EUROHPC SUMMIT 2024

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UNLEASHING THE POWER OF EUROPEAN HPC AND QUANTUM COMPUTING

Towards a holistic view of the origin of multiple stellar populations in globular clusters

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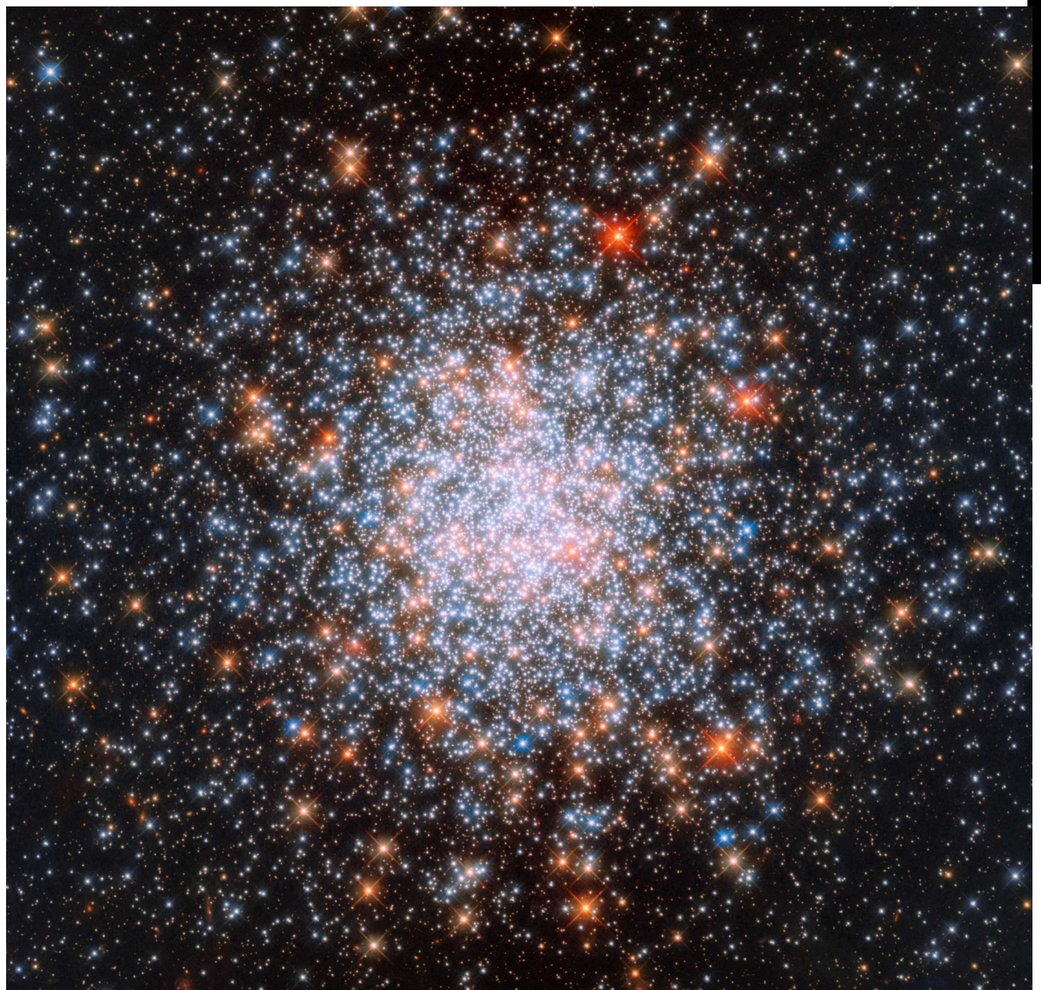
Project: "EHPC-REG-2021R0052"

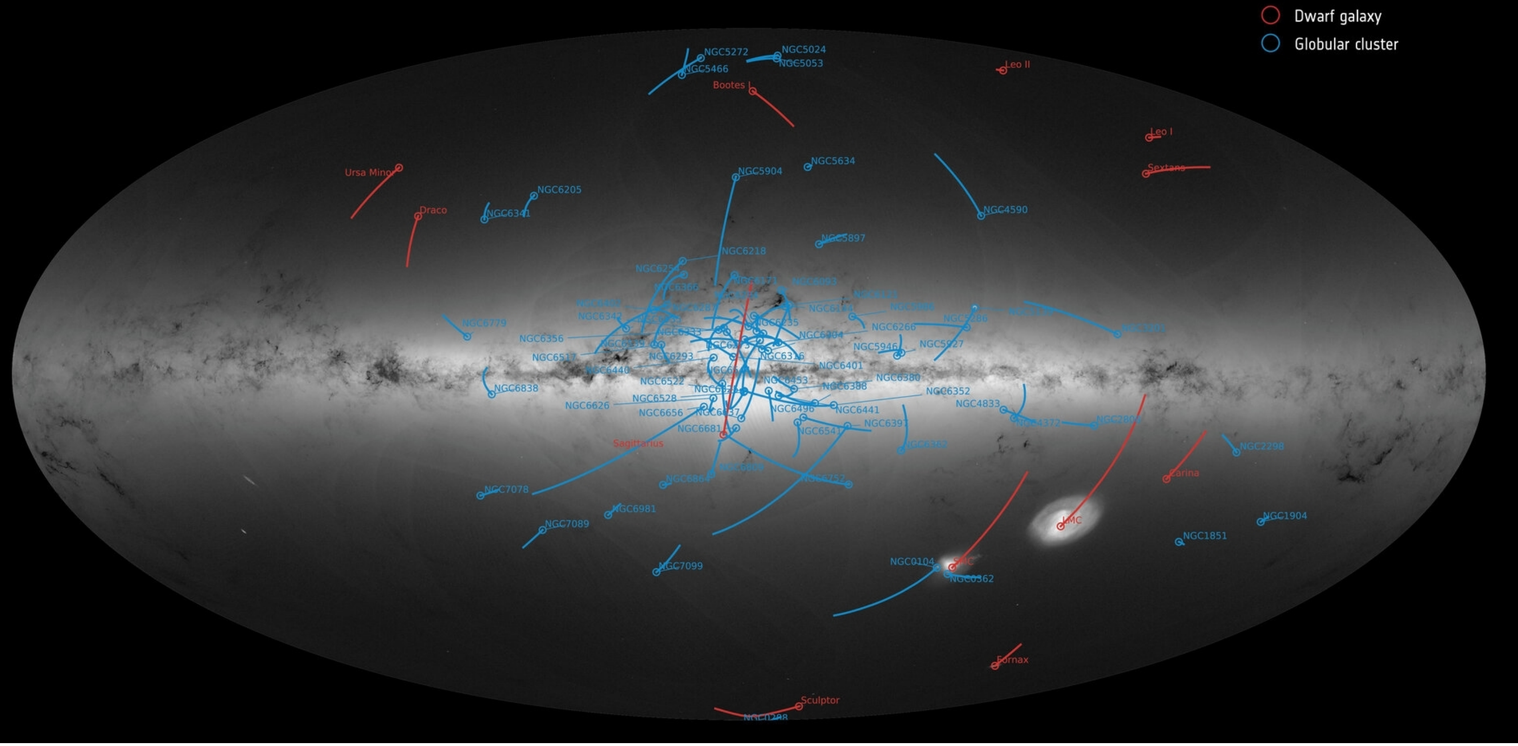
DISCOVERER

Globular clusters

NGC 1866

Credit: NASA / ESA / Hubble





- Gravitationally bound stars
- $N_\star = 10^5 - 10^6$
- Age $\sim 10 - 12$ Gyr
- Composed of multiple stellar populations with peculiar chemical composition

Modelling a realistic physical environment for the formation of multiple populations in globular clusters

Isolated clusters

Physical ingredients

- **Rotation** — *Lacchin+22*
- **CC-SNe** — *EL in prep.*
- **SNe Ia** — *Donati, EL in prep.*

Cosmological zoom-in simulations

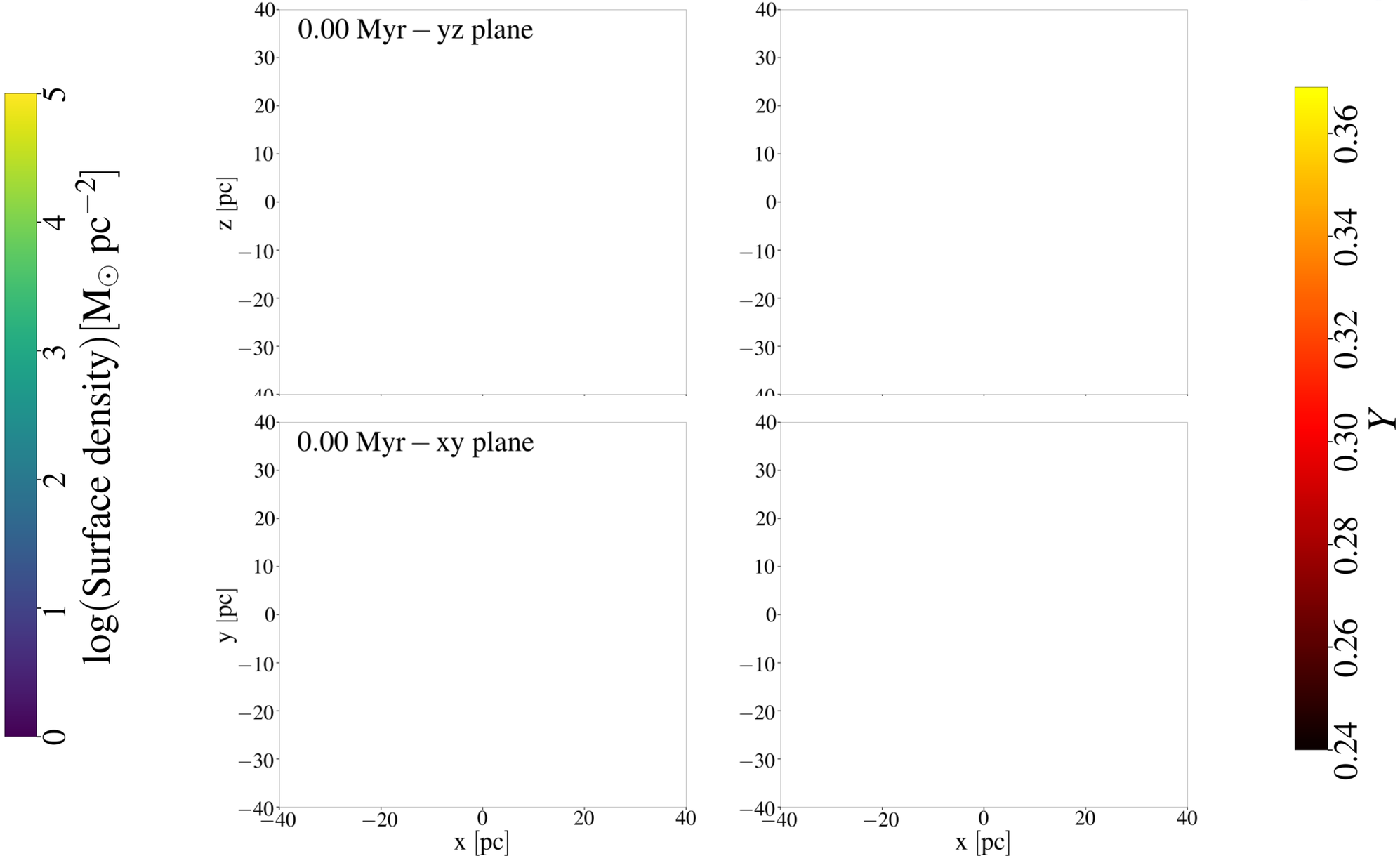
- Sub-pc resolution
- Feedback from individual stars
- Modelled for ~1Gyr

Calura, EL+22, Pascale, EL+23
Calura, EL in prep.

DISCOVERER

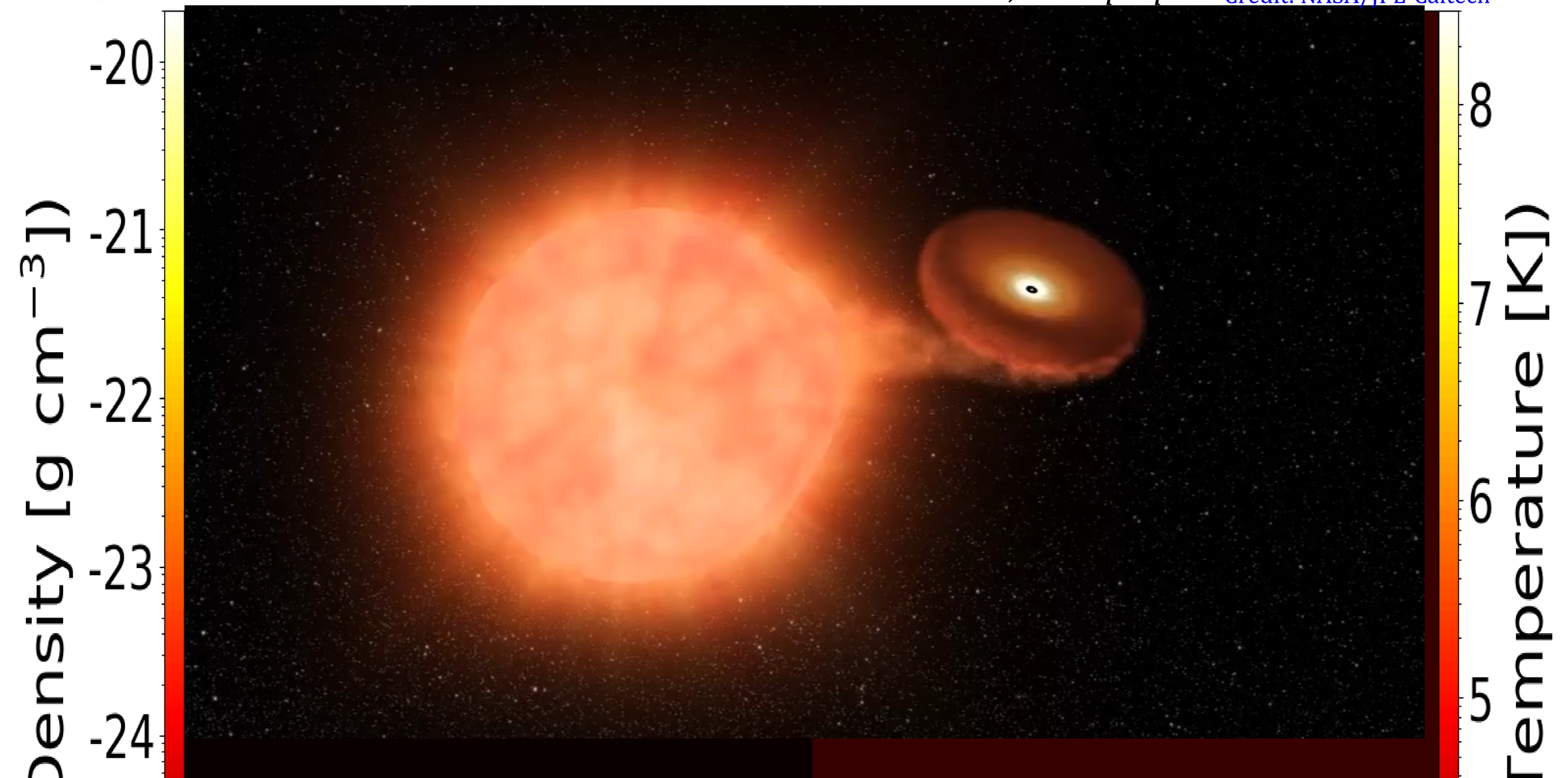
The evolution of the stellar component in a rotating system

Lacchin+22



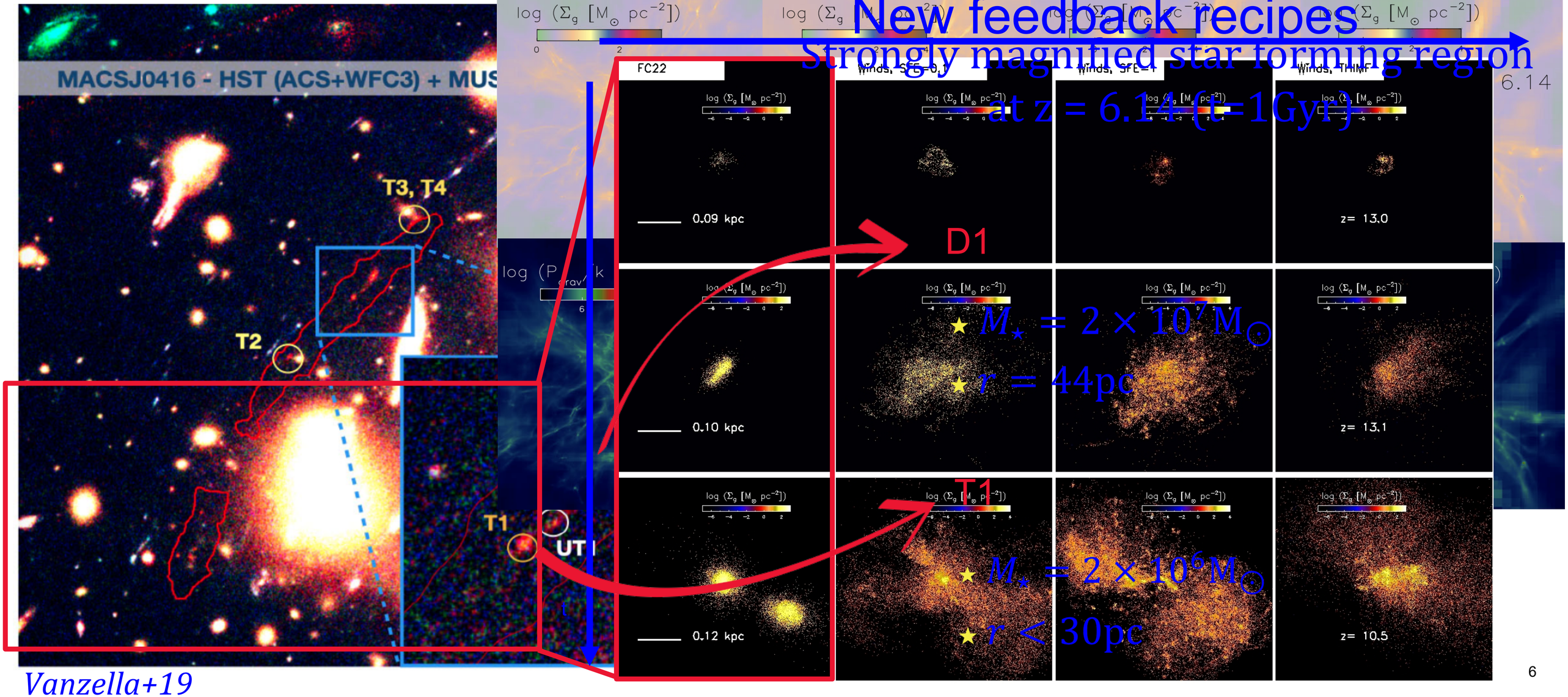
Supernova Ia feedback

Donati, EL in prep.



Cosmological simulations

Calura, Gallerani, Pallottini+22



Vanzella+19

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Destination Earth

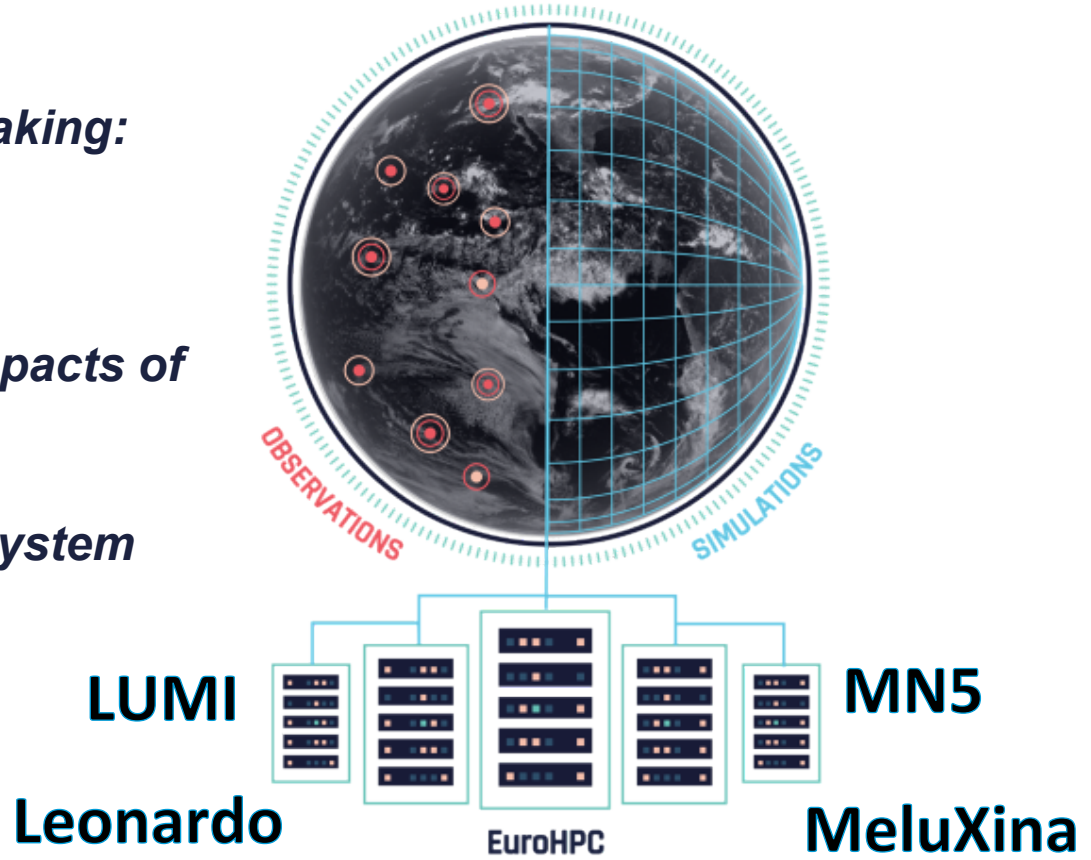
Building on European HPC excellence

Nils Wedi

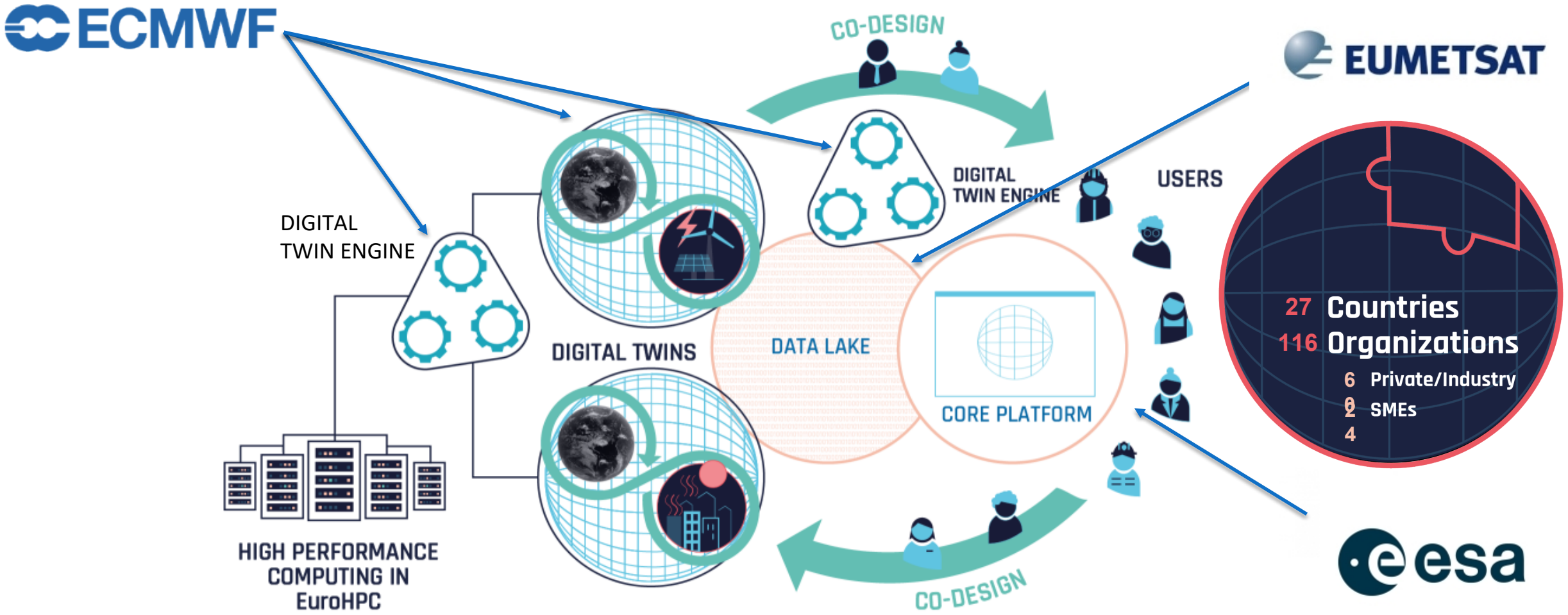
DESTINE: A DIGITAL REPLICA OF OUR PLANET TO RESPOND AND ADAPT TO CLIMATE CHANGE AND EXTREME EVENTS

DestinE, in strategic partnership with EuroHPC Joint Undertaking:

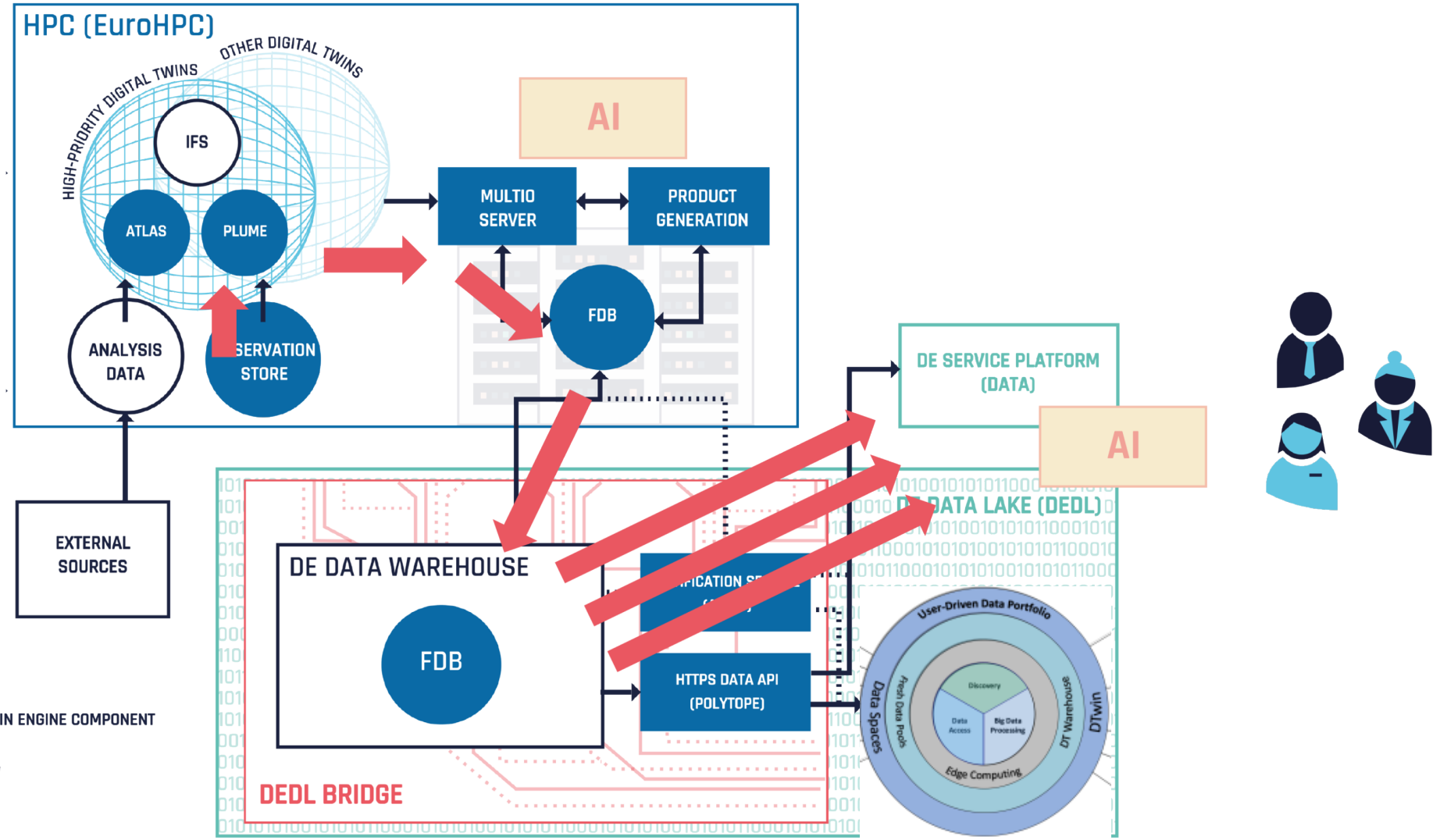
- ***Establishes bespoke cutting-edge simulation capabilities***
- ***Provides Earth-system information at scales where the impacts of extreme events and climate change are felt***
- ***Fosters an innovative and thriving AI-enabled digital ecosystem***



DESTINE: A EUROPEAN ENDEAVOUR

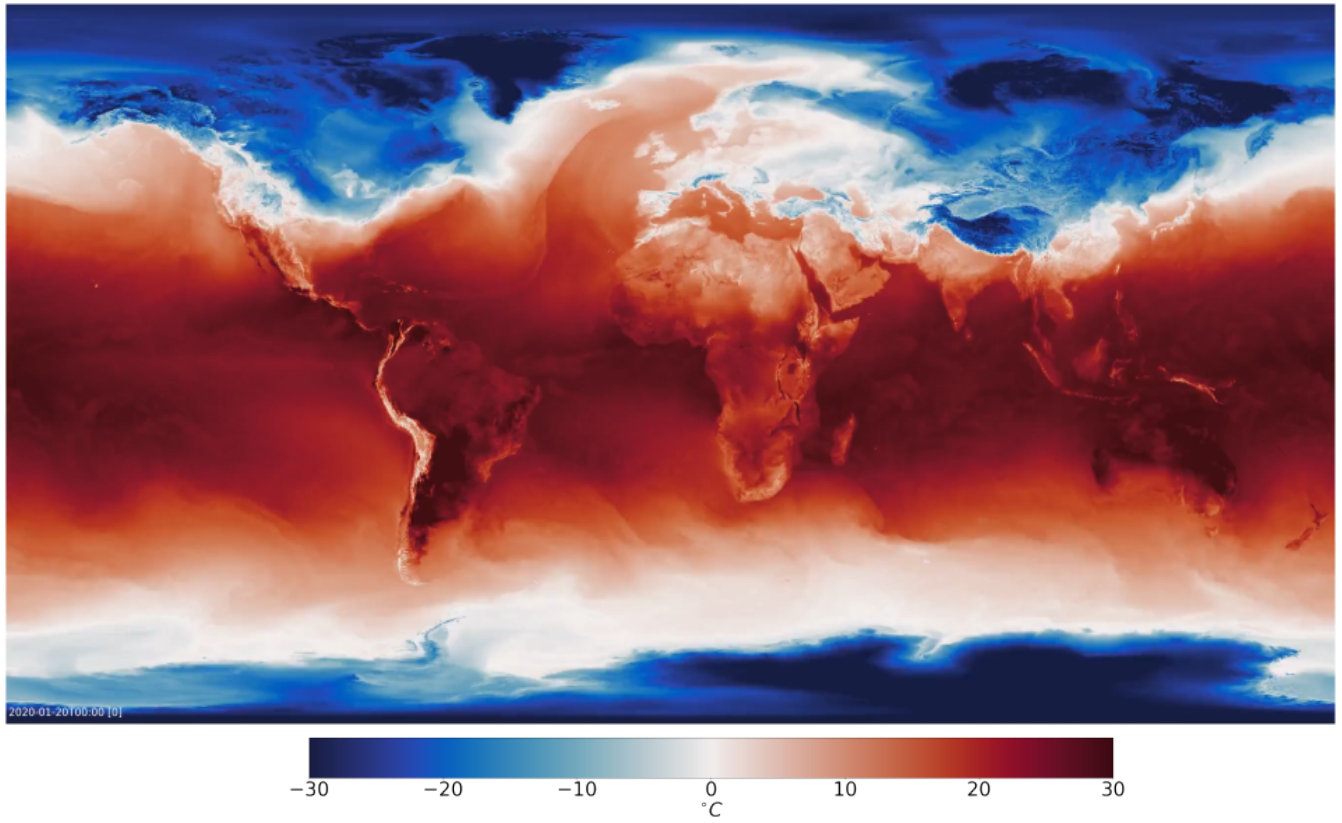


DESTINE COMPLEMENTS EUROHPC



CLIMATE DT: 1ST OPERATIONAL CAPABILITY FOR CLIMATE PROJECTIONS

To test the impact of certain events, scenarios or policy decisions on multi-decadal timescales



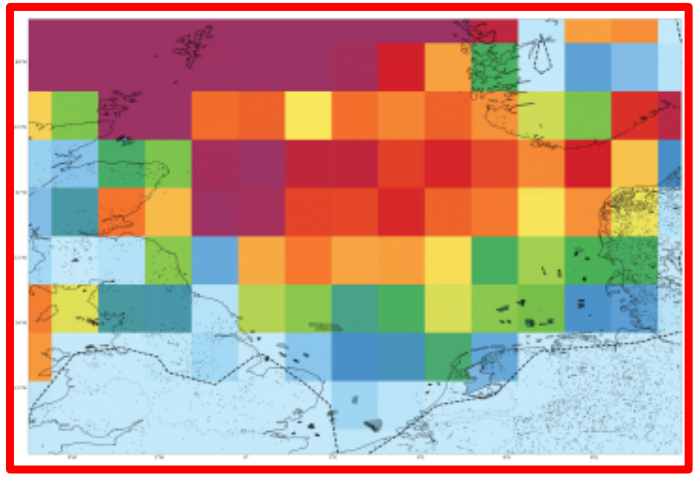
Regularly updated (yearly) and on-demand

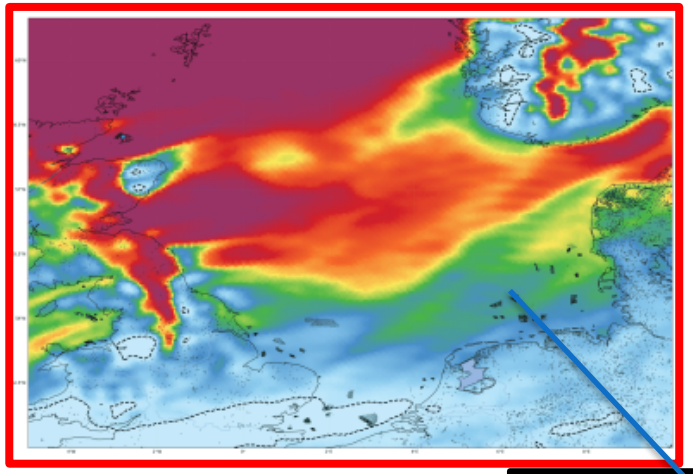
1 x scenario 30 years
== 1-1.5 Million GPU h or 34 Million CPU-core h

How will the climate evolve over the next decades following scenario A or B or if a particular event happens?

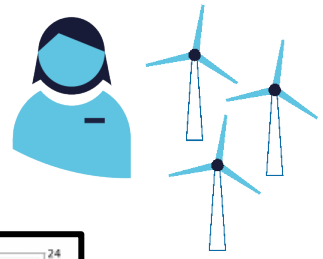
CLIMATE DT: GLOBALLY CONSISTENT CLIMATE INFORMATION A
K

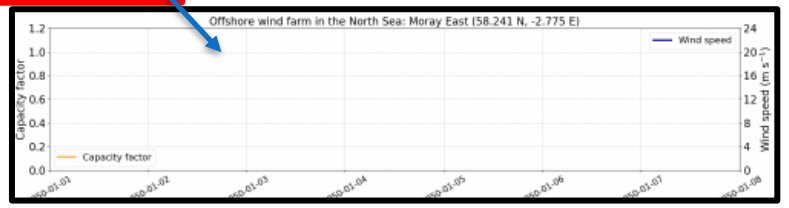
To allow industry, including SMEs, to make well informed business decisions





How to optimize a portfolio of windfarms to maximize energy yield ?

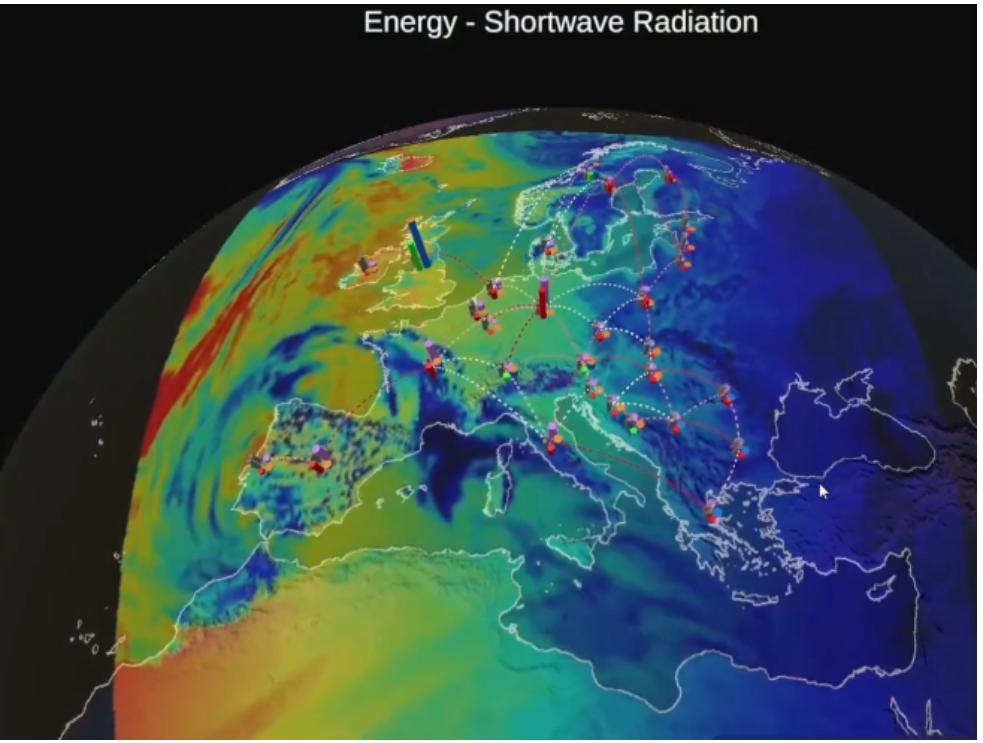




Current state-of-the-art:
- Low temporal resolution: 3 or 6-hourly data.
- Low spatial resolution: regional downscaling needed
- No information at hub height
- Large data extraction required

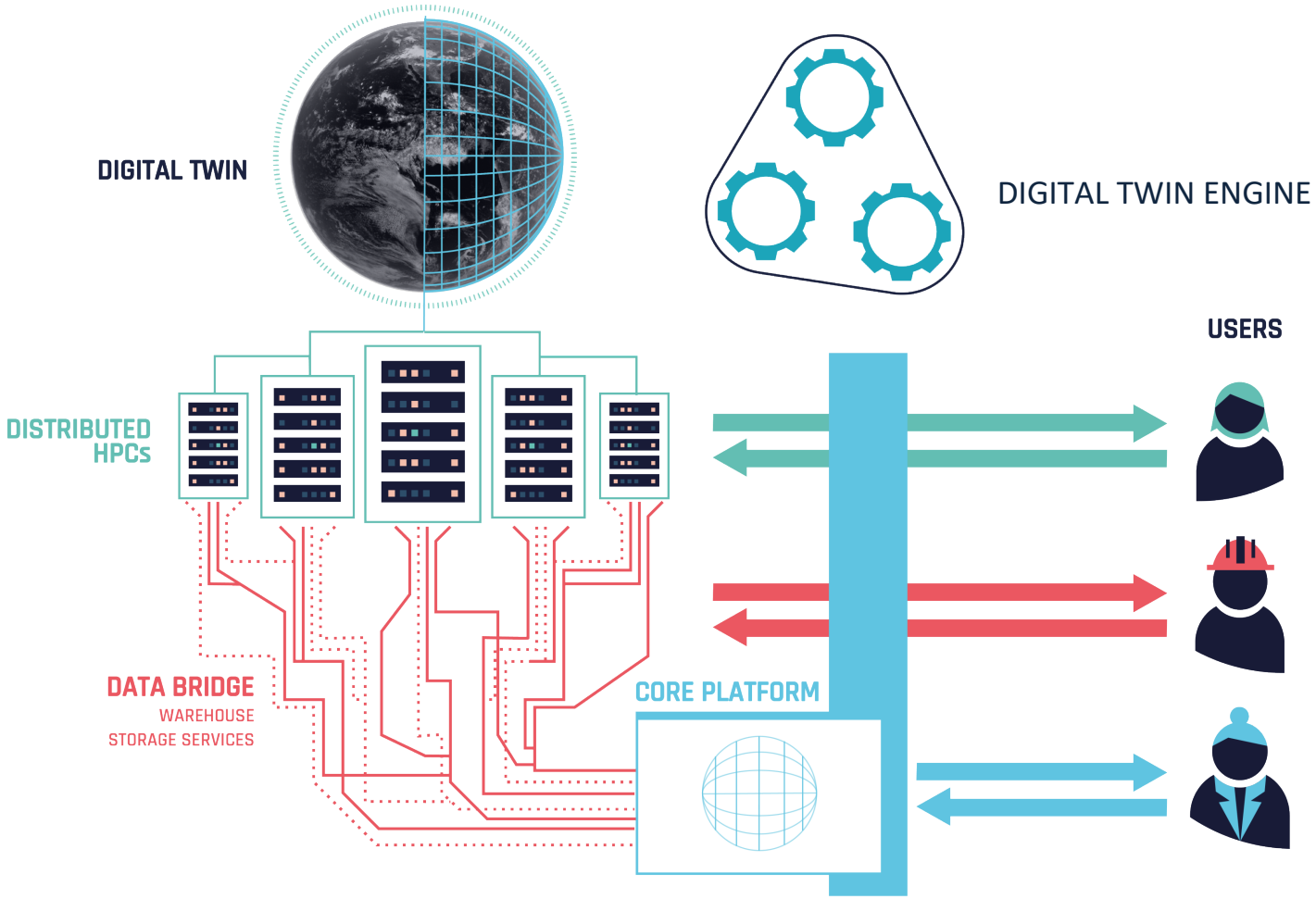
Climate DT:
- Global 1-hourly data.
- 5km resolution, globally
- 100 m wind speed
- Customized information is produced and streamed for any global locations

ENABLING USERS TO EXPLOIT THE DESTINE SYSTEM….



Exprivia/CMCC/DLR

Renewable energy online supply/demand/redistribution in a changing climate



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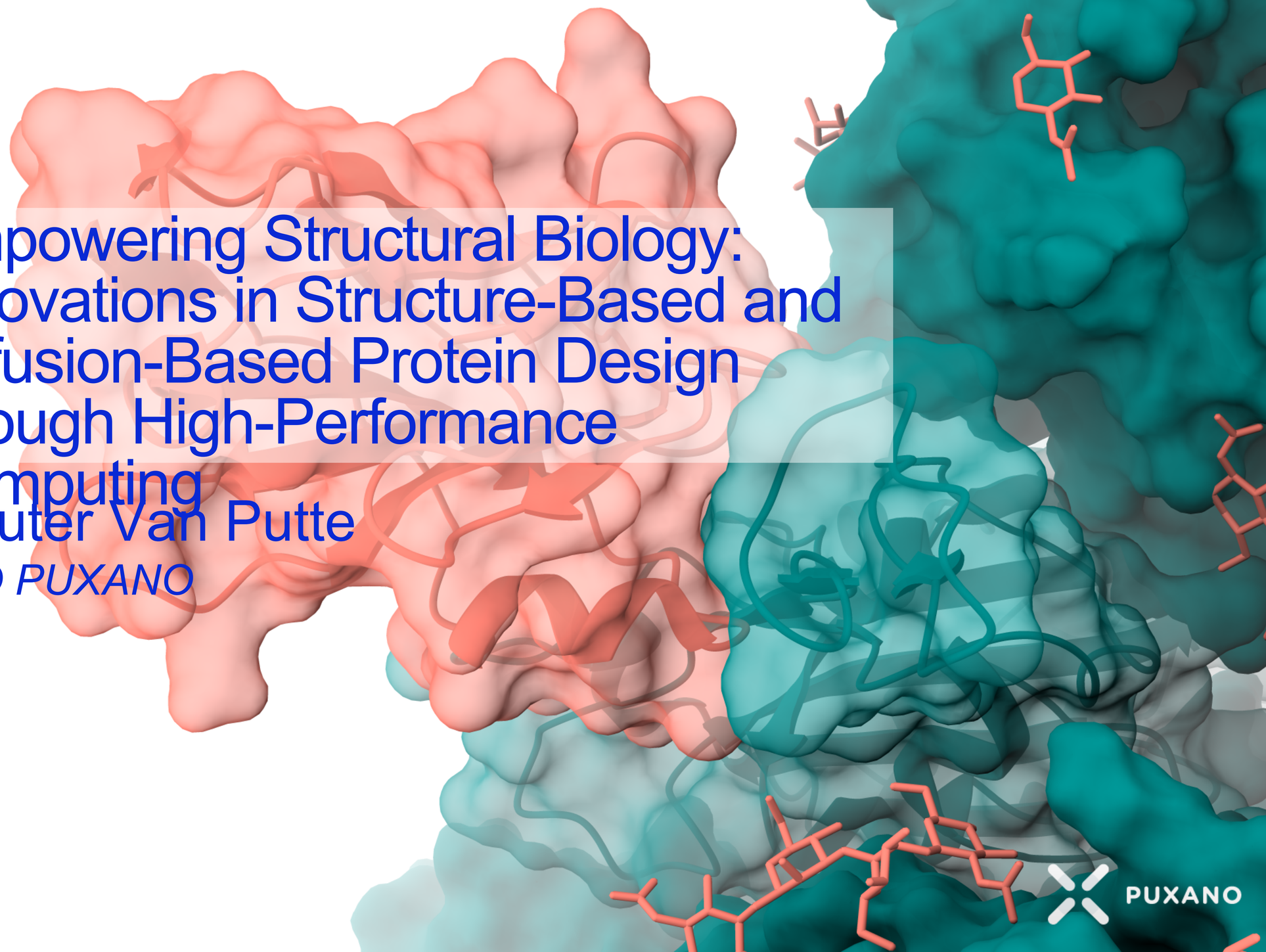
Empowering Structural Biology: Innovations in Structure-Based and Diffusion-Based Protein Design through High-Performance Computing

Wouter Van Putte

CEO PUXANO



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STRUCTURE BASED PROTEIN RESEARCH

POWDER

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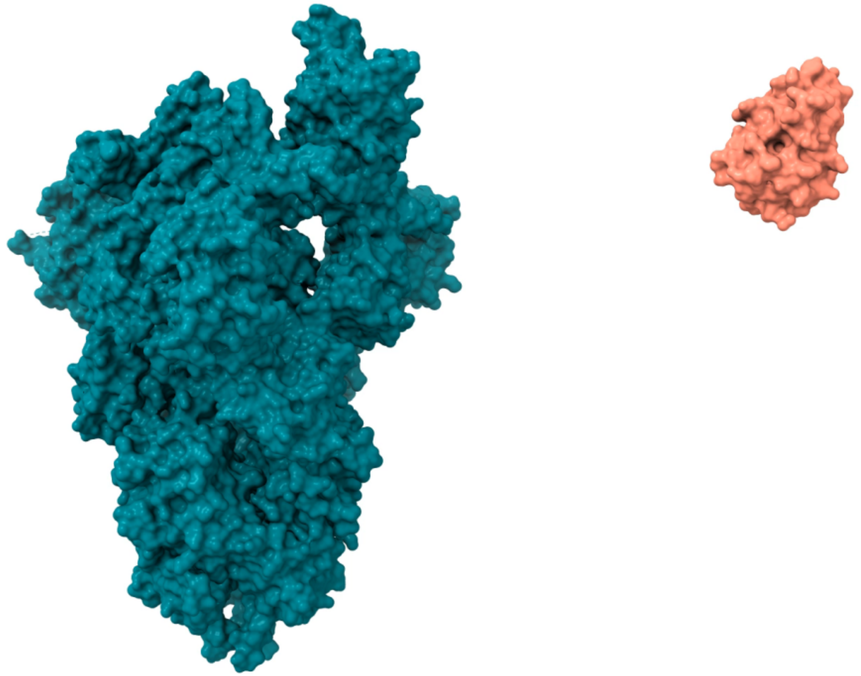

STRUCTURE

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STRUCTURE BASED PROTEIN ENGINEERING

procondor by PUXANO

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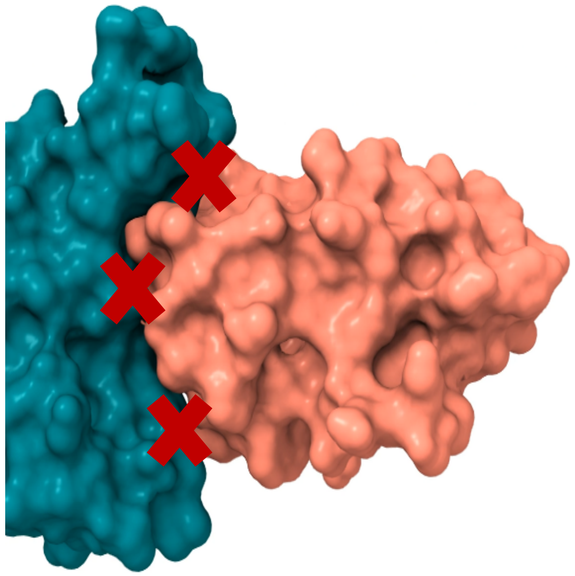

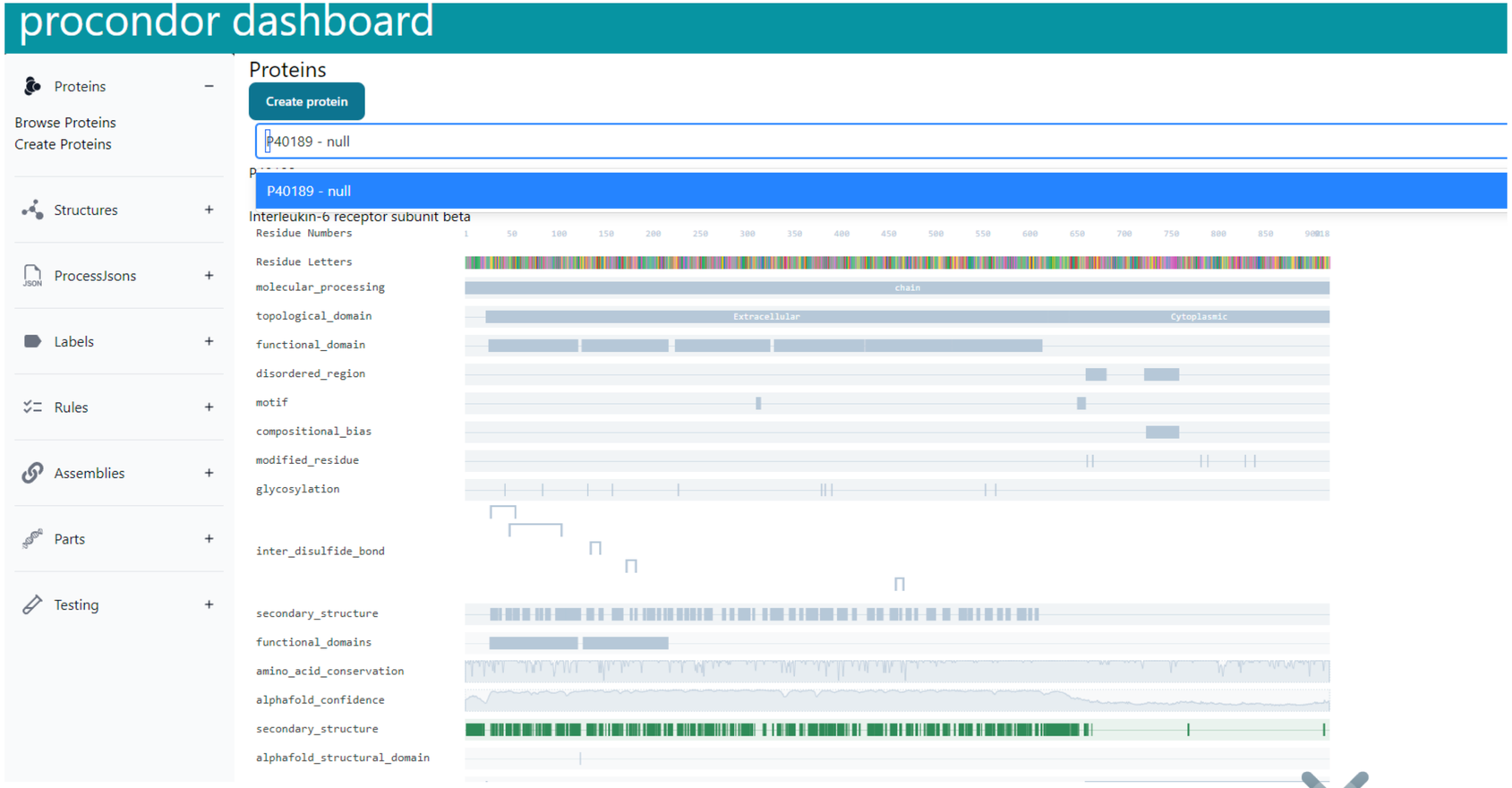

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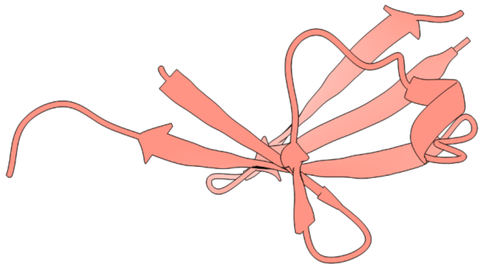
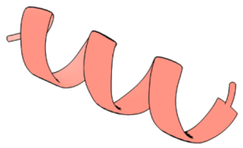
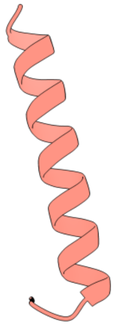
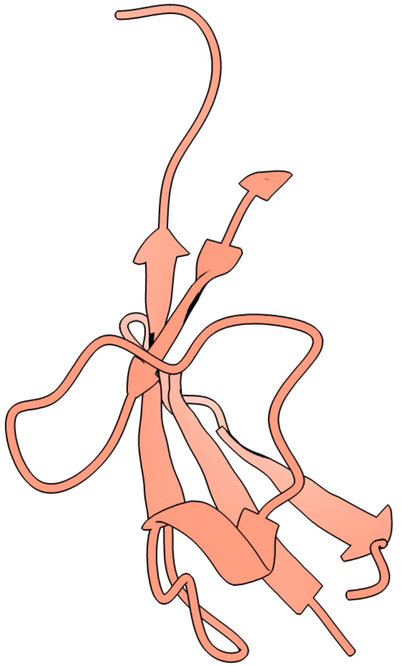
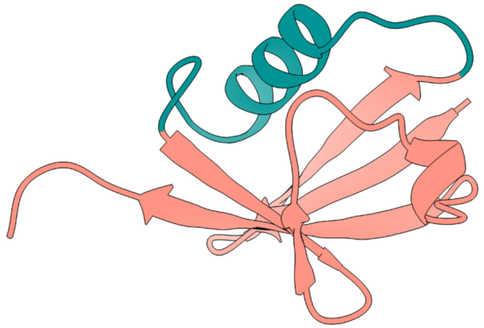
DIFFUSION-BASED PROTEIN DESIGN

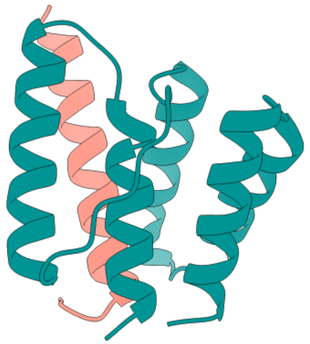












INPAINTING **SCAFFOLDING** **BINDER DESIGN**

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The importance of EuroHPC for young innovative startups.

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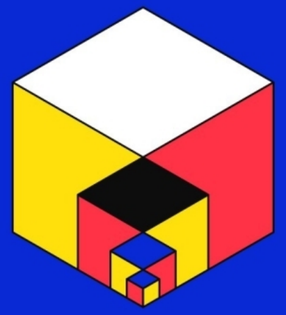

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Training acoustic models at the National Library of Sweden

Leonora Vesterbacka
National Library of Sweden

National Library of Sweden

- collects, preserves and gives access to everything **published** and **broadcasted** in Sweden
- legal deposit law from 1661
- 18 million objects

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