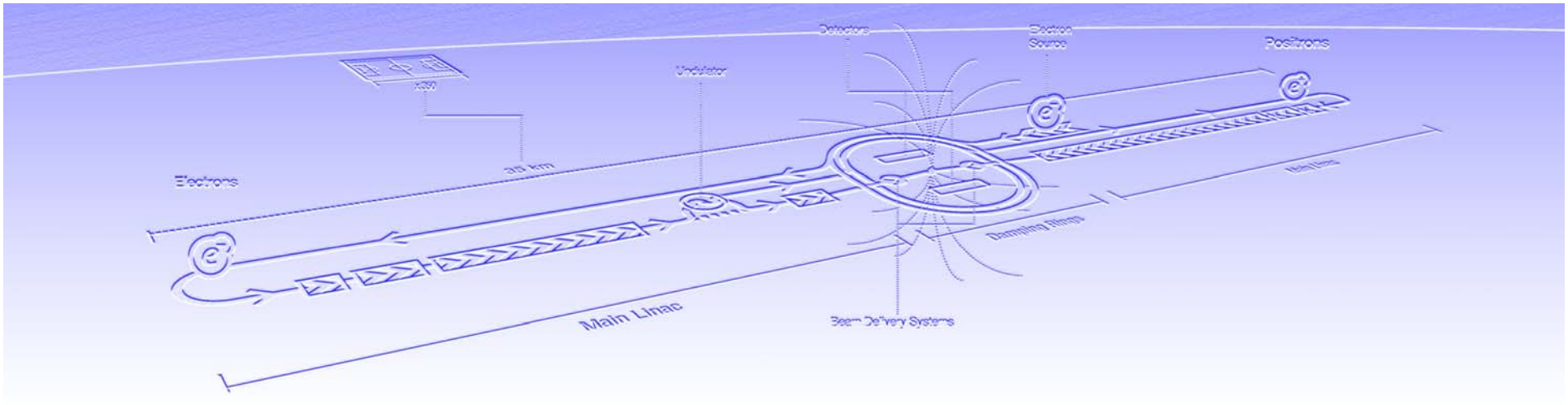


Steps for the LOI

SiD Tracking

SiD Collaboration Meeting
October 4, 2007

Rich Partridge, Marcel Demarteau

LOI

- Our field has way too many TLA's (Three Letter Acronyms) and FLA's (Four Letter Acronyms)

- Some people sometimes still associate TLA's with actual real words with the personal images they conjure

Un Roi, Une Loi, Une Foi

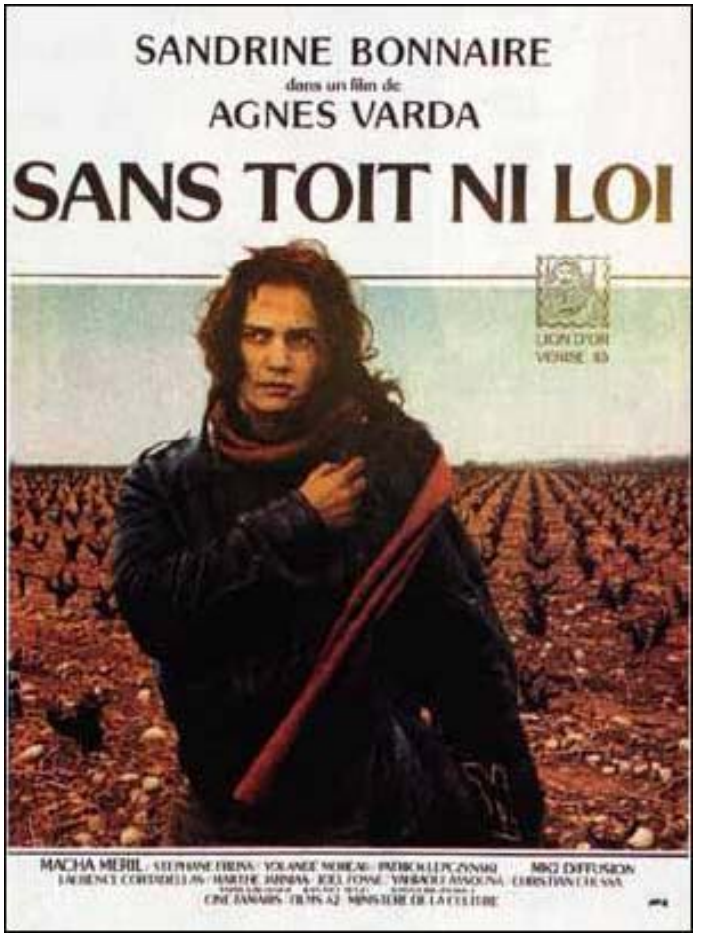
- King Louis XIV known for many things, among others, his famous exclamations:
  - '*l'etat - c'est moi*'
  - '*un roi, une loi, une foi*'
    - King Louis XIV was an activist in the anti-Protestantism movement in France, and a fervent supporter of restoring the roman catholic faith as the state religion of France.
    - Under this policy king Louis XIV revoked the edict of Nantes and enforced that roman Catholicism is the only faith of France. Huguenots were not tolerated.

- Un Roi, une LOI, une foi =

  Sakue Yamada, one LOI, the ILC ???

Sans Toit ni Loi

- Sans Toit ni Loi
  - A film about a vagabond woman who's condition becomes progressively worse until she finally falls ending in a scene with which the movie started, frozen and entrenched in misery in a ditch



- Sans Toit ni LOI
  - Notice the similarities with an ILC detector
  - Our fate without an LOI ?

Call for LOI

- ILC Steering Committee (ILCSC) has recently appointed Prof. Sakue Yamada (Univ. of Tokyo) as Research Director (RD) to:
  - Coordinate the detector R&D
  - Help establish two detector collaborations for the ILC
- ILCSC charged the RD with issuing a call for LOI's by October 2007 to be submitted by about October 2008
  - 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

- We do not yet officially know what the charge for the LOI submission will be
- The current SiD prejudice is that the LOI will not be a letter, but a document of about 100 pages that describes the SiD concept à la the DOD

LOI

- What Should be in an 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 the Goal of 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 for the LOI

- The tracking group perceives the LOI not as a goal in 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
    - 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
- Characterization of performance using traditional metrics
  - 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
  - Fake rate as function of angle and momentum

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 – complete (Lecce group); org.ilcsim (McCormick/Nelson)
  - Detailed simulation of tracker hits
    - Complete simulation of charge deposition in strips / pixels, readout, and clustering of strip hits to form “tracker hits” (Nelson)
    - Define extensions to existing org.lcsim framework needed for tracking (Kutschke + others)
  - Track finding algorithms
    - Vertex seeded tracking (Stevens / Partridge)
    - Conformal mapping algorithm (Baker / Graf)
    - Stand alone outer tracking (Deaconu / Nelson)
    - Calorimeter seeded tracking (Onoprienko)
    - Weight matrix (Sinev)
    - Kalman filter (Baker / Graf)
    - Fast helix finder for track finding (Stevens / Partridge)
  - Tracking performance studies
    - Multi-algorithm track finding (Rice / Schumm)
    - Forward tracking studies (Wenzel)
    - Tracking performance metrics (Meyer / Schumm)

Towards the LOI

- From Dima Onoprienko today:
  - He released code to convert TrackerCluster objects into standard org.lcsim.event TrackerHits.
  - Includes finding "crosses" in stereo disks, generating ghosts, etc.
  - Extended the library of available Segmenters (including one that tiles disks with wedges)
  - Added machinery for constructing all Sensor objects at the beginning of the job instead of "on demand", added machinery for chaining Segmenters, and made a few other improvements.

- We will take a first closer look at all of this at the ALCPG meeting in 3 weeks

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
  - Fake rate as function of angle and momentum

- 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
  - Determine weak spots in the mechanical design and re-optimize
- In parallel
  - Continue working out in more detail and optimizing the mechanical design
  - Continue fleshing out the readout system
  - Carry out the sensor R&D