Annecy Linear Collider group

Annecy-LAPP : 2 senior physicists, 2 research engineers, 3 students

Annecy-ESIA : 2 research-lecturers, 1 student

Ch.Boulais, V.Cozma, L.Di Ciaccio(10%), F.Formosa(20%), V.Fournier, S.Géneté, C.Girard(10%), A.Jeremie(80%), **Y.Karyotakis(20%)**, J.Lottin(10%)

Research subjects
Final focus quadrupole stabilization

- Vibration measurements
- Feedback loop
- Mechanical vibration simulations

Vibration Measurements

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Frascati, May 4-6 2004

Vibration measurements

Received new sensors from Geosig beginning of April :

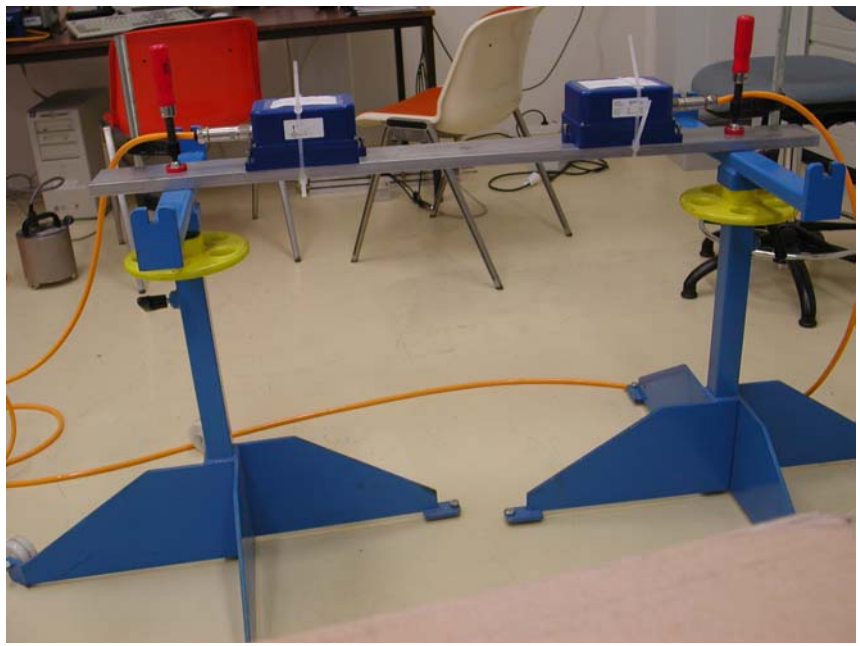
- 2 VE-23 triaxial velocity sensors
  - full scale ± 100mm/s (±10V)
  - Frequency range 4.5(10) to 315Hz

Just received other sensor from Geosig

- Guralp velocity sensor
  - Frequency range 0.033 to 50Hz

Vibration measurements

Test bench at LAPP



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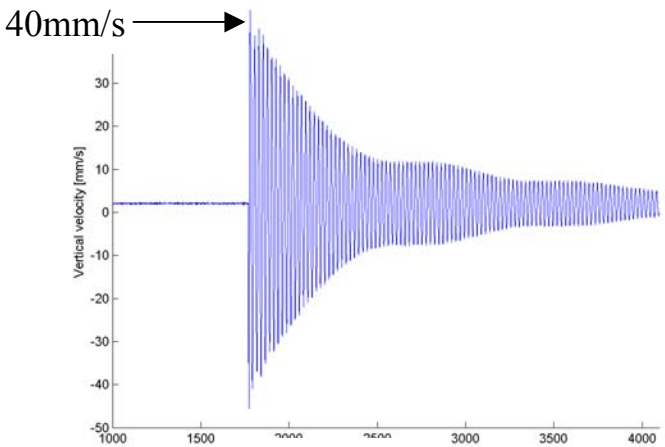
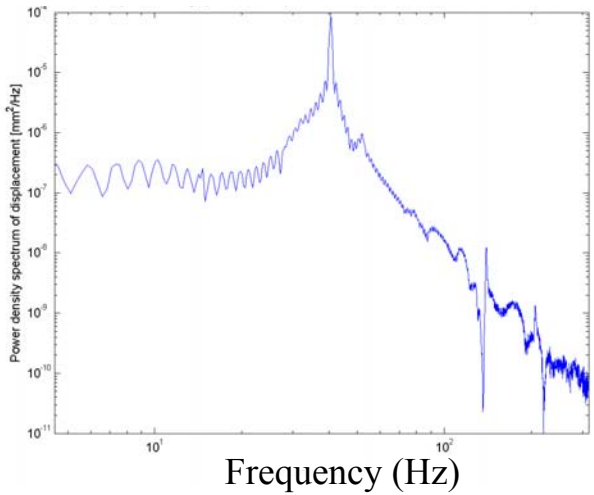
Vibration measurements

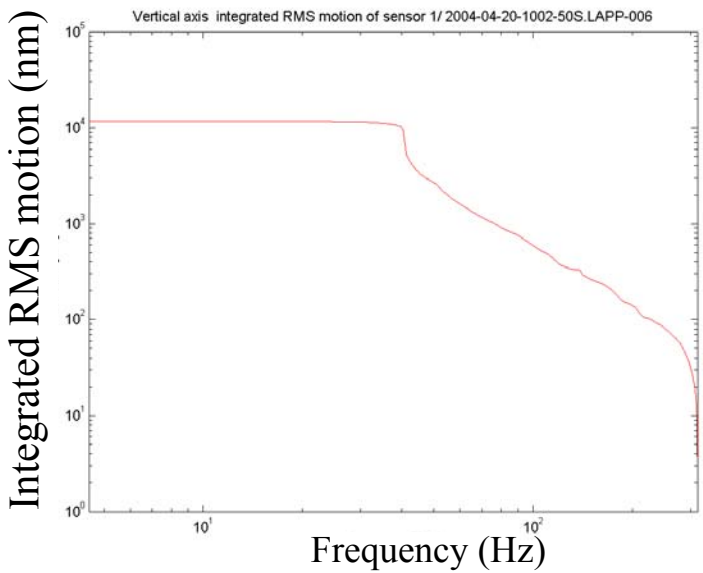
Vertical velocity due to hammer impact



mode n°	frequence en Hz
1	132,7
2	364,4
3	711
4	1168,7

Vertical power density spectrum (mm^2/Hz)





Feedback Loop

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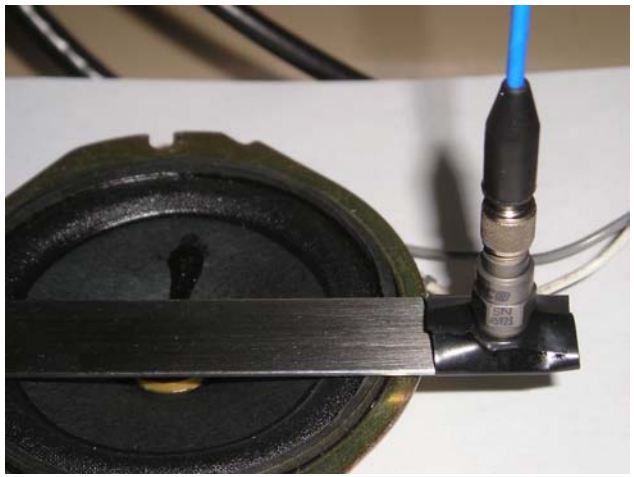
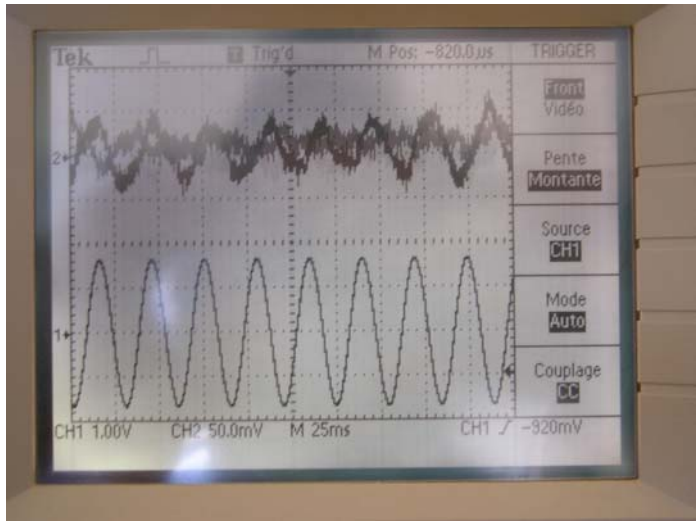
ELAN « little mock-up »

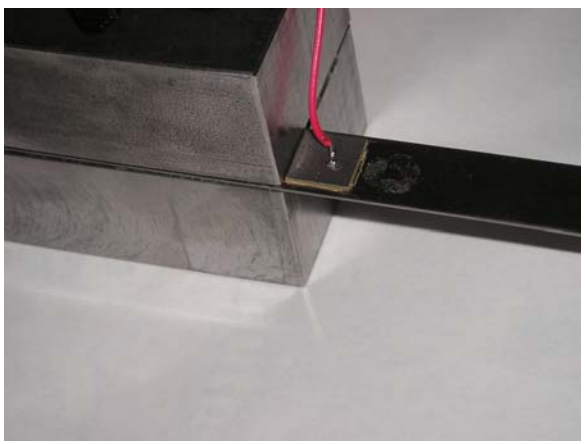


Sensor with excitation loudspeaker

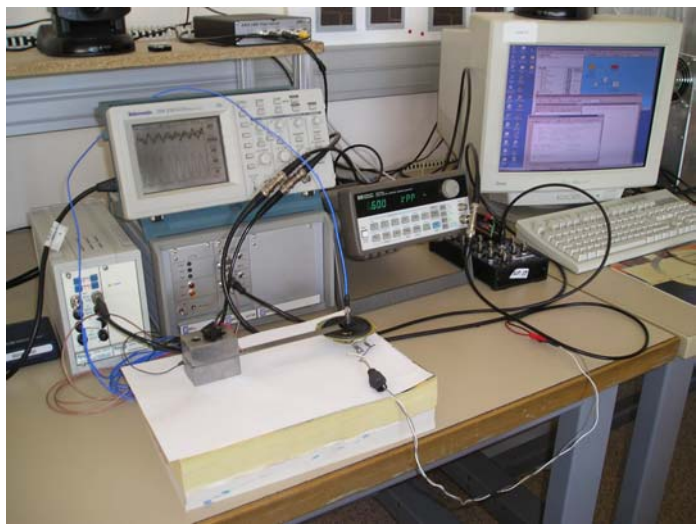


Signal recorded on sensor

Loudspeaker signal



Actuator



Global view

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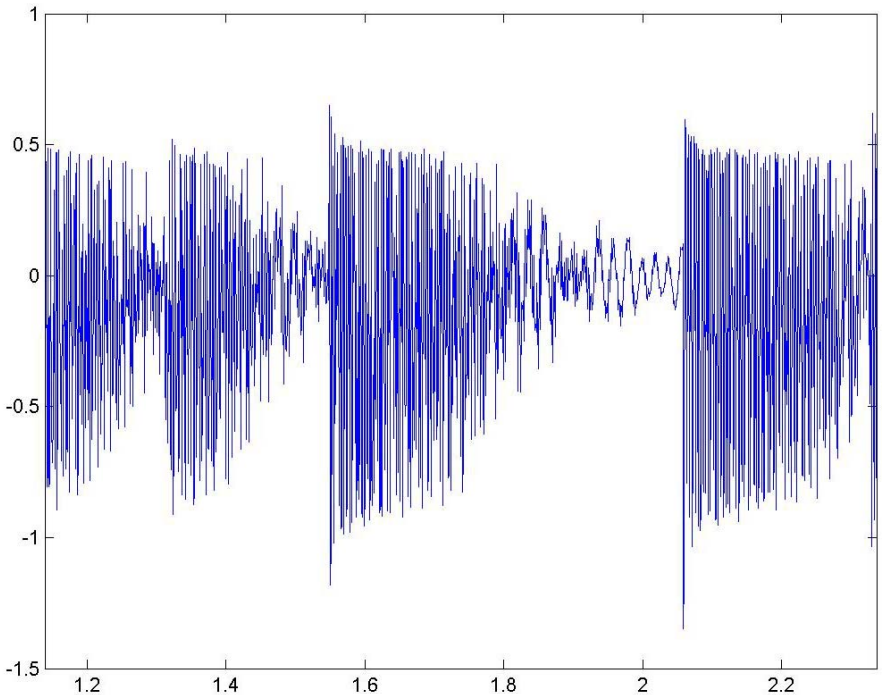
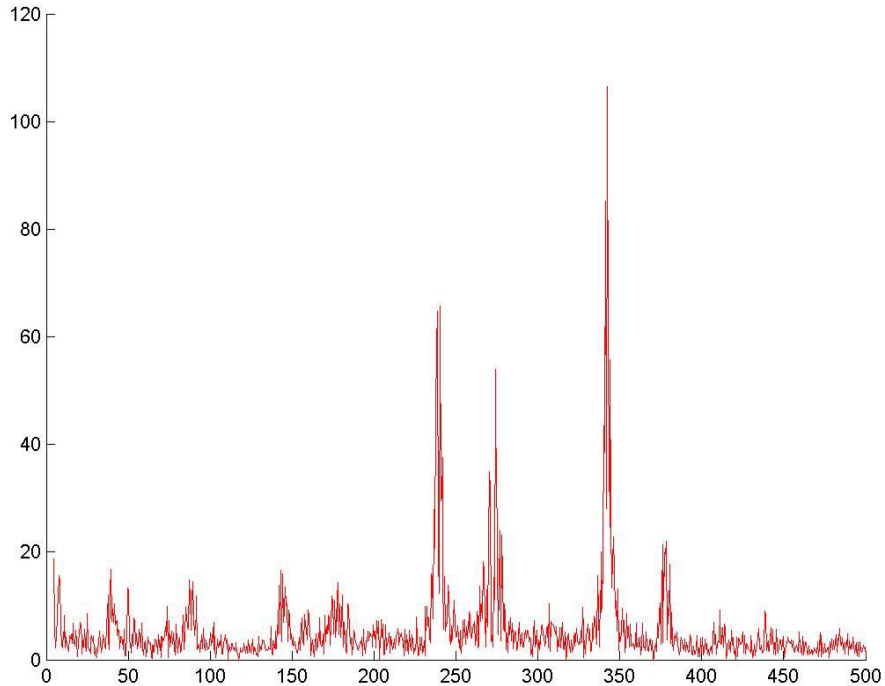
Vibration measurements

Hit response



Time (s)

Power density spectrum



Frequency (Hz)

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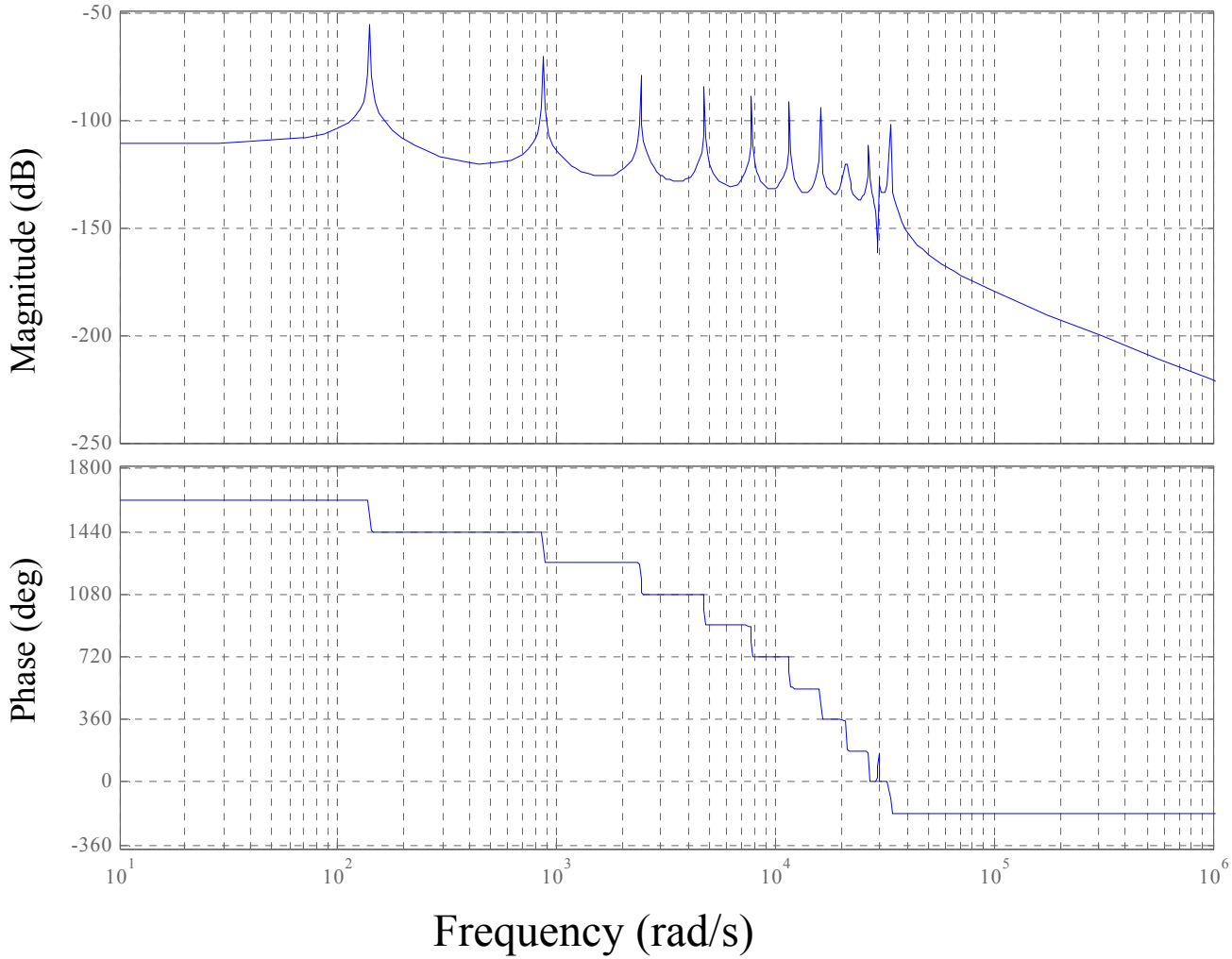
Bode diagram



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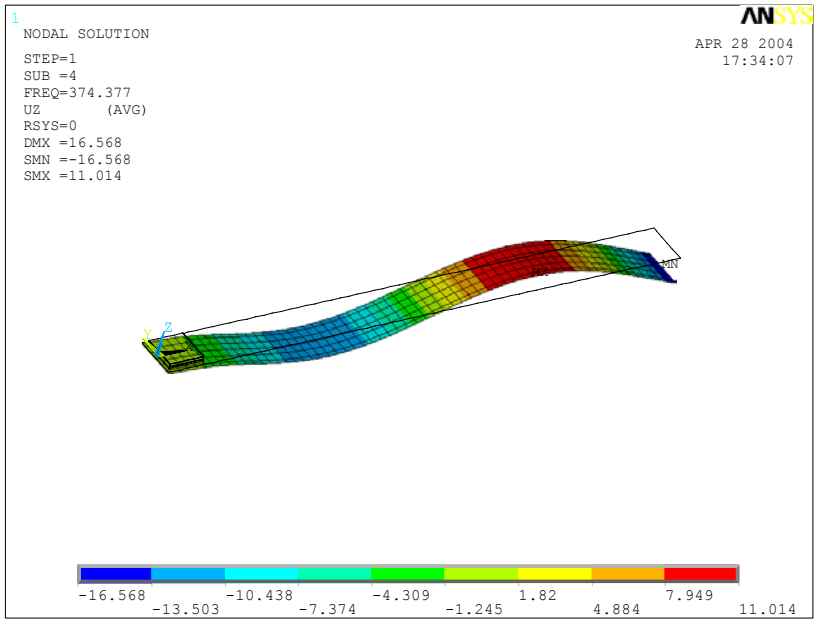
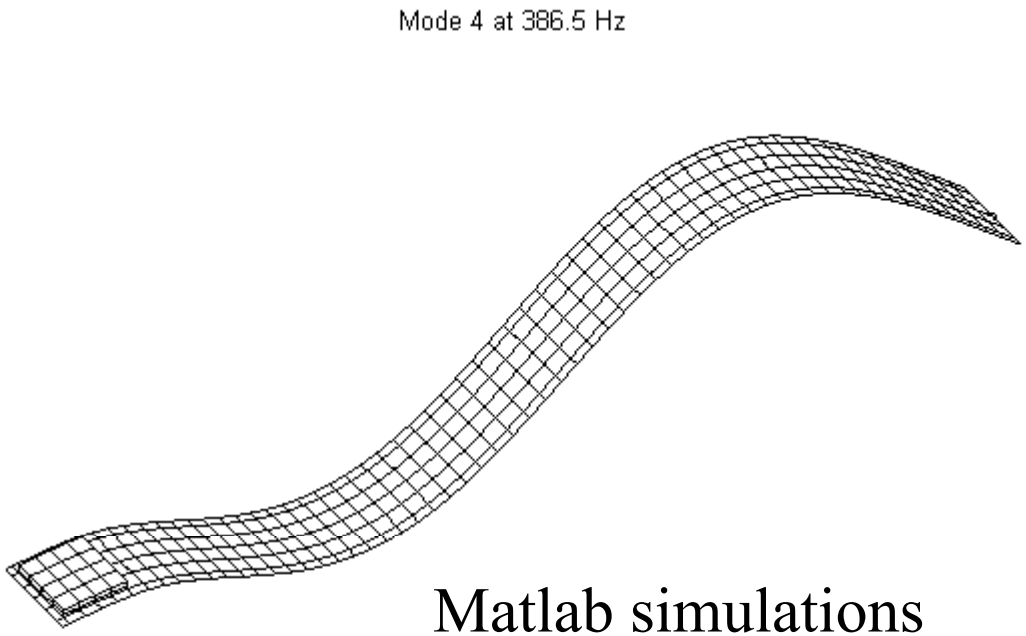
Vibration measurements



Ansys simulations



Matlab simulations

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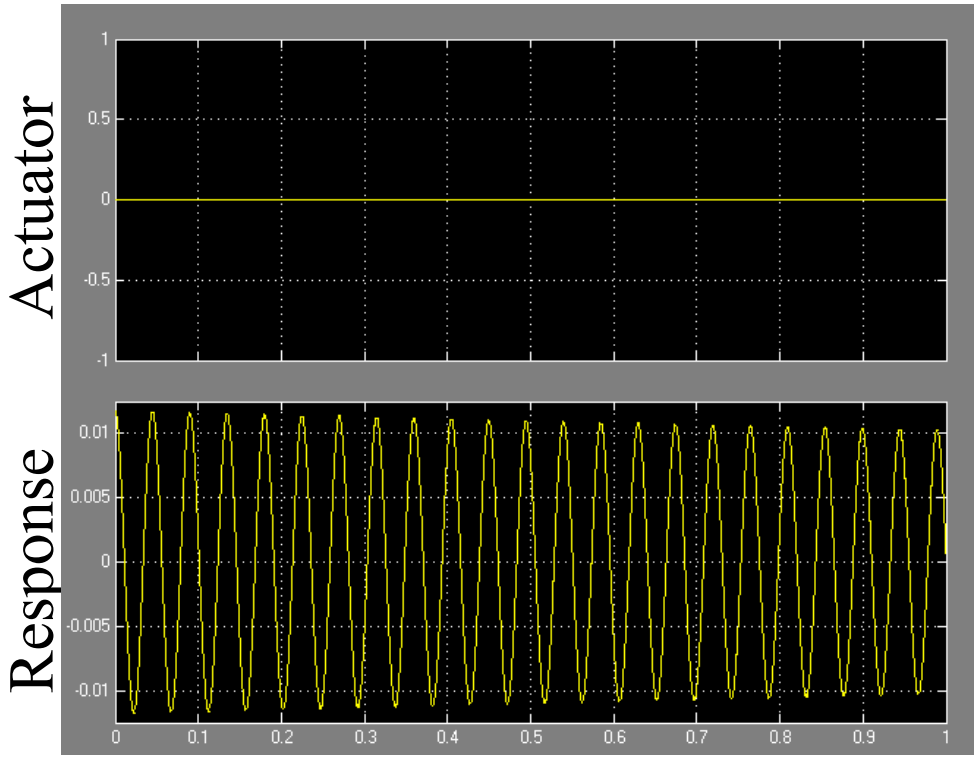
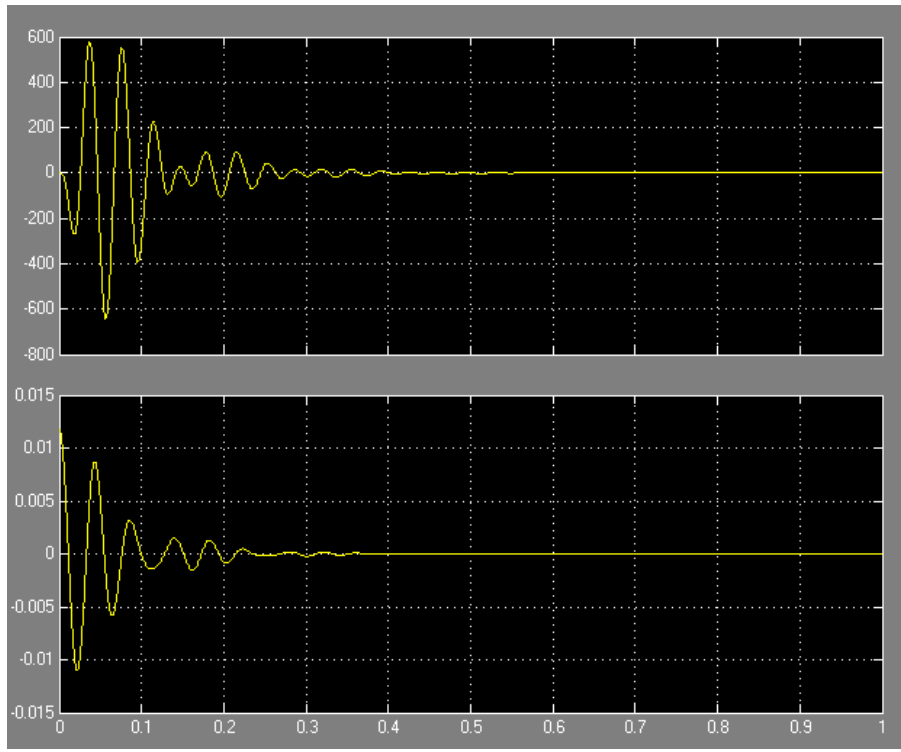
Feedback loop tests



Without feedback



With feedback

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Mechanical Simulations

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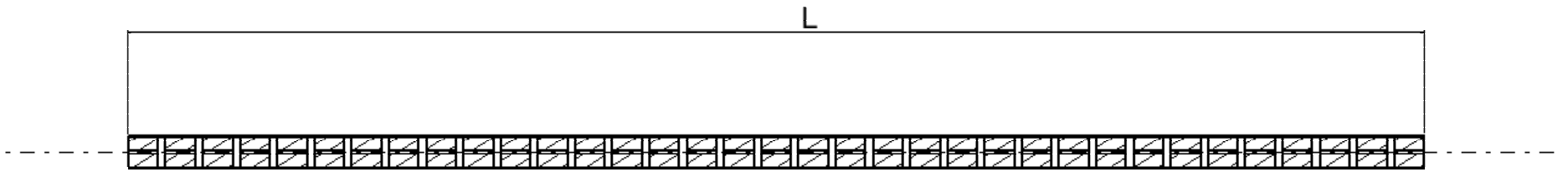
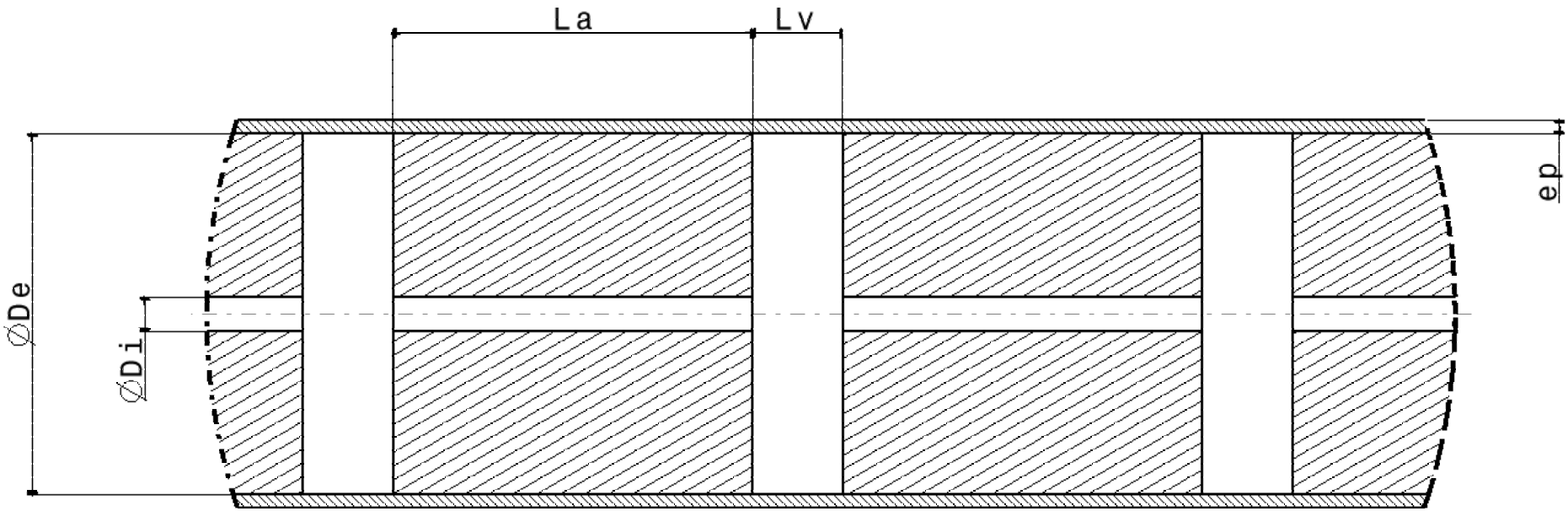
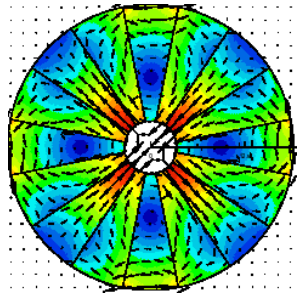
Mechanical simulations with CATIA



Taken from : M.Aleksa and S.Russenschuck CLIC Note 506, Study of some options for the CLIC Final Focusing Quadrupole and discussions with M.Aleksa



	Quadrupole characteristics
Quadrupole field	388T/m
Quadrupole length	3.5m
Aperture	3.8mm
Outer radius	43mm
Distance to IP	4.3m



tube material:	
Material	Steel : Structural (ASTM-A36)
Young modulus	2e+011N.m^2
Poisson Coefficient	0,266
Mass per unit volume	7860kg/m^3
thermal expansion coefficient	0,0000117
Yield point	2,5e+008N.m^2

quadrupole material:	
Material	Sm_2Co_{17}
Young modulus	1,5e+011N.m^2
Poisson Coefficient	0,3
Mass per unit volume	8400kg/m^3
thermal expansion coefficient	0,000012
Yield point	2,5e+008N.m^2

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Mechanical simulations : intrinsic modes

		Tubular		
		free 	embedded at both ends 	embedded on one side 
Frequency in Hz	1st	23	23,7	3,7
	2nd	63,4	65	23
	3rd	123,4	126,3	64,2
	4th	202,3	206,5	124,9
		Conical		
		free 	embedded at both ends 	embedded on one side 
Frequency in Hz	1st	41,1	39,5	10,6
	2nd	109,6	107,9	46,4
	3rd	210,2	208,9	115,1
	4th	341,2	340	215,3

Mechanical simulations

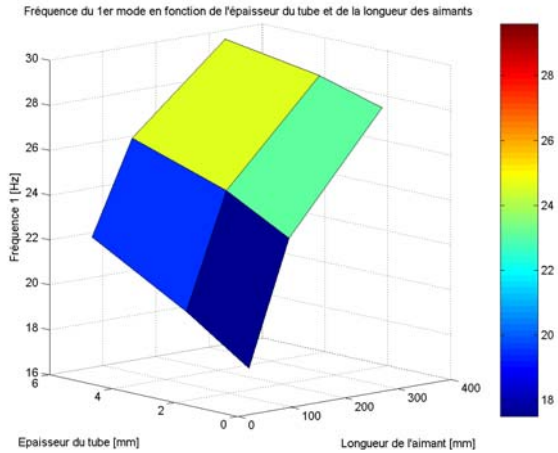
1st mode

2nd mode

3rd mode

One end fixed
(most probable case
in experiment)

Mechanical simulations
Variation of parameters



L(total length)	3480										
Lv(distance between magnets)	20								26,25	56	3480
La(lenght of magnet piece)	80			155	155	155	330	330	330		0
Di(aperture)	3,8										
De(outer diameter)	40										
ep(outer tube thickness)	3	1	6	1		6	1		6		
1st mode (Hz)	23	17,5	28,1	19,4	24,5	28,9	21,8	25,9	29,6	23	23,3	43,4

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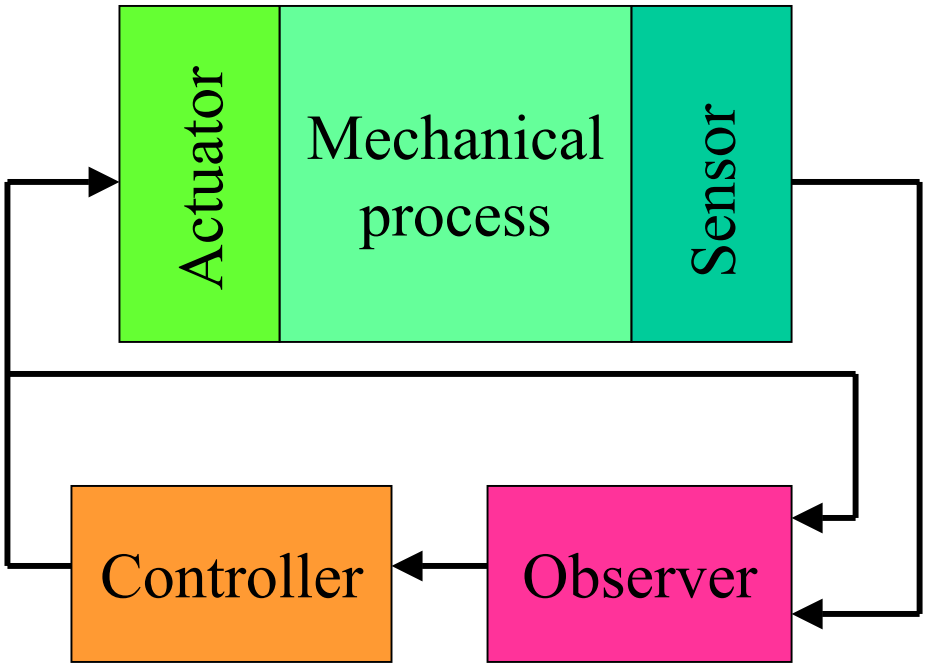
Next steps

Mechanical simulations : calculate intrinsic modes and design « large scale mock-up »

Feedback loop : Validate feedback loop by comparing Matlab simulations and « little mock-up » measurements

Vibration measurements : Characterize Annecy ground motion, find adapted sensors and actuators, and validate feedback loop on « large scale mock-up »


Actuator
Mechanical process
Sensor
Controller
Observer