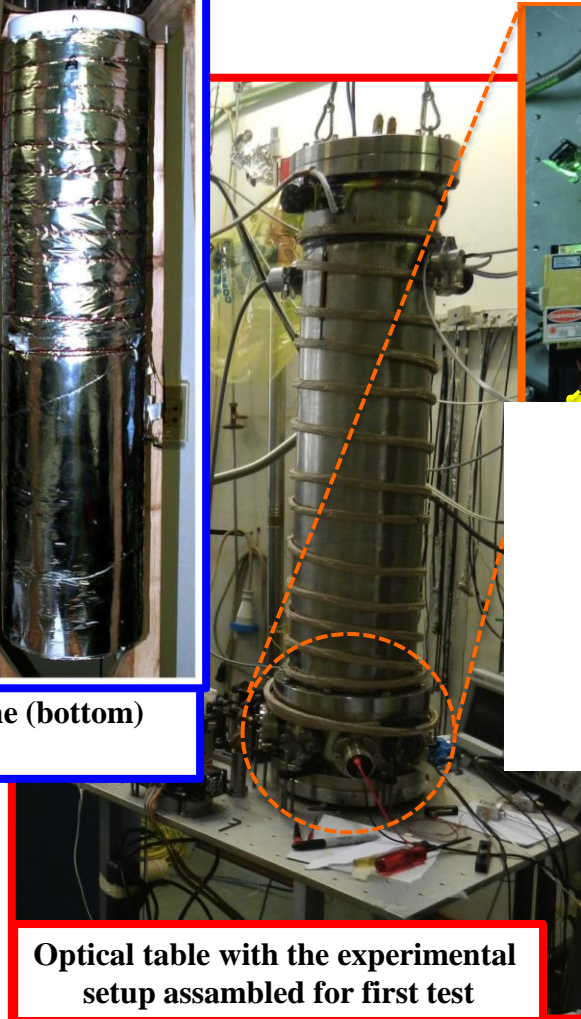
# Test criogenici



LN2 (top) and Lhe (bottom) chambers



Design of the new membrane holder and simulation of the temperature using LN2 in the bottom chamber.



Optical table with the experimental setup assembled for first test

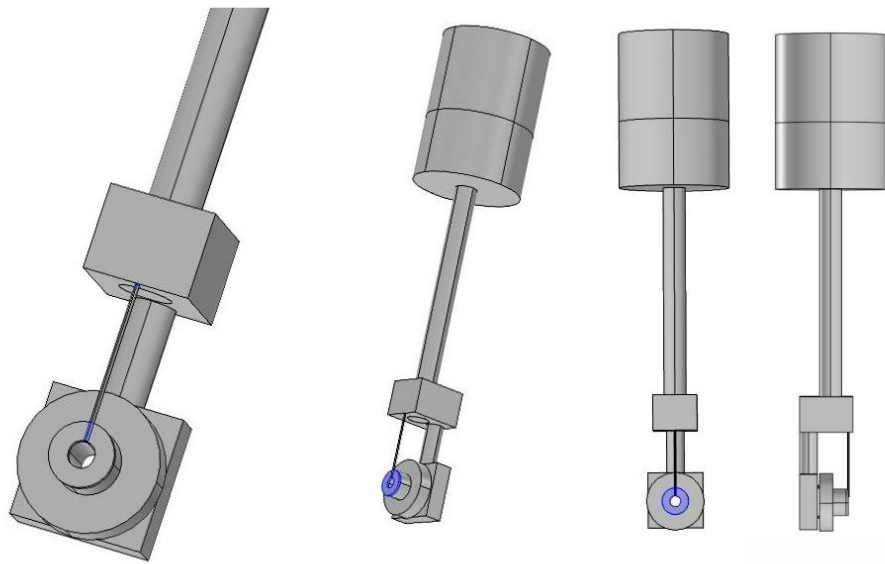
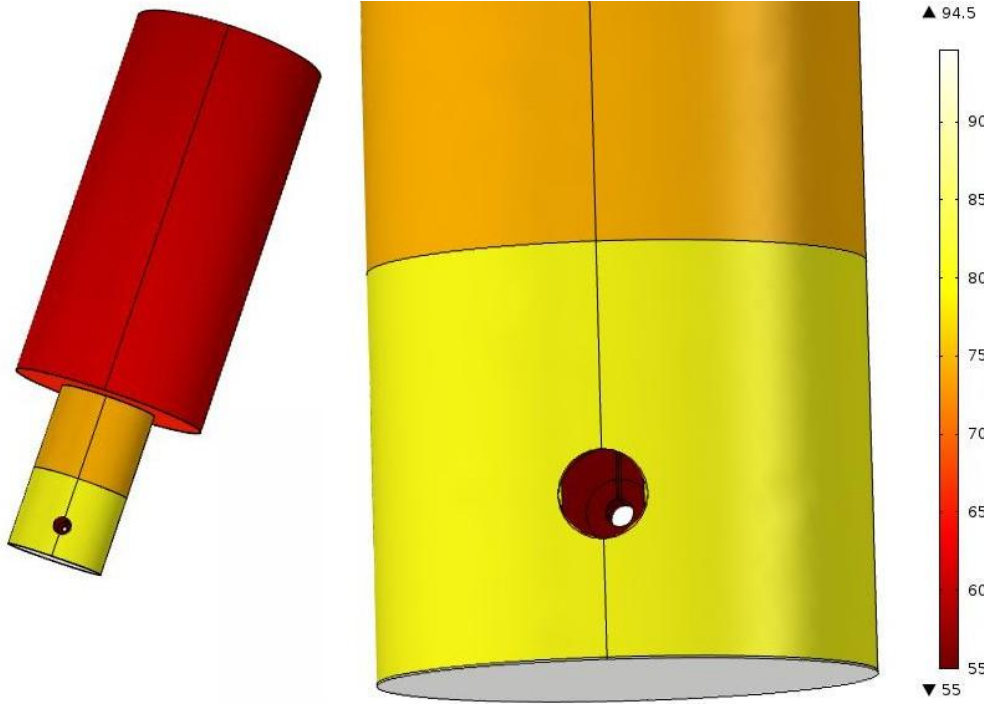
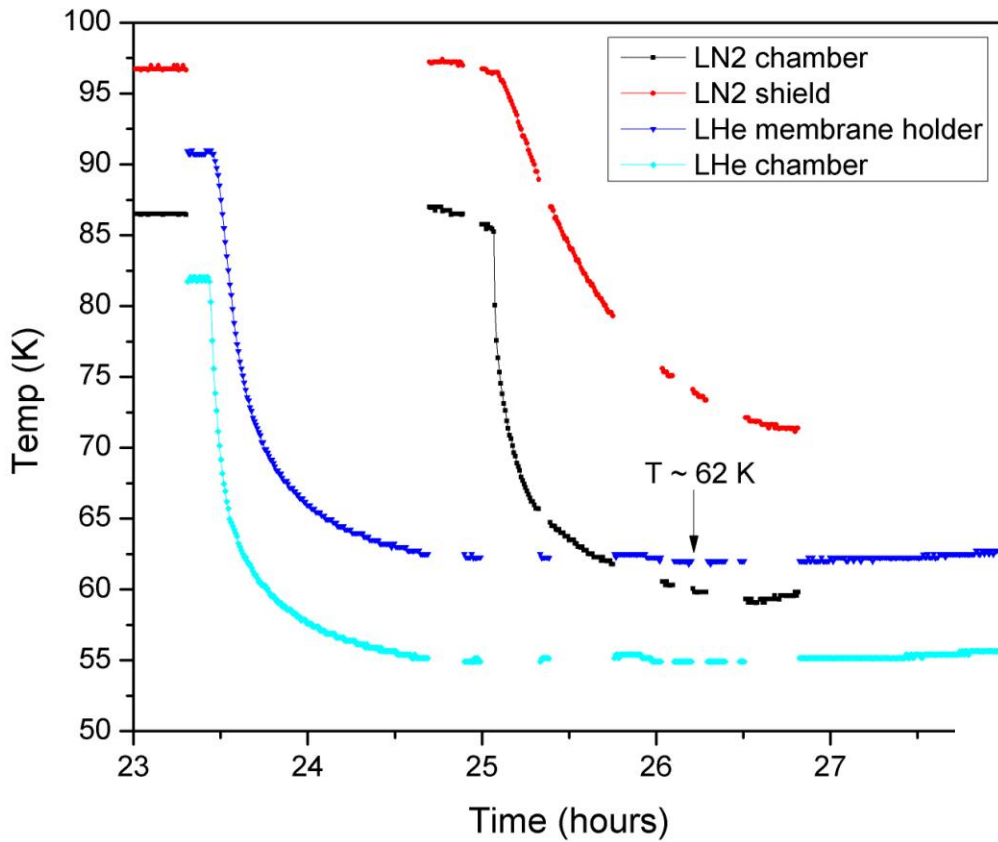


immagine del supporto  
membrana sul dito freddo



simulazione COMSOL  
in presenza degli  
schermi.

Ben confermata dal  
primo test



Temperatura durante il test



Pressione dentro la camera del criostato in corrispondenza della minima temperatura ottenuta durante il test

