June 26, 2004
International Symposium on
Ultrafast Accelerators for Pulse Radiolysis

Temperature control for systems

M. Uesaka, H. Iijima, Y. Muroya, T. Ueda, A. Sakumi,
Nuclear Engineering Research Laboratory, University of Tokyo
H. Tomizawa, N. Kumagai
SPring-8, Japan Synchrotron Radiation Institute

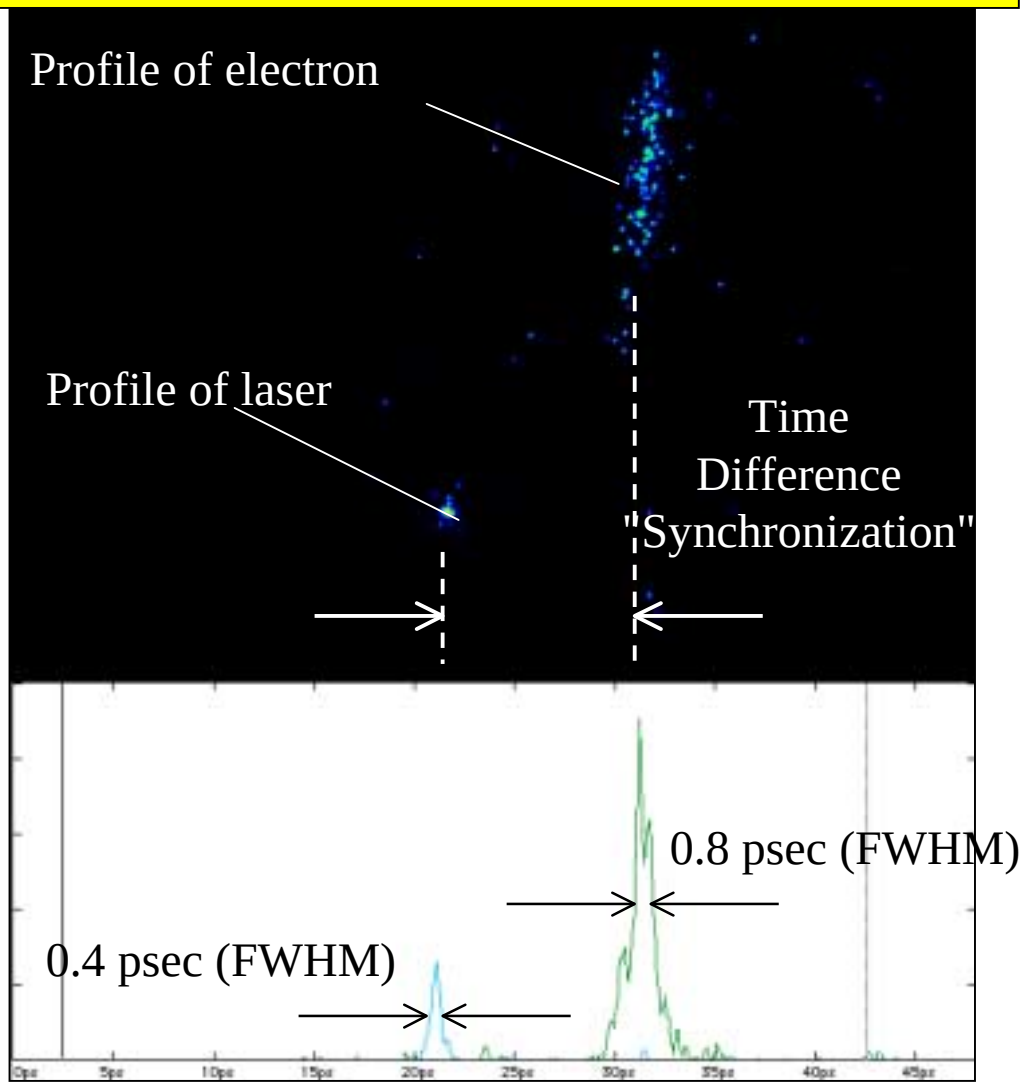
Requirement of stable synchronization

Typical Femtosecond Streak Camera Image of Synchronization

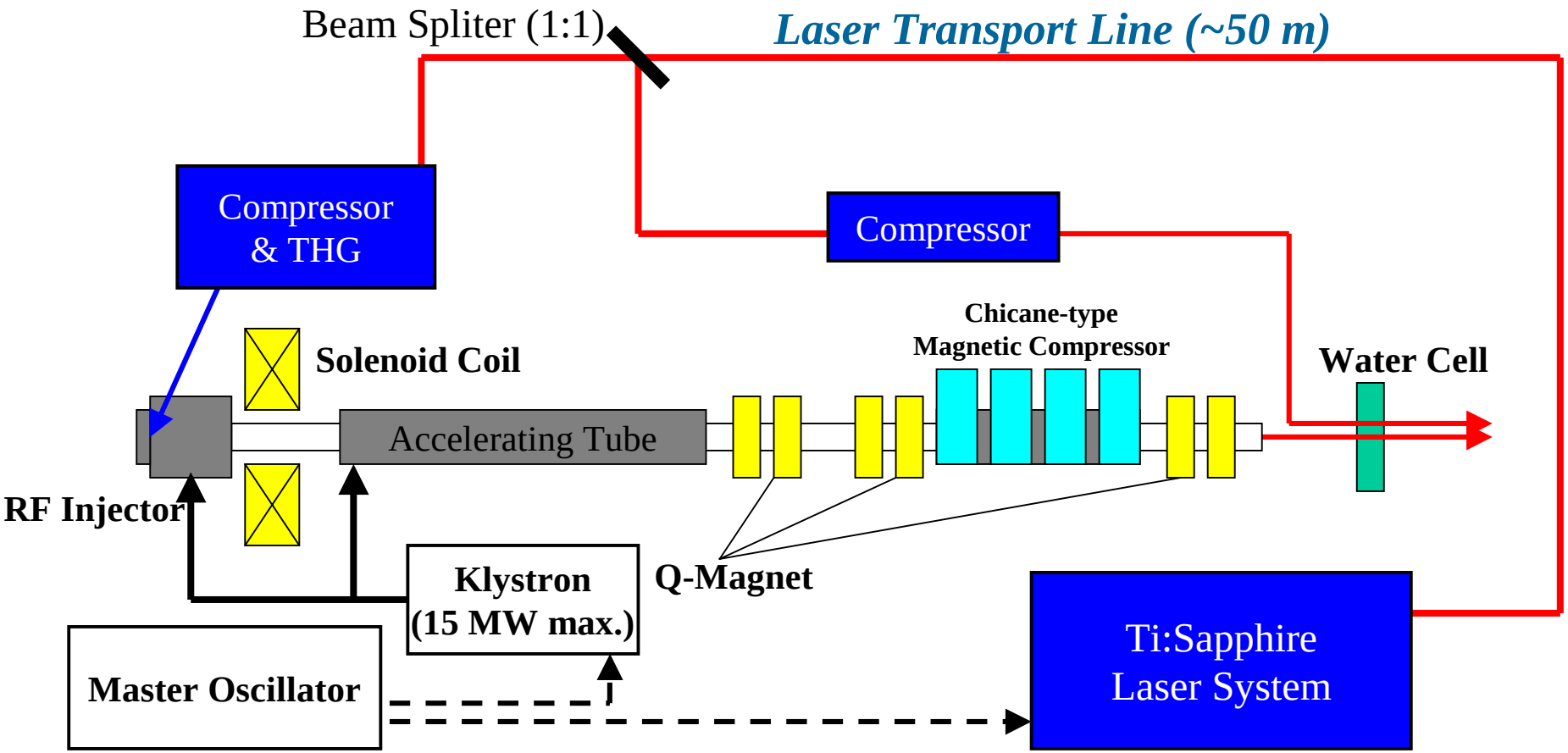
- The S-band linac with Mg photocathode RF injector has been developed for radiation chemistry.

- The radiation chemistry experiment requires a time resolution in a range of sub-picosecond.

- The time resolution is defined by… *pulse duration of pump-beam, and probe-laser, synchronization between the beam and laser, and the beam intensity*.

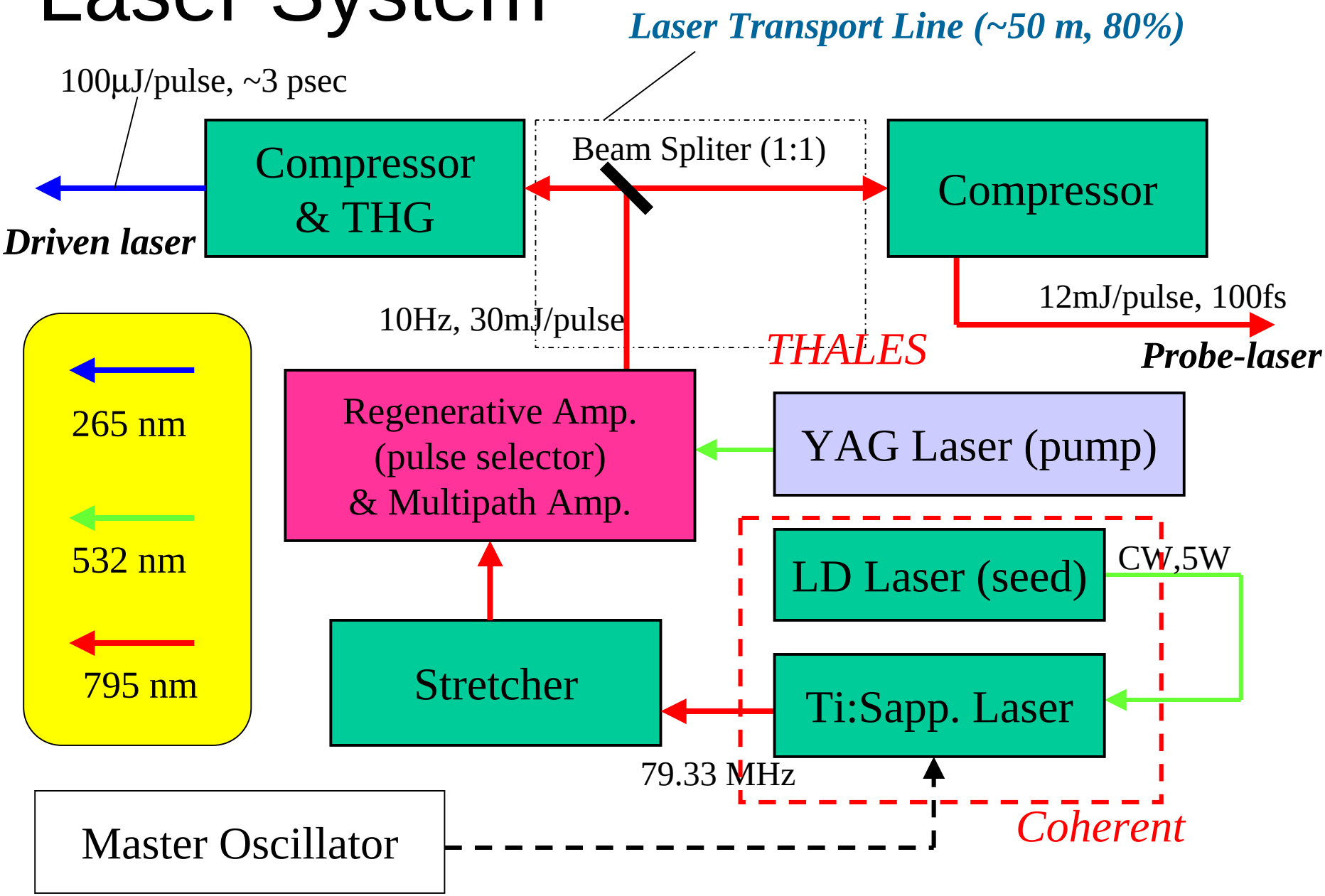


Linac System for Radiation Chemistory



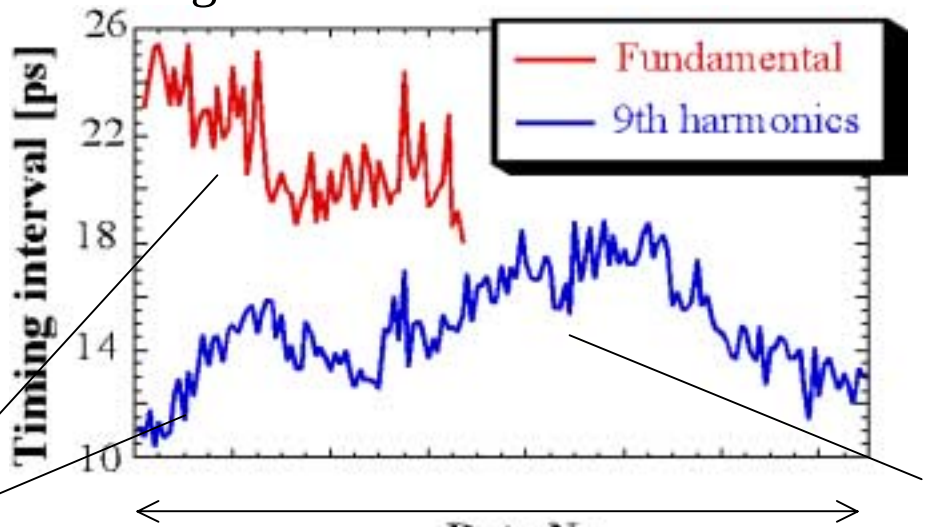
- The Mg photocathode is used as the injector.
- The electron is accelerated up to 22 MeV by a S-band accelerator.
- The electron bunch is compressed by a chicane-type magnetic compressor.
- The Ti:Sapphire laser is used for the driven laser of the injector and the probe-laser.

Laser System



Previous result

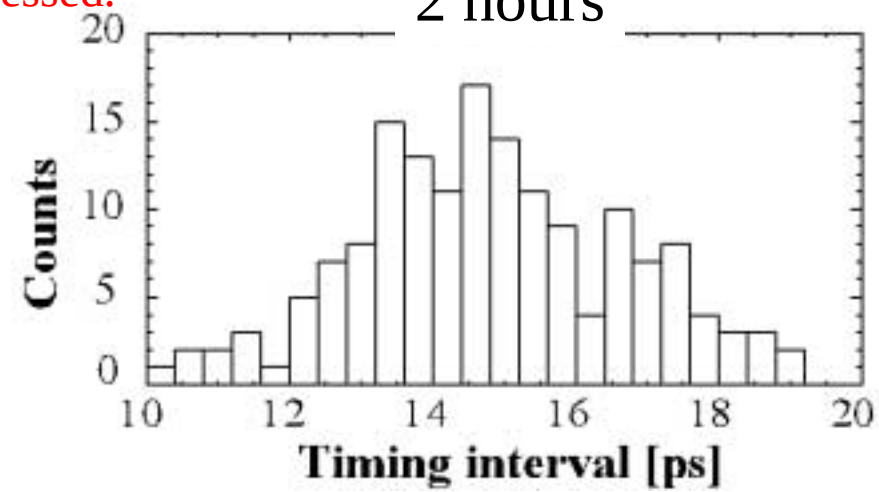
Timing interval between RF and laser



Timing drift of long term was left.

Timing jitter was suppressed.

2 hours



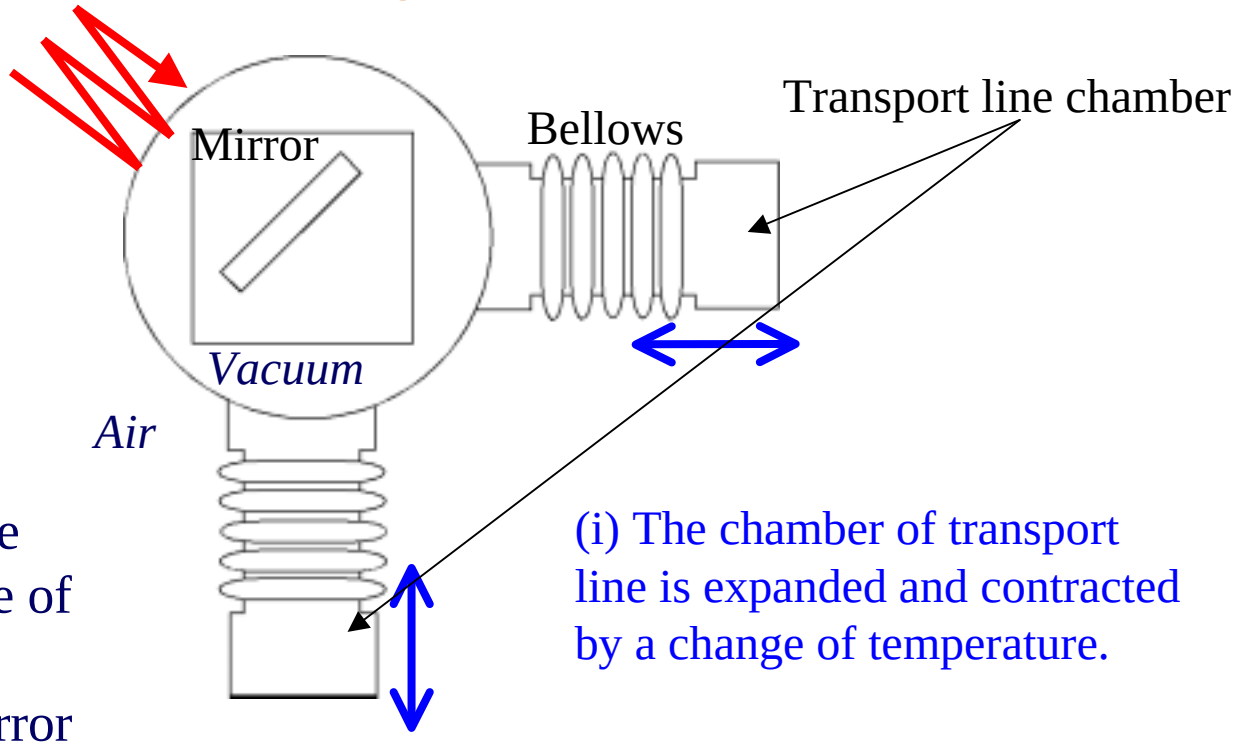
The phase-lock of higher harmonics suppresses the timing jitter, but the timing drift was remained.

Source of Timing Drift

Mechanism of timing drift

The laser transport line is 50 m long, and 14 bellows are used.

(iii) The mirror chamber with flexibility due to the bellows is moved by the pressure.



(ii) The pressure difference between inside and outside of the transport line chamber applies the force to the mirror chamber.

(i) The chamber of transport line is expanded and contracted by a change of temperature.

- In the chembers… Vacuum ➡ Atmospheric pressure N_2 gas.

To suppress the pressure effect!

Stable Synchronization

~ Result of transport line improvement~

The pressure effect due to evacuated transport line was suppressed.
The expansion and contraction effect due to temperature was left.