CLAIMS

1. An irradiation device using ionizing radiation, including for radiotherapy and/or radiobiology, simultaneously comprising at least:

a means for emitting ionizing radiation (MER) comprising:

at least one particle source which comprises at least:

a cathode and an anode, or a plasma,

a means for triggering particle emission, and

a means for accelerating a particle beam, and

a system for power pulse control,

an ionizing radiation dose detection means (DDM) comprising a detector,

a dose control means (DCM), configured to control triggering and stopping of the means for emitting ionizing radiation (MER), comprising:

control electronics (CE),

an amplifier and/or an attenuator amplifying and/or attenuating a signal emitted by the detector,

an integrator integrating, during a time of particle emission, said amplified and/or attenuated signal into an integrated signal, and

a comparator continuously comparing said integrated signal to settings for a specified dose (SAD) predetermined by an operator,

a control and actuating system (CAS) comprising:

a system for functional control (SFC) of members of said irradiation device, comprising:

a man-machine interface (MMI),

viewing tools, and

implementation means configured in order for the operator to program, at a single time, a nature of the radiation, an absorbed dose rate of ionizing radiation, a duration for the emission of the ionizing radiation, and the pulse settings,

wherein said means for emitting ionizing radiation (MER), said ionizing radiation dose detection means (DDM), said dose control means (DCM) and said control and actuating system (CAS), are configured for delivering and controlling doses of ionizing radiation of at least 0.01 Gy with an accuracy of at least 1 µGy at energies comprised between 1 MeV and 50 MeV, for times comprised between 0.1 µs and 100 ms,

wherein the system for power pulse control of the means for emitting ionizing radiation (MER) is configured for producing a particle beam of ionizing radiation, of energy in a range comprised between 1 MeV and 50 MeV, pulsed at a frequency (f) comprised between 5 Hz and 1000 Hz, with a pulse duration (d) of at least 1 ns, and for delivering an absorbed dose rate of at least 0.01 Gy/s,

wherein the control electronics (CE) of the dose control means (DCM) is configured for controlling a dose delivered for at least 0.1 µs, and

wherein the detector is an ultra-fast detector, coupled to a dose control means (DCM), configured to detect a dose of ionizing radiation in at least 0.01 ns and at dose rates of at least 0.01 Gy/s.

2. The irradiation device using ionizing radiation according to claim 1, wherein the means for emitting ionizing radiation (MER) is a particle accelerator comprising a power source and a pulse control system, said pulse control system being directly linked to the dose control means (DCM) so as to automatically stop the power source when the absorbed dose, detected and measured, has attained a value specified and predetermined by the operator via the man-machine interface (MMI), said man machine interface (MMI) further comprises a command station (CS) and a viewing interface management program.

3. The irradiation device using ionizing radiation according to claim 1, wherein the means for accelerating a particle beam is a microwave frequency acceleration means.

4. The irradiation device using ionizing radiation according to claim 1, wherein the means for emitting radiation (MER) further comprises plural of said means for accelerating a particle beam mounted in series and/or interleaved with means for deviation or recirculation of the particle beam through the plural means for accelerating a particle beam, each being supplied by at least one power source.

5. The irradiation device using ionizing radiation according to claim 1, wherein the detector is a semiconductor, diamond in monocrystalline or polycrystalline form, pure or doped, comprised between two polarization electrodes at terminals of which is applied a potential of plural volts adjustable according to a thickness of the detector via the man-machine interface, and is configured to obtain a response time of at least 0.01 ns, at high dose rates of at least 0.01 Gy/s.

6. The irradiation device using ionizing radiation according to claim 1, wherein the control electronics (CE) of the dose control means (DCM) comprises means for measuring electric current, of an electrical signal, produced by the interaction of the ionizing radiation with the detector, means for converting said electric current into absorbed dose rate units and means for integrating said electric current that are configured to accurately measure the absorbed dose accumulated during the emission of the ionizing radiation.

7. The irradiation device using ionizing radiation according to claim 1, wherein an electrical signal is produced by the detector, said electrical signal is measured and integrated by an electrometer during the emission of the ionizing radiation, the integrated value of said electrical signal is directly compared to the value of the dose specified and predetermined by the operator via the man-machine interface such that, as soon as the integrated value is greater than or equal to the specified and predetermined value, the signal of the means for triggering particle emission is interrupted to instantaneously stop the emission of the ionizing radiation, and preferably the high voltage source, in at least 1 ns.

8. The irradiation device using ionizing radiation according to claim 1, wherein the detector comprises at least one of the group consisting of quadrants, sectors, and voxels, each producing a detection signal (ADS) and configured to enable information to be deduced, from the detection signals (ADS), characterizing a position, a shape, and an energy of the ionizing radiation beam which passes through them, and furthermore so as to control and regulate the ionizing radiation beam, including the position, the shape and the energy of the ionizing radiation beam.

9. The irradiation device using ionizing radiation according to claim 1, wherein the detector comprises at least one of the group consisting of quadrants, sectors, and voxels, each producing a detection signal (ADS) and configured to enable information to be deduced, from the detection signals (ADS), characterizing at least one of the group consisting of a position, a shape, and an energy of the ionizing radiation beam which passes through them, and furthermore so as to control and regulate the ionizing radiation beam, including the at least one of the group consisting of the position, the shape and the energy of the ionizing radiation beam.

10. The irradiation device using ionizing radiation according to claim 1, wherein the means for triggering particle emission includes a grid, an electrode, or a laser.

11. The irradiation device using ionizing radiation according to claim 1, wherein the means for accelerating a particle beam is induction based.

12. The irradiation device using ionizing radiation according to claim 1, wherein the means for accelerating a particle beam is electrostatic based.

13. The irradiation device using ionizing radiation according to claim 1, wherein the detector is a semiconductor, comprised between two polarization electrodes at terminals of which is applied a voltage potential adjustable according to a thickness of the detector via the man-machine interface, and is configured to obtain a response time of at least 0.01 ns, at high dose rates of at least 0.01 Gy/s.

14. The irradiation device using ionizing radiation according to claim 1, wherein the means for emitting radiation (MER) further comprises plural of said means for accelerating a particle beam and means for deviation or recirculation of the particle beam through the plural means for accelerating a particle beam.