

Hydrogen recombination research in JÜLICH

Experimental Facilities & Code Development

Ernst-Arndt Reinecke, Hans-Josef Allelein

THOR Preparation Meeting, H2Nitidor, Italy, September 5, 2014

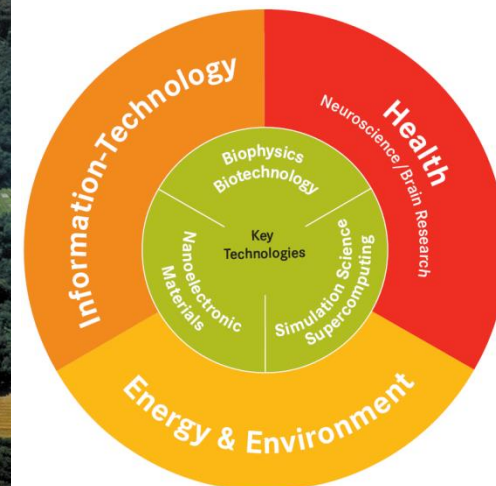
JÜLICH - Research & Development on 2.2 km²

Institute of Energy & Climate Research (IEK):

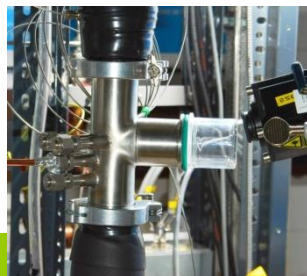
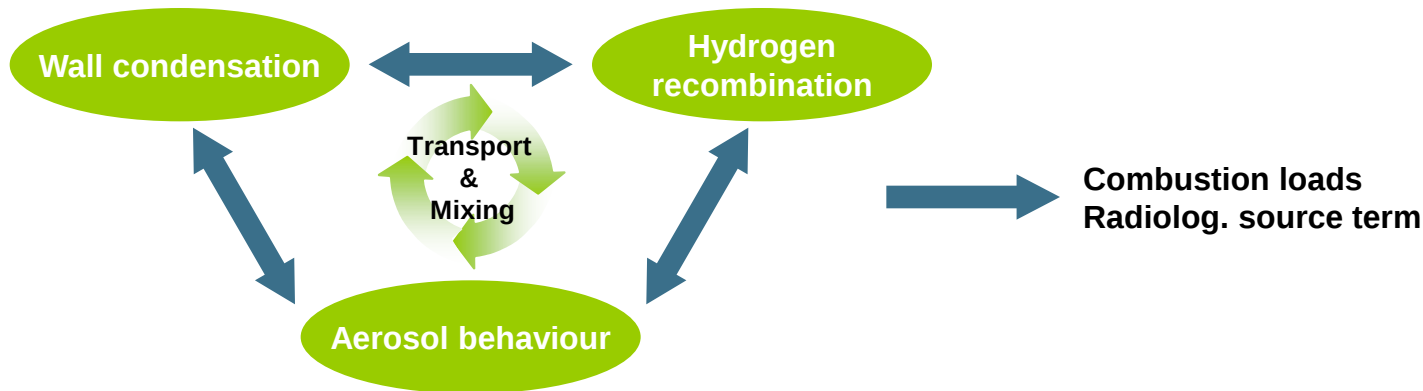
- Power Plant Technology
- Fuel Cells
- Photovoltaics
- Nuclear Fusion
- Nuclear Waste Management and Reactor Safety
- Stratosphere
- Troposphere
- System Analysis
- Electrochemistry

Budget ~ 484 Mio. €
Staff ~ 5000
 (~ 1750 Scientists)

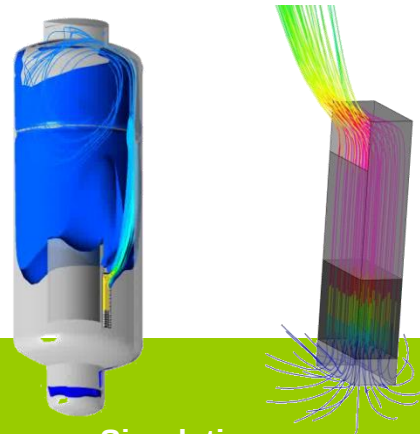
Retrieved: 2013



Containment Phenomena and Processes



Experiment

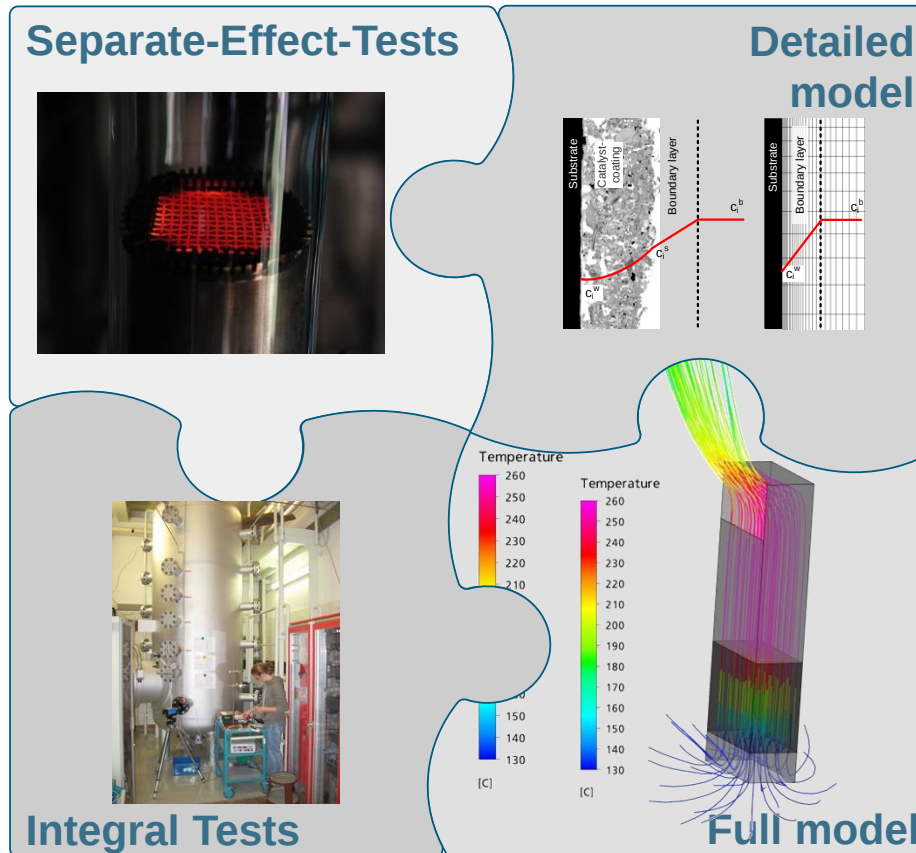


Simulation



Co-operation

Research on hydrogen recombination



Experiments and code development

Experiments

GRART

(lab-scale)



REKO-1

(lab-scale)



REKO-3

(lab-scale)



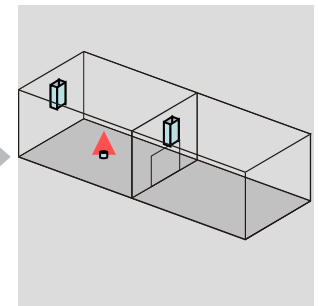
REKO-4

(5.5 m³)



MC-PAR

*(160 m³)
design phase*



REKO-DIREKT

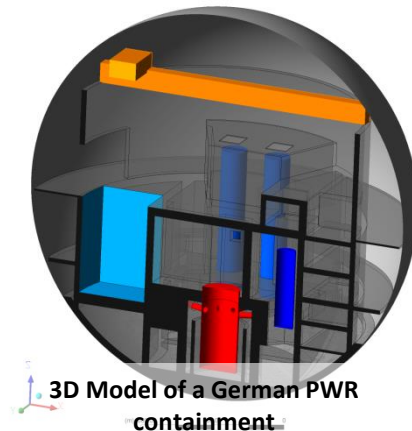
ANSYS-CFX

Code and model development

Computational Thermo-Fluid Dynamics

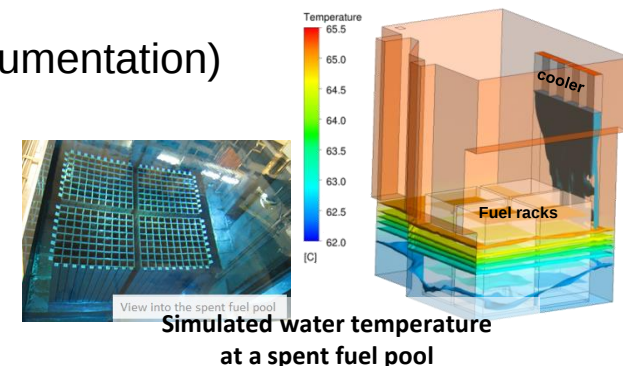
Model Development & Validation..

- Physical phenomena: mixing in buoyant flows, condensation ..
- Technical systems: hydrogen recombiner (PAR), heat exchanger ..
- Goal: Provide '*reliable*' and '*applicable*' models

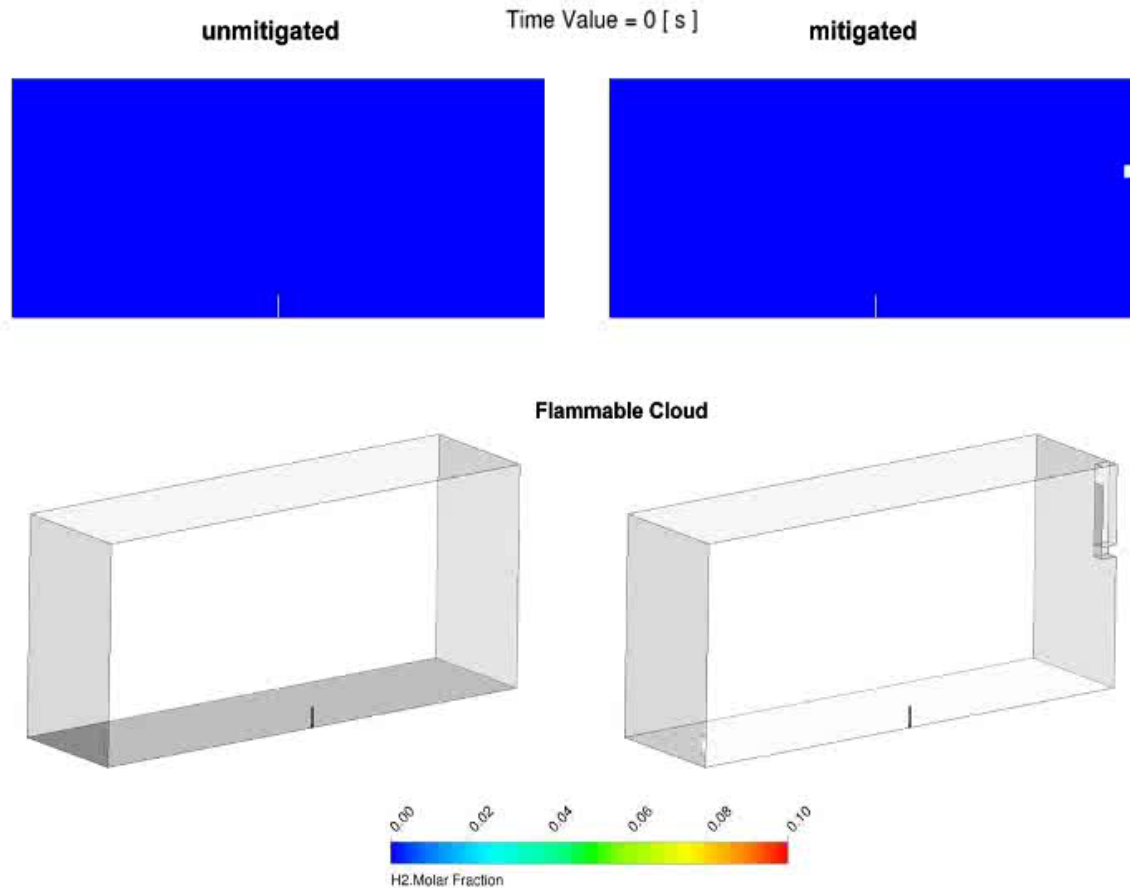


..and Application to Nuclear Safety Assessment

- Design and evaluation of experiments (e.g scaling, instrumentation)
- System analysis (containment atmosphere mixing, PAR effectivity, coolability etc.)
- Contribution to national and international research projects (e.g. OECD/NEA-WGAMA)



Simulation of hydrogen recombiners



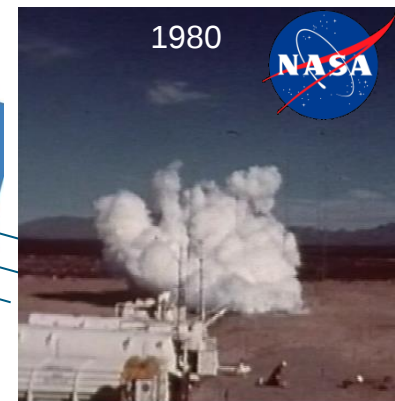
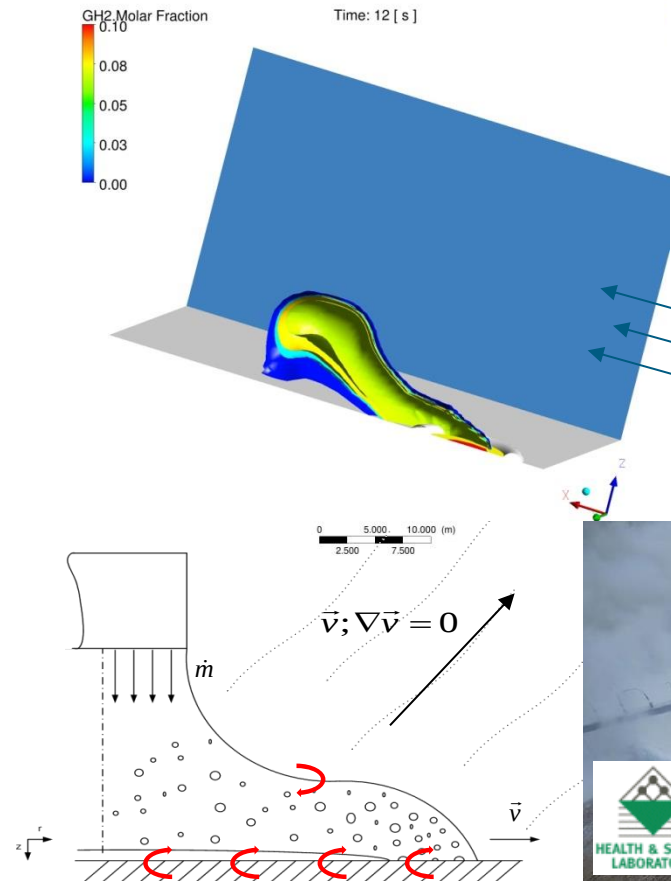
Highlight: Liquid hydrogen spill

CFD Simulation

Assessment of LH2 accident scenarios

3D simulation:

- pool spread and vaporisation
- additional phase change (e.g. air decomposition and liquefaction)
- gas cloud distribution



Thank you for your attention !