Fabry-Perot cavity & pulsed laser

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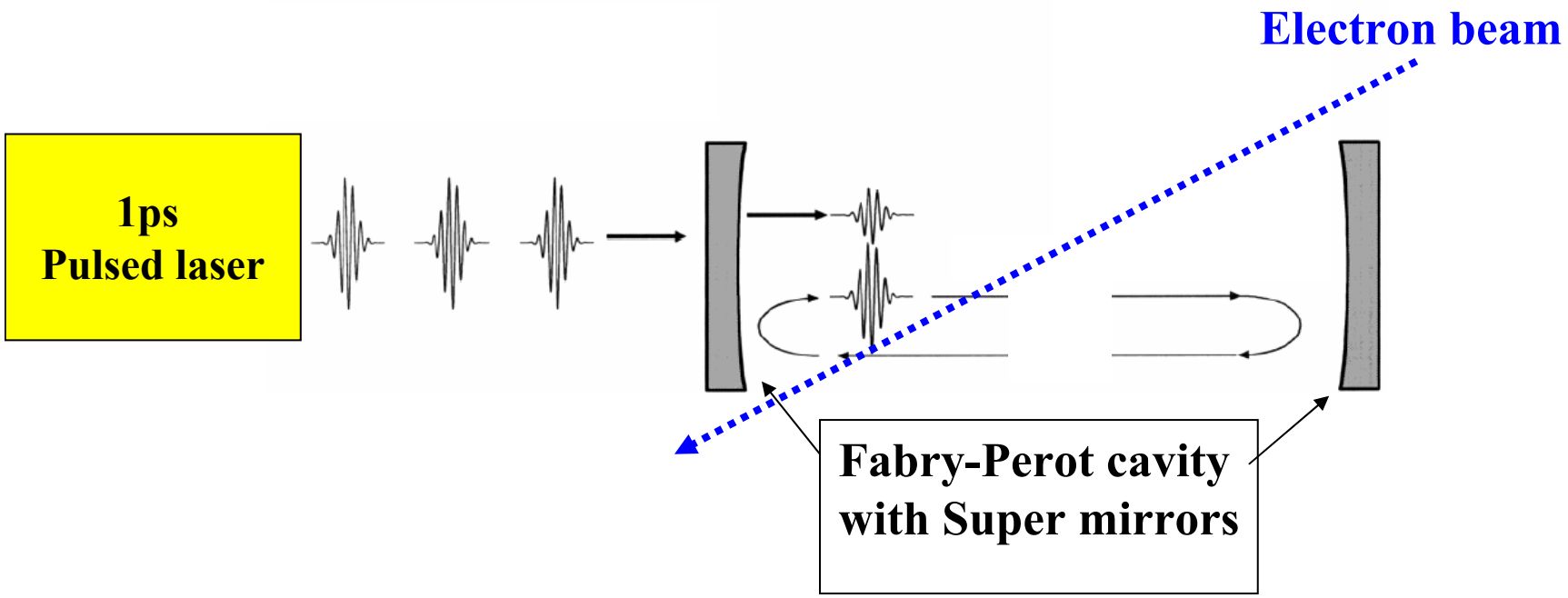
Outline

- **Fabry-Perot cavity, in pulsed regime**
- **R&D status**

Fabry-Perot cavity filled with a pulsed laser



- Pulse energy gain of the order of 10^4-10^5 can be obtained inside the cavity for pulse width ~1ps..
- BUT strong feedback needed…

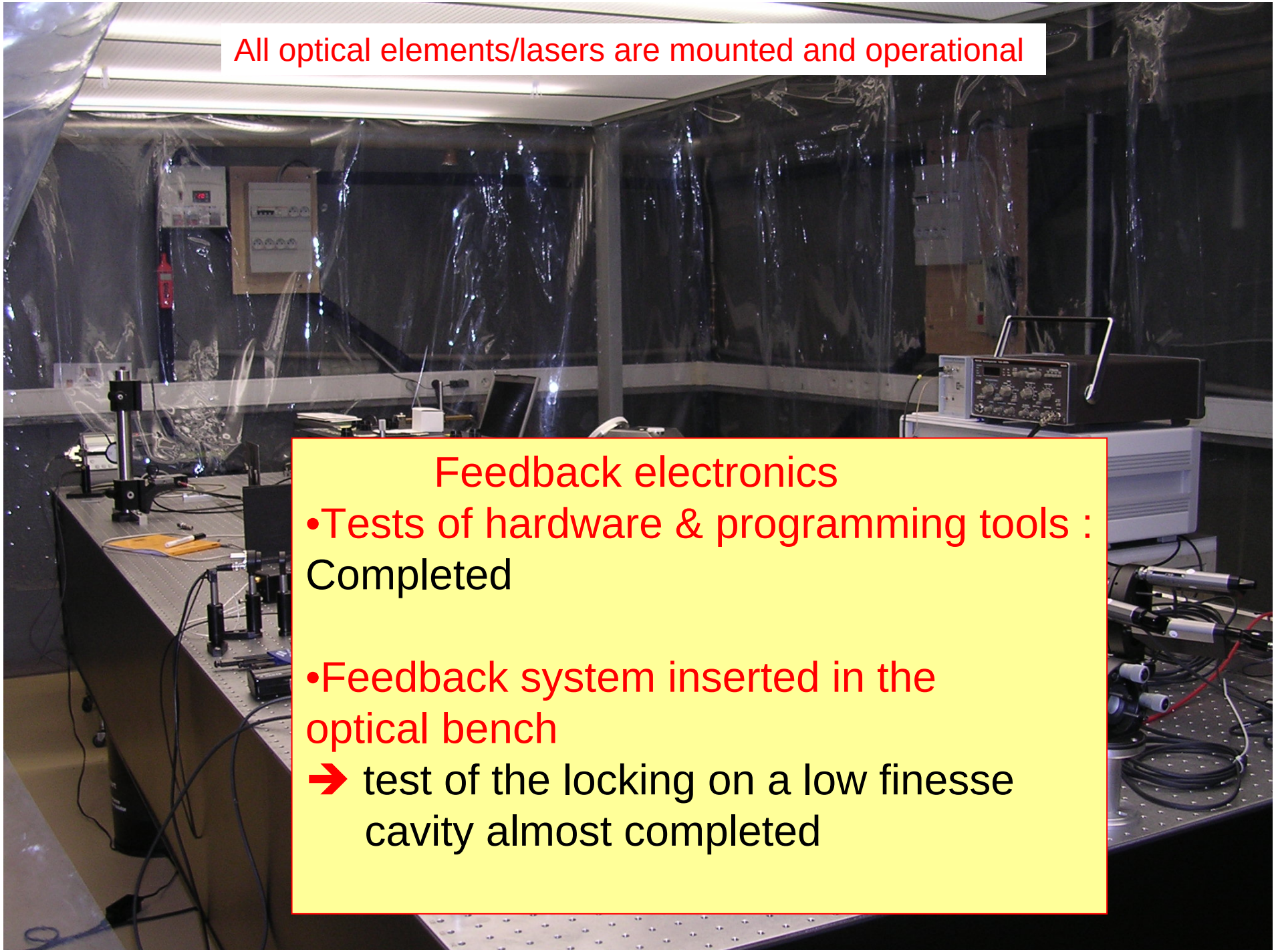
Goal of the Eurotev R&D at LAL/Orsay: pulsed cavity for a polarimeter [1ps, 100μJ/pulse@76MHz]

- Locking of a Ti:sa laser to a high finesse cavity (=2 spherical mirrors):
  - Feedback difficult & never done for 1ps pulses + very high finesse cavity (gain=10,000-100,000)
- Schedule
  - STEP 1: **Gain=$10^4 \rightarrow 10^5$**
    - Start: **Sept. 2005**→2007
  - STEP 2: **Reduction of the laser beam size**
    - Start (thanks to LAL/IN2P3 PhD.): Sept. 2006→2007(2008)

STATUS OF STEP 1

[High finesse cavity in pulsed regime]

All optical elements/lasers are mounted and operational



Feedback electronics

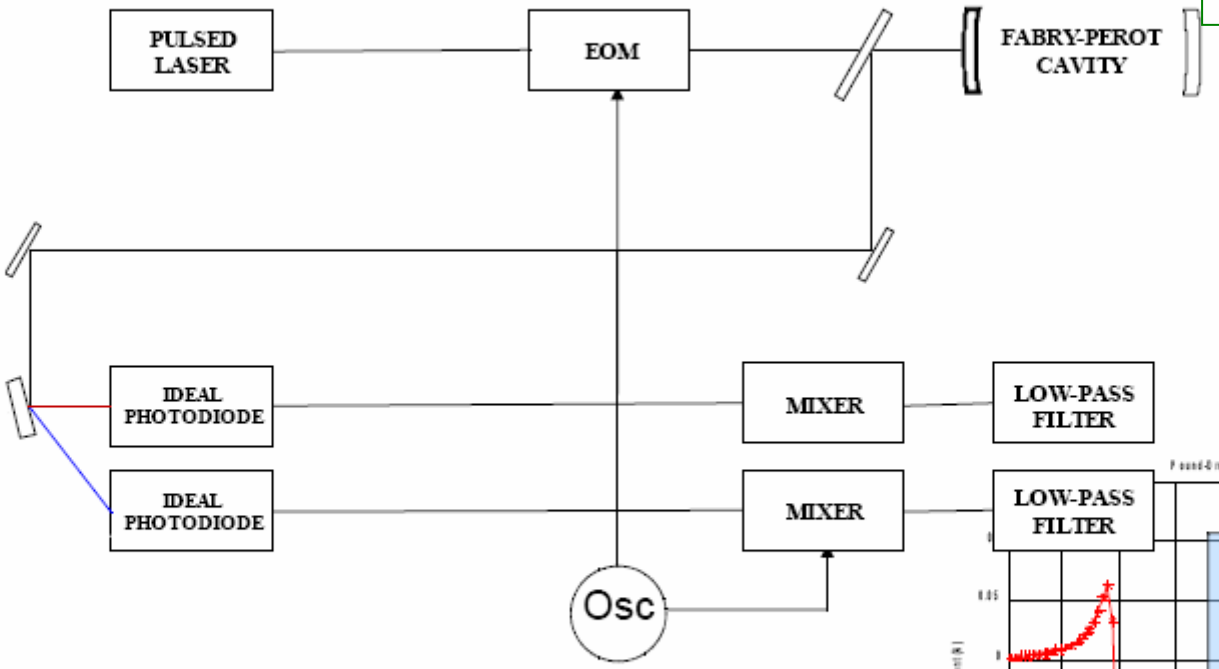
•Tests of hardware & programming tools : Completed

•Feedback system inserted in the optical bench

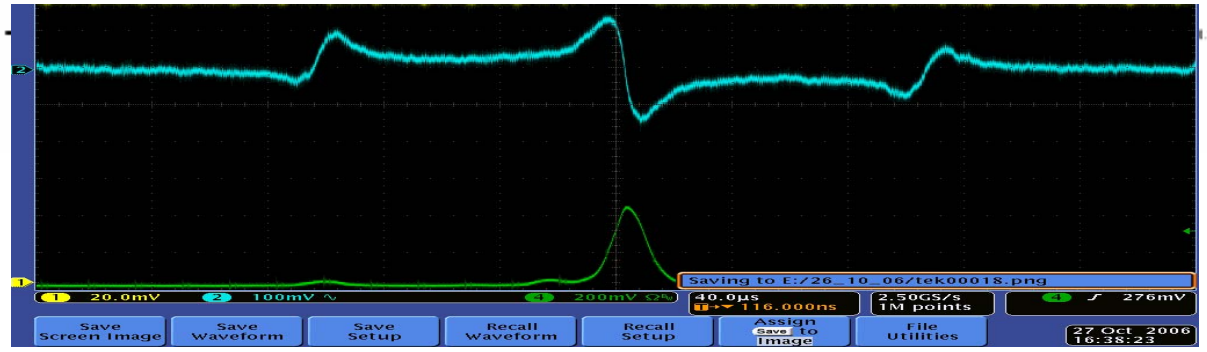
➔ test of the locking on a low finesse cavity almost completed

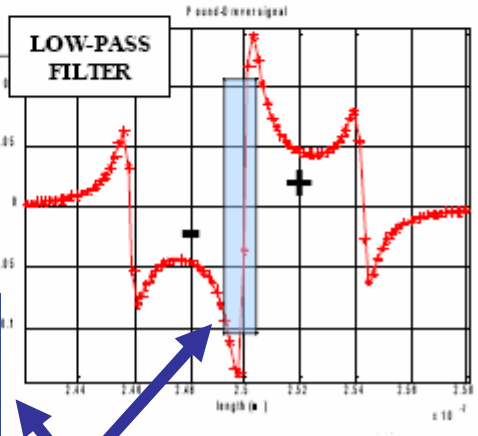
Error signal for the low finesse (~3000) cavity

Phase modulated laser oscillation
Fabry-Perot cavity reflection response



Transmitted power





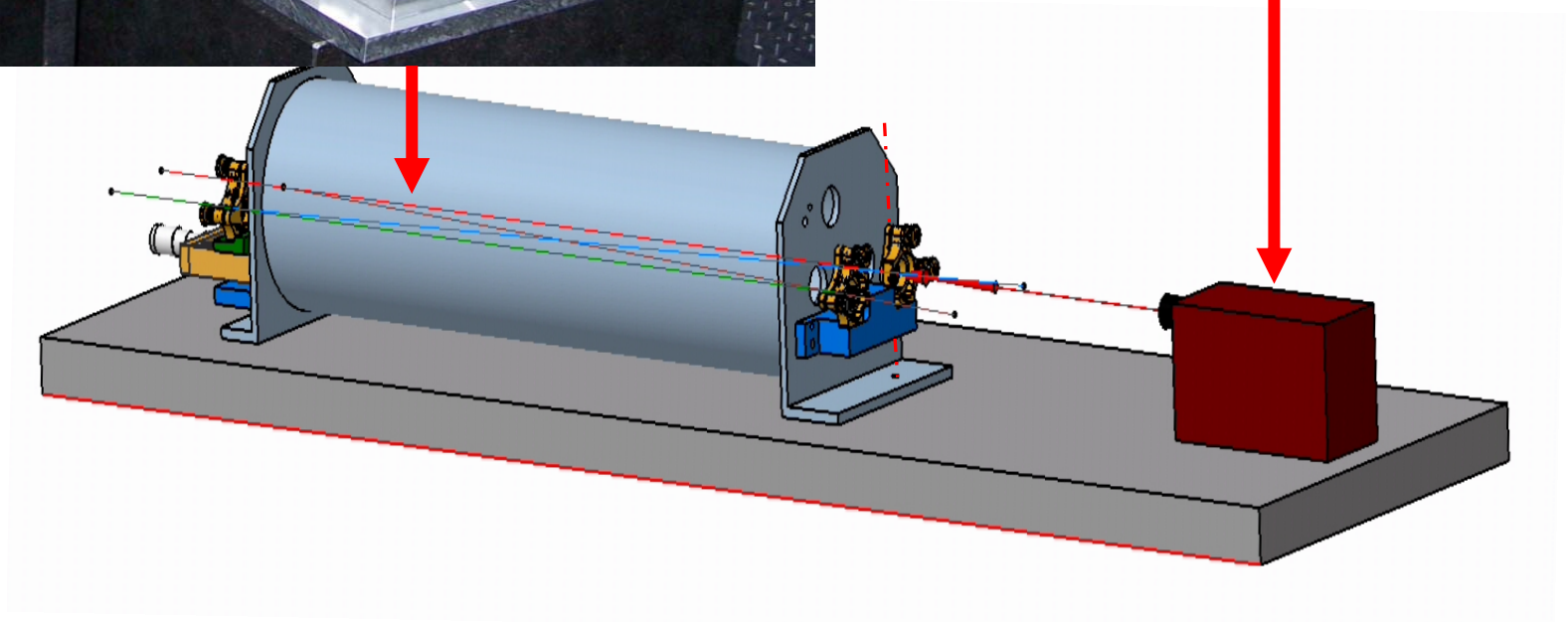
Error signal

STATUS OF STEP 2
[reduction of the laser beam size]

Four miroir ‘bow tie’ cavity

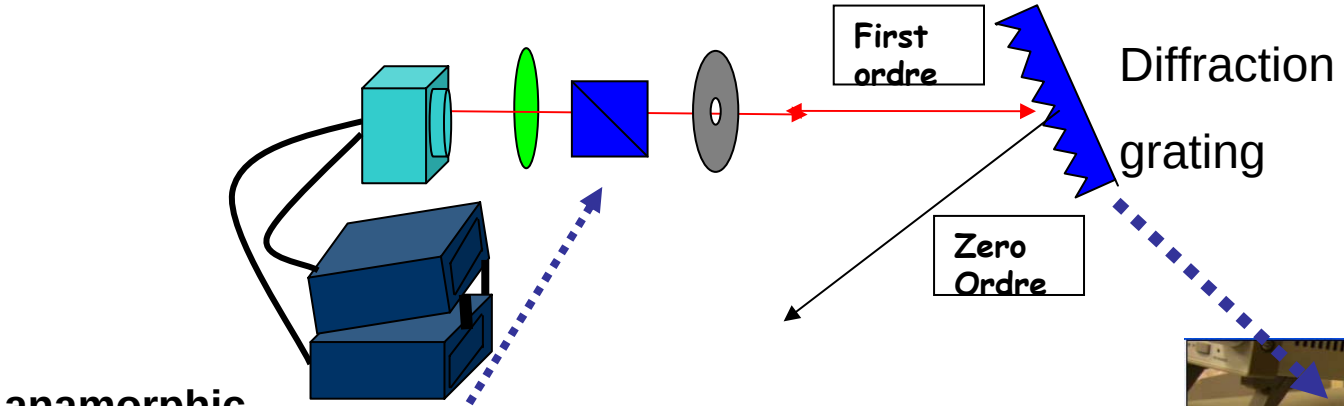
1rst Prototype for studying mode structures and beam waist
Build in the LAL workshop

Cheap laser= laser diode



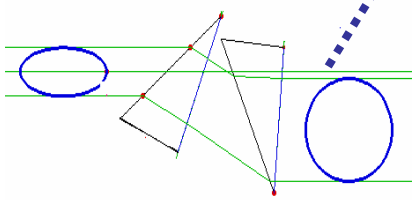
Work on the laser diode

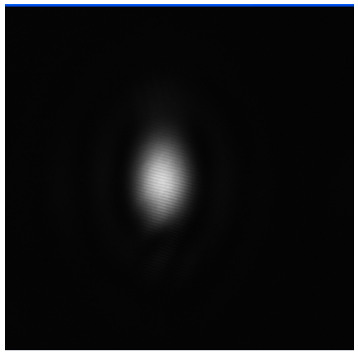
- Spectrale bandwidth reduction & ellipticity reduction: completed

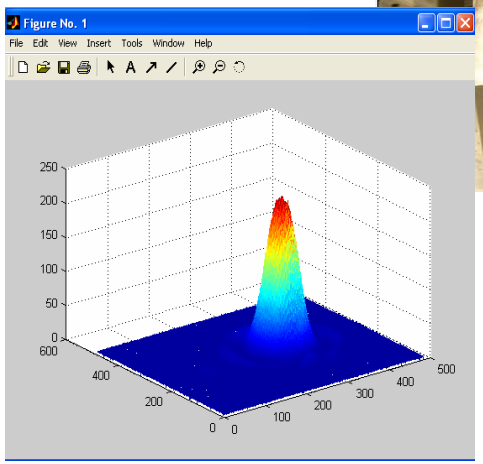


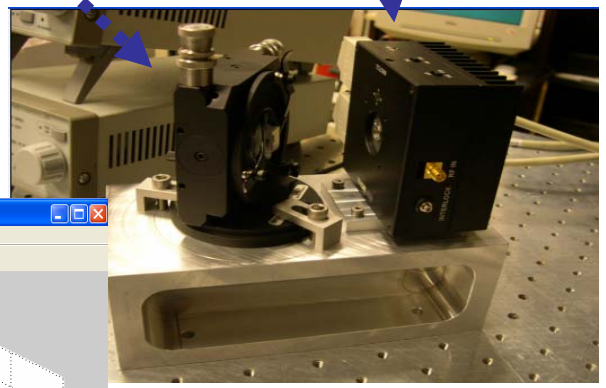
Laser diode

anamorphic prism









Check of the laser diode operation: 1D cavity modes

Current modulation of the laser diode

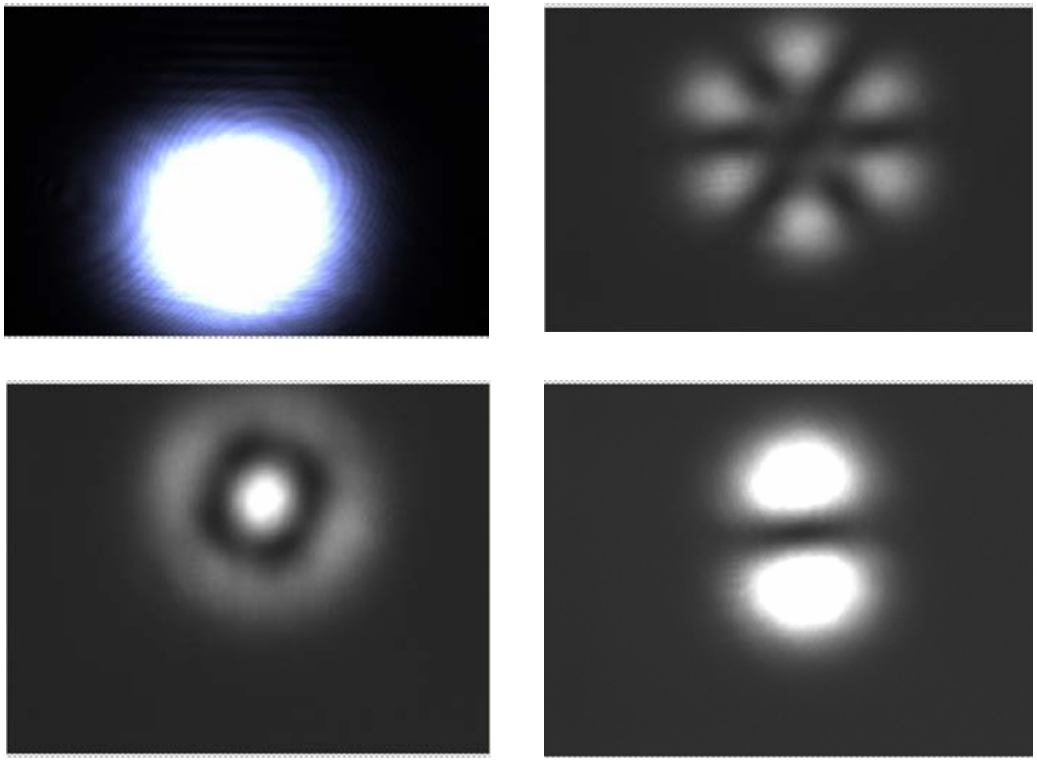
Cavity=2 mirrors

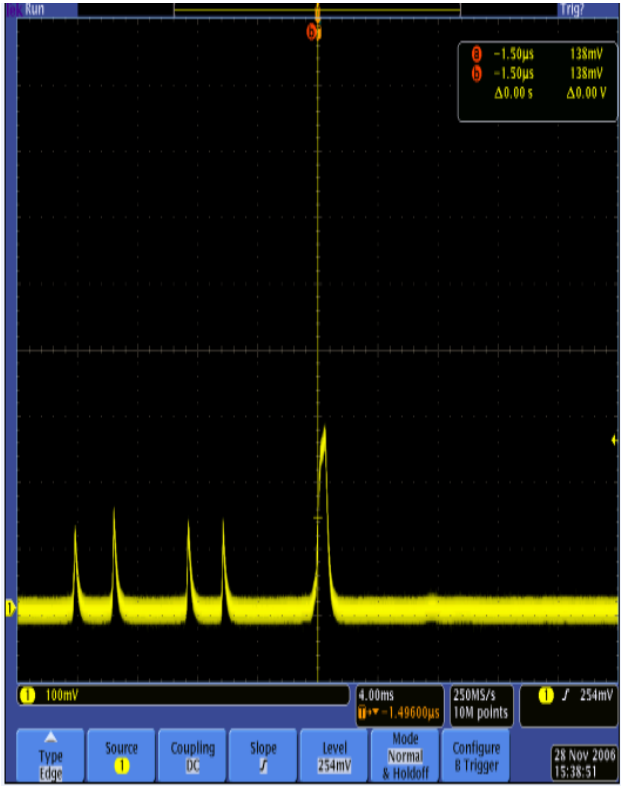
photodiode

CCD

modes

Transmitted power





Schedule for 2007

- Step 1: manpower problem solved
  - 1.5 FTE more for analog electronics (starts Jan.-Feb. 2007).
  - First results for high finesse (Gain=10^4) expected mid-2007, very high finesse (Gain=10^5) at the end of 2007
- Step 2: progressing
  - End of the mode structure studies for non-planar bow-tie cavity expected in spring 2007
  - Study of the length control of such cavity will start in Feb. 2007
- Step1+Step 2 would require one more year…
  - Possible experimental implementation at ATF