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M. Guionie, Marc Brunel, Anthony Carré, Goulc'Hen Loas, Ludovic Frein,
François Bondu, Emmanuel Pinsard, Benoit Cadier, Mehdi Alouini, Marco
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► **To cite this version:**

M. Guionie, Marc Brunel, Anthony Carré, Goulc'Hen Loas, Ludovic Frein, et al.. Phase locking of dual-polarization DFB fiber lasers through pump-power modulation. Journée du Club Optique et Micro-ondes (JCOM 2017), Jul 2017, Limoges, France. hal-01942365

HAL Id: hal-01942365

<https://hal.science/hal-01942365v1>

Submitted on 3 Dec 2018

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Phase locking of dual-polarization DFB fiber lasers through pump-power modulation

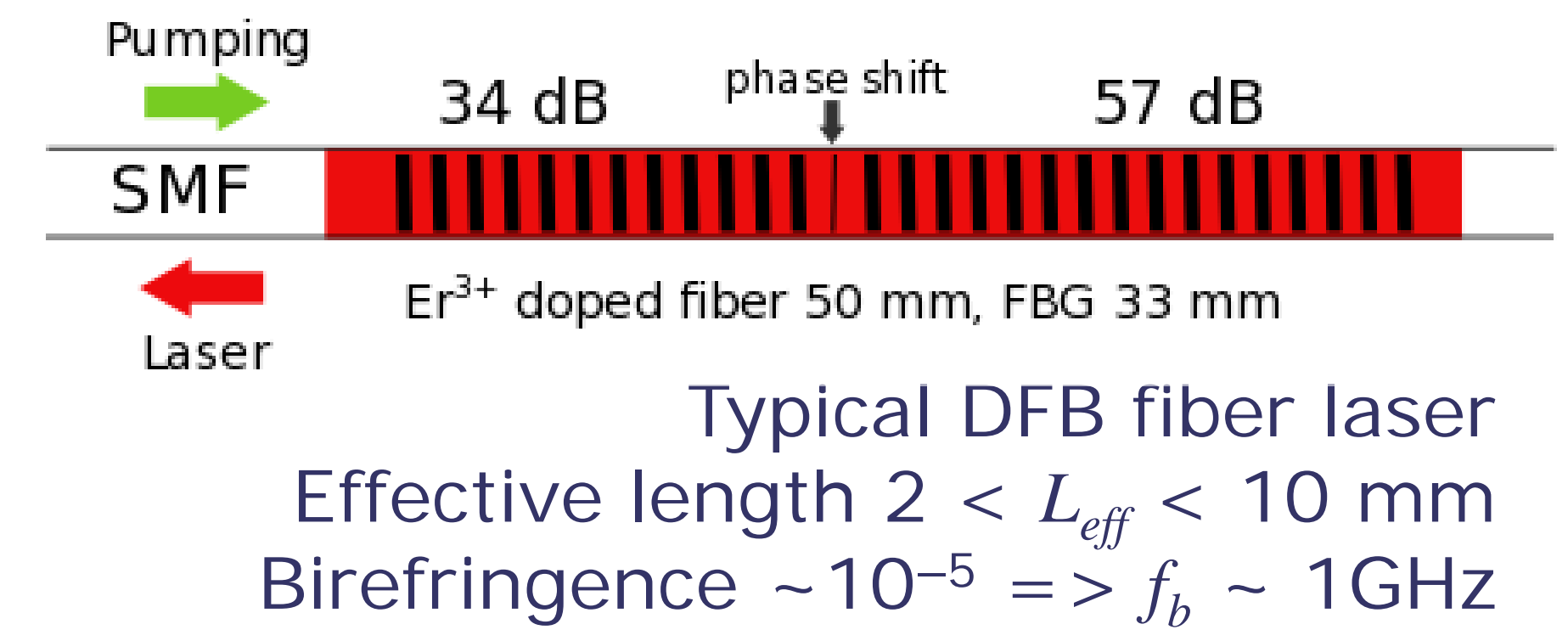
M. Guionie,¹ M. Brunel,¹ A. Carré,¹ G. Loas,¹ L. Frein,¹ F. Bondu,¹
E. Pinsard,² B. Cadier,² M. Alouini,¹ M. Romanelli,¹ and M. Vallet¹

¹Institut FOTON, Université de Rennes 1–CNRS, Rennes ²iXblue Photonics, Lannion

Motivation: DFB fiber laser as a microwave-optical source?

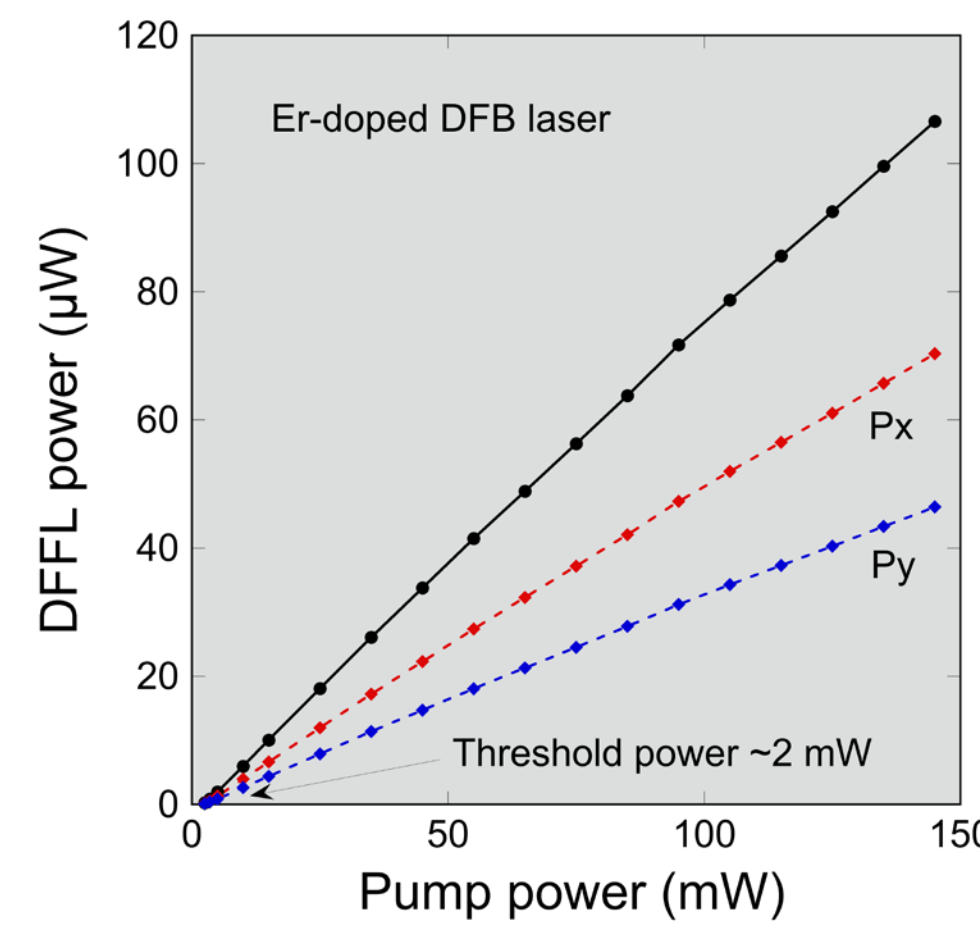
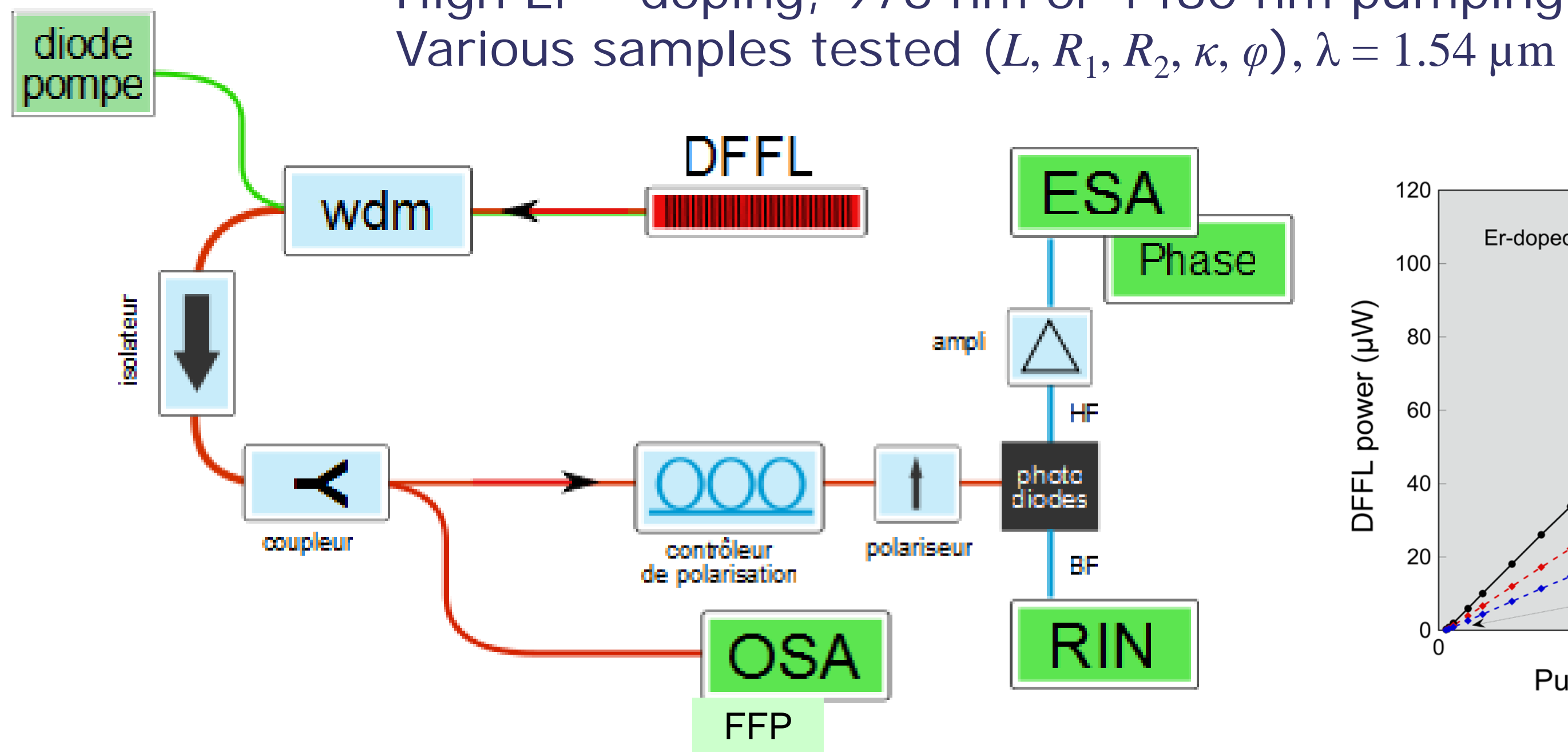
DFB fiber lasers => usually single-frequency, but dual-polarization oscillation possible – Birefringence due to photo-inscription of the FBG
Question: use the beat note for microwave photonics?

Aim: characterization and stabilization of a DFFL, here preliminary work on pump-power beat frequency tuning and locking

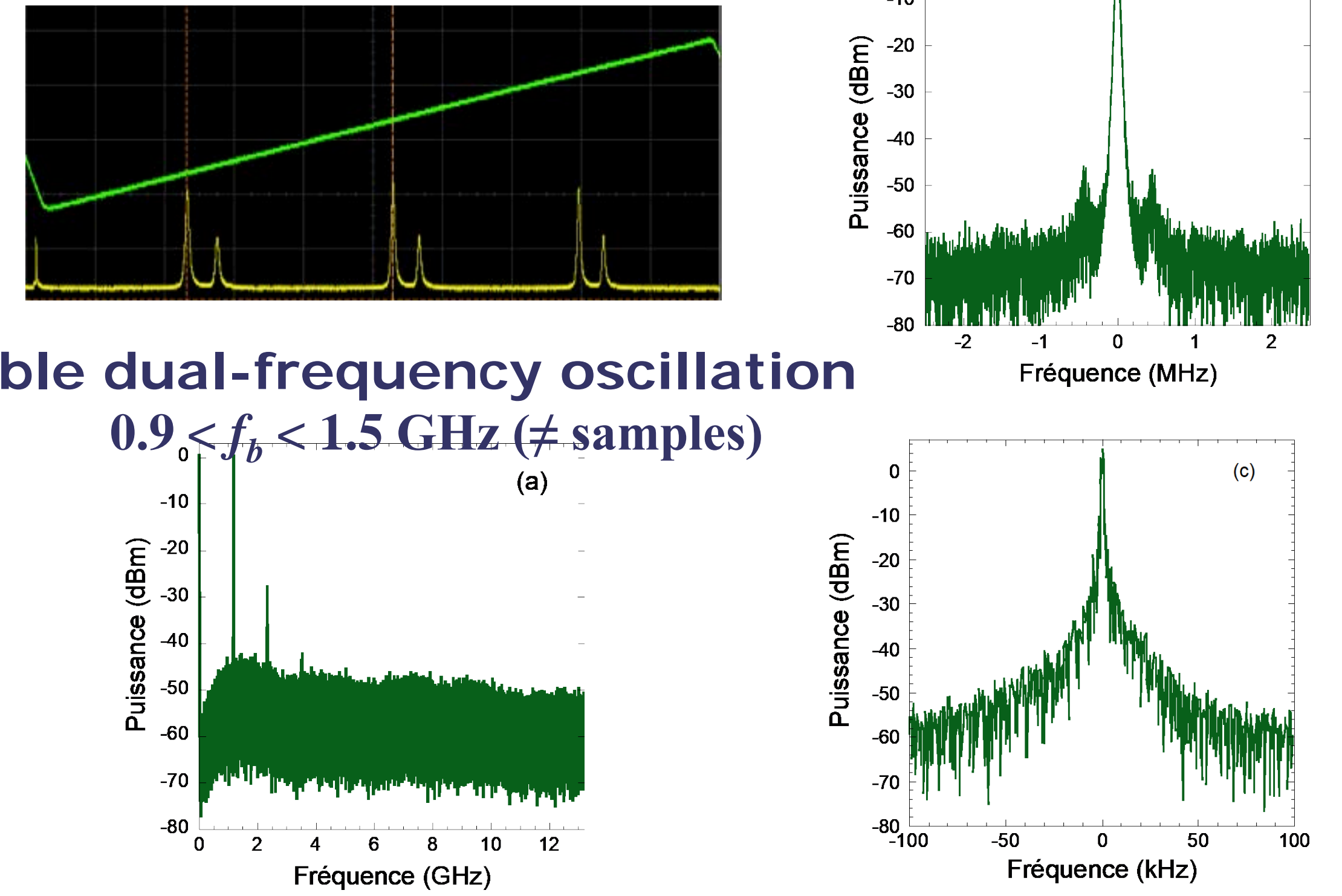


Dual-frequency fiber laser (DFFL) characterization

High Er³⁺ doping, 976 nm or 1480 nm pumping
Various samples tested ($L, R_1, R_2, \kappa, \varphi$), $\lambda = 1.54 \mu\text{m}$

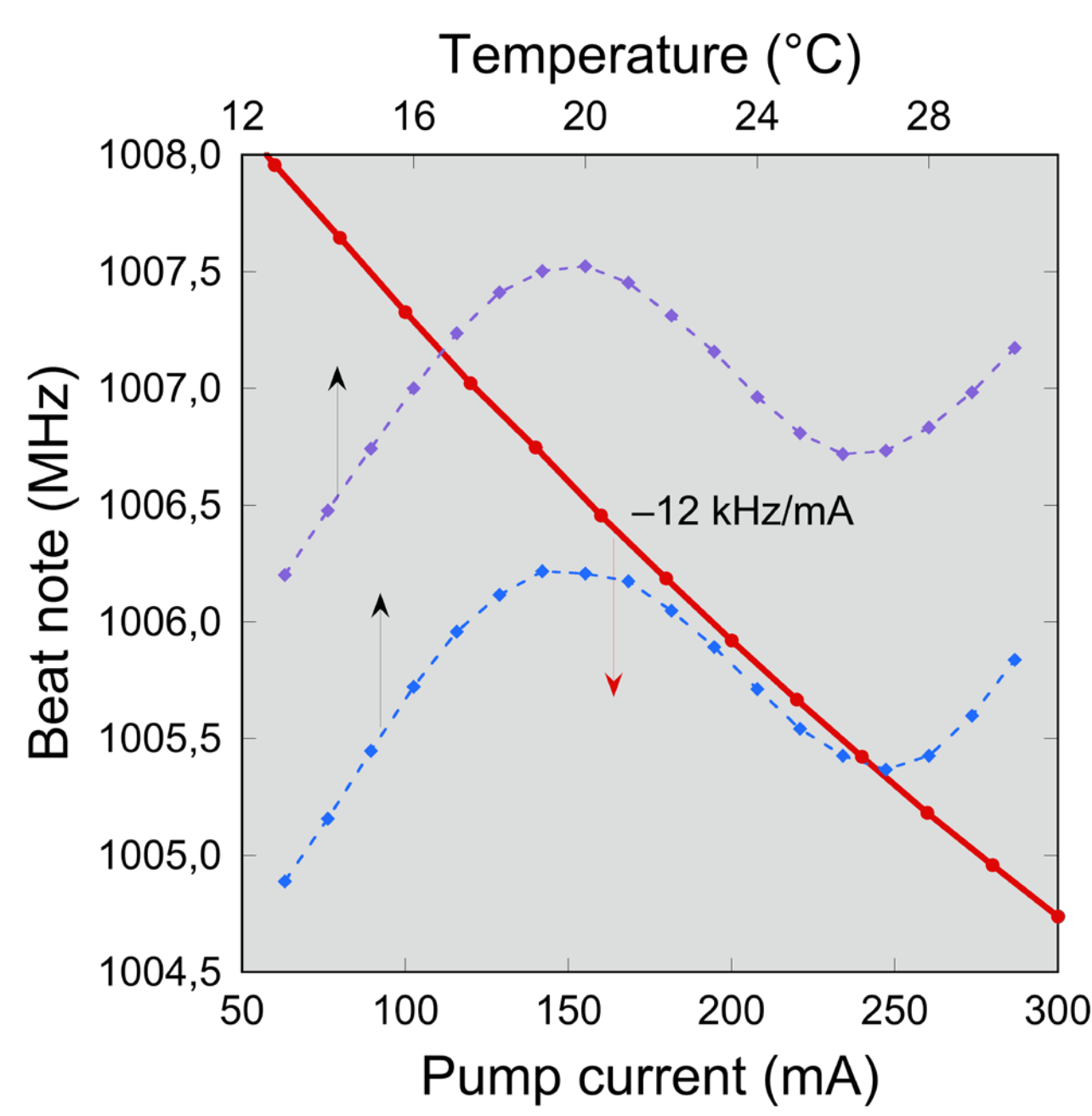


Stable dual-frequency oscillation
 $0.9 < f_b < 1.5$ GHz (\neq samples)



Beat frequency tuning and locking

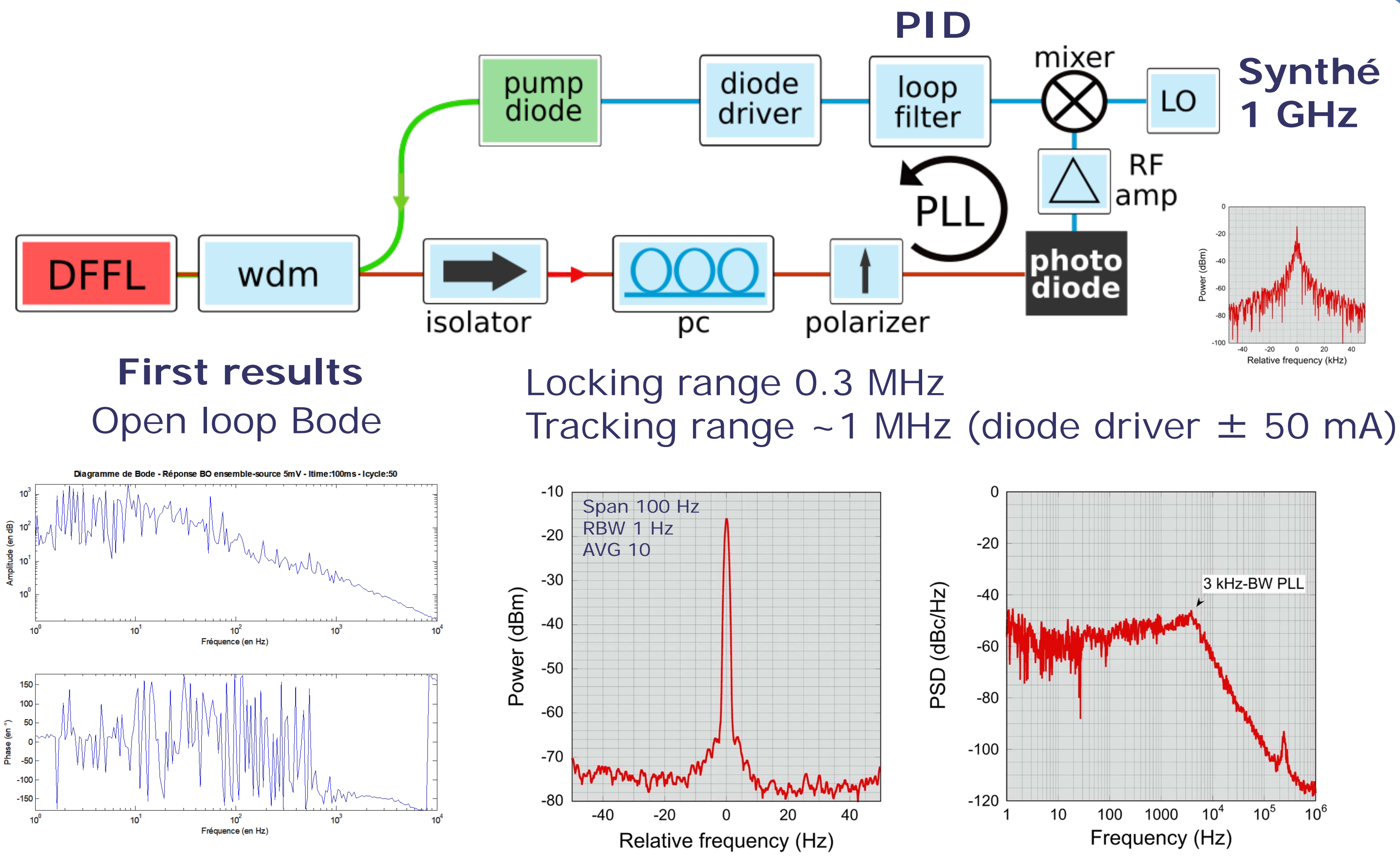
Temperature tuning $\frac{\partial n}{\partial T}$ + Pump power tuning



Independent of outside temp.

VCO actuator (low BW)

=> Needs dual-polarization modelling



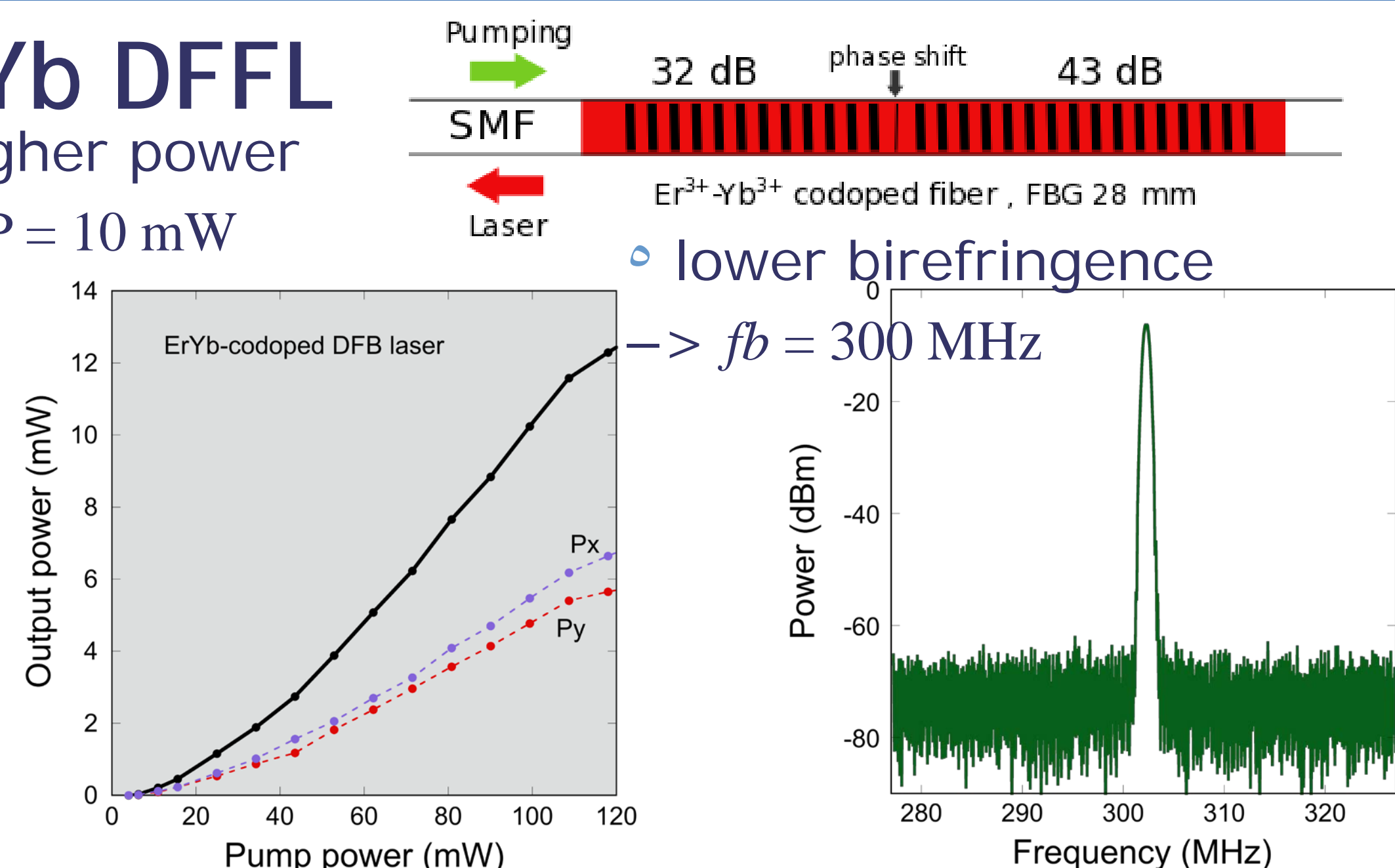
Er-Yb DFFL

higher power

-> P = 10 mW

lower birefringence

-> $f_b = 300$ MHz



Conclusions

- DFFLs characterized experimentally
 - simple phase-locked loop demonstrated for DFFL
 - compensates for slow drifts (< 3 kHz)
- Next...**
- Further loop optimization for phase noise reduction
 - Dual-polarization laser simulation
 - Study DBR architecture
 - PZT actuator for higher beat notes (10 GHz range)

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