

Coupled Closed-Loop and Physics Based Simulation using OSI

Solution Overview

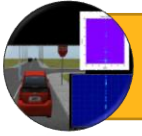
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How Ansys Delivers The Required Capabilities



Interconnected Simulation Tools

Engineering Challenges

- Verification and Validation
- Simulation fidelity using Reduced Order Models (ROM)
- Data exchange between different simulation tools

Ansys Capabilities

- Modeling of the driving environment
- Closed loop simulation
- Physics based simulation for a more in-depth analysis and edge cases detection
- Data exchange between different simulation tools using standardized interfaces

Example Outputs

- System behavior analysis in various driving environments.
- Analysis of sensor returns on different abstraction levels.
- Decreased amount of necessary physical testing.
- Scalability and interchangeability of data between different simulation tools.

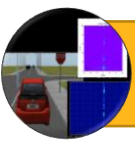
Sensor Simulation for Autonomous Driving

Capability Breakout



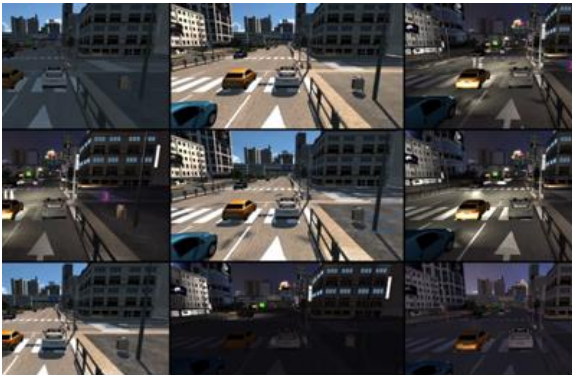
Interconnected Simulation Tools





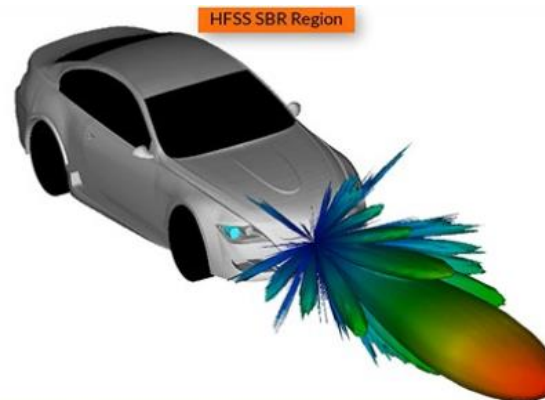
- From a general point of view and more precisely in the automotive domain, Ansys offers a comprehensive software suite that enables lean verification and validation approaches for autonomous driving development.

VRXPERIENCE



- Driving simulation environment
- ROM sensor simulation
- Closed loop simulation

Ansys HFSS SBR+

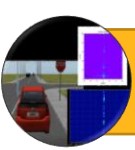


- Physics based **Radar** simulation

Ansys SPEOS



- Physics based **Camera/Lidar** simulation

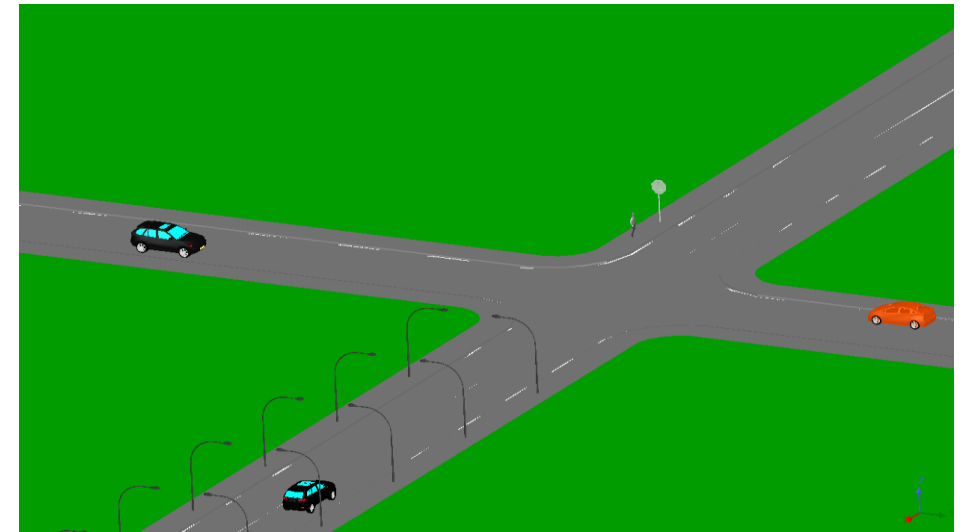


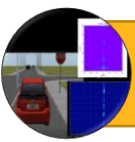
- **A tool-chain**, designated as an end-to-end solution that can leverage the advantages of already existing simulation tools:
 - Thus enabling higher fidelity physics-based simulations for sensor specific complex scenarios.

VRXPERIENCE

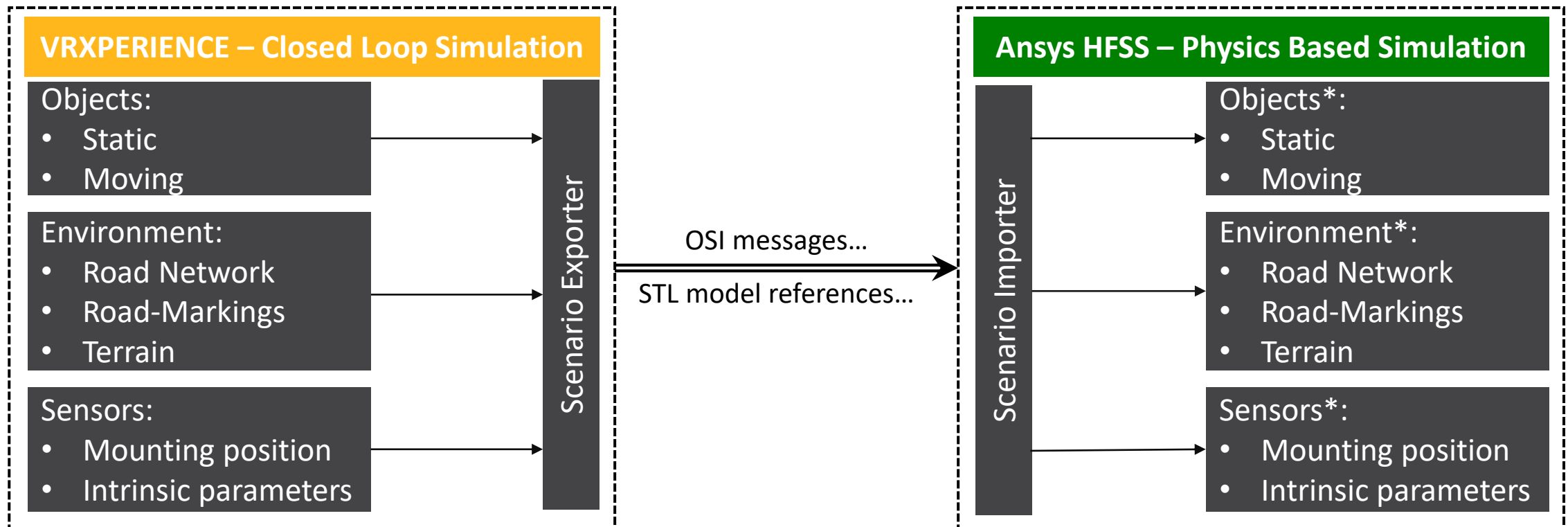


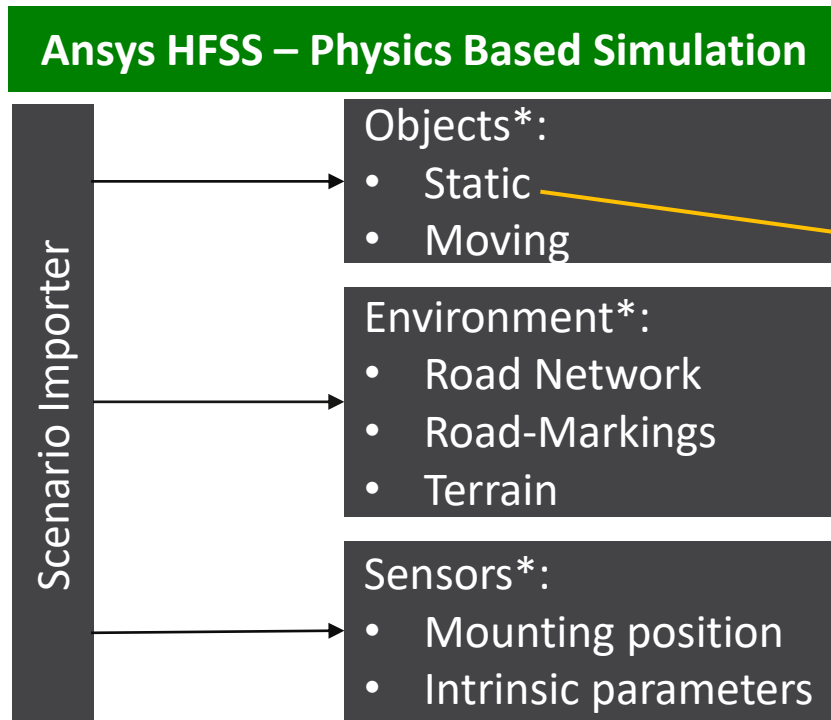
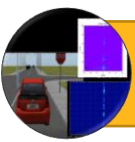
Ansys HFSS SBR+





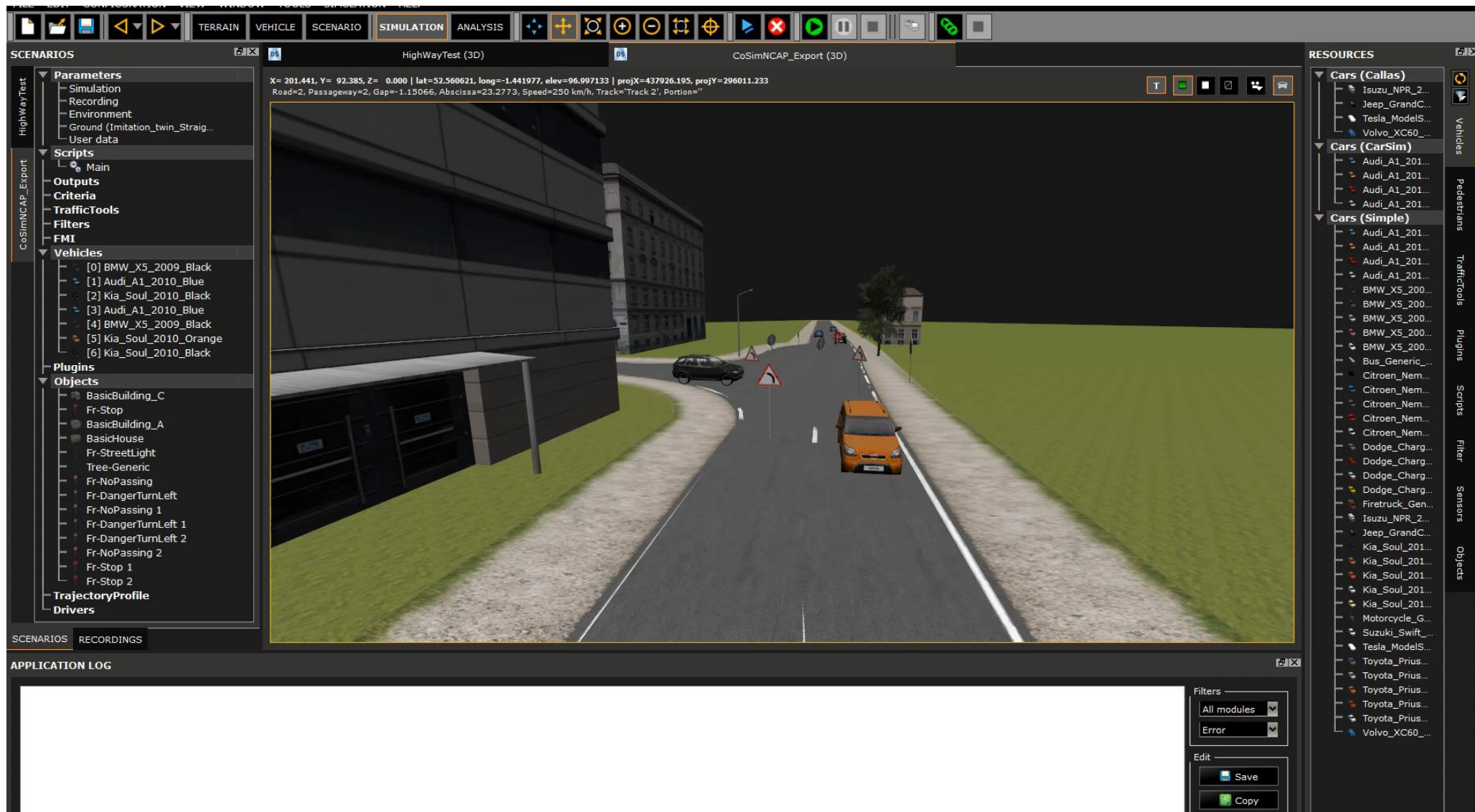
- Using CAD file formats, like STL, and standardized interfaces, like the Open Simulation Interface – OSI to facilitate scenarios exchange between different simulation tools.

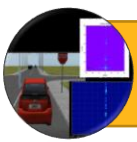




Position, orientation and model reference of Static objects are exported one time as a separate binary file. (This is necessary to create the simulation environment in Ansys HFSS)

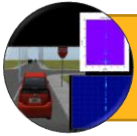
Automatic Export/Import





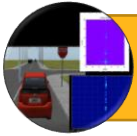
- Rendered snapshot for comparison radar returns comparison:



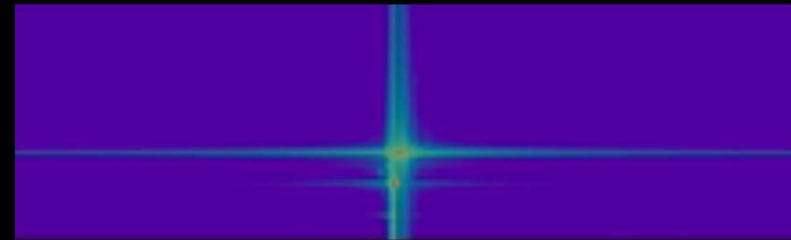
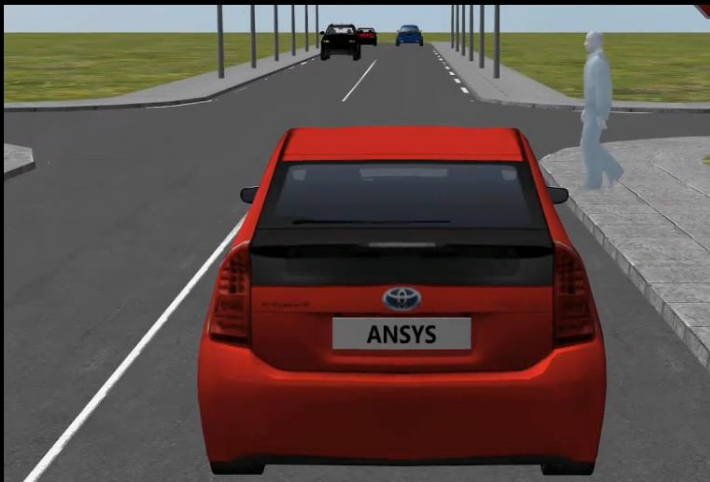


Range Doppler Map, HFSS SBR+ (top), VRXPERIENCE (bottom)

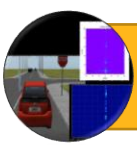




Range Doppler Map from HFSS SBR+

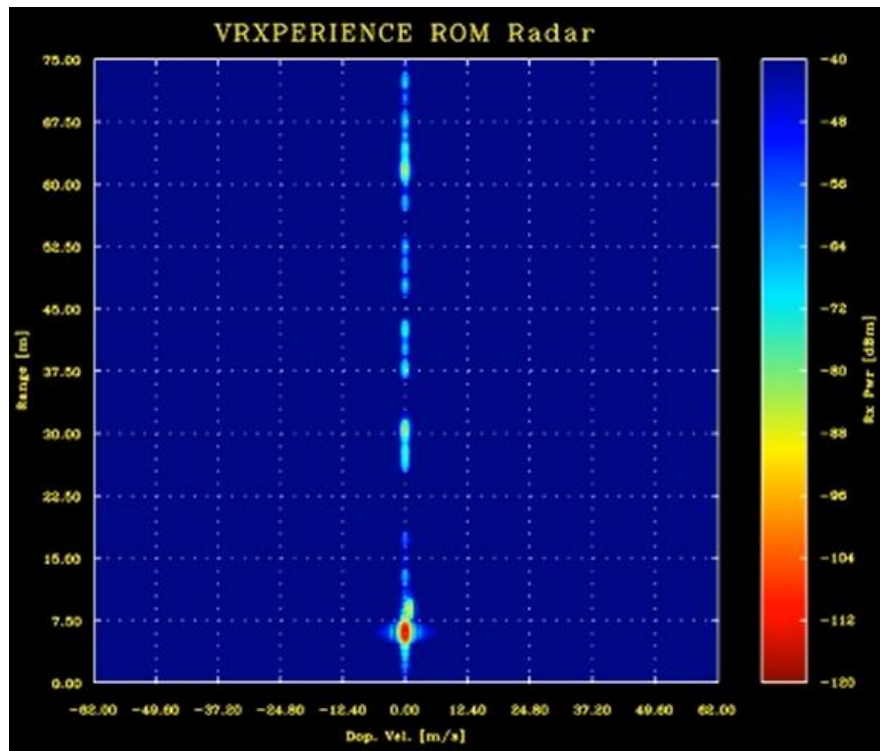


Pedestrian Micro-Doppler

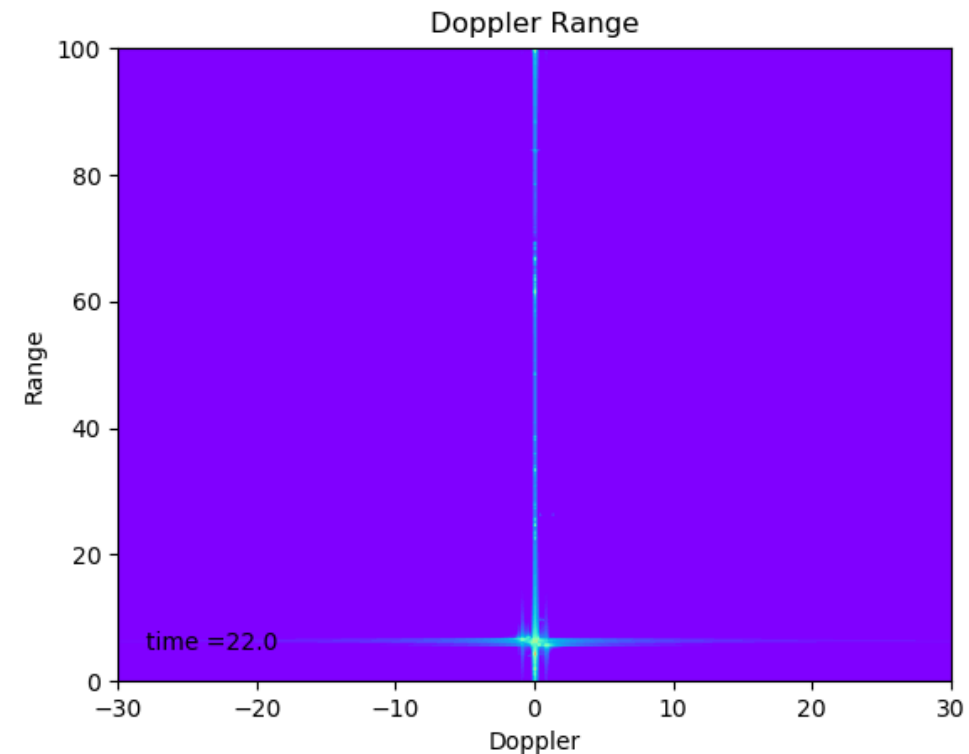


- Corresponding Simulation results:

VRXPERIENCE – Closed Loop Simulation



Ansys HFSS – Physics Based Simulation



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