MEANINGFUL RESULTS

The performance of an asphalt plant depends upon the interaction of many different processes. Astec has made substantial improvements in its ability to accurately simulate these different processes, generating large quantities of disparate data whose impact on the design issues at hand is often difficult to understand. Astec brings meaning to this data by combining results from different simulation tools and different design alternatives. Animations, graphs and explanatory text are merged into a single composite image using ANSYS EnSight. This gives the decision-maker everything he or she needs to know to improve product performance.

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Astec Industries continually works to improve the efficiency of aggregate dryers for asphalt production to reduce energy consumption and save energy costs for customers in this growing industry. Direct observation of the dryer drum in operation is difficult, so simulation offers the best opportunity to experiment with new designs. Astec provides a complete line of continuous and batch mix asphalt equipment, including rotating drum aggregate dryers that dry hundreds of tons per hour of wet aggregate rock to ensure that the rock will bind with liquid asphalt. Inside the drum, the aggregate is kept in motion by shaped scoops, called flights, that produce a veil of falling wet material that is heated by products of combustion from the burner. The company's ability to simulate

such complex products and processes has vastly increased due to a combination of the wide array of increasingly accurate physical models, the ability to merge simulations of different types of physics to better understand reality, design exploration tools that automate the process of investigating a design space, and high-performance computing (HPC).

After successfully simulating a complex product, the simulation engineer is often left with the challenge of filtering and organizing the results to present the most relevant and meaningful information to the engineers and managers who make design decisions. Astec addresses this challenge by using ANSYS EnSight post-processing software to combine multiple types of results from, for example, different software packages, different physics, different design alternatives and different operating conditions to demonstrate interaction and shed light on the appropriate design issues. Using EnSight, simulation users can combine relevant results into a single image that makes it easy to understand how a product can be improved.
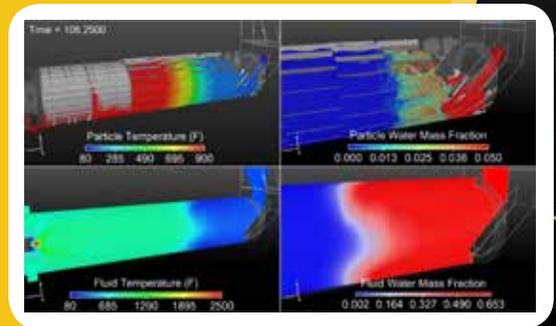
Presenting Results of Aggregate Dryer Simulation

The performance of Astec's aggregate dryers depends upon the operation of the burner that heats air entering the dryer, the flow pattern of the air through the dryer, the temperature and moisture content of the air in various locations of the dryer, and the movement of particles inside the dryer as driven by the flights. Astec uses ANSYS Fluent software to simulate the burner and flow of air through the dryer and EDEM discrete element modeling (DEM) software to visualize particle flow within the dryer. Over the past decade, the company has developed the ability to integrate particle and fluid simulation to deliver substantial increases in accuracy through bidirectional transfer of momentum, mass and heat between the particle and liquid phases. Both simulations generate large volumes of information on the behavior of the particles and gases. When viewed in their raw state, the sheer volume of data often makes it difficult to interpret what can be done to improve the performance of the dryer.

ANSYS EnSight combines aggregate dryer simulation results, including particle temperature (upper left), particle water mass fraction (upper right), gas temperature (lower left) and gas mass fraction (lower right).

So Astec engineers use EnSight to combine the results of the two software packages into graphics that highlight how the effects of fluid flow and particle flow interact to determine the performance of various design alternatives. In one case, the simulation engineers combined two pieces of information for greater impact. They superimposed a plot that shows how the water mass fraction of the particles is reduced as they move through the drum on another plot that shows that the relative humidity of air increases as it moves in the opposite direction through the drum and picks up water vapor evaporated from the particles. Engineers also created a graphic that shows the temperature of the particles throughout the drum superimposed on an image that shows the temperature of the gas in the dryer. These graphics help design engineers understand how the particle and fluid flow physics combine to determine the performance of the dryer and guide design engineers to improvements that could increase performance and reduce energy consumption, such as directing particles toward areas where the gas is hotter and drier to ensure full utilization of all the burner's energy.

Presenting Burner Simulation Results

The burner that heats the air before it is driven into the dryer also has a big impact on energy efficiency. Astec simulation engineers use ANSYS Fluent CFD software to evaluate the performance of design alternatives. In one case, they used Fluent to compare the flow through the
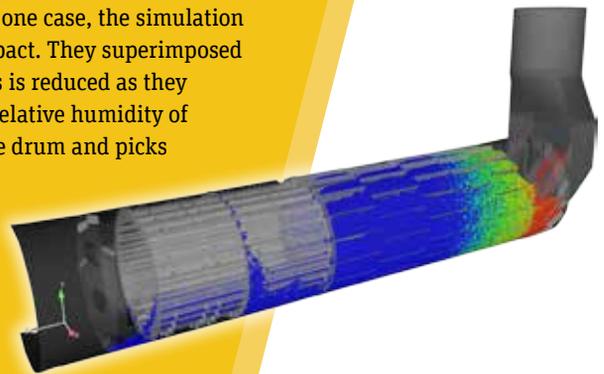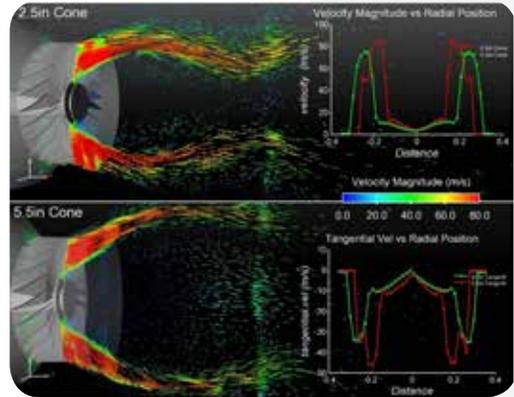
> **"** *ANSYS EnSight software enables engineers to assemble the most relevant simulation results into composite images that maximize the insights provided to design decision-makers.* **"**

burner with 5-inch and 2.5-inch cones. The Astec engineer summarized the performance differences by embedding two graphs over the flow analysis results. The first of these graphs compares the velocity magnitude (the combination of the axial, radial and tangential components) across the vertical axis for the two design alternatives; the second shows the maximum tangential velocity across the vertical axis for both options. Strategically positioning the most relevant results together with explanatory text led to a quick and successful design decision.

Aggregate dryers are critical to asphalt plant operation, and improvements in their efficiency translate directly into lower operating costs and reduced emissions over the dryer's operating life. Simulation provides deeper and more accurate understanding of dryers while avoiding the cost and lead time associated with physical testing.

ANSYS EnSight is used to embed charts of velocity versus radial position over flow analysis results.

ANSYS EnSight post-processing software enables simulation engineers to assemble the most relevant simulation results into composite images that maximize the insights provided to design decision-makers. The result is better design decisions that result in high product performance. ⋀

Introduction to ANSYS EnSight

ANSYS EnSight post-processor helps engineers make better decisions with their CFD, FEA crash, electromagnetics, DEM, rigid bodies and other simulation data. **This unique post-processing software:**

- Delivers extremely high-quality image and animation resolution with photorealistic output
- Reads up to 32 models at the same time so you can compare results from different data sources or solvers

It enables you to:

- Compare results between solvers or multiple runs of the same solver
- Perform fluid–structure interaction and optimization post-processing
- Input movies, photos and test data for assessment with simulation
- Use batch and interactive operations to run explorations during the day while EnSight completes batch post-processing overnight
- Display multiple viewports to provide large overviews and detailed views at the same time, or to study multiple models concurrently. Views can be linked for easy comparison across a number of perspectives
- Obtain efficient analysis and visualization for problems with a billion or more cells

As an optional feature, EnSight can accelerate the visualization and animation of large, complex transient simulations with huge datasets.

Analyze, Visualize and Communicate your Simulation Data with ANSYS EnSight
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