Experimenter's Guide – *Solving Navier-Stokes, Differently*

> **Context.** Clay Institute's €1 M Millennium Prize asks for a proof of existence/uniqueness. We take the *orthogonal* route: a **90-day falsifiable protocol** that bets on *Narrative Ticks* (NTs) and their **distance-ratio rhythm** to beat DNS on lead-time, RMSE, and GPU cost.
>
> We search for **the moment chaos begins to order itself**. That flip-point is the NT. Repeating ratios of NT distances reveal the *fractal rhythm* nature prefers.

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1 · Motivation

Classical CFD hunts for **order → chaos** breakdown (shear layers, vortex shedding …). Our lens inverts it:

Classical lens	NT lens
Track a smooth solution until it blows up	Detect the **first DU flip** (NT) — *where disorder sprouts*
Refine mesh / timestep	Study **successive NT-distance ratios** to expose hidden rhythm

Why ratios?

1. NT distances carry **scale-free memory**; their ratios cluster when the same physics repeats.
2. Over-lapping DU cycles still share the same ratio peaks — an invariant to test.

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2 · Scope & prerequisites

- Python ≥ 3.9 · NumPy · h5py · matplotlib · Streamlit (installed via `requirements.txt`).
- HDF5 file with dataset `G_t` (drag, lift, KE …) — shape `(N,)`, uniform Δt. — shape `(N,)`, uniform Δt.
- **Binder sandbox** → Launch notebook (no install).

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3 · 10-minute smoke-test

1. **Binder** → run `00_quicklook.ipynb` — red dots mark plausible NTs.
2. Run `01_ratio_quicklook.ipynb` — histogram should *not* be flat; expect sharp peaks.

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4 · Full 90-day protocol

Phase	Days	Tool	Deliverable
Data preparation	0-10	`agents/nt_detect.py`	`nt_times.txt`
Initial ratio scan	11-15	`01_ratio_quicklook.ipynb`	spiky histogram
Hyper-search σ	16-25	loop σ ∈ {1.0 … 2.0}	σ* giving strongest peak
LES / ML run	26-80	your solver	NT-aware forecast CSVs
KPI calculation	81-88	dashboard + CLI	`*_ratios.txt`, RMSE, GPU hours
PR submission	89-90	GitHub	`results/<lab_tag>/` folder

Success = lead-time ≥ 30 %, RMSE ≤ 5 % (vs DNS), GPU ≤ ½ DNS.

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5 · Local quick-start

```
# clone & env
git clone https://github.com/gradient-pulse/phi-mesh.git
cd phi-mesh/RGP_NS_prototype
python -m venv .venv && source .venv/bin/activate
pip install -r requirements.txt

# 1 Detect NTs
python agents/nt_detect.py data/example_G.h5 --sigma 1.5

# 2 Ratio histogram quick-look
jupyter lab notebooks/01_ratio_quicklook.ipynb   # or use Binder
```

Batch mode (CLI)

```
# Detect Narrative Ticks
python agents/nt_detect.py path/to/G_t.h5 --sigma 1.5

# Distance-ratio analysis (writes *_ratios.txt)
python agents/nt_ratio_cli.py nt_times.txt \
       --outdir results/ratios_run --sigma 1.5
```

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6 · FAQ (quick reference)

- **σ choice?** Scan 1.0 → 2.0; pick the σ with the clearest ratio peaks.
- **Over-lapping DU cycles?** Ratio signature survives; treat each NT as a cycle start.
- **Units?** Any scalar — `G(t)` in J, N, etc.; ratios are dimension-less.
- **No PR access?** Zip `*_nt.txt`, `*_ratios.txt`, `kpi.csv` and email marcusvandererve@icloud.com; we'll merge for you.

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7 · Reference

van der Erve, M. (2025). *Solving Navier–Stokes, Differently: What It Takes.* Zenodo. https://doi.org/10.5281/zenodo.15830659

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