



AREVA

forward-looking energy

Visualization of MELCOR Results for SAMG Training Purposes

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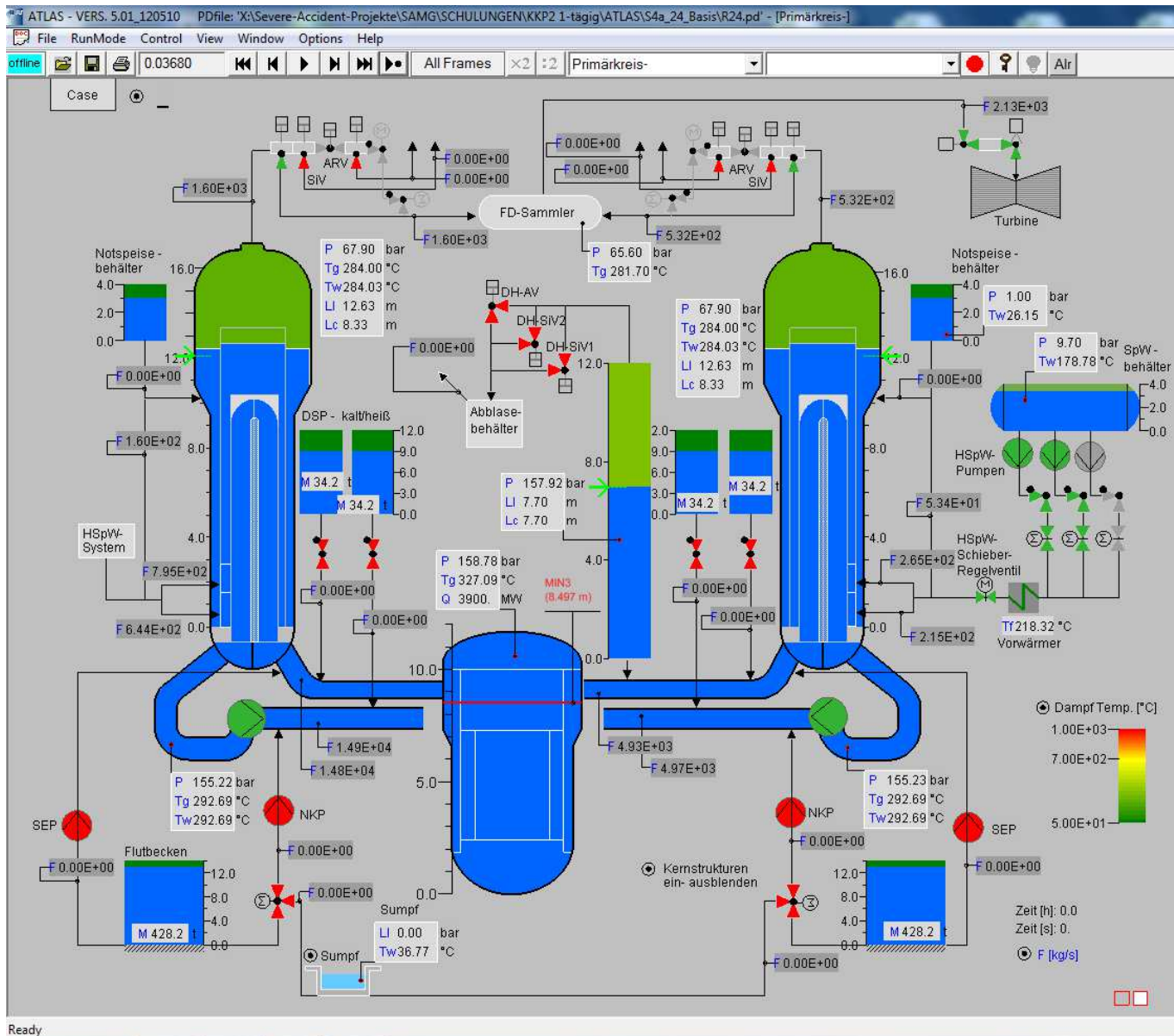


- ▶ **Visualization with ATLAS**
- ▶ **Introduction of the TVP-viewer**
- ▶ **80 cm² MBLOCA for a German PWR 1300 MW**
- ▶ **Summary and conclusion**

Visualization Tools – ATLAS

- ▶ For visualization of MELCOR results AREVA is using ATLAS
- ▶ Effort for preparing images is large
- ▶ Large parts of the work are usually done by student trainees

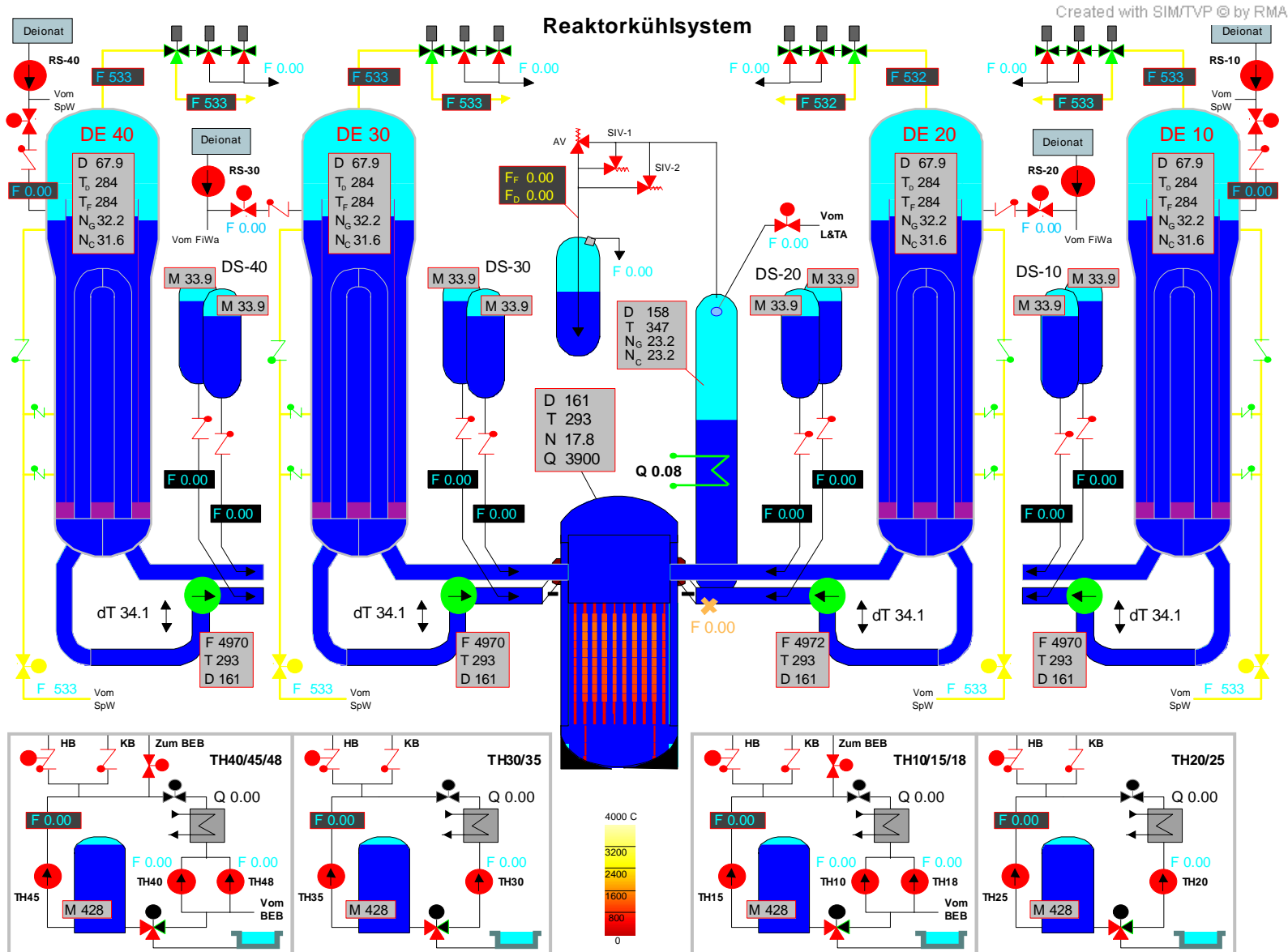
Example: visualization of MELCOR results. Primary circuit of a German PWR 1300 MW



Introduction of the TVP-Viewer

- ▶ Originally AREVA planned to develop a PC-based, interactive simulator for severe accidents
 - ◆ Full scope simulator not envisaged in Germany (limited operation time of NPPs)
- ▶ Shift and emergency response teams prefer images similar to the already known images of the visualization during operation
 - ◆ e.g. 4 steam generators, although only 2 loops calculated
 - ◆ Extensive changes in the ATLAS tool would be required
- ▶ Decision to adapt the existing externally developed visualization system: TVP-Viewer = Transient Visualization and Post-Processing
 - ◆ Scope reduced to activate existing pre-calculated accident scenarios from plot files
 - ◆ Extendable to existing PC-based interactive simulator: SIM = Simulation and Interactive Modeling
 - ◆ Developed in the USA by  (www.gorma.com)
- ▶ Used for SAMG training in Germany by the utility 

Introduction of the TVP-Viewer – Primary Circuit



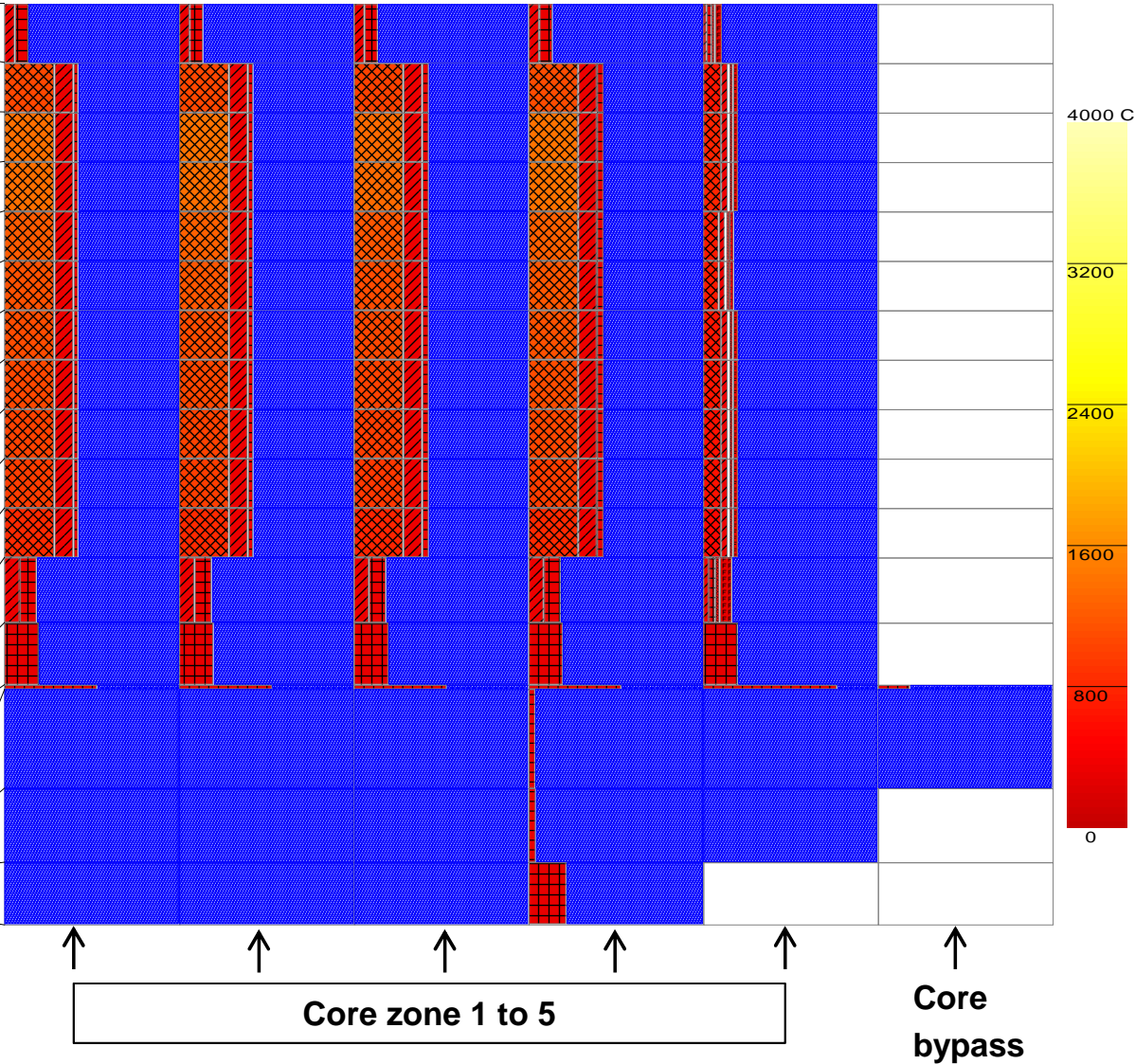
Introduction of the TVP-Viewer – Core



Created with SIM/TVP © by RMA

Cell Data:
 1) COR-TFU 2) COR-TCL 3) COR-TPD

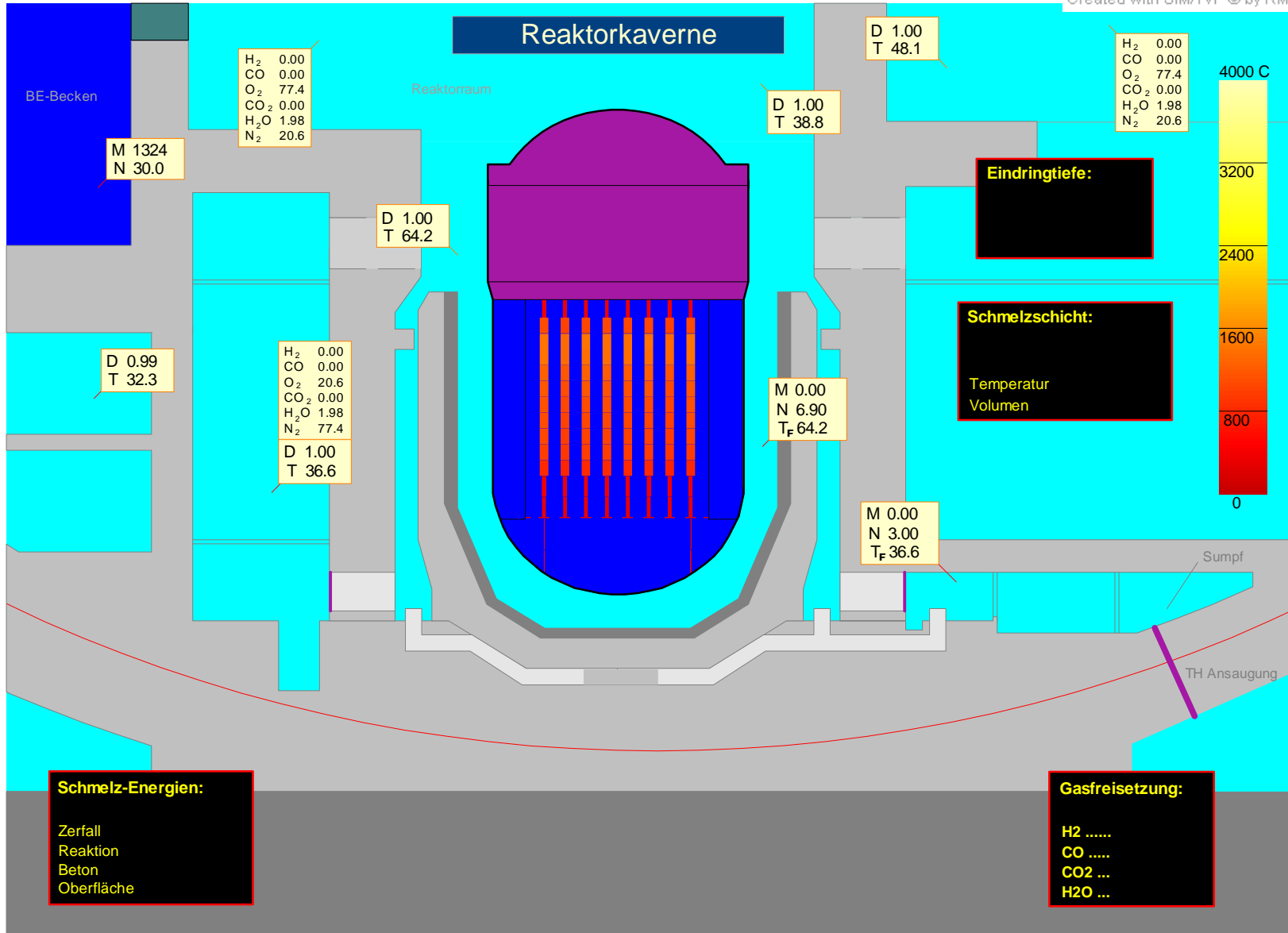
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0.00	925.37	1365.34	1304.60	1352.30	1339.07
0.00	623.94	624.93	624.84	624.91	624.90
0.00	0.00	0.00	0.00	0.00	0.00
0.00	1044.53	1711.02	1620.70	1691.60	1671.91
0.00	624.29	625.39	625.28	625.37	625.35
0.00	0.00	0.00	0.00	0.00	0.00
0.00	1034.85	1682.51	1595.81	1663.91	1645.03
0.00	624.27	625.35	625.25	625.33	625.32
0.00	0.00	0.00	0.00	0.00	0.00
0.00	983.67	1538.24	1462.56	1523.28	1508.00
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0.00	0.00	0.00	0.00	0.00	0.00
0.00	955.33	1456.51	1383.07	1440.52	1424.43
0.00	624.04	625.06	624.96	625.02	625.02
0.00	0.00	0.00	0.00	0.00	0.00
0.00	935.37	1394.85	1330.29	1380.93	1366.85
0.00	623.98	624.98	624.88	624.96	624.94
0.00	0.00	0.00	0.00	0.00	0.00
0.00	921.47	1354.01	1294.68	1341.29	1328.38
0.00	623.93	624.92	624.82	624.90	624.88
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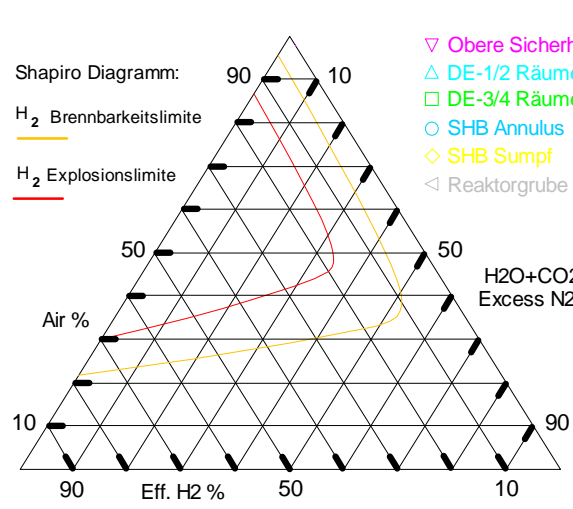
Introduction of the TVP-Viewer – Reactor Pit and Cavity



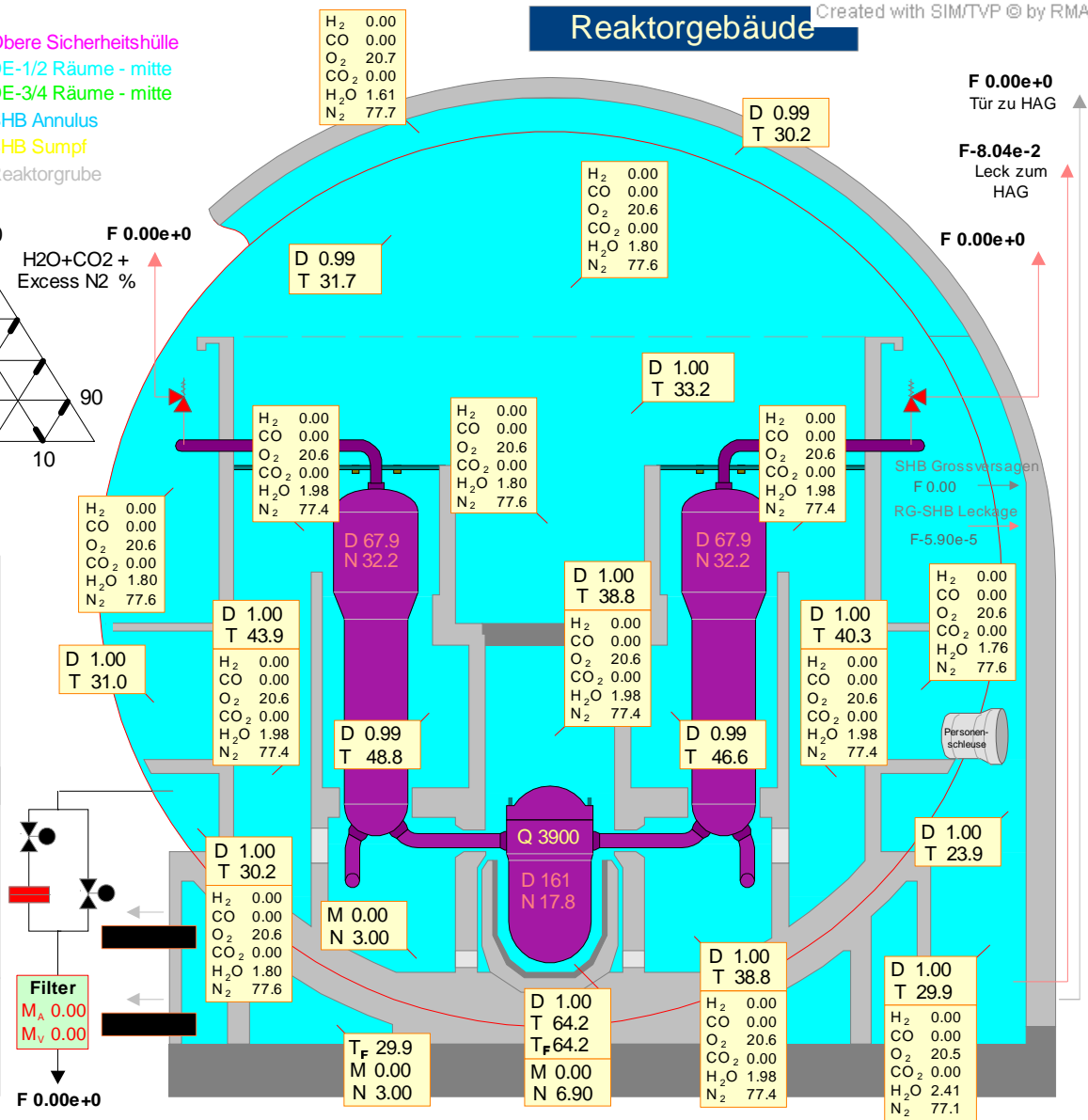
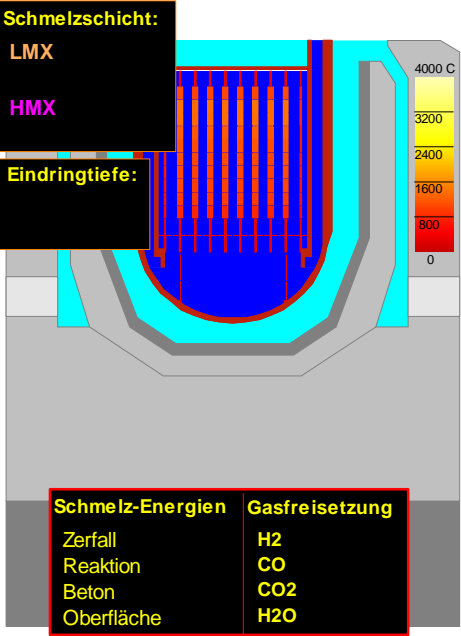
Created with SIM/TVP © by RMA



Introduction of the TVP-Viewer - Containment



- ▽ Obere Sicherheitshülle
- △ DE-1/2 Räume - mitte
- DE-3/4 Räume - mitte
- SHB Annulus
- ◇ SHB Sumpf
- ◁ Reaktorgrube



Visualization of 80 cm² MBLOCA



▶ Boundary conditions of the example scenario:

- ◆ Injection with 4 safety injection pumps and 4 residual heat removal pumps (RHRP) from borated water storage tanks is available
- ◆ All 8 accumulators are available
- ◆ Isolation of the 4 cold leg accumulators 500 s after reaching the emergency core cooling signal
- ◆ Failure to switch the RHRPs to the sump recirculation mode
- ◆ Automatic secondary side cooldown (100 K/h) is not available
- ◆ Main steam safety valves are available
- ◆ Emergency feed water system is available
- ◆ Failure of secondary side bleed and feed and primary side bleed and feed
- ◆ Annulus filtered ventilation system is available
- ◆ Spent fuel pool cooling is available
- ◆ Flooding of the melt in the reactor pit after penetration of the biological shield

Visualization of a 80 cm² MBLOCA for a German PWR 1300 MW



Summary and Conclusion

- ▶ **Development and drawing of visualization pictures requires a large effort**
- ▶ **AREVA uses**
 - ◆ **ATLAS (GRS tool) for all utilities**
 - ◆ **TVP-viewer for E.ON**
- ▶ **Shift and emergency response teams prefer images similar to the already known images like visualization during operation**
 - ◆ **e.g. 4 steam generators, although only 2 loops calculated**
 - ◆ **similar “look-and-feel” of the images**
- ▶ **For severe accident visualization, additional images for core degradation, containment, MCCI, etc., have been developed**
- ▶ **A full scope simulator for severe accidents is no longer envisioned in Germany**

Acknowledgment



- ▶ **We acknowledge the contribution to this presentation from Dr. Alfred Torri, Risk Management Associates, Inc.**



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Thank you for your attention!

**End of Presentation:
Visualization of
MELCOR Results for SAMG
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