
Sensors

# Compact Full-Field Ion Detector System (CFIDS)

## A next-generation radiation detector

**NASA's Glenn Research Center** has developed and patented the Compact Full-Field Ion Detector System (CFIDS), a radiation particle detection system that provides information on the kinetic energies, directions, and electric charges of subatomic particles. The integrated package consists of a spherical Cherenkov detector, a compact detector stack, and low-noise, large-area detectors based on silicon carbide. The detectors and configuration can be modified to suit specific applications. The technology is an improvement over more conventional gas ionization detectors because the higher density of the solid media provides higher sensitivity to radiation. Originally developed to measure the properties of cosmic rays in outer space, the technology could be adapted for use on Earth for radiation dosimetry aboard high-altitude aircraft and in proton radiation therapy for cancer treatment.

## BENEFITS

- High performance—offers improved performance over gas ionization detectors because higher density of solid media detectors provides higher radiation sensitivity; Glenn's design also offers improved energy range and angular coverage
- Improved safety—monitors radiation exposure of humans and sensitive instruments aboard manned and unmanned spacecraft and high-altitude aircraft
- Integrated package—incorporates technologies that provide information on the kinetic energies, directions, and electric charges of subatomic particles into a single, compact detection system

technology solution

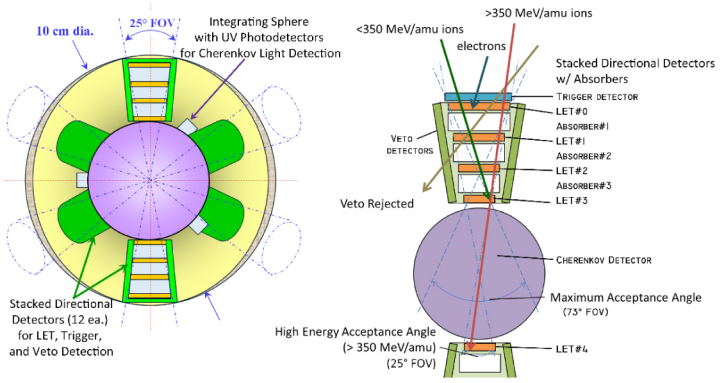
## THE TECHNOLOGY

The CFIDS is designed to be an extremely compact instrument, capable of being flown on a wide variety of deep space platforms, to provide comprehensive (composition, velocity, and direction) in-situ measurements of heavy ions in space plasma environments. Currently, Galactic Cosmic Radiation (GCR) ions are suspected to have a role in processes as diverse as space weathering, cloud formation, and magnetospheric shaping on Earth as well as inner planets, outer planet and small planetary bodies. The manner and extent of the impact of GCR ions on these processes are not systematically known.

The CubeSat is seen to be the ideal low-cost, low-risk platform for conducting this range of science observations either solo or in multiple locations as a swarm. However, current detector technology limits the measurement capability by restrictions of size, power and thermal stability of the CubeSat platform. The integration of these improved, low-power, and robust next-generation radiation detectors will allow CFIDS instrument to be adapted into CubeSat platforms for LEO or deep space, permitting in-situ studies of the impact of GCR ions on Earth as well as inner planets, outer planets and small planetary bodies.

Detectors based on wide band gap (WBG) semiconductors are being developed for integration into the CFIDS instrument to meet the challenges of low-power, low-noise, multi-directional, and robust detector for a wide range of ion energies and mass.

The CFIDS is comprised of a central spherical Cherenkov detector surrounded by detector stacks of arrays of Linear Energy Transfer (LET) detectors as well as Trigger and Veto (rejection) detectors for signal processing.




Schematic of the CFIDS instrument concept

## APPLICATIONS

- Space science missions
- Radiation dosimetry on high-altitude aircraft
- Monitoring of proton radiation therapy for cancer treatment
- General radiation exposure monitoring

## PUBLICATIONS

U.S. Patent 7,872,750

U.S. Patent 8,159,669

More Information

National Aeronautics and Space Administration

**Bob Kistemaker**

**Glenn Research Center**

21000 Brookpark Road
Cleveland, OH 44135
216.433.3483
ttp@grc.nasa.gov

http://technology.nasa.gov/

**www.nasa.gov**

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