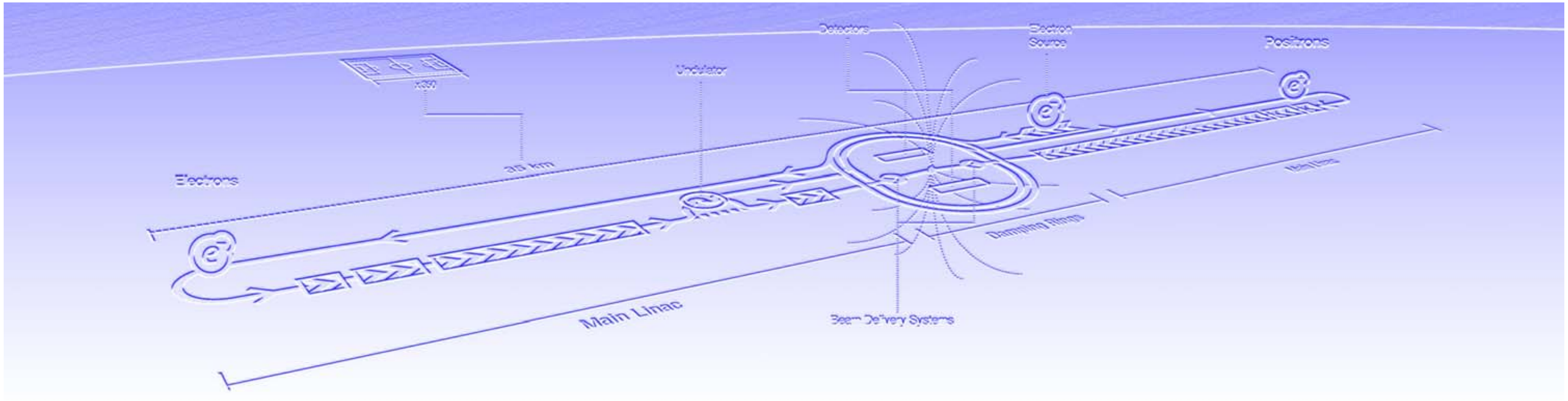

Plans for the LOI

SiD Tracking

SiD Tracking Meeting
October 19, 2007

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Call for LOI

- ILC Steering Committee (ILCSC) has recently appointed Prof. Sakue Yamada (Univ. of Tokyo) as Research Director to:
  - Coordinate the detector R&D
  - Help establish two detector collaborations for the ILC
- In early October, a call for LOIs was announced along with guidelines for the content of the LOI (copy posted on the agenda server)
  - Expression of interest to develop a design for a detector at the ILC
  - LOI will form the basis on which groups will be invited to further develop and detail its plans and eventually submit an engineering design report (EDR)
  - EDR submitted (along with the accelerator EDR) around 2010

Guidelines for LOI Technical Content

- Information on the proposed detector, its overall philosophy, its sub-detectors and alternatives, and how these will work in concert to address the ILC physics questions
- The evaluation of the detector performance should be based on physics benchmarks, some of which will be the same for all LOIs based upon an agreed upon list and some which may be chosen to emphasize the particular strengths of the proposed detector
- It should contain a discussion of integration issues with the machine
- It should be developed enough to allow a first preliminary assessment of civil engineering issues like interaction hall, support halls etc.
- It should enable the reader to judge the potential of the detector concept and to identify the state of technological developments for the different components
- Alternative technological options should be elaborated. Where needed, areas of further research and development should be identified, together with timelines and milestones
- The group submitting the LOI should define its position and role in the ongoing international research and development for a detector at the ILC
- The LOI should include a preliminary cost estimate for the detector
- The overall length of the LOI should not exceed 100 pages
- May be supplemented by additional technical documents

LOI

- What should be included in the LOI ?
  - Physics objectives
  - Requirements for the sub-detector
  - Choice of technology
  - Design choice and layout of the detector
  - Characterization of sub-detector performance
  - Characterization of integrated detector performance using benchmark processes
  - Readout and operation of detector
  - ...
- What is our goal for the LOI ?
  - Prove that the physics program can be carried out with a superior, robust and complementary detector and motivate the technology choice
  - Have a viable overall detector design

Tracking Perspective for the LOI

- The LOI should not be a goal in and of itself
- We like to see the LOI as a mile post along the road to an EDR
  - No effort diverted from the overall objective of getting ready for the EDR
  - Describe the SiD tracker technology choice, design, R&D status, and simulated performance as obtained with the tools being developed for an EDR
- Strategy
  - Decide on what plots should be in the LOI
  - Work backwards to see how to accomplish these tasks
  - Overall process is an iterative process

Towards the LOI

- Technology choice: silicon
- Motivated layout of the detector
  - General layout
    - Description of detector geometry, including number and locations of barrel and forward tracking layers
    - Average number of measurement planes intersected by infinite momentum particle as function of angle
    - Material budget as function of angle
  - Particle densities for background and physics processes
    - Motivates technology choice in certain regions: pixels versus strips
  - Segmentation and tiling
    - Longitudinal segmentation in barrel
    - Tiling in forward region
    - Occupancies (averaged over full layer and peak occupancy in jet core)
  - Detailed detector description
    - Describe baseline design and possible alternatives
    - Sensors, readout, modules, mechanical supports, cables, alignment, power, etc.
    - Some of this may need to be in a supplementary document

Performance Characterization

- Characterization of performance using traditional metrics
  - Momentum resolution as function of p_T and angle
  - Impact parameter resolution as function of p_T and angle
  - Track finding efficiency as function of p_T and angle
    - Isolated tracks as function of angle
    - Inside jet cores: Z-> qqbar @ 500 GeV as function of angle
    - e^+e^- -> tau+ tau- as function of angle
    - K_S efficiency
  - Fake rate as function of angle and momentum
  - What else?
- Characterization of performance using physics benchmark processes
  - ZH missing mass distribution
  - b/c tagging efficiency in Higgs decays?
  - Acollinearity of forward Bhabhas (luminosity spectrum)?
  - Forward benchmarks?
  - What else?

Towards the LOI

- Developing the infrastructure to quantify the performance in the traditional metric is still the bottleneck
  - MC description of tracker
    - Cylindrical barrel and disk geometry – complete
    - Planar detector geometry – barrel complete
  - Detailed simulation of tracker hits
    - Complete simulation of charge deposition in strips / pixels, readout, and clustering of strip hits to form “tracker hits”
    - Define extensions to existing org.lcsim framework needed for tracking
  - Track finding algorithms
    - Vertex seeded tracking
    - Conformal mapping algorithm
    - Stand alone outer tracking
    - Calorimeter seeded tracking
    - Weight matrix
    - Kalman filter
  - Tracking performance studies
    - Multi-algorithm track finding
    - Forward tracking studies
    - Tracking performance metrics

Milestone: SiD Workshop

- SiD workshop planned for February '08
- Goal is to have all infrastructure in place by Feb. '08 with a first pass at:
  - Decision on tiling choice for full tracker
  - Momentum resolution as function of p_T and angle
  - Track finding efficiency as function of p_T and angle
    - Isolated tracks as function of angle
    - Inside jet cores: Z-> qqbar @ 500 GeV as function of angle
    - e^+e^- -> tau+ tau- as function of angle
    - K_S efficiency
  - Fake rate as function of angle and momentum
  - What else

- At that point we branch out:
  - 1) Move towards benchmark physics processes
  - 2) Optimize the design
  - 3) Integrated detector performance (effect of tracking on PFA)

After February '08

- Move towards benchmark physics processes: develop the metrics that measures physics performance
  - Physics will apply a non-uniform weighting to the traditional metrics
    - Inefficiency at high momentum more critical than at low momentum
  - Weighting may depend on physics
    - For example, leptonic ZH heavily weights momentum resolution
- Integrated detector performance
  - What is needed for good PFA performance?
    - Impact of long-lived secondaries
    - Impact of inefficiency and fakes
    - Impact of material
- Optimize the design
  - Effect of adding a 6th layer / 5th disk
  - Effect of >0 barrel stereo layers
  - Determine weak spots in the mechanical design and re-optimize
- In parallel
  - Continue working out in more detail and optimizing the design
  - Continue a vigorous R&D program to meet requirements for an EDR