What do we need in CoRoT age ?

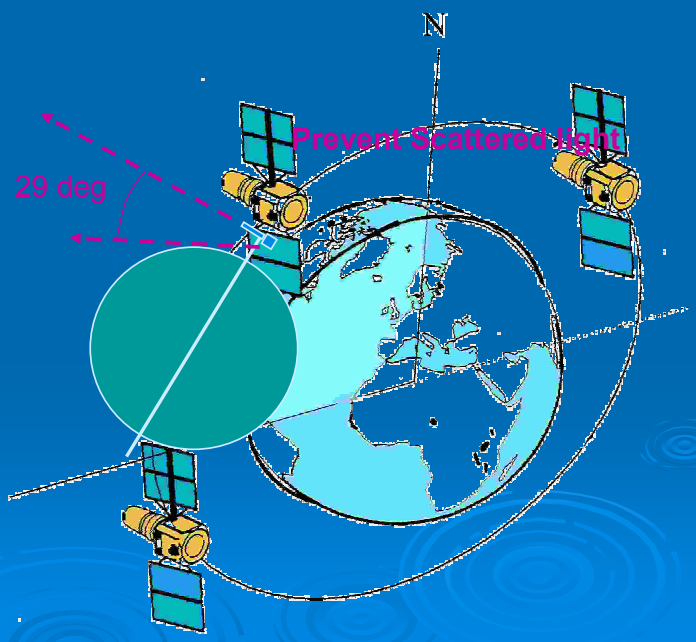
Eric Michel, Paris Obs. LESIA

COROT: *The Launch*

COROT will be launched

- **By Soyuz 2**
- **from Baikonour, Kazakhstan**
- **On the 21st of december 2006**

COROT: The orbit



to be placed on

- low Earth polar orbit
- 896 km altitude
- orbital period 6174s (~1h43mn,162μHz)

The ground segment

1.5Gb/d

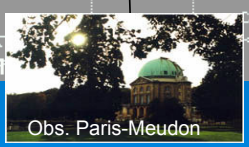
ICONES (CNES) (Kiruna)

ICONES Aussague

Vienna

Alcantara

Centre Spatial de Toulouse
Command Control Centre
Corot Mission Centre

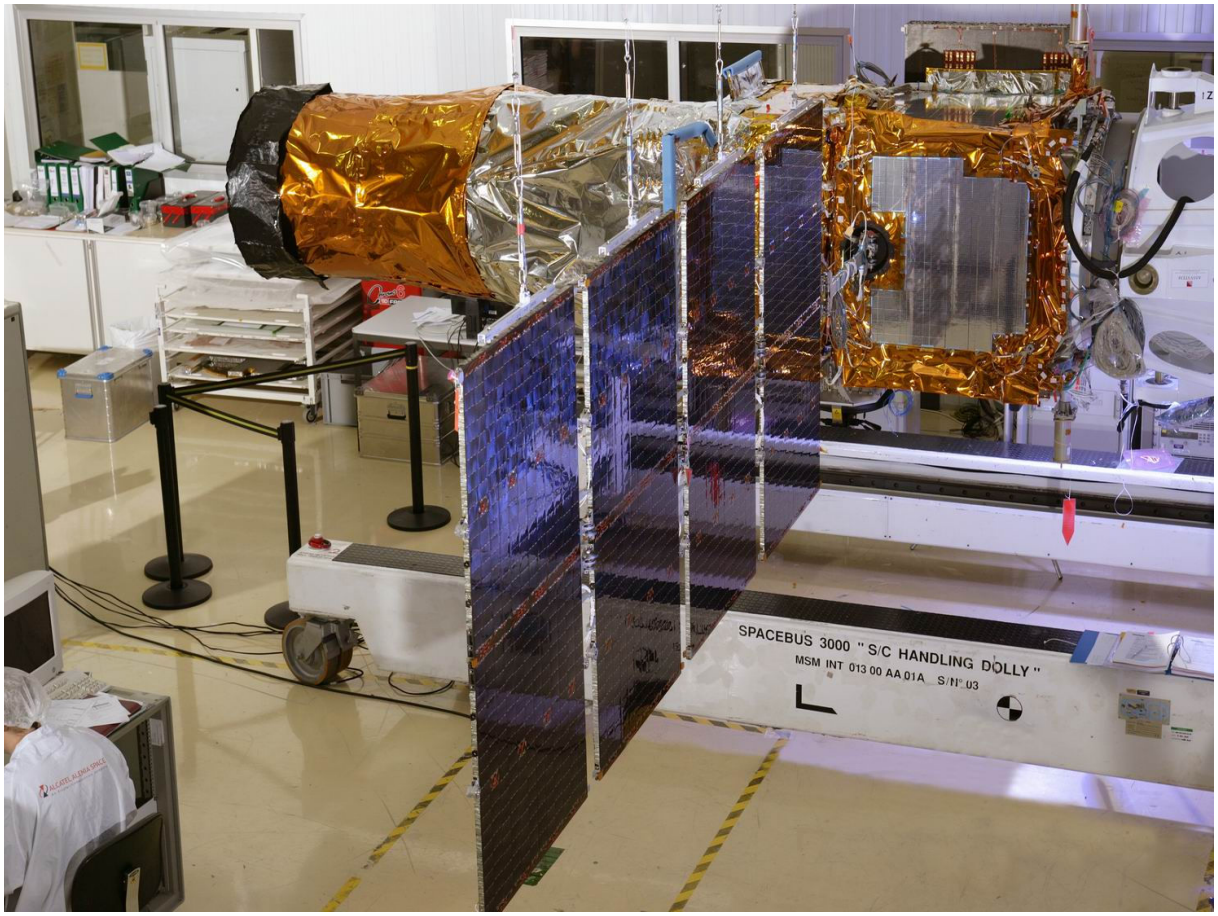

Obs. Paris-Meudon


IAS

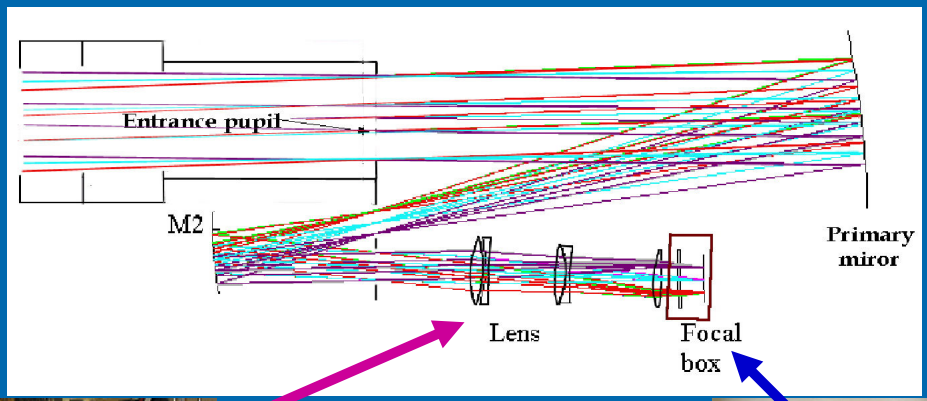

Obs. Midi-Pyrenees

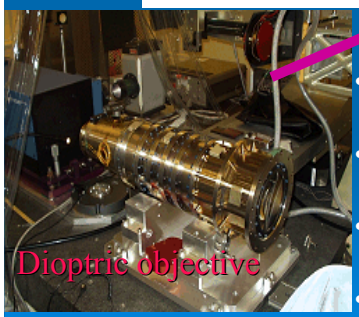

LAM

Archive

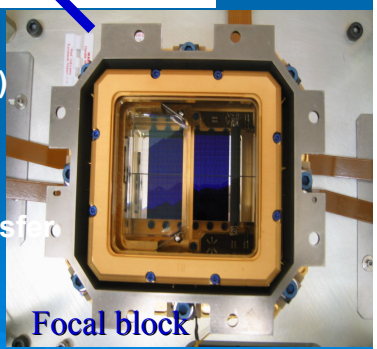


The instrument: integrated summer and delivered on nov. 05

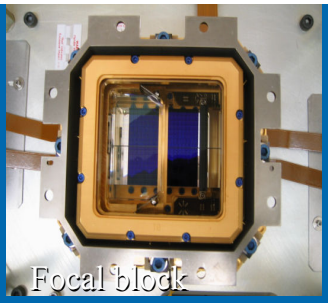




- Collecting area 588 cm^2 (*D~27cm*)
- Field of view 3°x 2.7°
- 4 CCDs 2000x4000 px Frame transfer
- Cooled at -40° (stabilized +- 10^{-2} °)



The focal plane



Seismology field
highly defocussed

Exoplanet field
On focus + prism

10 targets
5.4<mV<9
sampling 1 s

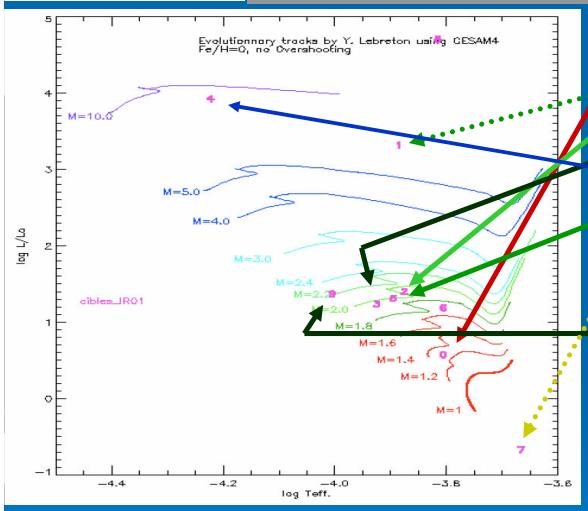
2.6 °

1.3 °

12000 targets
11<mV<16
sampling 512 s

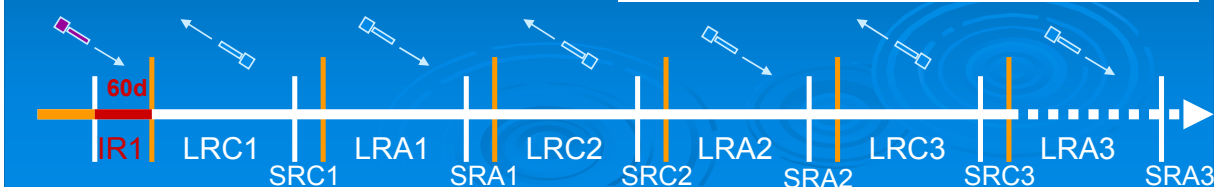
Solar/Stellar Models and Seismic Analysis Tools, Porto –nov. 2006

COROT-Initial Run1
IR1: >60days

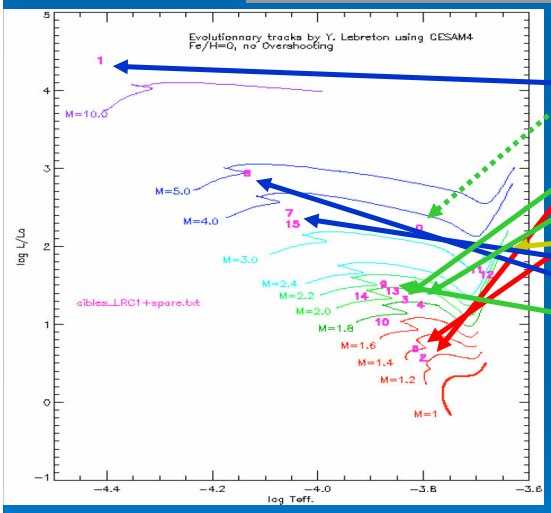


N	HD	mv	SpT	Vsini	com
0	49933	5.77	F2.0 V	10.9	sol-puls (Mosser et al 04)
1	50747	5.45	A4.0IV		Am
2	50844	9.1	A2.0	64	d Scu
3	50773	9.36	A2.0		Ap
4	50846	8.2	B5.0		ecl. Bin
5	51106	7.36	A3.0		Am
6	292790	9.48	F8.0		
7	50890	6.04	G6.0 III	12.8	
8	50170	6.82	F2.0	10.5	
9	50405	9.32	A0.0		ecl bin
10	50845	8.12	K0.0		Hip. Unsolv. Var.
11	50230	8.95	B3.0	22.6	
12	50583	8.28	B9.0		
13	50512	9.47	A2.0		
14	50347	9.0	F2.0		
15	50820	6.21	B3.0 IV		Be

spare

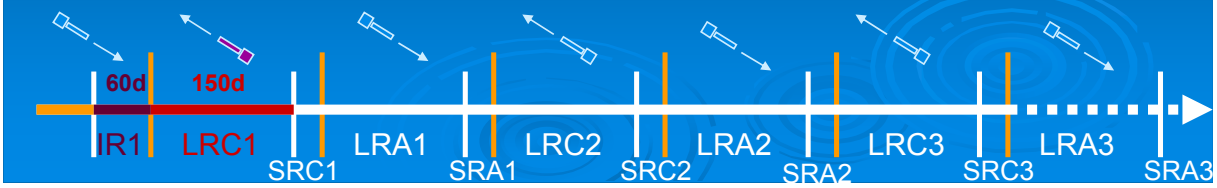


CoRoT-Long Run C1
LRC1: 150days

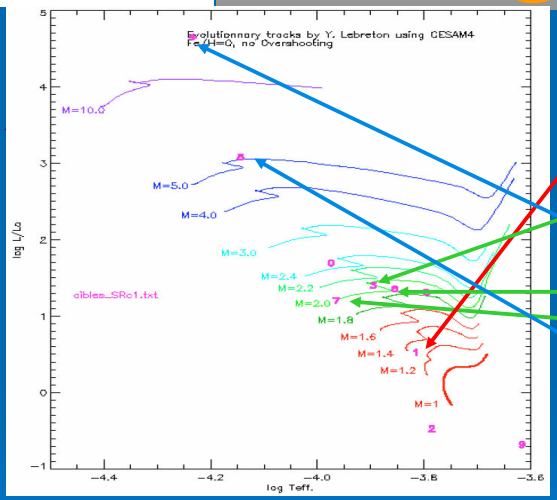


N	HD	mv	SpT	Vsini	com
0	181555	7.52	A5.0		dScu
1	180642	8.27	B1.5 II-III		Bet Cep
2	181906	7.65	F8	18	sol-puls cand crit0
3	181072	9.14	A2.0		
4	180973	6.74	F0.0	130	
5	181420	6.57	F2.0	21	sol-puls cand crit2
6	181907	5.81	G8.0 III		
7	182198	7.94	B9.0 V	25	
8	181231	9.69	B9.0 V		Be
9	181390	8.64	A0.0		
10	181439	8.97	F0.0	45	
11	181732	7.66	F5.0		
12	180622	7.63	K2.0		
13	181991	8.86	A2.0		
14	181690	9.03	B9.0 V		
15	181440	5.49	B9.0 III	56	

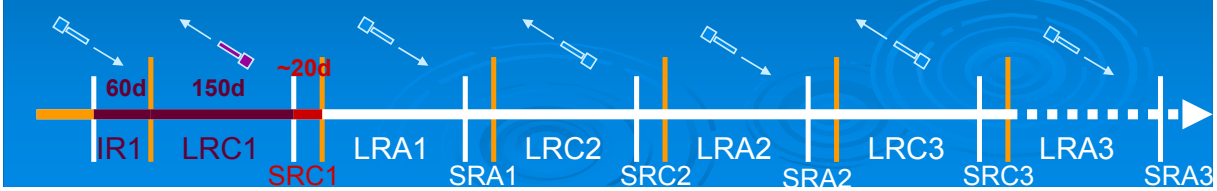
spare



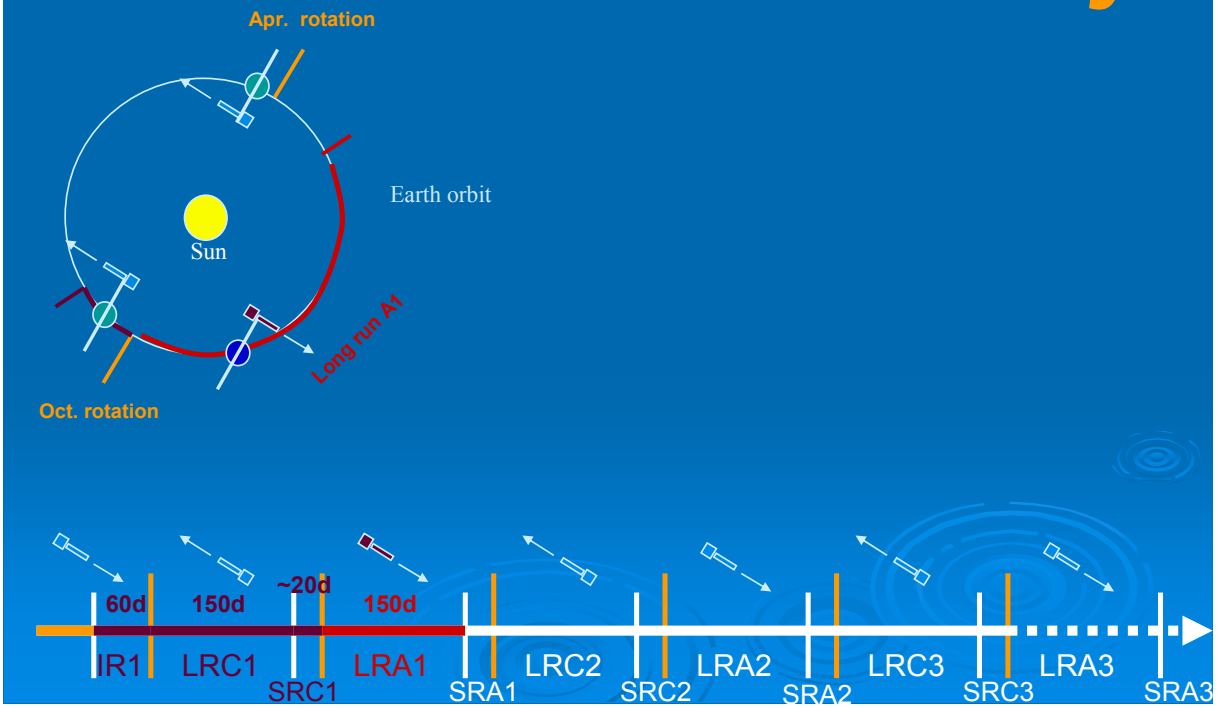
CoRoT-Short Run C1
SRC1: 20days



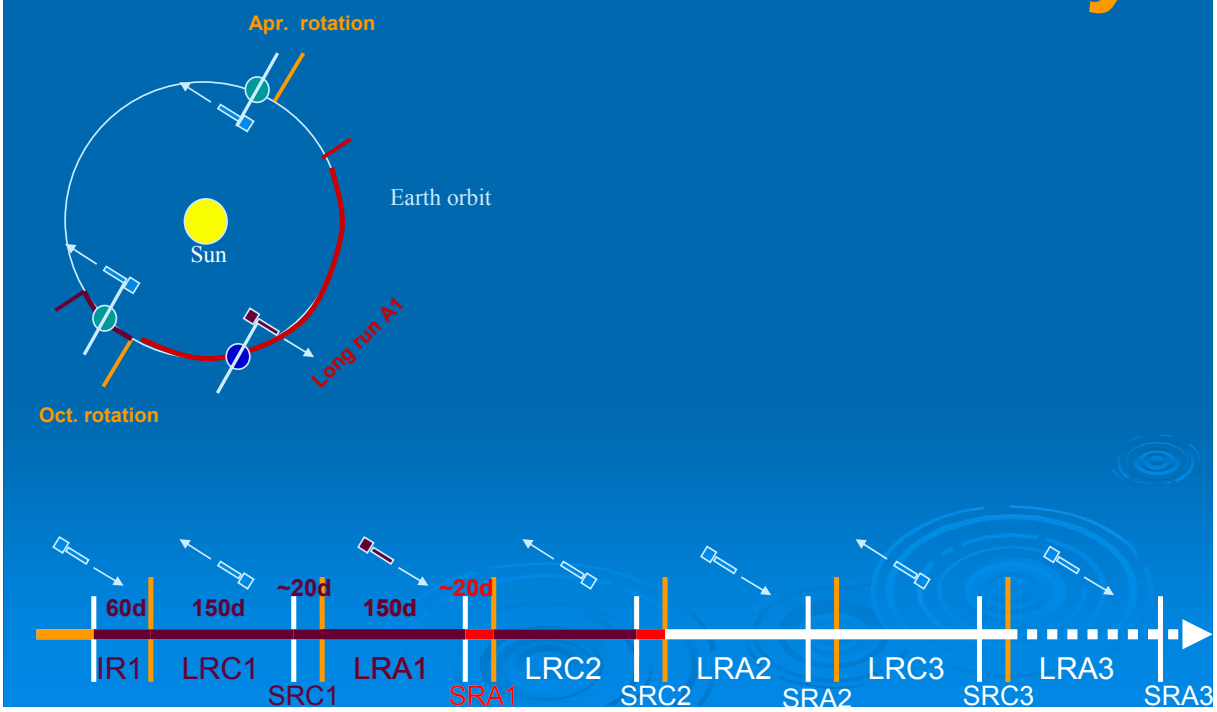
N	HD	mv	SpT	Vsini	com
0	182844	8.39	B8.0		
1	182922	8.14	F5.0		
2	182766	8.89	F6.0 V		
3	182740	8.06	A2.0		
4	183656	6.06	'A0.0'		Be
5	183018	9.04	F8.0		
6	183060	9.03	A2.0		
7	183324	5.8	A0.0 V	101.7	lambda Boo
8	183227	5.84	B6.0 III	57.3	
9	183589	6.08	K5.1 I	9.4	Hip. Uns. Var.



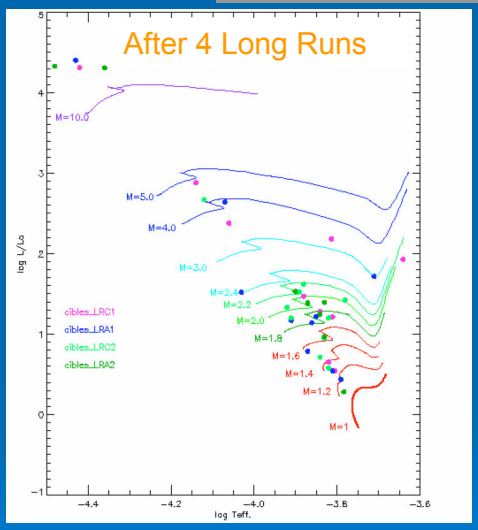
CoRoT-Long Run A1
LRA1: 150days



CoRoT-Long Run A1
LRA1: 150days



CoRoT Long runs



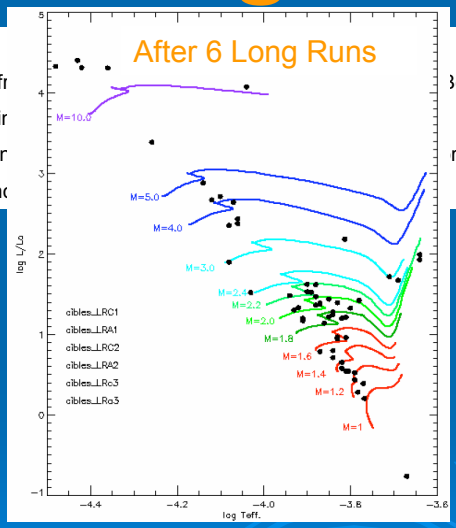
1 O.9 star

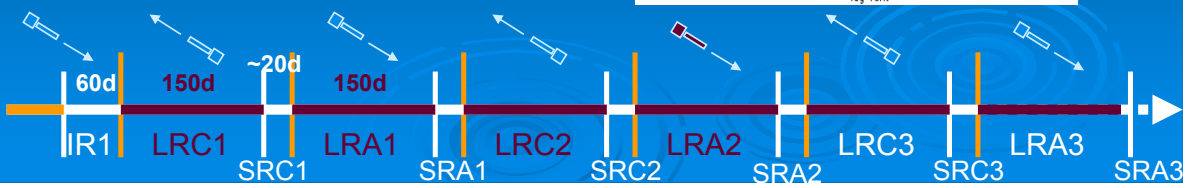
11 B stars fr

11 A stars ir

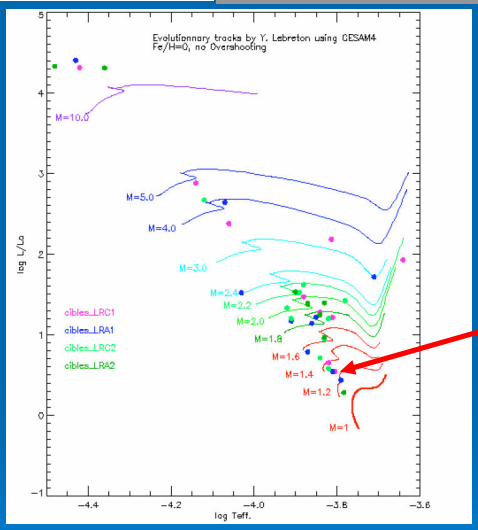
14 F stars ir

3 G stars inc





CoRoT Long runs



1 O.9 star

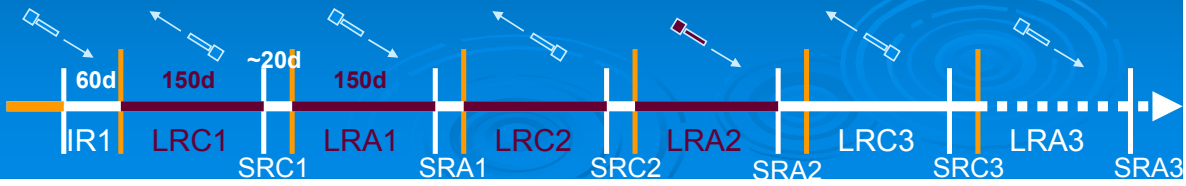
11 B stars from B0 to B9, including 1 known Beta Cep and 5 Be

11 A stars including 2 dScu (1 in ecl. Bin), 2 Ap

14 F stars including 6 sol-like cand (1 known), 1 dScu, 1 G Dor

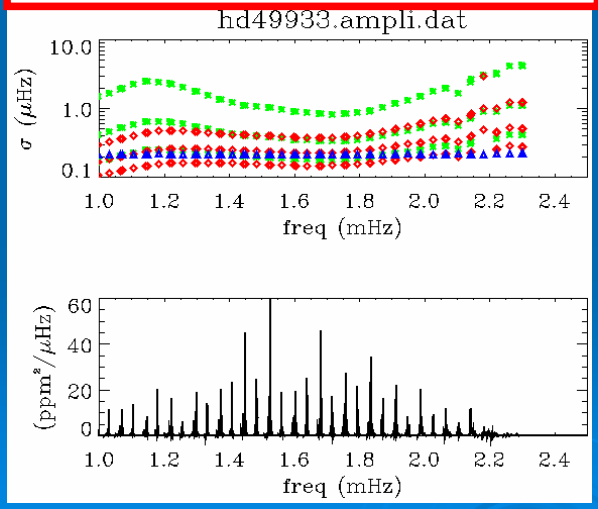
3 G stars including 2 sol-like cand (1 with a planet)

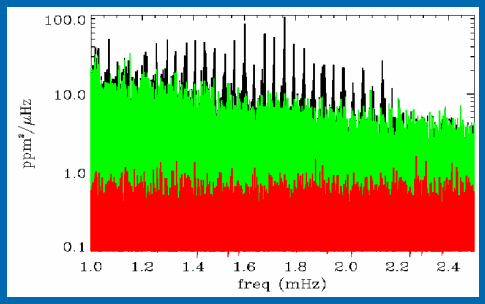
HD 49933, (mv=5.8)

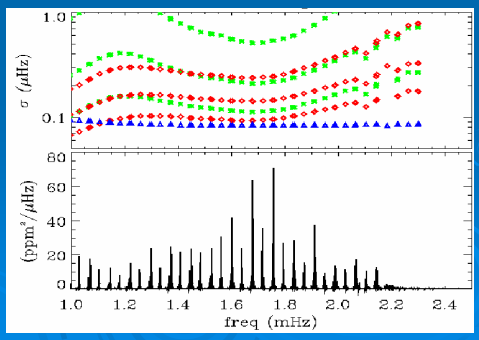


COROT: Long runs *Performances*

HD 49933, mv=5.8, 60 days IR1



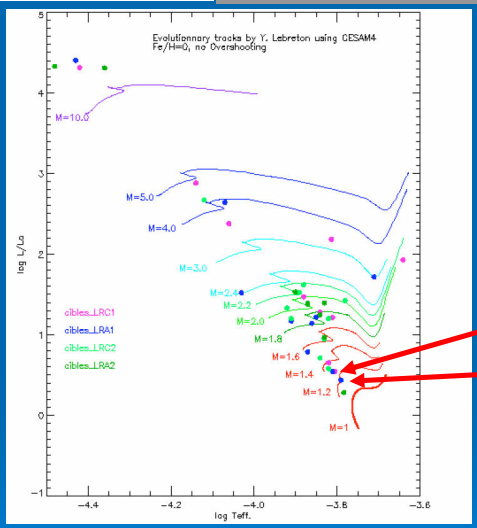




From Michel et al. (05)

Solar/Stellar Models and Seismic Analysis Tools, Porto –nov. 2006

CoRoT *Long runs*



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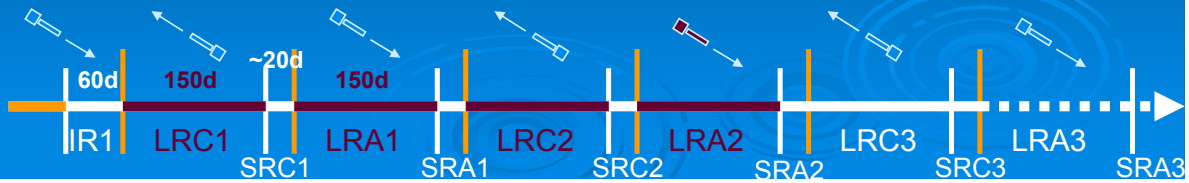
14 F stars including 6 sol-like cand (1 known), 1 dScu, 1 G Dor

3 G stars including 2 sol-like cand (1 with a planet)

HD 49933, (mv=5.8)

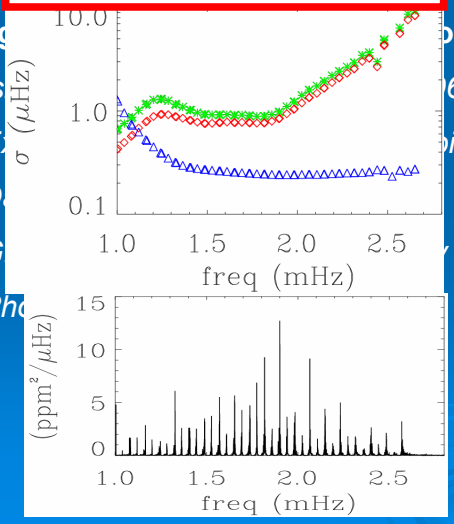
HD 49385, (mv=7.9)

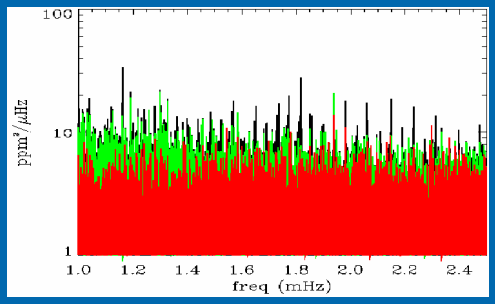


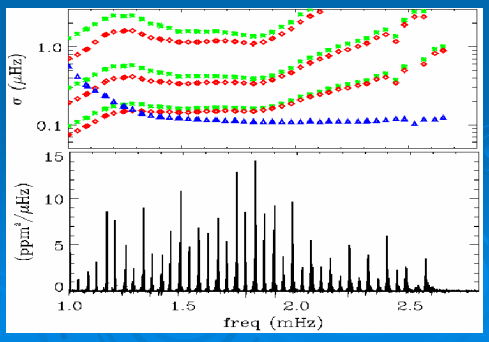
COROT: Long runs *Performances*

HD 49385, mv=7.9, 150 days

HD 49385, mv=7.9, 30 days







From Michel et al. (05)

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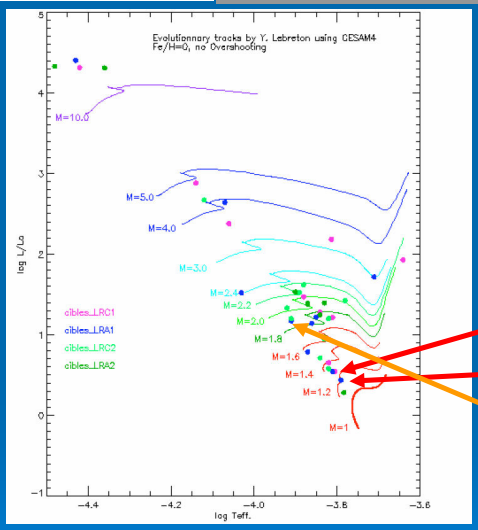
CoRoT *Long runs*



1 O.9 star

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11 A stars including 2 dScu (1 in ecl. Bin), 2 Ap

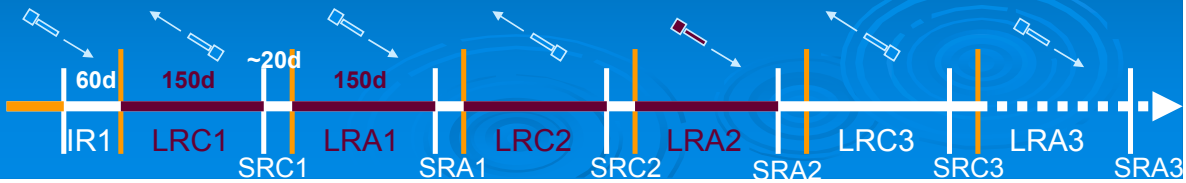
14 F stars including 6 sol-like cand (1 known), 1 dScu, 1 G Dor

3 G stars including 2 sol-like cand (1 with a planet)

HD 49933, (mv=5.8)

HD 49385, (mv=7.9)

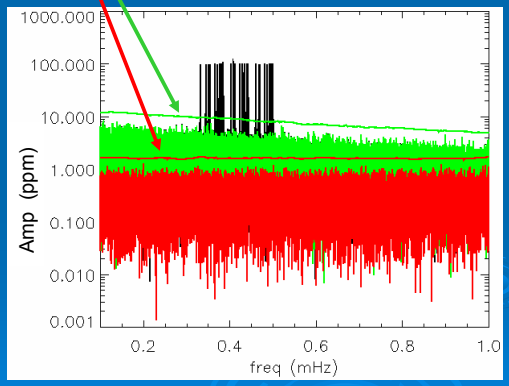
HD 49294, (mv=7, vsini=111km/s)



COROT: Long runs *Performances*

HD 49294, mv=7, 150 days

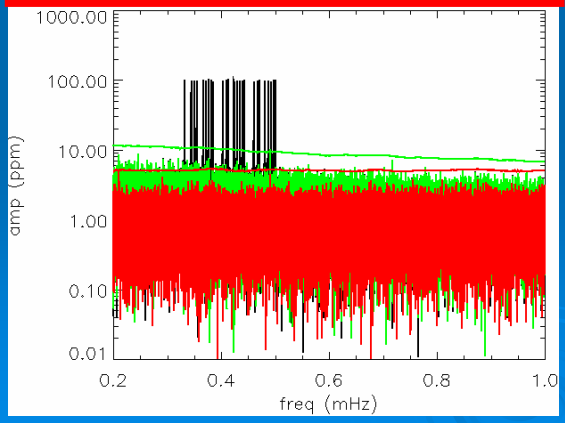
99 % detection conf level (Fisher test) → $\sigma_\nu < 1/(4\ T) \sim 0.02\mu Hz$



Light-curve and spectra simulation

HD 49294, mv=9.5, 150 days

06)



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COROT: *Performances*

HD 49294, mv=9.5, 20 days

99 % detection conf level (Fisher test) → $\sigma_\nu < 1/(4\ T) \sim 0.15\mu Hz$

Light-curve and spectra simulation

Noise:*(simuspec: Baudin, Samadi et al. 06)*

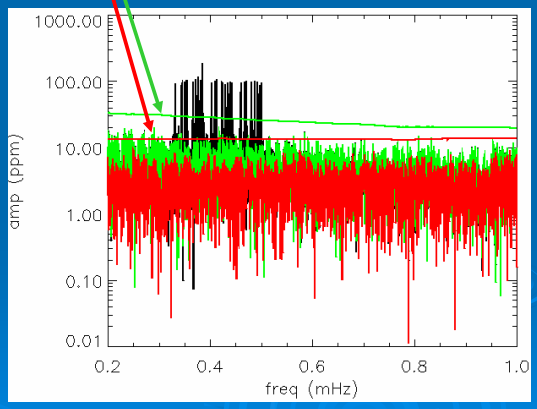
-Granulation noise following Harvey (85)

-Photon noise adapted to CoRoT

Oscillation spectrum:

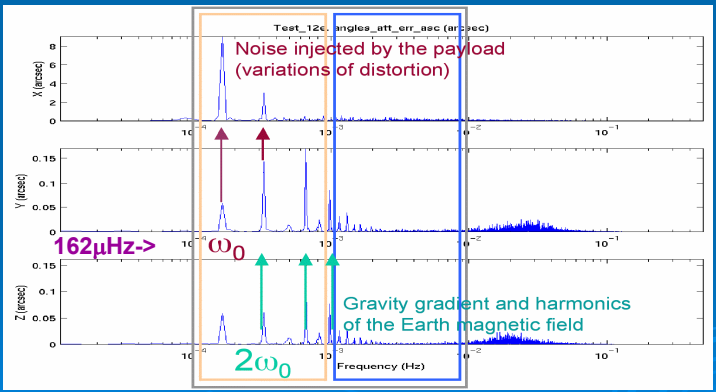
-L=0,1,2 in unstable range according to (M.A. Dupret)

-Arbitrary amplitude: 10^2ppm



COROT: Performances

Orbital perturbations



COROT: Long runs Performances

HD XXX, mv=8, 150 days

Light-curve and spectra simulation

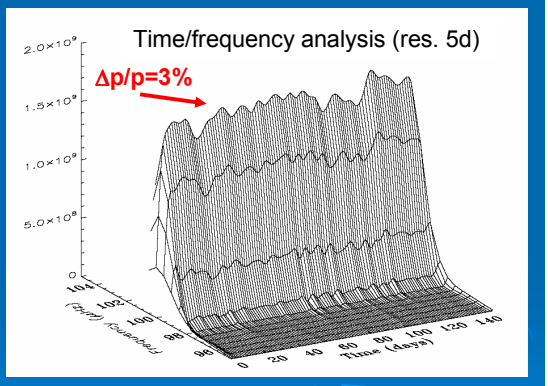
Noise:*(simuspec: Baudin, Samadi et al. 06)*

-Granulation noise following Harvey (85)

-Photon noise adapted to CoRoT

Oscillation spectrum:

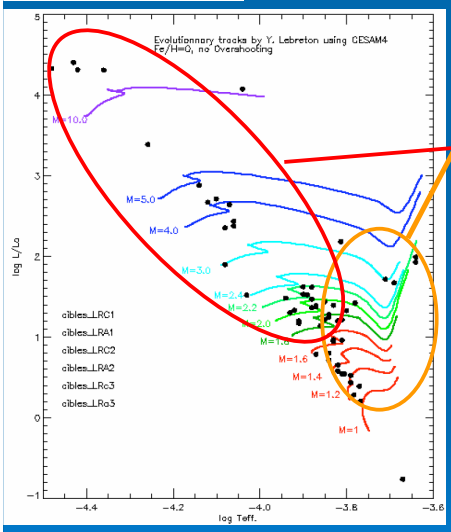
- a Sin(2$\pi\nu$t) with ν=100μHz, a= 4 10^{2}ppm



What do we need in CoRoT age ?

Expected precision

for observed oscillation frequencies:



For solar-like pulsators:

Precision down to 0.1μHz [1→ 0.1μHz]

For self maintained pulsators:

Precision eventually below 0.1μHz

The 0.1μHz precision required to be sensitive to fine structure effects we want to address:

-Base outer convective zone

-Limit of the convective core

-Rotation profile in classical pulsators

-…

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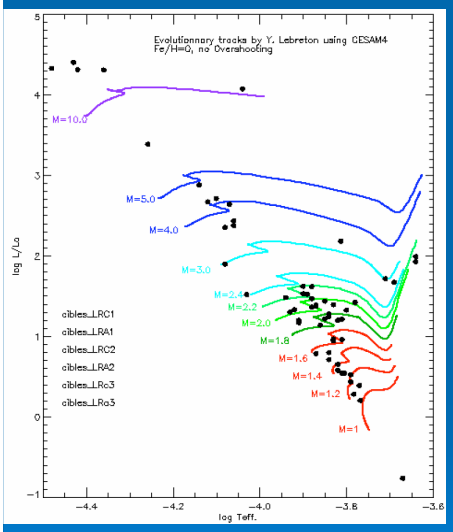
What do these frequencies tell us?



Precision at the level of:

- numerical precision (meshpoints distribution, boundary conditions,…)

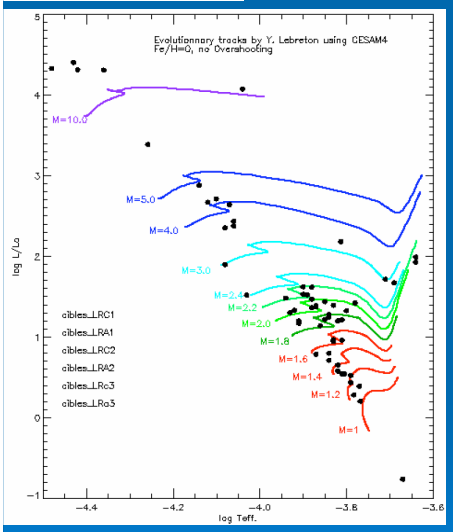
- numerical schemes (evolution and oscillations, but also e.g. opacity tables interpolations,…?)

- Input microphysics data flavors (opacities, EOS, diffusion coefficients,…)

- more input physics : rotational momentum transfert, effect of gravitational waves, magnetic field,…

- …

What do we need?



For a set of illustrative models (a grid?),

Effect on observables (including frequencies) of:

- numerical precision (meshpoints distribution, boundary conditions,…)

- numerical schemes (evolution and oscillations, but also e.g. opacity tables interpolations,…?)

- …

l'Observatoire de Paris — LESIA

Laboratoire d'Études Spatiales et d'Instrumentation en Astrophysique

LAS

IAS orsay

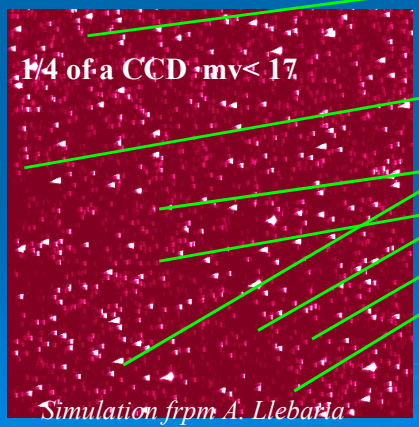
LAT, CESR at OMP
OCA
LUTH, GEPI at OPM

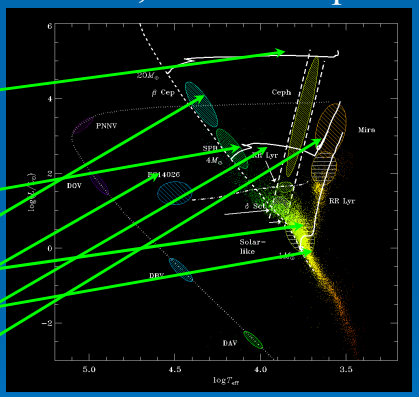
cnes
CENTRE NATIONAL D'ETUDES SPATIALES

Réalisation: J.P. Goudal - LAM

COROT: *Additional Program*

*Data collected for the exoplanet search, mv< 16, 6000 stars per CCD
*Specific targets (~100 per CCD)
* A few specific short runs

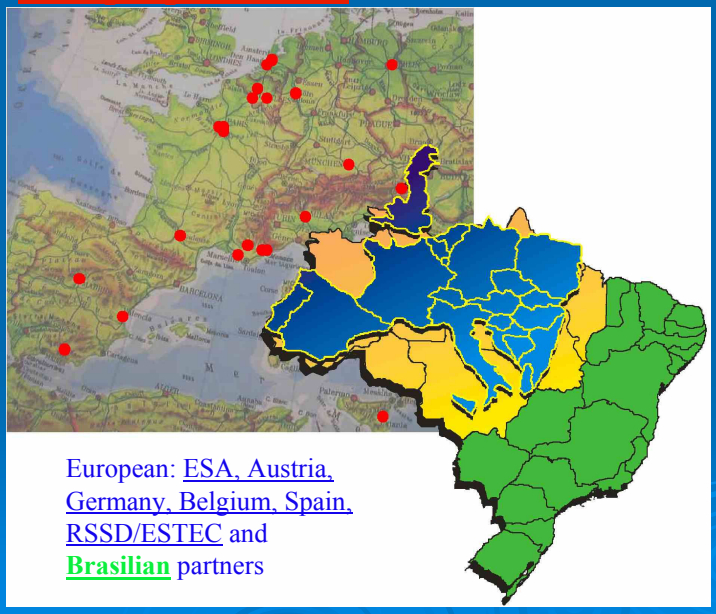




Access through an AO
(issued each year)
open to **all members**
of contributing countries

Started in 93 in response to a call for proposals for minisatellites issued by CNES; (launch 97!)

New proposal in 97



European: ESA, Austria, Germany, Belgium, Spain, RSSD/ESTEC and **Brasilian** partners