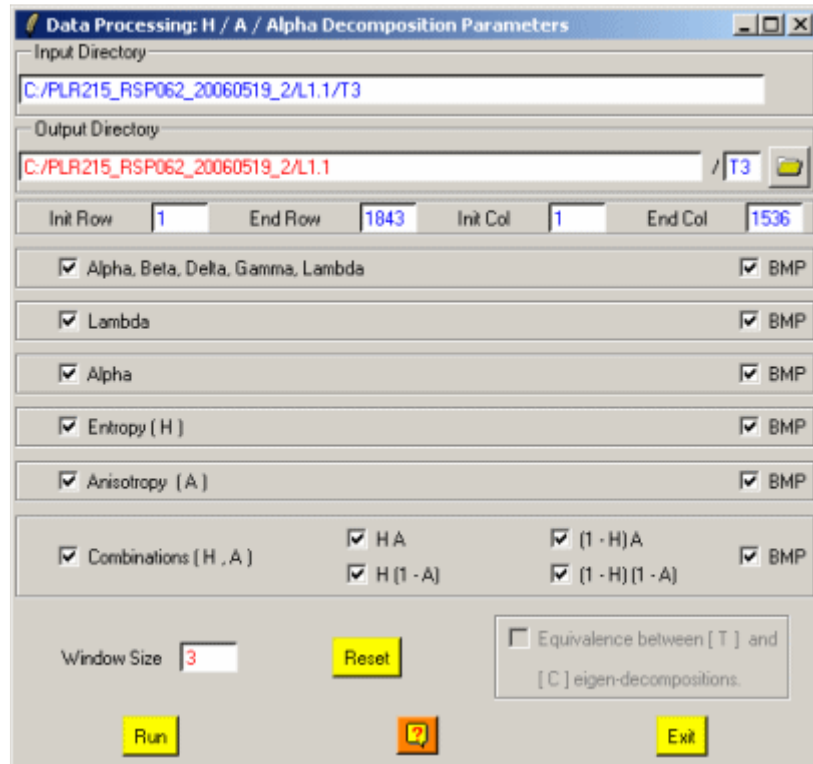# H/A/Alpha Decomposition

This program creates binary files corresponding to the different polarimetric descriptors obtained from the H/A/Alpha decomposition of the (3x3) complex Coherency matrix **[T3]** raw binary data.
.
An option may be set to simultaneously create the corresponding bitmap image files.

Description:

The H/A/Alpha polarimetric decomposition is based on an eigenvector decomposition of the (3*3) complex Coherency **[T3]** matrix.

The (3x3) complex Coherency **[T3]** matrix being hermitian, semi-definite positive, its eigenvectors are orthogonal and its eigenvalues are real positive.
The eigenvector decomposition of a distributed target coherency matrix is considered as a simple statistical model consisting in the expansion of the (3x3) complex Coherency matrix into a weighted sum of three coherency matrices.

Pseudo-probabilities of the (3x3) complex Coherency **[T3]** matrix expansion elements are defined, from the set of sorted eigenvalues.

The distribution of the probabilities can be fully described by two parameters :

- The entropy (**H**) indicates the degree of statistical disorder of the

scattering phenomenon. It derives, in the Von Neumann sense, from the set of probabilities as:

- For high entropy values, i.e. superior to 0.7, a complementary parameter is necessary to fully characterize the set of probabilities. The anisotropy (**A**) is defined as the relative importance of the secondary scattering mechanisms.

Each unitary eigenvector of the (3x3) complex Coherency **[T3]** matrix may be parameterized using **4** real angular variables.

The condition of mutual orthogonality between the eigenvectors involve that the **3** polarimetric parameters sets resulting from the expansion are not independent. For this reason, each polarimetric parameter is associated to a **3** symbol Bernoulli statistical process.
In this way, the estimate of the mean polarimetric parameter set is given by:

A physical interpretation has been given to these **4** polarimetric descriptors (S.R Cloude, E. Pottier).

Comments:

Parameters written in Red can be modified directly by the user from the keyboard.

Input/Output Arguments:

Input Directory   Indicates the complete location of the considered **Main Directory / T3 (MD / T3)** containing the **[T3]** matrix data to be processed.

Output Directory   Indicates the location of the processed data output directory.
The default value is set automatically to :
Main Directory / T3 (MD / T3).

Output Image Number of Rows/Columns:

The output image numbers of rows and columns are initialised to the input data set dimensions.
Users wishing to process a sub-part of the initial image can modify the **Init** and **End** values of the converted images rows and columns.
Note: init and end values have to remain within the range defined by the input image dimensions.

Processing parameters:

Window Size   Data to be decomposed may be processed through an additional filtering procedure consisting of a boxcar filter. Users have then to set the size of the (N*N) sliding window used to compute the local estimate of the average matrix.
The default value of N is set to **0**. Users wishing to avoid additional filtering may set N to **1**.