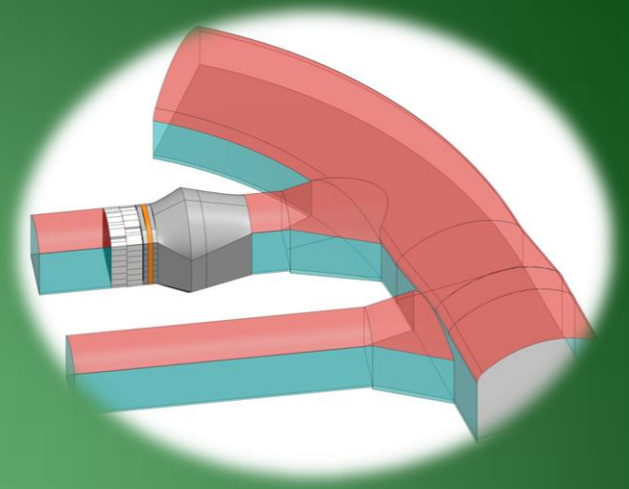


DOPAS end of project overview
Knowledge base at project outset and objectives
Lessons learnt and benefit

DOPAS coordinator,
Johanna Hansen, Posiva

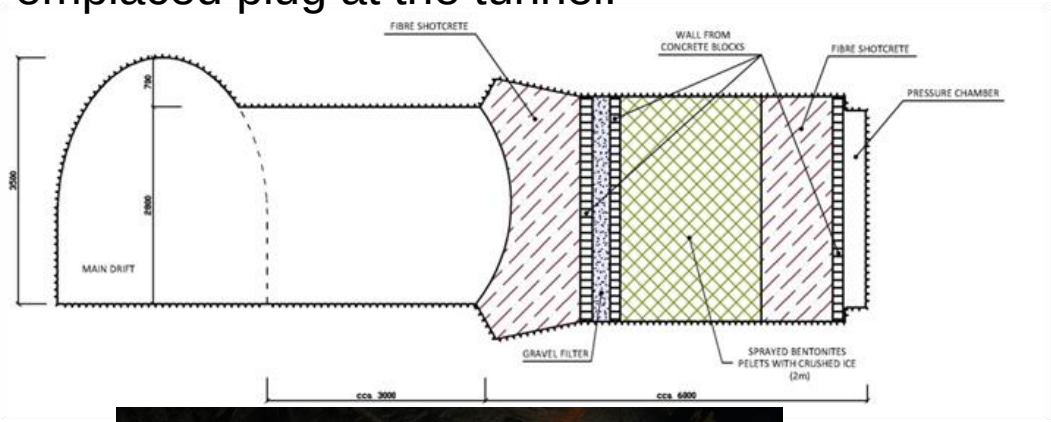
This presentation

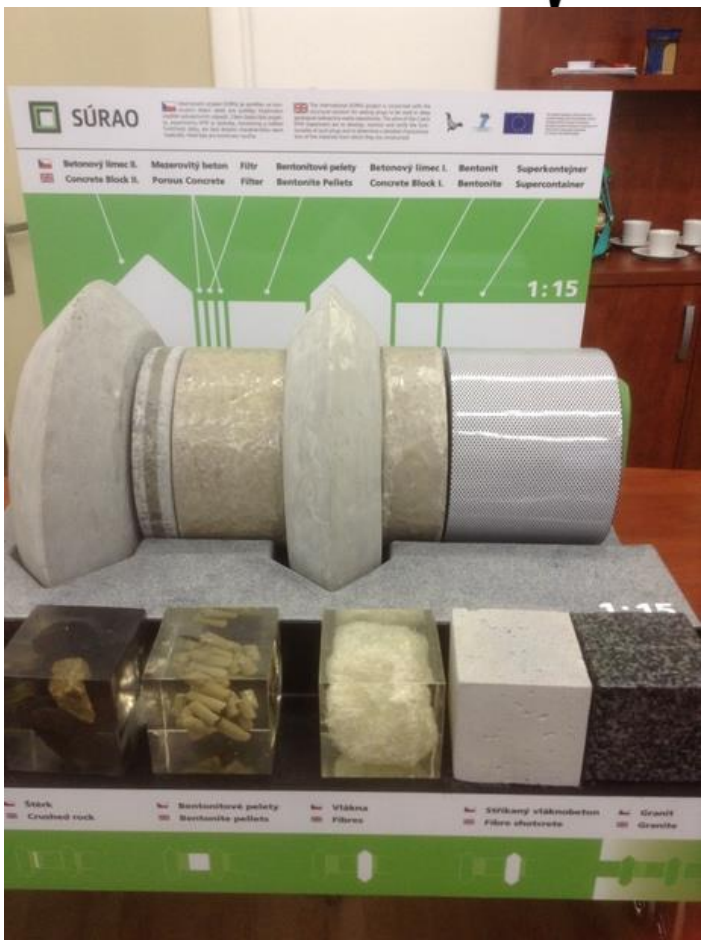
- State of the art for plugs and seals development chain
- Main objectives of DOPAS project and few facts about DOPAS project
- DOPAS Experiments and their scope
- The main findings about DOPAS project
- Lessons learned from integration and co-operation

DOPAS = Full Scale Demonstrations of Plugs and Seals

From desktop to the reality

From the first conceptual drawing, to the miniature dissemination purpose table size following with emplaced plug at the tunnel.

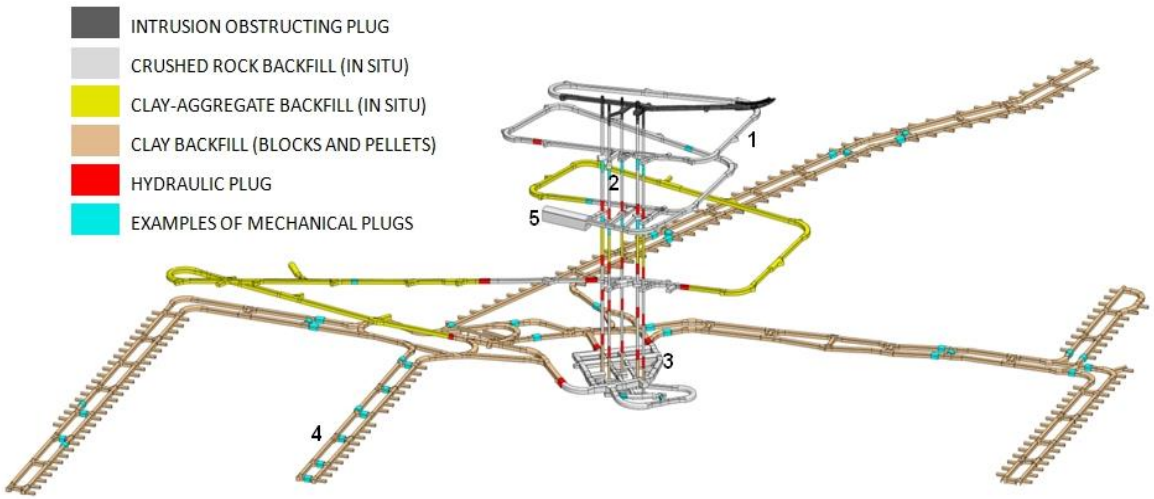


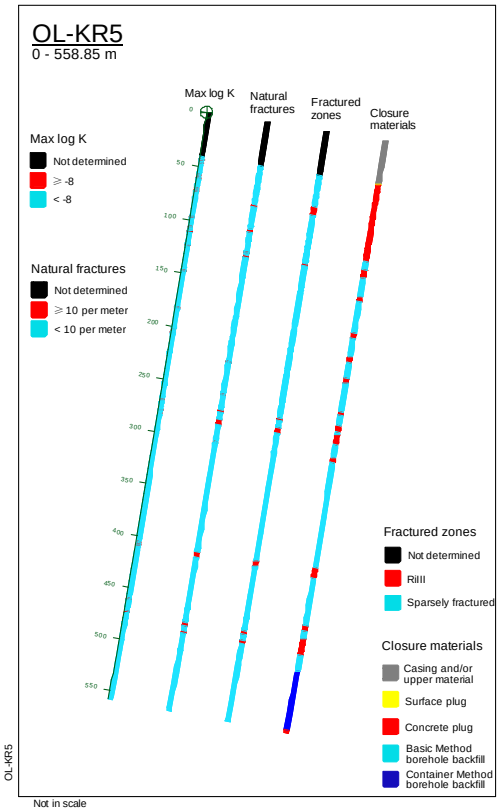


State of the art prior DOPAS project

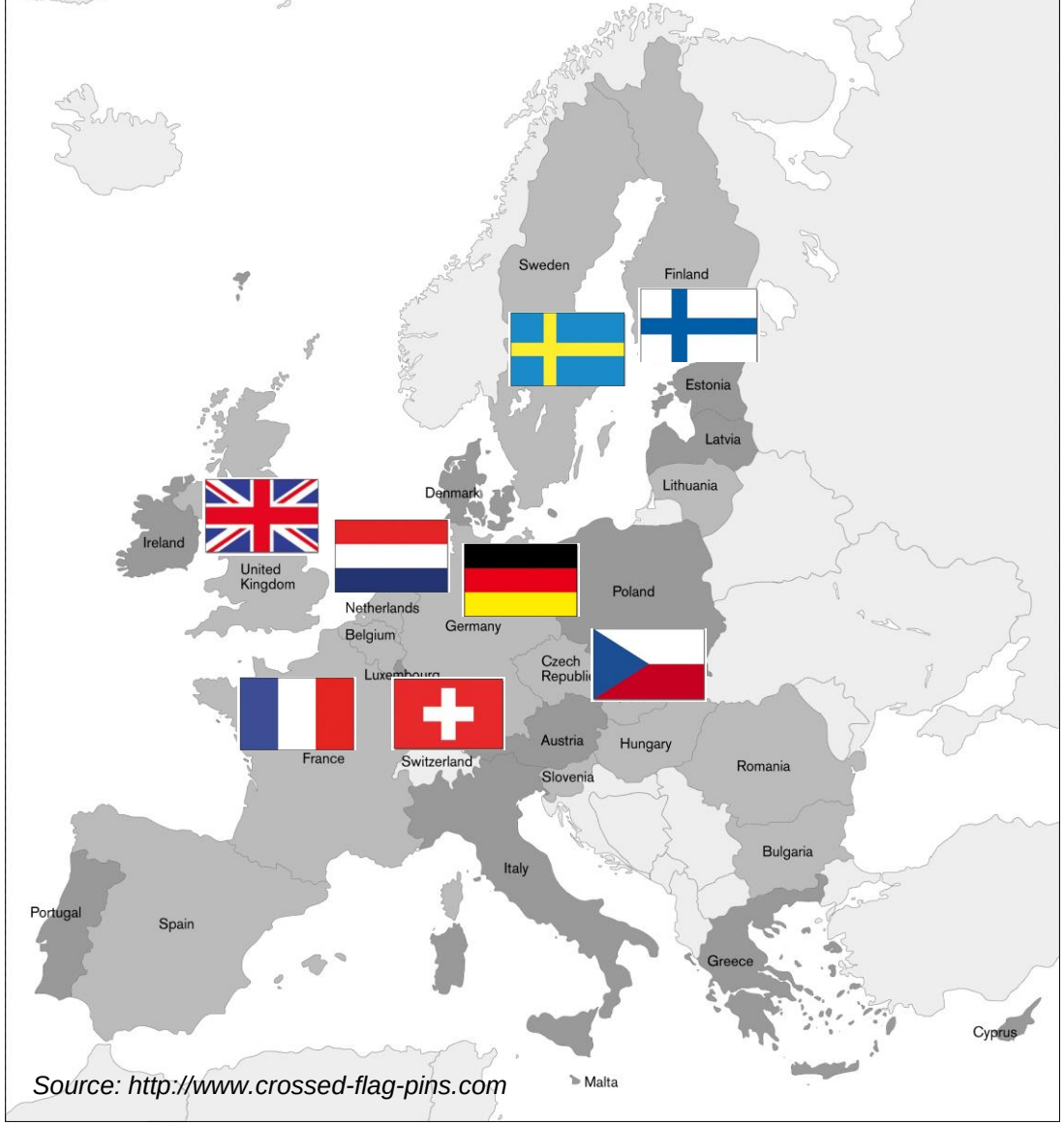
- Prototype repository, Esdred, ESP, Lucoex
- Support the achievement of Vision 2025 according the IGD-TP SRA deployment
- Open questions:
  - Design basis processes and conceptual designs
  - Siting and excavation of plug/seal locations
  - Installation, monitoring and performance of plugs and seals
  - Compliance of plug and seal designs with their functions

Plugs and seals in repository





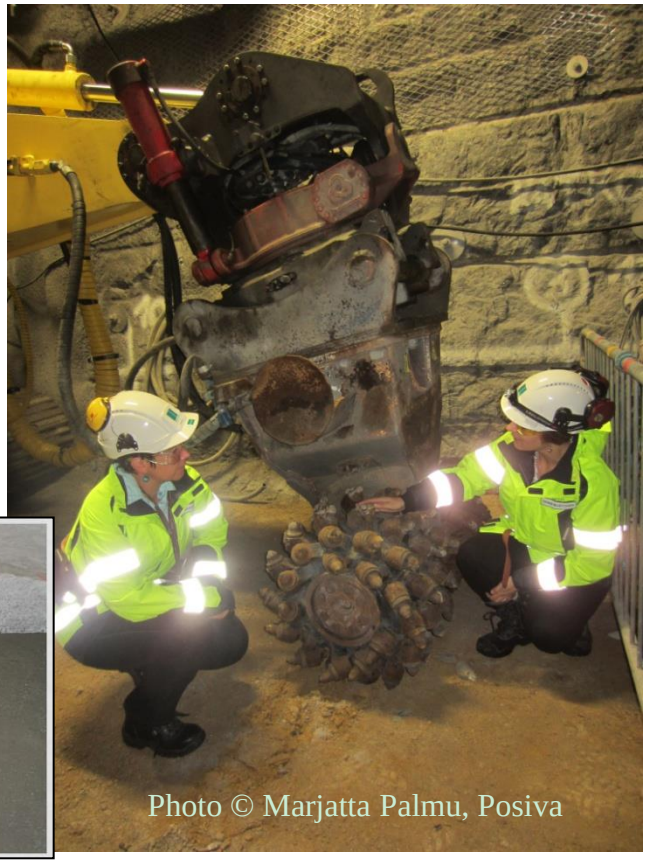
1-tunnels, 2-shafts, 3-technical area, 4-deposition tunnels, 5- LILW area



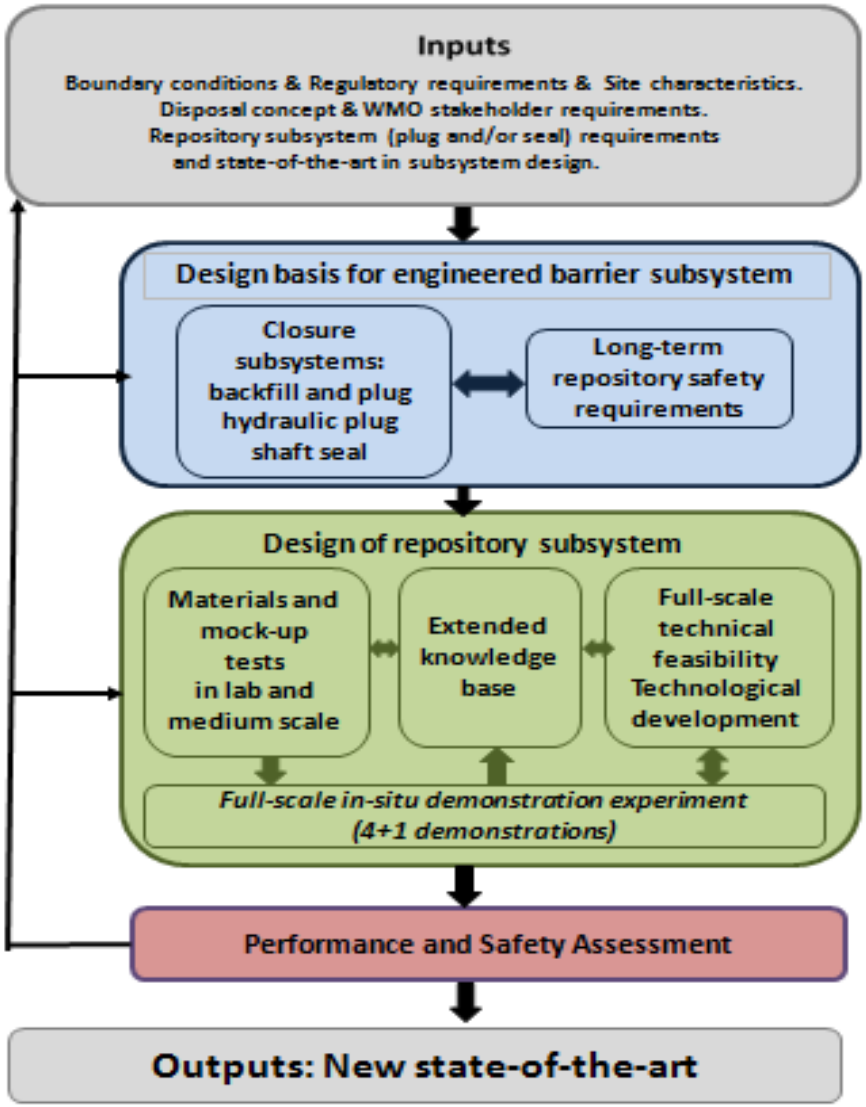
Source: http://www.crossed-flag-pins.com

DOPAS Experiments

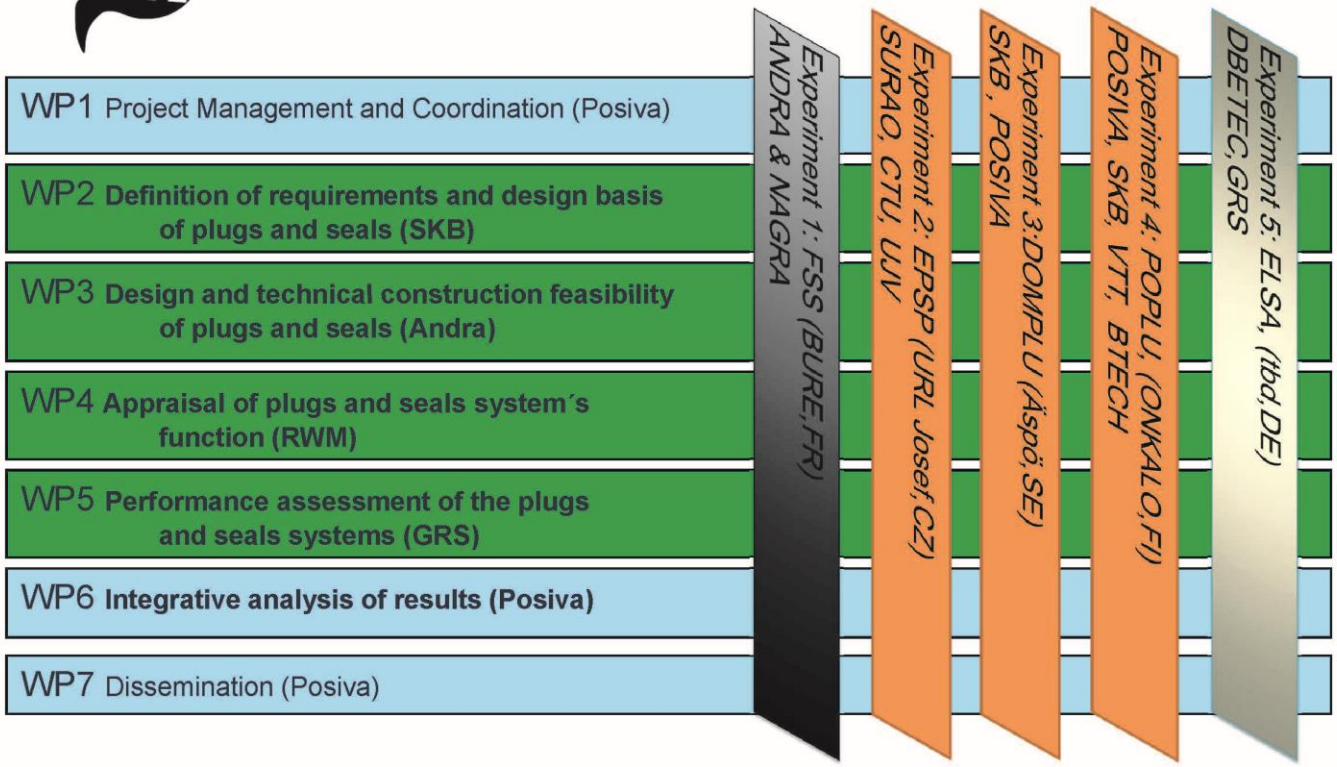
POPLU grinding of plug location



http://www.posiva.fi/en/dopas


Inputs
Boundary conditions & Regulatory requirements & Site characteristics.
Disposal concept & WMO stakeholder requirements.
Repository subsystem (plug and/or seal) requirements
and state-of-the-art in subsystem design.
Design basis for engineered barrier subsystem
Closure subsystems: backfill and plug hydraulic plug shaft seal
Long-term repository safety requirements
Design of repository subsystem
Materials and mock-up tests in lab and medium scale
Extended knowledge base
Full-scale technical feasibility Technological development
Full-scale in-situ demonstration experiment (4+1 demonstrations)
Performance and Safety Assessment
Outputs: New state-of-the-art

DOPAS Experiments and work packages

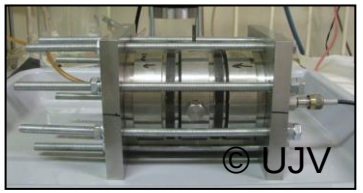


Key objectives of DOPAS project

- To develop design basis for different plugs and seals (WP2)
- To describe the reference designs (WP2)
- To (further) develop a comprehensive design basis for the in-situ demonstration experiments (WP3)
- To carry out large/full-scale demonstrations (WP3)
- To monitor full-scale demonstration (WP4)
- To address seal plug materials with respect to long-term behaviour (WP5)
- To integrate the achieved knowledge (WP6)

Different scales /concretes

Different scales /bentonite



Underground or above ground

Assessing the experiments

- Description of site constraints and future evolution
- Setting performance requirements
- Theoretical calculations to support the design and implementation phase
  - Model development
  - PA-methodology,
- Processes and phenomena
- Integration of results to the overall safety

Joint aspects and benefits for co-operation with plugs and seals

- Preparation for demonstrations before operation phase
- Similar type of materials and methods
- Improved quality and risk management including occupational and long-term safety
- Theoretical calculations to support the design and implementation phase
- Similar work phases is good way of benchmarking how other organisations are working
- The success and challenges are good to discuss and analyse with people having similar experience

DOPAS provides further

- Developed and described design basis, reference designs and strategies and examples
- Detailed design and implementation chain for different type of demonstrations
- Experiences on materials to be used in repositories and their interactions
- Improved quality and risk management procedures, which has been used in practice
- Experiences on plug performance in different conditions
- Experience on performance assessment tool for plugs and seals
- Role on plugs and seals in Safety case

As example how TRL was developed

Technology readiness level		POPLU TRL start	POPLU TRL end
design basis (requirements)		3	7
slot location siting		5	7
tunnel excavation relevant to slot		5	7
plug and seal location excavation		3	6
structural design		3	7
THMC modelling of plug experiment		4	5
Material (inc. Purchase, production, emplacement)	concrete	2	7
	grout	5	6
	bentonite	2	6
	steel	5	7
Material interactions		3	3
monitoring strategy for operation (parameter selection)		4	7
monitoring technology (sensors, wiring, data collection, etc.)		5	7
construction logistics		5	7
compliance assessment		2	5
quality management (procurement, contractor selection, documentation, etc.)		3	6
safety case		5	5

As example what was learned by RWM

- RWM current design assumptions, cost estimates and emplacement schedules could be updated in line with good practice.
  - Design of plugs/seals needs to integrate with overall disposal concept, but most significantly with the mass backfill.
- Learning on technology and materials can be readily applied in RWM research,
- Not sensible to spend substantial sums of money developing plug and seal designs at this current generic phase.
- DOPAS has been a very valuable project for RWM, and has provided confidence that the design of plugs and seals is both feasible and practicable.

DOPAS foreground and dissemination

- Each experiment produced a public summary report
- Integration of experiments presented in Work Package summary reports and DOPAS Technical summary
- Staff exchange programme
- Main DOPAS events:
  - Training workshop September 2015
  - DOPAS 2016 seminar May 2016
    - focusing on plugs and seals and the lessons learned around DOPAS demonstrations

DOPAS project experiences

- Integration between Experiments and Work Packages:
  - requires regular discussion between Exp. leaders and WP leaders (Work Package and management team meetings)
- Full scale demonstrations requires more resources (cost & personnel) than expected, but demonstrations are essential from learning and training point of view
- The DOPAS staff exchange programme has been useful
- Expert Elicitation process for summary reports has been found very useful

DOPAS

www.posiva.fi/en/dopas

DOPAS

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