Purpose: The Inclined Beam Line (IBL) is an innovative partial gantry design which provides two beam angles at 30 and 90 degrees with full flexibility of the patient positioning system of the gantry design. Compared to the full gantry design in proton therapy, the IBL is a simplified design allowing for less equipment maintenance, physics quality assurance, and costs. The purpose of this study was to demonstrate that IBL provides sufficient choice of beam angles and efficient beam delivery to treat most proton lung patients.

Methods: Eight lung patients who had proton treatment at our center were selected for this study. We designed three treatment plans for each of the eight patients in supine position, using beam arrangements with (1) full gantry, (2) IBL, and (3) hybrid, i.e., a combination of a gantry plan and an IBL plan with the patients being treated with each plan in alternative days. Xio TPS (CMS, St. Louis, MO) was used to design treatment plans.

Results: We have compared the dosimetric differences of the three planning strategies. The PTV D95 was within 1% for all three plans for each patient. On average, the lung V20, V10, and V5 were 3.6%/3.7%, 5.1%/3.7%, and 5.1%/1.6% higher for the IBL plans than that for the gantry/hybrid plans, respectively. Cord max dose, esophagus dose, and heart dose showed similar trends. Among all eight patients, IBL plan was not able to meet cord dose limit for only one patient who was treated for right posterior chest wall.

Conclusions: Our results showed that seven out of the eight patients (88%) could be treated with full gantry, IBL, or hybrid plans with sufficient target coverage and reasonable critical structure sparing. Therefore, IBL was a sufficient proton treatment delivery method for most of the lung patients in this study.