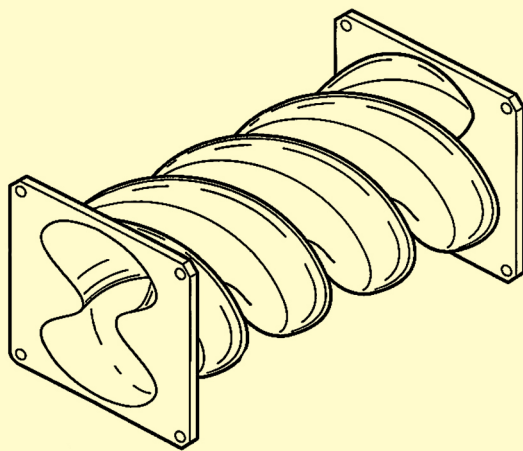


# Slow Waveguide Structures for Particle Accelerators

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**Perspective View of a Twisted Waveguide Structure**

## Technology Summary

A waveguide design that can save time and money in the construction and tuning of a particle accelerator was developed by ORNL researchers. Particle accelerators use electromagnetic fields to propel charged particles to high speeds within a well-defined beam. The beam line is used for basic science investigations as well as for applications in biotechnology and energy. This invention can be used in normal conducting and superconducting accelerators.

Acceleration of charged particles, such as protons, requires a radio frequency waveguide structure to support transmission of particles at speeds slower than the speed of light. Conventional waveguide designs use a multi-cell structure with corrugations along the beam axis. This method requires expensive construction techniques in addition to tuning of individual cells.

The ORNL invention instead uses a waveguide structure with a helical twist for this purpose. This tool is much simpler to construct since there is no variation in the shape of the transversal cross section along the axis of the structure. Additionally, this approach does not require tuning of individual cells since the field and frequency of the resonant mode depend on the whole structure rather than on the individual cells. Variation of the operating frequency or suppression of high order mode can also be accomplished outside the resonant waveguide structure.

## Advantages

- Simpler and less expensive to produce than existing waveguides
- Does not require individual cell tuning

## Potential Applications

- Basic and applied scientific research
- X-ray sources for medical imaging
- Machines for radiation treatment of cancer

## Patent

Yoon W. Kang, Aly E. Fathy, and Joshua L. Wilson, *Slow Wave Structures Using Twisted Waveguides for Charged Particle Applications*, U.S. Patent Application 12/784,571, filed May 21, 2010.

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