Status Report

SiD DD4hep Model

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SiD @ Glasgow

The **Glasgow Linear Collider Group** is working on the implementation of the SiD model in DD4hep, and is aiming to deliver a physics-ready model in close collaboration with SiD sub-detector experts and DD4hep developers.
We are: A. Robson, **D. Protopopescu** and B. Mischenko (MSc student)

Our work involves

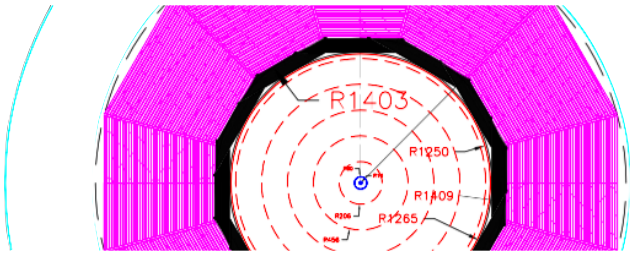
1) verifying the SiD geometry ported from `slic`
2) updating the code to the latest SiD model and parameters
3) validating the new detector implementation
4) maintaining software and configuration compatibility with the latest DDRec/DDSim development versions
5) providing the validated model to the detector optimisation group

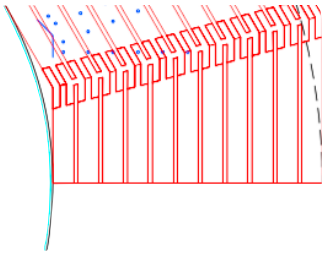
Along the way we

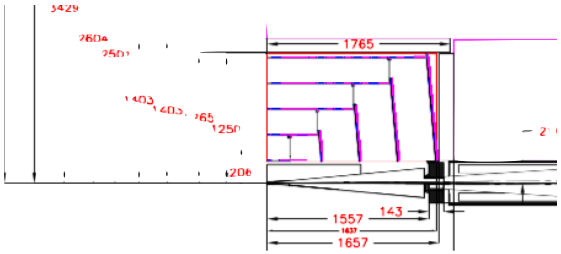
Incorporate detector geometry and spec changes as the SiD model evolves.

Document every step of the process for other users/ developers within the SiD and the wider LC communities.

Maintain contact with ILC, CLIC and ILD developers.







Geometry implementation path

Obtaining the latest geometry

The detector geometry is still being optimised, so it's a work in progress.

We must reiterate when changes are needed, so our implementation must allow to do this as easily as possible.

Implementing the latest SiD model in DD4hep

This means updating or rewriting:

1) the C++ drivers for the detector modules
2) XML description(s)
3) compatibility with latest DDSim features (which are under development as well)

Validating the newly implemented SiD

This is done by:

1) visual comparison with the previous implementation
2) checking overlaps
3) comparing simple particle tracks
4) eventually full physics simulations

Committing the changes to DESY SVN, Github (or both?)

Central repository where:

1) latest geometries can be stored
2) sub-detector conflicts can be checked
3) compatibility with DDSim and other DD4hep software modules is tested

Obtaining the code

At the moment, our code is committed to the DESY SVN repository, where the core DD4hep software and the CLIC and ILD models are stored as well. This is to make it easier to include SiD in the standard tests.
The latest/work version is labelled **SiD_o1_v01**. The XML configuration is located in `lcgeo/SiD/compact/SiD_o1_v01` and the C++ drivers are located in `lcgeo/detector/`

Browse or check out the code via https://svnsrv.desy.de/websvn/wsvn/General.ddsim/lcgeo

Build example

```
svn co https://svnsrv.desy.de/basic/ddsim/lcgeo/trunk lcgeo

source /cvmfs/sft.cern.ch/lcg/releases/gcc/4.8.4/x86_64-slc6/setup.sh
source /cvmfs/ilc.desy.de/sw/x86_64_gcc48_sl6/v01-17-09/init_ilcsoft.sh

cd lcgeo/
mkdir build
cd build
cmake -DCMAKE_CXX_COMPILER=`which g++` -DCMAKE_C_COMPILER=`which gcc` -C /cvmfs/ilc.desy.de/sw/
x86_64_gcc48_sl6/ILCSoft.cmake ..
make -j4
make install
source ../bin/thislcgeo.sh
```

Visualising the model

Build and display detector model with

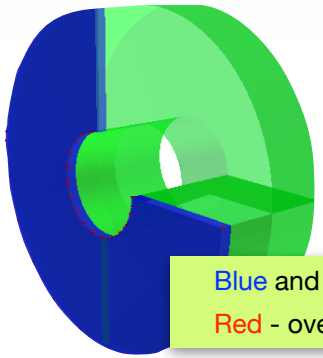
```
cd lcgeo/
source bin/thislcgeo.sh
geoDisplay SiD/compact/SiD_o1_v01/SiD_o1_v01.xml
```

or

```
teveDisplay SiD/compact/SiD_o1_v01/SiD_o1_v01.xml
```

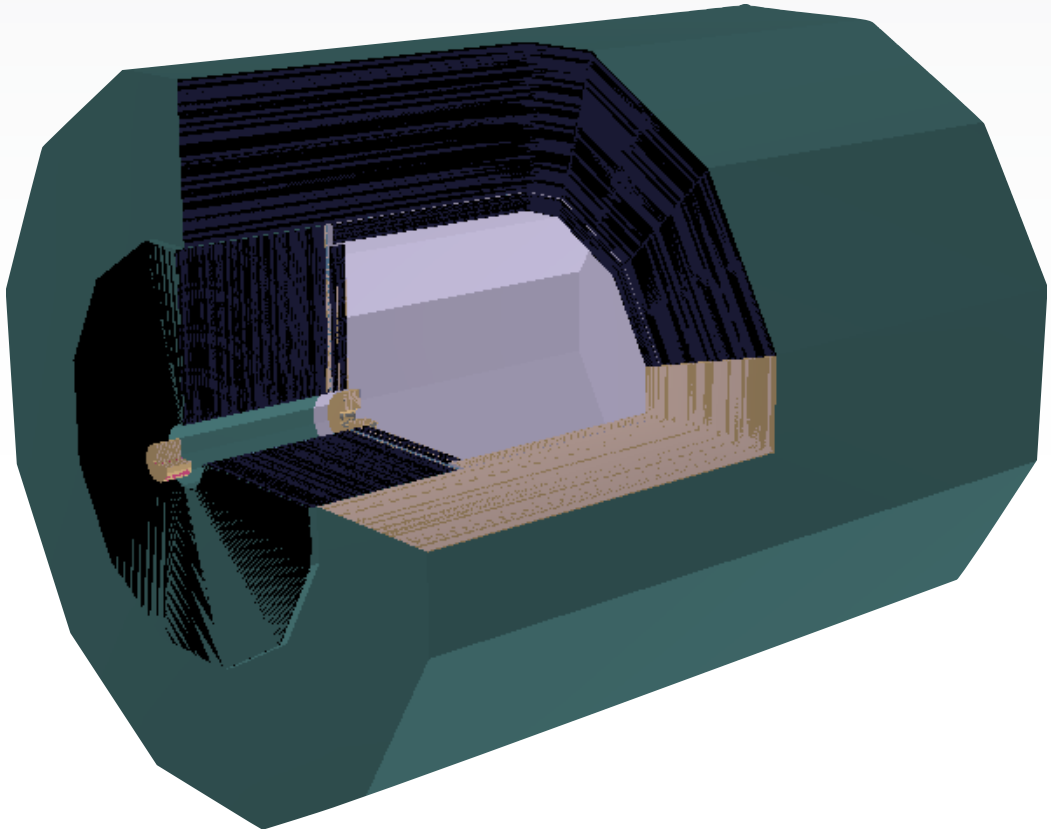
Check overlaps with

```
gGeoManager->CheckOverlaps(0.01);
gGeoManager->PrintOverlaps();
```



Blue and green - the two overlapping volumes
Red - overlap points

Example overlap in LumiCal



SiD_o1_v01

All sub-detectors are built at the moment using generic DD4hep drivers. Generic drivers are best for testing DDSim. Once testing is done, we will carry over the final version of the extensions to the detailed drivers.

SiD Subcomponent	XML	Driver
Vertex Barrel	sidloi3/in work	DD4hep_SiTrackerBarrel
Vertex Endcap	sidloi3/in work	DD4hep_SiTrackerEndcap2
Tracker Barrel	sidloi3/in work	DD4hep_SiTrackerBarrel
Tracker Endcap	sidloi3/in work	DD4hep_SiTrackerEndcap2
ECal Barrel	EcalBarrel_o1_v01_00	GGenericCalBarrel_o1_v01
ECal Endcap	EcalEndcap_o1_v01_00	GGenericCalEndcap_o1_v01
HCal Barrel	HcalBarrel_o1_v01_00	GGenericCalBarrel_o1_v01
HCal Endcap	HcalEndcap_o1_v01_00	GGenericCalEndcap_o1_v01
Muon Barrel	sidloi3/in work	DD4hep_PolyhedraBarrelCalorimeter2
Muon Endcap	sidloi3/in work	DD4hep_PolyhedraEndcapCalorimeter2
LumiCal	LumiCal_o1_v01_00	DD4hep_CylindricalEndcapCalorimeter
BeamCal	BeamCal_o1_v01_00	DD4hep_ForwardDetector
Beam pipe	sidloi3/in work	DD4hep_PolyconeSupport/TubeSegment
Supports and readout	sidloi3/in work	none

■ slic port, ■ updated XML, ■ DD4hep generic drivers, ■ Generic ILD/CLIC/SiD drivers that include Pandora extensions

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Vertex Endcap	sidloi3/in work	DD4hep_SiTrackerEndcap2
Tracker Barrel	sidloi3/in work	DD4hep_SiTrackerBarrel
Tracker Endcap	sidloi3/in work	DD4hep_SiTrackerEndcap2
ECal Barrel	sidloi3/in work	GGenericCalBarrel_o1_v01
ECal Endcap	sidloi3/in work	GGenericCalEndcap_o1_v01
HCal Barrel	sidloi3/in work	GGenericCalBarrel_o1_v01
HCal Endcap	sidloi3/in work	GGenericCalEndcap_o1_v01
Muon Barrel	sidloi3/in work	ep_PolyhedraBarrelCalorimeter2
Muon Endcap	sidloi3/in work	DD4hep_PolyhedraEndcapCalorimeter2
LumiCal	LumiCal_o1_v01_00	DD4hep_CylindricalEndcapCalorimeter
BeamCal	BeamCal_o1_v01_00	DD4hep_ForwardDetector
Beam pipe	sidloi3/in work	DD4hep_PolyconeSupport/TubeSegment
Supports and readout	sidloi3/in work	none

Work done:
- Updated XMLs to latest naming and structure conventions
- Updated dimensions as per latest engineering drawing
- Moved readouts and plugins to the individual detector descriptions to assure modularity
- Verified visualisation
- Checked overlaps and extrusions
- Code streamlining

■ slic port, ■ updated XML, ■ DD4hep generic drivers, ■ Generic ILD/CLIC/SiD drivers that include Pandora extensions

SiD_o1_v01

All sub-detectors are built at the moment using generic DD4hep drivers. Generic drivers are best for testing DDSim. Once testing is done, we will carry over the final version of the extensions to the detailed drivers.

need input from sub-detector experts

SiD Subcomponent	XML	Driver
Vertex Barrel	sidloi3/in work	DD4hep_SiTrackerBarrel
Vertex Endcap	sidloi3/in work	DD4hep_SiTrackerEndcap2
Tracker Barrel		DD4hep_SiTrackerBarrel
Tracker Endcap		DD4hep_SiTrackerEndcap2
ECal Barrel		GGenericCalBarrel_o1_v01
ECal Endcap		GGenericCalEndcap_o1_v01
HCal Barrel	HcalBarrel_o1_v01_00	GGenericCalBarrel_o1_v01
HCal Endcap	HcalEndcap_o1_v01_00	GGenericCalEndcap_o1_v01
Muon Barrel	sidloi3/in work	DD4hep_PolyhedraBarrelCalorimeter2
Muon Endcap	sidloi3/in work	DD4hep_PolyhedraEndcapCalorimeter2
LumiCal	LumiCal_o1_v01_00	DD4hep_CylindricalEndcapCalorimeter
BeamCal	BeamCal_o1_v01_00	DD4hep_ForwardDetector
Beam pipe	sidloi3/in work	DD4hep_PolyconeSupport/TubeSegment
Supports and readout	sidloi3/in work	none

- Tracker barrel can be greatly simplified;
- same for LumiCal, BeamCal.
- see work done by Marko on the CLIC trackers …

■ slic port, ■ updated XML, ■ DD4hep generic drivers, ■ Generic ILD/CLIC/SiD drivers that include Pandora extensions

Running the simulation

Might need to set

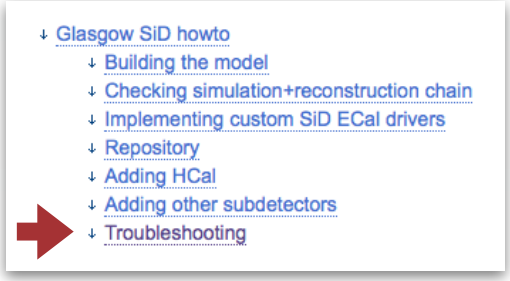
```
export LCGRELEASES=/cvmfs/sft.cern.ch/lcg/releases/LCG_84
export PYTHONDIR=$LCGRELEASES/Python/2.7.10/x86_64-slc6-gcc48-opt
export PATH=$PYTHONDIR/bin:$PATH
export LD_LIBRARY_PATH=$PYTHONDIR/lib:$LD_LIBRARY_PATH
```

also

```
export LCGRELEASES=/cvmfs/sft.cern.ch/lcg/releases/LCG_84
export PYTHONDIR=$LCGRELEASES/Python/2.7.10/x86_64-slc6-gcc48-opt
export PATH=$PYTHONDIR/bin:$PATH
export LD_LIBRARY_PATH=$PYTHONDIR/lib:$LD_LIBRARY_PATH
export PYTOOLSDIR=$LCGRELEASES/pytools/1.9_python2.7/x86_64-slc6-gcc48-opt
export PYTHONPATH=$PYTOOLSDIR/lib/python2.7/site-packages:$PYTHONPATH
export PATH=$PYTOOLSDIR/bin:$PATH
```

[or try `source /cvmfs/ilc.desy.de/sw/x86_64_gcc48_sl6/init_gcc48.sh`]

Visit the troubleshooting section or email Dan if problems …



Try for example

1. `make test` [might not work due to gun options mismatch]

2.
```
cd ..
python example/lcio_particle_gun.py
ddsim --compactFile=SiD/compact/SiD_o1_v01/SiD_o1_v01.xml --runType=batch --inputFile mcparticles.slcio -N=1 —
outputFile=testSiD_o1_v01.slcio
```

3. `materialScan SiD/compact/SiD_o1_v01/SiD_o1_v01.xml  0 0 0 100 0 0`

Summary

Done:

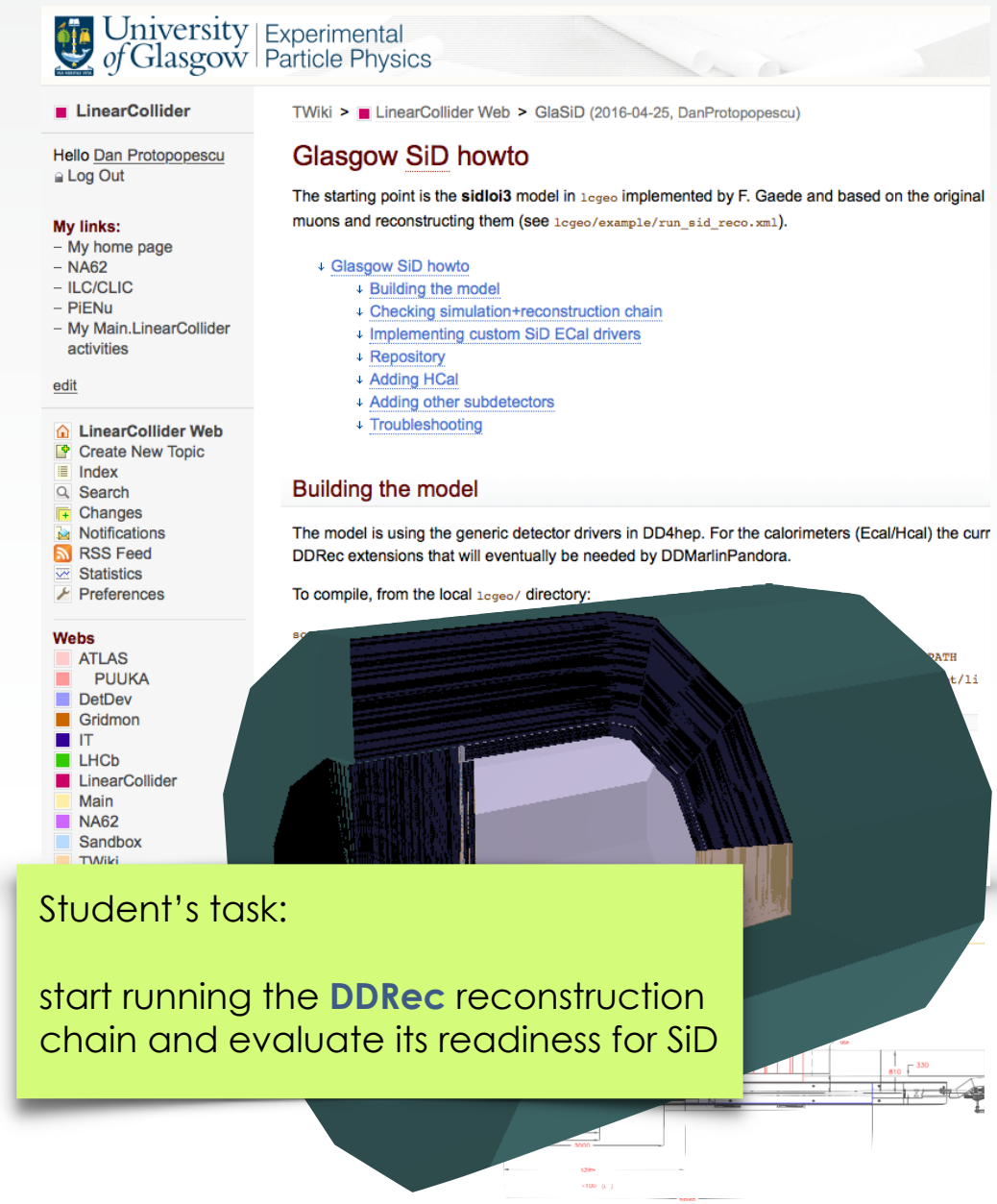
- `slic` sidloi3 port using generic drivers (F. Gaede)
- plugins and readouts moved to the individual detector's XML to assure modularity
- updated XMLs to the latest variable structure and naming conventions; updated dimensions

In progress by us:

- more work on XMLs and drivers
- committing code and writing documentation
- focus on simulation

To do (in general):

- finalise DD4hep implementation of all SiD sub-detectors
- customise C++ drivers to include more detailed geometry
- provide code for physics simulations and optimisation studies
- **benchmark reconstruction** (new MSc student)
- update everything if/when software and/or geometry are modified



Student's task:

start running the **DDRec** reconstruction chain and evaluate its readiness for SiD

THANKS!

QUESTIONS ?
SUGGESTIONS ?

Visit https://twiki.ppe.gla.ac.uk/bin/view/LinearCollider/GlaSiD

D. Protopopescu - April 2016