Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
ICSC Centro Nazionale di Ricerca in HPC, Big Data and Quantum Computing

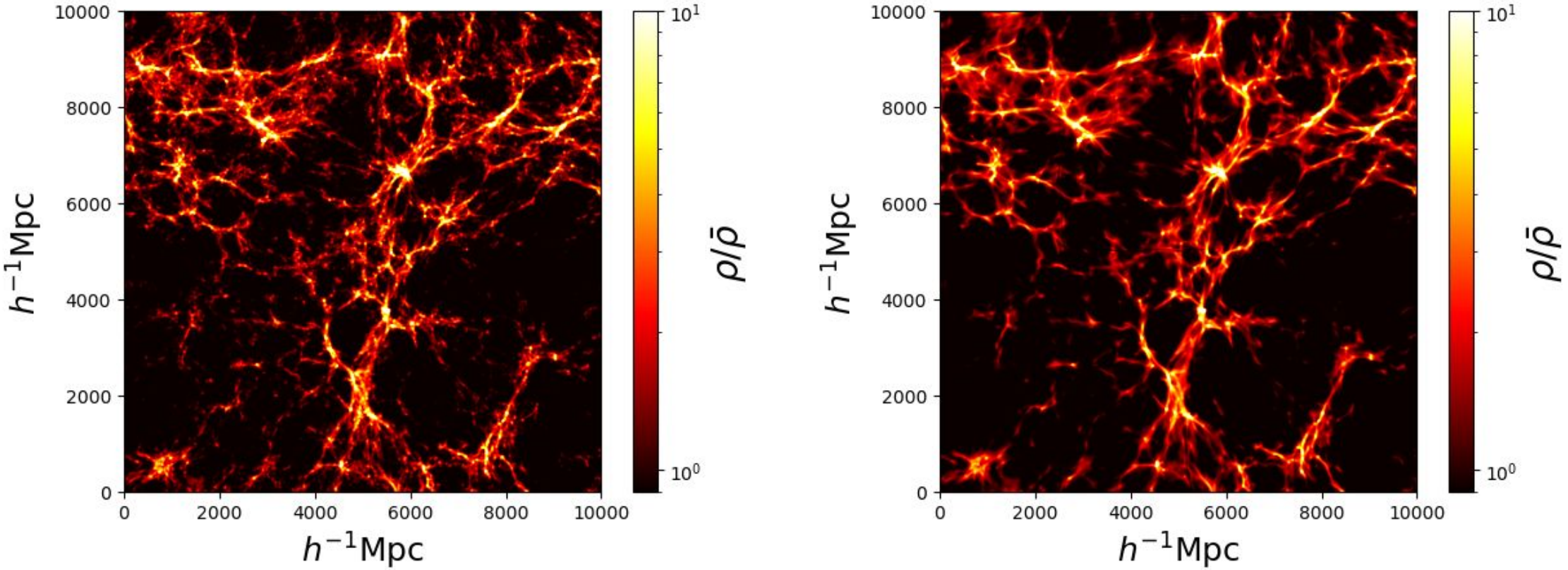
SLOTH: Shedding Light On dark matter wiTH cosmological simulations

Tiago Castro, Milena Valentini, Stefano Borgani, Jeppe Dakin, Klaus Dolag, Gabriele Parimbelli, Antonio Ragagnin, Luca Tornatore, and Matteo Viel

Spoke 3 Technical Workshop, Trieste October 11 / 11, 2023

Scientific Rationale

- Impact of dark-matter nature on the first galaxies



Technical Objectives, Methodologies and Solutions

- Two-flagship simulations with 10240^3 particles on 100 Mpc/h (one WDM with 3kev one CDM)
    - Downgraded to 6656^3 particles on 65 Mpc/h due to technical problems on Leonardo
    - Snapshot size: 10 Tb; Restartfile size: 65 Tb.
- 100 substructure catalogs extracted on-the-fly by SUBFIND
- Post-process it with GAEA semi-analytical method (“galaxy” painting)

- Technical Objective: Assess current parallelism performance of OpenGADGET on a large environment

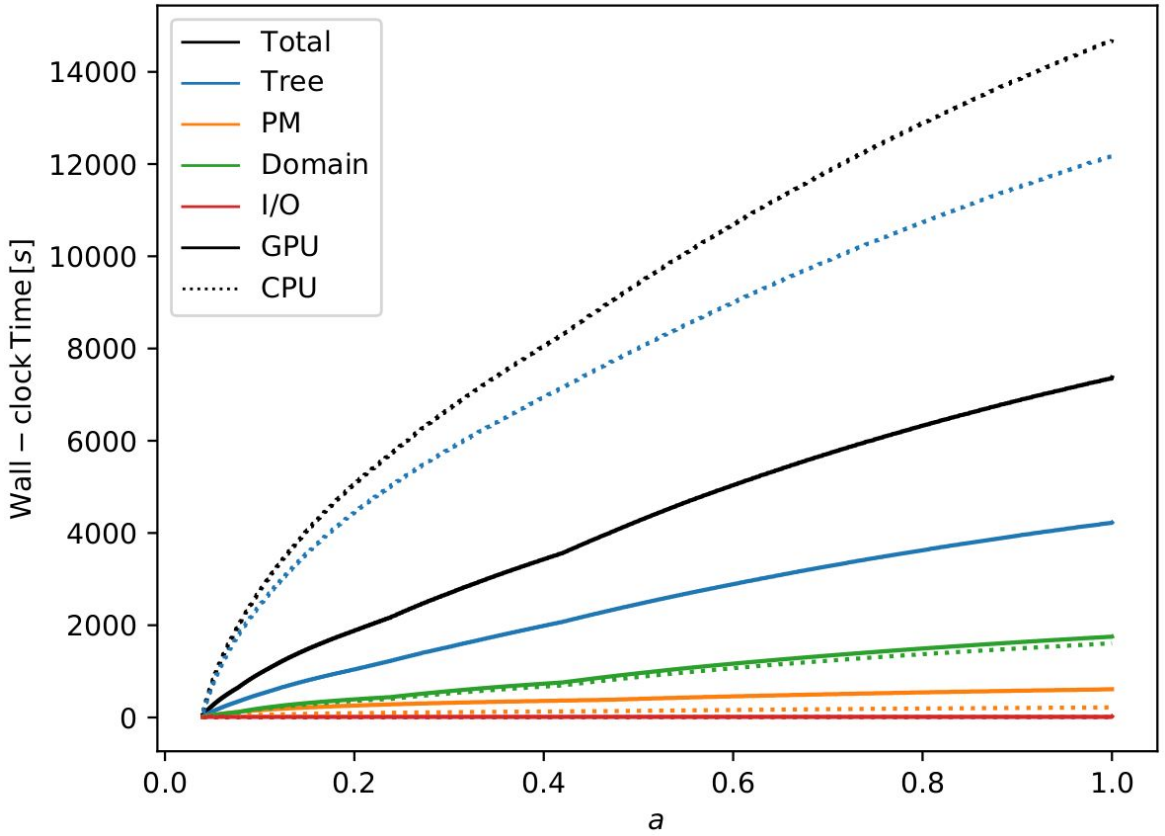
- OpenGADGET: Tree-PM code, mpi+OpenMP+OpenACC parallelized

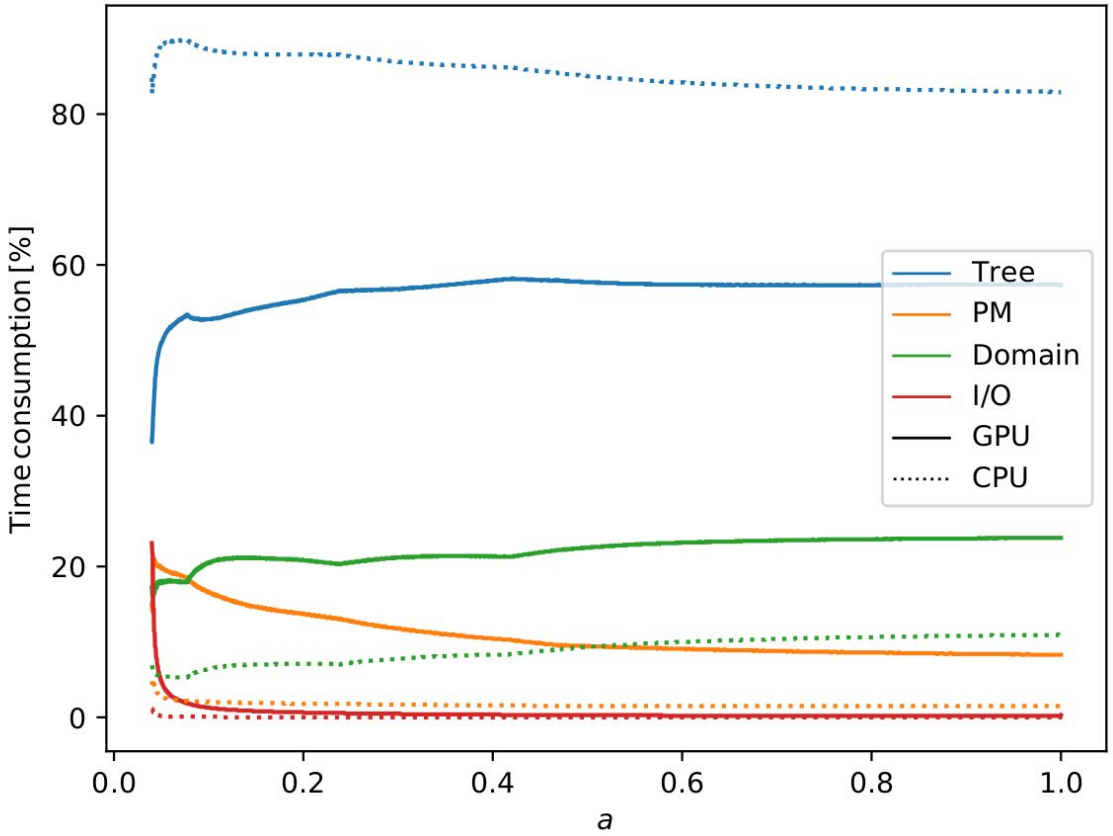
Timescale, Milestones and KPIs

- Timescale:
  - 6 months to run the simulations
  - 2 months to create the galaxy catalogs
  - 4 months to write the paper
- Milestones:
  - Assessment of OpenGADGET performance on GPUs
- KPIs:
  - Public access of the GAEA galaxy catalogs
  - Peer reviewed paper

Accomplished Work, Results

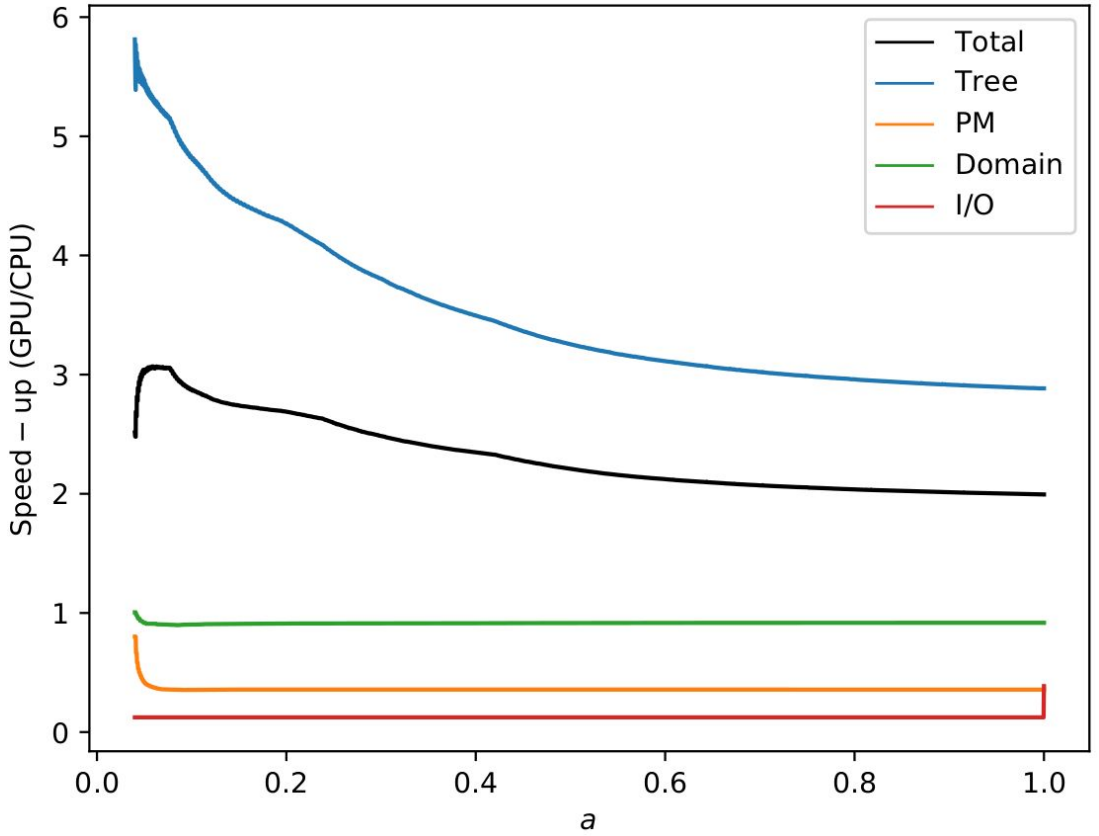
- Accelerators on OpenGADGET:





Accomplished Work, Results

- Accelerators on OpenGADGET:



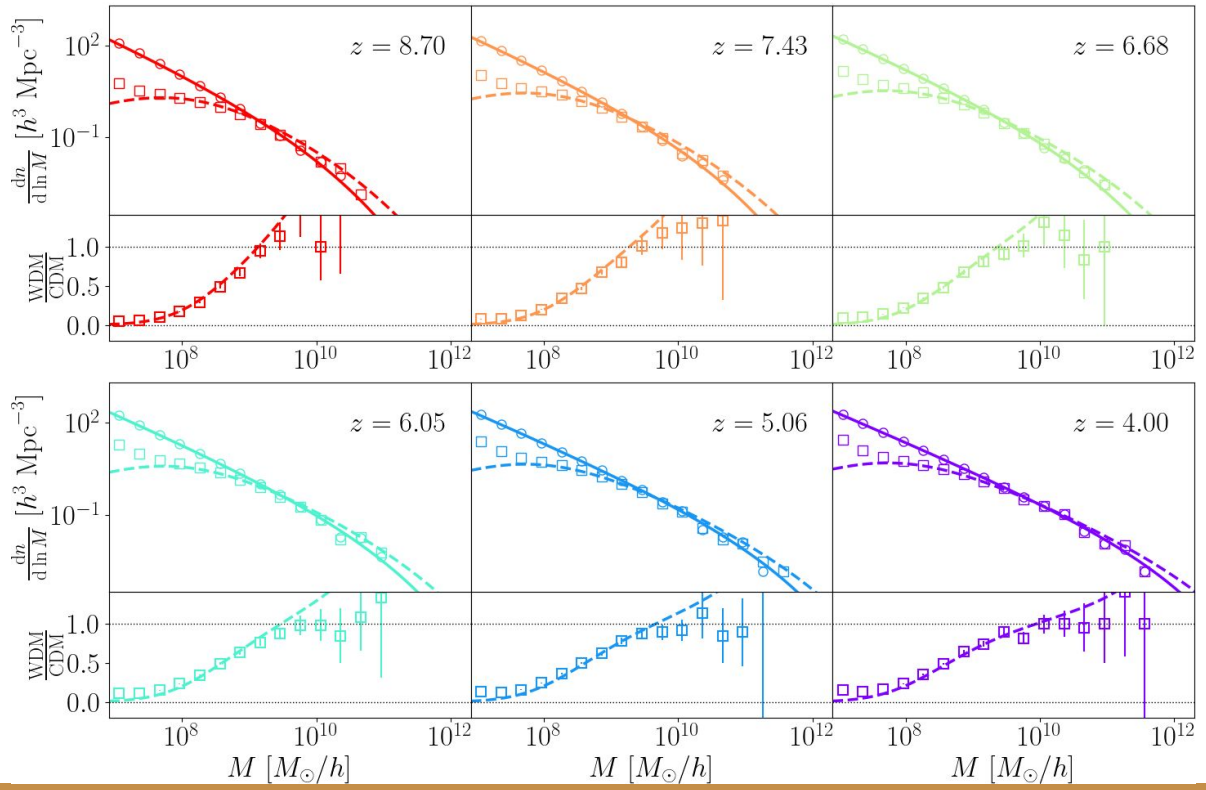
Accomplished Work, Results

- First results on WDM/CDM (10 Mpc/h; 1024^3 part):
  - Extraction of halo catalogs
  - Integration with GAEA

Accomplished Work, Results

- First results on WDM/CDM (10 Mpc/h; 1024^3 part):

Halo mass: FOF; universal function: Sheth-Tormen
ΛCDM: $a = 0.707, p = 0.3$
WDM 3 keV: $a = 0.707, p = 0.300$, window = smooth-k, $c_{M(R)} = 3.3, \beta = 4.8$



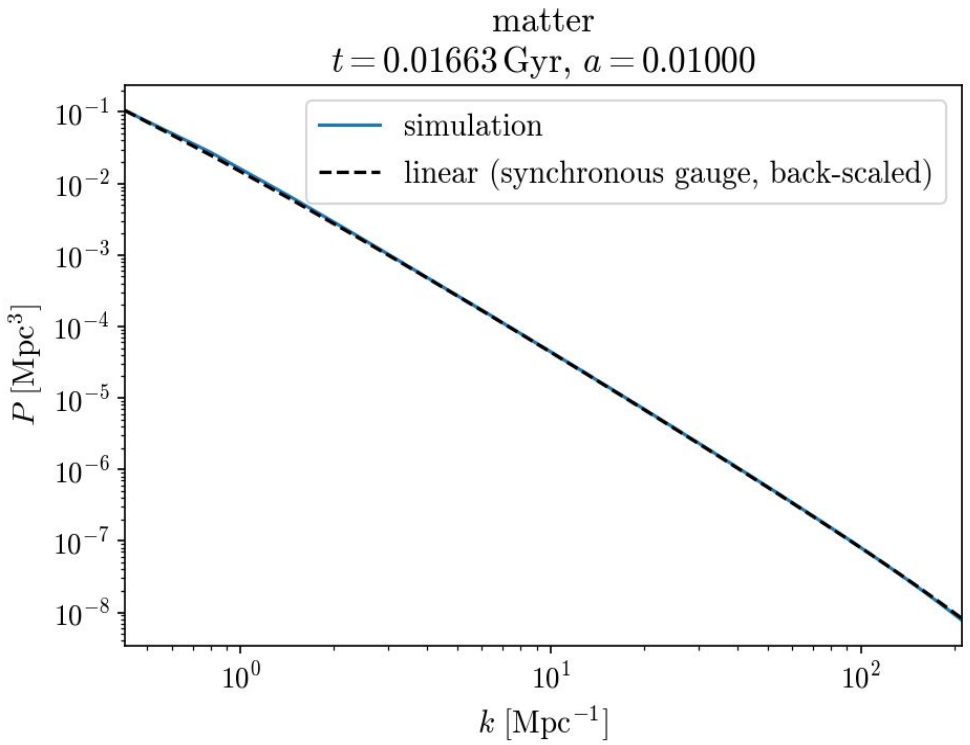
Thanks to Gabriele Parimbelli

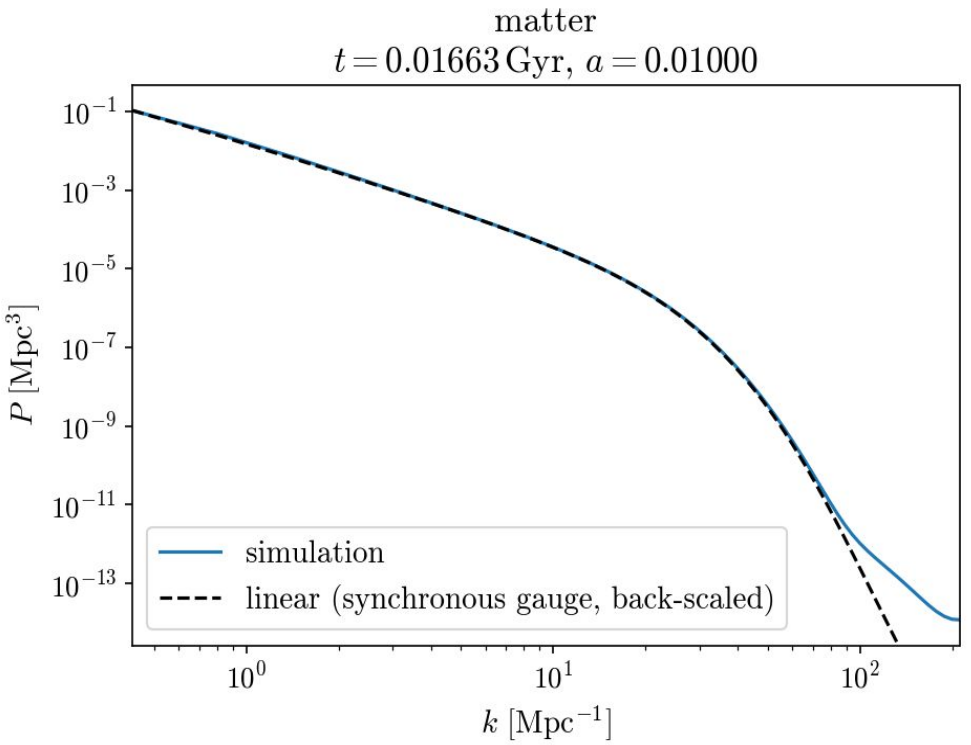
Accomplished Work, Results

Thanks to Jeppe Dakin

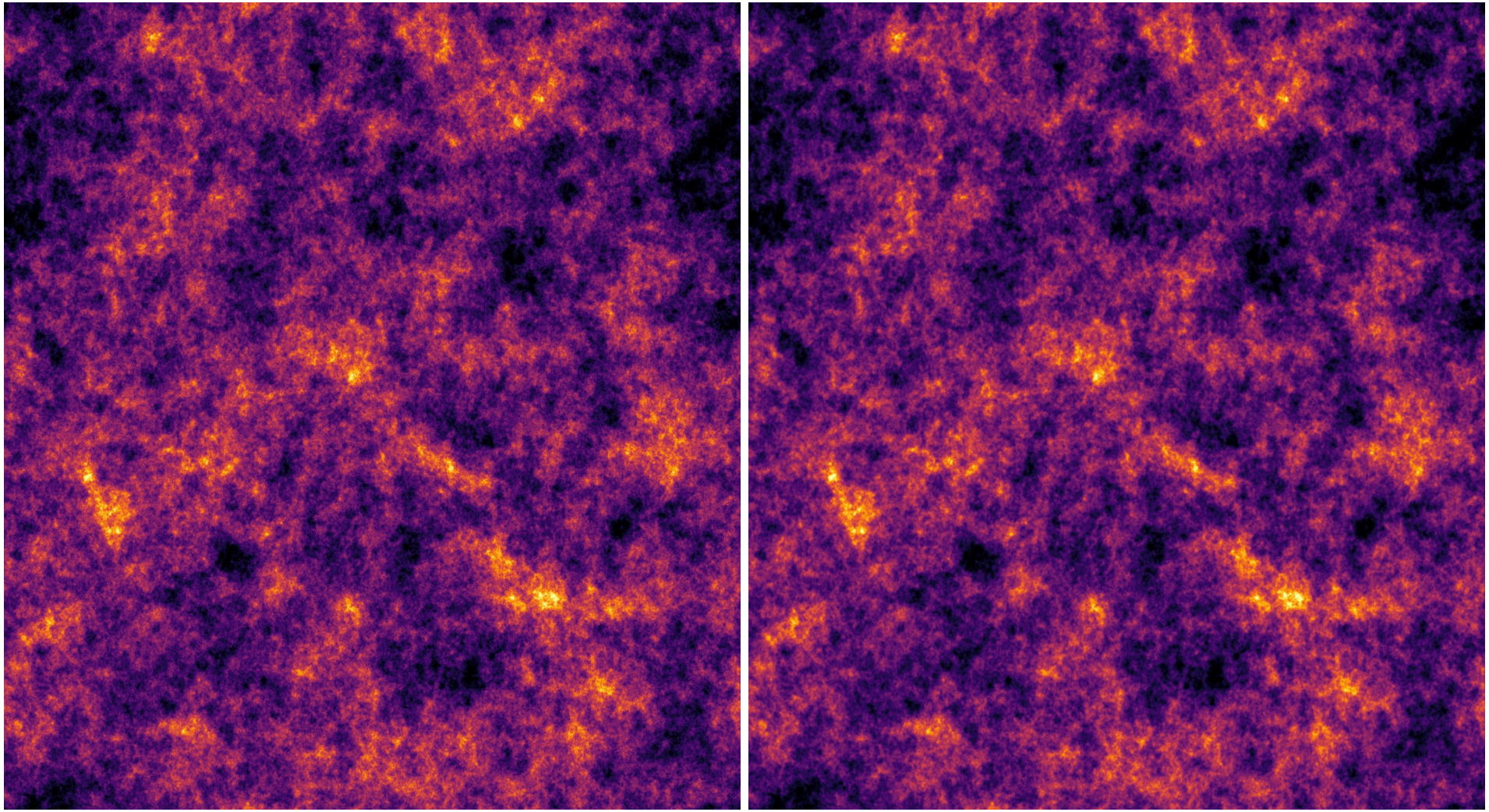
- First results on WDM/CDM Flagship runs:

- ICs created with CONCEPT (Give it a try)

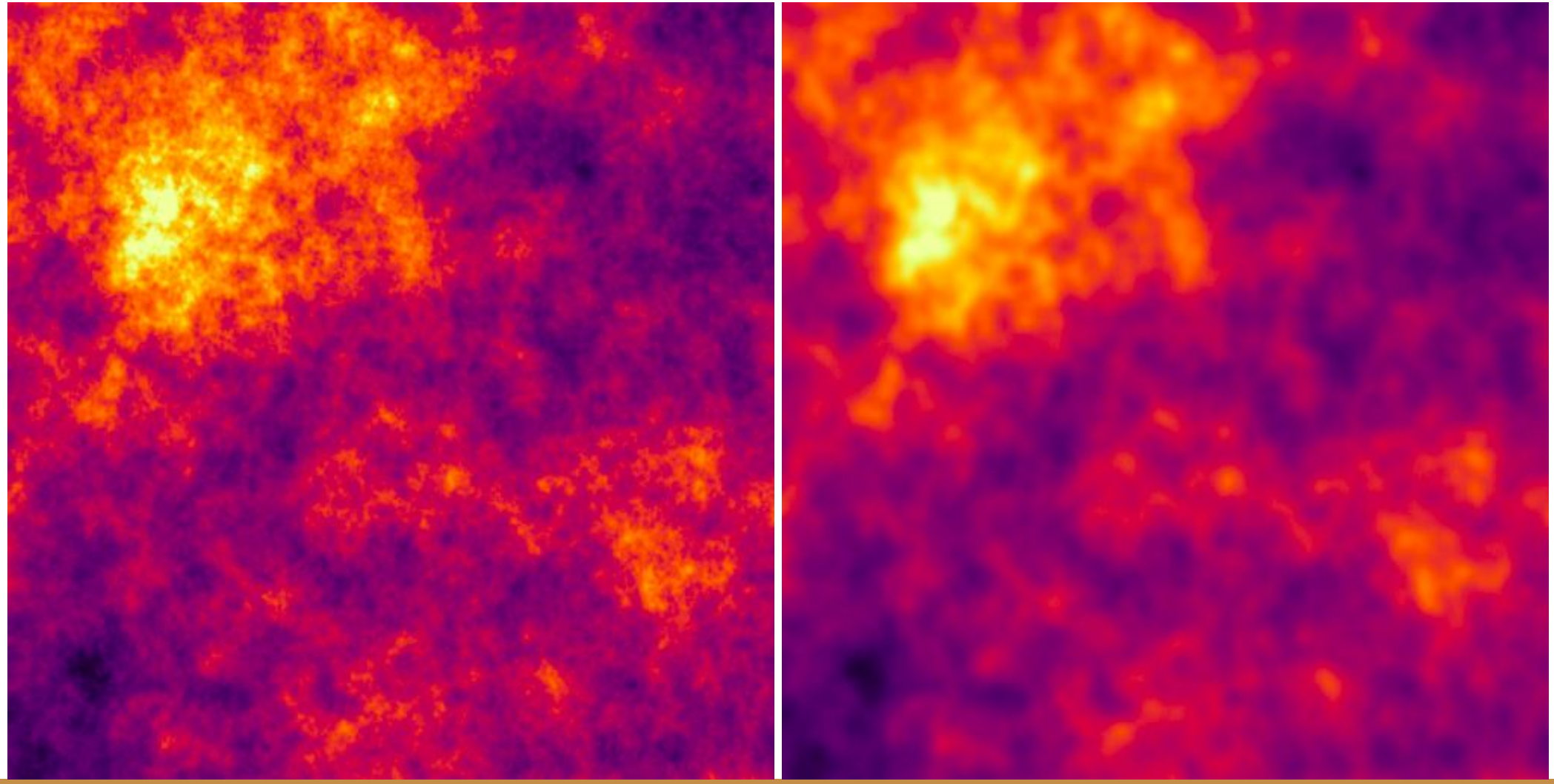




Accomplished Work, Results



Accomplished Work, Results



Accomplished Work, Results

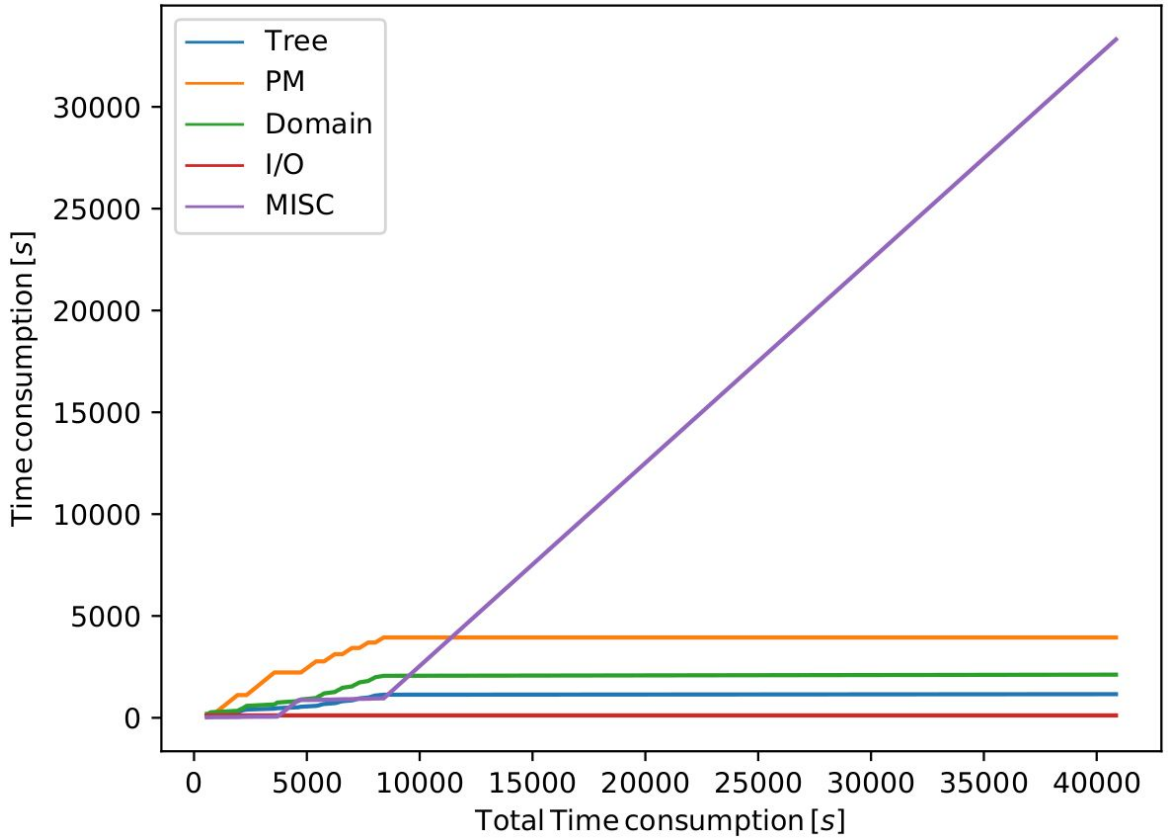
- "We should talk about Leonardo"

- On 479 jobs requesting 32 nodes, I have had 218 failures not catched by our code (45%).

- On 83 jobs requesting 256 nodes, I have had 69 failures not catched by our code (83%).

Accomplished Work, Results

- **"We should talk about Leonardo"**



Next Steps and Expected Results (by next checkpoint: April 2024)

- Use the small boxes to calibrate GAEA

- Run the Flagship simulations

- Create the Galaxy Catalogs