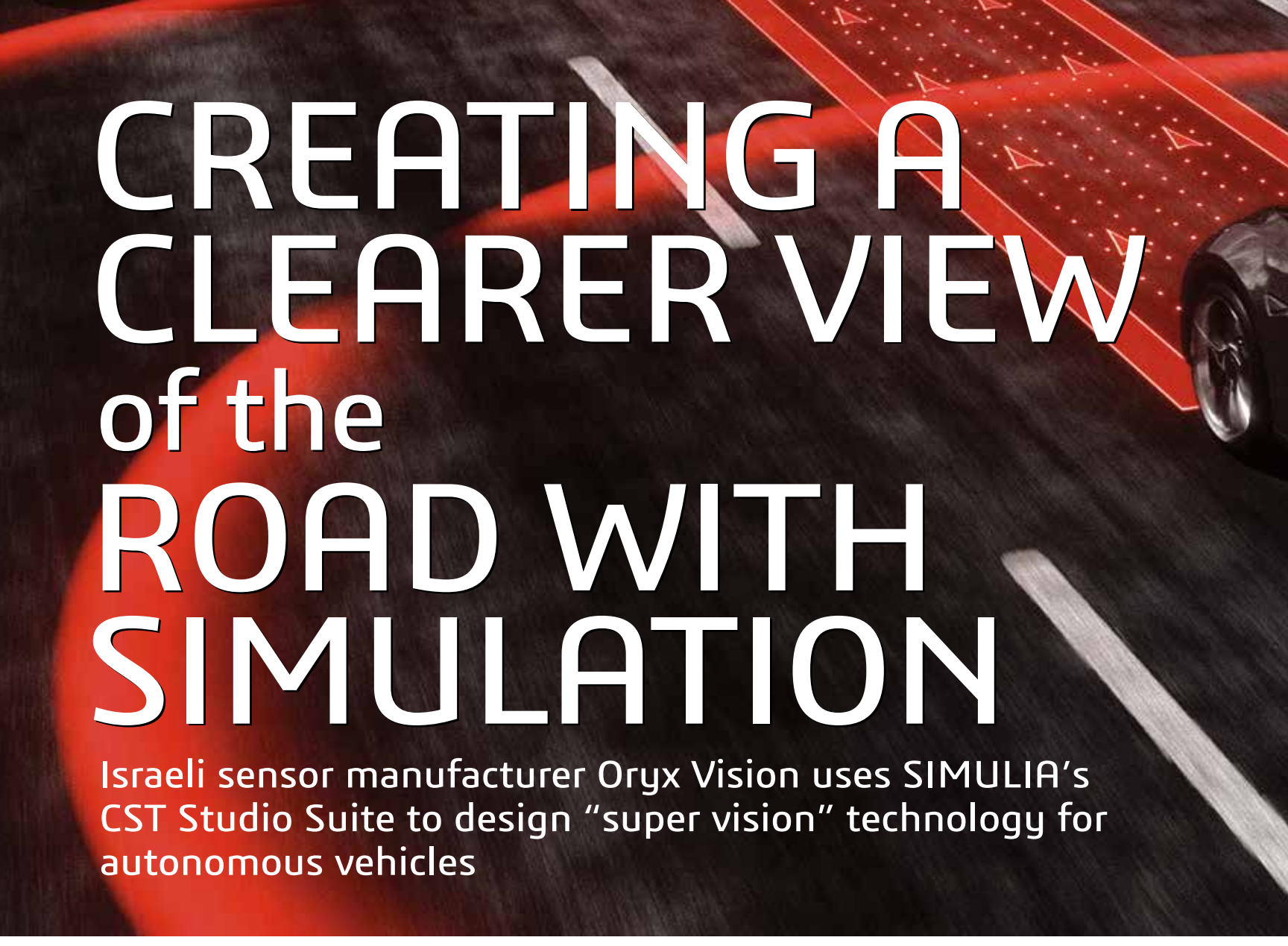


CREATING A CLEARER VIEW of the ROAD WITH SIMULATION

Israeli sensor manufacturer Oryx Vision uses SIMULIA's CST Studio Suite to design "super vision" technology for autonomous vehicles

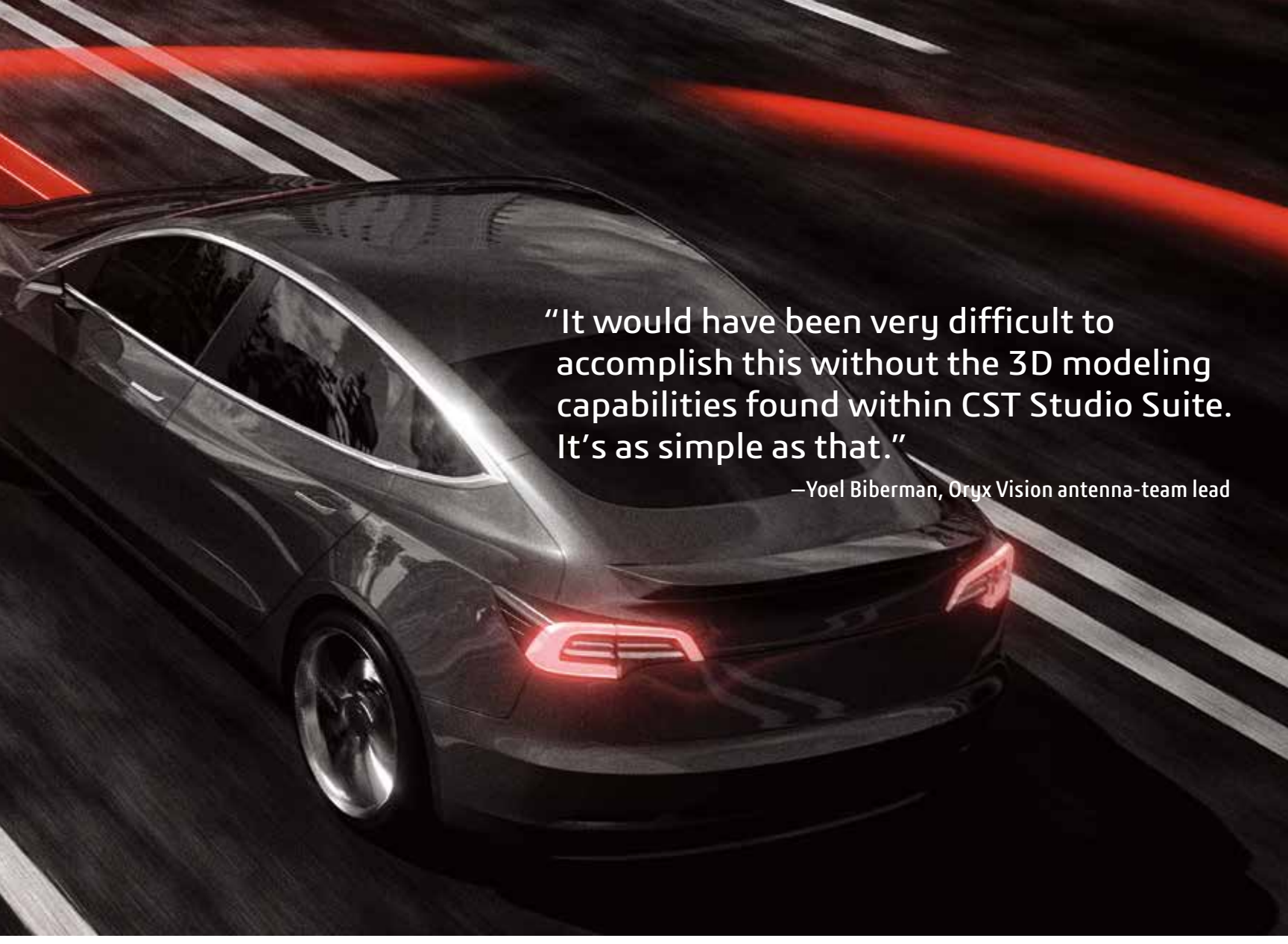
Autonomous vehicles are all the rage these days. From the promise of app-controlled driverless taxis to relaxing in the back seat while your robo-chauffeur drives you to work each day, taking human drivers out of the loop promises to make personal transportation both more convenient and safer. People can only look in one direction at a time, but potential hazards can appear from anywhere. Driving could be made significantly safer, if only your car could watch every angle for you.

SEEING THE LIGHT

Enter Oryx Vision. The brainchild of company founders Rani Wellingstein and David Ben-Bassat, the Israel-based sensor manufacturer is raising the bar on self-driving vehicles by greatly increasing all that they can see. If the car can see it, chances are better it can avoid it. The company's mission is not only to improve vehicle vision, but to replace existing bulky and expensive sensors with a sleek, lightweight and mass-producible chip.

Oryx Vision antenna-team lead Yoel Biberman says it's no easy task, but high-performance electromagnetics (EM) simulation software has made his team's work more manageable. "The CST Studio Suite from Dassault Systèmes has a powerful but friendly user interface," he explains. "Whether I need to perform frequency-domain verification of an antennae structure, share data with one of the mechanical engineers, or do any sort of complex simulation or design optimization, CST is the right tool for the job."

Biberman and his team members use SOLIDWORKS® for their CAD modeling needs. They are impressed with the two-way flexibility between it and the CST Studio Suite, which is integrated with the full range of design engineering tools on the **3D**EXPERIENCE platform. This enables the analysis of thermal, mechanical and other multiphysics challenges that can arise as a design evolves.



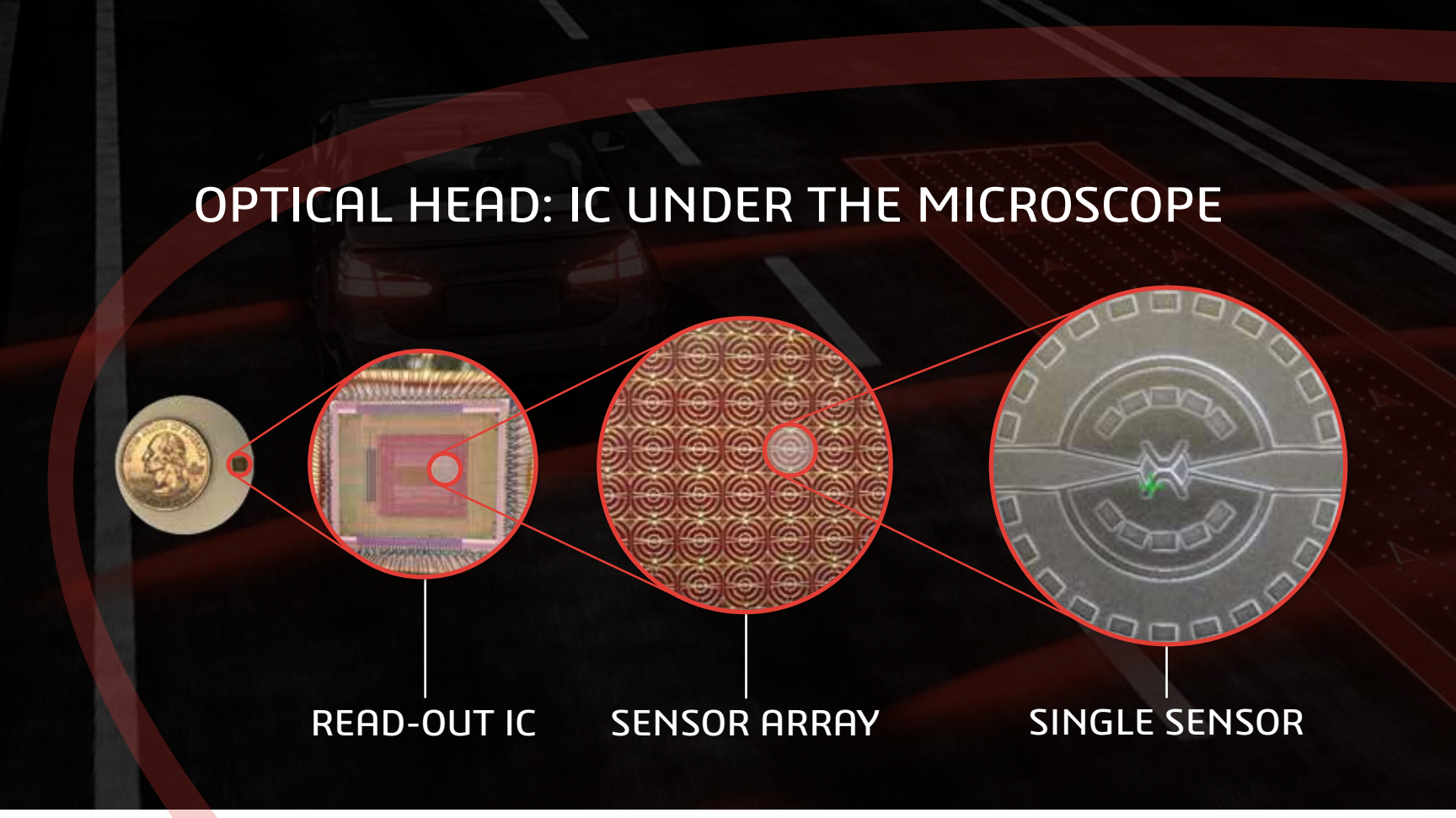
BUILDING BETTER VISION

But is this technology even necessary? Well-known companies such as Tesla and Google have logged millions of miles with their autonomous vehicles, and accidents have been few and far between, with these and other companies learning valuable lessons along the way. Do we really need a better set of eyes for our self-driving cars?

Ben-Bassat, who aside from his role as the co-owner of Oryx Vision is also the vice-president of research and development (and Biberman's boss), says we absolutely do. Where most automakers rely on a combination of cameras, radar, LiDAR (light detection and ranging), and sensor technology to visualize a car's surroundings, his company has created a revolutionary super-LiDAR that relies on silicon-based microscopic antennae to detect light waves. "Our coherent, frequency-modulated LiDAR achieves a signal-to-noise ratio one million times better than current competing technologies, and can be produced in volume at a fraction the cost," he says.

Other technologies may have the lead in market share so far, Biberman acknowledges. One CEO of a notable automaker suggests that an array of cameras together with a 70-gigahertz radar is all a car needs. Another proposes filling the car with sensors and connecting it to a cloud-based computer system—while the sensors provide a view of the immediate surroundings, the real-time cloud connectivity means the car can better avoid traffic jams and adverse road conditions.

"The advantage of LiDAR is its high resolution," Biberman says. "It works within a very short wavelength, which gives it the ability, for example, to identify a road marking or an obstacle at a fairly long distance—say 100 meters or so. But the disadvantage is the energy equation: LiDAR is not terribly efficient. Also, the photoelectric effect makes it non-coherent, meaning it can see objects but only statically—there's no Doppler effect, so traditional LiDAR can't tell whether something is coming towards you or moving away. What we've done is combine the high resolution of LiDAR with the high efficiency and coherency of radar, giving us a best-of-both-worlds advantage."



RAISING UP THE ANTENNAE

Though effective, the high efficiency of Oryx Vision's was challenging to achieve. The engineering team started by designing a virtual antenna in CST. After manufacturing, they measured the antennae using AFM (atomic force microscope) and imported the acquired 3D data into CST using SOLIDWORKS. Their goal was to verify and quantify the effects of the individual layers covering each dipole antennae, while also determining their geometry.

"This approach allowed us to conduct various experiments on the physical dimensions of each dipole, to determine and then verify the optimal ratio of each within the array," says Biberman. "It would have been very difficult to accomplish this without the 3D modeling capabilities found within CST Studio Suite. It's as simple as that."

With the correct physical configuration was confirmed, Oryx Vision applied semiconductor manufacturing techniques to build a microscopic array containing tens of thousands of individual antennae. The team placed their solid-state depth-sensing sensor system inside an "optical antenna chamber," giving them an opportunity to measure its various functions. The results were as predicted by the CST Studio Suite.

Because of their efforts, the "world's first coherent frequency-modulated flash automotive LiDAR" now provides previously unachievable depth-sensing capabilities. It is not "blinded" by bright sunlight (or even other LiDARs) as some systems are. It can be produced in large quantities at a significantly lower price point, but offers a longer operating range, greater precision, and a "richer" view of its environment.

NEXT STEPS

"I've worked at several other electronics companies and each of them used CST Studio Suite," says Biberman. "I can't imagine anyone trying to design antennae such as the one we have built without such an advanced simulation tool, especially considering the constraints we are under. There are literally thousands of miniature antennae on a chip just millimeters in size. It has no moving parts, and it works exceedingly well. It's quite simply a game changer."

Ben-David and Wellingstein agree. Having secured $50M in funding recently to pursue their groundbreaking technology further, Oryx Vision co-founder Wellingstein was quoted in a recent article as saying, "Oryx is building the first solution that will meet all the key requirements of automotive LiDARs—high performance, car durability and low price—without a trade-off. We are delighted to receive a vote of confidence in our vision from such sophisticated investors, and to have the resources to bring this technology to market quickly and at the highest quality."

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