Asian / Japanese Activities on LC

ISG-X
June 17, 2003
Report by Nobu Toge (KEK)
What’s New, Since ISG-9 (Dec. 2002)

- Progress at ATF – New RF gun, emittance studies.
- LC Globalization Committee (GLCC) at KEK: Final report in Dec, 2002.
- ACFA LC Symposium held in Tsukuba (Feb, 2003).
- Rename: JLC → GLC
- Launched: GLCTA as a joint extension of ATF/X-band efforts at KEK
- Renewal of KEK lab management: “Analytic continuation of basic policies” (by Y.Totsuka)
- Continued efforts with NLC group on TRC-II R1 and R2 challenges (not new, but stronger)
ATF Progress

New RF gun
(multibunch) since
Fall, 2003.
E=1.28GeV
Ne=1x10^{10} e-/bunch
1 ~ 20 bunches
RF Electron Gun with Multibunch Capability

- 20 bunches, 2.8 ns spacing with high quality beam
- BNL-style S-band cavities built within KEK
- Cs2Te cathode
- Nd:YVO4 357MHz mode-lock laser
Multibunch e- beam at 80 MeV point

- Beam Intensity
  ~1x10^{10}/bunch
- Normalized Emittance
  \( \varepsilon_y = 28 \times 10^{-6} \text{ rad.m} \)
- Bunch length
  \( \sigma_z = 6.4 \sim 7.9 \text{ ps} \)
- Energy spread
  \( \frac{dE}{E} = 4.9\% \text{ full-width} \)
- Q.E. of CsTe cathode
  16\% initial, 2~3\% with RF ON & constant over a week
Improvements in ATF DR

(A) New BPM electronics
(B) Beam based BPM offset correction (BBA)
(C) Frequent Beam based optics correction (COD Steer-BPM)
(D) Improved laser wire monitor

Typical Vertical COD and dispersion, May 2003 and Nov.2002
DR Beam Emittance Measured with Laser-Wire
(Single-bunch, April 16, 2003, Preliminary)

Vertical Emittance (rad.m) vs Total Current (mA)

- $\gamma \varepsilon_y = 1.3 \times 10^{-8}$ m
- Note: $\gamma \varepsilon_x \sim 4 \times 10^{-6}$ m
- so, emittance ratio $\sim 0.3 - 0.4\%$

$N = 1 \times 10^{10}$ / bunch

(Y. Honda)

Committee charge: examine how to realize JLC through a global-scale international collaboration.
- Examine the relation of LC-lab (GLCC), KEK, National / Local governments, overseas Labs, agencies overseas.

Chair: S. Yamada (KEK). Committee had 20 members (10 non-Japanese, from China, Korea, Taiwan, Russia, USA, Germany, France, CERN)

Final report available at the URL above.
Report from GLCC Committee

Possible paths -

(A) extension of an existing laboratory

(B) creation of a new international laboratory based on treaties,

(C) and in between the two cases.

Committee Conclusion:

(B) is the preferred way.

Long-term organizational stability and security, sharing of cost, human resources and responsibilities, desired openness for the scientific opportunity.
Pre-GLCC

- Precursor step towards GLCC.
- Similar to existing collaborations for high energy physics experiments in a way.
- The foundation is based on MoU among laboratories and universities.
- Building up the co-working spirit by actual R&D works and designing works.
- Multi-international centers (like ITER) might be a plausible way to start with.
LC Project “Roadmap” Report and ACFA LC Symposium

- Feb 12, 2003 in Tsukuba
- Jointly organized by ACFA, Japanese HEP Committee and KEK.
- Goal: inform the interested audience of the latest status of efforts towards realization of the JLC project.
- 315 participants (45 from overseas, 79 from industry)
- Web info at http://conference.kek.jp/acfalc/
- Presentations based on the “Roadmap Report” (co-authored by ACFA, KEK, and Ja-HEP Committee, about 600 scientists signed up as “contributors”. See http://lcdev.kek.jp/ProjReport/ )
ACFA LC Symposium
ACFA LC Symposium (Continued)

- 15 presentations
- Descriptions in the “Roadmap Report” (6) – Physics case, Accelerator R&D status, Conventional Facilities and Site studies, Organizational issues, Cost estimate, Possible schedule for project promotion (be always optimistic).
- “View point” talks (7) – ACFA member countries, US, EU
- Industry viewpoint talk (1)
- Remark from a senior scientist (Toshi Koshiba)

- Mini symposium presentation series was given in India in April as a follow-up (Possibilities of China, Korea also being discussed).
From ACFA LC Symposium
Physics Talk – Concurrent operation of JLC and LHC

Particle discovery

Establishing new principles

Higgs boson

Squark/gluino cascade decays

Slepton/chargino/neutralino

Higgs physics

TEVATRON

LHC

JLC

Spin/parity Coupling measurements

Higgs self-coupling

mass-generation mechanism

Supersymmetry

SUSY breaking mechanism

Proof of SUSY

Spin/coupling measurements

Higgs physics

Higgs boson
From ACFA LC Symposium – Conv Facilities

The design is done in close connection with industrial companies.

Main Tunnel (two parallel tunnels), Access Tunnels, Cooling Water Line, Electric Power Line, Experimental Hall, Surface Buildings (Labs, cooling towers, electric power substations)
From ACFA LC Symposium: Conventional Facilities -- Main Linac Tunnel
9 site candidates are selected based on good-geology (expect low ground motion).

4 additional site candidates are identified in the national R&D-base regions.

Need in-depth studies for final choice decisions.
From ACFA LC Symposium:

**Cost for the JLC Accelerator**

Assuming 1 beam delivery

- **(A)**
  - Ecm=500 GeV (tunnel for 1 TeV)
  - Sum = 495.1 BY
  - 60.5BY 220.3BY 7.6BY 13.1BY 193.1BY

- **(B)**
  - Ecm=500 GeV (tunnel for 500 GeV)
  - Sum = 459.9 BY
  - 60.5BY 216.4BY 7.6BY 13.1BY 162.4BY

- **(C)**
  - Ecm=300 GeV (tunnel for 300 GeV)
  - Sum = 315.2 BY
  - 60.5BY 128.4BY 7.6BY 108BY 10.8BY

This preliminary cost estimate is for mostly the purposes of scientific exercise to identify potential cost drivers and focus items of further R&D.

Not intending to go for a budget request based on this info (not there yet).
ALCSC under ACFA

- ACFA members: Australia, Bangladesh, China, India, Indonesia, Japan, Korea, Malaysia, Pakistan, Taiwan and Vietnam.
- ACFA web page: http://ccwww.kek.jp/acfa/
- October 2002 meeting in Melbourne created a temporary working group to establish ALCSC. The Chair will be Won Namkung of POSTECH, Korea.
- Aspects of SC charge and organization were reviewed in February 2003 in Tsukuba. Discussions continuing.
New Project Name: GLC

- Stands for Global Linear Collider.
- Intend to convey more clearly the international nature of the project, rather than re-reading “Joint LC”, etc.
- The new name was chosen through discussions within the ACFA community members.
GLCTA

- Joint extension of ATF and X-band test bench at KEK.
  - 2003: Build a structure test bench, driven by 2 solenoid-focused X-band klystrons, transferred from “AR-south exp hall”. In addition, procure 2 PPM klystrons and a modulator.
  - 2004: Possible extension of the RF power system with SLED-II or something that resembles DLDS. Also, possible extension of the ATF extraction beam line with S-band bunch compression.
  - 2005?: Connection with extracted beam from ATF, bunch-compressed for beam acceleration demonstration.

- Goal: Initiate building up the local infrastructure and expertise with X-band linac system technologies.

- Trying to make the activities compatible with TRC-II R1 and R2 efforts, if not directly benefiting them a lot.
GLCTA at KEK

- X-band High Gradient Test Station within JFY 2003
- ATF beam line extension JFY 2004 or later
- KEKB Crab Cavity Lab
- Bunch compressor (JFY 2004 or later)
GLCTA at KEK in Preparation
Conclusions (1)

- Almost all of the “promotional” activities for GLC are currently being done at the level of research scientists.
  - Players as of now: ACFA, JHEPC, KEK, in interactions with research community members from NA (i.e. you) and EU through collaborations of various forms and through ICFA discussions.
  - As of now: Outline scope of the project has been laid out at the level of research scientists – “genetic coding” of the project.
  - Discussions with members of the industry sector and among ACFA research communities are being intensified.
Conclusions (2)

- Discussions concerning formal activity coordination with the funding agencies is only being started, and yet to be established – e.g., MeXT in case of Japan at this point of time. Naturally we will need their guidance and directions in the future, particularly concerning –
  - Advanced-stage site studies.
  - Scheduling.
  - International negotiation processes.
Conclusions (3)

- We are VERY MUCH interested in learning how our colleagues in NA and EU are pursuing their versions of LC proposals, and what sort of similarities / differences of opinions / situations / problems exist compared to ours.

- However, the very first task to complete for the technical people (us) is to clear the TRC-II R1 and R2 milestones in a timely and decisive manner. The ISG collaboration continues to play a critical role in this regard. That is why we are here.