Purpose:To describe the Beam matching of linear accelerators by using the dose, first and second derivative differences in space from the dose profiles and the Depth dose curves.

Methods:Mathematical functions were used for matching of the beams for two linear accelerators having same make, model. The first derivative of the profile or the Percentage Depth Dose (PDD) curve in space indicates the rate of dose deposition or the slope and second derivative is the rate of change of the slope or termed as curvature. The open, wedged profiles and the Percentage Depth Dose for 10×10 sq cm from the reference machine were considered as standard curves. Different errors were introduced to the standard curve e.g. 1%, 2%, 3% dose(vertical) error (DE) 1mm, 2mm, 3mm spatial (lateral) shift (SE) and a combination of dose and spatial error of 1%-1mm, 2%-2mm, and 3%-3 mm The difference with reference curve was evaluated in terms of dose difference (D), and its first (D`) and second (D``) derivative difference. Profile curves were subdivided in fall/rise and constant slope region, PDD in build up and constant slope region.

Results:: 70% of the open and wedge profiles were matched within 1% DE or 1% DE -1mm SE Band Width (BW). Rest of the profiles matches with higher error BW. The first and second derivative differences of PDD in the build up region match within 1% DE -1mm SE. In the monotonic decreasing part of PDD only dose error (DE) was compared, 97% (9 out of 283) values matches within 1.5mm DE -1.5% SE. Maximum variation in out put factor between two machine was 0.7%.

Conclusions:This approach useful for identifying the beam matching in the vicinity of high gradient region for profile and PDD curves. Here the slope or curvature difference is more significant than dose difference.