ILC – Detector and Machine

E.Elsen

DESY PRC, Oct 1-2, 2008, Zeuthen

Strategy

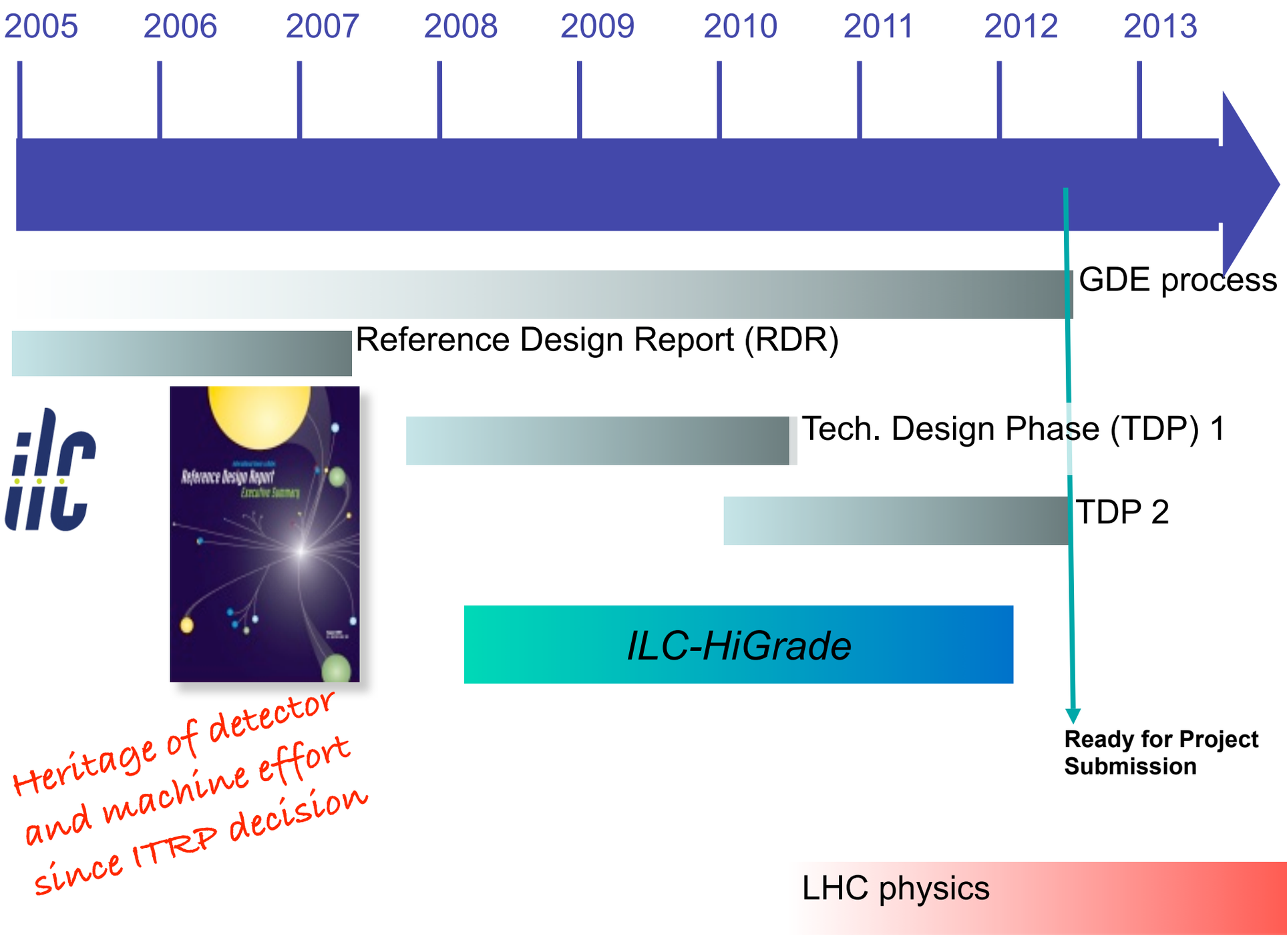
- European Strategy remains unchanged
  - Full exploitation of the LHC
  - Preparation of ILC
  - R&D for future linear colliders

be prepared

- DESY's efforts for a future lepton collider are fully embedded in this context
  - Home of the SRF ➟ Special role for the ILC
  - Vital element in "Physics at the Terascale"

Home of the ILC effort in Europe

Global Timelines for ILC



Heritage of detector and machine effort since ITRP decision

Overview of engagement for ILC

- Management activities for the ILC
  - One of three project managers from DESY (N Walker)
  - Support for European GDE director
  - and a few other exposed positions
- Address one of two critical issues identified
  - **High gradient programme for SRF**
  - *e-cloud effect in damping rings* (no further effort at DESY at this time)
  - some contributions to accelerator system (positron source)
- Prepare an ILC detector
  - R&D for detector technologies
    - some synergies with LHC
  - Advance a detector concept to maturity (ILD)

ILC-HiGrade

third party funding

- ILC-HiGrade is the Preparatory Phase project of the European Commission to work towards the realization of the **International Linear Collider** based on superconducting RF technology.

- The project is one of 30+ projects on the ESFRI list considered technically **mature for construction**. The two HEP projects SLHC-PP and ILC-HiGrade entered via the C.E.R.N. Council strategy list

- In order to reach an early status of readiness for construction ILC-HiGrade addresses

  - a key technical component that affects the cost, i.e. SRF gradient with a goal of running the ILC at 31.5 MV/m (a 6% saving over the current state-of-the-art gradient)

  - siting of the ILC and the formation of governance and financial structures in Europe that enable the realization of the project. The European Commission recognizes that this is a process with global implications

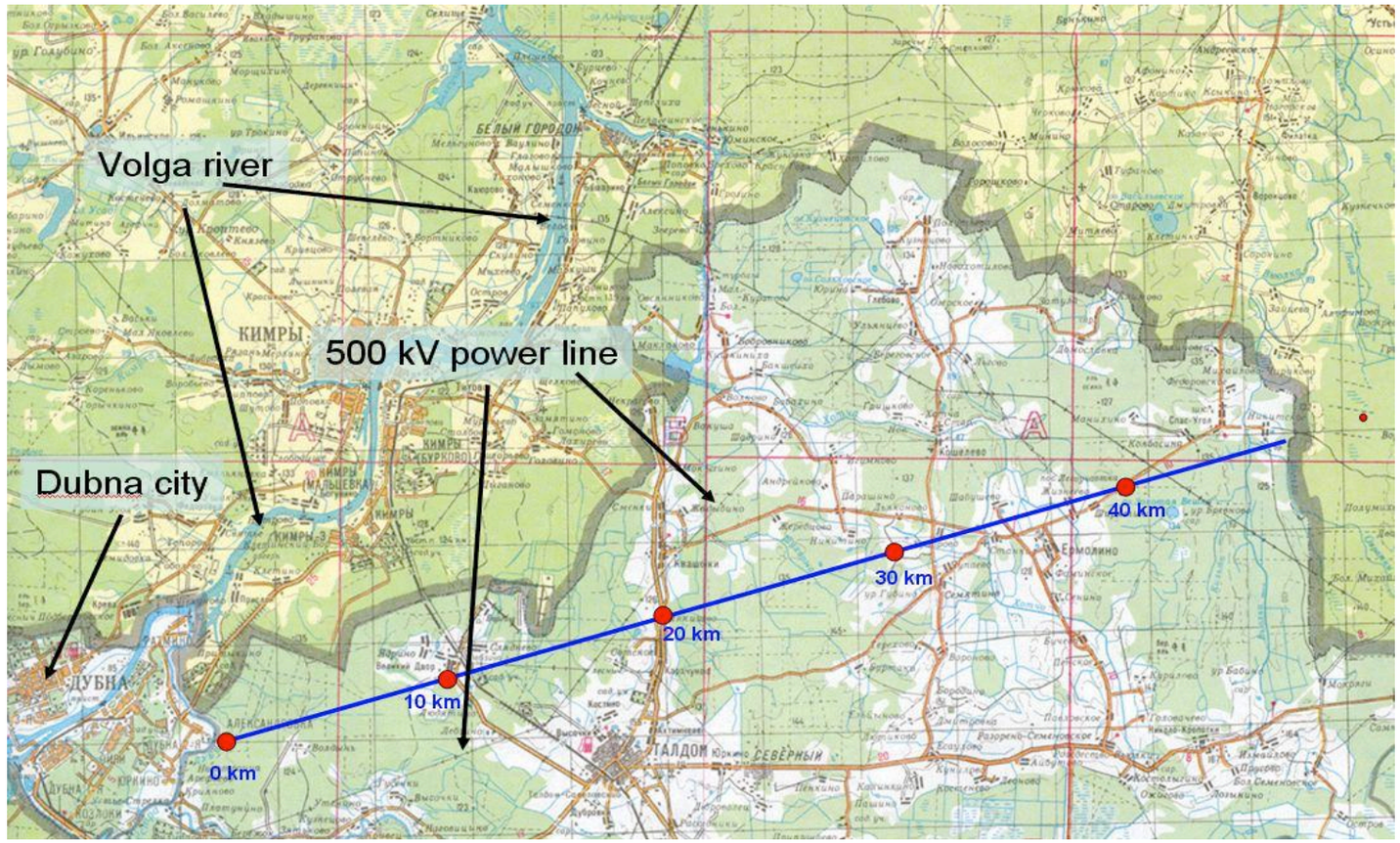
Imbedded in Gobal Design Effort

- GDE has installed a Study Group for Governance
- Siting is a priority topic for ILC
  - deep vs shallow tunnel
  - single vs twin tunnel
- Cavity gradient is one of two critical research topics
  - global effort with activities in Asia, America and Europe
  - European effort based on XFEL engagement and ILC-HiGrade

Reference Design Report is the basis for the Technical Design

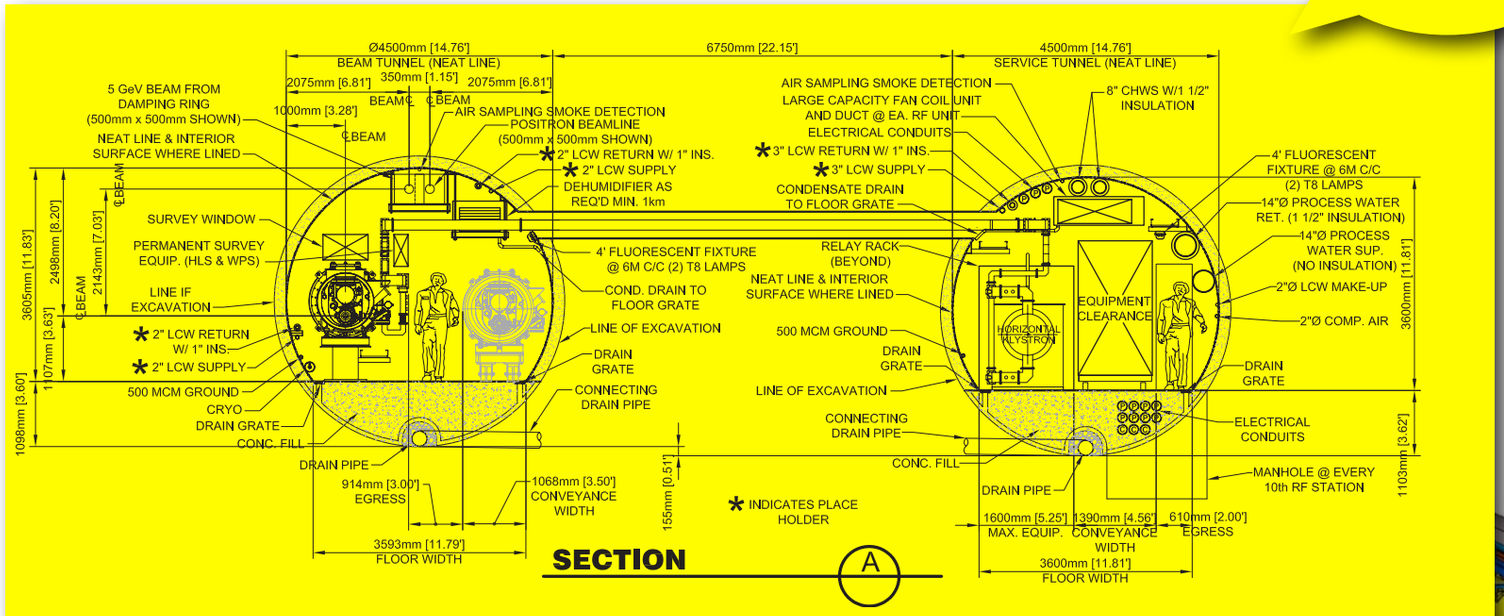
ILC Siting

- Current sample sites in
  - US (near FNAL)
  - EU (CERN)
  - Japan (several locations)
- Dubna offer a location that is particularly suited for shallow tunnel concepts
  - will be used as an example for exploration of cost benefits



ILC Tunnel

RDR

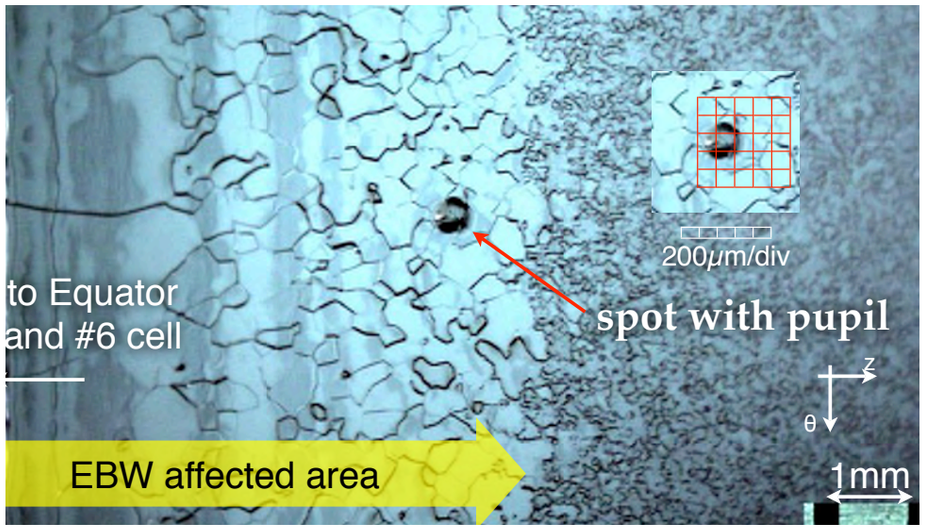


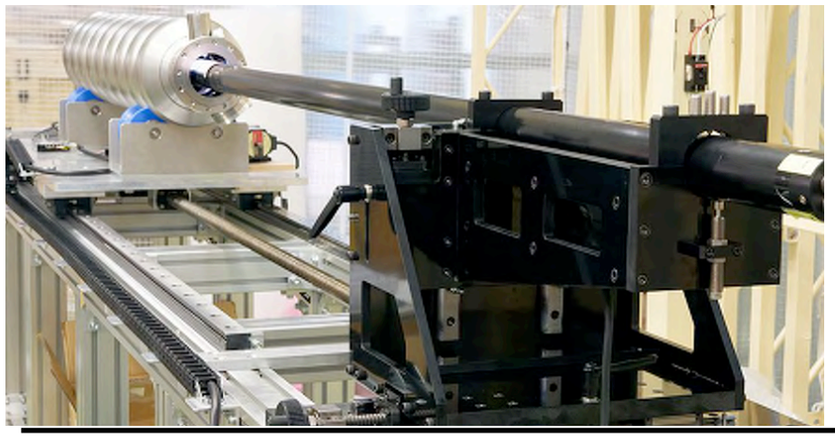
CERN, DESY & LAL

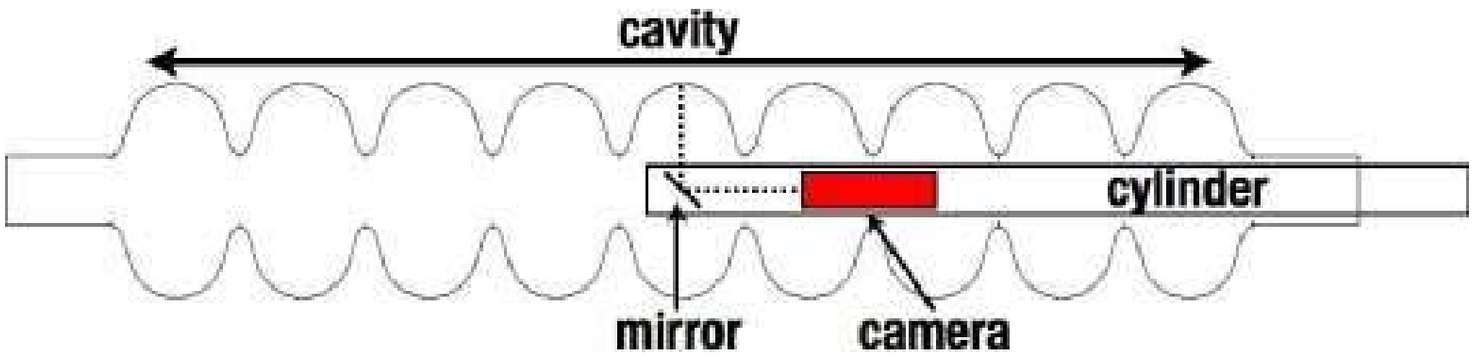
- ILC Reference Design Report is based on deep underground twin tunnel design.
- XFEL will give the existence proof for a 1 km single tunnel e^- linac near surface
- LHC & HERA expertise and CLIC planning effort

ILC High Gradient Activity

- High gradient cavities @ 40 MV/m have been produced in prototypes
- XFEL will order ~800 cavities specified at ~23.5 MV/m
- ILC-HiGrade will add another ~30 cavities from the same industrial production process. They will receive special final treatment according to the findings from the XFEL batch
  - Example: detailed surface inspection





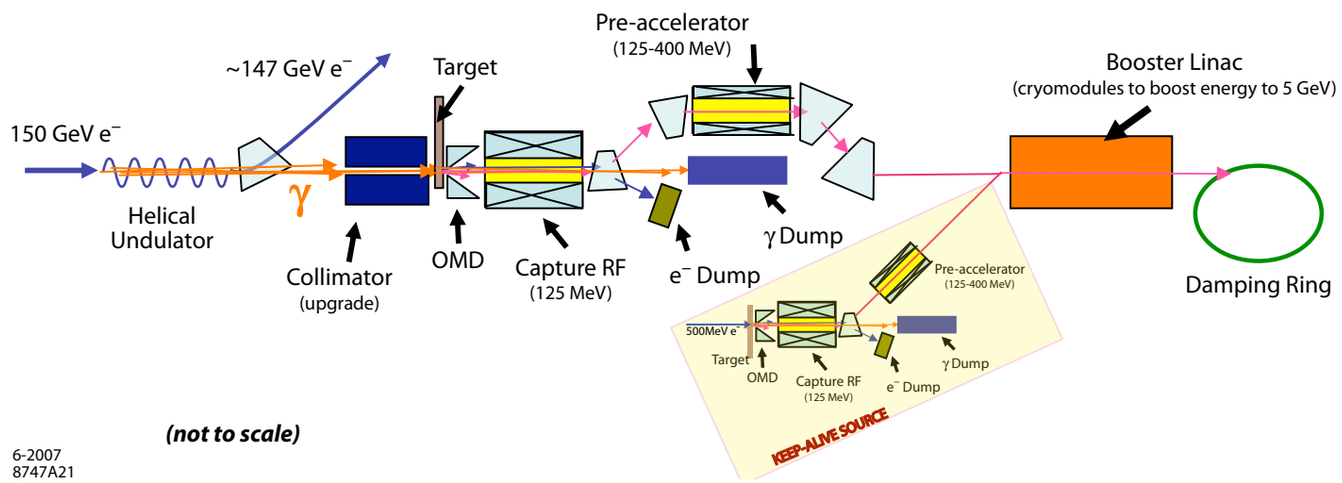


- Use of FLASH to establish ILC-like operation
  - 3 nC/bunch, 500 bunches @ 1 MHz established

a few days ago!

Beyond critical issues

- Positron source development
  - Baseline is an undulator source
    - technological optimization/ prototyping in collaboration with UK institutes
      - positron polarization
        - generation, measurement and transport
  - Polarimetry
    - at low and high energies
- Beam dynamics
  - Beam delivery and Machine detector interface
  - Advanced simulation tools available



affecting detector layout

Beyond ILC

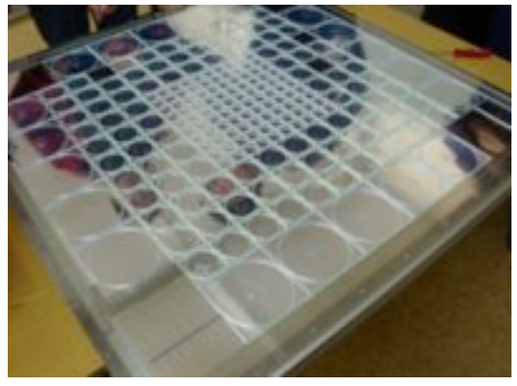
- Several concepts for gradients beyond what is technologically established
  - Cavities ~0.1 GV/m
  - Lasers and dielectrics ~1 GV/m
  - Plasma ~10 GV/m

initially not a priority

- DESY will follow the global developments and explore the options for a focussed engagement in the subsequent funding period
  - Seeking joint effort with Alliance "Physics at the Terascale"

ILC Detector R&D collaborations

- Vertex detector
  - qualification of MAPS and other Si-technologies, supportive infrastructure
- LC-TPC
  - TPC for ILC; fine-grained readout, low-mass tracking detector (goal $10\%X_0$)
- CALICE
  - HCAL large-scale prototype readout with SiPM
- FCAL
  - high rate forward calorimetry with integrated compact electronics and optical readout (direct application also at LHC)

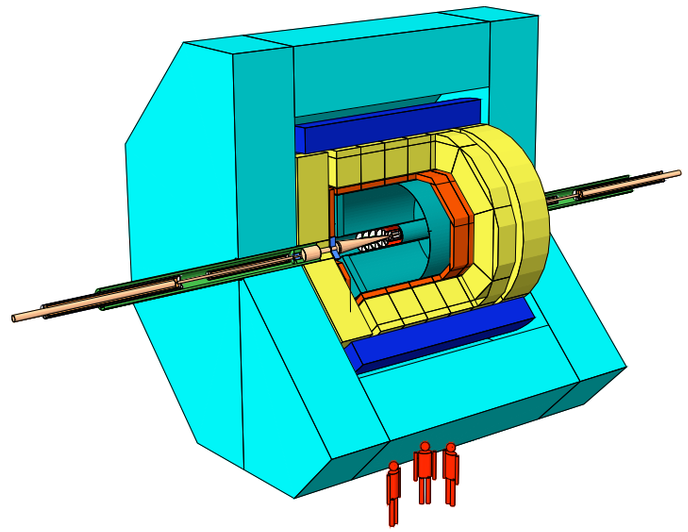


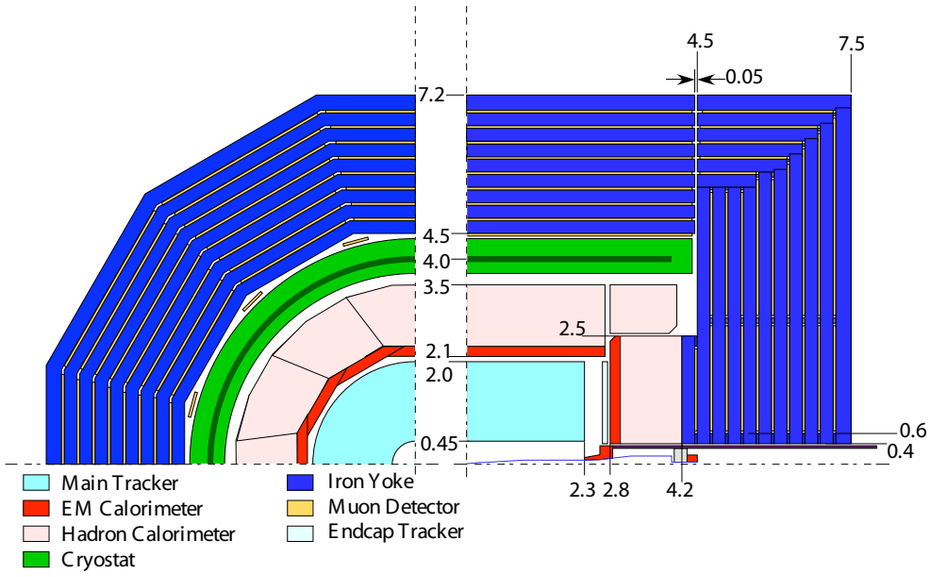
ILC Detector R&D collaborations

- R&D efforts fully embedded in the international effort to arrive on a conclusion for optimal detector design
  - Particle flow algorithm (PFA) can only be validated in a complete detector (not only calorimeter)
- Hence R&D collaborations have to resort to detector concepts to fully assess the performance of their detector component
- They also depend on comprehensive software support in order to simulate and analyze their detectors
  - Longstanding effort at DESY

ILD detector concept

- ILC is a merger of the former LDC (aka TESLA) and the GLD design
- Intense collaboration and exchange between Japanese and European groups
- DESY centrally involved in management and coordination of ILD
- en route to preparing the conceptual design for submission to Research Director for validation by IDAG





Potential developments (additional funding)

- ILC machine
  - prepare and extend the XFEL production capabilities at DESY and with industry for a smooth startup and continuation for ILC mass production
- ILC detector office
  - Coordinate tests of detector options at the system level
    - integrate European developments into an ILC detector
    - support for German universities

Summary of Programme

- Programme for preparation of a Linear Collider primarily targeted towards maintaining readiness for rapid realization of the ILC
  - the only option to respond quickly to the physics exploration needs for a TeV linear collider
    - addresses key issues of the accelerator
    - prepares one of the detector concepts (ILD)
- Consolidation an energetic detector development programme at DESY for ILC and sLHC at DESY
  - infrastructure
- Exploration of the options for future lepton colliders at very high energies