

Highlights of the FEL 2003 Conference

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General Observations

- Meeting held in Tsukuba, Japan at the Tsukuba Conference Center.
- FEL Prize went to Li Hua Yu for contributions to SASE Theory and for the concept of High Gain Harmonic Generation (HGHG).
- Still no new power records.
- CSR is out, LSC is in.
- Some interesting new ideas

New Lasers

Each year we welcome new lasing groups to the community through the new lasing session. There were four talks this year:

- Novosibirsk laser has lased
 - 0.12-0.18 mm wavelength
 - 5.6 MHz beam, 1 nC charge
 - All done with energy recovery
 - About 10 W output power
 - Only 0.015% efficiency!
- CATS laser at Frascati
 - Uses phasing to get energy out of the entire micropulse despite very large energy spread.
- IR Upgrade - 300 W maximum power output. 3 mA recirculated.
- Israeli EAFEL
 - Not fully optimized yet. Just got lasing before conference.
 - Lase at 100 GHz.
 - 6 W output during 8 μ sec. macropulse, not yet saturated.

High Power Lasers

- Michelle Shinn gave an invited talk in the workshop session discussing our 10 kW progress.
- The Novosibirsk project has lased but not yet at high power (in principle capable of over 10 kW of power).
- Los Alamos presented room temperature RF gun design. Specs merging with the DC gun specs.
- Israeli group hoping to get 10 kW for 1 msec pulses (10 J/pulse) in mm wave region.
- KAERI group getting closer to first light (multi-kilowatts possible).
- Rossendorf getting pretty close to first light (hundreds of Watts possible).

Short Wavelength FELs

- The SDL at Brookhaven has produced saturated output at 266 nm using HGHG and used the coherent third harmonic to do user experiments. They have demonstrated chirped pulse amplification.
- Start-to-end simulations are all the rage. They seem to retroactively predict machine performance.
- Argonne now mainly used for user experiments. Not much time available.
- SPPS has produced 30 kA beam at 30 GeV. Have measured 80 fsec FWHM pulse. Will be used for x-ray pulses.

Production of Bright Beams

- CSR is now a non-issue. Proper design of compressors with Landau damping can minimize emittance growth from CSR.
- Major problem now is longitudinal space charge (LSC). SLAC is now planning to use an inverse FEL to increase the uncorrelated energy spread on the beam.
- SLAC has now switched to magnesium. They were the last holdout.
- The SRF gun looks more and more promising but it is still a long way from realization with high charge operation.
- Peking University is making good progress on their DC-SRF gun with a 70 kV DC photocathode gun coupled to an SRF cavity.
- Los Alamos and AES presented room temperature high duty factor gun design.

Storage Ring FELs

- There is a new laser project in Tohoku with a storage ring similar to ELLETRA.
- ELLETRA's performance is slowly degrading with time due to failed bellows shields and small chamber heights. Are despairing of ever lasing with fluoride mirrors.
- Duke has now extracted the higher harmonics produce during pulsed lasing using a hole in the mirror.
- Theory and experiment are agreeing to high precision now.

FEL Technologies

- The Dundee group has used a modification of the single pulse bunchlength measurement to measure the microscopic electric field profile of an FEL pulse. This indicates that the resolution is much less than the 530 fsec optical period.
- The SDL group at BNL has demonstrated a phase space tomography reconstruction using a new technique that is more robust than the previous methods.
- Alex Lumpkin demonstrated a technique for electron beam alignment in SASE FELs. Unfortunately it only works at wavelengths longer than about 100 nm..



New Ideas and Proposals

- France wants to build a device similar to the 4GLS.
- MIT Bates proposed machine is now a higher energy, hard X-ray SASE FEL.
- Dave Dowell has an idea to use a two frequency RF gun to mimic a DC gun.



Applications

- **Prize talks were the highlight of the workshop.**
 - Alan Schwettman noted that FEL facilities must provide beam to multiple users simultaneously in order to be cost effective and attract users who might also just by a state of the art conventional laser.
 - Lex Van der Meer compared the cost of doing research using the FELIX facility to using a SR source and found it comparable. There are less and less applications which really need an FEL though.