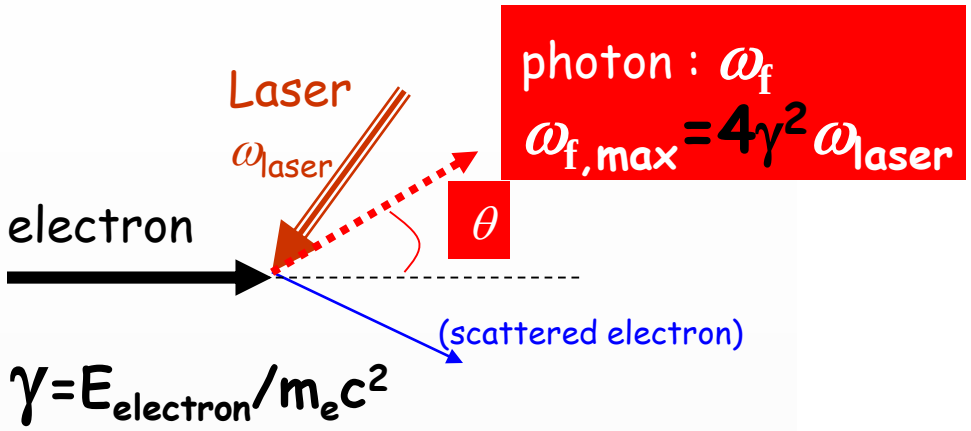
Fabry-Perot Cavity R&D at Orsay

Xing Liu

Laboratoire de l'Accélérateur Linéaire



photon : ω_f

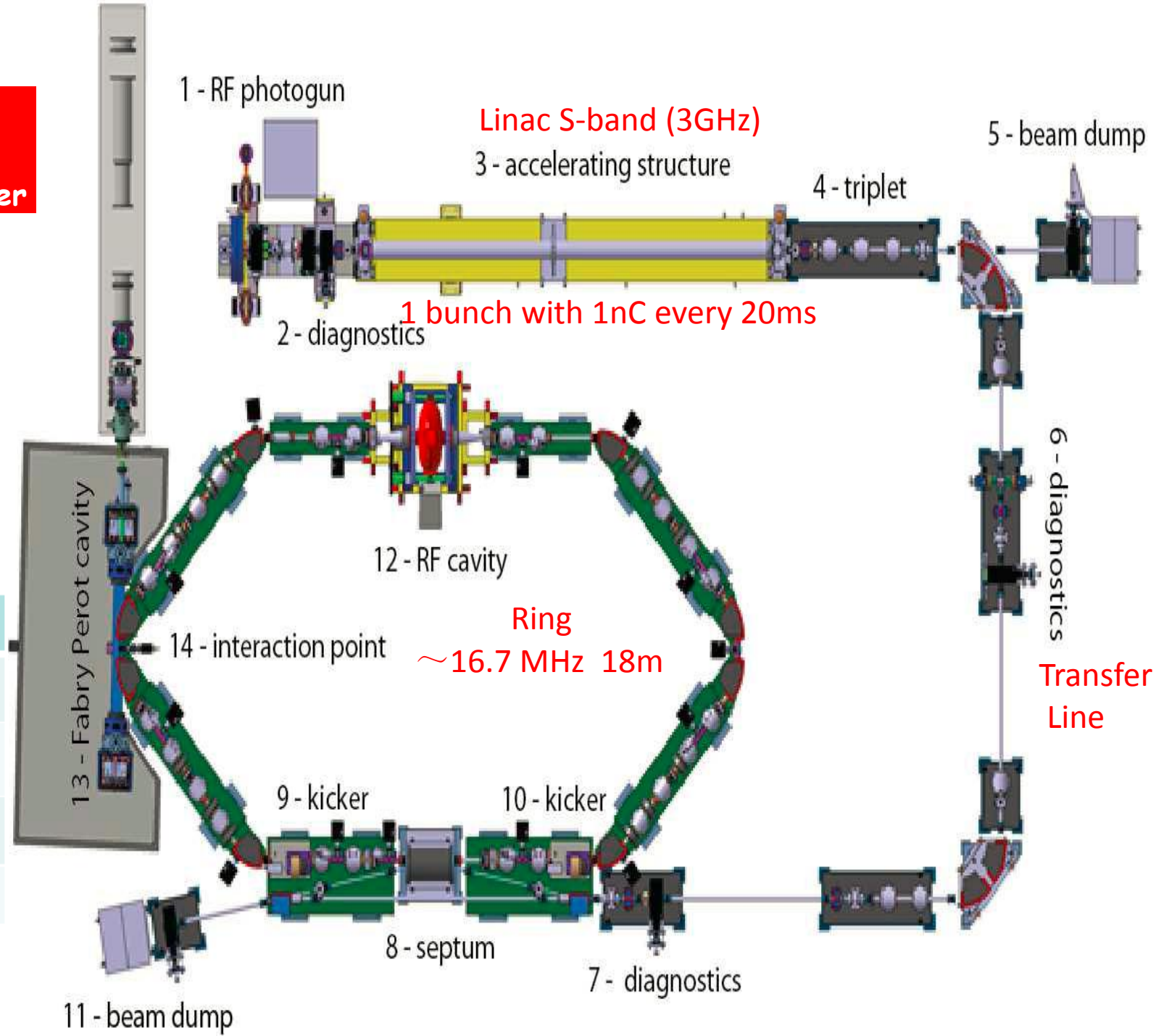
$\omega_{f,max} = 4\gamma^2 \omega_{laser}$

$\gamma = E_{electron}/m_e c^2$

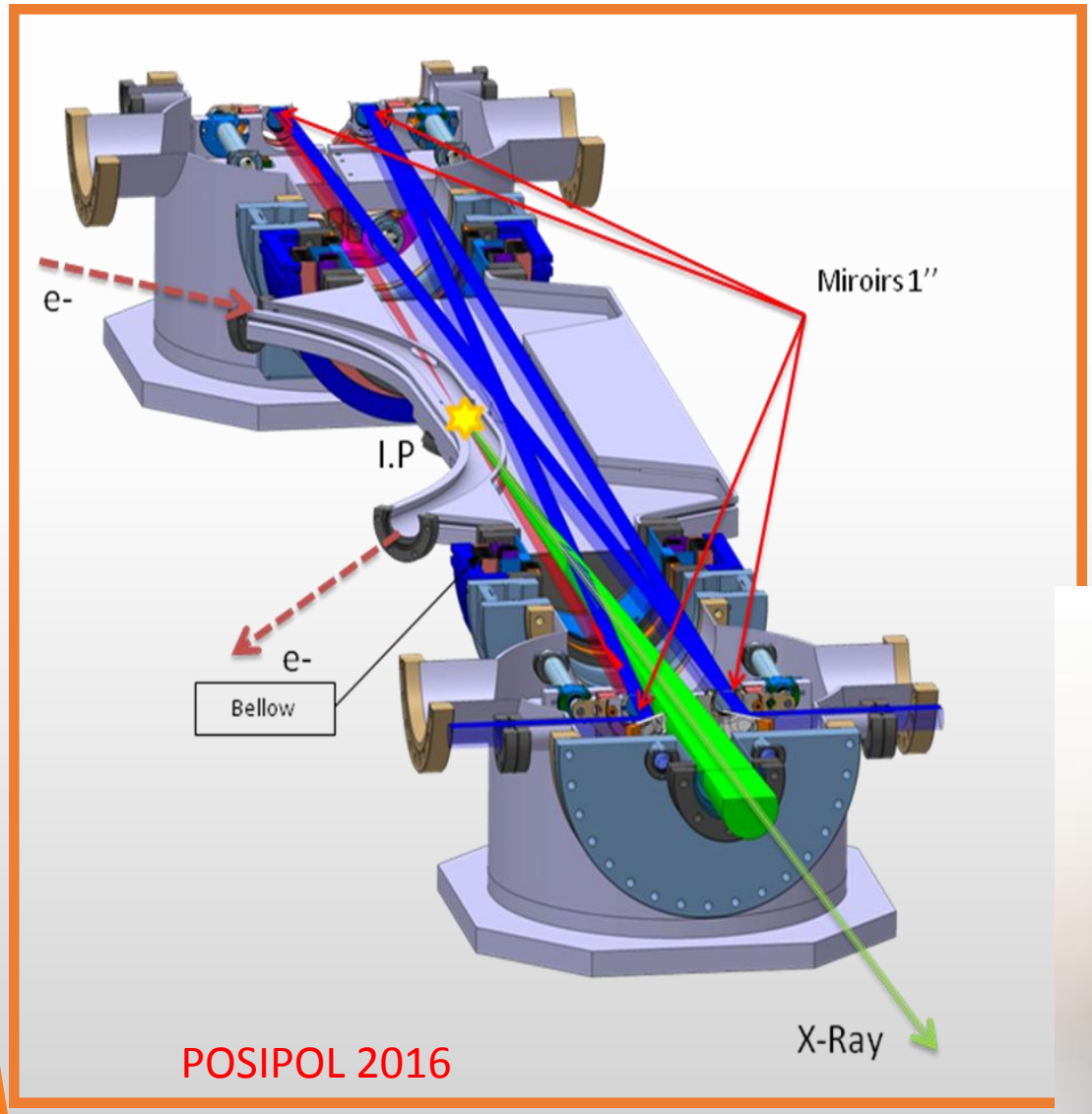
Compton scattering

Photon_laser + e → photon + e'

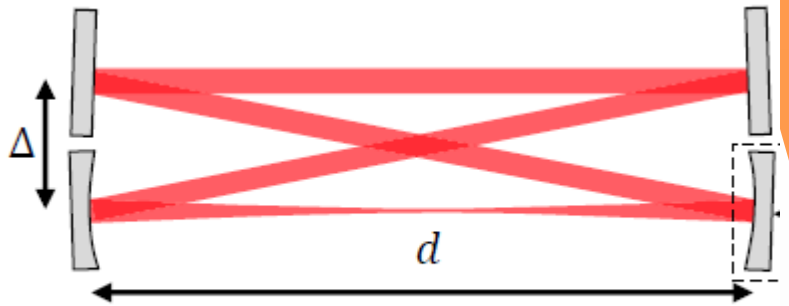
Source	
Photon energy cut-off	46 keV (@50 MeV), 90 keV (@ 70 MeV)
Total Flux	10^{11}-10^{13} photon/s
Bandwidth (with diaphragm)	1 % - 10%
Divergence	10 mrad (1/γ) without diaphragm @ 50 MeV



Optical cavity



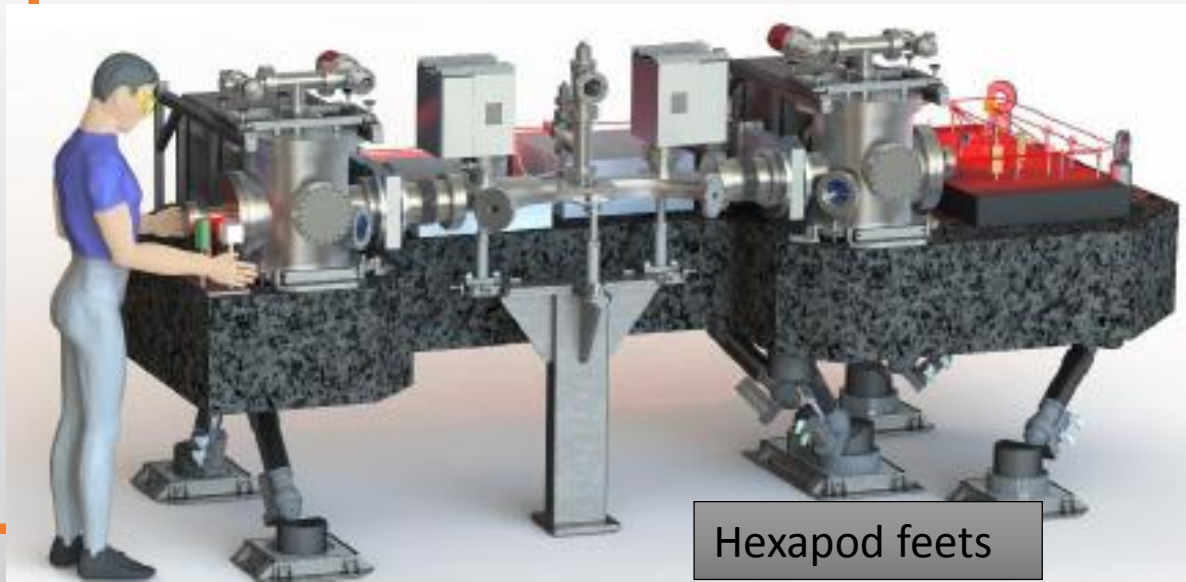
POSIPOL 2016



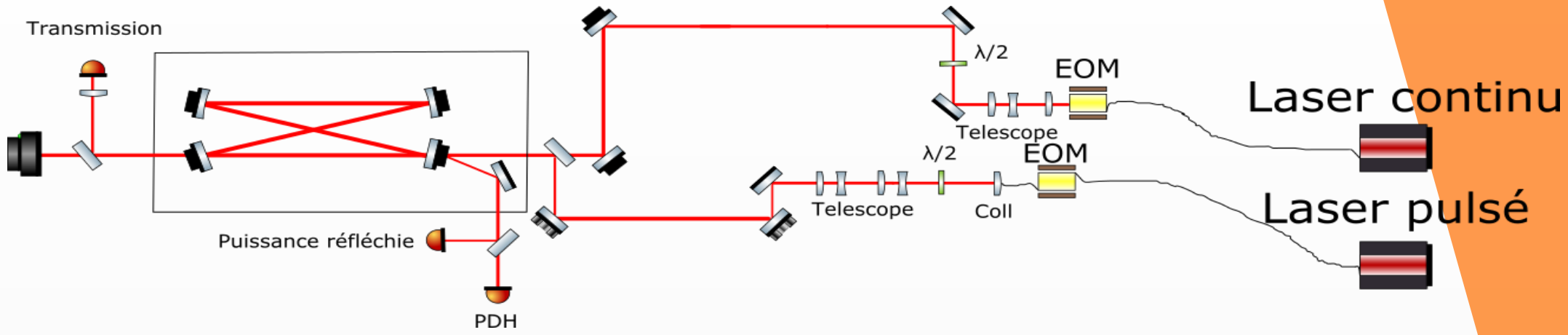
(a) Standard bow-tie (SBT) cavity

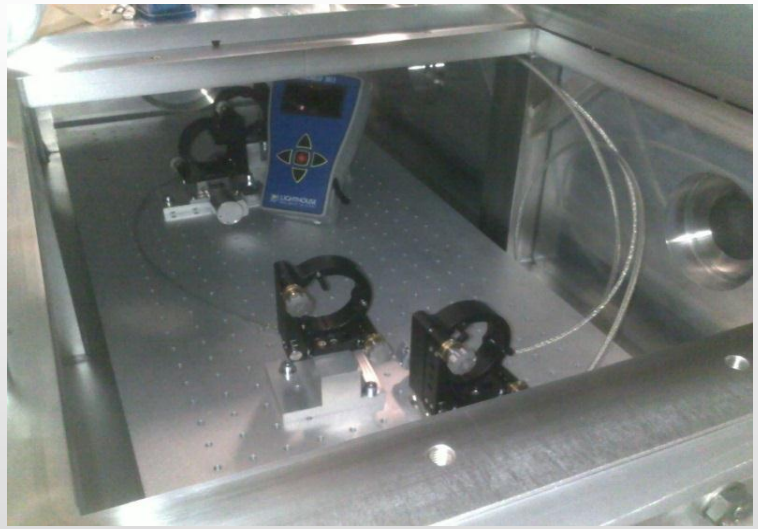
Laser wavelength	1030 nm
Laser and FP cavity Frep	33 MHz
Laser Power	150 W
FP cavity finesse / gain	30000 / 10000
FP waist	70 µm

The power inside the cavity: MW-leval



ThomX prototype cavity

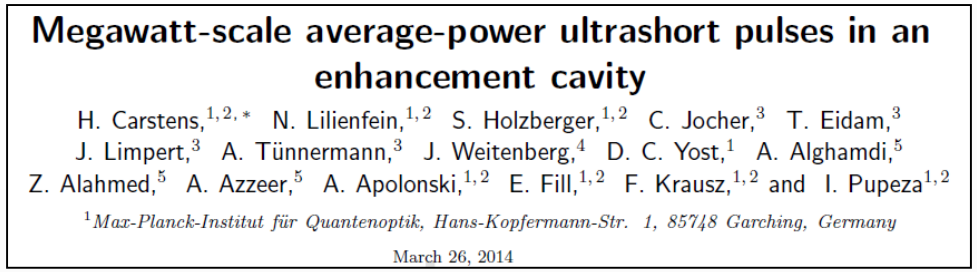




- R&D for ThomX

Decrease thermal effects -> New substrates

- ThomX: ULE mirrors (Ultra Low Expansion glass)
  - Deformation : 55x less than Silica
  - 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*

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- LMA Coating (Lyon, France)
  - Theoretical finesse ~ 28000
  - Theoretical gain ~ 15000
- Power transmission coefficients

  M1: **180 ppm**

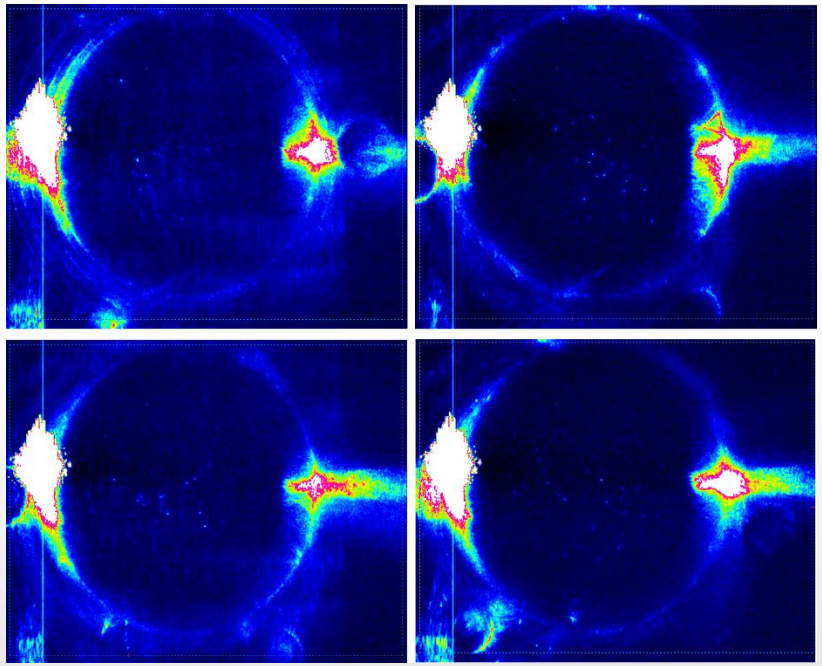
  M2, M3, M4: **2 ppm**

  Total losses by absorption/scattering: **40 ppm**

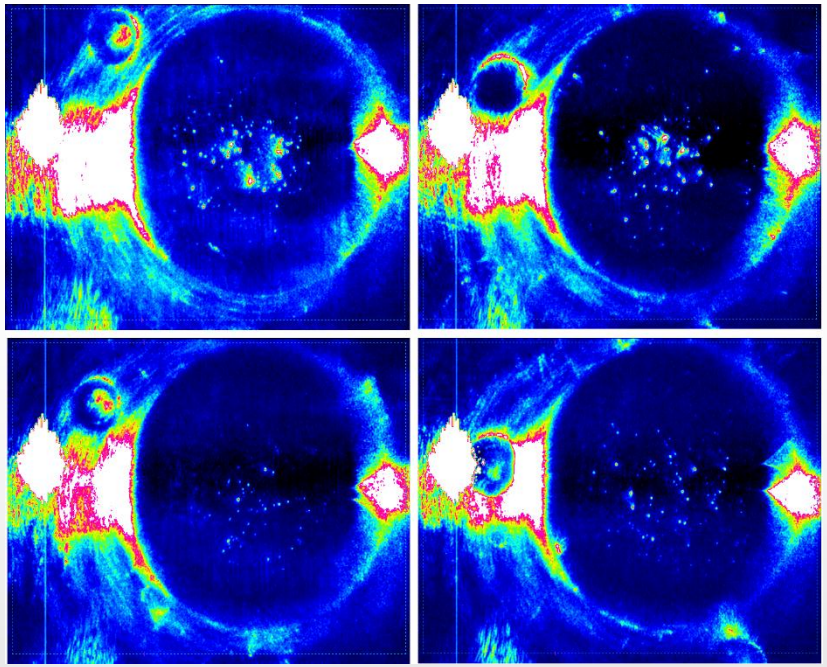
New mirrors implementation

- Optical surface test bench

ULE mirrors (new)

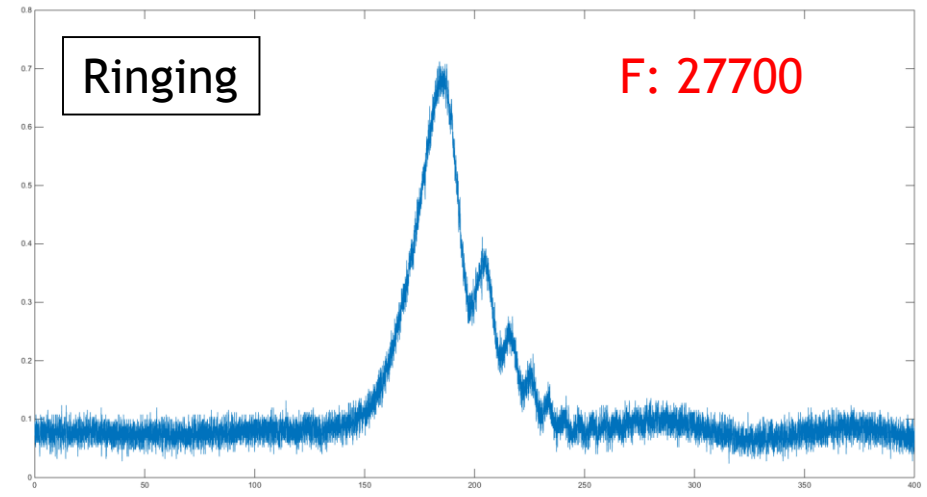


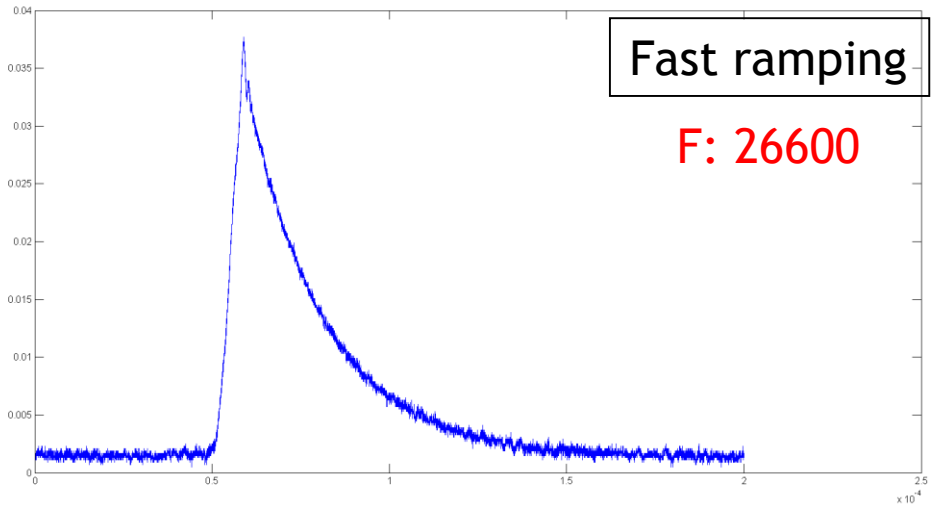
Mightylaser silica mirrors

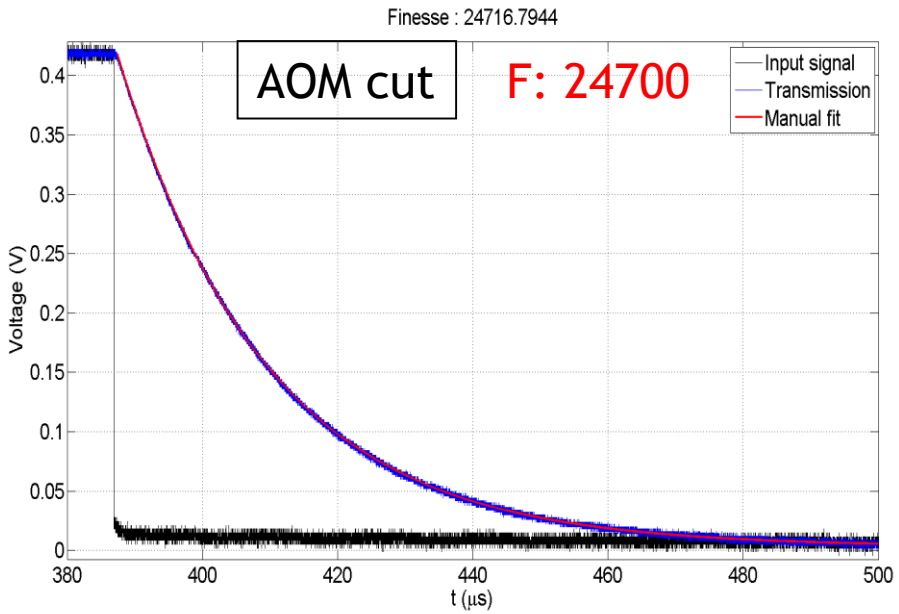


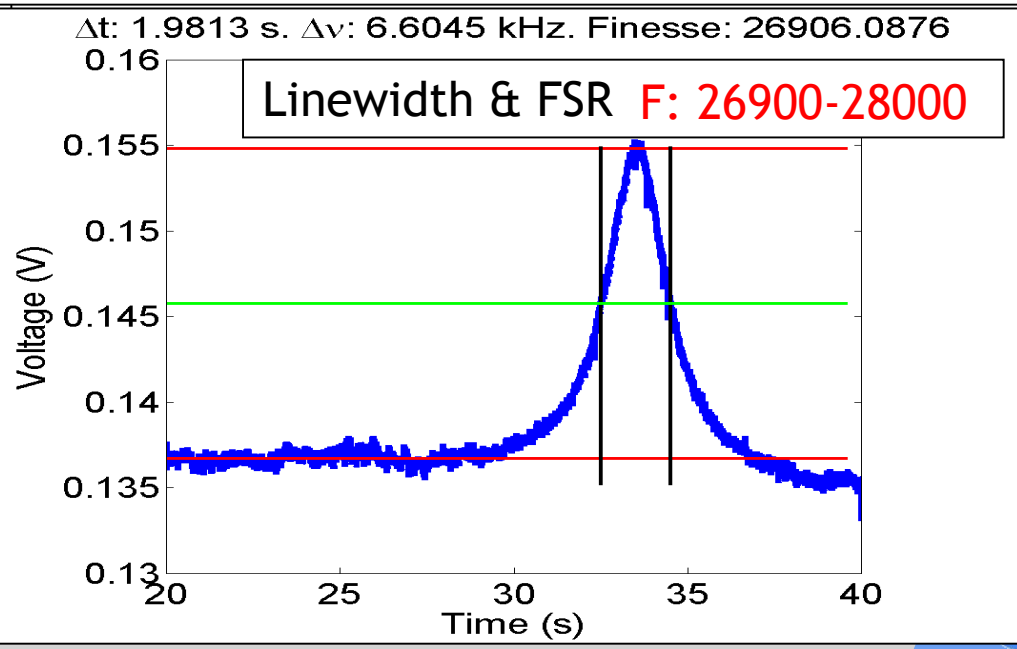
- ULE mirrors
  - Theoretical finesse: 28000
  - Measured finesse: **26000** (4 different methods).
  - Gain ~ **12000**

Finesse measurements. F: 26000



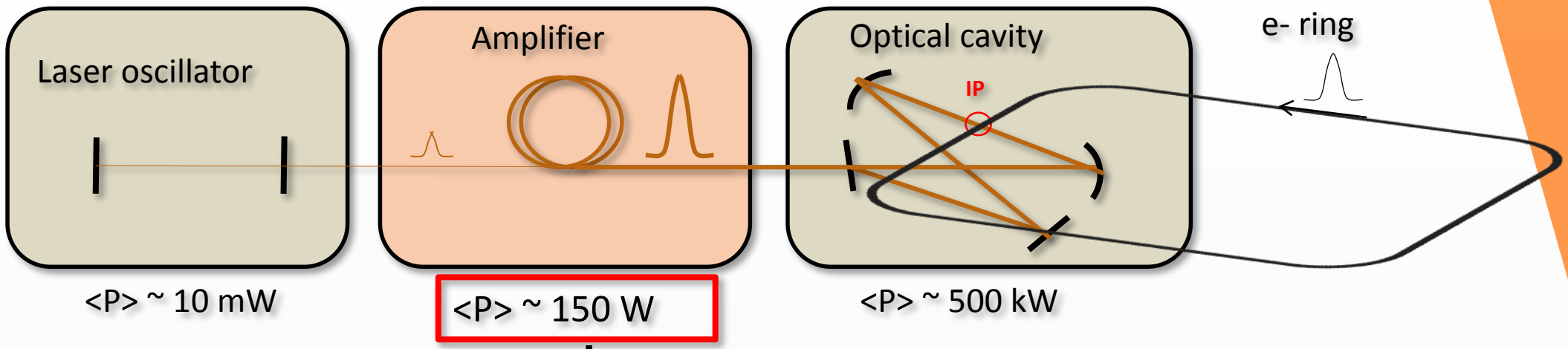






ThomX Laser amplification system:

CELIA Lab. (Bordeaux) & Pierre Favier (LAL)



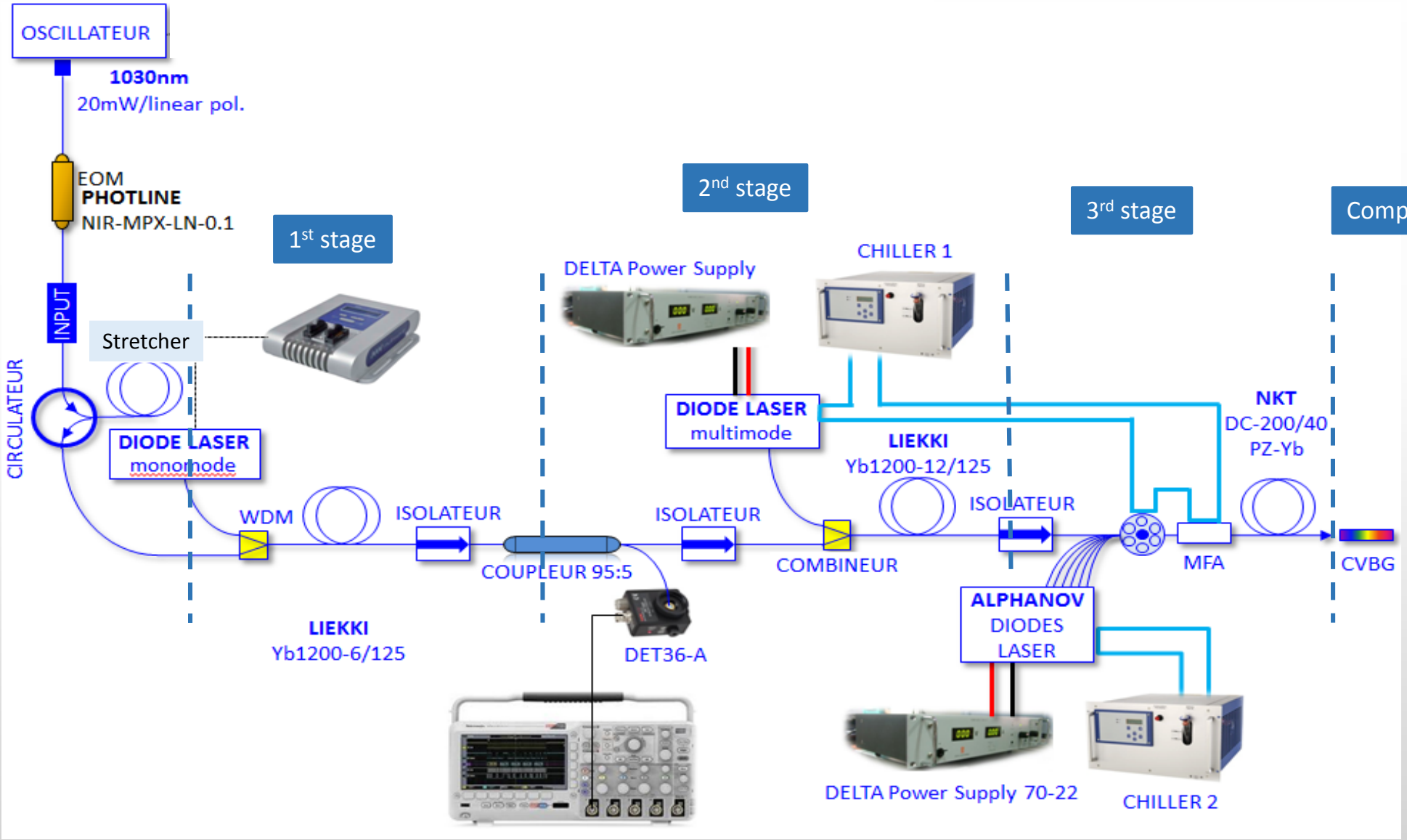
CFBG:
Chirped Fiber Bragg Grating

CVBG:
Chirped Volume Bragg Grating

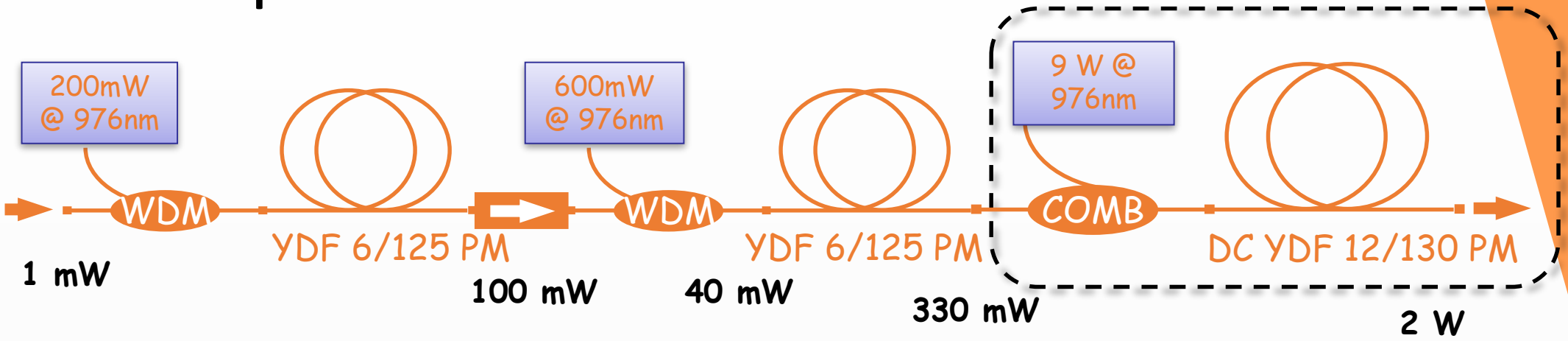
Goals: stack as much average power as possible in an optical resonator➔1MW

ThomX fiber amplifier

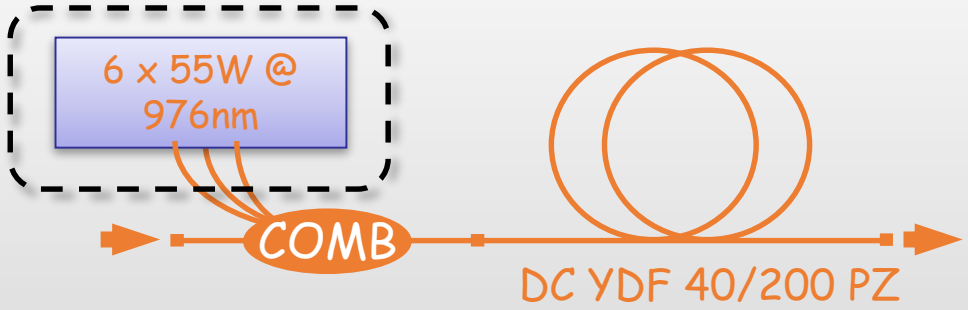
all fiber connectorised (spliced)



Pre-amplifiers

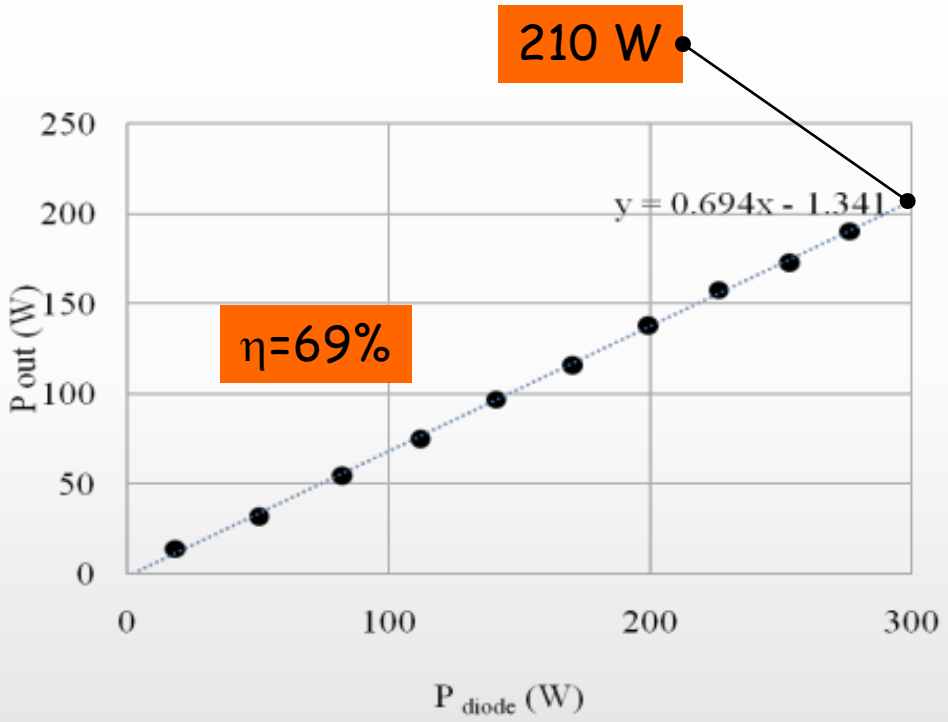


Main amplifier **6x 55 W**

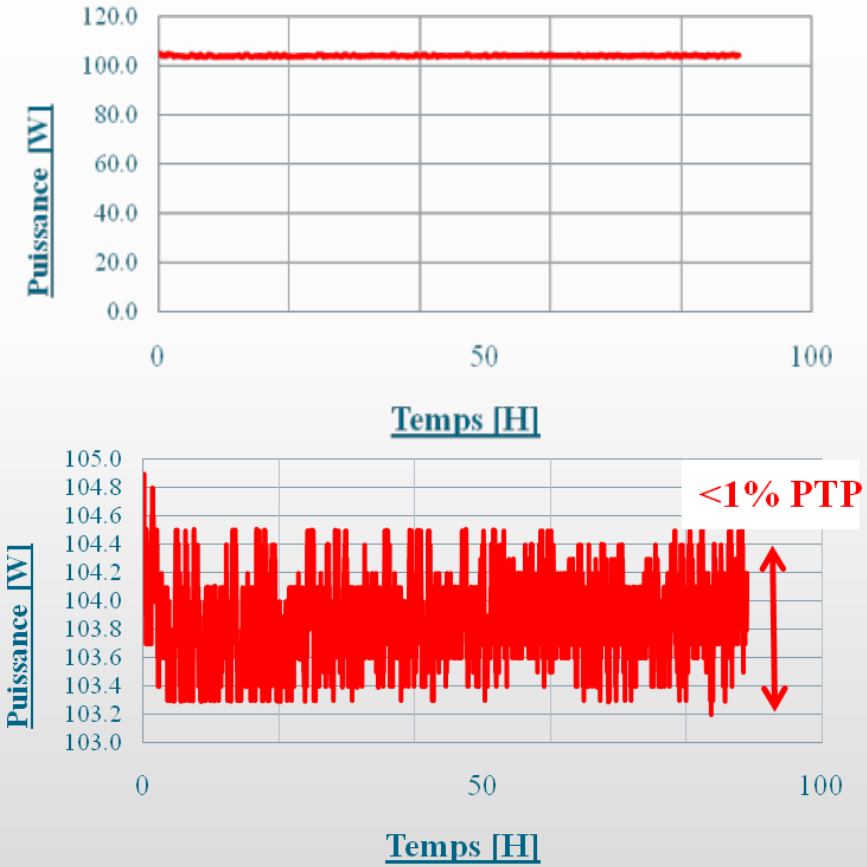


ThomX 150 W fiber amplifier: power

Max power: 210 W

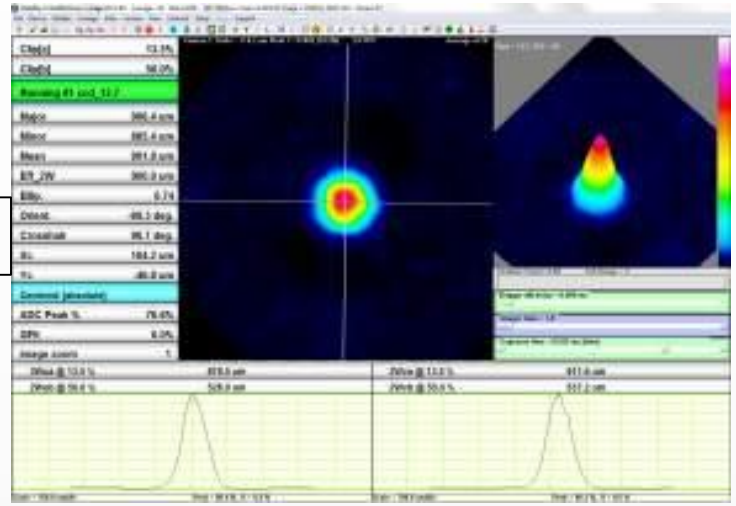


Stability over 90h @ 104 W :

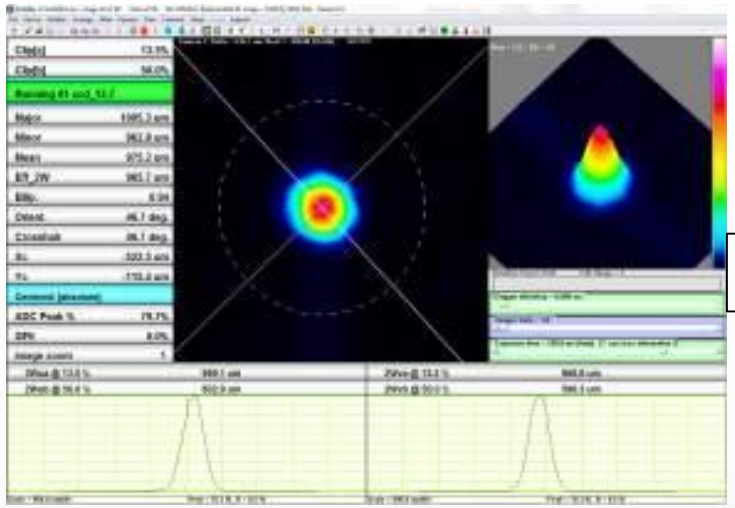


ThomX 150 W fiber amplifier: beam quality

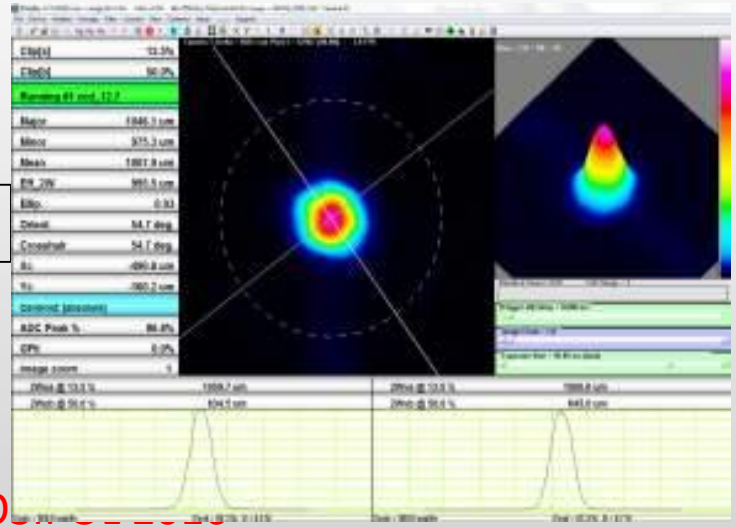
0A/4W



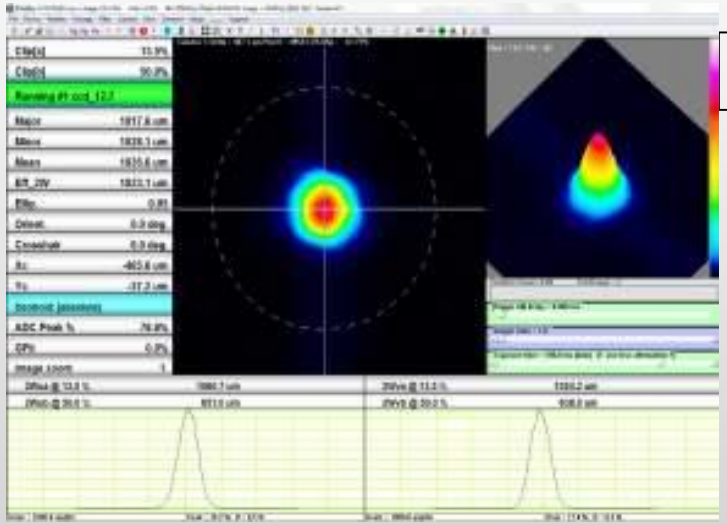
5A/97W



8A/158W



11A/200W



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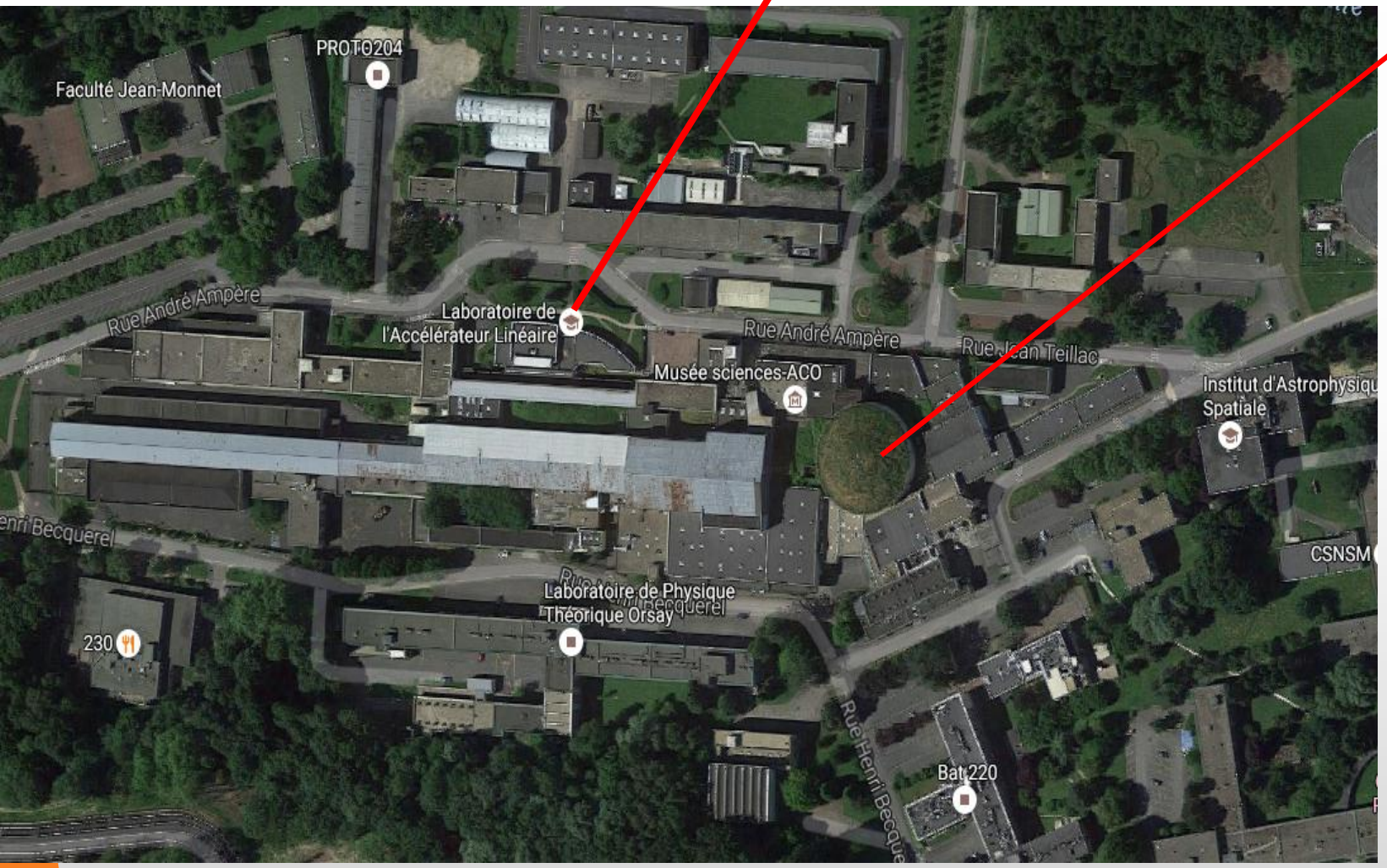
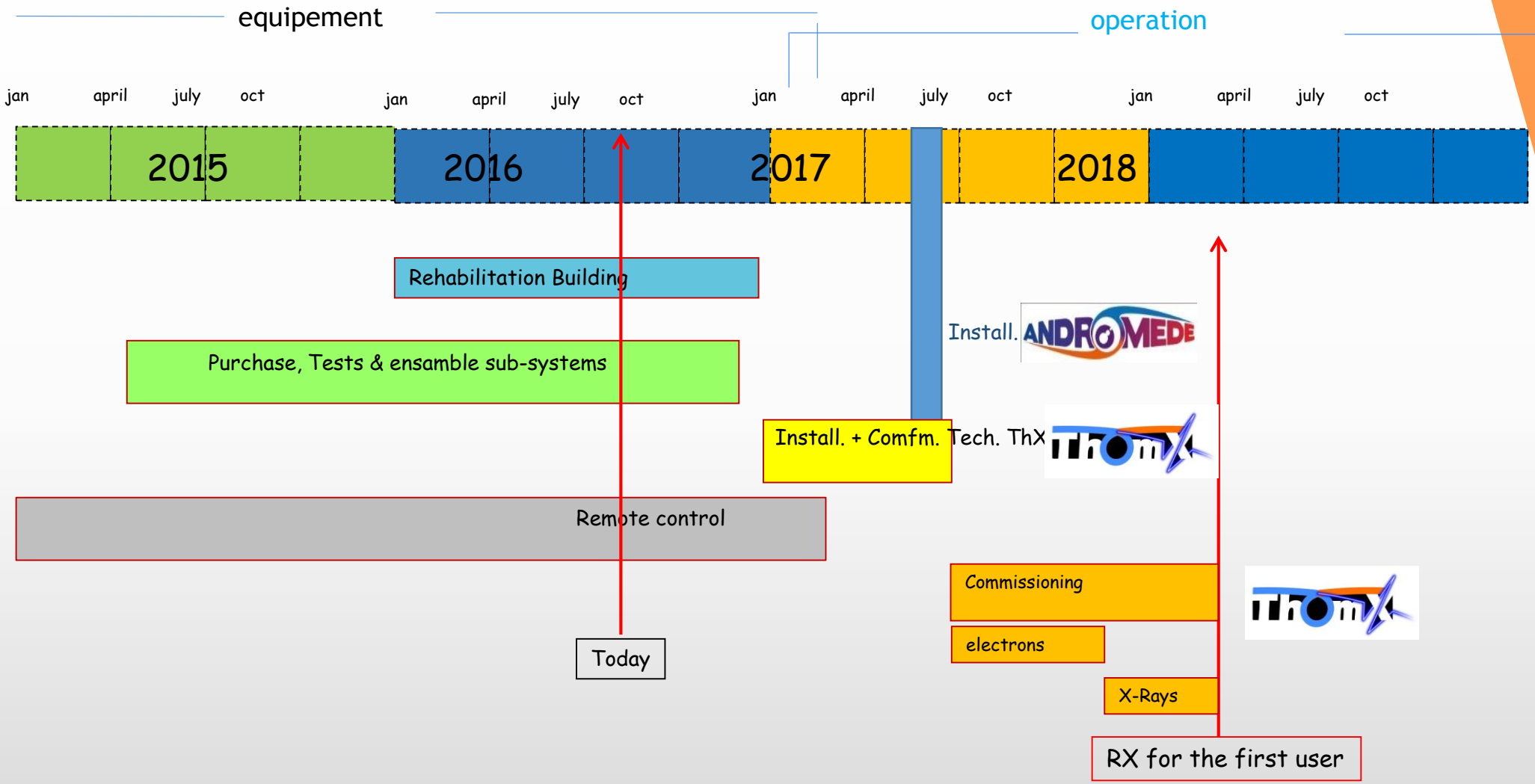
Site of Thom X



Planning of ThomX



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

Thank for your attention !