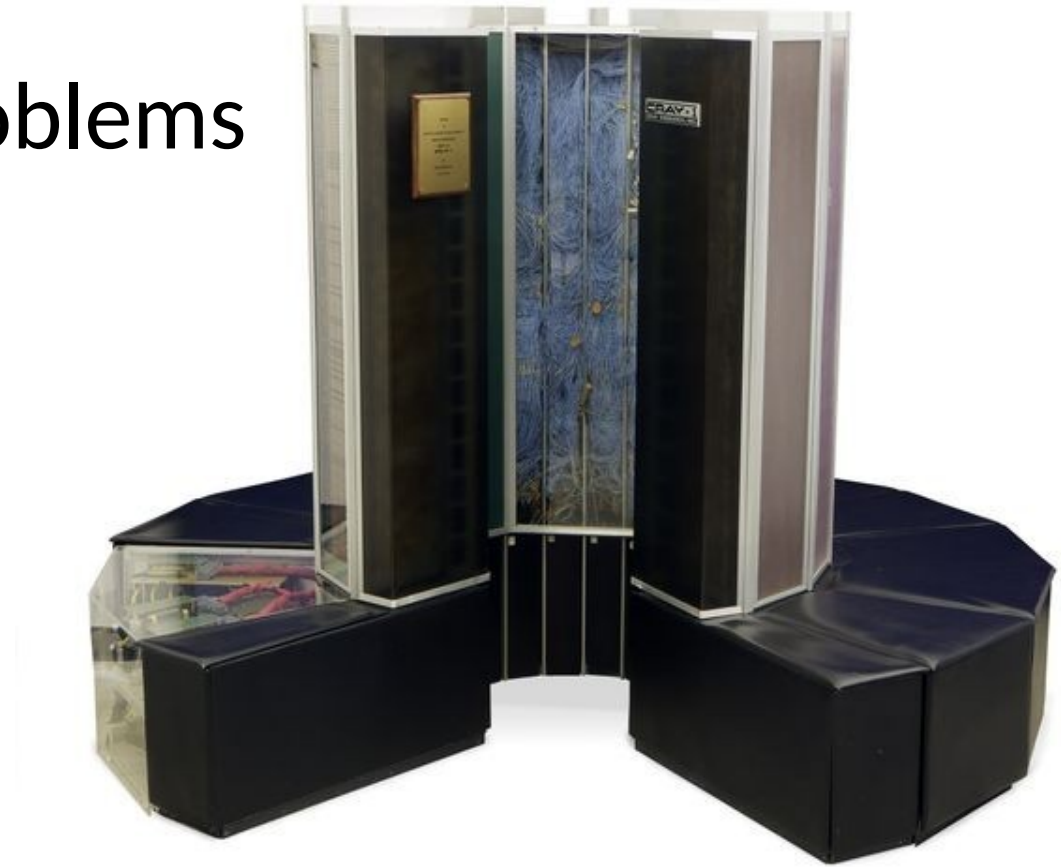

Supercomputers and the evolution of AI

Jan Jona Javoršek

Network Infrastructure Centre

Jožef Stefan Institute

- Competing of computer power
- Solving bigger, more complex problems (CPU, data, time)
- Technical challenges:
 - parallel processing
 - vectorization
 - efficiency



1976: Cray-1 ... 2022: Leonardo

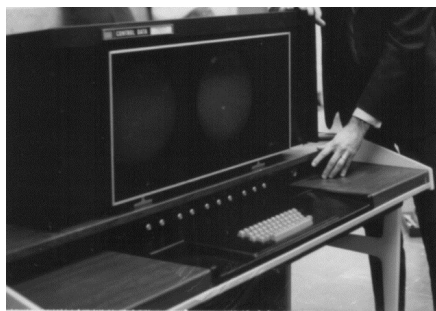
1990: networks, computing and the web

ICT and research in AI since 1972

Rich, long tradition



1960': Zuse Z 23



1970': CDC Cyber 74



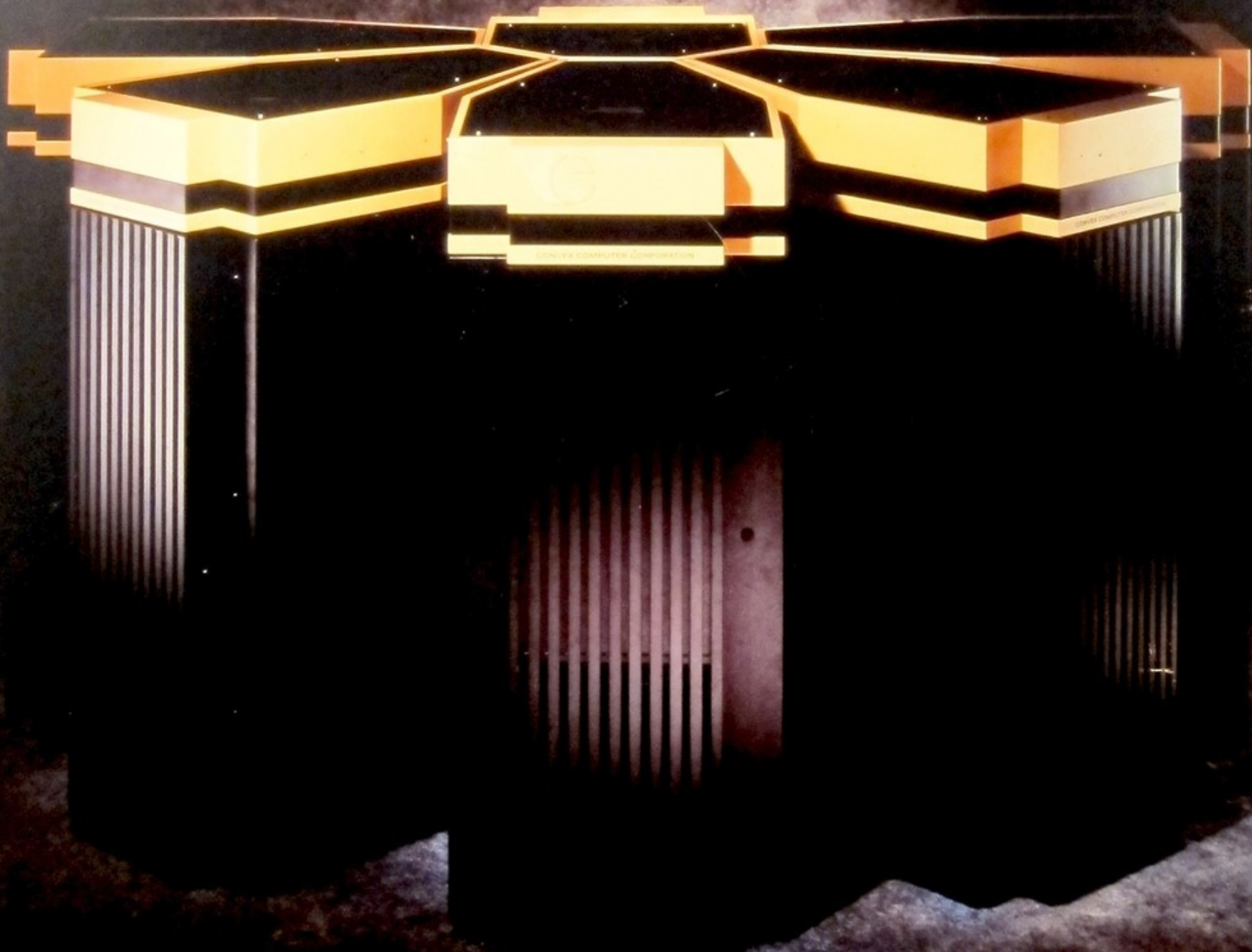
1990's:
CONVEX C3860

Internet: IJS-Nikef: link 1991



Slovenia @ WEB since 23 Nov 1993





Home » Josef Stefan Institut » C3860

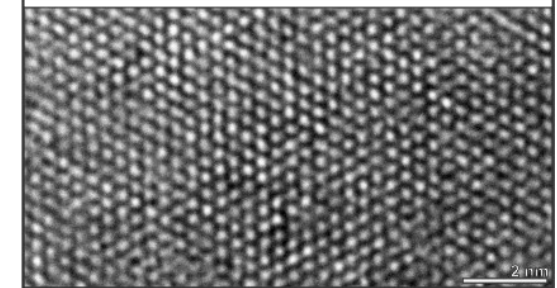
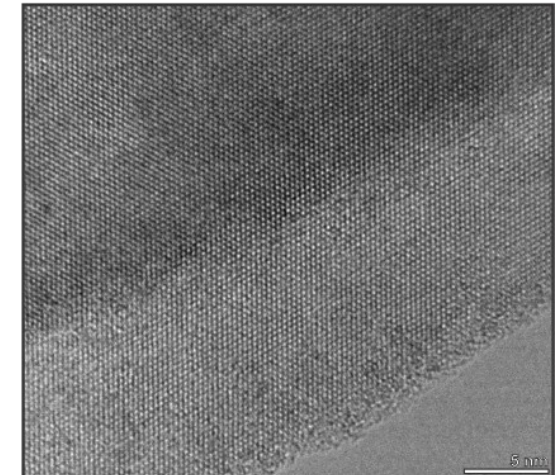
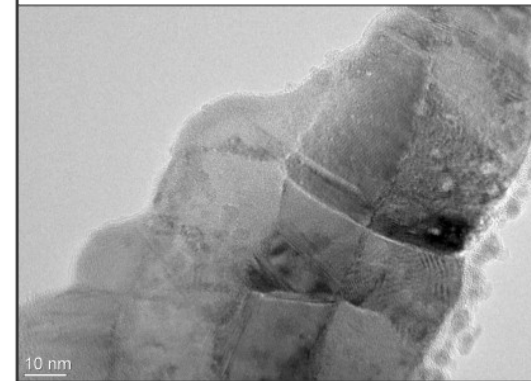
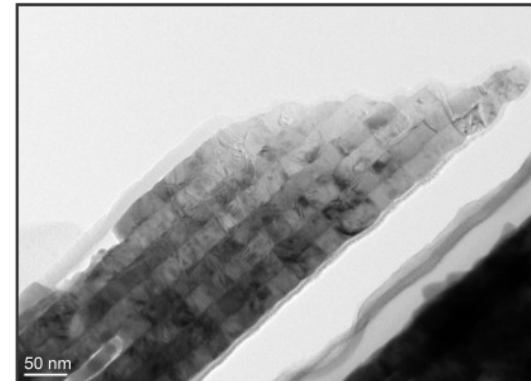
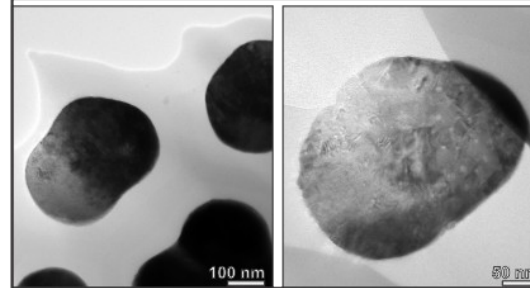
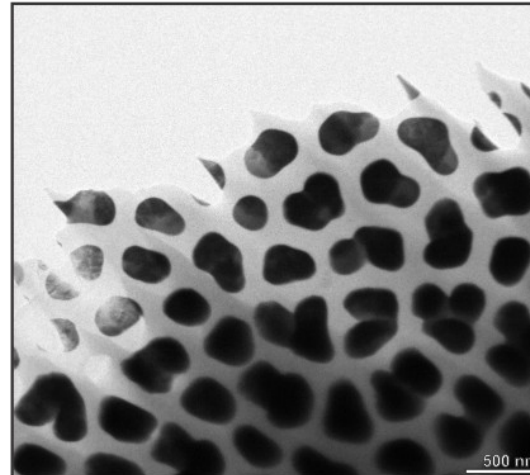
C3860

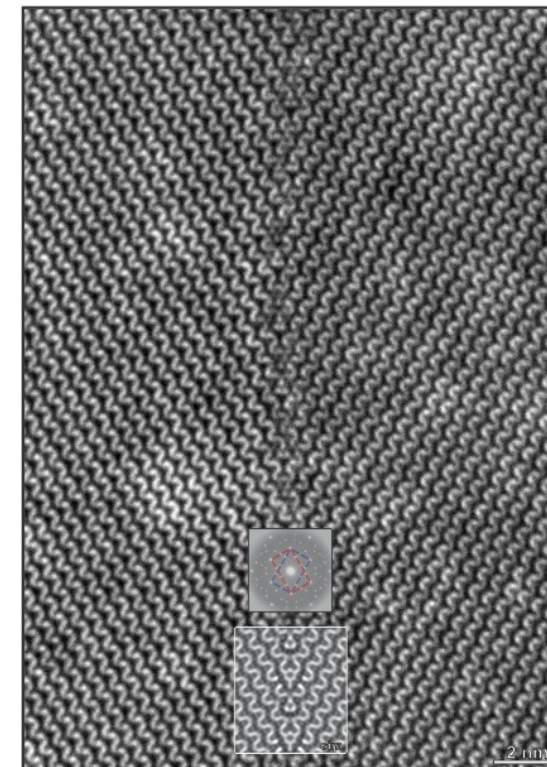
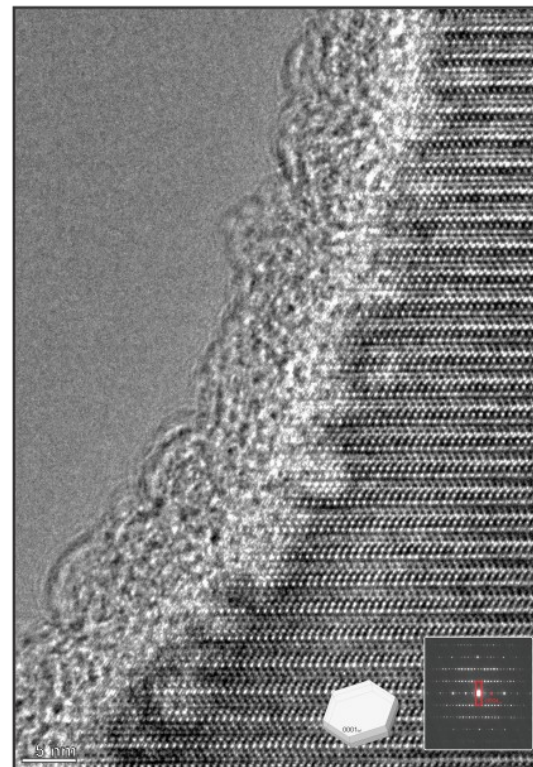
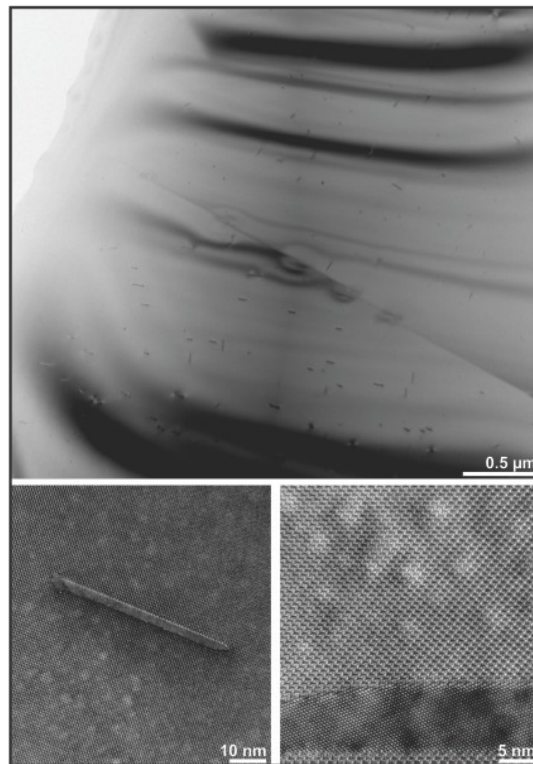
Site:	Josef Stefan Institut
Manufacturer:	HP
Cores:	6
Processor:	Convex 59MHz
Interconnect:	
Installation Year:	1993
Performance	
Linpack Performance (Rmax)	0.61 GFlop/s
Theoretical Peak (Rpeak)	0.72 GFlop/s
Software	
Operating System:	ConvexOS

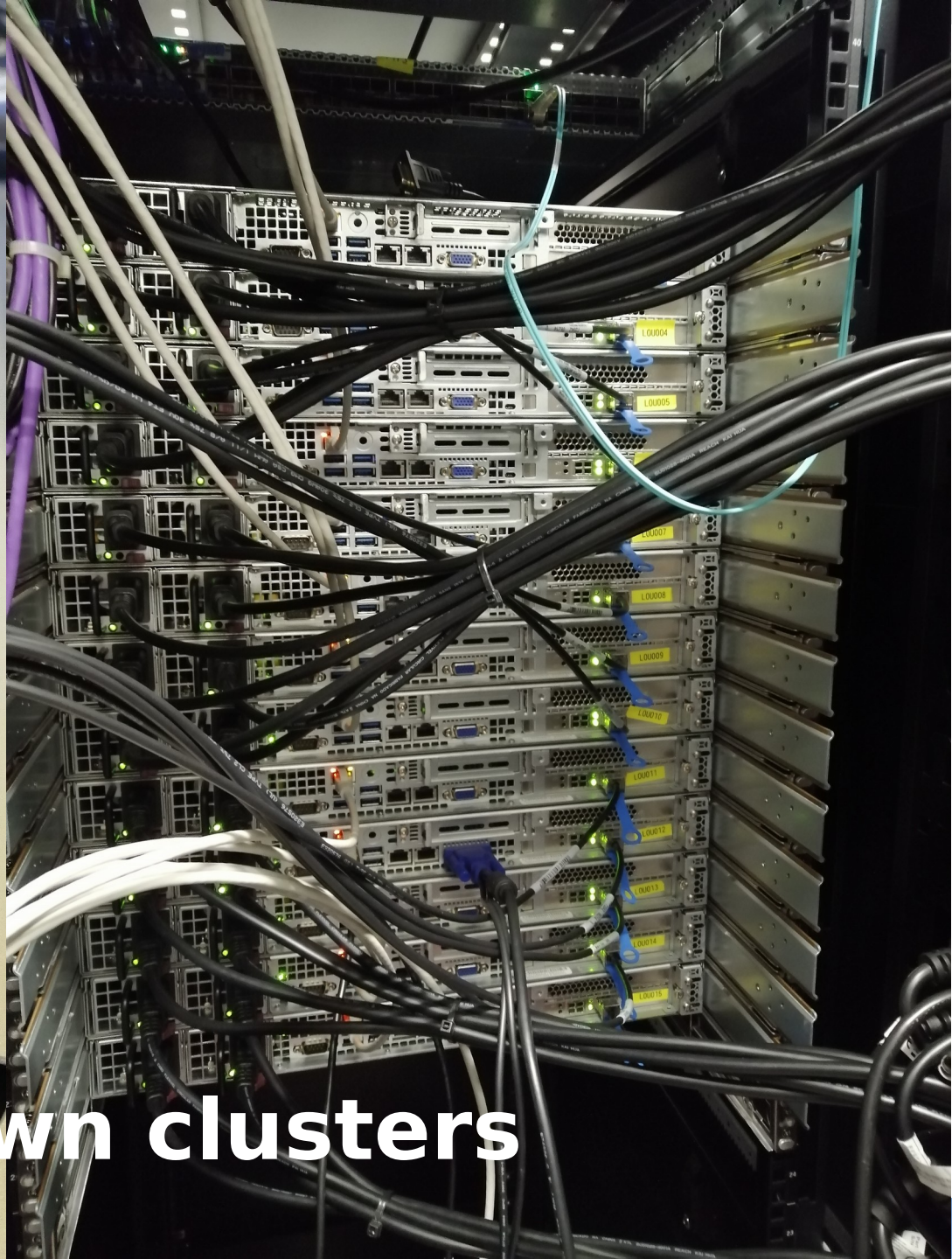
RANKING

List	Rank	System	Vendor	Total Cores	Rmax (GFlop/s)	Rpeak (GFlop/s)	P (l)
11/1993	425	C3860	HP	6	0.61	0.72	
06/1993	357	C3860	HP	6	0.61	0.72	

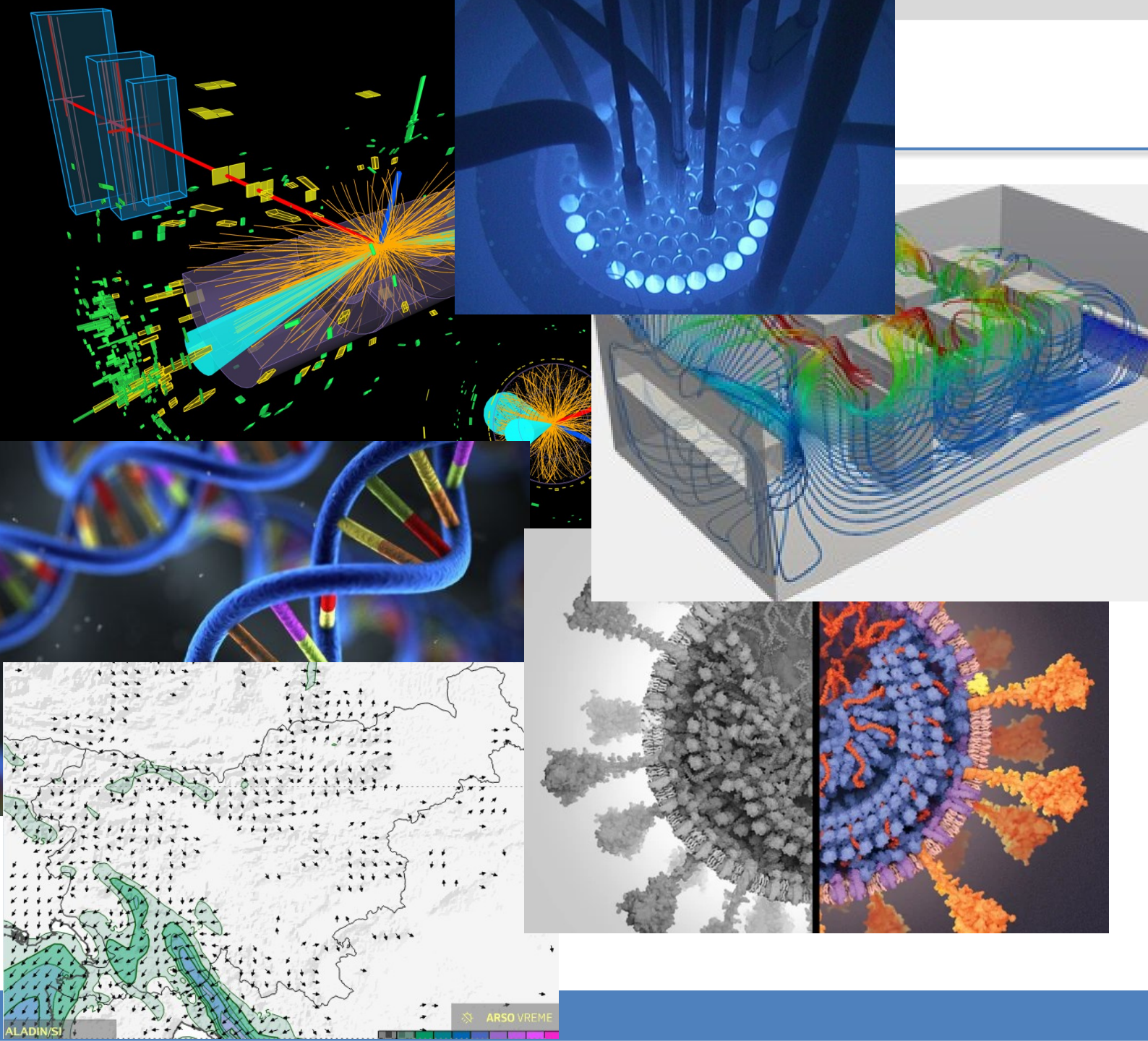
We like our equipment ...



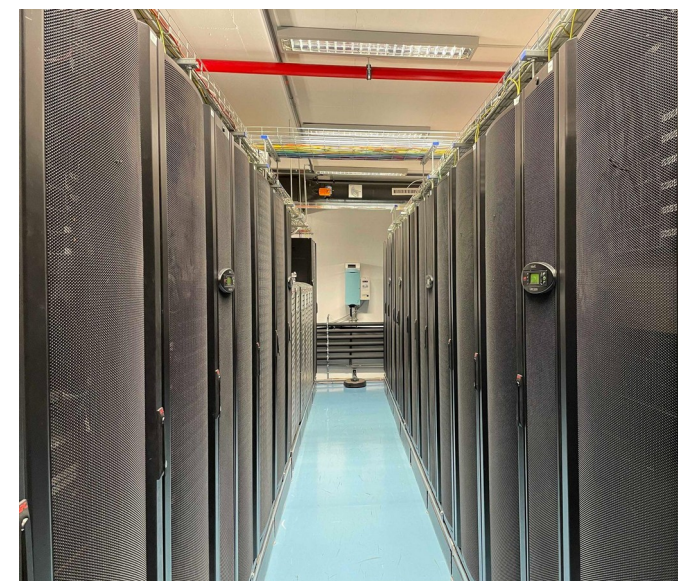
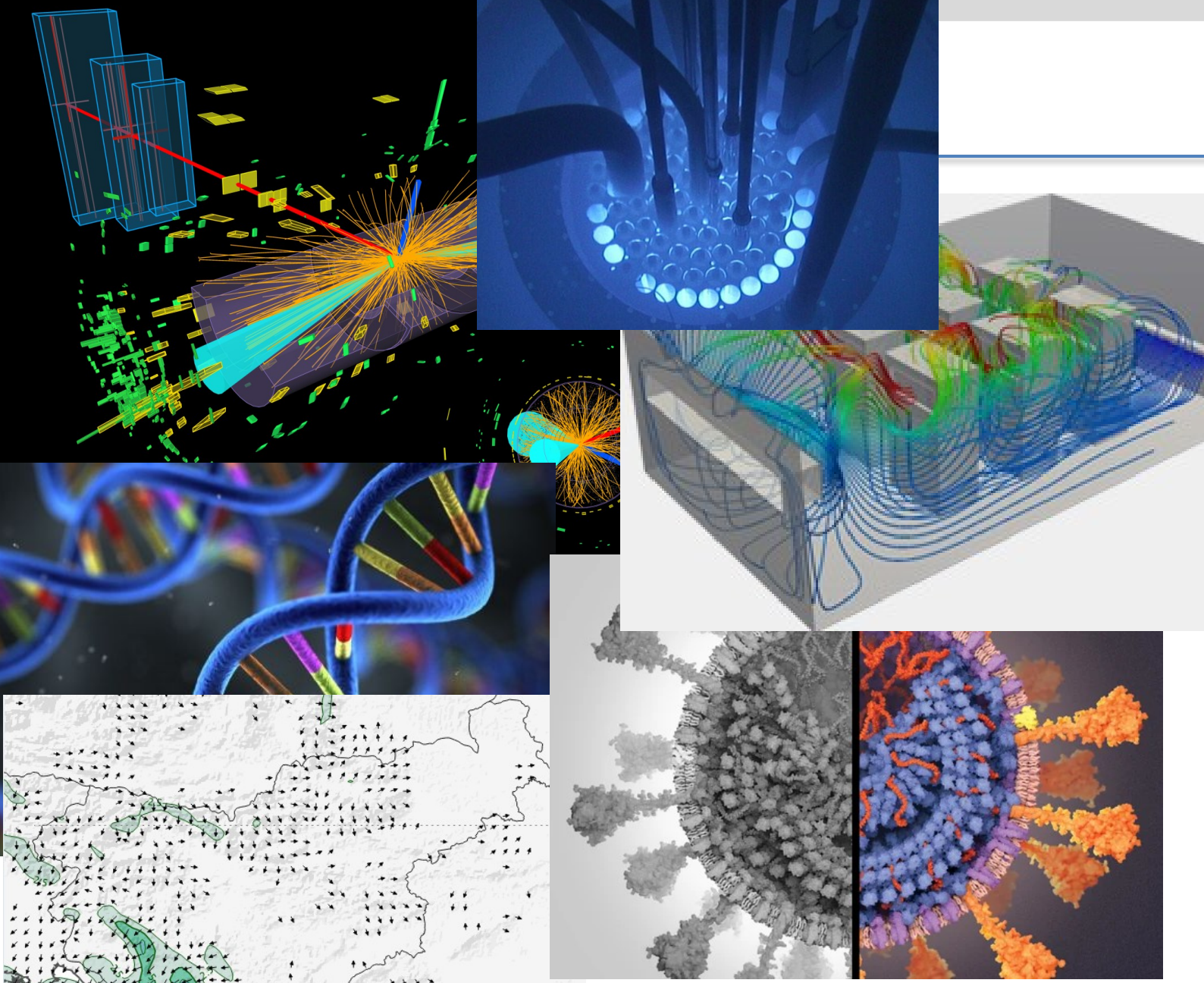




... so we run our own clusters



- High Energy Physics
- Theoretical Physics
- Nuclear physics
- Reactor engineering
- AI / Knowledge technologies
- Biochemistry
- Materials science





Evolution of Large Language Models

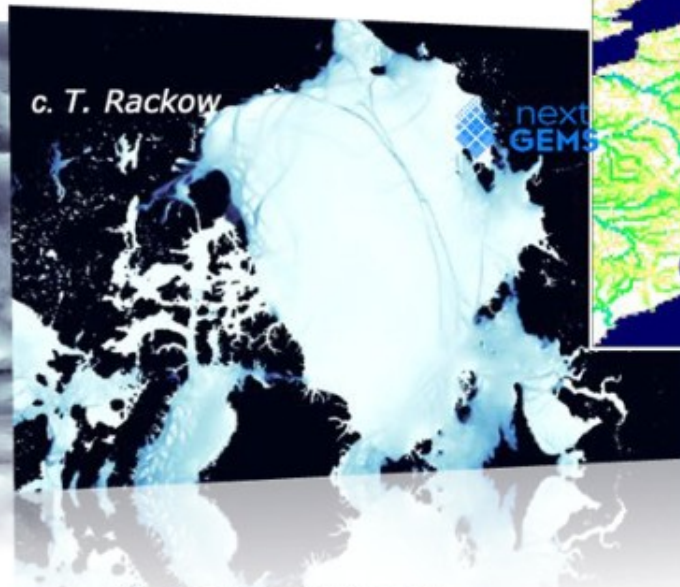


DestinE's Digital Twins: Quality + Impacts + Interaction

- 1. Better simulations** based on **more realistic models**
- 2. Better ways of combining all observed and simulated information** from entire Earth system = physical + food/water/energy/health **supporting action scenarios**
- 3. Interactive and configurable access to all data, models and workflows**



**More realistic at
*global scale***



**More realistic at
*local scale***

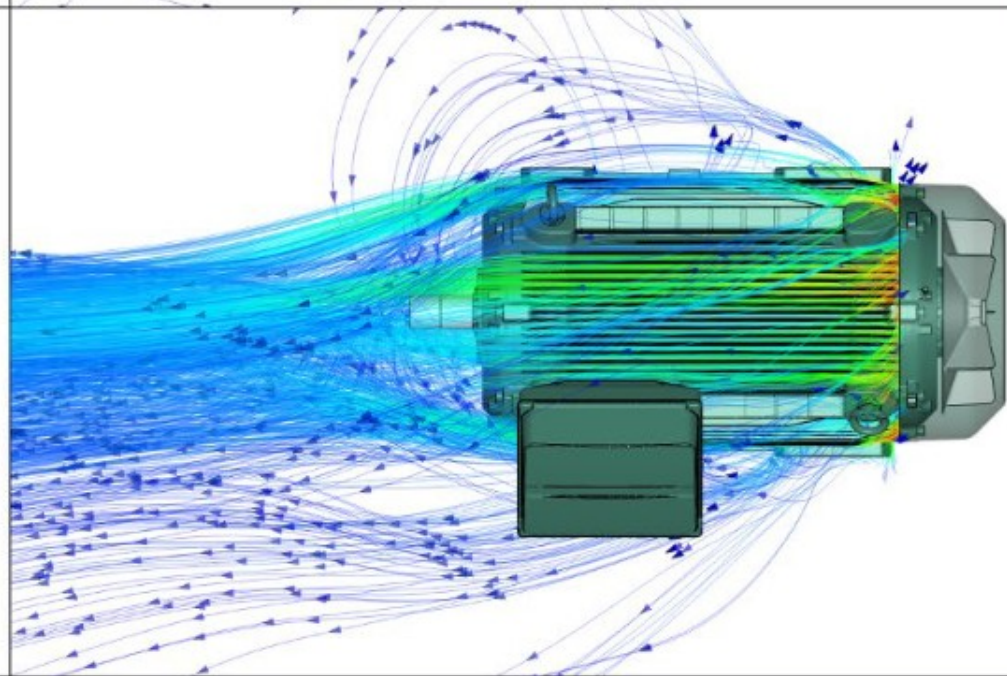
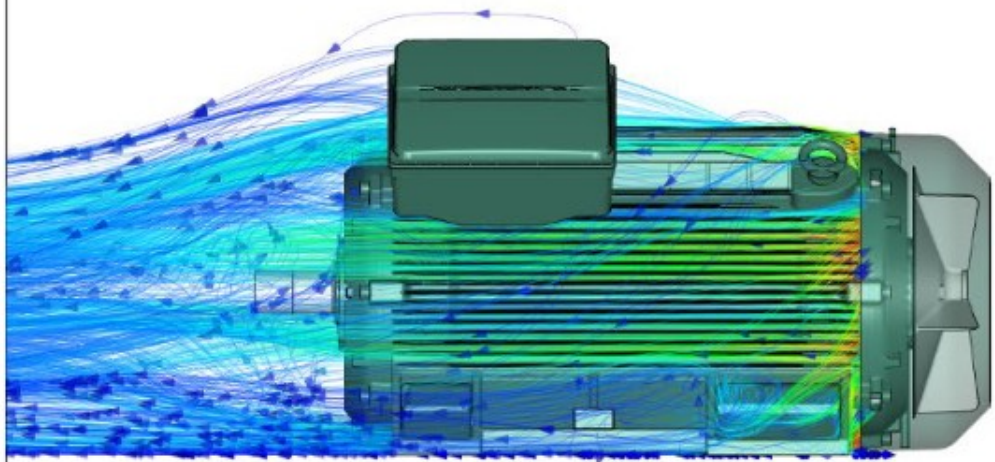
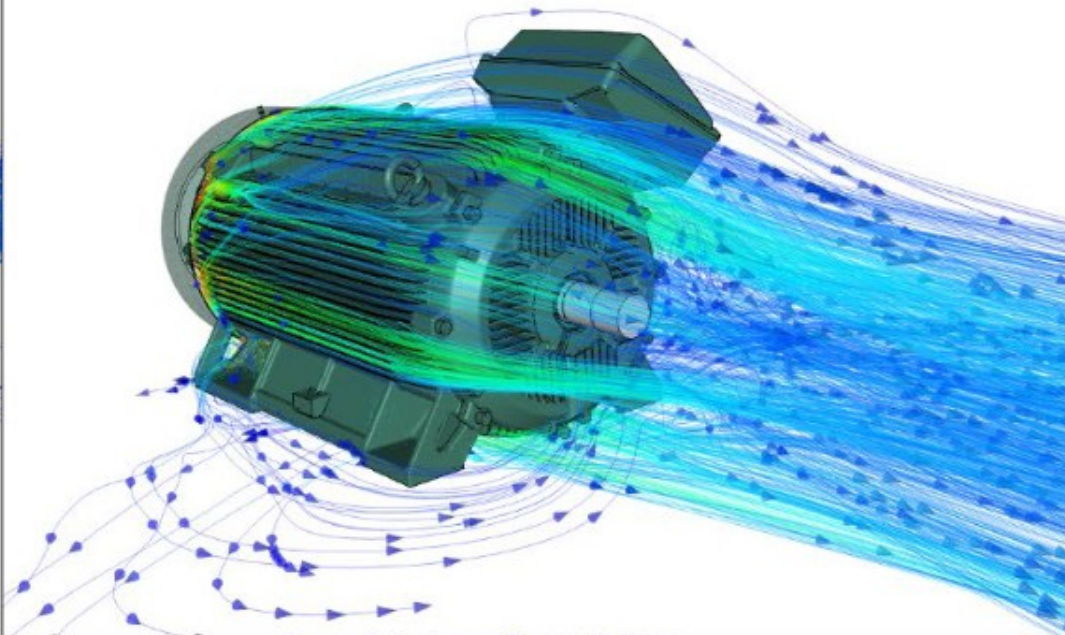
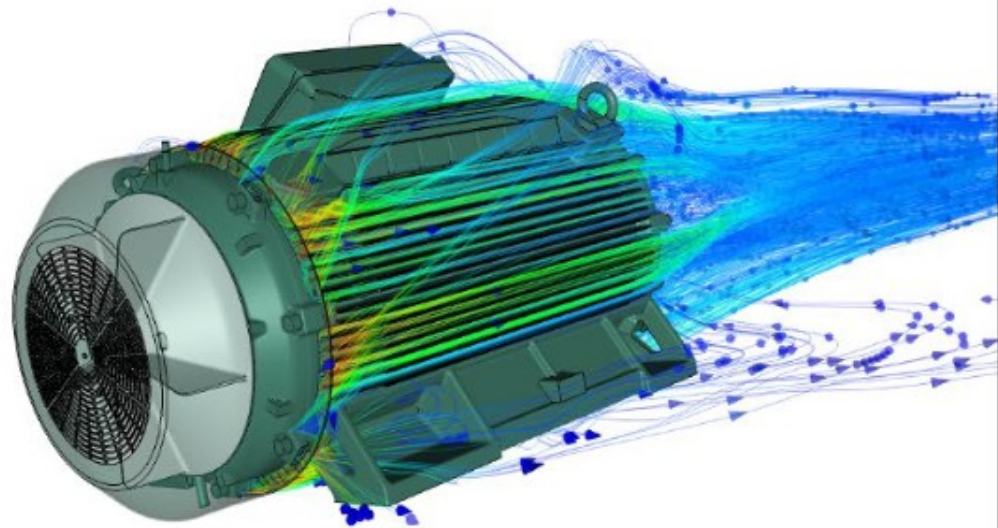


**Include impacts
where they matter**



**Trial different
adaptation
and mitigation
scenarios**







VEGA
HPC

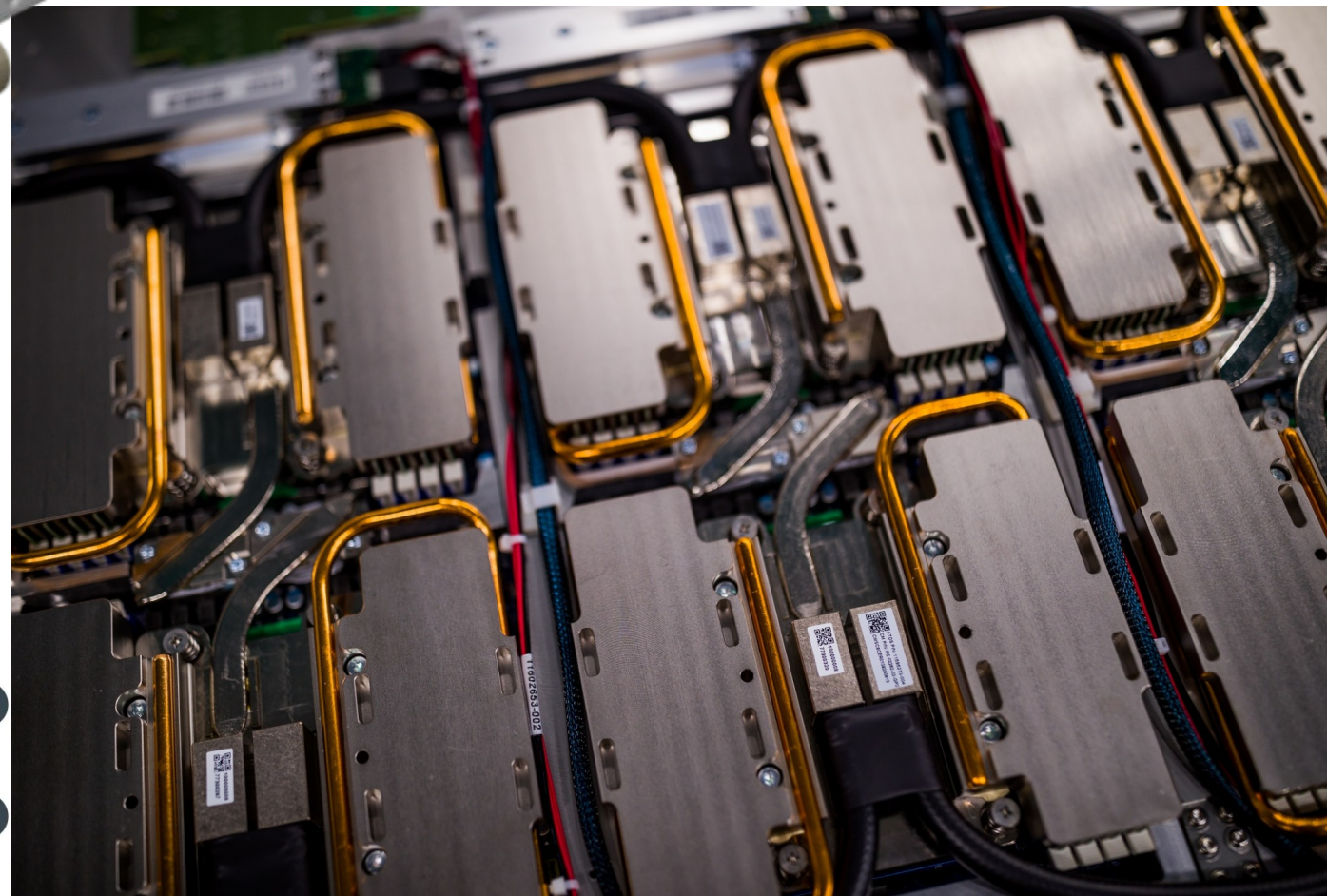
And also work with HPC Vega ...

Atos



LEONARDO

AI, big data and large models have special requirements...



BOOSTER MODULE

3456 NODES
240 PFLOPS HPL

**GENERAL PURPOSE
MODULE**

1536 NODES
9 PFLOPS HPL

Low latency Interconnect 200Gb/s

Ethernet Interconnect 100Gb/s

INFINIBAND/ETHERNET
GATEWAY
2.5 TB/s

STORAGE FAST TIER
5.4 PB, 1.4 TB/s

**STORAGE
CAPACITY TIER**
106 PB, 620 GB/s

**FRONT-END &
SERVICE PARTITION**

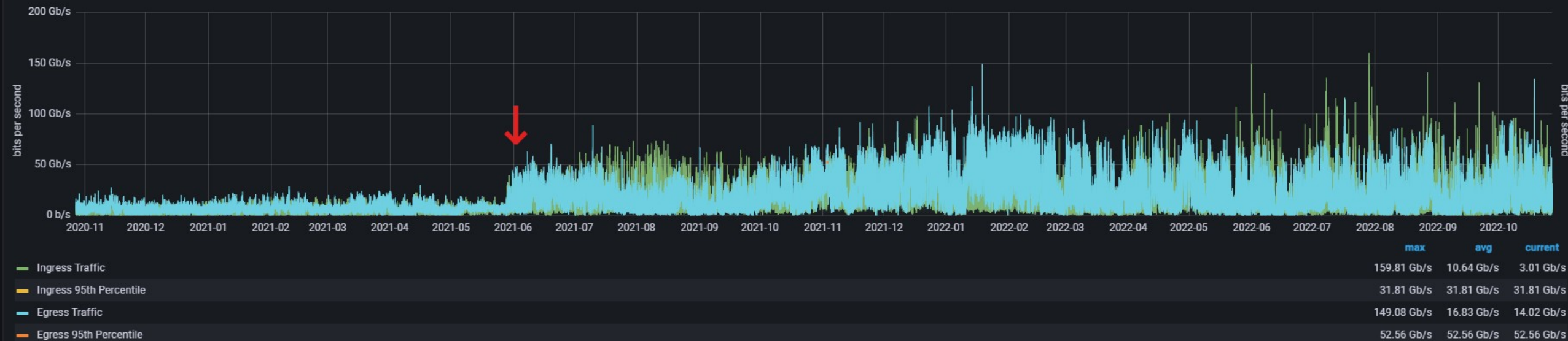
Login Nodes
Visualization Nodes
Service & mgmt

FACILITY DISTRIBUTION
& ROUTING

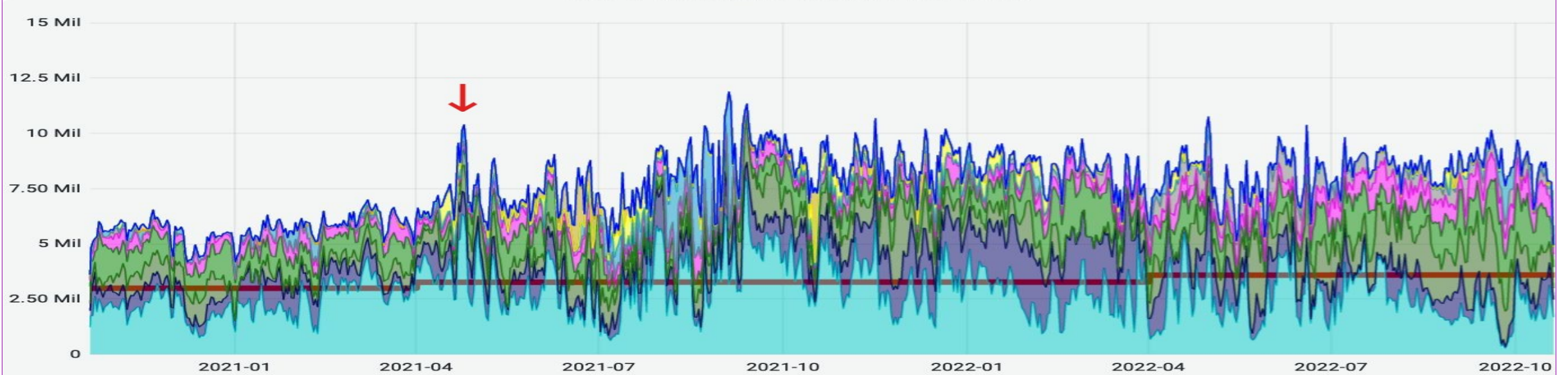
INTERNET & GEANT

... including huge network capacities!

mx2.lju.si - traffic - ae10.111 - SRV_L3VPN CUSTOMER ARNES #ARNES-AP1-LHCONE \$GS-00807 | ASN2107



Slots of Running jobs (HS06) by ADC activity



But details are for tomorrow ...





**it's a
long
way
to successful
collaboration**

- 1998, 2008 Italy-Slovenia Agreement on collaboration in science and research
- 2018 Memorandum on collaboration on supercomputing between Italy and Slovenia
- 21st April 2021: HPC Vega
- 22nd November 2022: HPC Leonardo
- EuroHPC priorities: DT, QC, AI: support COE, priority calls, AI accelerators



Možgani slovenskega naroda

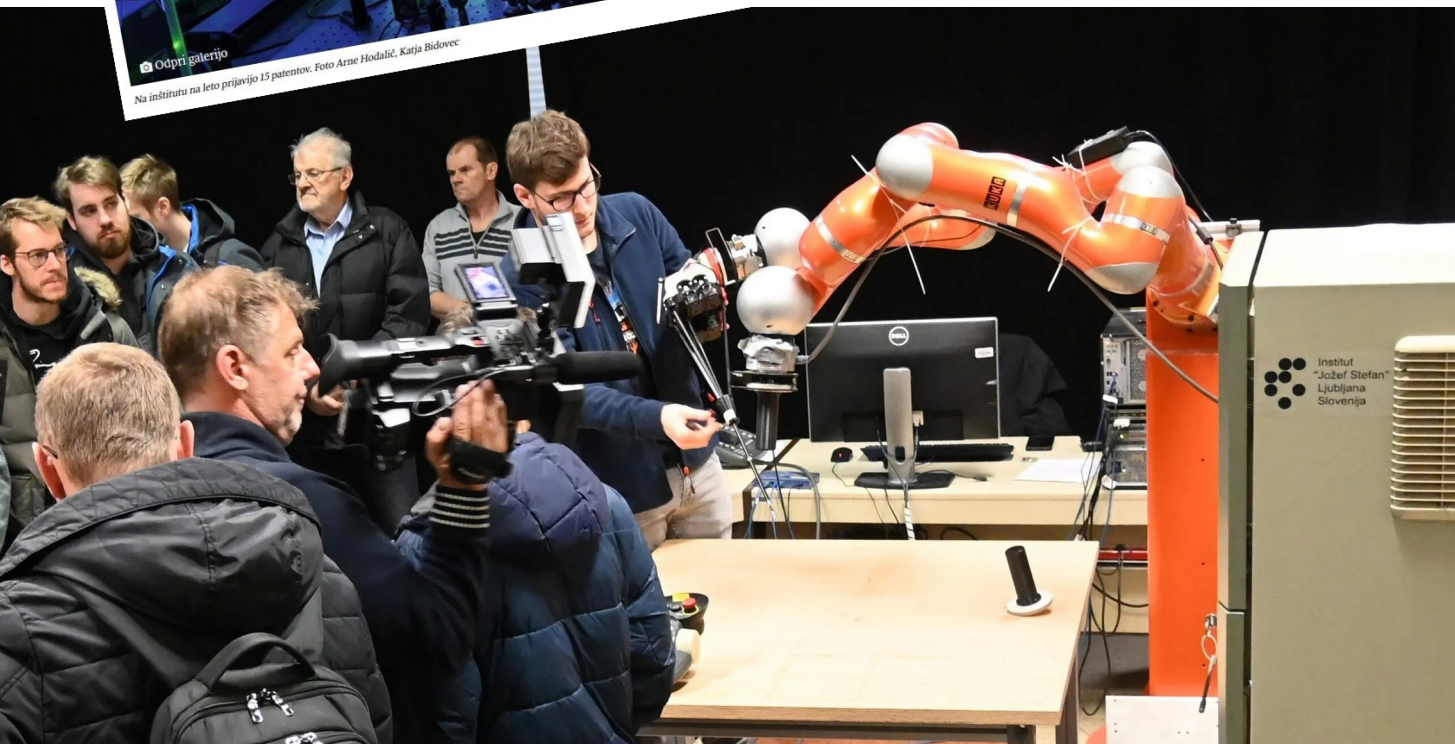
70 let Instituta Jožef Stefan: Od začetnega eksperimentiranja z jedrsko energijo do vsestranskega možganskega trusta.



Na inštitutu na leto prijavijo 15 patentov. Foto Arne Hodalič, Katja Bidovec

In Slovenia, as in Italy

it's people collaborating and creating opportunities





reception
in the JSI foyer





support@sling.si
superc@cineca.it

**national, EuroHPC,
scientific and industrial access**

Jan Jona Javoršek jan.javorsek@ijs.si

