The EXPLORER consortium recently completed construction of the world’s first total-body PET/CT scanner. The 194.8 cm axial field of view of the EXPLORER scanner is sufficient to cover the entire human body in a single acquisition and allows total-body pharmacokinetic studies with frame times as short as 1 second.

The large increase in sensitivity arising from total-body coverage, as well as increased solid angle for detection at any point within the body, leads to roughly a factor of 40 signal gain over conventional PET/CT and PET/MR scanners for whole-body imaging. For a single organ, such as the brain, the gain is still a factor of 4-5. This allows PET studies to be acquired with unprecedented count density, improving the signal-to-noise ratio of the resulting images. Alternatively, the sensitivity gain can be used to acquire high-quality PET images at radiation doses on the order of that received for a roundtrip transatlantic flight, or with very short scanning times. The high sensitivity allows fast dynamic imaging at high signal-to-noise ratio, and the total-body coverage means that brain and cardiac blood pool are always in the field of view, greatly facilitating quantitative kinetic modeling studies. These capabilities could have a profound influence on how PET is used both in biomedical research and clinical practice.

This presentation will discuss the design and technical capabilities of the EXPLORER PET/CT scanner and report on the first human studies using a range of different protocols that provide initial evidence that support the capabilities of this system. Opportunities for studying the brain and brain-body interactions will be highlighted.