Purpose: Online adaptive replanning can decrease doses to organs-at-risk (OARs) by reducing target margins. However, the practice of the online replanning can be challenging for a site with complex anatomy, e.g., pancreas. The purpose of this work was to develop an effective replanning strategy that uses only changes in target and/or duodenum (the most important dose-limiting OAR), eliminating the need for delineating other OARs.

Methods and Materials: We previously reported a replanning method composed of a segment aperture morphing (SAM). In this work, we applied the SAM algorithm based on only the anatomic changes in (1) the target (pancreatic head), (2) target and duodenum, and (3) the duodenum, with the final aperture shape formed by prioritizing individual aperture shapes. The importance of a structure imposes specific penalties on leaf position deviations from their SAM values. For the scenario considering only duodenum, the apertures morphed based on duodenum and those based on target translations as in the repositioning process were properly prioritized. Daily CTs acquired during IGRT for representative pancreatic cancer patients using a respiratory gated CT-on-Rails (CTVision, Siemens) were used to test each scenario and compare with the current IGRT practice of repositioning.

Results:
Application of SAM with all 3 scenarios resulted in better dosimetric results compared to the repositioning plans and did not result in increased doses to other OARs (liver, kidneys, stomach, small and large bowel, cord), while the SAM algorithm based on duodenum and target resulted in lowest duodenum doses (upto 7% reduction in the mean duodenum dose as compared to the repositioning plans).

Conclusion: The approach of the online replanning based only on the changes in duodenum and/or target can yield improved dosimetry over the current IGRT repositioning for pancreas irradiation, and improves the practicality of the online replanning.