Coupling MELCOR to other Codes

Tobias Szabó
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Institute for Nuclear and Energy Technologies (IKET)
Karlsruhe Institute of Technology (KIT)

http://www.comintec.it
backslash free jaw coupling "GAS/SG"

Outline

1. Introduction
2. MELCOR coupling interface
3. Test case
4. Conclusion and perspective

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1. Introduction

- Coupling of simulation codes = exchange boundary condition + coordination of time advancement
- Coupling to add modelling capacities to a code
- Coupling of MELCOR and the 3D CFD code GASFLOW (containment thermal hydraulics, hydrogen distribution and burn)

→ MELCOR can be coupled to other codes through existing coupling interface

2. MELCOR coupling interface

- MELCOR coupled to RELAP5-3D (Parallel Virtual Machine, PVM)
- MELCOR coupled to GILA (Message Passing Interface, MPI)
- Code coupling system
  - Executive program PVMEXEC (INL) or MPIEXEC (SANDIA)
  - Similar coupling interface in each code

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2. MELCOR coupling interface

- MELCOR coupling routines in versions 1.8.5 and 1.8.6:
  mexpvi, mexpvs, mexpvt, mexpvx, mexsnd, mexrcv

- Coupling routines for MPI are not functional in version 1.8.6
- Identified problems
  - Missing variable definitions
  - ```
    call mpi_reduce( value8(iv1),temp8(iv1),nvar,
    1      mpi_double_precision,mpi_sum,0,
   2   mpi_comm_reduce(myprocnum,i),info)
    ```

- Modifications

# 2. MELCOR coupling interface

## Requirements for MPI coupling

- Executive program for coupling MPIEXEC (SANDIA)
- Modifications in the MELCOR 1.8.6 coupling routines
- Implementation of MPI 2 standard, e.g. MPICH 2
- Coupling interface must be implemented into second code

# 3. Test case

- Coupling two instances of MELCOR
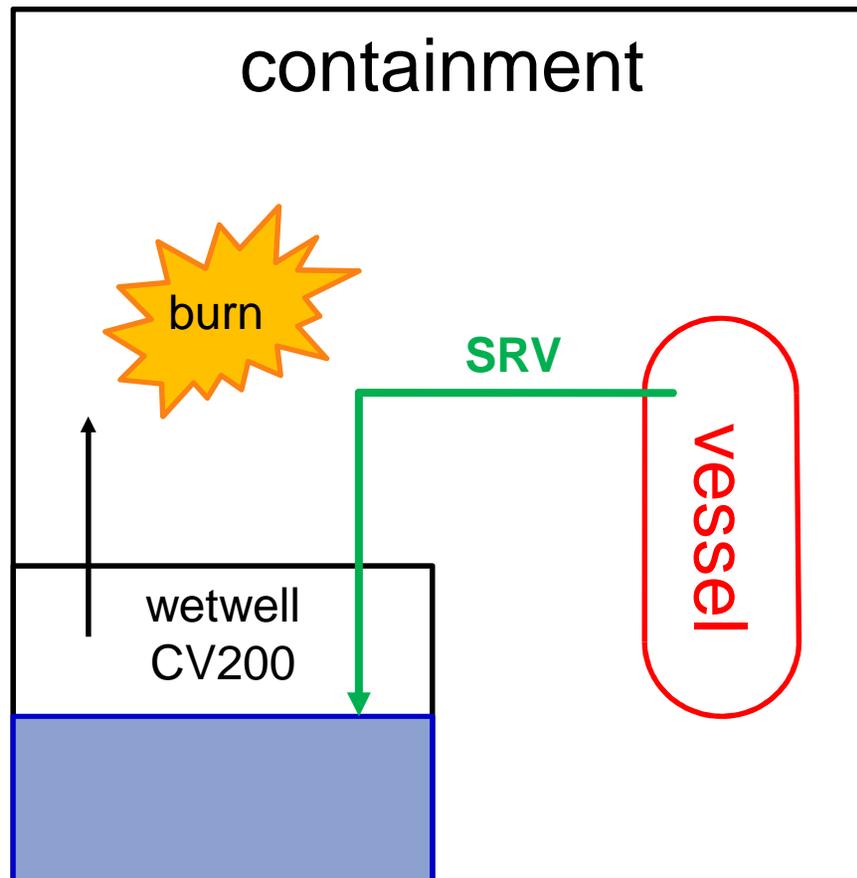


- BWR after shutdown
- Decay heat
- Outflow through safety relief valve
- Hydrogen production
- Hydrogen burn

simplified exercise from MELCOR workshop 2001

# 3. Test case

■ Containment        ■ Vessel

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# 3. Test case

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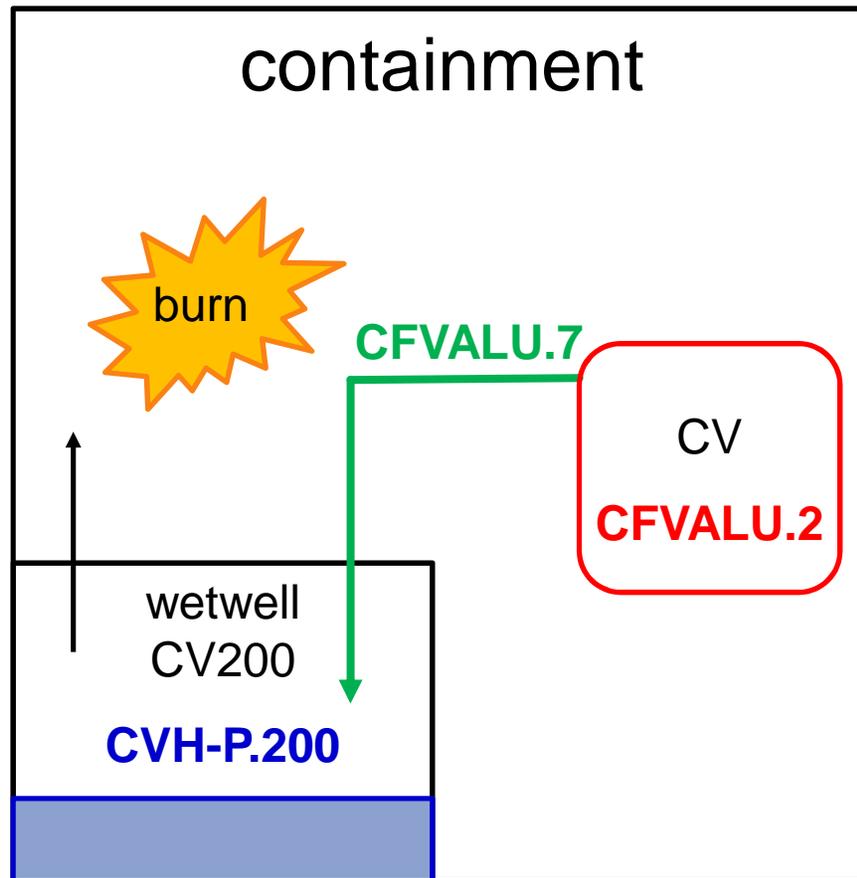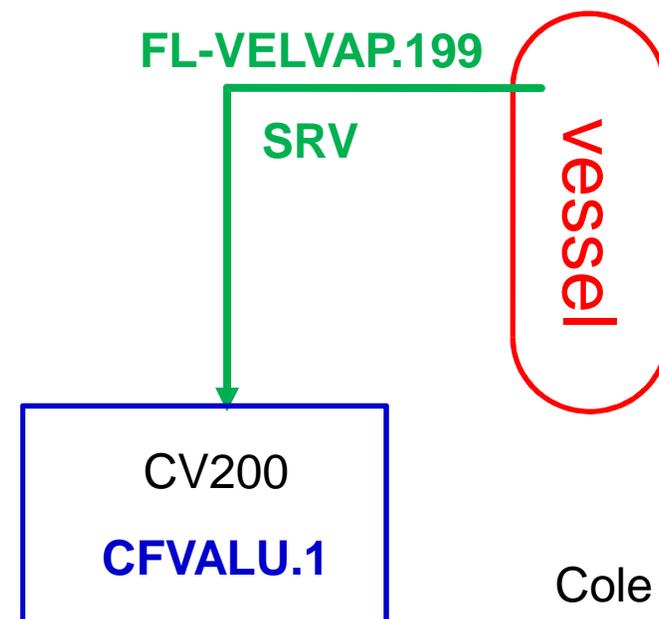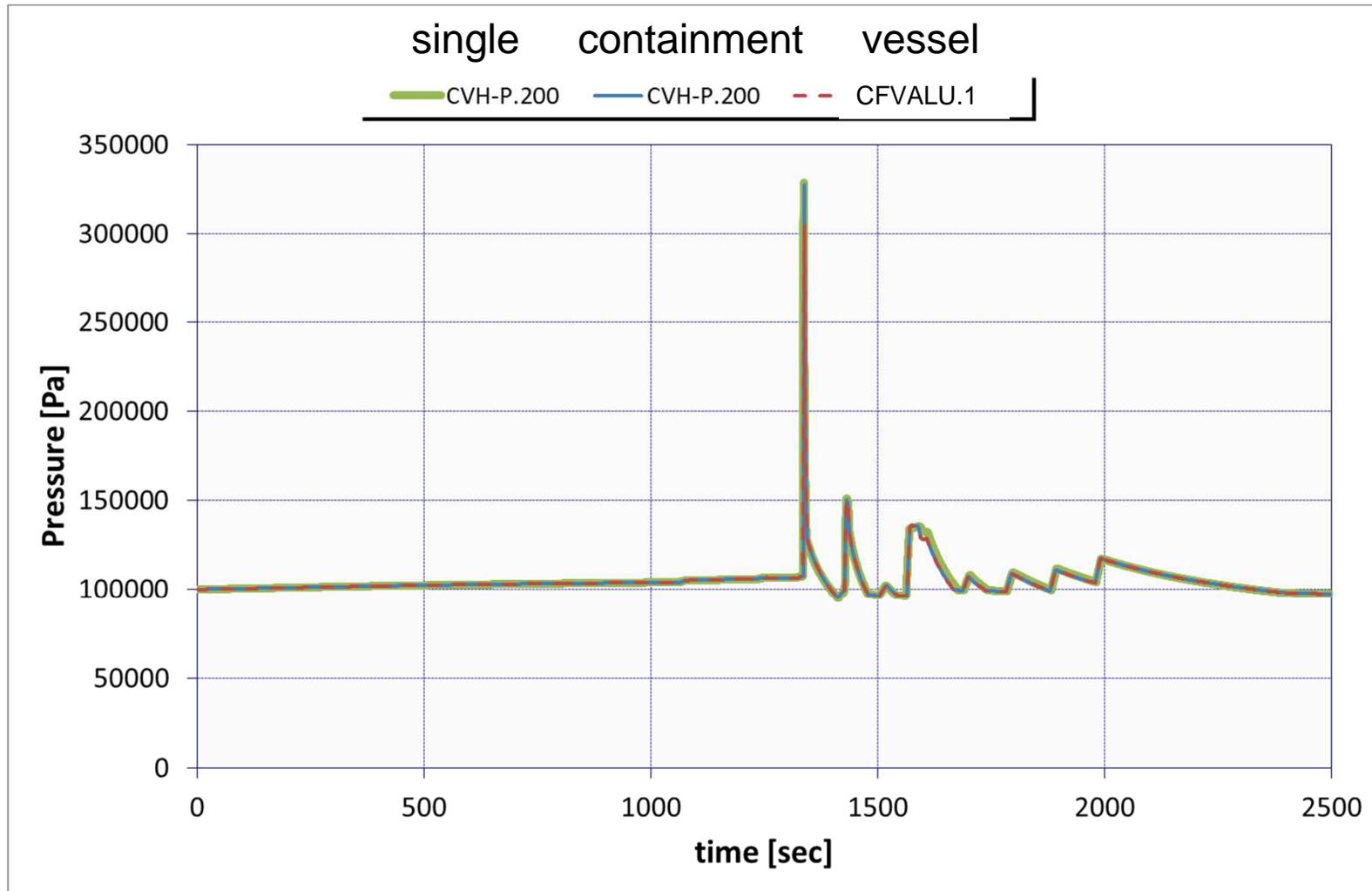
# 4. Conclusion and perspective

## Conclusion

- MELCOR 1.8.6 MPI coupling interface is fuctional after modifications
- Control Function utility is used for defining boundary conditions
- Example of two coupled MELCOR instances

## Perspective

- At KIT coupling MELCOR to GASFLOW
- MELCOR 2.1 coupled to other codes in the future

# Thank you for your attention!

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# Appendix literature

Literature:

- R.K. Cole. *Coupling of MELCOR to Other Codes under an Executive Program using PVM Message Exchange*. SAND2002-2440C. Sandia National Laboratories, Albuquerque, NM, USA. 2002.

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