# SepINRIA v1.7.2: Multiple Sclerosis Brain Visualisation, Comparison and Analysis Software

***http://www-sop.inria.fr/asclepios/software/SepINRIA/***


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## 1. Objectives

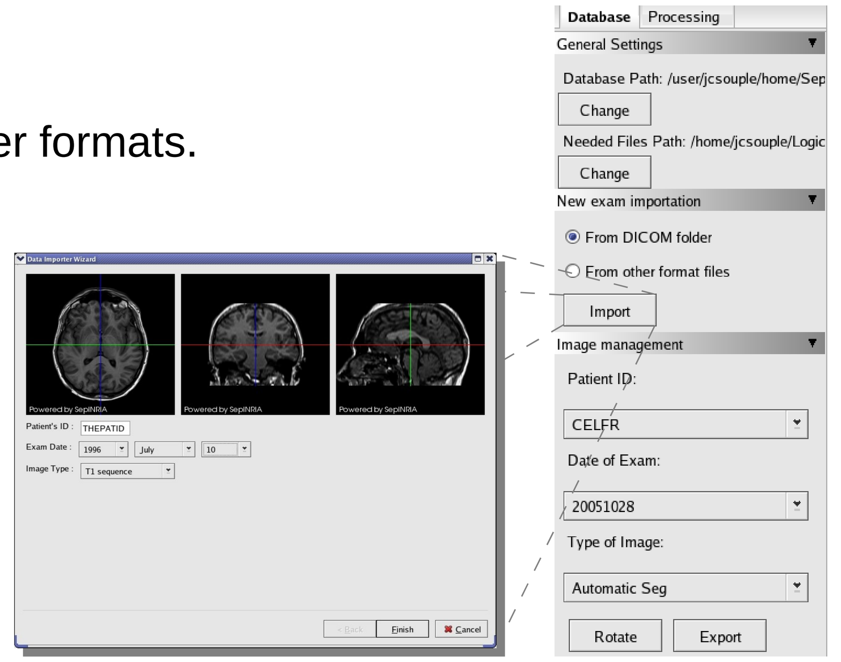
To provide clinicians with tools allowing to analyze Multiple Sclerosis (MS) brain MRI:

- Works on a convenient database.
- Visualisation of images in 2D and/or 3D.
- Quantitative lesion burden evaluation (manually or automatically).
- Brain atrophy evaluation (manually or automatically).
- Comparison of different sequences or of binary segmentations.

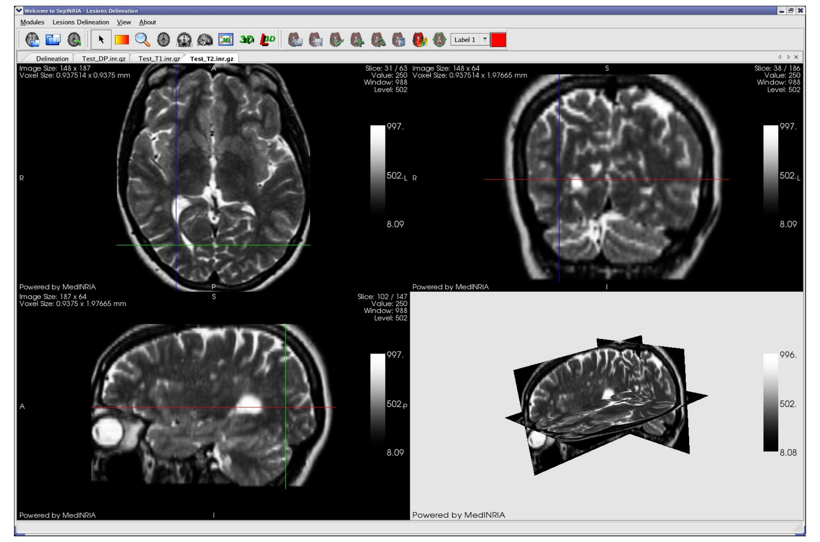
## 2. Data Management & Visualisation

**The database interface allows to:**

- Import images from DICOM and other formats.
- Rotate/Flip images.
- Export results in DICOM or other formats (e.g. the segmentations).



Database
Processing
General Settings
Database Path: /user/jcsouple/home/Sep
Change
Needed Files Path: /home/jcsouple/Logic
Change
New exam importation
From DICOM folder
From other format files
Import
Image management
Patient ID:
CELFR
Date of Exam:
20051028
Type of Image:
Automatic Seg
Rotate
Export

**Different interactions are possible:**

- Display in 2D/3D.
- Zoom.
- Windowing.
- Volume rendering.



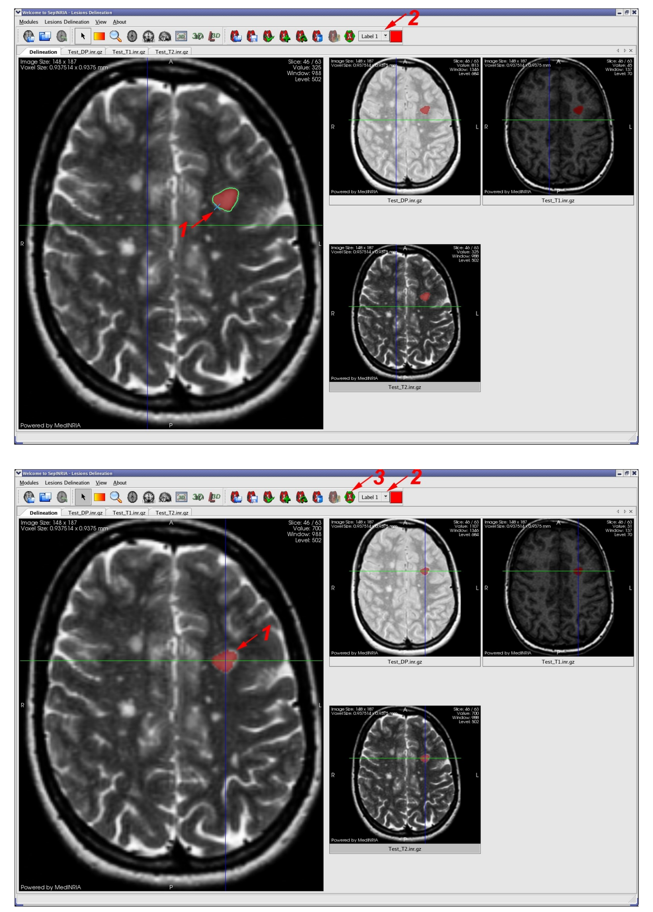
## 3. Lesion Segmentation

**Manually**:

- Drawing slice by slice.
- The drawing of a slice can be used for the following slice.

**Semi-automatically**:

- Click in the center of a lesion.
- The segmentation is achieved thanks to a 3D region growing.



**Automatically:**

- From four sequences (T2, PD, T1, T2-FLAIR).
- Images normalization.
- Segmentation of WM, GM, CSF taking into consideration partial volume effects.



- Segmentation of the lesions.
- Lesion burden computation.

**Results:**

- Visualisation in 2D or 3D of the lesions.
- Lesion burden computed from segmentations.
- Segmentations saved and exported.
- A quantitative comparison of two segmentations.

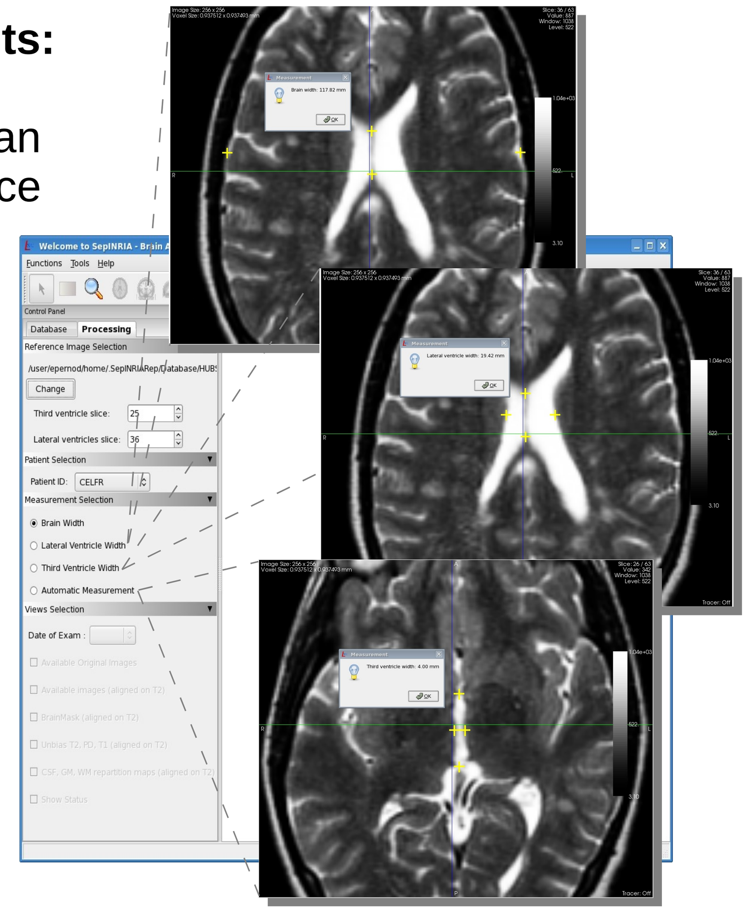


Label 1
Number of Lesions: 7
Volume: 1854 mm3
Label 2
Number of Lesions: 2
Volume: 116 mm3


## 4. Atrophy Evaluation

**2D linear manual measurements:**

- Automatic images aligning on an image of reference. Reference slices are saved into memory.
- Selection of the measurement:
  - Brain width,
  - Lateral ventricles width,
  - Third ventricle width.
- Automatic display of the corresponding 2D slice.
- Click to move landmarks.
- Save the measurement.



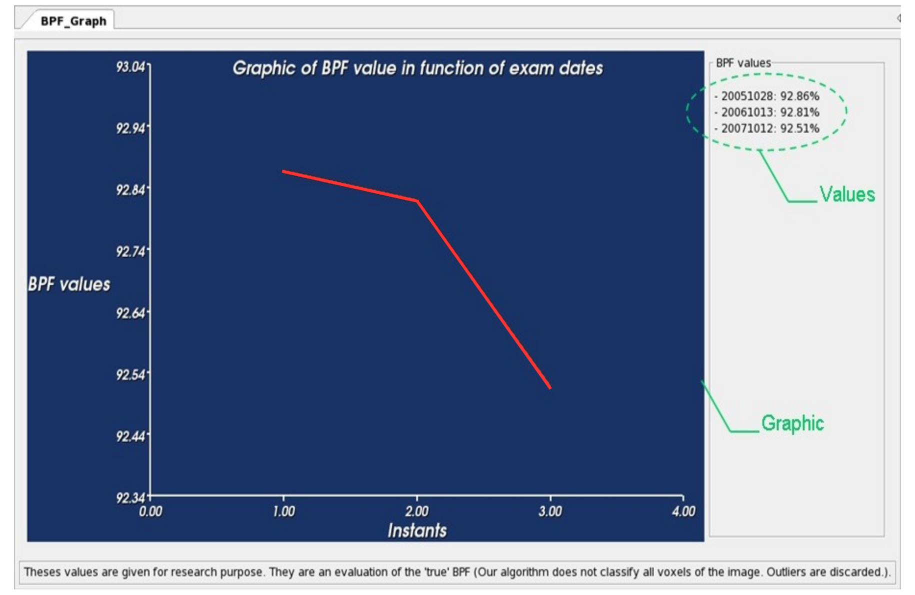
**Automatically:**

- From three sequences (T2, PD, T1).
- Sequences alignment.
- Segmentation of the brain.
- Intensity inhomogeneities correction.
- Segmentation of WM, GM, CSF taking into consideration partial volume effects.
- WM, GM, CSF volume and Brain Parenchymal Fraction (BPF) computation.

$$BPF = \frac{Volume(GM) + Volume(WM)}{Volume(GM) + Volume(WM) + Volume(CSF)}$$

**Results:**

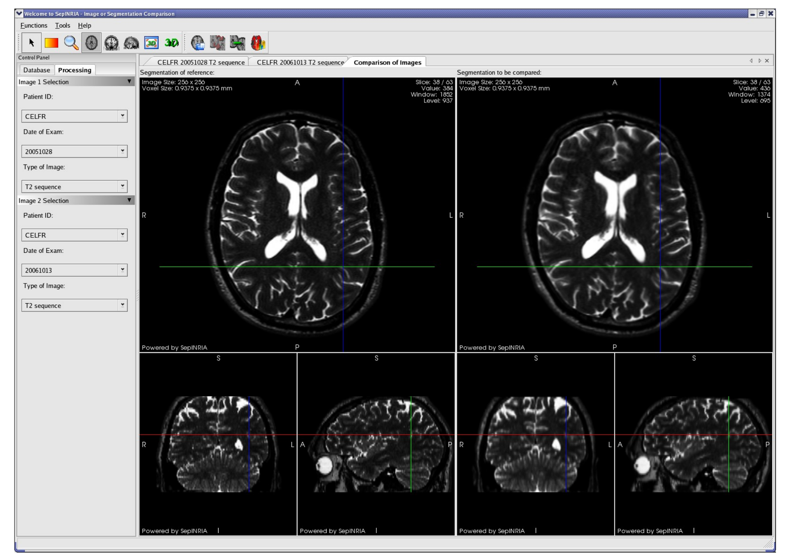
- 2D linear measurements saved and exported.
- Display evolution of the BPF. This evolution reflects atrophy

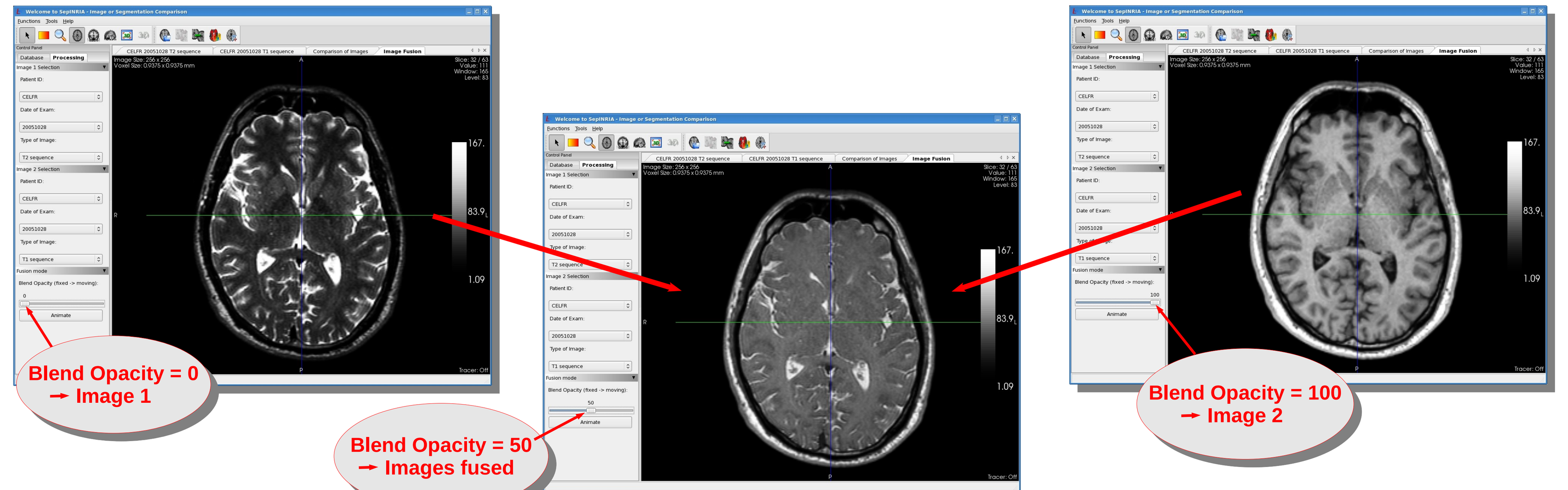


BPF_Graph
Graphic of BPF value in function of exam dates
BPF values
Instants
BPF values
- 20051028: 92.86%
- 20061013: 92.81%
- 20071012: 92.51%
Values
Graphic
Theses values are given for research purpose. They are an evaluation of the 'true' BPF (Our algorithm does not classify all voxels of the image. Outliers are discarded.).


## 5. Image comparison

- Automatic co-registration of images:
  - Monomodal,
  - Multimodal.
- Quantitative comparisons of two binary segmentations to assess evolutions:
  - Computation of the image difference.
  - Visualisation in the same window, side to side or by image fusion.



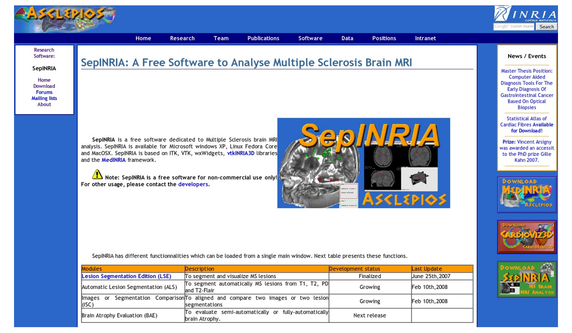


Blend Opacity = 0 → Image 1
Blend Opacity = 50 → Images fused
Blend Opacity = 100 → Image 2


## 6. Conclusion

- SepINRIA can be freely downloaded at:

  http://www-sop.inria.fr/asclepios/software/SepINRIA/



- SepINRIA is available on different platforms:
- SepINRIA is based on ITK, VTK, wxWidgets, vtkINRIA3D libraries and the MedINRIA framework.