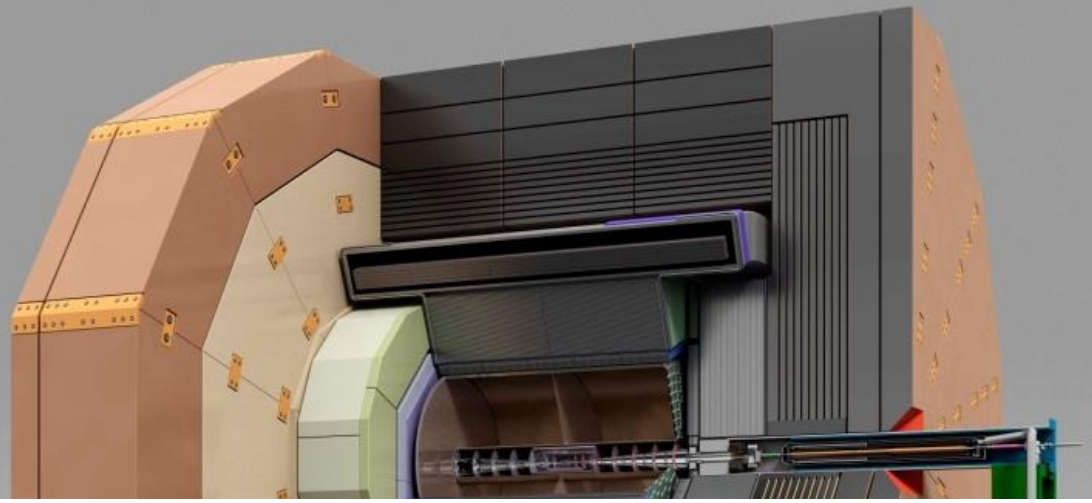
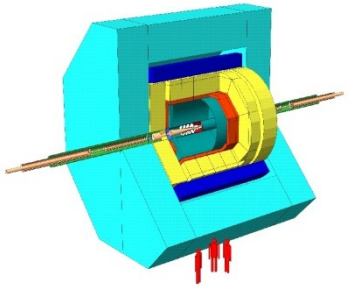


# ILD discussion session

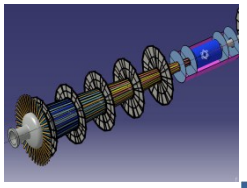
ILD status and plans

25.5.2012

# The Steps towards the DBD

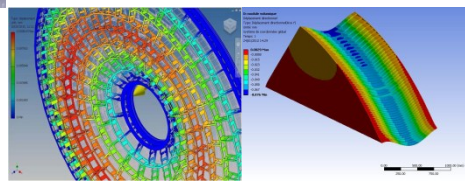


**LOI detector**



**Technologies**

Validation
Scalability
Simulation



**Engineering design:**

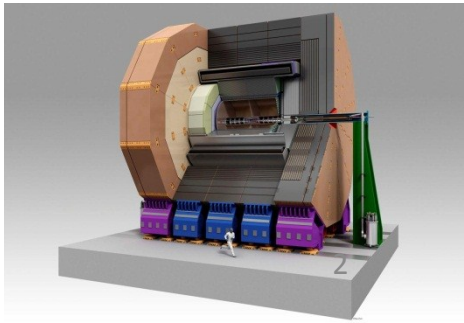
Conceptual design of the overall system with a focus on integration aspects

Criteria to be accepted as an option:

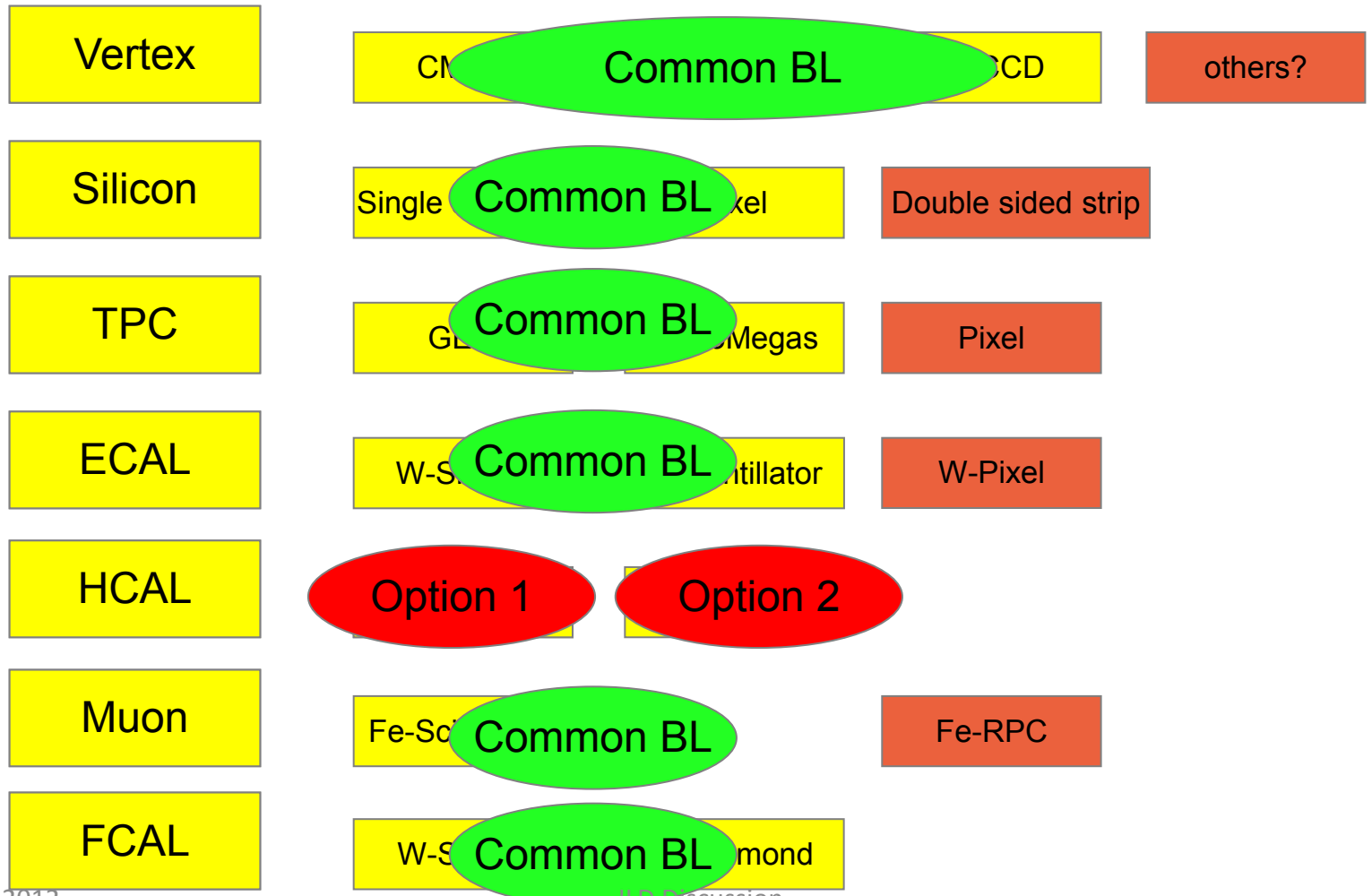
- Establish performance
- Validated simulation
- Operational experience
- Scalable technology solutions
- Open R&D issues

**DBD detector**

- Options
- Alternatives
- Issues



# ILD: baseline detector
# The current picture



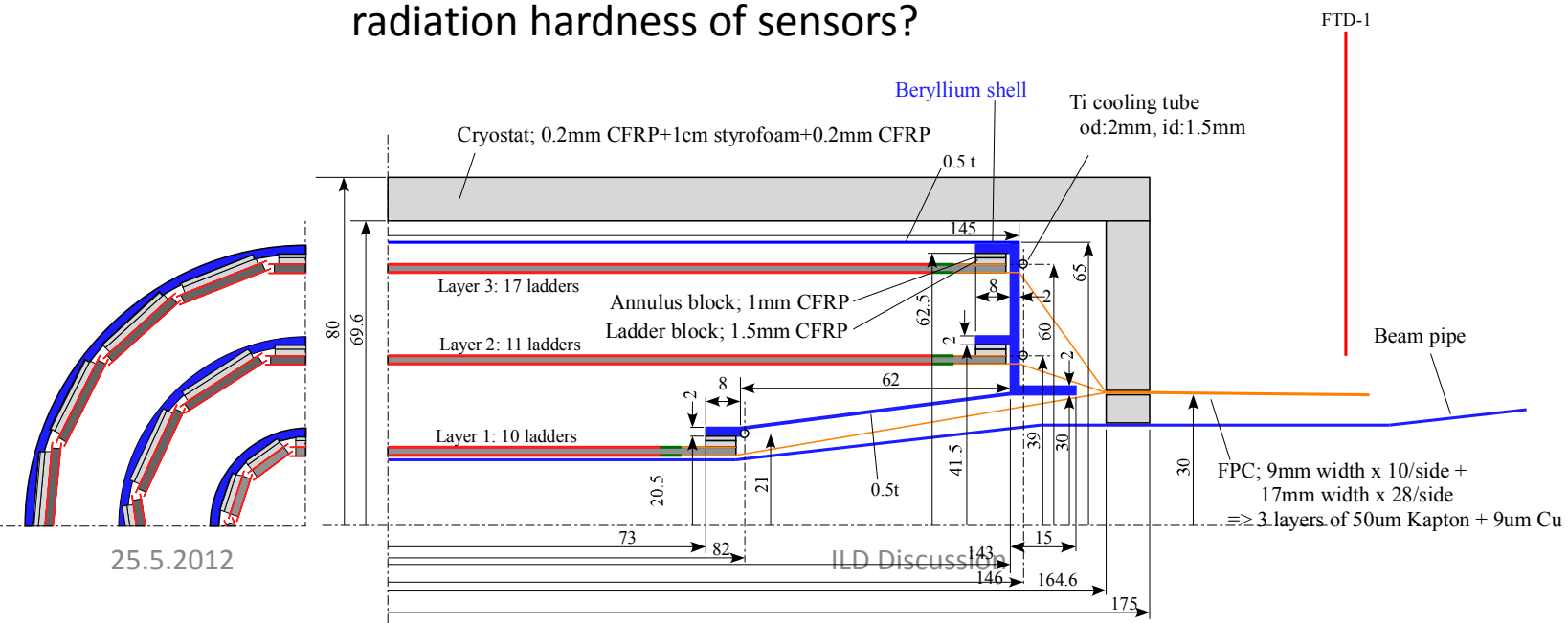
# Vertex Detector

Three options are proposed:

- CMOS
- FPCCD
- DEPFET

Fairly mature common design of the detector, performance indepent of technology for sake of DBD

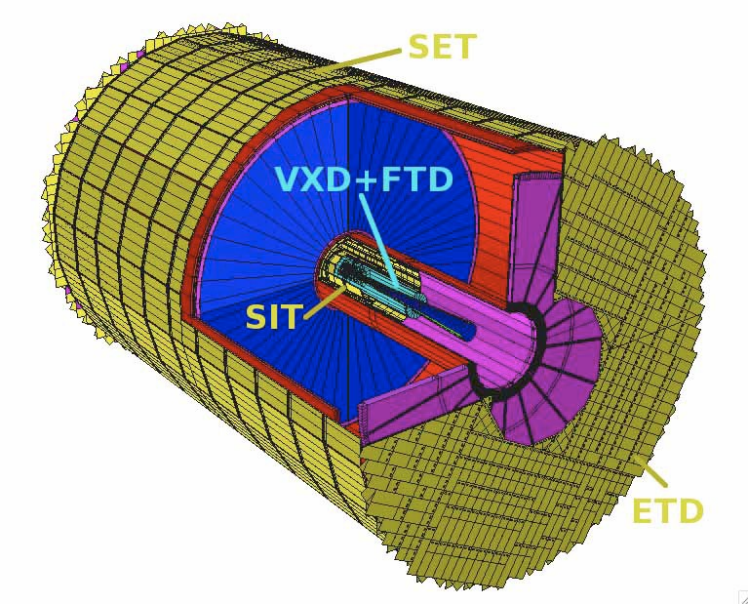
Issues: background occupancies
advantage of twin-layer structure has not really been demonstrated
radiation hardness of sensors?

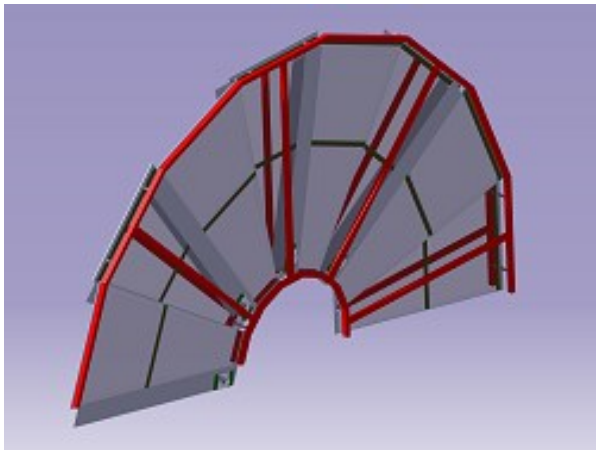


# Silicon tracking

Very complex, large area system

- Significant progress on the FTD design both mechanically and electrically
- Major problem of increase of material due to powering seems to have been solved for FTD
- Alignment system under design for FTD
- Need to make sure that SIT/ SET/ ETD are brought to comparable level
- Problem: design of the pixel layers in FTD, services for SIT

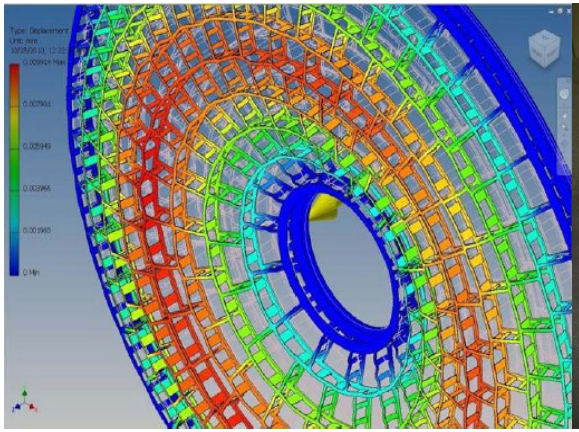


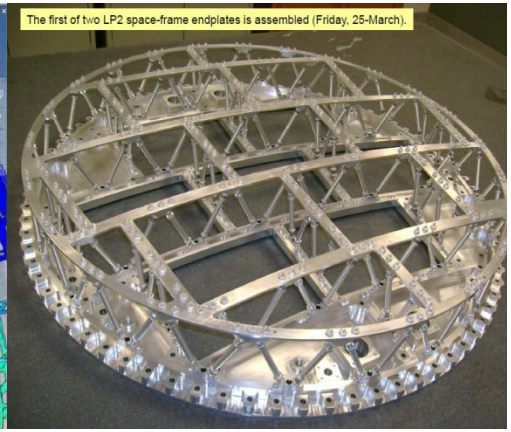



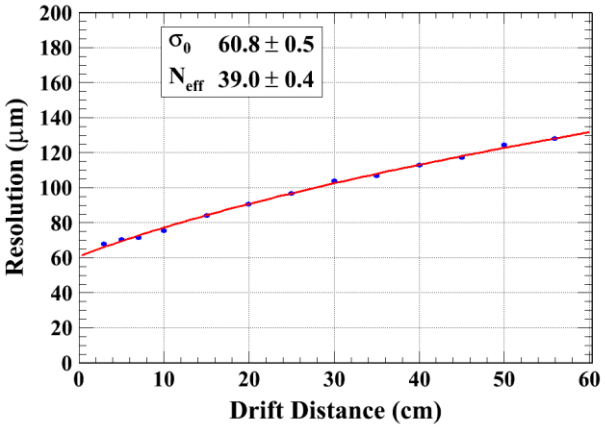
# TPC

Design of the TPC is progressing:

- Much more realistic idea about endplate, fieldcage, suspension etc.
- Basic performance has been demonstrated
- Two options: GEM and Micromegas pad readout, one alternative: pixel readout



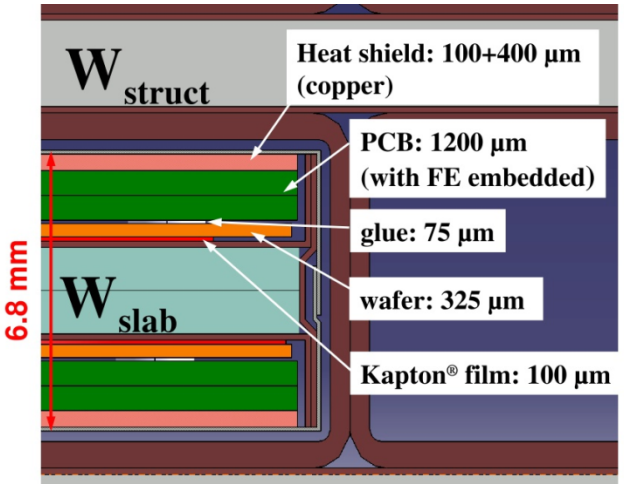


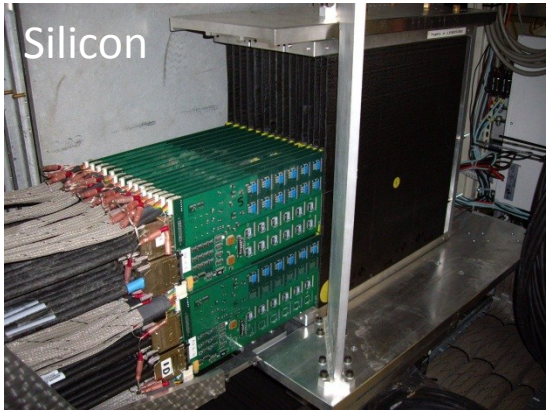
# ECAL

Two technologies as baseline:

- Si-W (established)
- Scintillator W (nice to see progress)
- Role of Hybrid in the DBD?




Physics prototypes for both technologies





Basic performance established
transition from physics prototype
to engineering prototype
will not be finished for the DBD,

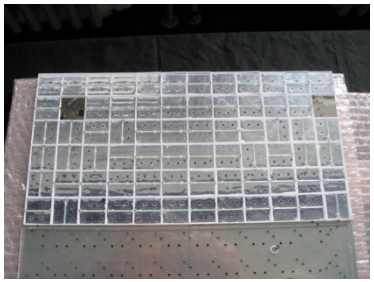
Many results available

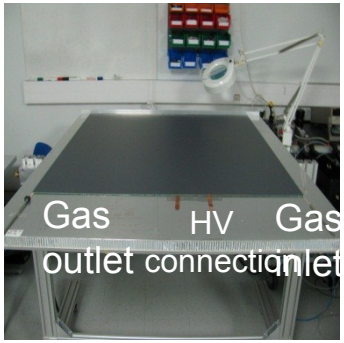
Hopefully have some first
results in time for DBD

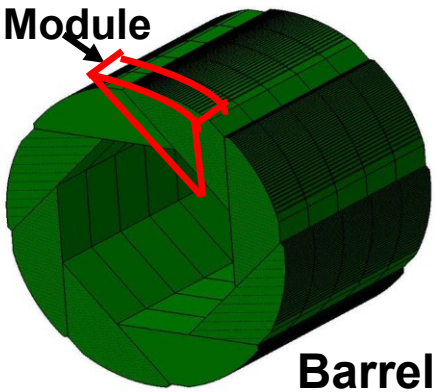
But many individual studies make
design believable.

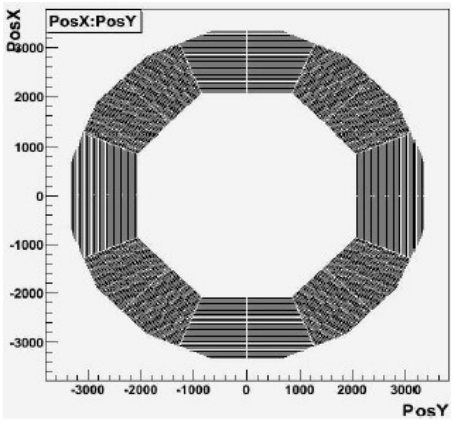
# HCAL

Two technologies, two geometries






Significant systems for both have been demonstrated (SDHCAL real prototype, AHCAL physics prototype)

Data from both are available

- Great success for both AHCAL and SDHCAL groups
- Both will be available in the simulation

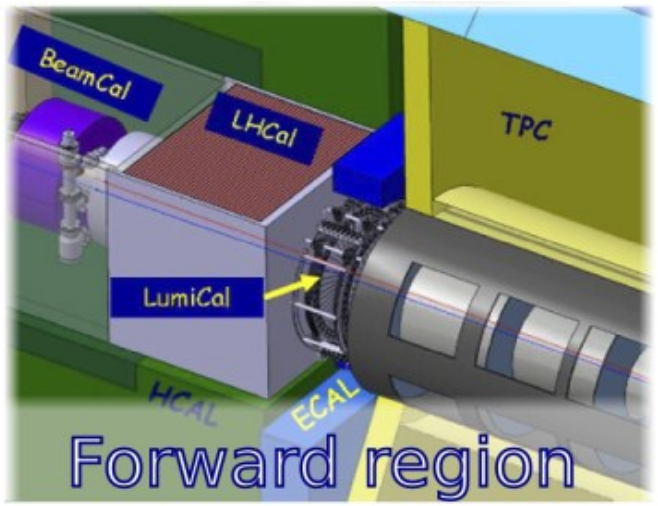
CALICE is preparing a document to document the input.

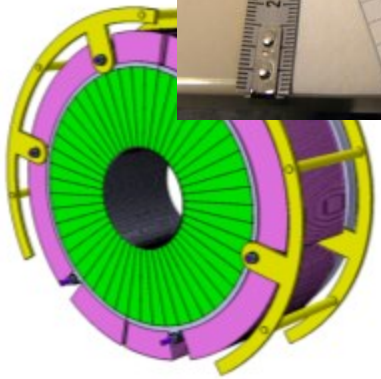
# FCAL/ Backgrounds

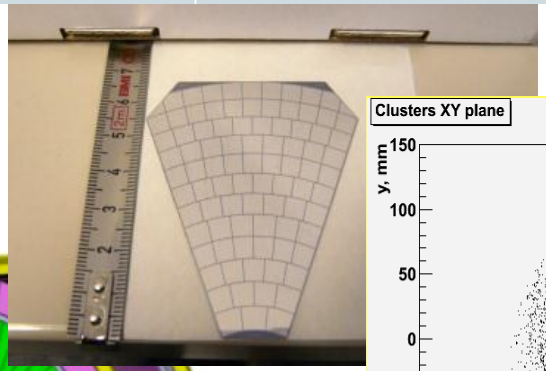
- Detailed design exist for the different components, except for SDHCAL
- Performance has been demonstrated and evaluated
- Need to urgently understand backgrounds as this will drive performance!

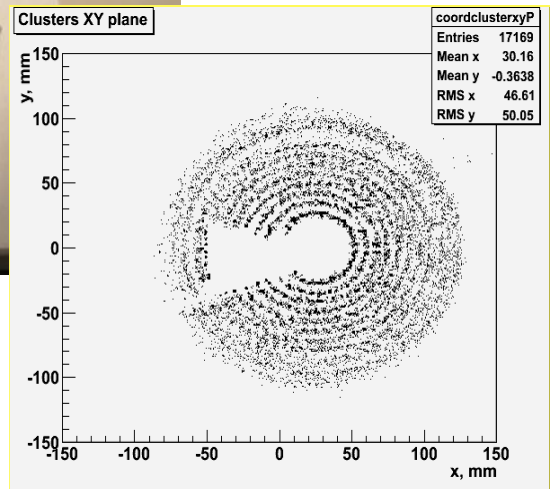
Pixel occupancy with new study

| Layer | 1TeV Without cut | 1TeV With Cut | Sb2009wTF-500 w/ cut |
|---|---|---|---|
| 1 | 20.1 % | 15.5 % | 3.079 % |
| 2 | 10.1 % | 7.79 % | 1.74 % |



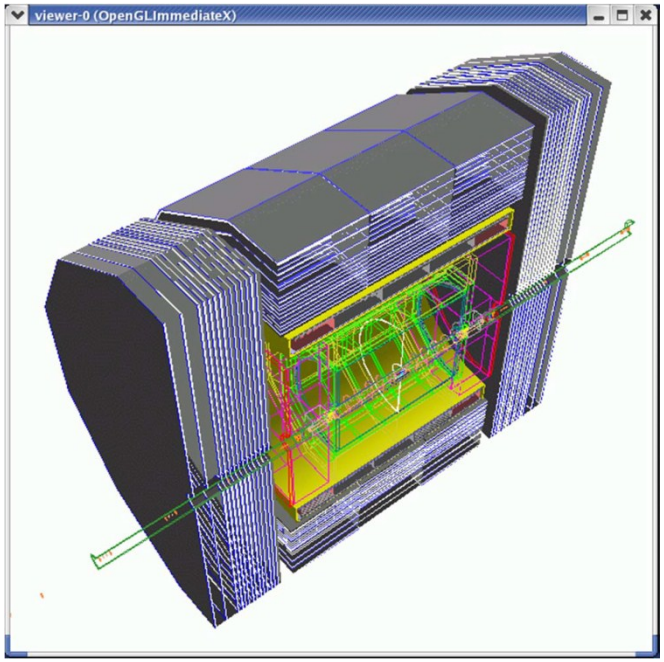




# Muon

Baseline design exists, based on scintillator

- Proposal is strips, simulation has implemented tiles
- Due to manpower other options are not currently studied (RPC's in particular)
- Layout of muon system frozen, but not really optimized




Performance of the system has not really been demonstrated at this meeting.

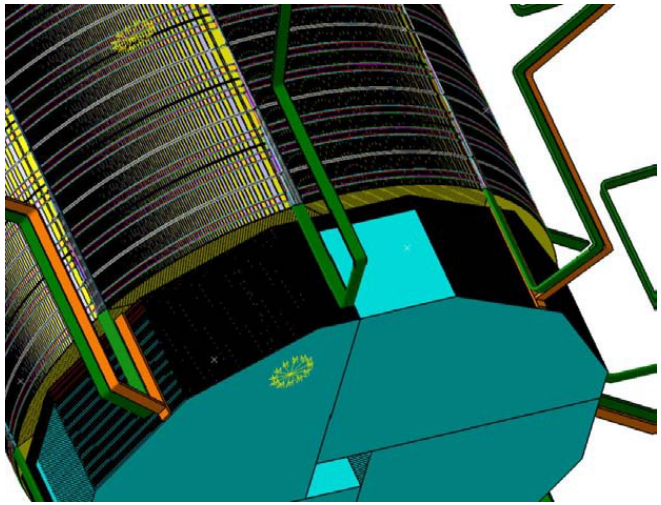
Overall state less advanced than some others. But not really cirtical

# Overall Integration

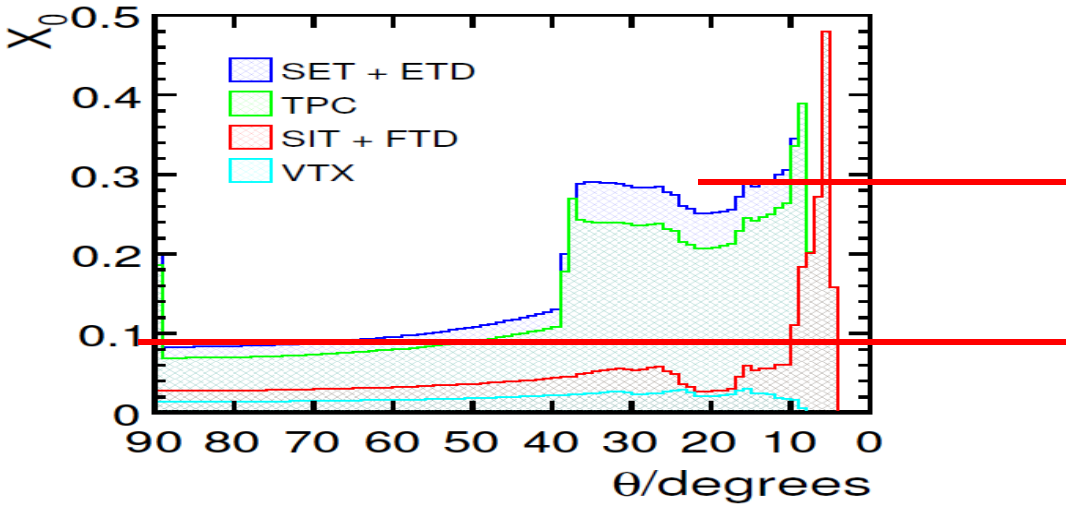
Enormous amount of work by integration group on integrating the different systems into one real and coherent detector.

I think we have met our goal of being realistic.

Example of detailed integration study



Material budget in ILD as of LOI



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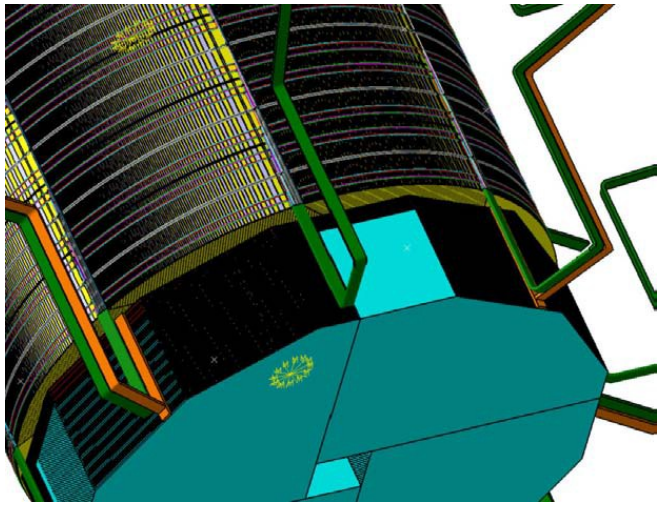
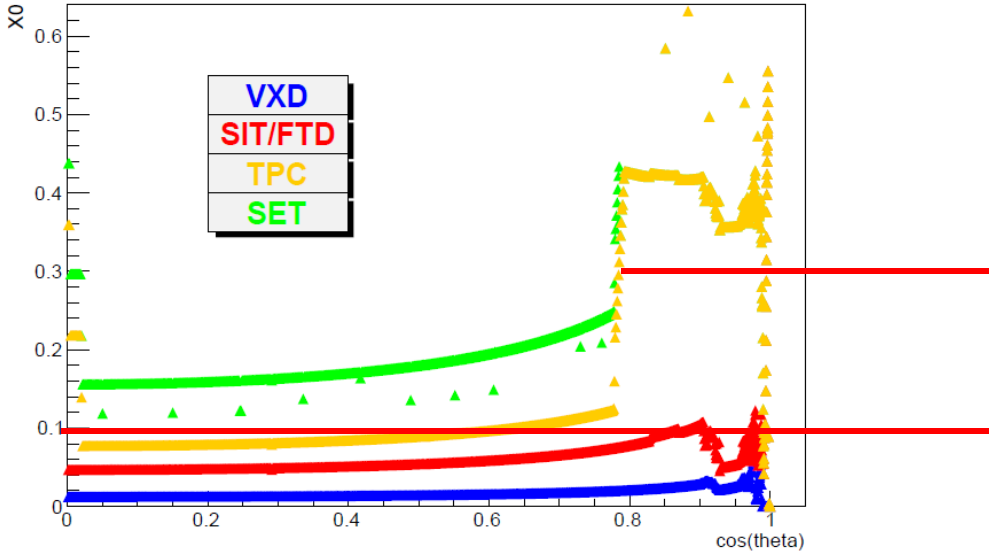


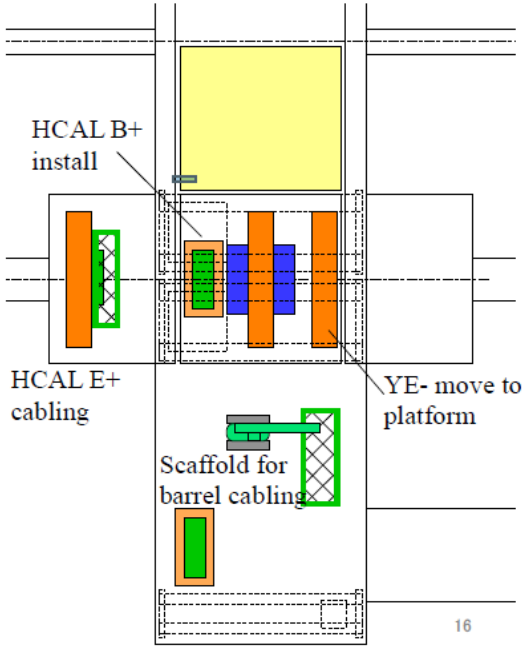
Material budget in ILD as of now

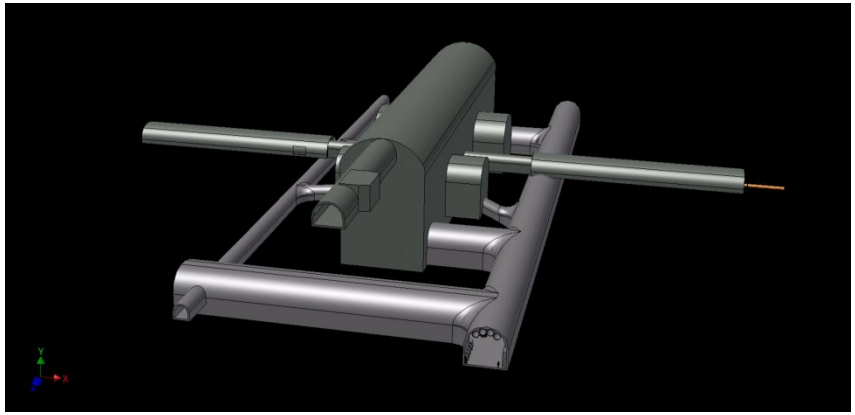


# MDI

Concrete planning is ongoing and well advanced
From ILD point of view solutions for both
“flat” and “mountainous” site are possible

For Japanese site: access “crowding” seems
a important point.



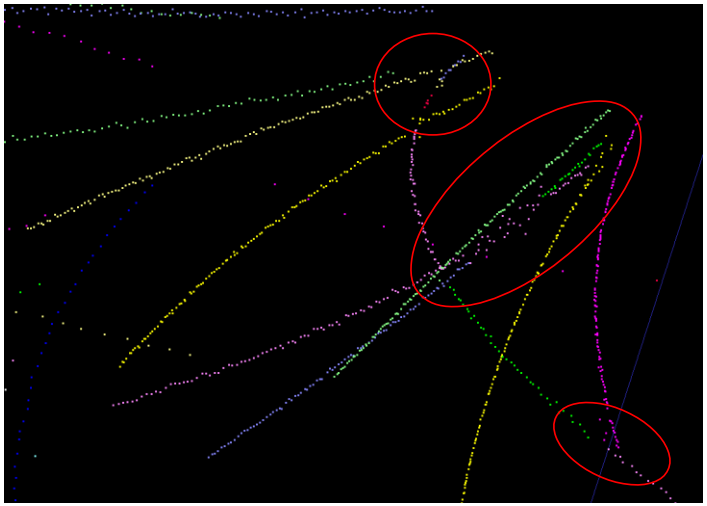
# Simulation/ Reconstruction

| detector | person | status |
|---|---|---|
| VXD | G.Voutsinas | done |
| SIT/SET | K.Androsov | done |
| FTD | J.Duarte | done |
| TPC | S.Aplin | done |
| ECal | D.Jeans | done |
| AHCal | Sh.Lu | done |
| SDHcal | G.Grenier | to be done |
| FCal | A.Rosca, B.Pawlik | done |
| Muon | V.Saveliev | ongoing |

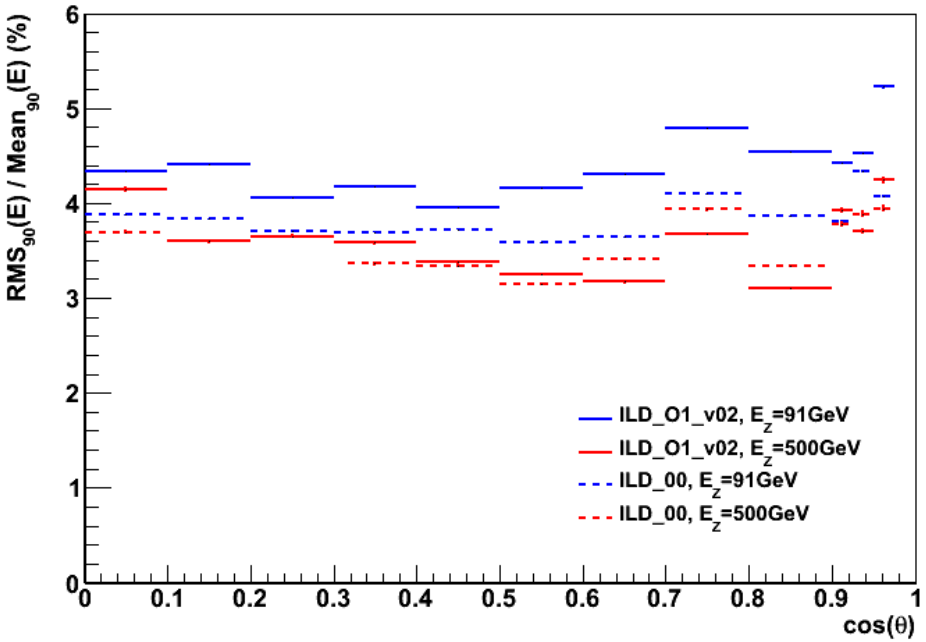
Simulation model for ILD mostly evaluated:

Nearly ready to start production of simulation samples

Complete re-write of the tracking:
System is now being tuned.



# Particle Flow




Particle flow in the "DBD" detector:

- Basically works
- Performance not yet as good as old version, needs to be understood

| $RMS_{90}(E_j)/\langle E_j \rangle$ | 91GeV | 500GeV |
|---|---|---|
| **ILD_00** | 3.69 ± 0.05 % | 3.40 ± 0.05 % |
| **ILD_O1_v02** | 4.15 ± 0.05 % | 3.48 ± 0.05 % |

# Common / Central Systems

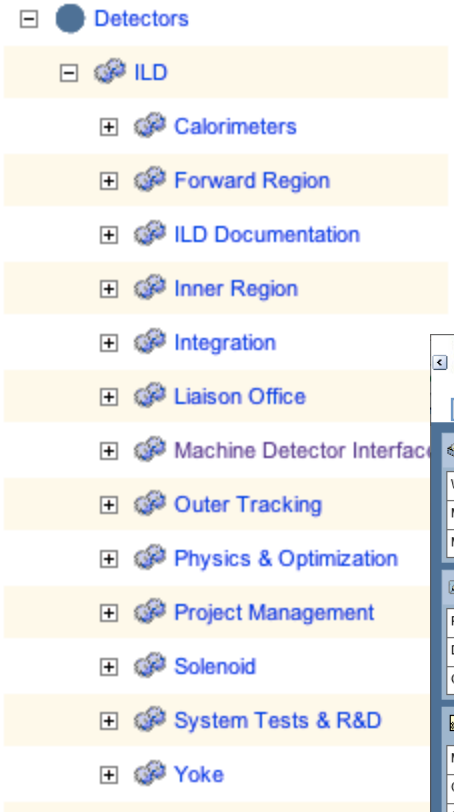
There are common issues which could profit from more collaboartion between sub-detectors:

- Alignment
- Cooling
- Power Pulsing
- Others?

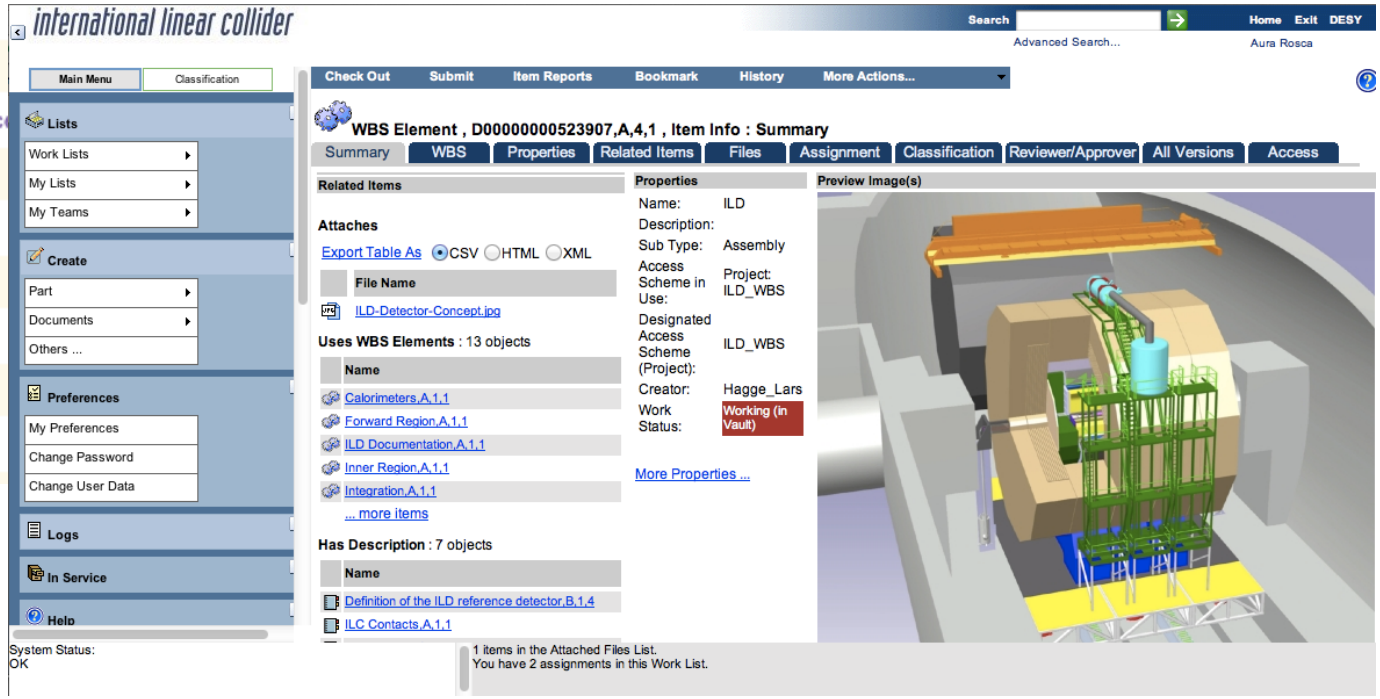
An example: cooling systems

- Leakless cooling (water)
- Gas cooling C4F14?
- CO2 for the TPC?
- Silicon?
- VTX?

# EDMS for ILD

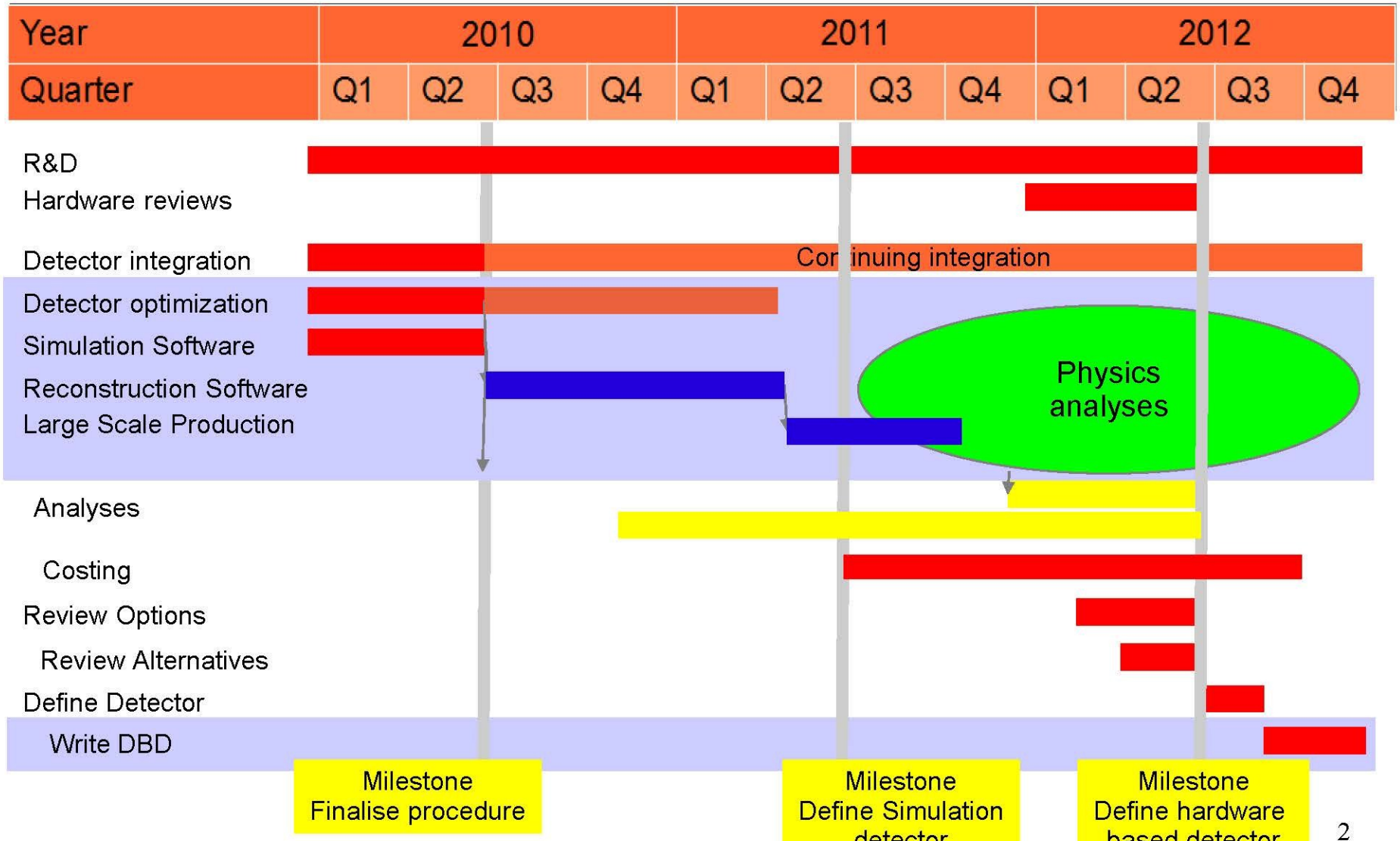



EDMS: System to store and track information
Basic system setup is finished, structures are there to be used.
We have to make sure that every sub-system is going to use this to make the documentation as complete as possible.

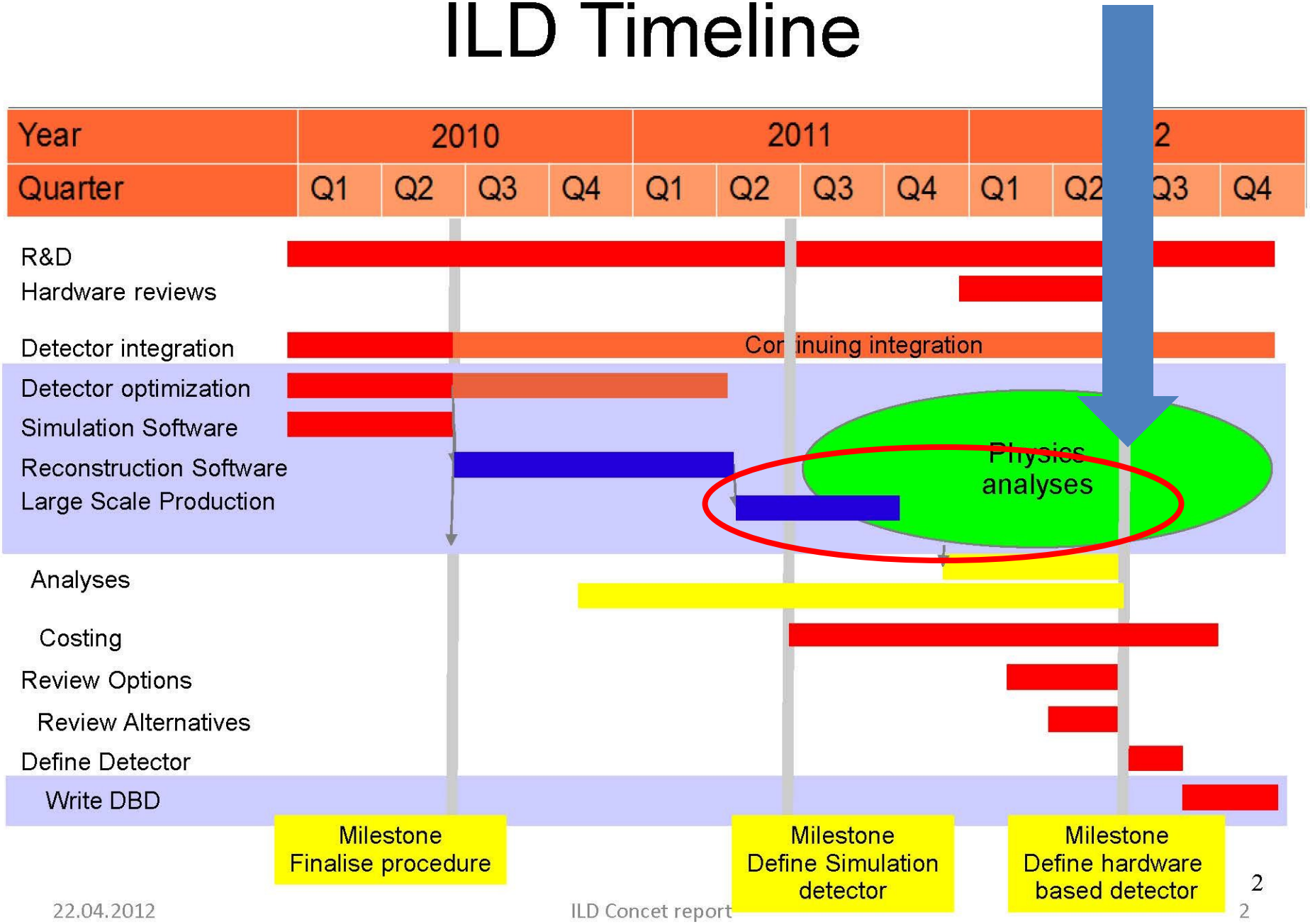



Contact in ILD: Catherine Clerc and Aura Rosca (both are here, ask!)

# ILD Timeline



# ILD Timeline



# Important Milestones

- Simulation baseline:
  - Code freeze: end of December 2011
  - Material description: end of January 2012
  - Validation: started February 2012

- Reconstruction code
  - Release December 2011
  - Software validation: January- May 2012: nearly finalized

- Start of mass production:
  - Planned for May/ June 2012: we are late!

- Towards the detector baseline

  - Discussions within the subdetector groups / R&D collaborations: -> May 2012
  - Discussions on baseline defitintion: ILD meeting May 2012

- Analyses
  - Final results during summer/ fall 2012: last deadline for contributions: LCWS2012 in Arlington

# DBD milestones

- Define DBD outline: January 2012
- Define DBD editors and chapter editors: 15.2.2012
- Setup technical infrastructure etc.: 31.2.2012

- Extended outline: 30.3.2012

ACFA meeting March 2012:
Present DBD sceleton to IDAG

- Start writing the “general” chapters: April 2012
- Deadline first draft for chapters: 30.6.2012
- Complete first draft for circulation: 30.8.2012
- First complete draft for review by IDAG: 30.9.2012

- Last possibility for “new” input: 15.11.2012

- Final draft for circulation: 15.12.2012

In particular the physics and results sections will be incomplete at this time!

# DBD Philosophy

DBD should describe the ILD detector concept

- complete, not only an extension of the LOI
- Self contained with the exception of overall topics like push – pull
- Due to the page restrictions cannot be too detailed: backup material?

Common sections:

- Push-pull and hall issues which are common with SiD
- Beam instrumentation issues: energy measurement, polarization
- “Generic” R&D on sub detectors

# DBD Layout: Common issues

**0. General Introduction of the Detailed Baseline Design document** (S. Yamada, 1 page)

**1.0 Physics and detector performance of an e+e- Linear Collider up to 1 TeV center-of-mass energy** (M. Peskin, J. Brau & H. Yamamoto, 12 pages)

**1.1 Physics reach** (M. Peskin, 7-8 pages)

**1.2 Detector challenges and technological requirements** (J. Brau, H. Yamamoto, 5-6 pages)

**1.3 The Physics and Detector Study of the International Linear Collider** (S. Yamada, 12 pages-mainly the same content as in the Interim Report)

**2.0 Description of common tasks and common issues** (0,5-1 page)

**2.1 Detector R&D** (M. Demarteau, Wolfgang Lohman, 10 pages)

**2.2 Common simulation and software tools** (A. Miyamoto, N. Graf et al., 7-9 pages)

**2.3 Machine-detector interface** (K. Buesser,, M. Oriunno, Y. Sugimoto, T. Markiewicz 5-7 pages)

# DBD Layout: Common Issues

**2.4 Common engineering tools** (C. Clerc, 2 pages)

**2.5 Beam Instrumentation** (2-3 pages) E. Torrence, M. Hildren, H. Yamamoto, J..List

**2.6 Detector Costing and methodology** (1-2 pages)

**3.0 The ILD detector concept** (150 pages)

**4.0 The SiD detector concept** (150 pages)

**5.0 Summary of the detector and physics study for the ILC** (2 pages)

# Common Section: Comment

R&D Section potentially has large overlap with ILD section:

- Need to understand the sharing of information
- Need to coordinate this between ILD and SiD to have a consistent document

MDI Section: boundary is fairly clearly defined, detailed to be worked out.

General philosophy: (my personal bias, the official view is still evolving)

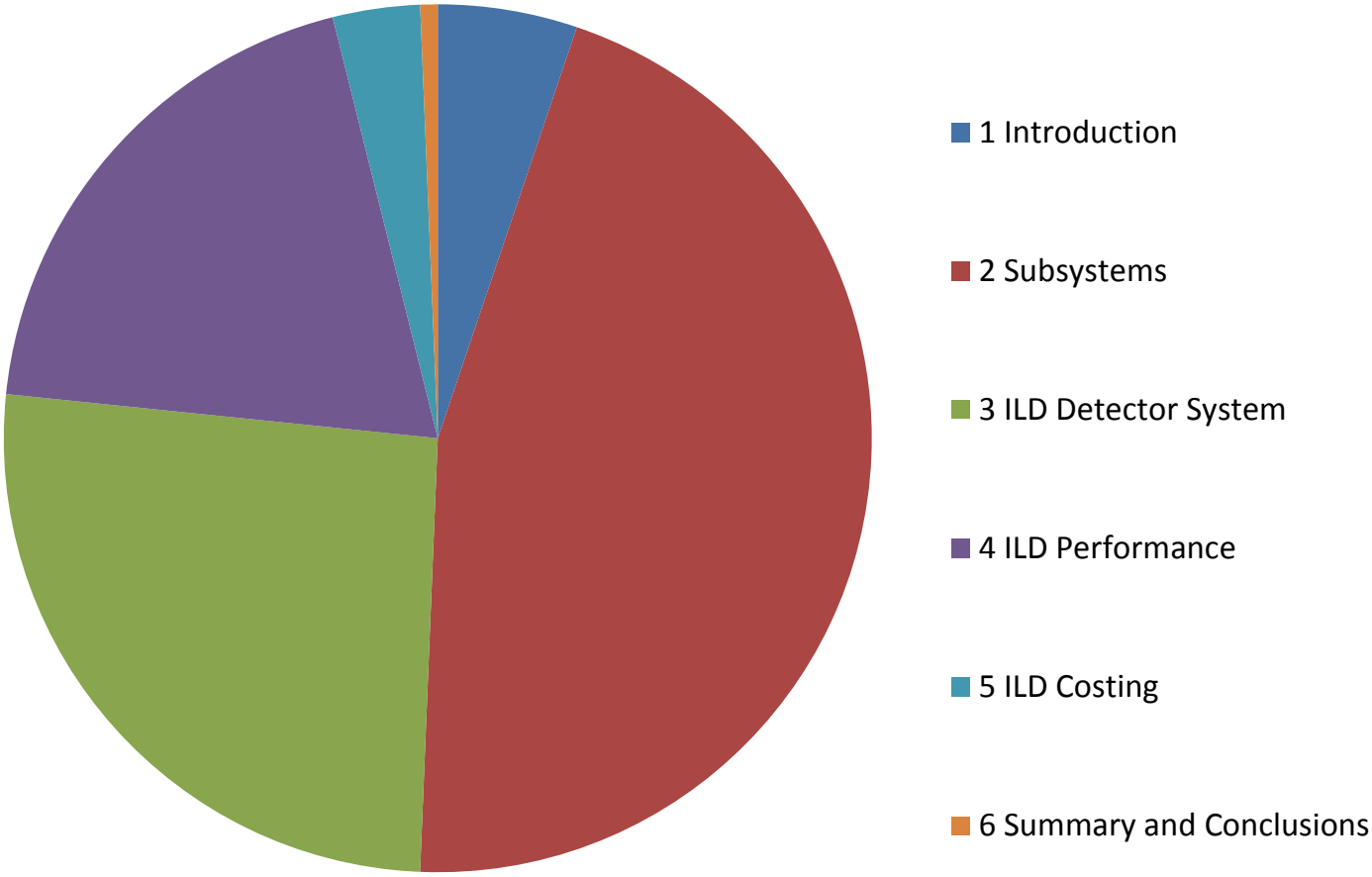
Common section should have the “generic” information, not specific
Common section should be forward looking, describe potential significant new developments, not so much the work done over the last N years.

# Overall ILD Structure

ILD (150 p)

- Introduction (5 p)
- Sub Detector Systems (70 p)
  - Technological discussion of the systems, including options and alternatives
  - System aspects as long as they are specific to this one system
- Detector integration (40 p)
  - Overall integration issues, mechanical concept
  - DAQ
  - Coil
- ILD Performance (30 p)
- Costing (5 p)
- Summary (1 p)

# DBD layout


1 Introduction
2 Subsystems
3 ILD Detector System
4 ILD Performance
5 ILD Costing
6 Summary and Conclusions

# People

Editorial team:

- People are known, responsibilities have been assigned
- Extended outline has been submitted on time to IDAG

Readers board:

- Team of “senior” people not directly involved in the relevant subsystem who are asked to critically review and follow the document and give advice to the authors
- This body is not yet final, suggestions for members are still welcome

# Question: Analysis section in ILD

We have to cover:
- Benchmark studies

We probably want to cover
- Any analysis done in full simulation for ILD

IDAG recommends:
- Review LOI analysis as well to make DBD self contained

Question:

For each analysis to be included in the DBD do we require a backup note?
- Was done for the LOI
- Did work quite well, but of course is additional effort.

# ILD Analyses

| | | | |
|---|---|---|---|
| BR(H->bb,cc,gg) measurement at 250 GeV | Hiroaki Ono | Nippon Dental University | Completed, updated since LOI |
| BR(H->WW*,ZZ*) measurement at 250 GeV | Hiroaki Ono | Nippon Dental University | |
| BR(H->gamma+gamma,gamma+Z) measurement at 250 GeV | Constantino Calancha | KEK | |
| Higgs BR measurements with nunuH at 1 TeV | Hiroaki Ono<br>Constantino Calancha | Nippon Dental University<br>KEK | DBD Benchmark #1 |
| Measurement of Higgs self coupling at 500 GeV | Junping Tian<br>Taikan Suehara<br>Tomohiko Tanabe | KEK<br>ICEPP, Tolkyo<br>ICEPP, Tokyo | Expect major updated since LOI;<br>To be included in DBD |
| Top Yukawa coupling at 500 GeV | Hajrah Tabassam | Quaid-i-Azam University, Islamabad | |
| | Ryo Yonamine | Sokendai/KEK | |
| Top Yukawa coupling at 1 TeV | Tony Price<br>Ryo Yonamine | University of Birmingham<br>Sokendai/KEK | DBD Benchmark #3 |
| WW at 1 TeV | Aura Rosca | DESY | DBD Benchmark #2 |
| Precision measurement of Higgs couplings to gauge bosons at 500 GeV | Junping Tian | KEK | |
| Top pair analysis at 500 GeV | Jeremy Rouene<br>Marcel Vos | LAL<br>IFIC Valencia | DBD Benchmark - ILD choice for 500 GeV |
| Measurement of Higgs total decay width at 250 GeV | Claude Duerig | University of Bonn | |
| Very light gravitino with stau NLSP at 500 GeV | Ryo Katayama | The University of Tokyo | |
| Bilinear R-parity violation SUSY (500 GeV) | Benedikt Vormwald | DESY | |
| Triple gauge couplings and polarization at 500 GeV | Ivan Marchesini | DESY | Completed |
| Model-independent WIMP characterization (500 GeV) | Christoph Bartels | DESY | Completed |
| Measurement of CP Violation in the MSSM Neutralinc | Mark Terwort | DESY | Completed |
| Mass degenerate Higgsinos in Hidden SUSY (500 GeV) | Hale Sert | DESY | |
| Chargino / Neutralino -> W / Z + LSP (500 GeV) | Madalina Chera | DESY | |
| Full Study of an MSSM scenario with rich (SPS1a'-like, but not LHC excluded) ILC phenomenology | Mikael Berggren,<br>Stefano Caiazza, Nicola | DESY | |

# Question: Signatories list

Currently three options are discussed:

1. One common big list (a la RDR) between Accelerator and physics commuinty applied to all volumes equally.

2. Different lists for TDR and DBD, but joined list for DBD (SiD, ILD, others)

3. Do it as in the interim report: separate lists for ILD and SiD, as an appendix to the document, double signatures are possible.

Do we have an ILD opinion for this?

# Writing the DBD

Availability of material:

- Central repository at DESY
  - WEB interface available:
    https://svnsrv.desy.de/baswebsvn/wsvn/General.ilddbd/trunk/ilddbd
    User ILDReader@desy.de, password ilddbd!
    Linked from the ILD Web page!

Instructions:

Please read the general instructions which are available in the repository under the “documentation” directory.

- General rules
- Citations
- Internal references.

# Some Rules

DBD is written using tex and bibtex

- Common style for TDR and DBD
- Please minimise the use of special definitions and style files
- Please use pdflatex
- Please stick to the (minimal) set of rules
- Please try to use as much as possible pdf files for figures.
- For fotos please provide high resolution versions of the files

# DBD repository


… and, for reference, the LOI repository is available from the same place for reference.

# Summary and Conclusions

ILD is on route to deliver the DBD at the end of this year

Significant progress on many systems

- Wide ranging test beam program in collaboration with the R&D collaborations
- Significant progress in the software representation of ILD and its reconstruction
- Intense effort to understand and develop the overall ILD integration
- DBD space (150 pages) will be tight to fully acknowledge all aspect

Question:

Do we want to do a dedicated and more complete “ILD” volume based on the DBD but extended for more detail, to document more fully the ILD detector?