An introduction to LIVVkit 2.0

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Climate Change Science Institute
Oak Ridge National Laboratory

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V&V is a set of confidence building techniques

- Software verification
  Did we build what we intended?
- Numerical verification
  Are we solving the equations correctly?
- Performance validation
  Did we build what the users needed?
- Physical validation
  Are we using the right physics?

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V&V is not enough! Credibility relies on

- Reproducibility
- Transparency
- Discoverability

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- Publicly released July 9, 2015.
- Used to verify 16 pull requests
  - $\approx$ 180 commits
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  - Performance verification
  - Basic validation structure

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    - Too complicated
    - Large dev. burden to learn LIVVkit and generate output
    - LIVVkit requirements unclear...

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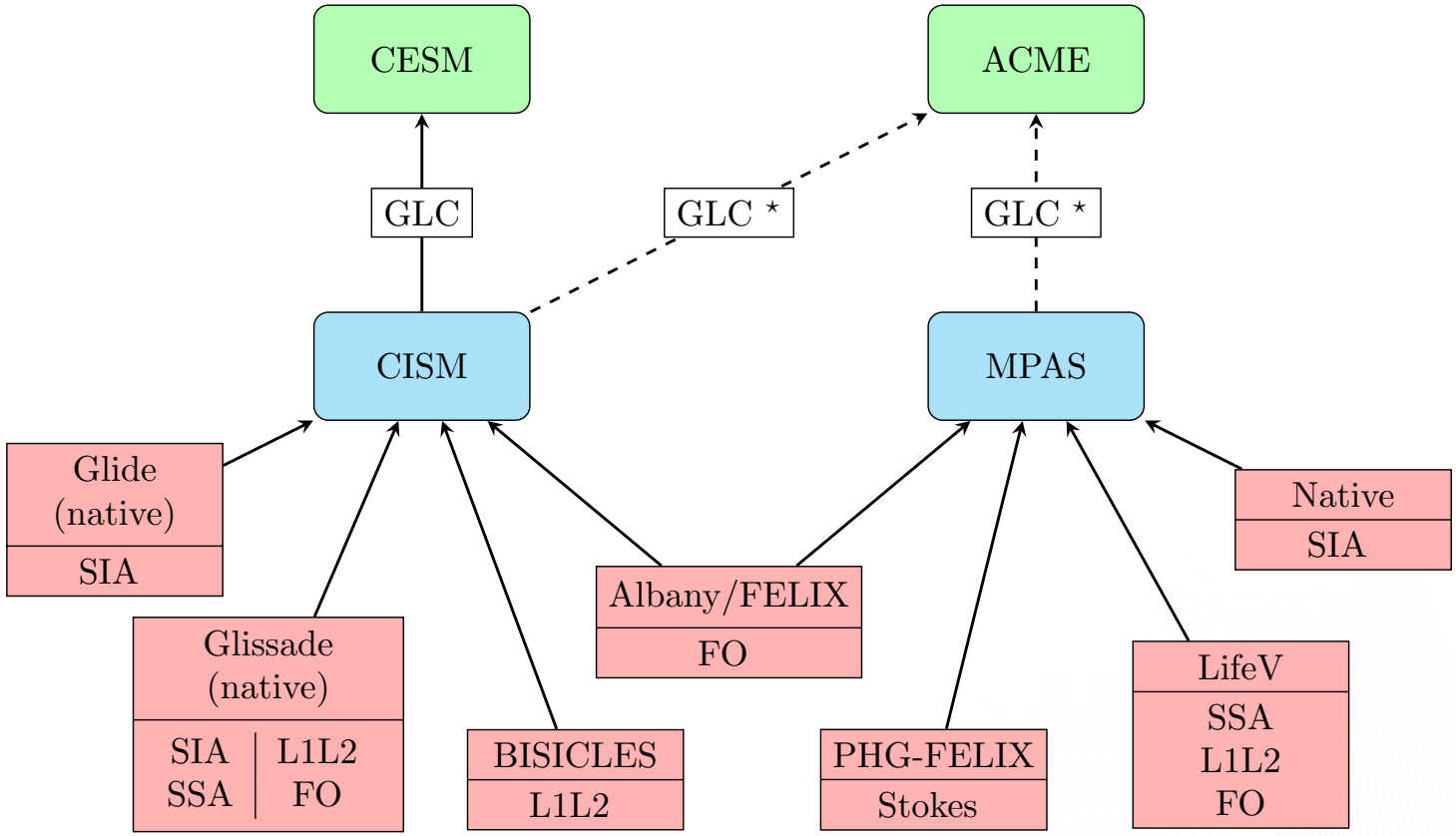
- Move beyond CISM-Glissade...

Models and dycores, and solvers, oh my!



LIVVkit 2.0

Release planned for: July 8, 2016

Paper submission to JAMES in July

- glossary
- defined purpose, philosophy, and requirements
- example analyses

Improvements:

- reduced command line options (5, 3 primary)
- modern python practices
  - packaged and installable (pip)
  - is a library
  - python 3 (or cross compatibility between 2,3)
  - documentation via Sphinx
  - anaconda

LIVVkit 2.0

"Full" coverage of V&V

- verification
  - numerical
  - software
  - performance
- validation
  - performance
  - physical

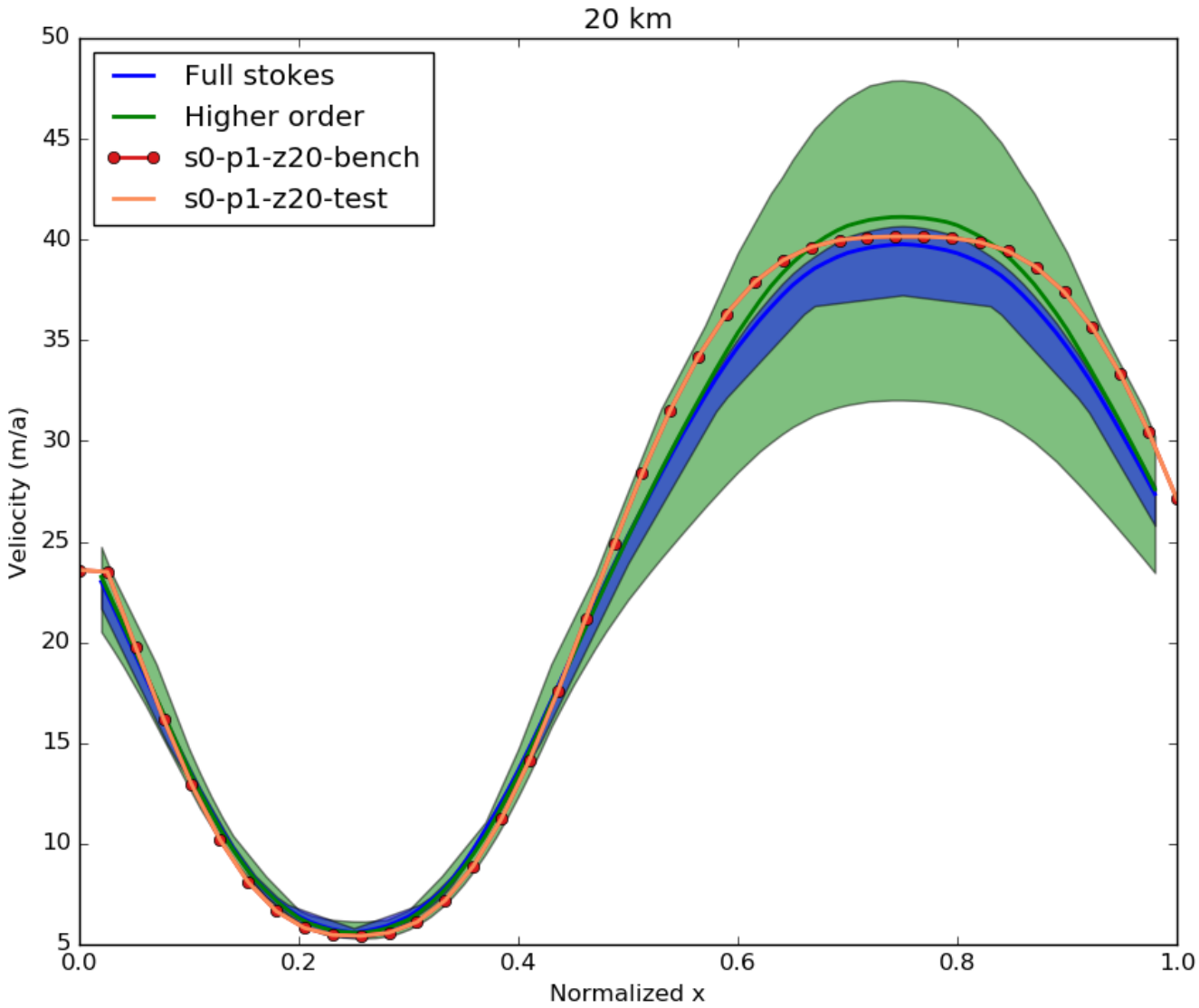
Validation structure has been improved

- Clarity and ease of use
- LIVVkit automatically renders output
  - 'element helper'

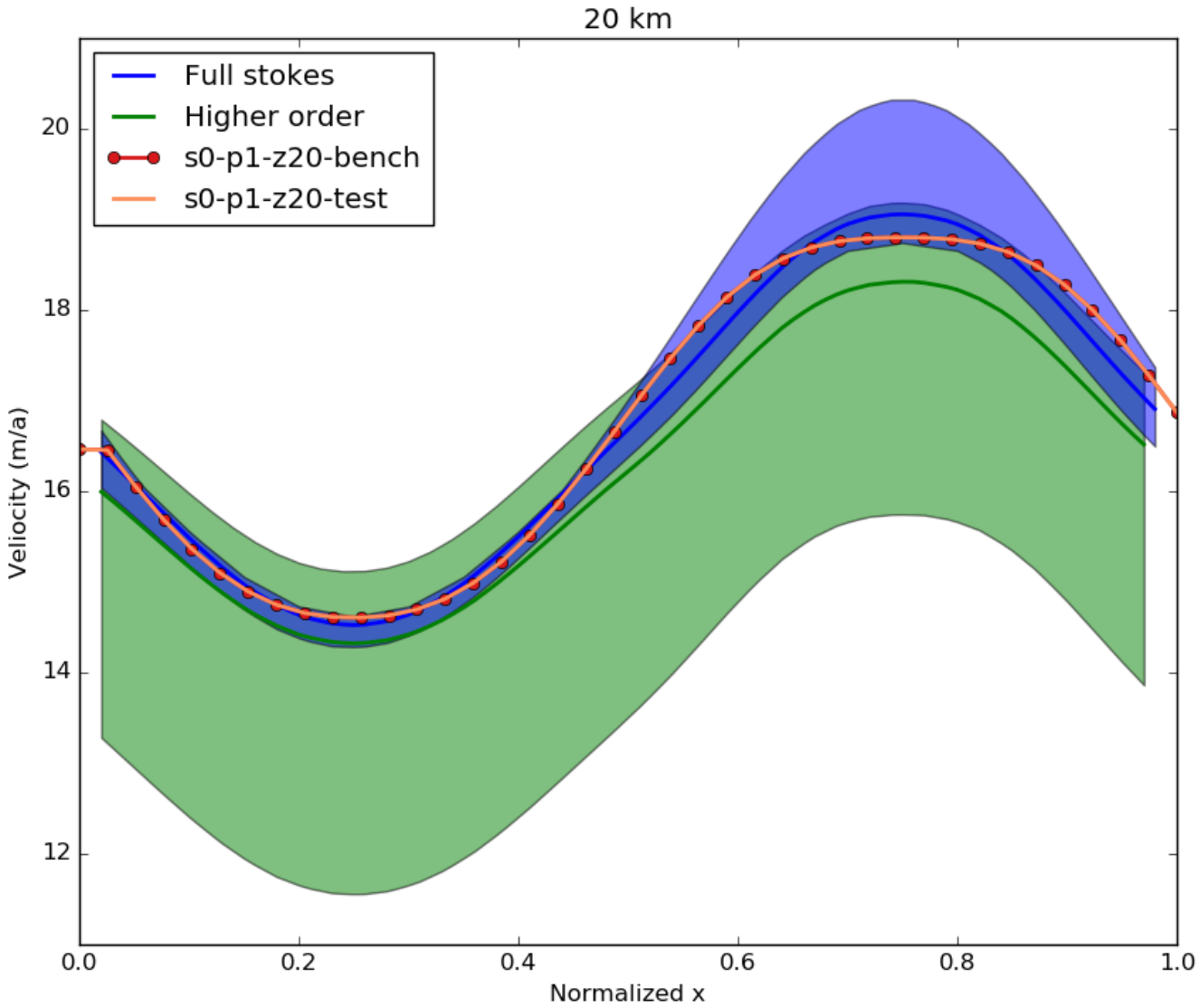
Models and dycores have now been encapsulated

- 'Bundles'
- LIVVkit and model-specific functionality separated

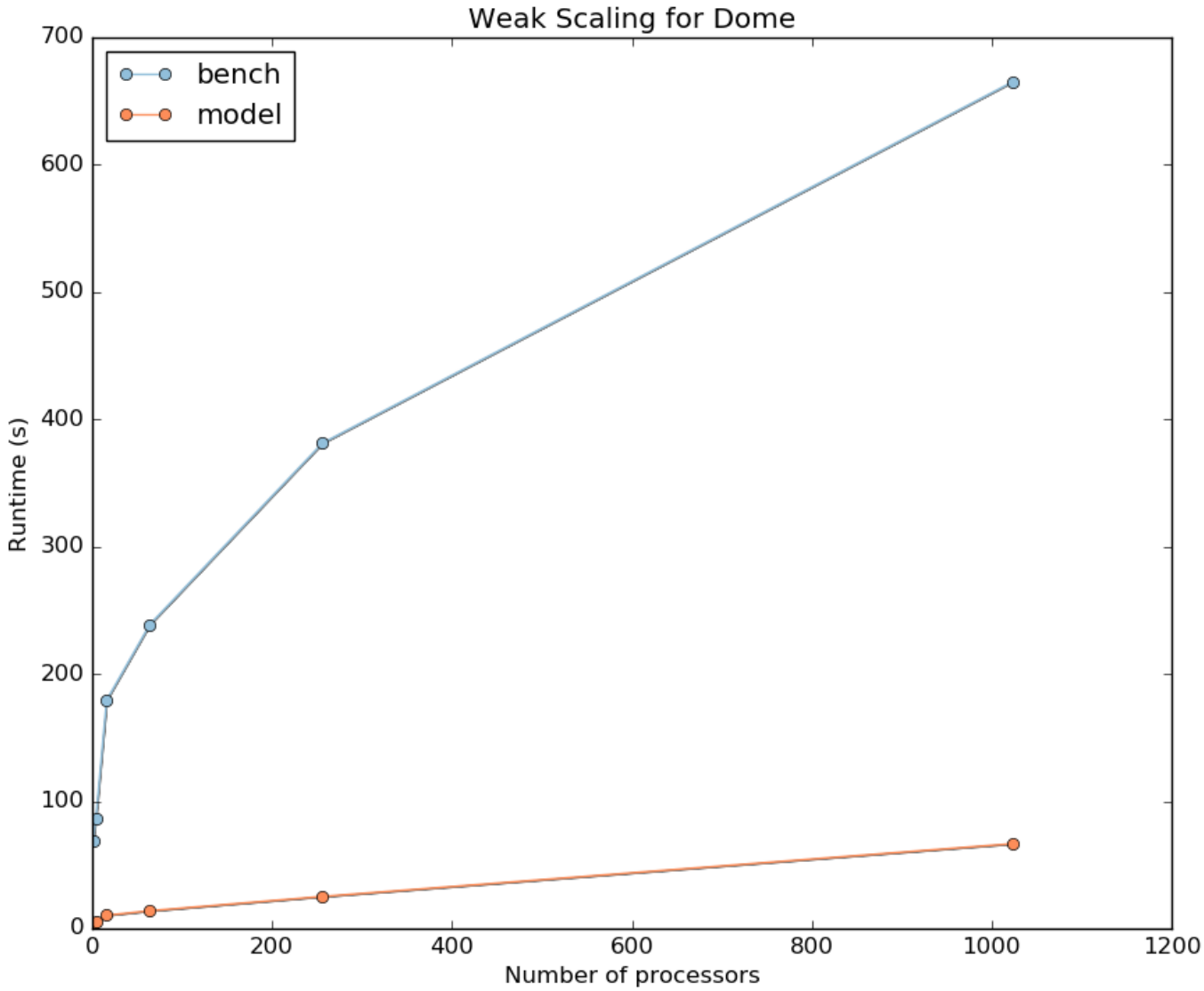
Numerics: ISMIP-HOM A



Numerics: ISMIP-HOM C



Performance: dome, weak scaling



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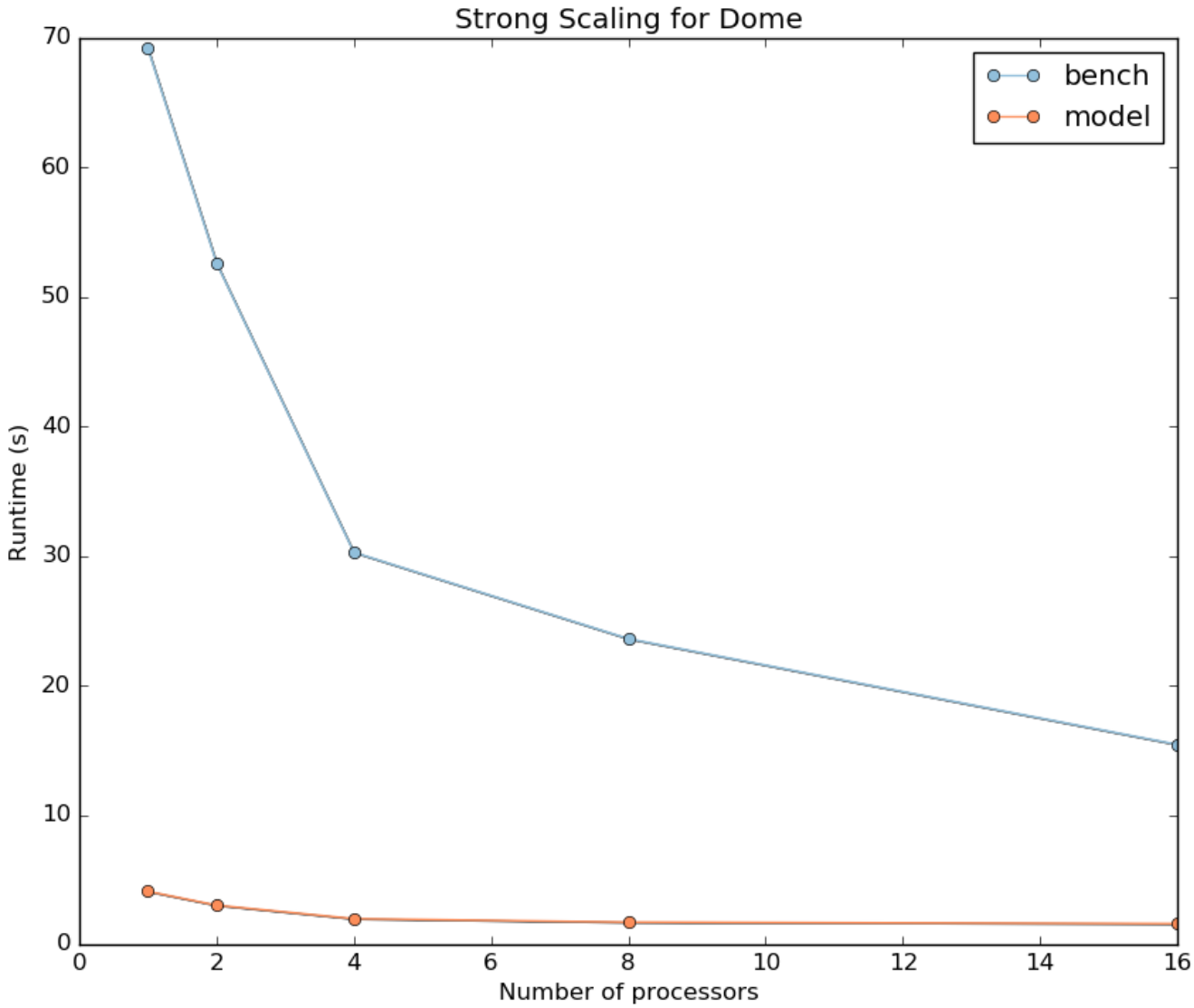
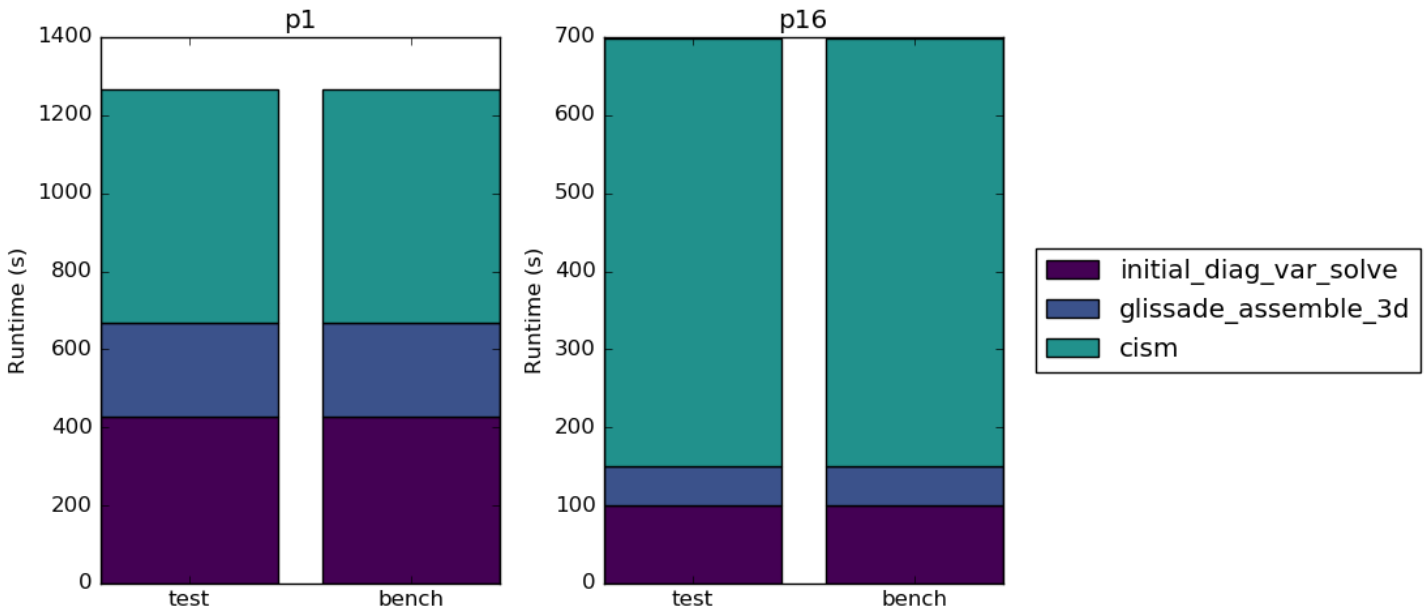


Performance: dome, timing



Validation: element helper

```
import matplotlib.pyplot as plt
from livvkit.util.datastructures import ElementHelper

...

plt.savefig(plot_file)
plt.close()

el =  ElementHelper.image_element(
            title,
            description,
            plot_file)
        )

return el
```

Next...

Validation: we need a list of variables of interest and data sources...

Workshop summer 2017, AGU session and/or town hall 2017...

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