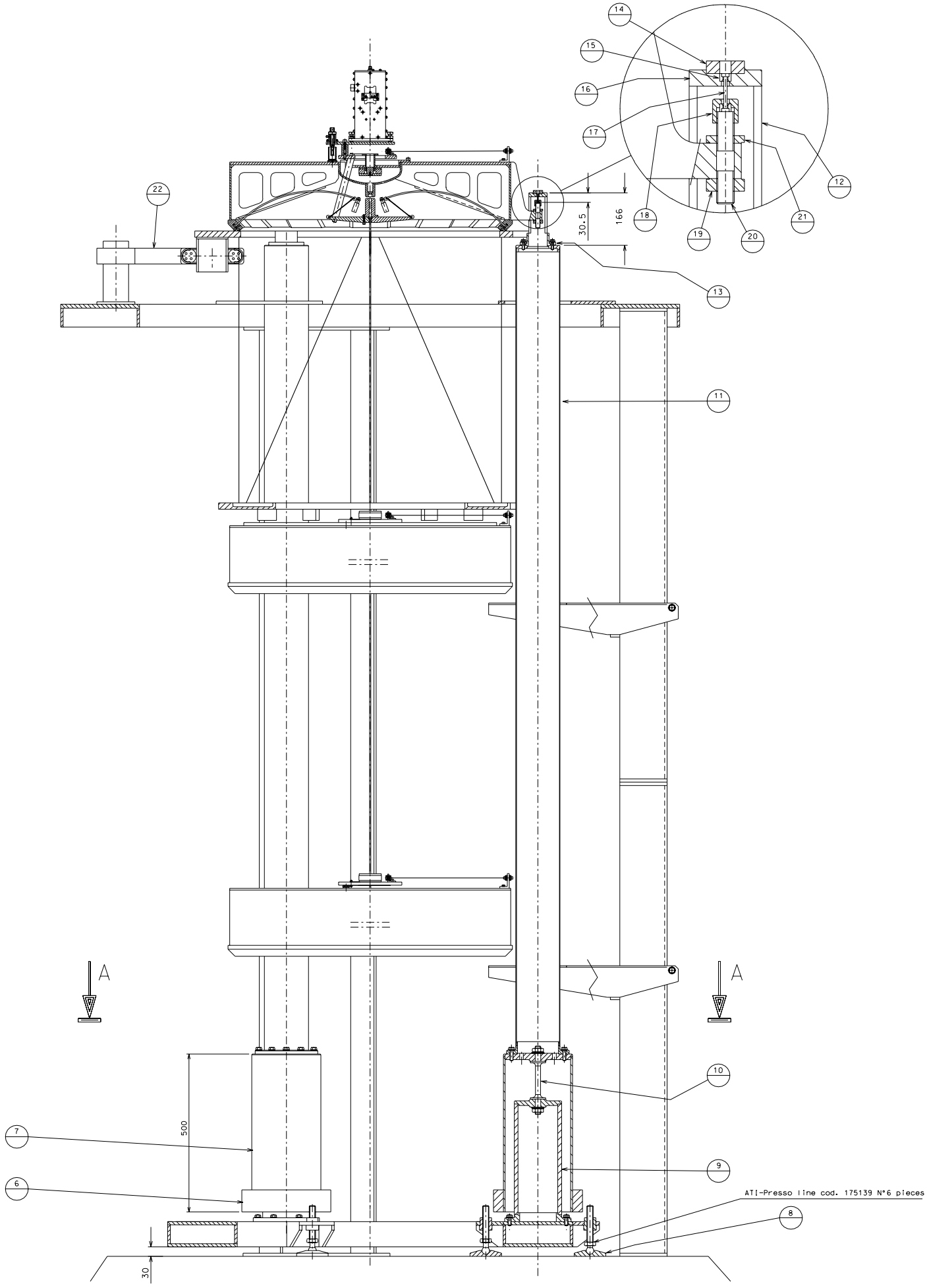
The SAS people

David	**Akavan**	**Berkeley**
Mark	**Barton**	**Caltech**
Alessandro	**Bertolini**	**Pisa Univ.**
Giancarlo	**Cella**	**Pisa Univ.**
Eugene W.	**Cowan**	**Caltech**
Erika	**D'Ambrosio**	**Pisa Univ**
Riccardo	**DeSalvo**	**Caltech**
Seiji	**Kawamura**	**NAO**
Joe	**Kovalik**	**LLO**
Henri	**Lubatti**	**Caltech**
Szabi	**Marka**	**Caltech**
Flavio	**Nocera**	**Caltech**
Kenji	**Numata**	**Tokyo Univ.**
Virginio	**Sannibale**	**Caltech**
Frederick	**Seve**	**INSA Lyon**
Akiteru	**Takamori**	**Tokyo Univ.**
Hareem	**Tarik**	**King's College**
Nicolas	**Viboud**	**INSA Lyon**
Chenyang	**Wang**	**Caltech**
Hiroaki	**Yamamoto**	**Caltech**

Talk Content

- SAS Basic Principles.
- Recents Results.
- Actual Status.
- R&D Short and Long Term Plans.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ATI-Presso line cod. 175139 N°6 pieces
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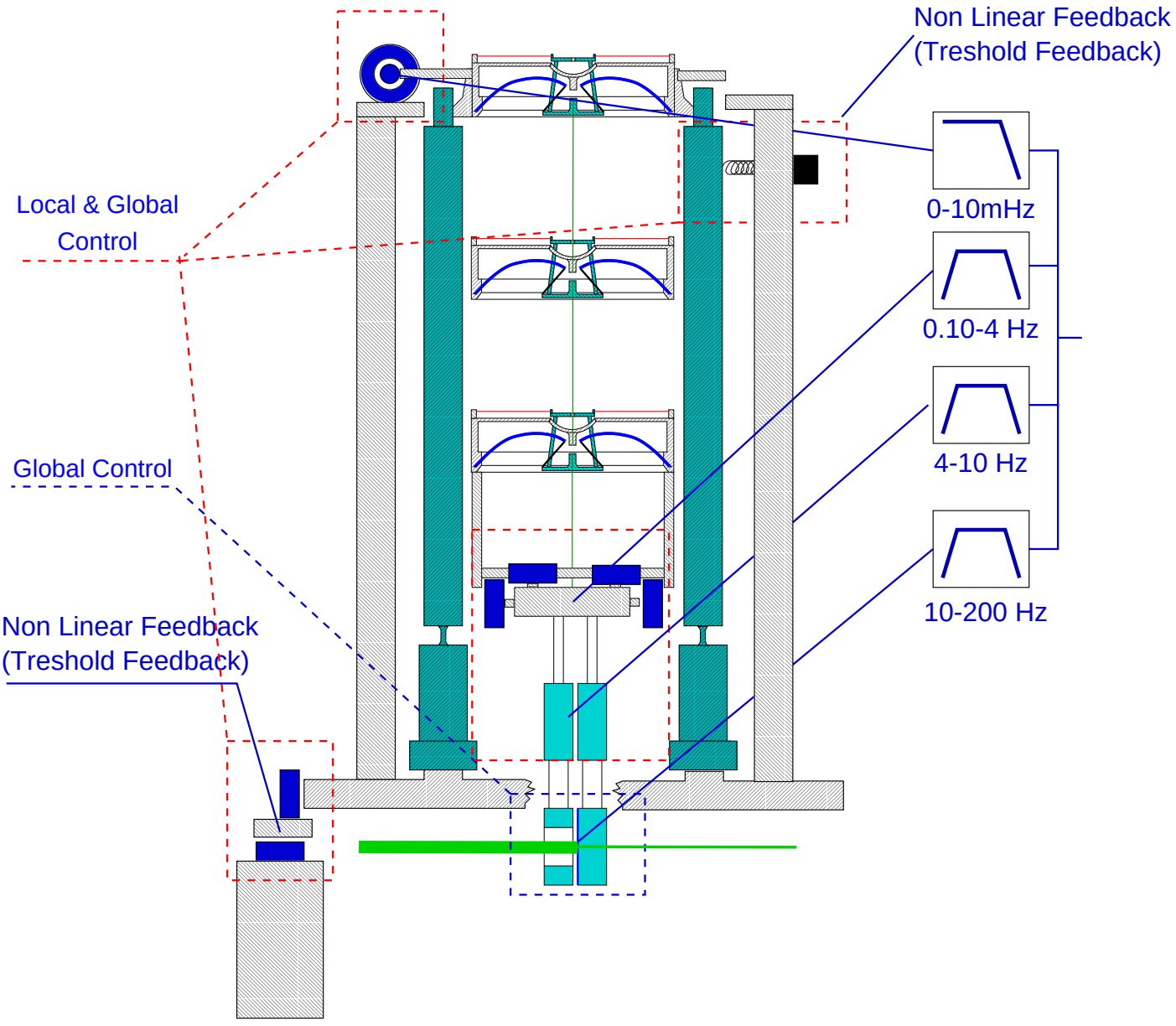
SAS-SUS Control
Control Hierarchy



Basic Design Principles

- Seismic Attenuation:
  - In Band Passive Attenuation.
    - 6 DOF Mechanical Very Low Frequency oscillator with High Q.
    - Cascaded Mechanical Oscillator.
    - Internal viscous damping for Internal Body Modes (Eddy/Focault current damping).
  - Spec.s Over-killing for reliability and robustness.
    - Very Low Frequency pre-isolation stages.
    - Additional stages.
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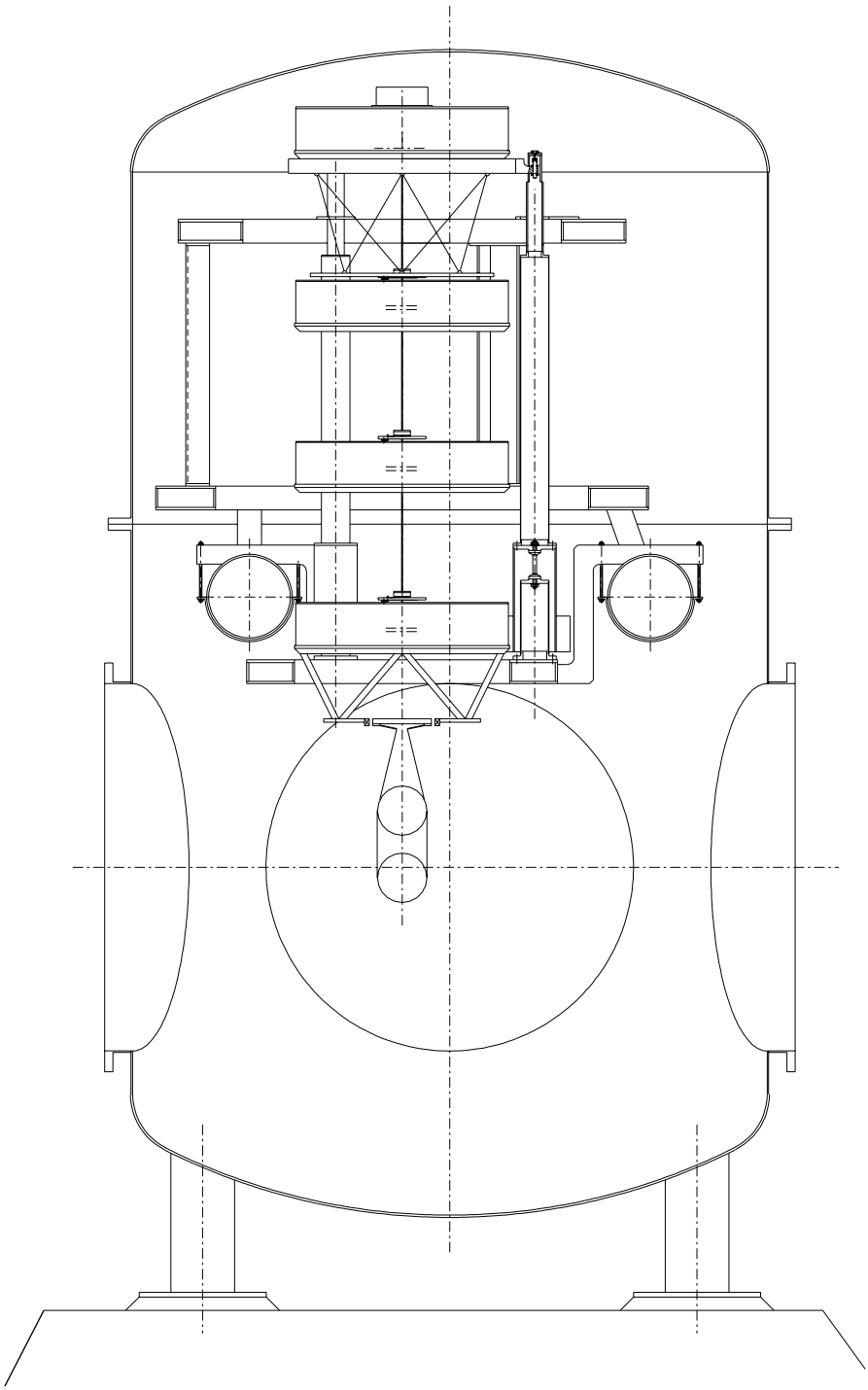
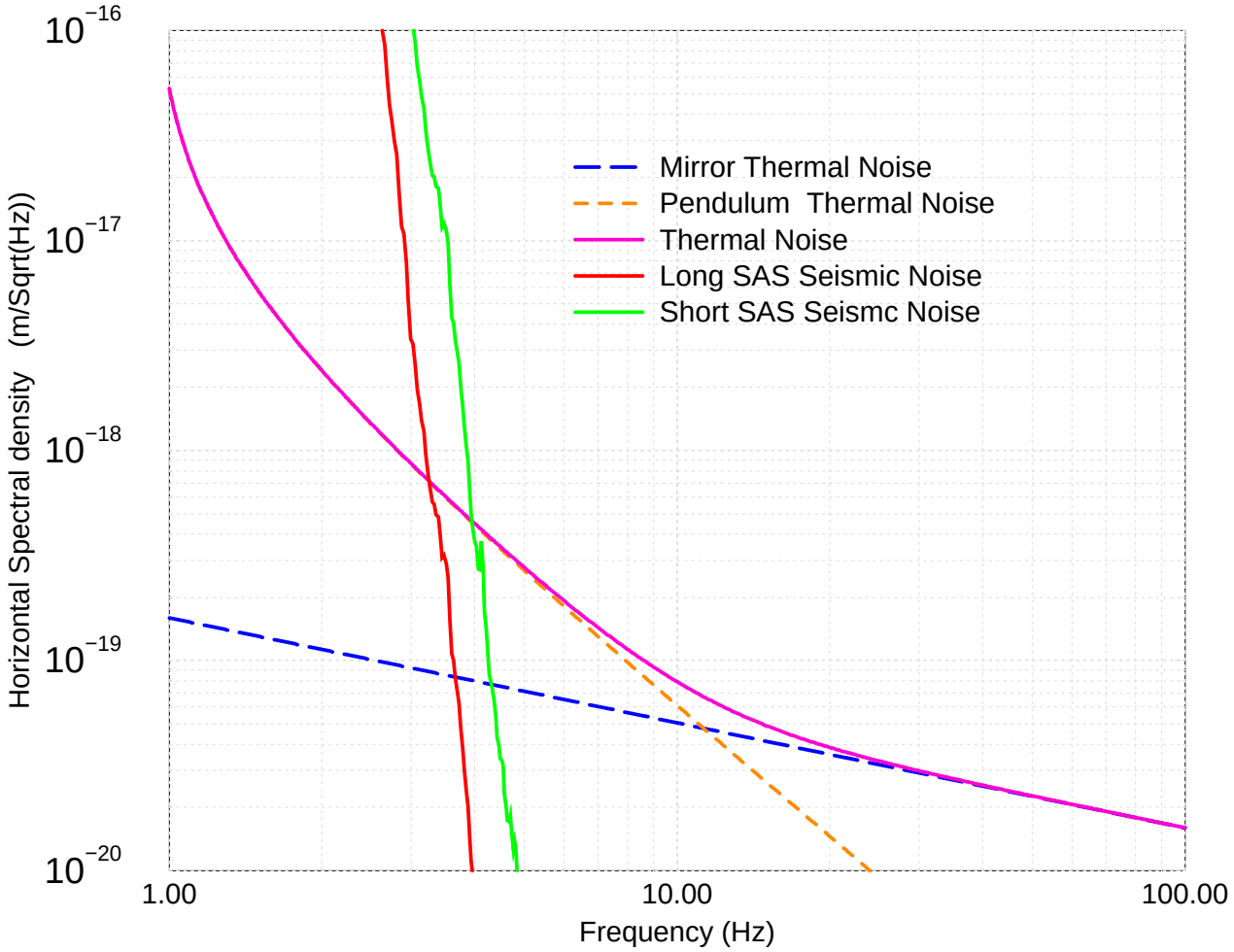
SAS Control Tasks

- Local Frame Positioning System (DC Positioning).
- RMS Noise Reduction for locking acquisition (Inertial Damping)
- Global Control Actuation (integration with LSC-ASC).

Actual SAS Design for LIGO2



SAS Goals



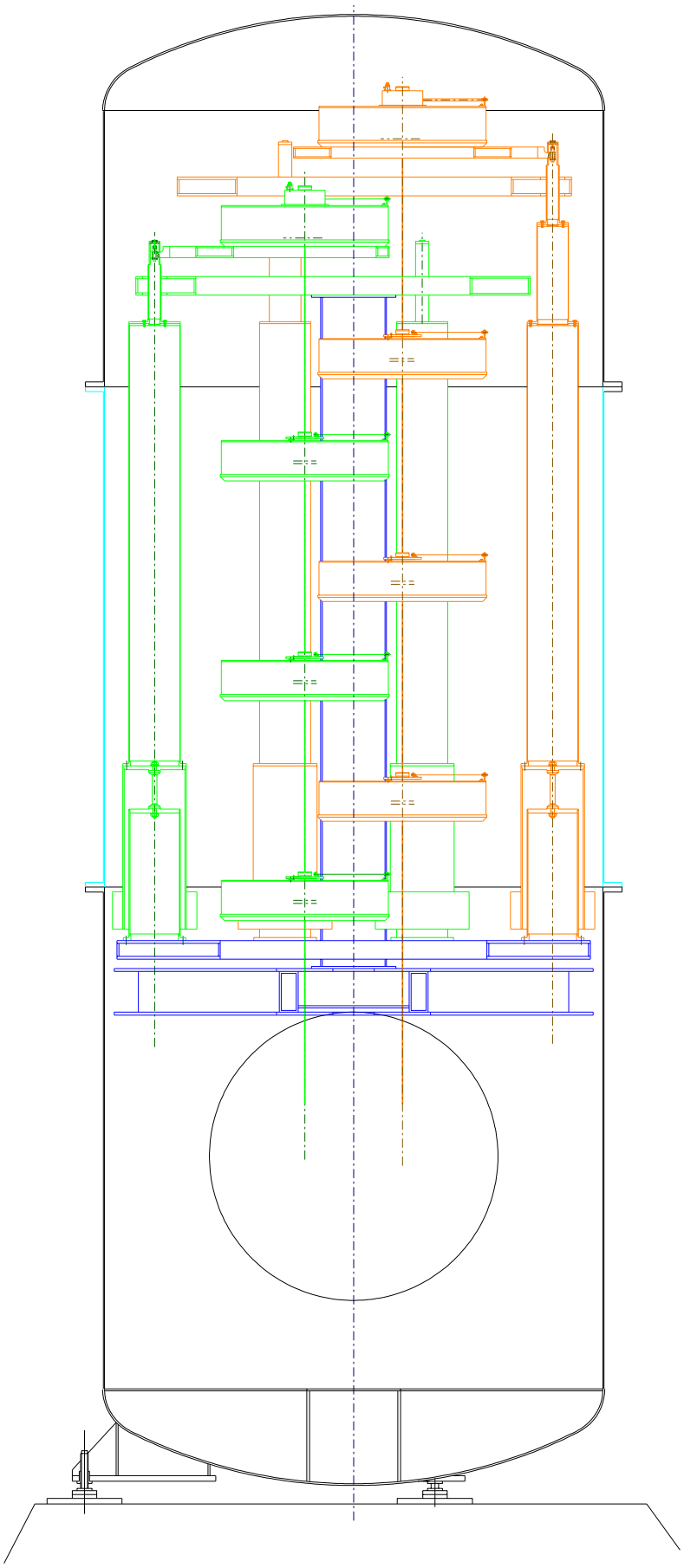
$$\delta\tilde{x}(\nu \simeq 6 \text{ Hz}) \simeq 10^{-18} \frac{\text{m}}{\sqrt{\text{Hz}}}$$

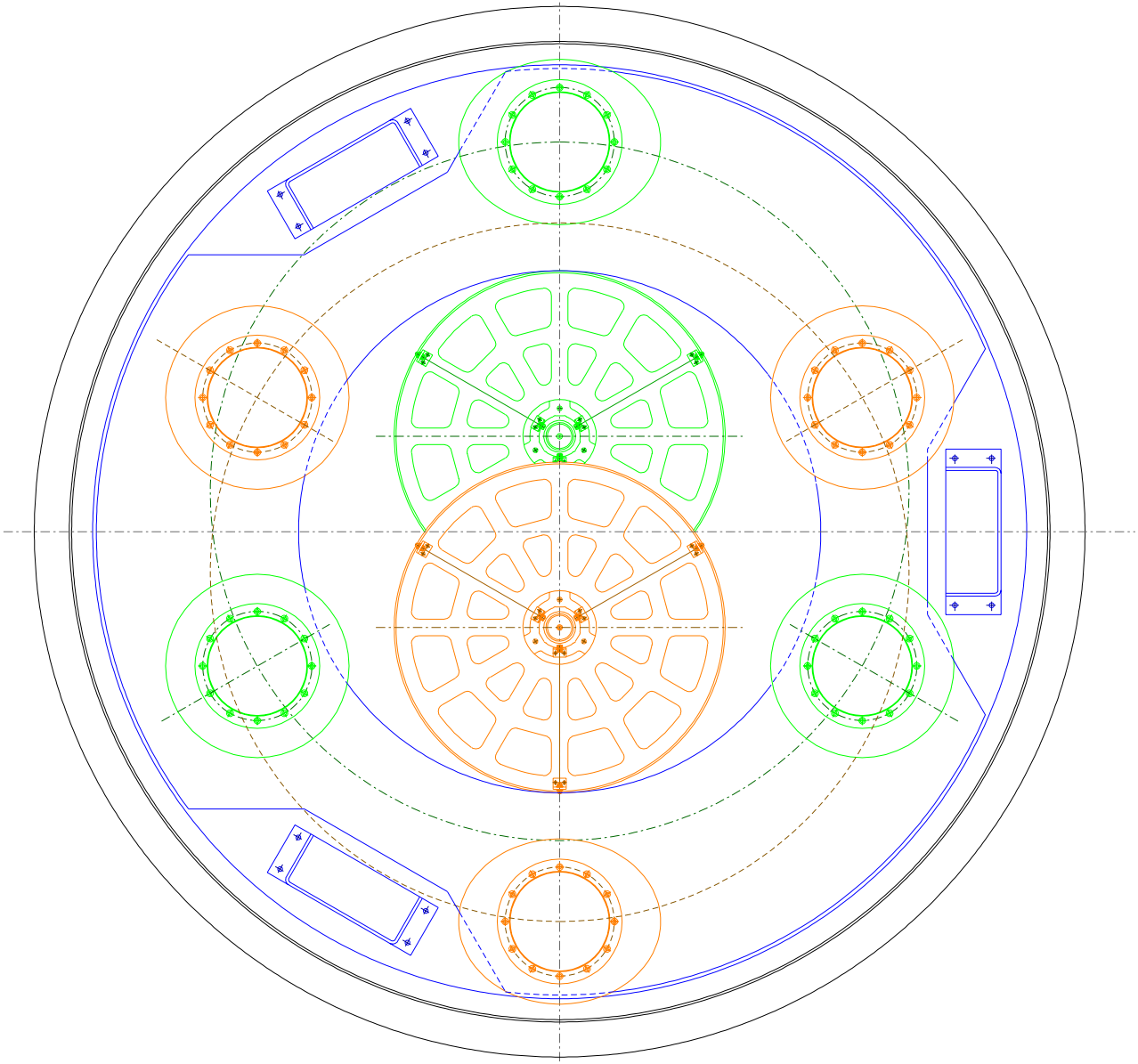
$$\delta x_{rms} \simeq 10^{-7} \text{ m}_{\text{rms}}$$

High Reliability and robustness

=>

uninterrupt running time of the order of months





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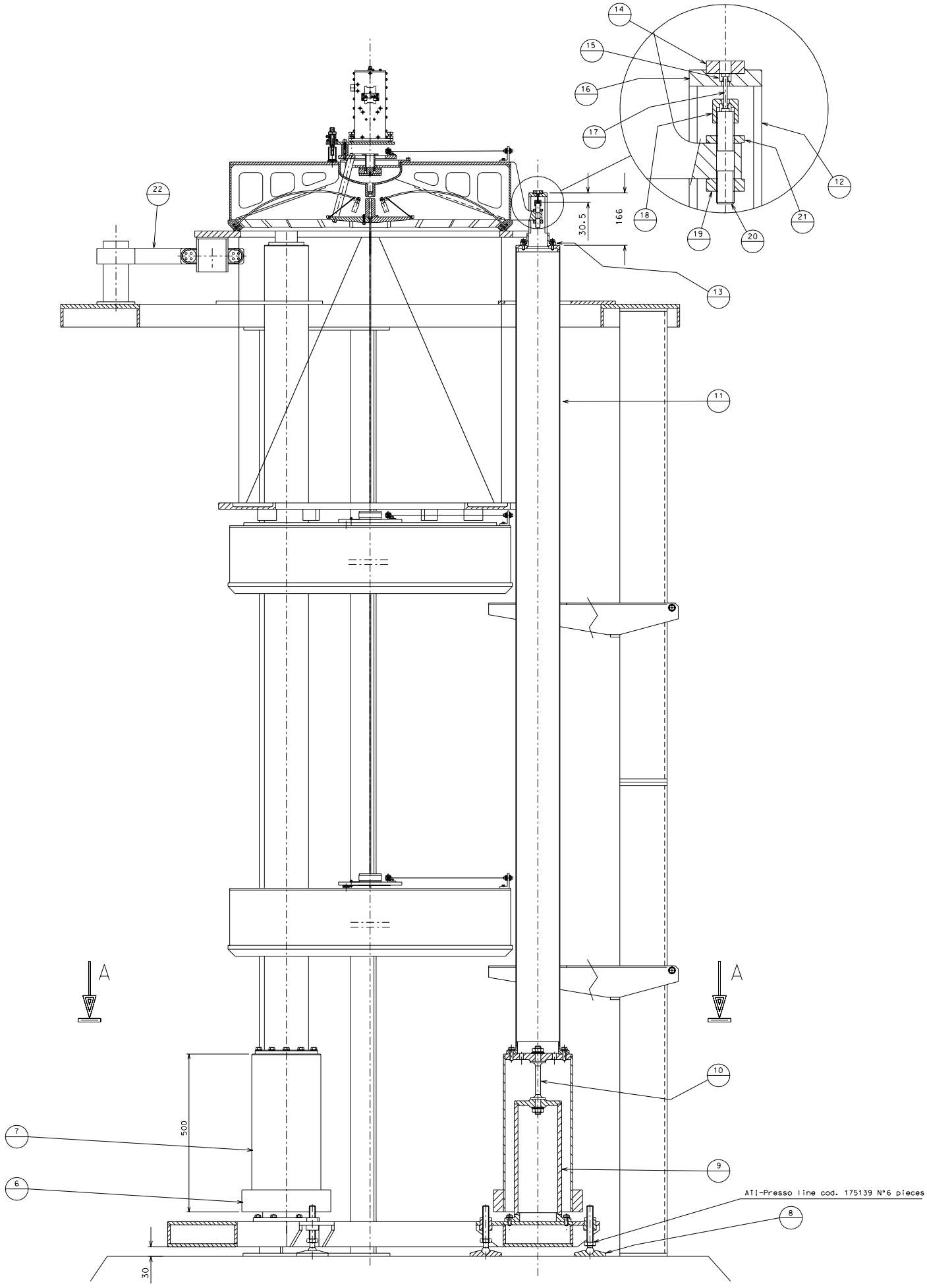
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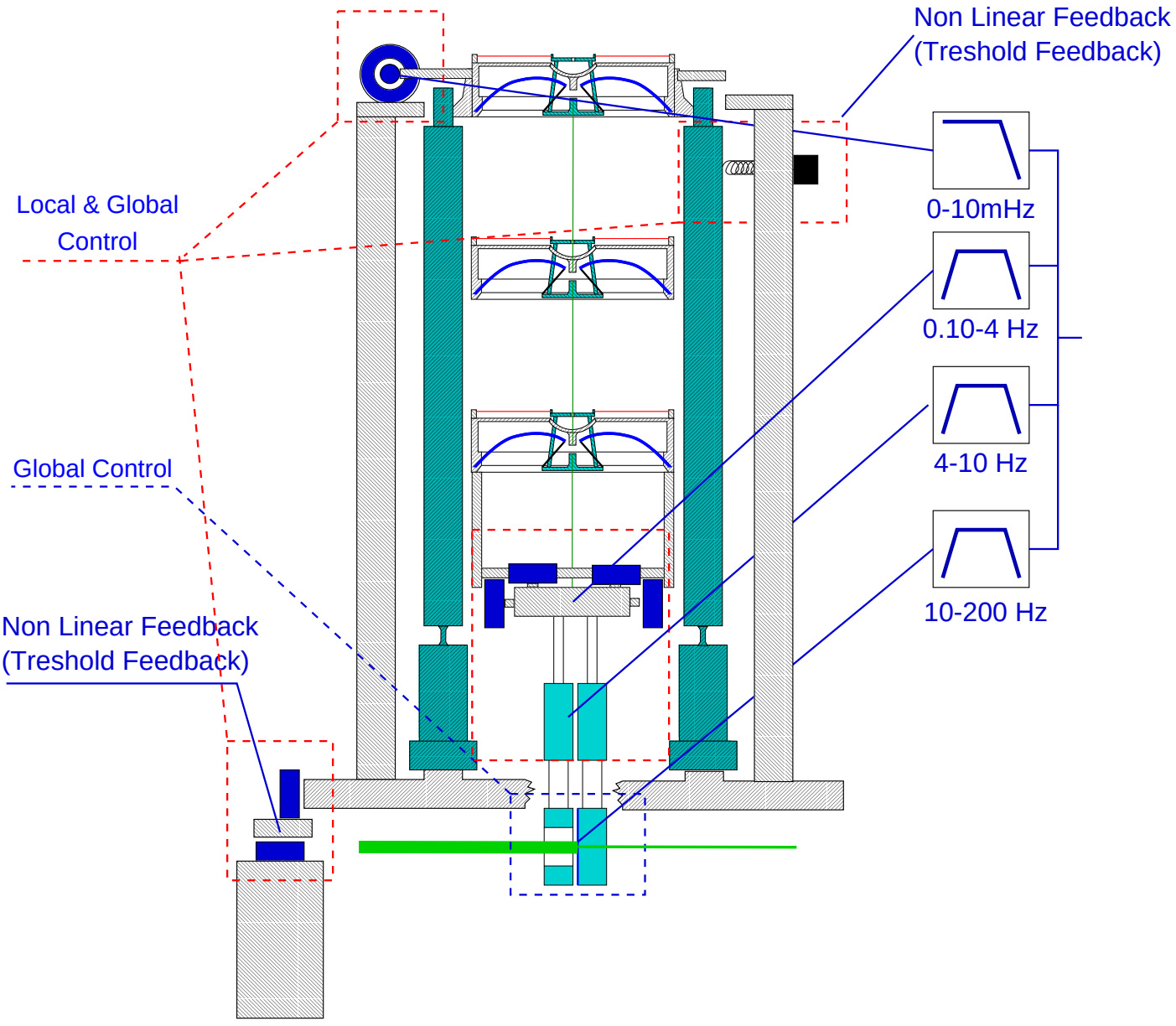

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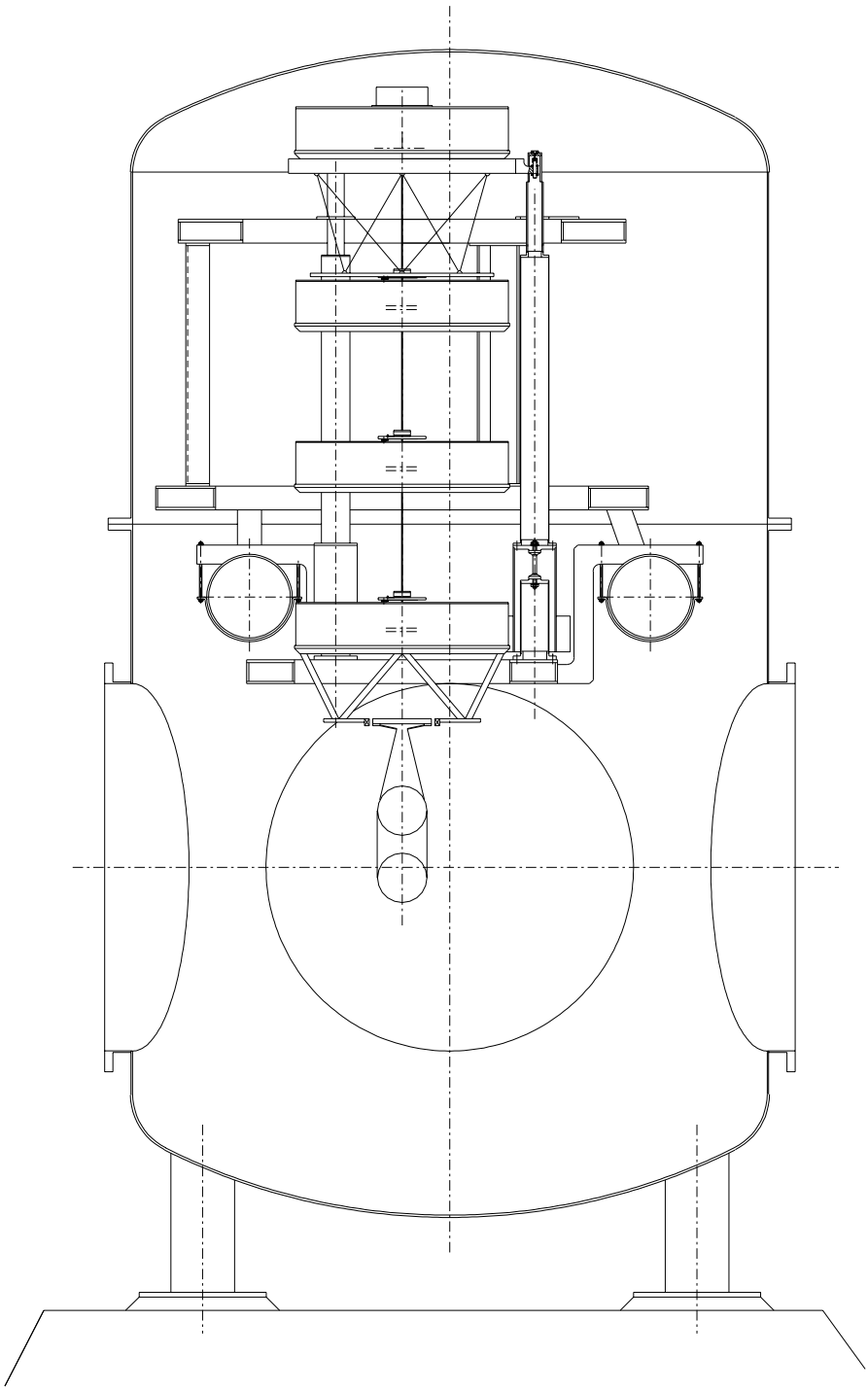
Actual SAS Design for LIGO2



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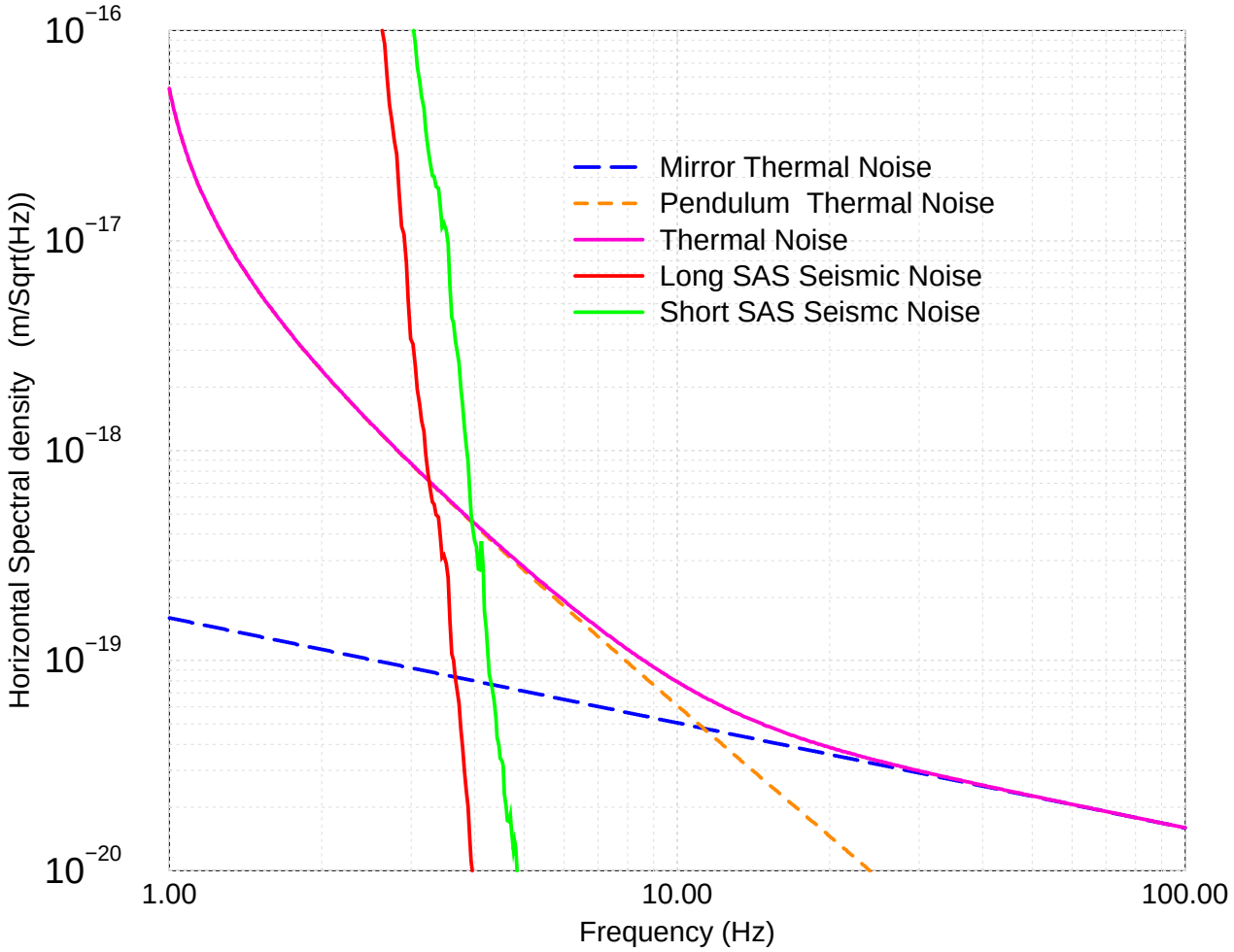

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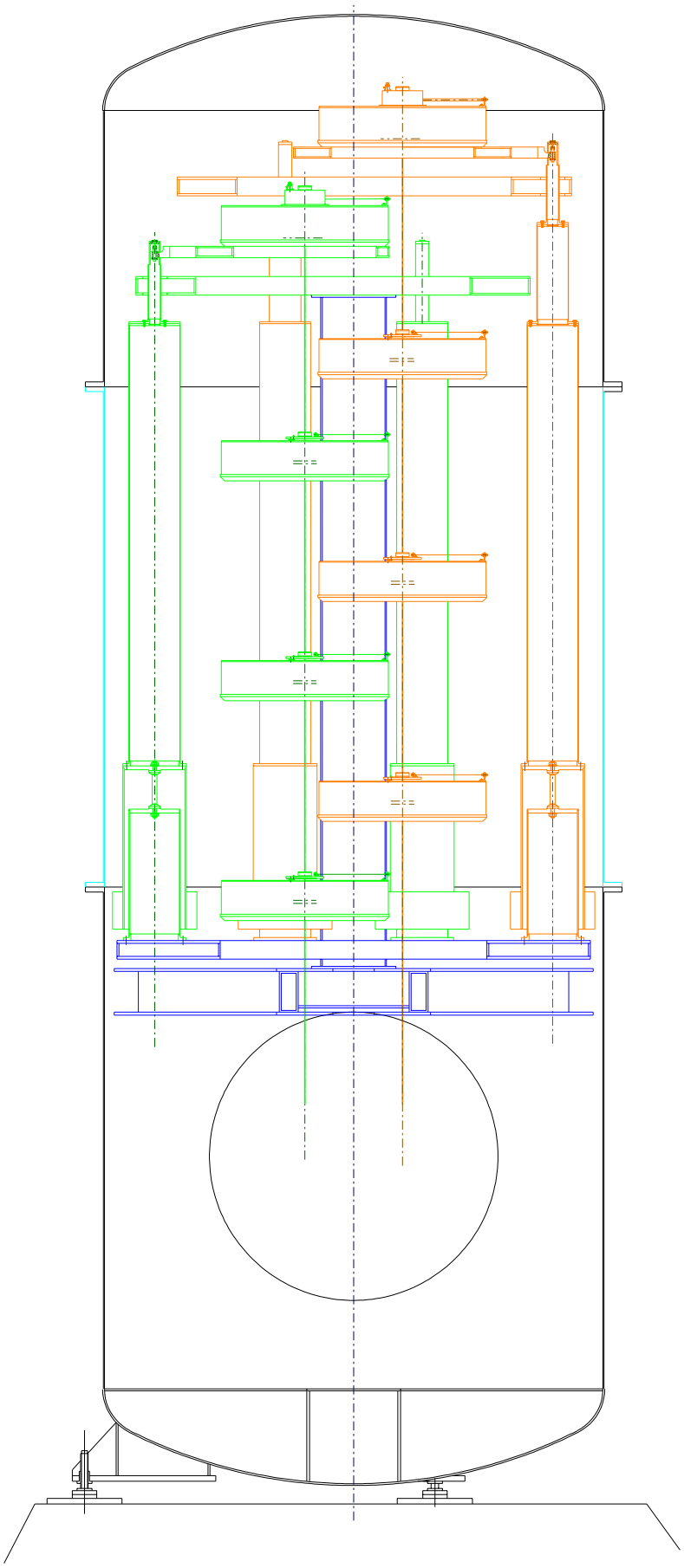
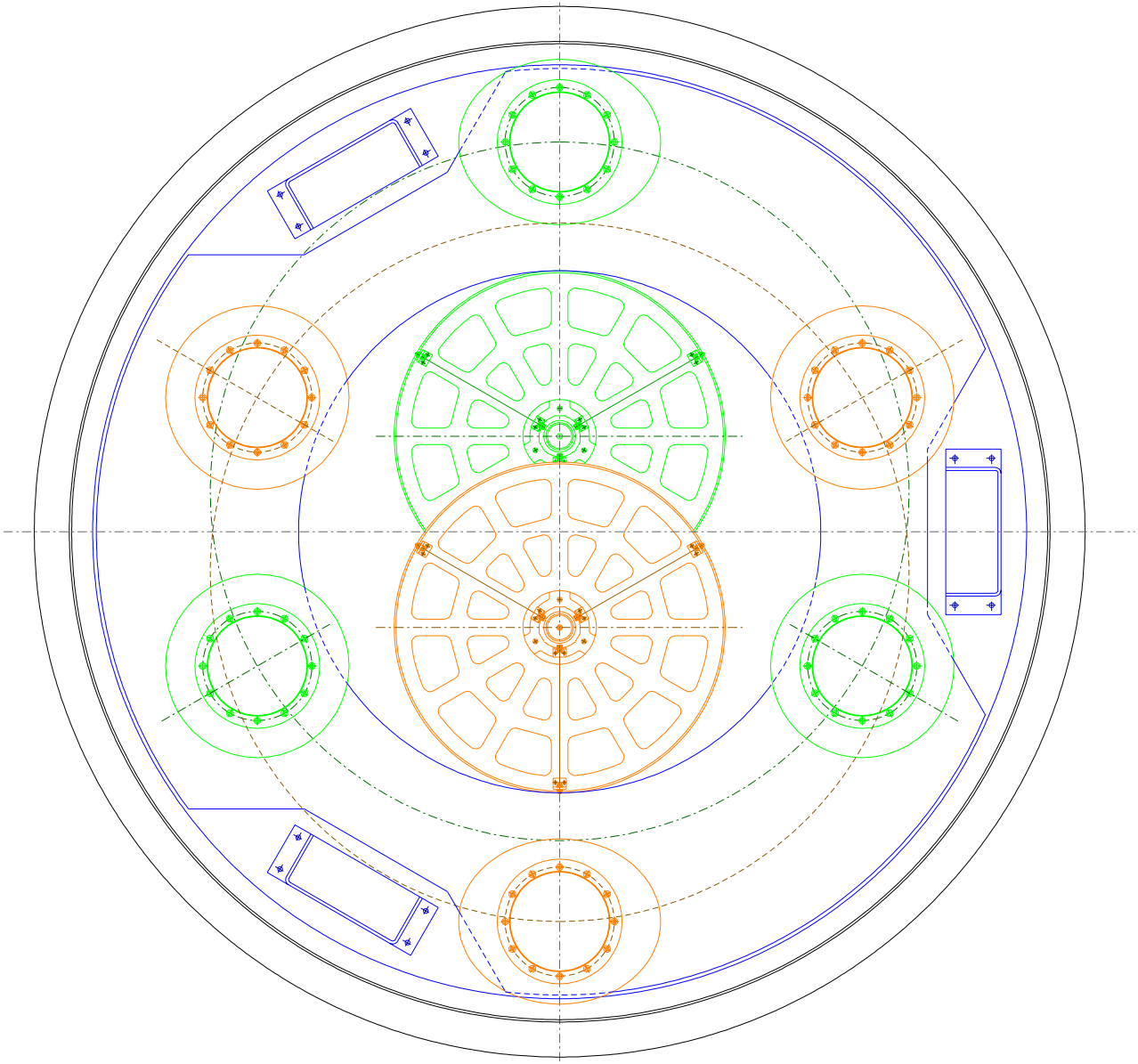
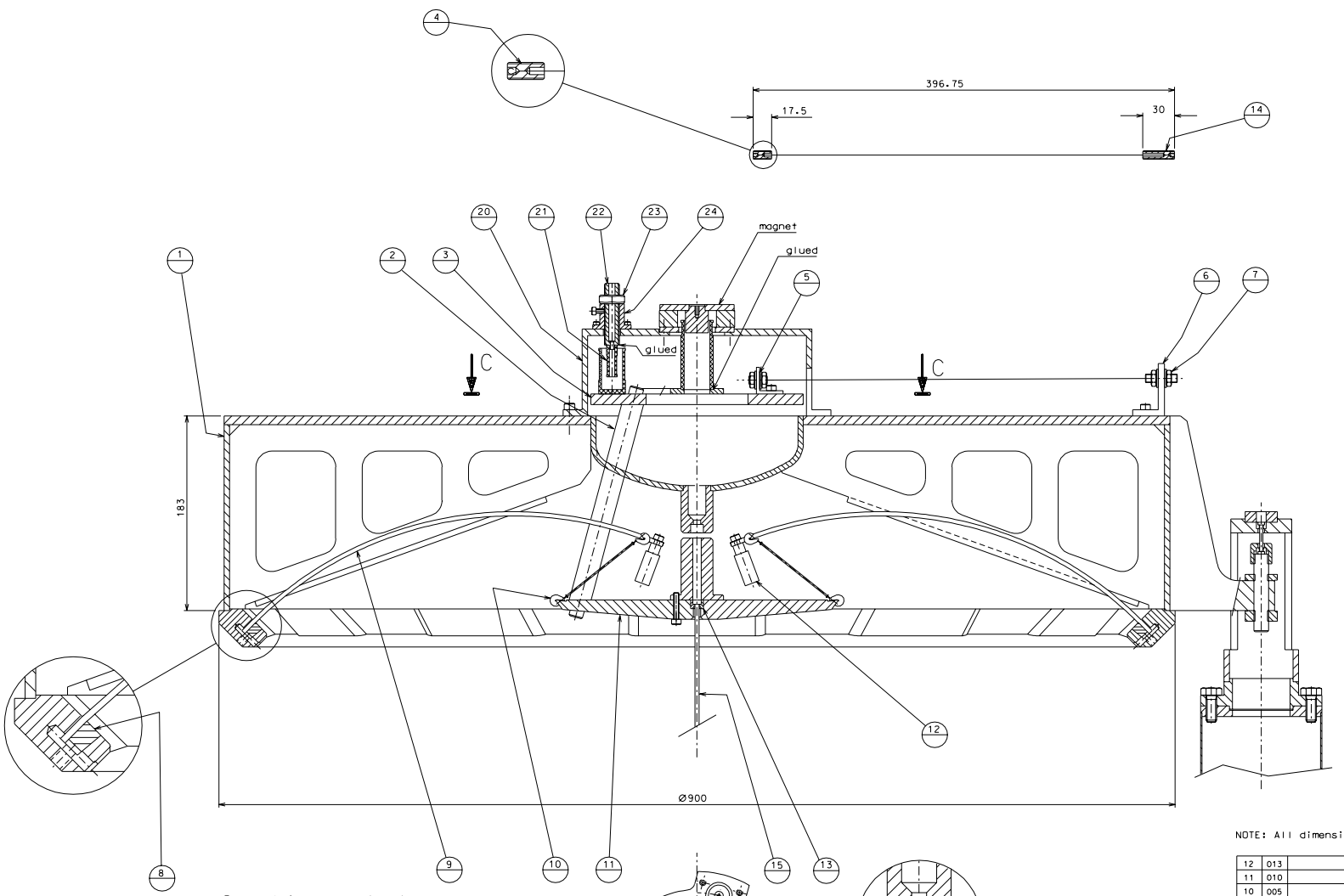






NOTE: All dimension in mm

ref.	dran.	group
12	013	
11	010	
10	005	
9	004	
8	009	
7	009	
6	009	
5	009	
4	009	
3	011	
2	009	
1	003	

ref.	dran.	group
24	016	
23	016	
22	016	
21	016	
20	016	
19	016	
18	016	
17	016	
16	011	
15	013	
14	009	
13	009	

ref.	note	date	signature
	modifications		

LIGO PROJECT

designed by R. De Salvo

ass. numb. Filter_0.000

dran. PROMEC 30-1-99

title
PROTOTYPE FILTER_0
LATERAL SECTION

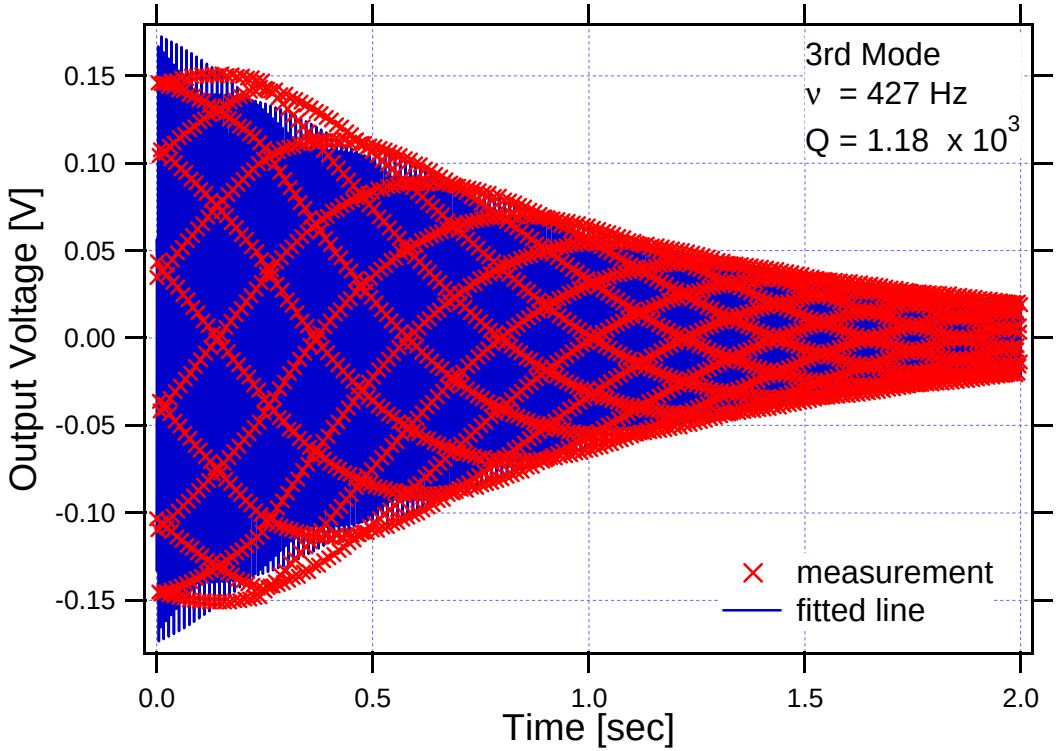
scale 1:2

replaces dr. Numb.

Filter Prototype

Present Status of Development of GAS

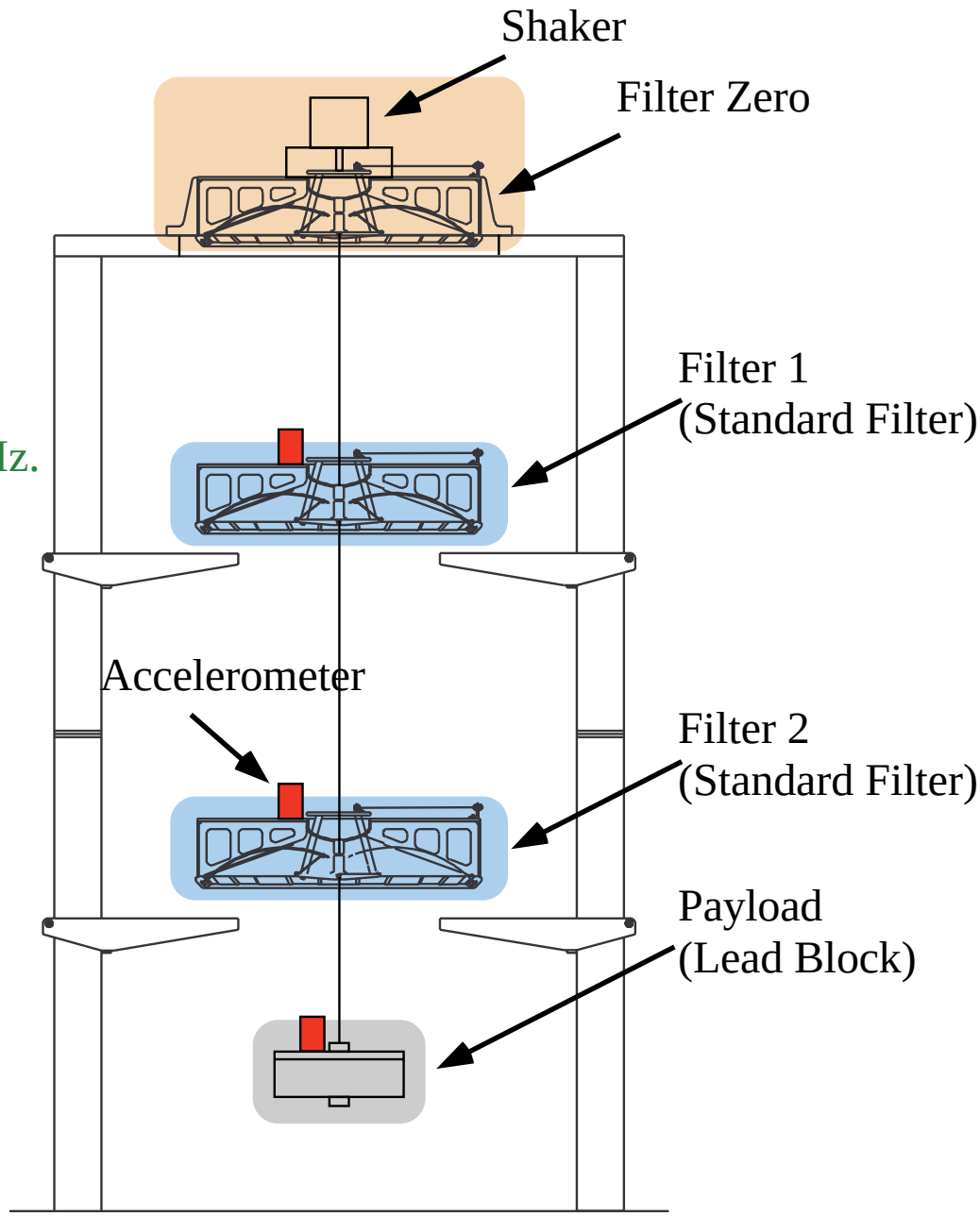
- Resonance Frequency & Q Factor of the Blade Internal Modes
  - Result (3rd Mode)



GAS Filter : Measurements

Vertical Isolation Performance

- Double GASF Chain
  - GASF Chain + Payload
  - Filter Zero is connected to a shaker.
  - Standard Filters are tuned to about 450mHz.

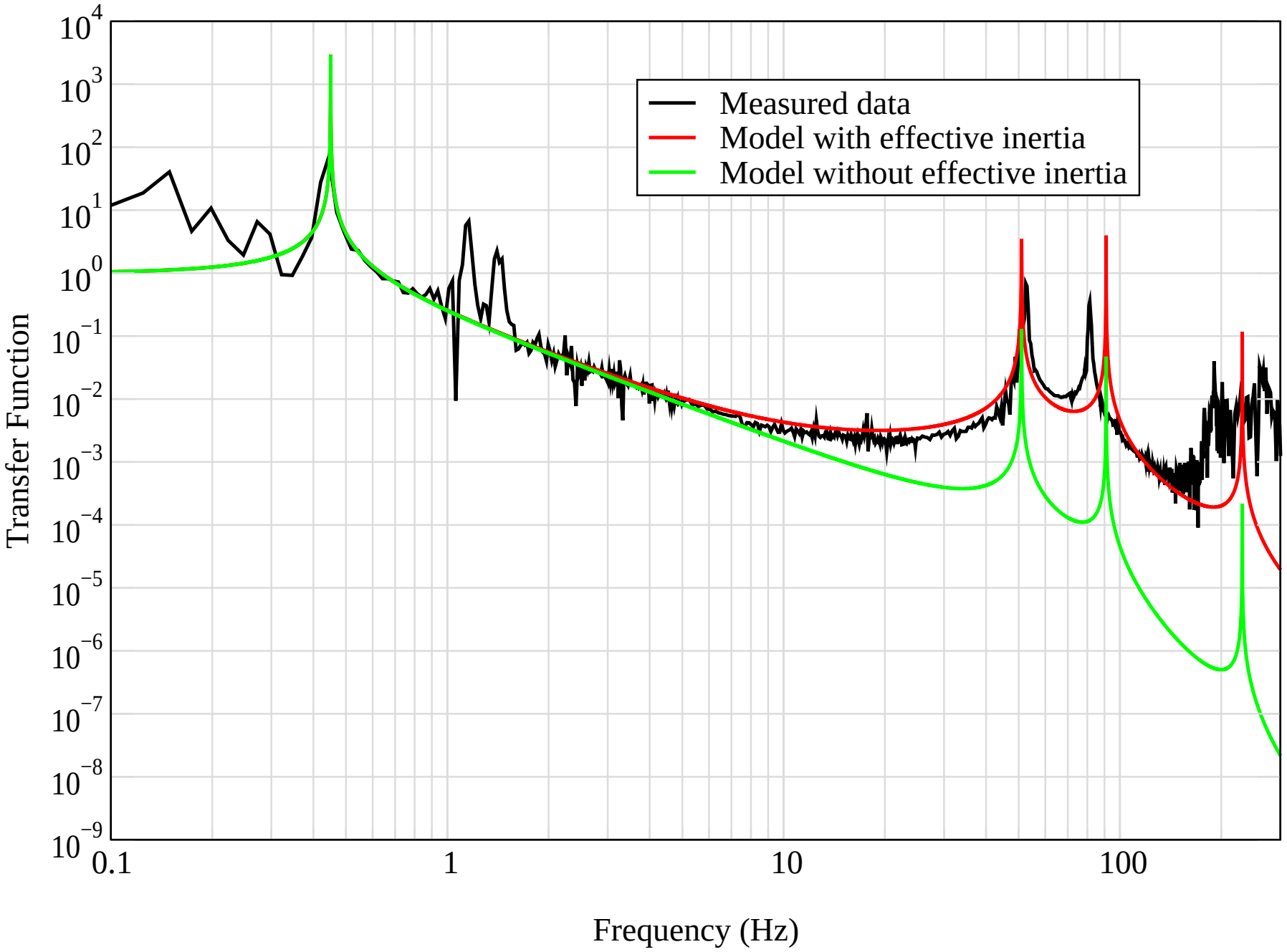



CAUTION DO NOT ENTER CAUTION DO NOT ENTER CAUTION DO NOT ENTER CAUTION DO NOT ENTER

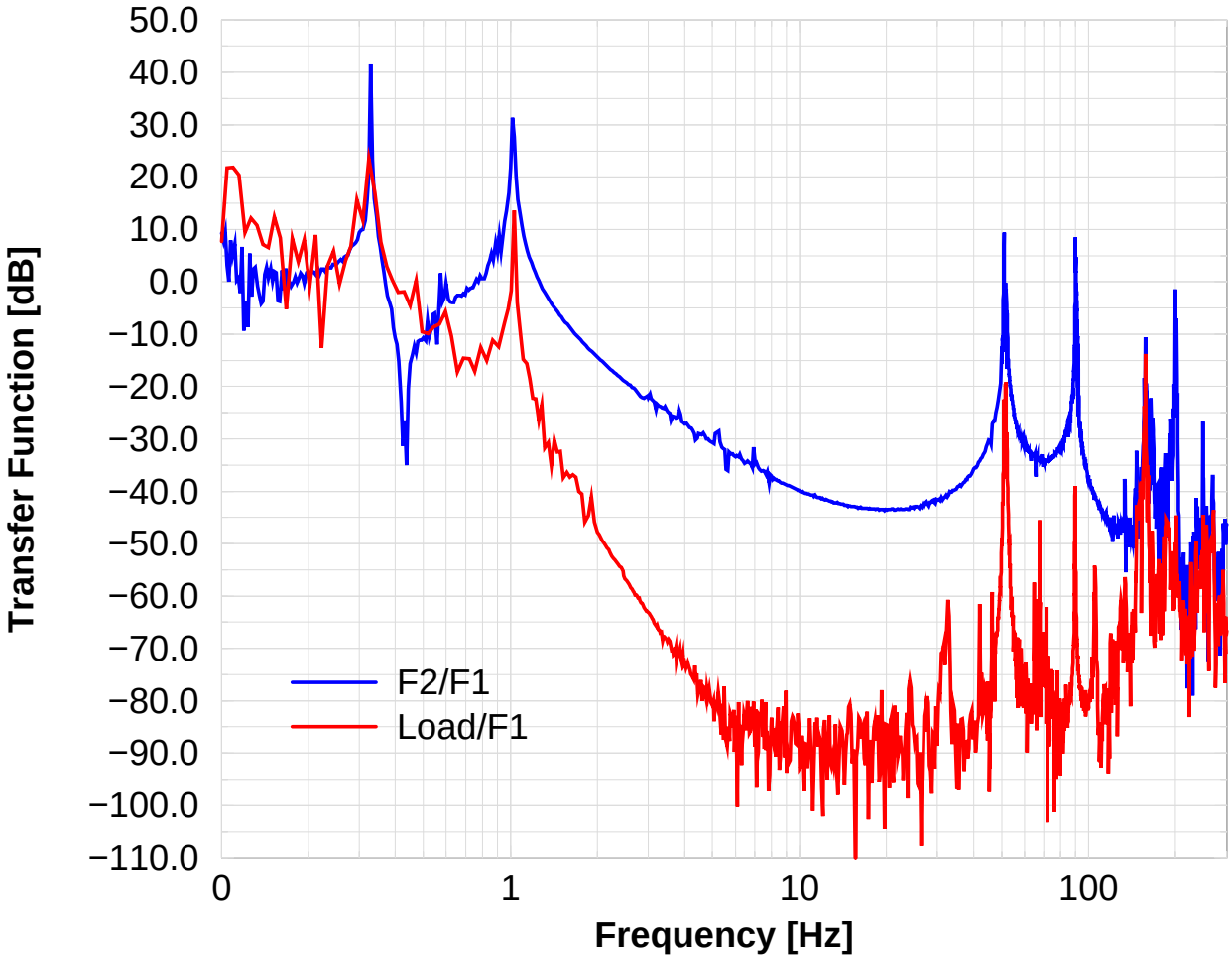
Test Tower

Vertical transfer function

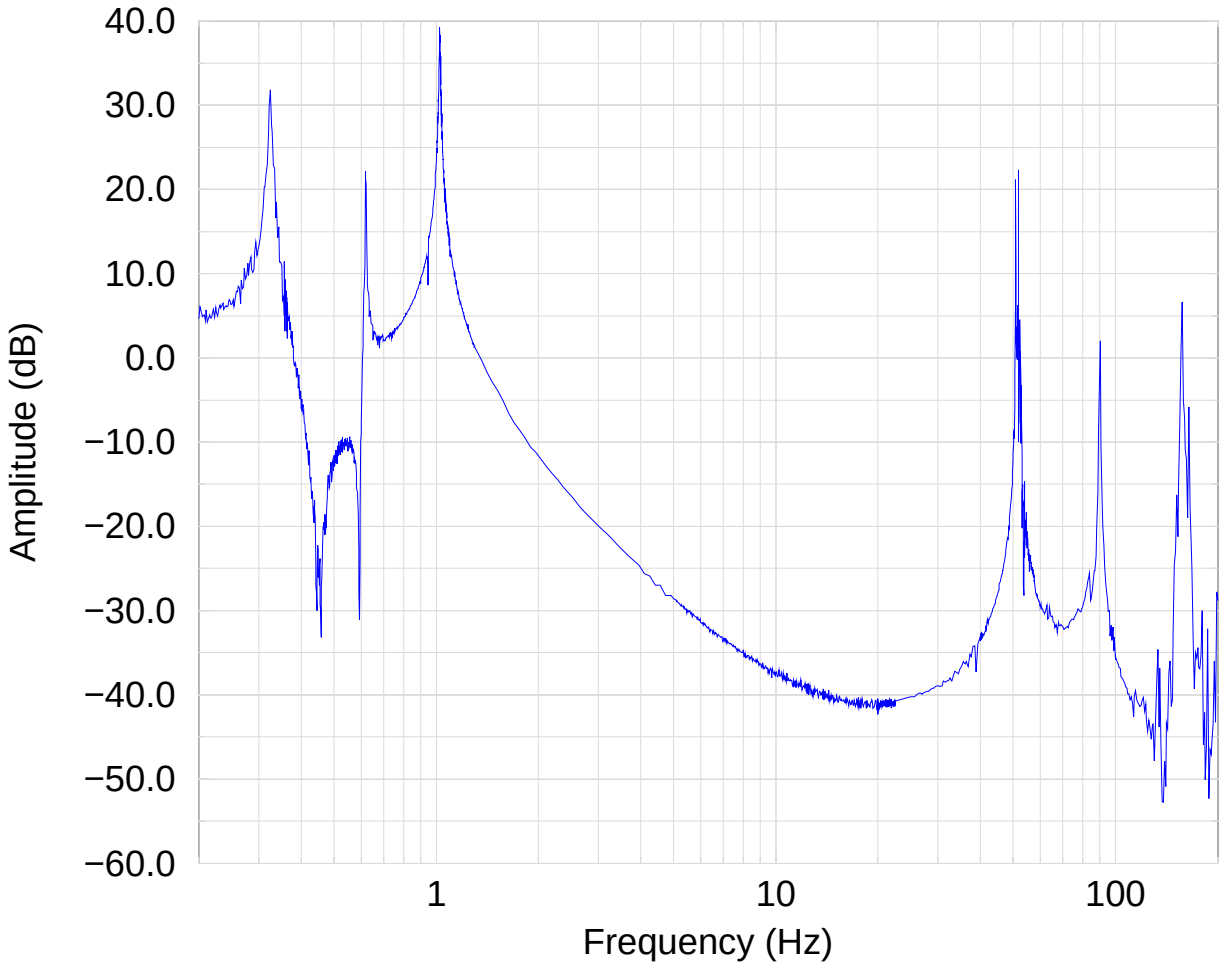
Model with 6 internal blade's modes

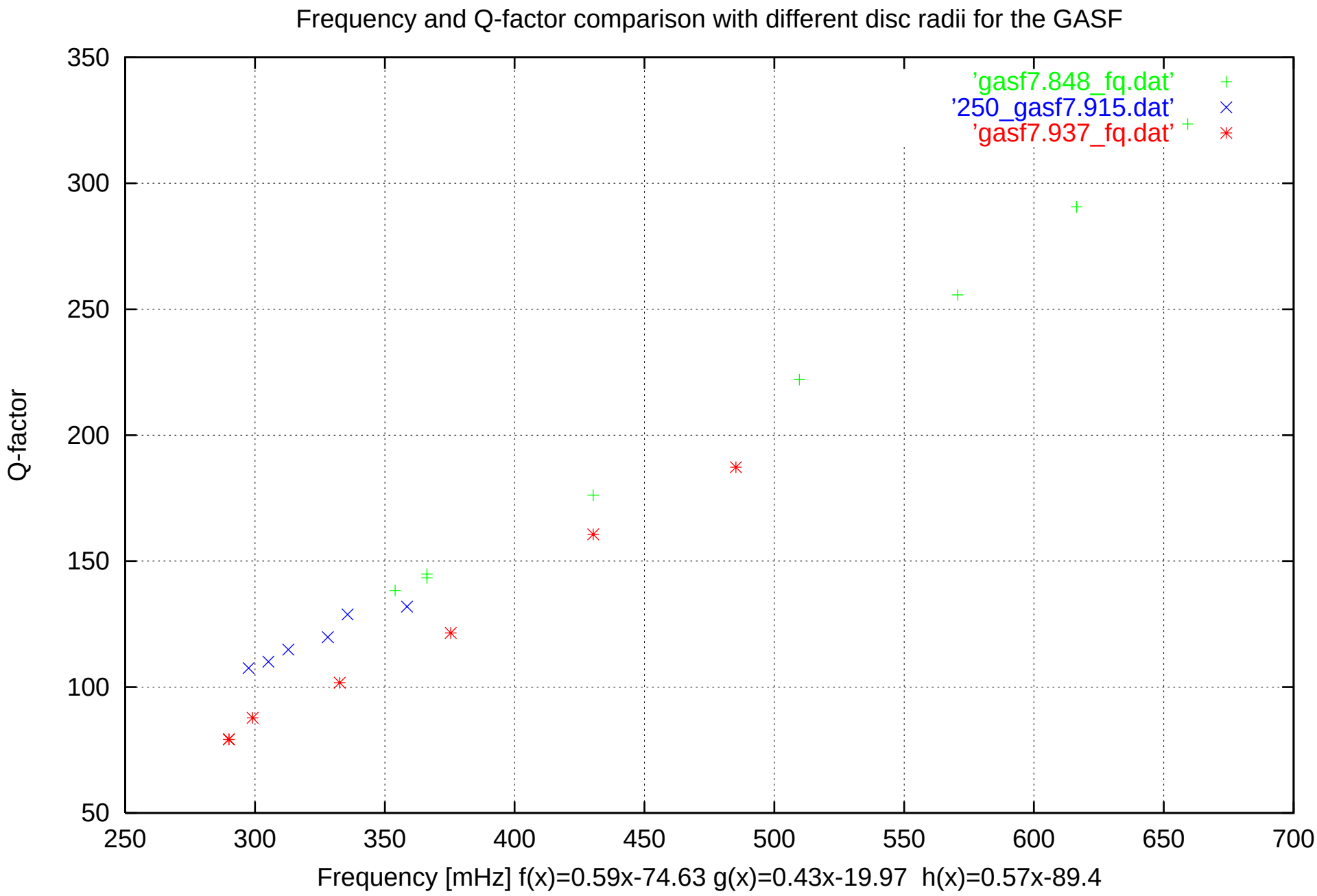


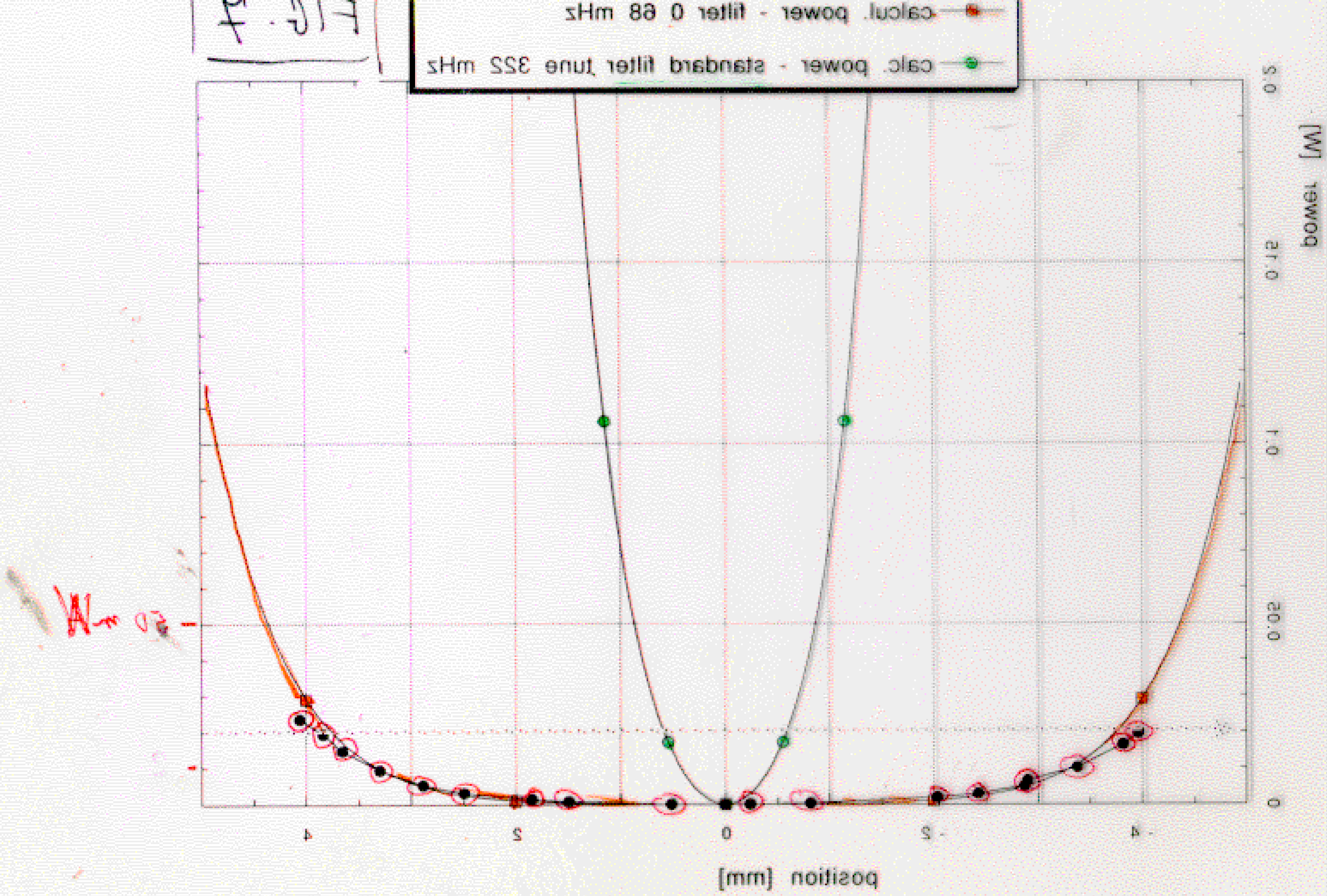
2 Standard Filter Chain, Vertical Transfer Function (Good filters balance)



2 Standard Filter Chain, Vertical Transfer Function (Bad filters balance)



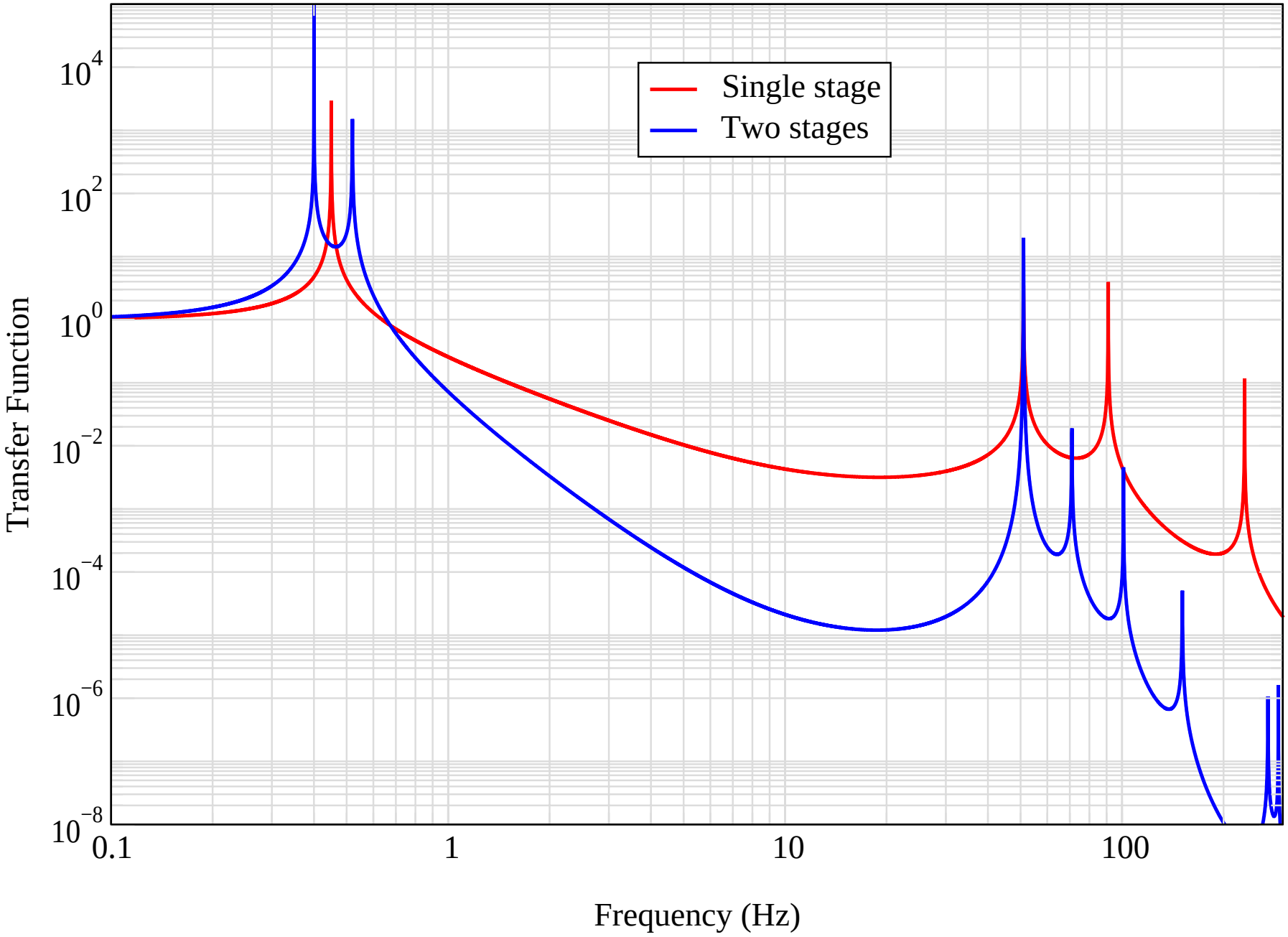

Frequency and Q-factor comparison with different disc radii for the GASF
'gasf7.848_fq.dat'
'250_gasf7.915.dat'
'gasf7.937_fq.dat'
Q-factor
Frequency [mHz] f(x)=0.59x-74.63 g(x)=0.43x-19.97 h(x)=0.57x-89.4
350
300
250
200
150
100
50
250
300
350
400
450
500
550
600
650
700

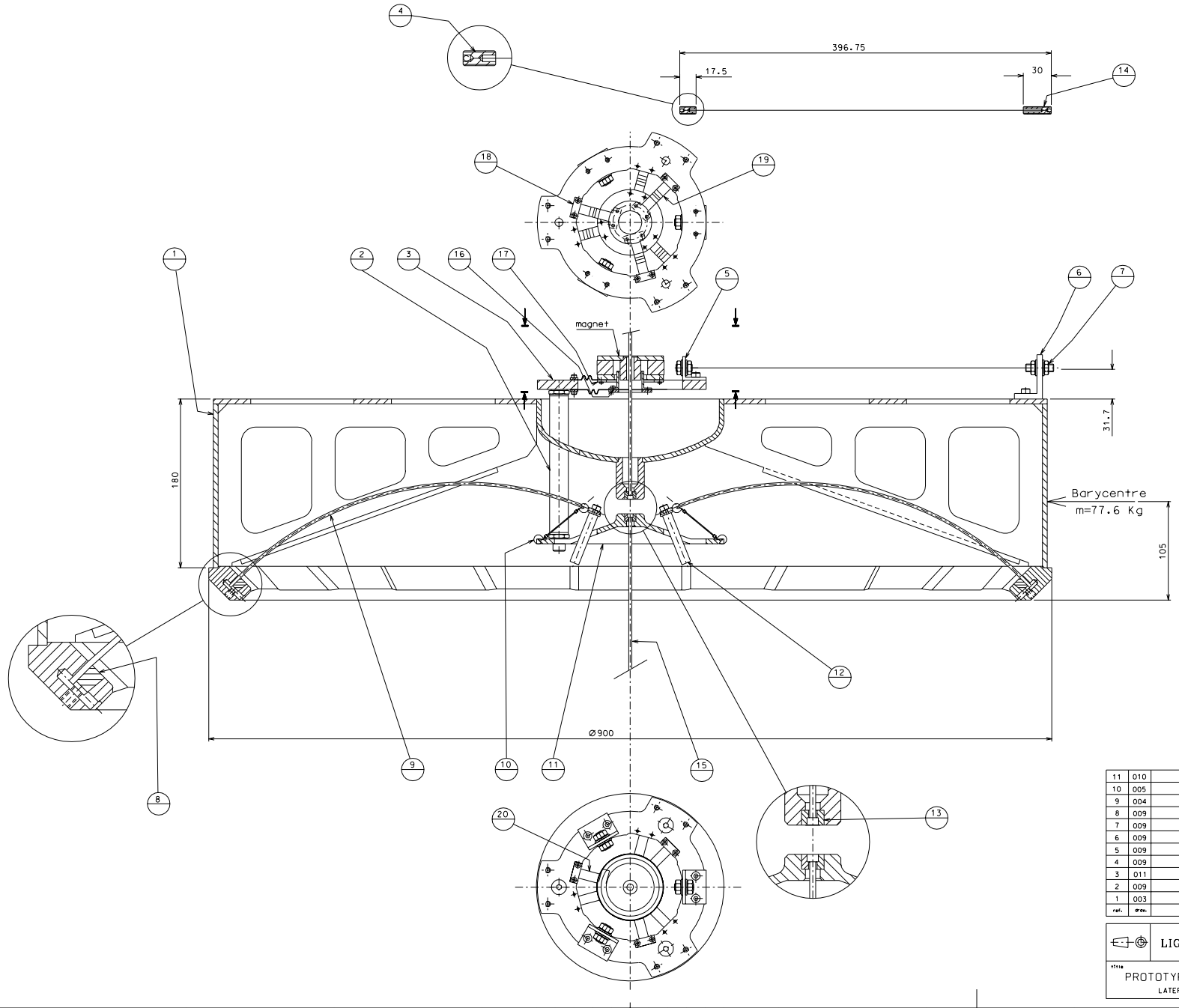


calc. power - standard filter june 322 mHz
calcul. power - filter 0 68 mHz
power [W]
position [mm]
50 mW

Vertical transfer function

Model with 6 internal blade's modes





11	010	
10	005	
9	004	
8	009	
7	009	
6	009	
5	009	
4	009	
3	011	
2	009	
1	003	
ref.	qnt.	group

20	016	
19	016	
18	016	
17	016	
16	016	
15	013	
14	009	
13	009	
12	013	
ref.	qnt.	group

LIGO PROJECT

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ass. numb. Filter.000

qnt. PROMEC 30-9-98

title

PROTOTYPE FILTER

LATERAL VIEW

scale 1:2

replaces dr. Numb.


CAUTION
SAFETY
FIRST