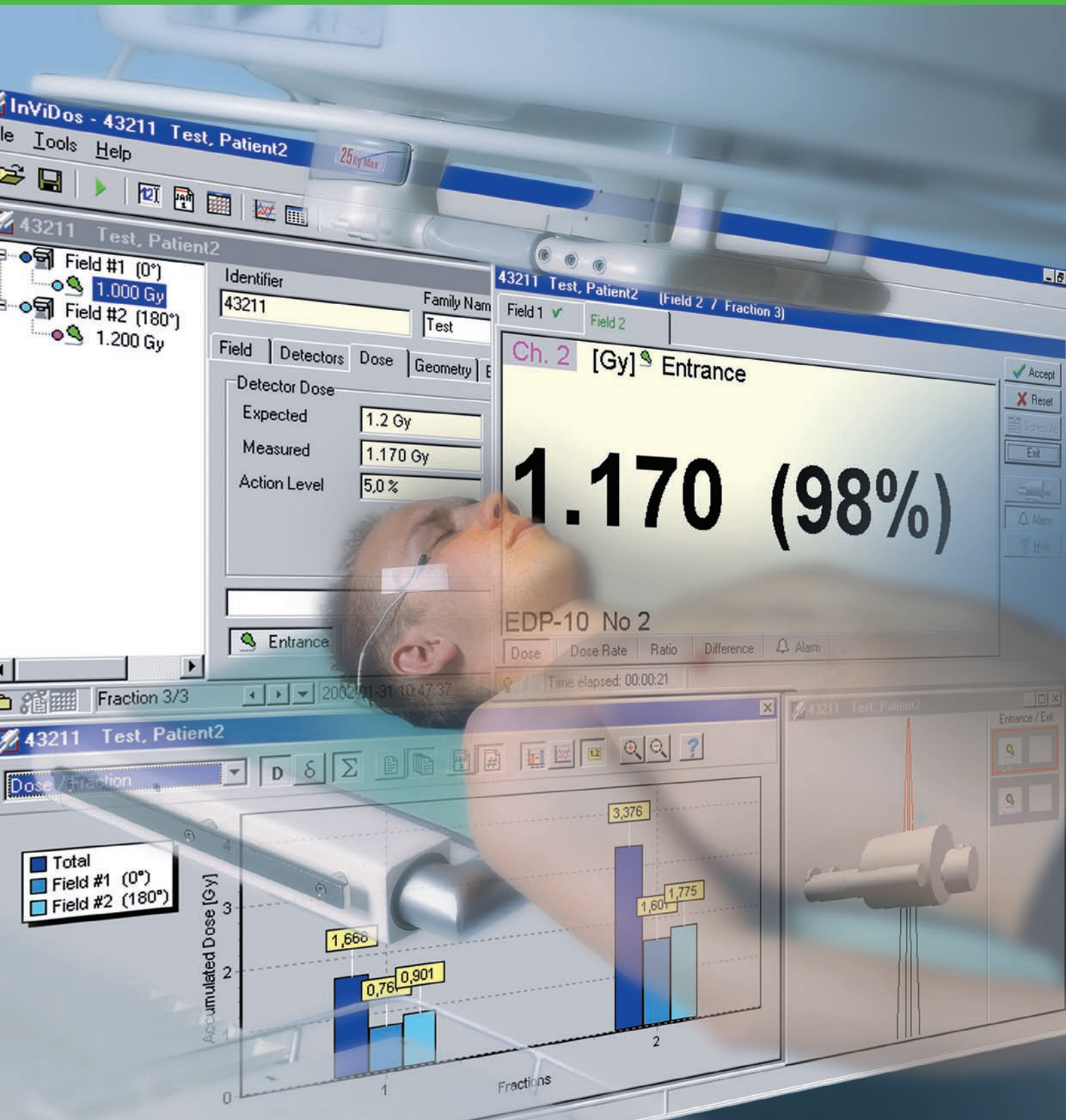
In Vivo Dosimetry

The fastest, most accurate and most reliable system



In Vivo treatment verification

- **Calibration Wizard in OmniPro-InViDos guides through new detector set-up**
- **User definable templates**
- **Low recalibration frequency of the detectors**

- **Independent patient database simplifies patient selection**
- **Several presentation formats of data per field, per fraction, accumulated dose, etc.**
- **Detectors continue to measure accurately even after 200 kGy of absorbed dose**

- **Verification of treatment and delivered dose by detecting systematical and stochastic errors in radiation therapy**
- **Detector calibration automatically performed in OmniPro-InViDos**
- **3 years detector warranty**

FASTest
mostACCURATE
mostRELIABLE

The rapid development of advanced treatment techniques and planning places higher demands on the verification of the dose delivered to the patient. In Vivo Dosimetry is an essential element in the quality assurance program used in today's radiotherapy department. In several European countries In Vivo Dosimetry has become mandatory, based on the directive "Medical Exposure Directive 97/43/Euratom", which recommends that In Vivo Dosimetry is performed.

Furthermore In Vivo Dosimetry is used to control the total accumulated dose in cases where the treatment planning system is less accurate, such as in total body irradiation (TBI), in the build-up region and in risk organs in the head and neck region.

Efficient management system for all tasks of In Vivo Dosimetry

OmniPro-InViDos is a dosimetry management system which handles all tasks of In Vivo Dosimetry. It simplifies the use of In Vivo Dosimetry by giving the user an overview of the calibration, together with tools to perform the calibration in an efficient way and by automatically selecting correction factors for each field. OmniPro-InViDos provides instruments for improving the accuracy of the treatment whilst reducing the time spent for In Vivo Dosimetry. It may be linked to the verification and therapy system, either locally on the same PC as the verification system, or via the internal network.

Control, display and calculation of the dose

OmniPro-InViDos gives the user control over the dose in each fraction and the cumulative dose to the patient. It keeps track of the entrance and exit dose to risk organs. For multiple field treatment OmniPro-InViDos monitors the entrance and exit dose for each field calculating the dose in the target volume. A detector that is used for entrance dose measurements is automatically reconfigured for exit dose measurements when applying two opposite fields.

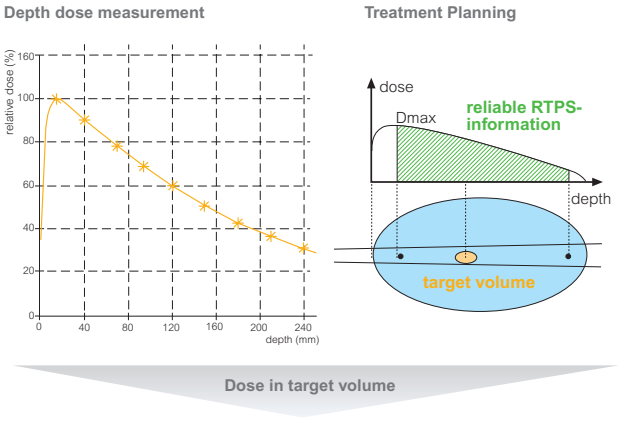
The dose can be displayed as the dose in Dmax or as the calculated dose in the prescription point. The dose can either be calculated from entrance/exit dose measurements or by using the TPS calculated relation between Dmax and the prescription point. This provides the user with essential information about the currently delivered dose and the accumulated dose from multiple fields.

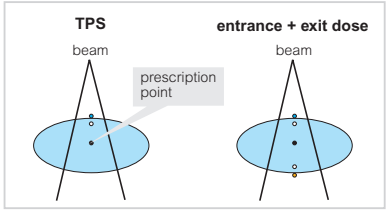
The data can be presented in several formats:

- Per field in the calibration point
- Per fraction in the prescription point
- Accumulated dose and biological effect
- Required dose in the next fraction with respect to the biological effect

The patient database can be used to generate reports of the patient history and the dose received. OmniPro-InViDos can list all measurements of different patients performed within a defined period of time, providing a measurement overview.

Dose calculation in the prescription point:





Integration with record and verification systems

OmniPro-InViDos seamlessly integrates the techniques used for In Vivo Dosimetry with the daily used record and verification systems. Due to the direct and continuous communication it saves time by providing:

- Automated set-up
- Correct mapping of patient data and dosimetry system data
- Information about the patient ID, fields and fractions; the treatment device that is used only needs to be entered once
- Automated selection of the correct dosimetry set whenever a treatment schedule is changed in the verification system
- Network solution that allows transfer of the patient to another machine without need of redefining the dosimetry set-up
- Import of patient data from all record and verification systems via RTP Link or RTPConnect (e.g. Lantis/Impac)

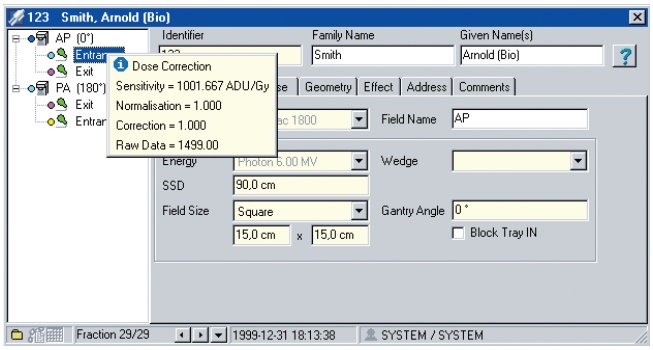
In addition to that the daily output calibration of the Linac or data from TLD can be used and an import from Multi-ACCESS without requiring access to the Multi-ACCESS system is possible. Optionally an export to VISIR directly after completed measurement of a single field is available.

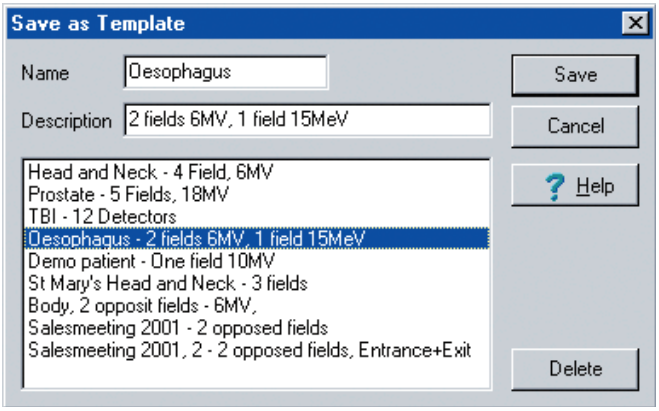
Fast and easy set-up

OmniPro-InViDos has all information about the instrumentation used and their calibration. This ensures that all data is consistent in the system even if a patient is transferred to another treatment room or if a detector is changed.

Furthermore it offers:

- Independent patient database for the therapist to simply select the patient; when connected to the verification system, the selection is done automatically
- Similar treatments can use a similar dosimetry set-up: the use of templates makes it very easy to define which measurements shall be performed and the typical instrumentation to be used
- Scheduling of measurements; if an additional measurement is done this is easily added to the scheme
- Graphic outlining of the placement of each detector on the patient, to ensure that the measurements are done at the correct position

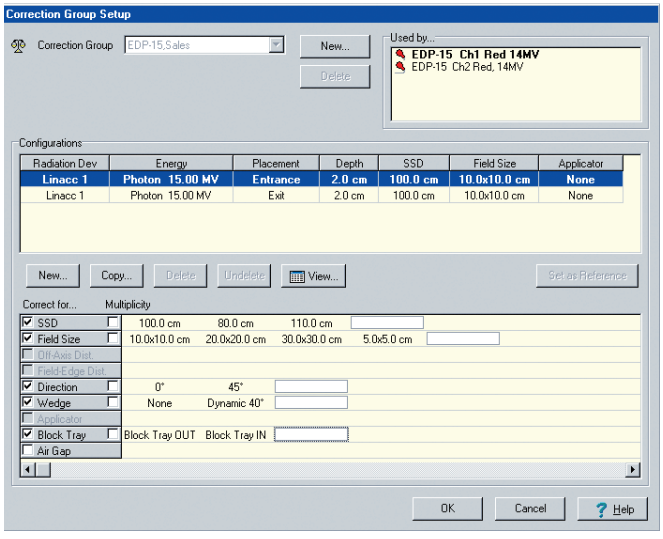




Calibration wizard

A calibration wizard optimizes the calibration and provides the user with an overview of the process together with tools to perform the calibration:

- Administration of correction factors by the system
- Automatic selection of correction factors for each field
- Guided calibration process when a new detector is used
- In case of a multi-modality machine, the use of correction factor multiplicity considerably reduces the number of calibrations
- Possibility to choose the order of calibrations to perform
- When the accumulated dose received by the detector exceeds a predefined level, a recalibration is suggested by the system
- The need for recalibration is minimized by dividing the calibration set into correction and sensitivity
- When the correction factors for energy, field size, SSD, etc. have been measured, it is sufficient to make a sensitivity recalibration of the detectors on a regular basis



Electrometers

OmniPro-InViDos supports the DPD-3 and DPD-12 (emX), and it can even use 2 emX in cascade to increase the number of detectors simultaneously used p to 24. OmniPro-InViDos also supports the former model DPD-510.

Detectors

Any In Vivo detector from IBA Dosimetry can be used with the OmniPro-InViDos system. The calibration wizard and automatic correction set selection is specially designed to handle our 3G-*p*Si detectors.

The In Vivo patient dosemeter

Together with the wide range of renowned high quality 3G-*p*Si detectors, the DPD-3 system can handle a variety of treatment situations: entrance dose, exit dose, risk organ monitoring and intracavitary dosimetry in brachytherapy.

The DPD-3 is a 3-channel electrometer system. Typically, two of the channels are used for photon and electron energies and the third for risk organ monitoring.

The DPD-3 is designed for ease of use, particularly in routine situations. Clinics demanding a high accuracy can define up to 99 correction factors which correct for different physical conditions in varying measurement situations. Commonly used functions such as selection of correction factors, printing results and electrometer reset are accessed through separate, clearly marked keys. A large LCD display for each channel is easily readable from a distance.

The electrometer works as a stand-alone system but also comes standard with a serial communication port for control from a personal computer.

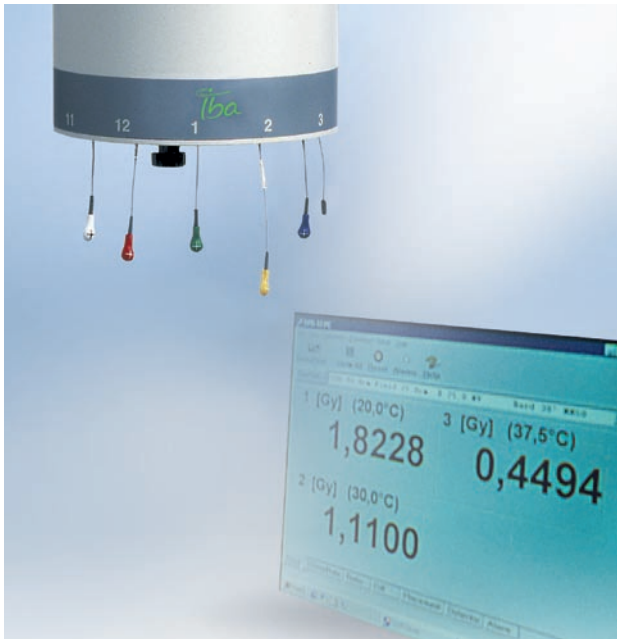
To allow high precision measurements with a minimum of work load, the calibration factor has been divided into a sensitivity factor correlated to the detector sensitivity and a correction factor.

When a recalibration has to be done due to change in detector sensitivity, only the corresponding sensitivity factor has to be updated. The user defined correction factors can be used unchanged.

The In Vivo patient dosimetry system

The DPD-12*pc* system consists of two products, the DPD-12 channel electrometer and the application software DPDpc, an alternative to the OmniPro-InViDos dosimetry management system.

With twelve channels, the system is ideal for a wide variety of applications such as entrance and exit dose measurements, risk organ monitoring, TBI and intracavitary measurements in both, teletherapy and brachytherapy.



DPD*pc* – user friendly software

- Intuitive graphical user interface
- Select measure mode with one mouse click (dose, dose rate, difference or ratio)
- Easy access buttons for frequently used functions (save/print, alarm on/off, reset electrometer, etc.)
- Quick toggle between display of active channels or all channels
- Individual alarm levels for each channel
- Unlimited number of correction and alarm sets
- Password protected calibration data
- Separate handling of corrections and sensitivity calibration
- Wizard for calibration process:
  - Use MU or reference detector as dose reference
  - Calibrate one or several detectors at the same time
  - Unlimited number of cycles for mean value calculation

The In Vivo 3G-*p*Si detectors

The IBA Dosimetry 3G-*p*Si detectors are designed to facilitate the implementation of a fast and accurate In Vivo Dosimetry routine.

- Proven long-term stability
- Low recalibration frequency
- Dose rate independence

- Build-up caps:
  - optimized for low field perturbation
  - minimized field size and directional dependencies
  - reduce the need for corrections
  - low temperature dependence

Application area	Photons	Electrons	Cobalt
Entrance dose, few corrections	EDP-10^{3G} (4-8 MV) EDP-15^{3G} (6-12 MV) EDP-20^{3G} (8-16 MV) EDP-HL^{3G} (16-25 MV) [1]	EDD-2^{3G} EDP-5^{3G}	EDP-5^{3G} (1.25 MeV)
Total body irradiation (TBI)	EDD-5^{3G} [2]	–	–
Entrance dose, low field perturbation	EDD-2^{3G} EDP-HL^{3G} (16-25 MV)	EDD-2^{3G}	EDD-2^{3G}
Exit dose	EDD-2^{3G}; any detector can be used	–	EDD-2^{3G}
Risk organ monitoring, measurements outside the field	EDD-5^{3G}	EDD-5^{3G}	EDD-5^{3G}
Intracavitary (Teletherapy) **Brachytherapy**	IDF-1^{3G} IDF-1^{3G} (e.g. rectum) IDF-3 (e.g. rectum) IDF-5 (e.g. rectum) IDF-thin (e.g. bladder)	–	–

[1] High energy, low perturbation; can be used up to 25 MV.
[2] When using spoiler (build-up), otherwise same recommendations as entrance dose, few corrections.

Detector	Application area build-up	Water equivalent	Sensitivity decrease measured at 250 Gy
EDD-2^{3G} (grey)	entrance dose, few corrections, low field perturbation, low directional dependence, exit dose	2 mm	<1% (less than the meas. accuracy) in ^{60}C
EDD-5^{3G} (black)	risk organ monitoring, TBI, low directional dependence, exit dose	5 mm drop shaped encapsulation	<1% (less than the meas. accuracy) in ^{60}Co
EDP-5^{3G} (blue)	entrance dose, few corrections, exit dose	5 mm	<1% (less than the meas. accuracy) in ^{60}Co
EDP-10^{3G} (green)	4-8 MV (Photons), entrance dose, few corrections, exit dose	10 mm	<1% (less than the meas. accuracy) at 5 MV
EDP-15^{3G} (red)	6-12 MV (Photons), entrance dose, few corrections, exit dose	15 mm	<1% (less than the meas. accuracy) at 6 MV
EDP-20^{3G} (yellow)	8-16 MV (Photons), entrance dose, few corrections, exit dose	20 mm	1.2% at 15 MV
EDP-HL^{3G} (white)	16-25 MV (Photons), entrance dose, few corrections, low field perturbation, exit dose	14 mm	4% at 21 MV
IDF-1^{3G}	4-12 MV, intracavitary (teletherapy), brachytherapy, external beam 12-16 MV, intracavitary (teletherapy), brachytherapy, extern. beam	–	<1% (less than the meas. accuracy) at 5 MV, 1.2 % at 15 MV
IDF-3	brachytherapy (e.g. rectum)	–	
IDF-5	brachytherapy (e.g. rectum)	–	
IDF-thin	brachytherapy (e.g. bladder)	–	

A 3-year warranty is standard on all detectors. This guarantees high usage capability at low lifetime costs and demonstrates the unsurpassed accuracy and life expectancy of these detectors.

Accessories

Detector support

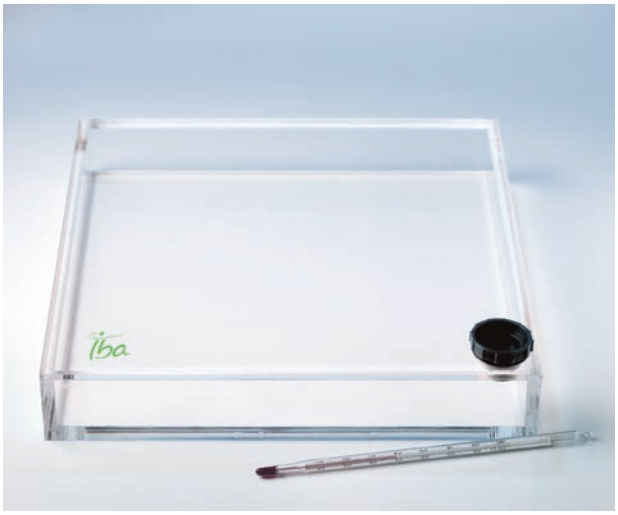
The detector support with automatic detector retraction is a significant time saving device. Additionally, it provides a safe, tangle free environment for the detectors when not in use. It can be configured with all available detector cable lengths.

The mechanics allow a detector to be pulled out to any length up to 3.50 m at constant force. The cable locks into position by simply moving it towards the central axis of the support and retracts automatically when it is moved out from the centre.

Additionally, the support has an integrated numerical index which clearly identifies each detector, thus helping to ensure that the correct detector is chosen for a given procedure.

Temperature calibration phantom

Since the temperature dependency of 3G-*p*Si detectors is stable, only a few corrections are required. However, an easy way to handle the correction process is to use the calibration phantom, which allows the user to calibrate the detectors at skin temperature, thus eliminating the need for later corrections. To achieve skin temperature the phantom should be filled with 40° water. The water temperature may be checked with the accompanying thermometer.



Technical specifications

OmniPro-InViDos

Processor:	Pentium® (or equivalent), 166 MHz or more
Random access memory:	minimum 32 MB of RAM, recommended 96 MB or more
Free disk space:	minimum 50 MB
Serial port:	RS-232, for electrometer communication
Screen resolution:	minimum 800 x 600 pixels and 256 colours
System software:	Windows® 98, NT, XP or 2000
Drivers:	OpenGL
	Additional requirements for Visir: VISIR version 1.3A or later, SYBASE ODBC driver

Electrometers

	DPD-3	DPD-12 (emX)
Input channels:	3	12 (24 in cascade)
Range dose:	9.999 Gy	14 Gy
Range dose/rate:	0.3-19.99 Gy/min (Above range is valid for a typical detector response of 30 nC/Gy)	0.3-20 Gy/min
Accuracy:	better than 0.3% (zero drift compensated)	better than 1% (zero drift compensated)
Connectors:	3 x BNC	37 pin D-sub
Cable:	3 x 20 m BNC-BNC	15 m RS-232, 10 m detector cable
Front display:	yes	no
Interface:	RS-232	RS-232
Regulatory requirements:	European MDD93/42 EEC (Annex II, Class IIb)	European MDD93/42 EEC (Annex II, Class IIb)
Standards:	IEC 60601-1 IEC 60601-1-2 IEC 60601-2-9	EN 60601-1 EN 60601-1-2 EN 60601-2-9

Temperature calibration phantom, external detectors

Size:	295 mm (L) x 295 mm (W) x 50 mm (H)
Material:	PMMA
	including 1 thermometer

Sensitivity calibration phantom, intracavitary detector

Size:	200 mm (L) x 200 mm (W) x 220 mm (H)
Material:	PMMA, 10 mm
Weight:	2.3 kg

Detector support

Size:	1080 x Ø 250 mm
Weight:	21 kg (26 with cables)
Number of mountable detectors:	12 (cables to be included)
Mounting console:	(to be used when ceiling is higher than 3 m)
Adjustable length:	200 – 1000 mm
Weight:	14 kg (full length)

3G-*p*Si detectors, general specifications

Sensitivity:	25 nC/Gy
SVWT:	0.25 ± 0.10%
Diameter:	2.0 mm
Cable length:	4 m (2 m on request)

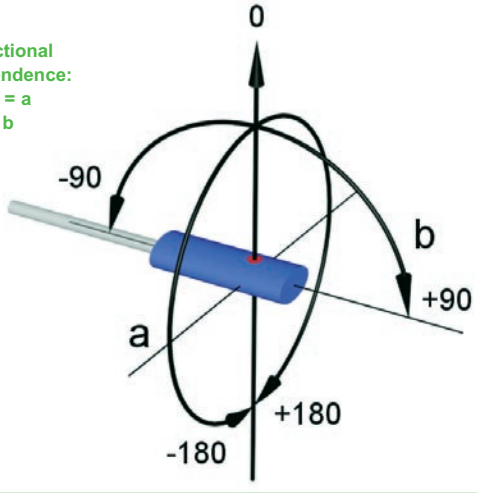
External detectors

	EDD-2[3G]	EDD-5[3G]	EDP-5[3G]	EDP-10[3G], -15[3G], -20[3G]	EDP-HL[3G]
Build-up material/ encapsulation:	Epoxy and Si	PVC, epoxy and Si	Polystyrene and epoxy	Stainless steel and epoxy	Tanthal
Perturbation, typical values at 5 cm depth in recommended energy:	1%	–	3%	5-6%	1.5%
Directional dependence, max. values within ± 45° in recommended energy:	axial < 2% tilt < 3%	axial < 2% tilt < 3%	< 2%	< 2% 30°	< 6% within
Sensitivity decrease per 250 Gy:	< 1% in ^{60}Co	< 1% in ^{60}Co	< 1% in ^{60}Co	< 1% at 5 MV (EDP-10[3G]) < 1% at 6 MV (EDP-15[3G]) < 1.2% at 15 MV (EDP-20[3G])	4% at 21 MV
Physical dimensions:					
width	8 mm	5 mm	12 mm	12 mm	12 mm
thickness	3.5 mm	11.5 mm	6.5 mm	6.5 mm	6.5 mm

Intracavitary detectors

	IDF-1[3G]	IDF-3	IDF-5	IDF-thin
Application:	Teletherapy	Brachytherapy	Brachytherapy	Brachytherapy
Build-up material/ encapsulation:	PVC, epoxy, plastic	PVC, epoxy, plastic	PVC, epoxy, plastic	FEP, epoxy
Directional dependence,				
– a* (radial) within ± 180	– < 3%	– < 3%	– < 3%	– < 3%
– b* (axial) within ± 30 in 5MV:	– < 5%	– < 5%	– < 5%	– < 5%
Physical dimensions:				
diameter	7 mm	7 mm	7 mm	3 mm
length	260 mm	260 mm	260 mm	450 mm
No. of diodes:	1	3, resolution 20 mm	5, resolution 20 mm	1

Directional dependence:
axial = a
tilt = b



Technical data is subject to change without prior notice.

IBA activities in a nutshell

IBA delivers solutions of unprecedented precision in the fields of cancer diagnosis and therapy. The company also offers sterilization and ionization solutions to improve the hygiene and safety of everyday life.

Diagnostics
IBA has unique expertise in the design of cyclotrons and in the production and distribution of radiopharmaceutical tracers which are used every day in hospitals to quickly and accurately detect cancer, neurological and cardiac diseases. IBA also offers dosimetry products used in many hospitals for quality assurance in X-Ray diagnosis and for patient-dose monitoring

Therapy
IBA has developed Radiotherapy solutions and dosimetry equipment to treat cancer with the greatest accuracy. IBA is the undisputed leader in Particle Therapy, acknowledged to be the most precise and effective clinical radiotherapy method in the selective destruction of cancer cells.

Sterilization & Ionization
IBA designs electron accelerators and high power X-Ray solutions used in many industries to sterilize medical devices, to cold pasteurize food products and to improve polymer properties. Over 250 IBA Industrial accelerators are used in the world today, some for more than 40 years.

IBA a Belgian company, is listed on the paneuropean stock exchange EURONEXT and its Annual Reports can be downloaded on the Website: www.iba-group.com.

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