

ILC Detector Strategy Questions

- Some of us have been wondering about the fundamental assumptions that seem to have been accepted - and are shaping the thinking about the interaction region for ILC.
- This is an early and perhaps biased set of questions...
- **... and I (Norbert) have tried to answer.**

Beneficial Occupancy

- We have been assuming that useful occupancy of the underground volume does not occur until shortly before beam. Why???
We were forced by the civil engineers. Be aware that both tunnel boring machines end in the experimental hall.
- What are the overall economics of having the collision hall available for detector assembly and beamline assembly 2 to 3 years before beam?
 - We have been assuming that magnetic measurements (which may be somewhat distinct from coil testing) occurs on the surface, and then the detector gets moved - in some set of pieces - to the hall. Maybe this is not a great idea?
With a surface assembly a la CMS I am not so much concerned. (You have to open the detector for maintenance anyhow.) But with a GLD style surface assembly I share your doubts.
 - Would underground assembly have real advantages if the facility was available early enough? **YES!**

Large Shaft

- We have been assuming that huge shafts are needed to lower big detector systems. Consider MINOs:
 - MINOS is a neutrino detector constructed deep underground at the Soudan mine.
 - Minos has ~5.4 KT of iron.
 - The Soudan shaft is inclined at 7° .
 - The Soudan cage has a base of ~1.2 m by 1.9 m, and a capacity of ~6T.
- The largest SiD unit appears to be the solenoid. It would fit down a shaft 6 x 7 m, and weighs ~160 Tonnes.
- The barrel iron segments would fit this shaft, and weigh ~375 Tonnes.
- An early, preliminary possibility is that a small shaft and 400 Tonne cranes above and below might be adequate.

Cavern Shape and Configuration

- How much of thinking of the underground shape of the cavern is based on CERN geology?
- Would larger cranes cost less in other rock?
It would surprise me!
- Are two shafts required for safety?
Yes and availability!
Could the secondary escape way be into a beam line?
Not today after the experience of several accidents in tunnels (Mont-Blanc-Tunnel (24. March 1999), Kaprun/Kitzsteinhorn (11. Nov. 2000), ...)
- Could the shafts (if there are two) be over the garage position? **NO!**
Is the major reason for offsetting the shaft safety?
YES! And the stairs in the shaft!

Deep Caverns

- This is politically incorrect - so please do not pay any attention to this slide.
 - Is it only politics that we are limited to deep sites?
Good question! Lack of interest and manpower? (at DESY?)
 - A first look at radiation indicates that a slightly buried linac - ie the top of the housing at grade, with the housing then buried under the excavated soil, is adequate for normal beam loss and accident scenarios.
 - This would require a very flat site.
 - This might save money.
The unofficial statement was that the shallow DESY sample site would cost the same as a deep site. (It's hard to believe this! People that had worked on the TESLA proposal were surprised.)
 - Such a site is not on the approved list.
In one of the last ILC news Barry made the point that it will be a task for the RDR.
 - This might permit a shallow hall.
 - **Especially with the need of a service tunnel for the klystrons and modulator a SLAC-like solution looks very charming.**

LHC Influence

- The LHC has enormous issues of radiation and rates, and makes the LHC detectors very challenging.
- ILC should have rate and radiation issues only very far forward where e^+e^- pairs are an issue, and should have a low rate, low radiation environment elsewhere.
Except the beam dumps!
- Are there any issues with self-shielding?
 - A concern is that the detector endcaps nominally are planes normal to the beam. The detector volumes ~look at the beamline. Is this an issue if the beam were to target a beamline component?
 - Are there other issues?**Self-shielding would work! Holes or gaps can be covered by chicanes.**
- Large cable plants coming off the detector are natural at the LHC. Are such plants needed for detectors at the ILC?
At least some! (Do not under estimate the supply lines (power, gas, cooling))
- Separate shielded areas for support facilities (e.g. power supplies) are needed at LHC. **Not for all! At CMS a lot of power supplies are at yoke!** Can they be more closely associated with the detector structures at ILC?
Yes, but where is the space? What about vibrations?
- It would appear that all data from a detector could be transmitted on modest numbers of fibers? **Yes!** Should detector control rooms be located on the surface? **Yes or Elsewhere? (“Global Experiment Network”)**

Platforms and Push-Pull

- Platforms seem to make the interface issues easier, but they increase the depth of the hall below beamline.
Depending on the site you may get it for free!
Are there technical risks that are increased by the platform approach - assuming that cable plants and other services are small.
The risks lie in the push-pull approach!
- As the time required to effect a detector interchange increases, the frequency of interchange will decrease to maximize luminosity. When do the sociological issues become problematic?
They are already a problem, but we have not yet notice because we do not have real collaborations.
Does a slow interchange push towards an eventual one detector outcome? **Yes!**
- What are the fundamental limits for interchange time?
Reliable and safe moving!
 - Is it obvious that a detector solenoid must be run down? **No!**

ILC Beams

- The ILC beams are quite small transversely. Is adequate attention being paid to vibration? **Not yet!**
- The ILC beam is quite short longitudinally. Is adequate attention being paid to EMI? **People are aware of the problem!**

Seismicity

- We do not have a site yet. What if ILC winds up in Japan? Or California?

We will be happy to build it and solve all the problems we identify beforehand.

Have you ever seen a machine that has reached its single design values (vibration, alignment, etc.)? But most of them reached their goals in the important terms like luminosity, results or discoveries. Or?

Detector Maintenance

- What scale of maintenance should be possible on beamline?
 - Access to the exterior of the detector during operation has been assumed by SiD.
 - Door opening of ~2 m is assumed. Is this adequate, particularly if there is a shift to “plug” style door? **May be not! It’s tight!** Might this affect hall width? **Of course!**
- What scale of maintenance should be possible off beamline?
 - If a detector requires major maintenance, can it interfere with the other detector? **Depends on the hall size!**
 - It seems that the ability to access the VXD is required, and this probably means removing the tracker. Is this the limit of major maintenance, **YES!** or should there be the possibility of even removing the solenoid? **No, but there might be sufficient space!**
 - Will crane motion interfere with machine operation? **Hopefully not! It’s a point for the vibration list!**

Summary

- These are a few questions that have been worrying us.
- There will be more.
- These seem to affect fundamental strategy for the IR. At this time, should we be making decisions or developing options?

We should develop options to prepare decisions!

Summary (N.Meyners)

- ~~• You did not question the fundamental assumptions that are the base for the push-pull solution:
 - ~~– That it would take days to re-establish a beam line~~
 - ~~– It is not possible to serve two detectors on a train by train base (i.e. 5Hz)~~
 - ~~– That we need to save ~500 Million ILC-units (~6% of total cost)~~~~
- **The detectors are half of the game. If they do not work or can not be maintained, repaired and upgraded the whole accelerator is or becomes nearly useless!**
- **So I do not understand why the detector have to go to the limit in saving money.**
 - We even try to save money before we know costs and consequences?
 - Why do we have to discuss extensively hall width and depth at this stage of the project? (We need some assumptions for the costs, but this is do for the moment. And we save 500Mbugs I am not willing to discuss some kbugs at the moment.)
- **We should at the moment concentrate on technical issues. Develop solutions, validate them and continue with the one, two, three most convincing one or?**