

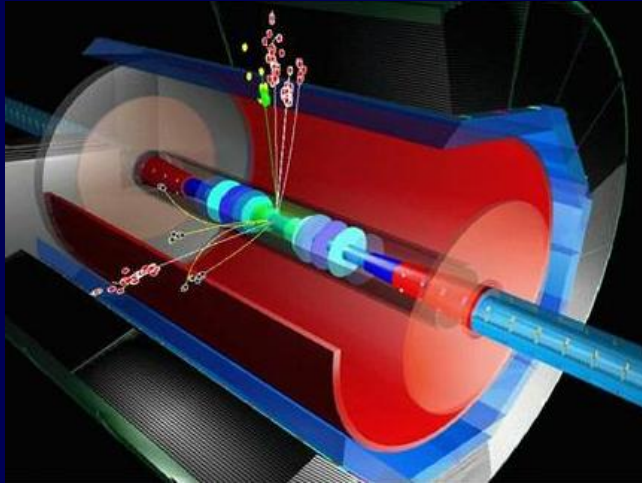
Implementation of the Different Detector Concepts in Mokka Simulation Framework

Snowmass
August 2005, DESY

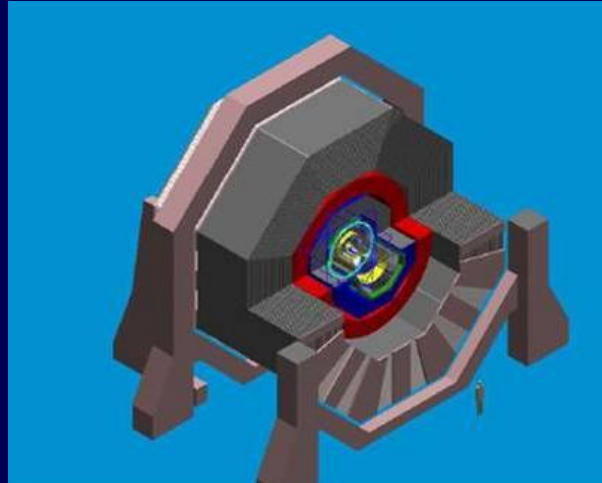
Valeri Saveliev
Obninsk State University / DESY, Hamburg

ILC Detector Concepts

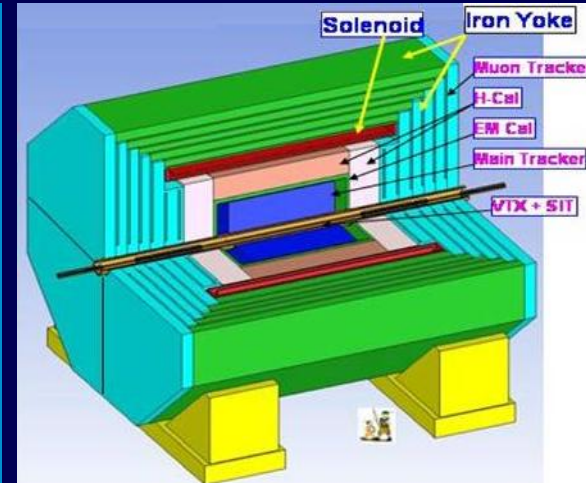
LDC



SiD



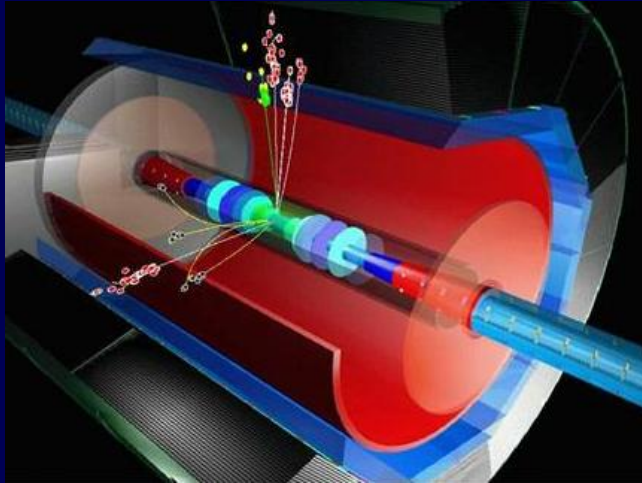
GLD



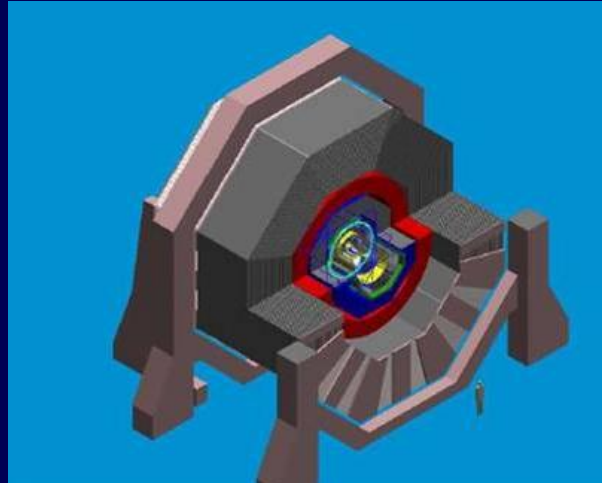
- $Zh \rightarrow ll+h$
 - $Br\ h \rightarrow bb, cc, gg$
 - $Zhh \rightarrow qqbbbb$
 - $h\nu\nu$
- Precise momentum Resolution,
 - Excellent Vertex/Flavor Identification,
 - Excellent Calorimetry, Particle Flow Algorithm,
 - Excellent Hermeticity, Missing Mass Resolution,
 - a lot of other physics

ILC Detector Concepts

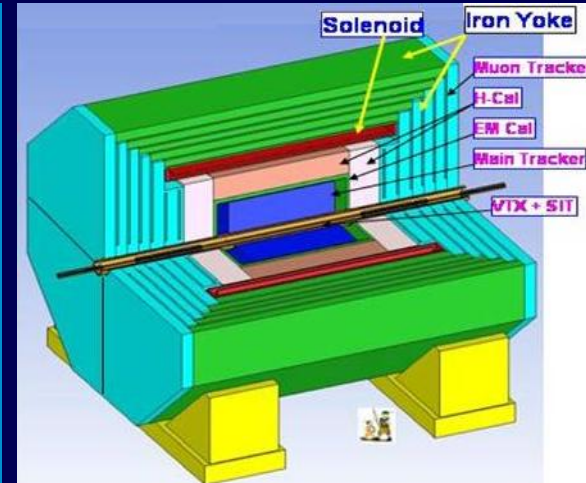
LDC



SiD



GLD



How we can perform an analysis and optimization of the Detector Concepts ?

Answer: Monte Carlo analysis and even better compatible Monte Carlo frame

What is the critical difference in the Detector Concepts ?

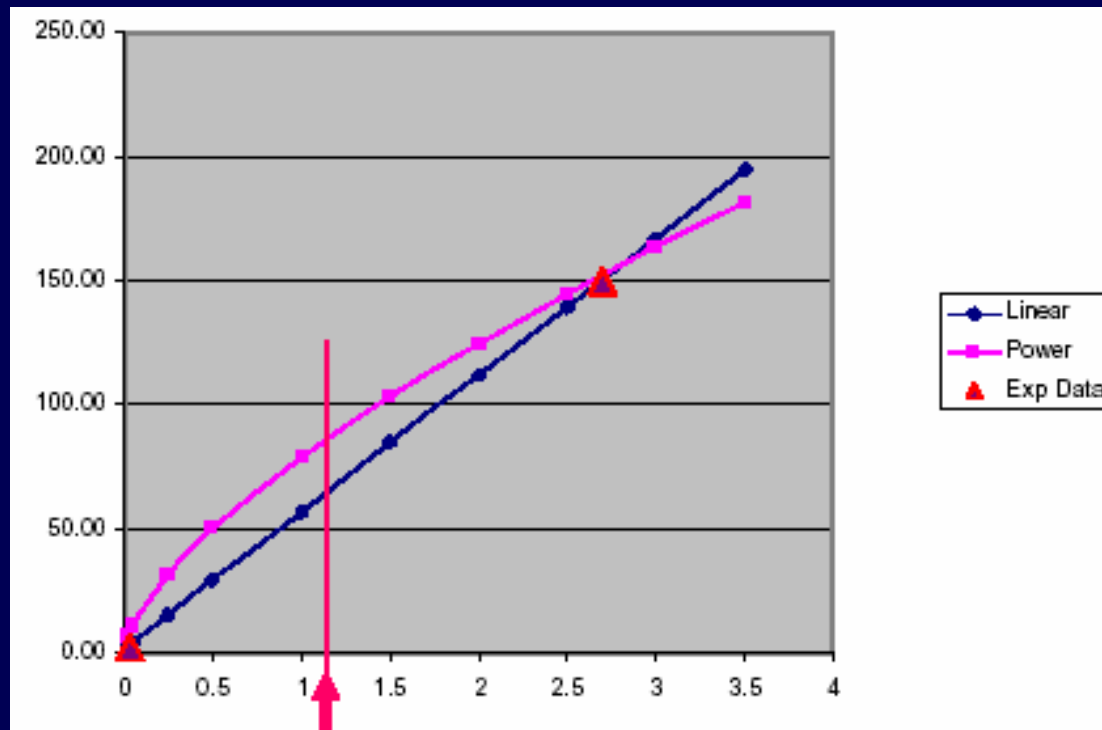
ILC Detector Concepts

	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	
• Muon system		Had: Fe/Sc technology, Crystal	

Two key points: Size of Detector and technology of Main Tracker

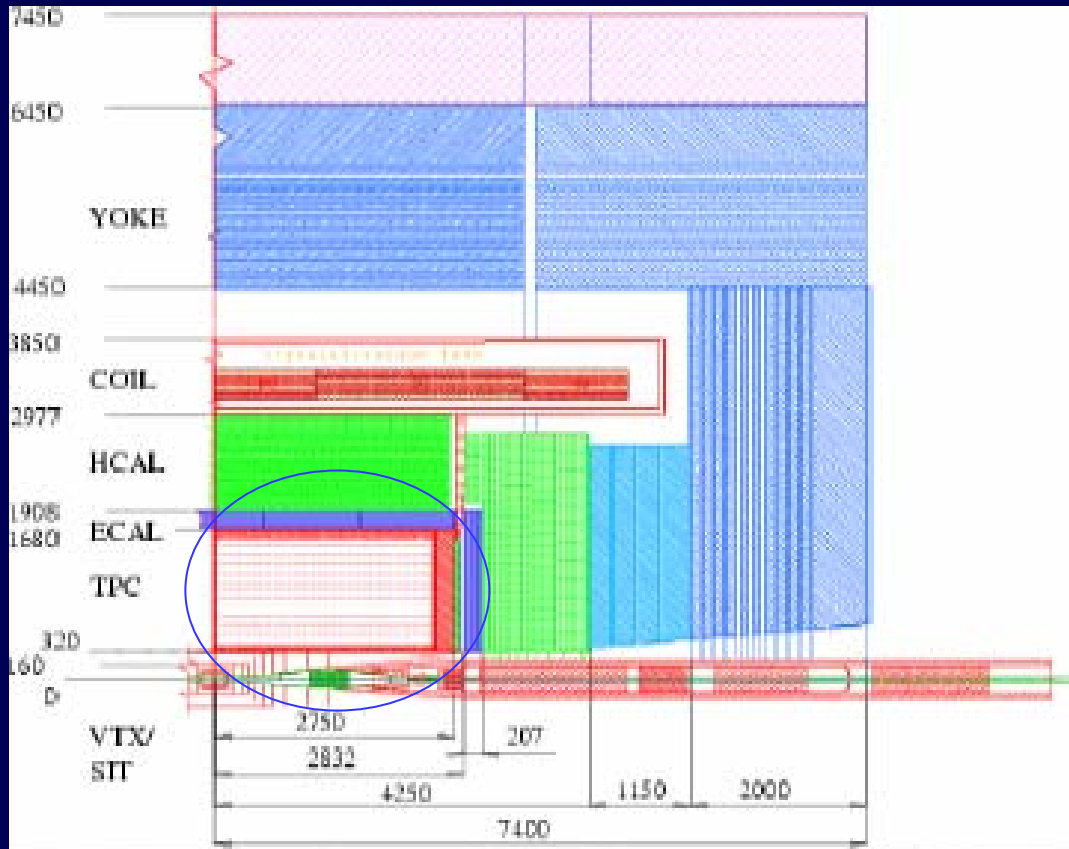
ILC Detector Concepts

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



Solenoid Cost in M\$ as function of Radius

ILC Detector (LCD)



TPC vs Silicon Main Tracker

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

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

- Best way to get one Simulation Framework – hope in future...
- Using all of this frameworks and try to comparison – present situation...
- To get framework with different detector concepts and unify output to Reconstruction and Analysis framework...

Unification of ILC Simulation Frameworks

Simulation Frameworks Geometry Description Problem

```
# 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);
```

LDC Mokka
MySQL

```
<sensitive_detectors>
<calorimeter name="CalNP" (1)
  hitsCollectionName="CalHi
    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>
```

SiD SLIC
GDML

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

ILC Simulation Frameworks Geometry Problem

Framework with different detector concepts and unified output to Reconstruction and Analysis framework

Mokka up to now has more Detailed Geometry Description

- Necessary the mechanism of scaling
- Different Main Tracker Concepts

ILC Simulation Frameworks (Mokka)

MOKKA Detector scaling on a few key parameters is implemented

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 Manual).

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/globalModelProperty command.

The new /Mokka/init/globalModelProperty command:

no matter the values storage in the database, the user can change the detector scale just inserting a set of /Mokka/init/globalModelProperty commands in the steering file.

ILC Simulation Frameworks (Mokka)

SiD Detector Concept (main Silicon Tracker) is implemented

SiD detector concept is implemented by using:

The calorimeters and so on from LDC,
Main Silicon Tracker from SiD,

with all parameters adapted the best possible to agree with all the current SiD proposal.

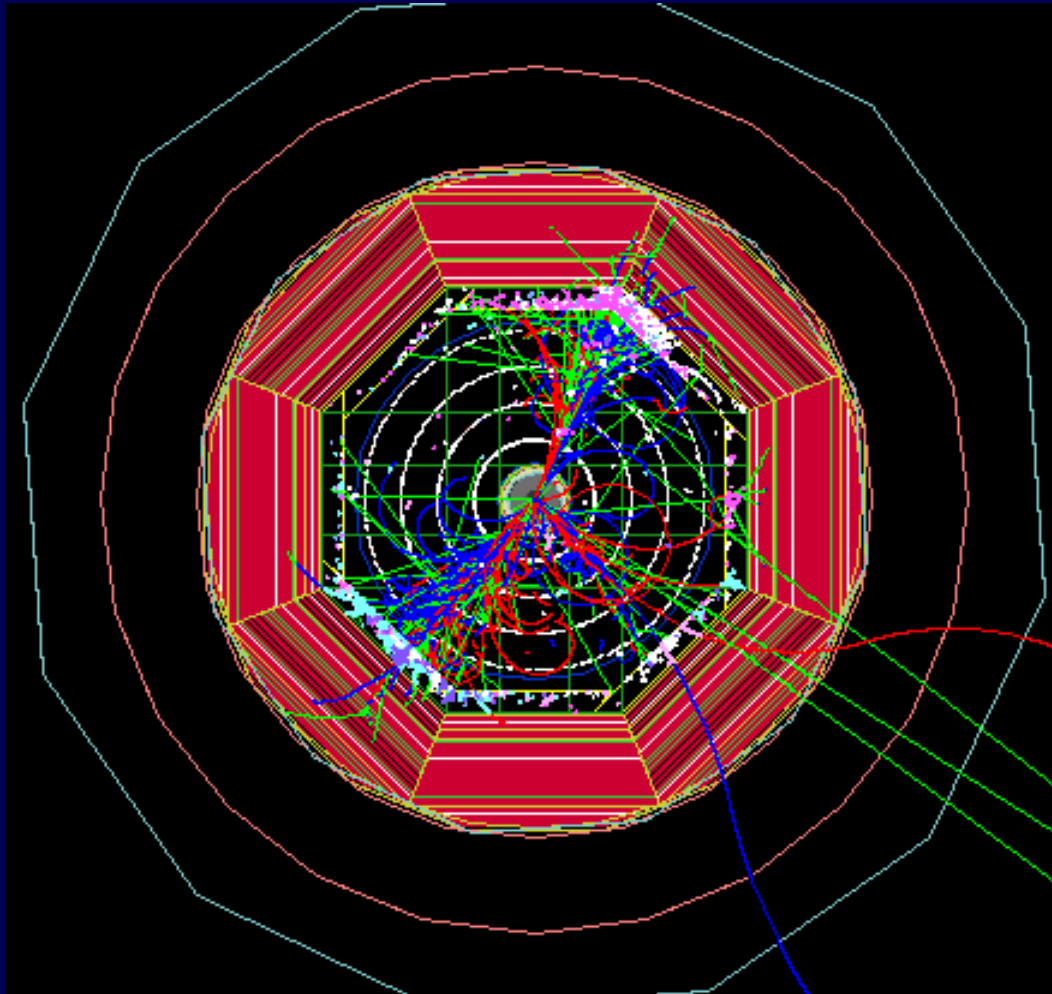
The Magnetic Field is set to 5.0 tesla.

Two models - SiD01 and SiD02 are compose both by the following drivers:

```
+-----+
| sub_detector |
+-----+ | SiDFwd00 | | SiDBar00 | | tubeSiD01 | | vxdSiD00 | | ftdSiD00 | |
              | SEcal01 | | SHcal01 | | SCoil01 | | SYoke01 | | SField01 | |
+-----+
```

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 Framework (Mokka)



SiD in Mokka
 $hZ \rightarrow b\bar{b} + q\bar{q}$

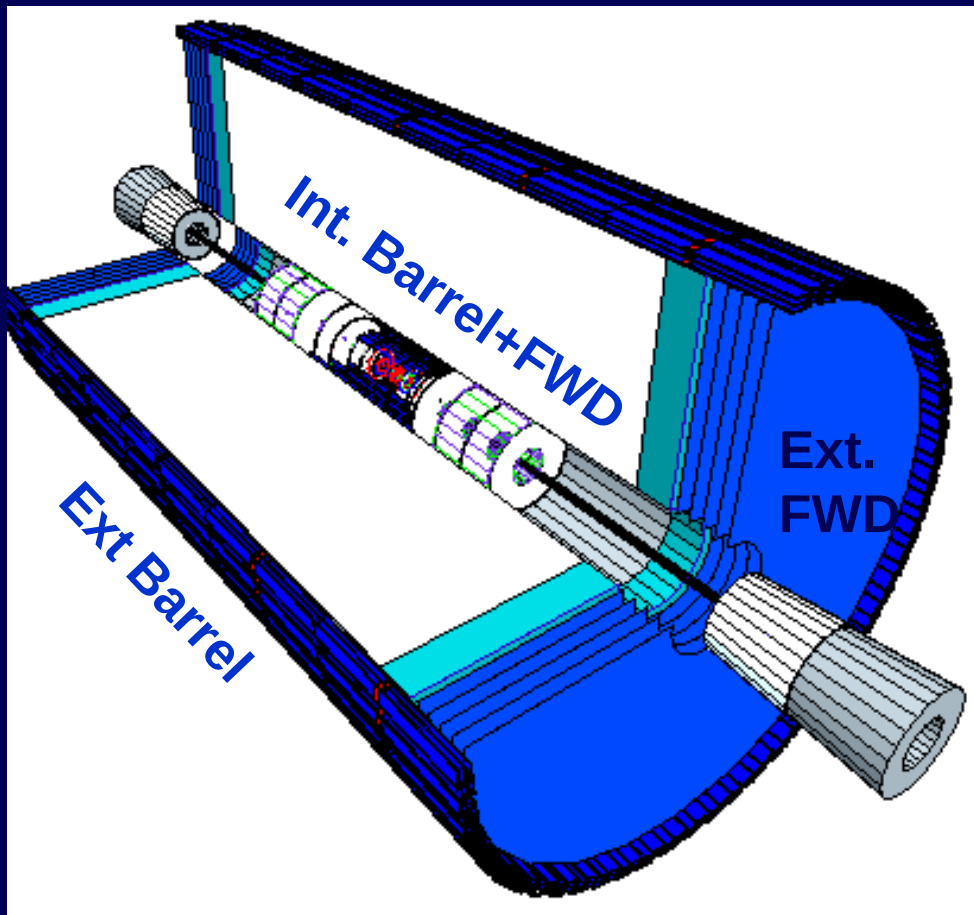
SiD Concept in Mokka Simulation Framework

ILC Simulation Framework (Mokka)

GLD Concept in Mokka Simulation Framework

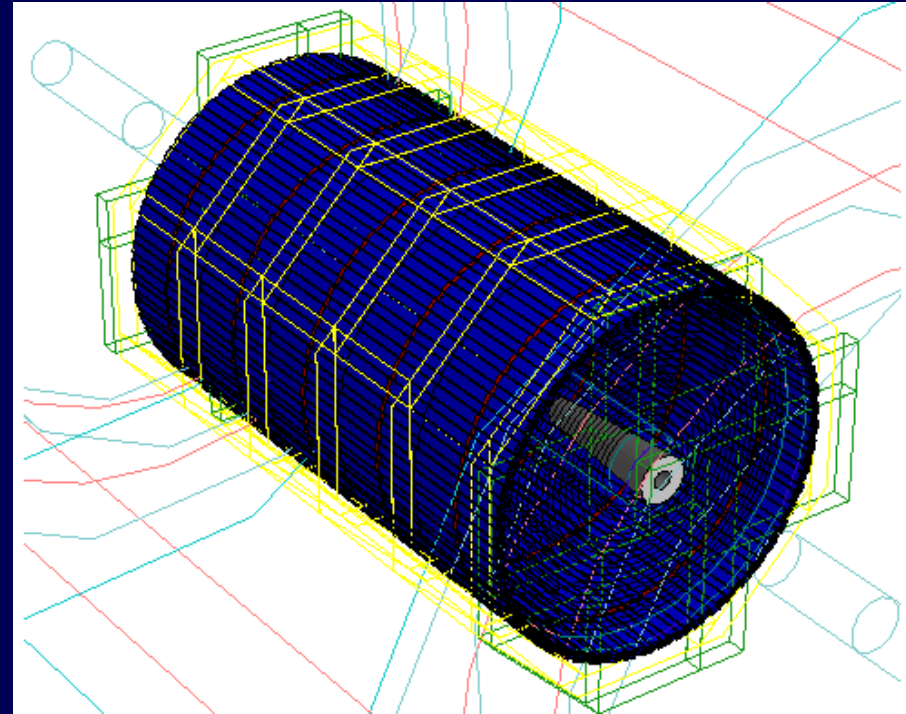
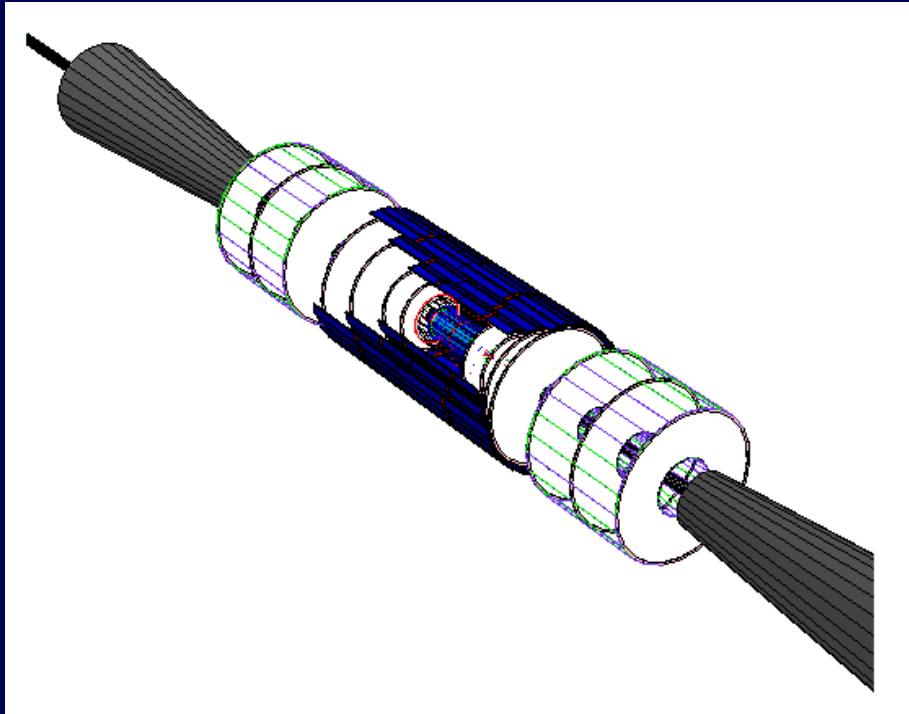
Scaling fits for first analysis

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 surrounding TPC
- External Forward Tracker (Si-Strip)

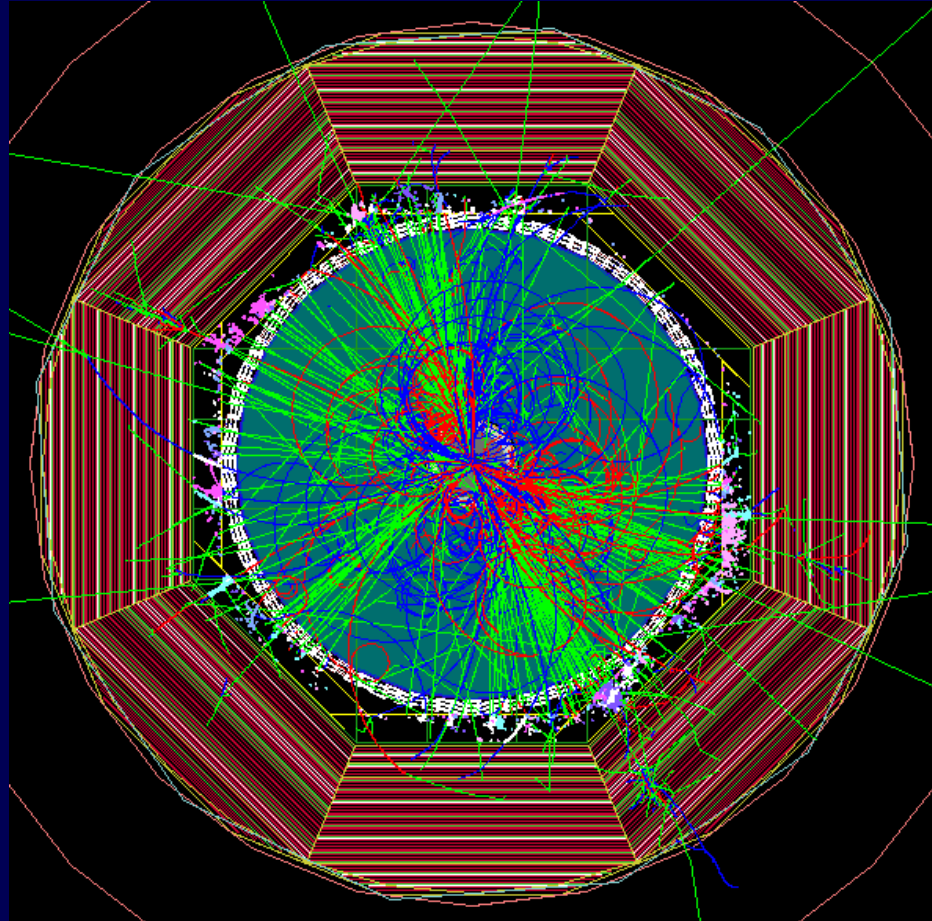
LDC Geometry with SILC in MOKKA



LDC Detector + SILC Silicon Trackers
(Detailed Description)

ILC Simulation Frameworks

LDC Mokka
 $t\bar{t}$ $\rightarrow$ 6jets



ILC Simulation and Analysis Frameworks

LDC

SID

GLD

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