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Calibration of the Radiation Environment Monitor

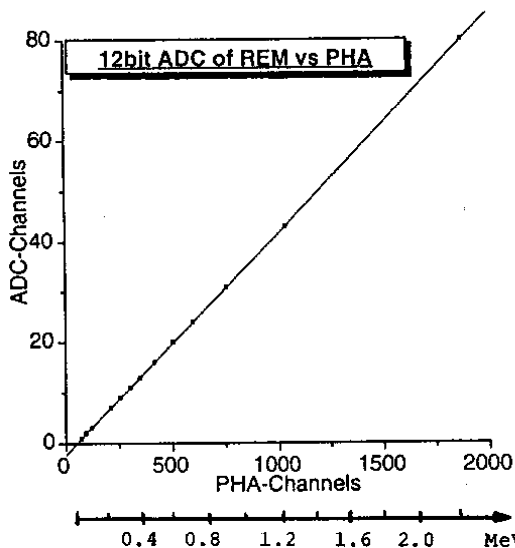
S.Ljungfelt

Paul Scherrer Institut, Astrophysics Division, CH-5232 Villigen PSI

The Radiation Environment Monitor (REM) is a simple device to be flown on future missions to determine the momentary particle fluxes in orbit which constitute a hazard for modern large scale integrated circuits.

The LET spectra of the charged particles is measured in thin, totally depleted Silicon diodes. The detector electronics are programmed to measure the energy deposit (which is registered by a charge-sensitive pre-amplifier and a 12-bit ADC) and increment one of 16 preset energy-deposit counter 'bins'.

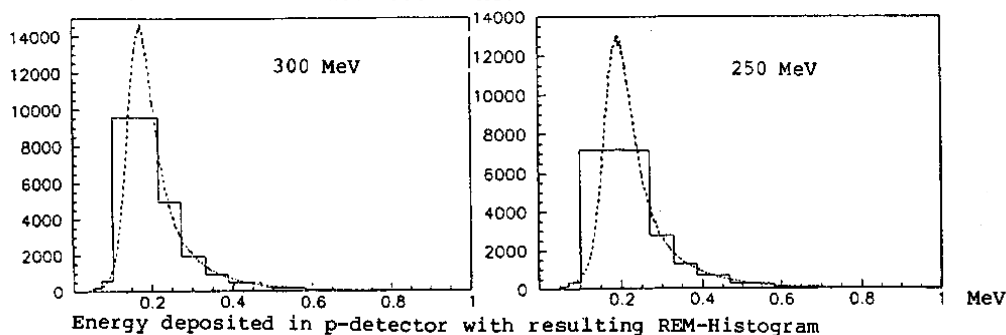
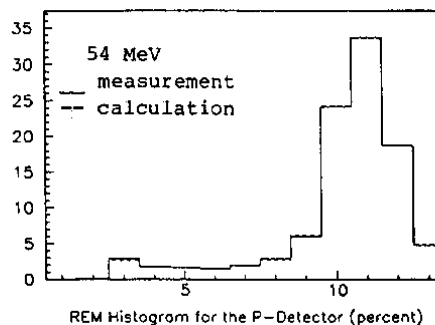
During the irradiation at the PIF facility, the analog signal of the REM Detector Suite was amplified (10x) and fed into a Pulseheight Analyzer (PHA). We used the testinput of the REM-suite to calibrate the REM instrument. The testinput had previously been calibrated with an α -source in vacuum. After fitting the PHA Channel-No. as function of the input amplitude the energy deposit for a certain PHA-channel was obtained.

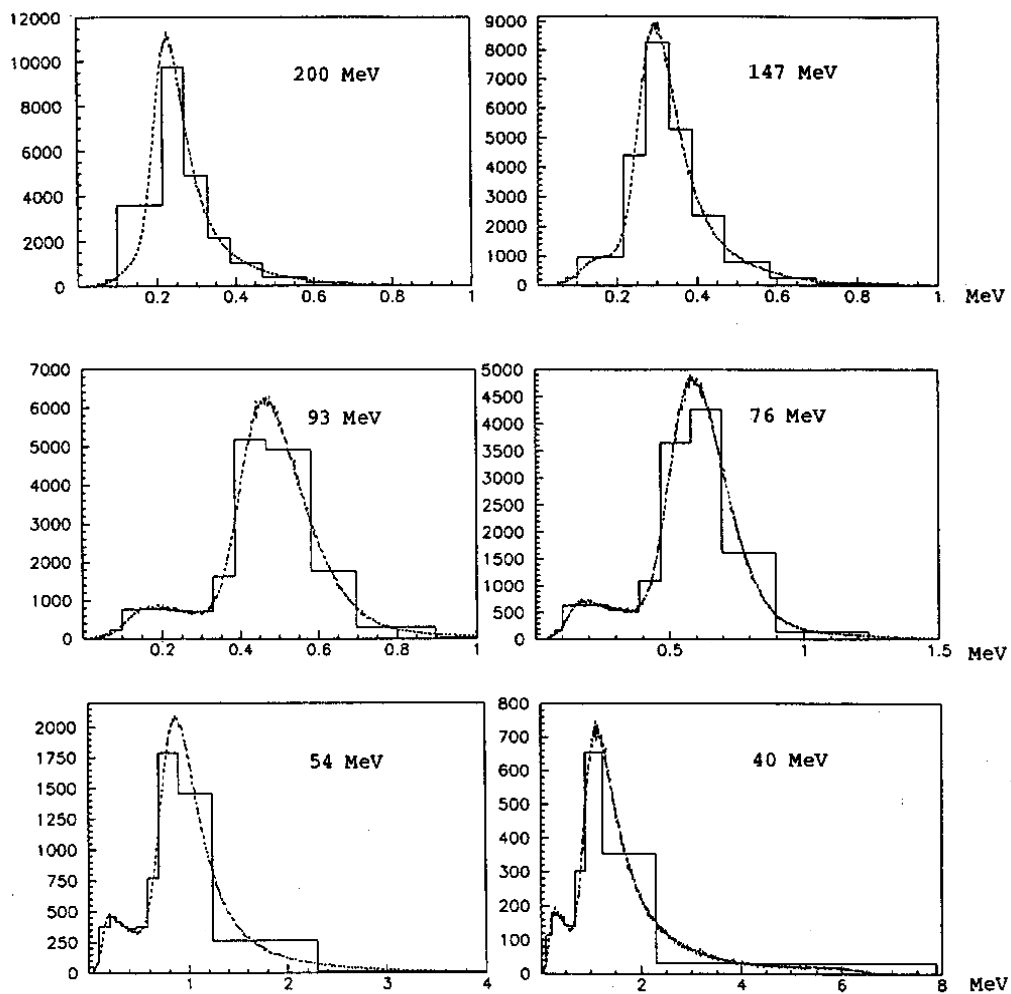


The 16-bin REM-histograms were compared with the PHA-spectra for eight proton energies between 40 and 300 MeV. Totally absorbed protons deposit a maximum of about 7 MeV which falls inside bin 13. Therefore only bin 1-12 (<2.3 MeV) which were fully covered by the PHA-data were used in this calibration. Assuming the range in the PHA-spectra sensitive to these 12 bins, the best values for the bin-limits in PHA-channels giving the REM-histograms were calculated for all energies. A linear relations between the so obtained PHA-channels and the programmed ADC-channels were fitted for all energies. After varying the range in the PHA-spectra, corresponding to bin 1-12, bin-limits (in PHA-channels) were extracted which well reproduced all the REM-histograms. The relation between these bin-limits in PHA-channels and the programmed bin-limits in ADC-channels was found to be very close to a straight line, cf. below.

A comparison of a calculated (dashed line) with a measured REM-histogram is also shown. The difference still existing corresponds to no more than the contents of 1 or 2 PHA-channels at the bin-limits.

The eight PHA-spectra together with the measured and calibrated REM-histograms (normalized to the bin-width) are also shown below.





Energy deposited in p-detector with resulting REM-Histogram for various incident proton energies