Purpose: To improve the performance monitoring capability of linear accelerators by applying a statistical process control (SPC) technique to daily quality assurance (QA). Extracted data from daily QA can yield information related to delivery performance.

Method and Materials: Daily QA data of 3 linear accelerators (Varian Trilogy, Varian EX, Elekta Precise) had been acquired by a Daily QA device (Sun Nuclear Co.) from July 2007 to present. The exported data from the Daily QA 3 was analyzed by an inhouse SPC developed using MatLab software. Acquired data from the Daily QA 3 were; absolute dose, flatness, symmetry, beam energy, and field size. In addition to this standard data, dose rate was deduced from the Beam On Time (BOT), recorded with 0.5 second resolution. The moving average (MA) and the exponentially weighted moving average (EWMA) techniques were applied to extract performance trends.

Results: The MA and the EWMA techniques strongly increased visibility of measured quantities. Specifically the variability of dose rate, which initially calculated with limited resolution of BOT, was drastically improved by these techniques. A trend of declining dose rate was evidenced by EWMA filtering, clearly identified a performance problem with one particular accelerator. Two dimension plots indicate dependencies (i.e. flatness vs. dose rate) not otherwise obvious.

Conclusions: This work demonstrates that the SPC is a powerful tool for efficient drift detection of QA data, especially compared with the low fluctuation indicated by low digital resolution. The SPC enables us to understand variability of QA data for performing real time feedback.