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

G.Guignard

CERN

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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

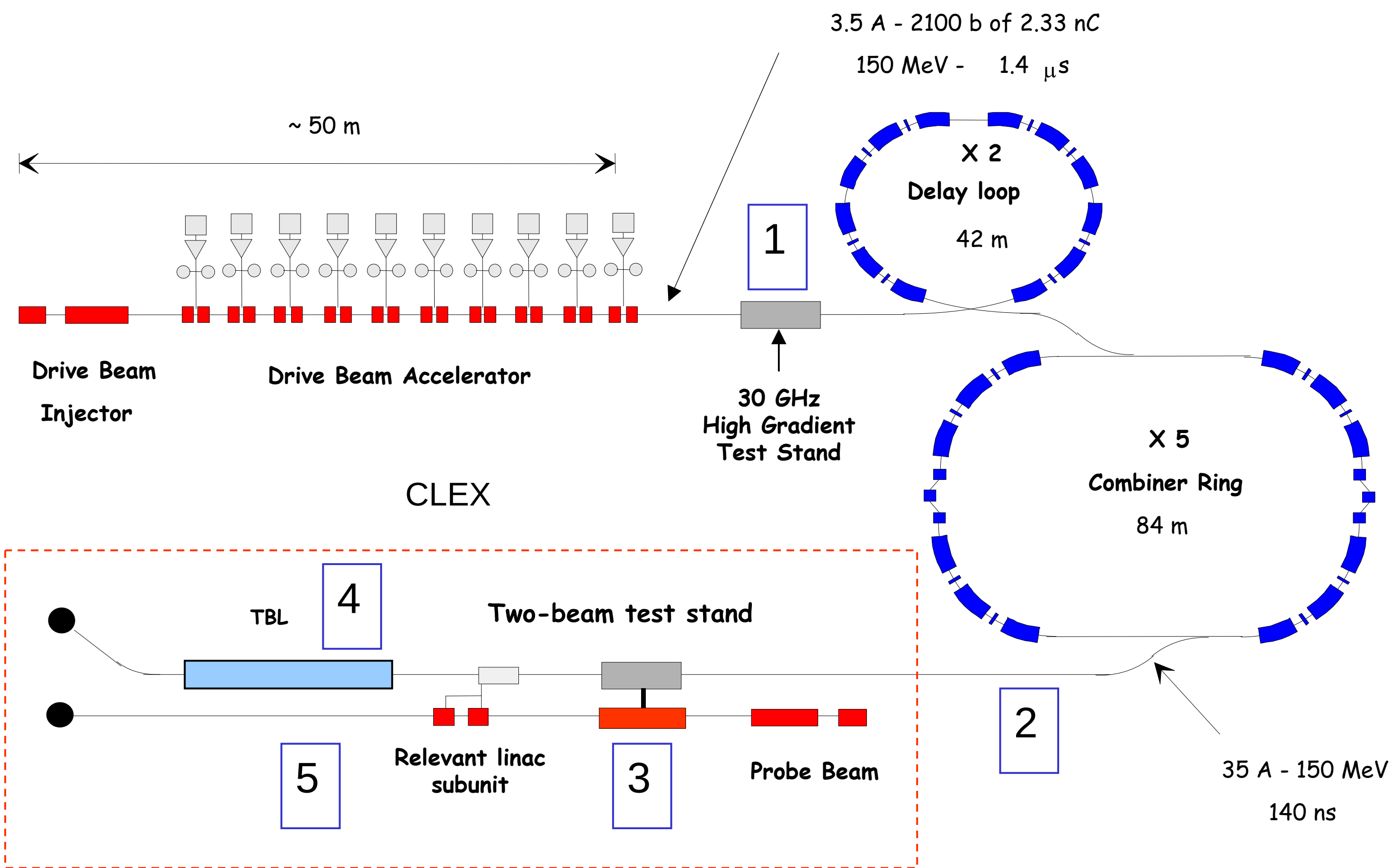
- **Build-up of beam halo is a concern for all linear colliders**
  - Study the potential halo sources to identify the most important ones
  - Study the most important loss mechanisms either analytically or by numerical simulations
  - Halo collimation, efficiency and impact on tuning.
  - Explore benchmarking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



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 → 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

[1] J. Frisch, D. Brown, E. Cisneros: "The RF phase distribution and timing system for the NLC"

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

Figure 3: The IPU assembled. On the front there are four pick-up outputs and two calibration inputs.

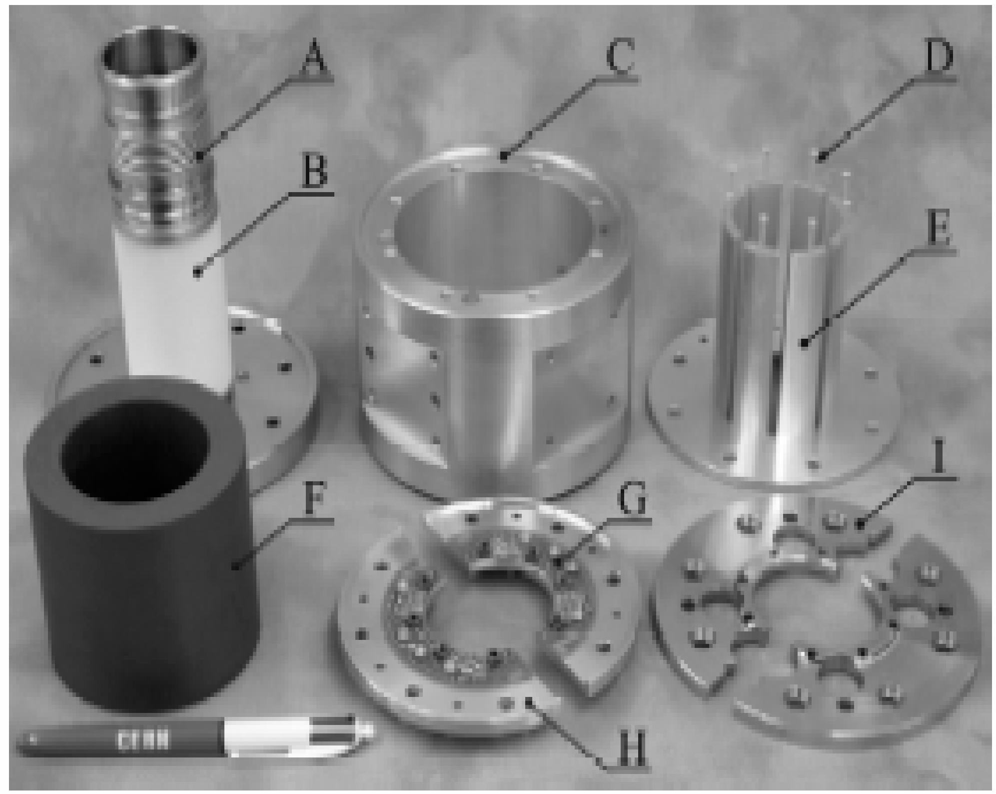
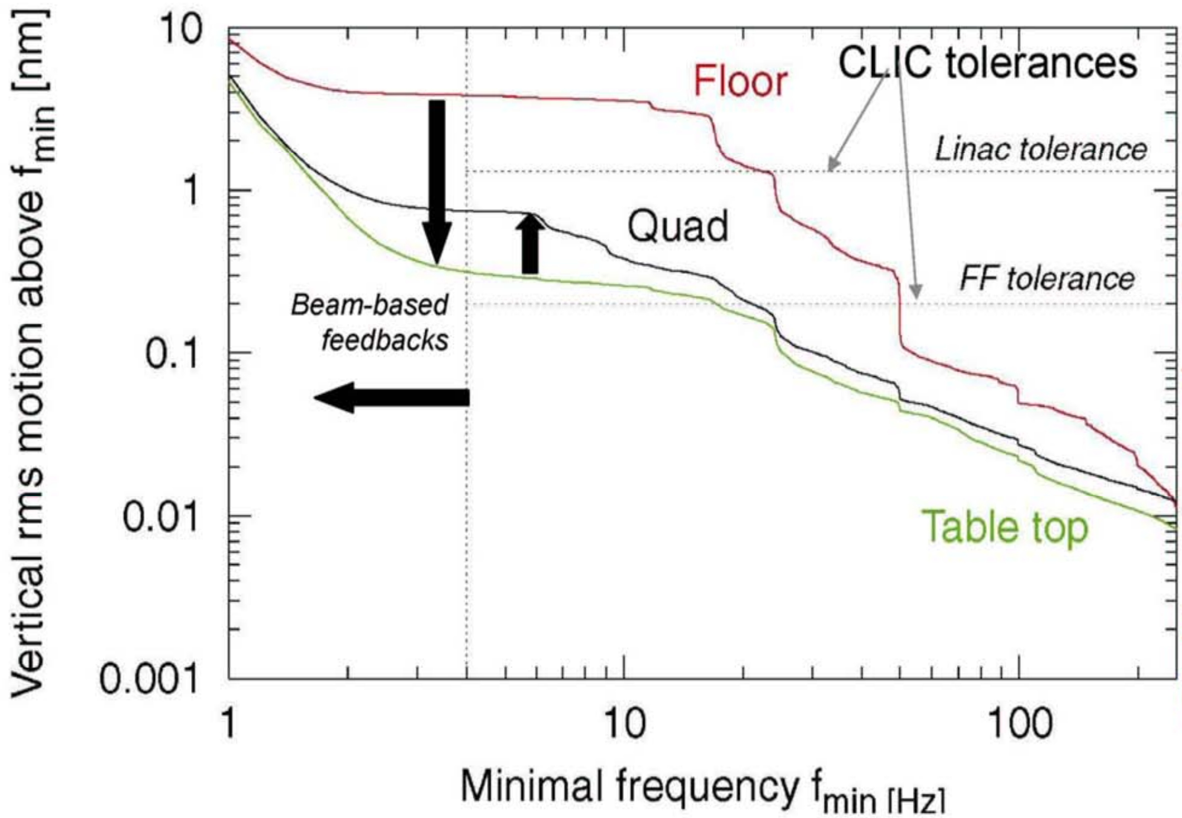


Figure 2: The IPU parts.

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 ± 0.1) nm

VERTICAL:
(0.9 ± 0.1) nm
(0.3 nm on table top)

LONGITUDINAL:
(3.2 ± 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