Baffle internal modes diagnostic

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For SLC team
With the contribution of A. Moggi and A. Magazzù

Introduction

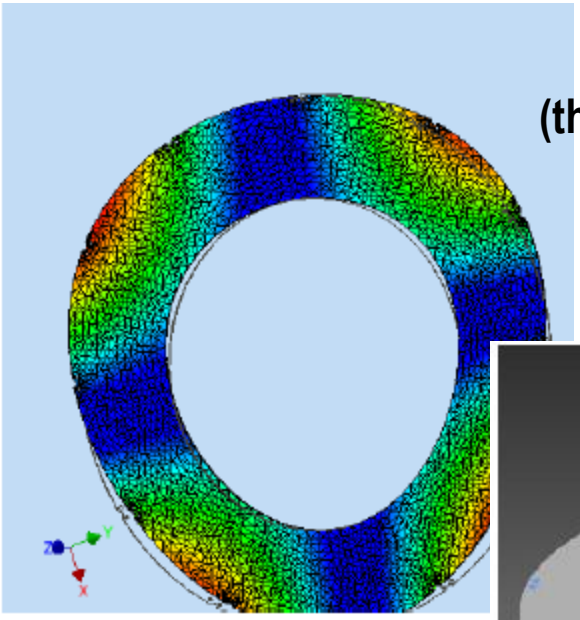
The stray light noise will be a crucial issue in the Advanced Virgo commissioning

For this reason it would be important to have a database of the baffle internal modes resonance frequencies to:

- **Have a preliminary diagnostic on the baffle implementation (i.e. if the measured resonance frequencies will be strongly different from what is foreseen, or very different among baffles)**
- **To speed up the ITF noise hunting phase.**

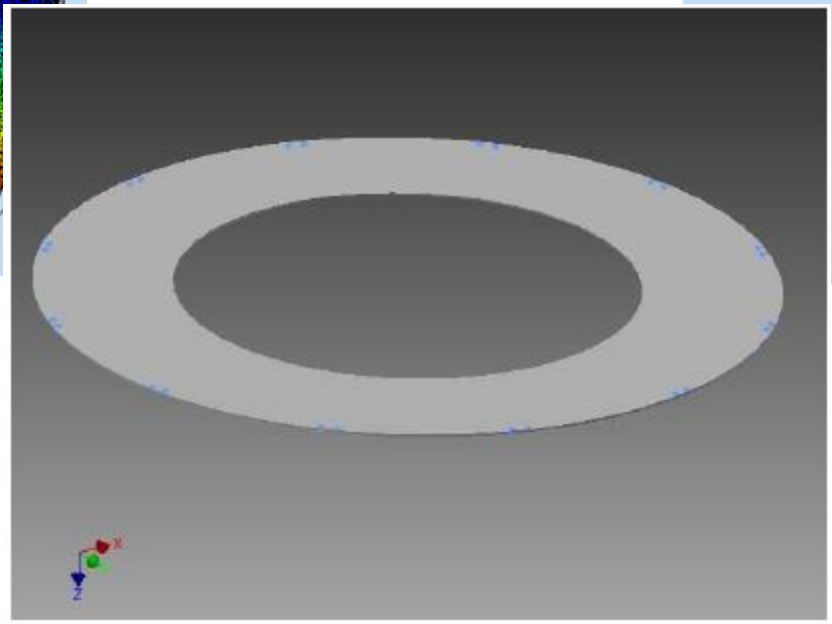
This presentation describes the preliminary work to define a procedure to measure the baffle internal modes.

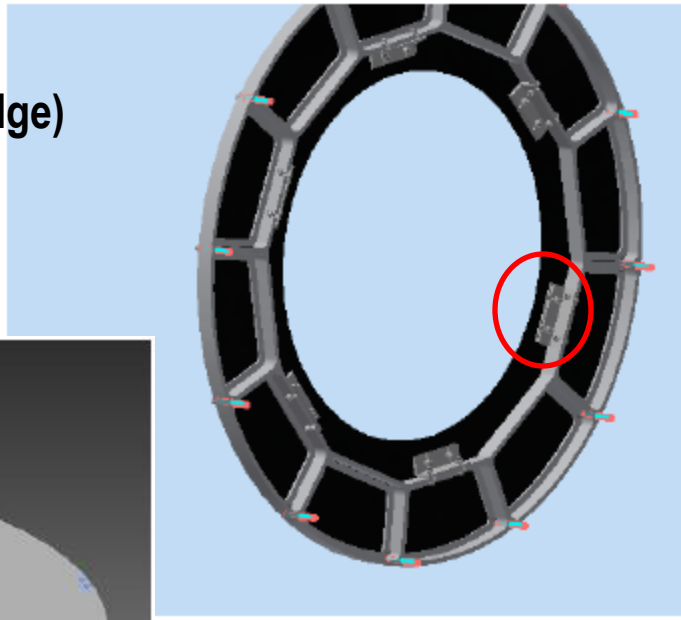
Mechanical simulations (A. Moggi)



Free baffle:
1st mode frequency
12.04 Hz

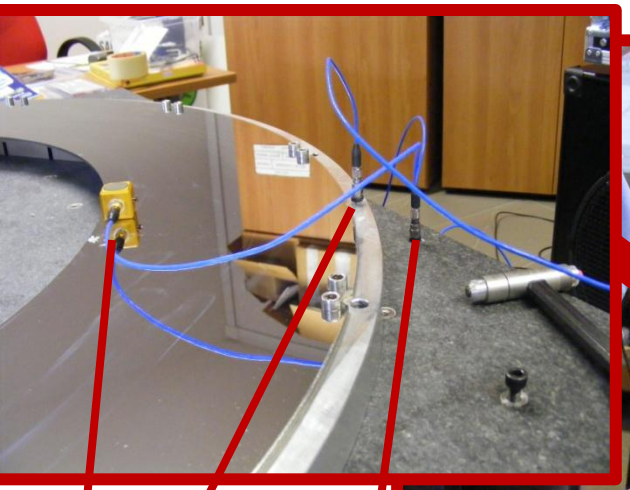
Semi-free baffle
(the constrains are only on the edge)
1st mode frequency
80.37 Hz





Final configuration baffle
(the constrains are on the edge and next to the inner aperture)
1st mode frequency
245.81 Hz

Preliminary Setup



Not clear if accelerometers can be used on site measurements (cleaning issues: accelerometers are attached with WAX)

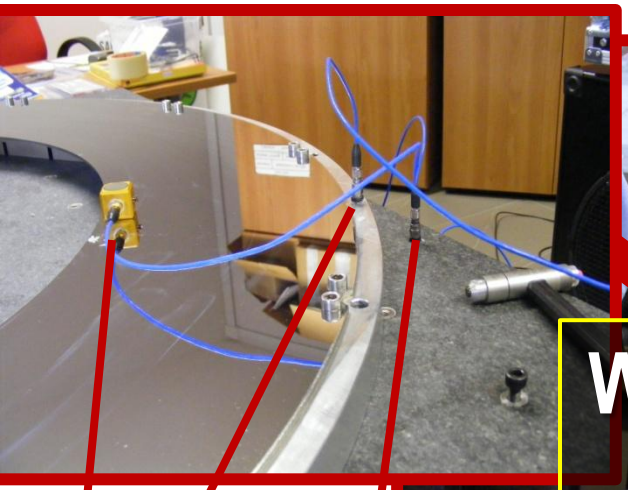
Connected to the frame

Connected to the baffle

Connected to ground (i.e. our Granite Bench)

Listening to excited baffle sound with Microphones has been tried without success

Preliminary Setup



Not clear if accelerometers can be used on site measurements (cleaning issues: accelerometers are attached with WAX)

Connected to the frame

Connected to the baffle

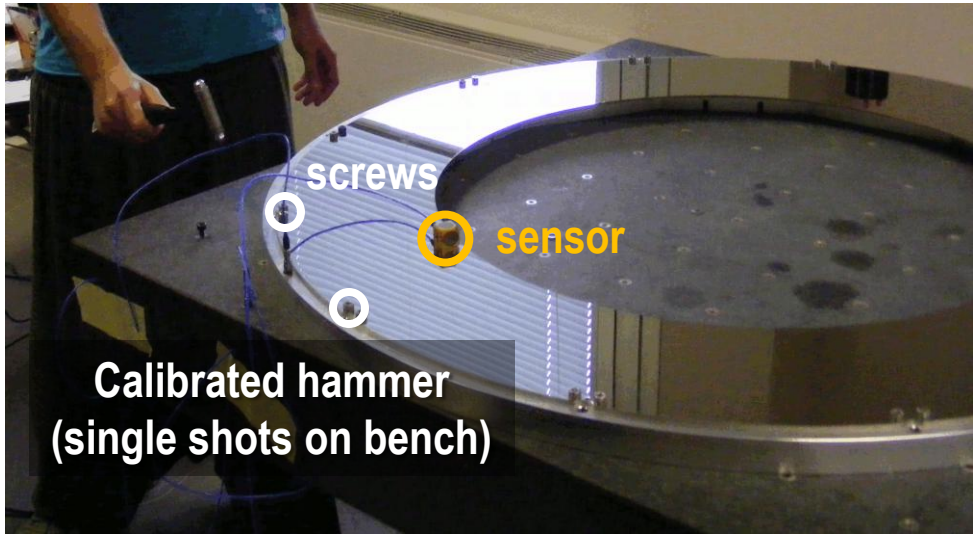
Connected to ground (i.e. our Granite Bench)

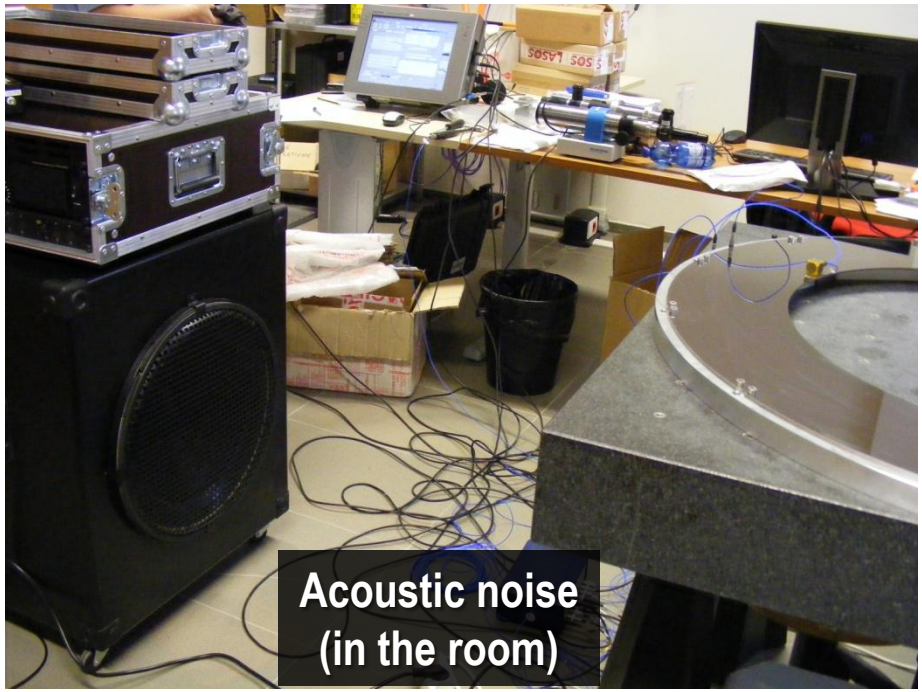
We expect to measure something slightly higher than 80.37Hz since the baffle was connected to the frame just with screws along the edge (no inner screws) and leans on the frame

Listening to excited baffle sound with Microphones has been tried without success

Excitation procedures

Two excitation procedures have been tried:

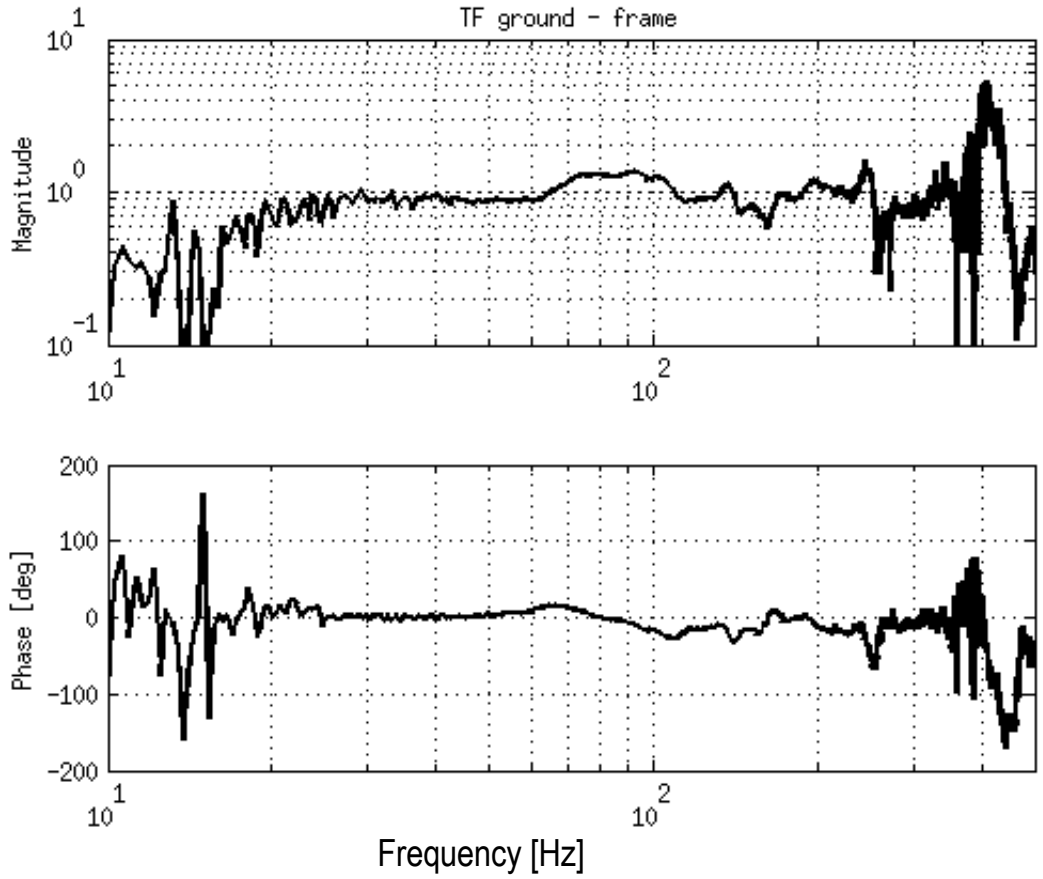




At the moment Hammering seems to be the most promising

(Acoustic noise injections act on the baffle along different paths - through bench, frame but also directly… which makes loosing coherence)

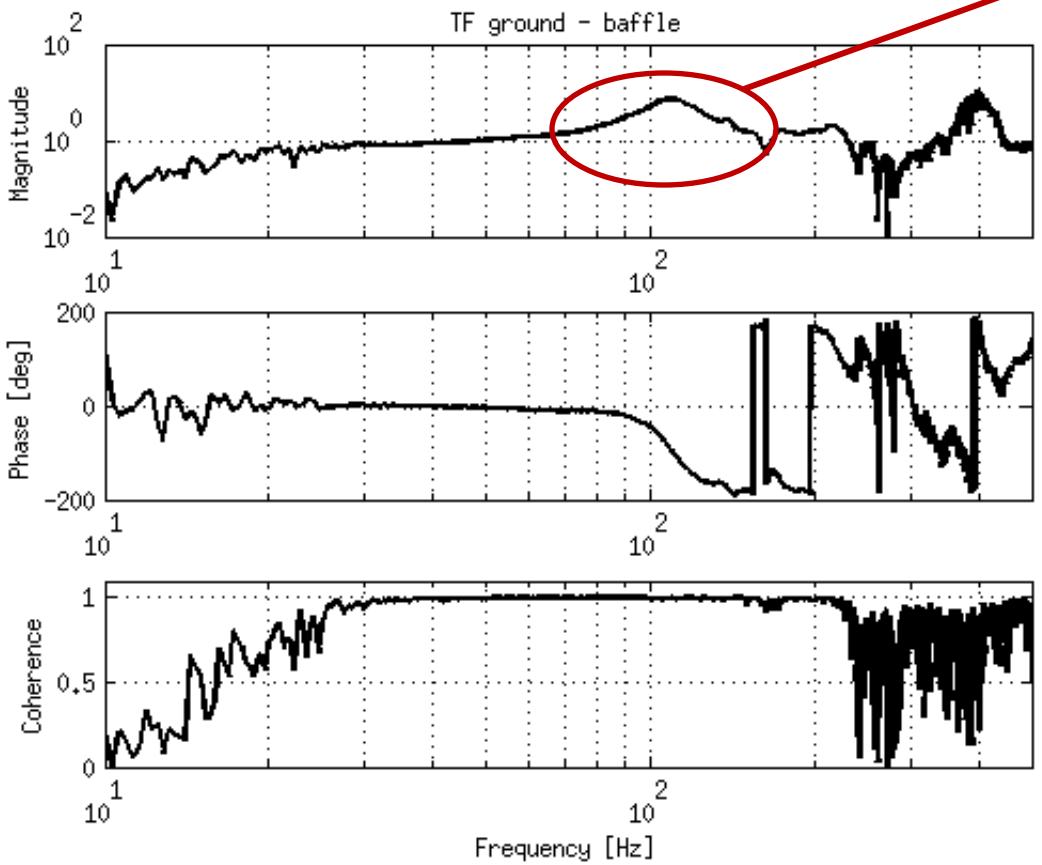
Measurements



The TF between the bench and the frame is ~1 thus the frame can be considered in this setup rigidly connected to the bench.

Measurements

TF between bench and baffle:



113Hz

Baffle resonance, in agreement with the mechanical simulations

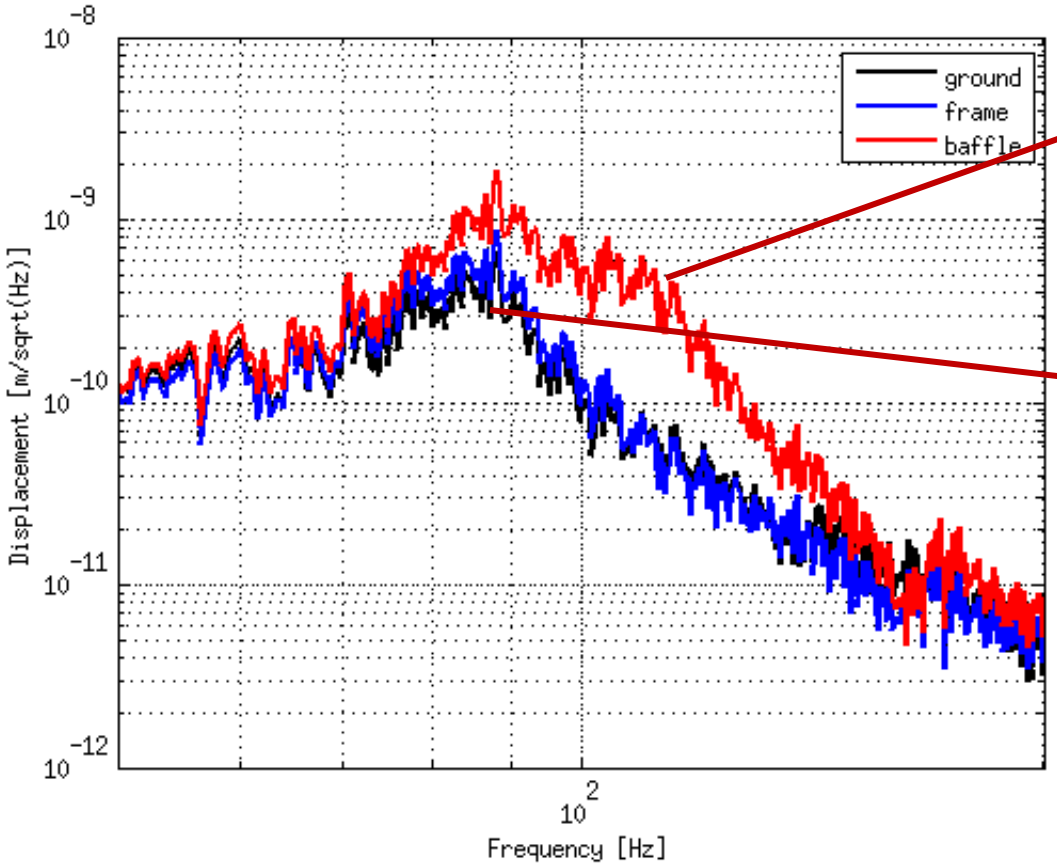
n.b. very low Q factor

For stray light noise issue it is good to have low Q factor (!!)

.. while for mode measuring an high Q factor would be preferable

Measurements

Accelerometers spectrum:



Baffle resonance @ ~113Hz

Bench resonance @ ~90Hz

Open discussion

Some ideas and next steps:

- Change the frame-ground connection (for instance putting spacers below the frame – under construction M.Bazzi) to evaluate the effect on the baffle mode frequency or Q.
- Measure the resonance in several positions on the baffle.
- Measure the baffle displacement with the *fiber bundle (*optical device *by F.Frasconi)… advantage: would be contactless.*
- Try to measure higher frequency modes
- …..

Please give us suggestions and ideas…