STATUS OF THE FERMI LASER SYNCHRONIZATION WORK AT ELETTRA

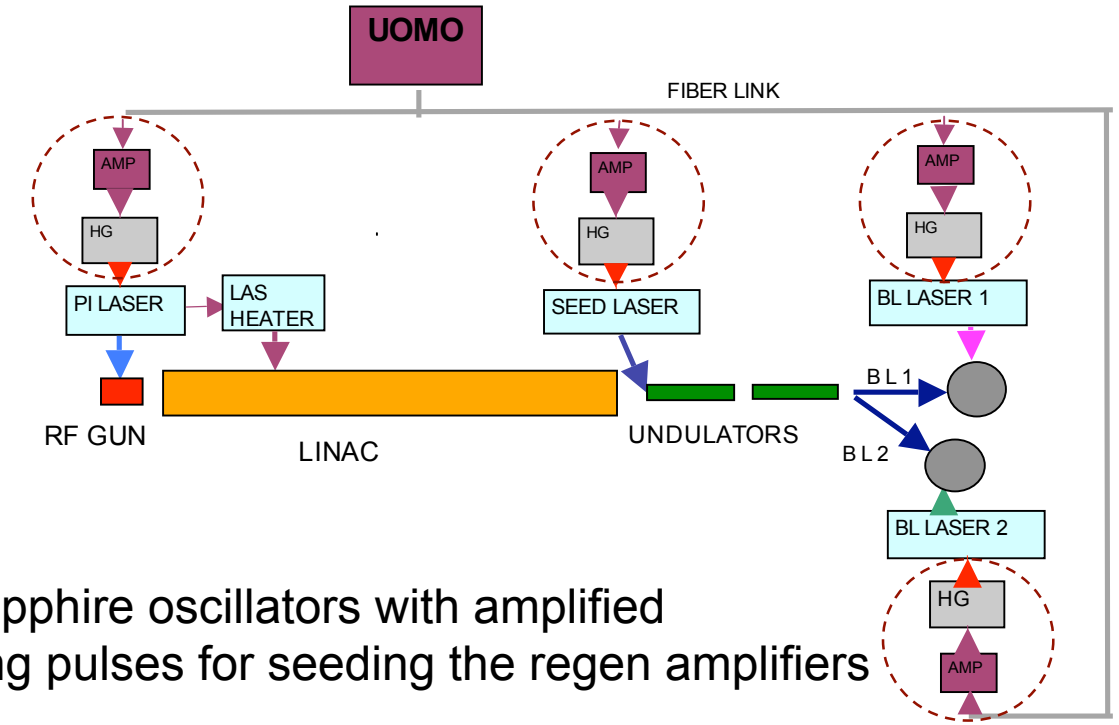
I. Status of 'direct seeding'

Miltcho Danailov

II. Work on laser to ext sync locking

Paolo Sigalotti

Direct seeding concept



Main idea: replace Ti:Sapphire oscillators with amplified frequency doubled timing pulses for seeding the regen amplifiers

Main issues:

-Pulse energy : >0.5 nJ , better 1 nJ, at 780-785 nm

- Bandwidth (FWHM) :>8 nm for a 100 fs system, >20 nm for 50 fs

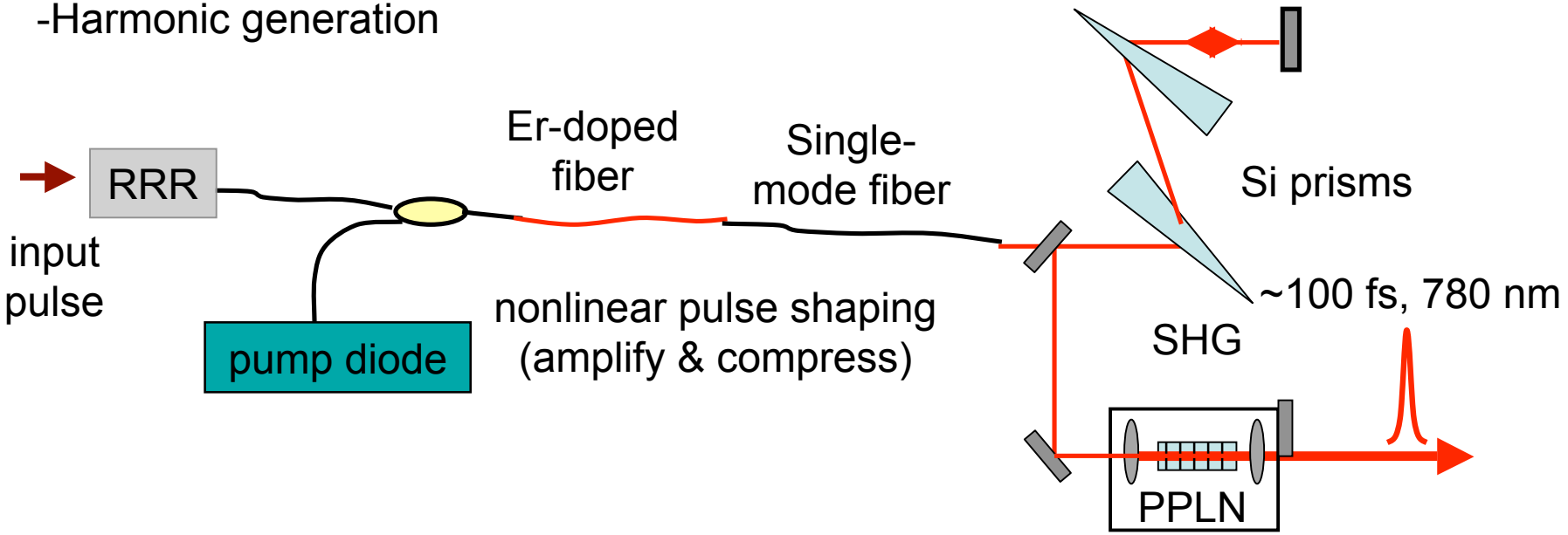
Direct Seeding Implementation

Timing pulses: 15-20 nm bandwidth @ 1560 nm, pulse energy <0.1 nJ, rep rate 157 MHz

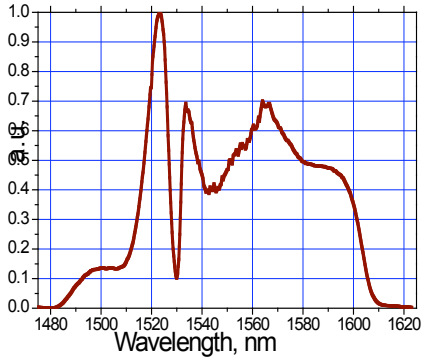
-Repetition rate reduction ; - Amplification to 5 (better 10) nJ range

-Bandwidth broadening to 30 (better 40) nm; - Compression (fibre+prism or grating compressor) to <100 fs

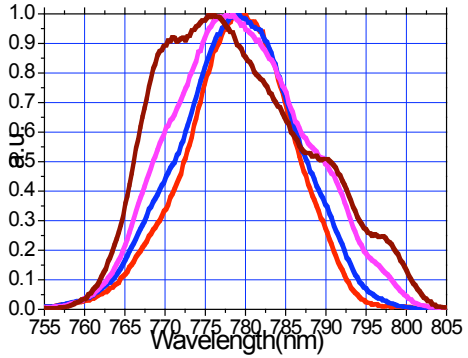
-Harmonic generation



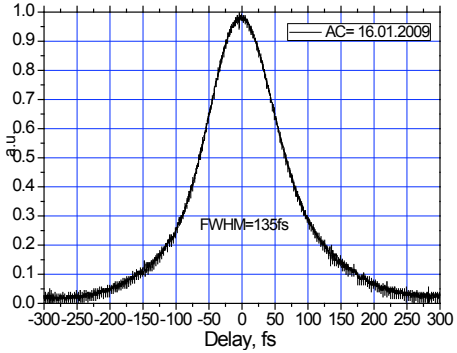
SHG results



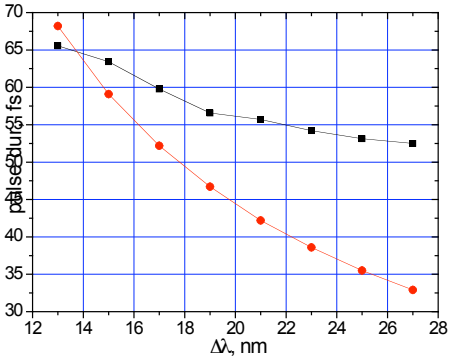
Input spectrum (Menlo TC1550)
1.1 nJ per pulse, 110 MHz



Spectra SH at different focus position in chirped PPLN



Autocorrelation curve fundamental



Pulse duration SH (from AC)
after compression in a prism pair

Fibre Amplifier and Compressor

- Setup prepared, pulse energy above 10 nJ obtained starting from <0.1 nJ

Problems to be solved:

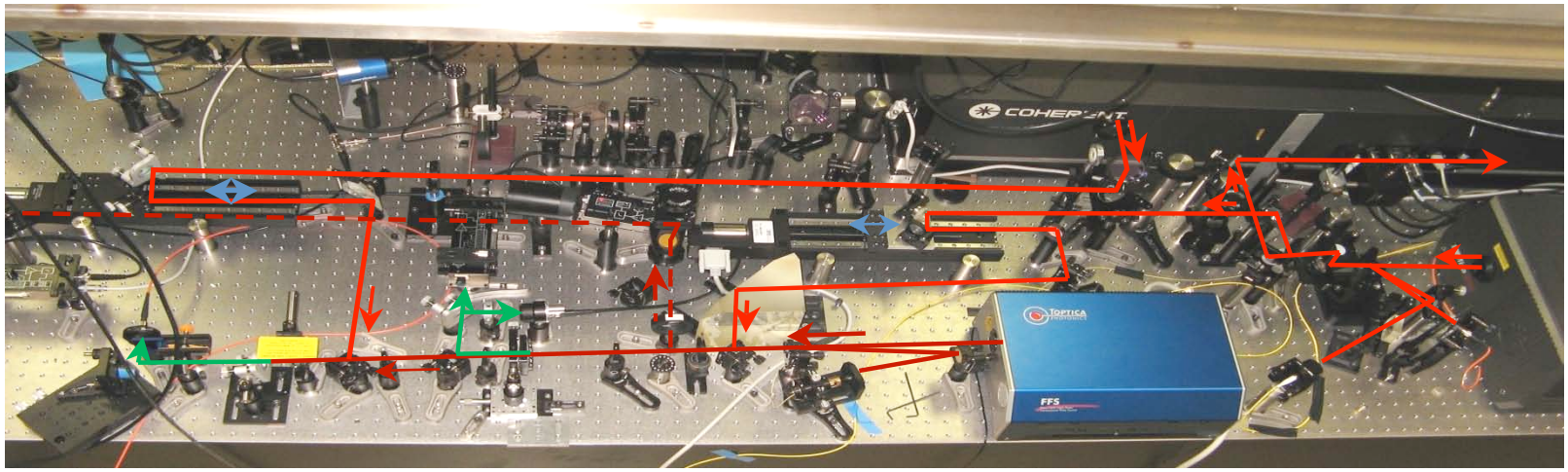
- 'Blue' shift during amplification , optimization fiber type in progress
- Spectrum too narrow
- Phase not linear -> TB product of compressed pulses too large

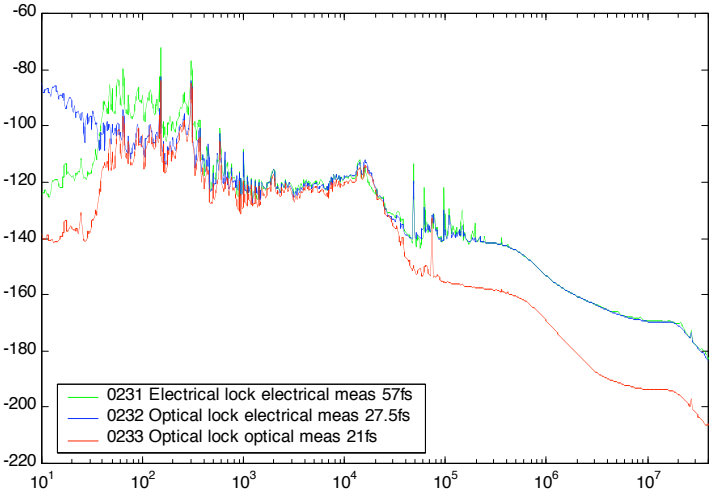
Schedule:

- Amplifier setup to be completed by end 2009
- Direct seeding prototype by end 2010 (IRUVX)

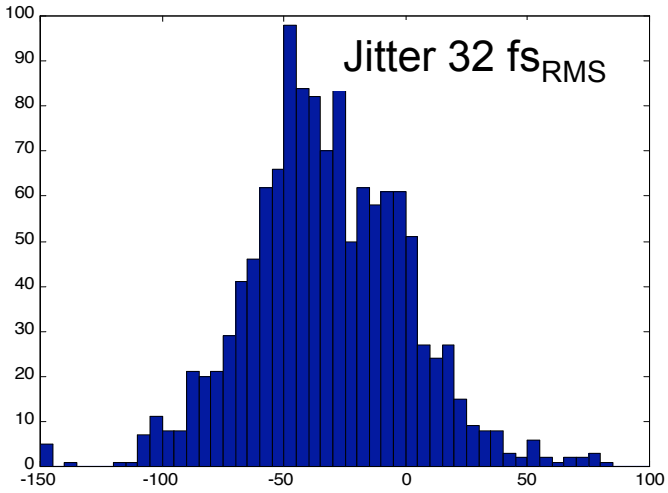
TESTS LASER JITTER REDUCTION

Test of PIL locking to an external fbre laser by optical cross-correlation





Phase noise measurement

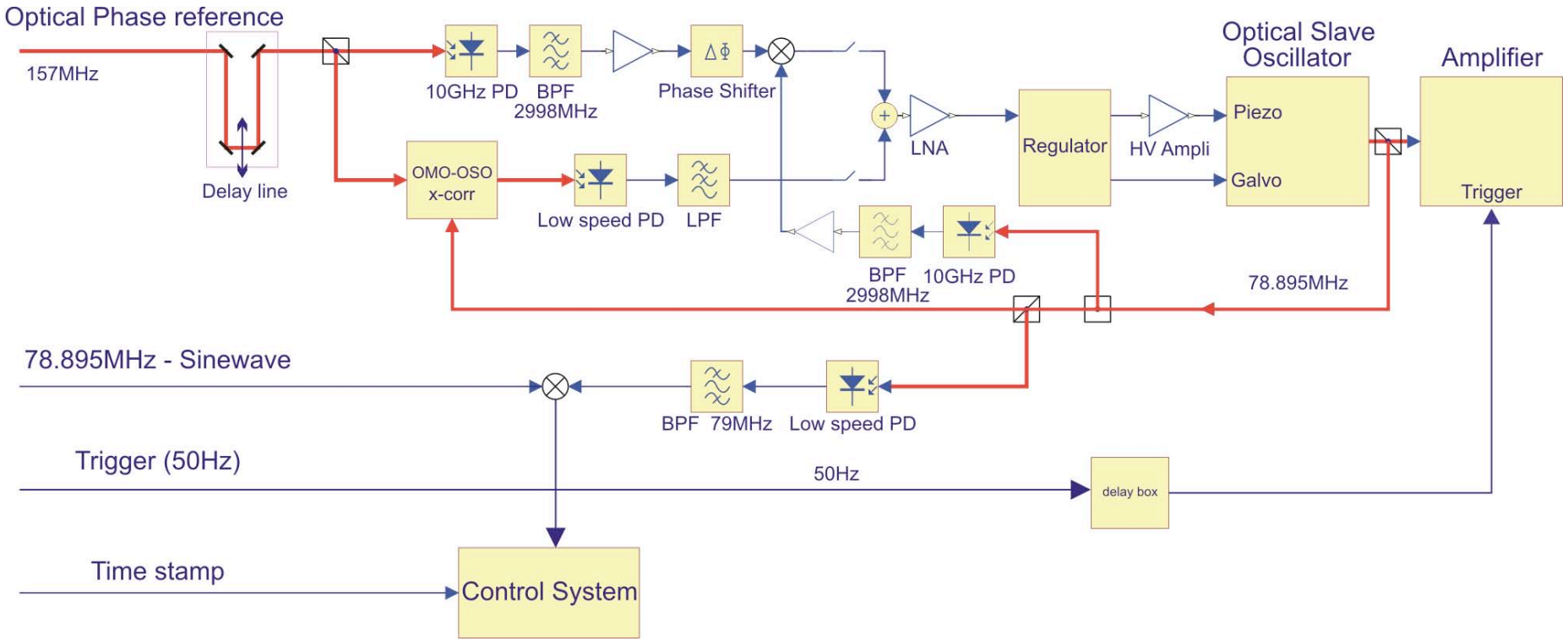


Distribution of arrival time at the second x-corr

M.Danailov and P.Sigalotti

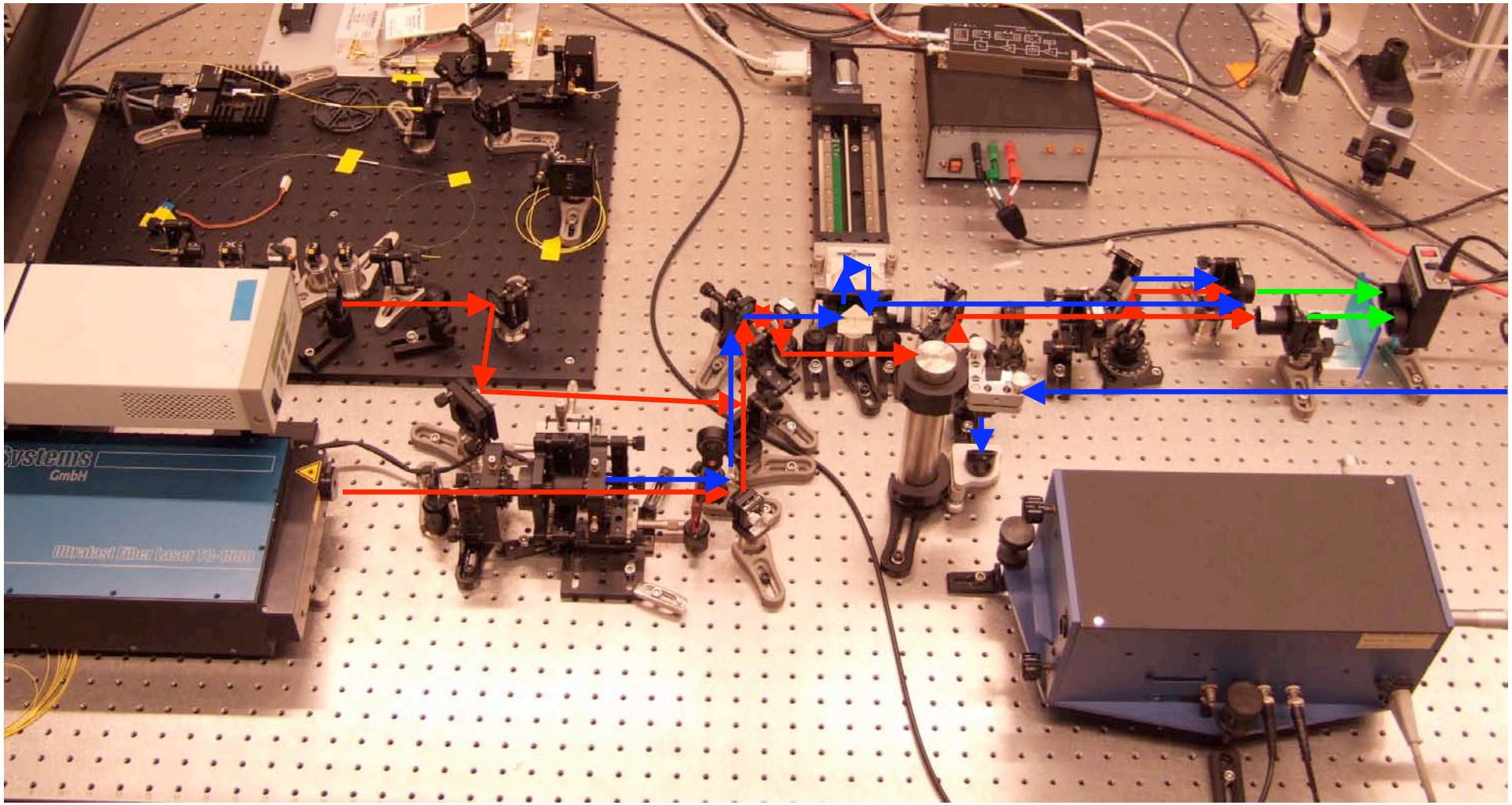
2nd Timing and Synchronization Workshop, Trieste, 9 March 2009

Locking setup



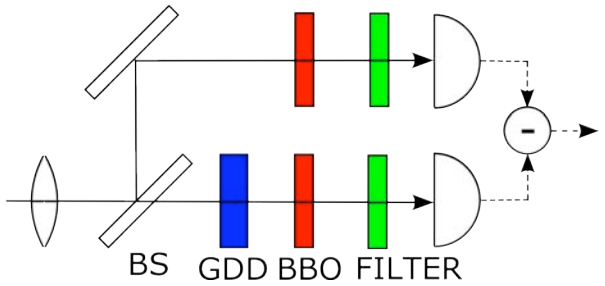
Final version of the laser locking scheme for FERMI

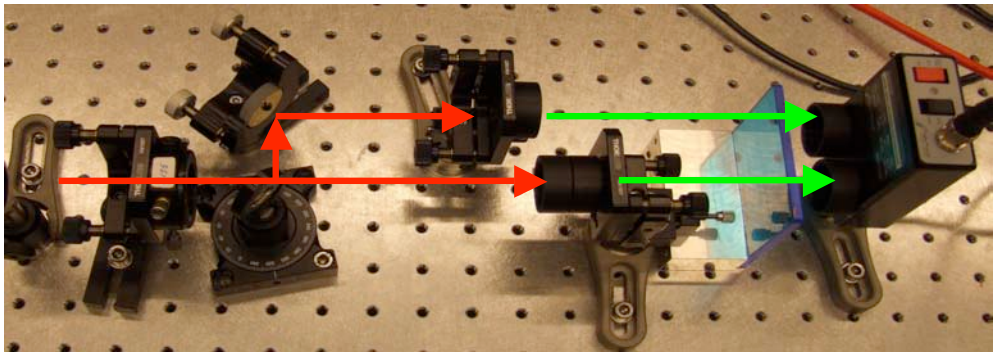
CrossCorrelator Test Bed

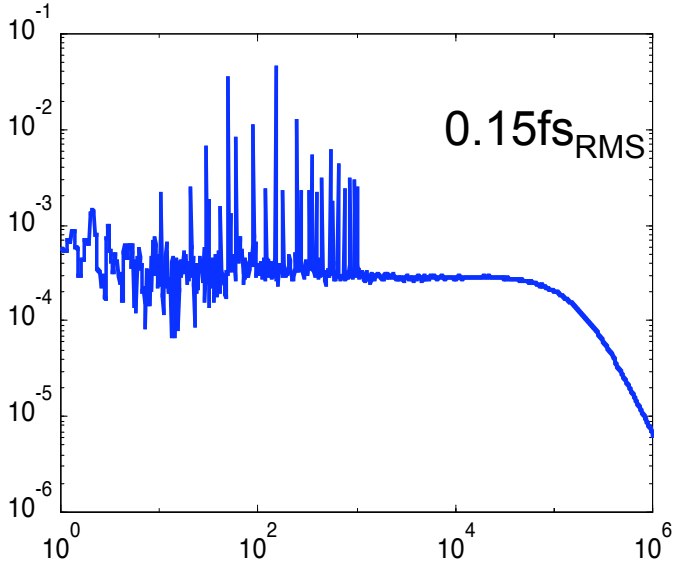


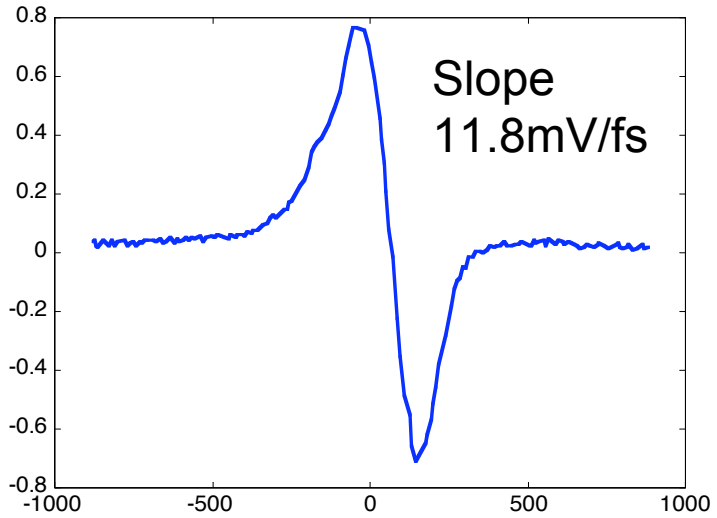
M.Danailov and P.Sigalotti

Balanced Crosscorrelator









First results on noise floor measurement

M.Danailov and P.Sigalotti

Schedule:

- *100 fs electrical synchronization PIL by end July*
- *<50 fs cross-correlator based locking for seed laser : spring 2010*
- *Fibre amplifier setup to be completed by end 2009*
- *Direct seeding prototype by end 2010 (IRUVX)*

People involved in the work:

- ***The Elettra laser group***

Miltcho Danailov, Alexander Demidovich, Rosen Ivanov, Ivaylo Nikolov, Paolo Sigalotti

- *Yuri Loyko , visiting scientist under ICTP TRIL program*
- *Paolo Cinquegrana, diploma student*

Collaboration:

- *Elettra timing&synchronization team*
- *DESY group*
- *Omer Ilday and his group at Bilkent University*