Analysator

What is Analysator

1. An analysis tool developed for vlasiator
2. Originally developed as a pointn'click tool to get a velocity distributions
3. Functions optimized with Scipy and Numpy libraries (close to C performance)

Functions

1. Reading and writing *numpy* arrays with *VLSV* files
2. Various *analysis* tools
   2.1 time-evolution of cells
   2.2 cut-throughs
   2.3 pitch angle distributions
   2.4 Can be combined with *every* python module and function
   2.5 ..
3. Plotting using *matplotlib*
4. Plotting Vlasiator *grids* using MayaVi library
5. An interface to Urs' superb *particle pusher*
6. Full easy-to-use *documentation* for every function

Example

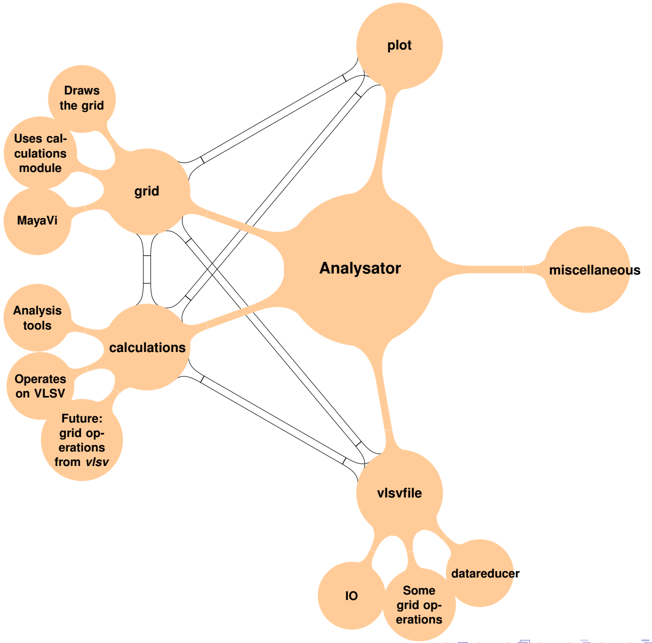
```python
# We are interested in reading data from the cell whose ID is 75

import pytools as pt # Import Analysator

# Open a vlsv file for reading
vlsvReader = pt.vlsvfile.VlsvReader('bulk.0003710.vlsv')

# Read a variable at cell id 75
rho = vlsvReader.read_variable( name='rho', cellids=75 )
```

Modules in Analysator



Navigation

Navigating through the code is the most important thing

```
# Import analysator
import pytools as pt

vlsvReader = pt.vlsvfile.VlsvReader('test.vlsv') #What?

cut_through = pt.calculations.cut_through(vlsvReader, point1=[0,0,0], point2=[2,5e6,0])
```

1. Otherwise you need to remember
   1.1 The name of the cut_through function
   1.2 The first function argument: *vlsvReader*
   1.3 The second argument: *point1*
   1.4 The third argument: *point2*
   1.5 The second and third argument's format and dimensions *(3d list)*

Navigation (the *most* important part)

```
# Import analysator
import pytools as pt

pt.
```

tab

```
In [2]: pt.
pt.calculations     pt.grid            pt.plot
pt.filemanagement   pt.miscellaneous   pt.vlsvfile
```

Navigation (the *most* important part)

```
# Import analysator
import pytools as pt

pt.calculations.
```

tab

```
pt.calculations.cell_time_evolution
pt.calculations.cut3d
pt.calculations.cut_through
pt.calculations.fit
pt.calculations.fourier
pt.calculations.gyrophase_angles_from_file
pt.calculations.lineout
pt.calculations.pitch_angles
pt.calculations.VariableInfo
```

Navigation (the *most* important part)

```
# Import analysator
import pytools as pt

pt.calculations.cut_through?
```

Enter

```
In [2]: pt.calculations.cut_through?
Definition: pt.calculations.cut_through(vlsvReader, point1, point2)
Docstring:
Returns cell ids and distances from point 1 for every cell in a line between
given point1 and point2

:param vlsvReader:       Some open VlsvReader
:type vlsvReader:        :class:`vlsvfile.VlsvReader`
:param point1:           The starting point of a cut-through line
:param point2:           The ending point of a cut-through line
:returns: an array containing cell ids, coordinates and distances in the following
format: [cell ids, distances, coordinates]

.. code-block:: python

   Example:
   vlsvReader = VlsvReader("testfile.vlsv")
   cut_through = cut_through(vlsvReader, [0,0,0], [2,5e6,0])
   cellids = cut_through[0]
   distances = cut_through[1]
   print "Cell ids: " + str(cellids)
   print "Distance from point 1 for every cell: " + str(distances)
```

Navigation summary

```
pt.calculations.
```

tab Autocompletion

```
pt.calculations?
```

Enter Getting documentation

Basic usage

1. Open a *vlsv* file
2. Read from the *vlsv* file
3. Operate on the data

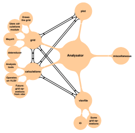
Basic usage

```python
# Import analysator
import pytools as pt

# Open a vlsv file
vlsvReader = pt.vlsvfile.VlsvReader('test.vlsv')

# Read vlsv data
rho = vlsvReader.read_variable('rho')
```

Examples

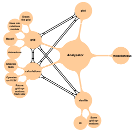


Hands-on

Note: if you have virtualbox you have to set up a shared folder:

```
sudo mount -t vboxsf -o rw,uid=1000,gid=1000 \
vlsv_data $HOME/share
```

Example from *calculations*



```
# Import analysator
import pytools as pt

# Open a vlsv file
vlsvReader = pt.vlsvfile.vlsvReader('testfile.vlsv')

# Get a cut-through starting at (x=0, y=0; z=0) to (x=2, y=5e6, z=0) :
cut_through = pt.calculations.cut_through(vlsvReader, point1=[0,0,0], point2=[2,5e6,0])

# We now have the cut_through, so now we want to print cellids:
cellids = cut_through[0]
print cellids
```