Examination and control of $\text{H}_3^+$ formation in ethane with intense laser pulses\textsuperscript{1} CHARLES J. SCHWARTZ, NAOKI IWAMOTO, S. ZHAO, J.L. NAPIERALA, S.N. TE GegN, A. SOLOMON, E. WELLS, Department of Physics, Augustana University, Sioux Falls, SD 57197 USA, BETHANY JOCHIM, KANAKA RAJU P., T. SEVERT, PEYMAN FEIZOLLAH, K.D. CARNES, I. BEN-ITZHAK, J.R. Macdonald Laboratory, Department of Physics, Kansas State University, Manhattan, KS 66506 USA — Guided by COLTRIMS identification of $\text{H}_3^+$ fragmentation channels, an adaptive learning algorithm supplied with 3D momentum based feedback is used to identify intense laser pulse shapes that control $\text{H}_3^+$ formation from ethane. Since a $\text{C}_2\text{D}_2^{2+}\text{-D}_2$ intermediate state is thought to lead to $\text{D}_3^+$ formation via roaming of the $\text{D}_2$, we use the $\text{D}_3^+:\text{C}_2\text{D}_2^{2+}$ ratio as the control objective. In a similar measurement, we control the ratio of $\text{D}_2\text{H}^+\text{-D}_3^+$ produced from the $\text{D}_3\text{C}-\text{CH}_3$ isotopologue of ethane, which selects between trihydrogen cations formed from atoms on one or both sides of ethane. Both the $\text{D}_3^+:\text{C}_2\text{D}_2^{2+}$ and $\text{D}_2\text{H}^+\text{-D}_3^+$ ratios can be modified by a factor of two or more. In addition, 2D scans of linear chirp vs. third-order dispersion are conducted for a few fourth-order dispersion values while the $\text{D}_2\text{H}^+$ production are monitored. These dispersion scans are not as successful at modifying the $\text{D}_2\text{H}^+:\text{D}_3^+$ ratio as the adaptive search.

\textsuperscript{1}Augustana University personnel and equipment were supported by National Science Foundation grant PHY-1723002. J.R. Macdonald Laboratory personnel and equipment were supported by the US Department of Energy under award #DE-FG02-86ER13491.