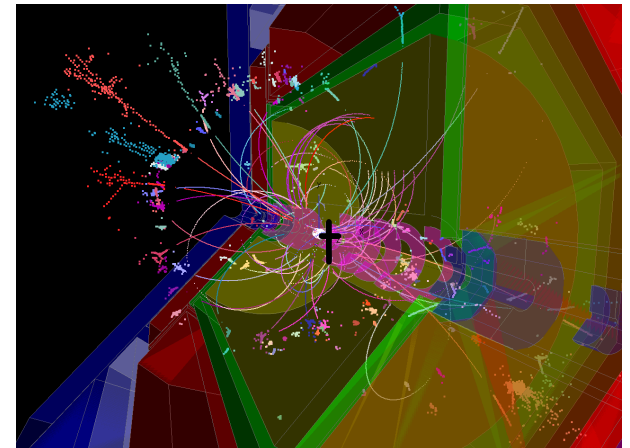
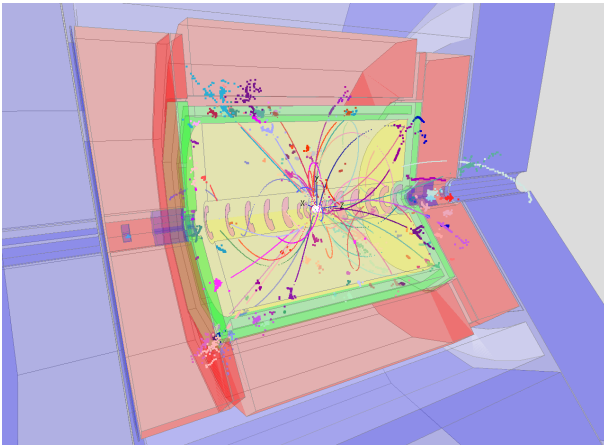


Status of ILD software

Towards a simulation baseline



Frank Gaede, DESY
ILD Meeting at ALCPG 2011
Eugene, March. 19-23, 2011

ILD software timeline

Frank Gaede, ALCPG11, Eugene, Mar 19-23, 2011

5 month	Analysis and Writing	13 month
t0 - 5m	Monte Carlo production finished	
5 month	Grid Production	
t0 -10m	start Monte Carlo production	
3 month	Test, Debug and release ILDsoft	
t0-13m	freeze ILDsoft development	
>1 month	implement baseline in simulation	~20 month
t0-x	ILD baseline defined	
	evaluate technology options develop tracking package develop geometry LCIOv2 improve simulation realism improve reconstruction study machine backgrounds	

agreed timeline for ILD software:

- -> would prefer a timeline that
- has any major MC production as late as possible (13 month before DBD)
- use time until then to
 - optimize detector
 - study options/alternatives
 - develop tools
- have 'optimal' detector for DBD incl. new results from R&D groups

2010-2011: time to develop new reconstruction code and improve core software tools

- many developments in last year:
 - core software
 - simulation (ILD_01)
 - reconstruction

DBD benchmark sample generation

- event generation sub group of SCTG:

- A.Miyamoto - KEK
- T. Barklow - SLAC
- M.Berggren - DESY

new benchmarks @ 1TeV:

$$\begin{aligned} e^+e^- &\rightarrow \nu\bar{\nu}h^0 \\ h^0 &\rightarrow \mu^+\mu^-, c\bar{c}, b\bar{b}, gg, WW^* \\ e^+e^- &\rightarrow W^+W^- \\ e^+e^- &\rightarrow t\bar{t}h^0 \\ h^0 &\rightarrow b\bar{b} \end{aligned}$$

Changes Since the LOI

- ▶ Distribute Event Generation between KEK, DESY and SLAC
- ▶ Include initial state particles and final state polarization and color flow in event record
- ▶ Improved data base for event generation information
- ▶ Include amplitudes with CKM-suppressed vertices in event generation
- ▶ Use particle aliasing to reduce the number of distinct WHIZARD processes (let the WHIZARD program do the flavor sums)

- started to prepare productions
- physics + rel. bg.
- aim for this summer to have gen. sample

Core software – recent developments

• **LCIO**

- direct access to events
- root dictionary (TTree::Draw())
- improve Lcio::Track (->this meeting)
- partial reading & file splitting (manpower?)

• **Marlin**

- local logging verbosity
- RandomSeeder (per event)
- command line parameters (ongoing)

• **CED**

- added mouse steering
- help menus
- remote client server mode
- improved 3D shapes

• **GEAR**

- added TGeo implementation of detailed geometry and material properties (A.Muennich)
- also via Mokka-CGA-geant4
- might need a few extensions to describe new tracking detectors...

• **build tools**

- greatly simplified CMakeLists.txt

• **test system**

- added ilcTest tools for unit tests
- tests run in Nightly Builds
- dashboard for monitoring

- core tools in good shape for DBD
- some minor development and maintenance needed

reco tools new developments & status

• MarlinReco

- digitizers – new: **FPCCD digitizer**
- LEPTacking/FullLDCTacking
- DSTMaker, RecoMCTruthLinker
- **recently improved for CLIC-CDR**
- **overall good shape**

• LCFIVertex

- improved Jet finding
- improved NN-parameters
- **ongoing work**

• SciEcal clustering

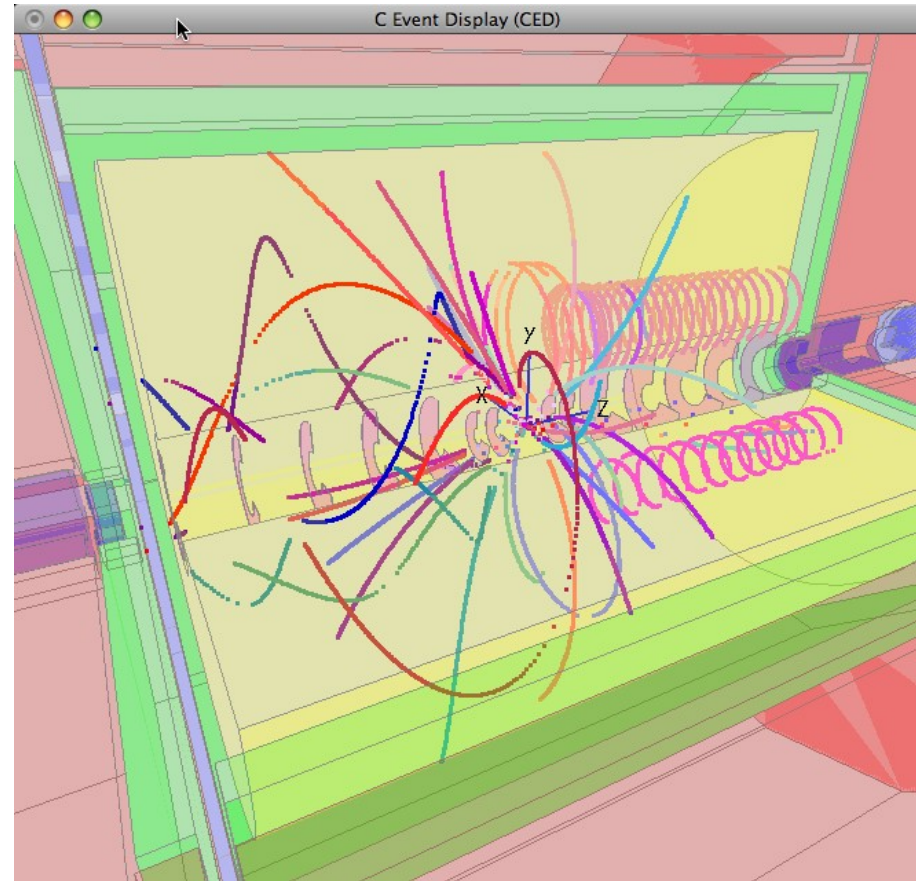
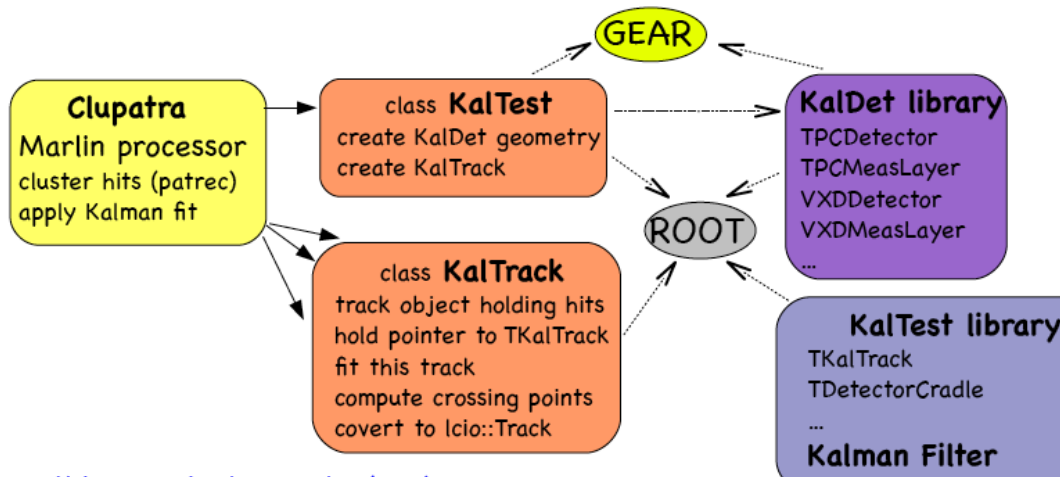
- recently improved: strip-splitting
- performance now closer to SiW
- **ongoing work**

• PandoraPFANew

- further improved algorithms
- works @ 1TeV & 3TeV (CLIC-CDR)
- **overall good shape**
- **question: performance tuning for sDHCAL ?**

- reco tools mostly in good shape for DBD
- fully functional – currently used for CLIC CDR
- however:
 - need to understand performance for technology options
 - new tracking code

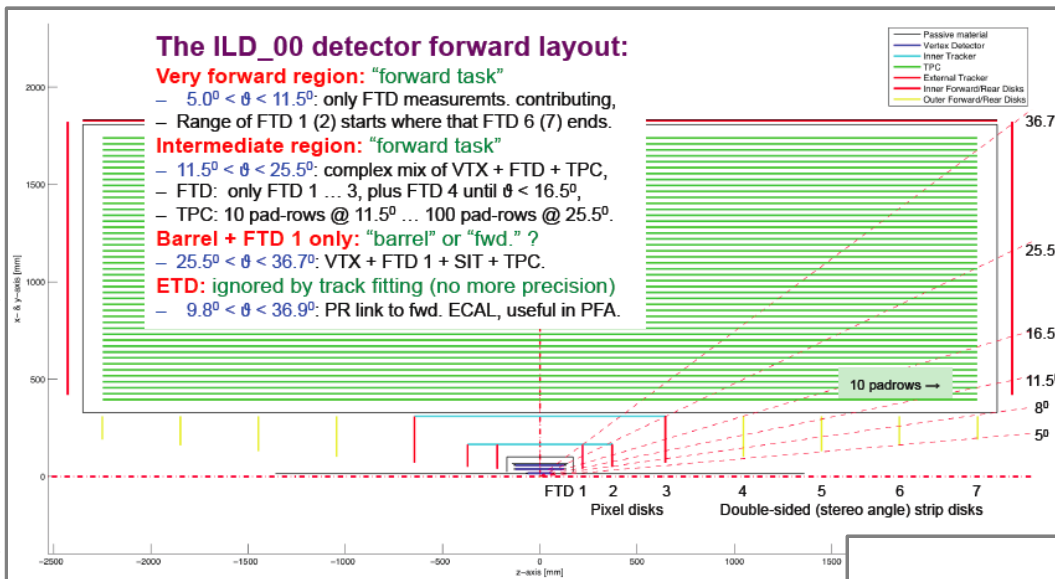
new TPC tracking with KalTest



- Kalman Filter from KalTest
- patrec based on **topological clustering**
- **API** between Marlin & KalTest
- works qualitatively (->see ttbar @500 GeV)
- hope to have quantitative results by next ILD meeting
- next steps: include VXD, SIT and SET in central region

ILD forward tracking

W.Mitaroff



• Stand-alone in FTD:

- This is the only possible strategy in the very forward region,
- Various algorithms exist – which to choose needs careful study,
- For small θ , hits from **beamstrahlung-induced background** may cause further problems (we need a reliable estimate),
- Layout for optimized track resolution (e.g. strip orientation and stereo angle) not necessarily optimal for track search.

• Combined TPC–FTD:

- This may be an optional strategy for the intermediate region:
- Inward extrapolation of tracks found by local PR in the TPC, FTD hits tested against and associated to them,
– **Timing problems** hopefully solved by "time stamps".

• Soft hit association:

- Hits may be shared among tracks, and the final association relegated to track reconstruction based on the DAF.

Sharing of responsibilities

Discussions at the ILD Software WS (DESY, July '10) and thereafter, consent about sharing of tasks for the new ILD tracking:

• DESY Hamburg:

Overall coordination and all barrel tracking: work has started.

• Spain (Santander, Valencia) and HEPHY Vienna:

All forward tracking, with the sub³-tasks

- (1,2) FTD geometry description, drivers in Mokka: Spain,
- (3) FTD digitizations: Spain with contributions by Prague,
- (4) FTD stand-alone fwd. track search: Spain and Vienna,
- (5) TPC-supported fwd. track search: Vienna,
- (6,7) DAF-based fits, precision track fit: Vienna.

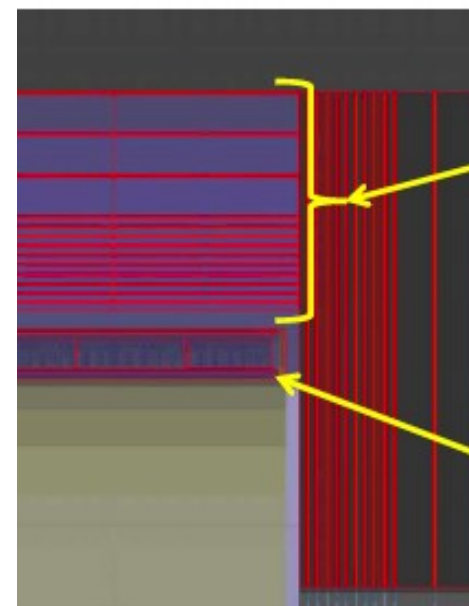
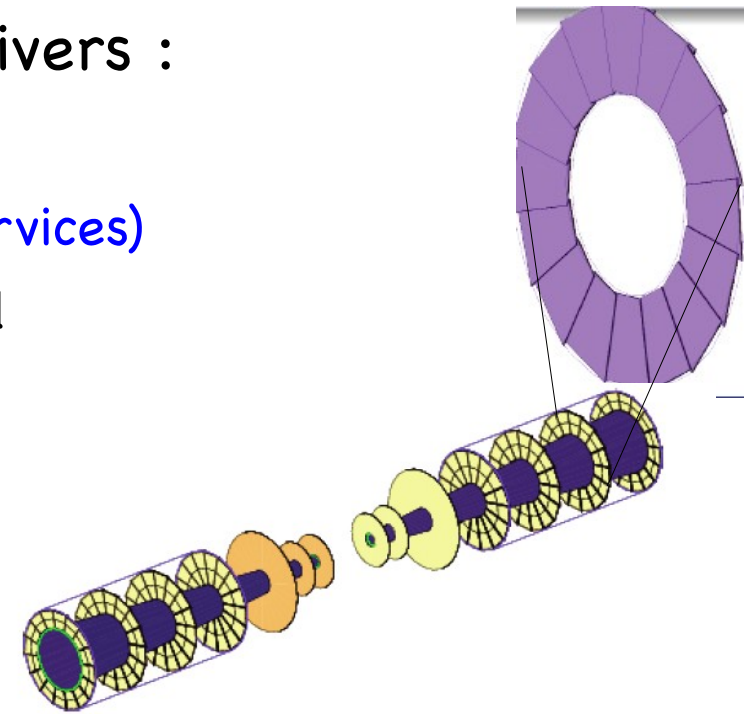
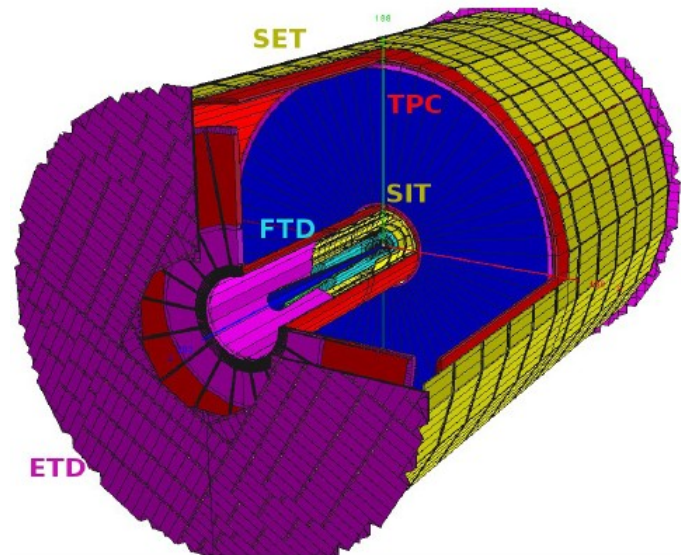
Active work expected to start after this Meeting (April '11 ?).

- active development yet to start
- budget issues in HEPHY
- forward tracking critical for DBD
- need to demonstrate fwd. tracking with backgrounds (not done in LOI)

new Mokka release – towards ILD_01

P.Mora de Freitas

- major rewrite of some sub detector drivers :
 - SIT, SET, ETD - FTD - Muon
 - increased level of detail and realism (incl. services)
 - driver for overall services for TPC, Ecal, Hcal
 - added electronics boards to ECal and Hcal



Muon chambers
inside Yoke in
the right place?

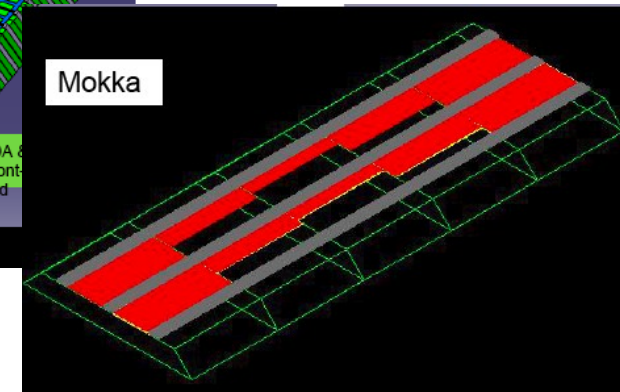
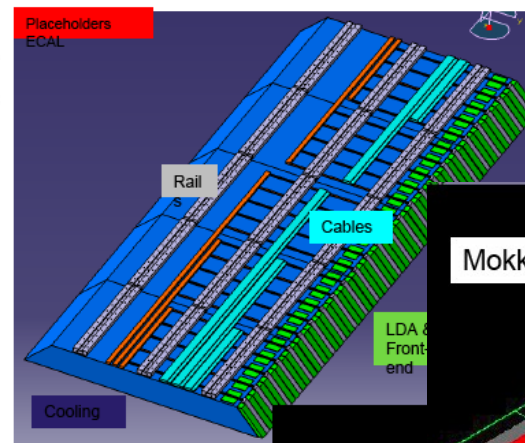
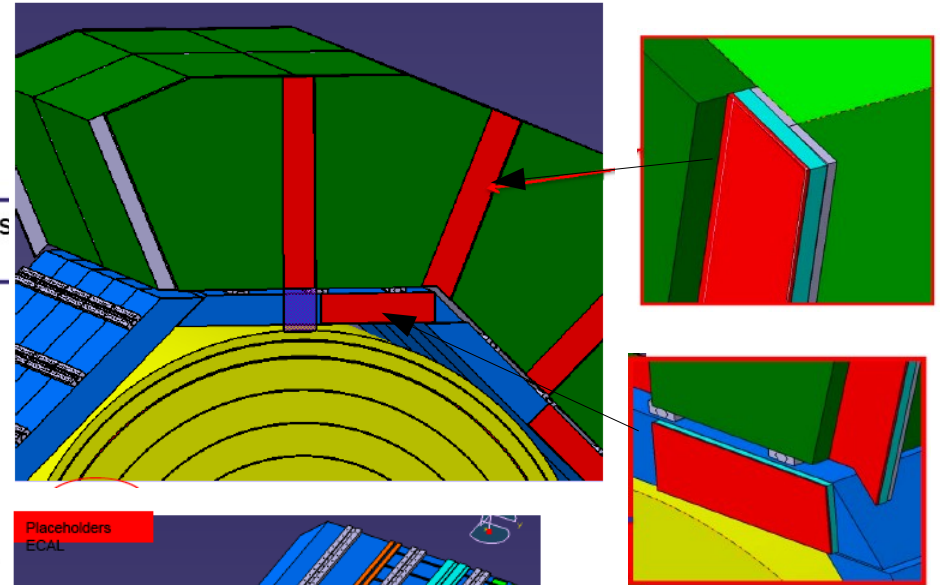
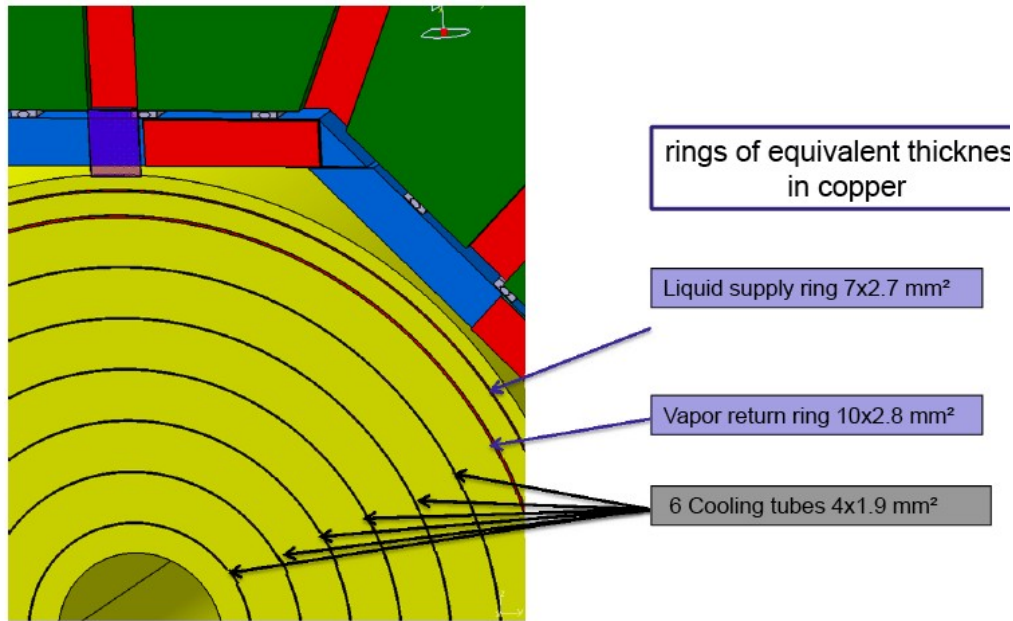
Detailed Coil,
but with muons
chambers
inside?

work of many people:

A.Charpy, J.Duarte, A.Saveliev, G.Musat,
A.Lucaci, P.Mora de Freitas,....

new Mokka release – towards ILD_01

- added cabling and services for TPC, ECal & Hcal (C.Clerc, G.Musat)
- still missing: inner detector services (to be defined by R&D groups)



big step forward in increasing realism of ILD detector simulation !

ILD simulation status overview

- beam pipe:
 - no final engineering design
 - first design exists
- B-field
 - realistic field map for bg studies
 - simple field for mass production
- Physics List
 - use QGSP_BERT (re. by geant4)
 - issues in tungsten @CLIC !?
 - possible other – FTF (results from Calice)
- VXD
 - realistic models for 3 double and five single layers
 - cabling missing
 - first estimate of services exist
- FTD
 - more realistic design implemented in Mokka
- SIT, SET, ETD
 - realistic and detailed sim. exists
 - now implemented in Mokka
 - cabling & services ?
- TPC
 - rather realistic simulation
 - cabling and support implemented

red: done since Simulation Workshop 2010 DESY
blue: ongoing work or to be addressed

ILD simulation status overview

- Sci- and Si/W ECal
 - realistic driver exists
 - can vary mix of Scint./Silicon
 - -> can study options !
 - cabling and services implemented
- dHcal - Sci Hcal
 - realistic simulation drivers exists
 - two geometries for dHCAL
 - cabling and services implemented
- Muon
 - new more realistic model exists
 - needs to be verified
 - strips vs. tiles ?
 - instrumented coil ?
- BeamCal
 - new engineering design exists
 - implemented in Mokka
- LCal
 - new realistic driver exists
 - including support, cooling
- LHCAI
 - no real design exists

towards a simulation baseline ILD_01

- new Mokka model ILD_01_pre01 'released'
 - including the new drivers for SIT, SET, ETD, FTD, Muon, Services
 - should have the required realism for the DBD !?
 - first iteration on tests (hit maps) and some minor debugging
 - -> no reconstruction yet !

- need to develop new reconstruction code:
 - digitization for new Si-tracking detectors
 - strips, ghost hits, smear on wavers (as opposed to cylinders and disks)
 - develop entirely new tracking code for these detectors
- => this is a major effort and it not clear that we will have everything in place for the DBD
- might have to 'de-scope', e.g. not use proper strip hits ...

- => need to use the well understood ILD_00 model for detector optimization and for studying technology options

towards the simulation baseline

- the current ILD_01_pre01 model is a first iteration towards the simulation baseline detector model for the DBD
- it is an evolution of the LOI model ILD_00 – i.e. 'same' technologies

- => have to choose technology options for the DBD:
 - **VXD: CMOS or FPCCD ?**
 - **Ecal: SiW vs StripEcal ?**
 - **HCal: analogue vs. digital digital HCal (which geometry ?)**
 - **Muon: which instrumentation ?**
 - **other options ?**
- -> need to do this at ILD meeting in May2011 !

- requirement for any option to go into the simulation baseline:
 - **verified (debugged) Mokka driver exists**
 - **reconstruction code with demonstrated performance exists**

Summary & Outlook

- manpower situation for ILD software is 'not optimal'
- ILD software is still in a reasonably good state – many developments since LOI to improve framework
- rather ambitious goals for new detailed silicon tracking detectors and new tracking code
 - might have to see how much of this is actually feasible in a few months
- goals for DBD to demonstrate physics capabilities of ILD @ 1 TeV with more realistic simulation should be achievable
- probably most concerning software issue is forward tracking:
 - this would have to be improved wrt. to the LOI in order to demonstrate that we can cope with background also in the forward region (mostly done for central region in LOI)