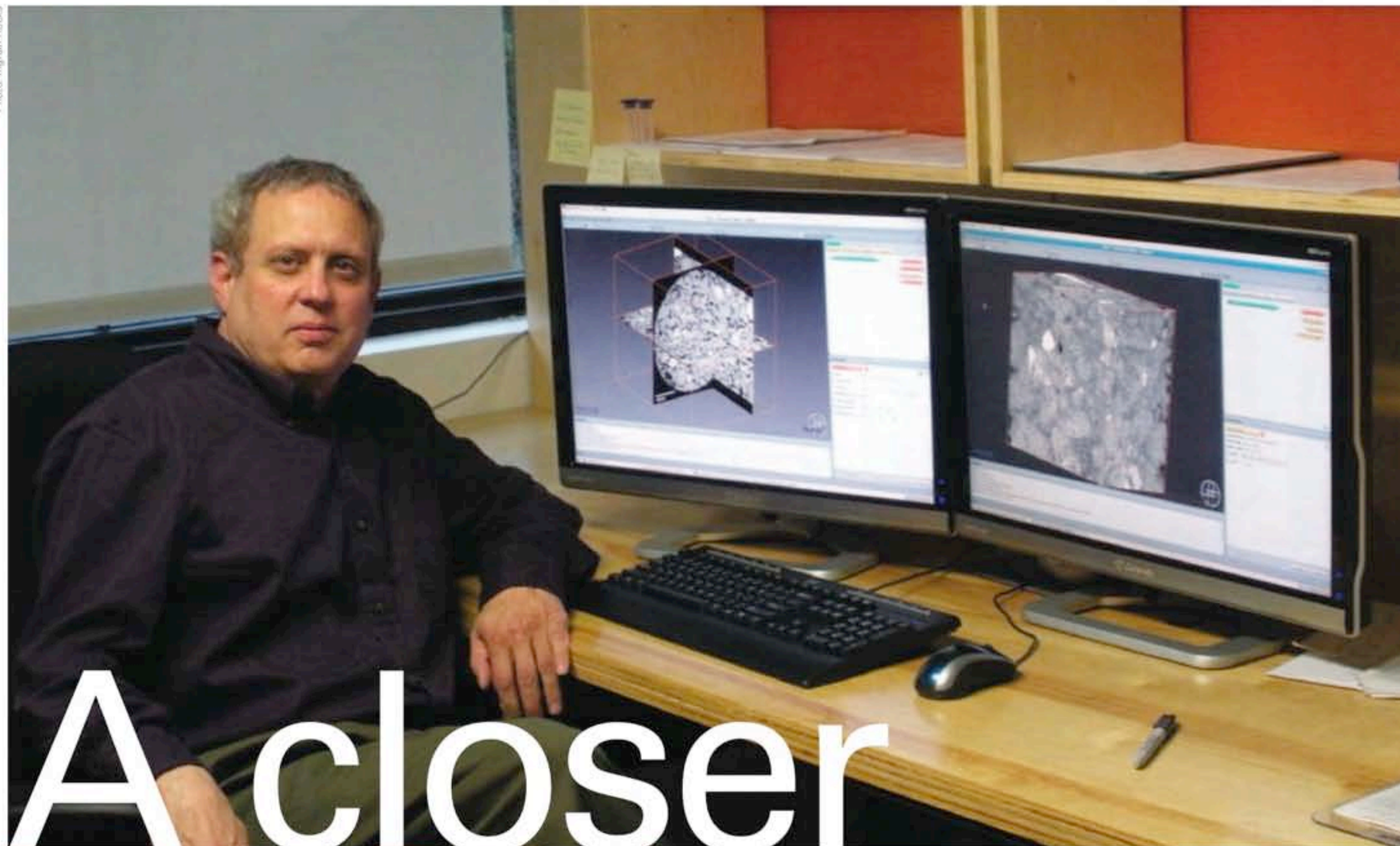


Photo: Ingrain Rocks



A closer LOOK

As earth scientists examine how to produce more oil from discovered resources, nanotechnology could provide added insight into reservoir properties

by Melanie Collison

Avrami Grader has an intense rock sensibility. "I love rocks," he says unabashedly. Like any lover, he wants to know the object of his affection intimately, right down to the pores. So when the opportunity was presented to be chief scientist at the month-old Houston-based Ingrain Rocks, Grader leapt at it in June.

The company uses micro-scale computed tomography (micro-CT) to reveal the physics of rocks. Ingrain integrates X-ray tomography, complex numerical computations, and geological understanding to produce a new systematic way to determine properties such as porosity, relative permeability, electrical conductivity, and elasticity, including compressional and shear acoustic velocities.

"At a start-up company, there's a buzz in the air. It was a great opportunity to do something new and very exciting," says the long-time professor of petroleum engineering at Pennsylvania State University. "We have been out here for a very short time and do not yet have success stories from

Dr. Avrami Grader, chief scientist with Houston-based Ingrain Rocks, is leading a closer look at reservoir properties.

information fed into modelling, but people in the industry can project the value of this.

"The scarcity of oil is driving us to look in much more difficult areas to produce than the standard stuff of the past," Grader says. "The easy oil is gone, so [we're developing] oilsands, tight sands, tight shales. They are huge reserves but very hard to get at, so it's even more important to understand them and become more efficient.

"Oil companies ask how much there is in the ground and how fast can we get it out? Looking at things that are much tougher to get out, we need to speed up the process. We need [to understand rock] properties."

Besides the difficult sources the industry is finding its way into, there's the enormous resource left in the ground from earlier production operations. In the Western Canadian Sedimentary Basin alone, researchers determined two years ago there was \$1 trillion worth of oil and natural gas yet to be produced. The numbers far outstrip that estimate now because they were doing calculations based on prices of \$45 per barrel oil and \$7 per thousand cubic feet for gas.

Their inventory report, *Ramping Up Recovery: A Business Case for the Increased Recovery of Conventional Oil and Gas*, said that deploying the most suitable technologies for the various fields could allow for the recovery of six billion barrels of oil and 22.5 trillion cubic feet of non-associated natural gas.

"To realize a trillion dollars, we need to continue to evolve. It doesn't require a eureka breakthrough, but improvement in enhanced recovery technologies," Michael Raymont, chief executive officer of the now-defunct industry-government collaboration EnergyNet Inc., said at the time. "It's moving the yardstick one or two steps further, making improvements in technology and implementation."

Ingrain has its eye on moving the yardstick rather more than a step or two.

"Any rock that came out of the ground now or 50 years ago, we can still address," Grader says. "All countries will have to go back into reserves they [have already developed]. It's just a question of when they become economically viable and when the world will need them. The time is now.

"We leave 40 per cent, 50 per cent behind us. As the price goes up it becomes viable to go back and produce that. We need to understand much better the reservoir and the recovery mechanisms, and be able to put together a coherent, effective, and efficient plan to produce them. Physical experiments are just too expensive and way too slow. Digital rock properties are going to be very, very valuable." ▶