

VI-grade 2022 NA Zero Prototype Summit

Tire Modeling for the **Virtual** World

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Stackpole Engineering Services, Inc.

Founded 1999

As a turnkey solutions provider in the tire and vehicle marketplace, Stackpole Engineering works closely with clients to understand their goals, identify their needs and efficiently execute solutions. Our talented staff of vehicle dynamics engineers, tire modelers and software engineers provide a wide range of tools and technical services to all tiers of the automotive industry worldwide.

Stackpole Engineering Services' Products and Services

- Tire testing, test method development, data processing and analysis.
 - Handling, Durability and Custom Tire Models developed for **Analysis**, **Off-line Simulation** and **Simulator** use.
- Tire model fitting/parameterization for both commercially compliant and custom tire models using in-house or commercial software and vendors.
 - **MF/PAC**, **Swift™**, **FTire™** and **CDTire™**
- Engineering and simulation software development, licensing, commercialization and data hosting/storage.
- Vehicle physics and tire dynamics development, validation and implementation.
- Vehicle dynamics services from custom physics development, model development and tire/vehicle analysis utilizing both commercially available tools and bespoke solutions developed by SES.



Stackpole Engineering and **VI-grade** announced a Strategic Partnership in September 2022.



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Progression of the Tire Model and the **Virtual** World

~2010 to Present

Tire Model Development shifts to support Immersive Virtual Environment

Advanced Methods to Support Virtual Development Focus



Mid 1990 - Early 2000

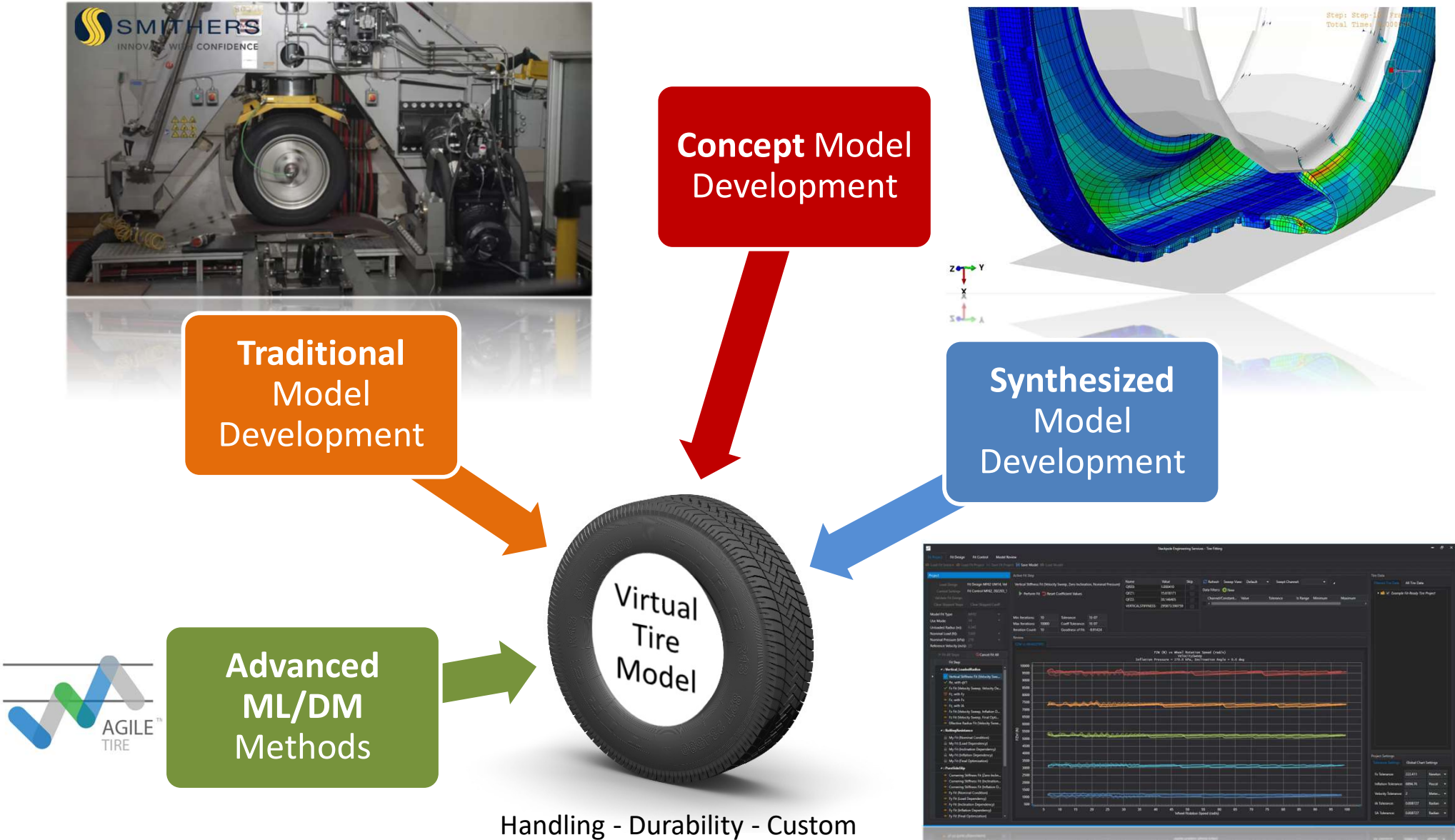
Tire Model Development focused on handling and durability using offline simulation methods



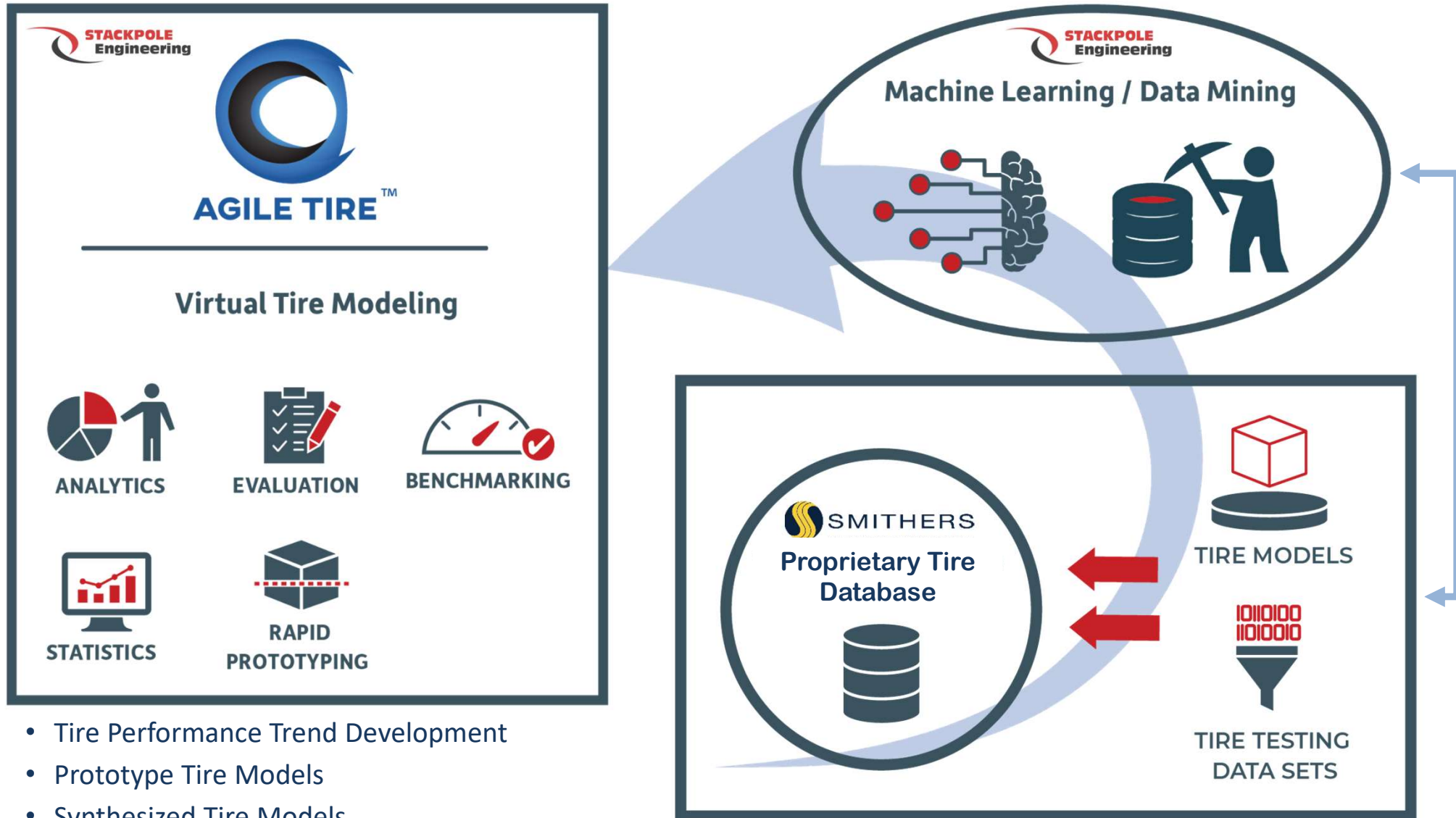
1990's

Tire Testing and Model Development was focused on support of the tire development process

SES Advanced Tire Modeling Methods for the **Virtual** Environment



SES **Virtual** Tire Modeling – Advanced ML/DM Methods



- Tire Performance Trend Development
- Prototype Tire Models
- Synthesized Tire Models
- Existing Tire Model Adjustments

SES **Virtual** Tire Modeling – VI-grade Desktop Simulator

- SES deployed a VI-grade Desktop Simulator in our main office in North Canton, Ohio.
 - Tire and Vehicle OEMs and Tier Suppliers are focused on increased utilization of the **Virtual** environment as part of their design and development processes.
 - The **Simulator** is a critical tool for our development and application engineers to support both our development efforts and to expand our service offerings.
 - Evaluation of tire model physics and certification of tire models.
 - Development, evaluation and implementation of commercial vehicle physics.
 - Develop a comprehensive understanding of the VI-grade environment.
- Stackpole Engineering is applying our flagship software **SES-AgileTire™** to evaluate, adjust and certify tire models in support of Simulator sessions.





SES Advanced Tire Modeling Methods : Simulator

Tire model performance contributes significantly to the experience on the **Simulator**. SES employs an internally developed method to evaluate and adjust tire models in preparation for **simulator** use.

- Stackpole Engineering Employs a Multi-Step Process using AgileTire to ensure tire models are appropriate for DiL use.

Evaluate

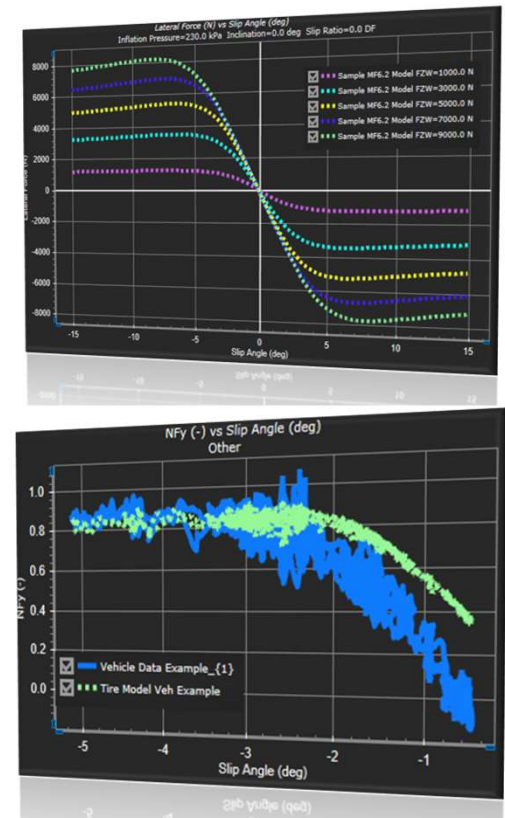
Evaluate the tire model through expanded states to ensure the tire model performs properly

Correlate

Compare to On-Vehicle data when possible, or use developed in-house standards to adjust lab data

Adjust

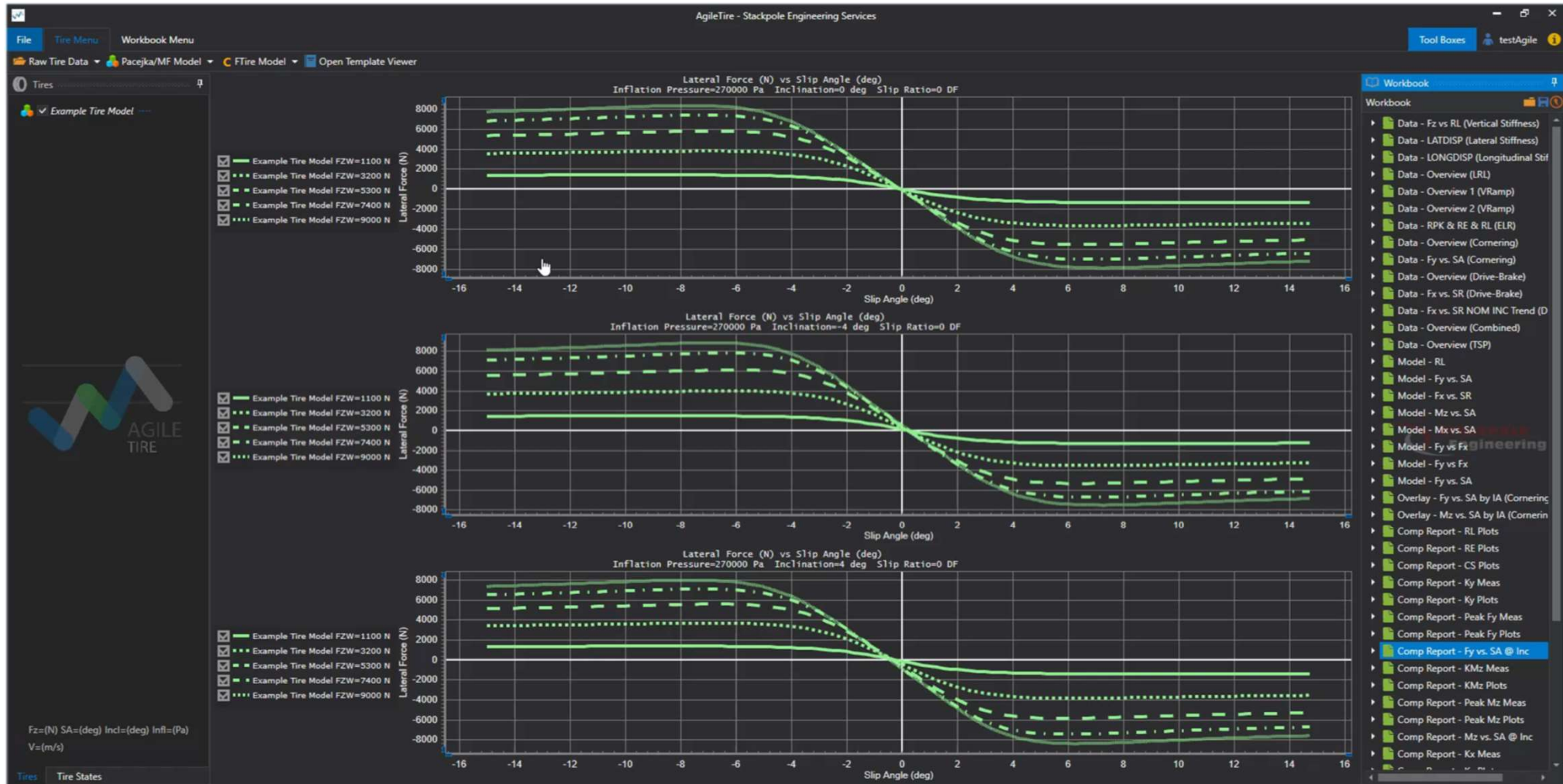
Make real-time adjustments during the session





SES AgileTire™ Use Case : Tire Model Adjustments

Real-Time Tire Model adjustment and evaluation during a **Simulator** testing significantly improves the efficiency of the session. SES utilizes **AgileTire™** to evaluate and adjust tire models during a Simulator session.



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Thank You - Questions

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