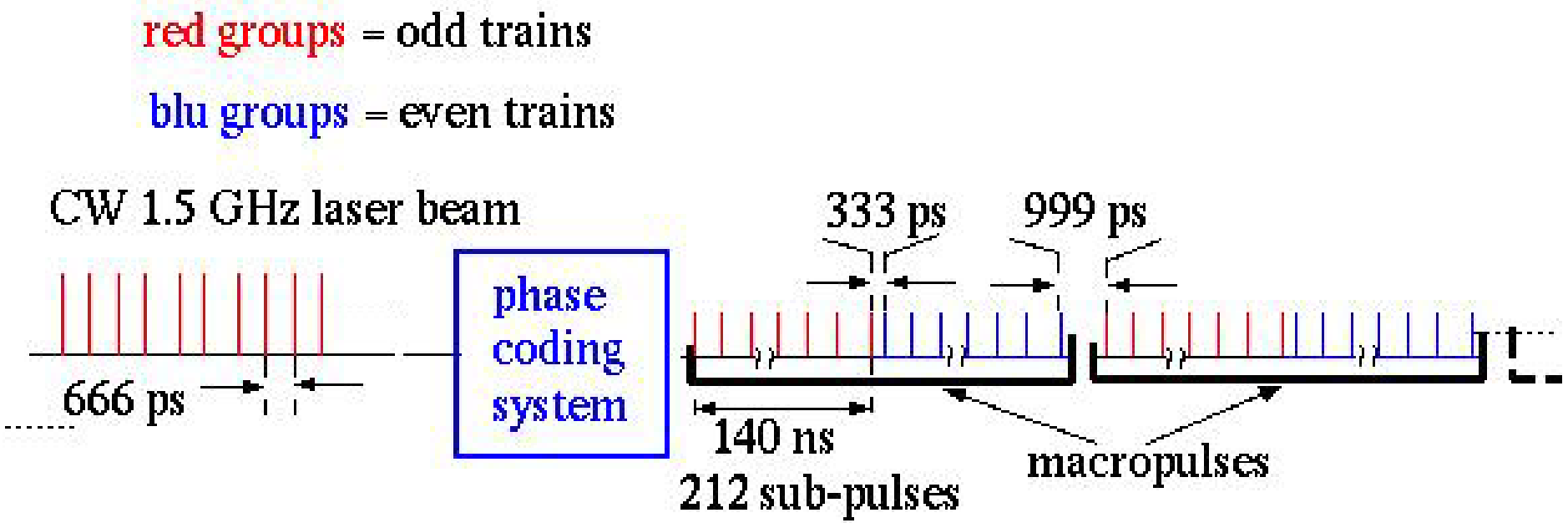
# Phase Coding System tests at Milano

I. Boscolo*, S. Cialdi, D. Cipriani

CTF3 Technical meeting CERN 20/1/2008

# Operation of the Phase Coding System

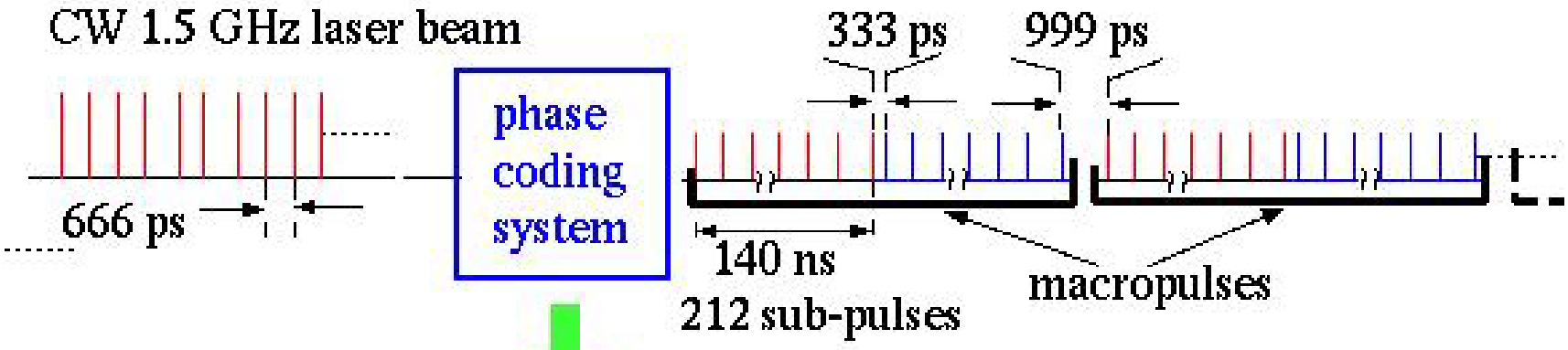
Re-pattern a CW 1.5 GHz mode-locked laser beam into a laser beam made up of a succession of trains as shown in figure;

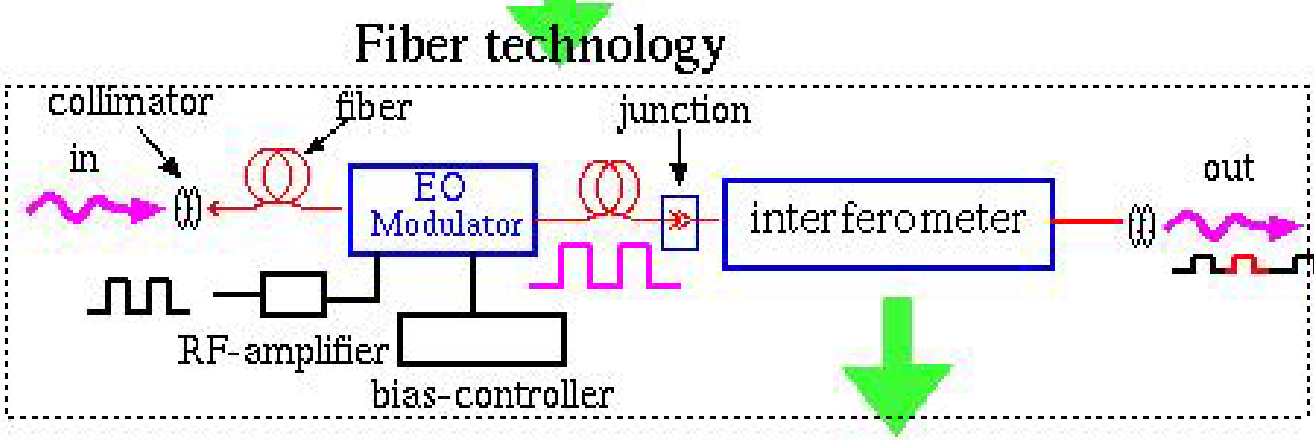


red groups = odd trains

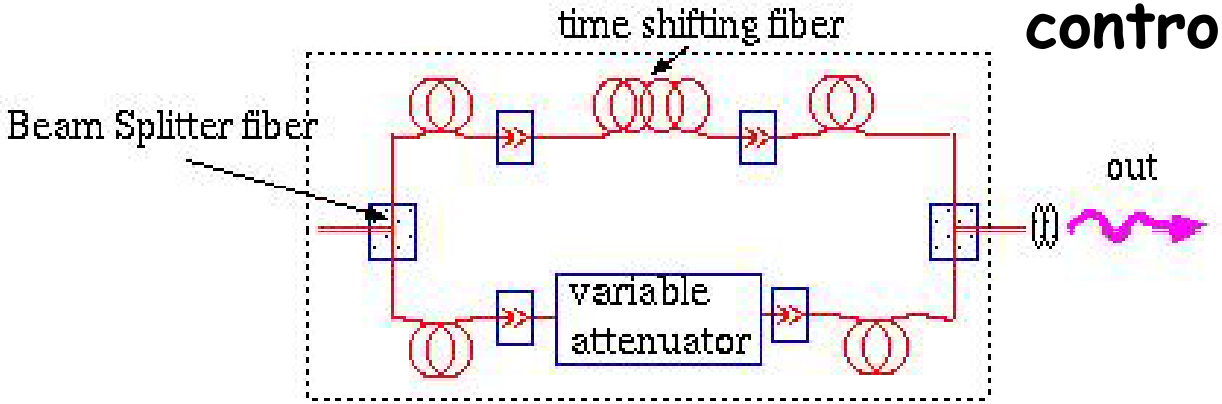
blu groups = even trains

**Pin =320 mW  Pout = 30 mW**




**Temperature controlled**



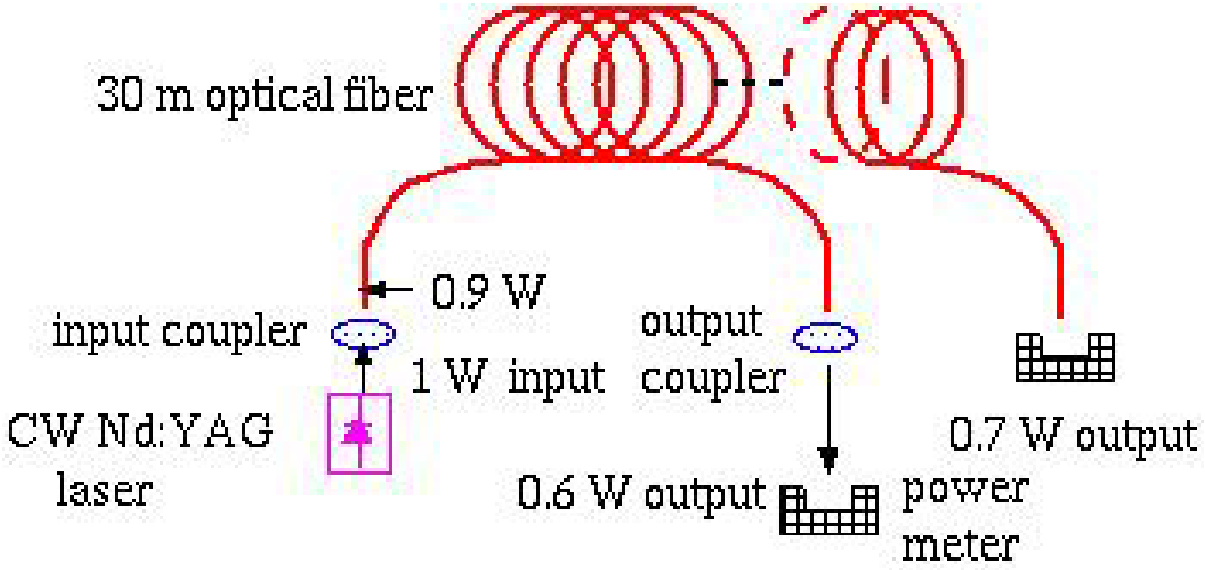
# The experimental tests carried out in Milano

1. fiber launch losses
2. Modulator losses
3. Fiber-fiber junction losses
4. Fiber beam-splitter losses
5. Entire system losses
6. RF-driver modulus test
7. Full system operation

# 1- Fiber launch losses

The scheme

Losses **1 dB**

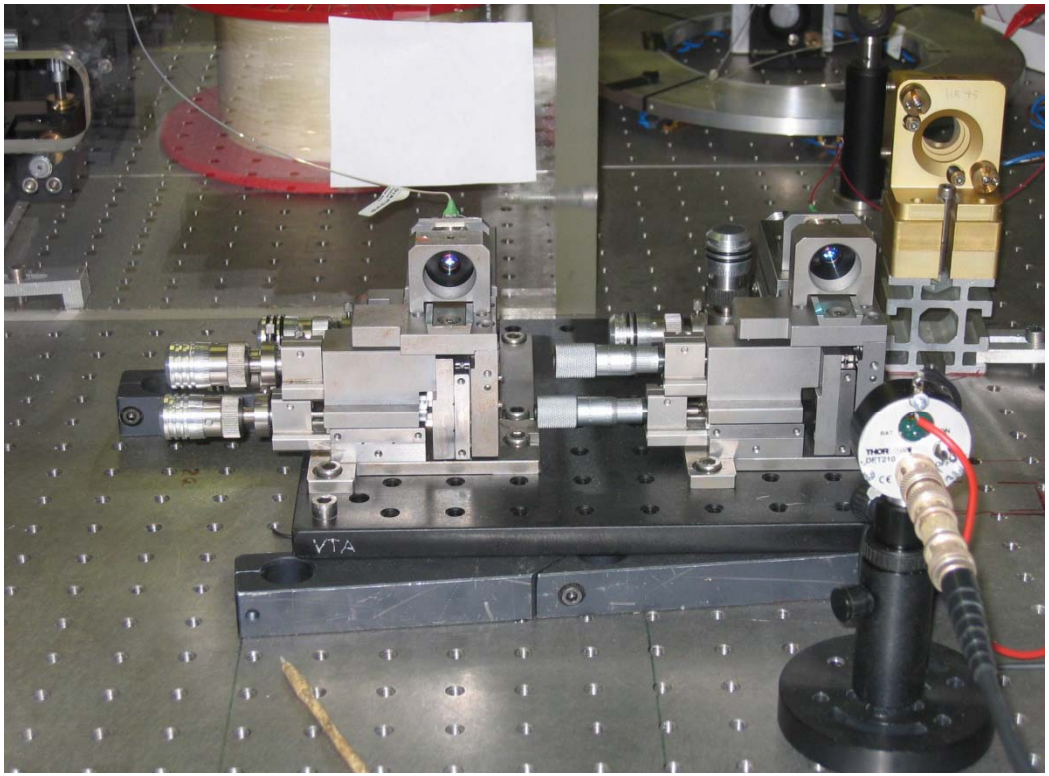



*input and output collimators are lossy about 15 %.*

**Indication: order in/out collimators tailored to our wavelength.**

Note: the mechanical tool for the launch does not work properly, the screws do not govern correctly the movements

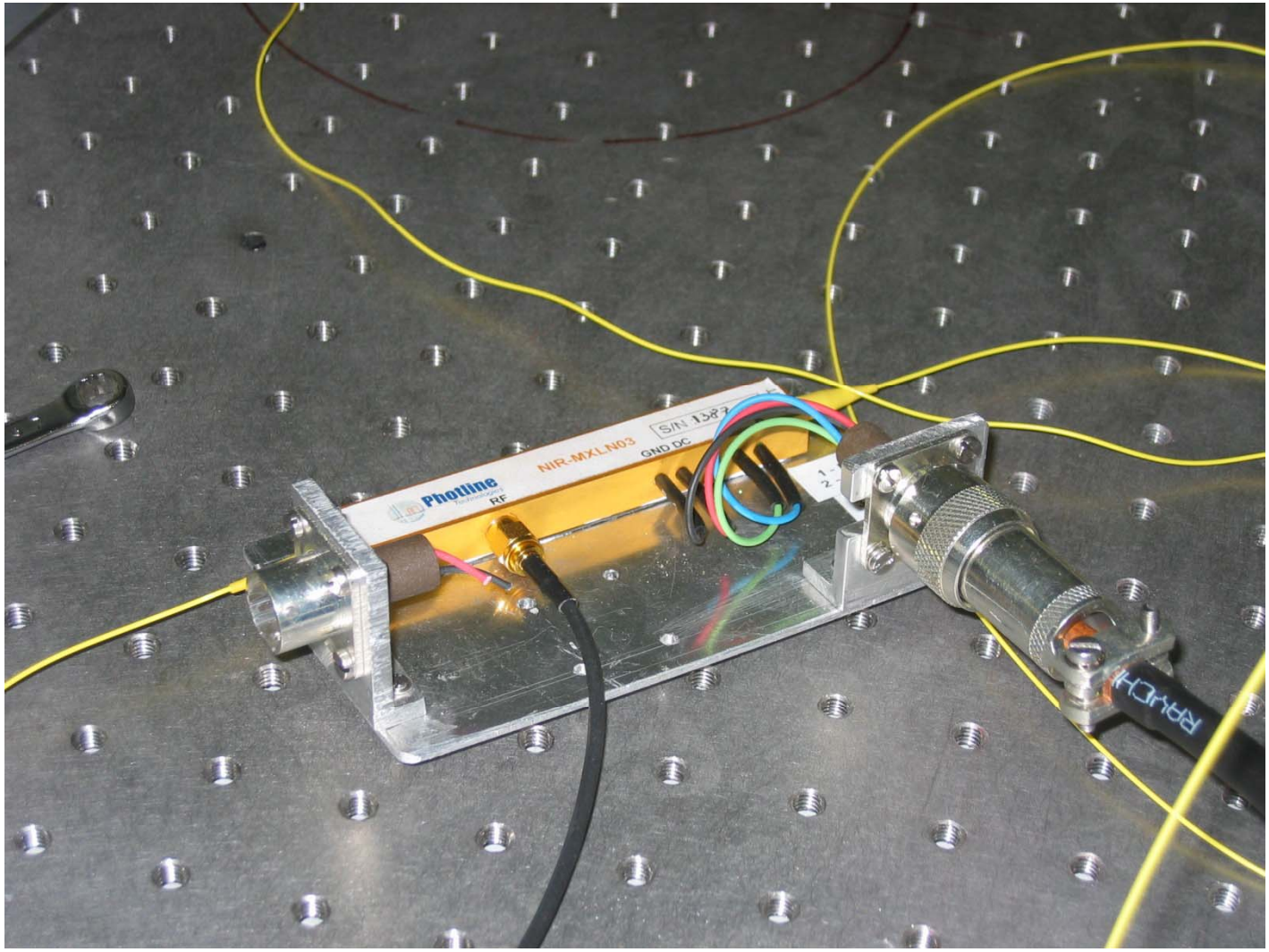
The ambient must be very clean



# 2-modulator losses

| Pin mW | Pout mW | ε % |
|---|---|---|
| 75 | 15 | 20 |
| 170 | 30 | 18 |
| 250 | 45 | 18 |

- We fought a lot with the modulator,
- we still are not completely confident of these results
- The operation with Bias controller in automatic lowers of 10 % the output
- The initial output power decays with time of about 30%


Photline
NIR-MXLN03
S/N 1587
GND DC
RF

## 3-Fiber-fiber junction losses

- We mesured a loss of about **0.5 dB**
- The precise set of the junction requires expertise

*Suggestion:*

*since we have 4 of this junctions in the system*

**Soldering of the fiber-fiber connetions to reduce the loss to 0.05 dB**

# 4- fiber beam splitter losses

A bit higher than 0.5 dB

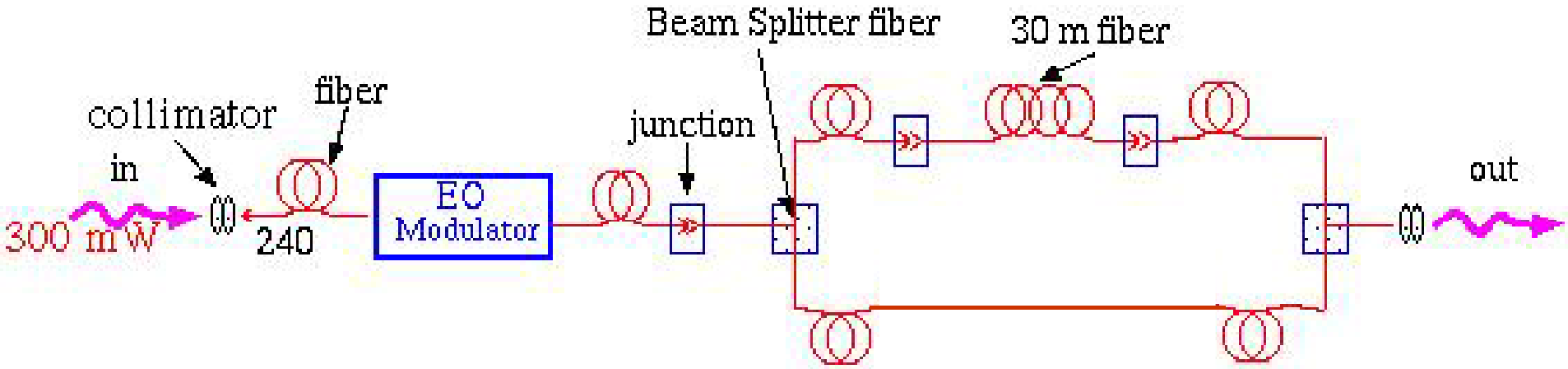
| Losses in dB | CCLRC estimate | Measured |
|---|---|---|
| 1. fiber launch (exit) | 1 | 1 |
| 2. Modulator | 4.5 | 7.3 |
| 3. Fiber-fiber junction | 0.3 | 0.5 |
| 4. Fiber beam-splitter | 0.3 | >0.5 |

*Remark: there is a further 3 dB (50%) losses due to the pattern formation*

| Efficiency of the items: | present | possible |
| --- | --- | --- |
| Total transmission | 0.035 | 0.09 |

# 5- Full system losses

**misure con fascio laser in continua (non mode-locked)**



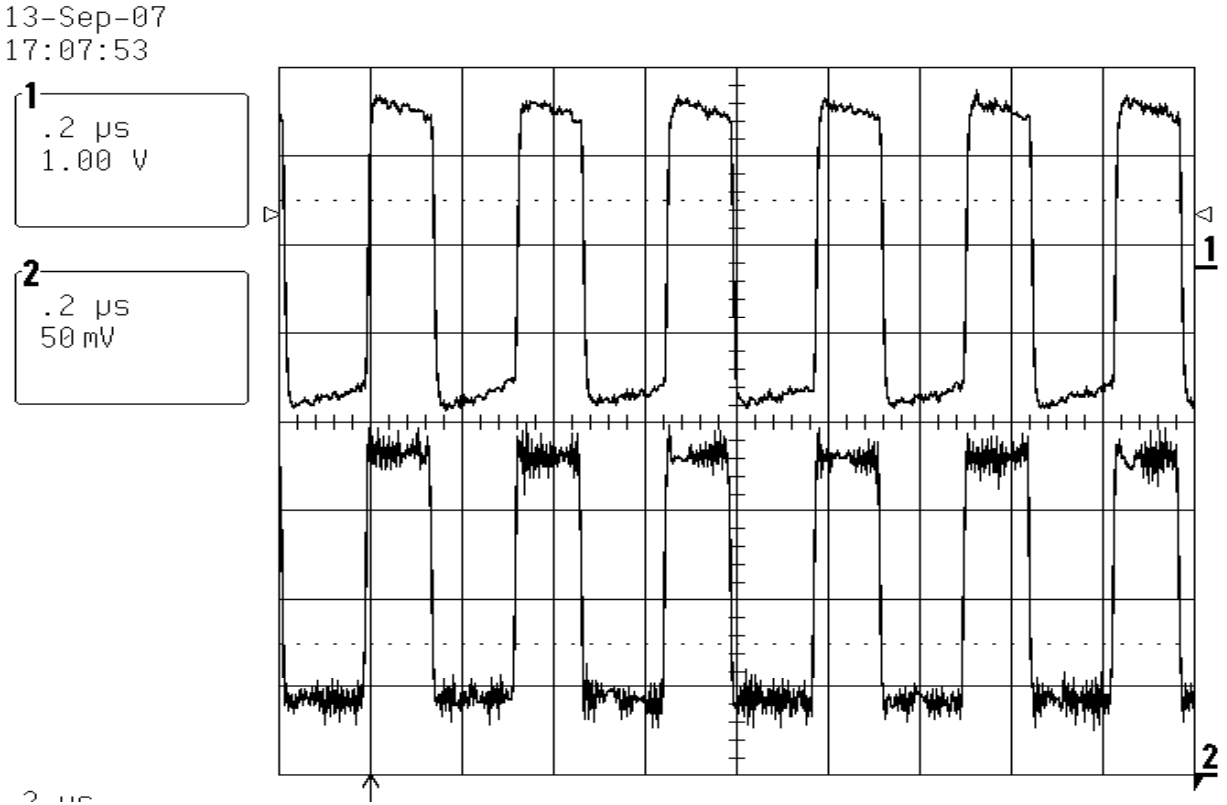

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CCLRC | 1 | 4.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | loss dB |
| assesments | 0.8 | 0.35 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | $P_o/P_i$ |
| Milano | ok | 7.3 | ok | >0..5 | ok | ok | >0..5 | |
| **measurements** | | 0.18 | | <0.9 | | | <0.9 | |

*Pin=300mW expected: Pout = 10.5 mW*

**Measured: Pout about 7 mW**

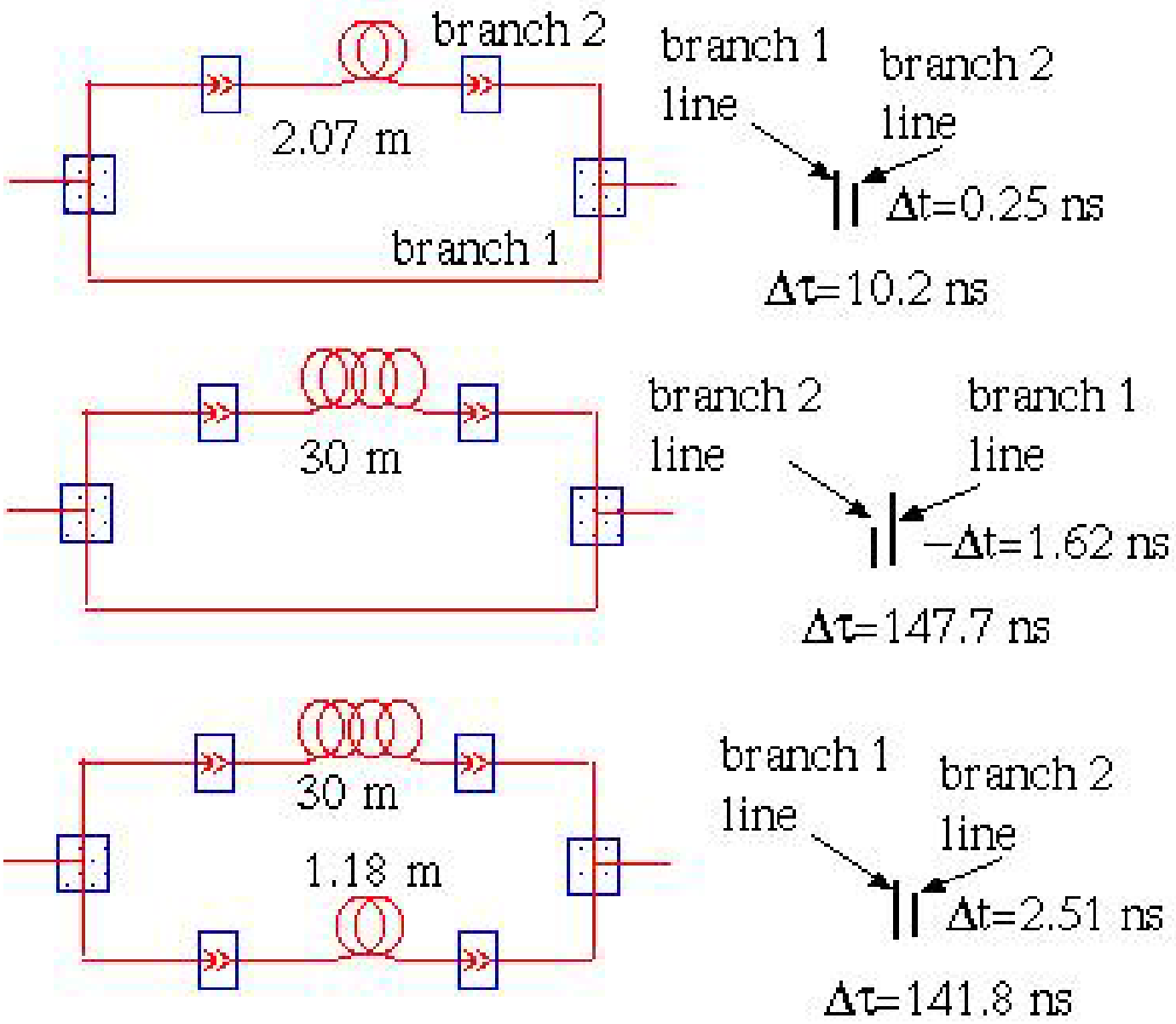
Very difficult to set correctly fiber junctions and input fiber launch

# 6- test of RF-driver amplifier

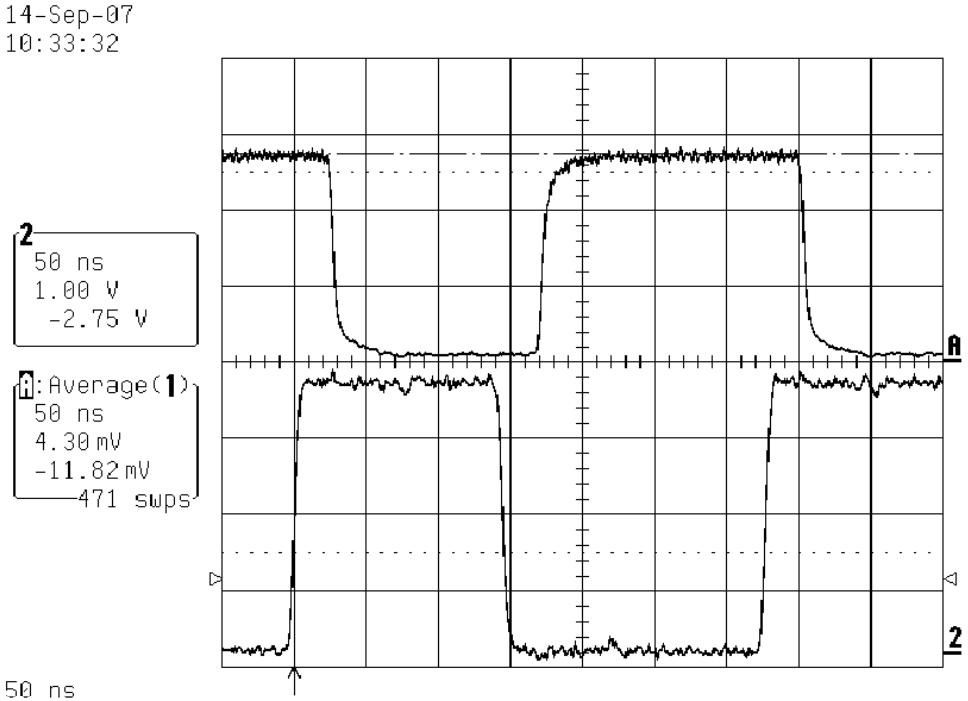



The amplified signal has a ramp thus the the bias controller cannot work: sent to company for fixing it up

# Test of the delay introduced by fibers

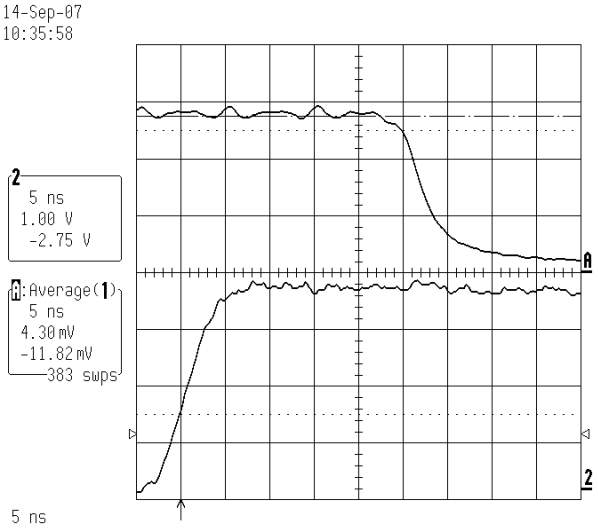


# Generation of the 141 ns long sub-trains driving the modulator by 3.5 square wave

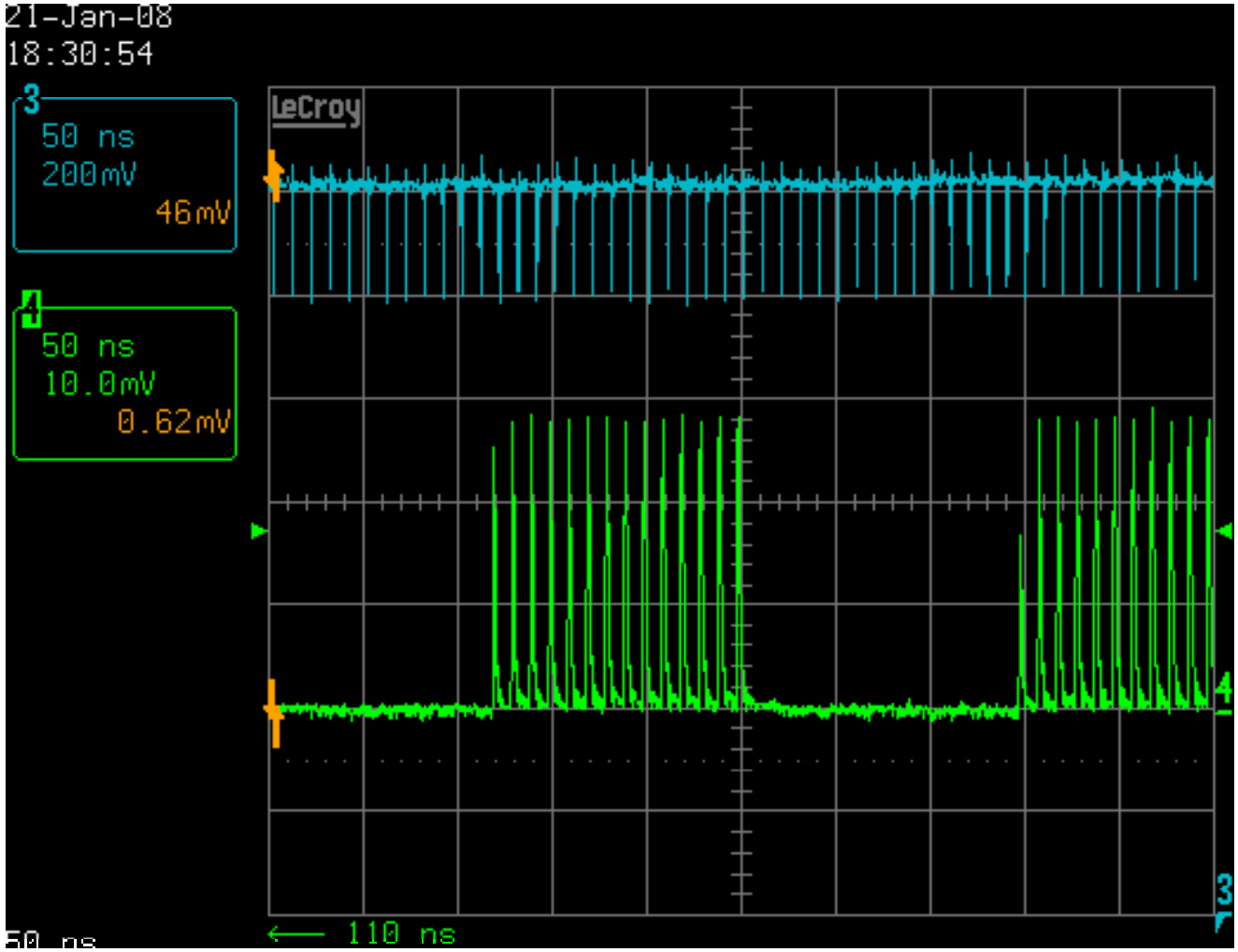



Laser signal

Driving RF signal

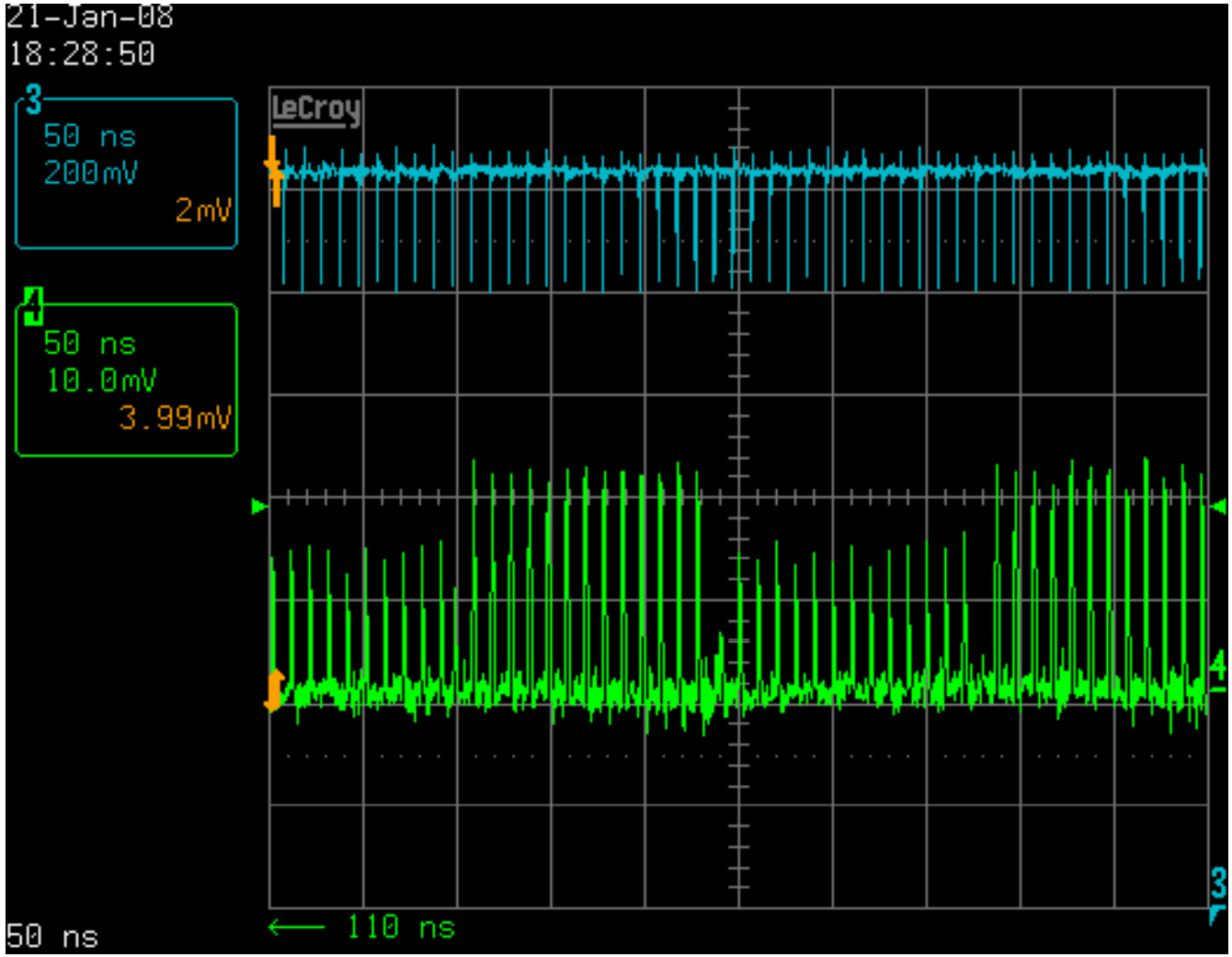



Rise and decay times are governed by monitor times




sub-trains of the right length are generated

# 7- full system operation




Interleaving of carriages is done

## Power test of full system

Pin = 300 mW

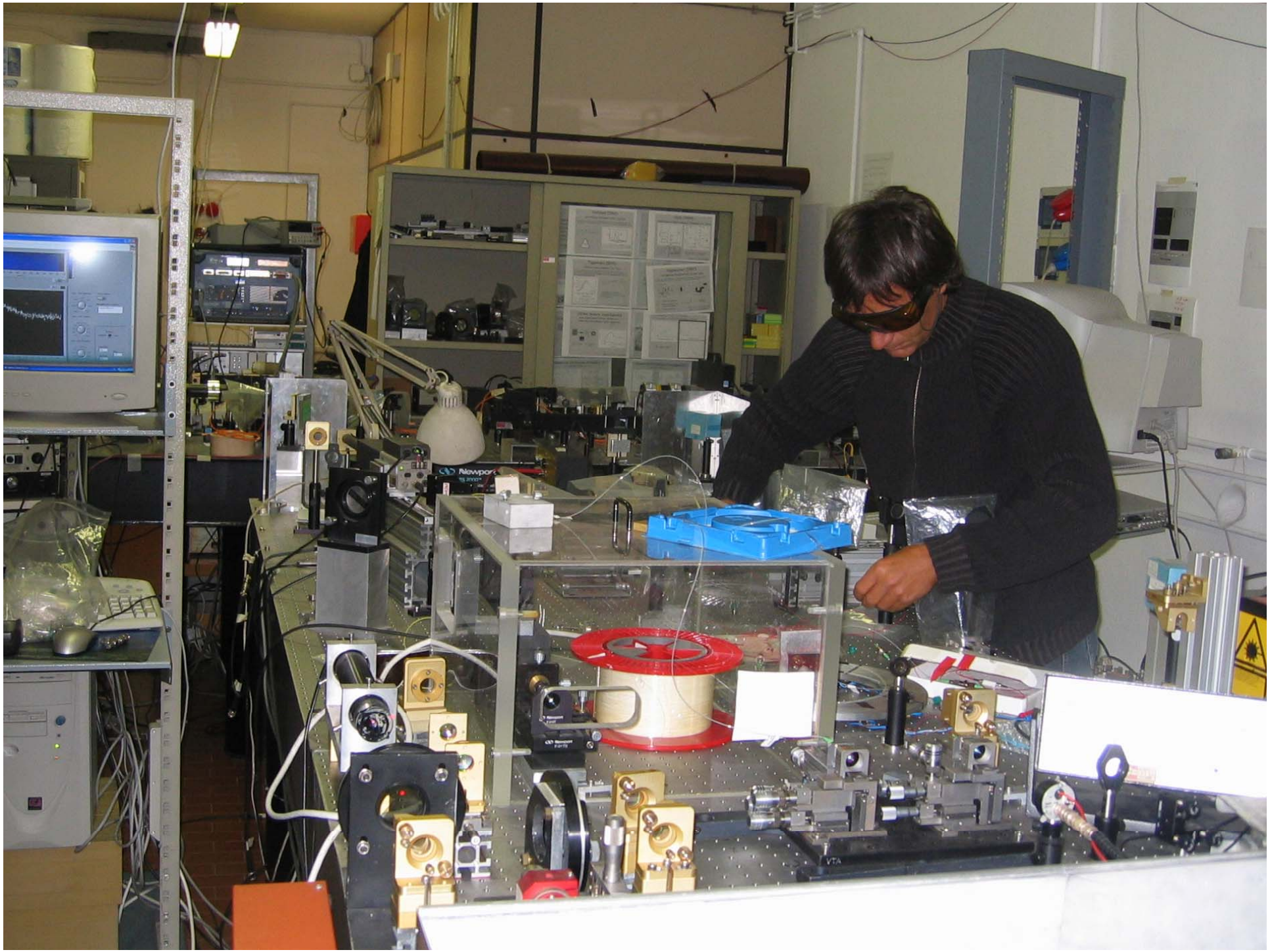
Pout = 2 mW measured

Assuming the best launch and junctions

Pout expected 0.017x300 = 5.2 mW

*System with soldered junctions and tailored collimators Pout expected 0.045x320= 14.4 mW*

Unless we can find a better performace with the modulator



# Next

1) Jitter measurements

depending on a) modulator
b) RF – generator
c) 1.5 GHz Laser

2) Amplitude stabilization:

we would have an idea of a feedback system to be designed and tested

THE END

# A tentative jitter test