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A gaseous time projection chamber with Micromegas readout for low-radioactive material screening

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Low-radioactive material screening is becoming essential for rare event search experiments, such as neutrinoless double beta decay and dark matter searches in underground laboratories. A gaseous time projection chamber (TPC) can be used for such purposes with large active areas and high efficiency. A gaseous TPC with a Micromegas readout plane of approximately 20 × 20 cm^2 is successfully constructed for surface alpha contamination measurements. We have characterized the energy resolution, gain stability, and tracking capability with calibration sources. With the unique track-related background suppression cuts of the gaseous TPC, we have established that the alpha background rate of the TPC is $(0.13 \pm 0.03)\times10^{-6}$ Bq/cm^2, comparable to the leading commercial solutions.

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