Contents

Chapter 1

Engineering, Integration and the Machine Detector Interface

1.1 Introduction

When the SiD LOI [1] was submitted there was already an agreement that the ILC would have only one interaction point shared between two detectors. The ILC Reference Design Report [2] was based on a site presumed to run ∼100 m below a topographically flat landscape. It specified the civil engineering parameters of a shared underground cavern accessed by two shafts symmetrically located around the beam line. Since the publication of the LOI there have been a number of developments:

- The definition of a set of functional requirements [3] for the design of the detectors and the interaction region of the ILC
- The validation [4] of the SiD and ILD detector concepts as those which would form the basis of the ILC design
- The agreement of the use of a platform [5] similar to the CMS shaft plug as the means of effecting the push-pull exchange of detectors
- The redesign and acceptance of a new cavern layout [6] featuring one shared 18 m diameter central shaft directly over the interaction point, serviced by a 4000 Tonne gantry crane, separate assembly areas accessible to the sliding platform and separate garage areas for major detector component replacement, each serviced by an 8 m equipment shaft and a 5.6 m personnel elevators shaft.
- The possibility that the ILC would be built in a mountainous site where the interaction region was accessed by a ∼km length tunnel of limited diameter

These features have been described in more detail in the common section of this Detailed Baseline Document and in the civil engineering sections of the companion ILC Technical Design Report.

Table 1.1: List of SiD detector element weights and sizes.

Name	Mass(10^3kg)	# Subcomponents	Mass(10^3kg)
Barrel			
EM Calorimeter	60	12	5.0
HCAL	367	12	31.7
Tracker	3	1	3
Coil	160	2	80
Loaded Coil	610		
Magnet Yoke	2700	8	340
Yoke Arch Supports	150	2	75
Peripherals	40		
Instrumented Barrel	3500		
Each of Two Endcaps			
EM Calorimeter	10	1	10
HCAL	23	1	23
Muon System	30		
MDI Components	10		
Door Steel Plates	2200	11	200
Door Leg Supports	140	2	70
Infrastructure	37		
Each Instrumented Door	2450		

1.2 IR Hall Layout Requirements and SiD Assembly Concepts

The main subcomponents of SiD are its central barrel and its two doors. The majority of the SiD's mass results from the flux return iron. The iron will be shipped to the ILC site from an industrial production facility in the form of sub-modules suitably sized ($\sim$100 T) for road transportation. The solenoid coil will likewise be wound industrially and transported in sections, probably two, amenable to transport. SiD expects the VXD, TRACKER, ECAL, HCAL and MUON modules to be built at collaborating labs and universities and transported to the ILC site for final assembly.

Table 1.1 lists the mass and size of the SiD detector elements that determine the crane capacity and shaft size for each installation scenario.

1.2.1 Vertical Access (RDR style)

Figure 1.1 shows the agreed upon layout of underground IR Hall. The layout allows that the 3 m thick SiD push-pull platform be positioned directly under the gantry. The service caverns allow for storage of the endcap doors and unimpeded access to the barrel region for the initial installation or replacement of detector subcomponents. Access to the service caverns is through an 8 m diameter shaft serviced by a 40 T crane.

The vertical access assembly presumes that SiD magnet, comprised of the superconducting coil, iron barrel yoke and iron endcap doors will be pre-assembled and tested in an above ground hall. Any detector subcomponents, notably the HCAL and ECAL, that are ready in time can be installed and tested above ground. Then SiD's

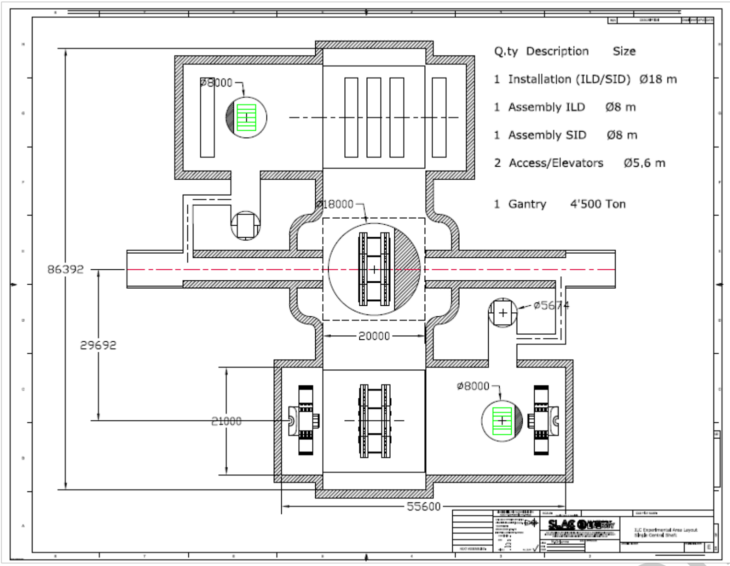

Figure 1.1: The push-pull system at the ILC: SiD and ILD on concrete platforms.

three main subcomponents, its barrel and two endcaps, will each be lowered as a unit to the push-pull platform below.

The basic requirements for the above-ground hall are:

- A devoted crane with a minimum of 215 Ton main hook capacity. The ILD and SiD cranes should roll on the same bridgework so that they can be used in tandem if the need arises.
- A steel reinforced concrete platform upon which SiD will be assembled which is structurally robust when supported on three sides as it slides over the 18 m diameter main access shaft to deliver the SiD barrel and doors to the gantry crane.
- A 4000 Ton capacity gantry that can lower the, roughly, 15 m x 5 m x 6 m 3500 Ton instrumented SiD Barrel and the two 11 m x 14 m x 6 m 2500 Ton doors to the 3 m thick push-pull platform in the underground IR Hall.

Given the ILC choice to invest in a moveable platform detector transport system, no motion system is foreseen for 3500 T SiD barrel. It will be assembled on the above ground delivery slab which will move it to the access shaft and once lowered, remain stationary on its ”push-pull” platform. The SiD doors on the other hand, which must routinely opened to service the detector will be supported by a system of rollers guided by hardened rails. The current plan is to lower the doors first and to put them in their service caverns before returning to the main shaft to collect the barrel. Once these three assemblies have been lowered the main shaft and gantry are no longer needed.

The ILC CFS group has foreseen that the above ground assembly hall is aligned with its long direction running along the beam line. The above-ground construction platform will move in this direction as well. The width of the platform will be, as below ground, 20 m, approximately the width of the building, while the length will be large enough to comfortably house the barrel and the doors when open. The platform surface will be at floor grade and thus run in a track. The doors will move across the platform-floor junction on the rollers when required to mate with the barrel.

The above ground assembly sequence for a vertical access site can also be used for a horizontal access subterranean site. In the latter case, the individual subcomponents are separately transported through an access tunnel of limited diameter to an underground assembly hall. In each case a 215 T bridge crane suffices for installation. Here follows a plausible assembly sequence.

- Assemble the two door leg supports on top of the platform.
- Transport each of 11 200 T door plates in 3 industrially manufactured segments to the crane and assemble into 11 m x 11 m octagonal plates. Mount each on the support legs and make plate to plate connections.
- Install muon chambers from the sides into each gap, and HCAL and ECAL to the innermost face.
- Once doors are completed move them to their alcoves.
- Assemble lower halves of barrel arch supports.
- Assemble industrially manufactured $\sim$100 T barrel steel stacked plate segments into 16 $\sim$210 Ton half-wedges and use the crane to assemble the 5 lower barrel wedges, forming a cradle open at the top.
- Assemble the solenoid coil segments and DID coils into their cryostat and test at low current. Lift coil with fixture and thread into the cradle.
- Finish the remaining 3 barrel wedges, install muon system and finish with shear plates at each wedge-to-wedge junction.
- Thread solenoid with an assembly beam and mount the HCAL assembly spider onto it. Load each of 12 32 Ton HCAL wedges onto the spider and push into barrel on rollers.
- Repeat HCAL sequence with the much lighter ECAL.
- Thread in TRACKER and VXD units when available.
- Move platform to alcove area, move doors back onto platform and load the QD0 assembly (QD0, masks, FCAL) from the rear of the door.
- Assemble detector mounted PACMAN shielding on the ends of the doors.

1.2.2 Horizontal Access (Japan style)

The weights and sizes of the SiD sub-assemblies that need to be transported to within access of the assembly crane are, by design, identical for both a vertical shaft site or a horizontal tunnel accessed site. As such, the installation procedures outlined above are directly applicable. One need only plan for the more lengthy procedure of loading the heavy sub-elements onto the tunnel transport carts and their delivery to the IR Hall assembly area.

The Japanese Mountain site design specifies an 11 m diameter tunnel, which is sufficient to transport the largest element of SiD, its solenoid. Figure 1.2 shows the

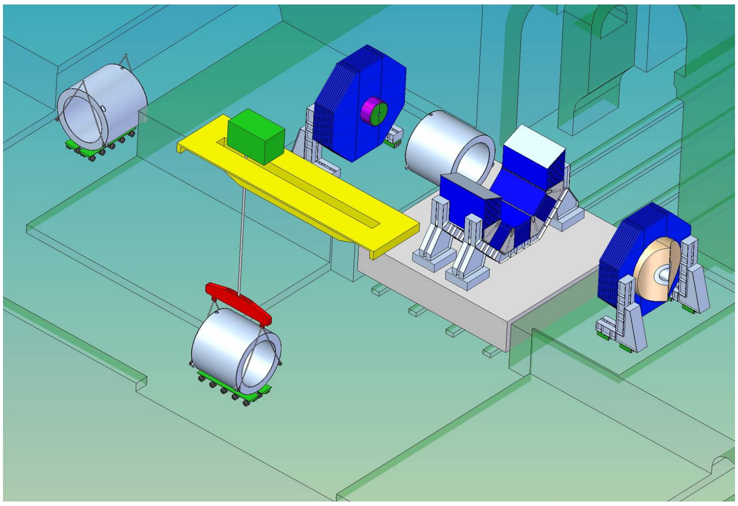

Figure 1.2: Transporting the largest detector element, the SiD Solenoid,through the 11m diameter access tunnel to the assembly area where the 215 Ton crane can lift it and place it within the SiD barrel.

SiD solenoid being transported around the final right angle bend to the underground assembly hall where it is lifted by the 215 T crane and place in the cradle formed by the lower elements of the SiD barrel yoke. Clearly, if the ILC schedule permits below-ground assembly of the detectors for the vertical access site, the diameter of the access shaft could be reduced from 18 m to 11 m.

Figure 1.3 shows the agreed-to footprint of the IR Hall of the Japanese Mountain site. During installation, the 20 m x 20 m x 3 m push-pull platform will sit in-line with the transverse alcoves. There will be 18 m of floor space between the beam-side edge of the platform and the IP and 34 m of access-tunnel-accessible floor space between the far-side of the platform and the end of the cavern. The entire 72 m half-length of the hall will be accessible to the 215 T crane and will be more than adequate for installation purposes.

1.2.3 Detector Access While on Beamline

1.2.4 Detector Access for Major Repairs

1.3 Detector Exchange Via a Sliding Platform

1.3.1 Introduction

The swap of detectors in and out of the beamline, a.k.a. push-pull, over a distance of 25 m is a totally unprecedented procedure for large experiments installed at the interaction point of particle colliders. Among the several challenges to be addressed in the design, the main are the reproducibility of tight alignment requirements to the beam, ± 1 mm, compared with large masses of the detectors systems, $\sim$10,000 to 15,000 tons; the time requested to complete the swap cycle must be as low as reasonable achievable since it will be virtually subtracted from the integrated luminosity; a limited but not

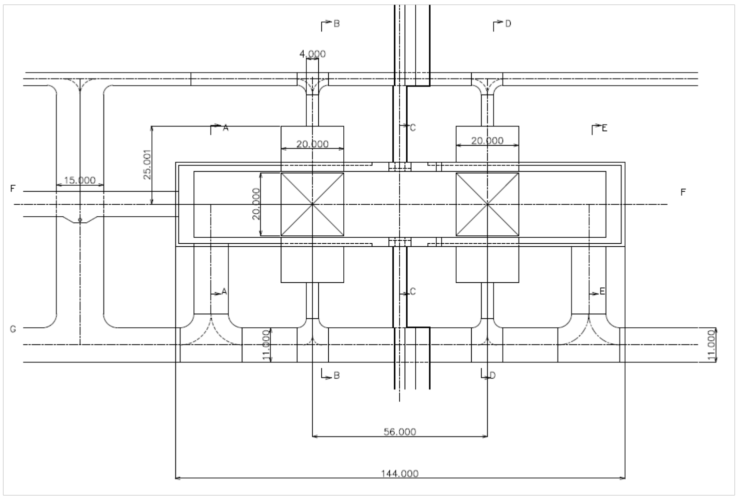

Figure 1.3: The agreed-to footprint of the IR Hall of the Japanese Mountain site.

negligible amount of umbilical are needed to keep the detector connected continuously with the DAQ and the technical infrastructures, like for instance cryogenics.

1.3.2 Platform

The above requirements have been addressed developing the concept of a reinforced concrete platform of 20 x 20 m^2 and 3.8 m tall for a total mass of ~4000 tons. The platform of SID will be thicker than the one of ILD to preserve the same height to the beamline in reason of the different size of the two detectors. Assuming 9000 tons as the total mass for SID, preliminary calculations have shown that the maximum static deformation achievable is less than 1 mm[7], at the locations where the detector is supported by the platform. The construction will be very similar to the concrete slab designed for the CMS experiments[8].

The total mass of the detector and the platform is ~14,000 tons. Two options are under consideration for the moving system, Air Pads or Hillman rollers both with hydraulic jacks above. For the Air pads the expected friction is 1% and the total force required for the horizontal motion is 140 tons. Assuming a maximum capacity for 350 tons for a single air pad, SID will require the installation of 40 units under the platform. For the rollers the friction will be ~3% and the force required for the horizontal motion will be ~420 tons, while only 14 units with 1 kTon capacity will be required. In both cases, to guarantee smooth and reliable operation fulfilling the requirements, the floor will need to be hardened with steel to prevent that the wear out of the surface would spoil the alignment performances. A reliable linear guiding system built-in the floor is also key for air pad as well as for rollers. The force required in both cases for the horizontal motion can be comfortably developed by a set of climbing jacks, which are hydraulic jacks pushing on the platform and against the floor. Another set of hydraulic jack will be place at the beamline location of the platform to correct transversally the final alignment if needed.

- Platform Mechanical Design
- Platform motion

- Platform Alignment

1.3.3 Vibration analysis and Luminosity Preservation

The L^* for SID has been set at 3.5 m locating the final focus system de-facto inside the detector. To facilitate the push-pull operations it has been decided to have the QD0 supported from the door, push-pulling together with detector, provided that only a short spool piece on the beam pipe is physically connecting the Detector to the BDS. With this configuration one must verify that the beam jitter induced by the vibrations from the ground and the technical infrastructure is below the maximum budget allowed (50 μm@5 Hz) by the IP Luminosity feedback system to minimize the luminosity loss. Another advantage of having the QD0 captured by the door is that, under the effect of the magnetic field, the iron of the detector will behave almost as a monolithic structure, insuring the highest correlation between the respective movement of the two doublets.

A structural dynamic model of the QD0 supported from SID, on the platform has been developed to calculate the free modes as well as the transfer function between the ground and the doublet. Using different ground vibration model available in literature and corresponding at different accelerator sites in the world, a maximum r.m.s. displacement of 20 nm has been calculated, more than a factor 2 under the maximum allowed. A campaign of experimental measurements of vibrations has been carried out to validate some key features of the model: the simulation of the reinforced concrete platform and correlation measurements between distant locations in the detector hall of CMS at CERN and SLD at SLAC. The reinforced concrete slab of CMS has been instrumented with geophones in various location and the data have been used to benchmark a finite elements model of the platform[9]. A good agreement between experimental data and simulation has been found with internal damping ratio of 6.5%, a little big higher of values recommended in literature for similar materials. The difference can be explained by the soil deformation and the presence of wheels, which both were not included in the model. The set of correlation measurements done at CMS and SLD have shown a good correlation at low frequencies between points at the two extreme sides of the cavern, i.e. the location of the final focus system[10].

1.3.4 Push Pull Detector Exchange Process and Time Estimate

The sequence of the push-pull operation should allow a fast detector interchange to minimize the interruption of the machine to deliver luminosity. Realistically it should not take more than few days to realize the swap, a little bit longer at the beginning of the project life. Defining as To the time when the beams have been dumped and the interlocks are released to allow the access of the technical personnel, the key steps are the opening of the Pacman shielding, the breaking of the vacuum between the QD0 and the QF1, a reasonably fast horizontal movement form the IP to the garage position with an easy and reliable alignment system. The cryogenic system will stay on during the pushpull, with the umbilical able to accommodate the 25 m movement requested. Figure **??** summarizes the steps and required time for the push-pull operation.

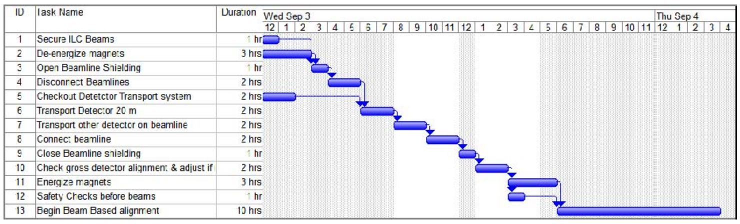

Figure 1.4: Summary chart of push-pull operational steps.

1.4 Beampipe and Forward Region Design

1.4.1 Introduction to the Near Beamline Design

In the SiD near-beamline design the distance from the front face of QD0 to the IP, L^*, is kept at the minimum 3.51 m which will accommodate a magnet with a 20 mm diameter input beam pipe, a 30 mm diameter exit beam pipe and the design 14 mrad crossing angle. Minimizing L^* should minimize sensitivity to beam and magnet errors and thus maximize luminosity. The SiD near-beamline design also minimizes the radial space required for the support and alignment of the final quadrupole lens QD0 to limit any loss of tracking and calorimeter acceptance. In the SiD design the silicon tracker slides over QD0 support to expose the vertex detector for servicing.

1.4.2 Beampipe

The beam pipe through the central portion of the vertex detector has been taken to be all-beryllium. Within the barrel region of the vertex detector, the beryllium beam pipe has been taken to be a straight cylinder with inner radius of 1.2 cm and a wall thickness of 0.04 cm. At z = ±6.25 cm, a transition is made to a conical beam pipe with a wall thickness of 0.07 cm. The half angle of the cone is 3.266°. Transitions from beryllium to stainless steel are made beyond the tracking volume, at approximately z = ±20.5 cm. The initial stainless steel wall thickness is 0.107 cm; it increases to 0.15 cm at approximately z = ±120 cm. The half angle of the stainless steel cone is 5.329°. The inner profile of the beam pipe is dictated by the need to avoid the envelope of beam-strahlung produced e^+e^- pairs.

1.4.3 Lumical, Beamcal, Mask and QD0 Support and Alignment

BNL has produced a detailed design [11], [12] of QD0 for ILD's desired L^* of 4.5 m, making every effort to minimize the diameter of its cryostat. SiD assumes that when the 390 mm outer diameter is scaled to its L^* of 3.51 m, the corresponding OD is 376 mm. To prevent stresses within the magnet QD0 is pinned to a stainless steel support tube with an ID of 388 mm and a 17 mm wall. The SLD doors will have, along their centerline a 432 mm ID/620 mm OD steel tube to prevent compression of the plates when the magnet is energized. Pockets in this steel annulus will house a wedge based alignment system that will position the 422 mm QD0 support tube to the required accuracy within the 5 mm annular gap. Figure 1.6 shows the current design of the wedge mover. Each mover is driven by a shaft and motor placed sufficiently remotely to function in the fringe field of the solenoid.

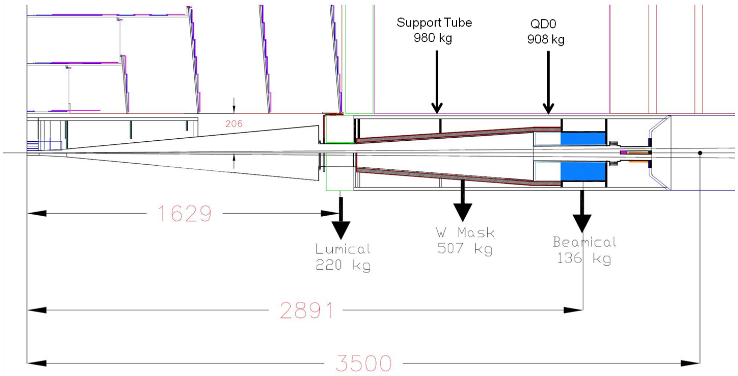

Figure 1.5: The region from the IP to the beginning of QD0.

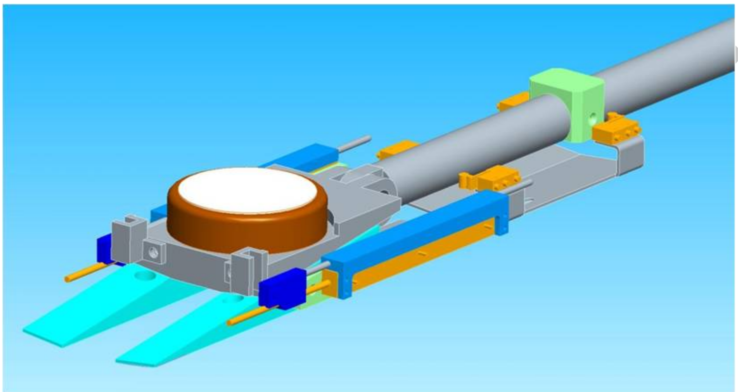

Figure 1.6: The QD0 Wedge Alignment Mover.

The QD0 support tube is extended toward the IP to support the 220 kg LUMICAL, the 507 kg 3cm thick conical tungsten mask, the lightweight 13 cm thick 25 cm diameter borated polyethylene neutron absorber and the 136 kg BEAMCAL. Along this forward part of its length, the support tube will be split along its centerline so that it can be opened to install the mask, absorber and BEAMCAL. The LUMICAL will be bolted to the front end of the tube and be positioned so that it hangs 10 cm in front of the endcap ECAL when the detector is closed. While this choice complicated the vertex detector support system, it minimizes any loss of acceptance between the LUMICAL and the endcap ECAL. The loading of the support tube results in a deflection of 100 μm when the door is closed, growing to 2.2 mm when the door is opened the nominal 2 m required to service the detector when on beamline, and 6 mm when the door is opened the maximum 2.8 mm allowed by the location of QF1 and the obstruction of the cryo-transfer line joining QD0 to its local 2 K refrigerator. The wedge mover system will need to act in conjunction with the door opening mechanism to keep the front end of the LUMICAL fixed in space.

The beampipe is of course very delicate, especially its 400 μm 1.2 cm ID 12.5 cm long central Be cylinder. At the far end of the first conical section of the beampipe, 1.5 m from the IP, the now 1.5 mm thick stainless steel cone is symmetric about the detector's centerline. As explained in the Forward Systems Chapter **??** of this document, the exit aperture at the base of the cone has a diameter of 120 mm and is centered on the outgoing 7 mrad beamline. To provide angular, but not position, compliance for the motion of the QD0/FCAL support system, a commercial 120 mm ID single convolution bellows is welded to a 120 mm ID 14 cm long stainless tube, ending in a large diameter vacuum flange, located immediately behind LUMICAL. The single convolution bellows, which may in the end be functionally replaced by a weld joint between the come base and the 14 cm tube, has been sized to protect the low angle acceptance of the LUMICAL [13]. While current studies do not seem to indicate that additional ion pumps are required to supply adequate vacuum in the IP region, the area behind LUMICAL and the area behind BEAMCAL are possible mounting locations.

As described in the Chapter **??**, the Vertex Detector is supported from the beampipe. The beampipe itself will be supported by a low mass dielectric fiber multi-arm spider from inner diameter of the barrel ECAL. These fibers will need to run over a pully system when making the two right angle bends that the LUMICAL-Endcap ECAL offset introduces.

Behind the LUMICAL the 1.5 mm wall stainless beampipe extends as a cone toward the polypropylene disk absorber. The cone and the disk are surrounded by the 3 cm thick W mask. At the disk end, the cone ends in a base at 2.815 m with a base which has a 66.3 mm diameter hole. This aperture is centered 2.5 mm toward the side of the exiting beamline so that it covers a virtual 30 mm diameter aperture for the exiting beam and 20 mm diameter aperture for the incoming beam separated by the 14 mrad crossing angle at the 2.95 m front face of BEAMCAL. In the SiD LOI separate 20 mm and 30 mm beampipes where maintained through BEAMCAL and the absorber. Vacuum considerations were the reason for the change described above; it is possible that future physics considerations may warrant reversing this decision.

The beampipe through BEAMCAL terminates in a commercial flange. The conversion of the common beampipe to separate incoming and outgoing beampipe takes place in the 215 mm space between the back of BEAMCAL and the front face of the QD0 cryostat at 3.283 m from the IP and is illustrated in Figure 1.7.

1.4.4 QD0-QF1 interface

Figure 1.8 shows a detail of near-beampipe region from the back end of the BEAMCAL to the front end of the QF1 magnet, which is fixed permanently in the tunnel leading to the IR Hall. In Figure 1.8 the SiD door (red plates) is closed. The support tube carrying QD0 extends 2.8 m beyond the back end of the door; its end marks the maximum extent to which the SiD door may be opened for access while SiD's QD0 magnet is connected to QF1. The QD0 cryostat service line, delivering 2 K liquid helium and current leads, breaks to one side to clear the beampipe before descending (down, out of the plane of the figure) to the platform below where the 2 K service refrigerator is located. The connection from QD0 to the service cryostat is considered semi-permanent.

Individual beampipes for the incoming and outgoing beams extend to the valve assembly immediately in front of QF1. Each beampipe has a commercial 1.5 in gate valve connected to a formed bellows and disconnect flange. One the QF1 side of the disconnect flange each beampipe has, first, an angle valve that connects to a roughout pump and ion pump and a vacuum instrumentation cluster with a RGA. This is followed by the gate valve which isolates QF1 during the push-pull detector exchange. On the QD0 side of the incoming beamline gate valve is located the 75 cm long kicker that, with the exit line BPM, comprises the intratrain feedback system.

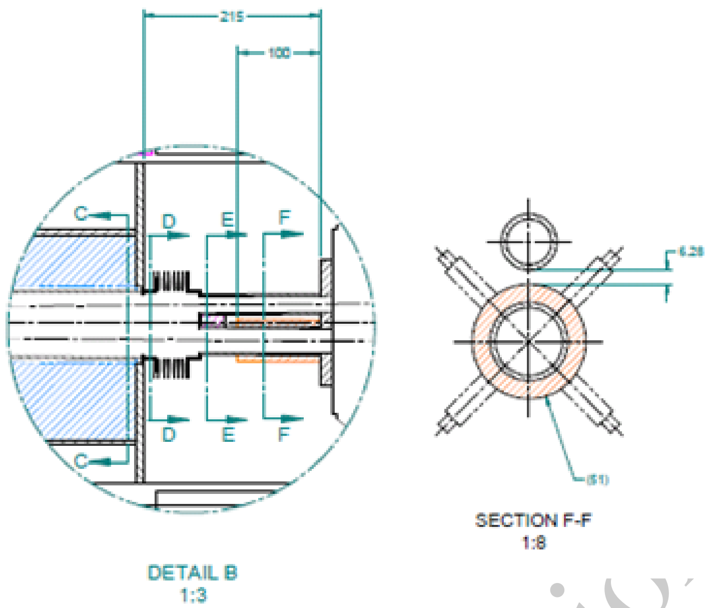

Figure 1.7: The BPM region between BEAMCAL and QD0.

Figure?? is an elevation view of the QD0-QF1 region with the SiD Door open to its maximum 2.8 m. In this view the individual beampipes, kicker and alignment wedge are not occluded by the QD0 service line. A key feature is the strut extending down at the the far side of the support tube. This strut will connect to a fixed feature of the QF1 support system and prevent relative z motion between the two cryostats.

1.4.5 Vacuum System and Performance

1.4.6 Feedback and BPMs

Section n.mm if the ILC TDR[14] describes the concept of the ILC Intratrain Feedback, which is conceptually identical to that described in the TESLA Design Report[15]. The parameters of the BPM and Kicker system that can achieve the signal to noise proper-

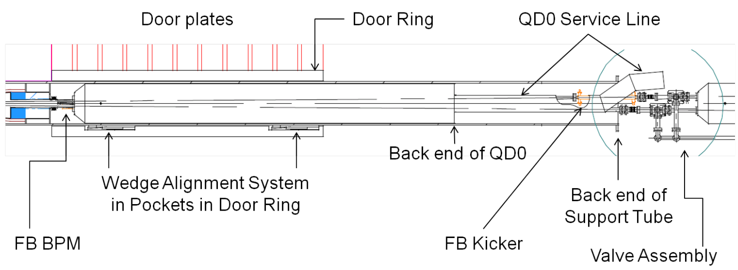

Figure 1.8: Plan view of the near-beampipe region from the BEAMCAL to the beginning of QF1.

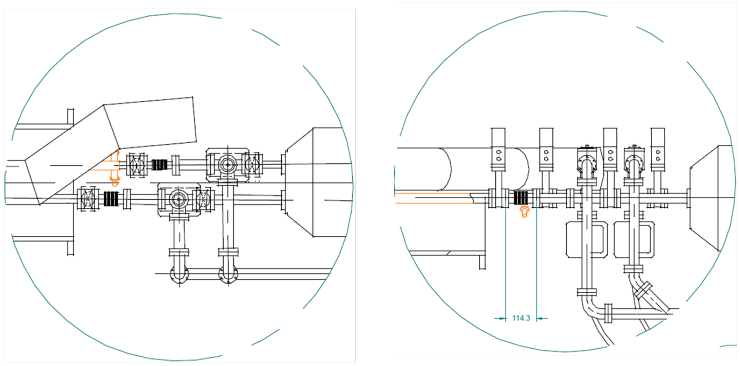

Figure 1.9: Detail of the valve, flange and pump assembly that allows QD0 to be separated from QF1 for push-pull operations. The left figure is the plan view. The right figure is the elevation view.

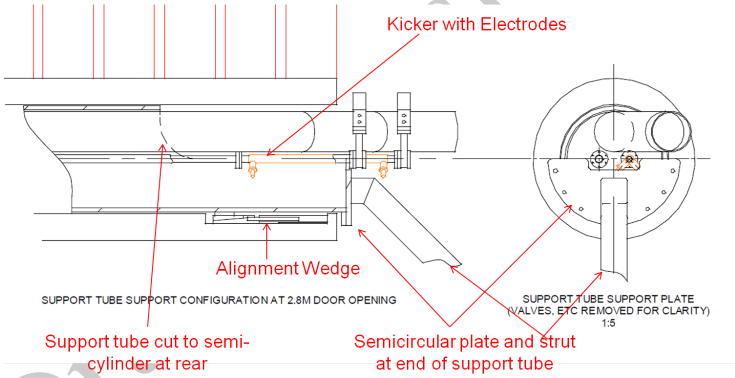

Figure 1.10: An elevation view of the QD0-QF1 region with the SiD Door open to its maximum 2.8 m.

ties required for robust functioning of the system have been designed[16]. By combining a ground motion model with a set of transfer functions describing the vibrational effect of the magnet support system, in this case the SiD platform and detector, the reduction of luminosity loss can be studied [17]-[18].

Figure **??** shows the fractional loss of nominal luminosity as a function of the rms x and y vibration of the SF1/QF1 and SD0/QD0 magnet systems. The feedback system maintains the luminosity to 96% of the nominal value for rms motions up to 200 nm, $\sim$40 times the vertical spot size of beam at the IP.

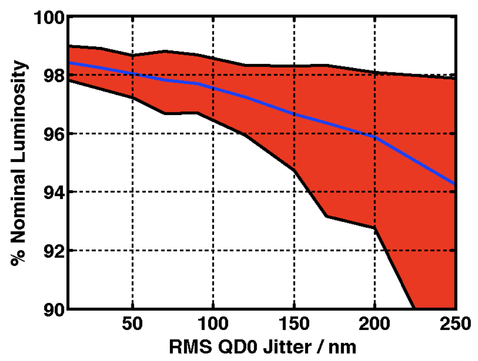

Figure 1.11: The fractional loss of nominal luminosity as a function of the rms x and y vibration of the SF1/QF1 and SD0/QD0 magnet systems.

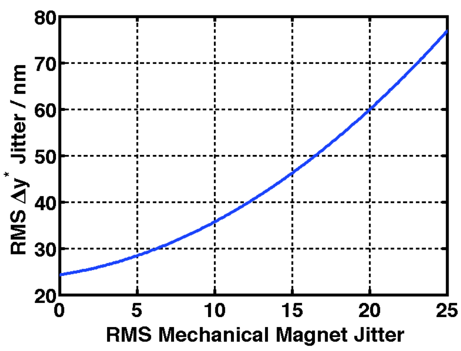

Figure 1.12: Contribution of Mechanical jitter to overall vibration budget.

1.4.7 Wakefield and Higher Order Mode Analysis

1.4.8 Frequency Scanning Interferometric Alignment of QD0 and QF1

1.4.9 Routing of Detector Services

1.5 Impact on Adjacent Detector While SiD in Operation

1.5.1 Radiation Calculations

Figure 1.13 shows the simulated[19] radiation dose that results when a 20 radiation length Cu target is placed 14 m from the IP. The maximum integrated dose per event is $\sim$100 μSv which is much less than the 30 mSv dose specified in the functional reuirements. The corresponding peak dose rate is 1800 mSv/hr which is much greater than the peak dose rate of 250 mSv/hr arising from the artificial nature of the calculation.

1.5.2 Fringe Fields and Magnetics

Figure 1.14 shows the calculated[20] fringe field as a function of position for a quadrant view of SiD.

Bibliography

[1] (Ed.) Aihara, H., (Ed.) Burrows, P., (Ed.) Oreglia, M., E.L. Berger, V. Guarino, et al. SiD Letter of Intent. 2009, 0911.0006.

[2] (ed.) Brau, James, (ed.) Okada, Yasuhiro, (ed.) Walker, Nicholas J., (ed.) Djouadi, Abdelhak, (ed.) Lykken, Joseph, et al. International Linear Collider reference design report. 1: Executive summary. 2: Physics at the ILC. 3: Accelerator. 4: Detectors. 2007.

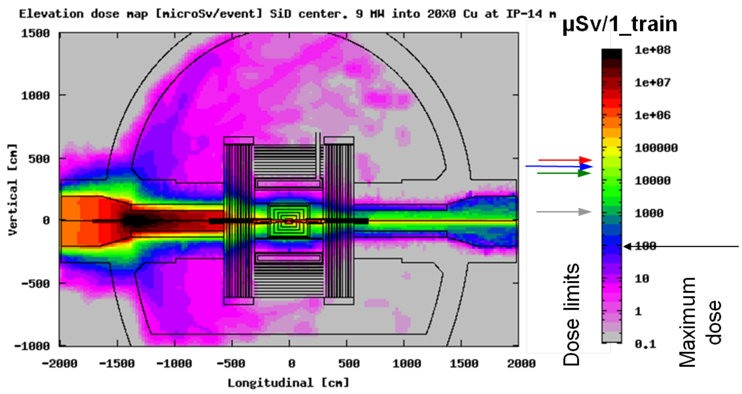

Figure 1.13: The simulated radiation dose that results when a 20 radiation length Cu target is placed 14 m from the IP.

[3] B. Parker, A. Mikhailichenko, K. Buesser, J. Hauptman, T. Tauchi, et al. Functional Requirements on the Design of the Detectors and the Interaction Region of an e+ e- Linear Collider with a Push-Pull Arrangement of Detectors. 2009.

[4] ILC IDAG. IDAG Report Valdation of ILC Detector Concepts.

[5] MDI Common Task Group. MDI CTG Agreement Granada 2011 to use Platform for Push-Pull.

[6] MDI Common Task Group and ILC CFS Group. MDI CTG and CFS Agreement Granada 2011 for Layout of Vertical Access IR Hall.

[7] ARUP. ARUP final report: task 2.

[8] CMS. CMS TDR.

[9] CERN Vibration Team. CERN EDMS 1099646.

[10] K. Bertsche. CERN EDMS 1027459.

[11] B.. Parker. ???????????

[12] Brau et al. Volume ??, Section ??, ibid.

[13] T. Maruyama. Indico entry ????

[14] B. et al Barish. Ilc technical design report. 2013.

[15] (ed.) Richard, F., (ed.) Schneider, J.R., (ed.) Trines, D., and (ed.) Wagner, A. TESLA: The superconducting electron positron linear collider with an integrated X-ray laser laboratory. Technical design report. Pt. 1: Executive summary. 2001, hep-ph/0106314.

[16] S. Smith. Sid intratrain feedback bpm and kicker design. 2011.

[17] G.R. White, G.R. White, D. Schulte, and N.J. Walker. Design and simulation of the ILC intra-train orbit and luminosity feedback systems. Conf.Proc., C060626:3041–3043, 2006.

[18] G. White. Bean-beam feedback, alcpg11, eugene, or, 2011.

[19] M. Santana. Radiation protection studies for sid, lcws, beiging, china. 2010.

[20] W. Craddock. Sid magnetic field studies. 2010.

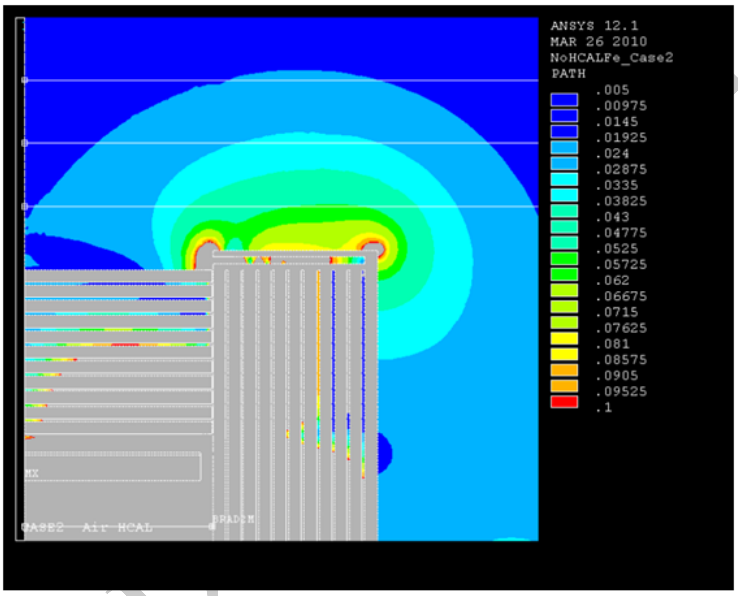

Figure 1.14: Fringe field as a function of position for a quadrant view of SiD.