PURPOSE
Radiographic film is a useful tool for measuring dose distributions with large gradients because of its high spatial resolution. Film has often been used to verify the delivered dose before, during, or after irradiation of animals and cell cultures using various experimental configurations. Film can also be used to verify models of physical phenomenon such as the scattering of charged particles. Scatter distributions may be studied using small beams of a few millimeters in diameter incident upon slabs of various test materials but, typical accelerator beams when focussed to small spots have intensities that saturate the optical density response well before the beam becomes stable. A low sensitivity film would allow the beam to become stable prior to delivery of a significant amount of dose to the film. The purpose of this study was to obtain dose response curves for a relatively new radiographic film with a low sensitivity.

METHOD AND MATERIALS
The 56 GeV (1 GeV/n) nominal energy iron ion beam at the Brookhaven National Laboratory / NASA Space Radiation Laboratory was used to irradiate Kodak EDR-2 radiographic film. The beam was magnetically focussed to provide an approximately 150 mm square field size. The dose delivered per beamline detector monitor unit at four different depths on the central axis in a polystyrene block phantom was calibrated with a NIST-traceable 0.055 cc parallel plate chamber. The charge collected by the ion chamber at all depths was converted to dose-to-water using the ICRU # 59 protocol and a value for w/e of 34.4 J/C and a water-to-air stopping power ratio of 1.130. Films were then exposed with multiple doses at each of the four depths. After development, the films were scanned using a Vidar VXR-16DP scanner and RIT113 dosimetry software at a resolution of 178 µm. Dose response curves were then constructed.

RESULTS
Based upon the residual range of the beam in water, the energies of the primary iron ions at the four depths where the dose response curves were constructed were 962, 821, 671, and 511 MeV per nucleon. The dose rate delivered at the films was between 115 and 70 cGy/min. Although the sensitivity of the film was much less than most other radiographic films, its response was still large enough that the intensity of most accelerator beams must be reduced dramatically in order to perform scattering experiments.

CONCLUSIONS
EDR-2 film retains the high spatial resolution common to most radiographic films but it is less sensitive allowing iron ion doses up to 1,000 cGy to be used.

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