

Hydrogen and Fuel Cells



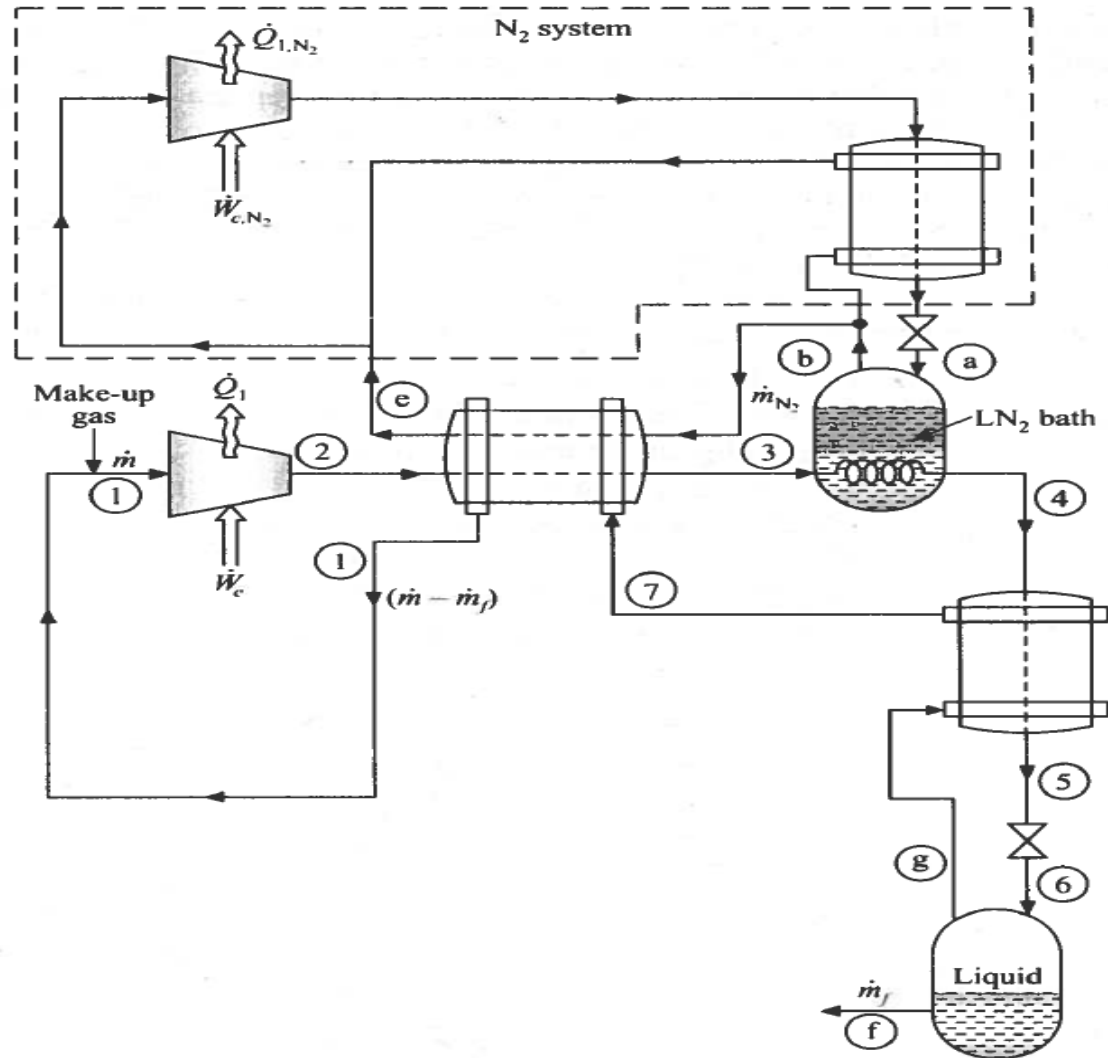
INSTALLATION OF ANACONDA AND COOLPROP

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Ing. Pivetta Davide

AY 2023 – 2024

Simple Linde-Hampson cycle for H₂ liquefaction





ANACONDA®

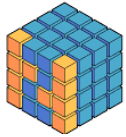
Introduction to Anaconda



Working environment suitable for using the Python programming language. Anaconda is one of the most widely used environments for data science and the development of calculation models.

ADVANTAGES:

- Rapid management of libraries and tools;
- Simplified development of calculation systems;
- Contains tools for data and performance analysis;
- Contains packages for graphical representation of results.



Numpy: package for scientific calculation (matrix operations, definition of functions, etc.)



Pandas: is a fast, powerful and flexible tool for the analysis and simple manipulation of data.



Matplotlib: is a comprehensive library for creating static, animated and interactive visualisations.



Spyder: is an Integrated Development Environment (IDE), used for writing, analysis, error correction, etc. (suitable for solving scientific and engineering problems).



Jupyter: is an interactive web-based development environment. It adapts to the user interface to support a wide range of workflows.



Download Anaconda

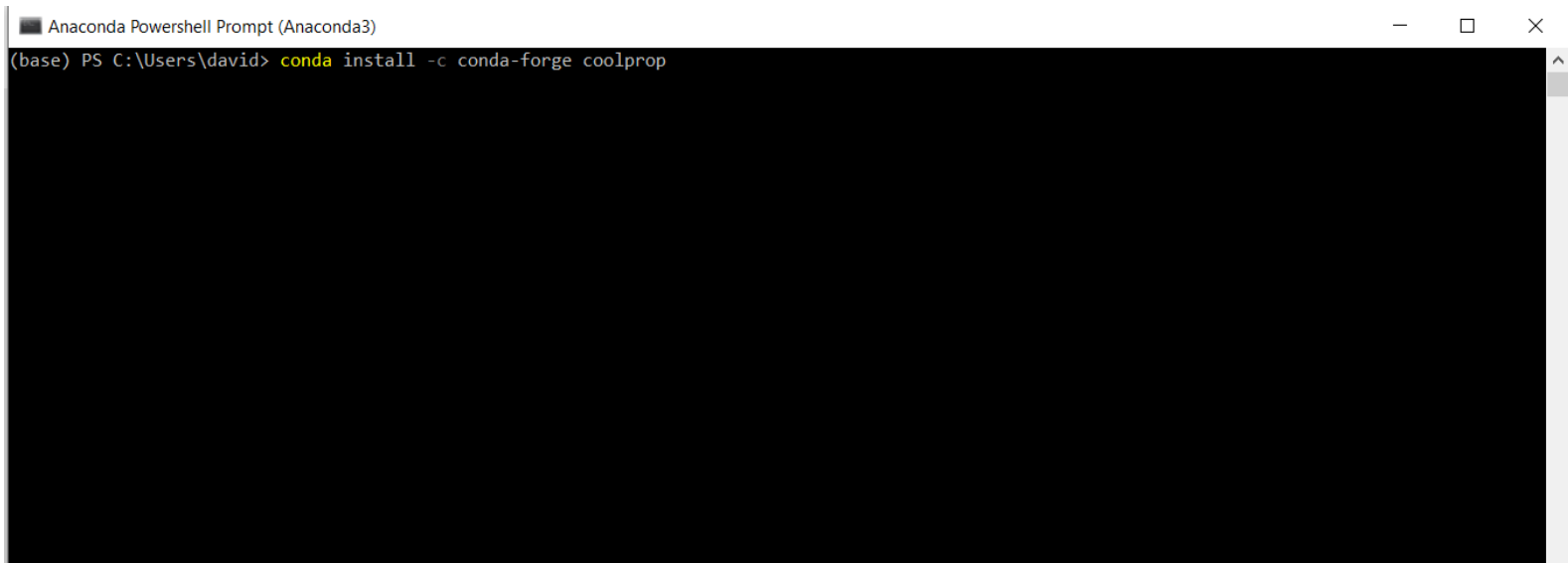


Download Anaconda:

<https://www.anaconda.com/distribution/>











Installation of Coolprop package

Write in powershell prompt:
`conda install conda-forge::coolprop`






```
Anaconda Powershell Prompt (Anaconda3)
(base) PS C:\Users\david> conda install -c conda-forge coolprop
```

Applications on base (root) Channels
Refresh

 <p>console_shortcut 0.1.1</p> <p>Console shortcut creator for Windows (using menuinst)</p> <p style="text-align: center;">Launch</p>	 <p>JupyterLab 1.1.4</p> <p>An extensible environment for interactive and reproducible computing, based on the Jupyter Notebook and Architecture.</p> <p style="text-align: center;">Launch</p>	 <p>Notebook 6.0.1</p> <p>Web-based, interactive computing notebook environment. Edit and run human-readable docs while describing the data analysis.</p> <p style="text-align: center;">Launch</p>	 <p>powershell_shortcut 0.0.1</p> <p style="text-align: center;">Launch</p>	 <p>Qt Console 4.5.5</p> <p>PyQt GUI that supports inline figures, proper multiline editing with syntax highlighting, graphical calltips, and more.</p> <p style="text-align: center;">Launch</p>	 <p>Spyder 3.3.6</p> <p>Scientific Python Development Environment. Powerful Python IDE with advanced editing, interactive testing, debugging and introspection features</p> <p style="text-align: center;">Launch</p>
 <p>Glueviz 0.15.2</p> <p>Multidimensional data visualization across files. Explore relationships within and among related datasets.</p> <p style="text-align: center;">Install</p>	 <p>Orange 3 3.23.1</p> <p>Component based data mining framework. Data visualization and data analysis for novice and expert. Interactive workflows with a large toolbox.</p> <p style="text-align: center;">Install</p>	 <p>RStudio 1.1.456</p> <p>A set of integrated tools designed to help you be more productive with R. Includes R essentials and notebooks.</p> <p style="text-align: center;">Install</p>	 <p>VS Code 1.43.0</p> <p>Streamlined code editor with support for development operations like debugging, task running and version control.</p> <p style="text-align: center;">Install</p>		

Documentation

Developer Blog



Using Anaconda

The screenshot displays the Anaconda Navigator application window. The interface includes a sidebar on the left with navigation options: Home, Environments, Learning, and Community. The main area shows a grid of application cards under the heading 'Applications on base (root) Channels'. Each card features an icon, the application name, version number, a brief description, and a button to either 'Launch' or 'Install' the application. The applications shown are: console_shortcut (0.1.1), JupyterLab (1.1.4), Jupyter Notebook (6.0.1), powershell_shortcut (0.0.1), Qt Console (4.5.5), Spyder (3.3.6), Glueviz (0.15.2), Orange 3 (3.23.1), RStudio (1.1.456), and VS Code (1.43.0). A blue oval highlights the grid of application cards, and a blue arrow points from the bottom of this oval to the text 'HERE, Anaconda packages and tools'.

HERE, Anaconda packages and tools



Using Anaconda

HERE you can view, update and download Python libraries and tools



Anaconda Navigator



Upgrade Now

Sign in to Anaconda Cloud

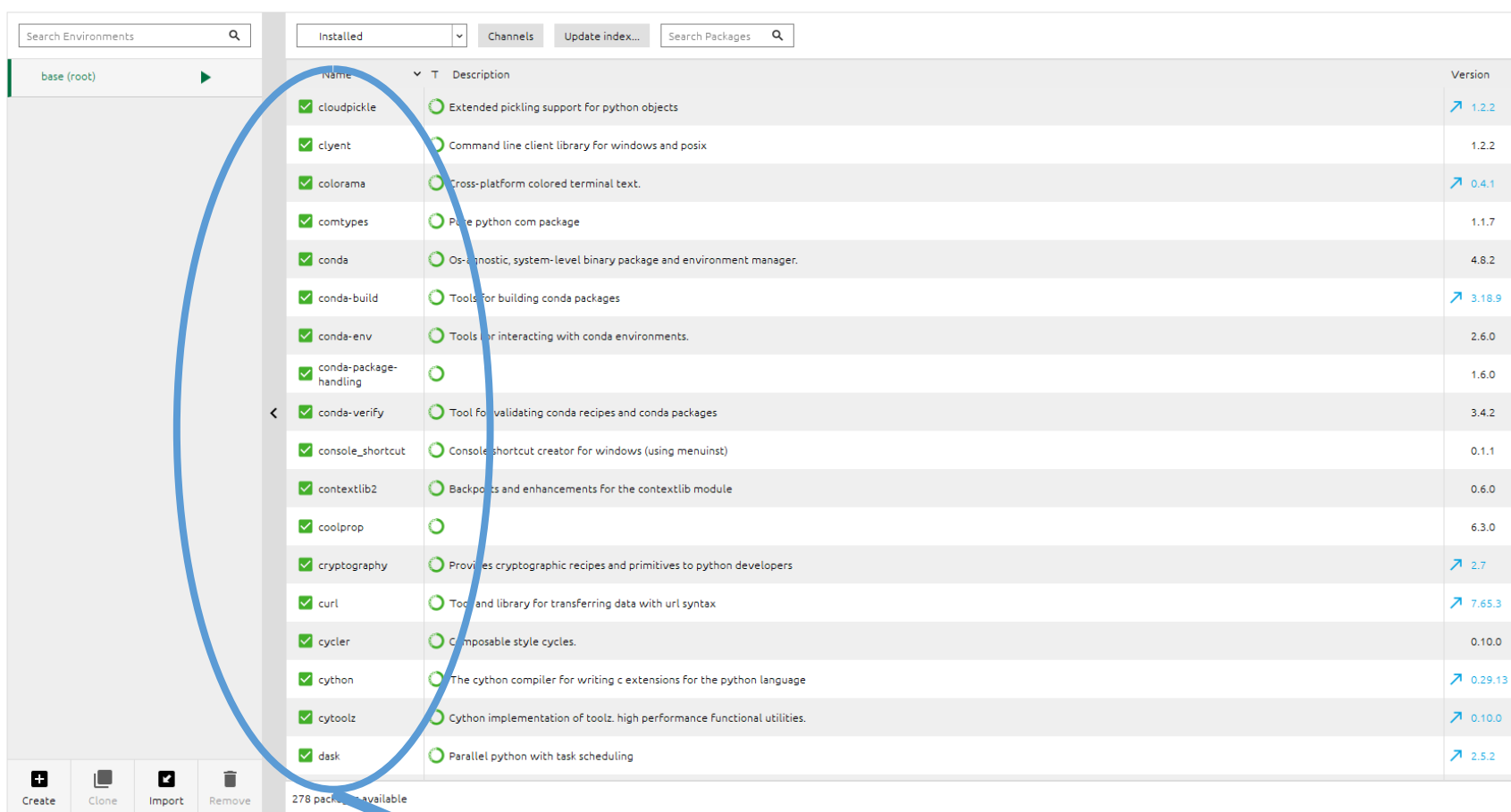
Application: base (root) Channels Refresh

Environment Name	Version	Description	Action
console_shortcut	0.1.1	Console shortcut creator for Windows (using menuinst)	Launch
JupyterLab	1.1.4	An extensible environment for interactive and reproducible computing, based on the Jupyter Notebook and Architecture.	Launch
Notebook	6.0.1	Web-based, interactive computing notebook environment. Edit and run human-readable docs while describing the data analysis.	Launch
powershell_shortcut	0.0.1		Launch
Qt Console	4.5.5	PyQt GUI that supports inline figures, proper multiline editing with syntax highlighting, graphical calltips, and more.	Launch
Spyder	3.3.6	Scientific Python Development Environment. Powerful Python IDE with advanced editing, interactive testing, debugging and introspection features	Launch
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Using Anaconda

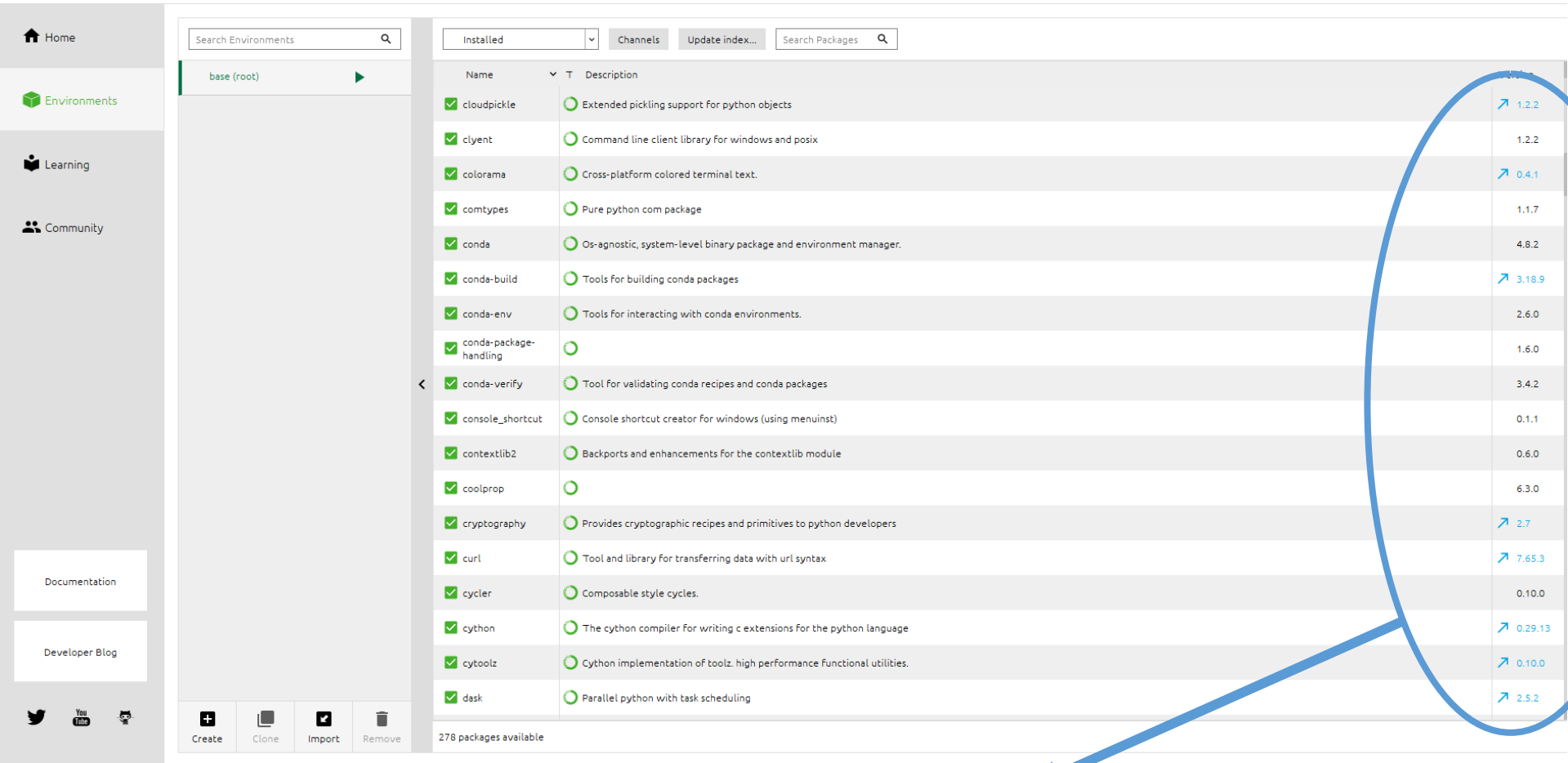


The screenshot shows the Anaconda environment manager interface. The left sidebar contains navigation options: Home, Environments, Learning, and Community. The main area displays a list of installed packages for the 'base (root)' environment. The 'Name' column is highlighted with a blue oval, and a blue arrow points from it to the text 'HERE find installed package'.

Name	Description	Version
cloudpickle	Extended pickling support for python objects	1.2.2
clyent	Command line client library for windows and posix	1.2.2
colorama	Cross-platform colored terminal text.	0.4.1
comtypes	Pure python com package	1.1.7
conda	Os-agnostic, system-level binary package and environment manager.	4.8.2
conda-build	Tools for building conda packages	3.18.9
conda-env	Tools for interacting with conda environments.	2.6.0
conda-package-handling		1.6.0
conda-verify	Tool for validating conda recipes and conda packages	3.4.2
console_shortcut	Console shortcut creator for windows (using menuinst)	0.1.1
contextlib2	Backports and enhancements for the contextlib module	0.6.0
coolprop		6.3.0
cryptography	Provides cryptographic recipes and primitives to python developers	2.7
curl	Tool and library for transferring data with url syntax	7.65.3
cycler	Composable style cycles.	0.10.0
cython	The cython compiler for writing c extensions for the python language	0.29.13
cytoolz	Cython implementation of toolz: high performance functional utilities.	0.10.0
dask	Parallel python with task scheduling	2.5.2

HERE find installed package

Using Anaconda



The screenshot shows the Anaconda environment manager interface. The left sidebar contains navigation options: Home, Environments, Learning, and Community. The main area displays a list of installed packages for the 'base (root)' environment. The packages are listed in a table with columns for Name, Description, and Version. A blue arrow points to the version numbers column.

Name	Description	Version
cloudpickle	Extended pickling support for python objects	1.2.2
clyent	Command line client library for windows and posix	1.2.2
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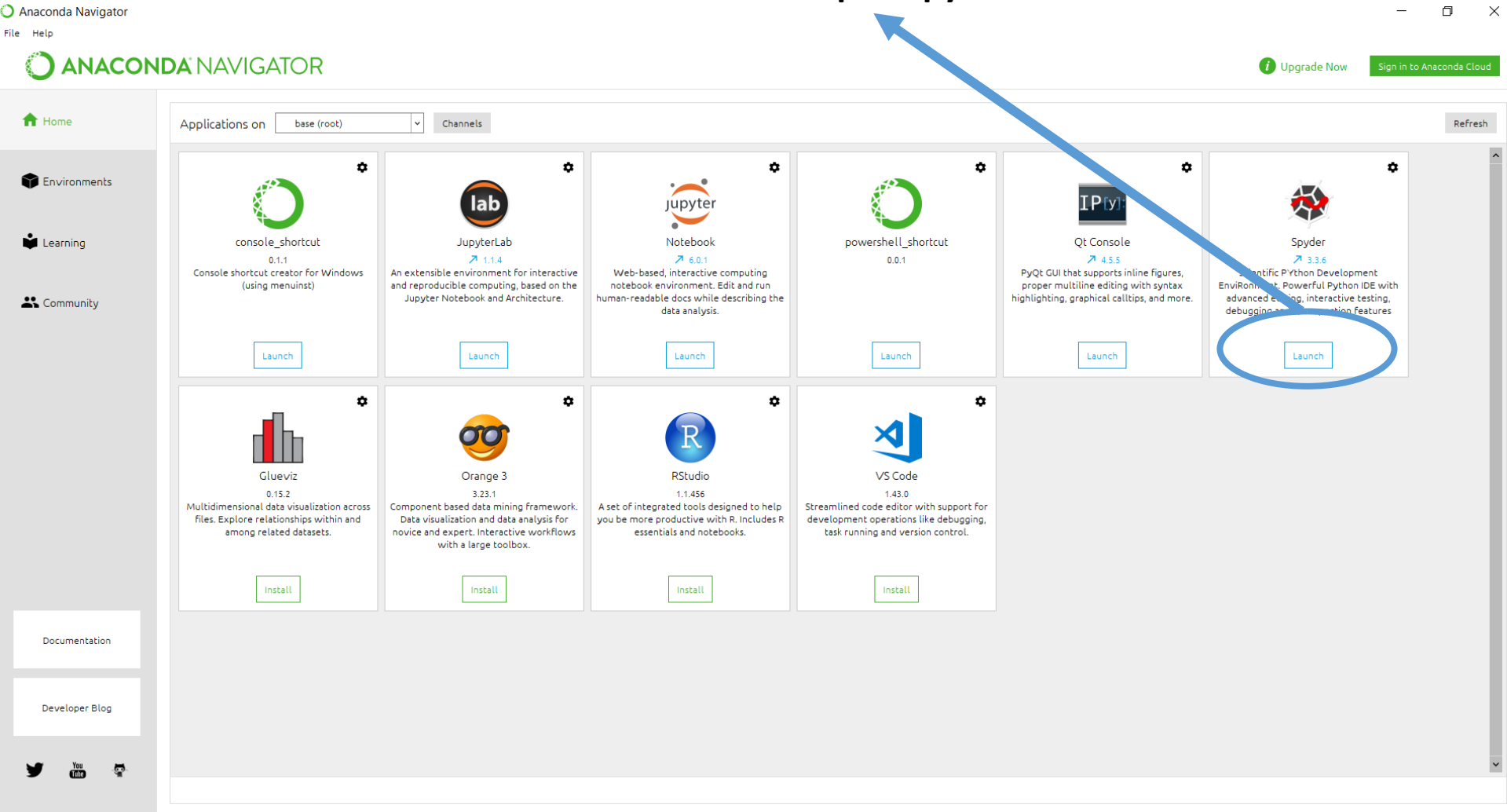
278 packages available

HERE installed packages and their version number

Using spyder



Now open Spyder



The screenshot shows the Anaconda Navigator interface. The top bar includes the Anaconda Navigator logo and navigation options like Home, Environments, Learning, and Community. The main area displays a grid of application cards under the heading 'Applications on base (root) Channels'. The cards are:

- console_shortcut 0.1.1: Console shortcut creator for Windows (using menuinst). [Launch]
- JupyterLab 1.1.4: An extensible environment for interactive and reproducible computing, based on the Jupyter Notebook and Architecture. [Launch]
- Notebook 6.0.1: Web-based, interactive computing notebook environment. Edit and run human-readable docs while describing the data analysis. [Launch]
- powershell_shortcut 0.0.1: [Launch]
- Qt Console 4.5.5: PyQt GUI that supports inline figures, proper multiline editing with syntax highlighting, graphical calltips, and more. [Launch]
- Spyder 3.3.6: Scientific Python Development Environment. Powerful Python IDE with advanced editing, interactive testing, debugging and visualization features. [Launch]
- Glueviz 0.15.2: Multidimensional data visualization across files. Explore relationships within and among related datasets. [Install]
- Orange 3 3.23.1: Component based data mining framework. Data visualization and data analysis for novice and expert. Interactive workflows with a large toolbox. [Install]
- RStudio 1.1.456: A set of integrated tools designed to help you be more productive with R. Includes R essentials and notebooks. [Install]
- VS Code 1.43.0: Streamlined code editor with support for development operations like debugging, task running and version control. [Install]

A blue arrow points from the text 'Now open Spyder' to the 'Launch' button of the Spyder application card, which is also circled in blue.



Thermodynamic properties and units

Parameter	Units	Input/Output	Trivial	Description
DELTA , Delta		IO	False	Reduced density (ρ/ρ_c)
DMOLAR , Dmolar	mol/m ³	IO	False	Molar density
D , DMASS , Dmass	kg/m ³	IO	False	Mass density
HMOLAR , Hmolar	J/mol	IO	False	Molar specific enthalpy
H , HMASS , Hmass	J/kg	IO	False	Mass specific enthalpy
P	Pa	IO	False	Pressure
Q	mol/mol	IO	False	Mass vapor quality
SMOLAR , Smolar	J/mol/K	IO	False	Molar specific entropy
S , SMASS , Smass	J/kg/K	IO	False	Mass specific entropy
TAU , Tau		IO	False	Reciprocal reduced temperature (T_c/T)
T	K	IO	False	Temperature
UMOLAR , Umolar	J/mol	IO	False	Molar specific internal energy
U , UMASS , Umass	J/kg	IO	False	Mass specific internal energy
ACENTRIC , acentric		O	True	Acentric factor
ALPHA0 , alpha0		O	False	Ideal Helmholtz energy
ALPHAR , alphas		O	False	Residual Helmholtz energy
A , SPEED_OF_SOUND , speed_of_sound	m/s	O	False	Speed of sound
BVIRIAL , Bvirial		O	False	Second virial coefficient

<http://www.coolprop.org/coolprop/HighLevelAPI.html#propssi-function>

Thermodynamic properties and units

Thermodynamic properties	Mark	Unit
Enthalpy	H	J/kg
Entropy	S	J/kg/K
Temperature	T	K
Pressure	P	Pa

<http://www.coolprop.org/coolprop/HighLevelAPI.html#propssi-function>

Fluids in CoolProp



All the fluids included in CoolProp

Name	EOS	c_{p0}	λ	η	melt	σ
1-Butene	[17]					[18]
Acetone	[19]					[18]
Air	[10]		[20]	[20]		
Ammonia	[21]		[22]	[23]		[18]
Argon	[24]		[20]	[20]	[24]	[18]
Benzene	[25]		[26]	[27]		[18]
CarbonDioxide	[28]		[29]	[30]	[28]	[18]
CarbonMonoxide	[19]				[31]	[18]
CarbonylSulfide	[19]					[18]
CycloHexane	[32]			[33]	[34]	[18]
CycloPropane	[35]	[35]				[36]
Cyclopentane	[37]		[38]	[39]		[36]
D4	[40]					[36]
D5	[41]					[36]
D6	[42]					[36]
Deuterium	[43]					[18]
Dichloroethane	[40]					
DiethylEther	[44]					[36]

http://www.coolprop.org/fluid_properties/PurePseudoPure.html#list-of-fluids

Tips and useful links

COOLPROP:

- <http://www.coolprop.org/>
(General information)
- <http://www.coolprop.org/coolprop/HighLevelAPI.html#propssi-function>
(Propsi functions and input table)
- <http://coolprop.org/fluidproperties/PurePseudoPure.html#list-of-fluids>
(Fluids available)

Anaconda/Python:

- <https://conda-forge.org/>
- <https://github.com/>

For any questions: Davide Pivetta – davide.pivetta@phd.units.it

Thank you for the attention!

