The Pencil Code Newsletter

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1 Code updates

1.1 No yz-slices?

During one of the Pencil Code office hours in 2026, a problem about missing yz slices was reported. It turns out that on Dardel, those slices are not written when optimization O2 is used. O1 is ok.

1.2 New output trigger

Matthias and Axel have added the possibility to output spectra and slices based on another trigger than just the time. Therefore, in general, the time may not be available, which could be unfortunate. Therefore we added it to the spectra. In the usual case, the time comes now twice, but the advantage is that we don't need to nake complicated queries. Let us know if there are questions.

2 Default changes

2.1 Lorentz spectra for kinematic flows

Since 6-mar-26 (i.e., since revision r42876), we compute Lorentz spectrum also for lhydro_kinematic.and.iux/=0, i.e., when the velocity is defined as an auxiliary array.

3 Code additions

3.1 Regarding GPUs

There have been lots of changes for enhancing or providing GPU capability. We need to explain the meaning of `!$omp do collapse(2)` and `!$omp workshare`, etc.

Also, it is not clear why do we need `m=m_loc;n=n_loc`? We should explain this both in the newsletter and in `src/power_spectrum.f90`. Also, why do we need things like "pencil_needs_ivv"

4 sourceme.sh

When excecuting sourceme.sh or sourceme.csh, it now changes the git properties so that one always uses –rebase.

5 Signalling NaNs

Initializing the code with signalling NaNs can be helpful in detecting uninitialized variables. To enable this, one can compile the code with with `FFLAGS += -finit-real=sNaN` (for the gnu compiler) and with `FFLAGS += -finit-integer=-2147483648` for integer. During the last `Pencil Code` office hours

in May, Philippe reminded us that such options and similar ones are listed in the directory

`pencil-code/config/compilers/extensions`

in the file

`GNU-GCC_debug.conf`

```
~/pencil-code/config/compilers/extensions/ \
  GNU-GCC_debug.conf
```

6 Excessive NaN output

We some applications, ones used to get excessive NaN run-time output when the code crashes. This is usually far too much and one may overlook more important output that is now hidden. This NaN output from the density module can now be suppressed by putting ip>14 (14 is the default).

7 ReadTheDocs: tutorials and postprocessing

ReadTheDocs hosts the central Pencil Code documentation and resources: general documentation, developer guides, API reference, tutorials, and sample workflows. See `https://pencil-code.readthedocs.io/` for an overview.

7.1 The Pencil Code: samples

The documentation now includes a new set of tutorial samples that walk users through complete workflows for different physical processes. Each sample is designed to cover:

- Scientific background and motivation
- Simulation configuration and setup
- Useful runtime checks and diagnostics
- Post-processing with Python for analysis and visualization

This makes it easier for new users to reproduce results and learn standard workflows.

The first published example is a simple convection simulation, with a step-by-step guide from problem setup through execution and Python-based postprocessing: Convection simulation

This is the beginning of a larger tutorial collection, and we encourage contributors to add new samples for other physics cases. If you are working with existing example directories under `pencil-code/samples`, your material would be a great addition.

7.2 IDL to Python

A new documentation page provides an expanded translation guide from IDL to Python, tailored to the Pencil Code ecosystem. It explains how to convert legacy IDL analysis scripts into modern Python code, including recommended Pencil Code utilities, common syntax differences, and practical examples for arrays, plotting, and file handling.

This guide is especially useful for users who want to migrate existing IDL workflows while preserving the same data-processing logic in Python. It helps users modernize legacy analysis without losing existing workflow logic. See the new page here: IDL to Python

8 Pencil Code Python: package, tests, and recent meetings

The idea of these meetings is to share developments, discuss ideas, present new work, and help the community.

This year we held two meetings (on Jan 29 and Mar 30). The Python postprocessing group has made rapid progress on packaging, testing, and providing tutorials; the meetings concentrated on three priority areas: making the Python toolkit an installable package, establishing automated Python tests, and organizing tutorial samples linked from the documentation.

Key outcomes and ongoing work:

- Packaging: the project is moving toward an official pip-installable package (`pypencil`); this is a high-priority effort led by Alberto and will make installation as simple as "pip install pypencil".
- Testing: now that we have a set of Python tests covering about 20% of the Python code, the next step is to host these on an automated server (options such as Nordita machines are being explored) so tests run on new commits.
- Tutorials and docs: the group agreed to develop a set of tutorial samples; the first published example is the convection simulation described in section **??**. Samples live in subdirectories of `pencil-code/samples` (for example `pencil-code/samples/conv-slab`); each sample may be a Jupyter notebook or an RST file and will be linked from ReadTheDocs.

- API and usability improvements: work is underway to standardize array-order conventions, unify error handling (raise informative exceptions), harmonize debug output defaults ("quiet" flag), and provide example usage in docstrings to aid both users and tests.

- Interoperability: routines to export var files to other formats (e.g., Athena-compatible output) are being modularized and integrated into the Python toolkit.

The `pypencil` package is a high-priority effort and will make it straightforward to install the postprocessing toolkit via pip.

We warmly encourage the community to join the Python working-group meetings, propose agenda items, and contribute tests or tutorial samples (place them under `pencil-code/samples`). Your participation directly shapes priorities and improves the tools for everyone.

9 Papers since January 2026

As usual, we look here at new papers that make use of the Pencil Code. Since the last newsletter of December 2025, 17 new papers have appeared on the arXiv, plus 23 others, some of which had been just preprints and now have been published with a journal reference on ADS. We list both here, altogether 40. A browsable ADS list of all Pencil Code papers can be found on: `https://ui.adsabs.harvard.edu/public-libraries/iGR7N57OSy6AlhDMQRTe_A`. If something is missing in those entries, you can also include it yourself in: `https://github.com/pencil-code/pencil-code/blob/master/doc/citations/ref.bib`, or otherwise just email brandenb@nordita.org. A compiled version of this file is available as `https://github.com/pencil-code/website/blob/master/doc/citations.pdf`, where we also list a total of now 155 code comparison papers in the last section "Code comparison & reference". Those are not included in our list below, nor among the now total number of 764 research papers that use the Pencil Code.

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