Experimental
Team for
Virgo&ET

Laboratoire AstroParticule et Cosmologie

anr agence nationale de la recherche

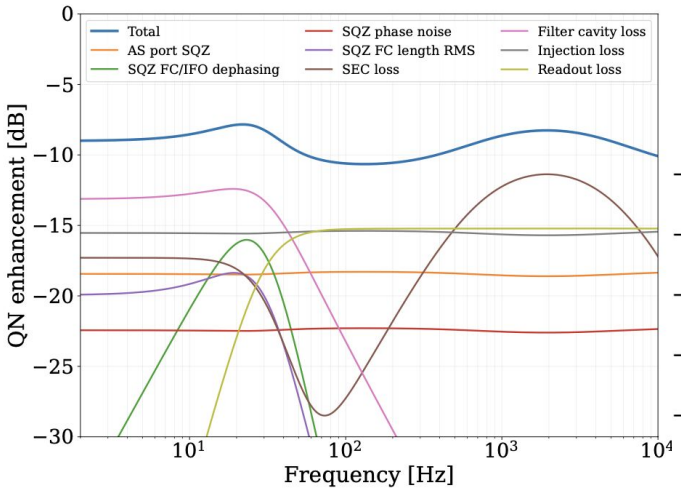
Université Paris Cité

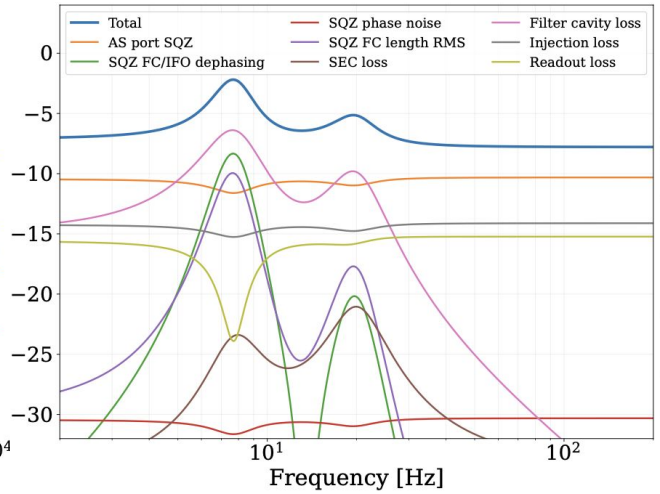
Status of quantum-FRESCO project

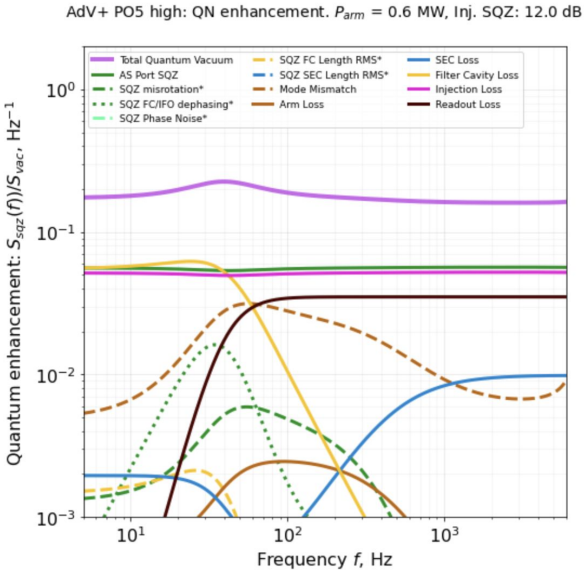
Yuhang ZHAO for APC team

Motivation

- The “10dB squeezing goal” is crucial for reaching ET/Virgo_nEXT sensitivity target
- R&D activity is necessary especially to adapt squeezing to detuned interferometers





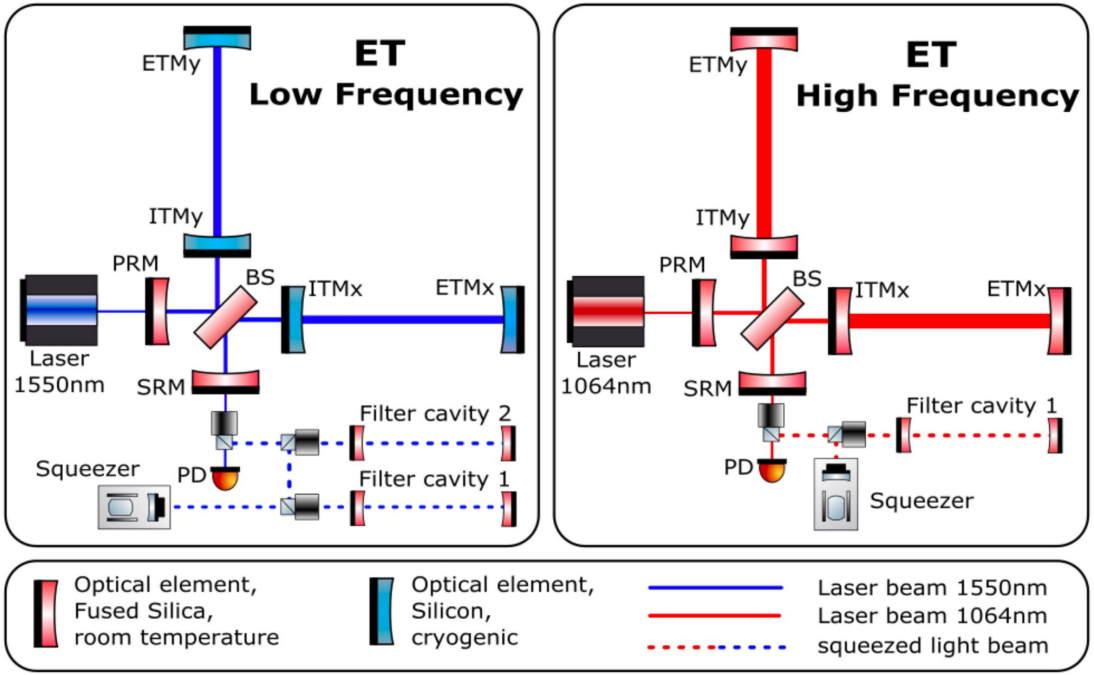


ET-0230A-23

VIR-0138D-22

Introduction

- Current frequency dependent squeezing (FDS) with a s single filter rcavity cannot be directly applied to a detuned GW detector

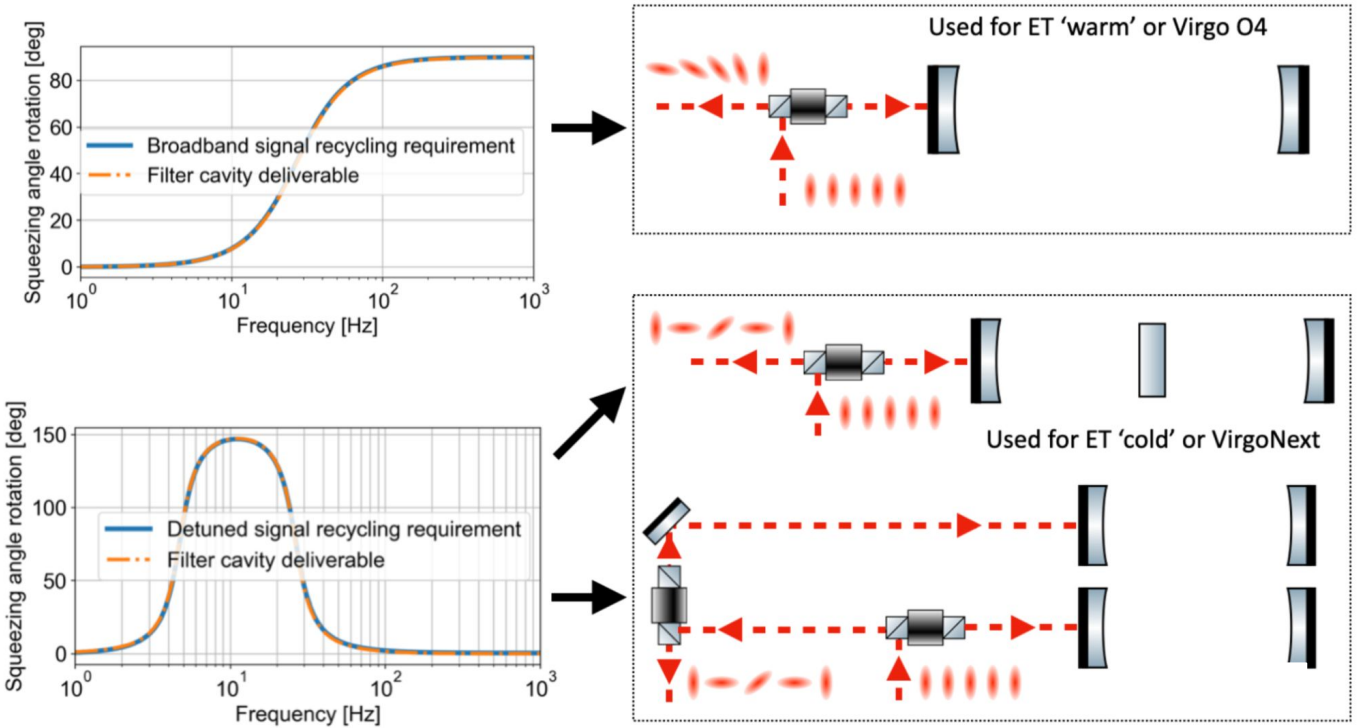


- Current proposal: to use **two filter cavities** for the ET-LF (with detuned SR)

ET-0007A-20 ET Design Report Update (2020)

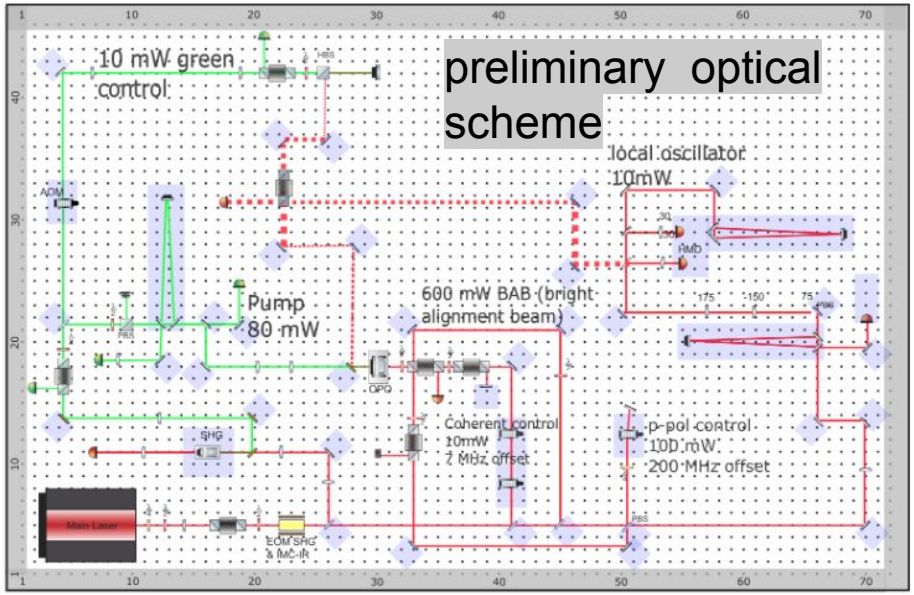
Introduction

- Non-trivial squeezing ellipse rotation can be achieved with **two cavities** or with **a coupled cavity**



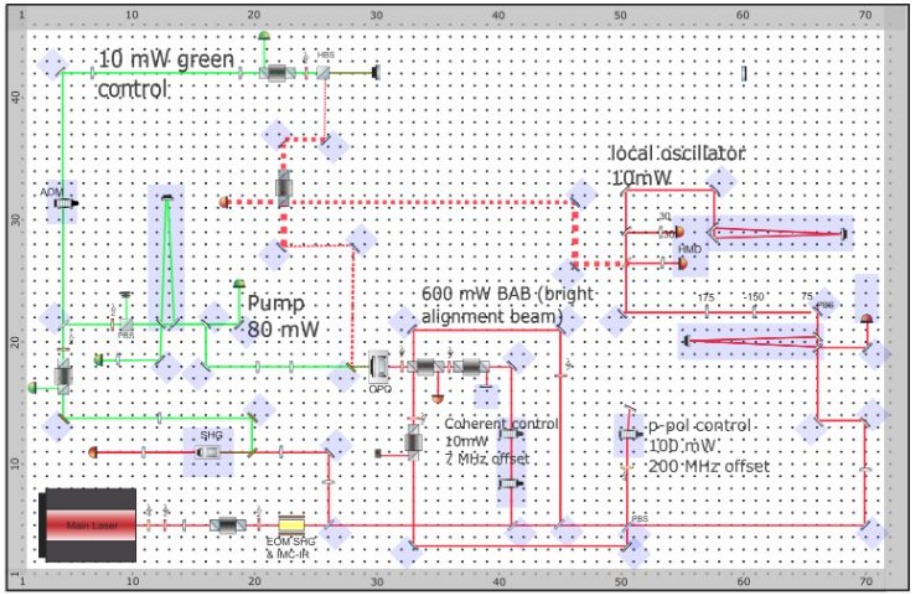
The quantum-FRESCO project @ APC

- **4 year ANR JCJC project**
- **Goal:** demonstrate non-trivial squeezing rotation with a table top experiment
  - With two cavities
  - With a couple cavity



Experiment status: optical design of the sqz source

- Almost finalized, targeting MHz frequency region
- Realized with OptoCad but plan to redo it with gtrace (python based)



Experiment status: laser source

- We have just received 2W laser from Coherent
- Characterization on-going

Virgo Logbook | Add Report | Drafts (0) | L-Mail | Admin | Users | Statistics

Reports **1-23** of **23**

Logged in as: EleonoraCapocasa

Quantum_fresco (optics) EDIT COMMENT

YuhangZhao, AnneDaumas - 18:14 Monday 12 February 2024 (25)

2W laser characterization

Today we opened the new laser box and did characterization for this 2W laser. To be safe, we followed the instruction from the manual put in the laser box.

Laser : temperature 28C (same as LG laser) .temperature when opening the laser : 25.26 degrees

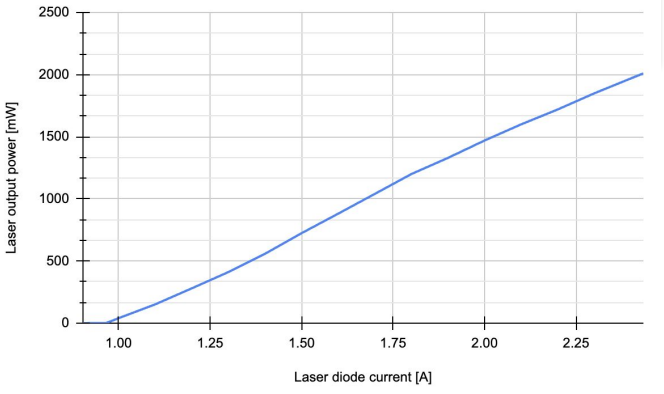
room temperature : ? room humidity: ?

LD current [A]	0.902	0.965	0.98	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2	2.1	2.2	2.3	2.4	2.434
Out power [mW]	0	0.5	16.3	39.8	151	280	411	558	724	881	1040	1200	1330	1470	1600	1720	1850	1970	2010

We can see that the power reached the specified power 2W that we asked at a laser diode current of 2.434 A.

I think we can say that the laser works quite well from this sense of power provided. But we will need to characterize beam parameter and amplitude noise as well in the next days.

Images attached to this report



Experiment status: data acquisition system

- Virgo style data acquisition system is being restored with the help of LAPP
- Deployment planned for the next month

Experiment status: cavity optics, mechanics, control

- Main optics purchased, will be coated at LMA
- Mechanics for OPO, SHG,mode cleaners in production
- Analog control boards for cavities designed and purchased
- Control scheme for the double/couple cavity under study

Summary

- We are developing a MHz SQZ source at APC for a table-top test of non-trivial rotation of squeezing ellipse for detuned interferometers with different configuration
  - two cavities
  - a couples cavity
- We plan to use it also as a testbench for study mismatching effect (important limitation for reaching 10 dB)
- Studying squeezing response to coupled cavity, is also interesting for ITF (similar to SR+ARM configuration)

Thank you for your attention!

You’re welcome to visit our website