PyRe: A Cyclus Pyroprocessing Archetype

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Outline

Columns

Sometimes things need to be put side by side, in two nice looking columns. Maybe one column involves a quotation.

> *Explicit is better than implicit. – The Zen of Python*

And, also, perhaps, a logo.

Figure 1: A caption describing the image. [**?**].

Some Code

I have to use the fragile syntax for code slides. python def meow(volume): """Make a demanding noise at the specified volume
Parameters ———- volume: int The volume of the demand. No relation to importance.
Returns ——- str meow """ o = 'o'*volume return 'me'+ o + 'ow'

Outline

Motivation

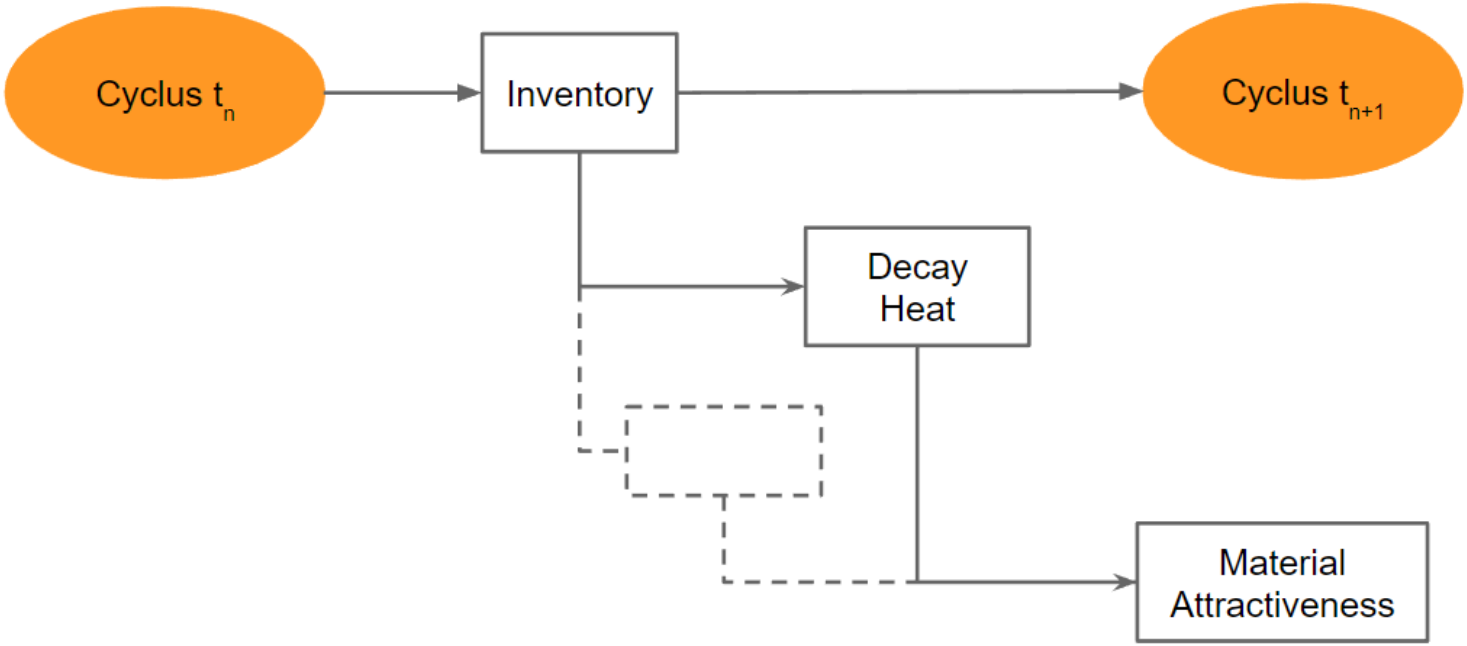
What is the goal?

PyRe will be used to answer the following questions

- What is the effect of introducing pyroprocessing plants in the fuel cycle?
- How do various facility designs affect throughput and efficiency?
- Where in a pyroprocessing plant will monitoring most effectively detect material diversion?

The first two can be directly answered by the archetype. The third requires data analysis via diversion algorithms.

Diversion


Cyclus t_n
Inventory
Cyclus t_{n+1}
Decay Heat
Material Attractiveness

Outline

Methodology

How does PyRe work?

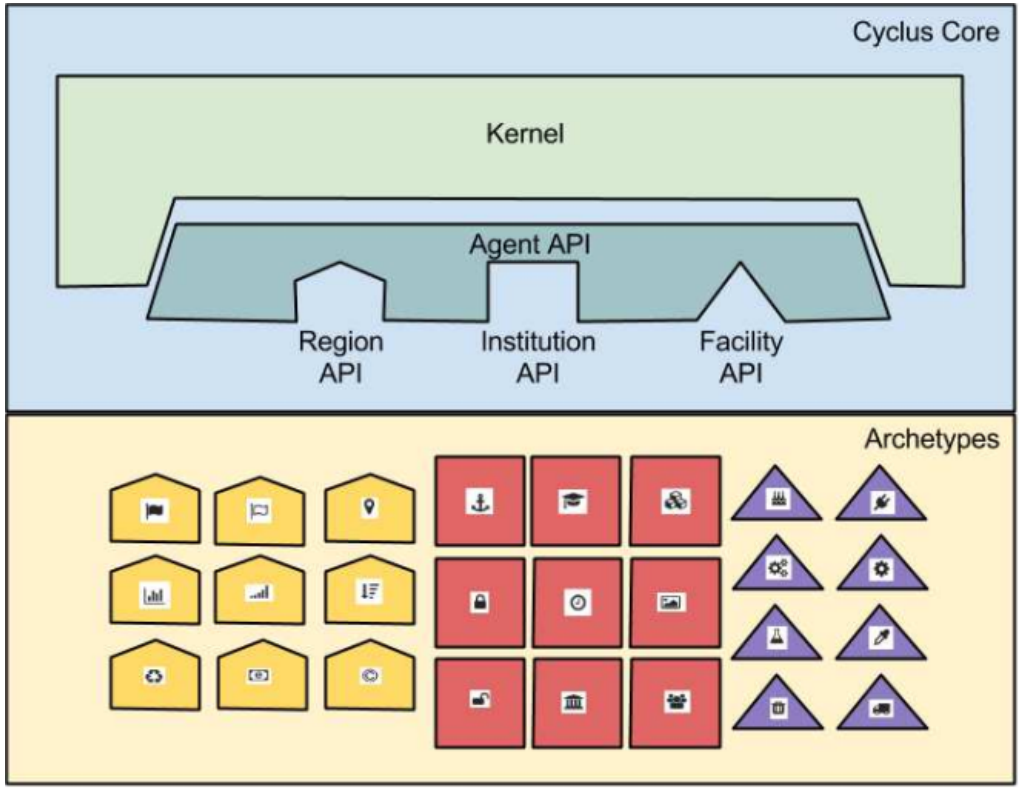
PyRe does the following with an input stream and facility configuration parameters:

- Pass fuel to voloxidation.
- Generate efficiencies from parameters.
- Multiply stream by efficiency matrix.
- Record stream compositions.
- Repeat for each process.

Cyclus

What is Cyclus?

Cyclus is a modular agent based fuel cycle simulator for tracking commodity transactions between facilities.



Why Cyclus?

Cyclus allows the construction of specific scenarios through the addition of archetypes. These archetypes are modular and the transactions can be tracked.

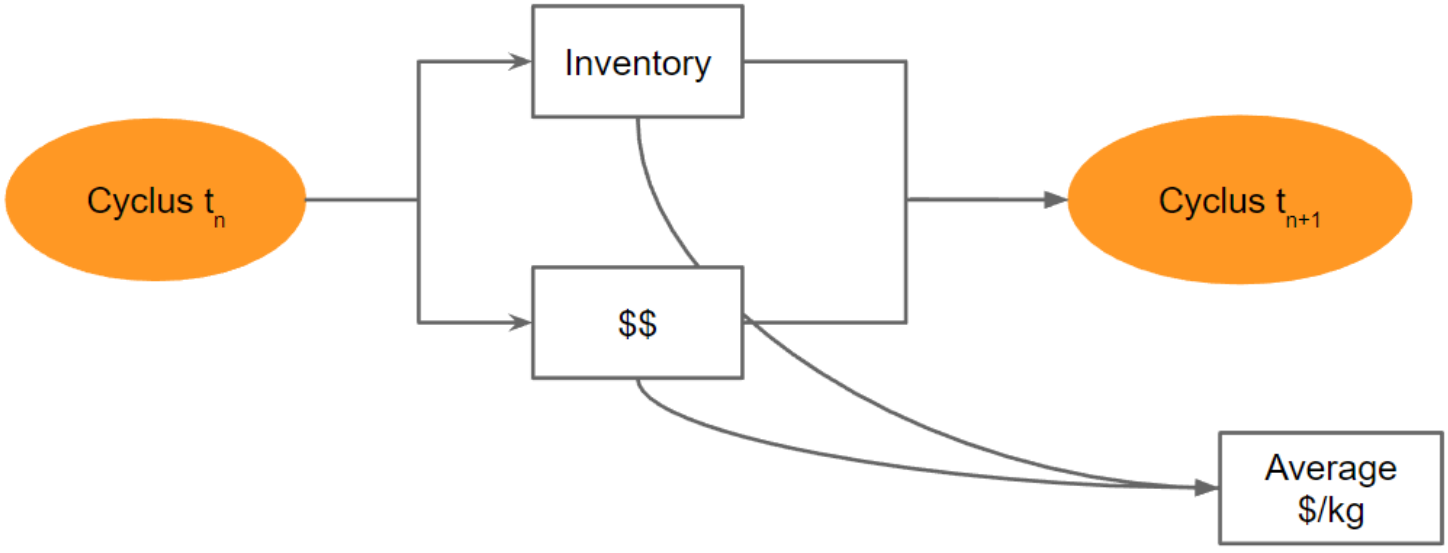
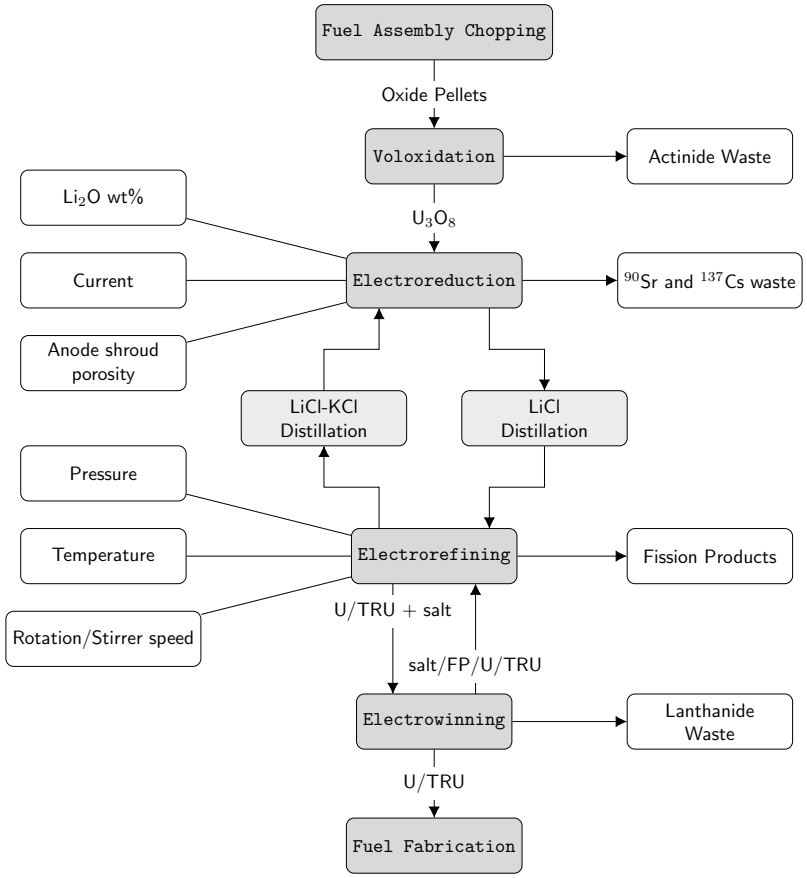


Figure 2: Cyclus tracks material flow through the fuel cycle.

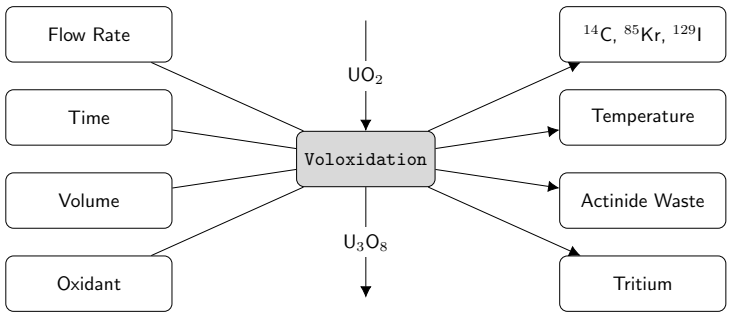
Assumptions

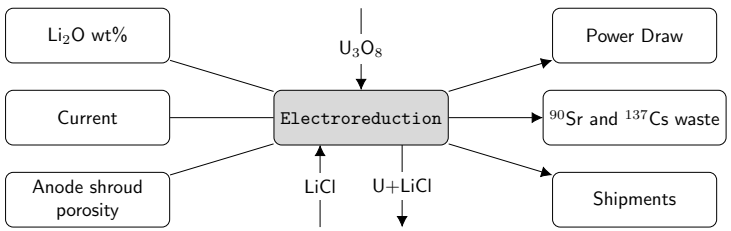
Cyclus Requirements

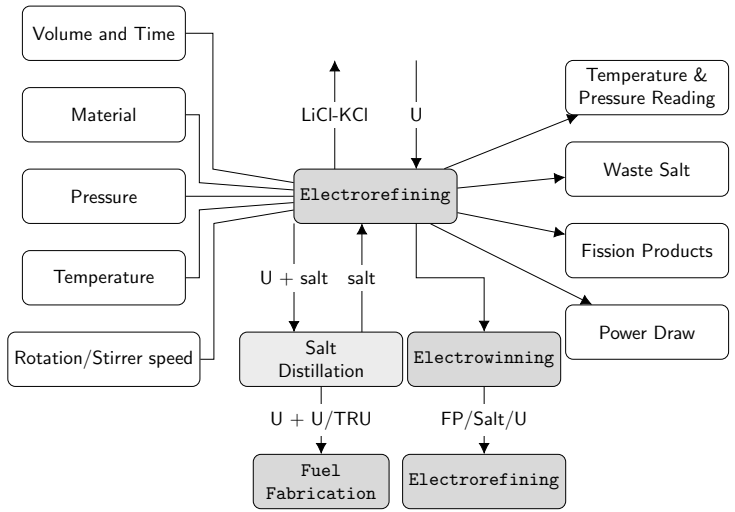
- Modular.
- Time step $\geq$ 1 month
- Streams must be in a trade-able form.
- Parameters are constant for the simulation.
  - Here is where I would mention the toolkit.
- Diversion detection must be added after.

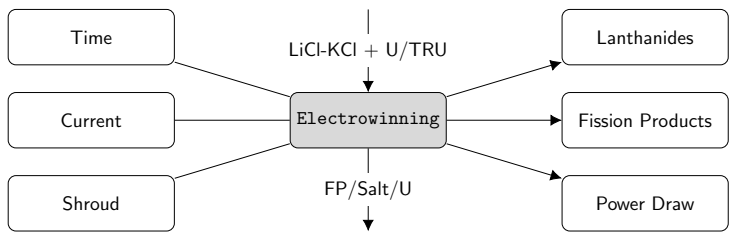


Subprocesses









Outline

Average Sim

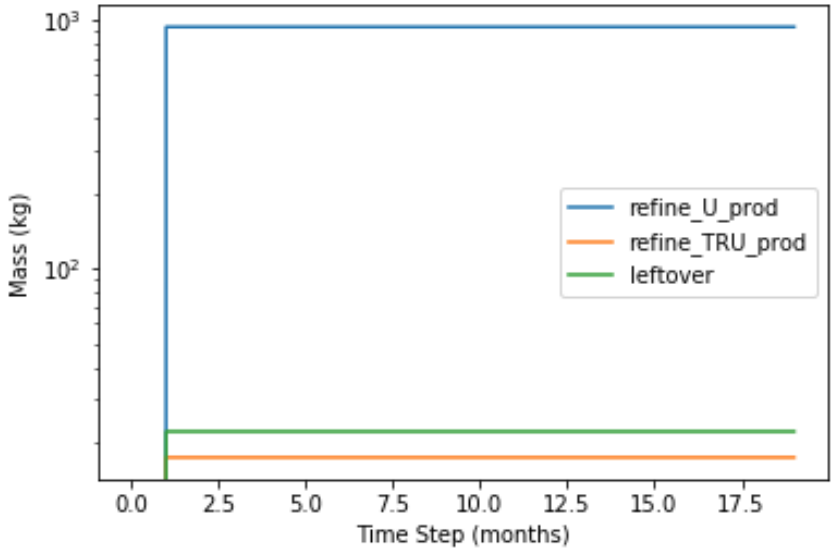


Figure 3: Product time series of a simple simulation.

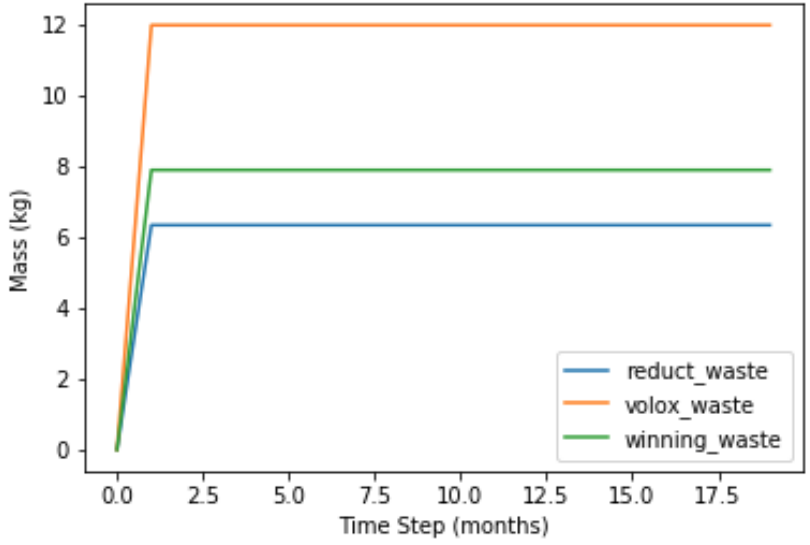


Figure 4: Waste time series of a simple simulation.

Isotopic Composition of Waste Streams

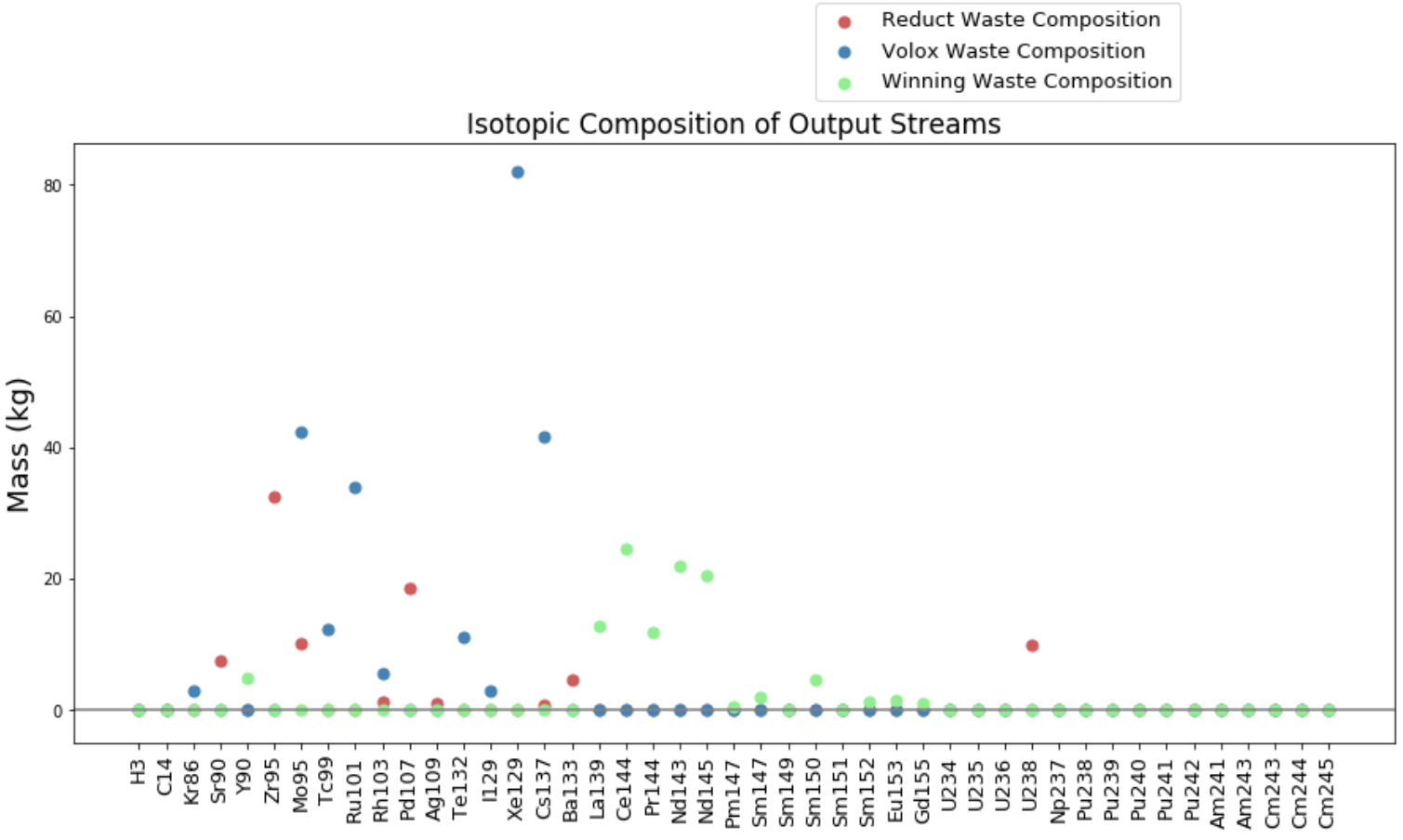


Figure 5: Isotopic Composition of Average Waste Streams

Current Diversion

Figure 6: Isotopic Composition of Current Diverted Waste Streams

Isotopic Range

Figure 7: Range of Isotopic Values

Outline

Future Work

We have shown that PyRe allows Cyclus to simulate a simple pyroprocessing scenario. Future work includes:

- Increase scenario complexity - test shadow diversion
- Improve user input
  - Allow user-defined equations as input
- Chemistry detail

Uses of PyRe:

In the beginning we marked the following objectives:

- What is the effect of introducing pyroprocessing plants in the fuel cycle?
- How do various facility designs affect throughput and efficiency?
- Where in a pyroprocessing plant will monitoring most effectively detect material diversion?

Diversion Algorithm

The first two questions can be answered through the addition of PyRe to Cyclus. However, to address the last we must employ an algorithm to analyze small differences between multiple simulations.

Acknowledgement

Acknowledgements should include both people who helped and funding streams. If you are funded by an NEUP grant, that number usually goes here. .

References I