Coriolis User's Guide

Contents

Credits & License

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Release Notes

Release 1.0.1475

This is the first preliminary release of the CORIOLIS 2 framework.

This release mainly ships the global router KNIK and the detailed router KITE. Together they aim to replace the ALLIANCE NERO router. Unlike NERO, KITE is based on an innovating routing modeling and ad-hoc algorithm. Although it is released under GPL license, the source code will be avalaible later.

Contents of this release:

1. A graphical user interface (viewer only).
2. The KNIK global router.
3. The KITE detailed router.

Supported input/output formats:

- ALLIANCE `vst` (netlist) & `ap` (physical) formats.
- Even if there are some references to the CADENCE LEFDEF format, its support is not included because it depends on a library only available to SI2 affiliated members.

Release 1.0.1963

Release 1963 is alpha. All the tools from CORIOLIS 1 have been ported into this release.

Contents of this release:

1. The STRATUS netlist capture language (GENLIB replacement).
2. The MAUKA placer (still contains bugs).
3. A graphical user interface (viewer only).
4. The KNIK global router.
5. The KITE detailed router.
6. Partially implemented python support for configuration files (alternative to XML).
7. A documentation (imcomplete/obsoleted in HURRICANE's case).

Release 1.0.2049

Release *2049* is Alpha.

Changes of this release:

1. The HURRICANE documentation is now accurate. Documentation for the Cell viewer and CRLCORE has been added.
2. More extensive Python support for all the components of CORIOLIS.
3. Configuration is now completly migrated under Python. XML loaders can still be useds for compatibilty.
4. The `cgt` main has been rewritten in Python.

Release v2.0.1

1. Migrated the repository from `svn` to `git`, and release complete sources. As a consequence, we drop the distribution packaging support and give public read-only access to the repository.
2. Deep rewrite of the KATABATIC database and KITE detailed router, achieve a speedup factor greater than 20...

Installation

Note
As the sources are being released, the binary packaging is dropped. You still may find older version here: http://asim.lip6.fr/pub/coriolis/2.0 .

In a nutshell, building source consist in pulling the `git` repository then running the `ccb` installer.

Main building prerequisites:

- cmake
- g++
- boost
- libxml2
- yacc & lex.
- Qt 4
- LEF/DEF (optional).
- hMetis (optional).
- doxygen.
- latex
- latex2html.
- python-docutils (for reStructuredText).

Fixed Directory Tree

In order to simplificate the work of the `ccb` installer, the source, build and installation tree is fixed. To successfully compile CORIOLIS you must follow it exactly. The tree is relative to the home directory of the user building it (noted `~/` or `$HOME/`). Only the source directory needs to be manually created by the user, all others will be automatically created either by `ccb` or the build system.

Sources	
Sources root **under git**	~/coriolis-2.x/src ~/coriolis-2.x/src/coriolis
Architecture Dependant Build	
Linux, SL 6, 32 bits Linux, SL 6, 64 bits FreeBSD 8, 32 bits FreeBSD 8, 64 bits	~/coriolis-2.x/Linux.slsoc6x/Release.Shared/build/<tool> ~/coriolis-2.x/Linux.slsoc6x_64/Release.Shared/build/<tool> ~/coriolis-2.x/FreeBSD.8x.i386/Release.Shared/build/<tool> ~/coriolis-2.x/FreeBSD.8x.amd64/Release.Shared/build/<tool>
Architecture Dependant Install	
Linux, SL 6, 32 bits	~/coriolis-2.x/Linux.slsoc6x/Release.Shared/install/

FHS Compliant Structure under Install	
Binaries	.../install/bin
Libraries (Python)	.../install/lib
Include by tool	.../install/include/coriolis2/<project>/<tool>
Configuration files	.../install/etc/coriolis2/
Doc, by tool	.../install/share/doc/coriolis2/en/html/<tool>

Note

Alternate build types: the `Release.Shared` means an optimized build with shared libraries. But there are also available `Static` instead of `Shared` and `Debug` instead of `Release` and any combination of them.
`Static` do not work because I don't know yet to mix statically linked binaries and Python modules (which must be dynamic).

Building Coriolis

The first step is to create the source directory and pull the `git` repository:

```
dummy@lepka:~$ mkdir -p ~/coriolis-2.x/src
dummy@lepka:~$ cd ~/coriolis-2.x/src
dummy@lepka:~$ git clone https://www-soc.lip6.fr/git/coriolis.git
dummy@lepka:~$ cd coriolis
```

Second and final step, build & install:

```
dummy@lepka:src$ ./bootstrap/ccp.py --project=coriolis --make="-j4 install"
dummy@lepka:src$ ./bootstrap/ccb.py --project=coriolis --doc --make="-j1 install"
```

We need two steps because the documentation do not support to be generated with a parallel build. So we compile & install in a first step in `-j4` (or whatever) then we generate the documentation in `-j1`

The complete list of `ccb` functionalities can be accessed with the `--help` argument. It also may be run in graphical mode (`--gui`).

Additionnal Requirement under MacOS Coriolis make uses of the `boost::python` module, but the MacPorts `boost` seems unable to work with the Python bundled with MacOS. So you have to install both of them from MacPorts:

```
dummy@macos:~$ port install boost +python27
dummy@macos:~$ port select python python27
```

Then proceed with the generic install instructions.

Packaging Coriolis

Packager should not uses `ccb`, instead `bootstrap/Makefile.package` is provided to emulate a top-level `autotool` makefile. Just copy it in the root of the Coriolis git repository (`~/corriolis-2.x/src/coriolis/`) and build.

Sligthly outaded packaging configuration files can also be found under `bootstrap/`:

- `bootstrap/coriolis2.spec.in` for `rpm` based distributions.
- `bootstrap/debian` for Debian based distributions.

Hooking up into Alliance

Coriolis relies on Alliance for the cell libraries. So after installing or packaging, you must configure it so that it can found those libraries.

This is done by editing the one variable `cellsTop` in the Alliance helper (see Alliance Helper). This variable must point to the directory of the cells libraries. In a typical installation, this is generally `/usr/share/alliance/cells`.

Environment Helper

To simplify the tedious task of configuring your environment, a helper is provided in the `bootstrap` source directory:

```
~/coriolis-2.x/src/bootstrap/coriolisEnv.py
```

Use it like this:

```
dummy@lepka:~> eval `~/coriolis-2.x/src/bootstrap/coriolisEnv.py`
```

Documentation

The general index of the documentation for the various parts of Coriolis are avalaibles here Coriolis Tools Documentation.

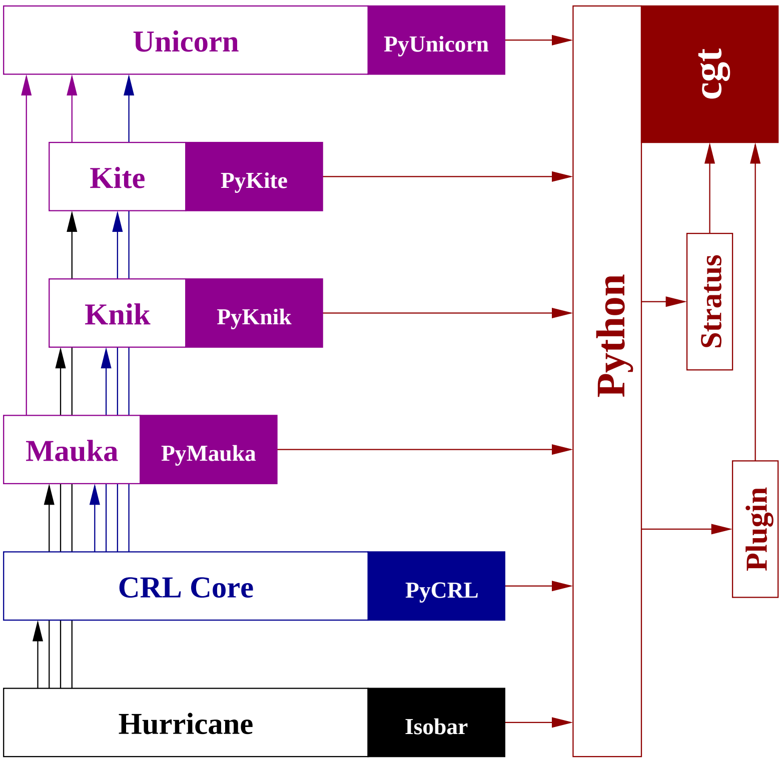
Note

Python Documentation: Most of the documentation is related to the C++ API and implemetation of the tools. However, the PYTHON bindings have been created so they mimic *as closely as possible* the C++ interface, so the documentation applies to both languages with only minor syntactic changes.

General Software Architecture

CORIOLIS has been build with respect of the classical paradigm that the computational instensive parts have been written in C++, and almost everything else in PYTHON. To build the PYTHON interface we used two methods:

- For self-contained modules `boost::python` (mainly in `vlsisapd`).
- For all modules based on HURRICANE, we created our own wrappers due to very specific requirements such as shared functions between modules or C++/PYTHON secure bi-directional object deletion.



Coriolis Configuration & Initialisation

All configuration & initialization files are Python scripts, despite their `.conf` extention. From a syntactic point of view, there is no difference between the system-wide configuration files and the user's configuration, they may use the same Python helpers.

Configuration is done in two stages:

1. Selecting the symbolic technology.
2. Loading the complete configuration for the given technology.

First Stage: Symbolic Technology Selection

The initialization process is done by executing, in order, the following file(s):

Order	Meaning	File
1	The system setting	/etc/coriolis2/coriolis2_techno.conf
2	The user's global setting	${HOME}/.coriolis2_techno.conf
3	The user's local setting	<CWD>/.coriolis2_techno.conf

Thoses files must provides only two variables, the name of the symbolic technology and the one of the real technology. For example:

```
# -*- Mode:Python -*-

symbolicTechno = 'cmos'
realTechno     = 'hcmos9'
```

Second Stage: Technology Configuration Loading

The TECHNO variable is set by the first stage and it's the name of the symbolic technology. A directory of that name, with all the configuration files, must exists in the configuration directory. In addition to the technology-specific directories, a common/ directory is there to provides a trunk for all the identical datas across the various technologies. The initialization process is done by executing, in order, the following file(s):

Order	Meaning	File
1	The system initialization	/etc/coriolis2/<TECHNO>/<TOOL>.conf
2	The user's global initialization	${HOME}/.coriolis2.conf
3	The user's local initialization	<CWD>/.coriolis2.conf

Note

The loading policy is not hard-coded. It is implemented at Python level in /etc/coriolis2/coriolisInit.py, and thus may be easyly be amended to whatever site policy.
The truly mandatory requirement is the existence of coriolisInit.py which *must* contain a coriolisConfigure() function with no argument.

Configuration Helpers

To ease the writing of configuration files, a set of small helpers is available. They allow to setup the configuration parameters through simple assembly of tuples. The helpers are installed under the directory:

```
<install>/etc/coriolis2/
```

Where <install>/ is the root of the installation.

ALLIANCE Helper The configuration file must provide a allianceConfig tuple of the form:

```
cellsTop = '/usr/share/alliance/cells/'

allianceConfig = \
    ( ( 'SYMBOLIC_TECHNOLOGY', helpers.sysConfDir+'/technology.symbolic.xml'    )
```

```
    , ( 'REAL_TECHNOLOGY'    , helpers.sysConfDir+'/technology.cmos130.s2r.xml')
    , ( 'DISPLAY'            , helpers.sysConfDir+'/display.xml'               )
    , ( 'CATALOG'            , 'CATAL')
    , ( 'WORKING_LIBRARY'    , '.')
    , ( 'SYSTEM_LIBRARY'     , ( (cellsTop+'sxlib'   , Environment.Append)
                               , (cellsTop+'dp_sxlib', Environment.Append)
                               , (cellsTop+'ramlib'  , Environment.Append)
                               , (cellsTop+'romlib'  , Environment.Append)
                               , (cellsTop+'rflib'   , Environment.Append)
                               , (cellsTop+'rf2lib'  , Environment.Append)
                               , (cellsTop+'pxlib'   , Environment.Append) ) )
    , ( 'SCALE_X'            , 100)
    , ( 'IN_LO'              , 'vst')
    , ( 'IN_PH'              , 'ap')
    , ( 'OUT_LO'             , 'vst')
    , ( 'OUT_PH'             , 'ap')
    , ( 'POWER'              , 'vdd')
    , ( 'GROUND'             , 'vss')
    , ( 'CLOCK'              , '^ck.*')
    , ( 'BLOCKAGE'           , '^blockageNet*')
    )
```

The example above shows the system configuration file, with all the available settings. Some important remarks about thoses settings:

- In it's configuration file, the user do not need to redefine all the settings, just the one he wants to change. In most of the cases, the `SYSTEM_LIBRARY`, the `WORKING_LIBRARY` and the special net names (at this point there is not much alternatives for the others settings).
- `SYSTEM_LIBRARY` setting: Setting up the library search path. Each library entry in the tuple will be added to the search path according to the second parameter:
  - `Environment::Append`: append to the search path.
  - `Environment::Prepend`: insert in head of the search path.
  - `Environment::Replace`: look for a library of the same name and replace it, whithout changing the search path order. If no library of that name already exists, it is appended.

  A library is identified by it's name, this name is the last component of the path name. For instance: `/soc/alliance/sxlib` will be named `sxlib`. Implementing the ALLIANCE specification, when looking for a *Cell* `name`, the system will browse sequentially trought the library list and returns the first *Cell* whose name match.
- For `POWER`, `GROUND`, `CLOCK` and `BLOCKAGE` net names, a regular expression (GNU regexp) is expected.
- The `helpers.sysConfDir` variable is supplied by the helpers, it is the directory in which the system-wide configuration files are locateds. For a standard installation it would be: `/soc/coriolis2`.
- Trick and naming convention about `SYMBOLIC_TECHNOLOGY`, `REAL_TECHNOLOGY` and `DISPLAY`. In the previous releases, thoses files where to read by XML parsers, and still do if you triggers the XML compatibility mode. But now, they have Python conterparts. In the configuration files, you still have to name them as XML files, the Python file name will be deduced from this one with thoses two translation rules:
  1. In the filename, all dots, except for the last (the file extention), are replaced by underscores.

2. The `.xml` extention is substituted by a `.conf`.

For the symbolic technology, it would give:

```
/soc/coriolis2/technology.symbolic.xml
                         --> /soc/coriolis2/technology_symbolic.conf
```

A typical user's configuration file would be:

```
import os

homeDir = os.getenv('HOME')

allianceConfig = \
    ( ('WORKING_LIBRARY'    , homeDir+'/worklib')
    , ('SYSTEM_LIBRARY'     , ( (homeDir+'/mylib', Environment.Append) ) )
    , ('POWER'              , 'vdd.*')
    , ('GROUND'             , 'vss.*')
    )
```

Tools Configuration Helpers All the tools uses the same helper to load their configuration (a.k.a. *Configuration Helper*). Currently the following configuration system-wide configuration files are defined:

- `misc.conf`: commons settings or not belonging specifically to a tool.
- `nimbus.conf`: for the Nimbus tool.
- `hMetis.conf`: for the hMetis wrapper.
- `mauka.conf`: for the Mauka tool.
- `kite.conf`: for the Kite tool.
- `stratus1.conf`: for the Stratus1 tool.

Here is the contents of `mauka.conf`:

```
# Mauka parameters.
parametersTable = \
    ( ('mauka.annealingBinMult' , TypePercentage, 5      )
    , ('mauka.annealingNetMult' , TypePercentage, 90     )
    , ('mauka.annealingRowMult' , TypePercentage, 5      )
    , ('mauka.ignorePins'       , TypeBool      , False  )
    , ('mauka.insertFeeds'      , TypeBool      , True   )
    , ('mauka.plotBins'         , TypeBool      , True   )
    , ('mauka.searchRatio'      , TypePercentage, 50     )
    , ('mauka.standardAnnealing', TypeBool      , False  )
    )

layoutTable = \
    ( (TypeTab   , 'Mauka', 'mauka')
    # Mauka part.
    , (TypeOption, "mauka.standardAnnealing", "Standart Annealing"    , 0 )
    , (TypeOption, "mauka.ignorePins"       , "Ignore Pins"           , 0 )
    , (TypeOption, "mauka.plotBins"         , "Plot Bins"             , 0 )
    , (TypeOption, "mauka.insertFeeds"      , "Insert Feeds"          , 0 )
    , (TypeOption, "mauka.searchRatio"      , "Search Ratio (%)"      , 1 )
    , (TypeOption, "mauka.annealingNetMult" , "Annealing Net Mult (%)", 1 )
```

```
    , (TypeOption, "mauka.annealingBinMult" , "Annealing Bin Mult (%)", 1 )
    , (TypeOption, "mauka.annealingRowMult" , "Annealing Row Mult (%)", 1 )
    , (TypeRule  ,)
    )
```

Taxonomy of the file:

- It must contains, at least, the two tables:
  - `parametersTable`, defines & initialise the configuration variables.
  - `layoutTables`, defines how the various parameters will be displayed in the configuration window (The Settings Tab).
- The `parametersTable`, is a tuple (list) of tuples. Each entry in the list describe a configuration parameter. In it's simplest form, it's a quadruplet `(TypeOption, 'paramId', ParameterType, DefaultValue)` with:
  1. `TypeOption`, tells that this tuple describe a parameter.
  2. `paramId`, the identifier of the parameter. Identifiers are defined by the tools. The list of parameters is detailed in each tool section.
  3. `ParameterType`, the kind of parameter. Could be:
     - `TypeBool`, boolean.
     - `TypeInt`, signed integer.
     - `TypeEnumerate`, enumerated type, needs extra entry.
     - `TypePercentage`, percentage, expressed between 0 and 100.
     - `TypeDouble`, float.
     - `TypeString`, character string.
  4. `DefaultValue`, the default value for that parameter.

Hacking the Configuration Files

Asides from the symbols that gets used by the configuration helpers like `allianceConfig` or `parametersTable`, you can put pretty much anything in `<CWD>/.coriolis2.conf` (that is, written in PYTHON).

For example:

```
# -*- Mode:Python -*-

defaultStyle = 'Alliance.Classic [black]'

# Regular Coriolis configuration.
parametersTable = \
    ( ('misc.catchCore'          , TypeBool      , False  )
    , ('misc.info'               , TypeBool      , False  )
    , ('misc.paranoid'           , TypeBool      , False  )
    , ('misc.bug'                , TypeBool      , False  )
    , ('misc.logMode'            , TypeBool      , True   )
    , ('misc.verboseLevel1'      , TypeBool      , False  )
    , ('misc.verboseLevel2'      , TypeBool      , True   )
    , ('misc.traceLevel'         , TypeInt       , 1000   )
    )

# Some ordinary Python script...
import os
```

```
print '       o  Cleaning up ClockTree previous run.'
for fileName in os.listdir('.'):
  if fileName.endswith('.ap') or (fileName.find('_clocked.') >= 0):
    print '          - <%s>' % fileName
    os.unlink(fileName)
```

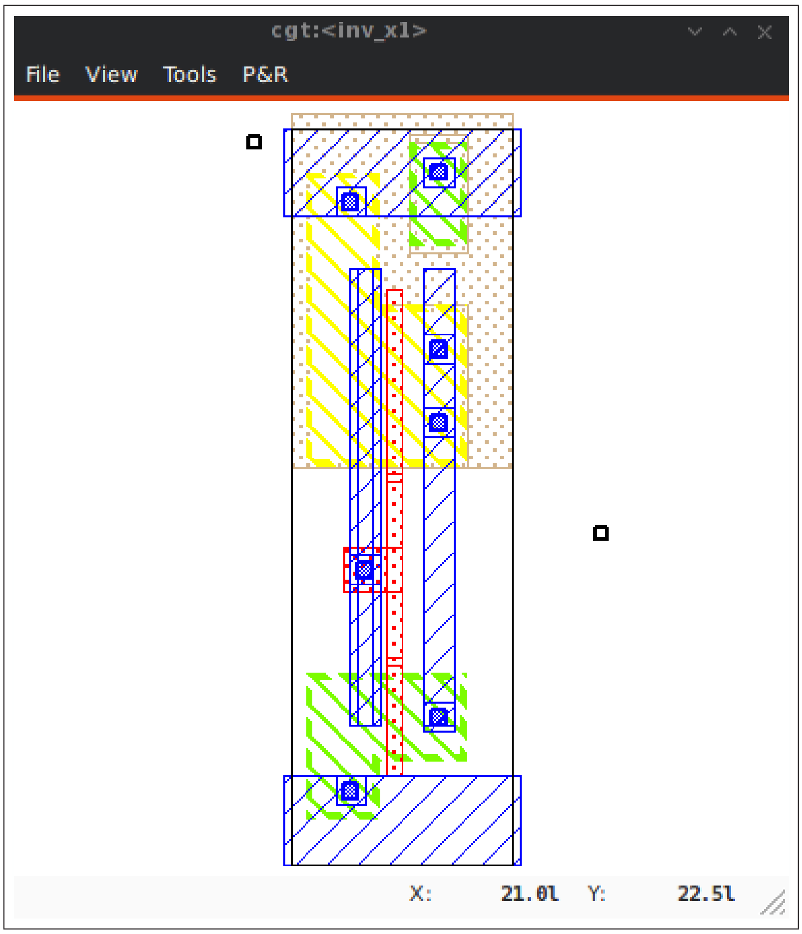
See Python Interface to Coriolis for more details those capabilities.

CGT - The Graphical Interface

The CORIOLIS graphical interface is split up into two windows.

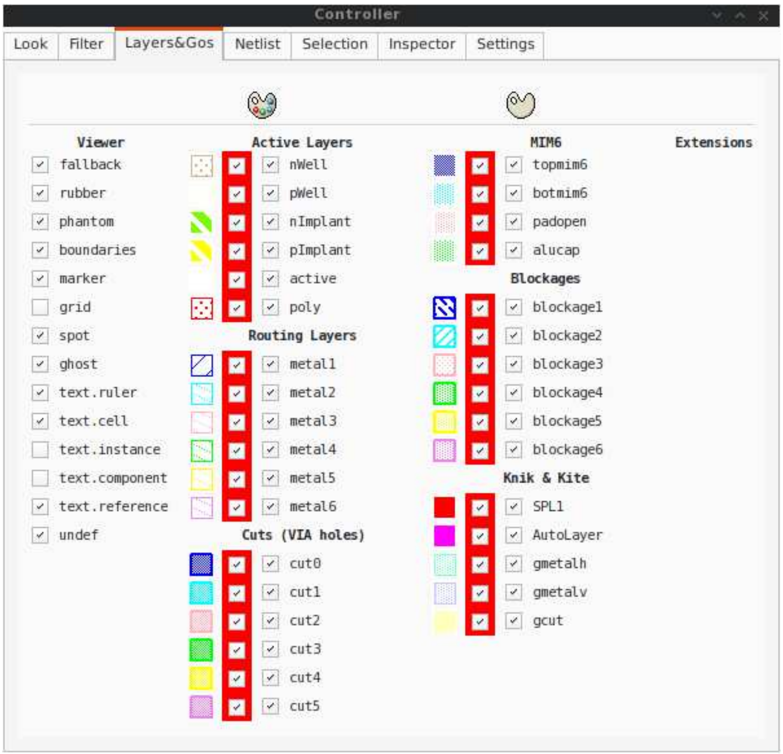
- The **Viewer**, with the following features:
  - Basic load/save capabilities.
  - Display the current working cell. Could be empty if the design is not yet placed.
  - Execute Stratus Scripts.
  - Menu to run the tools (placement, routage).

Features are detailed in Viewer & Tools.



- The **Controller**, which allows:
  - Tweak what is displayer by the *Viewer*. Through the *Look*, *Filter* and *Layers&Gos* tabs.
  - Browse the *netlist* with eponym tab.
  - Show the list of selected objects (if any) with *selection*

- Walk through the Database, the Cell or the Selection with *Inspector*. This is an advanced feature, reserved for experimented users.
- The tab *Settings* which give access to all the settings. They are closely related to Configuration & Initialisation.



Viewer & Tools

Stratus Netlist Capture

Stratus is the replacement for GenLib procedural netlist capture language. It is designed as a set of Python classes, and comes with it's own documentation (Stratus Documentation)

The Hurricane Data-Base

The Alliance flow is based on the MBK data-base, which has one data-structure for each view. That is, `Lofig` for the *logical* view and `Phfig` for the *physical* view. The place and route tools were responsible for maintaining (or not) the coherency between views. Reflecting this weak coupling between views, each one was stored in a separate file with a specific format. The *logical* view is stored in a `vst` file in VHDL format and the *physical* in an `ap` file in an ad-hoc format.

The Coriolis flow is based on the Hurricane data-base, which has a unified structure for *logical* and *physical* view. That data structure is the *Cell* object. The *Cell* can have any state between pure netlist and completly placed and routed design. Although the memory representation of the views has deeply changed we still use the Alliance files format, but they now really represent views of the same object. The point is that one must be very careful about view coherency when going to and from Coriolis.

As for the first release, Coriolis can be used only for two purposes :

- **Routing a design**, in that case the *netlist* view and the *layout* view must be present and *layout* view must contain a placement. Both views must have the same name. When saving the routed design, it is advised to change the design name otherwise the original unrouted placement in the *layout* view will be overwritten.

- **Viewing a design**, the *netlist* view must be present, if a *layout* view is present it still must have the same name but it can be in any state.

Mauka -- Placer

Mauka was originally designed to be a recursive quadri-partionner. Unfortunatly it is was based on the hMETIS library (*not* METIS) which is no longer maintained (only an old binary 32 bits version is available).

So now it is only working in simulated annealing, with performances identical to the Alliance placer `ocp`. In other words, it is slow...

> **Note**
>
> *Instance Duplication Problem:* a same logical instance cannot have two different placements. So, either you manually make a clone of it or you supply a placement for it. This is currently a drawback of our *folded hierarchy* approach.

Reseting the Placement
Once a placement has been done, the placer cannot reset it (will be implemented later). To perform a new placement, you must restart `cgt`. In addition, if you have saved the placement on disk, you must erase any `.ap` file, which are automatically reloaded along with the netlist (`.vst`).

Knik -- Global Router

The quality of Knik global routing solutions are equivalent to those of FGR 1.0. For an in-depth description of Knik algorithms, you may download the thesis of D. Dupuis avalaible from here~: Knik Thesis.

The global router is (not yet) deterministic. To circumvent this limitation, a global routing *solution* can be saved to disk and reloaded for later uses.

A global routing is saved into a file with the same name as the design and a `kgr` extention. It is in Box Router output format.

Menus:

- **P&R** → **Step by Step** → **Save Global Routing**.
- **P&R** → **Step by Step** → **Load Global Routing**.

Kite -- Detailed Router

Kite no longer suffers from the limitations of Nero. It can route big designs as its runtime and memory footprint is almost linear (with respect to the number of gates). It has successfully routed design of more than *150K* gates.

However, this first release comes with the temporary the following restrictions:

- Works only with SxLib standard cell gauge.
- Works always with 4 routing metal layers (*M2* through *M5*).
- Do not allow (take into account) pre-routed wires on signals other than power or ground.

> **Note**
>
> **Slow Layer Assignment.** Most of the time, the layer assignment stage is fast (less than a dozen seconds), but in some instances it can take more than a dozen *minutes*. This is a known bug and will be corrected in later releases.

After each run, KITE displays a set of *completion ratios* which must all be equal to *100%* if the detailed routing has been successfull. In the event of a failure, on a saturated design, you may decrease the *edge saturation ratio* (argument *--edge*) to balance more evenly the design saturation. That is, the maximum saturation decrease at the price of a wider saturated area and increased wirelength. This is the saturation of the *global* router KNIK, and you may increase/decrease by steps of 5%, which represent one track. The maximum capacity of the SXLIB gauge is 10 tracks in two layers, that makes 20 tracks by KNIK edge.

Routing a design is done in three ordered steps:

1. Global routing **P&R** → **Step by Step** → **Global Route**.
2. Detailed routing **P&R** → **Step by Step** → **Detailed Route**.
3. Finalize routing **P&R** → **Step by Step** → **Finalize Route**.

After the detailed routing step the KITE data-structure is still active. The wiring is thus represented in a way that allows KITE to manage it but which is not completly finished. The finalize step performs the removal of the KITE data-structure and finish/cleanup the wiring so that its connex in the sense of HURRICANE. *Do not* try to save your design before that step, you would get gaps in it.

You may visualize the density (saturation) of either KNIK (on edges) or KITE (on GCells) until the routing is finalized. Special layers appears to that effect in the The Layers&Go Tab.

Kite Configuration Parameters As KNIK is only called through KITE, it's parameters also have the `kite.` prefix.

The KATABATIC parameters control the layer assignment step.

All the defaults value given below are from the default ALLIANCE technology (`cmos` and `SxLib` cell gauge/routing gauge).

Parameter Identifier	Type	Default
Katabatic Parameters		
`katabatic.topRoutingLayer`	TypeString	`METAL5`
	Define the highest metal layer that will be used for routing (inclusive).	
`katabatic.globalLengthThreshold`	TypeInt	1450
	This parameter is used by a layer assignment method which is no longer used (did not give good results)	
`katabatic.saturateRatio`	TypePercentage	80
	If `M(x)` density is above this ratio, move up feedthru global segments up from depth `x` to `x+2`	
`katabatic.saturateRp`	TypeInt	8
	If a GCell contains more terminals (`RoutingPad`) than that number, force a move up of the connecting segments to those in excess	
Knik Parameters		
`kite.hTracksReservedLocal`	TypeInt	3
	To take account the tracks needed *inside* a GCell to build the *local* routing, decrease the capacity of the edges of the global router. Horizontal and vertical locally reserved capacity can be distinguished for more accuracy.	
`kite.vTracksReservedLocal`	TypeInt	3
	cf. `kite.hTracksReservedLocal`	
Kite Parameters		
`kite.eventsLimit`	TypeInt	4000002
	The maximum number of segment displacements, this is a last ditch safety against infinite loop. It's perhaps a little too low for big designs	

... continued on next page

Parameter Identifier	Type	Default
`kite.ripupCost`	TypeInt	3
	Differential introduced between two ripup cost to avoid a loop between two ripped up segments	
`kite.strapRipupLimit`	TypeInt	16
	Maximum number of ripup for *strap* segments	
`kite.localRipupLimit`	TypeInt	9
	Maximum number of ripup for *local* segments	
`kite.globalRipupLimit`	TypeInt	5
	Maximum number of ripup for *global* segments, when this limit is reached, triggers topologic modification	
`kite.longGlobalRipupLimit`	TypeInt	5
	Maximum number of ripup for *long global* segments, when this limit is reached, triggers topological modification	

Executing Python Scripts in Cgt

Python/Stratus scripts can be executed either in text or graphical mode.

> **Note**
> **How Cgt Locates Python Scripts:** `cgt` uses the Python `import` mechanism to load Python scripts. So you must give the name of your script whitout `.py` extension and it must be reachable through the `PYTHONPATH`. You may uses the dotted module notation.

A Python/Stratus script must contains a function called `ScriptMain()` with one optional argument, the graphical editor into which it may be running (will be set to `None` in text mode). The Python interface to the editor (type: `CellViewer`) is limited to basic capabilities only.

Any script given on the command line will be run immediatly *after* the initializations and *before* any other argument is processed.

For more explanation on Python scripts see Python Interface to Coriolis.

Printing & Snapshots

Printing or saving into a PDF is fairly simple, just uses the **File -> Print** menu or the CTRL + p shortcut to open the dialog box.

The print functionality uses exactly the same rendering mechanism as for the screen, beeing almost *WYSIWYG*. Thus, to obtain the best results it is advisable to select the `Coriolis.Printer` look (in the *Controller*), which uses a white background and much suited for high resolutions 32x32 pixels patterns

There is also two mode of printing selectable through the *Controller* **Settings -> Misc -> Printer/Snapshot Mode**:

Mode	DPI (approx.)	Intended Usage
Cell Mode	150	For single `Cell` printing or very small designs. Patterns will be bigger and more readable.
Design Mode	300	For designs (mostly commposed of wires and cells outlines).

> **Note**
> *The pdf file size* Be aware that the generated PDF files are indeed only pixmaps. So they can grew very large if you select paper format above A2 or similar.

Saving into an image is subject to the same remarks as for PDF.

Memento of Shortcuts in Graphic Mode

The main application binary is `cgt`.

Category	Keys	Action
Moves	Up, Down Left, Right	Shift the view in the according direction
Fit	f	Fit to the Cell abutment box
Refresh	CTRL + l	Triggers a complete display redraw
Goto	G	*apperture* is the minimum side of the area displayed around the point to go to. It's an alternative way of setting the zoom level
Zoom	z, m	Respectively zoom by a 2 factor and *unzoom* by a 2 factor
	 Area Zoom	You can perform a zoom to an area. Define the zoom area by *holding down the left mouse button* while moving the mouse.
Selection	 Area Selection	You can select displayed objects under an area. Define the selection area by *holding down the right mouse button* while moving the mouse.
	 Toggle Selection	You can toggle the selection of one object under the mouse position by pressing CTRL and pressing down *the right mouse button*. A popup list of what's under the position shows up into which you can toggle the selection state of one item.
	S	Toggle the selection visibility
Controller	CTRL + i	Show/hide the controller window. It's the Swiss Army Knife of the viewer. From it, you can fine-control the display and inspect almost everything in your design.

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Category	Keys	Action
Rulers	k, ESC	One stroke on k enters the ruler mode, in which you can draw one ruler. You can exit the ruler mode by pressing ESC. Once in ruler mode, the first click on the *left mouse button* sets the ruler's starting point and the second click the ruler's end point. The second click exits automatically the ruler mode.
	K	Clears all the drawn rulers
Print	CTRL + p	Currently rather crude. It's a direct copy of what's displayed in pixels. So the resulting picture will be a little blurred due to anti-aliasing mechanism.
Open/Close	CTRL + o	Opens a new design. The design name must be given without path or extention.
	CTRL + w	Close the current viewer window, but do not quit the application.
	CTRL + q	*CTRL+Q* quit the application (closing all windows).
Hierarchy	CTRL + Down	Go one hierarchy level down. That is, if there is an *instance* under the cursor position, load it's *model* Cell in place of the current one.
	CTRL + Up	Go one hierarchy level up. if we have entered the current model through CTRL + Down, reload the previous model (the one in which this model is instanciated).

Cgt Command Line Options

Appart from the obvious `--text` options, all can be used for text and graphical mode.

Arguments	Meaning
-t|--text	Instruct `cgt` to run in text mode.
-L|--log-mode	Disable the uses of ANSI escape sequence on the `tty`. Useful when the output is redirected to a file.
-c <cell>|--cell=<cell>	The name of the design to load, without leading path or extention.
-g|--load-global	Reload a global routing solution from disk. The file containing the solution must be named *<cell>.kgr*.
--save-global	Save the global routing solution, into a file named *<design>.kgr*.
-e <ratio>|--edge=<ratio>	Change the edge capacity for the global router, between 0 and 1 (KNIK).
-G|--global-route	Run the global router (KNIK).
-R|--detailed-route	Run the detailed router (KITE).
-s|--save-design=<routed>	The design into which the routed layout will be saved. It is strongly recommanded to choose a different name from the source (unrouted) design.

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Arguments	Meaning
--events-limit=<count>	The maximal number of events after which the router will stops. This is mainly a failsafe against looping. The limit is sets to 4 millions of iteration which should suffice to any design of *100K*. gates. For bigger designs you may wants to increase this limit.
--stratus-script=<module>	Run the Python/Stratus script `module`. See Python Scripts in Cgt.

Some Examples :

- Run both global and detailed router, then save the routed design :

```
> cgt -v -t -G -R --cell=design --save-design=design_kite
```

- Load a previous global solution, run the detailed router, then save the routed design :

```
> cgt -v -t --load-global -R --cell=design --save-design=design_kite
```

- Run the global router, then save the global routing solution :

```
> cgt -v -t -G --save-global --cell=design
```

Miscellaneous Settings

Parameter Identifier	Type	Default
Verbosity/Log Parameters		
`misc.info`	TypeBool	`False`
	Enable display of *info* level message (`cinfo` stream)	
`misc.bug`	TypeBool	`False`
	Enable display of *bug* level message (`cbug` stream), messages can be a little scarry	
`misc.logMode`	TypeBool	`False`
	If enabled, assume that the output device is not a `tty` and suppress any escaped sequences	
`misc.verboseLevel1`	TypeBool	`True`
	First level of verbosity, disable level 2	
`misc.verboseLevel2`	TypeBool	`False`
	Second level of verbosity	
Development/Debug Parameters		
`misc.traceLevel`	TypeInt	`0`
	Display trace information *below* that level (`ltrace` stream)	
`misc.catchCore`	TypeBool	`False`
	By default, `cgt` do not dump core. To generate one set this flag to `True`	

The Controller

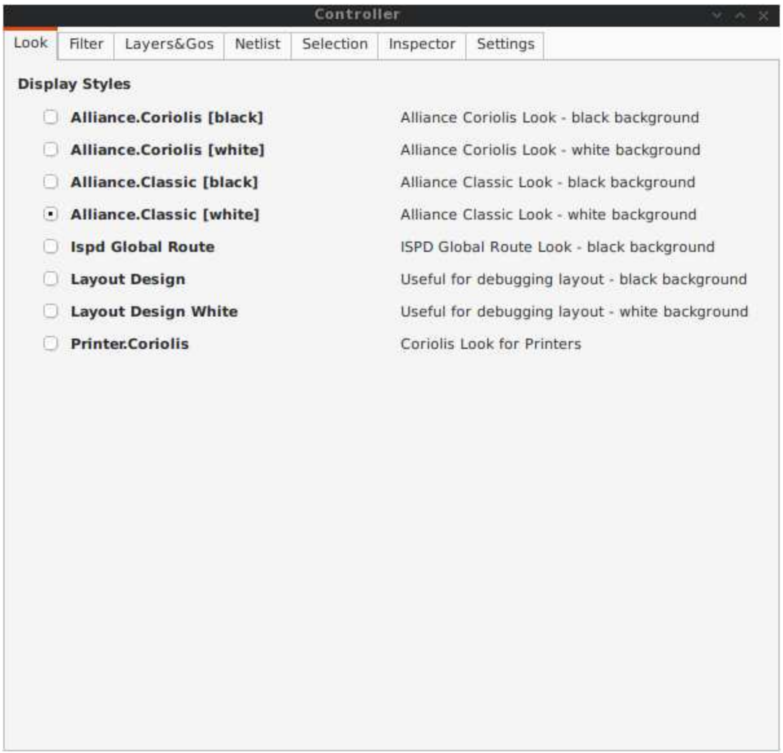
The *Controller* window is composed of seven tabs:

1. The Look Tab to select the display style.

2. The Filter Tab the hierarchical levels to be displayed, the look of rubbers and the dimension units.
3. The Layers&Go Tab to selectively hide/display layers.
4. The Netlist Tab to browse through the *netlist*. Works in association with the *Selection* tab.
5. The Selection Tab allow to view all the currently selected elements.
6. The Inspector Tab browse through either the DataBase, the Cell or the current selection.
7. The Settings Tab access all the tool's configuration settings.

The Look Tab

You can select how the layout will be displayed. There is a special one `Printer.Coriolis` specifically designed for Printing & Snapshots. You should select it prior to calling the print or snapshot dialog boxes.



The Filter Tab

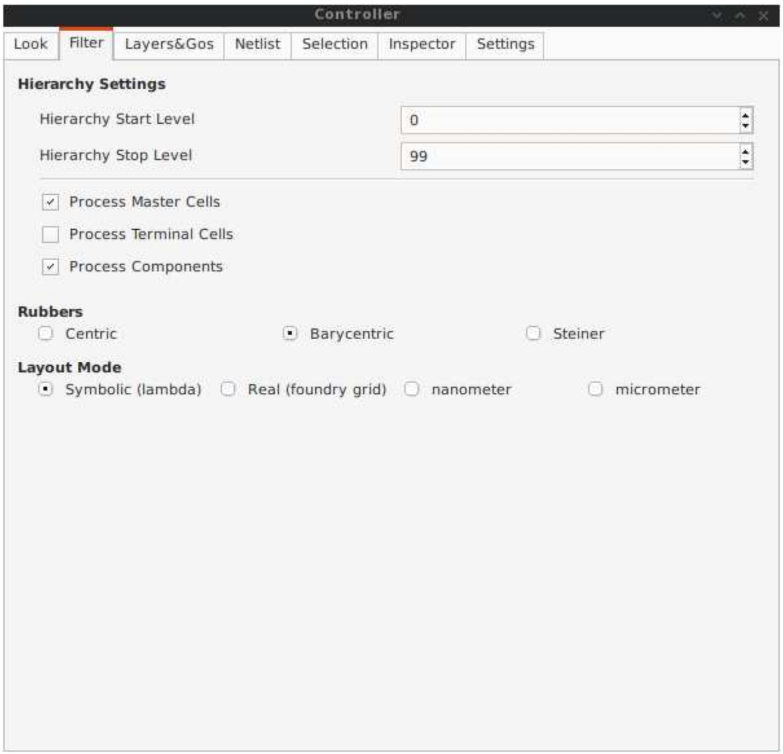
The filter tab let you select what hierarchical levels of your design will be displayed. Hierarchy level are numbered top-down: the level 0 correspond to the top-level cell, the level one to the instances of the top-level Cell and so on.

There are also check boxes to enable/disable the processing of Terminal Cell, Master Cells and Compnents. The processing of Terminal Cell (hierarchy leaf cells) is disabled by default when you load a hierarchical design and enabled when you load a single Cell.

You can choose what kind of form to give to the rubbers and the type of unit used to display coordinates.

Note

What are Rubbers: HURRICANE uses *Rubbers* to materialize physical gaps in net topology. That is, if some wires are missing to connect two or more parts of net, a *rubber* will be drawn between them to signal the gap.
For example, after the detailed routing no *rubbers* should remains. They have been made *very* visibles as big violet lines...



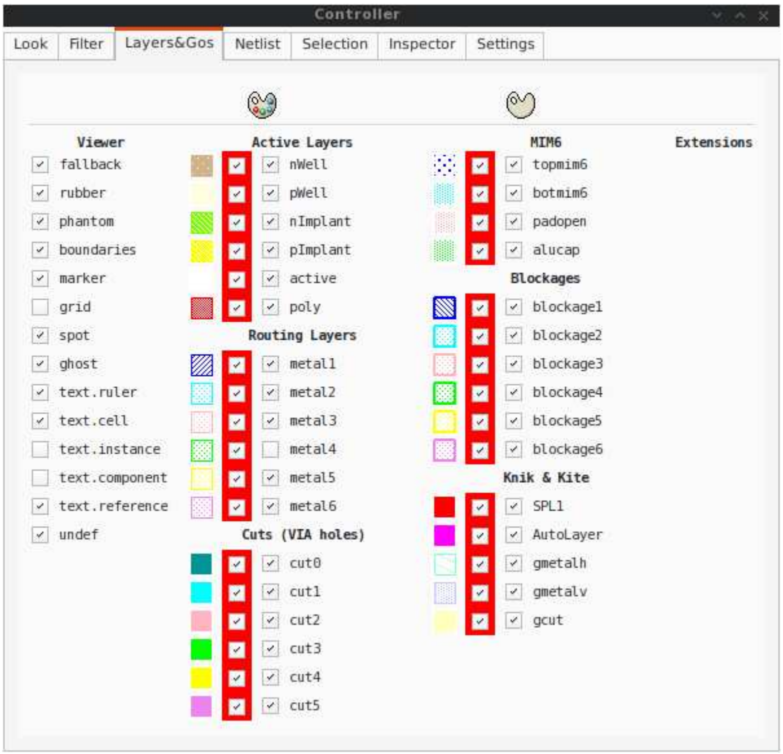
The Layers&Go Tab

Control the individual display of all *layers* and *Gos*.

- *Layers* correspond to a true physical layer. From a HURRICANE point of view they are all the *BasicLayers* (could be matched to GDSII).
- *Gos* stands from *Graphical Objects*, they are drawings that have no physical existence but are added by the various tools to display extra information. One good exemple is the density map of the detailed router, to easily locate congested areas.

For each layer/Go there are two check boxes:

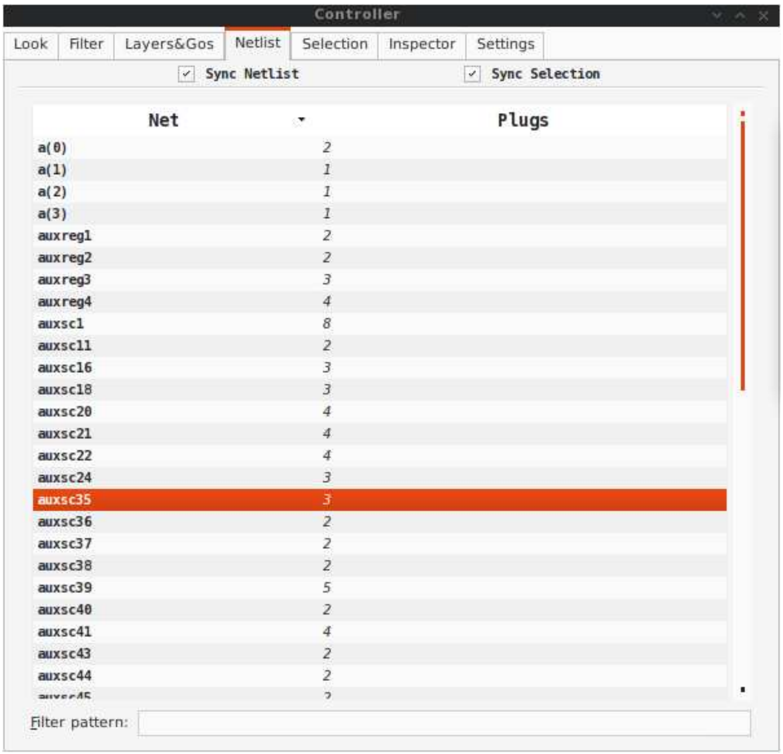
- The normal one triggers the display.
- The red-outlined allows objects of that layer to be selectable or not.

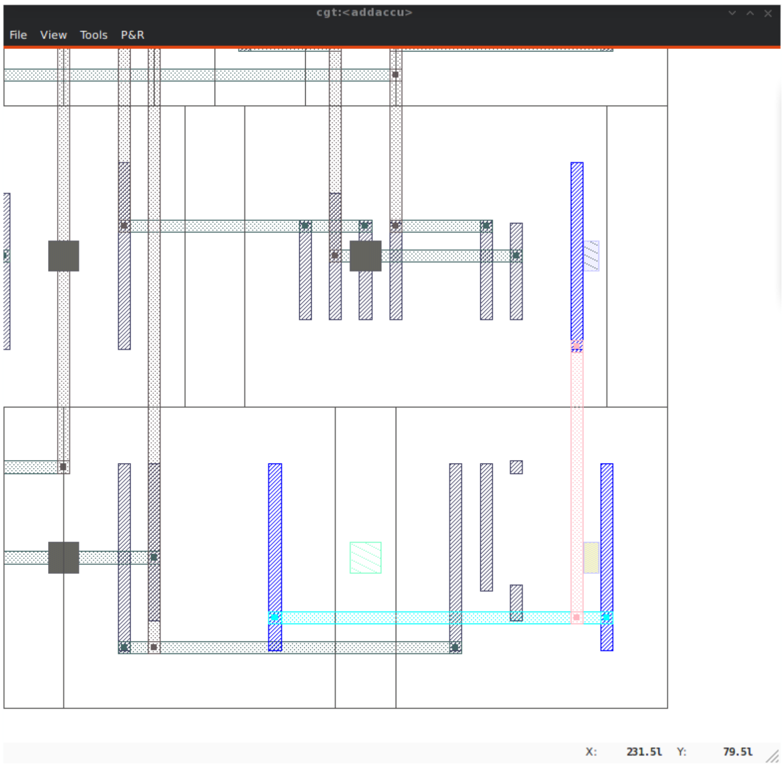


The Netlist Tab

The *Netlist* tab shows the list of nets... By default the tab is not *synched* with the displayed Cell. To see the nets you must check the **Sync Netlist** checkbox. You can narrow the set of displayed nets by using the filter pattern (supports regular expressions).

An very useful feature is to enable the **Sync Selection**, which will automatically select all the components of the selected net(s). You can select multiple nets. In the figure the net `auxsc35` is selected and is highlited in the *Viewer*.



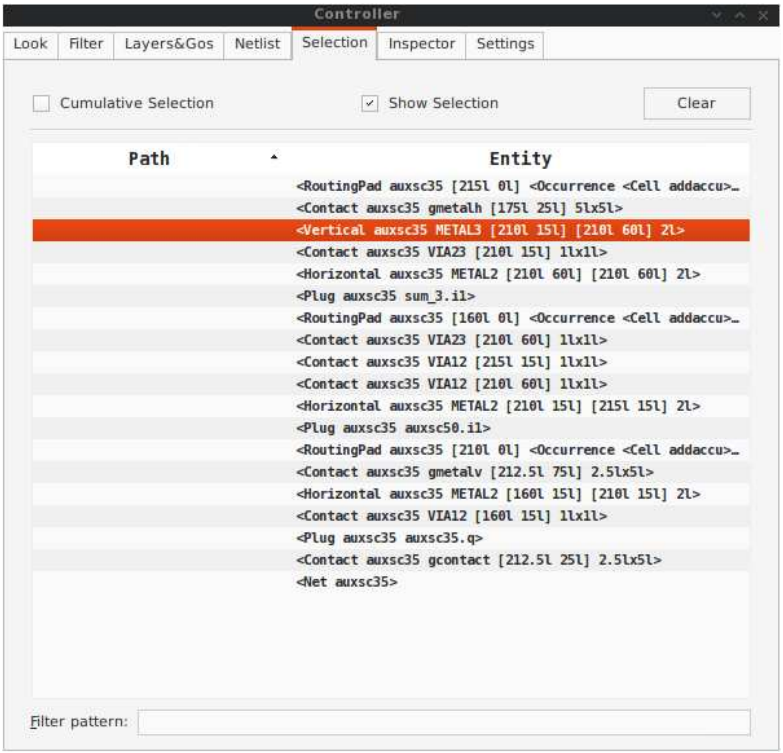


The Selection Tab

The *Selection* tab list all the components currently selecteds. They can be filtered thanks to the filter pattern.

Used in conjunction with the *Netlist* **Sync Selection** you will all see all the components part of *net*.

In this list, you can toggle individually the selection of component by pressing the `t` key. When unselected in this way a component is not removed from the the selection list but instead displayed in red italic. To see where a component is you may make it blink by repeatedly press the `t` key...



The Inspector Tab

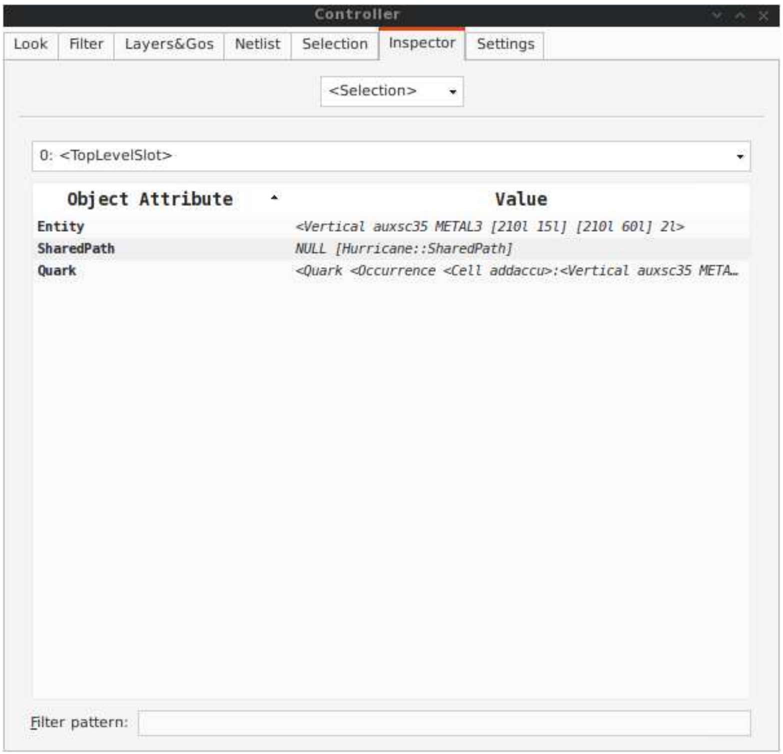
This tab is very useful, but mostly for CORIOLIS developpers. It allows to browse through the live DataBase. The *Inspector* provide three entry points:

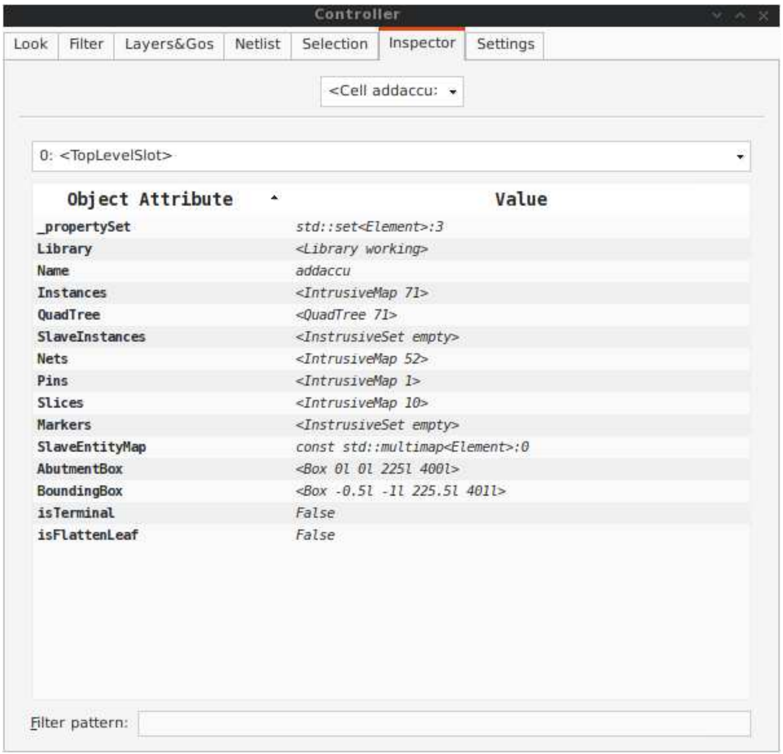
- **DataBase**: Starts from the whole HURRICANE DataBase.
- **Cell**: Inspect the currently loaded Cell.
- **Selection**: Inspect the object currently highlited in the *Selection* tab.

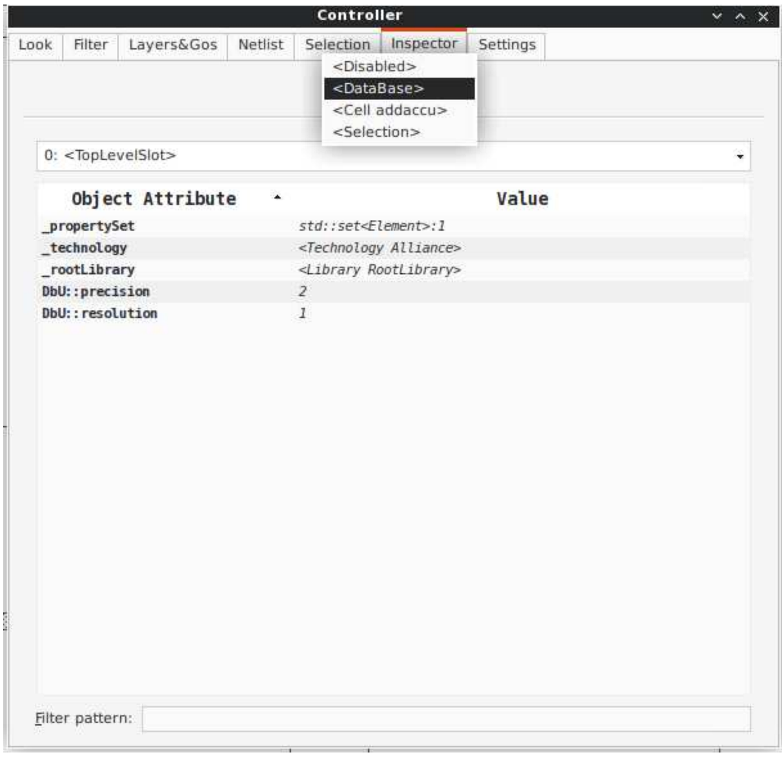
Once an entry point has been activated, you may recursively expore all it's fields using the right/left arrows.

> **Note**
> *Do not put your fingers in the socket:* when inspecting anything, do not modify the DataBase. If the any object under inspection is deleted, you will crash the application...

> **Note**
> *Implementation Detail:* the inspector support is done with `Slot`, `Record` and `getString()`.

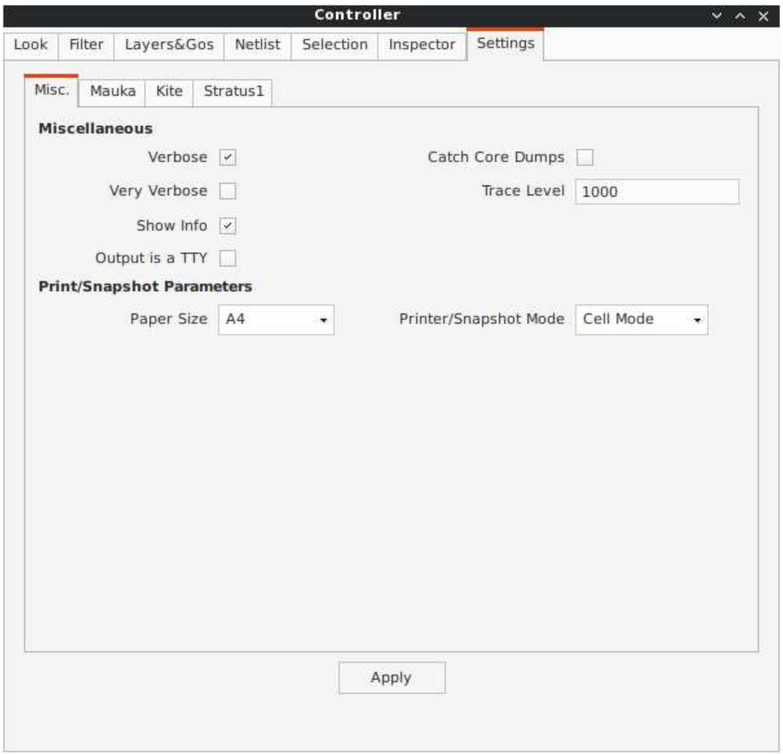

Controller
Look
Filter
Layers&Gos
Netlist
Selection
Inspector
Settings
<Selection>
0: <TopLevelSlot>
Object Attribute
Value
Entity
<Vertical auxsc35 METAL3 [210l 15l] [210l 60l] 2l>
SharedPath
NULL [Hurricane::SharedPath]
Quark
<Quark <Occurrence <Cell addaccu>:<Vertical auxsc35 META…
Filter pattern:


Controller
Look
Filter
Layers&Gos
Netlist
Selection
Inspector
Settings
<Cell addaccu:
0: <TopLevelSlot>
Object Attribute
Value
_propertySet
std::set<Element>:3
Library
<Library working>
Name
addaccu
Instances
<IntrusiveMap 71>
QuadTree
<QuadTree 71>
SlaveInstances
<InstrusiveSet empty>
Nets
<IntrusiveMap 52>
Pins
<IntrusiveMap 1>
Slices
<IntrusiveMap 10>
Markers
<InstrusiveSet empty>
SlaveEntityMap
const std::multimap<Element>:0
AbutmentBox
<Box 0l 0l 225l 400l>
BoundingBox
<Box -0.5l -1l 225.5l 401l>
isTerminal
False
isFlattenLeaf
False
Filter pattern:



The Settings Tab

Here comes the description of the *Settings* tab.



Python Interface for HURRICANE / CORIOLIS

The (almost) complete interface of HURRICANE is exported as a PYTHON module and some part of the other components of CORIOLIS (each one in a separate module). The interface has been made to mirror as closely as possible the C++ one, so the C++ doxygen documentation could be used to write code with either languages.

Summary of the C++ Documentation

A script could be run directly in text mode from the command line or through the graphical interface (see Python Scripts in Cgt).

Asides for this requirement, the python script can contains anything valid in PYTHON, so don't hesitate to use any package or extention.

Small example of Python/Stratus script:

```
from Hurricane import *
from Stratus   import *

def doSomething ():
    # ...
    return

def ScriptMain ( editor=None ):
  if globals().has_key( "__editor" ): editor = __editor
  if editor: setEditor( editor )

  doSomething()
  return

if __name__ == "__main__" :
  ScriptMain ()
```

This script could be run directly with Python (thanks to the two last lines) or through `cgt` in both text and graphical modes through the `ScriptMain()` function.

A Simple Example: AM2901

To illustrate the capabilities of CORIOLIS tools and PYTHON scripting, a small example, derived from the ALLIANCE `AM2901` is supplied.

This example contains only the synthetized netlists and the `design.py` script which perform the whole P&R of the design. Just lanch `cgt` then execute `design.py`.