IRL CROSSING
PART OF “AI @ CNRS”

Jean-Philippe DIGUET – CNRS

jean-philippe.diguet@cnrs.fr

CROSSING
French Australian Laboratory for Humans-Automonous Agents Teaming

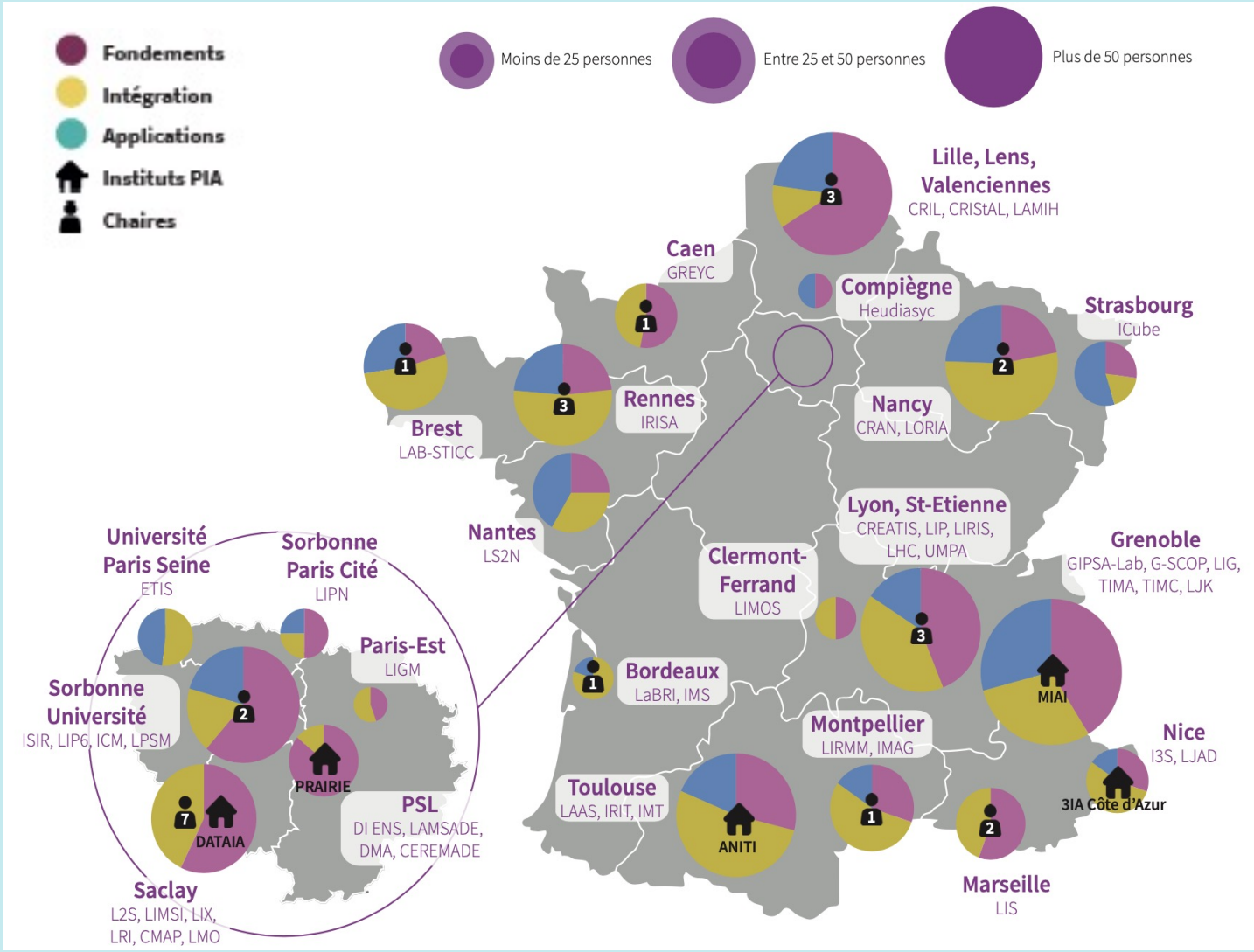
Agenda

I. AI @ CNRS
II. CROSSING Roadmap
III. Some projects
IV. Collaboration schemes with CROSSING

I-The main National Task force

CNRS joint research units:

- Over 1100 researchers
- Spanning the whole spectrum of the field



I-Jean ZAY @ IDRIS | CNRS: an AI dedicated supercomputer

I-AI RESEARCH NETWORKs (a.k.a GDR)

GDR IA

Formal and algorithmics foundations of AI

GDR ISIS

Statistical signal processing, vision, image processing, ML, etc.

GDR MADICS

Big Scientific data processing. Data-driven KDD in Science. Promotes interdisciplinarity.

GDR TAL

Natural language processing

I-INNOVATION & INDUSTRIAL COLLABORATIONS

Start-ups from CNRS Labs

DRONE INTERACTIVE

Syha Advanced Robotics for Agriculture

TEXIS Sense for Life

CND-Drones CONTRÔLES NON DESTRUCTIFS ET DIMENSIONNELS

4D 4DIVIRTUALIZ

YHNOVA NANTES - BATIPRINT 3D

KAYRROS ENLIGHTENING ENERGY

Joint Labs with industry

SIVALab : common laboratory Heudiasyc / Renault on autonomous vehicles

Rob4Fam : LabCom LAAS / Airbus on robots for the future of Aircraft Manufacturing

BEHAVIORS.AI

Common lab Hoomano/LIRIS

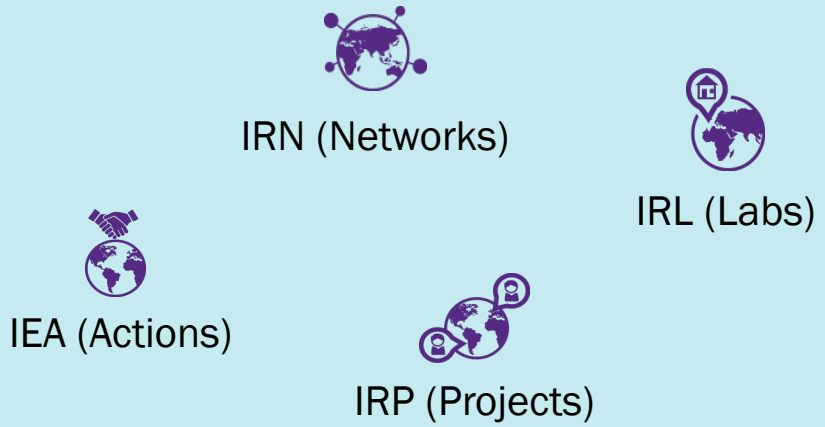
I-INTERNATIONAL COOPERATION

International Actions

- Develop a network of key international partners to establish long-term collaborations with teams abroad

International Research Labs wit activities in AI

- Singapour – IPAL + DESCARTES CREATE Project
- Japan – JFLI (Tokyo)
- Australia – CROSSING (Adelaide), with Naval Group
- Canada – ILLS (Montreal), starting in 2022



Partnerships in EU Programs

- CNRS Labs are partners of the CLAIRE and ELLIS Networks.
- Joint actions with MPG, Royal Society, etc.

II- IRL CROSSING since Jan. 21

- Partners:
  - France: CNRS, IMT Atlantique, Naval Group
  - Australia: The Univ. of Adelaide, UniSA, Flinders

- Australian Institute for Machine Learning (Prof. Ian Reid, Prof. Javen Shi)
- Active Vision Lab. (Prof. Anna Ma-Wyatt)

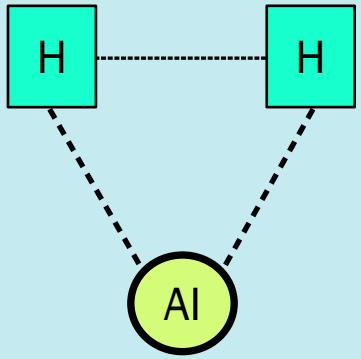
- Sleep and Chronobiology Lab. (Prof. Siobhan Banks)
- Australian Research Centre for Interactive and Virtual Environments (IVE) (Prof. Bruce Thomas)

- Centre for Maritime Engineering (Prof. Karl Sammut)
- Line Zero Industry 4.0

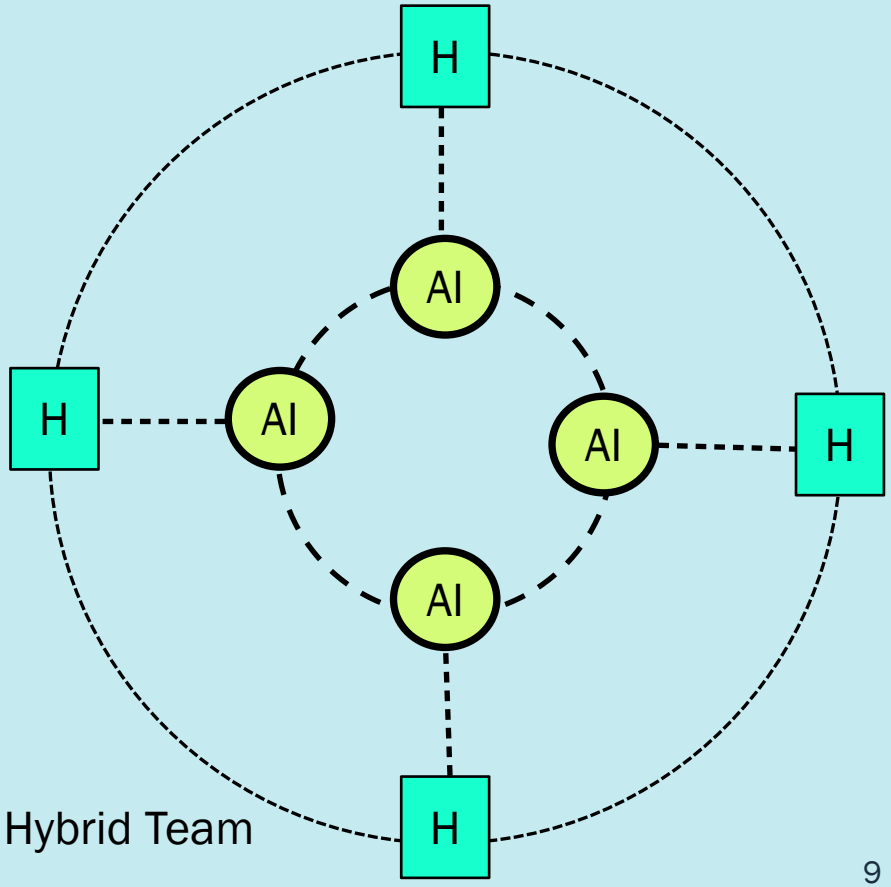
II- Scientific Question

- *Considering the growing presence of AI/Artificial Agents in our Environments*
  How these systems can be integrated into work and home environments, and leveraged to improve and augment human performance

Augmented Operator



AI Mediation



Hybrid Team

II- Multidisciplinary team

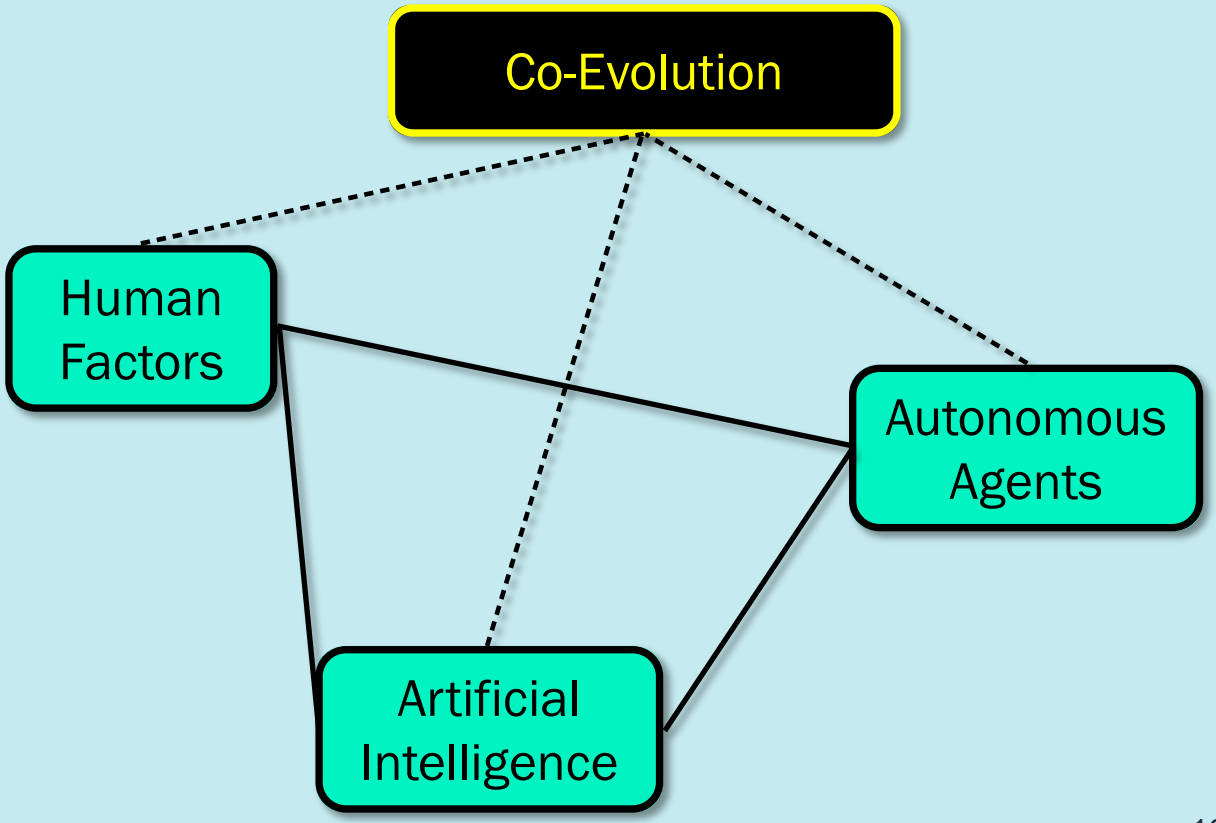
- Many key unsolved questions at the confluence of different disciplines

Multidisciplinary research fields:

- *AI*
- *Human Factors*
- *Cognitive Psychology*
- *Humans / Machines Interactions*
- *Robotics / Autonomous systems*
- *Computer Vision*
- *Signal Processing*
- *Augmented/Virtual Reality*
- *Embedded systems*

With realistic constraints :

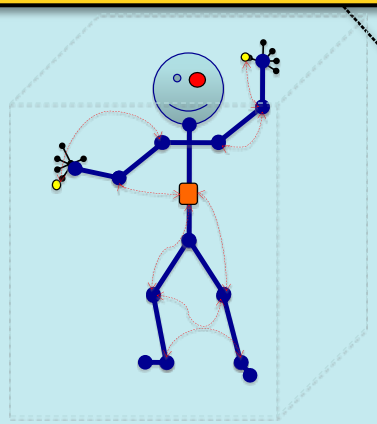
- **Real** environment (out of labs)
- Energy **efficiency**
- **Wearable** computing



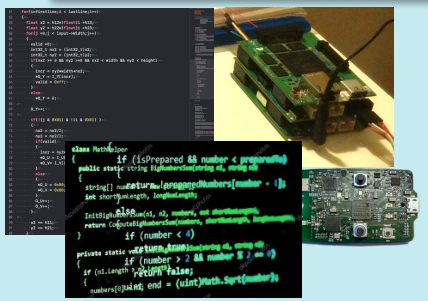
I- Roadmap: 4 Thrusts

- 4 interconnected **Thrusts** decomposed in 10 **Axis**

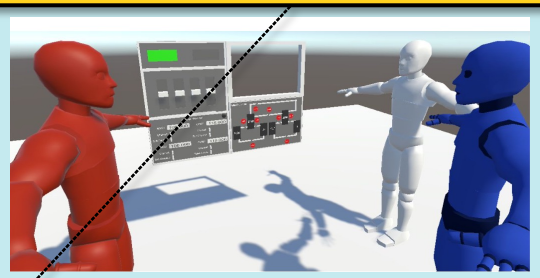
(1) New Models to understand and Anticipate Human Behaviour



(2) Improve Efficiency, Embeddability and adaptation capability of Learning



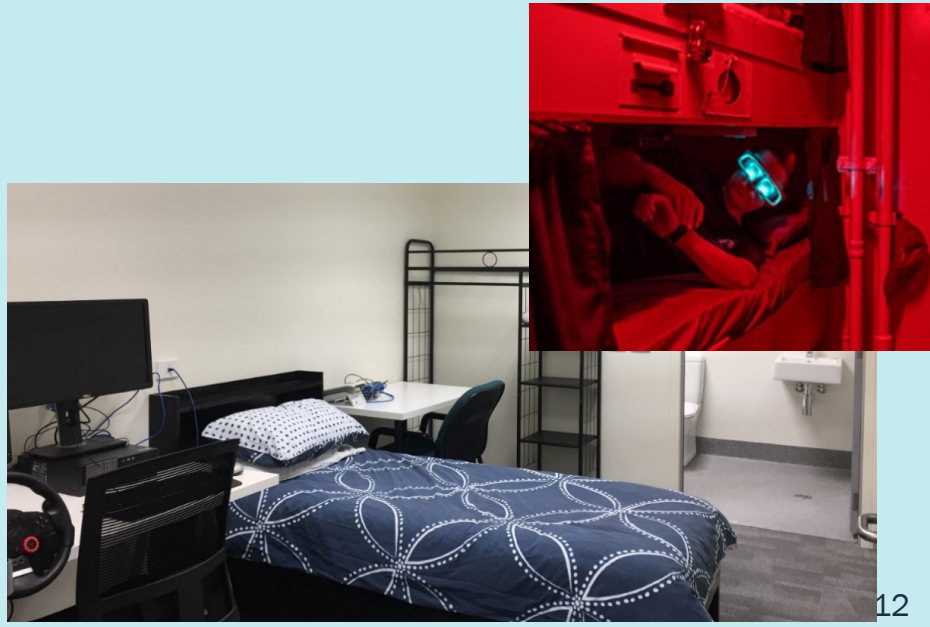
(3) New paradigms for AI/Human Interaction and understanding



(4) New solutions for Management of Hybrid Teams

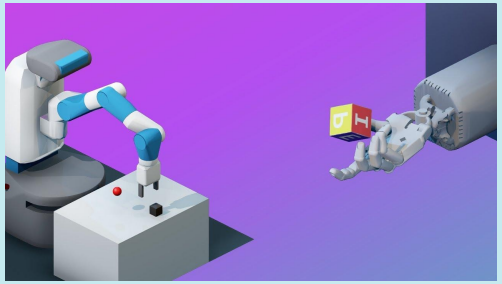
II- Some ongoing projects: Thrust 1
Fatigue and team performance in maritime environment

- **Project members:** Bailey Hadlum (PhD student), Prof. S. Banks (UniSA), P. Rauffet (CNRS/UBS), G. Coppin (IMT), C. Maïs (NG)
- **Objectives:**
  - *Examine the effect of Fatigue on Team Performance*
  - *Monitoring/Tracking of Team Performance under Fatigue*
- **PhD Grant funding:** NG
- **Infrastructure:**
  - *UniSA - Sleep, Chronobiology Lab. (250m^2, time-isolated, temperature and light-controlled rooms).*
- **Positioning:**
  - ***Thrust 1/ Axis 1** (Capture of Human Physiological, Cognitive Performance and Emotional State) - **Axis 3** (Human Activity, Capability and Performance Understanding)*



II- Some ongoing projects: Thrust 2
Learning by Robot manipulation demonstration via GAIL

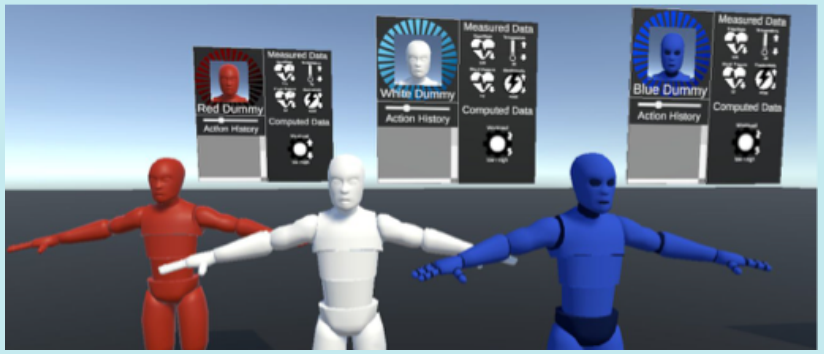
- **Project members**: M. Khalil Jabri (PhD Student), Prof. Javen Shi, A/Prof. Ehsan Abbasnejad (The University of Adelaide), A/Prof. Panagiotis Papadakis (IMT Atlantique).
- **Objective:**
  - Assist frail people in accomplishing tasks of daily living
- **Method:**
  - Robot to learn using a simple and direct way: Imitation
  - Generative Adversarial Imitation Learning (GAIL) (GAN/IL)
- **PhD funding:**
  - *Cotutelle IMT Atlantique / Univ. Of Adelaide*
- **Infrastructure:**
  - *AIML and IMT Atlantique robots and computing centers.*
- **Positioning:**
  - ***Thrust 2 /Axis 4:*** *Cross learning between humans and machines*



Robotnik RB-1 platform with Kinova JACO arm

II- Some ongoing projects: Thrust 3
Perceiving distant collaborative activity with Mixed Reality

- **Project members**: Thomas Rinnert (PhD Student), Prof. Bruce Thomas (UniSA), Prof. Thierry Duval, Prof. G. Coppin (IMT Atlantique).
- **Objective:**
  - Study how to enhance awareness of collaboration: awareness of each other inside a Collaborative Virtual Environment, focusing on sharing user states.
- **Method:**
  - *Augment Team-Mate Avatar with State Information and study impact on team performance.*



- **PhD funding:** CNRS Grant
- **Infrastructure:** UniSA IVE and IMT Atlantique MR labs + possible remote online experiments
- **Positioning**:
  - ***Thrust 3 /Axis 8:*** *New interaction frameworks and technologies to facilitate cooperation within a hybrid system*

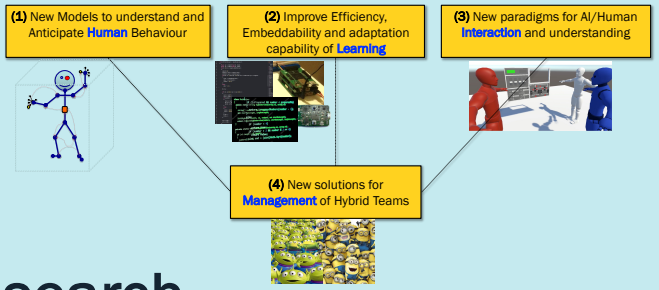
II- Ex. of Current Application : Multimodal analysis & learning of human interactions in Industrial Context

- **Project members**: A/prof. Paulo Santos (Flinders), Prof. Cedric Buche (CNRS), Delphine Keller (NG) …
- Objectives / Methods:
  - Train a robot to act when the user needs assistance
  - Machine learning strategies for identifying, detecting and fulfilling the needs of a human agent
  - Analysis of physical and non-verbal actions

- (expected) Funding:
  - *Defense Innovation Partnership SA*
  - *Cotutelle PhD*
- Infrastructure:
  - *Real Industrial Robot compliant to NG shipyard*
  - *Line Zero Industry 4.0 Real-life Demonstrator*
- Positioning: Thrust 2 / Thrust 3

III-Collaborations with CROSSING

- A multidisciplinary project that intersects the IRL roadmap
  - *Get access to the great Adelaide Research Ecosystem*



- Join CROSSING as a visitor scientist for short- or long-term Research
  - *CNRS Delegation*
  - *Mobility Grant from another Institute*
  - *Possible support from the IRL*

- Various funding schemes for Cooperation projects:
  - *As a CNRS Lab, usual French schemes: ANR, AID, Horizon, …*
  - *As an Australian Lab, strong links with ARC (Australian ANR) and DSTG (Australian DGA)*
  - *And various schemes for PhDs and Postdoc grants.*