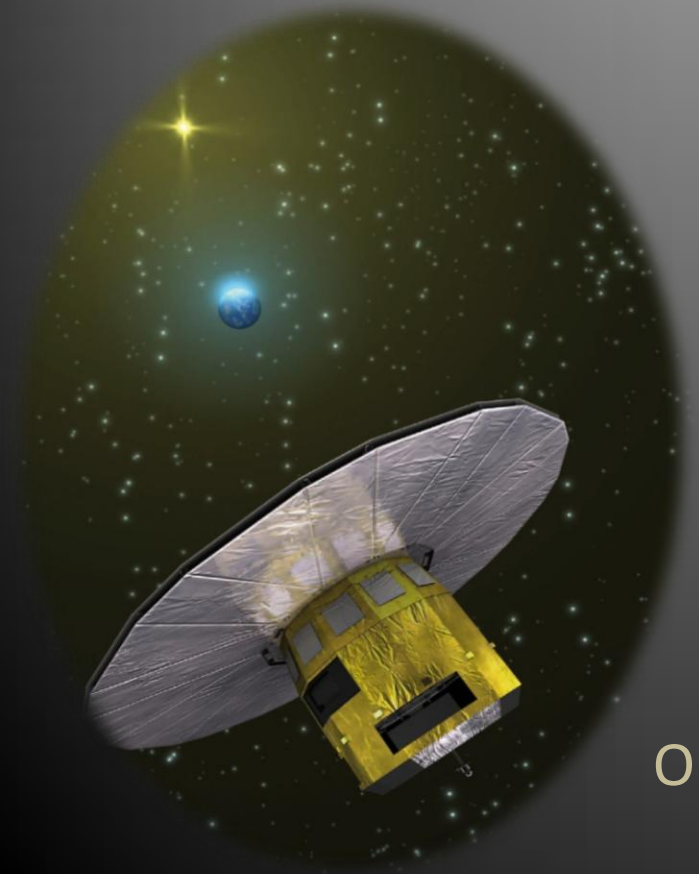
Extending the GAIA planet catch by combining with precise radial velocities



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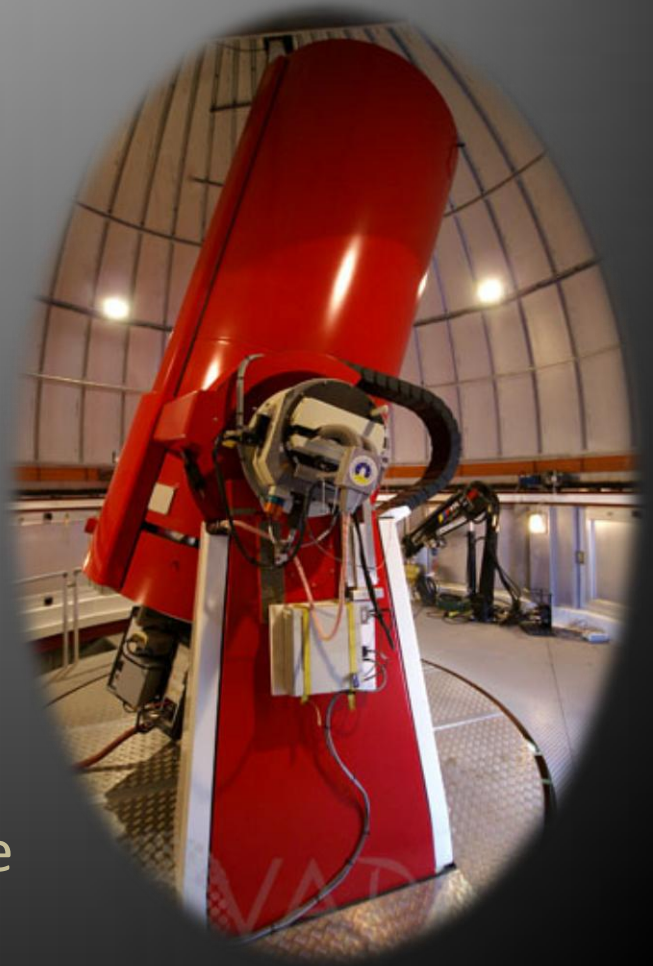
D. Queloz
D. Ségransan
Observatoire de Genève



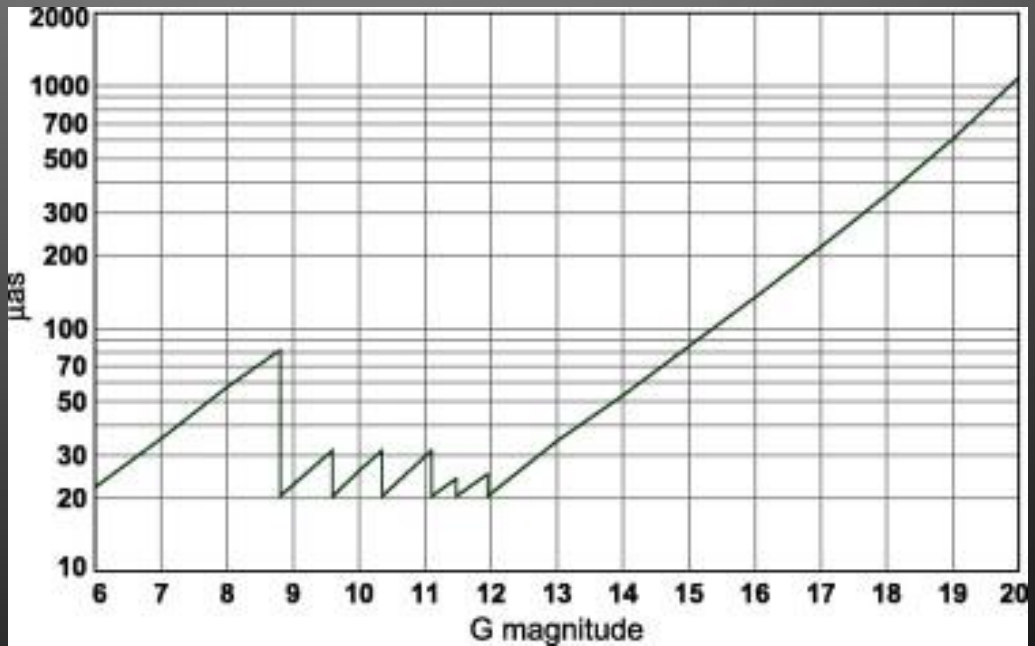
Assumptions

- Intrinsic noise : Coralie 3m/s

  Harps 1m/s

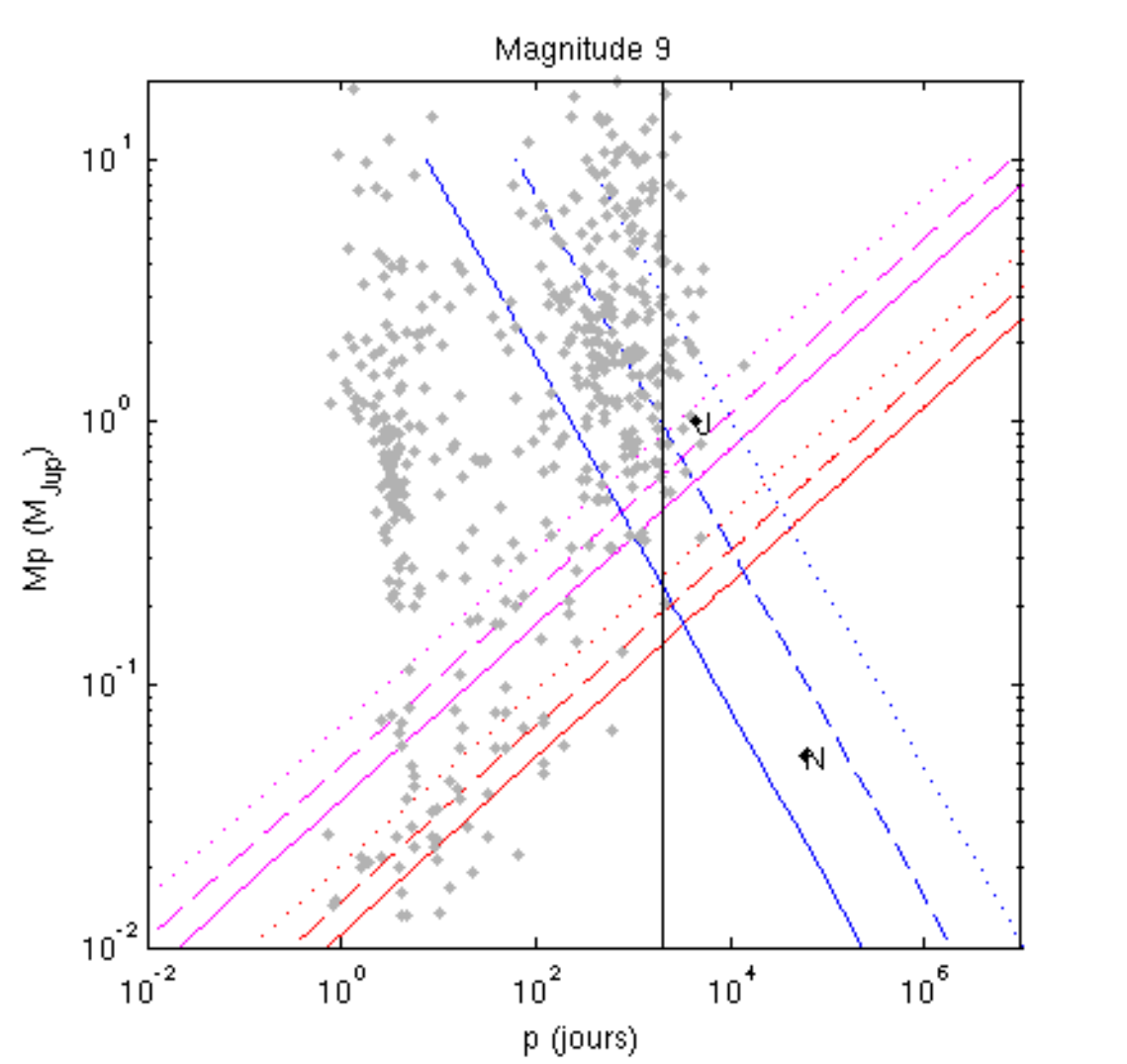
  Photon noise : Bouchy et al. (2001)

- Astrometric precision expected with Gaia for a *single observation* :



Mignard 2011

Domains of detectability



Assumptions

- Stellar distribution : Besançon model

  Spectral types : F,G,K

- We explore planets masses and periods :

  0.1 to 25 M_{Jup} and 10 to 2000 days

- We consider that each star hosts one planet

Detection criterion

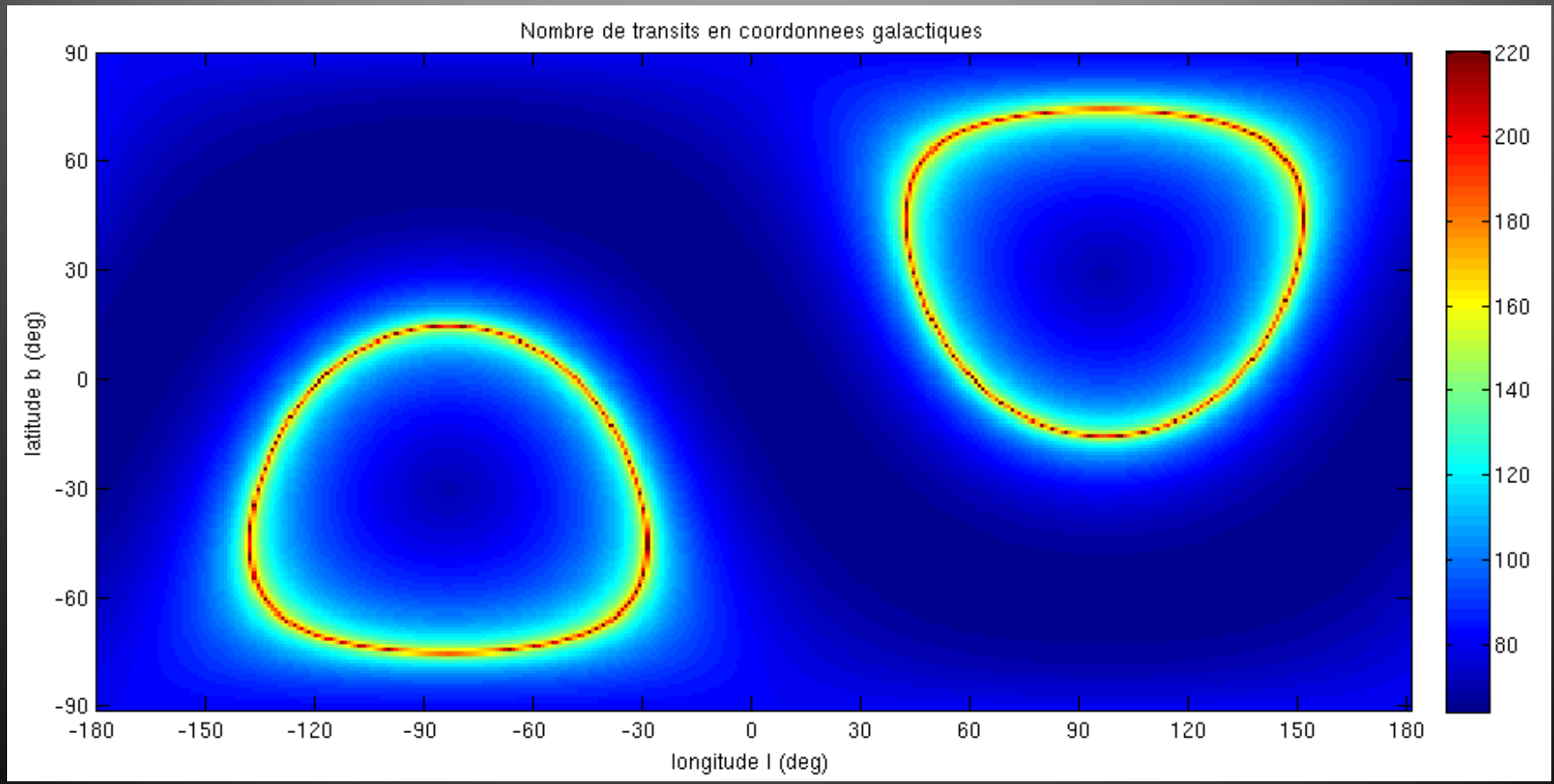
- RV : signal amplitude > 5 x instrument precision
- Astrometry : $\mathrm{SNR_{det}} = \mathrm{As}\ \sigma_{\mathrm{gaia}}\ \mathrm{N}^{-1/2} > 17$

  (Casertano et al. 2008 : $\mathrm{SNR_{det}} > 20$)
- When astrometry combined with RV : $\mathrm{SNR_{det}} > 7$

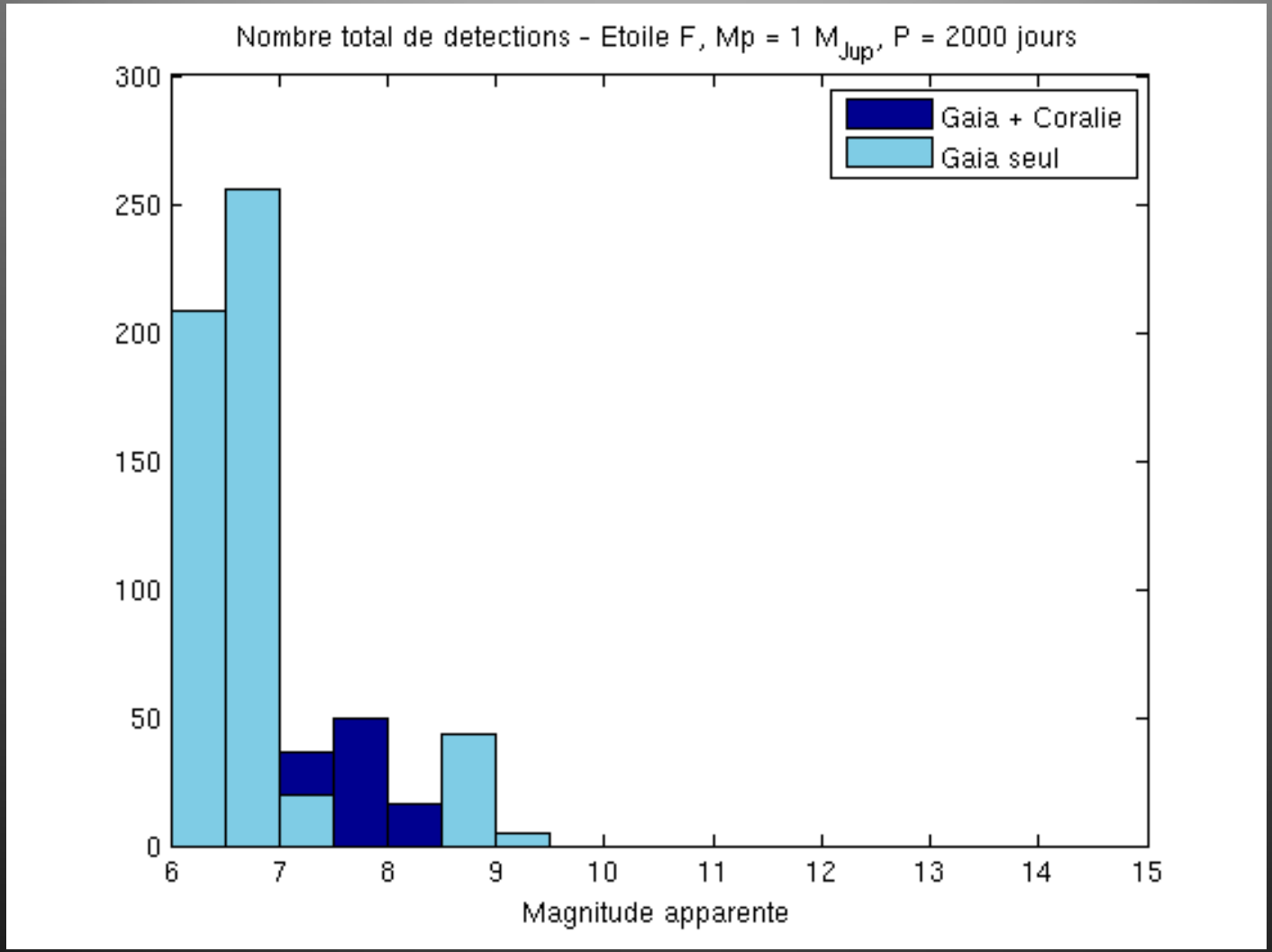
  (Sahlmann et al. 2011a)
- Detection treshold at end of mission

Assumptions

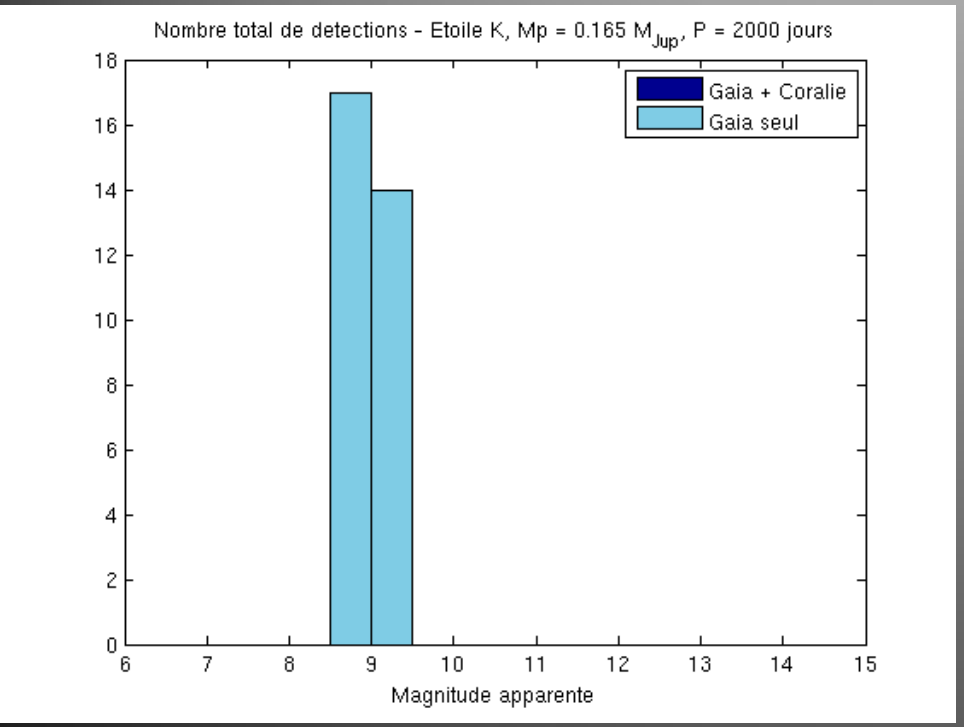
Gaia scanning law



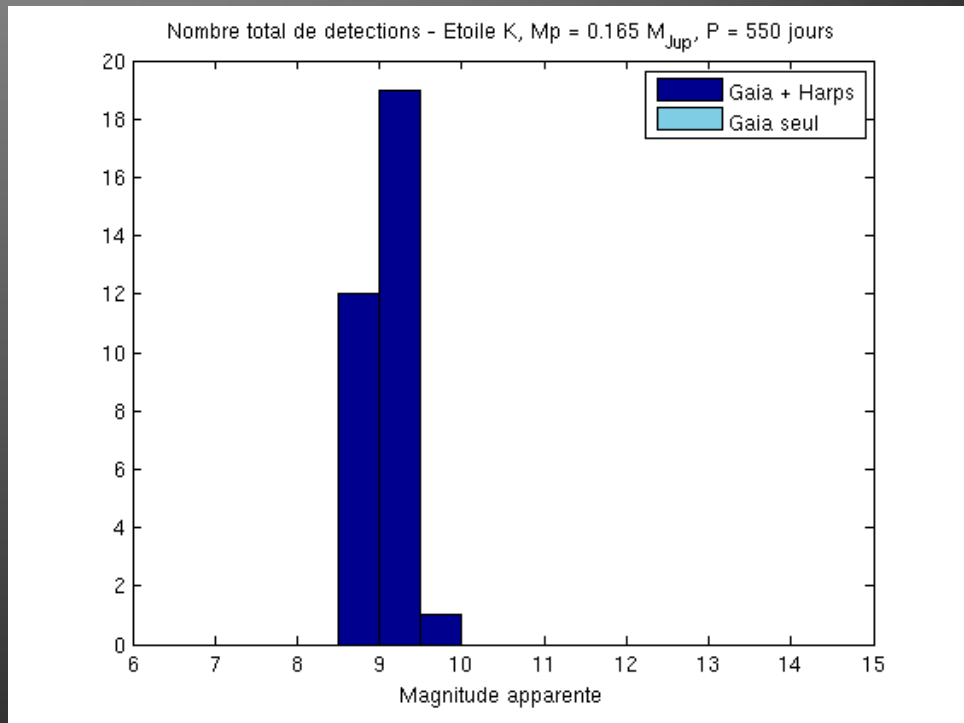
Res 1 : complete Gaia detections



Res 2 : improve the minimum mass detectable

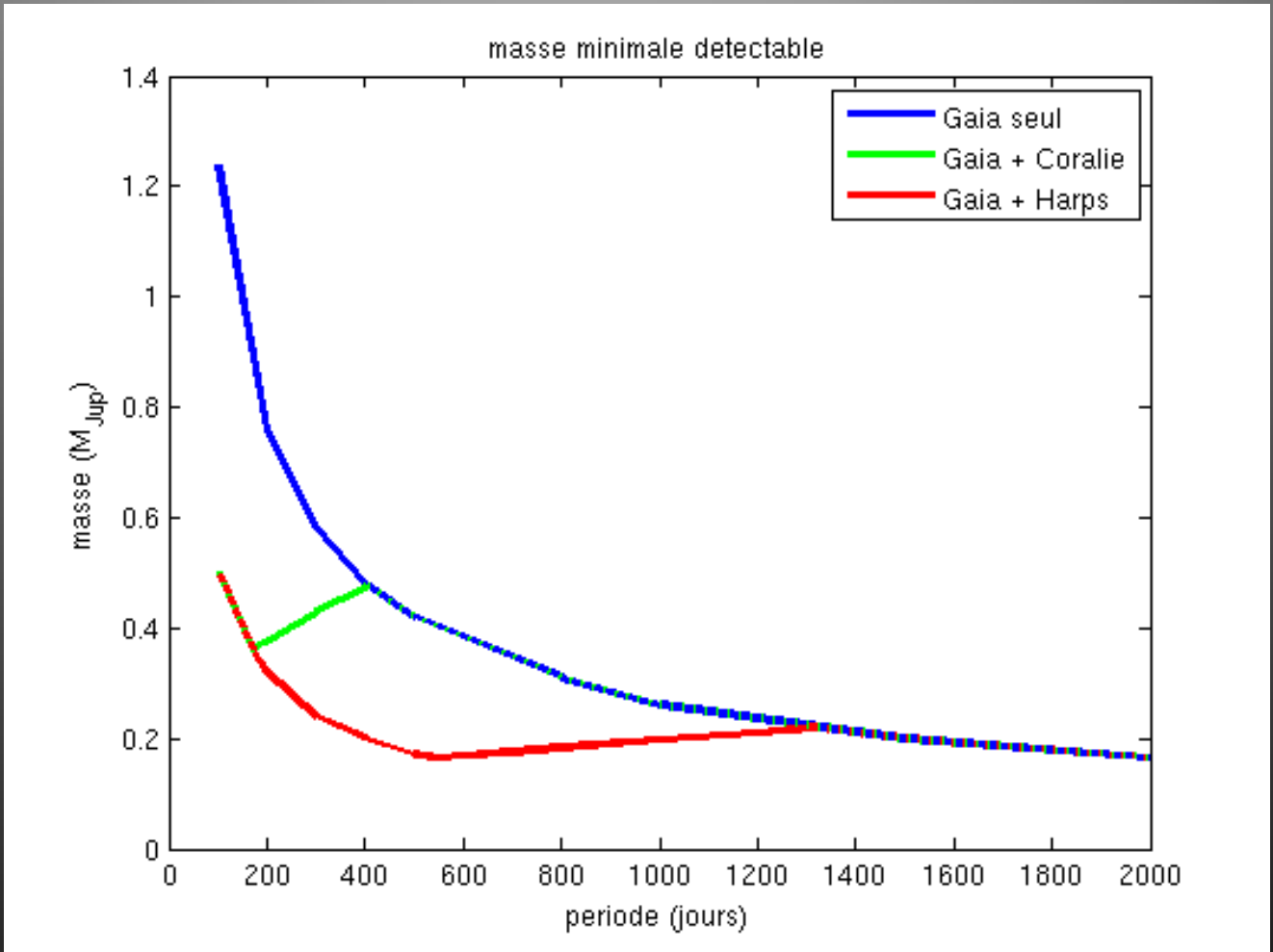


Gaia : 0.165 M_{Jup}
2000 days

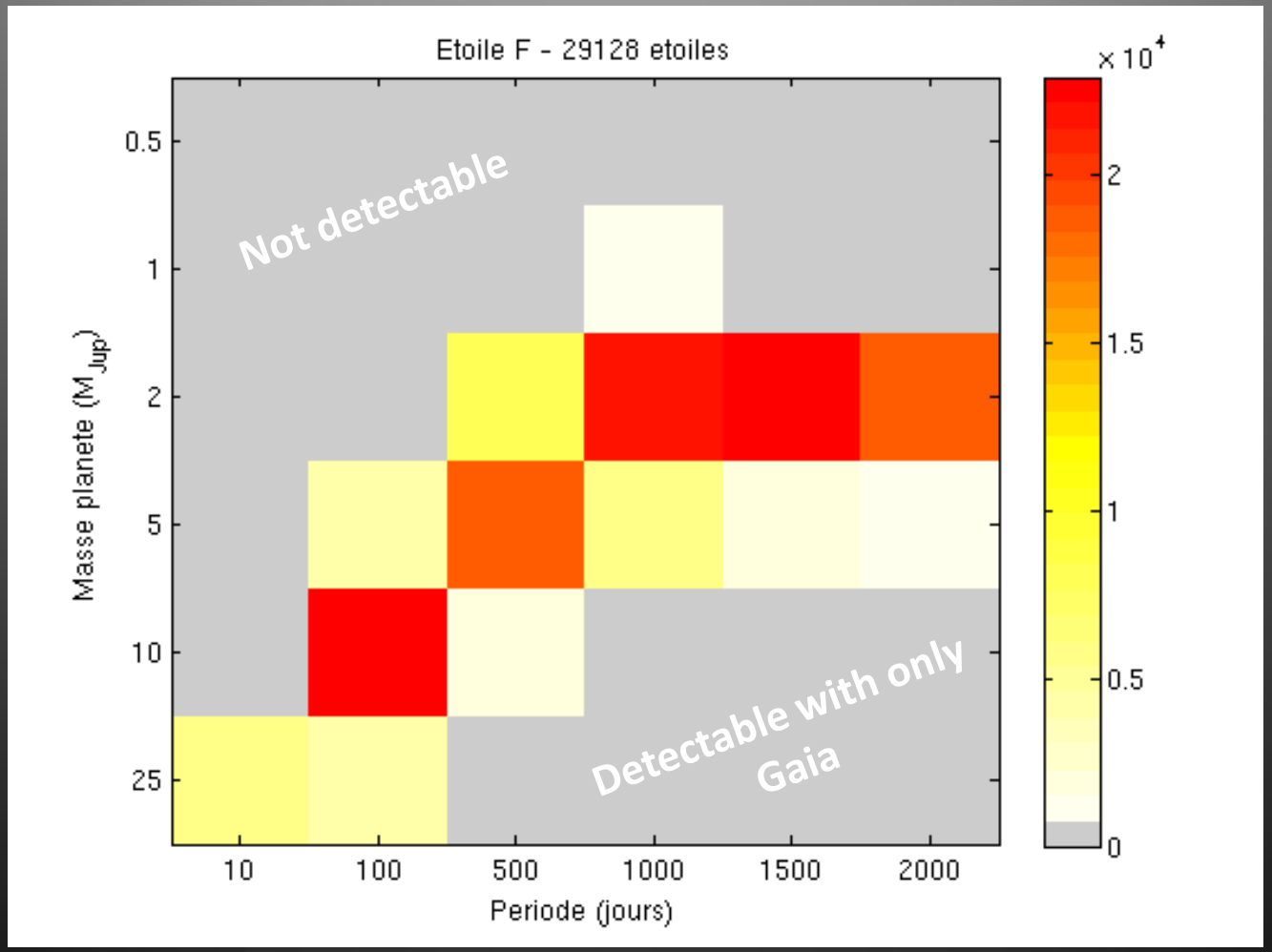


Gaia + Harps : 0.165 M_{Jup}
550 days

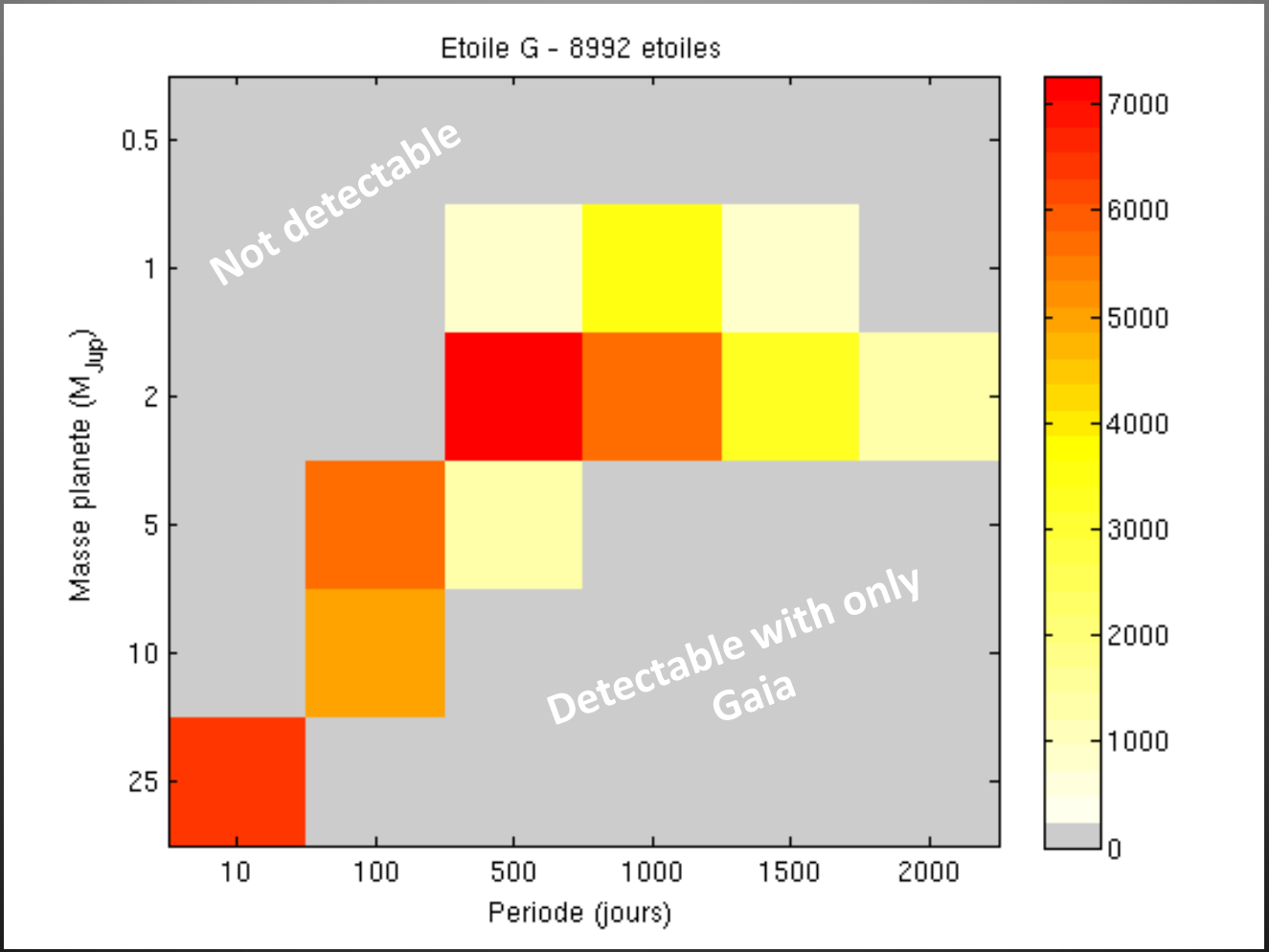
Res 2 : improve the minimum mass detectable



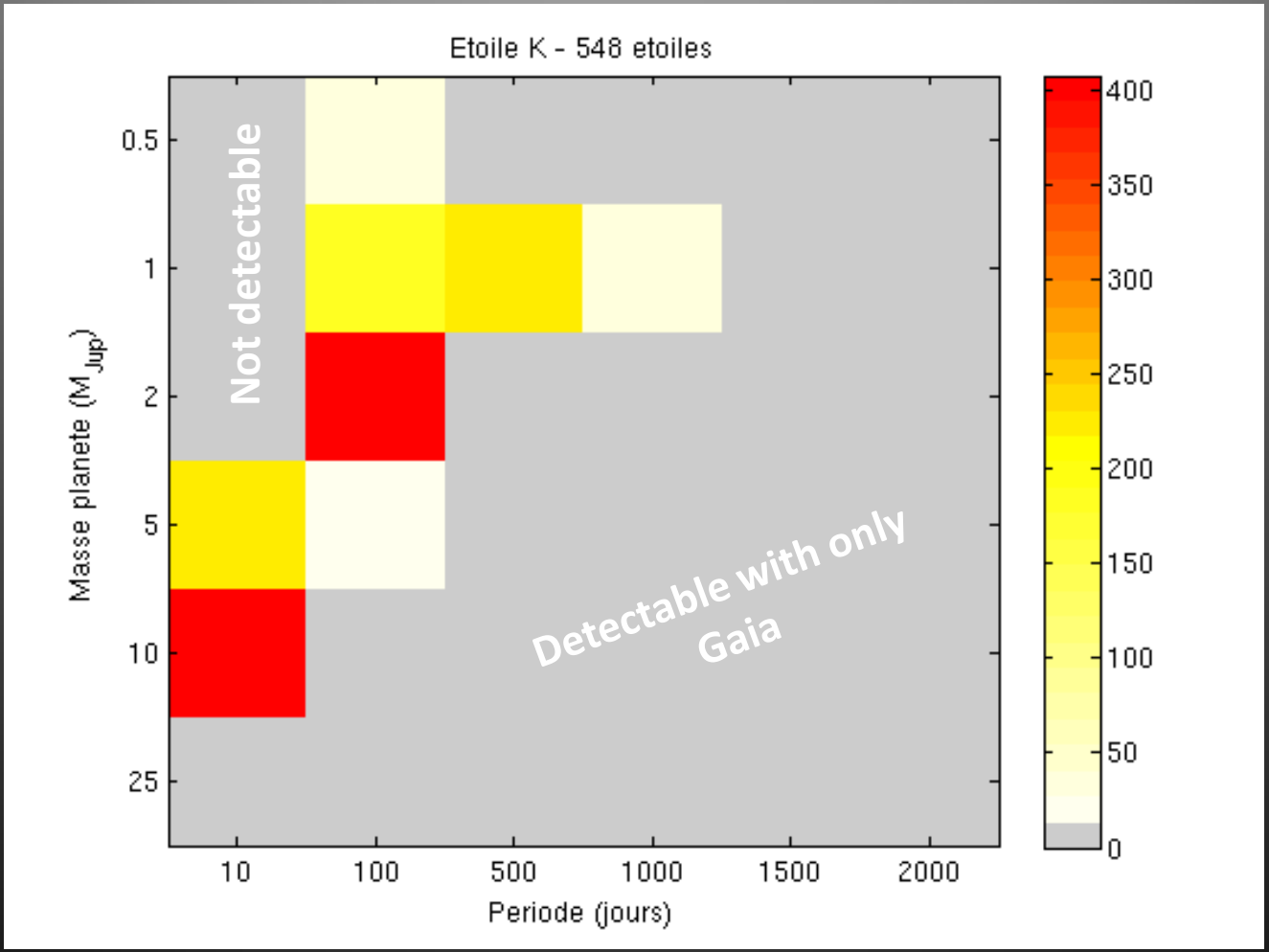
Detectable planets only when combined with Coralie, around F stars with a magnitude <10 - 29128 stars



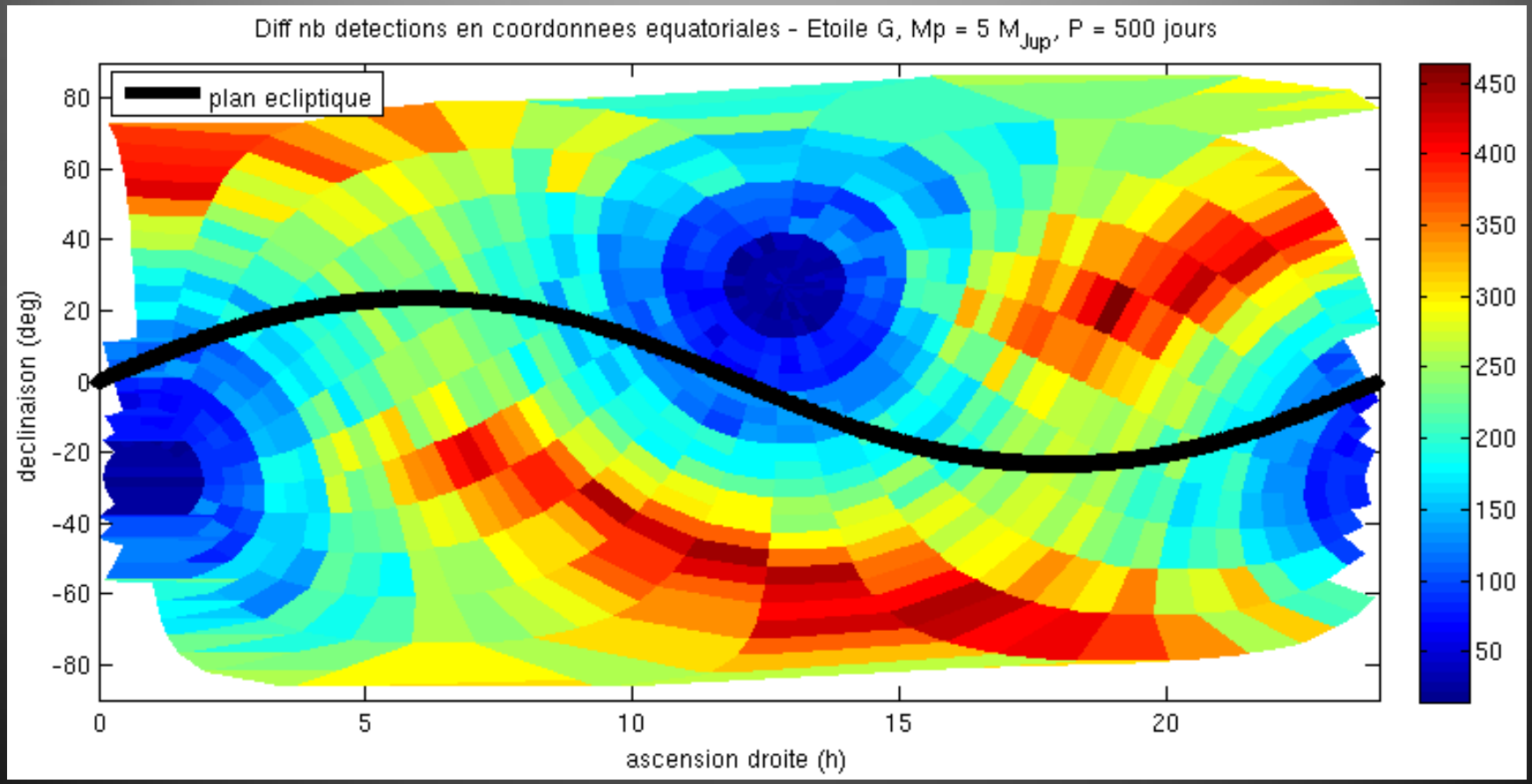
Detectable planets only when combined with Coralie, around G stars with a magnitude <10 – 8992 stars



Detectable planets only when combined with Coralie, around late K stars with a magnitude <10 – 548 stars



Most interesting zones



Equatorial coordinates

Conclusion

- Using high precision spectrometry improves the minimum mass detectable but not enough to detect Neptunes

- For Jupiters of periods between 100 and 1000 days the improvement is significant