

# Software “Baseline”

Ties Behnke, discussion session

## Strategy:

We need a well defined and debugged software detector to be able to study seriously the physics potential.

We like to make sure that the different subdetectors are at a similar level of detail and sophistication

We have to ensure that the overall performance of the system is ok and meets our requirements

We want to ensure that all relevant ILD technologies are properly represented

# Criteria

- Debugged MOKKA driver exists
- Debugged and realistic digitizer exists
- Reconstruction software exists
- Integration into overall reconstruction exists (meaning particle flow etc.)
  
- Technical performance established in test beam as much as possible
- Simulation validated using data as much as possible
  
- Simulation model includes services and support/ crack etc.
- Simulation model is backed up by detailed engineering model.

# Proposal

- For Lol production there where a large number of physics studies
  - o Justified full SM production
- For DBD we back off from full multi-million SM production
  - o Our experience from the LOI tells us, this is not really necessary for a relatively small number of benchmark channels (many background sources removed by first cut)
  - o We do not gain a lot from this type of study: design pre-cuts, and use those to reduce significantly the number of background events required
- Our goal is to have validated simulations for all options we are considering. Following the discussions we will have two subdetectors with significantly different options, which need different software models:
  - o Analogue HCAL, Digital HCAL, SiW ECAL, Sc-strip E ECAL

# Proposal

Propose we start now with the validation of the first options, analogue HCAL + SiW ECAL.

We will use this to validate the full detector with a validated and well-understood software release by early fall 2011

- o This model will be used to develop an integrated simulation system
- o This model will be used to validate the system performance

We will develop and validate a second/third baseline

the semi-digital + strip options.

There will be complete symmetry

The two (more?) models will be used for a production of signal events and (if resources allow) a set of background events. The samples/physics processes will be those thought to be sensitive to the performance differences between the options. We will make sure that the samples always exist in pairs, to enable direct comparisons.

All models will be used to evaluate the complete system performance

# Vertex

Options discussed within ILD:

MAPS (CMOS) technology

FPCCD technology

Agreement has been reached between both groups on a common simulation which will be able to represent appropriate performance.

VTX groups (CMOS and FPCCD have agreed at this meeting to provide a “common” baseline within a few weeks (2 month or so)

# Silicon

SIT: mechanical model exists, integration not final,  
Integration depends on VTX integration (cryostat etc.)  
Detailed Mokka driver exists, digitization and reconstruction not

FTD: detailed mechanical model exists  
Integration is being worked on / exists  
Detailed simulation model exists, needs to be verified  
Reconstruction: to be worked on

ETD: LOI model does not fit with current overall detector integration scheme  
Detailed simulation model exists  
Digitization does not exist  
Reconstruction does not exist  
Need to adapt design to current integration (reduce thickness: reduce number of layers?)

SET: detailed model exists  
Integration model exists.  
Detailed simulation driver exists,  
Digitization/ reconstruction do not  
Integration into ILD: status not clear

General remark:  
SI mechanical work needs  
to be merged into the  
central ILD CAD model

# TPC

Simulation model exists, recent upgrades fix problems and make it more realistic

Digitization exists, semi – realistic level

Reconstruction:

- LOI reconstruction still works, with the known problems
- New pattern recognition and reconstruction by Frank close to release: hope for this to be available for major release.

Integration:

Internal TPC integration realistic,  
Integration into the ILD to be improved.

# ECAL

## Si-W ECAL

Detailed, well understood model exists  
Digitization exists  
Reconstruction exists

## Sci- ECAL:

Model and simulation under development, not yet fully realistic  
Strip pattern recognition not yet available  
Digitization ?  
Reconstruction not yet fully available.

## Integration:

Detailed models exist for both options.  
SiW option extensively validated and experimentally studied  
Mixed option (Scintillator / Si) under study, encourage implementation of realistic model and reconstruction.



# HCAL

## Analogue HCAL:

Detailed simulation model exists, in agreement with technical design,  
for TESLA geometry

Detailed digitization exists, validated against test beam data on particle and hit level  
HCAL intrinsic performance demonstrated and experimentally verified  
Integration into ILD reconstruction exists and delivers appropriate results  
Experimental validation of particle flow performance has started.

## Semidigital HCAL:

Detailed simulation model exists, in agreement with technical design,  
for both TESLA and Videau geometry

Detailed digitization exists, validated against test beam data on hit level  
HCAL intrinsic performance studied, agreement data Monte Carlo verified,  
performance goal not yet reached  
Integration into ILD reconstruction has started,  
final performance not yet reached.

In general the level of detail and of integration of both options is impressive and very advanced. Validation of either models is advanced, and in particular for the semi-digital option, is very quickly catching up to the level of sophistication of the AHCAL. The optimization of the reconstruction for the semi-digital option is not yet finished.

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Detailed simulation model exists, in agreement with technical design  
Detailed digitization exists, validated against test beam data on particle and hit level  
HCAL intrinsic performance studied, agreement data Monte Carlo verified  
Integration into ILD reconstruction has started, final performance not yet reached  
Experimental validation in progress, results

General comment:

Need to define GEANT model and physics list which fullfills all requirements.

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Detailed digitization exists, validated against test beam data on particle and hit level  
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Though driven by calorimeter, it is still relevant for the complete simulation

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# Forward

Detailed design of beamcal exists

MOKKA drivers exist

Detailed design of lumical exists

Both are integrated into the ILD detector

Analyses using FCAL exist, but by default the information is not used in any ILD reconstruction

# Muon

Detailed engineering of the Yoke exists

ILD option  
CLIC option

Detailed model of the scintillator readout exists, but is not (yet) part of the baseline nor part of the software release

Realistic implementation of a scintillator option not yet done.

Digitization exists in principle

Reconstruction exists in principle (Pandora, stand alone)