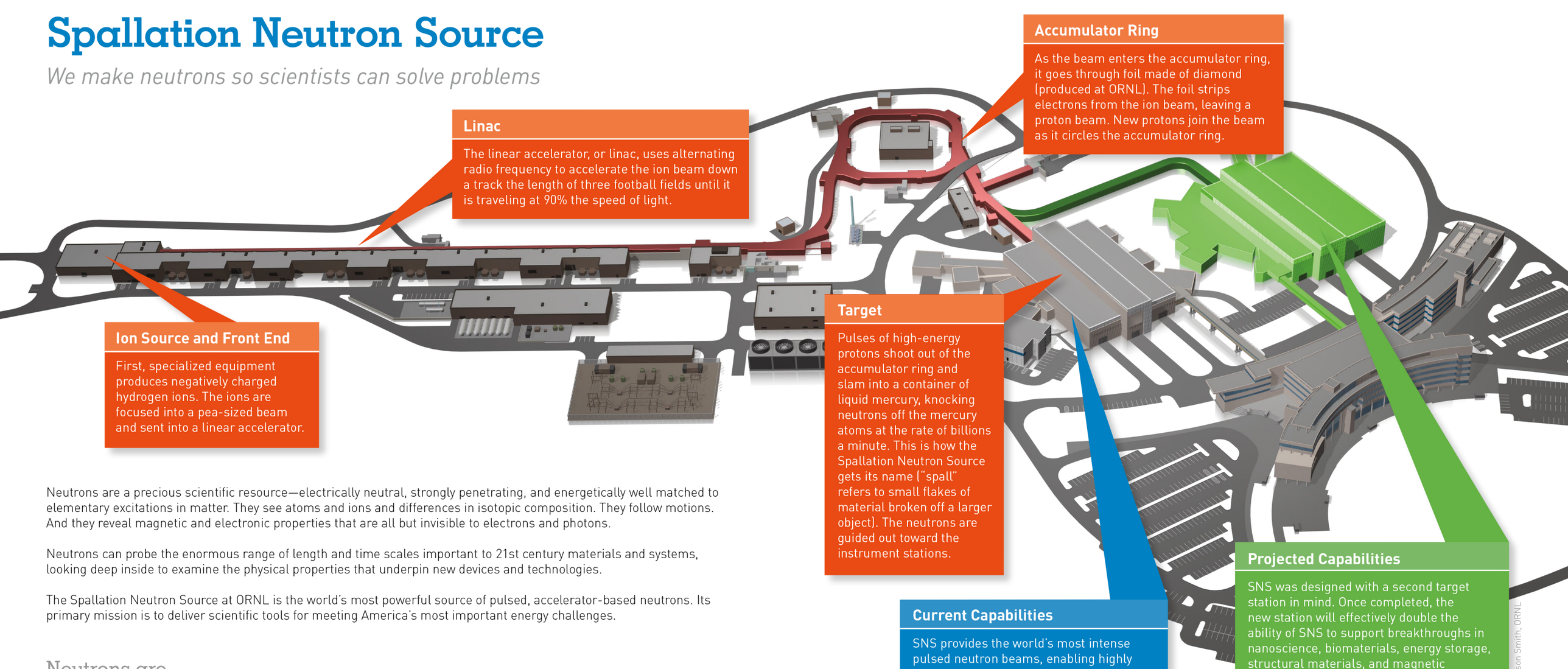
Spallation Neutron Source

We make neutrons so scientists can solve problems



Ion Source and Front End

First, specialized equipment produces negatively charged hydrogen ions. The ions are focused into a pea-sized beam and sent into a linear accelerator.

Linac

The linear accelerator, or linac, uses alternating radio frequency to accelerate the ion beam down a track the length of three football fields until it is traveling at 90% the speed of light.

Accumulator Ring

As the beam enters the accumulator ring, it goes through foil made of diamond (produced at ORNL). The foil strips electrons from the ion beam, leaving a proton beam. New protons join the beam as it circles the accumulator ring.

Target

Pulses of high-energy protons shoot out of the accumulator ring and slam into a container of liquid mercury, knocking neutrons off the mercury atoms at the rate of billions a minute. This is how the Spallation Neutron Source gets its name ("spall" refers to small flakes of material broken off a larger object). The neutrons are guided out toward the instrument stations.

Current Capabilities

SNS provides the world's most intense pulsed neutron beams, enabling highly sensitive measurements that would be impossible at a less powerful facility. Each year the facility provides 4,500 hours of beam time, allowing more than 1,500 researchers to conduct 450 experiments on its 18 instruments.

Science priorities at the SNS include

- quantum materials
- materials synthesis and performance
- soft molecular matter
- biosciences

Projected Capabilities

SNS was designed with a second target station in mind. Once completed, the new station will effectively double the ability of SNS to support breakthroughs in nanoscience, biomaterials, energy storage, structural materials, and magnetic systems. It will also allow researchers to study material properties that have never been studied before.

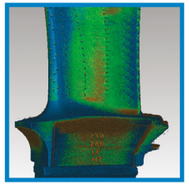
Image credit: Jason Smith, ORNL

Neutrons are a precious scientific resource—electrically neutral, strongly penetrating, and energetically well matched to elementary excitations in matter. They see atoms and ions and differences in isotopic composition. They follow motions. And they reveal magnetic and electronic properties that are all but invisible to electrons and photons.

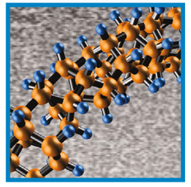
Neutrons can probe the enormous range of length and time scales important to 21st century materials and systems, looking deep inside to examine the physical properties that underpin new devices and technologies.

The Spallation Neutron Source at ORNL is the world's most powerful source of pulsed, accelerator-based neutrons. Its primary mission is to deliver scientific tools for meeting America's most important energy challenges.

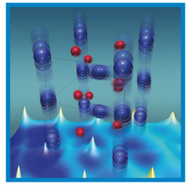
Neutrons are...



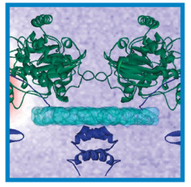
Peering deep inside 3-D printed turbine blades.



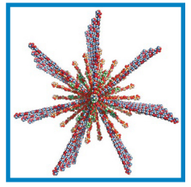
Confirming the structure of super strong nanothreads.



Analyzing atomic vibrations in metals.



Resolving protein structure for future drug development.



Designing future materials at the molecular level.