Introduction: 3D dose verification of IMRT delivery is very time consuming. With the expectation of the increase uses of adaptive IMRT plans in the near future, one has to think about more efficient ways of performing IMRT QA. We are going to study the possibility of using a 3D diode array for routine treatment machine QA for IMRT delivery, and hope it can lead to less plan specific IMRT QA.

Method and Materials: The treatment planning system is Varian Eclipse, and the treatment unit is Varian Trilogy with 6MV and 10 MV photon beams. Sliding window technique is used for IMRT delivery. The 3D diode array is the Delta4 system from Scandidos. Delta4 has 1069 P type Si diodes on three wings, which are inserted to two planes in a cylindrical PMMA phantom.

 Four single beam plans (one open field, one wedge field with CAX almost parallel to one diode plane for each energy) and two IMRT plans (one typical head and neck with 6MV, and one typical prostate with 10 MV) are used to irradiate the Delta4 weekly. The data of first measurement is set as reference data, subsequence measurement is compared with it by using 2D isodose display, profile comparisons, percentage dose deviation, and DTA and Gamma index. The open field measurement checks the combination of output, PDD, and flatness and symmetry. The IMRT measurement checks the combination of the above parameters plus IMRT delivery at various gantry angles.

Results: Table 1 and Figure 1 to Figure 3 show some result of the measurements. The result of 10 MV prostate IMRT are comparable with those of single beams. The result of 6 MV IMRT is not as good, some days are much worse than others.

Discussion: As expected, the gamma index of 10 MV prostate plan and single beam plans are very good. The result of 6 MV head and neck IMRT plan show more variation, some gamma percentage is only about 80%. For one measurement with a 78.7% gamma percentage, it is interesting to notice that the profiles agree very well on one diode plane, but not so well on the other one (see figure 4). In the future, we will try to do more careful study to see if it is due to the setup error, diode system error or machine delivery error if the gamma percentage is less than 90%.

		6 MV open	10 MV open	6 MV wedge	10 MV wedge	6 MV IMRT	10 MV IMRT
Dose	Average	91.4	92.3	91.4	93.0	82.9	79.6
Deviation	SD	5.2	1.8	2.0	3.5	15.0	4.8
	Average	80.7	82.7	88.5	89.8	74.3	86.5
DTA	SD	6.1	4.5	1.7	3.9	13.3	2.9
Gamma	Average	97.0	98.0	98.0	98.3	91.5	97.9
	SD	1.6	1.1	0.6	1.4	9.3	1.1

Table 1 Percent of diodes with dose deviation of 3% or less, DTA of 3 mm or less, Gamma index of 1 or less.
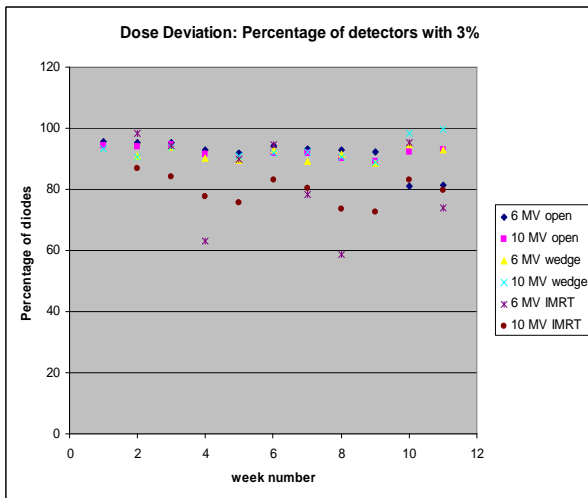

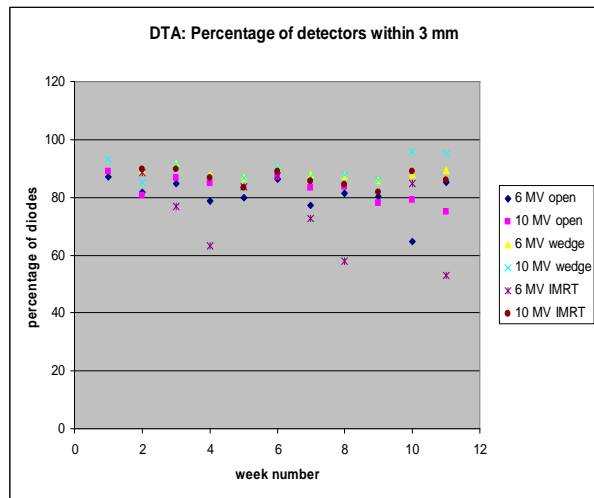Figure1. Percent of diodes with dose deviation of 3% or less.

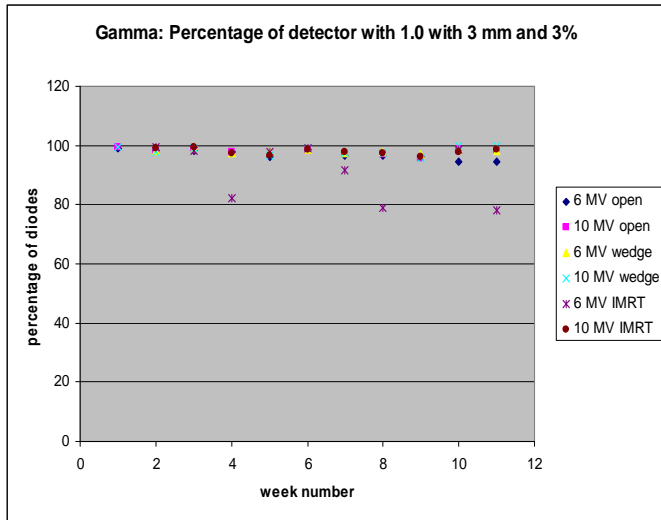Figure2. Percent of diodes with DTA of 3 mm or less.

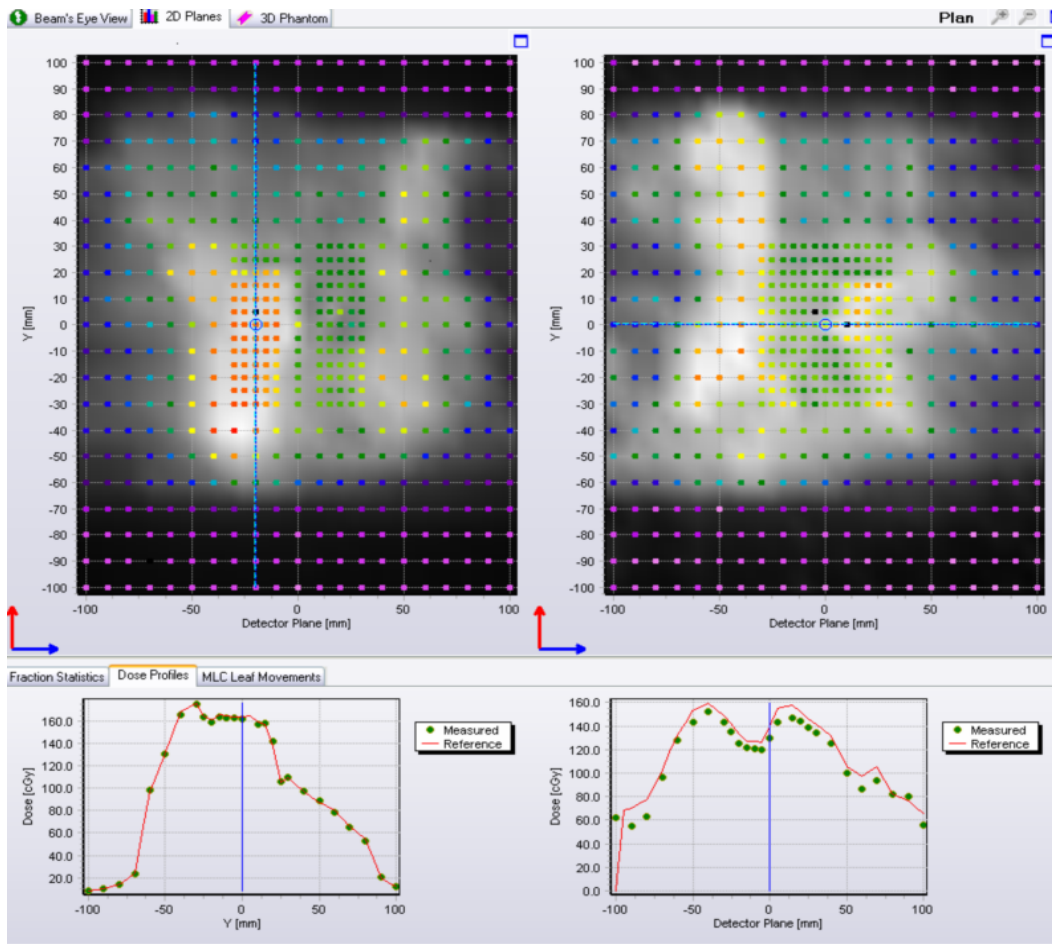Figure3. Percent of diodes with Gamma index of 1 or less.

Figure4. A screen capture of isodose and profile comparison of the 6 MV IMRT plan.