CHANGE REQUEST NO. ILC-CR-000N	EDMS No: **D0000000xxxxxxx**	Created: **16-09-2014** Last modified: **24-09-2014**

DETECTOR HALL WITH VERTICAL SHAFT ACCESS

Change the underground experimental hall to a design that has a large vertical shaft and allows for the "CMS style" assembly of the detectors.

RATIONALE

Introduction

The baseline (TDR) design of the interaction region (IR) for the ILC in Japan foresees an underground experimental hall that can be accessed only via a horizontal O(1km) long tunnel of ~11m width and a slope of O(7%). This has been defined before the Kitakami site has been selected for the ILC in Japan under the assumption that any Japanese site would be in a mountainous area that does not allow to have an assembly and maintenance area directly on top of the underground IR. The Kitakami site, however, allows to find a position for the IR that has a reasonably flat area above the IR and where a vertical shaft of O(70m) length could be built to access the underground areas.

Detector Assembly and Timelines

In the "CMS assembly style", both detectors will be assembled and tested mainly on surface. This is especially of significance for the detector magnet systems (solenoids and yokes). The large pre-assembled pieces will be lowered via the vertical shaft into the underground hall using a temporary gantry crane that can lift O(4000t). The lowering of the detector parts happens rather late in the ILC construction schedule, about 1-2y before the start of beam commissioning. In the baseline version that allows only access via a horizontal tunnel, the detectors need to be assembled from smaller pieces. This requires a longer underground assembly time (~3y) and more underground assembly space. The vertical access design therefore decouples to a larger extent the time lines for the CFS work and the installation of the machine and the detectors. This reduces the risk of time delays and associated cost increase. In addition, the total construction schedule can be reduced by ~1y removing the installation of the detectors from the critical path. The new proposed scheme requires less underground infrastructure in terms of heavy duty cranes (250t) and transportation infrastructure for the horizontal tunnel.

Transportation Issues

The boundary conditions for heavy-duty transports in the Kitakami area are not finally understood. It has to be assumed, that the maximum mass for a truck is in the order of 25-50t. This needs to be reflected in the design of the detectors. So far it has been assumed that heavy transports of up to 200t could be done and the studies on the detector assemblies in the baseline version rely on this. If now the detectors need to be assembled from many smaller and lighter pieces, probably more underground space would be needed in the baseline design. It would be easier and probably cheaper to do the assembly from the smaller pieces on surface in the "CMS style".

Service Paths

The possibility to access the underground regions vertically reduces the path lengths for services for the machine and the detectors significantly, from O(1km) to O(100m).

SCOPE: MDI, CFS, OTHERS

CFS Design

Studies have been performed to find an IR solution with vertical shaft access in the Kitakami region. The proposed design of the underground area is shown in Attachment 1.0. This design has one vertical 18m shaft directly over the interaction point that is used by both detectors for the assembly. The diameter of the shaft is given by the largest detector elements that have to pass it. In addition, services for the detectors (e.g. cryogenics) can be routed through the central shaft. Additional access to the underground area is provided by a service shaft of 10m diameter and by a horizontal tunnel with a width of 8m that mainly serves as access path to the damping rings. The vertical shaft assembly scheme requires sufficient space for assembly buildings on the surface directly above the underground areas.

This current proposal has been discussed with all stakeholders in the IR region and finds approval.

Further detailed studies are needed, especially with respect to the surface area above the IR. This includes the assembly buildings for the detectors and the related infrastructure (cranes, platforms) as well as the services for machine and the detectors (cryogenics, power, cooling, etc.) and other buildings, e.g. for workshops and office space. This requires a broad discussion with all participating groups (detectors, machine, etc.) and is probably outside of the scope of this change request as no detailed design of the surface area has been defined in the TDR.

Timelines

The construction timelines have been studied for the new design (Attachment 2.0). The construction time in the baseline version is estimated to be about 116 months, while the estimate for the new design is 103 months. A more detailed study is required that takes into account the transportation boundary conditions as they become more definite.

ILC Position and Geology

In the baseline TDR design of the ILC, the IR is located underneath a mountain. The geology of this position has been verified with sample drillings and the rock is expected to be stable enough to support the underground detector hall.

Implementing the new IR design with vertical shaft access would require to move the ILC interaction point – and with it the complete machine – by O(700m) to the north. The implications of this shift need to be studied in terms of the geology at the new IR location as well as on impacts that might affect the ILC design at other places away from the IR.

Environmental Impact

So far no detailed study of the environmental impact of the IR installations during construction and operations has been done. The environmental implications of the new proposed IR design and the shift of the ILC position to the north need to be looked into in future studies.

COST IMPACT

Initial cost estimates have been performed by the CFS group and Japanese contractors. Assuming that the geological properties at the new IR location are the same as at the baseline position, the cost estimate for the new proposed scheme is slightly lower than for the baseline scheme.

In addition to the cost impact, there is also an estimated time impact. The total construction time of the IR area and the detectors will be shorter by ~1y in the new design.

Note: in comparison to the baseline design, the new IR design has been studied in more detail w.r.t. safety egress issues and service paths.

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Processed by:	

Attachments:

Number:	modified:	by:
1.0	Drawing of the detector hall	YN
2.0	Construction timelines	GO

Change History:

Version:	modified:	by:	what:
1.0	16-09-2014	KB	creation
2.0	24-09-2014	KB	Included comments from CFS group

IMPLEMENTATION PLAN

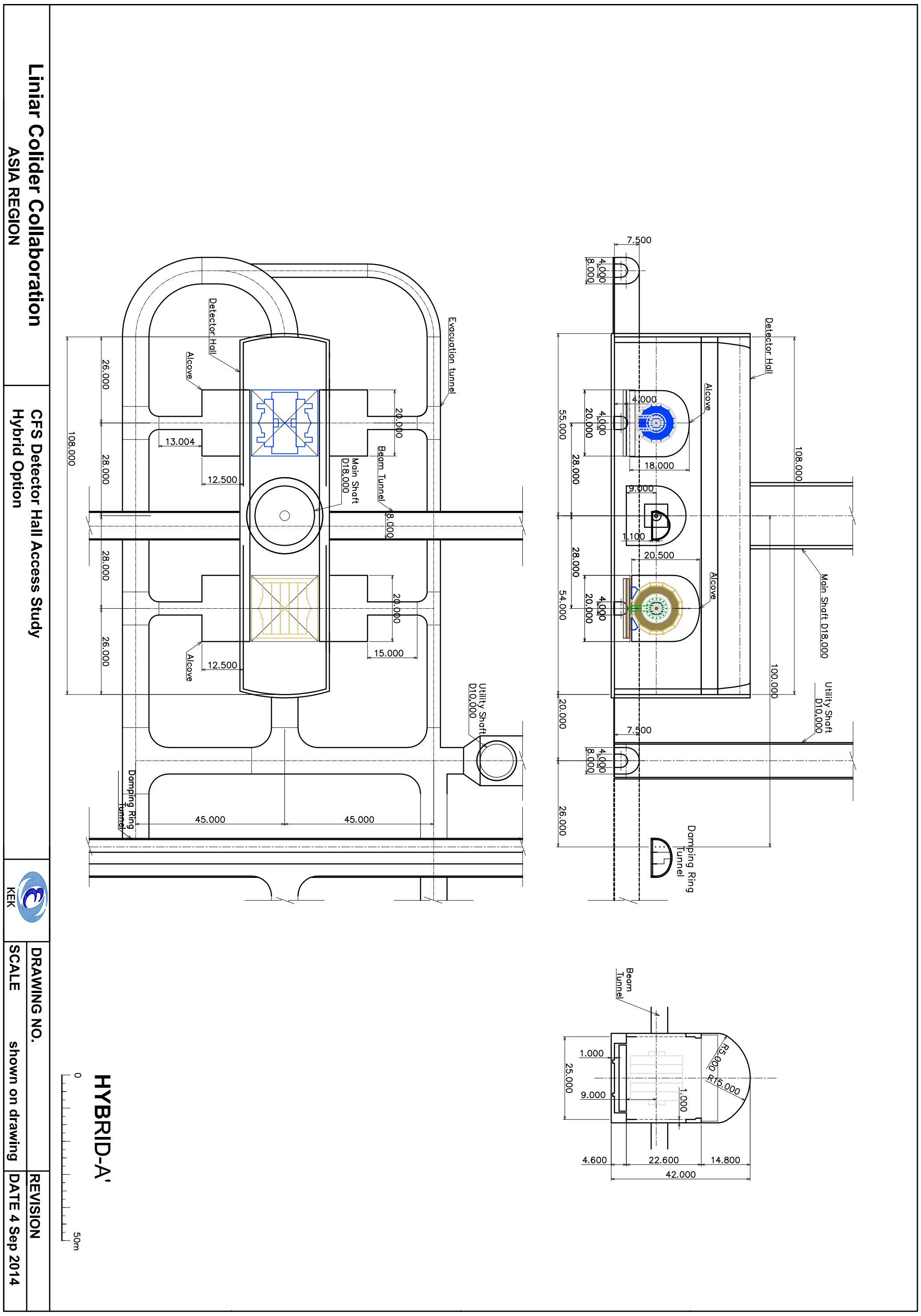
Concerned Parties (Work Packages, Coordinators, Suppliers etc.)

Affected documents

EDMS ID	Title	Remark

ATTACHEMENT 1.0

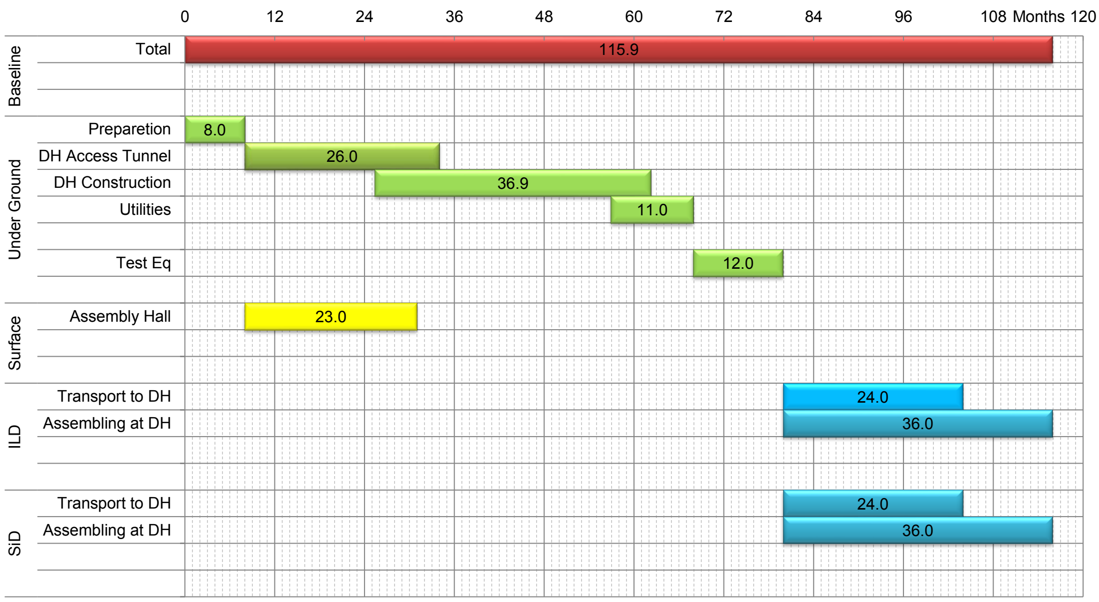
Drawing of the detector hall in the new proposed design with vertical shaft access (Y. Nishimoto, J-POWER).


Liniar Colider Collaboration
ASIA REGION
CFS Detector Hall Access Study
Hybrid Option
KEK
DRAWING NO.
SCALE shown on drawing
REVISION
DATE 4 Sep 2014
HYBRID-A'
Detector Hall
Alcove
Evacuation tunnel
Beam Tunnel
Main Shaft D18.000
Utility Shaft D10.000
Damping Ring Tunnel
Main Shaft D18.000
Utility Shaft D10.000
Damping Ring Tunnel
Beam Tunnel

ATTACHEMENT 2.0

Construction schedules for the baseline design and for the new proposed IR design (G. Orukawa, J-POWER).

Const. Schedule for the Baseline Design



Const. Schedule for the Hybrid A' Design