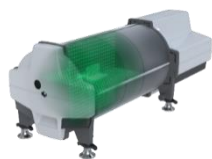


Delta⁴ Phantom+: Competitor analysis



	Delta ⁴ Phantom+	Wrapped 2D array	Rotating 2D array
Diode based	Yes	Yes	No, Ion chambers
Detector layout	One vertical and two horizontal 2D plates form a + shaped 3D configuration with the highest density of detectors gathered in the isocenter. Plates are 20x20 cm with the central 6x6 cm having a doubled density of detectors.	Detectors consist of a 2D array wrapped in a cylinder. Distribution is with a helical shape with 1 cm distancing.	Interchangeable 2D array that follow the gantry angle with the help of an inclinometer.
Measurement in user selected region, mainly around the isocenter	Yes	No, only entry and exit dose	Yes, but only one plane. Subject to added uncertainty due to rotation (up to 1 sec delay between gantry motion and phantom).
Inner detector resolution	5 mm	None	Depends on detector plate used. 7,1 mm with 1500 detector plate, no higher density area 2,5 mm with 1600 SRS detector plate
Peripheral detector resolution	10 mm	10 mm	7,1 mm with 1500 detector plate, no higher density area 5 mm with 1600 SRS detector plate
Measurement area size	20 x 20 cm	21 x 21 cm	27 x 27 cm with 1500 detector plate, 15 x 15 cm with 1600 SRS plate
Suitable for SRS	Yes, central 6x6 cm has 5mm resolution. Merging measurements can increase resolution extra in z-direction.	No, detector spacing is 1cm over entire measurement area. No measurements in central region.	Yes, if used with SRS detector plate – extra cost since this plate is too small for normal fields (15x15 cm), so clinic needs both
No re-calibration	Calibrated at factory and no re-calibration needed - ever	Needs re-calibration every 1-3 years (at customer site)	Array needs re-calibration, recommended to be done each year (at PTW Germany, takes around 2 months)
Warm up time	Can measure instantly	No	Yes, few minutes including calibration measurements that is recommended to be performed 3-4 times to stabilize (can be done once too, matter of preference).

Instant results after beam off	Yes	No, post processing and a lot of mouse clicks to get to relevant results	No, a lot of mouse clicks to get to relevant results
Completely wireless	Yes, phantom is connected by wifi to a router in the bunker and is battery powered. Bunker router is connected with a network cable to control room/measurement computer. MR version needs 2 cables. Network and power.	No, a cable between the phantom and connection interface device in the measurement computer/control room. From the interface there are 2 cables, one usb to computer and one power cable	No, 3 or more heavy cables to connect (see video on PTW website), can get tangled/damaged from the twisting
Calibration at every use session	No, not necessary. If preferred, one or more square fields can be irradiated to correct for daily output variations of the linac.	Yes, one minute procedure	Yes, static field to be delivered 3-4 times.
Automatic temperature correction per detector	Yes, each diode measures its own temperature	No	No
Inclinometer needed	No, Measurements per pulse together with software eliminates need. But can be used if desired.	No, entry/exit dose system can compute angle.	Yes, needed for detector to be able to follow gantry
Pulse-by-Pulse Measurement	Yes, Delta4 is unique in that it measures each dose pulse with a resolution of 50 nGy, completely capturing the dose and allowing for very high dose rates to be measured without add-ons to the system. Other systems without this capability miss some elements of the dose and therefore do not give sufficient accuracy.	No	No
Room for inserts	Ion chamber insert. No film insert or imaging inserts. Custom quarter for accuracy ball cube insert – this can in principle hold other inserts and film, but not anything provided by Delta4.	Multiplug insert can hold film cassette and tissue equivalent inserts for HU testing. Cavityplug can hold detectors such as ion chambers or change cavity material to solid.	Yes, different phantom tops for large or small body parts. Phantom insert plates for PTW detectors.
Merge function for long measurements or small fields	Yes, infinite number of measurements can be merged	Yes, two measurements can be merged	Yes, two measurements can be merged for longer fields
MR only: Iso center at 14 cm above tabletop – the isocenter height of Elekta Unity	Yes	No	No