ILC International Linear Collider

ILC – Baseline Configuration Document

Conventional Facilities & Siting

CFS Group of GDE

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Frascati, 7-9 December 2005

SUMMARY

- *Organization overview / Activity of the CFS Group since Snowmass*
- *Requirements and general parameters*
- *American Sample Site*
- *Asian Sample Site*
- *European Sample Site (CERN and DESY Sample Site)*
- *Conventional facilities :*
  - *Facilities Design (Main tunnel, Access, Detector, surface building)*
  - *Power Distribution*
  - *Ventilation & Air-conditioning System*
  - *Cooling Water System*
  - *Handling Equipment*
  - *Safety and Fire Fighting System*
  - *Survey and Alignment*
- *Conclusion / Next Year Activities*

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ACTIVITY OF THE CFS GROUP SINCE SNOWMASS

- ***7 meetings by video-conference***
- ***2 meetings between CERN and DESY (at CERN and at DESY)***
- ***Several Iteration of the Conventional Facilities portion of the Baseline Configuration Document have been completed***
- ***4th version of the BCD – Conventional Facilities & Siting***
- ***The Final Draft of the BCD will be sent prior to the GDE Meeting at INFN (Frascati) 7-9 December 2005.***

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Conventional Facilities and Siting Requirements and General Parameters

1. ***Accelerator energy: 0.5 TeV cm Initial, upgradeable to 1 TeV cm***
2. ***Accelerator gradient: 31.5 MV/m Initial (500 GeV CM), 36 MV/m Final, each w/75% fill factor***
3. ***Accelerator length: ~26 km Initial, including BC1, BC2, undulator, diagnostics, etc.***
4. ***Crossing angles: 20mrad & 2mrad, length of BDS between wyes 3.84km***
5. ***Damping ring length: 3 @ 6 km circumference each (1 line for electrons, two stacked lines for positrons)***
6. ***Linac elevation; continuously curved to follow earth's curvature (horizontal)***
7. ***Beam line alignment: Follow earth's curvature, laser straight Beam Delivery***
8. ***Number of tunnels: 2, with periodic surface buildings***
9. ***Number of interaction regions: 2 Final. One IR hall will be fully costed initially.***
10. ***Overall Length of the Tunnel : ~30 km initial ; the site should accommodate ~50 km.***
11. ***Vibration requirements***

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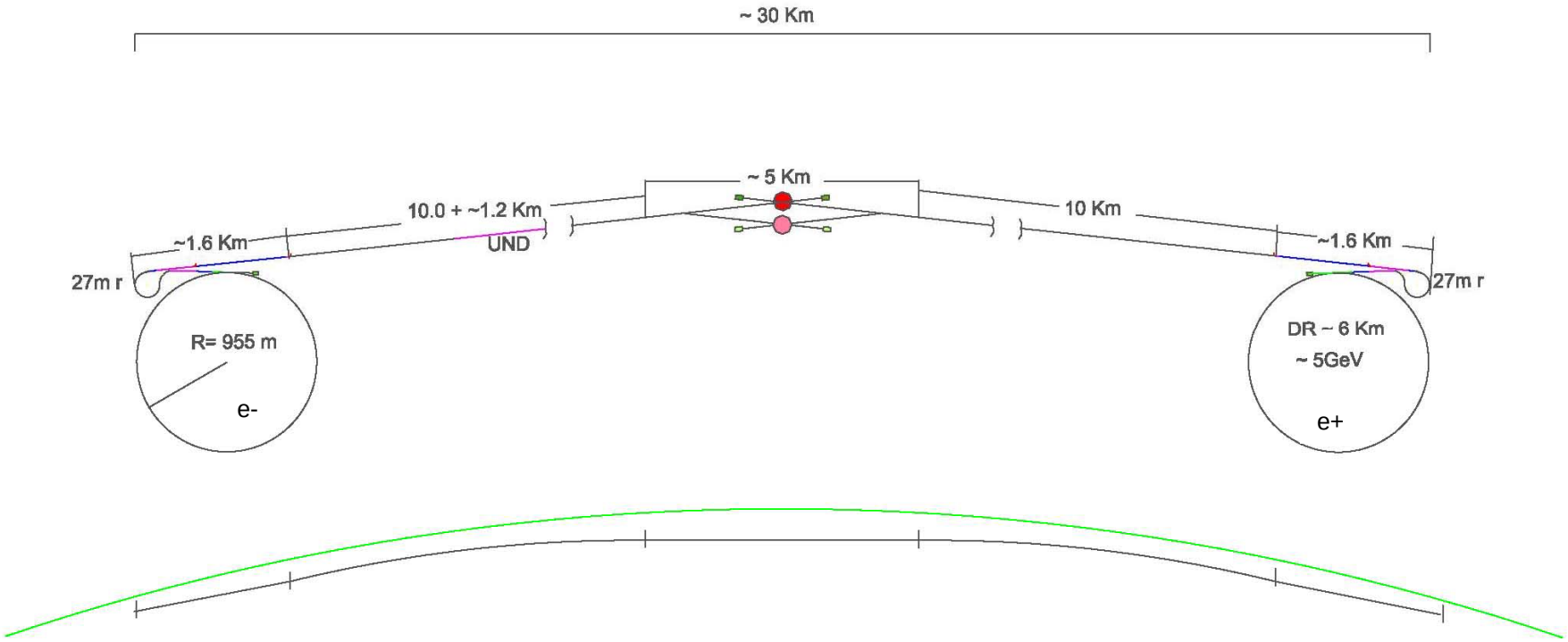
SCHEMATIC LAYOUT – PHASE I



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Methodology for sample site selection : Assessment Matrix

1. ***Site Impacts on Critical Science Parameters,***
2. ***Scientific /Institutional Support Base,***
3. ***Land Acquisition,***
4. ***Environmental Impacts,***
5. ***Construction Cost Impacts,***
6. ***Operational Cost Impacts,***
7. ***Environmental, Safety and Health Issues,***
8. ***Regional Infrastructure Support, and***
9. ***Risk Factors***

Americas Sample Site

Situation :

In solid rock, close to existing institute, close to the city of Chicago and international airport, close to railway and highway networks.

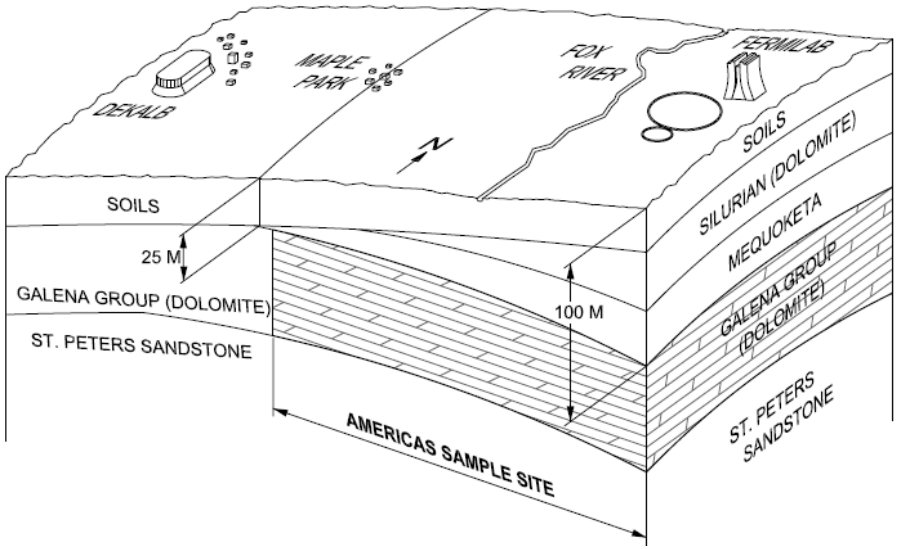
Geology :

Glacially derived deposits overlaying Bedrock. The concerned rock layers are from top to bottom the Silurian dolomite, Maquoketa dolomitic shale, and the Galena-Platteville dolomites.

Depth :

Average ~ 135 m

Americas Sample Plan / Section



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Asian Sample Site

There are several Asian Sample sites which are suitable for the ILC site.

Sample Site selection is under way and will be available for the Reference Design Phase.

European Sample Site - CERN

Situation :

Proximity of CERN existing site and the city of Geneva with its international airport. Possibility of connection with the SPS tunnel. Close to railway and highway network connections.

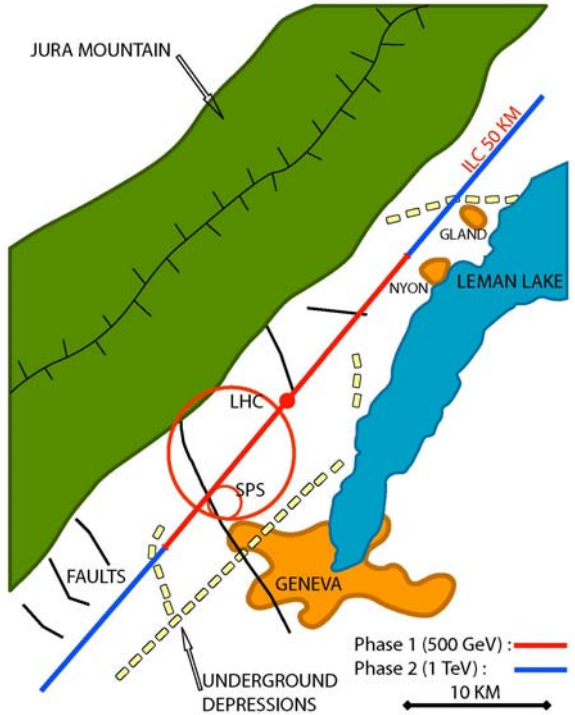
Geology :

Solid an stable bedrock called "molasse" (sandstone), which stretches between Jura mountains and Lake of Geneva.

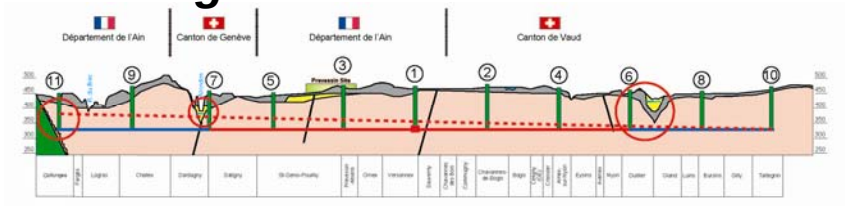
Depth :

Average ~ 120 m

CERN Sample Plan



Longitudinal cross-section



European Sample Site - DESY

Situation :

Closed to DESY existing site and the city of Hamburg with its international airport and seaport. The ILC layout will follow closely The TESLA layout on the first 32.8 km and then be extended to 50 km in the same specific direction. Possibility of connection with the HERA tunnel. Close to railway and highway network connections.

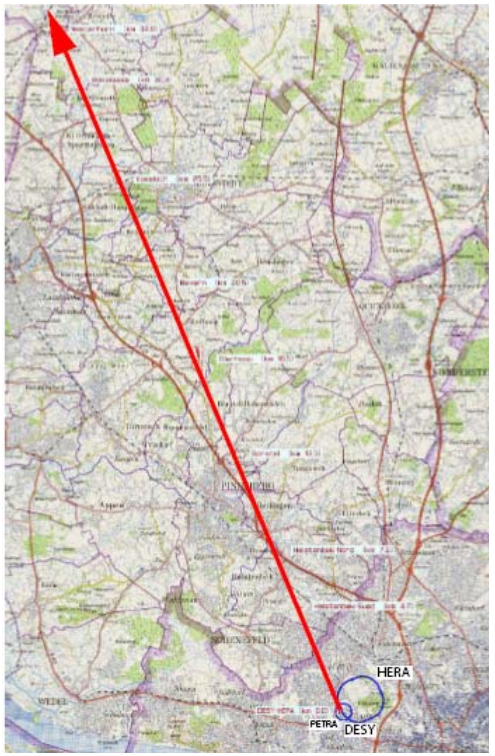
Geology :

Quaternary sand and smaller part in marl. Tunnel situated below the ground water table over nearly entire length.

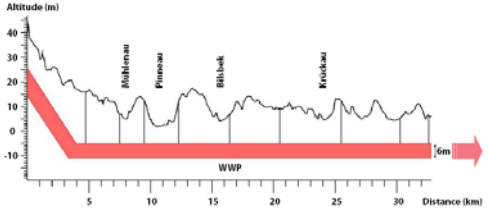
Depth:

Shallow position, average ~ 20 m

DESY Sample Plan



Longitudinal cross-section



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Conventional Facilities - Civil Engineering

Main Tunnels

Preliminary Design Data	Americas Region	Asian Region	European Region (CERN)	European Region (DESY)
Accelerator Tunnel Diameter	4 m	3.2 m	3.2 m	3.2 m
Service Tunnel Diameter	4 m	4 m	4 m	4 m
Depth of Tunnel (Range)	120 m to 150 m	TBD	Baseline 100 to 130m. Alternative 30 to 130 m	7 m to 30 m
Tunnel Excavation Method	TBM	TBD	TBM with precast concrete lining	Hydro shield TBM with precast concrete lining
Type of Rock	Galena Platteville Dolomite	TBD	Molasse sandstone rock of Lemanic Plain	Quarternary sand for the majority, and marl for small part
Length of site	50 Km or more	50 Km or more	50 Km or more	50 Km or more

And a lot more ! (Access shaft every ~5 km, 6 km long Damping Rings, surface facilities, etc.)

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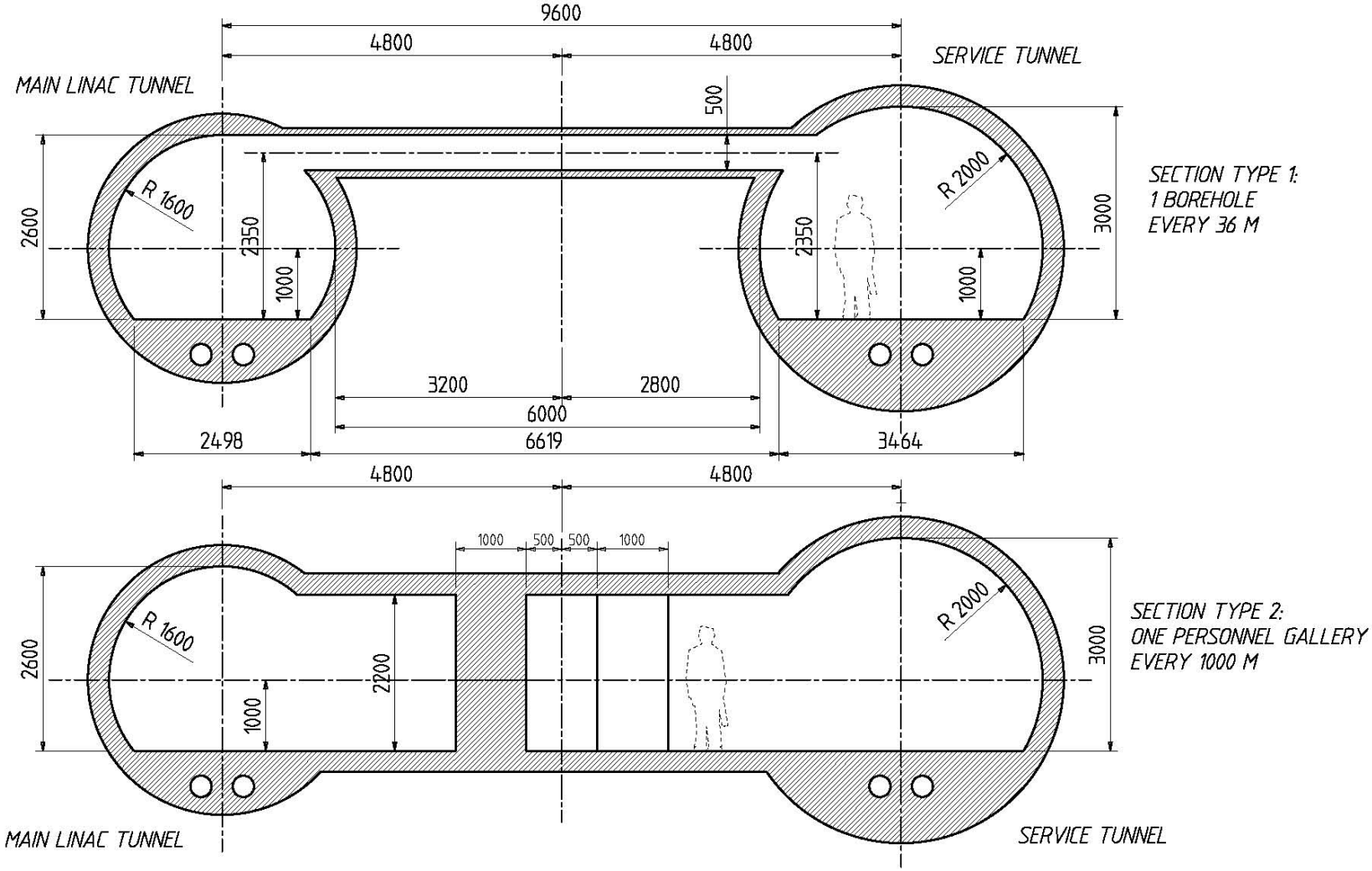
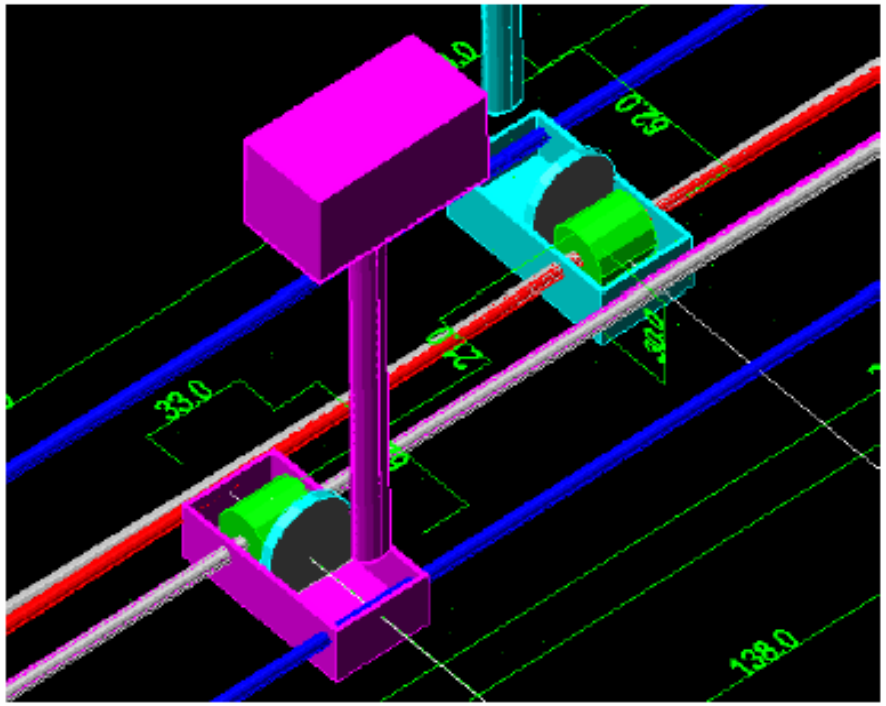
ILC Tunnel Cros sections



Detector Hall

- *Two interaction zones*
- *An above grade assembly building and below grade collision hall.*
- *Inside space for each IR collision halls is 33 meter wide by 62 meter long by 30 meter high.*
- *Steel multi storey mezzanines to provide areas for computer, control room and office facilities.*
- *Other utility areas to house process water systems, electrical power services and air handling equipment.*



Interaction Region

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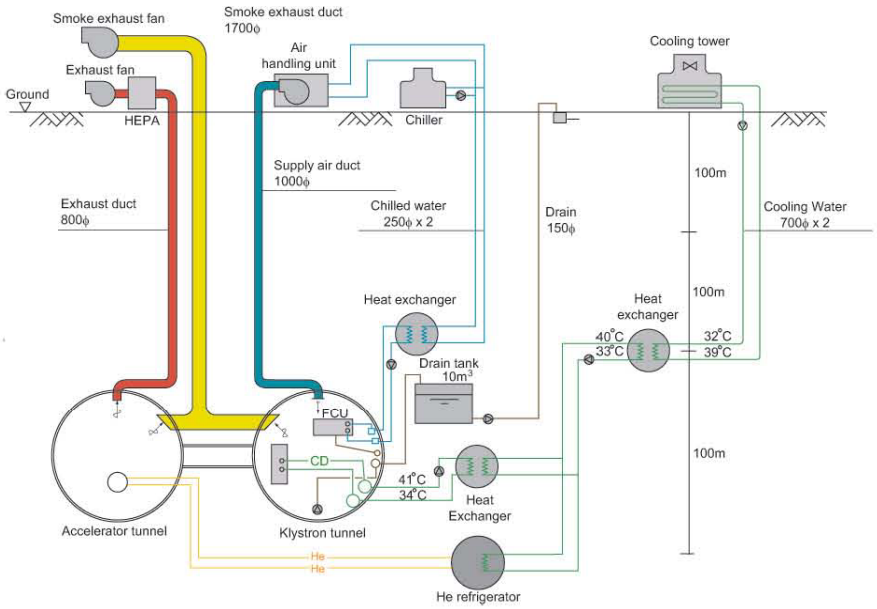
Conventional Facilities – Power distribution

- ***Supply from high voltage local network***
- ***Substations → Staged medium voltages – buried transport lines (loop ?)***
- ***Supply to large users directly from medium voltage (cryo-compressors, modulators, …)***
- ***Substations → Low voltage for other users on short distances***
- ***Safety systems with charger / battery devices or stand by generators***
- ***Network monitoring from industrialized systems***

Conventional Facilities – Ventilation and Air-Conditioning

- ***Heat extracted with water whenever possible***
- ***Air handlers in surface buildings, → required temperature and humidity for tunnel***
- ***Chilled water / an coils in service tunnel to remove heat***
- ***Tunnels used as full section ducts***

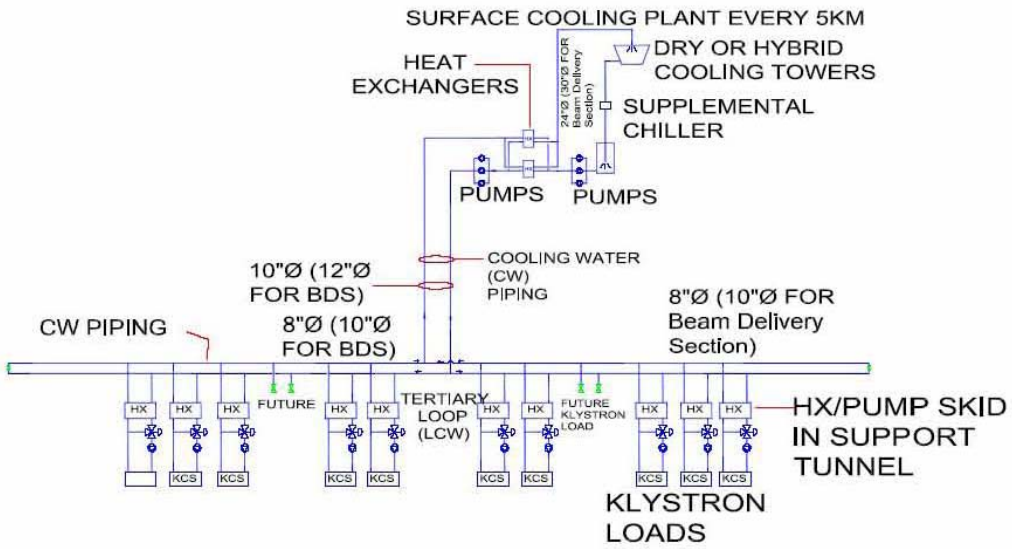


Asian Region Ventilation and Cooling Scheme

Conventional Facilities – Cooling water system

- ***Efficient cooling of klystrons, modulators and fan coils in service tunnel with water***
- ***Cooling towers / hybrid towers / dry coolers / chillers in surface plants (every ~5 km)***
- ***Heat exchangers and pumping station either at surface or underground***

Americas Region Cooling Water Scheme



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Conventional Facilities – Safety and fire fighting System

- ***Difficulties in trying to find appropriated codes for accelerators tunnels***
- ***Two tunnels linked with fire protected accesses : an important asset.***
- ***Access safety and access control systems a major design issue.***
- ***Other systems to be carefully considered : smoke and heat detection, fire protection, emergency lighting, Audible Emergency Evacuation, Oxygen Deficiency hazard, …***

<u>Safety issues need to be addressed at early stage !</u>

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Conventional Facilities – Survey and Alignment

- ***Geodesic network with references points close to shafts.***
- ***Additional leveling network.***
- ***Geometry transferred to tunnels level through dedicated space in shafts.***
- ***Underground references network to be set up (on slab or deeply anchored).***
- ***Traverses based on gyroscopy likely to be sufficient for Civil Engineering work.***
- ***Substantial studies and R&D to be carried out for alignment of components.***
- ***Possible use of hydrostatic leveling system for linacs alignment.***
- ***At IP, need for permanent view along beam through or aside detector.***

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Conclusions

- ***CFS Group organized to continue efforts next year for development of RDR***
- ***A time schedule for 2006 activities will be set up soon after FRASCATI***
- ***BCD requirements of other GDE Groups to be translated into consistent set of CF Criteria***
- ***Criteria and design solutions to be reviewed with « single points of contact »***
- ***Common solution to all regions whenever possible (more likely for non Civil Engineering CF)***
- ***A lot of efforts to be put in costing next year, eased by common solutions***