1) Wilson Hall
Hello, and welcome to Fermilab, a particle physics lab, where we work with scientists from 50 countries to study the building blocks of the universe and the forces at work between them. By creating beams of particles with accelerators and measuring them with detectors, we can learn more about how the universe works.

We are a national lab owned by the United States Department of Energy’s Office of Science and operated by a partnership between the University of Chicago and the Universities Research Alliance. Today’s driving tour will last approximately 30 minutes. It will take you all over the site’s public areas, giving you a look at our science, nature, architecture, art, and history. Right now, you should be parked in the parking lot next to Wilson Hall. It's the high rise that soars above the Fermilab site. If not, we suggest you pause the tour and make your way there.

This tour is GPS enabled, so you won’t need to handle your cell phone during the drive. Using hand held devices while driving is prohibited on the Fermilab site. Please be safe during the tour, obey all traffic laws, and make sure to pay attention to the road as you learn about the lab. We'll provide directions and keep you on track.

Our tour begins by Wilson Hall. It's named for the lab’s founder and first director, Dr. Robert Wilson. Wilson was an artist, scientist, and cowboy from Frontier,
Wyoming. He was involved in almost every aspect of creating Fermilab, from building the powerful Main Ring accelerator to the design of this central lab building. To get just the right height for the building, Wilson ascended in a helicopter and plotted the aesthetic factor based on height. The sixteen-story high-rise contains conference rooms, a cafeteria, a library, an art gallery, and office space for many of the labs 1800 employees and thousands of visiting scientists.

Now, let's start driving!

From your parking space, exit the parking lot, driving towards the reflecting pond that's in front of Wilson Hall.

As you pass in front of the building, you'll see flagpoles on your left, which hold the flags of some of the countries we partner with on Fermilab experiments. To the right is the Fermilab logo made out of grass. The iconic logo is made of two parallel lines, representing a dipole magnet, and four curved lines, representing a quadrupole magnet. These two kinds of magnets help steer and focus our particle beams.

2) Kautz Road
When safe, continue straight through the intersection to drive past the flag poles.

3) Rd. A / Discovery Road
Turn left here and continue driving, keeping the lake on your left.

4) Tevatron Ring
Turn right here at the end of the pond onto Pine Street.

After turning, look to your right. You'll see a large earthen berm that curves away. The Tevatron tunnel sits twenty to thirty feet below the berm. The Tevatron was the world's most powerful accelerator for more than 25 years. It was used for a number of discoveries, including the discovery of the top quark, the heaviest fundamental particle we know of. The two main detectors on the Tevatron were called CDF and DZero, each of which had about 600 collaborators.

5) IARC and Tractricious
The blue and white building ahead on your right is the Illinois Accelerator Research Center. It's a state-of-the-art facility for developing particle accelerator technology. The focus is on partnering with universities and industry to find
applications for accelerator tech in medicine, energy and the environment, national security and discovery science.

On the left is the 36-foot-tall metal sculpture called Tractricious, designed by Robert Wilson. The sculpture has 16 freestanding outer tubes that are made from spare parts from the Tevatron’s dipole magnets. Each weighs 550 pounds.

Those buildings behind Tractricious are the Industrial Building complex, where we design, build, and test some of the world's most powerful magnets and other accelerator components.

6) Industrial buildings
Keep an eye out for the bison herd on the left, and feel free to pull into a viewing location and pause the tour if you’d like to hang out with them.

A bit more about the Industrial Building complex we passed. That’s where we built magnets for what is now the most powerful collider in the world, the Large Hadron Collider at CERN in Europe. International partnership is crucial for today’s large physics experiments. Such cooperation led to the 2012 discovery of the Higgs boson, the last fundamental particle we expected to find.

The technology behind the Fermilab magnets is also used in magnets for MRIs in medical centers. They are superconductive, meaning they conduct currents without any electrical resistance. Our magnets are operated at around -450 degrees Fahrenheit and weigh about 11,000 pounds.

7) Dog Training Area
Continue straight through the intersection ahead.

On your right, just past the intersection, is the Fermilab Dog Training Area, where you can bring your pet for an off-leash training session in the grass. As you’ve probably noticed, Fermilab has a variety of natural areas, from grassland and forest to ponds and agricultural land. We still rent out some of the land for farming, a nod to this area’s agricultural history.

8) History and science
The lab’s official birthday is June 15, 1967, but its story begins before that. There was a desire for a truly national lab dedicated to physics, and a number of sites around the country were proposed. In late 1966, the village of Weston and surrounding farmland was selected to be the site of the new National Accelerator Laboratory. This was later renamed the Fermi National Accelerator Laboratory in
honor of Enrico Fermi, who worked at the nearby University of Chicago until 1954. Many of the village houses and barns still stand on the site. The Fermilab Village now contains offices, labs, housing for visiting scientists, a gathering space to relax, and a gym. Those areas are just ahead on your left. They're restricted to Fermilab employees and users, so we'll be taking a right at the intersection ahead.

9) Right on Sauk Circle
Turn right here, into Sauk Circle. Then continue straight to the end of the road.

Ahead is Lake Law, a public area where you can put your fishing license to use, take a walk, or look for one of the 300 species of birds that have been seen on site.

10) Lake Law
Welcome to Lake Law.

11) Lake Law 2
Feel free to pause the tour, stretch your legs, and look for some birds, if you’d like.

12) Lake Law 3
To continue the tour, just turn around and make a left back onto Batavia Road, which will lead us back towards the Dog Training Area.

13) Turn left onto Batavia Road
Turn left here and continue driving. Keep an eye out for Wilson Hall, which you should see peeking above the trees. Researchers in Wilson Hall and around the lab work on all sorts of different things. Among them is Fermilab’s flagship experiment, the Deep Underground Neutrino Experiment, or DUNE. This international project will send tiny neutral particles called neutrinos through 800 miles of earth to massive detectors at the Sanford Underground Research Facility in South Dakota. We’ll measure these particles here on site, and again in South Dakota. Why do we care so much about neutrinos? There are huge quantities of these tiny particles all around us, but they aren’t well understood yet, and they have some weird characteristics. They might help explain why there is so much matter in the universe.

In addition to groundbreaking work on neutrinos, Fermilab is the US hub for scientists working on the Compact Muon Solenoid or CMS experiment. This is one of the four main experiments at the Large Hadron Collider in Switzerland,
and one of two that discovered the Higgs boson in 2012. Scientists here work on the design and operation of the detector and analyze the data.

14) Stick right on Batavia Road
Head through this intersection and keep to the right to head toward the barn.

15) Bison
Perhaps the best-known attraction at Fermilab is the herd of bison, often mistakenly called buffalo. Robert Wilson brought the first North American Bison to Fermilab in 1969. Today’s herd averages between 16 and 20 animals, except for when the babies arrive in April. These plains bison grow to around five feet tall and weigh around 2500 pounds. They can run at speeds up to 30 miles per hour – particularly when in an ill humor. The bison, now the national mammal, has always been a symbol for Fermilab, recognizing both the lab’s ties to the prairieland where it sits and its place at the frontier of high energy physics.

16) Left on Road C
Take a left at the intersection onto Road C.

17) Proton Pagoda
Coming up on the right is the Proton Pagoda.

It was once a control room and part of Fermilab’s proton area, where some fixed target experiments were conducted. Fixed target experiments are different to the collider experiments that were located on the Tevatron. They used a particle beam that was siphoned off from the powerful accelerator and sent to an unmoving target. This was the last of the Fixed Target Areas constructed and was the site of the discovery of another fundamental particle, the bottom quark, in 1977.

18) Feynman Computing Center
When you come to the end of this road you’ll see the Feynman Computing Center, a curved white building behind a fountain.

Fermilab had the third website in the world and continues to push the boundaries of computing for science, including work on machine learning and quantum computing. We serve as one of two US computing centers that processes and analyzes data from experiments at the Large Hadron Collider, as well as from our
own experiments on site. The lab can store about 500 petabytes of data – more data than would fit on 100 million DVDs.

19) Right on Road B
Now, let’s make a right at the intersection onto Road B. Head over the hill. I’ll meet you at the intersection coming up.

20) Master Substation, power poles, and geodesic dome
Turn right onto Discovery Road.

On the left you’ll see Fermilab’s Master Substation, which provides power for Fermilab and our energetic experiments. Recent upgrades revitalized the 45-year-old substation.

Have a look at the white power poles on your left. Robert Wilson didn’t like the look of the traditional power poles and, after some fighting with the power company, got his design for the power poles approved. Some think they resemble the Greek letter pi.

We’re traveling along the longest beamline in the fixed target area, which heads toward the neutrino area. This is where scientists used a 15-ft bubble chamber to study neutrinos, which created images with beautiful spiral tracks. Neutrinos are now the subject of many Fermilab experiments that use different detection methods. The suite has some fancifully named projects, including NOvA, MINERvA, MicroBooNE, ICARUS, and DUNE. Until 1988, the bubble chamber was housed in the geodesic dome at the end of the road on the right. The area now houses labs and office space. It’s also where scientists assembled components for the South Pole Telescope now installed in Antarctica and the 570-megapixel camera that was built for the Dark Energy Survey. That camera now sits at an observatory in Chile and images the southern sky to better understand a phenomenon called dark energy, a mysterious force that is accelerating the expansion of our universe.

21) Turn right onto Eola
Turn right at the stop sign onto Eola Road.

22) Turn right onto Road C
Turn right again at Road C, and then make an immediate right into the parking lot. You can park and take a minute to check out the bubble chamber up close!
23) Bubble Chamber parking lot
Pull into a parking space and let me tell you about the Bubble Chamber.

This bubble chamber was commissioned in 1973, making it the largest liquid hydrogen bubble chamber in the world at that time. The liquid hydrogen was kept at negative 423 degrees Fahrenheit, and the chamber was wrapped in an impressive 150-ton superconducting magnet made by Fermilab and nearby Argonne Lab. A gigantic piston, six feet across, kept the liquid hydrogen under pressure. At a signal from the Control Room, that piston would drop more than four inches in about 60/1000ths of a second, lowering the pressure on the Chamber and expanding the liquid. The effect of the expansion was similar to shaking a soft drink; bubbles would appear in many places, but it also made the paths of the particles that had passed through the chamber visible. Cameras mounted in the top of the chamber took pictures of those tracks, sometimes snapping more than 10,000 in a single day. People called “scanners” would analyze the film and pick out the important neutrino interactions.

24) Bubble Chamber parking lot 2
When you’re done at the bubble chamber, retrace your steps to make a left out of the parking lot and a left at the stop sign. This will lead us back to Discovery Road, the same way we got here.

25) Meson Area; FTBF
Turn left back onto Discovery Road and continue driving back the way we came.

Here at Fermilab, we explore the Standard Model, our basic picture of particle physics. We’ve already talked about some of the fundamental building blocks. There are the quarks, which come in six varieties: up, down, top, bottom, charm, and strange. Up and down quarks combine to make up the protons and neutrons in your atoms.

Mesons are particles made of one quark and one antiquark, and ahead on your right is the orange and blue-roofed Meson Building. This is now the home of the Fermilab Test Beam Facility, where researchers test their experimental components before putting them in their projects. In fact, this is the only facility in the United States that lets scientists from all over the world test their detectors with high-energy hadron beams. A hadron is a kind of particle made of quarks, and includes mesons as well as baryons, which are made of three quarks.

Quarks are one big chunk of the Standard Model. Another group contains the leptons, the most famous of which is the electron that powers electronics. There
are also other leptons: heavier versions of the electron called the muon and the tau, as well as the three flavors of neutrinos – the electron, muon and tau neutrinos. Finally, there are the force carriers, or bosons, and the famous Higgs boson, which gives particles mass.

26) Discovery Road South
Continue straight at the intersection, following the road as it curves slightly to the right and becomes Discovery Road South.

27) Acqua Alle Funi
Ahead you'll see the 32-foot-tall Acqua Alle Funi sculpture, rising out of the pond. This hyperbolic obelisk is another one of Robert Wilson’s creations. He apprenticed himself to the masterwelder in the machine shop and welded the three stainless steel plates before and after work, at lunch, and on the weekends.

28) Right on Pine Street
Now, let’s take a right onto Pine Street West and head through the woods.

29) Prairie, Interpretive Trail
These woods are just one part of Fermilab’s massive natural areas restoration project. The lab also cultivates oak savannah, scrub brush, and prairie.

Ahead on the right is a pull-off for the Margaret Pearson Interpretive Trail, where you should feel free to pause the tour and take a walk. This quarter-mile trail traverses restored prairie as well as native woodland. There are information panels along the trail and hikers can see prairie plants including compass plant, foxglove beardtongue and wild bergamot. Dr. Robert Betz, a biology professor, began the prairie restoration project in 1973.

When you’re done at the trail, continue on this road toward the Broken Symmetry sculpture at the Pine Street Entrance.

30) Broken Symmetry
The three-pronged Broken Symmetry sculpture was created from the deckplate of the USS Princeton aircraft carrier and installed in 1978. It represents the notions of symmetry and symmetry breaking that are vital to physics. The arch appears perfectly symmetrical when viewed directly from above or below but has carefully calculated asymmetry from its other views.
31) Return on Pine Street
Let’s turn left before the guard shack and make another left to return along Pine Street.

32) Neutrino experiments
Continue straight.

Ahead on your right is a spiral-shaped building that provides access to the underground areas more than 300 feet below the surface.

There, you can find the NOvA experiment – a long-distance neutrino experiment that operates over 500 miles between Fermilab and Minnesota. DUNE, the Deep Underground Neutrino Experiment that is coming to life over the next decade, will study neutrinos over 800 miles. Another experiment that studies neutrinos, MINERvA, is also underground here. Other buildings in this area house MicroBooNE and ICARUS, two additional neutrino experiments revealing new information about those tricky particles.

33) Right to Lederman Science Center
At the guard shack ahead, you’ll need to show your ID again. Then we’ll take an immediate right into the parking lot to visit the Lederman Science Center.

34) Lederman Science Center
We’re now at the Lederman Science Center, and the end of our tour, so find a place to park while I tell you a little bit more about it.

This space is designed for K-12 educators and students and is named after Fermilab’s second director – Nobel Prize winner Leon Lederman. The science center is open six days a week to anyone interested in science. It contains hands-on exhibits, technology and science labs, the teacher resource center, and a store. There’s also a racetrack shaped like our accelerator complex outside. We encourage you to get out and explore.

When you’re finished, consider heading back to Wilson Hall, where you can enjoy the soaring atrium. Monday through Friday, from 8am to 4:30pm, you can visit the art gallery on the second floor. You can also check out the lab from the viewing areas on the 15th floor during those same hours, or between 9am and 3pm on the weekends. Please sign in at the reception desk upon your arrival.
We encourage everyone to come back and take a guided tour of Wilson Hall and the linear accelerator, where our operators create and guide the powerful particle beams that feed our experiments. The weekly free tour is on Wednesday mornings at 10, and you can get more information online at fnal.gov. Fermilab also hosts an arts and lecture series, which brings in speakers and performers throughout the year. Most of these events take place in Ramsey Auditorium, located on the south side of Wilson Hall. If you check it out, be sure to look up! The wood used in the auditorium is made from black walnut trees that were illegally cut down during the lab’s construction and later recovered. And on top of Ramsey Auditorium is another sculpture. The Mobius Strip is a stainless-steel art piece welded by Robert Wilson and dedicated in 1974.

Thanks for taking an interest in Fermilab and in particle physics. You can follow Fermilab on most social media platforms and find out more about our science discoveries and upcoming events. Check the description of this tour for links to our website and social media. We hope to see you again soon.