

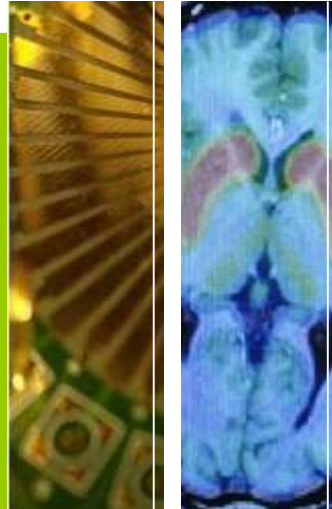
## Computing center for research and Technology - CCRT

Christine Ménaché – CEA/DIF/DSSI  
*Christine.menache@cea.fr*

## Low carbon energies (Nuclear and renewables)



## Technological research for industry



## Fundamental research (physical sciences and life sciences)



## Defence and security



Fundamental research

16 000 employees

Training and dissemination  
of knowledge



Partnerships and  
technology transfers

# CEA HPC Facilities

“Extreme Computing” lab  
BULL/CEA

“Exascale Computing Research” lab  
INTEL/CEA/UVSQ

Technological  
watch, experimental  
systems



TERA:  
Classified computing



TERA 1000

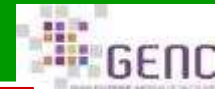
TGCC- CEA very large  
supercomputing centre



CCRT



Curie



To share

- technological watch
- HPC expertise
- infrastructure expertise

To manage

large HPC and data  
centers

To meet the needs of

- CEA simulation Programme
- French and European research
- Industry

# TGCC hosting strategies

CEA and industrial partners  
(CCRT)

**COBALT(\*\*)**  
1.5 Petaflop/s  
2.5 PB @ 60 GB/s



Extension (≈ 2018)



Own

Operate

Host

CEA ↗

Public research  
French - Europe  
(Tier-0 - Tier-1)

**CURIE(\*)**  
2 Petaflop/s  
5 PB @ 150 GB/s



IRENE- 1 (2018)  
≈ 9 Petaflop/s  
IRENE- 2 (2019)



Operate

Host

CEA ↗

INRA  
(National institute for  
agricultural research)

**2 “Cubes”**  
2017



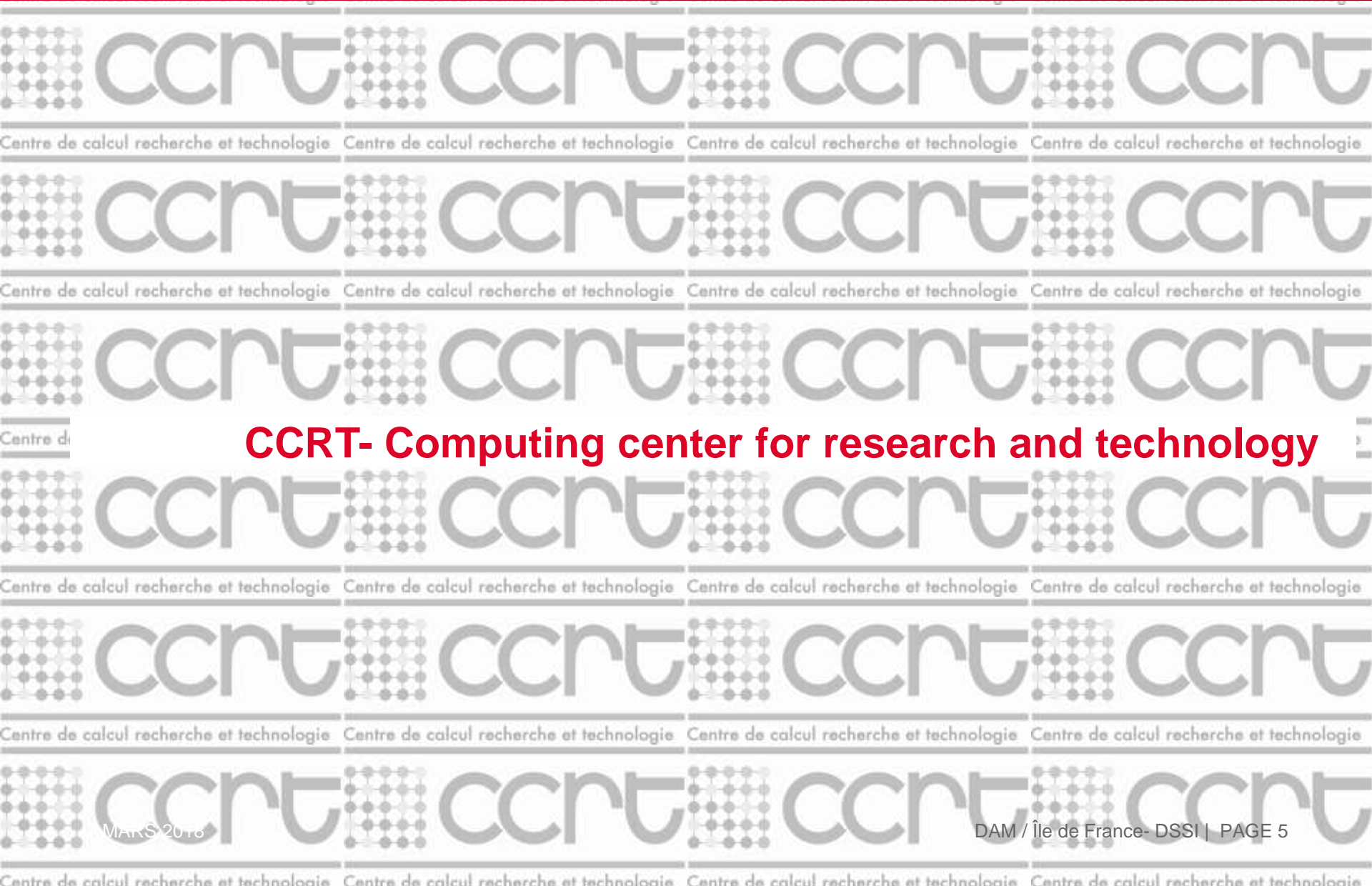
Host

CEA ↗

(\*) Curie supercomputer, made available by GENCI, is the French contribution to PRACE Infrastructure. Curie is operated by CEA in its TGCC facility.

(\*\*) Co-funded by CEA and industrial partners

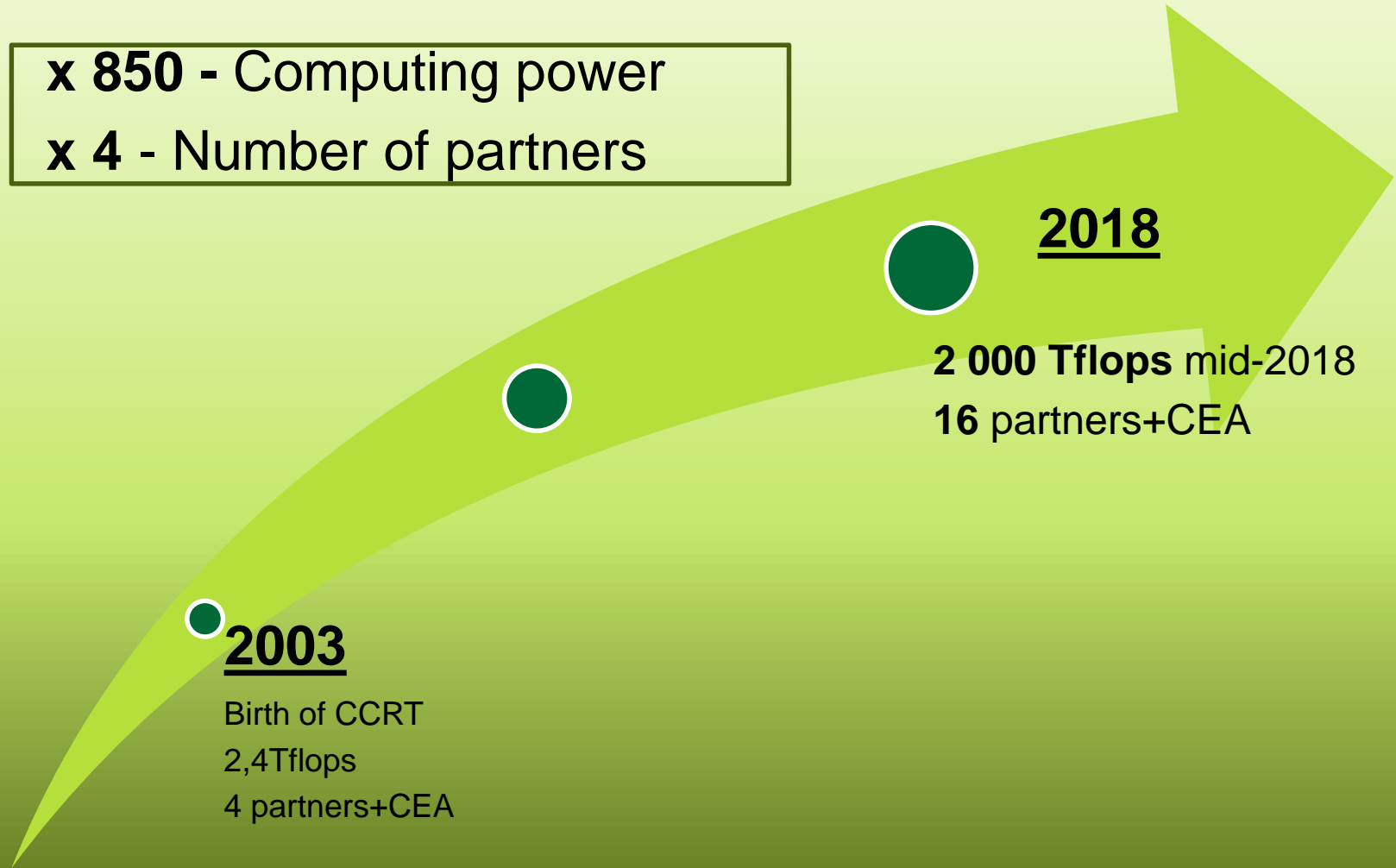




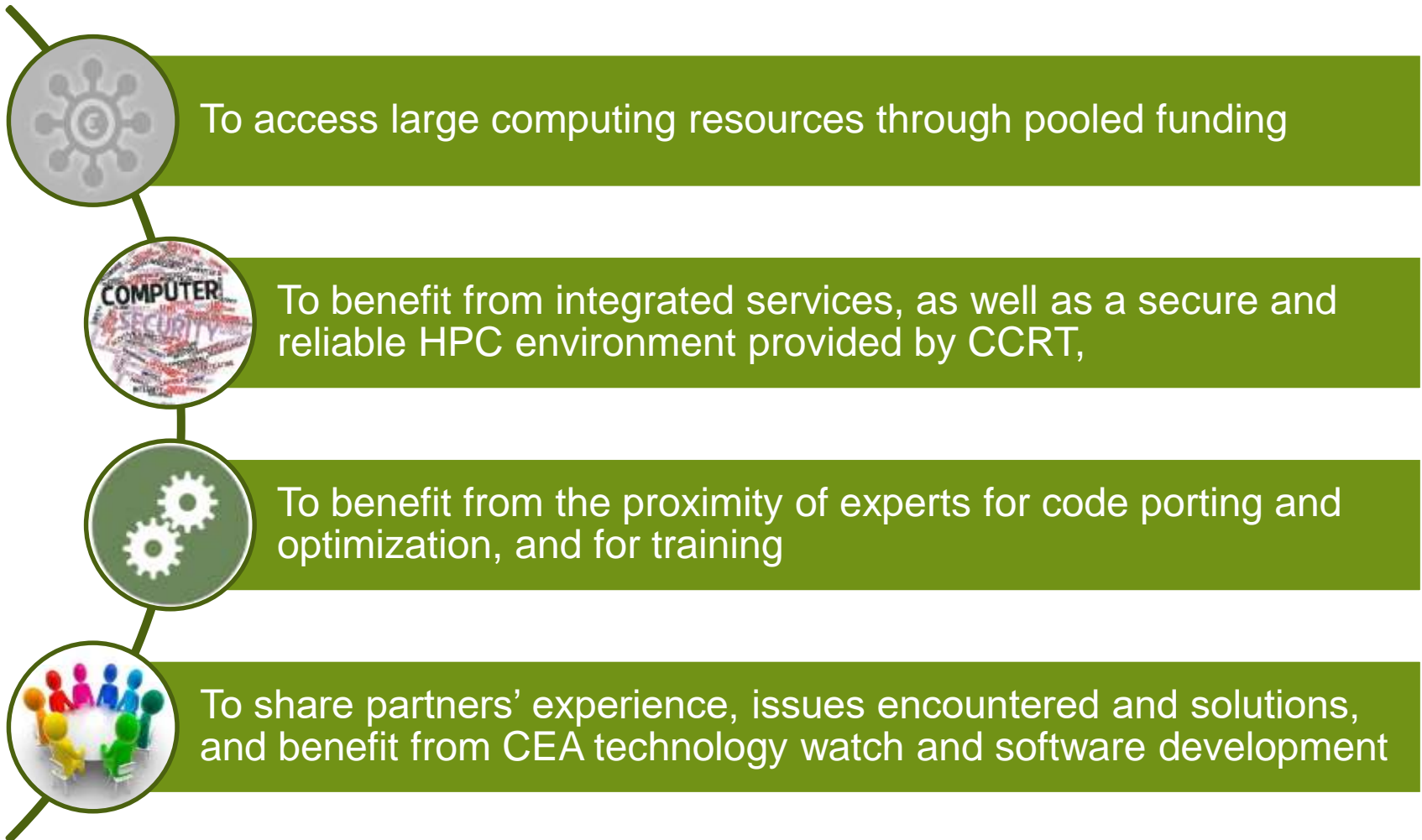
## CCRT- Computing center for research and technology

# CCRT GROWING (2003-2018)

**x 850** - Computing power  
**x 4** - Number of partners



# WHY BECOME A CCRT PARTNER ?



# HOW TO BECOME A CCRT PARTNER?

Through ~3 years renewable partnership contract

- Each partner has a share proportional to its financial participation
- The contribution is based on TCO: investments, operation costs included

CCRT governance: two committees, including representatives of each partner:

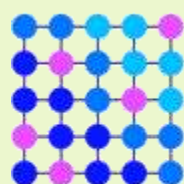
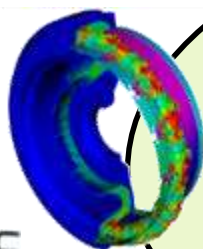
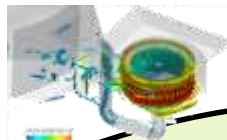
- **Strategic committee COFIL:** for budget decision making, new partners approval, strategic orientations, commissioning of new services
- **Technical committee COMUT** for resource management policy and rules, new needs...



# 2018 CCRT partners



Safran Helicopter Engines  
Safran Aircraft Engines  
Safran Aero Boosters  
SafranTech

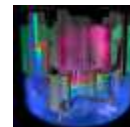


# ccrt

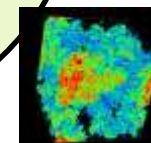
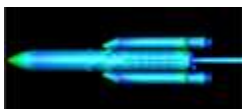
Centre de calcul recherche et technologie



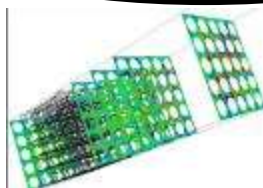
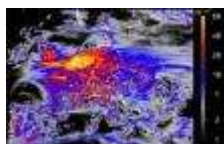
DAM



DEN



DRF



Traitement des données



# CCRT RESSOURCES AND SERVICES

+ 7200  
Intel SKL  
cores  
mid-2018

Computing and data-processing resources  
**1,5 Pflops - COBALT**



**Secure environment**

## COBALT

**39 816 cores** Intel Broadwell - 2,4 Ghz  
(28 cores and 128 GB of memory/node)  
**18 hybrid nodes** (Intel Broadwell-Nvidia P100)

- Storage services
- Post-processing services
- Remote visualization services
- Virtualization services PCOCC

Hotline, users assistance  
Optimisation and migration of codes

**Infiniband EDR network**  
**Private storage 2,5 PB**

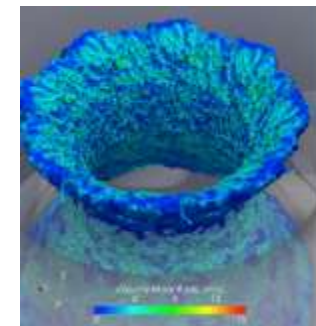
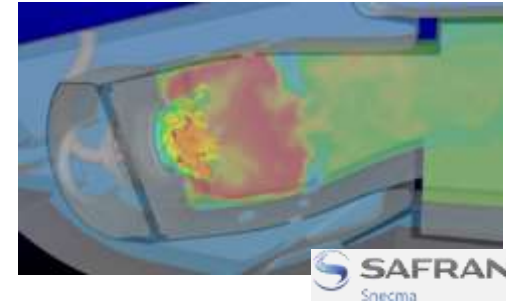
- Trainings
- Technical Workshops
- Annual Scientific conference

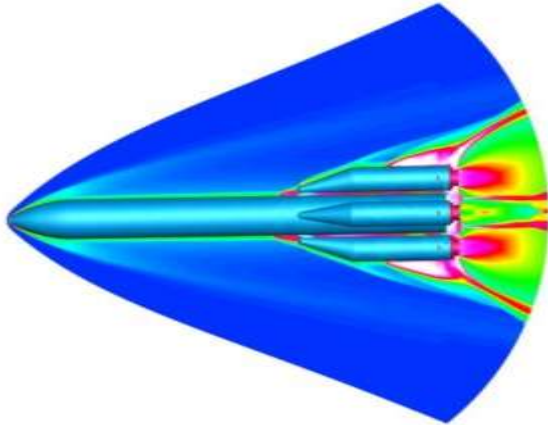
## Current CCRT usage

- Energy use reduction of 15 % for Leap, Silvercrest, Passport engines with numerical simulation

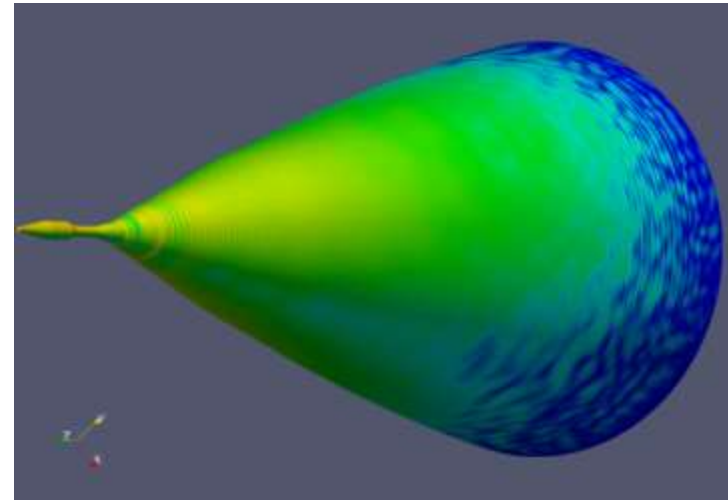
## Future

- Simulation of the full combustion chamber in 1 day - 10 billion tetrahedra mesh in 2020
- Decrease engine fuel consumption and their environmental impact

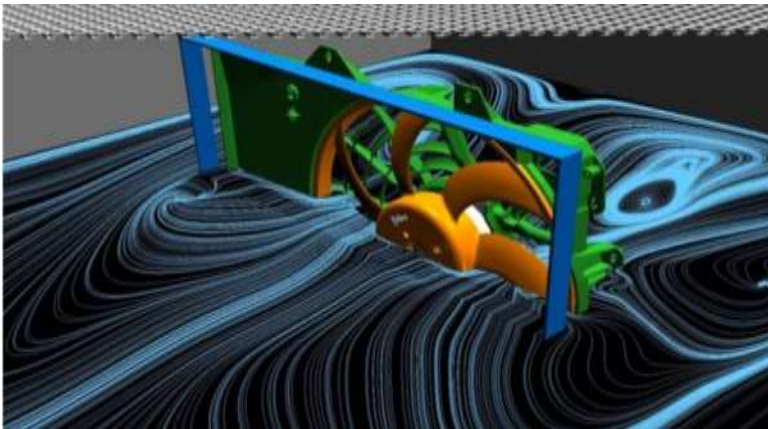




Simulations of interaction between external aerodynamics and propulsion on Ariane 6— **ArianeGroup**



Surface current on a fighter aircraft nose cone radome— **Thalès SAS**



Motor driven fan simulation - **Valéo**



Simulation of fine particle concentrations in the Northern hemisphere. - **Inéris**



## Current CCRT usage

- **Physically realistic modelling of hair.**  
**From fibre physics to hair movements.**  
A L'Oréal – Inria collaboration

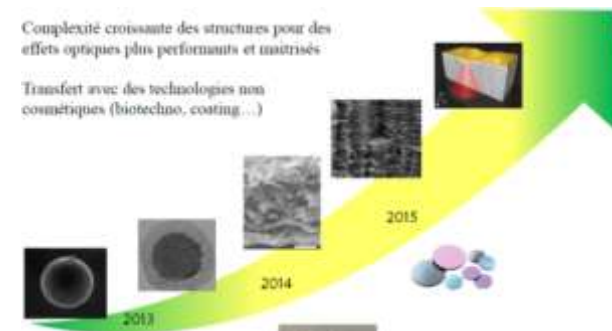
*Today, 1 000 hair*

*Tomorrow, ...150 000 hair*

## Future forecasts

- to predict product efficiency / safety
- to simulate the different skin types in the world

Effet d'un gel fixant



## Workshop : training on numerical quality of codes

- 30 January 2018: « A practical approach to the analysis of floating-point usage in large-scale numerical simulation codes. »

## Forthcoming workshop « Quantum computing – state-of-the art and perspectives for HPC »

- **Atos/BULL presentation**
  - « Recent advances in quantum engineering, unimaginable just a few years ago, suggest the first quantum processors in the next few years. After a quick introduction to these technologies and the latest advances, we will present the quantum computing opportunities for HPC applications
- **Use-case : EDF, CEA/DRF, ...**
- **Discussions**



## Deep learning

- Some frameworks ready to be tested by users on Cobalt:
  - CAFFE,
  - DIGITS
  - TORCH
  - TensorFlow
  - THEANO
- Aeronautics, Life sciences ...

# Journée CCRT 2017

CCRT et nouveaux  
usages

7 décembre 2017

TGCC

CEA/Bruyères-le-Châtel

CCRT

Questions ?

