The contribution of current CERN R&D to EUROTeV linear collider program.

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Choice of CERN Contributions

• Technology independent items with CERN expertise
• Generation and transport of low emittance beams, sources and damping rings
• Beam Delivery and IP issues, related to small beam sizes, collimation and stabilization
• Advanced instrumentation for bunch-train and single-bunch characteristics and timing
• Modeling, code development, tuning procedure and feedbacks
ILPS Integrated Luminosity Performance Studies (←→DIAG)

- Analysis of the performance obtained by tuning, using realistic assumptions for the static and dynamic imperfections, critical study for all LC.
  - tuning strategy from damping ring to beam dump, integrated simulations
  - develop simulation tools, identify/specify diagnostics (reference codes exist at CERN)
  - tuning performance in realistic conditions
  - revision of tuning procedures as required
ILPS Integrated Luminosity Performance Studies (↔DR)

- Study of electron clouds, which is a very critical problem in all linear colliders, damping rings, and for other accelerators like LHC

  - Study code reliability for e-cloud build-up, benchmarking with experimental data from existing machines (PS, SPS, KEKB), build-up in wigglers
  - Similar study for the e-cloud interaction with beam

  - Use both codes to predict effects in ILC-DR
  - Benefit from the ongoing work on it in LHC (existing codes, extended to DR, confirmed at KEK)
ILPS Integrated Luminosity Performance Studies (<>BDS)

• Collimator system study, valid for any LC
  - Development of a potential nonlinear collimation system
  - Design of collimation system and evaluation of performance with errors
  - Evaluation of beam based feedback and fast luminosity feedback, dynamical simulations
  - Modeling spoiler wake-fields and benchmarking codes
ILPS Integrated Luminosity Performance Studies

• Build-up of beam halo is a concern for all linear colliders
  - Study the potential halo sources to identify the most important ones
  - Study the most important loss mechanisms either analytically or by numerical simulations
  - Halo collimation, efficiency and impact on tuning.
  - Explore benchmarking possibilities
Diagnostics (<-> ILPS)

• Diagnostics are crucial for ILC and deserve strong development, improvement and tests as part of the generic advanced research

• Wide-band current monitor
  - development of a bunch charge monitor capable to accurately resolve single bunch charge and timing in a bunch train -> in injectors, linac and DR
  - design and construction of a prototype
  - beam tests in CTF3
CTF3 test infrastructure

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Similar wide-band current monitor on which development will be based
Precision Phase Reference

• Develop a phase reference system with high stability over long distances -> tests with beam (CTF3)
• Precise phase stability of the main beam with respect to the RF is required for LC.
• XFEL requirement is 10fs \(\Rightarrow\) Spin-off
• But differences for LC because of colliding beams and damping rings
• Best demonstrated in accelerator environment [1]:
  – Fiber link jitter 250fs
  – RF/beam phase measurement jitter 300fs

Diagnostics <-> DR, ILPS

- Precision beam position monitor (PBPM) applicable to BDS and Damping Ring
  - study design of an inductive pick-up, less sensitive to beam halo than RF and strip-line PU, working for a large range of bunch spacing and allowing to observe fast beam movement.
  - design of PBPM with 100nm resolution, 100µm precision, rise time of 15ns (evolution from LIL and CTF3 PU design)
  - fabrication of prototype
  - beam tests in CTF3
Similar inductive PU, on which development will be based.
Stabilization of vibration ( <-> MTRSTB )
Test bench for stabilization study of quadrupoles
Facility which will be exploited by LAPP
Vibration Stabilization Results achieved with this set-up

On magnet top: without cooling water.

HORIZONTAL: $(0.4 \pm 0.1)$ nm

VERTICAL: $(0.9 \pm 0.1)$ nm

(0.3 nm on table top)

LONGITUDINAL: $(3.2 \pm 0.4)$ nm
Concluding remarks

• During the next few years, the ILC will need to be designed.
• The listed CERN contributions to EUROTeV will contribute to this design independently of the technological choices to be made.
• Existing codes and tools already provided important results
• CERN increased its commitment to e-cloud to keep this key-activity at the needed level