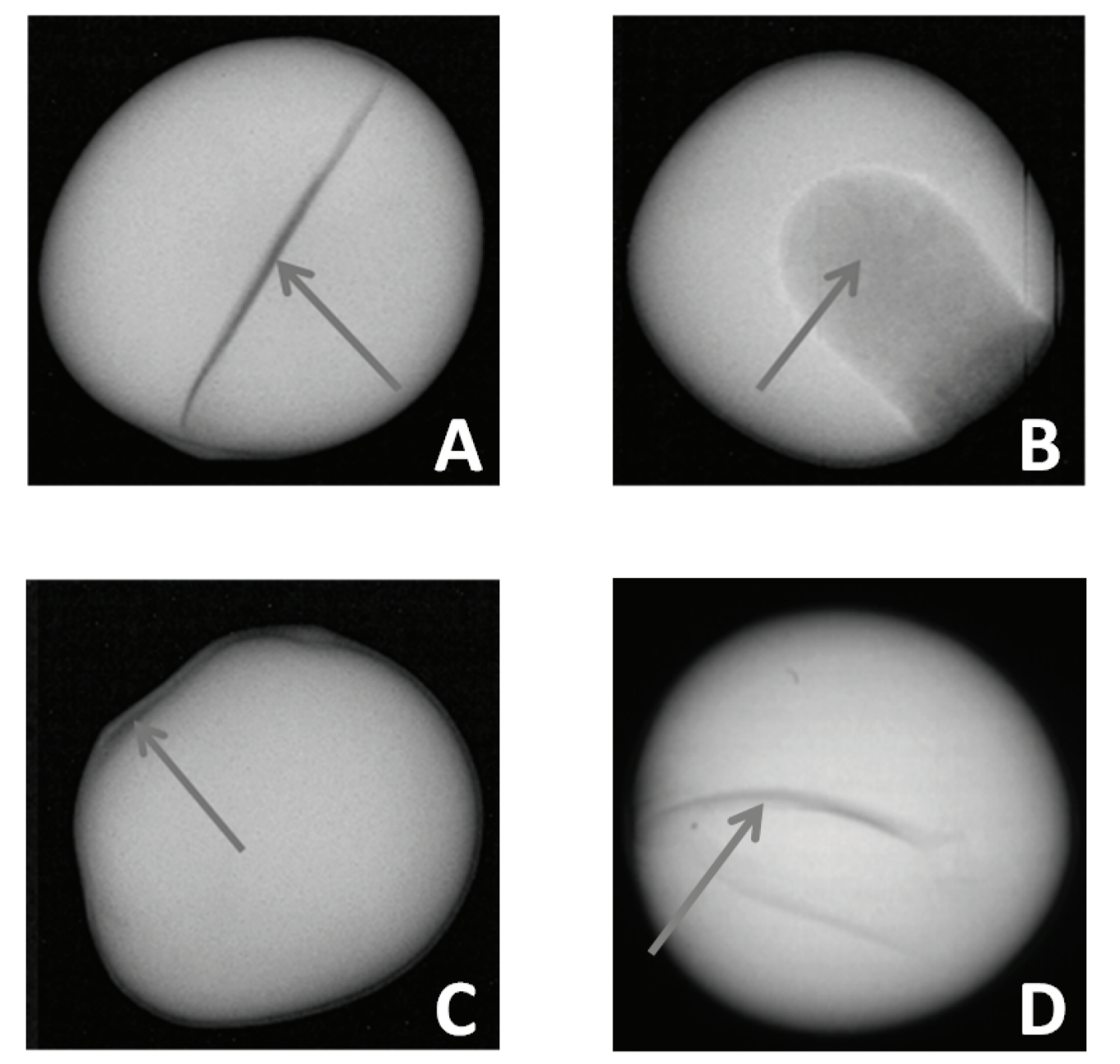


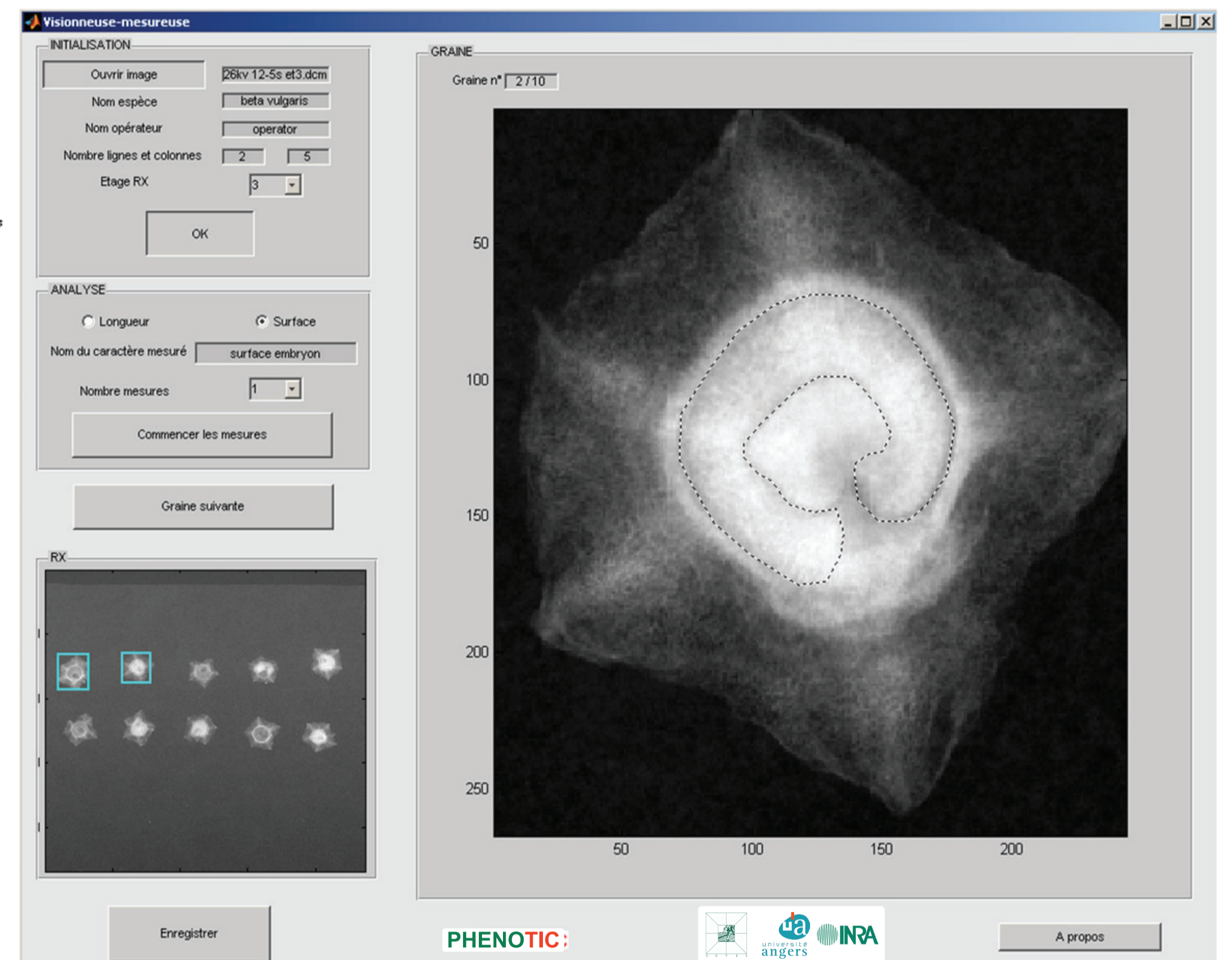
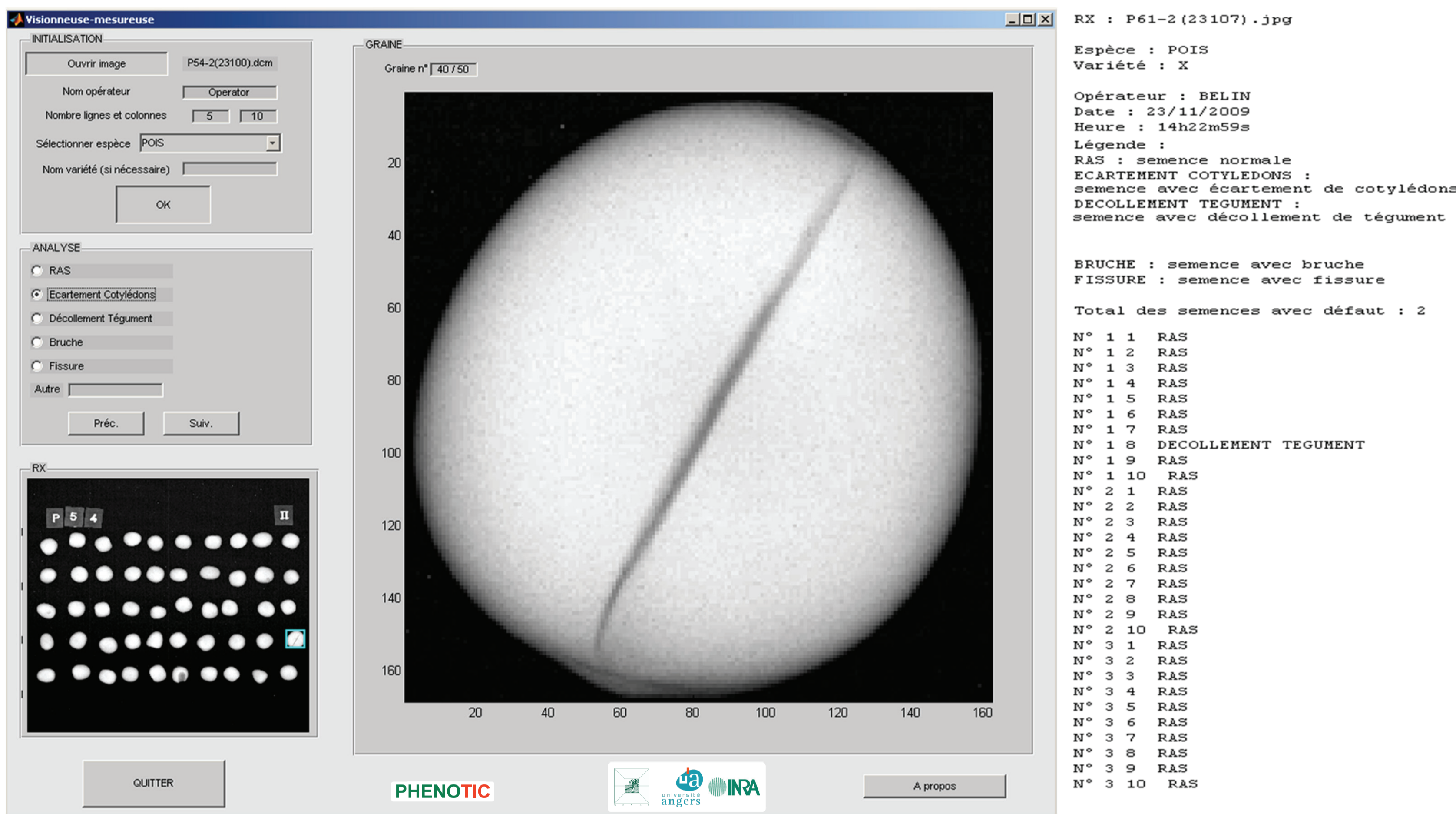


### X-ray imaging for seed analysis

Seed analysis with X-ray imaging allows the detection of defects for a large range of species, predicting possible problems in the future development of the plant like physiological abnormalities during phases of imbibition, germination or seedling growth. The defects can be analyzed from the internal structural information available with X-ray imaging. For the phenotyping of seeds, semi automatic and automatic tools are developed to help expert operator to perform seed diagnosis and to provide an automatic detection of one specific defect on pea seeds.



### Semi automatic tool



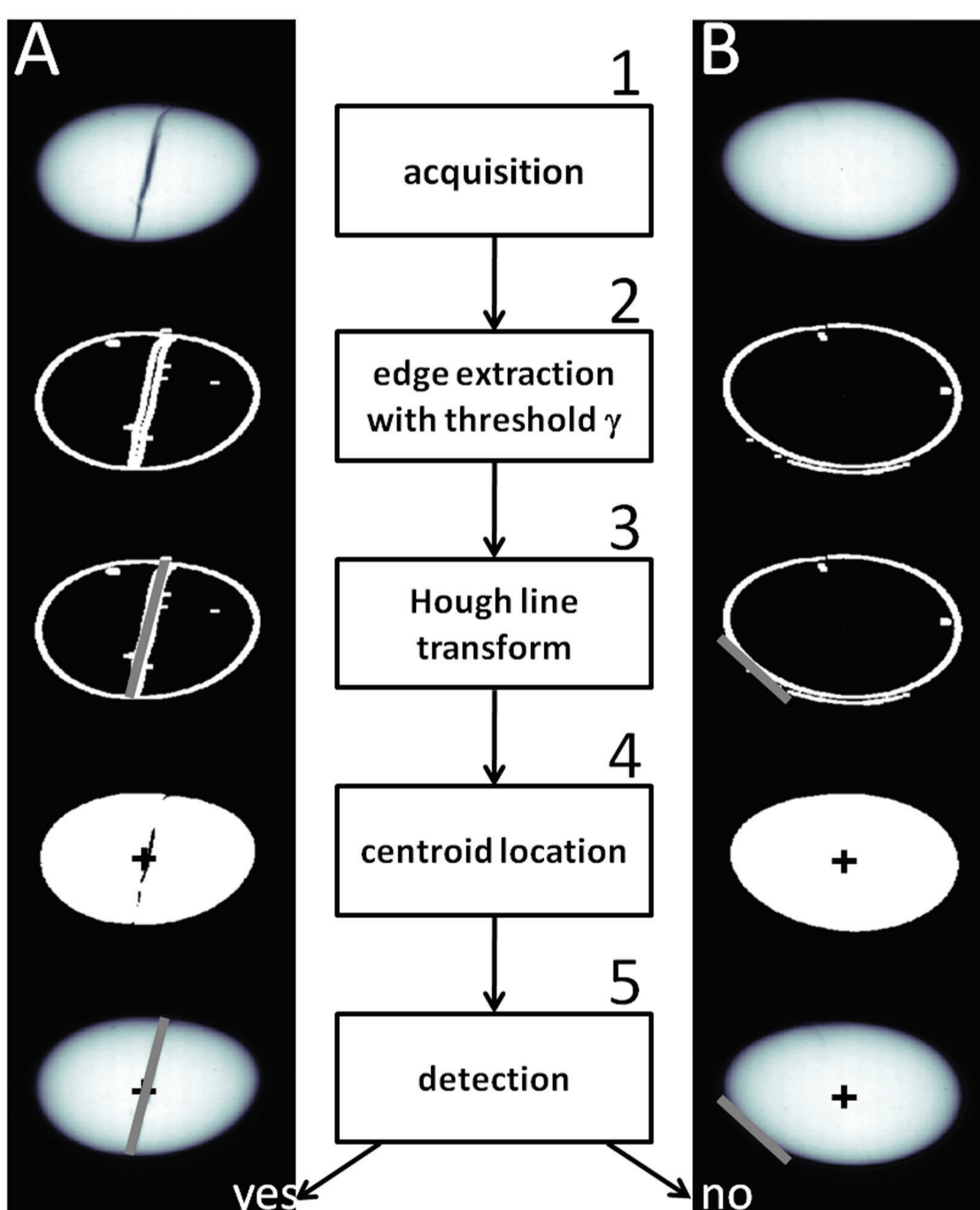
This user interface for X-ray images analysis allows the operator to view all the seeds one by one and successively characterize them

Measurements of length or area can be done on each component of a seed (tegument thickness, embryo and perisperm areas,...)

Result files provide good traceability as seeds are referenced by their horizontal and vertical position in row and column. With this semi automatic tool usable for the phenotyping of seeds of any species, the processing time of an X-ray image containing 50 seeds is about 2 minutes.

### Automatic detection

The automated detection of a specific defect relies on the presence or absence of its spatial signature. Focus is here on one particular defect of pea seeds: the spacing between cotyledons.



The obtained results are in complete agreement with the independent visual notation of an expert operator performed with the user interface. The edge extraction involves the identification of a threshold. Its influence on the performance of the algorithm can be appreciated with a receiving operating characteristic (ROC) curve. One example of ROC curve is given where the evolution of probability of detection is plotted against the probability of false alarm for various values of threshold.

