Guide 9: Python environment for offline machines

Python, a virtual environment and pyflightstream on a machine with no internet, Windows and Linux

Written for pyflightstream 0.58.2.

Sources: the package's installation notes and the `pip` documentation [1, 2].

pyflightstream is the work of Geovana Neves: `https://github.com/nevesgeovana/pyflightstream`, concept DOI `10.5281/zenodo.21482924`.
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Who reads this

- The person who installs pyflightstream on a machine that cannot reach the internet: a Windows workstation behind a closed network, a Linux workstation, or the shared file system of an HPC cluster.
- It happens once per machine and per version. Everybody else activates the environment with one line (Guide 2).
- The same recipe serves both systems: **download on a connected machine, carry one folder, install with the network forbidden**.

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Part 1

The idea

Two machines and one folder



- A **wheel** is a ready-built package. With wheels only, the offline machine needs no compiler and no network.
- The download names the **target's** Python version and platform, not the connected machine's.
- The install forbids the network, so it either installs from what was carried or fails naming what is missing. It never hangs.

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What the target needs to be

Python 3.12 or newer

- The package declares `requires-python = ">=3.12"`, following the scientific-python support schedule SPEC 0 [3].
- 3.9 and 3.10 lack `tomllib` and `enum.StrEnum`, which the package uses. 3.11 is below the declared floor: `pip` refuses it naming `Requires-Python`.
- Download for the same minor version the target runs: 312.

Target	Platform tags to download
Windows, 64 bit	`win_amd64`
Linux x86-64, glibc 2.28 or later	`manylinux_2_28_x86_64` *and* `manylinux2014_x86_64`

Linux: check the C library first

`ldd --version` on a node must print 2.28 or later (RHEL 8 and its rebuilds, and newer). Older systems cannot run the current `numpy` wheels [4].

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Why two Linux tags

- `--platform` tells `pip` which wheels the target accepts. It accepts **exactly the tags you list**, so list every one the target can run.
- The structural solver of the FSI extra, PyNiteFEA, needs `numpy >= 2.4`, whose Linux wheels are `manylinux_2_28` only: with `manylinux2014` alone the download fails.
- Other dependencies (`pydantic-core`) publish `manylinux2014` wheels only: with `manylinux_2_28` alone the download fails too.
- Both tags together resolve. A glibc 2.28 system runs both kinds.

Takeaway *If the download fails with ResolutionImpossible, a platform tag is missing; do not drop `--only-binary`.*

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Part 2

Python on the offline machine

Windows: one installer, no administrator

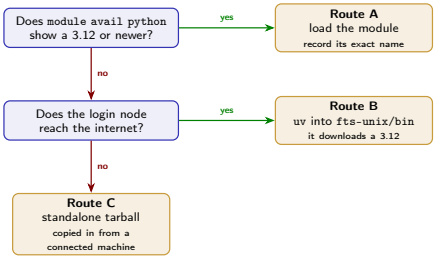
- On the connected machine, download the **Windows installer (64-bit)** of the latest Python 3.12 from `python.org` [5], and carry it with the wheels.
- On the offline machine, run it for the current user only: leave *Install for all users* off. No administrator is needed.
- Keep the `py` launcher on. Check:

```
py -3.12 --version
```

Corporate images

A machine may already carry a managed Python. Use it only if it is 3.12 or newer; otherwise install beside it, per user, and always call it as `py -3.12`.

Linux: three routes to a 3.12, no administrator



Route C always works. The interpreter is relocatable and writes nothing outside `fts-unix`; it is not compiling Python.

- A cluster's system Python is usually older than 3.12. Put a 3.12 **inside the shared install folder** (`<cluster-root>/fts-unix`); none of the routes touches the system Python.
- Route C always works on an offline machine: a relocatable CPython from the python-build-standalone project [6], copied in.

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Linux, Route C: choosing the standalone archive

Choice	Take	Why not the other
version	`3.12`	the wheels are cp312; a 3.13 rejects them
CPU level	`x86_64`	`x86_64_v3` needs AVX2 and dies on an older node
contents	`install_only_stripped`	the same interpreter, about a third of the size
libc	`linux-gnu`	`musl` is for Alpine

Copy the archive into the shared folder, then on the Linux machine:

```
export FTS=<cluster-root>/fts-unix
cd $FTS
sha256sum cpython-3.12*-install_only_stripped.tar.gz   # compare with the release
tar -xzf  cpython-3.12*-install_only_stripped.tar.gz   # creates $FTS/python
$FTS/python/bin/python3.12 --version
```

The interpreter finds its standard library relative to its own binary and writes nothing outside `$FTS`. Nothing is compiled.

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Part 3

The wheels

Download on the connected machine

For a Linux target (one command, written for the Windows command prompt, where ^ continues a line; use \ in a Linux shell and a backtick in PowerShell):

```
python -m pip download "pyflightstream[fsi]==0.58.2" -d pfs0410-linux ^
    --python-version 312 --only-binary=:all: ^
    --platform manylinux_2_28_x86_64 --platform manylinux2014_x86_64
```

For a Windows target:

```
python -m pip download "pyflightstream[fsi]==0.58.2" -d pfs0410-win ^
    --python-version 312 --only-binary=:all: --platform win_amd64
```

Option	What it prevents
`--python-version 312`	downloading for the connected machine's Python
`--platform ...`	downloading the connected machine's own wheels
`--only-binary=:all:`	downloading source, which would need a compiler

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A development build, and the check before carrying

A development build (a version ending in `.dev<N>`) is not on the package index. Name its wheel file instead of the version; `pip` copies it and downloads its dependencies:

```
python -m pip download ^
  "pyflightstream-<version>.dev<N>-py3-none-any.whl[fsi]" ^
  -d pfs0410-win --python-version 312 ^
  --only-binary=:all: --platform win_amd64
```

The failure that gives no warning

Without `--platform` and `--python-version`, `pip` quietly downloads for *your* machine. The folder looks right and copies fine, and the install fails on the target after everything was moved.

Check

Every file must end in `.whl`; one `.tar.gz` means source got in. The platform files must carry the target's tag.

Part 4

Installing

Linux: the environment at its final path

```
$FTS/python/bin/python3.12 -m venv --copies $FTS/py-venv/pfs0410
source $FTS/py-venv/pfs0410/bin/activate
ls $FTS/pfs-wheels/pfs0410-linux | wc -l      # the folder pip will read
pip install --no-index --find-links $FTS/pfs-wheels/pfs0410-linux "pyflightstream[fsi]"
python -c "import pyflightstream; print(pyflightstream.__version__)"
pyfs-matrix --help
```

- `--no-index` forbids the internet; `--find-links` says where to look instead.
- `--copies` puts the interpreter inside the environment, so it survives anybody tidying up `python/` later.
- The version line must print the version you downloaded, and `pyfs-matrix --help` must answer.

Windows: the same, with the launcher

```
cd C:/<work-folder>/fts-workspace
py -3.12 -m venv .venv
.venv\Scripts\activate
pip install --no-index --find-links <folder>\pfs0410-win "pyflightstream[fsi]"
python -c "import pyflightstream; print(pyflightstream.__version__)"
pyfs-matrix --help
```

- `<folder>` is where the carried wheels are; any local or network folder works.
- `deactivate` leaves the environment.
- A development build installs the same way: its wheel is in the folder.

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Rules of a shared environment

Build it at its final path

A virtual environment cannot be moved: its absolute path is written into `activate` and into every command. Built in `$HOME` and copied, it breaks for a colleague days later with `bad interpreter`.

The interpreter is recorded, not configured

A run writes the path of the Python that ran it into the solver's action programs. The environment must therefore sit at a path valid on every node.

Takeaway *Put the version in the folder name (`pfs0410`). Older environments stay beside the new one, and an old study stays reproducible.*

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Two folders with the same name

`py-venv/pfs0410` is the environment, and `venv` creates it. `pfs-wheels/pfs0410-linux` is the folder of wheels, and only the copy from the connected machine creates it. When the second is missing, `pip` answers:

```
WARNING: Location '.../pfs-wheels/pfs0410-linux' is ignored: it is either
a non-existing path or lacks a specific scheme.
ERROR: No matching distribution found for pyflightstream
```

Takeaway *An `ls` of `py-venv/` shows a folder that looks like proof. It is the other folder: list the one `pip` reads.*

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One activation file for everybody (Linux)

```
# $FTS/bin/pfs0410-env
export PATH=<cluster-root>/fts-unix/py-venv/pfs0410/bin:$PATH
```

- Users write `source $FTS/bin/pfs0410-env` at the top of a session or of a job script.
- It exports `PATH` rather than defining an alias, because a job script does not expand aliases.
- The files of older environments stay beside it.
- To leave it: a new shell, or take the folder off `PATH` again.

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Part 5

Running and recording

Running a matrix locally on Linux

The rule

To run a matrix locally on Linux, change only the executable path in executables.toml.

- The row's `FS_BUILD` id maps to the executable in `inputs/executables.toml`; a path true of one machine only goes in `inputs/executables.local.toml`, read over it. Nothing else changes.
- With a profile in `inputs/hpc/` the run would submit; keep it here:

```
source $FTS/bin/pfs0410-env
pyfs-matrix run matriz.fs --workspace . --local
```

Records say `forced_local`; no `collect` needed afterwards.

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Record what you did

Fact	Why the next person needs it
where the 3.12 came from	the module name, or the standalone archive and its sha256
the environment folder	`py-venv/pfs0410`, and the activation file
the package version	what `pyflightstream.__version__` printed
the platform tags used	the download command, verbatim
when, and by whom	so the next installation is the same one

Takeaway *Two facts exist only in the head of whoever installed. Write them down, beside the environment.*

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Command summary

Windows target

```
pip download "pyflightstream[fsi]==0.58.2" ^
  -d W --python-version 312 ^
  --only-binary=:all: --platform win_amd64
py -3.12 -m venv .venv
.venv\Scripts\activate
pip install --no-index --find-links W ^
  "pyflightstream[fsi]"
pyfs-matrix --help
```

Linux target

```
pip download "pyflightstream[fsi]==0.58.2" \
  -d L --python-version 312 \
  --only-binary=:all: \
  --platform manylinux_2_28_x86_64 \
  --platform manylinux2014_x86_64
$FTS/python/bin/python3.12 -m venv --copies $FTS/py-
      venv/E
source $FTS/py-venv/E/bin/activate
pip install --no-index --find-links L \
  "pyflightstream[fsi]"
```

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References

[1] Geovana Neves, *pyflightstream documentation*, page "Getting started". `https://nevesgeovana.github.io/pyflightstream/latest/getting-started/`, and the repository's `README.md`: `https://github.com/nevesgeovana/pyflightstream`.

[2] Python Packaging Authority, *pip documentation*: `pip download` and `pip install`, 2026. `https://pip.pypa.io/en/stable/cli/pip_download/`

[3] Scientific Python, *SPEC 0: minimum supported dependencies*. `https://scientific-python.org/specs/spec-0000/`

REF-57 N. J. Smith, T. Kluyver, *PEP 600: future manylinux platform tags for portable Linux built distributions*, 2019. `https://peps.python.org/pep-0600/`

[4] Python Software Foundation, *Python releases for Windows*. `https://www.python.org/downloads/windows/`

[5] Astral, *python-build-standalone*: relocatable CPython builds. `https://github.com/astral-sh/python-build-standalone`

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