ILC Vertex Detector Oriented Activities in AIDA

(PROPOSAL)

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on behalf of Bristol, DESY, Oxford, Geneva, Strasbourg, ... collaboration

OUTLINE

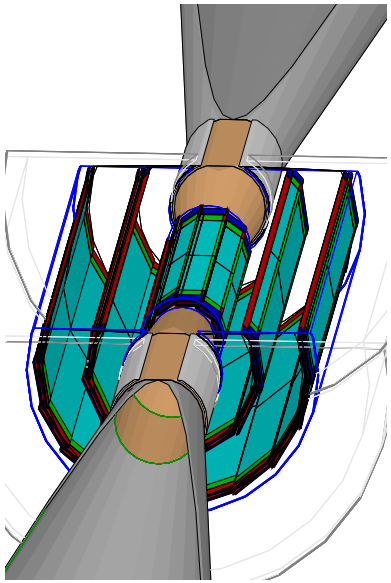
- ILC vertex detector development objectives until 2012/13
- Activities which could be achieved within AIDA
- Infrastructure required and general purpose outcome
- Interested contributors
- Summary

ILC VTX Objectives for 2012/13 vs AIDA

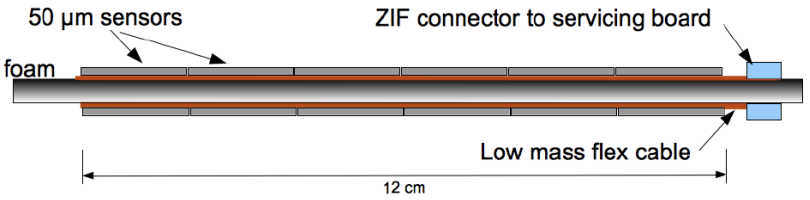
- **Challenge for high precision vertex detectors:** preserve resolution on impact parameter provided by high precision thin pixel sensors

  $\sigma_{IP} = a \oplus b/p \cdot \sin^{3/2}\theta$ with $a < 5\ \mu m$ and $b < 10\ \mu m$

  - consequences on system integration: alignment ! cooling !
  - consequences on detector operation: power cycling !
  - added value of double-sided ladders w.r.t. single-sided ones



- **PLUME collaboration developping double-sided ladder:**
  - Bristol - DESY - Oxford - Strasbourg
  - Synergy with Vertex Detector of CBM/FAIR
  - Synergy with non-ILC experiments under discussion

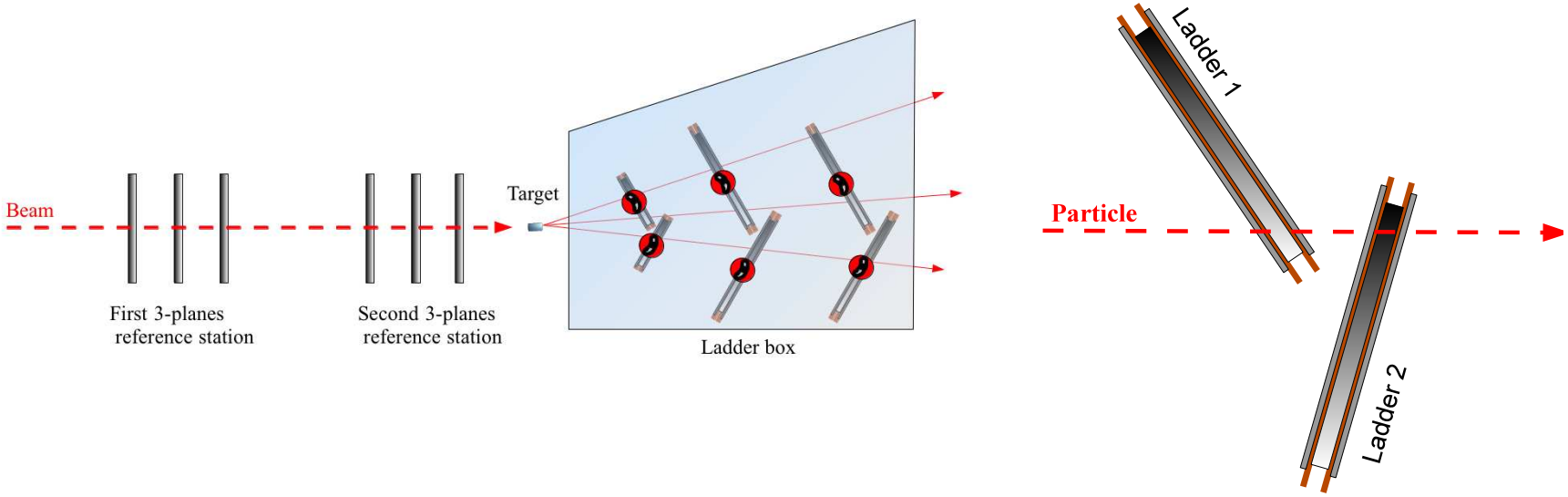


- **Perspective:**
  - use ladders produced by the European ILC vertex detector community (e.g PLUME coll.) for system integration studies within AIDA $\longmapsto$ make it compatible with wishes of non-ILC users

    $\Rightarrow$ develop necessary infrastructure, including software tools, within AIDA
  - study proposed within AIDA is crucial for Detailed Baseline Design document due by 2012

VTX Oriented Infrastructures Proposed for AIDA WP-9.2

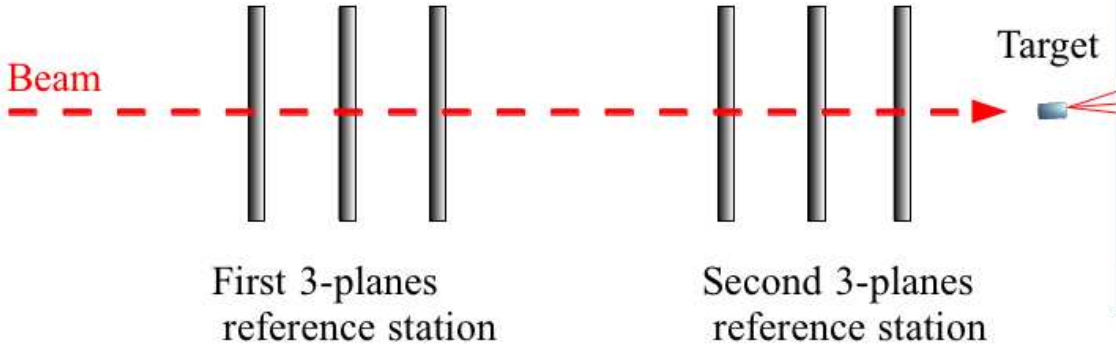
- **On-beam test infrastructure:**
  - ※ Large Area beam Telescope (LAT)
  - ※ Alignment Investigation Devices (AID): mini-telescope and/or ladder box
  - ※ Very thin removable target



- **Off-beam test infrastructure:**
  - ※ thermo-mechanical studies, including effect of air-flow based power extracting system
  - ※ power cycling effect in strong magnetic field, e.g. Lorentz forces, on ultra-light ladders

On-Beam Infrastructure Proposed: LAT

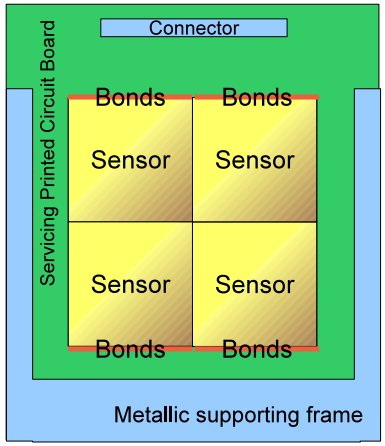
- **Large Area beam Telescope:**
  - ⁂ Extension of ultimate version of EUDET-BT
  - ⁂ Either 2×2 or 3×3 MIMOSA-28 sensors :
    - ◇ 18.4 μm pitch with binary output
      $\Rrightarrow$ $\sigma_{sp} \lesssim 4\ \mu m$
    - ◇ 1088 columns of 10^3 pixels
      $\Rrightarrow$ 20×18.5 mm^2 active area
    - ◇ read-out time $\lesssim$ 200 μs
      $\Rrightarrow$ adapted to $> 10^6$ particles/cm^2/s
    - ◇ thinned to 50 μm
    - ◇ to be fabricated, characterised and commissioned within EUDET-BT in 2010
  - ⁂ Installed in front of removable thin target
  - ⁂ Provides $\sim$ 2 μm resolution on interaction vertex of beam particles in the target
  - ⁂ Active area of $\sim$ 40×37 mm^2 or $\sim$ 60×55 mm^2 (tbd)



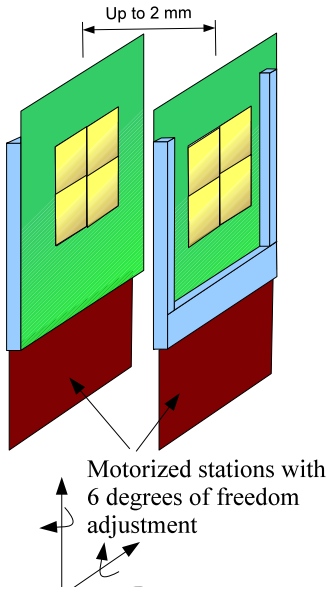
On-Beam Infrastructure Proposed: AIDA

- **DUT Telescope (i.e. inside LAT):**
  - ※ 2 layers of 2× or 2 MIMOSA sensors
  - ※ Each layer is mobile in a well controled way
    - ◇ 6 degrees of freedom
    - ◇ Micrometric rotations and translations
    - ◇ Potentially 2 indenpendent half planes per layer
  - ※ Aim of device: generate controled missalignments and find it back with beam tracks in LAT

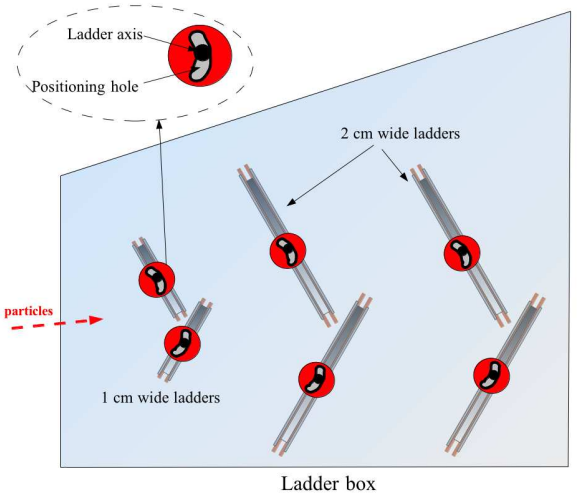
Standalone 2-sensors plane



Double plane with adjustable alignment

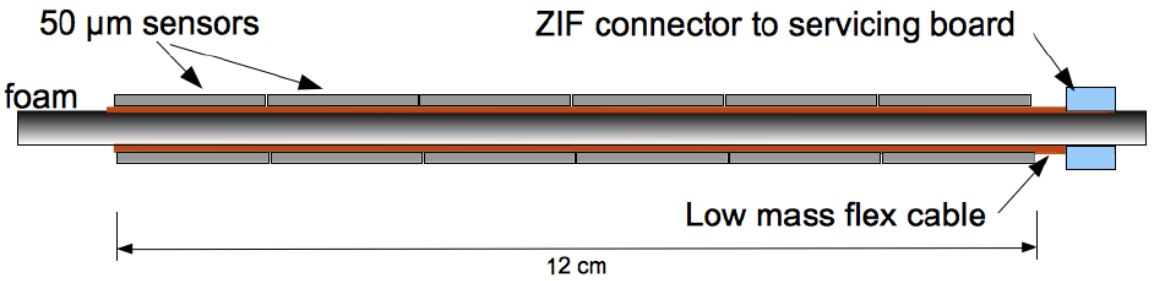


- **Box making mechanical support for 3 pairs of ladders:**
  - ※ input: ladders produced externally (e.g PLUME coll.)
  - ※ ladders fixed on micrometric movable supports
  - ※ assess alignment (& vertexing) capability of 3 layers of overlapping ladder pairs ⇒ double- vs single-sided ladders
  - ※ study powering of the whole system
  - ※ study air flow effects (?)



Off-Beam Infrastructures Proposed

- **Thermo-mechanical study:**
  - Follow movements of ladders with sensors/camera exposed to air flow or power cycled
  - Simulated with dedicated software
  - Measure and simulate temperature gradient over ladder



- **Power cycling:**
  - Operate ladder in high B-field
  - Power pulse sensors mounted on ladder
  - Study mechanical effects on ladder (sensors, camera)

Organisational Aspects

- **Participants :**
  - EUDET-JRA-1 teams: Geneva, DESY, Strasbourg, Warsaw, ...
  - PLUME collaboration: Bristol, Oxford (+ DESY & Strasbourg)
  - Emerging interest: French teams in ALICE, ATLAS ...

- **Sites envisaged:**
  - On-beam infrastructure: CERN-SPS
  - Off-beam infrastructure: DESY

- **First estimate of funding request:**
  - Infrastructure (material for LAT, AID, target): $\sim$ 500 kE
  - Missing manpower: software studies $\rightarrowtail$ 1–2 postdocs ?