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The Alpha Magnetic Spectrometer (AMS)

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The AMS collaboration

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Abstract

The Alpha Magnetic Spectrometer (AMS) is a large acceptance (0.65 sr m^2) detector designed to operate in the International Space Station (ISS) for three years. The purposes of the experiment are to search for cosmic antimatter and dark matter and to study the composition and energy spectrum of the primary cosmic rays. A "scaled-down" version has been flown on the Space Shuttle Discovery for 10 days in June 1998. The complete AMS is programmed for installation on the ISS in October 2003 for an operational period of 3 yr. This contribution reports on the experimental configuration that will be installed on the ISS.

The Alpha Magnetic Spectrometer (AMS) (see Fig. 1) is a large acceptance (0.65 sr m^2) detector designed to operate in the International Space Station (ISS) for 3 yr. The purposes of the experiment are to search for cosmic antimatter and dark matter and to study the composition and energy spectrum of the primary cosmic rays. A "scaled-down" version has been flown on the Space Shuttle Discovery for 10 days in June 1998 [1]. The complete AMS is programmed for installation on the ISS in October 2003 for an operational period of 3 yr.

This contribution reports on the experimental configuration that will be installed on the ISS.

The spectrometer consists in a superconducting magnet with a total analysis power of $BL^2 = 0.8\ Tm^2$, equipped with eight planes (6 m^2) of silicon microstrip detectors for track reconstruction. The spatial resolution of the silicon tracker is better than 10 μm in the bending plane. The

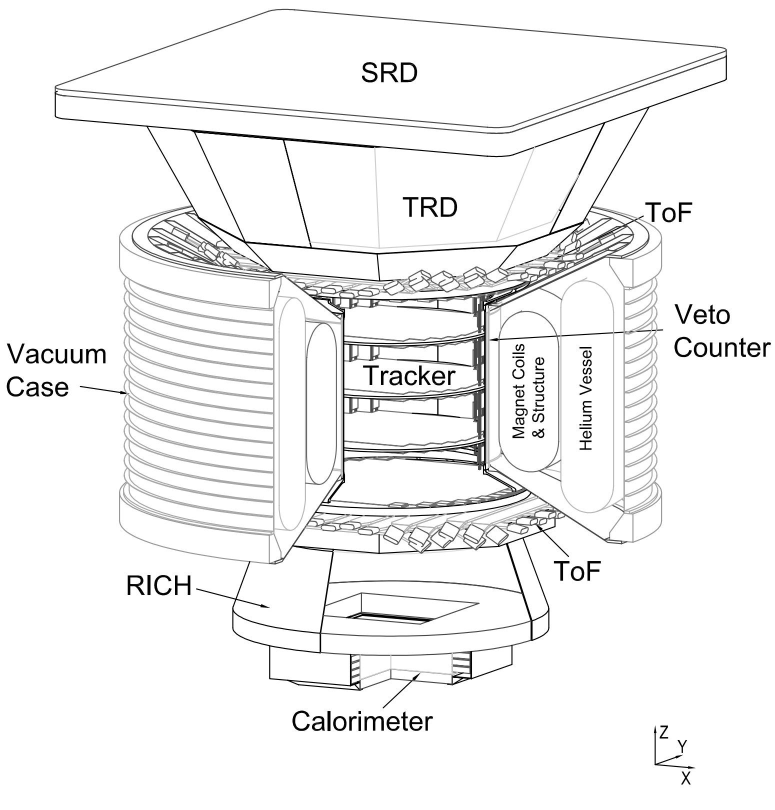

Fig. 1. AMS O2 (Alpha Magnetic Spectrometer).

resulting expected momentum resolution is of about 2% at 1 GeV.

Four scintillator counter-planes placed just above and below the magnet provide the fast trigger to the full experiment, limited particle identification up to about 2 GeV and distinguish upward from downward going particles with a separation of 10^{-8}.

A proximity-focusing Ring Imaging Cherenkov Counter (RICH) provides a high efficiency rejection of albedo particles above threshold. The velocity measurement ($\Delta\beta/\beta = 10^{-8}$) combined with the momentum measurement by the magnetic spectrometer will determine the particle mass up to $A \simeq 25$ in the momentum range $p = 2$–10 GeV.

A Transition Radiation Detector (TRD) made by straw drift tubes filled with Xe/CO_2, combined with a lead-scintillating fibres Electromagnetic Calorimeter (ECAL) $16X_0$ deep will provide electron/proton separation up to about 1 TeV.

As for the detection of antimatter, the AMS detector will be able to distinguish a possible antihelium nucleus among 10^8–10^9 estimated background helium nuclei.

The total weight of the experiment is about 6 t with a total available power of 2 kW. The limitations in weight and power and the requirements of radiation hardness force the use of very sophisticated technologies specifically designed for space operations.

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