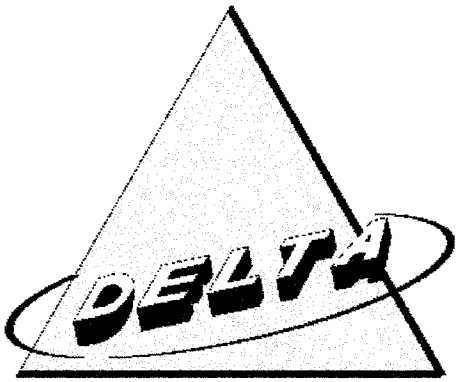

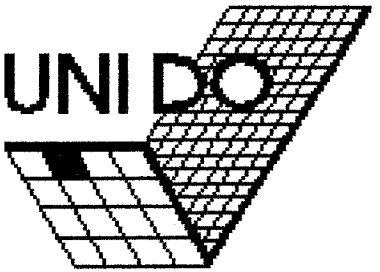

First Lasing of the FELICITA I FEL at DELTA

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Introduction: FELICITA I

general	
wavelength	470 nm
electron energy	450 MeV
bunchpattern	1, 2, 4
electro magnetic undulator	
period length	250 mm
number of periods	7 + 7 (OK)
dielectric mirrors	
substrates	quartz
radius of curvature	8.0 m
optical cavity	
length	14.4 m
Rayleigh length	2.4 m

The History of FELICITA I

first idea	1984
project foundation	1992
installation of the undulator	1995
installation of the mirror-chamber	1996
trying to lase	1997

First Lasing **January 28th 1999**

…two days after the arrival of a streak camera

Stages of the Commissioning

Nov. 1996 till Apr. 1997

commissioning of the ring at low energies with undulator

Nov. 1997 till Jan 1998

alignment with the undulator and the mirrors

no longitudinal information, weak transversal criteria

Mai 1998

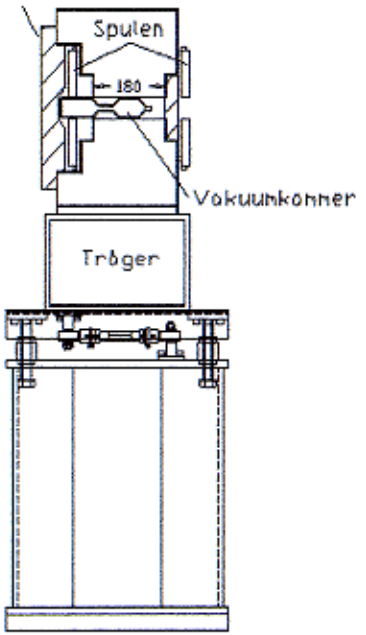
first try with a streak camera

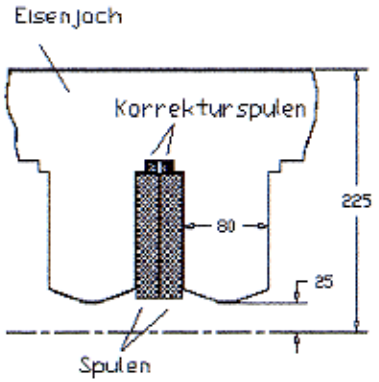
short in sextupole: $I_{MAX} \leq 3$ mA

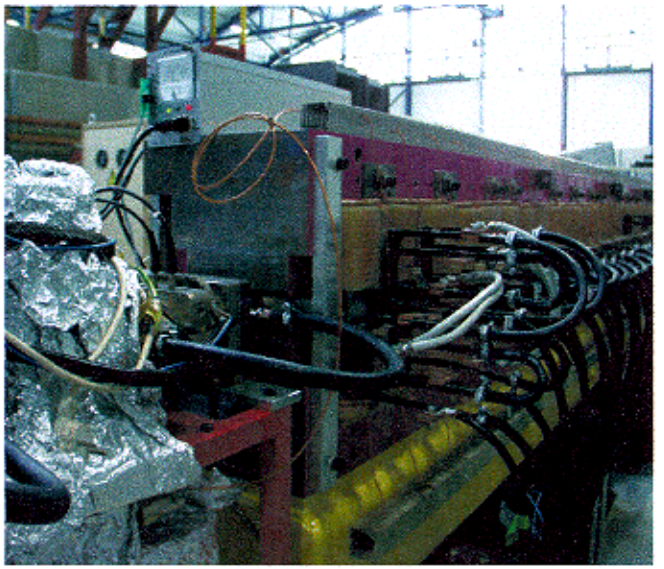
Jan. 1999

good transversal alignment: LASING

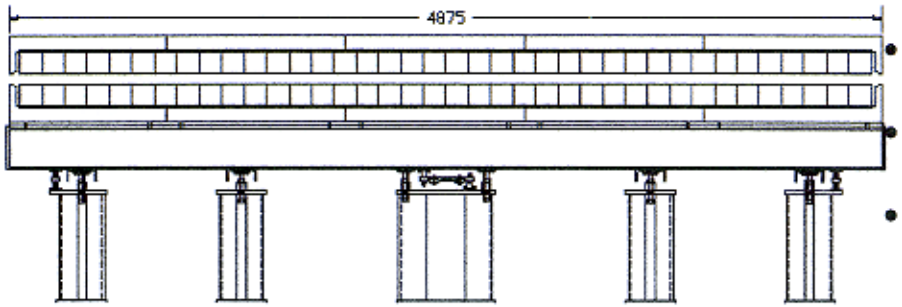
The electromagnetic Undulator







- two-in-one electromagnetic undulator
- optical klystron and pure undulator with one beam accessible
- λ_U = 250 mm($\Rightarrow$ 50 mm gap size, standard vacuum tube useable)



- 17 full periods as pure undulator
- 7 + 7 full periods as optical klystron
- N_D larger than 100 possible

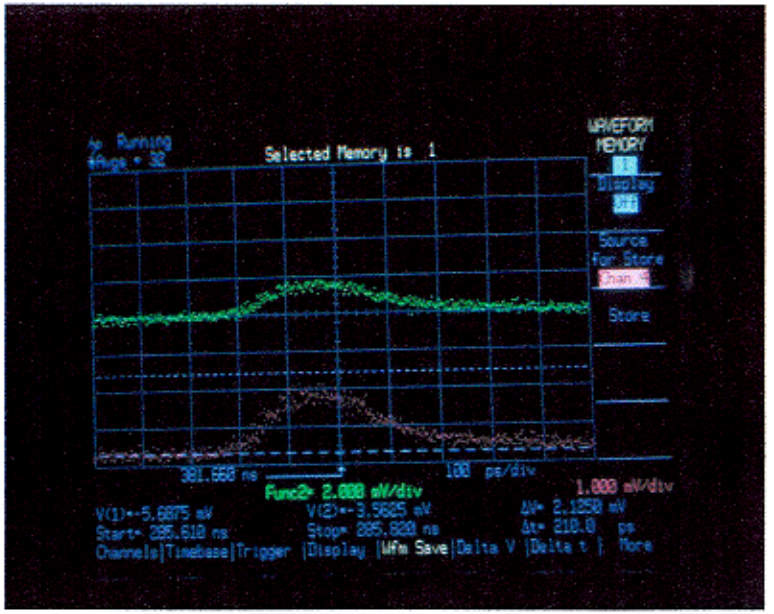
Longitudinal Alignment I: (50 GHz Scope) Moving the Mirror-chamber

stored light-pulses in a misaligned cavity add up to tails

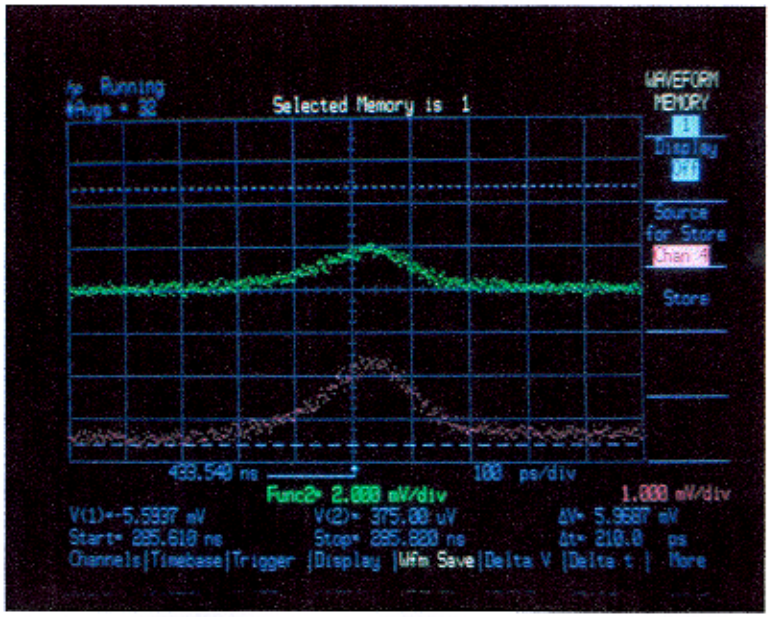
moving the chamber by ±0.3 mm changes the tail

=> longitudinal position known to ±10 kHz

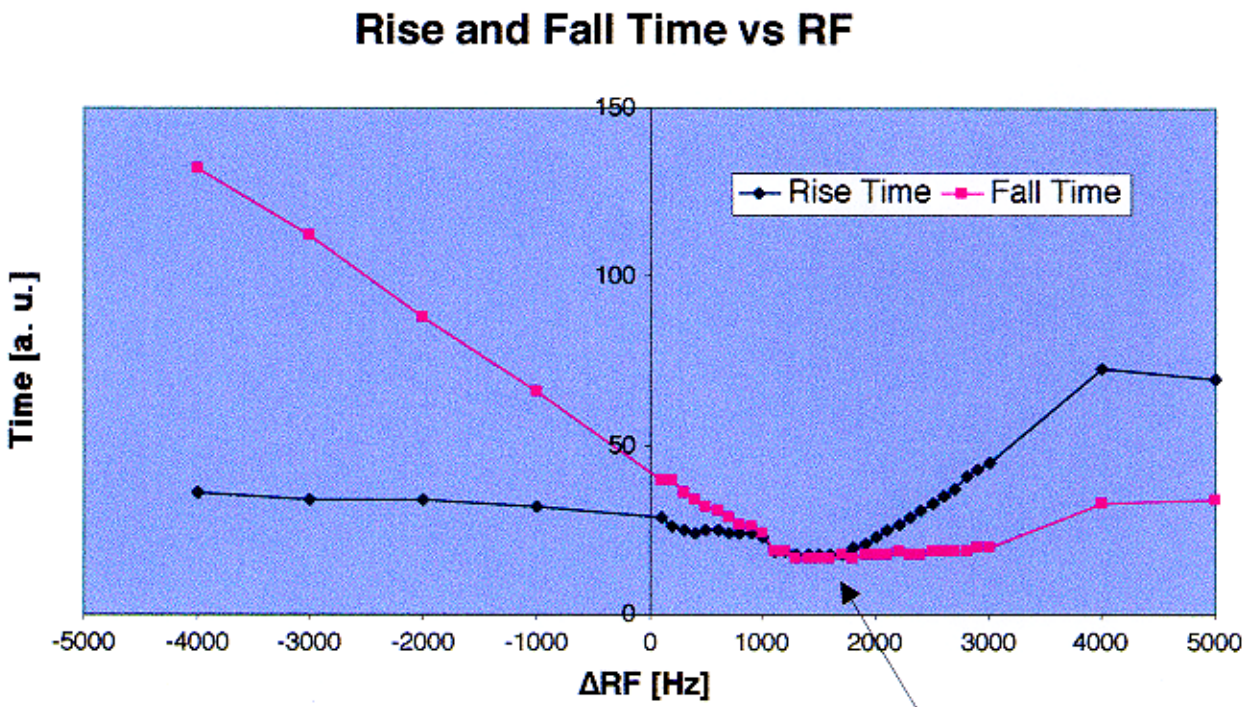
0.3 mm too long



0.3 mm too short



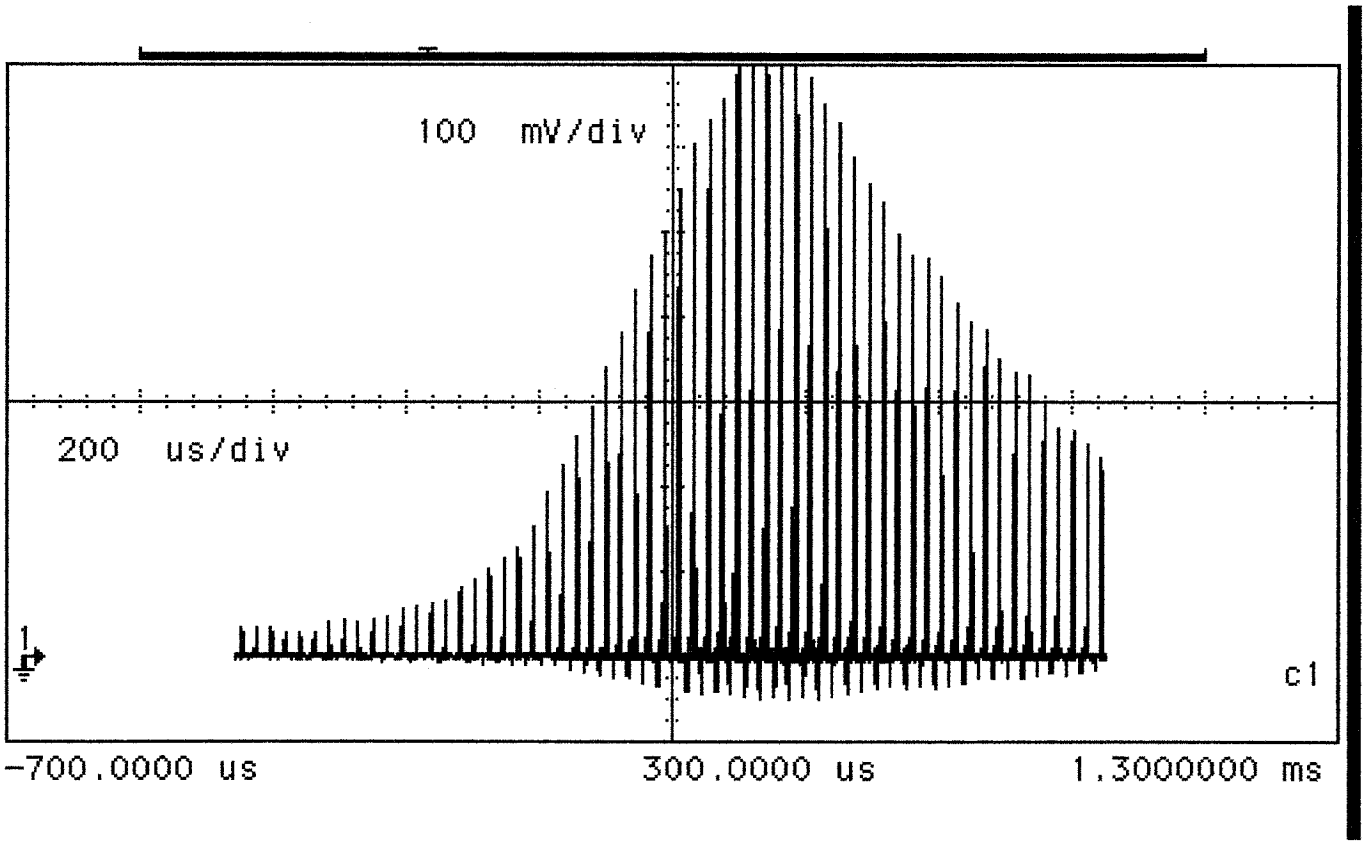
Longitudinal Alignment II: Streak Camera



The streak camera increases the resolution to ±15 μm (±500 Hz).

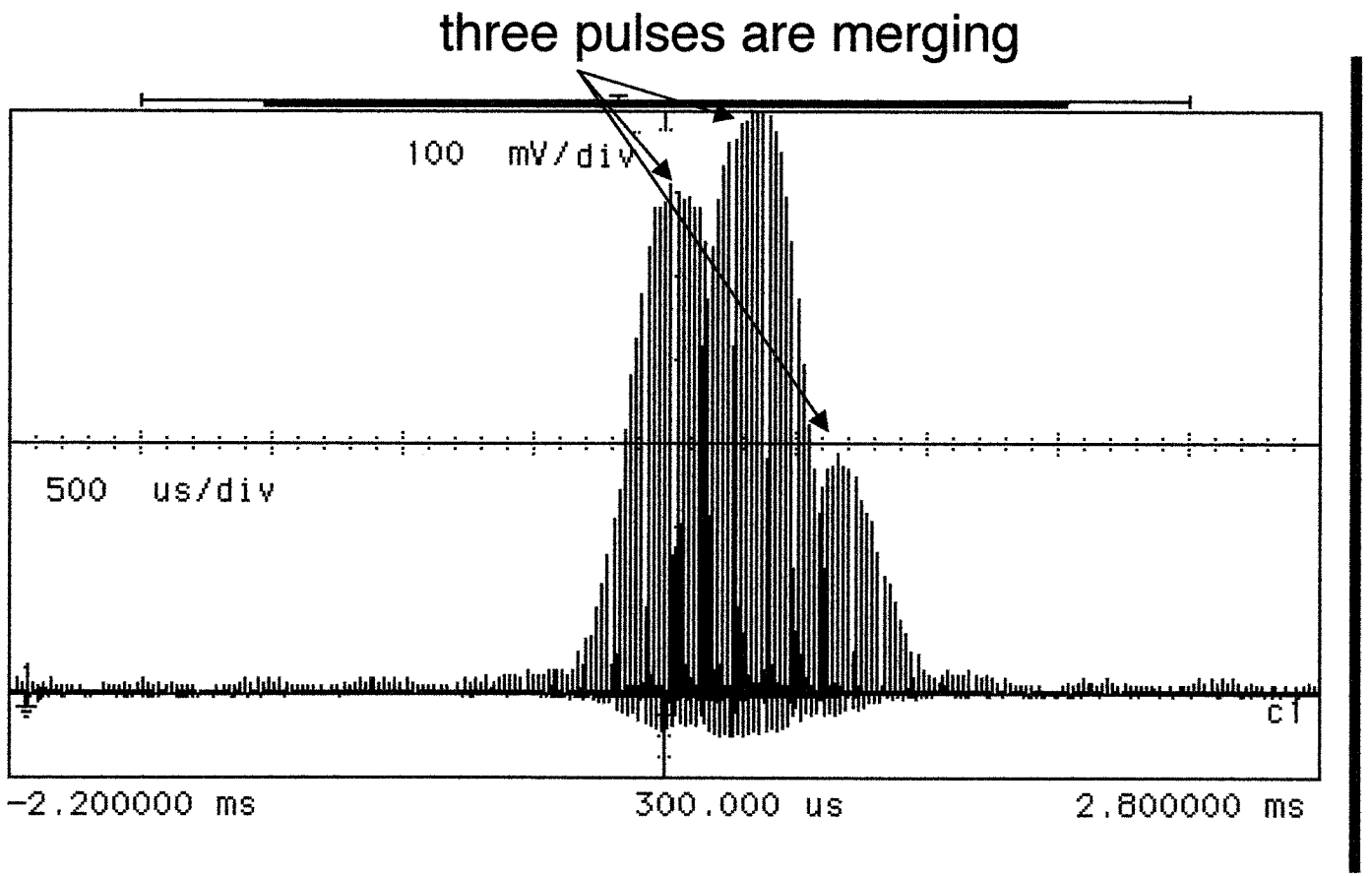
First Lasing

January 28th 1999, 14[12] h



losses > 5 %; net gain > 10 %

Interesting Pulses



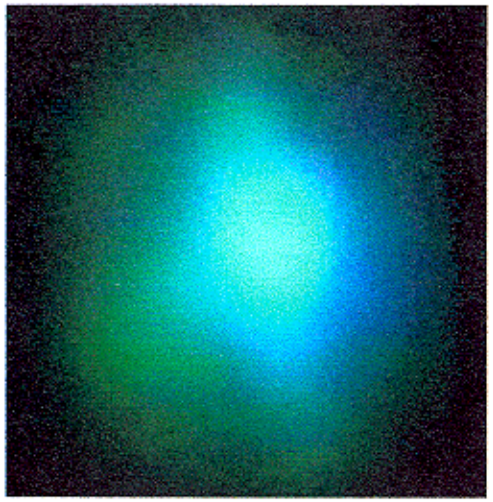
First Results

• threshold current	5 mA (single bunch)
• pulse duration	500 μs – 5 ms
• repetition rate	30 ms – 10 s
• filling pattern	single & two bunches
• rf sensitivity	4 – 40 Hz (0.1 – 1 μm)
• Gain	larger than 1 %/mA

Plans for the Future

next run in April 1999 (still 35 MeV LINAC)

wavelength: 420 nm



things to measure:

- pulse-length
- spectrum
- output-power
- stability

parameter:

- N_d (pure undulator-mode)
- beam current
- misalignments
- filling pattern

mid-term: mirrors for 257 and 225 nm are in house