UNIVERSITY OF BIRMINGHAM

Software Preparation for Modelling Workshop

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Contents

1   Introduction

This document provides information on getting started for a hands-on session on optical simulations. The aim of the hands-on sessions is to provide a basic introduction to concepts behind the optical simulation tools used in the gravitational wave community by working directly with code and with simulation tools.

Computers with the modelling software should be provided by the school. However, it might be more convenient if you work on your personal laptop. The installation instructions below should guide you though the process of installing all the required software packages. If you have questions or need help, you can contact us at: finesse@star.sr.bham.ac.uk

2   Installation for simulation tools

Our hands-on session will make use of **Python** and **Jupyter notebook**. The Python ecosystem has to be installed first. The way we recommend to run Finesse and PyKat is through the Conda package manager: http://conda.pydata.org/miniconda.html. We have created Conda packages to automate and easily install both PyKat and Finesse in one command.

Figure 1: We recommend running Python 3 (Python 2 is now being phased out) so select the installer according to the operating system of your computer.

From the section titles pick the one that suits your current condition the most.

2.1   I am a Python user and have Anaconda/Conda installed already (Windows, OSX, or Linux)

If you already use Anaconda or Miniconda on your system, then installation is very easy! You can just straight ahead to section 2.5.1.

2.2   I am a Python user and have my own environment already set up that I want to use

If you have Python already installed on your machine and you are using it regularly for other tasks, you might not want to follow the instructions exactly as they are written below, as you don't want to interfere with your previous Python setup. You can install Conda as per the instructions below just to try out Finesse and in such a way that it doesn't interfere with your Python setup as you have it. You need to follow the instructions below as described for your operating system. On Windows you can install Conda, Pykat, and

Finesse and it will be entirely separate from your original setup, if you don't want it anymore just uninstall it. On OSX and Linux, you should follow the instructions below but should avoid the commands that edit the `/bash_profile` changing the PATH variable and setting a default environment to start up. Just Install it and call the `miniconda3/bin/activate` tool just when you want to use Finesse. This will temporarily setup your environment to use the Pykat and Finesse tools but is easily deactivated and returned to your normal setup.

For those that don't want to use Conda at all you need to install the Finesse binary file for your operating, please see the installation instructions for Finesse and PyKat on the project pages at: http://www.gwoptics.org/finesse and http://www.gwoptics.org/pykat on how to do this.

If you're not sure what to do at any point and have general questions about setting it all up, please email us at finesse@star.sr.bham.ac.uk and we'll be happy to advise you.

2.3   For Windows users without Conda installed

First download the Python 3 Miniconda installer from the website linked above. Double click on the *.exe and follow the instruction on screen. You can just use all default settings given by the installer. Once the Miniconda has been installed, search for **Anaconda Prompt** in the start menu. This could be in the **Anaconda** folder. See Figure 2.
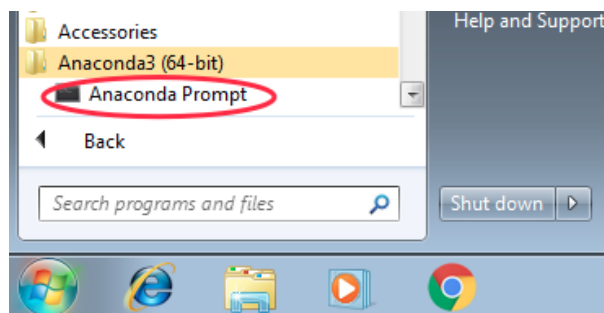

Figure 2

This will open a new command window which can run Conda and Python. Type: `conda info`. If the installation has been successful, you should see the information related to Conda on the screen (see Figure 3).
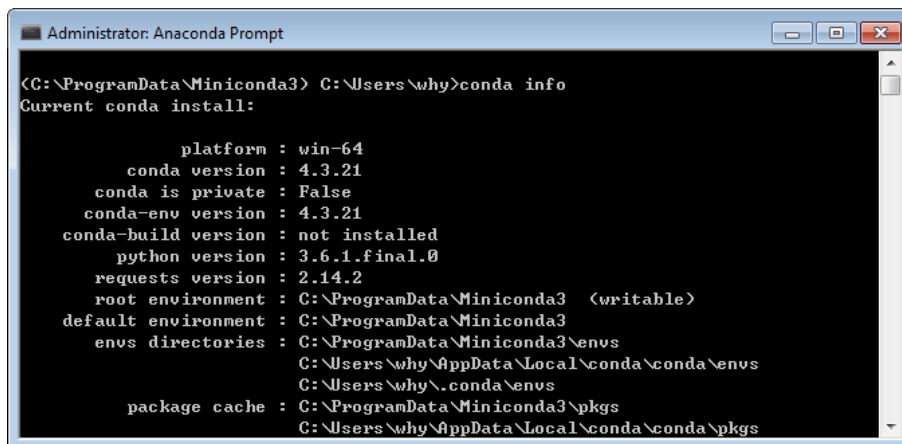
Now move on to section 2.5.1.

2.4   For Mac OSX without Conda installed

Open up a new Terminal window. Here we will download the latest Conda installer and setup the terminal to use the default environment. Run each command one after another:

```
curl "https://repo.continuum.io/miniconda/Miniconda3-latest-MacOSX-x86_64.sh" -o ~/Miniconda3.sh
bash ~/Miniconda3.sh -b
echo #Added during Finesse and Pykat Conda installation >> ~/.bash\_profile
echo export PATH="~/miniconda3/bin:\$PATH" >> ~/.profile
echo source activate root >> ~/.profile
source ~/.profile
```

Type `conda info`, you should see a similar output to below:

Figure 3

```
Current conda install:

            platform : osx-64
       conda version : 4.3.21
     conda is private : False
    conda-env version : 4.3.21
  conda-build version : not installed
        python version : 3.6.1.final.0
      requests version : 2.14.2
      ...
```

The main Conda environment will be activated each time you open a new terminal and will be ready for you to use straight away. You can tell that the environment is activated by the fact that `(root)` should now appear before each line in the terminal. If you want to switch off the environment, simply type `source deactivate`. You can stop the environment from being permanently activated by removing the `source activate root` line from the file `/.profile` in your home directory.

Now move on to section 2.5.1.

2.5   For Linux users without Conda installed

Open up a new Terminal window. Here we will download the latest Conda installer and setup the terminal to use the default environment. Run each command one after another:

```
wget https://repo.continuum.io/miniconda/Miniconda3-latest-Linux-x86_64.sh -O ~/Miniconda3.sh
bash ~/Miniconda3.sh -b
echo #Added during Finesse and Pykat Conda installation >> ~/.bash\_profile
echo export PATH="~/miniconda3/bin:\$PATH" >> ~/.bash\_profile
echo source activate root >> ~/.bash\_profile
source ~/.bash\_profile
```

Type `conda info`, you should see a similar output to below:

```
Current conda install:
```

```
         platform : linux-64
    conda version : 4.3.21
 conda is private : False
 conda-env version : 4.3.21
conda-build version : not installed
    python version : 3.6.1.final.0
  requests version : 2.14.2
    ...
```

The main Conda environment will be activated each time you open a new terminal and will be ready for you to use straight away. You can tell that the environment is activated by the fact that `(root)` should now appear before each line in the terminal. If you want to switch off the environment, simply type `source deactivate`. You can stop the environment from being permanently activated by removing the `source activate root` line from the file `/.bash_profile` in your home directory.

Now move on to section 2.5.1.

2.5.1 Installing PyKat, Finesse and Jupyter with Conda

Note to Windows users: When we say open a Terminal, we mean open Anaconda Prompt from now on.

Open up a new Terminal window use the following commands one after another to install all packages we need:

`conda update conda`

`conda config --add channels gwoptics`

`conda install pykat jupyter`

`activate root`

Type `y` for yes when asked and wait for the installation complete. If you run the following command:

`python -c "import pykat"`

You should see the PyKat header. Then type:

`kat -v`

and it should show the Finesse version. If any errors appear at this stage please contact us at finesse@star.sr.bham.ac.uk.

One can see the list of the installed packages with the command `conda list`. Now see section 3 on Jupyter notebooks.

3 Using Jupyter notebook to run Finesse

Using Jupyter notebook is a nice way to keep your technical notes with results. The Jupyter notebook should already have been installed on your computer in Section 2.5.1.

For Windows system, to open the Jupyter notebook, open the **Anaconda Prompt** command window, and type `jupyter notebook`. Or you can also find it in your computer **Start** menu under **Anaconda** folder (see Figure 4).

For OS X and Linux system, to open the Jupyter notebook, open the **Terminal** window, and type `jupyter notebook`.
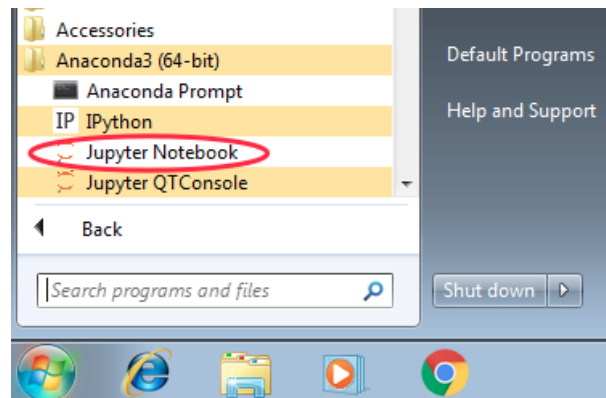
Figure 4

The Jupyter notebook will be opened with your default Internet browser. You can go to, or create, your preferred working folder. Press **New** and chose **Python 3** (shown in Figure 5) to create a new notebook.
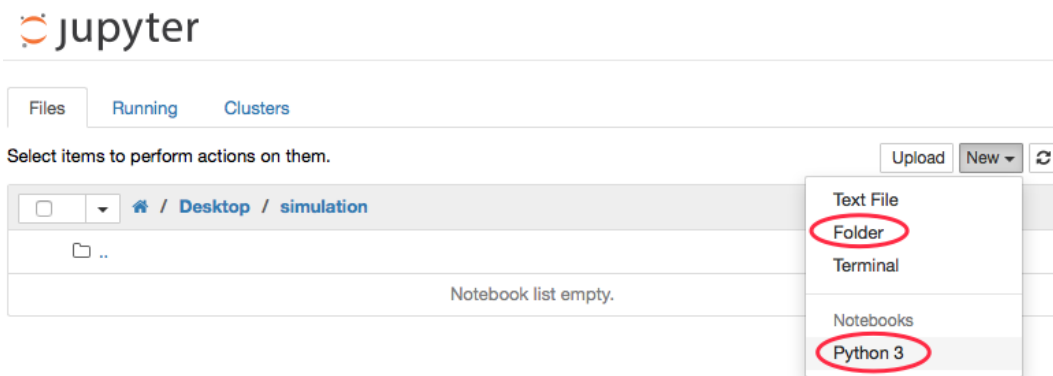

Figure 5