



www.acsept.org

a new step in the future demonstration
of advanced fuel processing

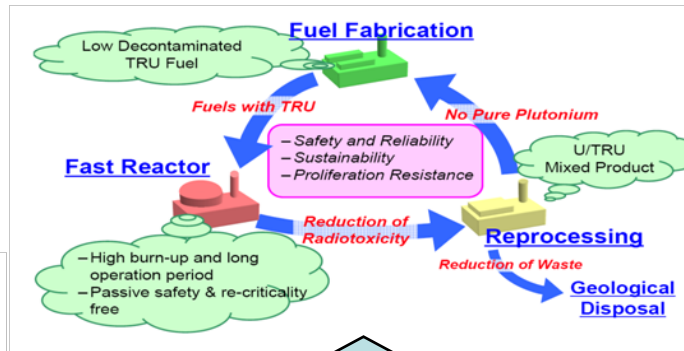
Actinide reCycling by SEParation and Transmutation
FP7 EURATOM CP 2007-211267 - (March 2008 – February 2012)

Stephane.Bourg@cea.fr

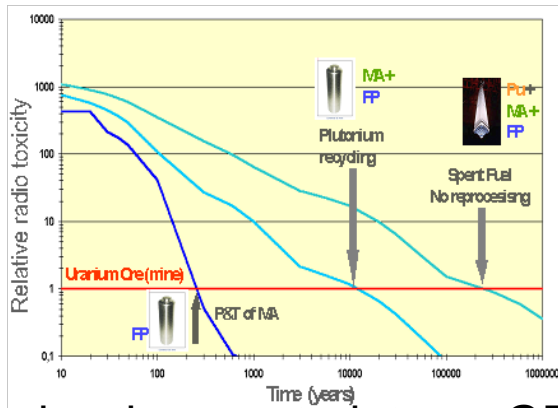
Clément Hill, Concha Caravaca, Chris Rhodes, Christian Ekberg

a significant common trunk despite the different national strategies envisaged for managing nuclear wastes in Europe

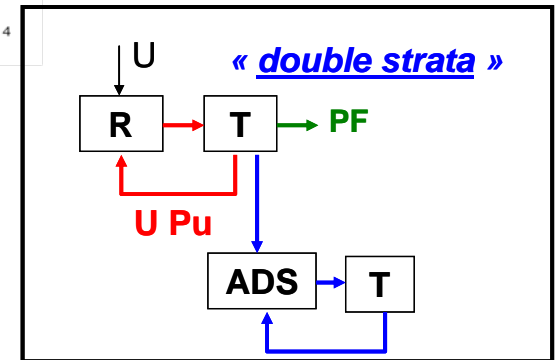
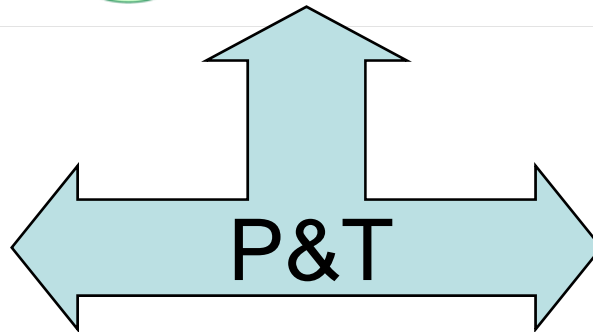
Courtesy of JAEA



optimize the use of natural resources, recycle, increase resistance to proliferation



relax the constraints on GD
 reduce the monitoring period

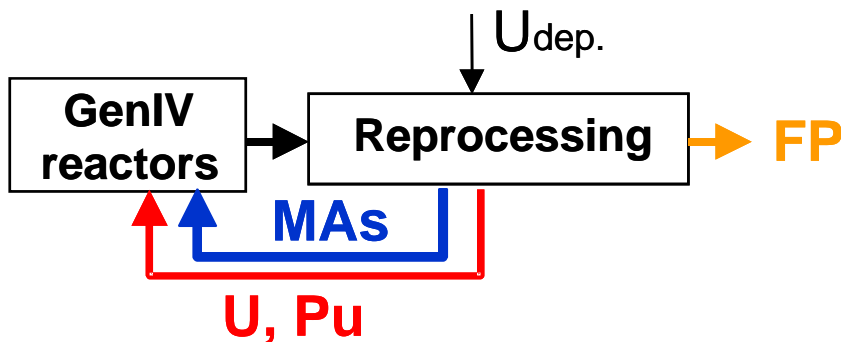


phase out of nuclear energy
 minimise the LLW
 to be disposed of

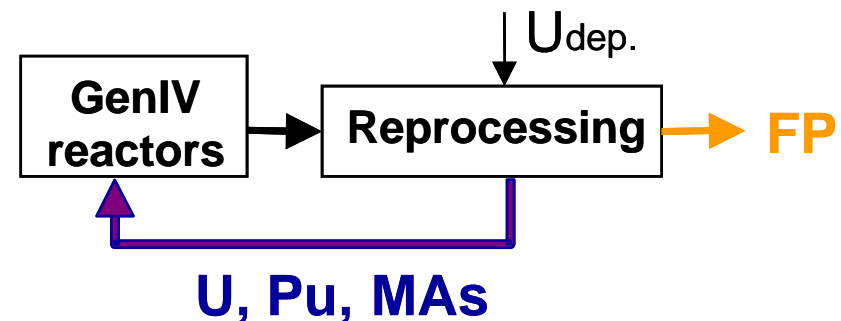
- Prepare future demonstrations of fuel treatment and refabrication at the pilot scale

Heterogeneous recycling of the minor actinides (MA)

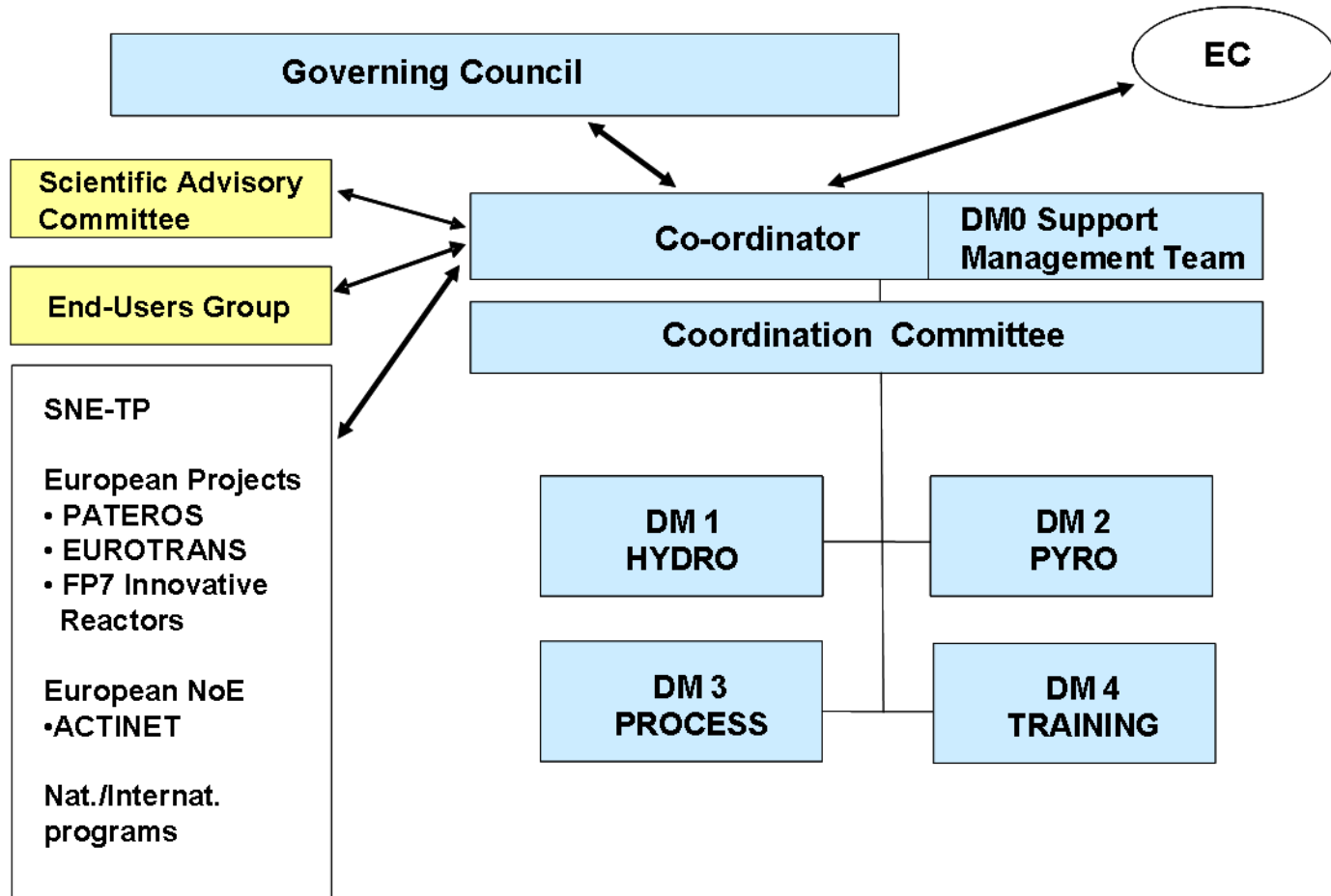
+ possible double strata (Accelerator Driven Systems)

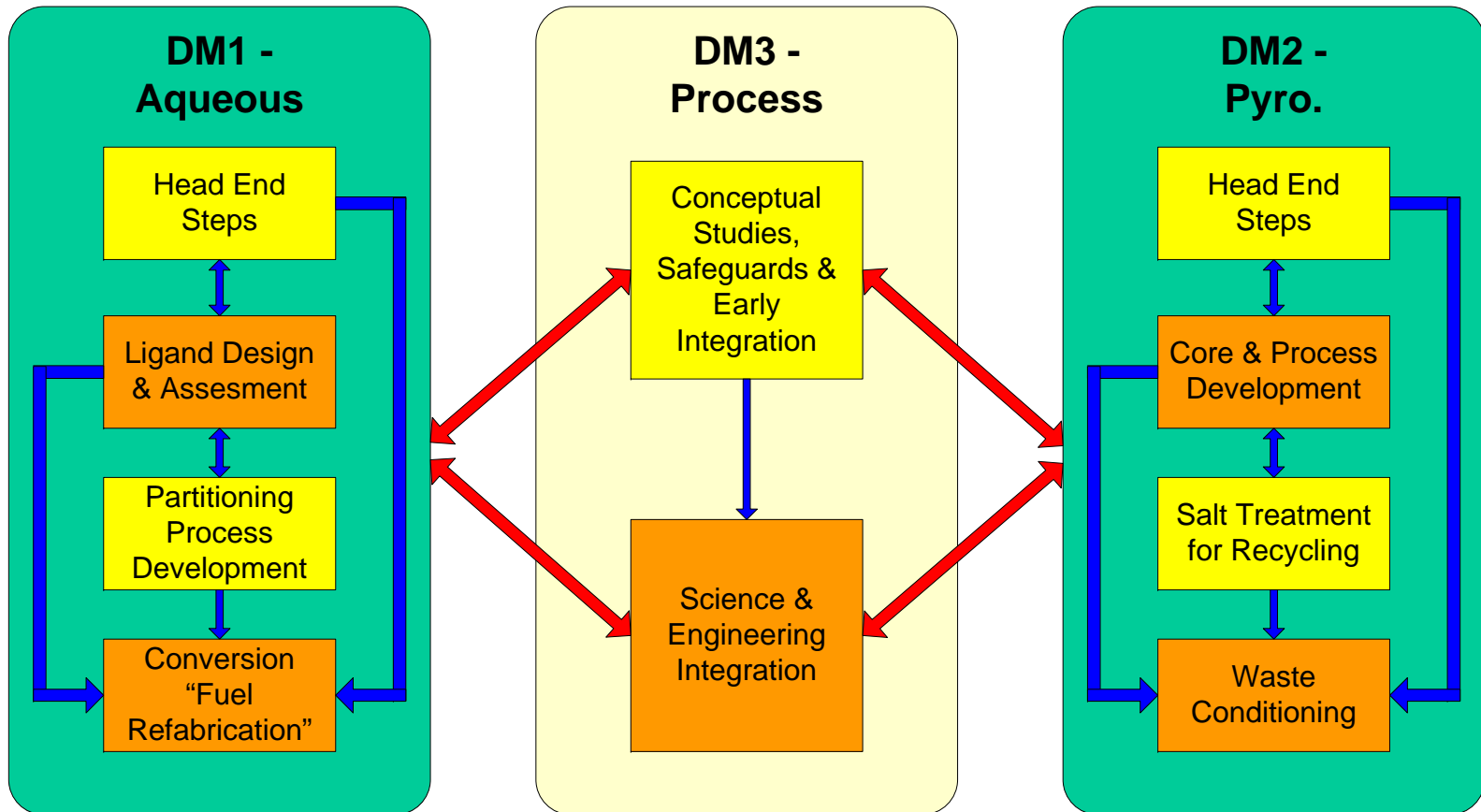


Homogeneous recycling of the MA



Hydrometallurgy or Pyrometallurgy





- **Support laboratory scale demonstrations of advanced dissolution, separation and refabrication processes**
- **Studies not only focussing on solvent extraction**
 - Head-end steps (dissolution)
 - Fuel refabrication (sol-gel...)
- ***Validation of the technical feasibility at the laboratory scale***
 - Taking into account the diversity of future nuclear fuels and fuel cycles
 - Feasibility of each technological brick should be validated

- Heterogeneous recycling

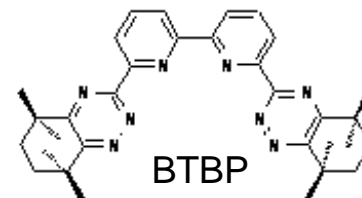
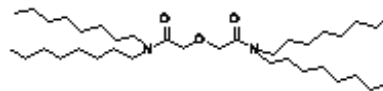
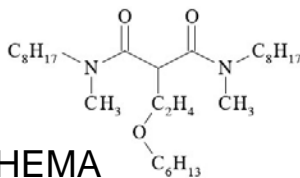
To the less challenging to the more challenging

- “regular” SANEX (on a DIAMEX raffinate), selective actinide extraction

Two SANEX processes based on BTBP/DMDOHEMA and BTBP/TODGA systems were developed within EUROPART and tested in the beginning of ACSEPT. Data will be transferred to DM3 for process integration studies. If necessary, an appropriate DM1 R&D programme will be proposed.

- “innovative” (stripping) SANEX (on a PUREX raffinate), Extraction of An, Ln and selective stripping of An.

- “1 cycle” SANEX (on a PUREX raffinate), selective extraction of An



- Homogeneous recycling

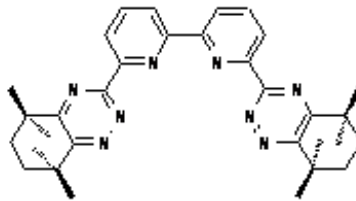
- GANEX, group actinide extraction

Two cycles:

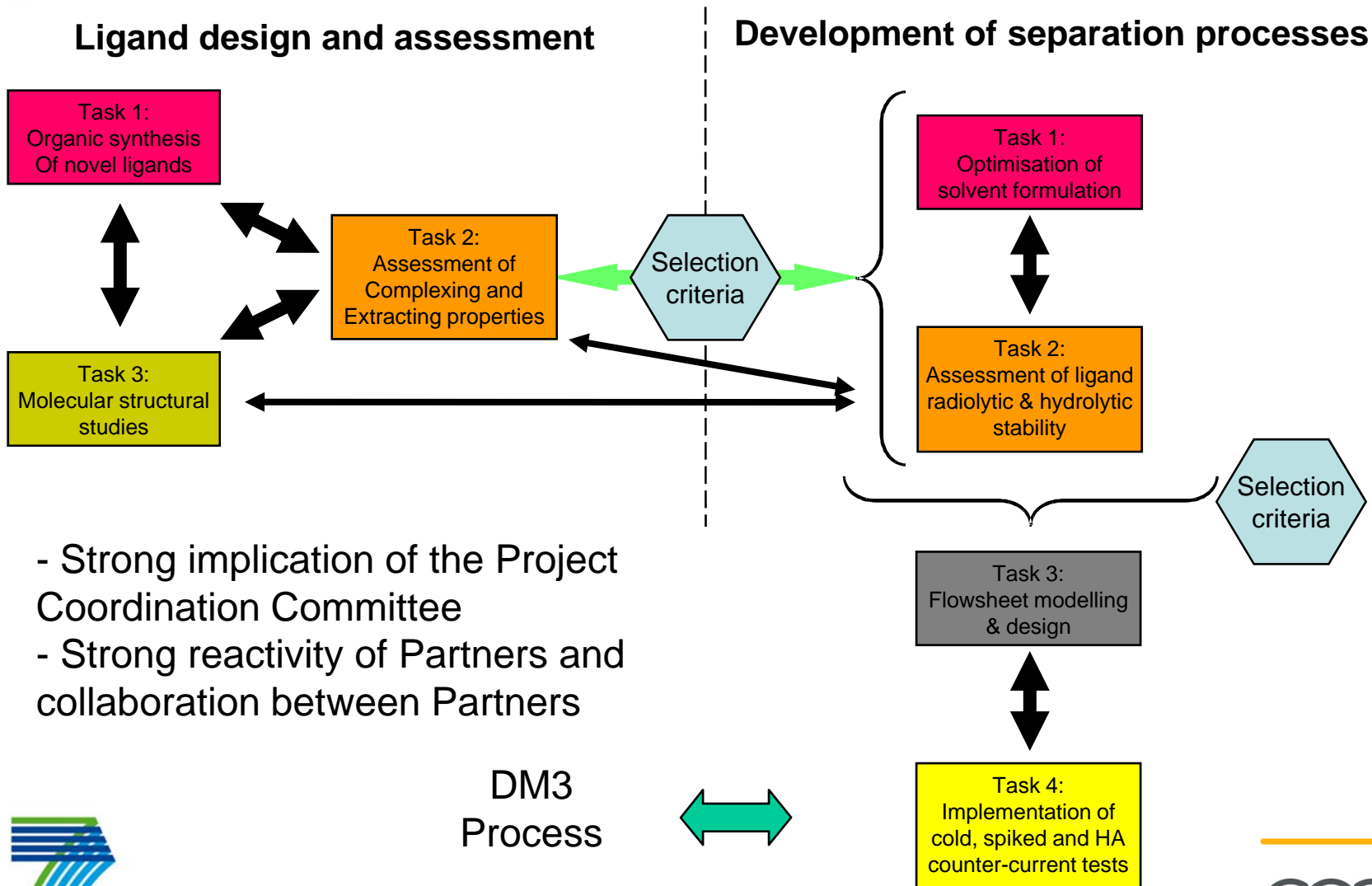
1st cycle : quantitative Uranium extraction,

2nd cycle : group actinide extraction

Only the second cycle is under studies within ACSEPT

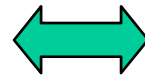


BTBP ?



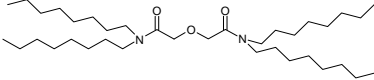
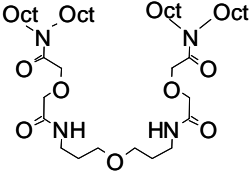
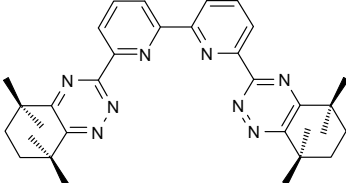
- Strong implication of the Project Coordination Committee
- Strong reactivity of Partners and collaboration between Partners

DM3
Process



Task 4:
Implementation of
cold, spiked and HA
counter-current tests

→ Molecules under study

Family	Example	To be used in
TODGA (+TBP)		Co-extraction "An + Ln(III)"
Bis-DiGlycolAmides		Co-extraction "An + Ln(III)"
Bis-Pyridines-Bis-Triazines (BTBP)		Separation "An(III)/Ln(III)" Understand selectivity !

→ New proposed molecules

- Hydrophilic BTP derivatives for selective An(III) stripping
- Hydrophilic DGA derivatives for Ln(III) stripping
- Lipophilic pyridine-dicarboxamides derivatives

→ Challenge: can we be more innovative?

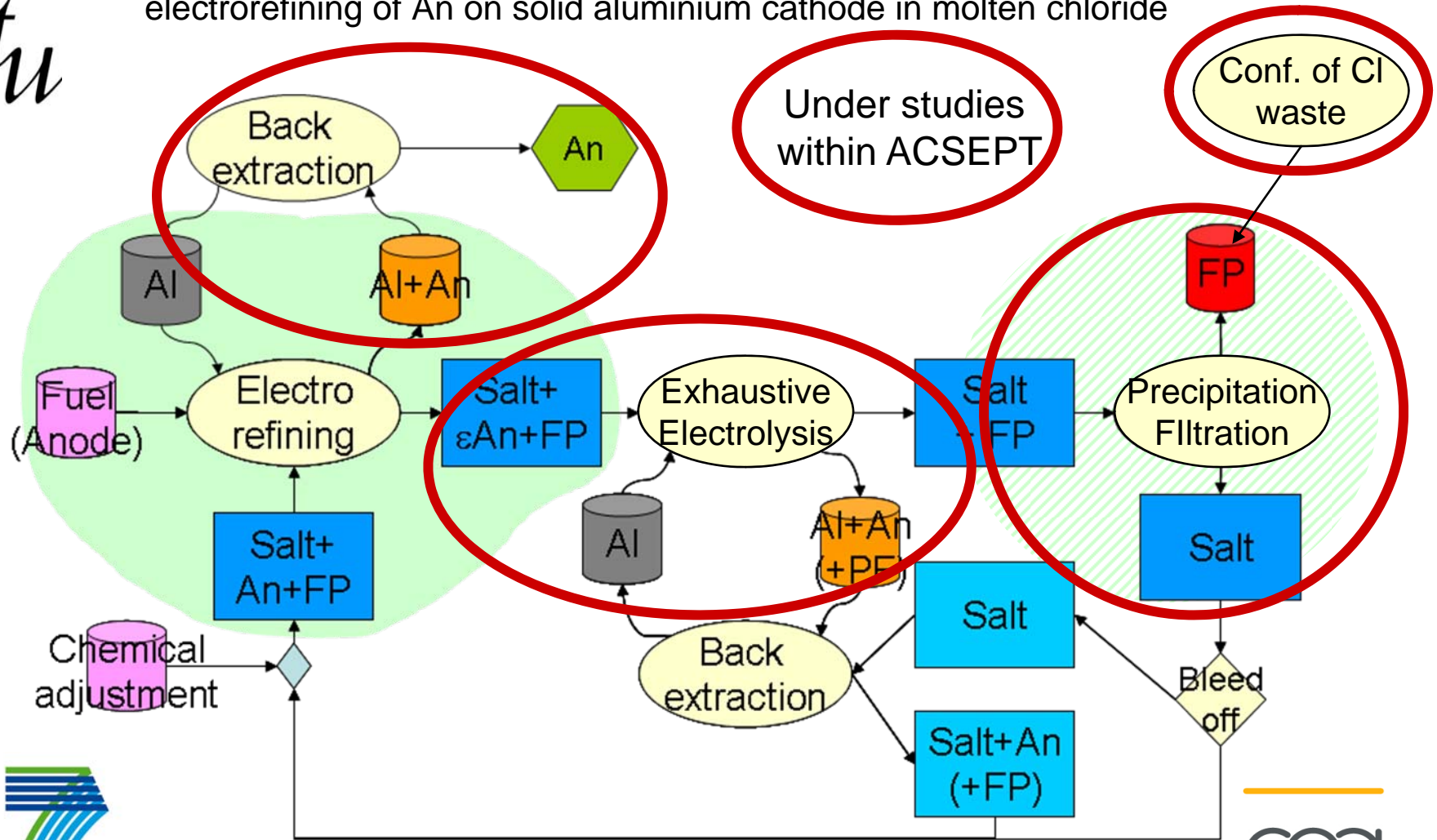
Launching of an important brainstorming work
on extracting molecules

- Develop pyrochemical separation processes beyond the current state of the art, as an alternative option for the longer term
 - Propose reprocessing schemes based on system studies and centered on the two reference cores of process identified during EUROPART
 - Electrorefining on solid aluminium cathode in molten chloride and
 - Liquid-liquid reductive extraction in molten fluoride/liquid aluminium
 - Go further in the alternative electrochemistry in molten fluoride and in the liquid-liquid reductive extraction in molten chloride
 - Validation of the scientific feasibility of each technological brick, at laboratory scale

Electrorefining in molten chloride

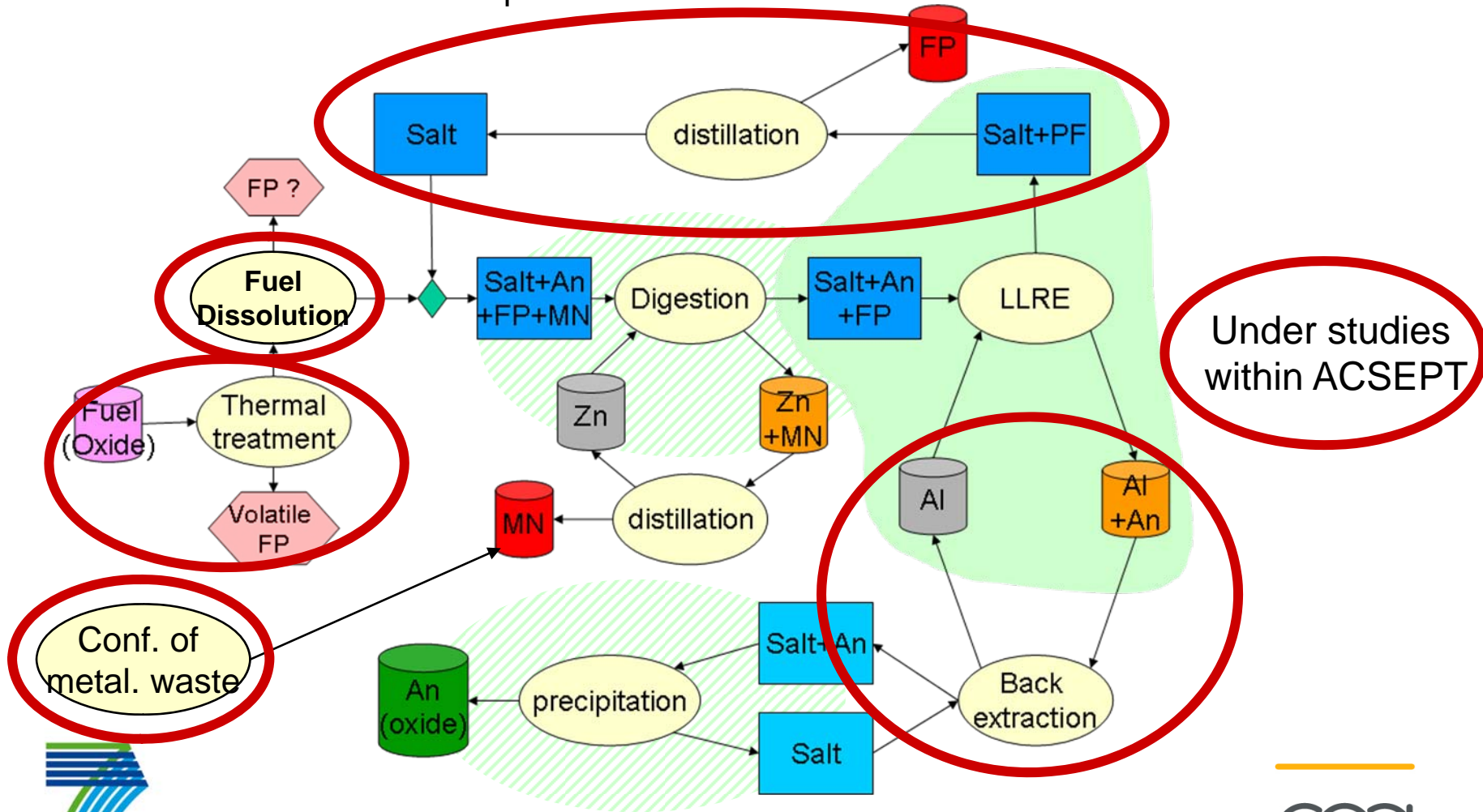
- Based on the IFR concept, the process is centered on the selective electrorefining of An on solid aluminium cathode in molten chloride

itu



Liquid-liquid reductive extraction

- This process is centered on the selective extraction of An in molten fluoride / liquid aluminium.



Domain 3 is a domain of engineering integration, covering aqueous, pyro, and hybrid systems

- **Industrialisation**
- **Provide active feedback to Domains 1 & 2**
- **Integrate with work packages across Europe (SNE-TP)**
- **Identify early challenges & refine axis of research**
- **“Educate” about early integration**

(Two workshops organized last September during the Prague Meeting.)

- **studies on scale-up issues, on-line monitoring, corrosion**
- **Design of MA bearing targets prior their fabrication and irradiation in HFR within the FAIRFUELS project**

Investing in people

4 one year "post doc" scholarships are planned

- Increase the individual young scientist knowledge in a broader field
- Spread the knowledge and procedures used by the different partners
- Criteria : Integration in term of partnership and in term of scientific scope

Dissemination of knowledge, training

- Appointing lecturers during ACSEPT meetings .
- Organising two international workshops at half time and at the end of the project.
- Funding the organisation of seminars, scientific workshops or summer schools
- Developing a simple and easy access internal Communication System (electronic portal with login and passwords)
- Collecting course and lecture materials for wider dissemination

Communication / fostering visibility

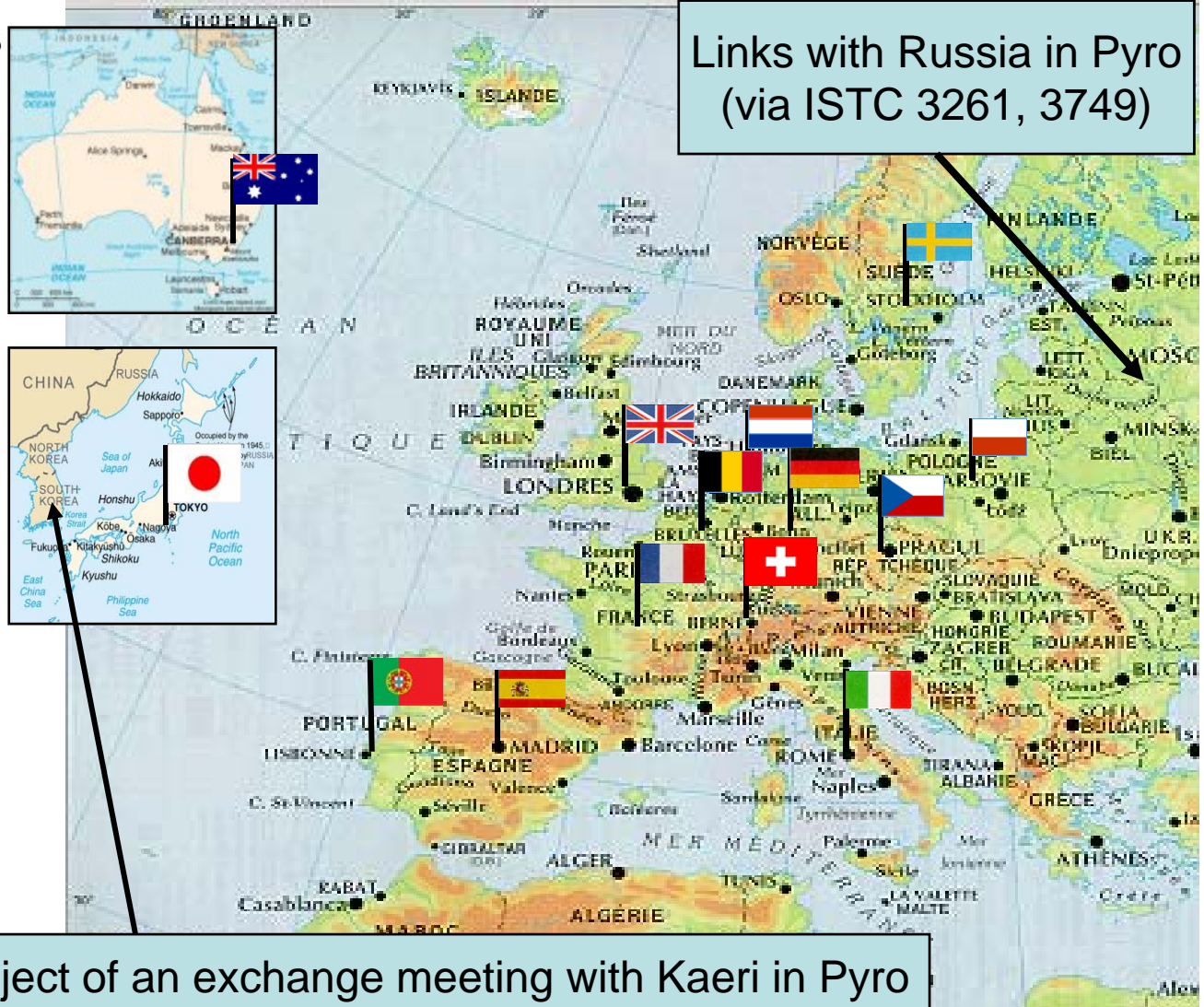
- Developing a open website for general access for information and adverticements
- Making representations or presentation about ACSEPT where appropriate.
- Promoting other actions that improve the visibility of the project or consortium

12 European countries

- Belgium
- Czech Republic
- France
- Germany
- Italy
- Netherlands
- Poland
- Portugal
- Spain
- Sweden
- Switzerland
- United Kingdom

+ Japan and Australia

• 34 Partners



Links with Russia in Pyro
(via ISTC 3261, 3749)

Project of an exchange meeting with Kaeri in Pyro

European Nuclear Research Laboratory:

- JRC-ITU,

National Nuclear Research laboratories:

- ANSTO
- CEA,
- CIEMAT,
- ENEA,
- FZJ,
- FZK-INE,
- ITN
- NNL-UK
- NRG
- PSI

Nuclear Industrial Companies:

- ALCAN
- AREVA NC
- EDF,
- NRI,
- CRIEPI

Universities and/or National Fundamental Research Laboratories:

- Chalmers University, (Gothenborg)
- CTU, (Prague)
- CNRS, (Strasbourg, Toulouse, Orléans, Paris)
- CSIC-ICMAB, (Madrid)
- CUNI, (Prague)
- ICHTJ, (Varsovie)
- ICIQ, (Catalogne)
- IIC, (Prague)
- PoliMi, (Milan)
- RUG (Gröningen),
- UEDIN, (Edinburgh)
- ULG, (Liège)
- ULP, (Strasbourg)
- UNIPR, (Parme)
- UPMC (Paris)
- UReading, (Reading)
- UTwente (Twente)

Small and Medium Size Enterprises:

- CINC

Thank you for your attention

**For more information
Lectures of G. Modolo, J Uhler,
Posters III-3 (Komper-Geist), III-5 (Espartero), III-7 (Hill)**