

## Expected Backgrounds in (a,g) Capture Experiments

The usual measure of background is the suppression factor, defined as  $R_l / (e \cdot R_b)$ , where  $R_l$  is the leaky beam rate,  $e$  is the detection efficiency, and  $R_b$  is the incident beam rate. The  $^{12}\text{C}(a,g)^{16}\text{O}$  experiment proposes to measure cross sections down to  $0.1 \text{ nb} = 10^{-34} \text{ cm}^2$ , which will require a suppression factor of  $10^{-34} \cdot \rho$ , where  $\rho$  is the target density in atoms per  $\text{cm}^2$ . Assuming a 10 cm long He target of pressure 10 Torr,  $\rho = 4 \times 10^{18} \text{ cm}^{-2}$ , and therefore the desired suppression factor is  $10^{-34} \cdot 4 \times 10^{18} = 4 \times 10^{-16}$ . This suppression factor is smaller than the  $10^{-15}$  factor we needed for the  $^{15}\text{O}(a,g)^{19}\text{Ne}$  experiment, and therefore would represent Dragon's biggest challenge.

The  $^{14}\text{N}(a,g)^{18}\text{F}$  runs of Oct. 9 have similar kinematics to the proposed (a,g) measurements and so offer an opportunity to determine suppression factors under similar conditions to those expected in the proposed experiments. The figure below shows the analyzed spectra for two different gas target pressures, 4.6 Torr in the left column and 2.2 Torr on the right. The bottom spectra are end-detector pulse-heights with cuts as shown in the upper spectra, which cuts select real and random coincidence times and impose a gamma-energy threshold. The "singles" spectra show large leaky-beam peaks, the high-energy tails of which extend under the "capture" peaks. The amount of overlap was computed by integrating the "singles" peaks over the region of the capture peak, to the right of the vertical lines, and then scaling down these numbers of events by the ratios of "singles" to "randoms" counts in the spectra to the left of the lines. This extrapolation procedure makes up for the vanishing statistics of the randoms' data in the regions of the capture peak, due to limited integrated-beam in these runs.

