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Study of The Physical Properties of Different Wedge Modalities

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List of Abbreviations

Abbreviation:

AAA:	Anisotropic Analytic Algorithm.
CADD:	Central Axis Depth Dose.
CAX:	Central Along Axis.
CCCS:	Collapsed-Cone Convolution Superposition.
CCD:	Charge Coupled Device.
CL:	Confidence limit.
COF:	Center Of Field.
DW:	Dynamic Wedge.
DTA:	Distance to Agreement.
DVH:	Dose Volume Histogram.
EDWOF:	Enhanced Dynamic Wedge Output Factor.
EDW:	Enhanced Dynamic Wedge
EDWF:	Enhanced Dynamic Wedge Factor.
EPID:	Electronic Portal Imaging Device.
GSTT:	Golden Segmented Treatment Table.
GTV:	Growth Target Volume.
HDLG:	High Dose Low Gradient.
HDSDG:	High dose, small dose gradient.
HDLDG:	High dose, large dose gradient.
ICRU:	International Commission on Radiation Units and Measurements.
ICRP:	International Commission on Radiological Protection.

IEC: International Electrotechnical Commission.

IMRT: Intensity Modulated Radiation Therapy.

LDA: Linear Diode Array.

LDSDG: Low dose, small dose gradient.

MUs: Monitor Units.

MLC: Multileaf Collimator.

MW: Motorized Wedge.

MWF: Motorized wedge factor.

MC: Monte Carlo.

NWF: Normalized Wedge Factor.

NGSTT: Normalized Golden Segmented Treatment Table.

NAT: Normalized Agreement Test.

O.F: Output Factor.

OAR: Off-Axis Ratio.

OAF: Off- Axis Factor.

OAR: Organ At Risk.

OD: Optical Density.

PW: Physical Wedge.

PDD: Percentage Depth Dose.

PBC: Pencil Beam Convolution.

PWF: Physical Wedge Factor.

PC: Personal Computer.

PP: Parallel Plate.

PTW: Physician Technique Workstation. (Physikalisch-Technische Werkstätten)

PTV: Planning Target Volume.

PTA: Planning Target Area.

QA: Quality Assurance.

ROI: Region of Interest.

RTP: Radiotherapy Treatment Planning.

RGB: Red – Green - Blue.

SSD: Source to Surface – Distance.

SAD: Source to Axis – Distance.

SsIMRT: Step-and-Shoot Intensity-Modulated Radiation Therapy.

STT: Segmented Treatment Table.

SWD: Source to Wedge Distance.

SD: Standard Deviation.

TIFF: Tagged Image File Format.

TSD: Target to Surface Distance.

TPS: Treatment Planning System.

TLD: Thermoluminescence Detector.

UW: Universal Wedge.

VW: Virtual Wedge.

VWF: Virtual Wedge Factor.

WF: Wedge Factor.

WTF: Wedge Transmission Factor.

Abstract

The study objective was to investigate three wedge modalities physical and dosimetric properties using **6Mv** photon beam. This study included **3D Eclipse commercial TPS** (version **6.5.0**) and dose predicted according to clinical current calculation model {pencil beam convolution algorithm (**PBC**)} accuracy evaluation. All measurements were performed at three different radiation therapy machines, **Varian 600c** equipped with nominal **15°, 30°, 45° and 60°** physical wedges (**PWs**), **Elekta linac** with internal motorized wedge (**MW**) of angle range from **0° to 60°** and **Varian DBX** with **10°, 15°, 20°, 25°, 30°, 45° and 60°** enhanced dynamic wedges (**EDWs**). OFF-axis dose profiles were measured by **Profiler** and **Kodak x-omat V** films for up to **20x20 cm²** field sizes. Some measurements were performed with **0.125 cm³ CC13** chamber in **3D** water phantom for **60° MW** and **PWs**. Absolute dose measurements were carried out using **0.6cc** farmer chamber with **PTW** unidose electrometer. Central axis depth doses at depths down to **20cm** and for up to **20x20 cm²** field sizes were measured and verified by **Kodak X-omat V** films. Wedge factors were measured in **PMMA** phantom with **0.6cc** cylindrical chamber. Field factor was measured relative to **10x10 cm²** area and at **10cm** depth.

For **EDW** profiles, the obtained results by profiler were found to be in agreement with those calculated by **3D Eclipse TPS** with a $< \pm 1.5\%$ deviation. This was in good agreement with those obtained by films within $\pm 2\%$ except for hot spot and peripheral dose under the toe region where a $< \pm 1.5\%$ systematic underestimate dose was appeared. Similarly for **MW**, the deviation was **0.4%** within **80%** field width and **2.3%** outside. For **PW**, the deviation was $< \pm 1.5\%$ and the peripheral dose was slightly underestimated (a $< 2\%$ deviation). Three wedge modalities calculated **PDDs**, for different wedge angles, different field sizes and at depths down to **20cm** agreed with those measured within $\pm 2\%$. **EDW**