Effective Control Limits for Predictive Maintenance of Accelerator Beam Uniformity

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PdM: Beam Uniformity

[Diagram showing electron gun, steering coils, focusing coils, accelerating waveguide, and vacuum system.]

- Electron gun
- Steering coils
- Focusing coils
- Accelerating waveguide
- Vacuum system

[Diagram elements are connected to show the process flow.]
PdM: Beam Uniformity

- 3 Linacs were tracked for >15 months
- Mock intervention was initiated after SCC exceeded control limit
- Overall, results ranged from minimal change to no measurable change in beam uniformity
Controlled Experiment: Single SCC change vs Beam Uniformity

Based on experimental observations the control limits were reformulated.

Goal was to reduce false positive rate but ensure detection of 1% change in beam uniformity.

Alarm 1 = Subgroup > 6SD; Alarm 2 = 9 Subgroups in a row on either side of mean;
Alarm 5 = 2 out of 3 Subgroups > 2SD.
• 3 Linacs tracked for another 8 months with no limits exceeded
• Beam scanning confirmed no change in beam uniformity
• 1% intentional asymmetry results in control limit alarm
The reformulated upper control limit was exceeded on Sept 19 but the accelerator did not go down until Oct 3.
We are in the process of developing first generation software for a TrueBeam predictive maintenance program.

We plan to deploy software to a limited number TrueBeam sites in 2014.

Thank You!