P. Grannis
Beijing GDE meeting
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FALC Technology Benefits study

FALC = Funding Agencies for Large Colliders is composed of representatives from funding agencies, some large research institutes (+ chairs of ICFA and ILCSC).

Its proposed 'Terms of Reference' includes:

"To provide a forum to promote knowledge of the applications of the technologies to be developed for large colliders, both in other scientific areas and in industry."

FALC has appointed a subgroup to coordinate a report on ILC technology benefits by November 2007.

Karsten Wurr (DESY), Masa Yamauchi (KEK/MEXT), Paul Grannis (DOE).

We see potential applications of two types:

a) Developments that will find use in new facilities for other branches of science

b) Technology that may enter the broader industrial sector.

Focus the report on an industrial audience, expecting that they will be most effective in bringing the technological benefits to the attention of governments.

- Eleven technology areas were identified (you may wish to argue for more – or less?).

Some of these areas are closely related.

Technology Benefit topics

1. Use of high gradient linear accelerators based on ILC technology in broader societal applications – medical treatment, radioisotope production, electronics fabrication, nuclear waste transmutation …

2. High gradient superconducting rf for science

   SRF can be applied for new facilities in other science areas – free electron lasers, energy recovery linacs, neutron sources, high intensity proton or ion accelerators.

   These will stimulate new advances in biology, chemistry, materials science, nuclear physics, astrophysics, neutrino studies, environmental science …

Technology Benefit topics continued

3. rf superconductivity science

   Advance understanding of rf superconductivity/material science. Develop new materials, new information on surface metallurgy, processing methodology, new fabrication methods.

4. High power rf systems

   Develop more efficient, reliable rf power systems (modulators, klystrons); new more efficient rf power distribution methods.

Technology Benefit topics continued

5. High intensity storage rings

   High intensity, small phase space beams for ILC damping rings with improved understanding of non-linear and collective effects and their mitigation. Fast kickers for injection/ejection; pulse compression schemes.

6. Nanometer scale beam instrumentation

   New instrumentation capable of measuring nanometer or micrometer sized beam position, profile – higher order mode monitors, laser wires, X-ray synchrotron devices, etc.

Technology Benefit topics continued

7. Large scale metrology and alignment

   Robotic survey systems for real-time, dynamic, micrometer-level alignment over kilometer scales. Feedback systems for restoring alignment. Remote alignment systems for large devices (magnets, cryomodules, etc.). Improved mitigation of vibration and ground motion.

8. Sources

   New technology for electron beam sources, time programmed lasers, photo-cathodes, electron gun technology, low-emittance high-current electron sources, undulators for intense photon production, high intensity Compton backscattering polarized positron beams.

Technology Benefit topics continued

9. Accelerator simulations

   Development of new cradle-to-grave simulations codes for study of beam transport in the presence of collective effects, wakefields, element misalignment, ground motion. Advanced modelling of electromagnetic structures.

10. Particle detector instrumentation

    Finely segmented pixel detectors for general imaging applications in medical, security, materials scanning. New detector technologies such as thinned silicon pixels, GEMs, Micromegas etc.

Technology Benefit topics continued

11. Further development of GRID computing through distributed computing, data set handling.

    New applications of artificial learning techniques for decoding complex topologies.

- The list of topics focuses on potential applications to other areas of science more than on the broader non-scientific applications. We need help in broadening in this direction.
- It will be important not to oversell the benefits.

Our plan:

Phase 1: Address the above topics in each region using the most appropriate methodology for the region.

Regional studies charged to develop potential spinoffs, focussing on key examples. Estimate economic, scientific impacts where possible.

Engage industry and accelerator scientists as best fits the needs in the region.

Reports from regional study groups by June 2007.

Phase 2: Collect and coordinate input to find the common themes and regional emphases.

Add section on status of ILC technologies and subsystems

Chapter on selected past benefits from accelerator science

Final report to FALC by November 2007.

We welcome your comments on potential applications we have missed and pointers to sources and studies that will help us quantify the impacts.

…Thank you