

# EPR Dosimetry – Traceable and high sensitive Alanine dosimetry with individually packed pellets

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## Pellet formulation:

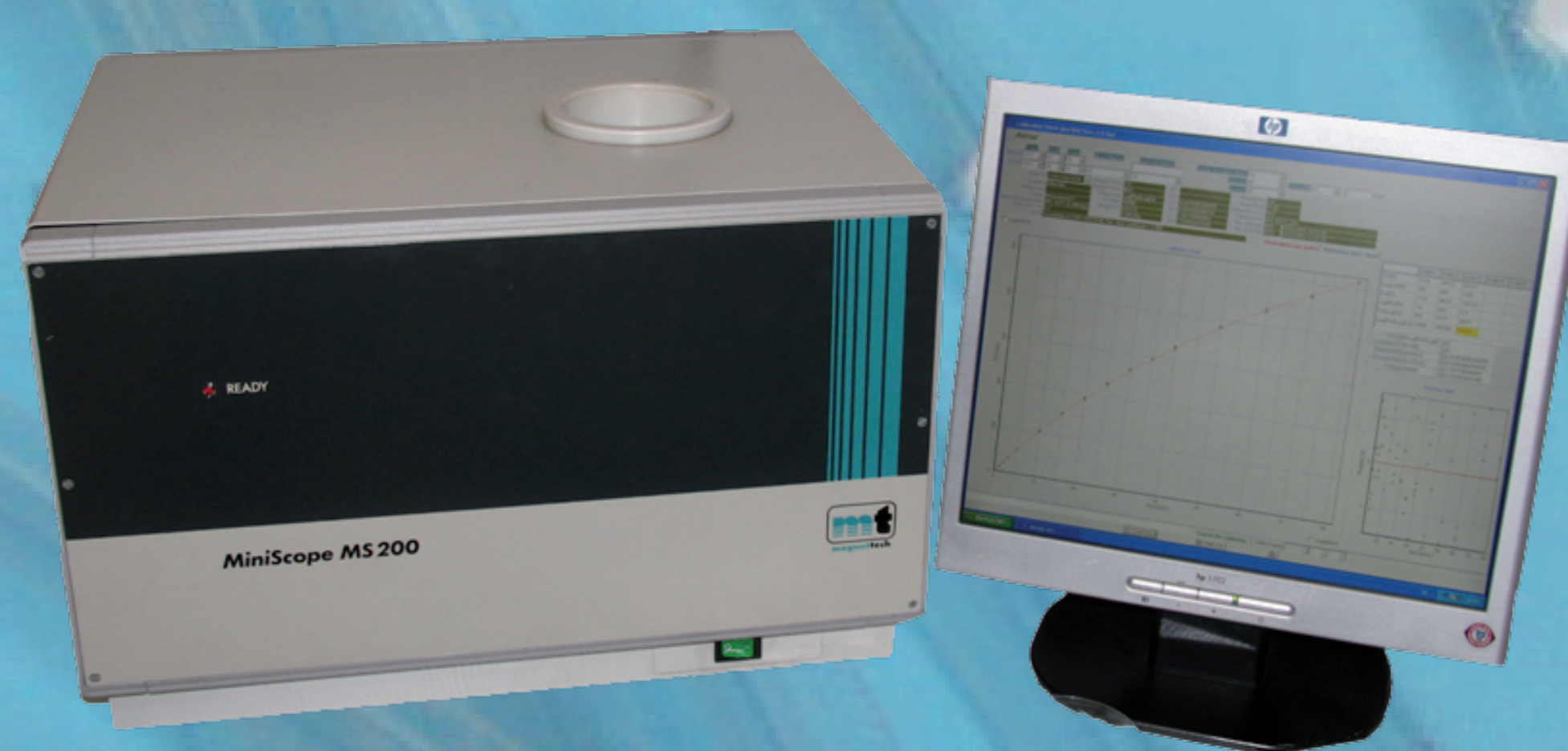
Alanine pellets contain L-Alanine – Eudragit NE 30D – Myvatex TL® Pellets are manufactured at a target mass of 36.5 mg and individually sorted into mass intervals (+/- 0.15% at 1  $\sigma$ ) thanks to a specially designed robot.

## Packaging:

Pellets are individually packaged in a rigid polyester blister. The packaging has been developed to be very resistant, easy to manipulate and with limited influence on dose reading.

## EPR Spectrometer:

Modern EPR spectrometer allow fast and reliable readings of alanine dosimeters. The MS 300 spectrometer is a very stable and sensitive bench top EPR equipment from Magnetech, Berlin, Germany



## Introduction :

EPR dosimetry presents a great interest for quality control in radiation processing of medical devices, pharmaceuticals, combination products, food and packaging but also for very low doses in radiotherapy.

In order to win confidence and to be more widely used in the industrial irradiation environment, our industry needs an Alanine pellet dosimeter which cannot lose its individual identification, which is robustly protected and better yet, very easy to manipulate.

We have developed a high sensitivity individually packed and traceable Alanine pellet dosimeter which can be irradiated and readout with its packaging in the EPR spectrometer.

## EPR Spectrometer parameters:

Power : 10 mW, Sweep : 2 mT, Sweep time : 12s,  
Modulation : 0.2 mT, Filter : 50 ms, Number scans : 1

## Results of dosimetry system characterization:

Different tests have been performed to demonstrate the potential use of this packaged dosimeter in industrial applications. It is easy to use, reproducible, not humidity sensitive and resists to tough conditions. Reproducibility has been assessed by irradiations with electron beams (Risö-Linac 10 MeV, Aérial-Van de Graaff 2.5 MeV) at absorbed doses from 0.5 kGy to 50 kGy. An average reproducibility of 0.6 % has been calculated (Figure a). The calibration curve (Figure b) derived from 7 dose points (4 repetitions) from 5 to 50 kGy shows a very homogeneous data distribution around the curve with a standard deviation on the residuals of less than 1 %. Environmental effects such as humidity effect and crash resistance have been evaluated. Figure c shows the EPR signal evolution with increasing hammering of the packaged pellet. A very limited signal loss (2%) could be found, due to the robust pellet protection. For the same reason, when immersed in water, no significant EPR signal loss could be measured (Figure d). As the alanine pellet is readout with its Polyester packaging, a short term fading study has been performed on both packaged alanine and polyester polymer. Background EPR signal from polymer is lower than 0.5 % and disappears within 4 hours after irradiation (Figure e).

Figure a : Measurement reproducibility

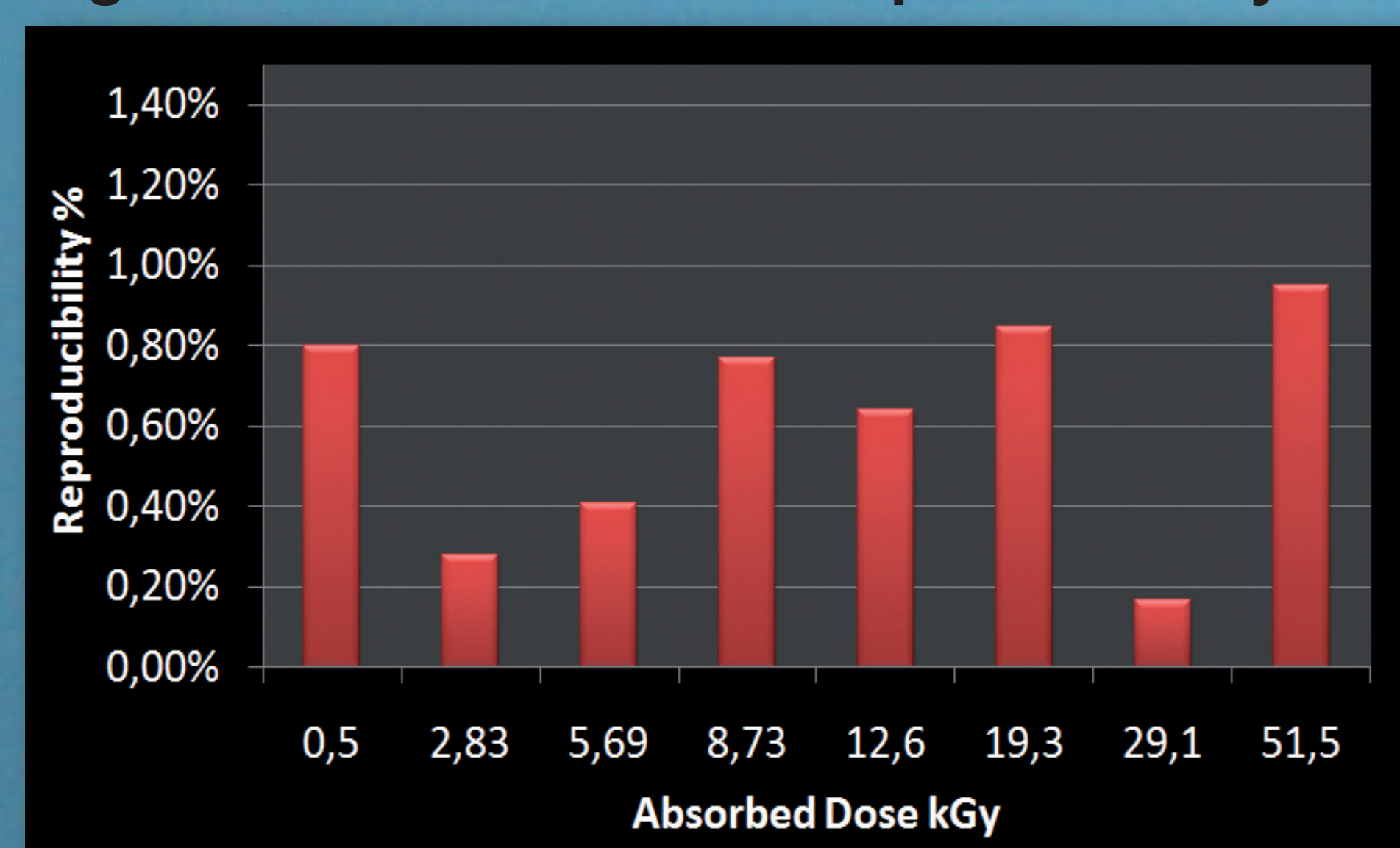


Figure c : Constraint resistant

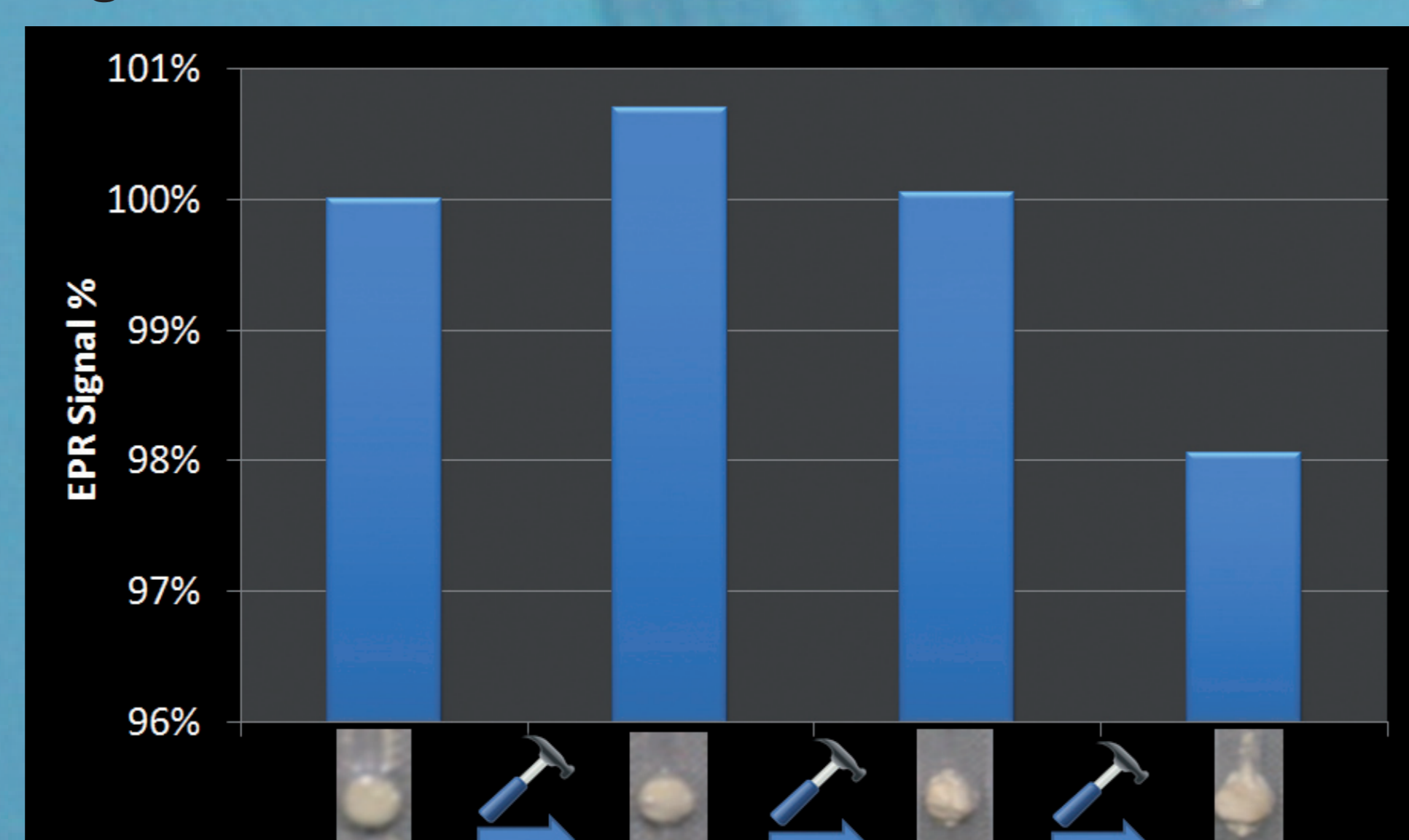


Figure d : Better resistance to Water/humidity

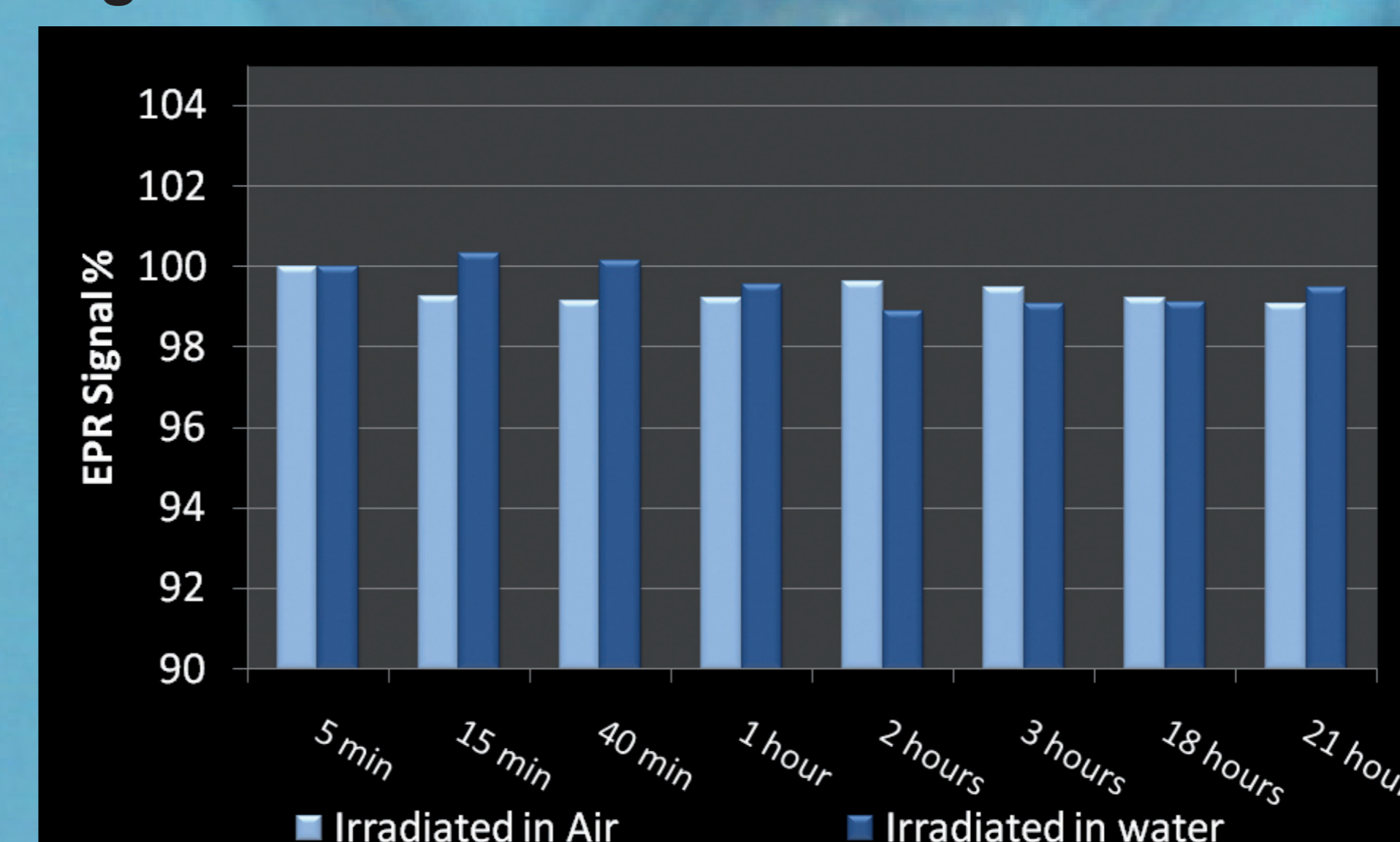


Figure e : EPR Signal short term fading

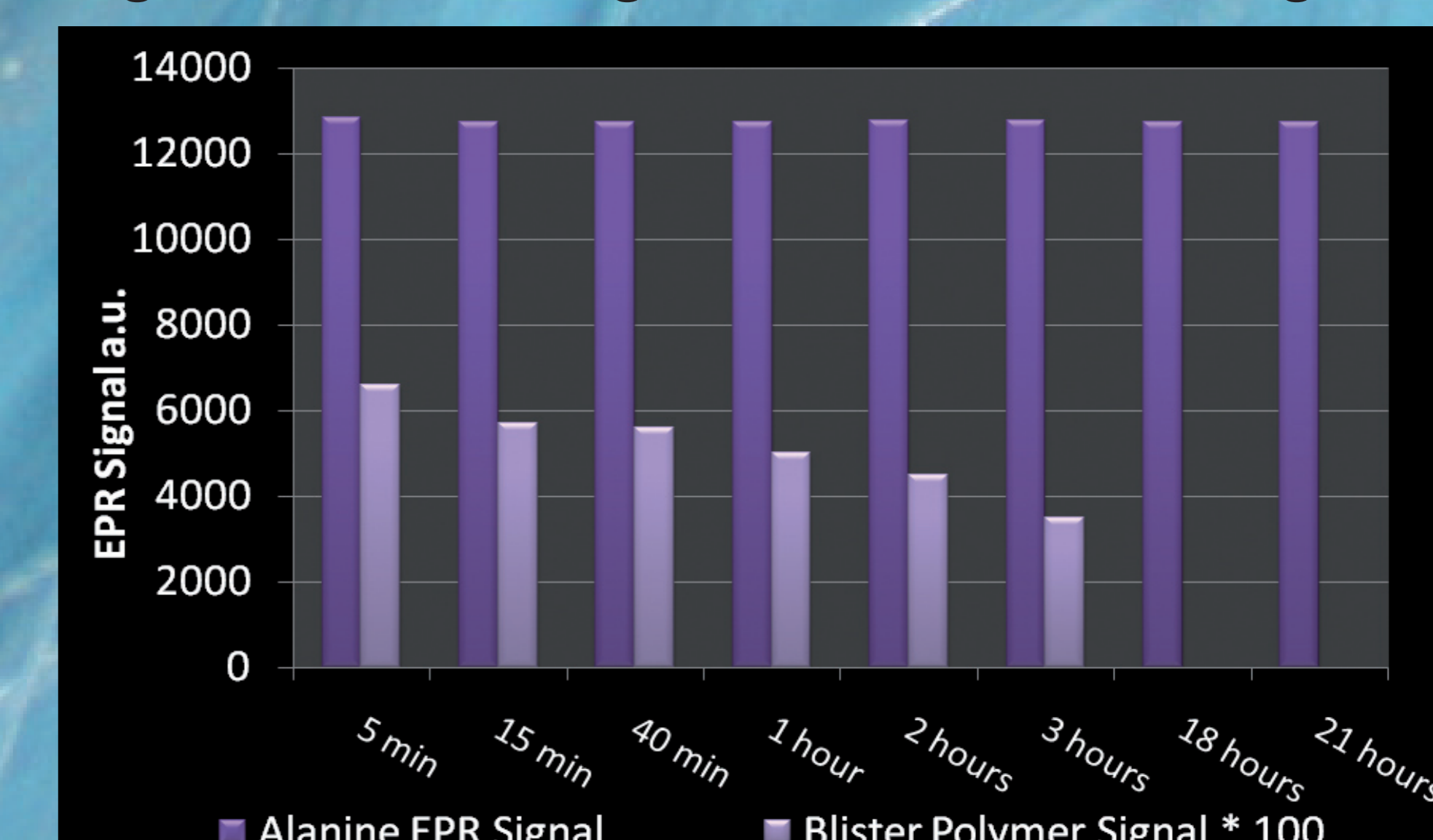
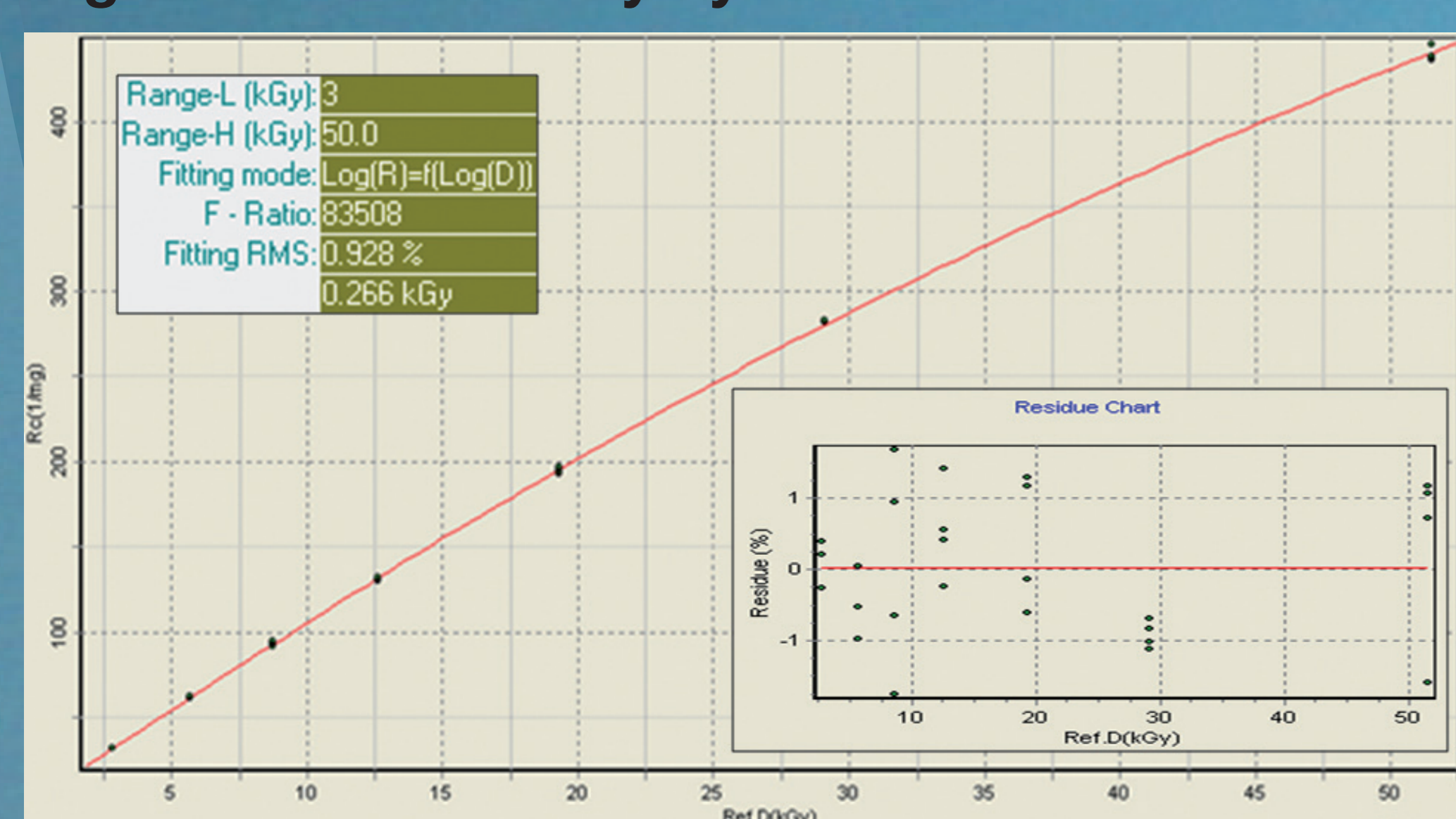


Figure b : Dosimetry system calibration



## Conclusion:

Newly developed and highly innovative individually packaged alanine dosimeters have been characterized in order to define its application limits. These dosimeters, produced in batches of 100,000 units allow very rapid, user friendly (limited manipulation) and reproducible dose measurement over a broad dose range without individual pellet weighing. According to the very good reproducibility (less than 1%), one can estimate the overall uncertainty of the dosimetry system to be approx. 4% at 2  $\sigma$  including primary standard uncertainty.

