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CIDA

Cometary and Interstellar Dust Analyzer for the NASA Mission STARDUST

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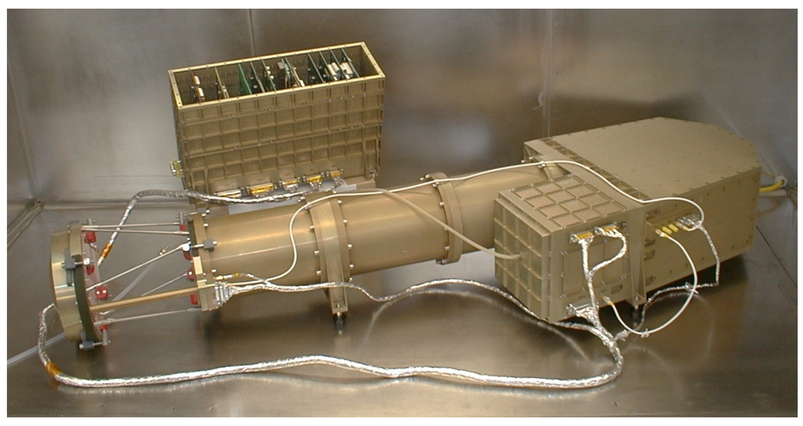
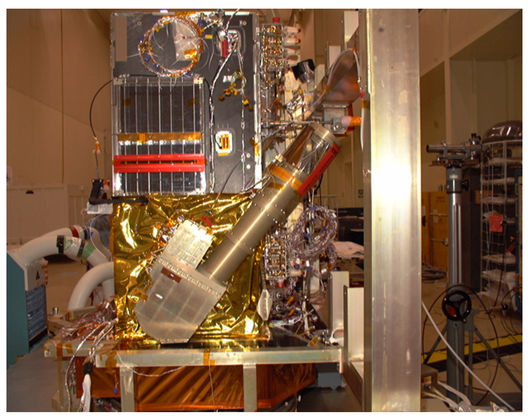
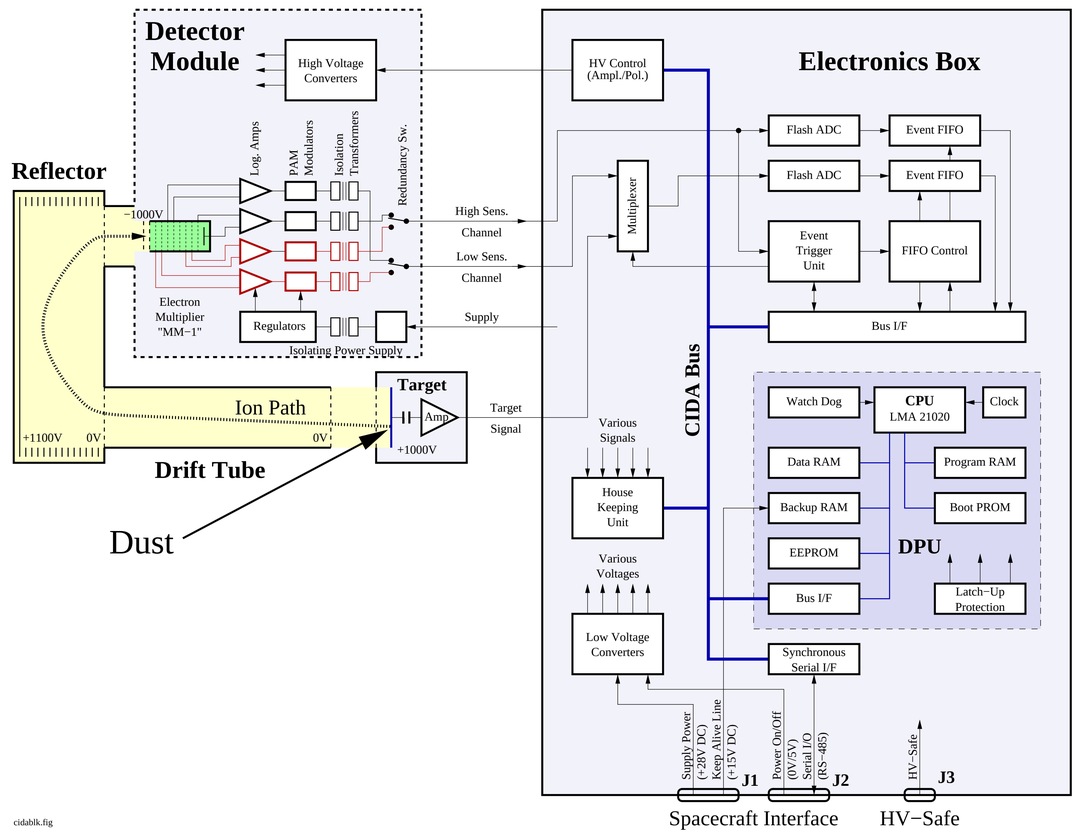
CIDA Sensor and E-Box



CIDA on STARDUST S/C



CIDA Block Diagram



CIDA's Scientific Objectives

Analysis of the elementary and molecular composition of interstellar and cometary dust grains.

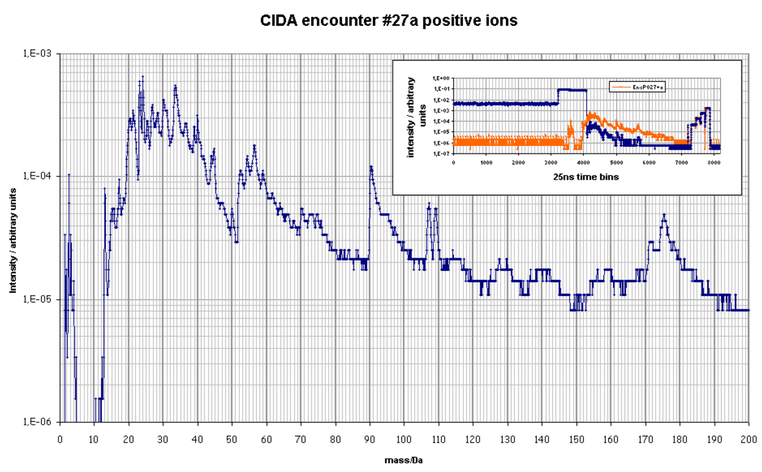
Target: Comet Wild 2 at 2 Jan. 2004

During cruise, CIDA measured 10 spectra of pos. ions, and 35 spectra of neg. ions—the first ever neg. dust spectrum! During encounter there were 27 pos. and 2 neg. spectra.

CIDA Specifications

Mass sensitivity	1×10^{-13} g @ 6 km/s
Atomic mass range	1…350 Da
Target area	130 cm² or 8 cm², automatic
Relative atomic mass resolution m/dm at m = 100	>200
Sustained event rate	>40 spectra/s
CIDA instrument mass	10.4 kg
Power consumption from 28 V DC	max. 15 W

CIDA Spectrum (Encounter)



The CIDA Team

vH&S The **von Hoerner & Sulger GmbH** is prime contractor and responsible for the overall design, management, production, and qualification testing.

The **Max-Planck-Institut für extraterrestrische Physik (MPE)**, Garching, Germany, then with Director Prof. G. Haerendel, hosted the PI Dr. Jochen Kissel, and contributed mechanics.

The **Bergische Universität und Gesamthochschule Wuppertal (BUGH)** participated in development of the detector amplifiers and the data acquisition unit FDAQ.

The **Finnish Meteorological Institute (FMI)**, Helsinki, Finland, provided the CIDA flight software, the GSE, and operational support.

The **Ingenieurbüro Dr. Franz Krueger**, Darmstadt, Germany, provided cleanliness analyses, scientific methods for spectra interpretation, and developmental effort for the target.

The **Institut d' Astrophysique Spatiale (IAS)**, Orsay, France, provided the low voltage converters.

The **Jet Propulsion Laboratory (JPL)**, Pasadena, USA, contributed electronical components.

Nyle Utterback †, Santa Barbara, CA, did the ion optics design.

STARDUST Launch

NASA photo

CIDA Timeline

End 1994 Study on Large Area Dust Impact Spectrometer (LADIS) by vH&S on DLR contract.

June 1996 First CIDA interface meeting of vH&S with Lockheed-Martin Astronautics (LMA) in Denver, CO.

May 1998 vH&S delivers the CIDA flight model to LMA.

7 Feb. 1999 STARDUST launch from Cape Canaveral.

2 Jan. 2004 Comet Wild 2 encounter.

15 Jan. 2006 Return of STARDUST's dust sampling capsule to Earth.

Happy PI with CIDA

The CIDA Project

The PI Dr. Jochen Kissel proposed the CIDA experiment, and is leading the overall investigation. CIDA has been developed, manufactured, tested, and delivered by company vH&S as prime contractor.

The CIDA Project has been funded by the DARA/DLR, and the national space agencies of the team members.

CIDA Measurement Principle

CIDA is a Time-Of-Flight (TOF) mass spectrometer with impact ionization:

1 impact ⟹ 1 spectrum!

- Cometary or interstellar dust hits a flat silver target, which is exposed to space.
- The high-velocity impact leads to instantaneous decomposition and ionization of the dust particle.
- The generated ions (pos. or neg.) are accelerated by electrical fields (polarity selectable), and travel fixed distance through drift tube and ion reflector.
- A stacked dynode multiplier (MM-1) with set of logarithmic amplifiers is used to detect the ions.
- The arriving ion charge is digitised by a pair of fast transient recorders.
- The mass spectra are calculated from the time-of-flight spectra.

Technical Highlights

Ion detector MM-1 Electron multiplier stack of 20 dynodes. Advantages: Flat surface → precise end-of-flight. Excellent pulse handling due to high electrode conductivity. Access to intermediate dynodes.

Logarithmic amplifiers Log. stage by UHF transistor arrays. Redundant design, two low/high sensitive channel pairs. Integrated test pulses.

Triggering Weighted integral and pulse trigger modes.

Bipolar Stacked HVCs Polarity switchable for analysis of pos. or neg. ions.

Software Totally and automatically relocatable software to survive memory errors. Hand optimized Rice compression for the spectra.

CIDA Contact, Links

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http://www.vh-s.de/projects/cida-stardust/press/cidaposter-a4.pdf

FMI CIDA Homepage http://www.geo.fmi.fi/PLANETS/cida.html

STARDUST Homepage http://stardust.jpl.nasa.gov

Literature

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