Development and first tests of the Homodyne detection board for squeezed light

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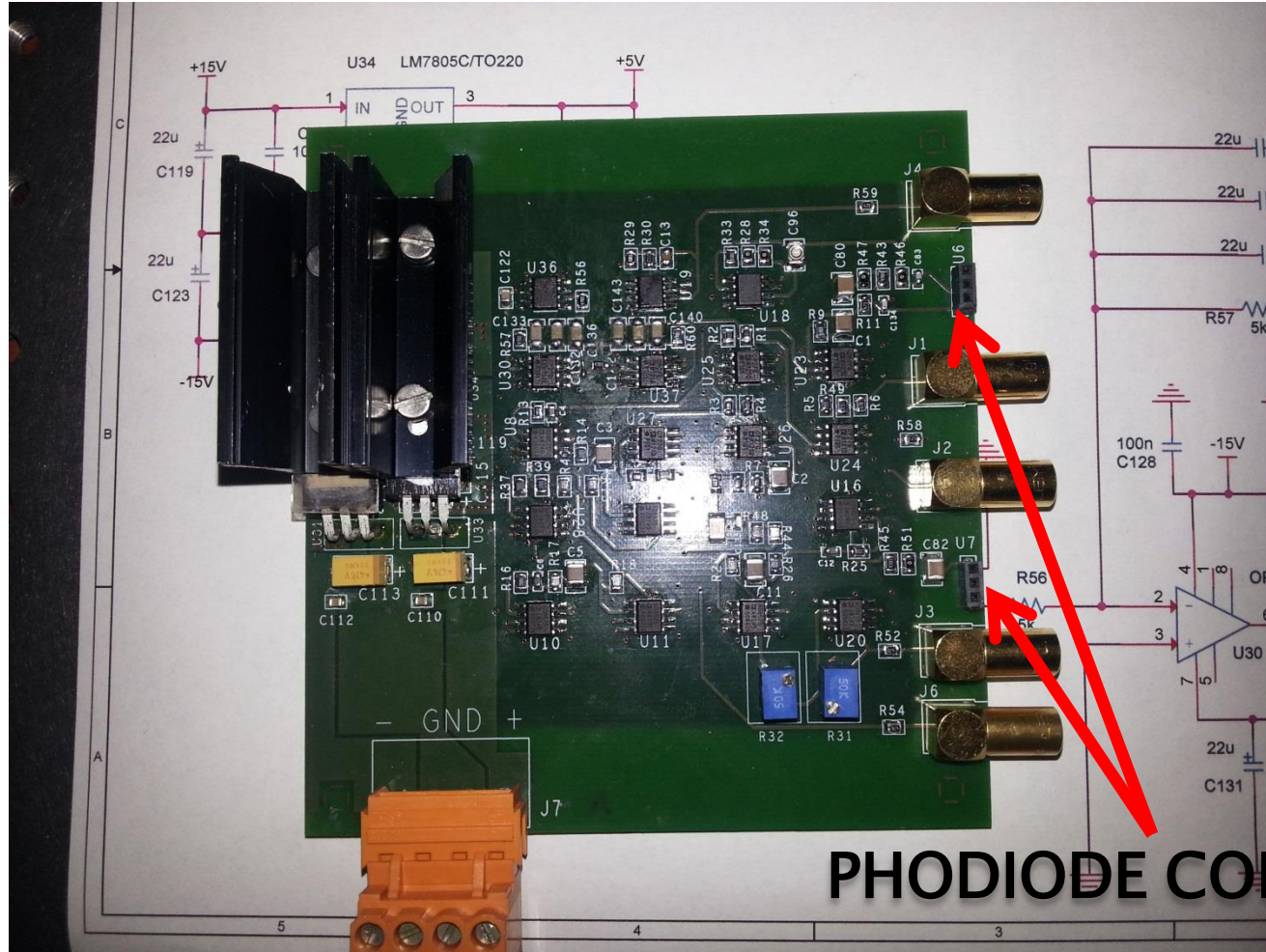
Homodyne detection board
First designed prototype

RADIO –

AUDIO –

AUDIO +

DC J1
DC J2

PHODIODE CONNECTORS
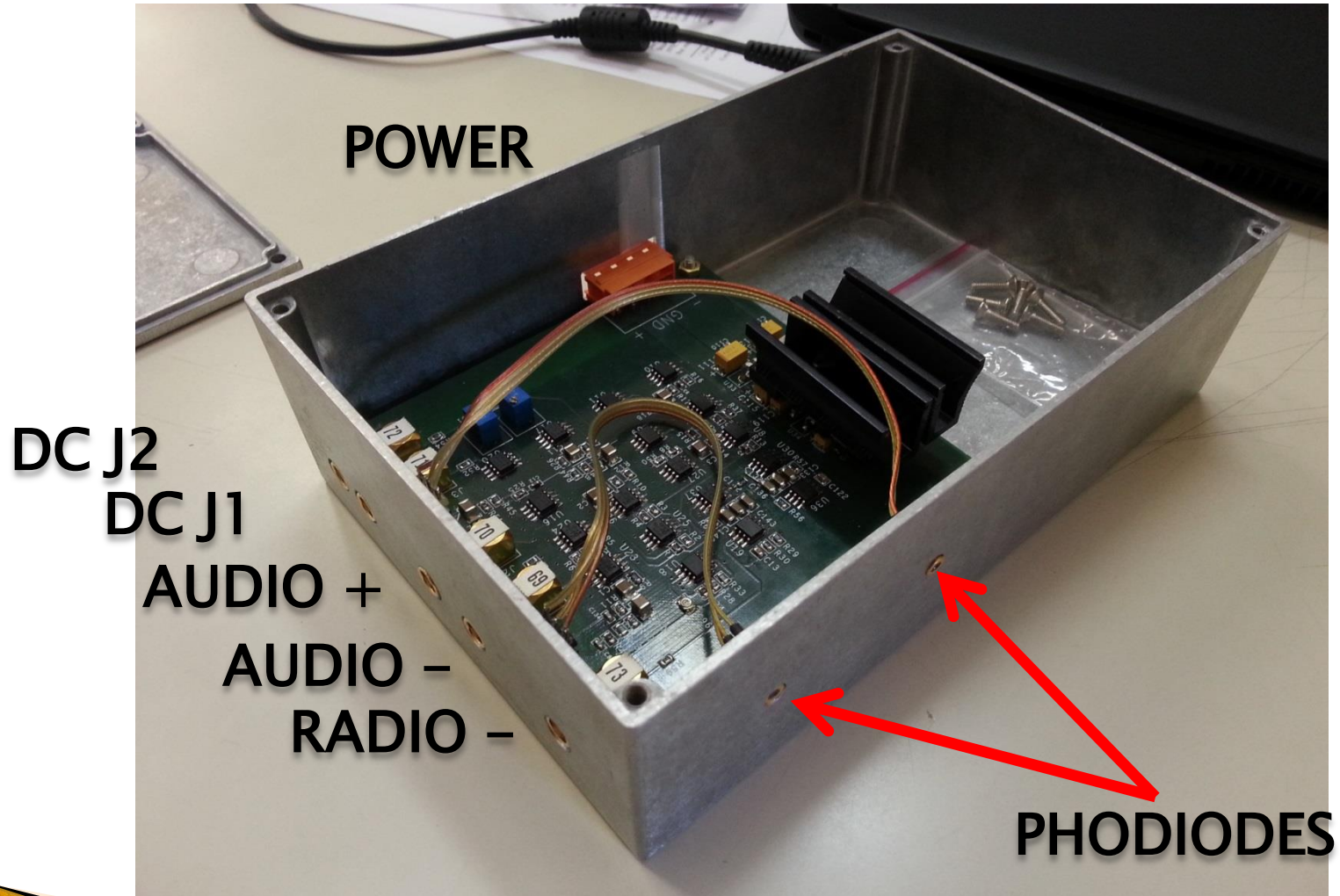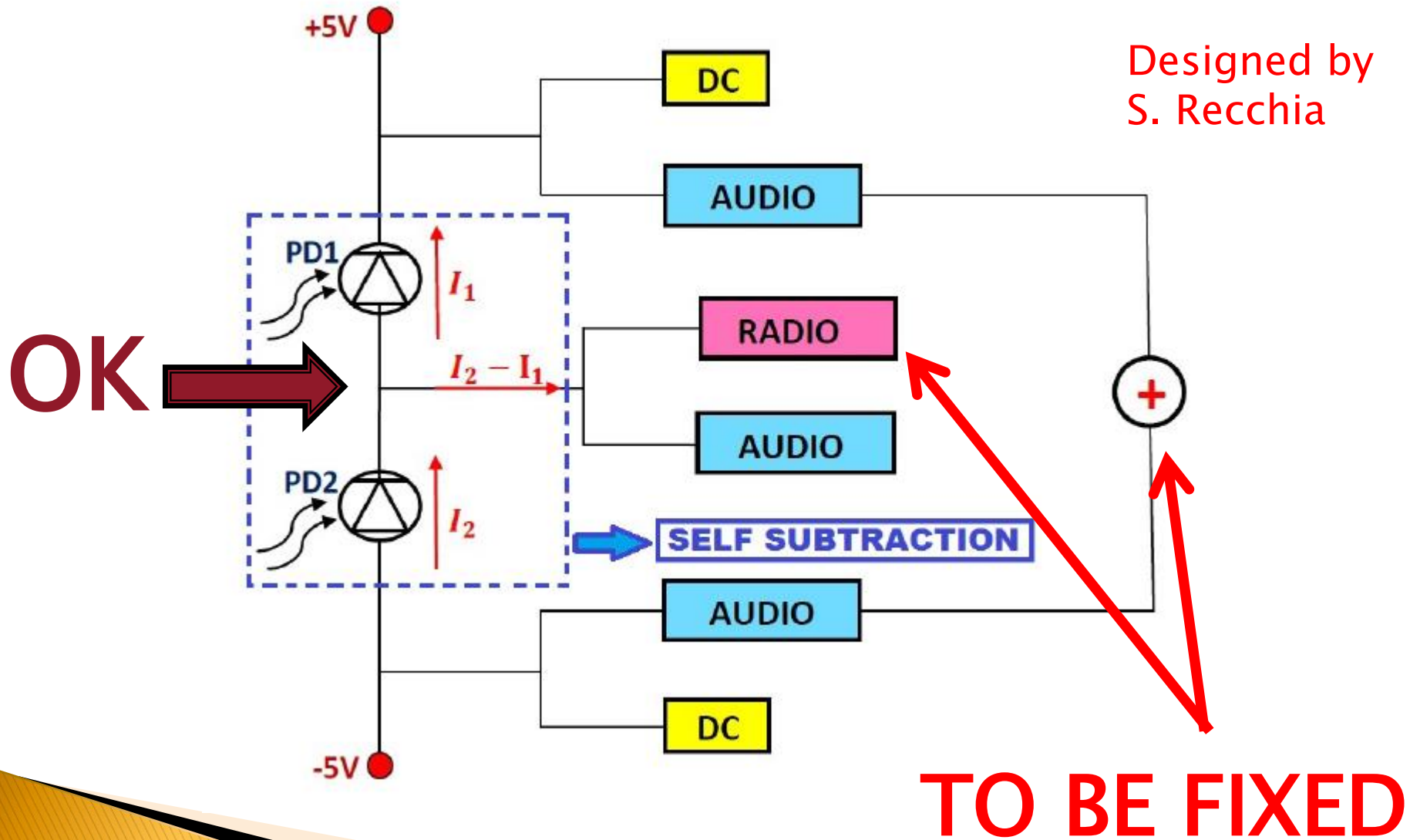
POWER (+/–19V 0.8A)

Homodyne detection board
First designed prototype

POWER

DC J2
DC J1
AUDIO +
AUDIO –
RADIO –

PHODIODES

Homodyne detection board
First designed prototype

Designed by S. Recchia

OK

TO BE FIXED

Homodyne detection board

- **Detection Board Prototype check**:
  - Fixed minor mistakes in the realization (wrong R, C..)
 - Emiting IR led used to test the two **EPITAXX ETX500T** photodiodes:
    - DC & AC test: OK
    - fotodiodes electronics balancing: OK
    - background noise measurement: OK, *compliant with the theoretical predictions*)
  - Found a main «bug» in the electronics design: «+» and «−» circuits (audio band) do the same thing: $I_1 + (-I_2) = I_1 - I_2$! *We will overcome this problem re-designing a new detection board (modified op-amp connections);*
  - Radio-difference circuit must be fixed and will be tested soon using the laser source (Mephisto laser, 200 *mW*).

SINCE THE SUBTRACTION CIRCUIT BETWEEN I_1 AND I_2 WORKS, THE PROTOTYPE DETECTION BOARD CAN BE USED IN THE OPTICAL TEST BENCH !

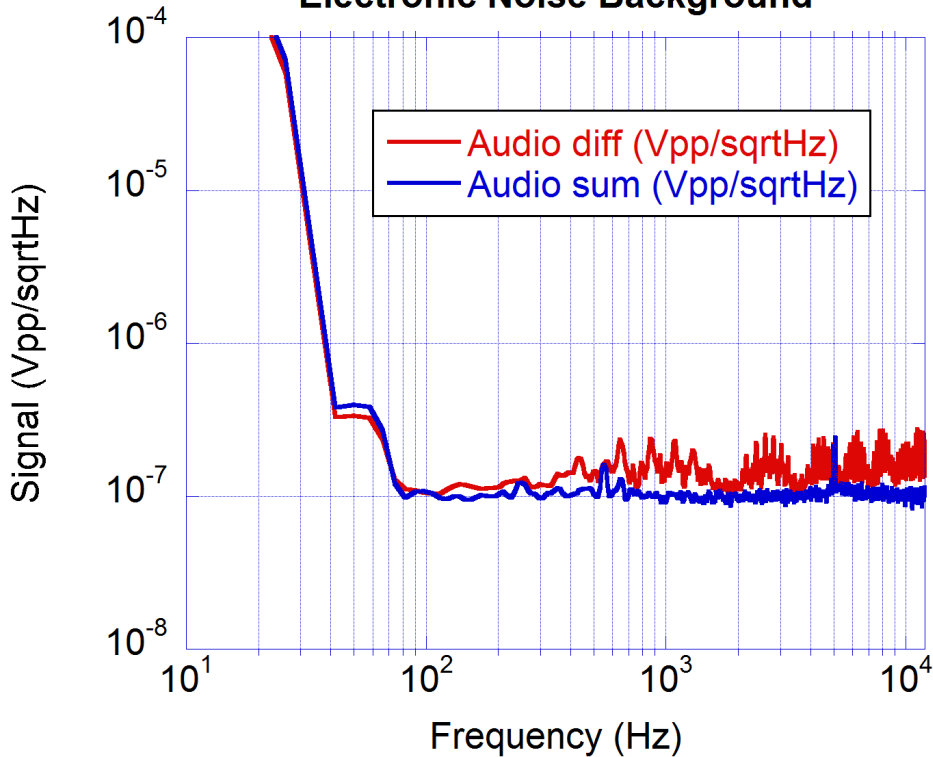# Homodyne detection board
Background noise from electronics
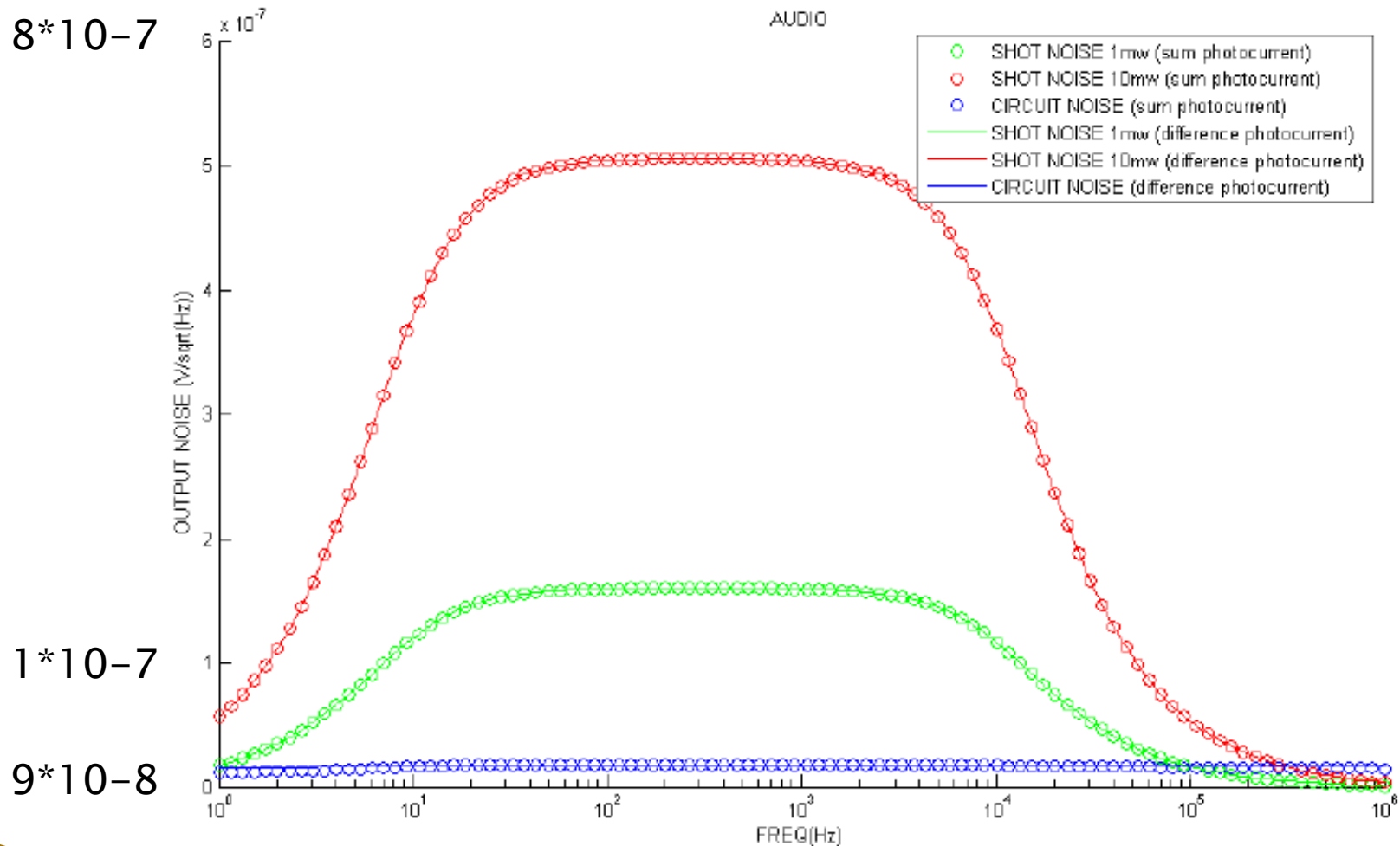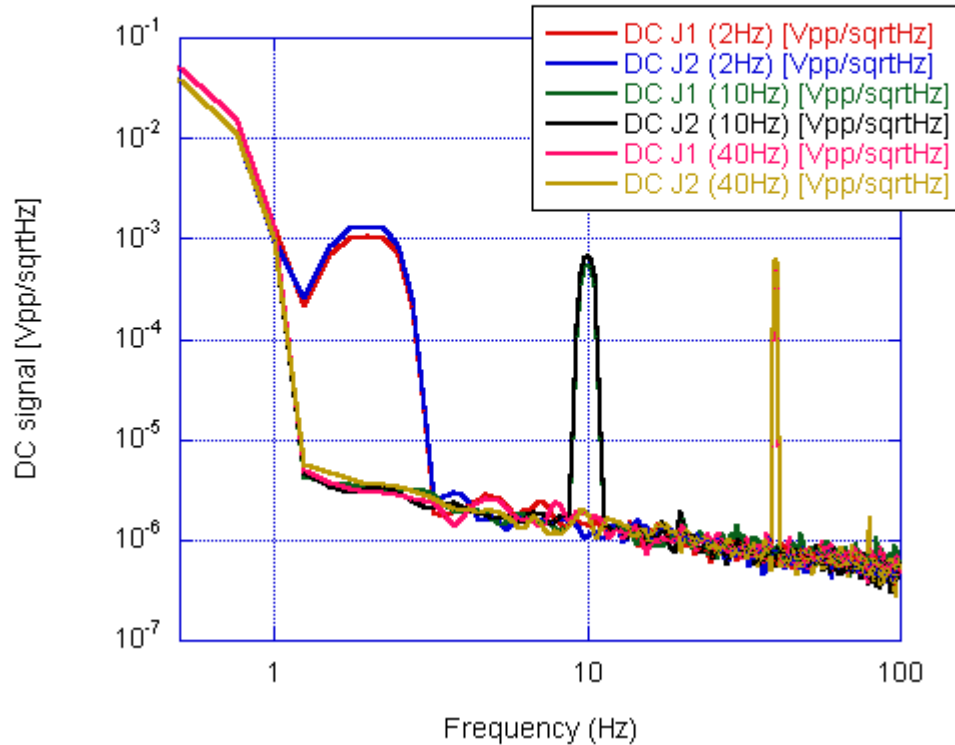
Homodyne detection board
Background noise from electronics

N.B. : Audio+ and Audio− show the same output since Audio+ circuit still have to be fixed ! ; measures are in Vpp/sqrt(Hz)

Homodyne detection board
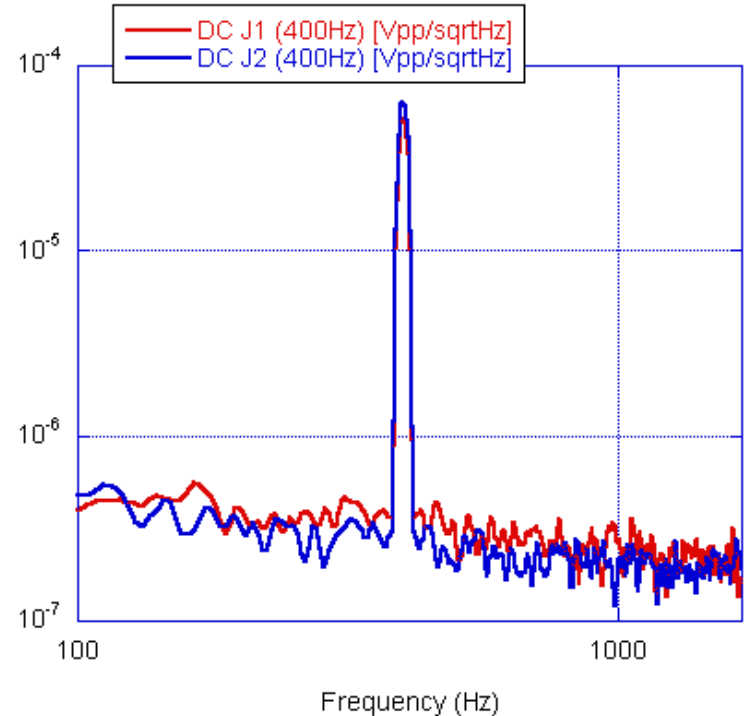## Pulse test with IR emitting led

Homodyne detection board
Pulse test with IR emitting led

Homodyne board
Audio +/- test with pulsating IR LED signal
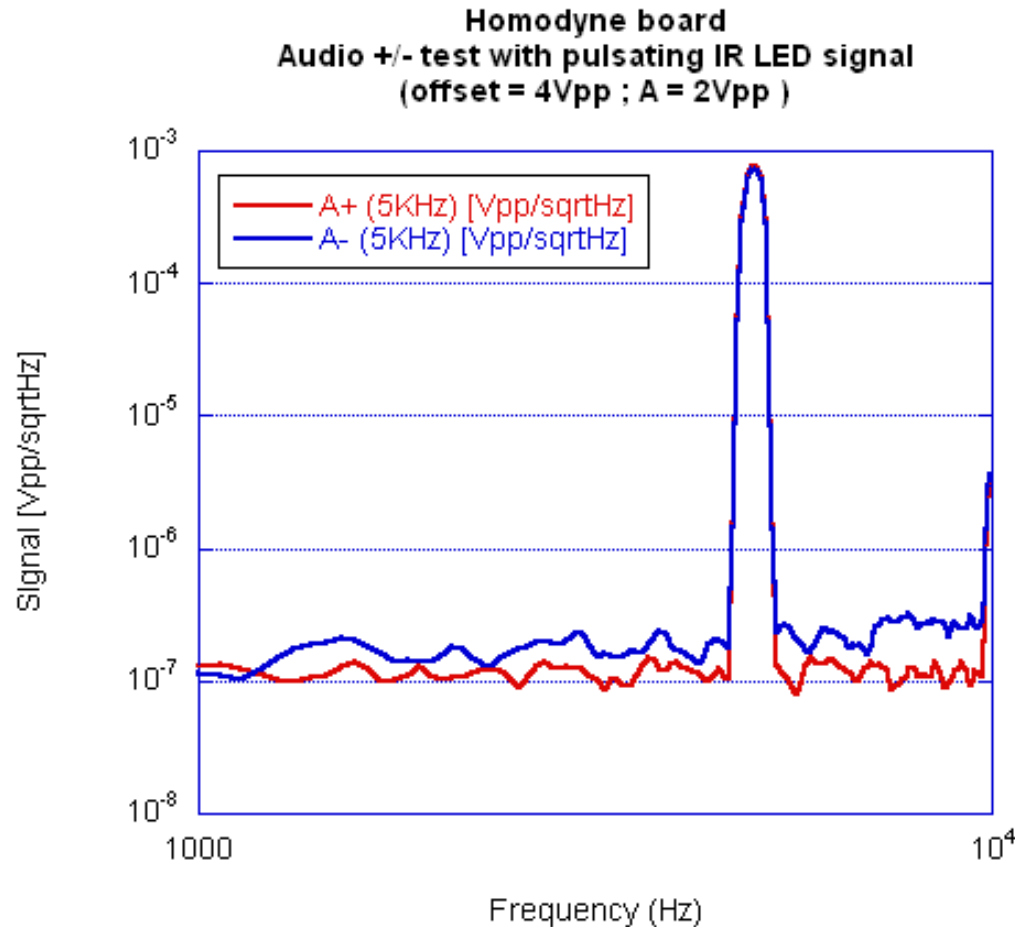**(offset = 4Vpp ; A = 2Vpp)**

N.B. : Audio+ and Audio− show the same output; the peak is produced by the amplified unbalancing between the two different IR emitting leds used in the test (misalignment, distance)

Homodyne detection board

Optical Layout for the test

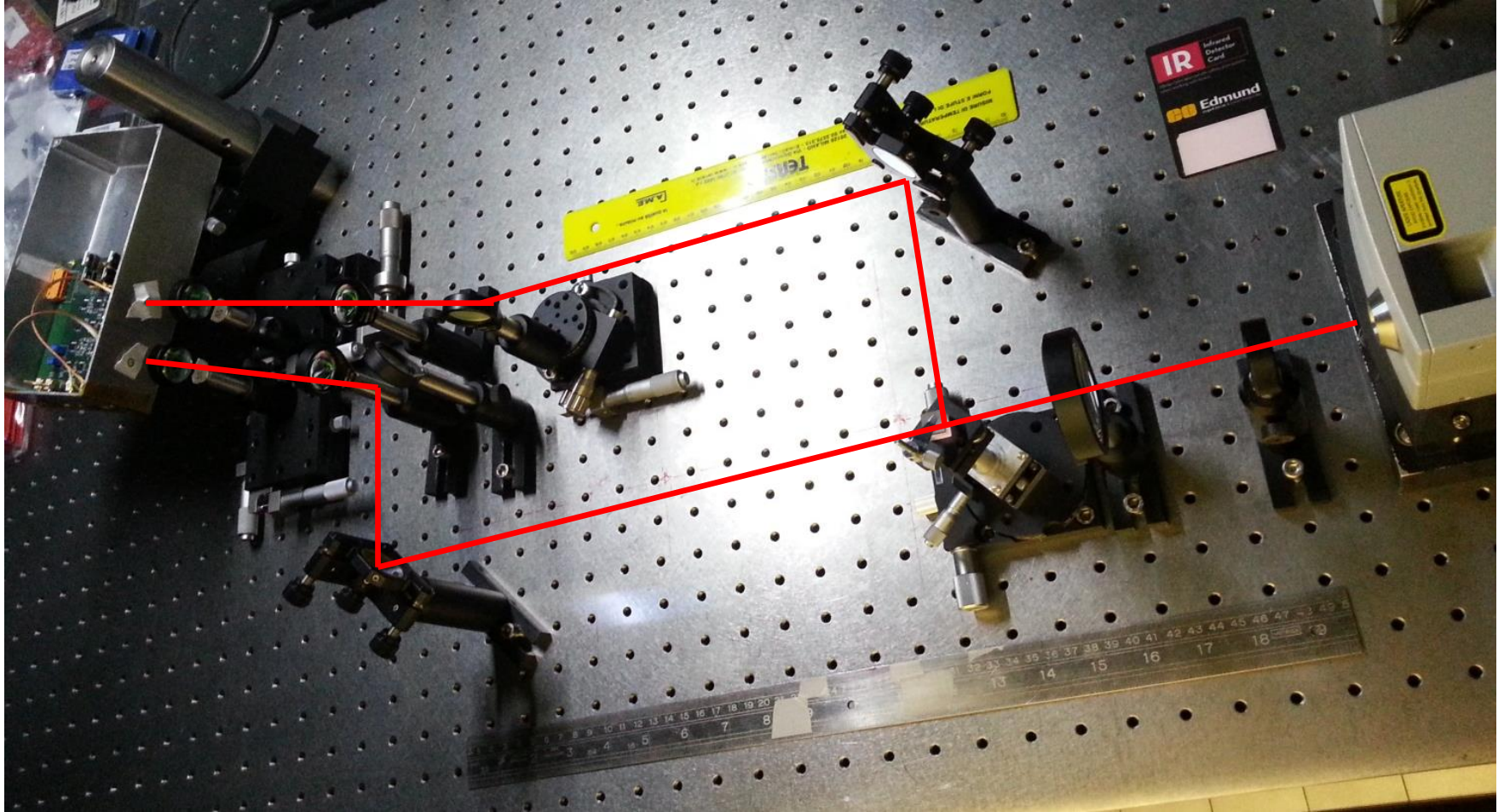(almost finished, 3 grad students are currently working on it)

IR Laser Source: Mephisto (200 mW) // polarized

L

Input telescope

BS

P

P

Output telescopes

PhotoDiodes
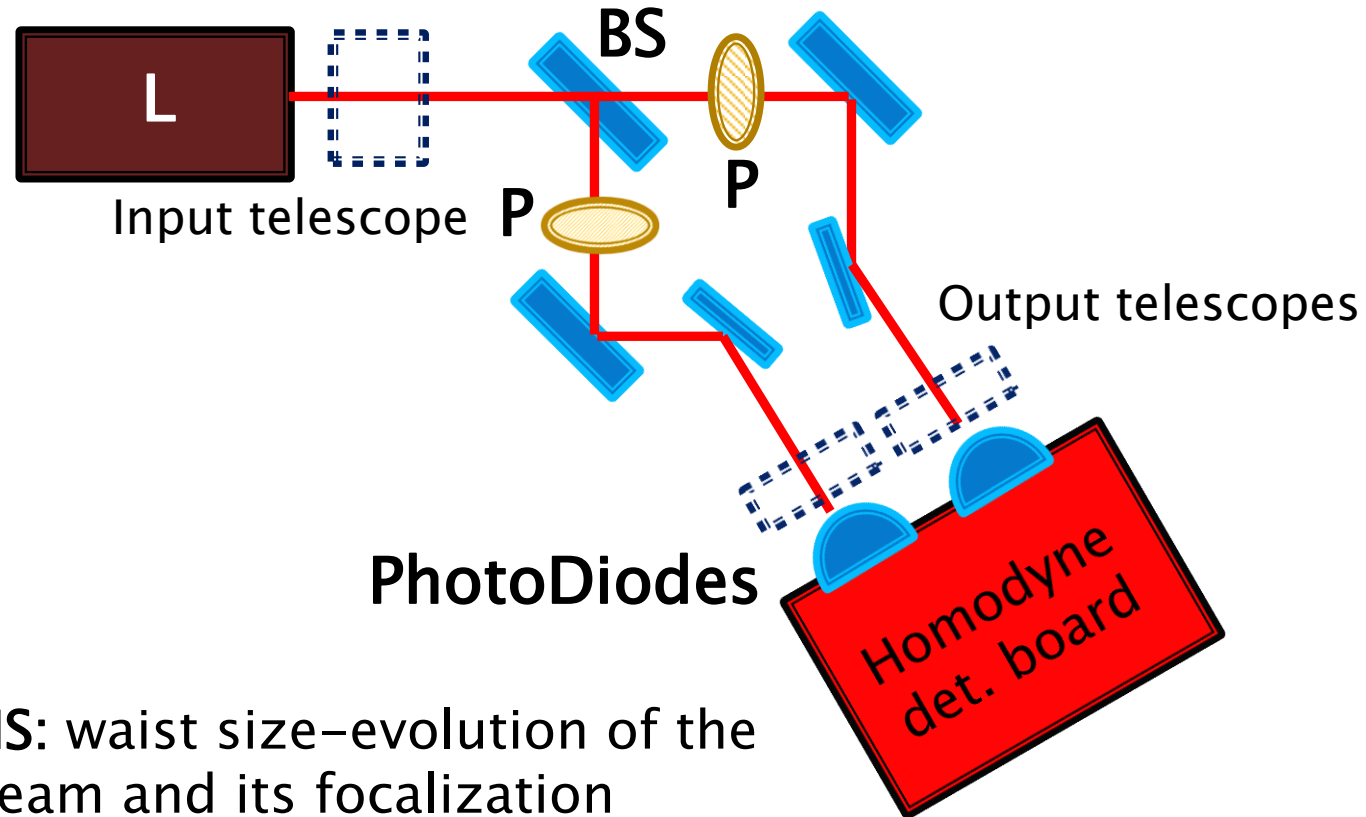
Homodyne det. board

--> **SIMULATIONS:** waist size-evolution of the gaussian laser beam and its focalization (**gaussianbeam** + **zeemax**)

Homodyne detection board
Optical Layout for the test

…work in progress!