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Visualization of MELCOR Results for SAMG Training Purposes

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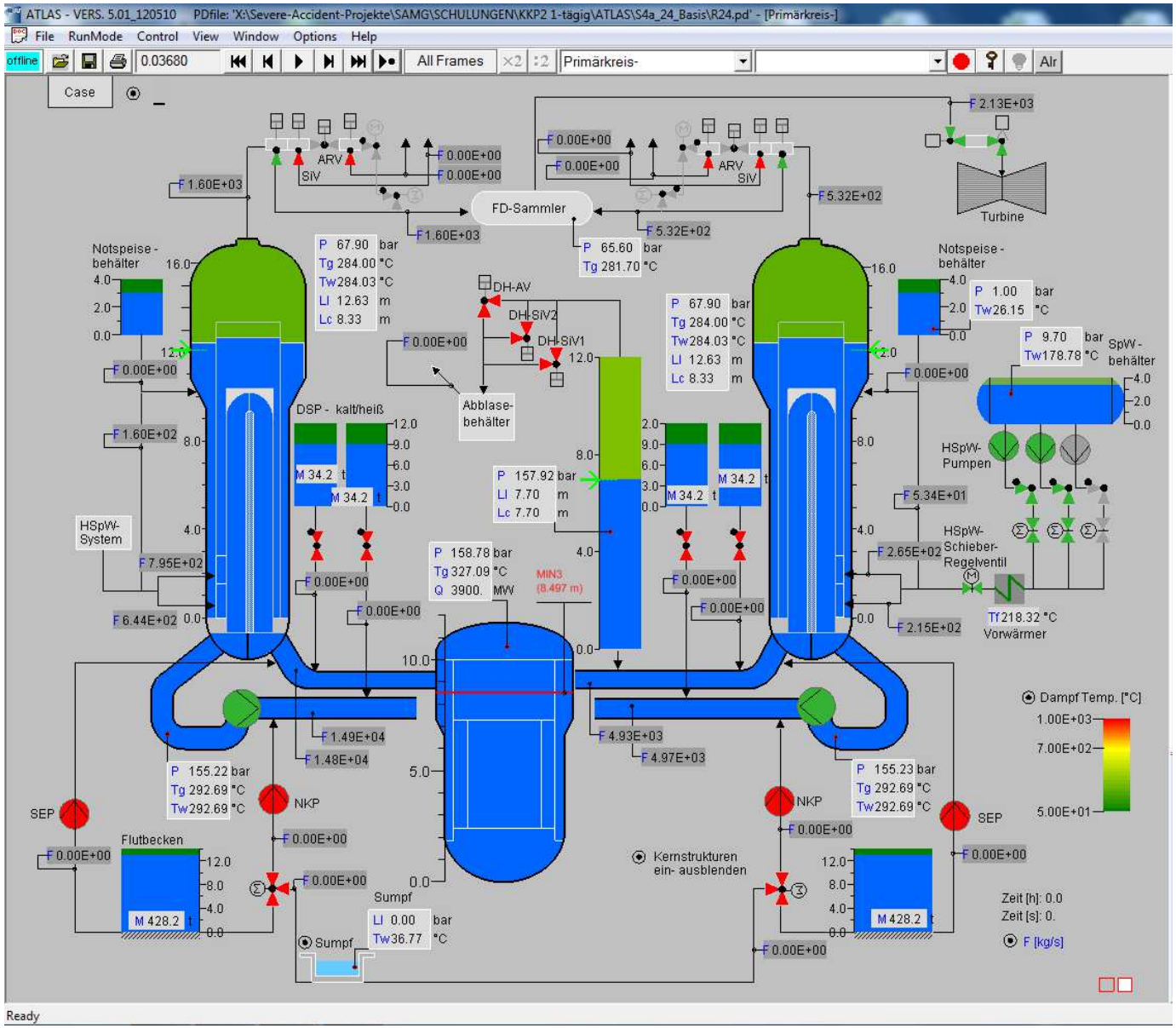
Content

- Visualization with ATLAS
- Introduction of the TVP-viewer
- 80 cm^2 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

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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** RMA Risk Management Associates, Inc. **(www.gorma.com)**
- **Used for SAMG training in Germany by the utility** e·on

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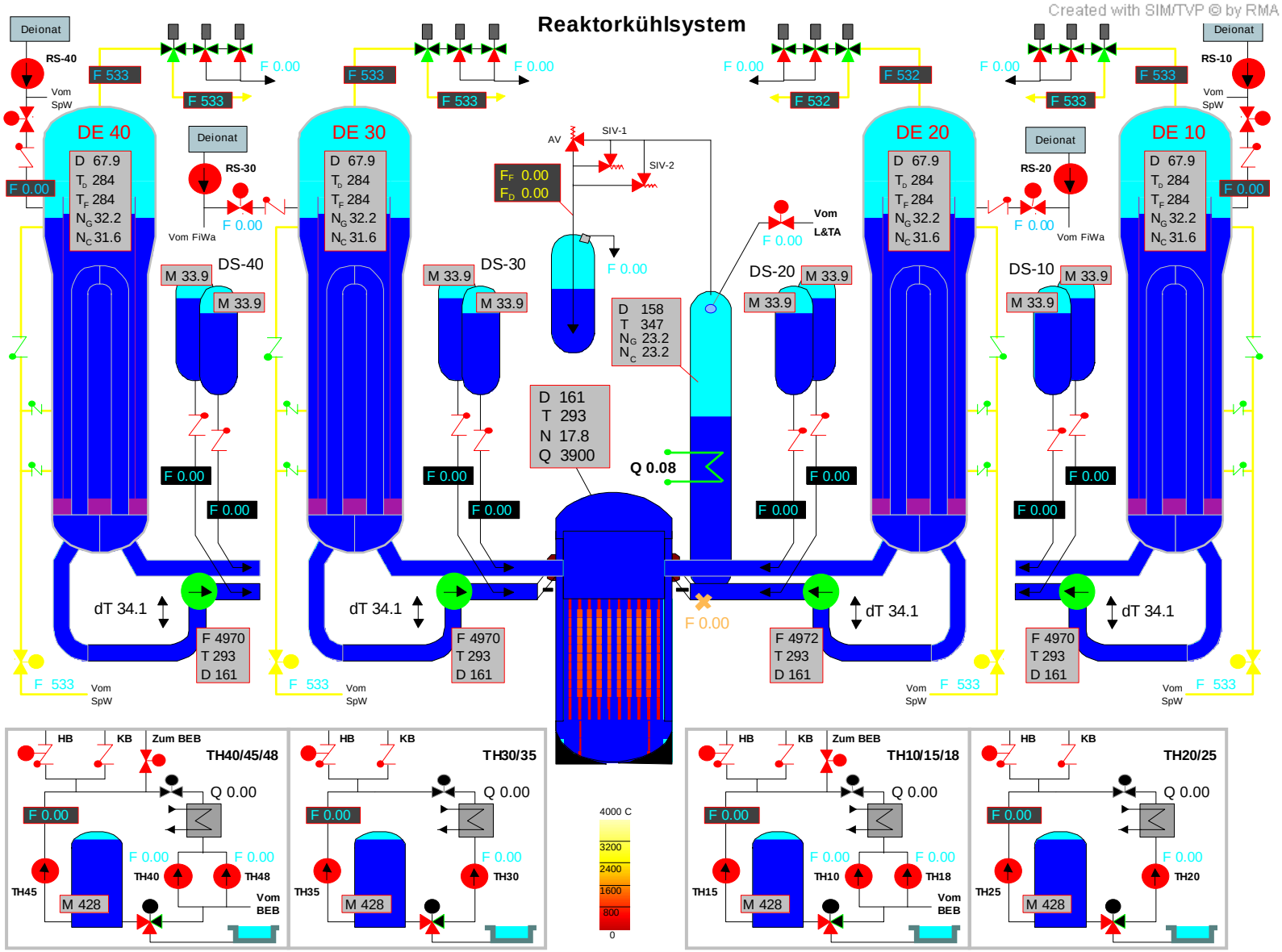
Introduction of the TVP-Viewer – Primary Circuit



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Introduction of the TVP-Viewer – Core

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

0.00	0.00	0.00	0.00	0.00	0.00
0.00	601.56	601.56	601.56	601.56	601.56
0.00	0.00	0.00	0.00	0.00	0.00
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
0.00	624.13	625.17	625.07	625.15	625.13
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	625.04	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
0.00	0.00	0.00	0.00	0.00	0.00
0.00	907.75	1315.06	1260.32	1303.37	1291.48
0.00	623.88	624.85	624.76	624.83	624.82
0.00	0.00	0.00	0.00	0.00	0.00
0.00	888.70	1262.72	1213.65	1252.29	1241.65
0.00	623.81	624.76	624.67	624.74	624.73
0.00	0.00	0.00	0.00	0.00	0.00
0.00	830.73	1104.96	1067.88	1097.07	1089.03
0.00	623.56	624.45	624.36	624.43	624.42
0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00
0.00	601.56	601.56	601.56	601.56	601.56
0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00
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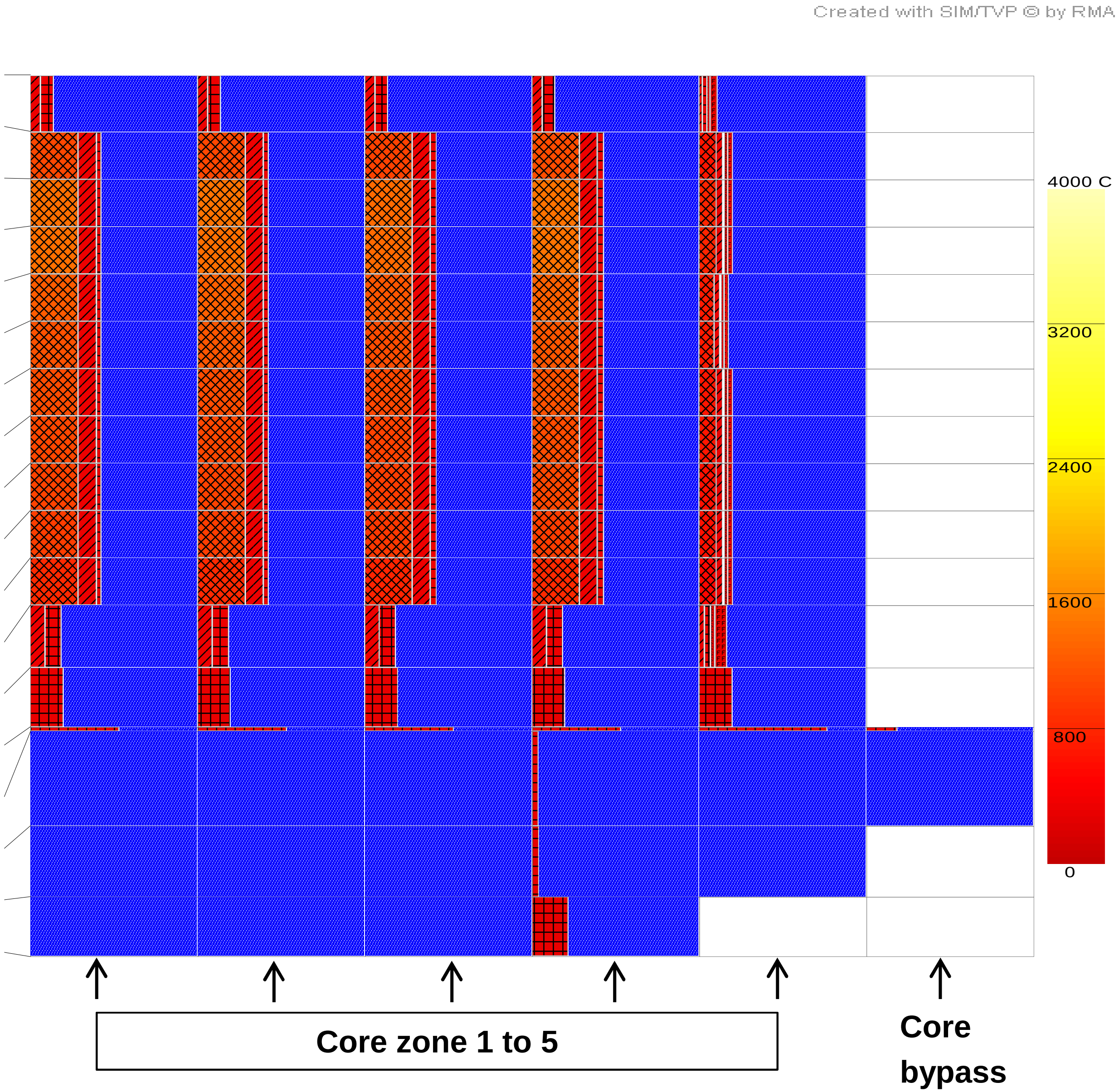
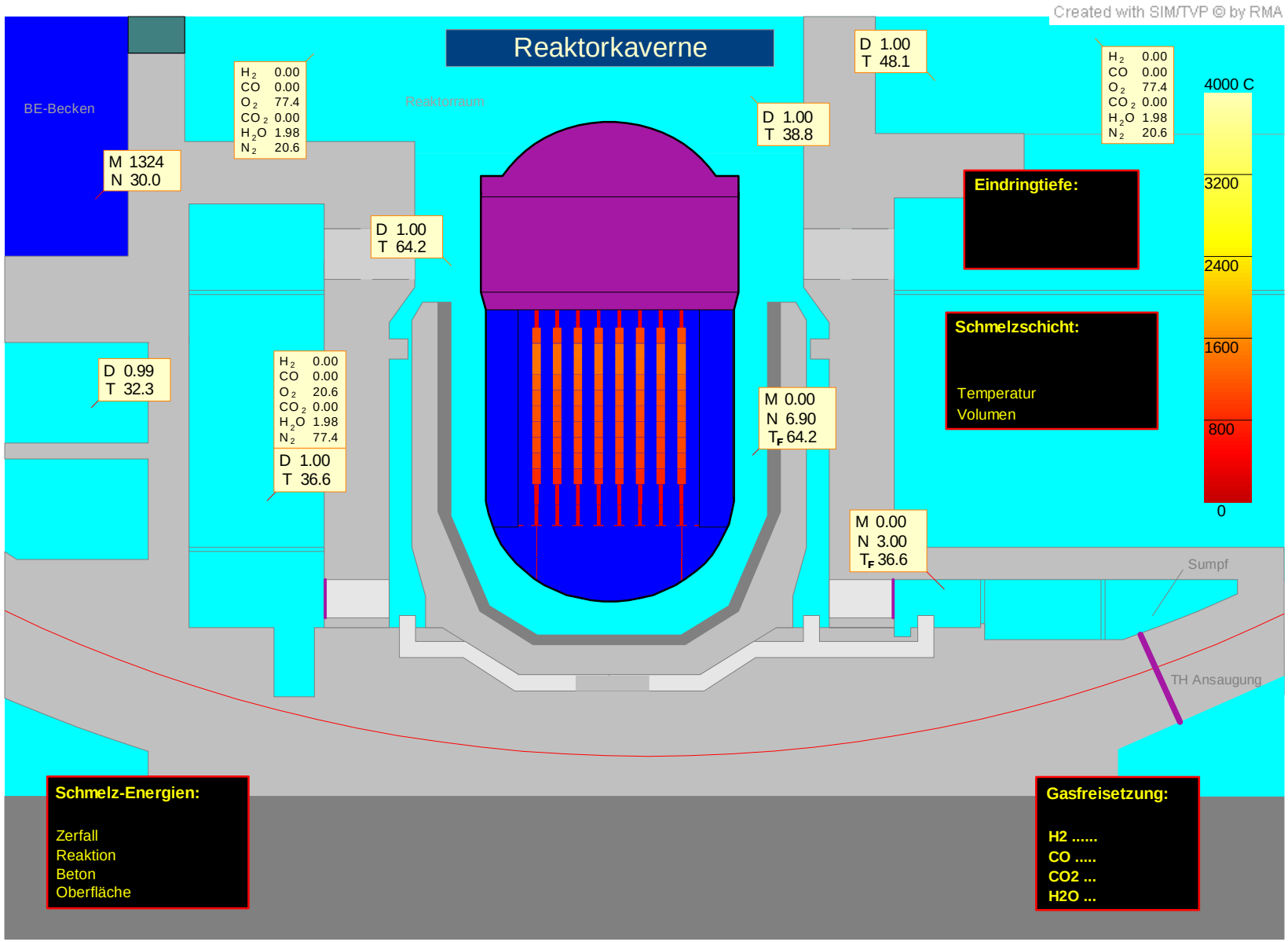


Introduction of the TVP-Viewer – Reactor Pit and Cavity



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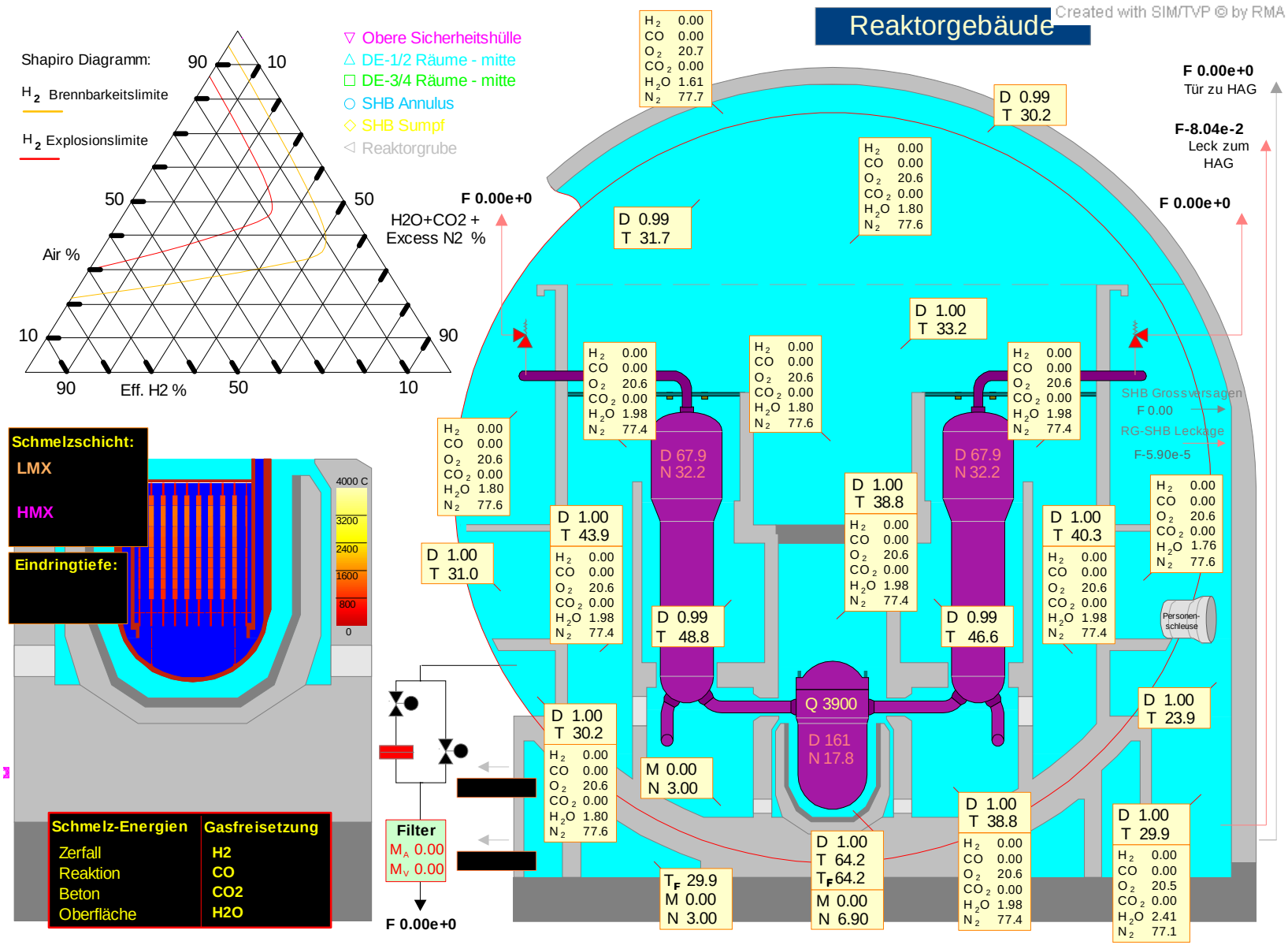
Introduction of the TVP-Viewer - Containment



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Visualization of 80 cm^2 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

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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**

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Thank you for your attention!

End of Presentation: Visualization of MELCOR Results for SAMG Training Purposes

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