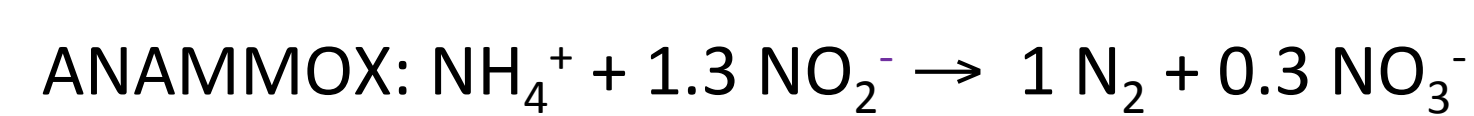
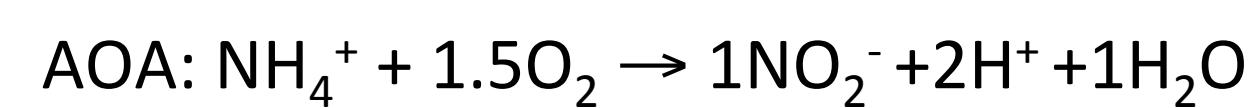


Project Overview

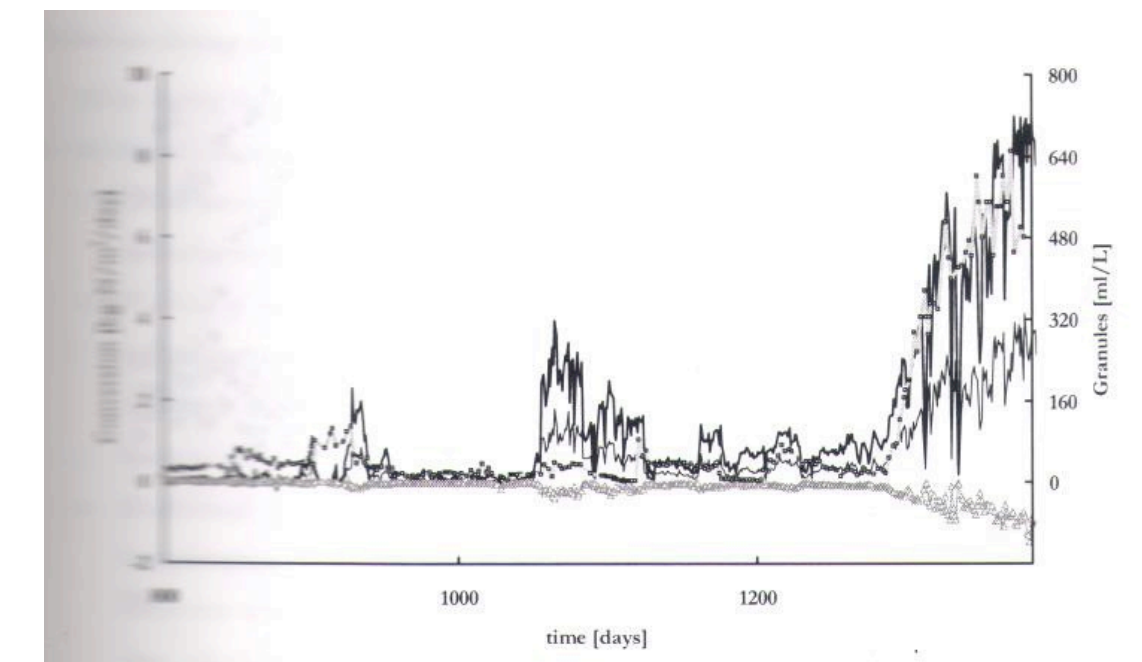
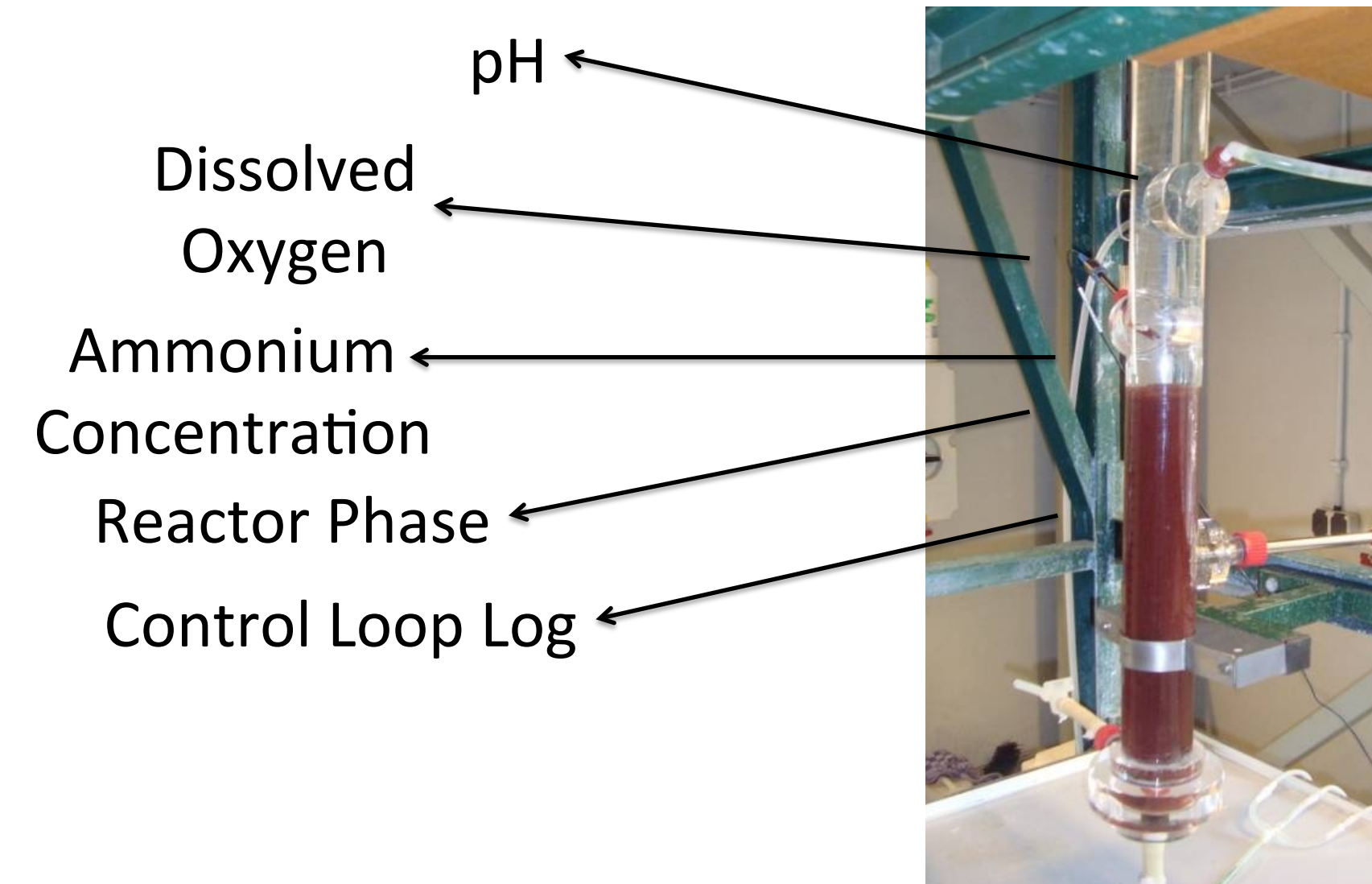


Development of Nitrogen Removal System for Wastewater Treatment:

- Nitrogen pollution in our water ways can cause eutrophication (i.e. Algal Blooms), so it must be removed in wastewater treatment.
- A more co-culture system for converting nitrite into nitrogen gas
- Ammonia oxidizing archaea (AOA)
 - Convert ammonia to nitrite
- Anaerobic ammonia oxidation (ANAMMOX)
 - Convert ammonia and nitrite to nitrogen gas
- Experiments are conducted in sequence batch reactor
 - Numerous probes, controls status data



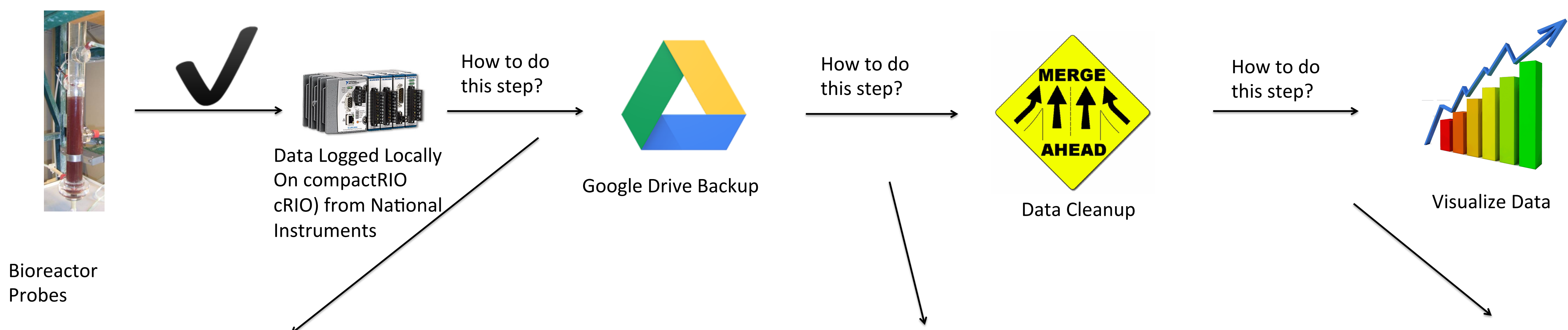
How can we organize & visualize all this noise?



(van der Star, 2008)

More than 1200 days of data!
Many data points per day!
Multiple plots!

Project Components



Data Logging and Storage



Locally Logged Data → Internet

- Data accessed via HTTP protocol GET request
→ returned as an XML string w/ reactor values at instant of HTTP request
- Can get this programmatically with urllib2

Go To:
<http://reactor.ip.address:port/cRIOtoWeb/DataTransfer?reactorno=1>

Get Back:

This XML file does not appear to have any style information associated with it. The document tree is shown below.

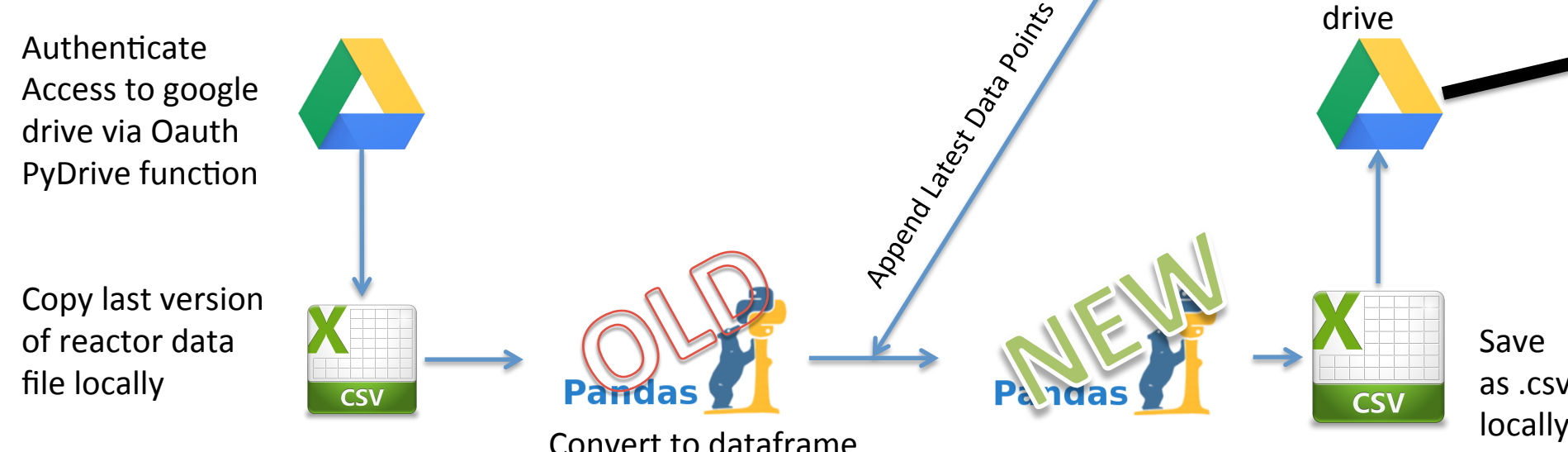
```
<?xml version="1.0"?>
<Response>
  <XMLData>
    <Name>R1Status</Name>
    <Value>
      <Name>Media Pump</Name>
      <Value>0</Value>
      <Name>Refluent Pump</Name>
      <Value>0</Value>
      <Name>Acid Pump</Name>
      <Value>0</Value>
    </Value>
  </XMLData>
</Response>
```

Parse XML String into Dataframe

- Libraries Used are XML Element Tree & pandas



Append this dataframe to the csv file saved on google drive with PyDrive



Data Cleanup

The data is comprised into three data sets (3 instruments), each dataset is collected at different frequency.

Instrument_1 DataFrame

Collected every minute

Instrument_2 DataFrame

Collected once a day
Contains "junk" data from other users



User_input():

Instrument_3 DataFrame

Collected once a week
Manually entered

Combined DataFrame

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---	---
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---	---
---	---

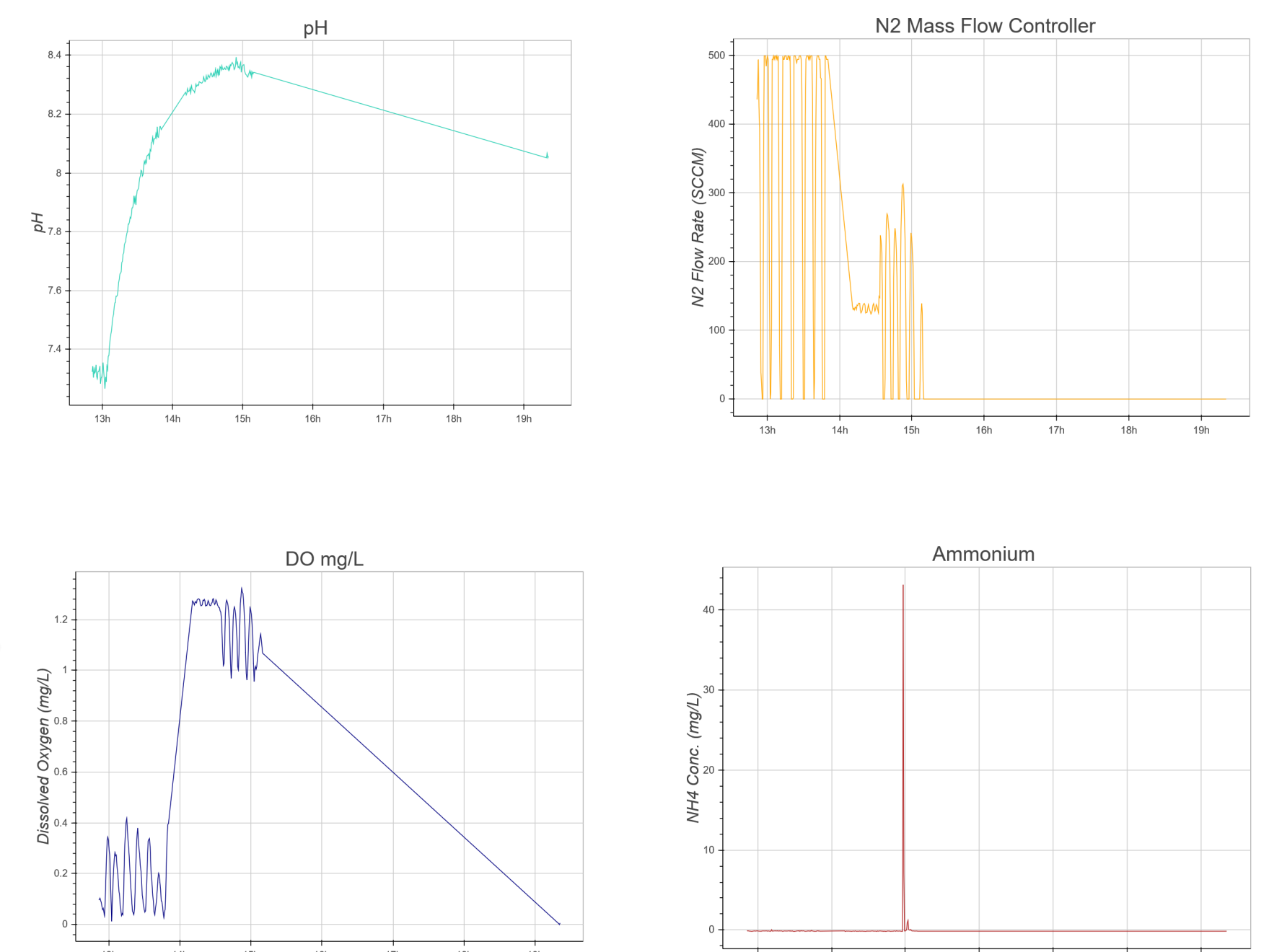
Bokeh



Bokeh – Python language based visualization system (instead of GUI)

- Interactive visualization (panning and zooming)
- Browser-based
- Visualization for big-data
- Driven by python
- Plot "react" to live data source
- "Easy" to learn but enough depth for pro-users
- Hella good documentation and examples

Bokeh server example: Live plotting of updating data



*Graphs reflect reactor's initial start up operation and operational inconsistencies