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Supplemental Material
Hierarchical Optimization of the As-Rigid-As-Possible Energy

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A. Thingi10K

To test the effectiveness of our approach we applied our method to a set of meshes from the Thingi10K [ZJ16] dataset. For this, we chose all single-component, manifold meshes with more than 100K vertices. We automated constraint selection by identifying the largest bounding box axis, fixing the lowest 5% of vertices, and marking the highest 5% as dynamic along this axis. The dynamic constraints were rotated 180 degrees and translated, creating an extreme bending scenario (Figures 1, 2, 3, 4). We also rotated the dynamic constraints by 90 degree to create a twisting scenario (Figures 5, 6, 7, 8). We measured the elapsed time and the resulting energy of both the classic ARAP algorithm and the hierarchical approach at specific convergence criteria (10^{-6} to 10^{-10}) on the high resolution level and used a fixed convergence criterion of 10^{-6} on the coarse levels.

Figures 1-8 show the ARAP energy curves on the finest level using our hierarchical approach. We can see that the hierarchical approach usually converges to a lower energy but in some cases this is not the case.

References

[ZJ16] ZHOU Q., JACOBSON A.: Thingi10k: A dataset of 10,000 3d-printing models. *arXiv preprint arXiv:1605.04797* (2016). 1

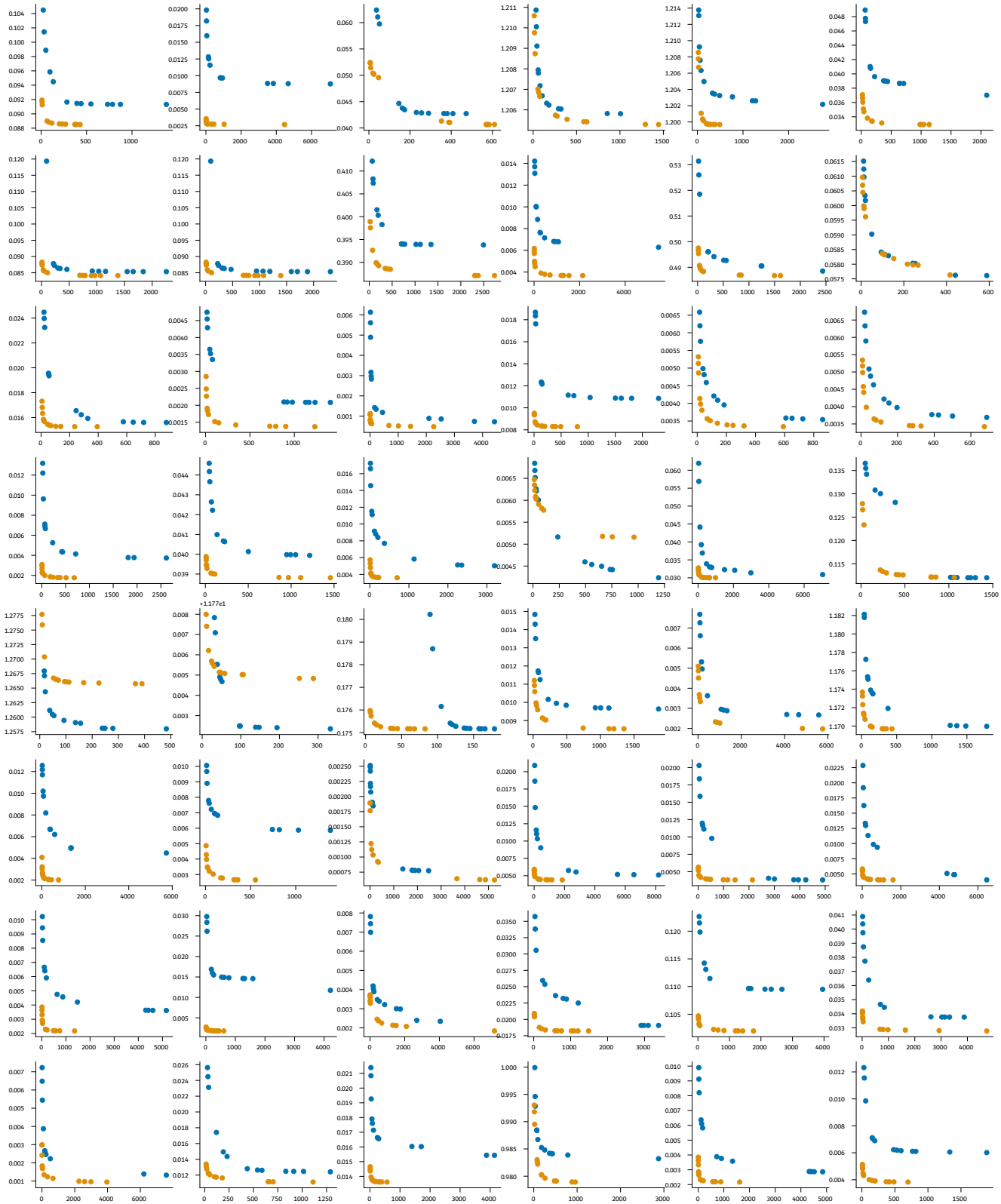

Figure 1: *Runtime (in seconds) of HARAP and the resulting ARAP energy. Curves show multiple data points at different convergence criteria.*

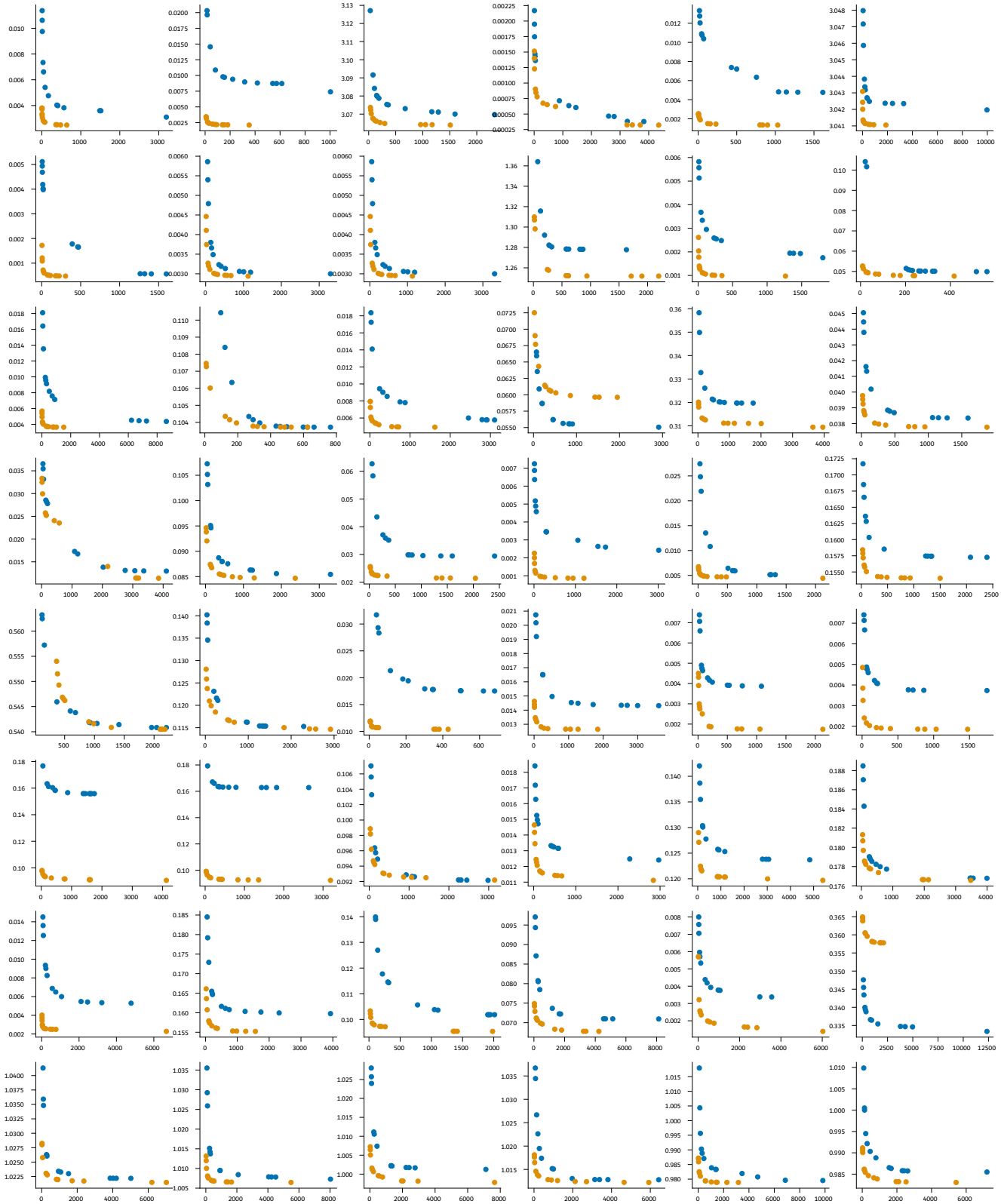

Figure 2: *Runtime (in seconds) of HARAP and the resulting ARAP energy.Curves show multiple data points at different convergence criteria.*

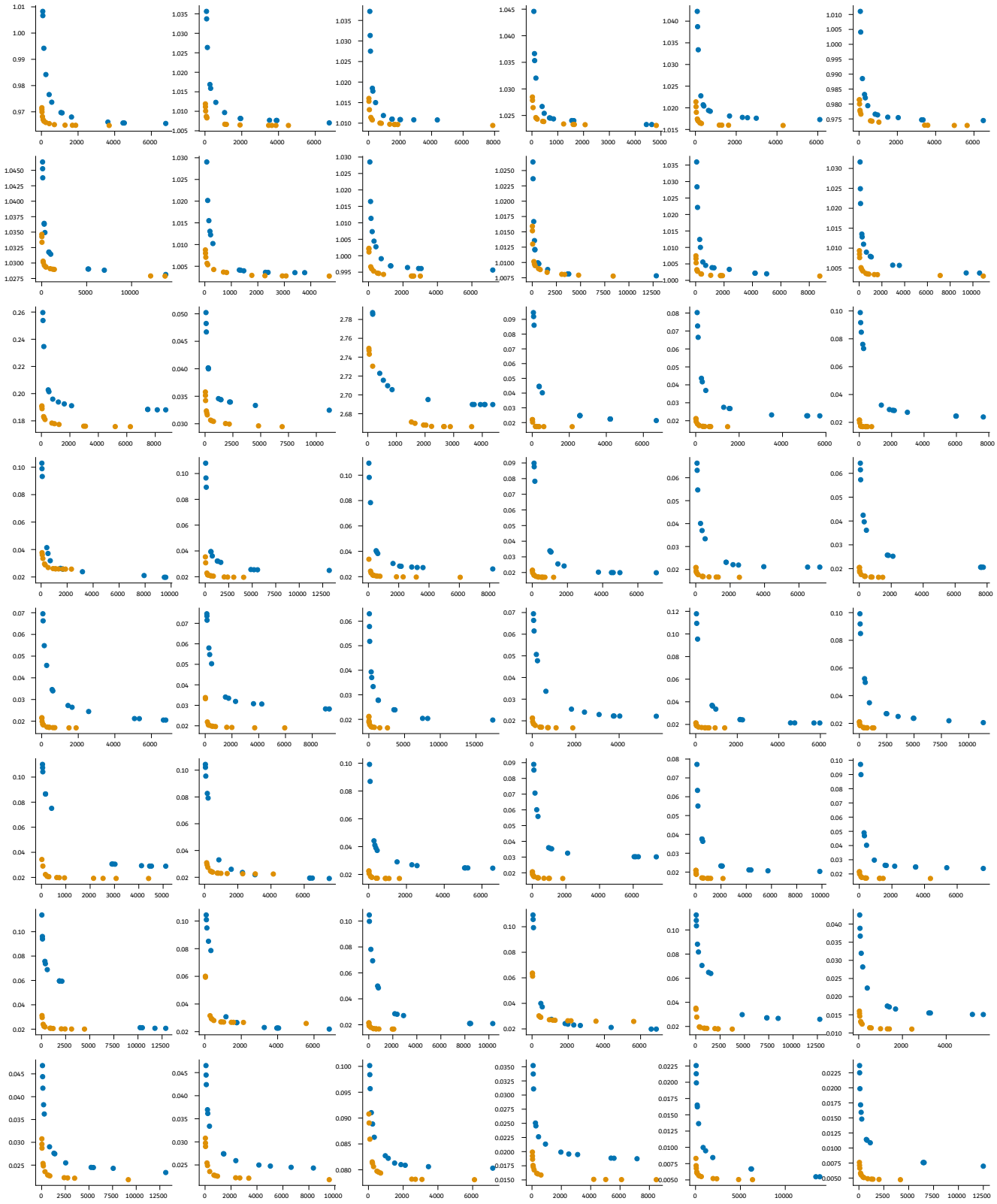

Figure 3: *Runtime (in seconds) of HARAP and the resulting ARAP energy.Curves show multiple data points at different convergence criteria.*

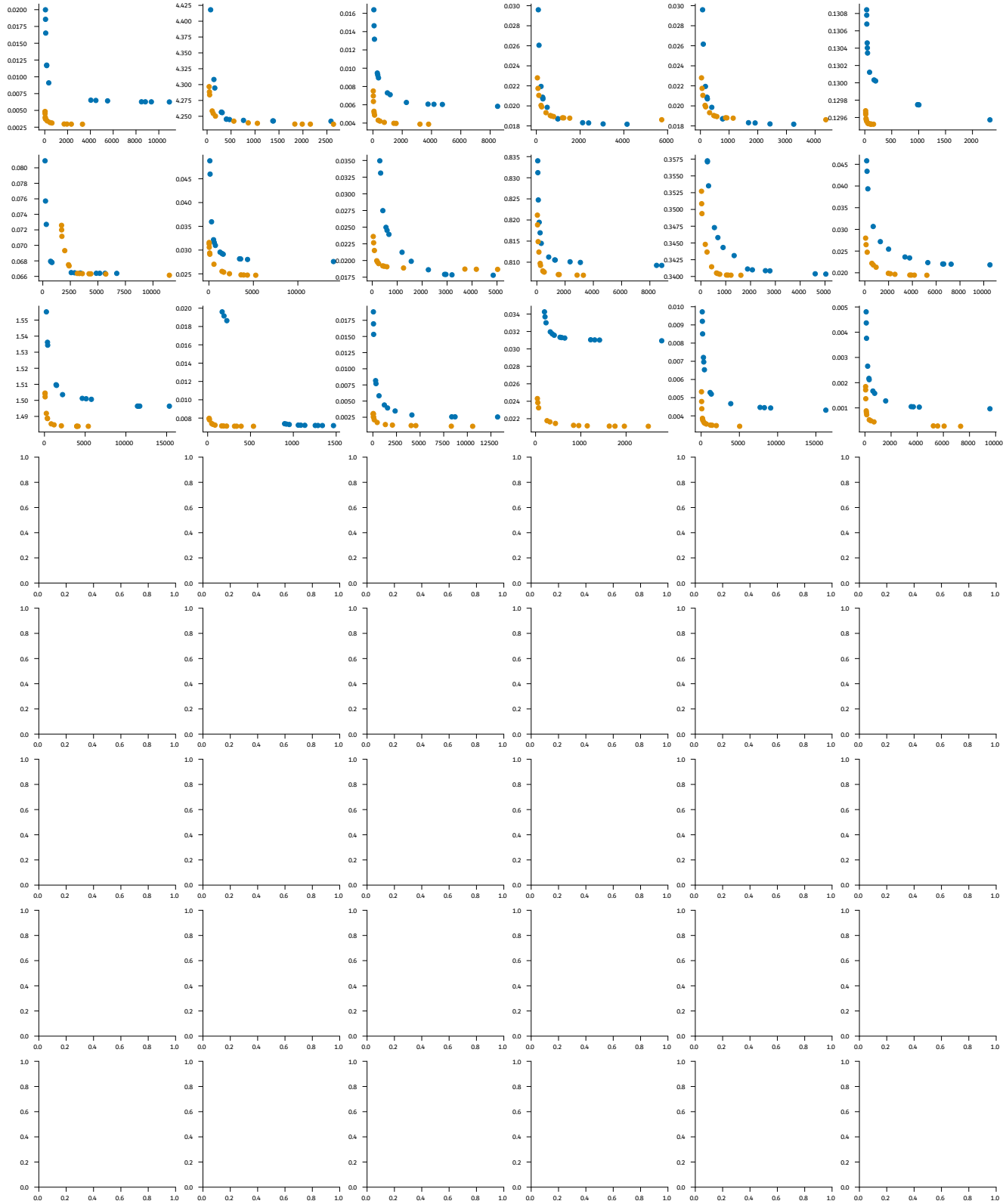

Figure 4: *Runtime (in seconds) of HARAP and the resulting ARAP energy.Curves show multiple data points at different convergence criteria.*

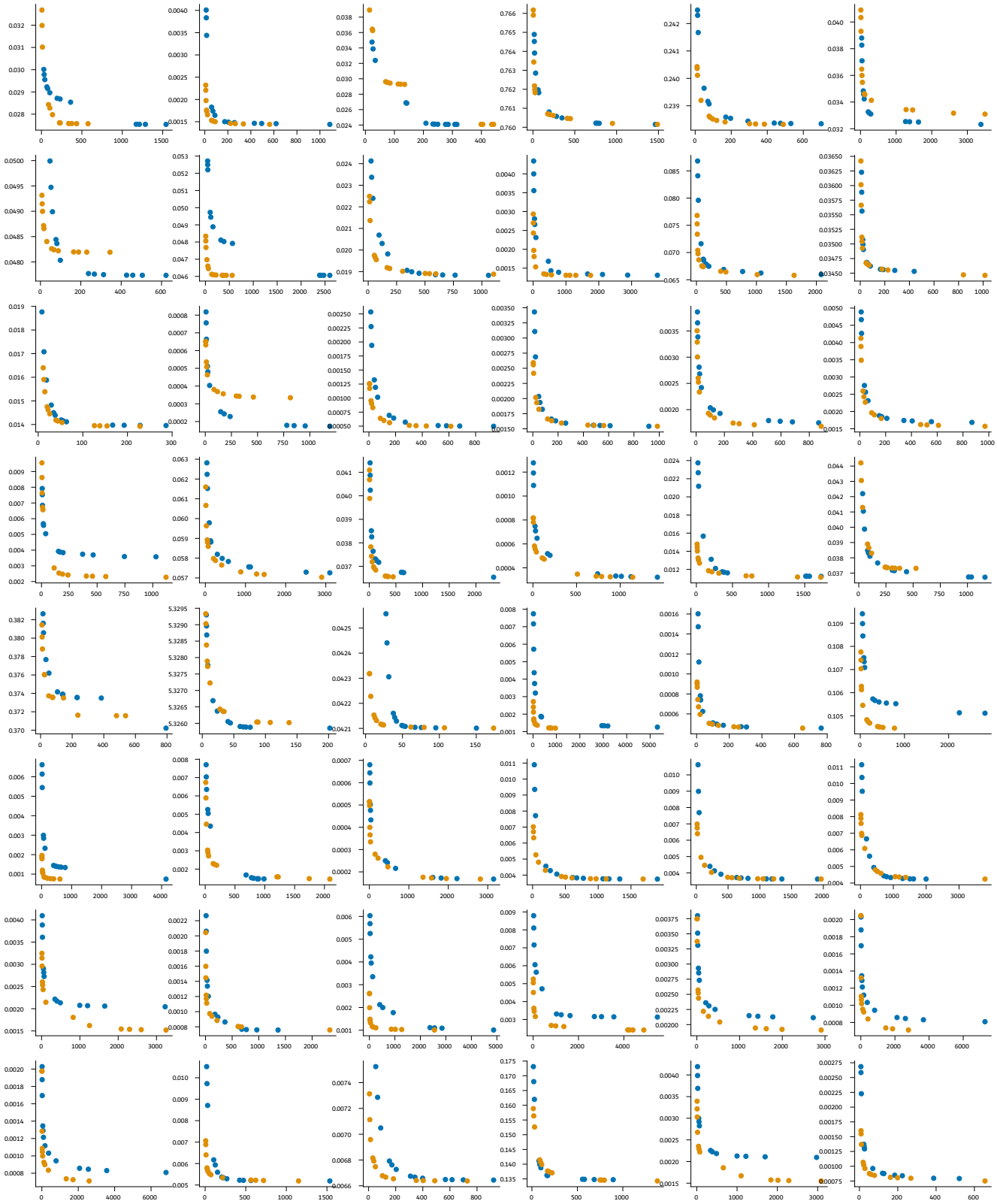

Figure 5: *Runtime (in seconds) of HARAP and the resulting ARAP energy. Curves show multiple data points at different convergence criteria.*

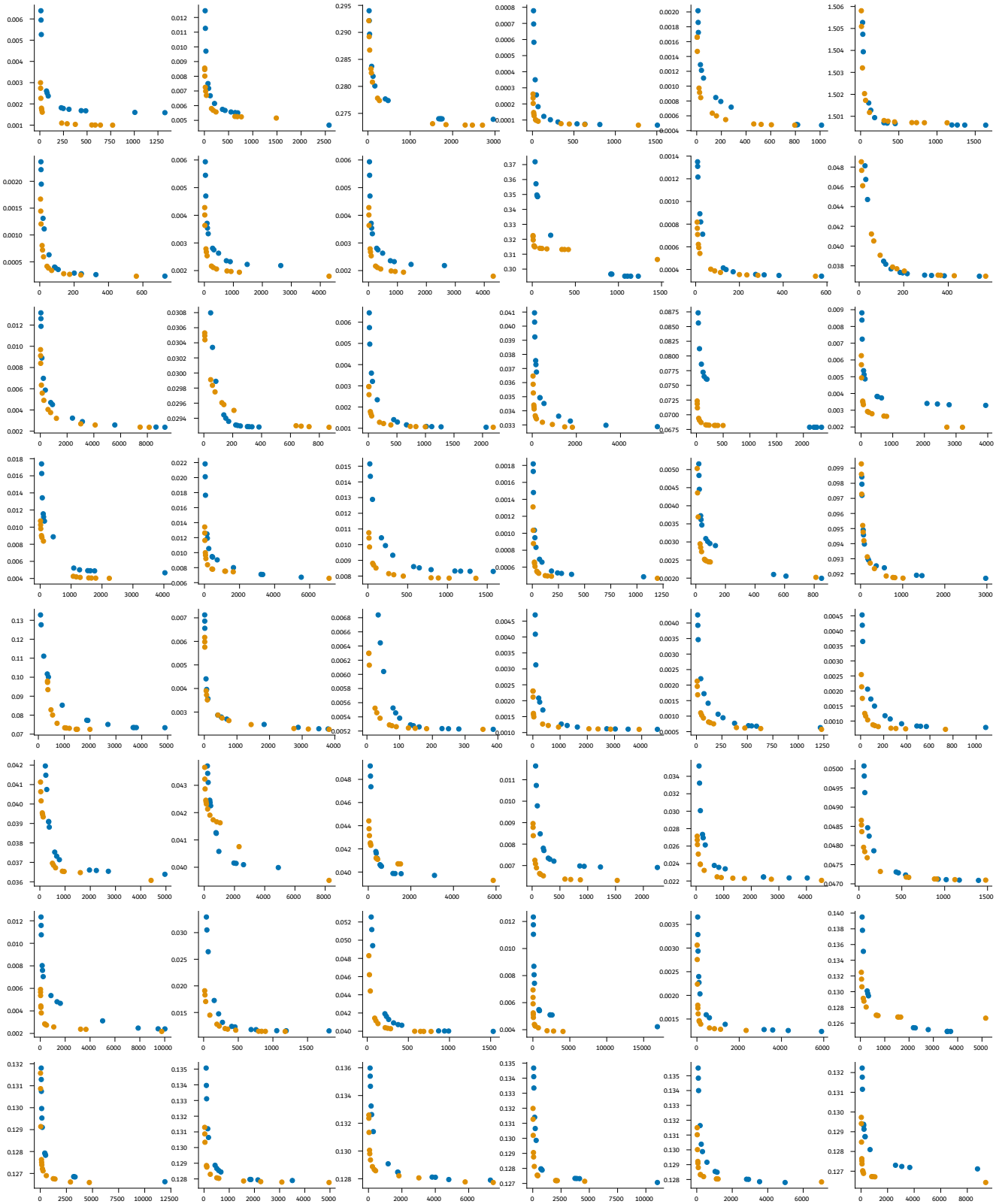

Figure 6: *Runtime (in seconds) of HARAP and the resulting ARAP energy.Curves show multiple data points at different convergence criteria.*

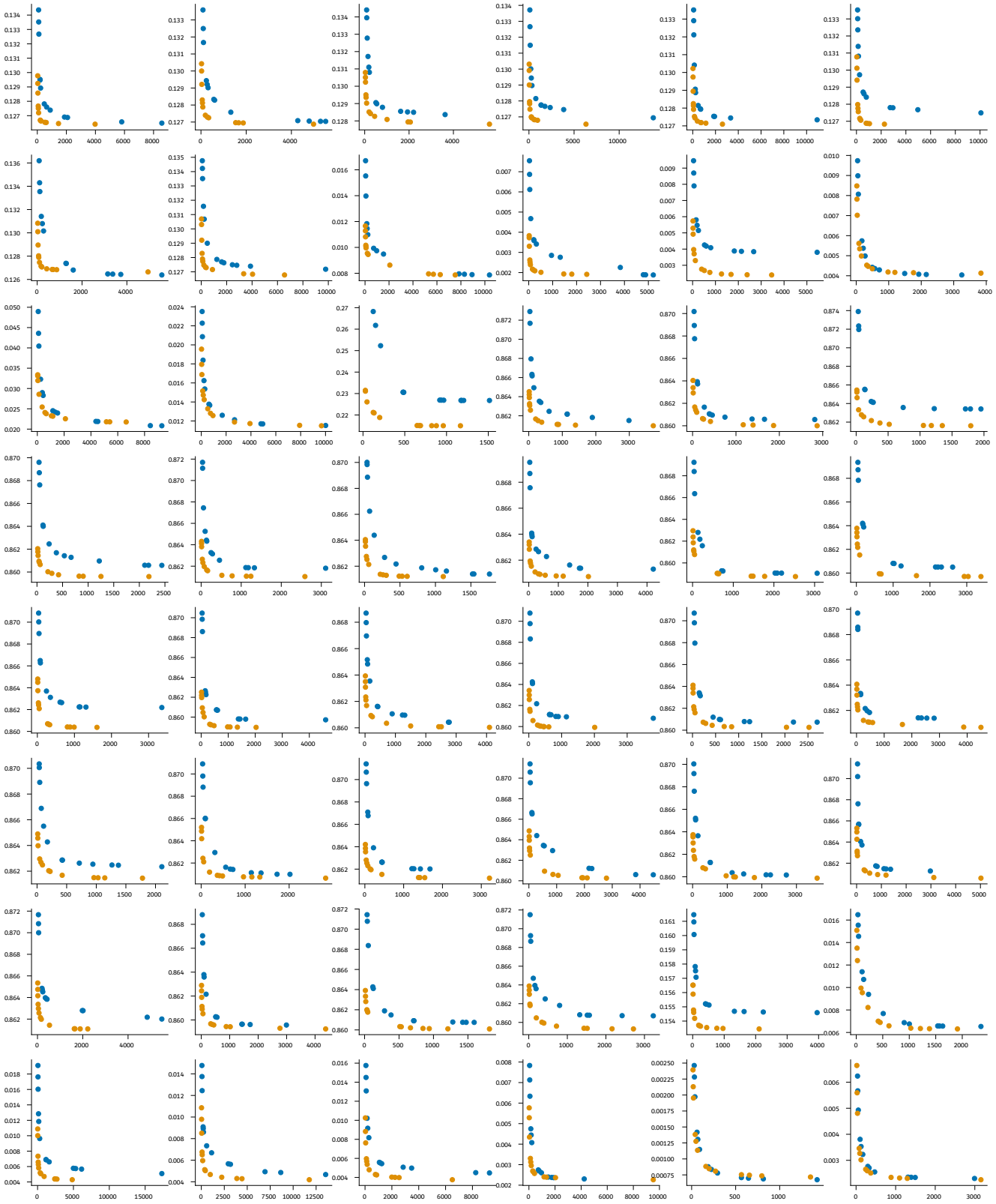

Figure 7: *Runtime (in seconds) of HARAP and the resulting ARAP energy.Curves show multiple data points at different convergence criteria.*

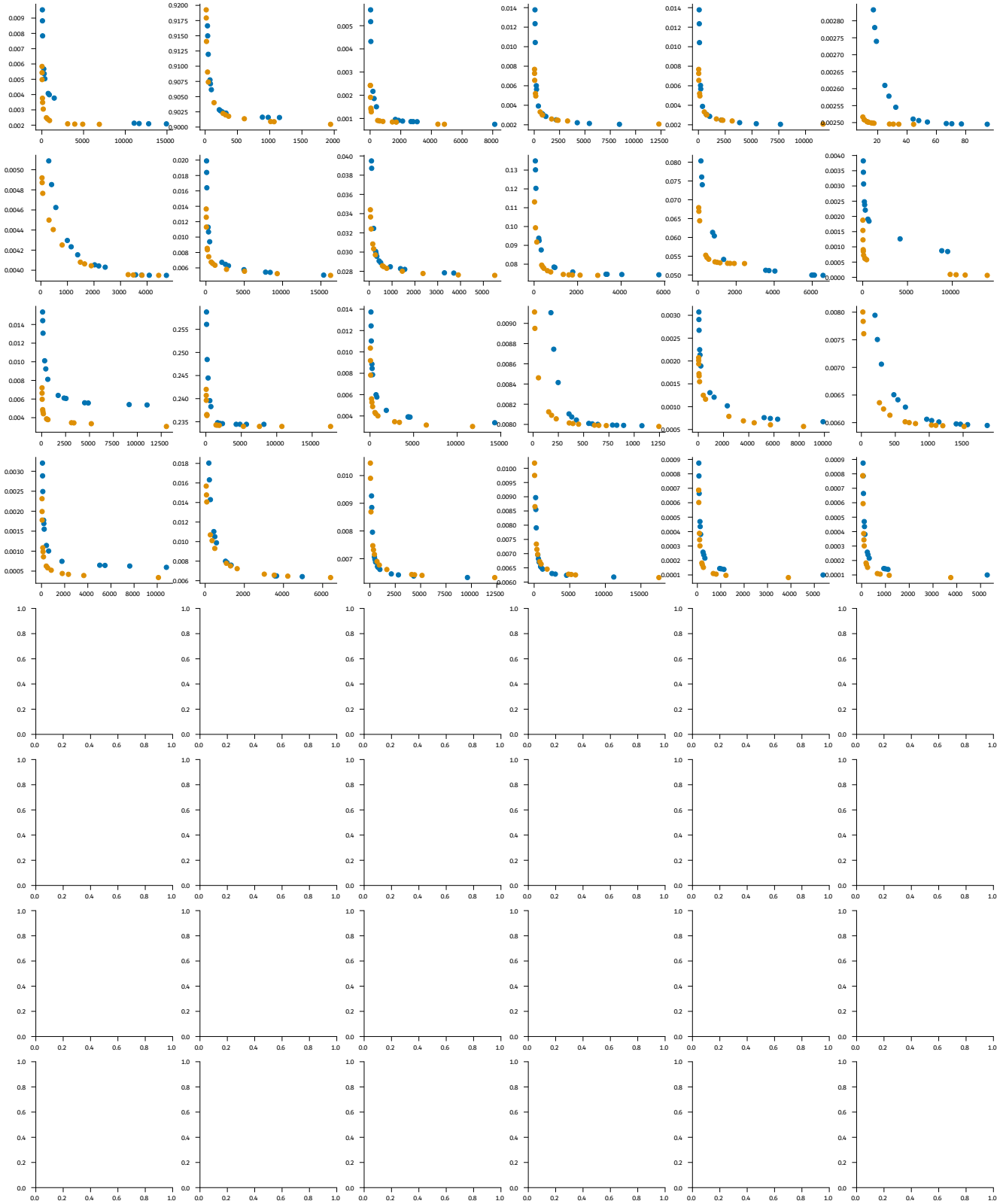

Figure 8: *Runtime (in seconds) of HARAP and the resulting ARAP energy. Curves show multiple data points at different convergence criteria.*