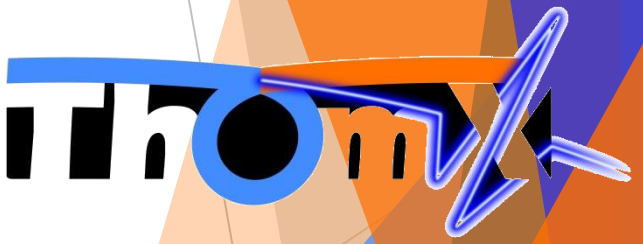
Fabry-Perot cavity



Pierre Favier

Laboratoire de l'Accélérateur Linéaire

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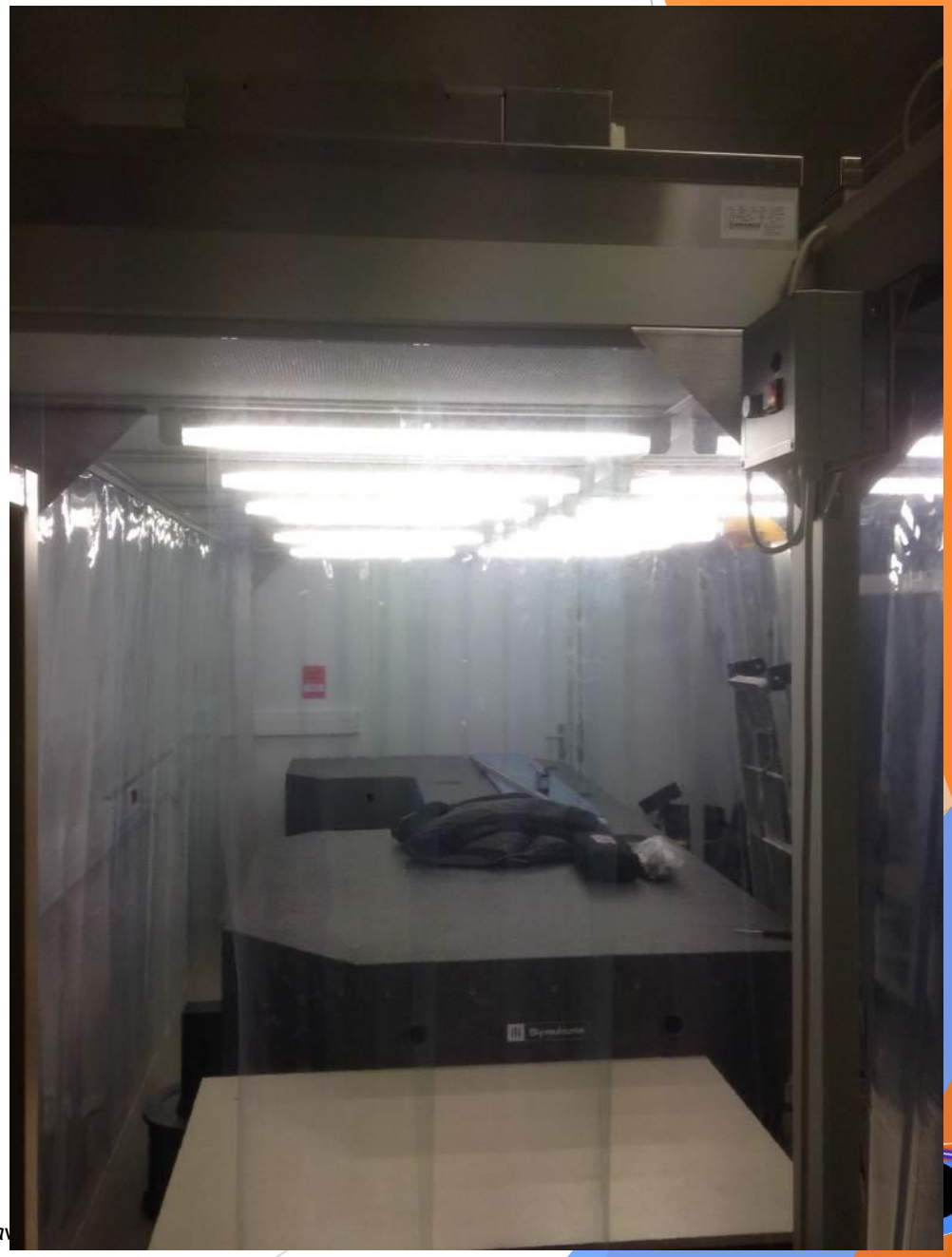
Optical table

Flux



Vacuum chamber + ionic pumps

Tube + soufflets + vannes

ThomX mirrors received

- Input mirror: Saphir
- Other substrates in ULE (Ultra Low Expansion glass)
  - Deformation : 55x less than silice
  - Already demonstrated

Megawatt-scale average-power ultrashort pulses in an enhancement cavity

H. Carstens,[1,2,*] N. Lilienfein,[1,2] S. Holzberger,[1,2] C. Jocher,[3] T. Eidam,[3] J. Limpert,[3] A. Tünnermann,[3] J. Weitenberg,[4] D. C. Yost,[1] A. Alghamdi,[5] Z. Alahmed,[5] A. Azzeer,[5] A. Apolonski,[1,2] E. Fill,[1,2] F. Krausz,[1,2] and I. Pupeza[1,2]

[1]*Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, 85748 Garching, Germany*

March 26, 2014

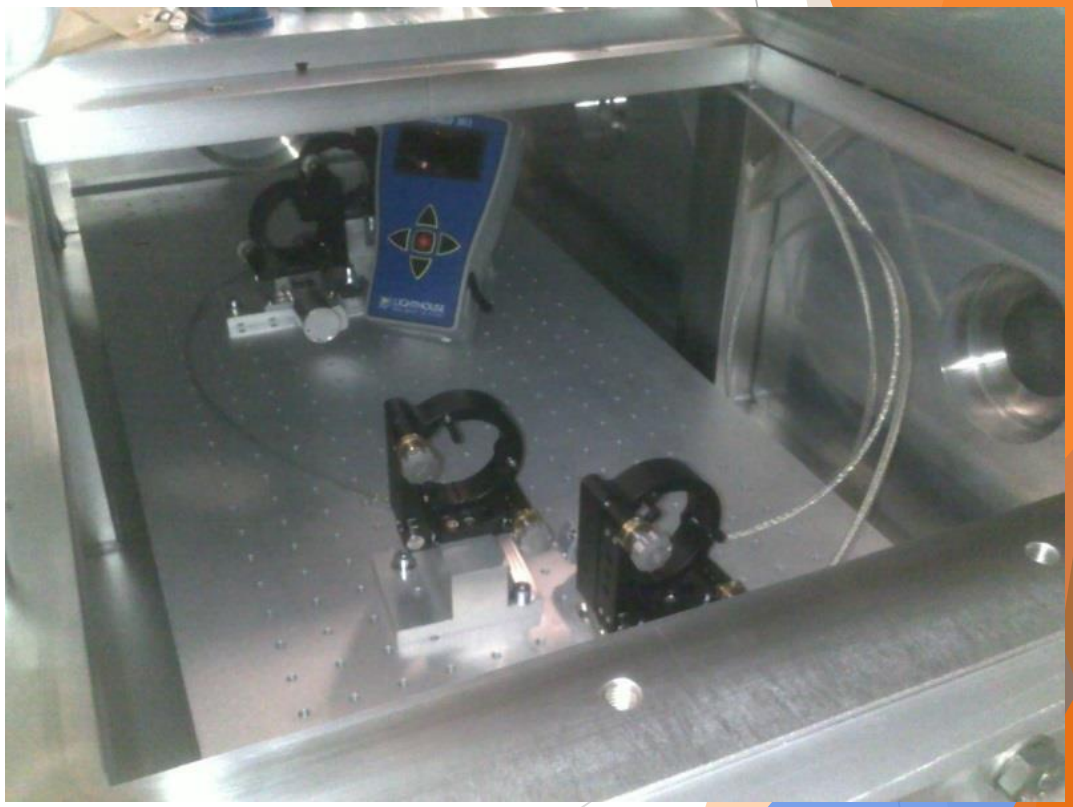
- Coating from LMA (Lyon)
  - Theoretical finesse ~ 42000
  - Theoretical gain ~ 22000
  - Theoretical band-width ~ 800 Hz

Prototype for ThomX

Airlock

Clean room. Laminar flux ISO 4

Prototype for ThomX



Mirror changing protocol

- Clean room, full suit, powderfree gloves
- Ionising gun
- Slow movements to limit air flow

- Injection mirror changed 3 times in 2 weeks
- Finesse measurements always in agreement with theoretical value
- Good repeatability

- About ½ day to replace and realign

Laser oscillator

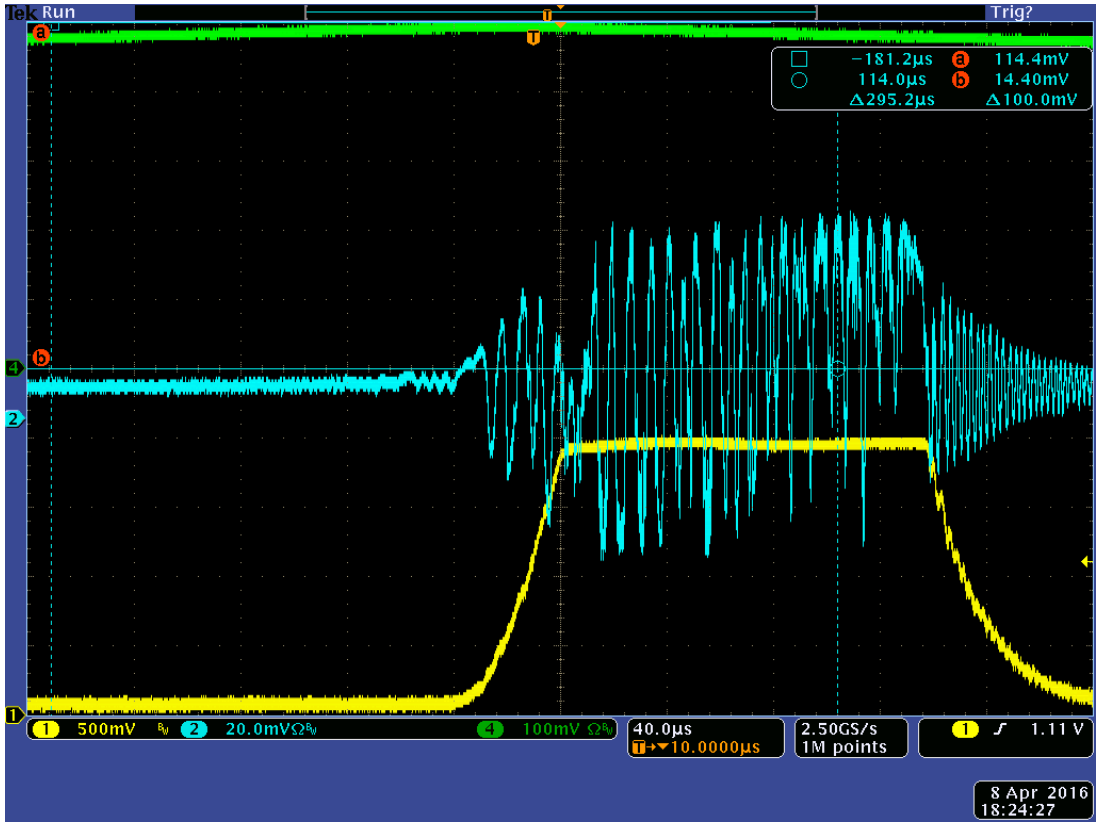
- Two OneFive oscillators (serial + spare).
- Ordered for ThomX -> June/July

- Spare oscillator received
- Used on prototype
  - For high power test
  - Check certifications for ThomX's oscillator

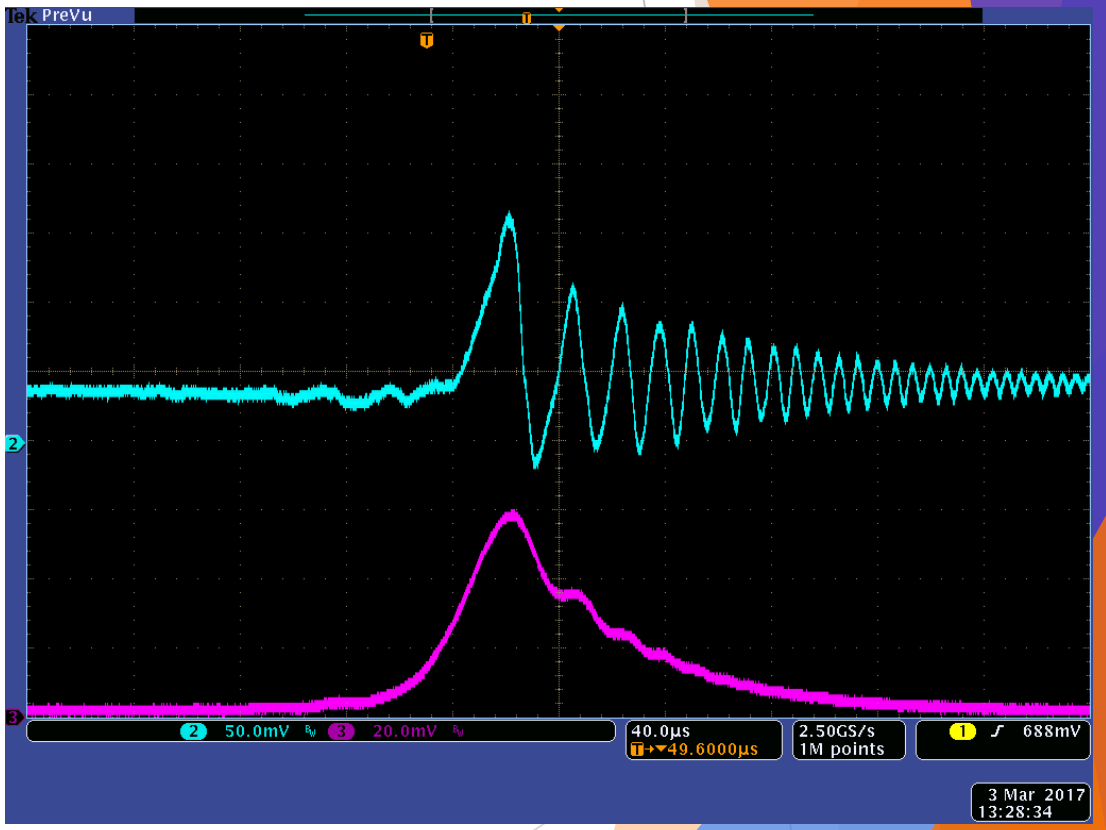
  - Phase noise below our reference (CW laser)
  - Good CEP stability
  - Lock only with the PZT (fast loop not needed)

Error signal (PDH)

MENLO

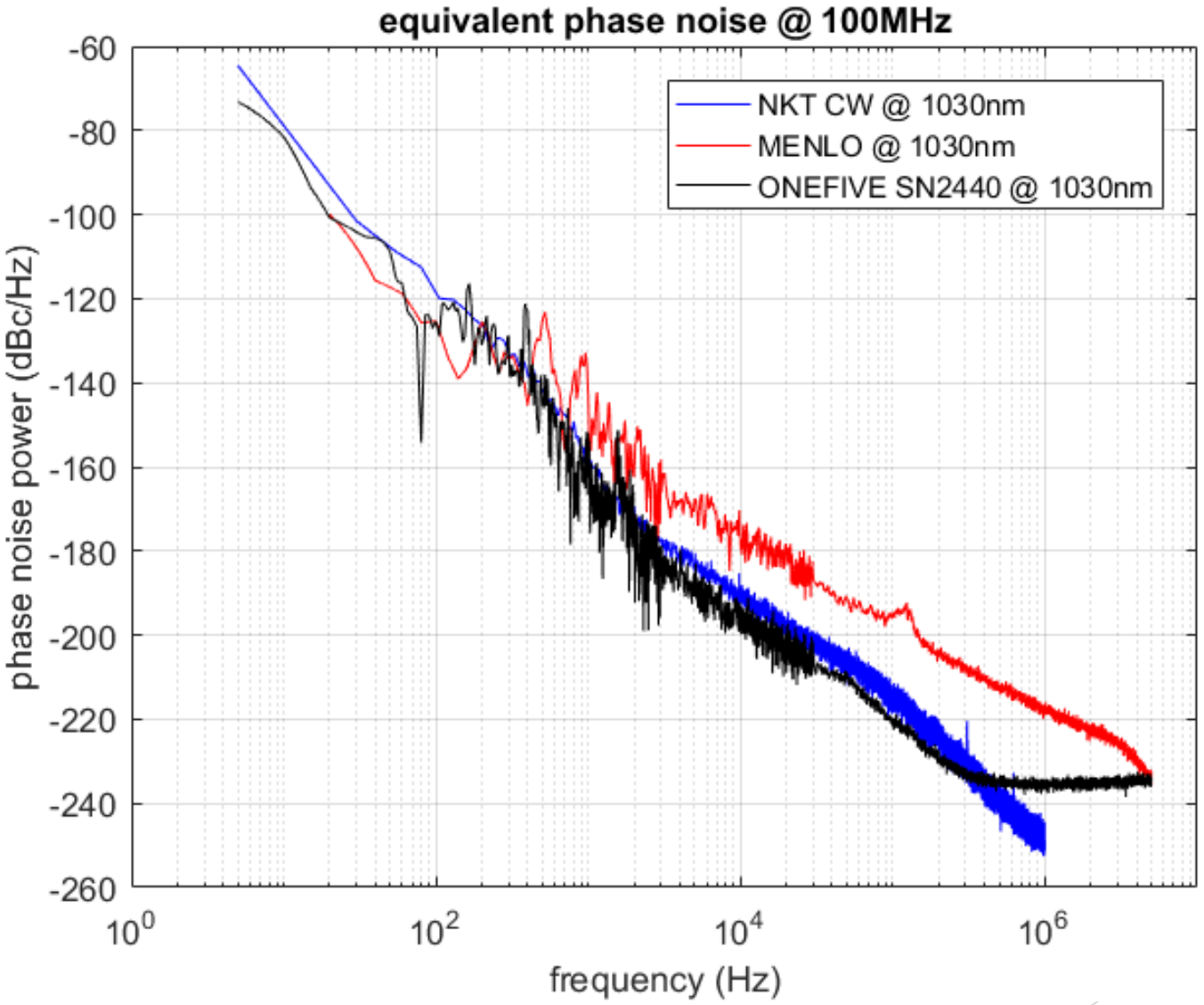


OneFive



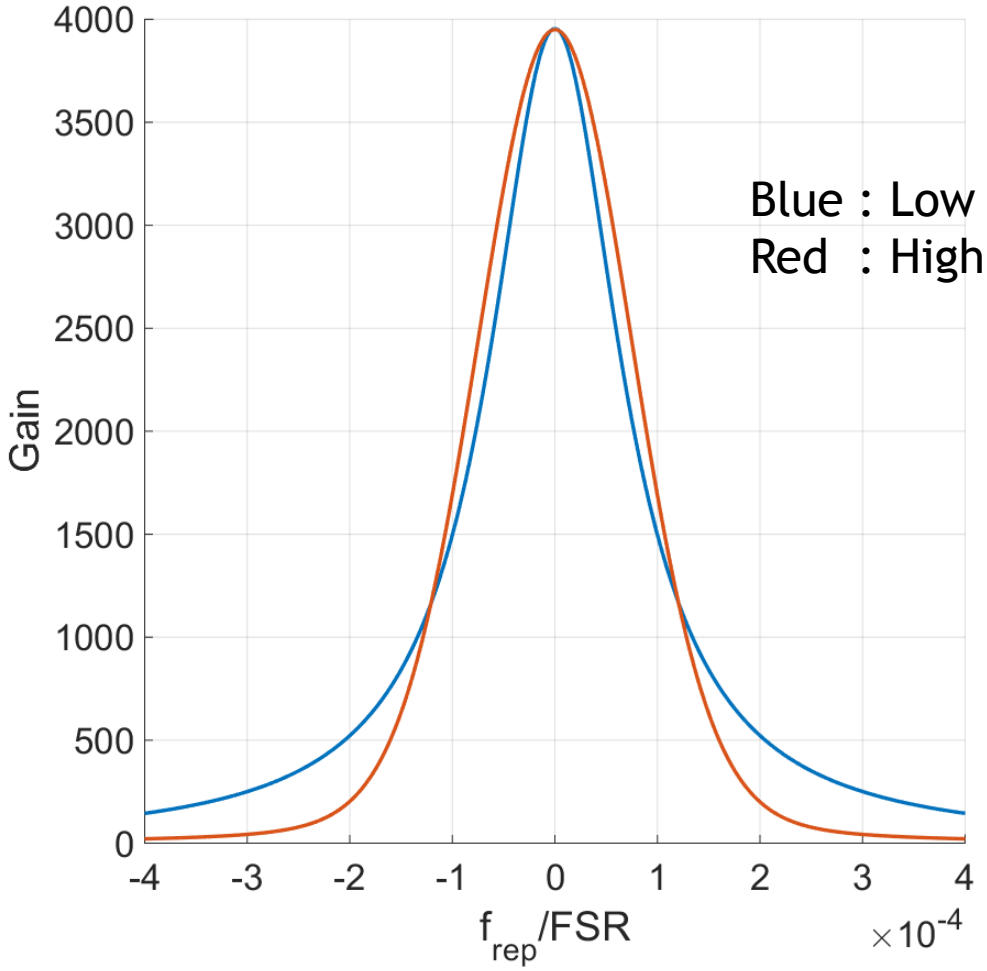
Cavity bandwidth: 5 kHz → ThomX cavity: 0,8 kHz

Phase noise


equivalent phase noise @ 100MHz
NKT CW @ 1030nm
MENLO @ 1030nm
ONEFIVE SN2440 @ 1030nm
phase noise power (dBc/Hz)
-60
-80
-100
-120
-140
-160
-180
-200
-220
-240
-260
10^0
10^2
10^4
10^6
frequency (Hz)

Increase the bandwidth

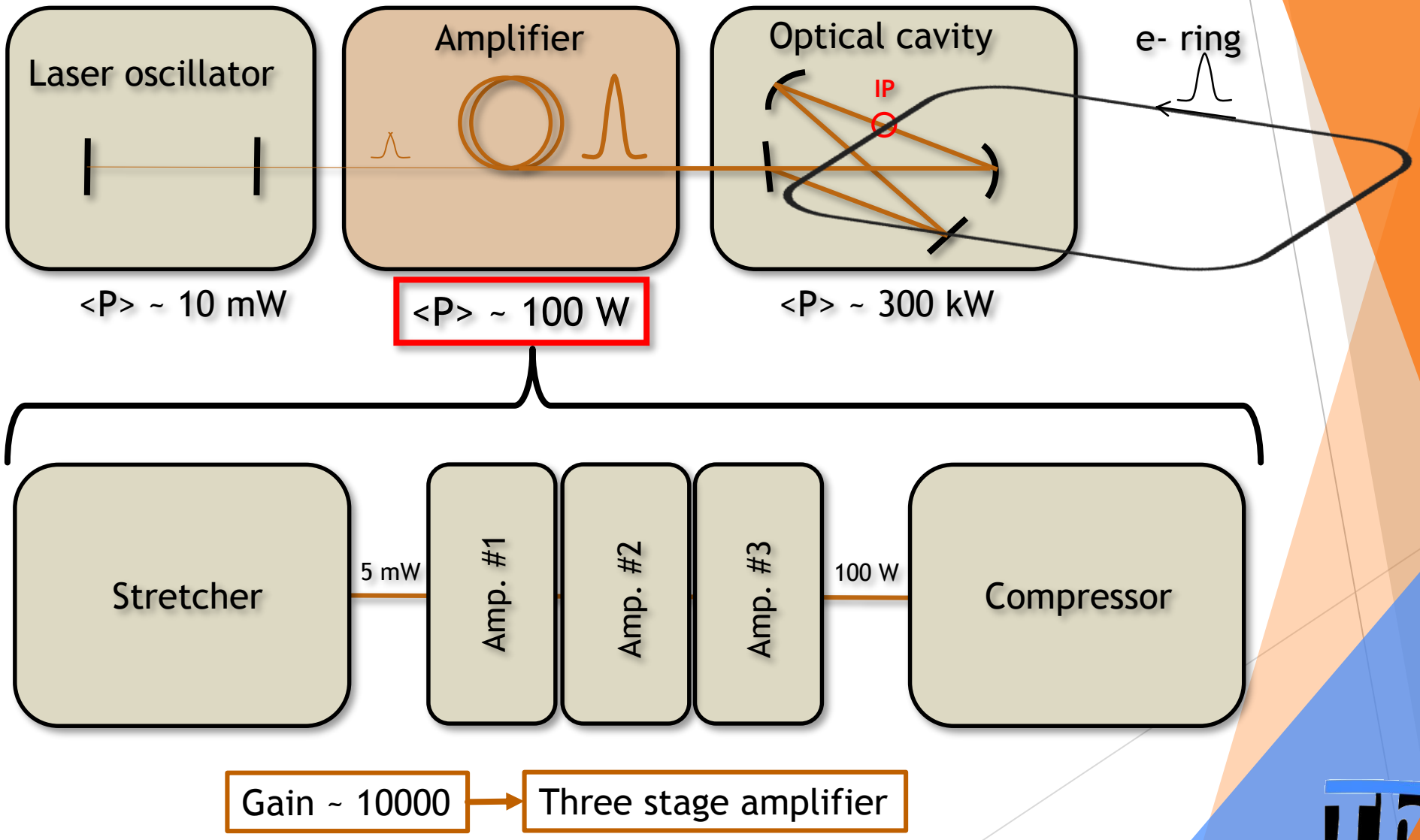
- Analytical calculations
  - High finesse « degraded » > Low finesse
  - Same gain but larger bandwidth



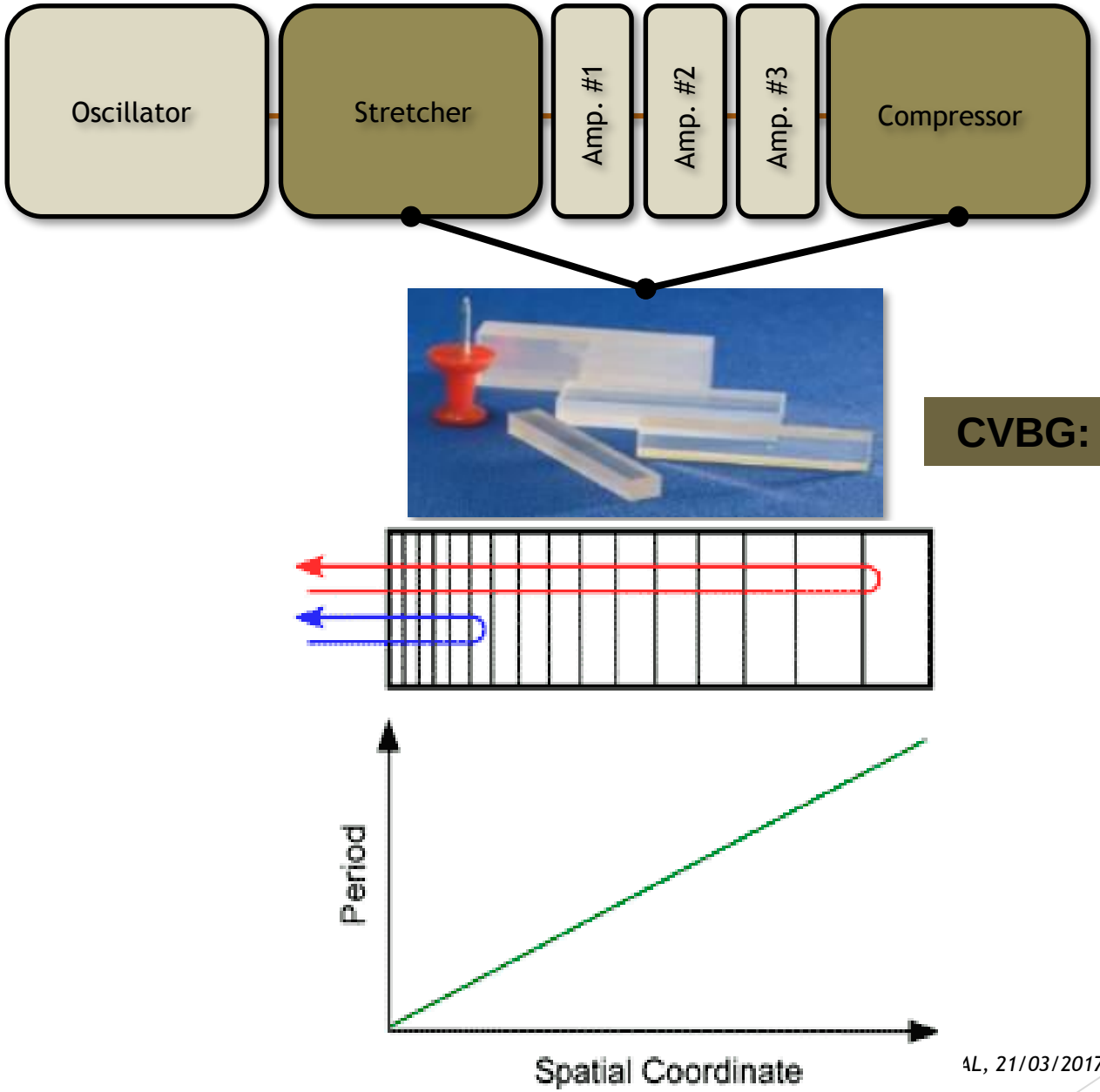
Blue : Low finesse
Red : High finesse « degraded »

Degradation → Change CEP

Fiber amplifier. CELIA



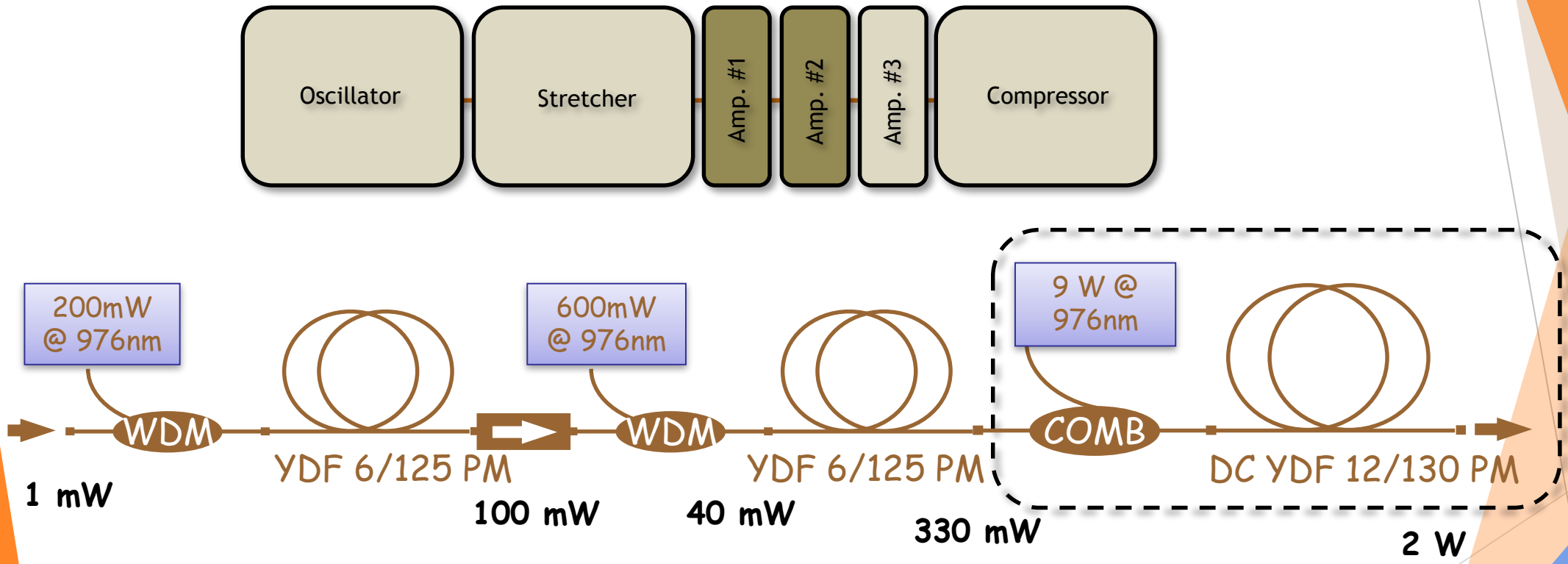
Fiber amplifier: design



CVBG: Chirped Volume Bragg Grating

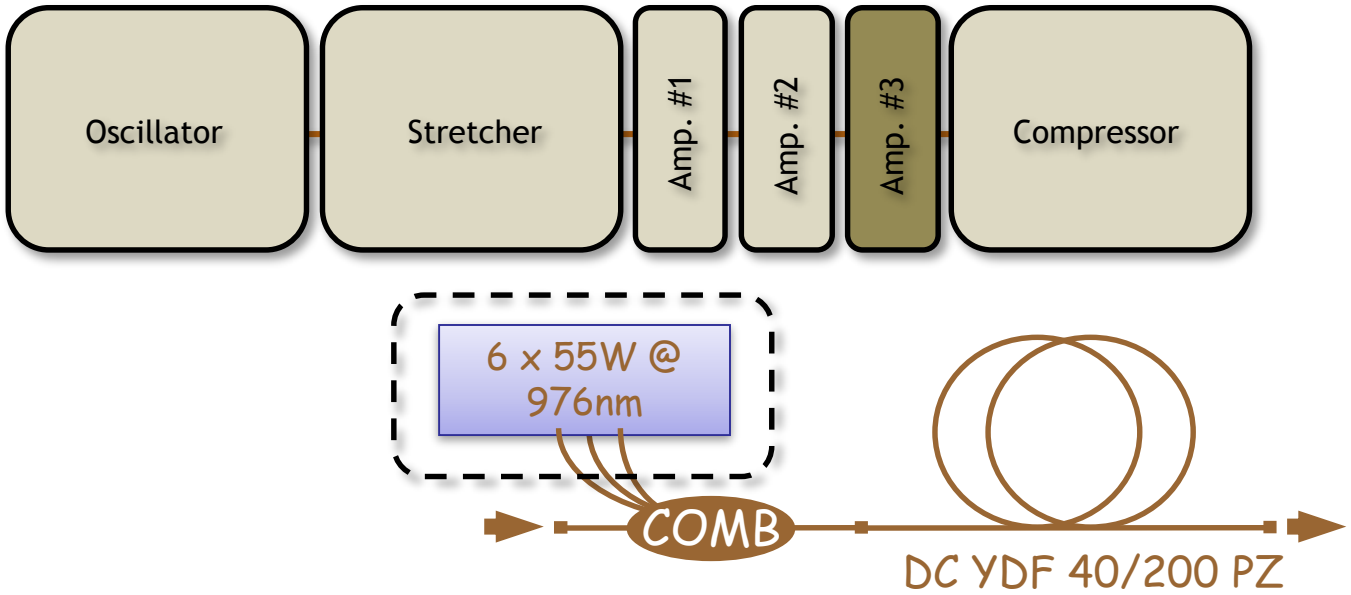
Fiber amplifier: design

- Preamp

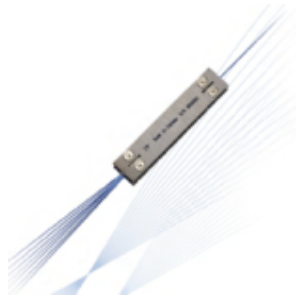


Fiber amplifier: design

- Ampli principal. **6x 55 W**



Pump module



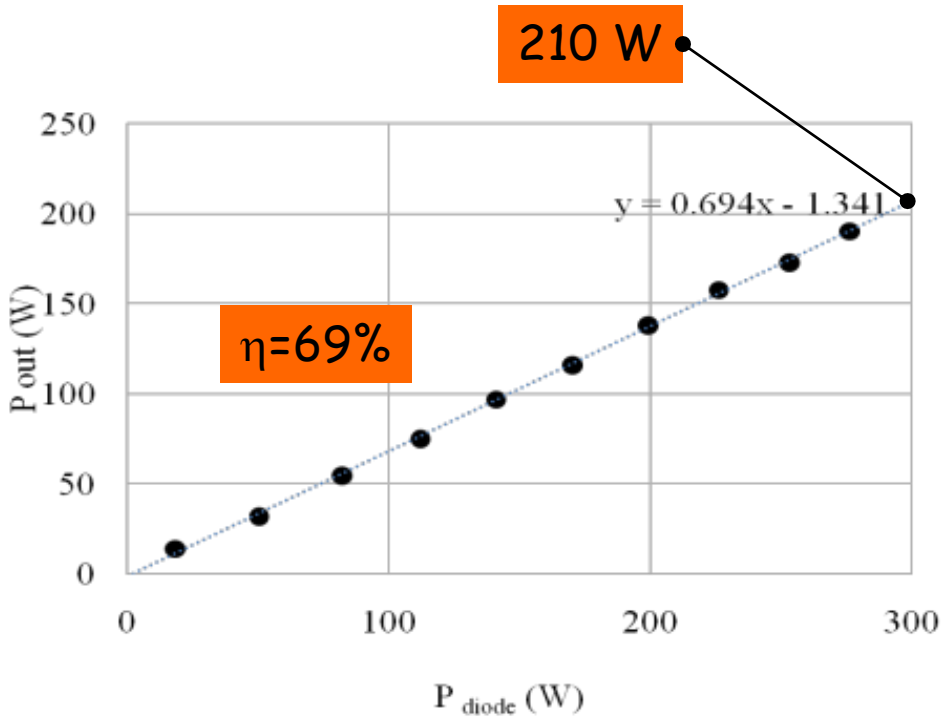
Combiner 6+1 to 1

NKT Photonics the power of light

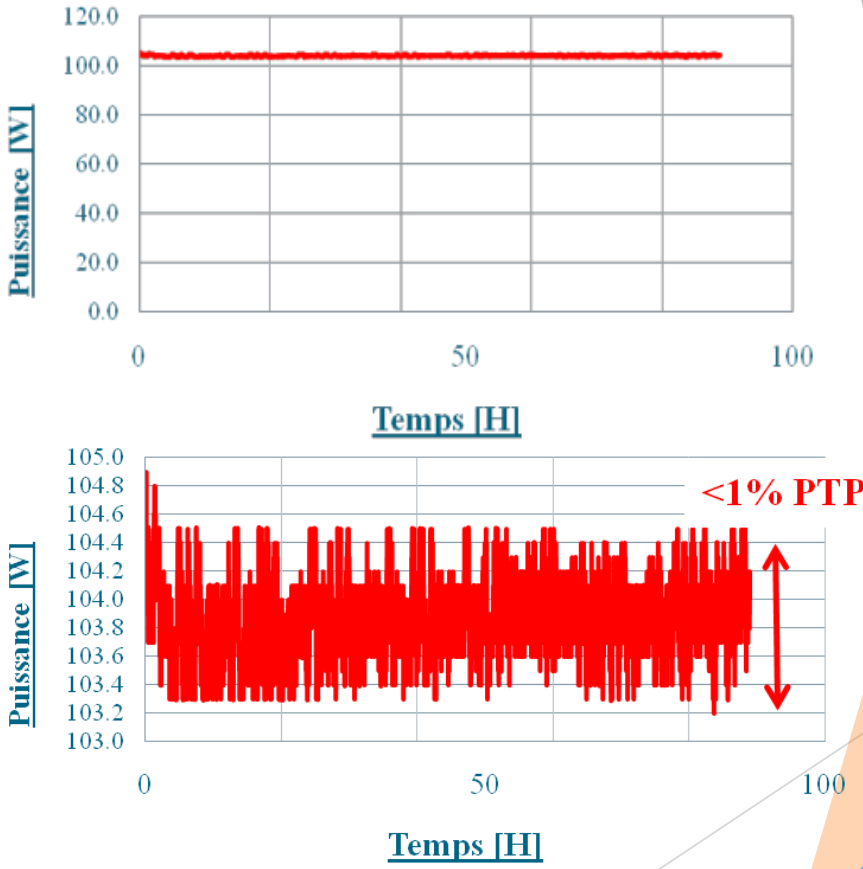
Yb-doped DC fiber 40/200 PZ

Fiber amplifier: results

Max power: 210 W

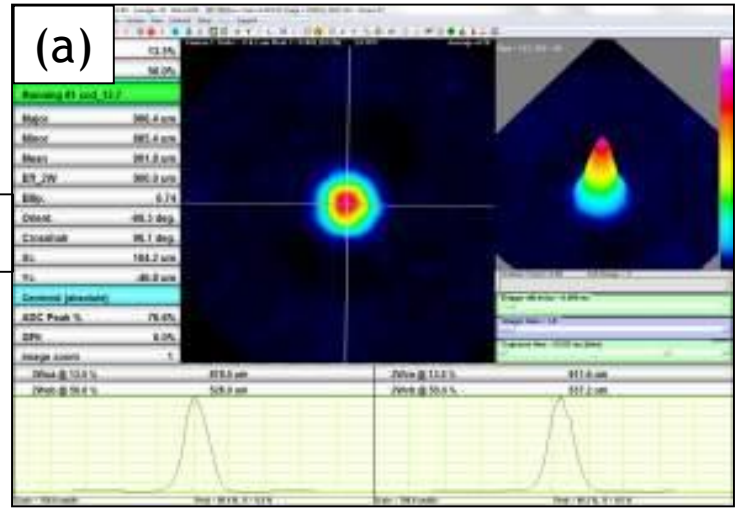


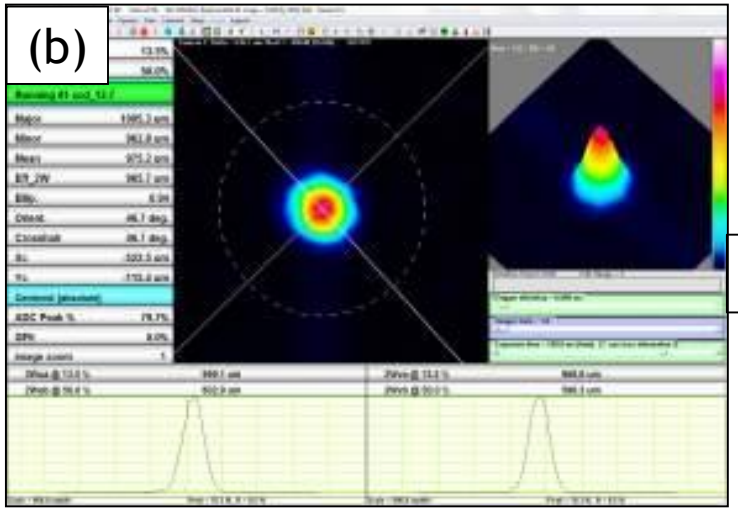
Stability over 90h @ 104 W :



Fiber amplifier: beam quality

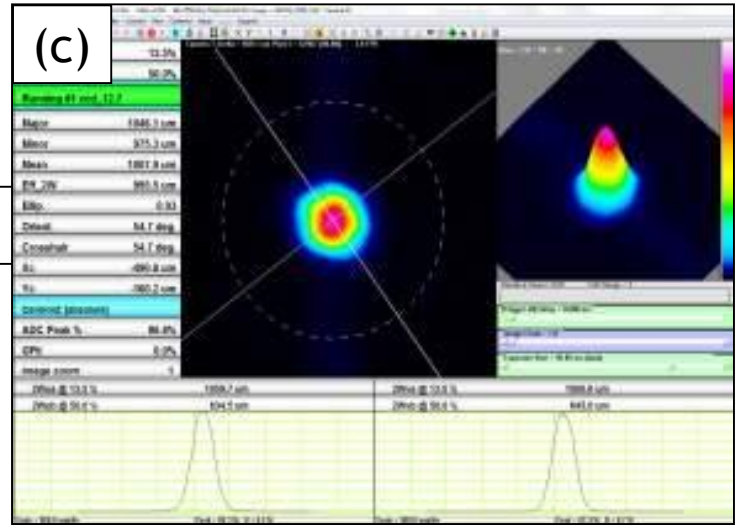
0A/4W

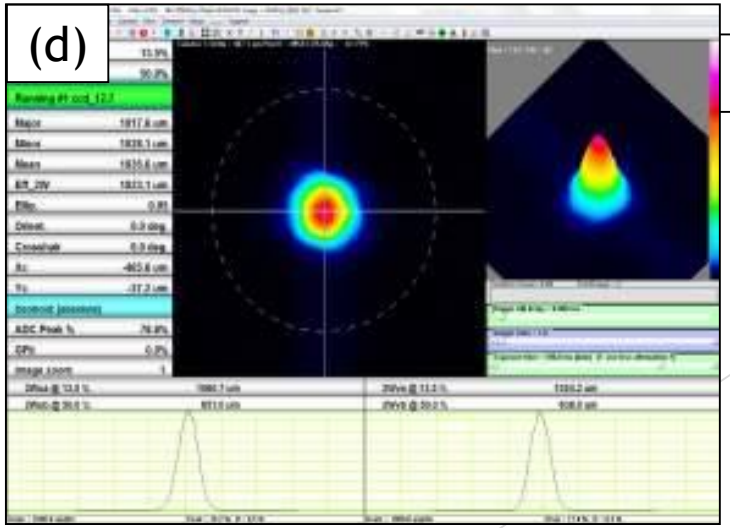




5A/97W

8A/158W





11A/200W

Conclusions et prospects

- Spare oscillator of excellent quality
  - Fiber amplifier of Mightylaser being repaired (35 W)
  - High power tests on cavity should start this week
- Serial oscillator ordered
- Amplifier in the last stage of conception
- Mirors received (installation in prototype in April)
- Clean room OK
- Optical table, mechanics, vacuum, finishing
- First alignement ~ April with CW oscillator
- May-June: High power in ThomX cavity

Cassou, Chiche, Cormier, Douillet, Favier, Jehanno, Lhermite, Liu, Martens, Peynaud, Plaige, Rusquart, Soskov, Trochet, Zomer.