Tech Tour Day Eight: Super Spartans

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The great thing about Michigan State University is that I could do Tech Tours from now until Doomsday and they'd never run out of cool things to show me.

I learned that again Thursday as the Great Lakes Innovation and Technology Report Fall Tech Tour rolled through East Lansing on its annual visit.

MSU PR science writer Layne Cameron ably squired me around campus, showing me some of the most fascinating research this giant school has to offer.

I started with Marcos Dantus, university distinguished professor of chemistry, whose work with lasers is opening new doors in imaging, homeland security and medicine.

Dantus is a pioneer in femtosecond lasers — hugely powerful lasers that stay lit for just a tiny period of a few billions of a second.

"What's special about these lasers, why this particular type of laser has already resulted in two Nobel prizes and will probably result in more is that their timing ratio is shorter than it takes atoms to move," Dantus said. "What that leads to is a huge number of things. The laser can act on a material and take out material faster than the material would take to get hot or melt or so on. So you can machine and make perfect cuts without any thermal scar, without any thermal damage. You can use it for imaging and look under tissue for two millimeters with sub-cellular resolution. What that implies for medicine is that instead of cutting something and getting biopsy results back three days later, you can bring the laser there and say it's cancer, it isn't cancer, and if it's cancer whether it's metastasized. Those are life and death decisions. It can also give a kick to molecules and set them vibrating all at the same time. That property is what we use for sensing."

Dantus began using the lasers to detect roadside bombs in a U.S. Army project in 2007. A test in 1998 showed the concept was viable, and last year, an effort with the Department of Homeland Security demonstrated the laser had the sensitivity to detect explosive residue at a considerable distance, and the selectivity to prevent false alarms.
Dantus said he’s seeking about $1 million to see the device through its next round of testing.

Dantus is also working on a “laser scalpel” project funded by the Michigan Economic Development Corp. The project uses a femtosecond laser that cuts strong molecular bonds but preserves weak ones.


My next visit was with Gemma Reguera, an environmental microbiologist who has developed patent-pending microbes that both clean up toxic waste and generate electricity.

Reguera said she starts out focusing on organisms that thrive in contaminated environments, figuring out how they thrive and how they interact with the contaminant — and whether they could be used to remove the contaminant.

The bugs she’s most interested, called geobacter, actually clean up toxic metals and radioactive materials — while using the process of stripping electrons from the toxic materials to create electricity. The bugs’ waste process can even be controlled to produce desired materials, say, ethanol.

So — the bugs eat pollution and defecate fuel, while giving off electricity as a byproduct.

Reguera said she can see a day when farmers have fermenters full of these critters next to their silos, munching on corn stover or waste grass, and turning it into electricity and ethanol. Very cool.

Then it was off to MSU’s Medical Cyclotron, where Bryan Harris, senior health physicist in MSU’s office of radiation, chemical and biological safety, talked about MSU’s efforts in nuclear medical testing supplies.

MSU partnered with Cardinal Health to open a “radio-pharmacy” on campus, a move that streamlines access to nuclear imaging agents
created at an MSU cyclotron and used in medical procedures such as PET scans. Harris said the medical products have very short half-lives and lose their radioactivity quickly, meaning quick production and transport is very important.

MSU is now making FDG, fluoro-deoxyglucose, sugar with briefly radioactive fluorine 18 in it (with a half-life of 110 minutes); Sodium Fluoride, a bone scan imaging agent with a half-life of 10 minutes; and Nitrogen 13 Ammonia, with a half-life of 10 minutes, which is used for cardiac blockage studies.

Harris said MSU uses a General Electric PET 16-million-electron-volt cyclotron’s proton bombardment of enriched oxygen-18 water to produce fluorine 18. Translated — it’s alchemy, MSU is using a stable isotope of oxygen, with 10 neutrons instead of the usual eight, to make liquid fluorine 18, which is missing a neutron compared to normal fluorine 19.

Harris said MSU has created about 20 jobs in manufacturing radioactive materials.

My final visit Thursday was a repeat with Thomas Glasmacher, director of the Facility for Rare Isotope Beams, the $600 million atom smasher MSU will build between now and 2017.

Glasmacher said the preliminary civil construction design from Detroit’s Smith Group is nearly done, and construction manager Barton Malow of Southfield, is 1 of Detroit, A&E, finishing final design in the next couple of months.

That means site preparation will start in February, with construction beginning in late spring — starting with excavation of the atom smasher’s underground pathway, which will be 50 feet deep, 70 feet wide and 550 feet long.

Civil construction will be done by 2015, Glasmacher said, with tweaking on the technical construction lasting through 2017 before the FRIB goes into full operation.

Glasmacher said the machine could do research in four major areas — finding out what holds matter together in atomic nuclei; finding out how heavier elements are made in stars, producing isotopes for use in society, and doing experiments on the fundamental properties of matter.

And that was that for my Spartan Thursday, a fine visit as usual jam-packed with world-class technology, the kind that only a Big Ten school can muster up.

Friday, the Tech Tour wraps up with a visit to Flint’s Kettering University. They may just show me some automotive tech — plus a whole lot more.