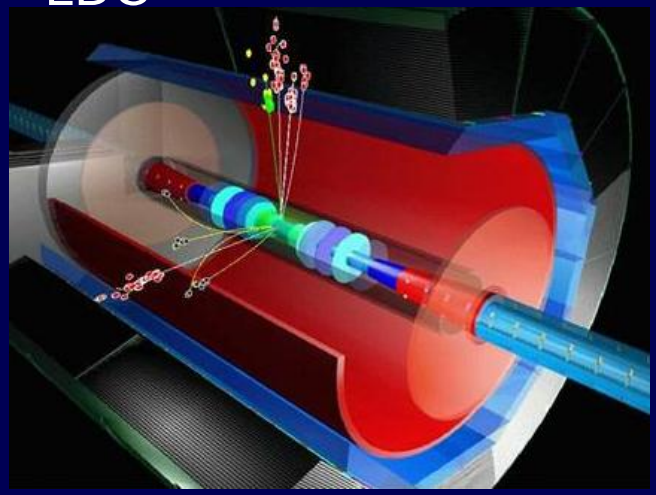
Implementation of the Different Detector Concepts in Mokka Simulation Framework

Snowmass
August 2005, DESY

Valeri Saveliev
Obninsk State University / DESY, Hamburg

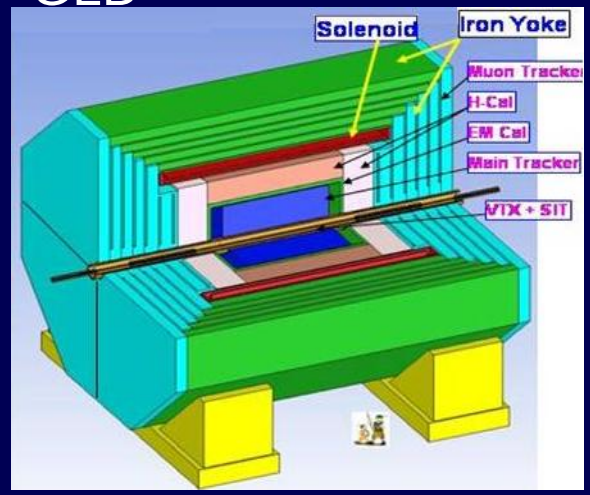
ILC Detector Concepts

LDC



SiD

GLD



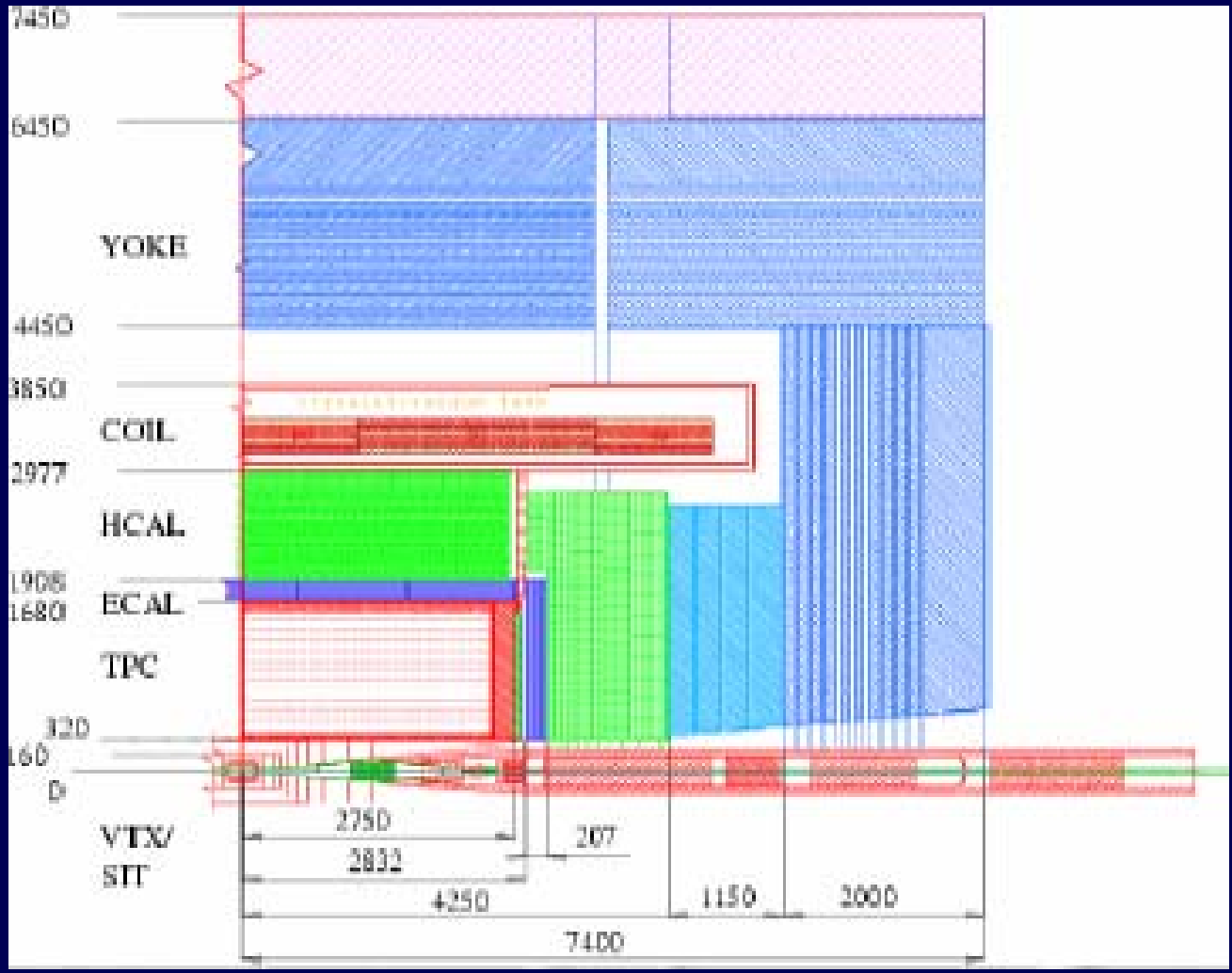
- Zh ->ll+h - Precise momentum Resolution,
- Br h ->bb,cc,gg - Excellent Vertex/Flavor Identification,
- Zhh ->qqbbbb - Excellent Calorimetry, Particle Flow Algorithm,
- hνν - Excellent Hermeticity, Missing Mass Resolution,

a lot of other physics

ILC Detector Concepts

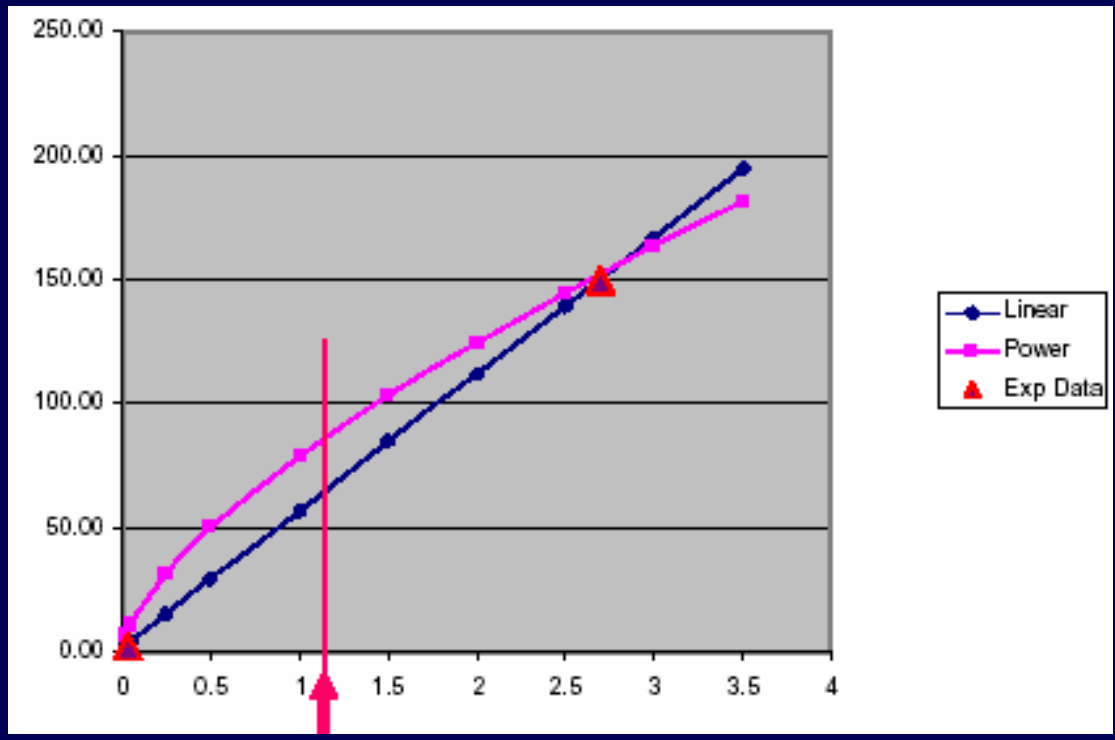
	LDC	SiD	GLD
• Vertex Detector	Si technology, geometry is practically the same		
• Intermedia and Forward Tracking	Si technology, geometry is practically the same		
• Main Tracker	TPC + Add Si Trackers	Si technology	TPC +
• Calorimetry	EM:W/Si technology		
	Had: Fe/Sc technology		
	Crystal		
• Muon system			

ILC Detector (LCD)



ILC Detector Concepts

Low material budget, Robustness, Easy to build and to work with, Low cost



Solenoid Cost in M$ as function of Radius

ILC Simulation Frameworks

LDC	SiD	GLD
• BRAHMS (G3) • MOKKA (G4) Geometry MySQL DB Output is in LCIO	• SLIC (G4) Geometry GDML Output is in LCIO	• JUPITER(G4ROOT) Geometry ROOT or DB Output is in LCIO

How we can make an analysis of the Detector Concepts ?

ILC Simulation Frameworks (Mokka)

MOKKA Detector scaling on a few key parameters

Thanks to a new CGA geometry building schema is able to automatically scale the detector devices depending on some key parameters. This new schema is called "super drivers" in Mokka.
In this release six new super drivers are available (see Mokka).

The available key parameters are registered in the table parameters of the models03 database, with a description and a default value.
The default values for the key parameters are overwritten by the default values found in the model_parameters, if a model-parameter association is found in this table.

The default values for the key parameters can still be overwritten by:
- using a pre-existing setup in the database which sets a set of parameters-values pairs and/or
- the new /Mokka/init/globalModelParameter command.

The new /Mokka/init/globalModelParameter command:
no matter the values storage in the database, the user can change the detector geometry just inserting a set of /Mokka/init/globalModelParameter commands in the steering file.

Thanks Paulo Mora de Freitas

ILC Simulation Frameworks (Mokka)

MOKKA Detector scaling on a few key parameters

Super drivers can share key parameters. Moreover, a super driver can change on the fly shared parameters by other super drivers in such way to propagate the changes in the geometry and to avoid detector overlaps.

For this reason the detector build order becomes very important, so the "build_order“ new attribute for the ingredients table (see below).

Shared parameters are registered in the "sharing" table. Selectin the n-tuples for a given parameter name gives you the list of super drivers sharing the given parameter name.

The order which Mokka initialize a key parameter before launching the a super driver construction is the following:

1) default values found in the parameters table;
2) the value found in the model_parameters table, if a model-parameter association is found in this table;
3) the value found in the setup_parameters table, if a setup-parameter association is found in this table;
4) the value set by a /Mokka/init/globalModelParameter command if the parameter name matches.
5) the value set by a previous super driver construction, if both super drivers share the parameter and if the previous super driver changed the parameter value.

ILC Simulation Frameworks Geometry

Still Problem with Unification of the Geometry Descriptions

Mokka up to now has more Detailed Geometry Description

Work is going on for the translation of the XML to MySQL

ILC Simulation Frameworks Geometry (MySQL)

LDC Mokka

```
# MySQL dump 8.13
#
# Host: flc23 Database: ecal02
#--------------------------------------------------------
# Server version 3.23.37-log
#
# Current Database: ecal02
#
CREATE DATABASE /*!32312 IF NOT EXISTS*/ ecal02;
USE ecal02;
#
# Table structure for table 'barrel'
#
CREATE TABLE barrel (
      barrel_phi_offset float(10,4) default NULL,
      inner_radius float(10,4) default NULL,
      staves_gap float(10,4) default NULL,
      modules_gap float(10,4) default NULL
) TYPE=ISAM PACK_KEYS=1;
#
# Dumping data for table 'barrel'
#
INSERT INTO barrel VALUES (0.0000,1700.0000,2.0000,1.0000);
```

ILC Simulation Frameworks Geometry (XML)

SiD SLIC

```
<sensitive_detectors>

<calorimeter name="CalNP" (1)
             hitsCollectionName="CalHitsA"
                                    ecut="0.25"
                                    eunit="MeV"
                                    verbose="0">
<gridXYZ gridSizeX="5.0"
                                    gridSizeY="5.0"
                                              gridSizeZ="0.0"
                                    lunit="mm"/>
</calorimeter> <calorimeter name="CalPrj" (2)
             hitsCollectionName="CalHitsB"
                                    ecut="0.25"
                                    eunit="MeV"
                                              verbose="0">
<projectiveCylinder ntheta="1440" nphi="1440" />
 </calorimeter>
<calorimeter name="CalPrjZ" (3)   hitsCollectionName="CalHitsC"
                                    ecut="0.25"
                                    eunit="MeV"
                                    verbose="0">
<projectiveZPlane ntheta="360" nphi="360" /> </calorimeter>
```

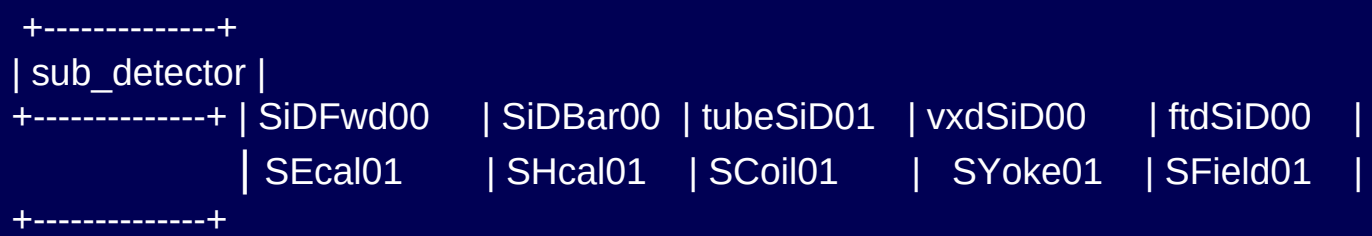
ILC Simulation Frameworks (Mokka)

SiD Detector Concept Implementation

SiD01,SiD02 implements the SiD detector concept using the calorimeters and so on from LDC, with all the parameters adapted the best possible to agree with all the current SiD proposal.

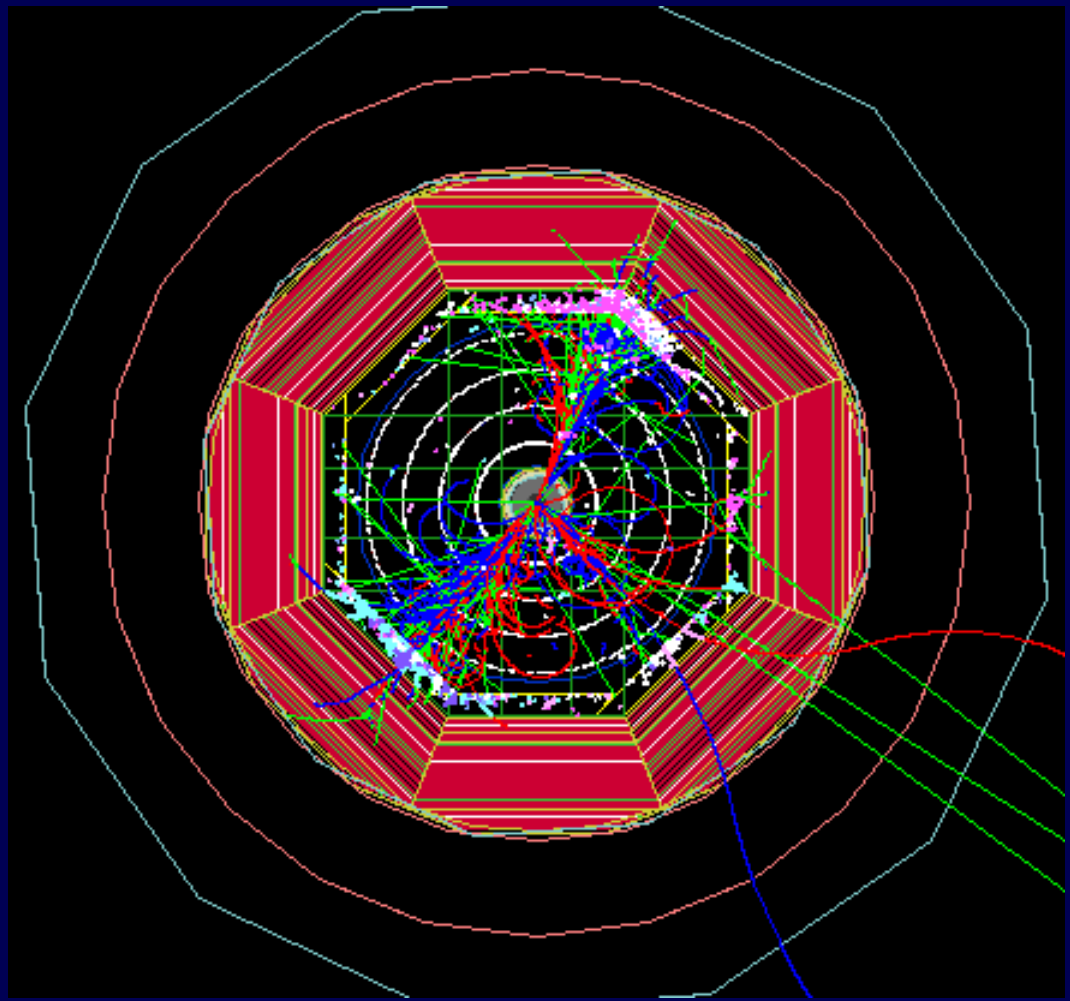
For both models the field is set to 5.0 tesla.

SiD01 and SiD02 are compose both by the following drivers:



SiDBar00 implements the Si Tracker barrel and SiDFwd00 the Si Tracker end caps. tubeSiD01, vxdSiD00 and ftdSiD00 are LDC devices adapted for the SiD dimensions. ftdSiD00 works as the Si VDX disks for these models.

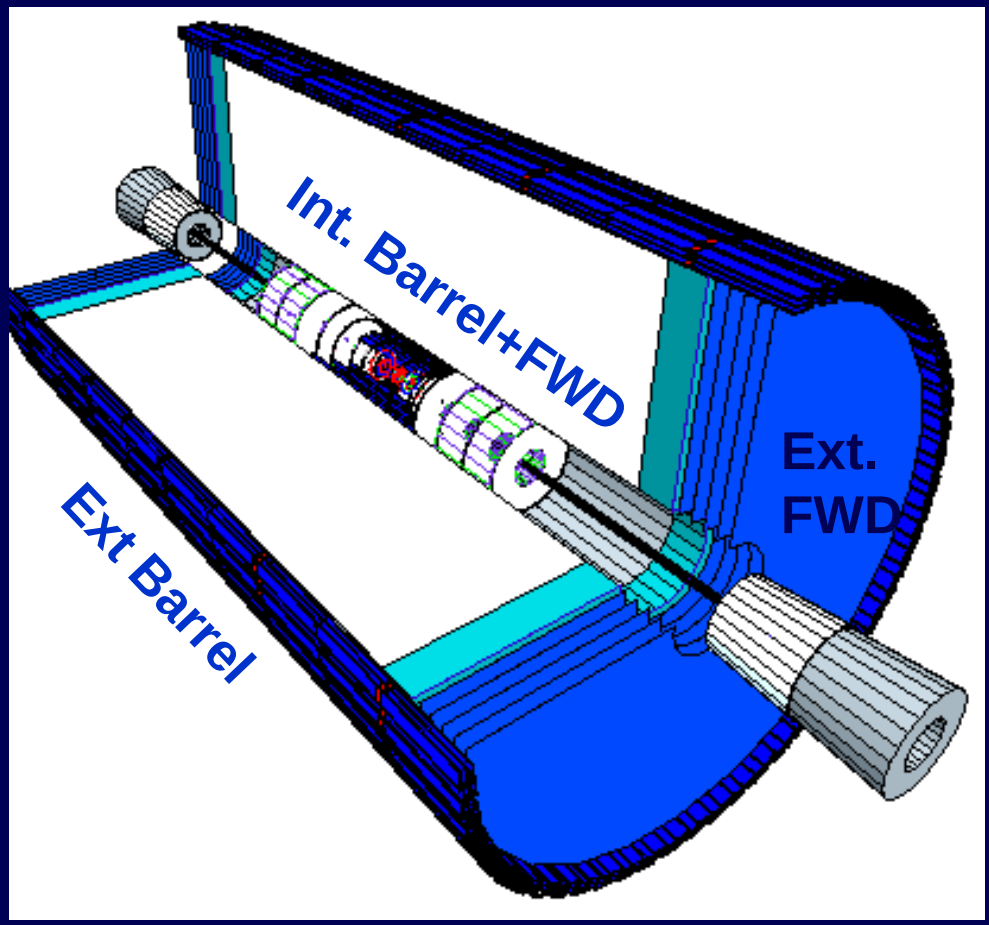
ILC Simulation Frameworks



SiD in Mokka
hZ –>bbbar+qqbar

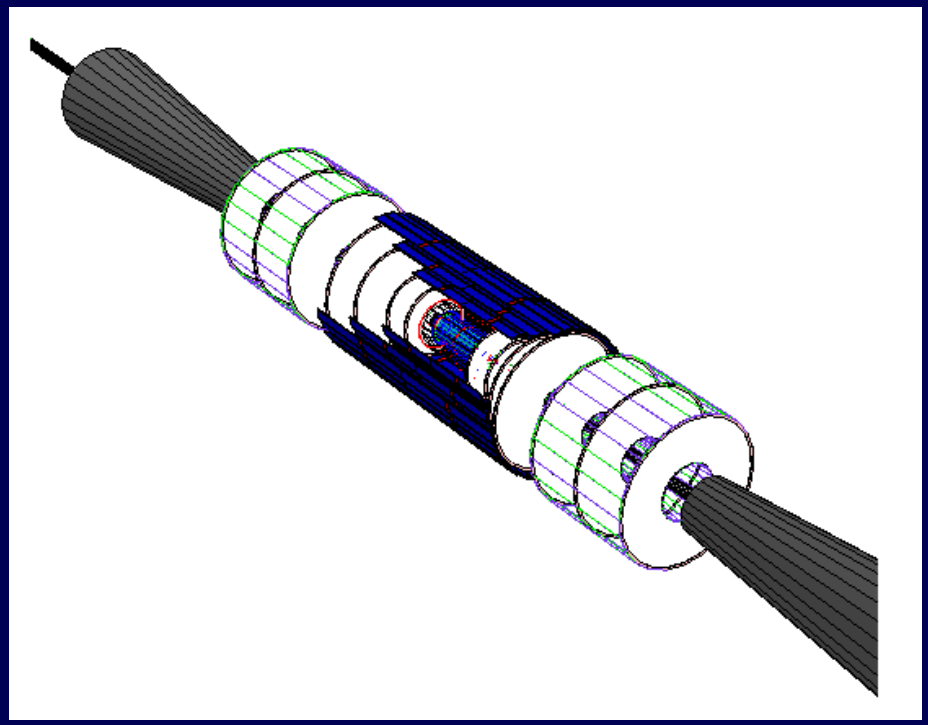
SiD Concept in Mokka Simulation Framework

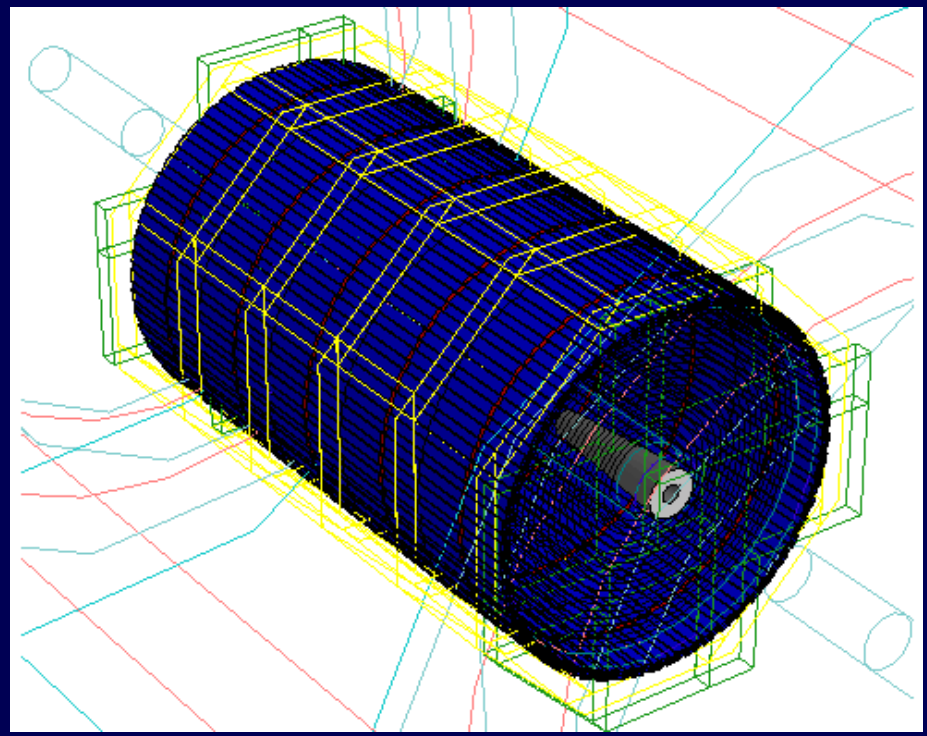
LDC Geometry with SILC in MOKKA



- Compact TPC
  (40 cm shorter in Z , 10 cm in radius)
- Internal Barrel (Si-Strip)
- Internal Forward (Si-Strip)
- External Barrel surraunding TPC
- External Forward Tracker (Si-Strip)

LDC Geometry with SILC in MOKKA

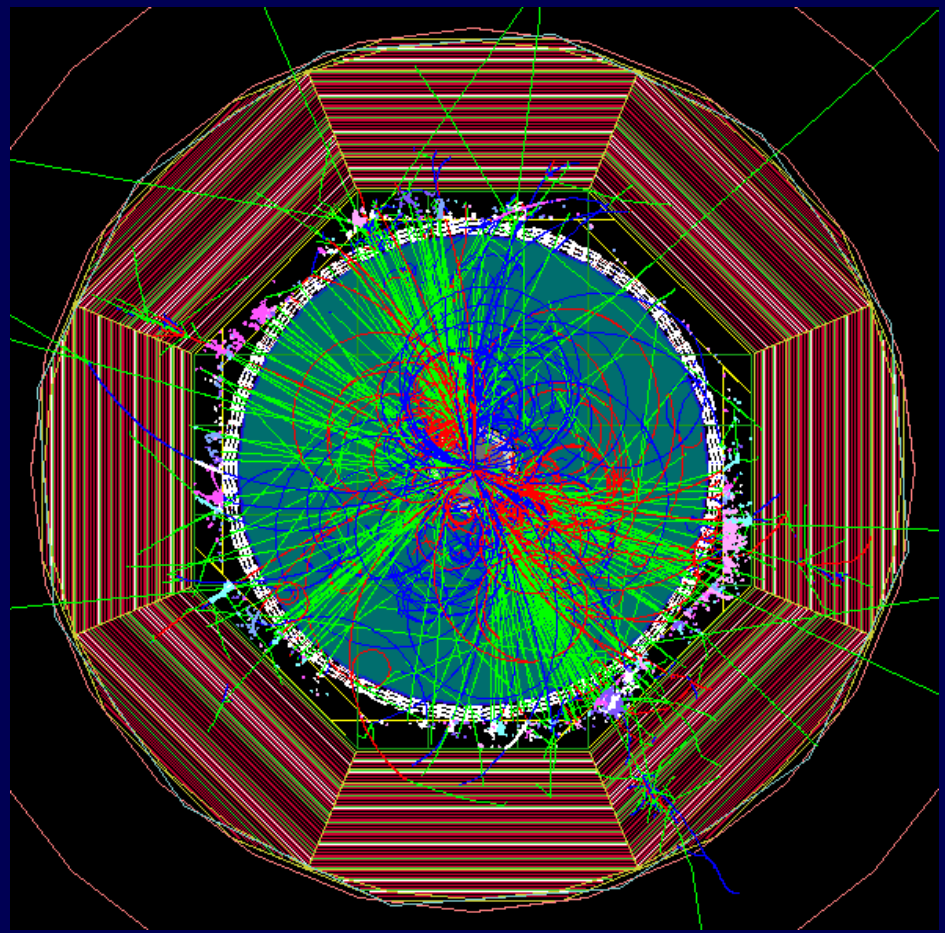




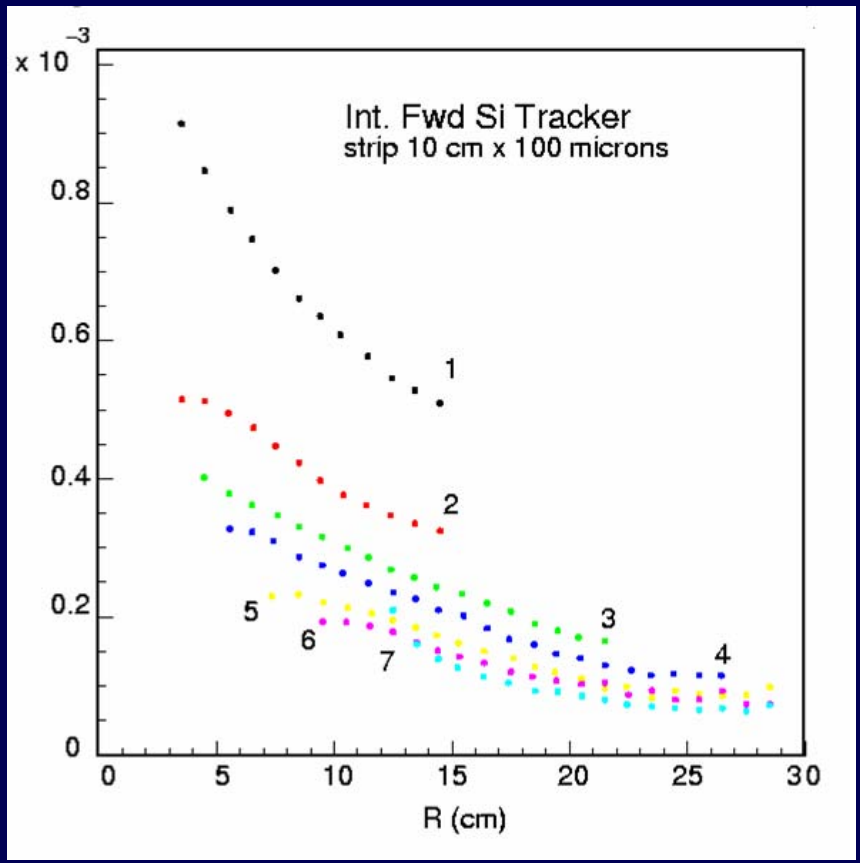
LDC Detector + SILC Geometry

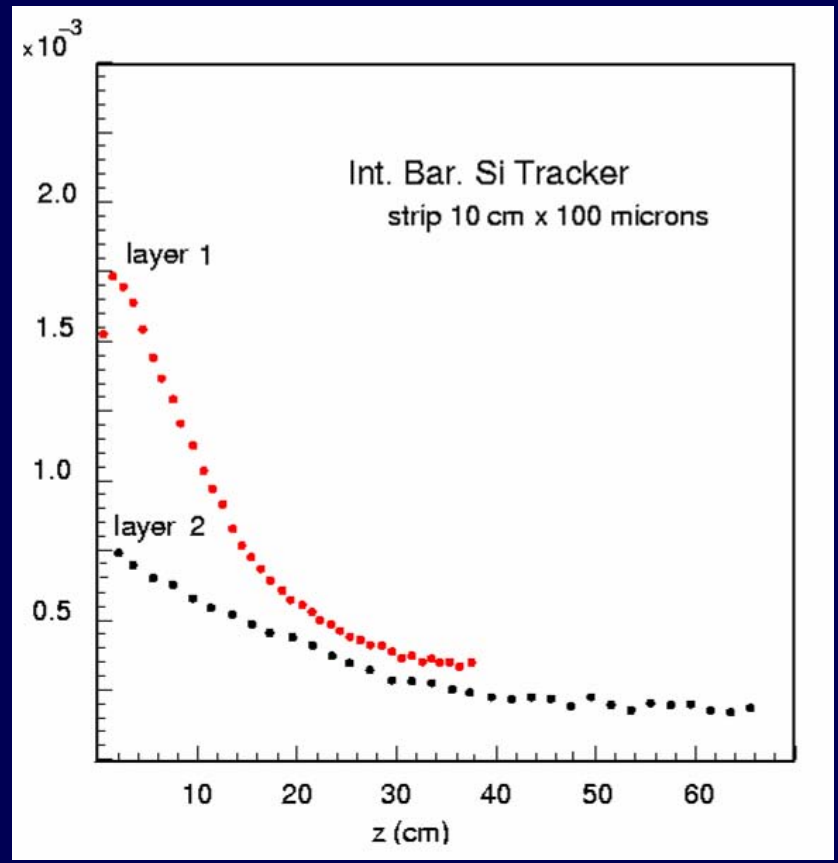
ILC Simulation Frameworks

LDC Mokka
ttbar-> 6jets



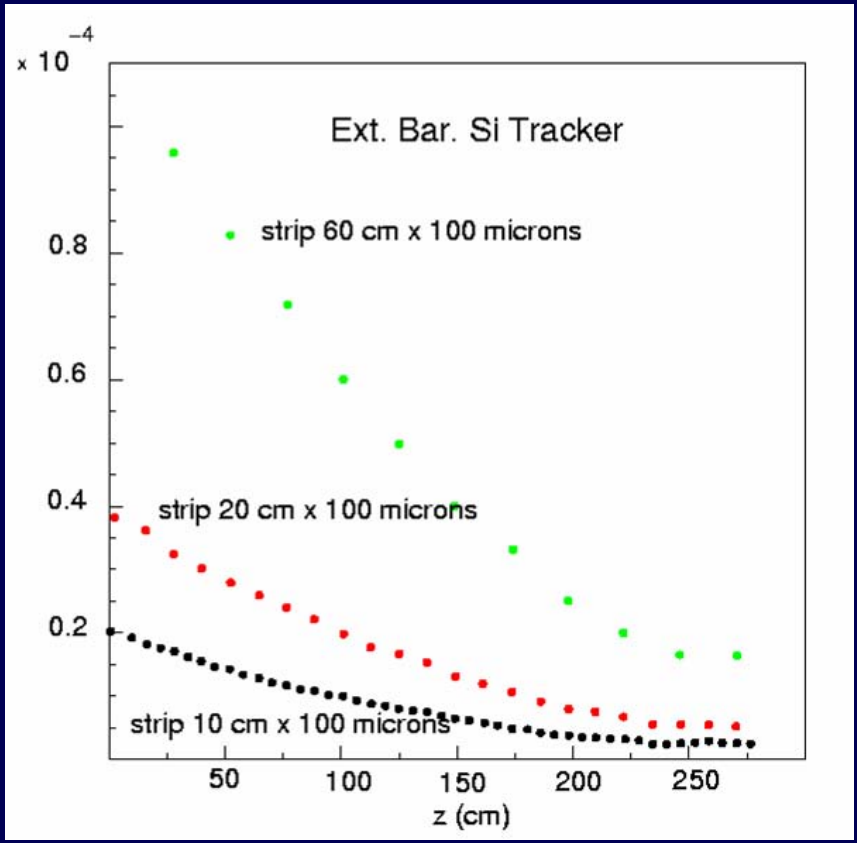
LDC with SILC Occupancies Study

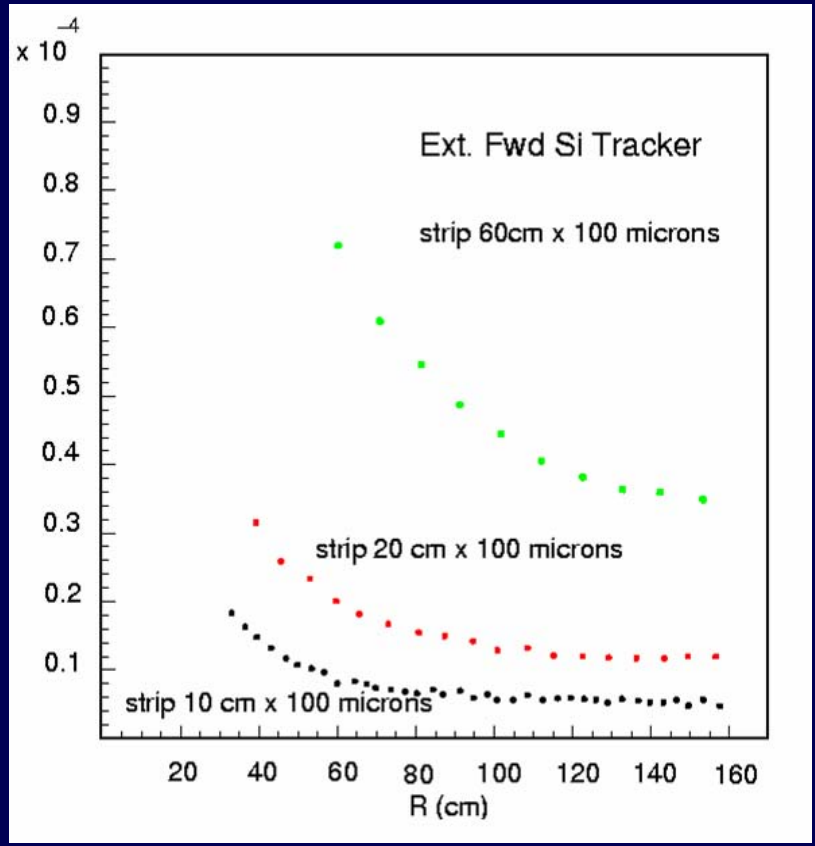




LDC Detector + SILC Geometry

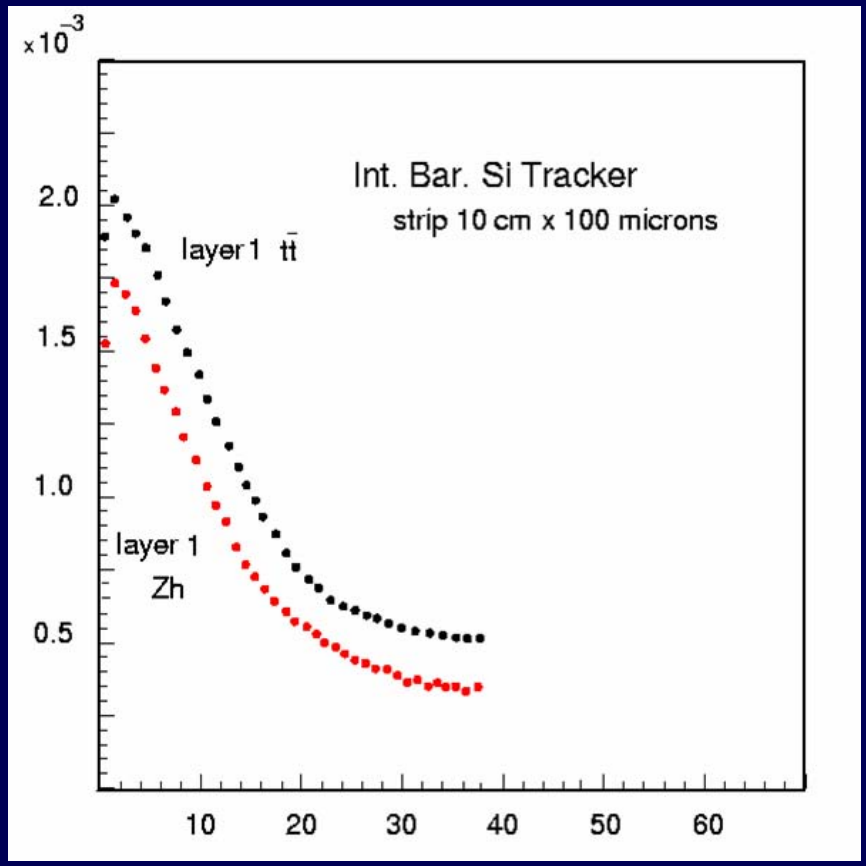
LDC with SILC Occupancies Study





LDC Detector + SILC Geometry

LDC with SILC Occupancies Study



ttbar/ HZ gives ~20% higher occupancy

Occupancies are calculated with full simulation (Si-Envelope+TPC), Higgstrahlung (hZ) with bbbar and qqbar at Ecm=500 GeV
Values at most of order 1% for the hotest places in the detector!

ILC Simulation and Analysis Frameworks

LDC **SID** **GLD**

- Connection to the Reconstruction and Analysis Frameworks
- Optimization of the different ILC detector Concepts