



→ **POLINSAR 2013**

The 6th International Workshop on Science and Applications of SAR Polarimetry and Polarimetric Interferometry

2003 – 2013 : 10 Years of the PoISARpro Software

New updates and its link with the ESA PoISAR-Ap Project

E. Pottier – C. Lopez Martinez

28 January - 1 February 2013 | ESA-ESRIN | Frascati (Rome), Italy

European Space Agency



The central graphic is a rounded rectangular box with an orange-to-brown gradient background. At the top right, the ESA logo is present. Below it, the text '→ POLSARPRO V. 5.0' is displayed in white on a dark orange background, followed by the subtitle 'The Polarimetric SAR Data Processing and Educational Tool' in a smaller white font. The middle section features a colorful SAR image of a forest with various colored overlays. At the bottom, a white bar contains the URL 'http://earth.esa.int/polsarpro'. The bottom left corner shows 'www.esa.int' and the bottom right corner shows 'European Space Agency'.



10 Years of POLSARpro

PoISARpro v5.0 SOFTWARE



A Bit Of History



PoISARpro



A BIT OF HISTORY



APPLICATIONS OF SYNTHETIC APERTURE RADAR POLARIMETRY



Polarimetric SAR Data Processor v1.3

POLSARPRO v1.3
POLARIMETRIC SAR
DATA PROCESSOR

Run (c) Eric POTTIER - Laurent FERRO-FAMIL (November 2002) Exit

POLinSAR 2003

Workshop on Applications of SAR Polarimetry and Polarimetric Interferometry

ESA-ESRIN Frascati, Italy
14-16 January 2003



A BIT OF HISTORY



The initiative development of **PolSARpro Software** is a direct result of recommendations made during the **POLinSAR 2003 Workshop** held at ESA-ESRIN in January 2003.

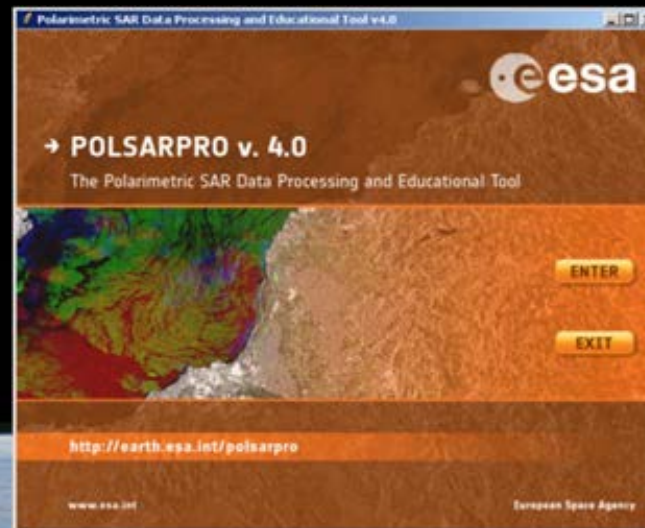
A BIT OF HISTORY



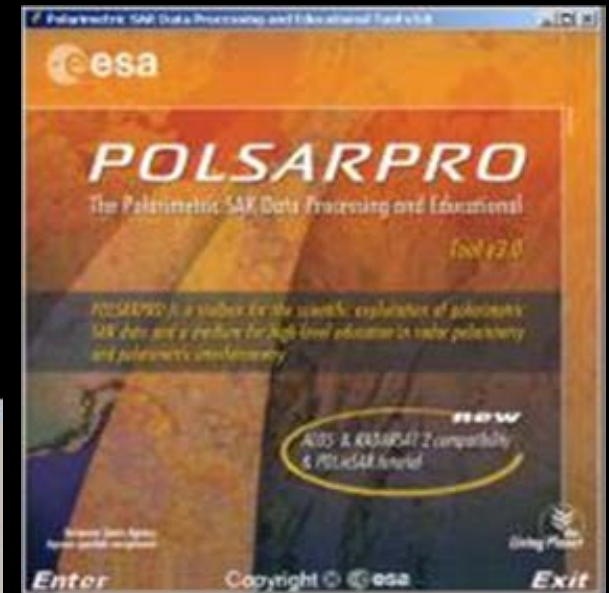
2004



2005



2009 (v4.0) – 2011 (v4.2)



2007

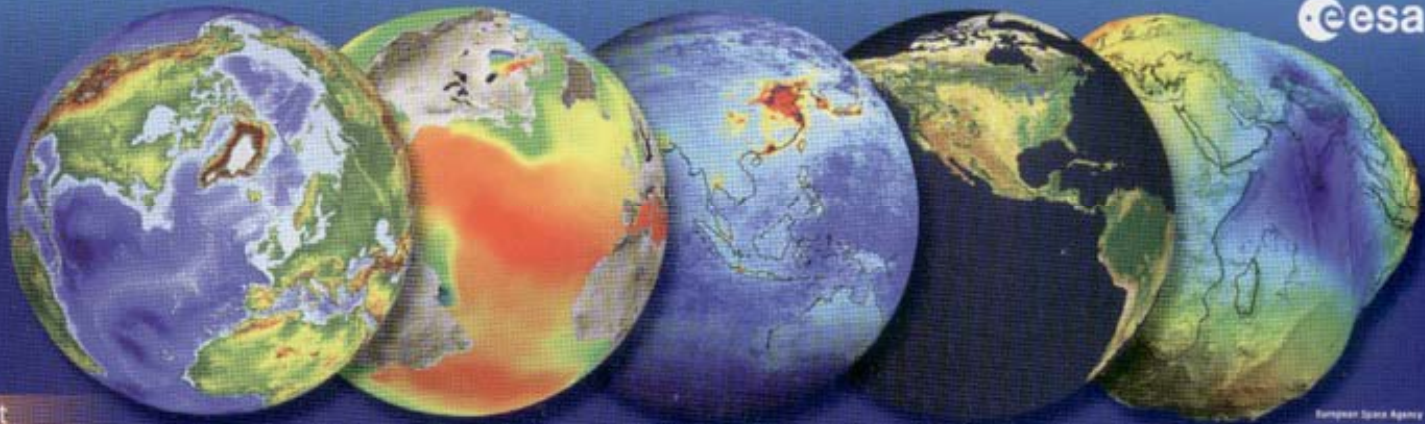
PoSARpro v5.0 SOFTWARE



→ EOPI

Earth
Observation
Principal
Investigator
Portal

<http://eopi.esa.int>



European Space Agency

<http://earth.esa.int/gut>



<http://earth.esa.int/polsarpro>



<http://earth.esa.int/nest>



<http://earth.esa.int/beam>



<http://earth.esa.int/beat>



<http://earth.esa.int/brat>



ESA free TOOLBOXES to exploit ESA & ESA TPM data available at <http://earth.esa.int/resources/softwaretools/>

A BIT OF HISTORY



MAIN MENU



INITIAL BINARY DATA DIRECTORY SETTING

DATA CONVERT :

- Decode AIRSAR, EMISAR, ESAR, PISAR SLC-MLC DATA
- Fully polarimetric data format conversion
 $S \Rightarrow T, C$; $T \Rightarrow C$; $C \Rightarrow T$ Bistatic, Monostatic cases
- Full \Rightarrow partial polar conversion

ELLIPTICAL BASIS TRANSFORMATION:

H-V \Rightarrow LC-RC, +45 / -45, H-V \Rightarrow (ϕ, τ)

SPECKLE FILTER : (Monostatic, Bistatic, Partial) BoxCar, Lee Filter

DATA PROCESS: Coherency, Covariance, Partial Polar Parameters
H/A/ α Decomposition
Unsupervised Wishart H/A/ α Classifier
Polarimetric Decompositions, Freeman, Krogager
Supervised classification

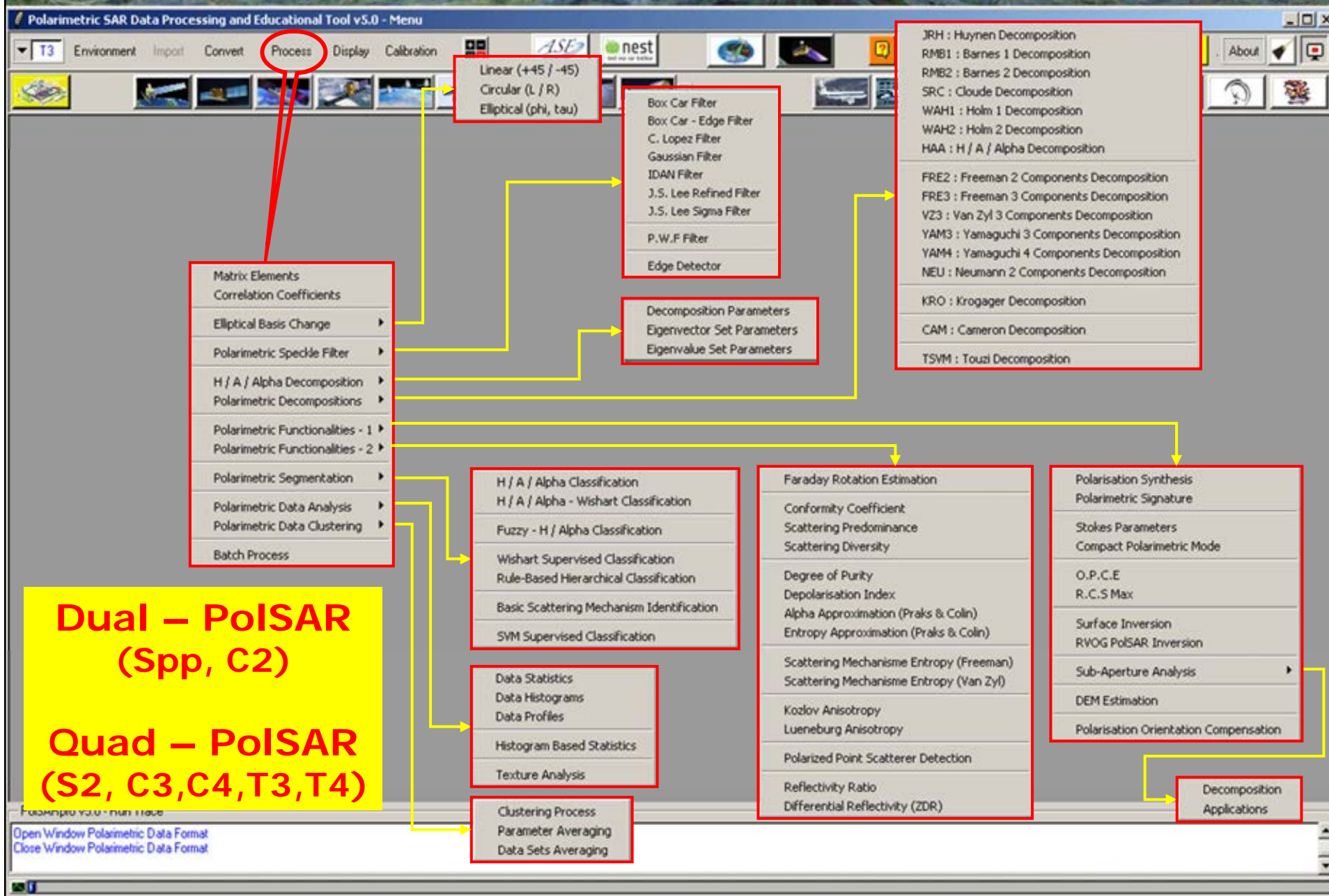
BMP IMAGE PROCESS: Create BMP File from Binary Data
Create color coded RGB File, 3 inputs
View BMP Image

TOOLS : File / Directory Create, Delete, Move ...
Data file Rotate, Flip, Transpose, FFT

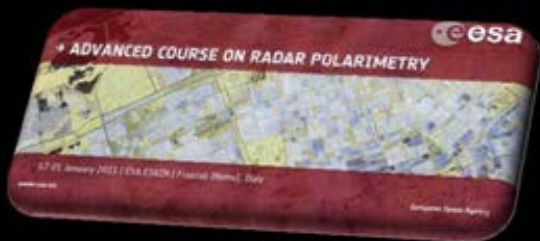
BATCH PROCESS: From S3 to Wishart H/A/ α Classification



PoISARpro v5.0 SOFTWARE

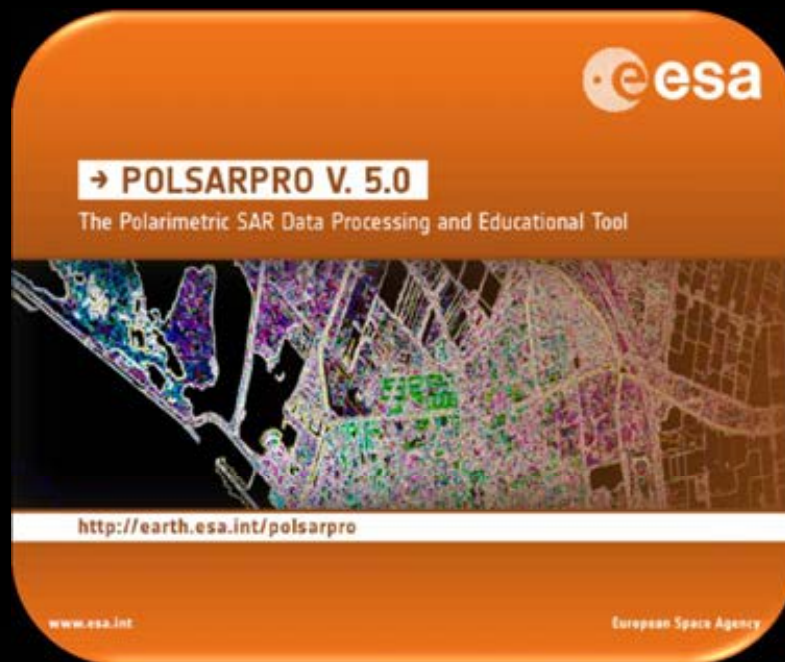


A BIT OF HISTORY



v4.2

Jan. 2011



v5.0

Jan. 2013



PoSARpro v5.0 SOFTWARE



Tool specifically designed to handle :
Polarimetric data
and
Polarimetric Interferometric data.

A software cover image for PoSARpro V. 5.0. It features an orange header with the ESA logo, a central image of a SAR data visualization, and a white footer with the website URL and ESA name.

→ **POLSARPRO V. 5.0**
The Polarimetric SAR Data Processing and Educational Tool

<http://earth.esa.int/polsarpro>


www.esa.int European Space Agency

PoSARpro v5.0 SOFTWARE



Educational Software offering a tool for
self-education
in the field of **POLSAR** and **POL-InSAR**
data processing and analysis.

The cover image shows a SAR data visualization of a coastal area, with a grid overlay and various colored regions representing different features. The background is a dark blue and black gradient.

esa

→ **POLSARPRO V. 5.0**
The Polarimetric SAR Data Processing and Educational Tool

<http://earth.esa.int/polsarpro>

www.esa.int European Space Agency

PoISARpro v5.0 SOFTWARE



Developed to be **accessible** to :
a wide range of users
from **novices** to **experts**
in the field of **POLSAR** and **POL-InSAR**.

The cover of the POLSARPRO V. 5.0 manual. It features an orange header with the ESA logo and the title '→ POLSARPRO V. 5.0' in a white box. Below the title is the subtitle 'The Polarimetric SAR Data Processing and Educational Tool'. The central image is a colorful SAR data visualization of a coastal area. At the bottom, there is a white bar with the URL 'http://earth.esa.int/polsarpro' and an orange footer with 'www.esa.int' and 'European Space Agency'.

PoISARpro v5.0 TEAM



Eric Pottier



Laurent Ferro-Famil



Sophie Allain



Stéphane Méric



Shane R. Cloude



Irena Hajnsek



Kostas Papathanassiou



Mark Williams



Yves-Louis Desnos



Tim Pearson
(PoISARpro v2.0)



Andrea Minchella
(PoISARpro v3.0)



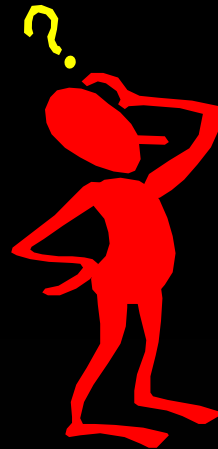
In collaboration with :



PoISARpro Software : ESA Funded Project



WPx : Other Functionalities



PoISARpro : A tool to promote the most important scientific developments conducted in PoISAR and Pol-InSAR

In collaboration with :



University of Illinois at Chicago

University of Niigata

University of Alicante

University of Tor Vergata

University of Pisa

University of Sendai

University of Fairbanks

University of Marne la Vallée

University of Tsinghua

Naval Research Laboratory

NASA – JPL

Ressources Naturelles Canada

... ..



UPC

IE - CAS (MITL)

CEODE - CAS

CNES

GIPSA – Lab

Alaska Sar Facility

SERTIT

CSRE - IITB

PoISARpro v5.0 SOFTWARE



OPEN SOURCE DEVELOPMENT

PoISARpro v5.0 Software is made available following the:

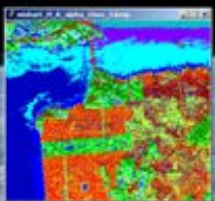
Open Source Software Development (OSSD) approach, and follows the:

GNU General Public License v2 – June 1991.

PoISARpro v5.0 Software runs today on:

Windows 98+, Windows 2000, Windows NT 4.0, Windows XP, Windows 7 and Linux I 386

Macintosh OS:



PoSARpro v5.0 SOFTWARE

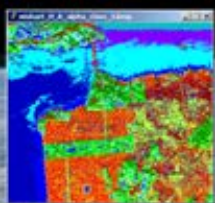


USER INTERFACE

PoSARpro v5.0 Software is conceived as a flexible environment, with a friendly and intuitive Graphical User Interface (GUI)

The graphical user interface (GUI) is written in **Tcl-Tk**

- **331185 lines** managing **189 widget windows**
- **1078 C routines (464803 lines)** performing well-established algorithms in the field of POLSAR and POL-InSAR.



PoISARpro v5.0 SOFTWARE



WHAT IS NEW IN THE VERSION v5.0 ?

PoISARpro v5.0 SOFTWARE



PoI-SAR Sensors

PoISARpro v5.0 SOFTWARE



AIRSAR



ONIERA



SETHI



PISAR

NASDA
CR



DCRS

EMISAR

ESAR



FSAR

New!



CNRC-NRC
Canadian Research

CONVAIR

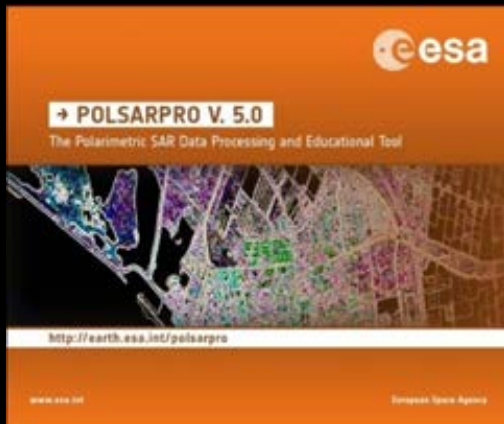
UAV-SAR



NASA
JPL

PoISARpro v5.0 Software offers the possibility to handle and convert polarimetric data from a range of well established polarimetric airborne platforms.

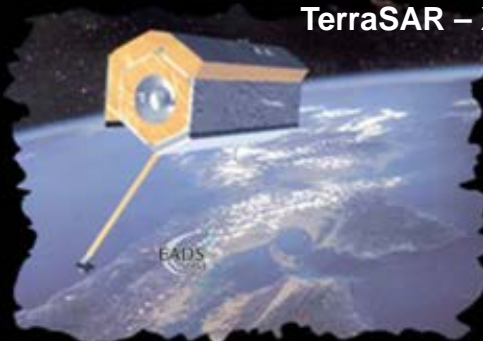
PoISARpro v5.0 SOFTWARE



ALOS - PALSAR



TerraSAR - X

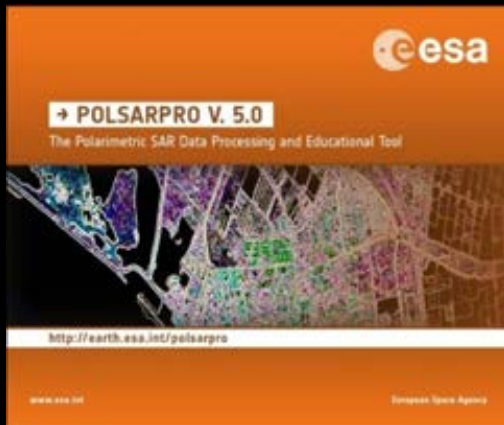


RADARSAT 2

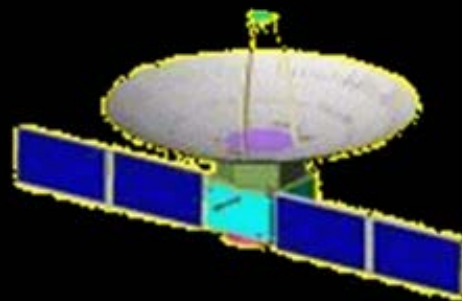


PoISARpro v5.0 Software offers the possibility to handle and convert polarimetric data from a range of well established polarimetric spaceborne platforms.

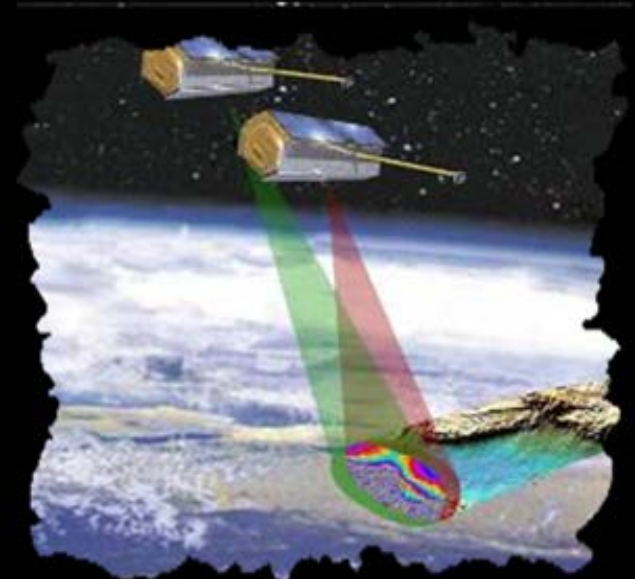
PoISARpro v5.0 SOFTWARE



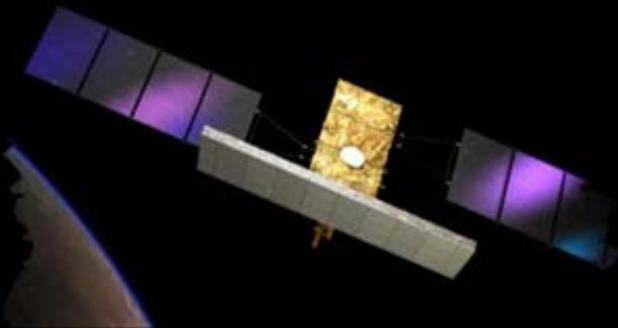
RISAT



TANDEM-X



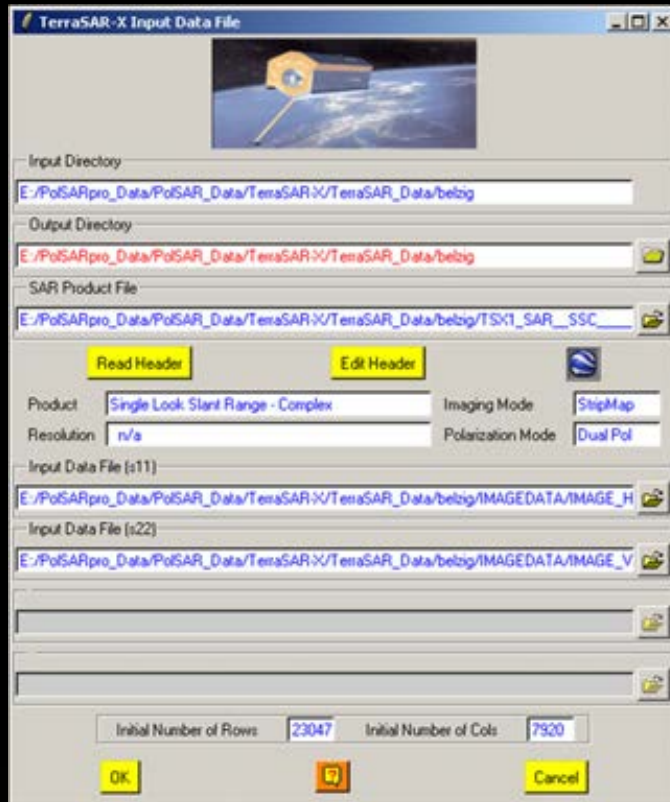
COSMO - SKYMED



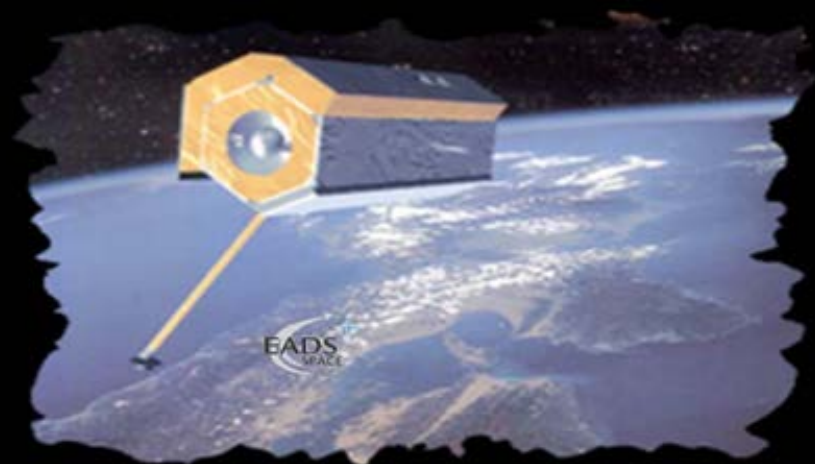
New!

PoISARpro v5.0 Software offers the possibility to handle and convert polarimetric data from a range of well established polarimetric spaceborne platforms.

PoISARpro v5.0 SOFTWARE



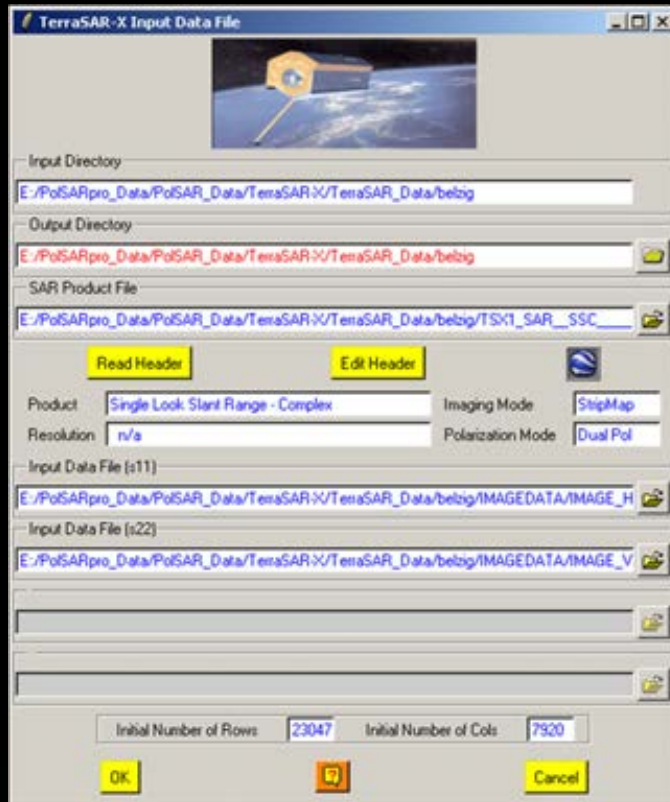
TerraSAR – X



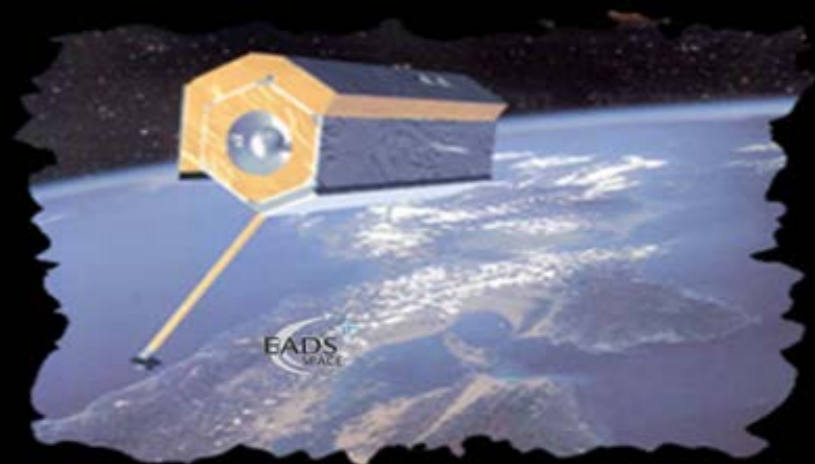
• TerraSAR – X Dual POL

SSC: Single Look Slant Range Complex
EEC: Enhanced Ellipsoid Corrected
GEC: Geocoded Ellipsoid Corrected
MGD: Multi-Look Ground Range

PoISARpro v5.0 SOFTWARE



TerraSAR – X



SSC: Single Look Slant Range Complex

• TerraSAR – X Quad POL

PoSARpro v5.0 SOFTWARE



TANDEM-X Input Data File

- Input Directory
D:/PoSAR_Data/Juanma/Rice_Scene

- TANDEM-X Product File
D:/PoSAR_Data/Juanma/Rice_Scene/TDM1_SAR_COS_BIST_SM_D_SRA_20110608T062951_20110608

Read Header **Edit Header** Polarization Mode Dual Pol : pp3

- Input Master Directory
D:/PoSAR_Data/Juanma/Rice_Scene/TSX1_SAR_SSC_BTXX1_SM_D_SRA_20110608T062951_20110608

- Output Master Directory
D:/PoSAR_Data/Juanma/Rice_Scene/master

- Input Slave Directory
D:/PoSAR_Data/Juanma/Rice_Scene/TDX1_SAR_SSC_BFX2_SM_D_SRA_20110608T062951_20110608

- Output Slave Directory
D:/PoSAR_Data/Juanma/Rice_Scene/slave

Master Directory **Edit Header** Initial Number of Rows 8836 Initial Number of Cols 12894 Slave Directory **Edit Header**

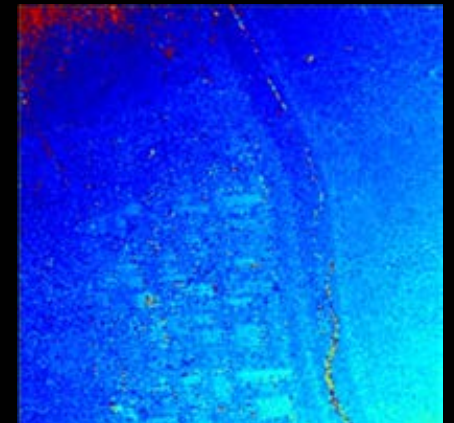
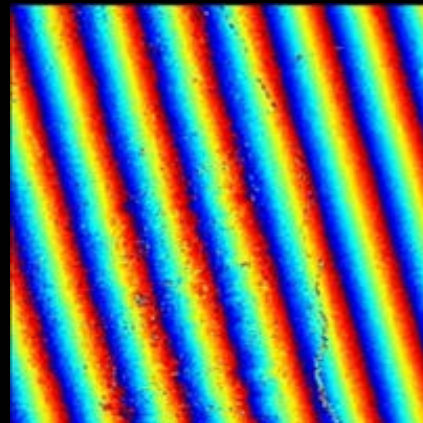
- Input Master Data File (s11)
D:/PoSAR_Data/Juanma/Rice_Scene/TSX1_SAR_SSC_BTXX1_SM_D_SRA_20110608T062951_20110608

- Input Master Data File (s22)
D:/PoSAR_Data/Juanma/Rice_Scene/TSX1_SAR_SSC_BTXX1_SM_D_SRA_20110608T062951_20110608

- Input Slave Data File (s11)
D:/PoSAR_Data/Juanma/Rice_Scene/TDX1_SAR_SSC_BFX2_SM_D_SRA_20110608T062951_20110608

- Input Slave Data File (s22)
D:/PoSAR_Data/Juanma/Rice_Scene/TDX1_SAR_SSC_BFX2_SM_D_SRA_20110608T062951_20110608

OK **Cancel**



• TanDEM – X Dual POL

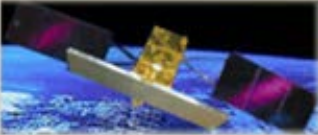
New!

PoISARpro v5.0 SOFTWARE



COSMO-SKYMED

COSMO-SKYMED Input Data File



Input Directory
D:/D_POLSAR_DATA/CSK_Images/10F02911-114_20120211_sougeal/7zEF9CC.tmp

Output Directory
D:/D_POLSAR_DATA/CSK_Images/10F02911-114_20120211_sougeal/7zEF9CC.tmp

SAR Product File
D:/D_POLSAR_DATA/CSK_Images/10F02911-114_20120211_sougeal/7zEF9CC.tmp/CSKS1_!

Check Files

Satellite ID Station ID Frequency


Incidence Angle Look Side Orbit Direction

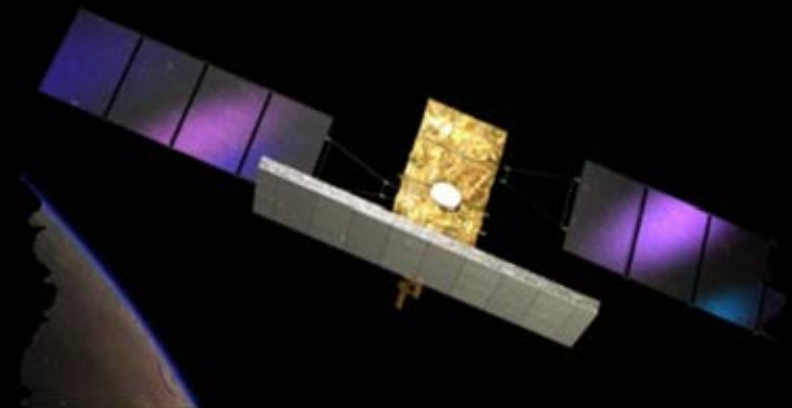
Column Spacing Line Spacing Polar Type

Scene Sensing
Start Stop

Dump hd5 to bin Files

Initial Number of Rows Initial Number of Cols

OK  **Cancel**



SSC: Single Look Slant Range Complex

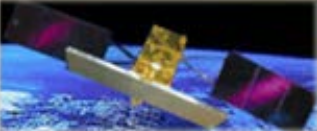
• COSMO-SKYMED Dual POL

New!

PoISARpro v5.0 SOFTWARE



COSMO-SKYMED Input Data File



Input Directory
D:/D_POLSAR_DATA/CSK_Images/10F02911-114_20120211_sougeal/7zEF9CC.tmp

Output Directory
D:/D_POLSAR_DATA/CSK_Images/10F02911-114_20120211_sougeal/7zEF9CC.tmp

SAR Product File
D:/D_POLSAR_DATA/CSK_Images/10F02911-114_20120211_sougeal/7zEF9CC.tmp/CSKS1_!

Check Files

Satellite ID Station ID Frequency


Incidence Angle Look Side Orbit Direction

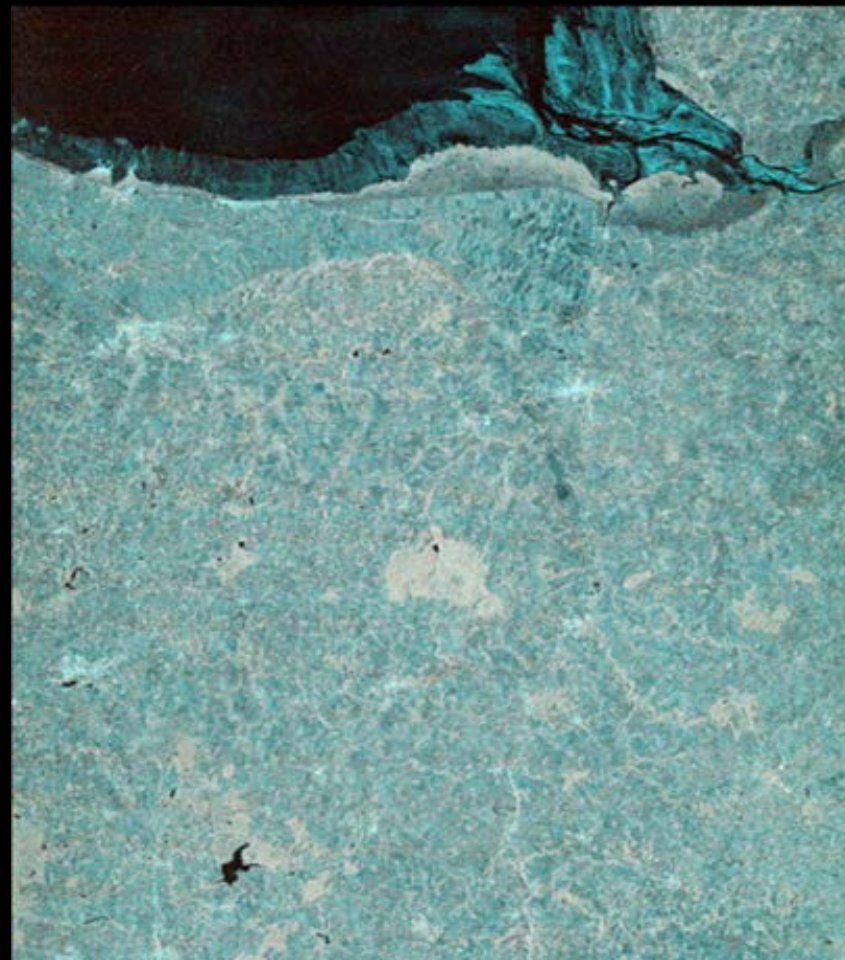
Column Spacing Line Spacing Polar Type

Scene Sensing
Start Stop

Dump hd5 to bin Files

Initial Number of Rows Initial Number of Cols

OK  **Cancel**



• COSMO-SKYMED Dual POL


New!

PoISARpro v5.0 SOFTWARE



RISAT

RISAT Input Data File (CEOS Format)



Input Directory:

Output Directory:

Band-Meta File:

Read Header Scene ID: Mode:

Mode: Level: Format: Inc Ang:

Res Rg: Res Az: Pix Rg: Pix Az:

SAR Leader File:

SAR Image Files:

s11:

s12:

s21:

s22:

Initial Number of Rows: Initial Number of Cols:



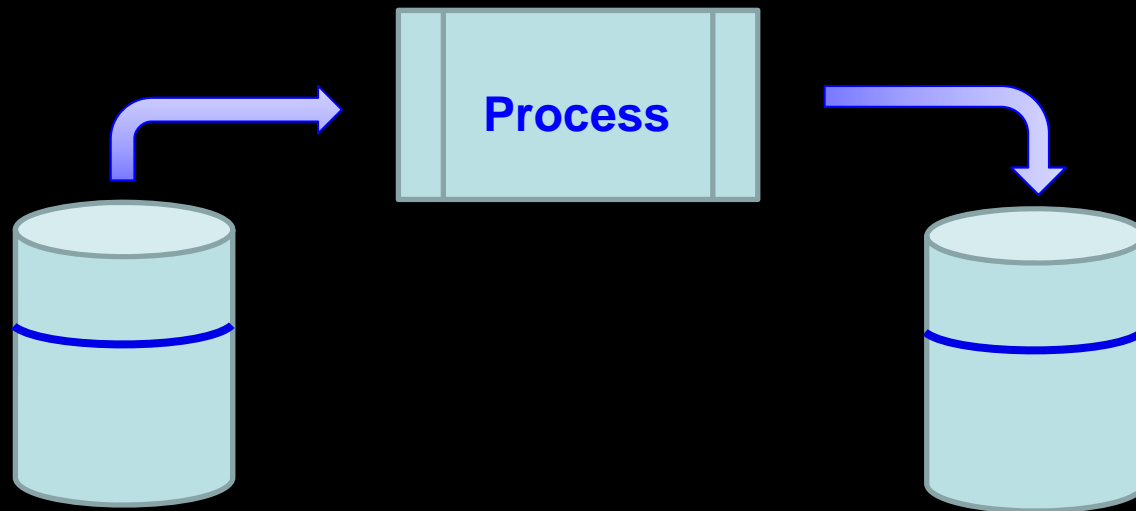
• RISAT Dual POL – Compact POL

New!

PoISARpro v5.0 SOFTWARE



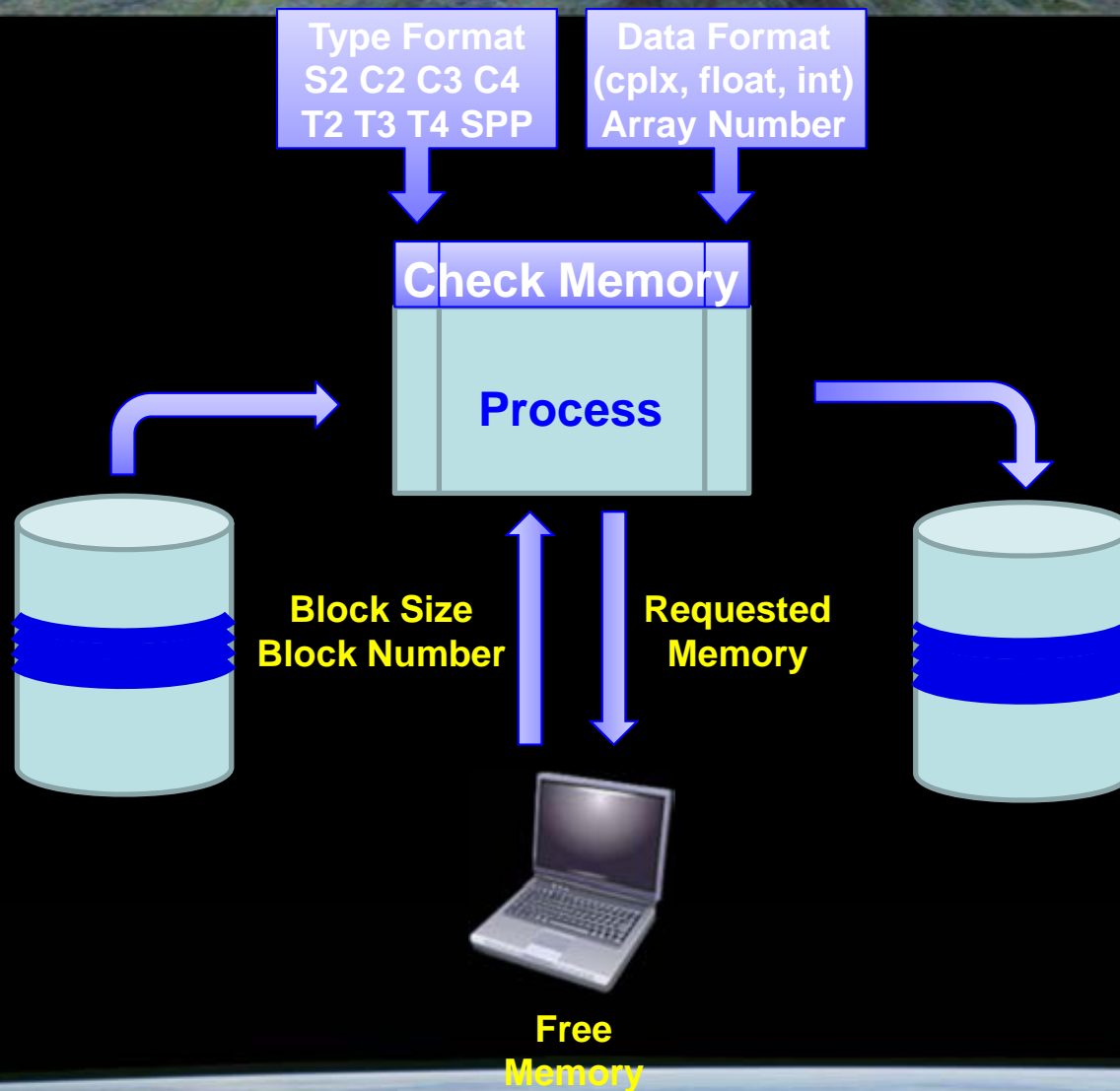
A NEW ENGINE !



PROCESS DATA : ROW per ROW

RUN PROCESS : v1.0 to v4.2

PoISARpro v5.0 SOFTWARE



RUN PROCESS : v5.0

PoISARpro v5.0 SOFTWARE



```
Invite de commandes
D:\DEV_PoISARpro_v4_v5\Soft\data_process_sngl>h_a_alpha_decomposition_T3
  A processing error occurred !
  h_a_alpha_decomposition_T3 in_dir out_dir Nwin offset_lig offset_col sub_nlig s
ub_ncol albetdelgam lambda alpha entropy anisotropy CombHA CombHimA CombimHA Co
mbimHimA
D:\DEV_PoISARpro_v4_v5\Soft\data_process_sngl>
```

RunProcess.exe arg1 arg2 arg3 arg4 argN

RUN PROCESS : v1.0 to v4.2

PoISARpro v5.0 SOFTWARE



```
CA Invite de commandes
D:\DEU_PoISARpro_v5.0\Soft\data_process_sngl>h_a_alpha_decomposition

A processing error occured !
Not enough input arguments
Usage:

h_a_alpha_decomposition.exe

Parameters:
(string)      -id      input directory
(string)      -od      output directory
(string)      -iodf    input-output data format
(int)         -nwr     Nwin Row
(int)         -nwc     Nwin Col
(int)         -ofr     Offset Row
(int)         -ofc     Offset Col
(int)         -fnr     Final Number of Row
(int)         -fnc     Final Number of Col
(int)         -fl1     Flag Parameters (0/1)
(int)         -fl2     Flag Lambda (0/1)
(int)         -fl3     Flag Alpha (0/1)
(int)         -fl4     Flag Entropy (0/1)
(int)         -fl5     Flag Anisotropy (0/1)
(int)         -fl6     Flag Comb HA (0/1)
(int)         -fl7     Flag Comb H1mA (0/1)
(int)         -fl8     Flag Comb 1mHA (0/1)
(int)         -fl9     Flag Comb 1mH1mA (0/1)

Optional Parameters:
(string)      -mask    mask file (valid pixels)
(int)         -mem     Allocated memory for blocksize determination (in Mb)
(string)      -errf    memory error file
(noarg)       -help    displays this message
(noarg)       -data    displays the help concerning Data Format parameter

D:\DEU_PoISARpro_v5.0\Soft\data_process_sngl>_
```

RUN PROCESS : v5.0

PoISARpro v5.0 SOFTWARE



```
CA Invite de commandes
D:\DEV_PoISARpro_v5.0\Soft\data_process_sngl>h_a_alpha_decomposition

A processing error occurred !
Not enough input arguments
Usage:

h_a_alpha_decomposition.exe

Parameters:
(string)      -id      input directory
(string)      -od      output directory
(string)      -iodf    input-output data format
(int)        -nwr     Nwin Row
(int)        -nwc     Nwin Col
(int)        -ofr     Offset Row
(int)        -ofc     Offset Col
(int)        -fnr     Final Number of Row
(int)        -fnc     Final Number of Col
(int)        -fl1     Flag Parameters (0/1)
(int)        -fl2     Flag Lambda (0/1)
(int)        -fl3     Flag Alpha (0/1)
(int)        -fl4     Flag Entropy (0/1)
(int)        -fl5     Flag Anisotropy (0/1)
(int)        -fl6     Flag Comb HA (0/1)
(int)        -fl7     Flag Comb H1mA (0/1)
(int)        -fl8     Flag Comb 1mHA (0/1)
(int)        -fl9     Flag Comb 1mH1mA (0/1)

Optional Parameters:
(string)      -mask    mask file (valid pixels)
(int)        -mem     Allocated memory for blocksize determination (in Mb)
(string)      -errf    memory error file
(noarg)      -help    displays this message
(noarg)      -data    displays the help concerning Data Format parameter

D:\DEV_PoISARpro_v5.0\Soft\data_process_sngl>_
```

Polarimetric Data Format

RUN PROCESS : v5.0

PoISARpro v5.0 SOFTWARE



```
Invite de commandes

D:\DEV_PoISARpro_v5.0\Soft\data_process_sng1>h_a_alpha_decomposition -data

Usage :

Polarimetric Input-Output Data Format

S2T3 input : quad-pol S2      output parameters derived from coherency T3
S2C3 input : quad-pol S2      output parameters derived from covariance C3
S2T4 input : quad-pol S2      output parameters derived from coherency T4
S2C4 input : quad-pol S2      output parameters derived from covariance C4
C2    input : covariance C2    output parameters derived from covariance C2
C3    input : covariance C3    output parameters derived from covariance C3
C3T3 input : covariance C3    output parameters derived from coherency T3
C4    input : covariance C4    output parameters derived from covariance C4
C4T4 input : covariance C4    output parameters derived from coherency T4
T3    input : coherency T3    output parameters derived from coherency T3
T4    input : coherency T4    output parameters derived from coherency T4

D:\DEV_PoISARpro_v5.0\Soft\data_process_sng1>
```

RUN PROCESS : v5.0

PoISARpro v5.0 SOFTWARE



```
CA Invite de commandes
D:\DEV_PoISARpro_v5.0\Soft\data_process_sngl>h_a_alpha_decomposition

A processing error occured !
Not enough input arguments
Usage:

h_a_alpha_decomposition.exe

Parameters:
(string)      -id      input directory
(string)      -od      output directory
(string)      -iodf    input-output data format
(int)         -nwr     Nwin Row
(int)         -nwc     Nwin Col
(int)         -ofr     Offset Row
(int)         -ofc     Offset Col
(int)         -fnr     Final Number of Row
(int)         -fnc     Final Number of Col
(int)         -fl1     Flag Parameters (0/1)
(int)         -fl2     Flag Lambda (0/1)
(int)         -fl3     Flag Alpha (0/1)
(int)         -fl4     Flag Entropy (0/1)
(int)         -fl5     Flag Anisotropy (0/1)
(int)         -fl6     Flag Comb HA (0/1)
(int)         -fl7     Flag Comb H1mA (0/1)
(int)         -fl8     Flag Comb 1mHA (0/1)
(int)         -fl9     Flag Comb 1mH1mA (0/1)

Optional Parameters:
(string)      -mask    mask file (valid pixels)
(int)         -mem     Allocated memory for blocksize determination (in Mb)
(string)      -errf    memory error file
(noarg)       -help    displays this message
(noarg)       -data    displays the help concerning Data Format parameter

D:\DEV_PoISARpro_v5.0\Soft\data_process_sngl>_
```

Allocated Memory

RUN PROCESS : v5.0

PoISARpro v5.0 SOFTWARE



```
CA Invite de commandes
D:\DEV_PoISARpro_v5.0\Soft\data_process_sngl>h_a_alpha_decomposition

A processing error occured !
Not enough input arguments
Usage:

h_a_alpha_decomposition.exe

Parameters:
(string)      -id      input directory
(string)      -od      output directory
(string)      -iodf    input-output data format
(int)         -nwr     Nwin Row
(int)         -nwc     Nwin Col
(int)         -ofr     Offset Row
(int)         -ofc     Offset Col
(int)         -fnr     Final Number of Row
(int)         -fnc     Final Number of Col
(int)         -fl1     Flag Parameters (0/1)
(int)         -fl2     Flag Lambda (0/1)
(int)         -fl3     Flag Alpha (0/1)
(int)         -fl4     Flag Entropy (0/1)
(int)         -fl5     Flag Anisotropy (0/1)
(int)         -fl6     Flag Comb HA (0/1)
(int)         -fl7     Flag Comb H1mA (0/1)
(int)         -fl8     Flag Comb 1mHA (0/1)
(int)         -fl9     Flag Comb 1mH1mA (0/1)

Optional Parameters:
(string)      -mask    mask file (valid pixels)
(int)         -mem     Allocated memory for blocksize determination (in Mb)
(string)      -errf    memory error file
(noarg)       -help    displays this message
(noarg)       -data    displays the help concerning Data Format parameter

D:\DEV_PoISARpro_v5.0\Soft\data_process_sngl>
```

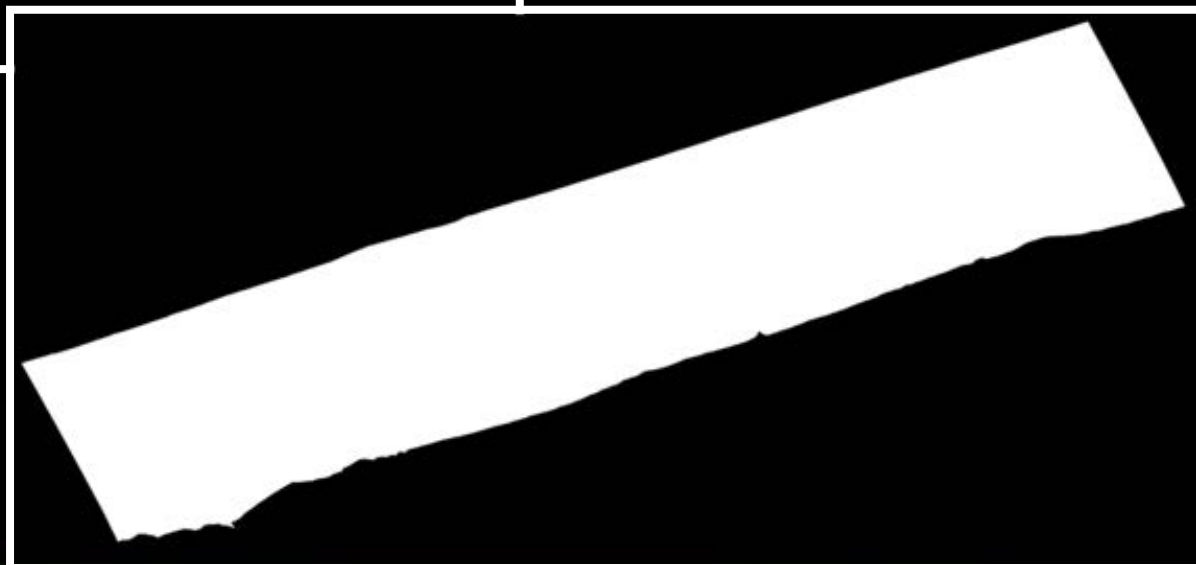
Valid Pixel Mask

RUN PROCESS : v5.0

PoISARpro v5.0 SOFTWARE



Valid Pixel Mask



RUN PROCESS : v5.0

PoISARpro v5.0 SOFTWARE



Window Size Nrow = Window Size Ncol

```
Invite de commandes
D:\DEV_PoISARpro_v4_v5\Soft\data_process_sngl>h_a_alpha_decomposition_T3
A processing error occurred !
h_a_alpha_decomposition_T3 in_dir out_dir Nwin offset_lig offset_col sub_nlig s
ub_ncol albetdelgan lambda alpha entropy anisotropy CombHA CombHimA CombimHA Co
mbimHimA
D:\DEV_PoISARpro_v4_v5\Soft\data_process_sngl>
```

RunProcess.exe arg1 arg2 **Nwin** arg4 argN

RUN PROCESS : v1.0 to v4.2

PoISARpro v5.0 SOFTWARE



```
CA Invite de commandes
D:\DEV_PoISARpro_v5.0\Soft\data_process_sngl>h_a_alpha_decomposition

A processing error occurred !
Not enough input arguments
Usage:

h_a_alpha_decomposition.exe

Parameters:
(string)      -id      input directory
(string)      -od      output directory
(string)      -iofff   input output data format
(int)         -nwr     Nwin Row
(int)         -nwc     Nwin Col
(int)         -ofr     Offset Row
(int)         -ofc     Offset Col
(int)         -fnr     Final Number of Row
(int)         -fnc     Final Number of Col
(int)         -fl1     Flag Parameters (0/1)
(int)         -fl2     Flag Lambda (0/1)
(int)         -fl3     Flag Alpha (0/1)
(int)         -fl4     Flag Entropy (0/1)
(int)         -fl5     Flag Anisotropy (0/1)
(int)         -fl6     Flag Comb HA (0/1)
(int)         -fl7     Flag Comb H1mA (0/1)
(int)         -fl8     Flag Comb 1mHA (0/1)
(int)         -fl9     Flag Comb 1mH1mA (0/1)

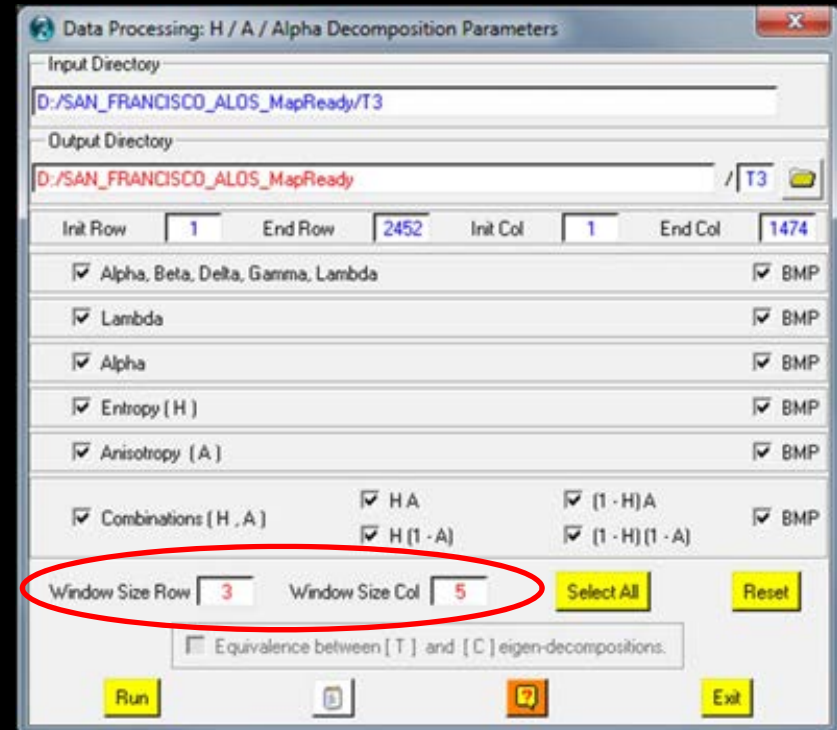
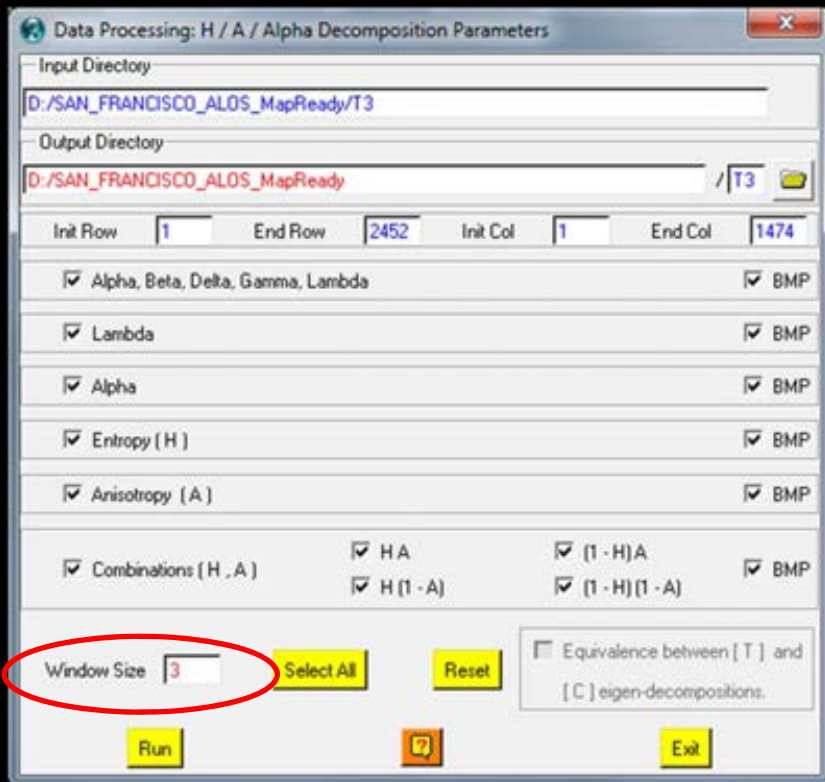
Optional Parameters:
(string)      -mask    mask file (valid pixels)
(int)         -mem     Allocated memory for blocksize determination (in Mb)
(string)      -errf    memory error file
(noarg)       -help    displays this message
(noarg)       -data    displays the help concerning Data Format parameter

D:\DEV_PoISARpro_v5.0\Soft\data_process_sngl>_
```

**Window Size Nrow
!=
Window Size Ncol**

RUN PROCESS : v5.0

PoSARpro v5.0 SOFTWARE



RUN PROCESS : v1.0 to v4.2

RUN PROCESS : v5.0

PoISARpro v5.0 SOFTWARE



Software – General Presentation

PoISARpro v5.0 SOFTWARE



PoISARpro v5.0 MAIN WINDOW

Full Screen



PoISARpro v5.0 SOFTWARE



Polarimetric SAR Data Processing and Educational Tool v5.0 - Menu



PoISARpro – PoCal (Pocket Calculator)

PoISARpro v5.0 - Run Trace

Open Window Polarimetric Data Format
Close Window Polarimetric Data Format

PoSARpro v5.0 SOFTWARE



New!

Calculator v1.0

Op #1 (Op#1) Operator (Op#2) Op #2

Operand #1
File Mat S / M 2x2 mat 3x3 mat 4x4 mat

STO RCL MC AC

Input File
Input File Data Format Init Row End Row Init Col End Col OK

Input Matrix Directory
Input Matrix Data Format Init Row End Row Init Col End Col OK

Input Value Type
 Complex Value Float Value Integer Value Input Value +j OK

N x N Matrix
 Complex Float Hermitian Special Unitary OK

m11	<input type="text"/>	+j	<input type="text"/>	m12	<input type="text"/>	+j	<input type="text"/>	m13	<input type="text"/>	+j	<input type="text"/>	m14	<input type="text"/>	+j	<input type="text"/>
m21	<input type="text"/>	+j	<input type="text"/>	m22	<input type="text"/>	+j	<input type="text"/>	m23	<input type="text"/>	+j	<input type="text"/>	m24	<input type="text"/>	+j	<input type="text"/>
m31	<input type="text"/>	+j	<input type="text"/>	m32	<input type="text"/>	+j	<input type="text"/>	m33	<input type="text"/>	+j	<input type="text"/>	m34	<input type="text"/>	+j	<input type="text"/>
m41	<input type="text"/>	+j	<input type="text"/>	m42	<input type="text"/>	+j	<input type="text"/>	m43	<input type="text"/>	+j	<input type="text"/>	m44	<input type="text"/>	+j	<input type="text"/>

Output Value +j Exec Save ? Exit

Operator : File

- (file) + value (file) - value (file) * value (file) / value
- (file) .+ (file) (file) .- (file) (file) .* (file) (file) ./ (file)
- . real (.) . imag (.) . arg (.) . abs (.)
- . cos (.) . sin (.) . tan (.) . conj (.)
- . acos (.) . asin (.) . atan (.) . boxcar (?x?) OK
- . sqrt (.) . (.)^2 . (.)^3 . (.)^(?)
- . log (| . |) . ln (| . |) . 10^(.) . exp (.)
- . 10log (| . |) . 20log (| . |) . (.) < (?) . (.) > (?)

Operator : Sinclair Matrix : S2

- [S] + value [S] - value [S] * value [S] / value
- [S] .+ (file) [S] .- (file) [S] .* (file) [S] ./ (file)
- [S] .+ [S'] [S] .+ [mat] [S] .* [S'] [S] .* [mat] OK
- [S] .* [S]^n [U] .* [S] .* [U] .
- . conj [S] . tr [S] . det [S] . inv [S]
- . eig1 [S] . eig2 [S] . eig1 [G] . eig2 [G]

Operator : Hermitian Matrix : C2, C3, C4, T2, T3, T4

- [M] + value [M] - value [M] * value [M] / value
- [M] .+ (file) [M] .- (file) [M] .* (file) [M] ./ (file)
- [M] .+ [M'] [M] .+ [mat] . inv [M] [U] .* [M] .* inv [U] OK
- . conj [M] . tr [M] . det [M] tr (inv [mat] .* [M])
- . eig1 [M] . eig2 [M] . eig3 [M] . eig4 [M]

Operator : Complex / Hermitian / Float / Special Unitary NxN Matrix

- [mat] + value [mat] - value [mat] * value [mat] / value
- [mat] .+ [mat'] [mat] .- [mat'] [mat] .* [mat'] [mat] ./ [mat'] OK
- . det [mat] . tr [mat] . conj [mat] . inv [mat]
- . eig1 [mat] . eig2 [mat] . eig3 [mat] . eig4 [mat]

PoISARpro v5.0 SOFTWARE



External Softwares

PoISARpro v5.0 SOFTWARE



GIS SOFTWARES

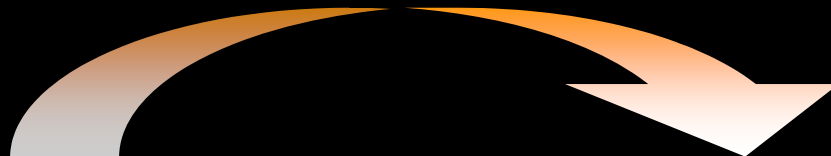
MAP READY



v 4.0



NEST



esa

→ POLSARPRO V. 5.0
The Polarimetric SAR Data Processing and Educational Tool

<http://earth.esa.int/polsarpro>

www.esa.int European Space Agency

New!

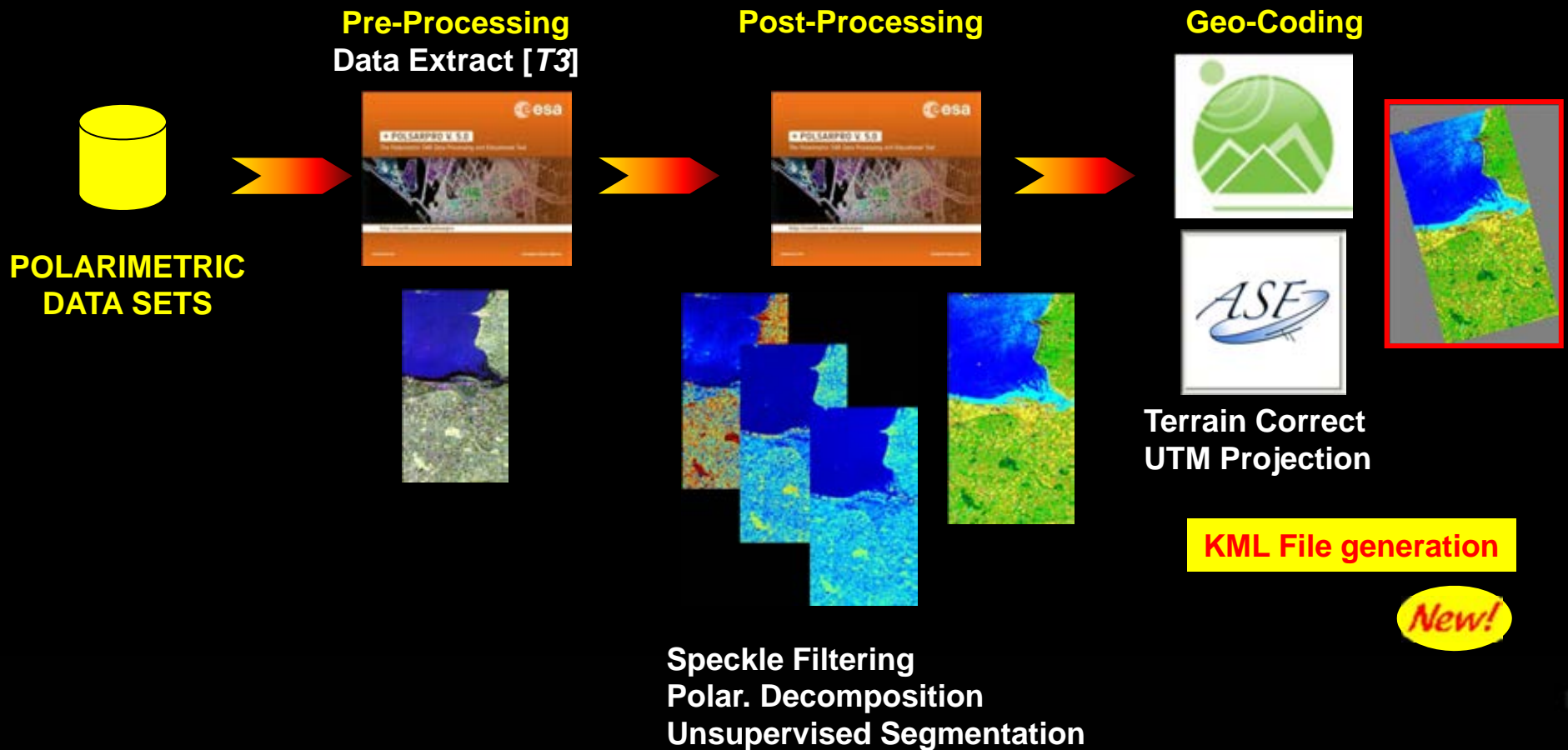
nest
next esa sar toolbox



PoISARpro v5.0 SOFTWARE



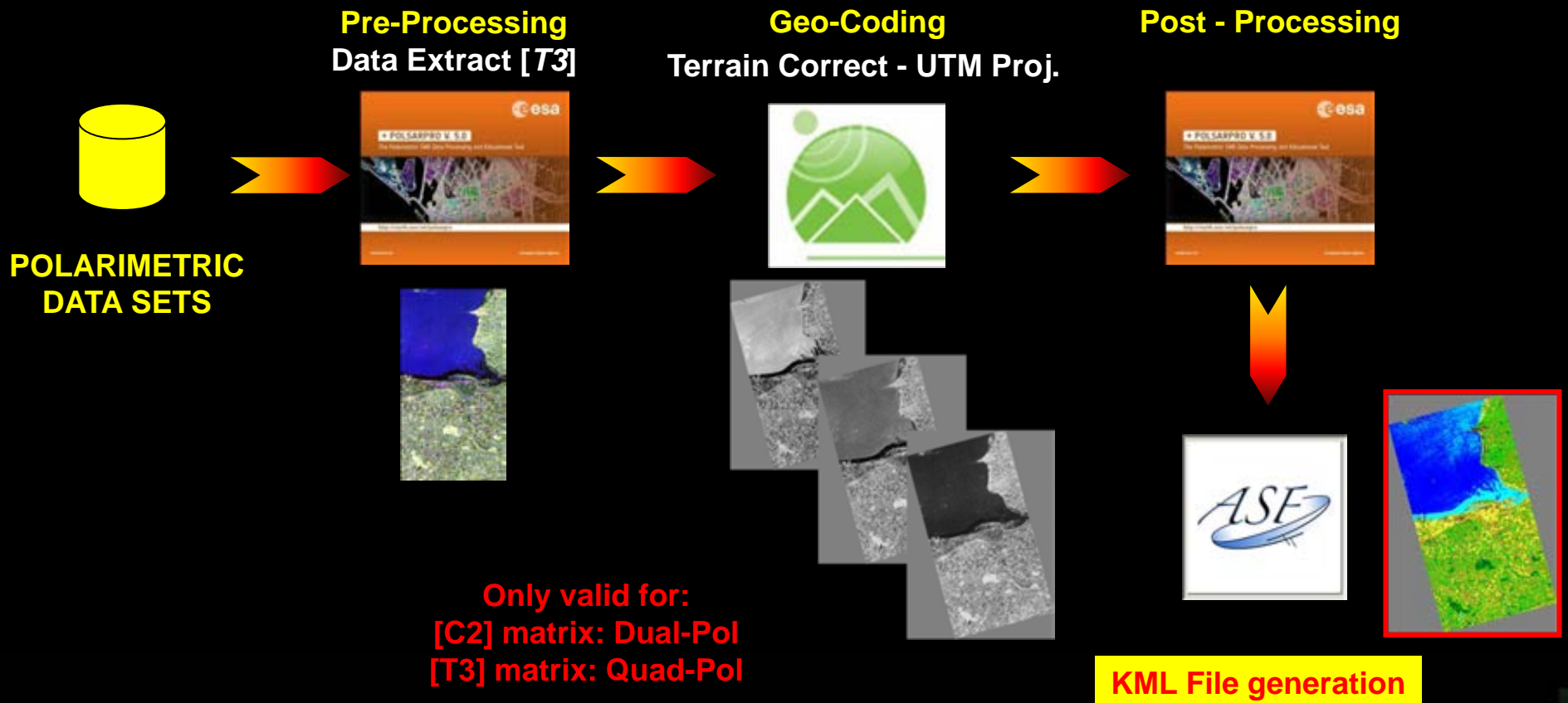
MAP READY - NEST



PoISARpro v5.0 SOFTWARE



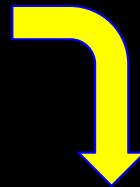
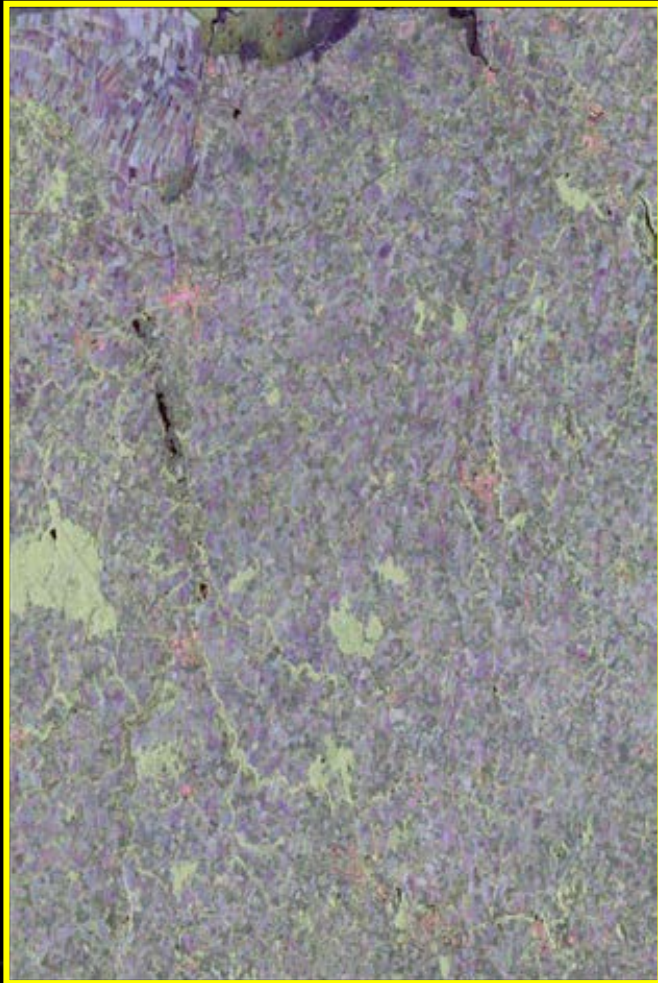
MAP READY - NEST



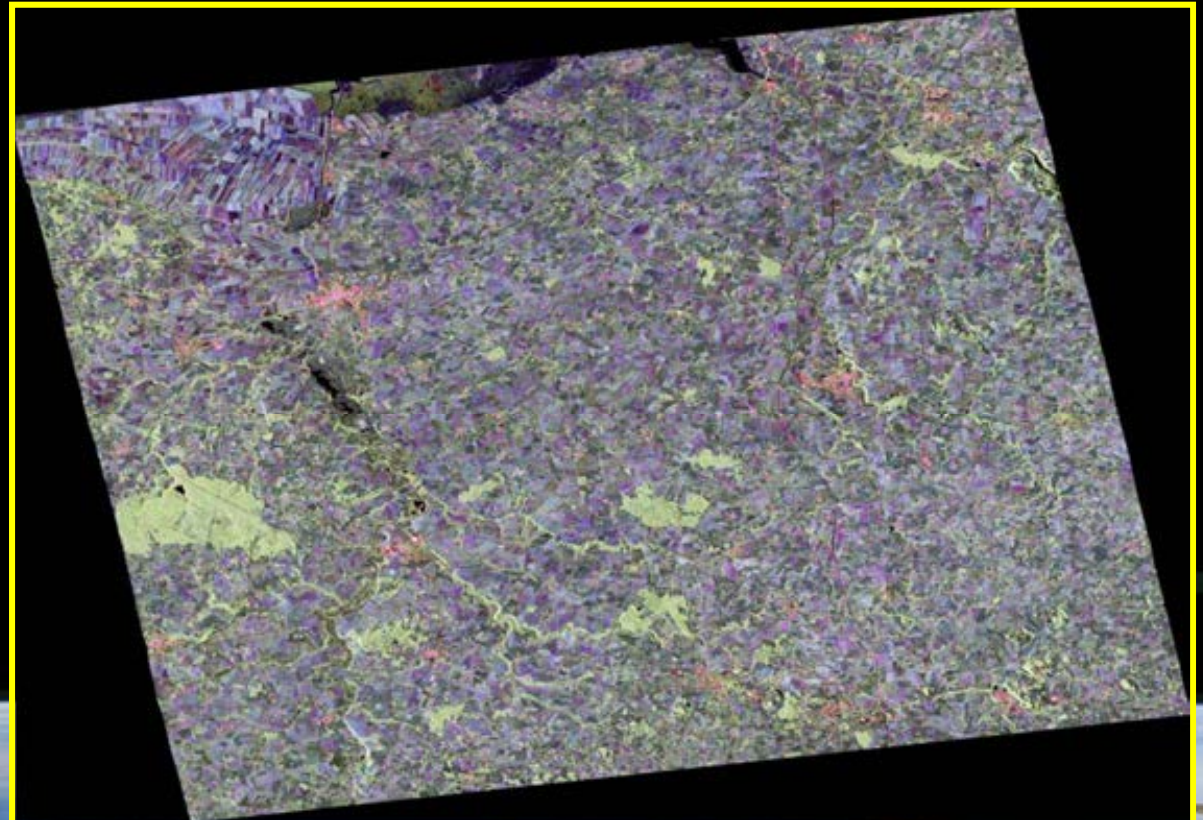
PoISARpro v5.0 SOFTWARE



MAP READY - NEST



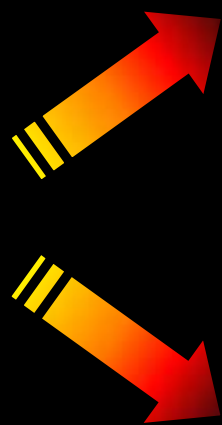
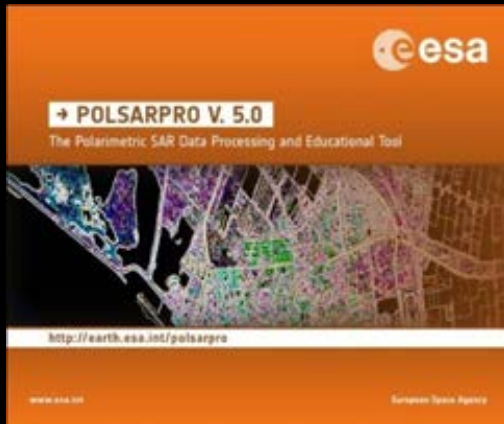
[T3] matrix



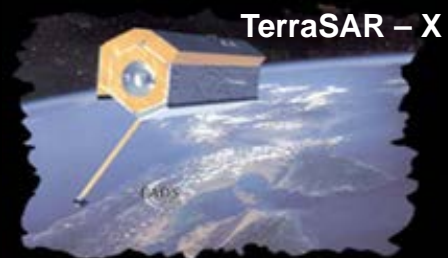
PoISARpro v5.0 SOFTWARE



NEST



Dual-Pol ([C2])
Quad-Pol ([T3])



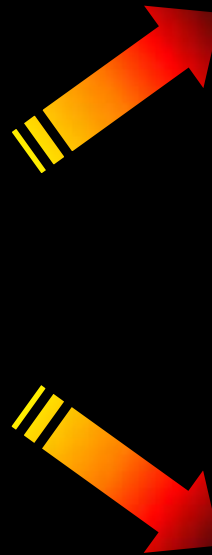
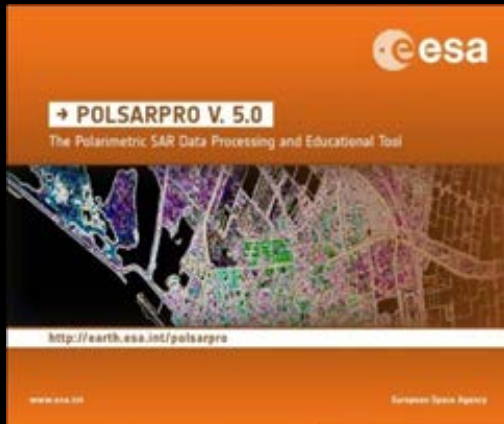
Dual-Pol ([C2])



PoSARpro v5.0 SOFTWARE



MAP READY



ALOS – PALSAR



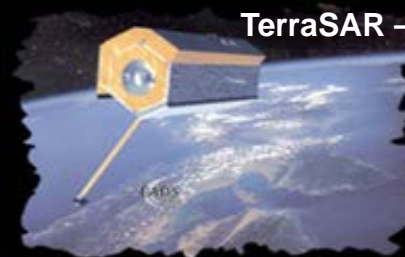
Dual-Pol ([C2])
Quad-Pol ([T3])

RADARSAT 2



Dual-Pol ([C2])
Quad-Pol ([T3])

TerraSAR – X



Dual-Pol ([C2])

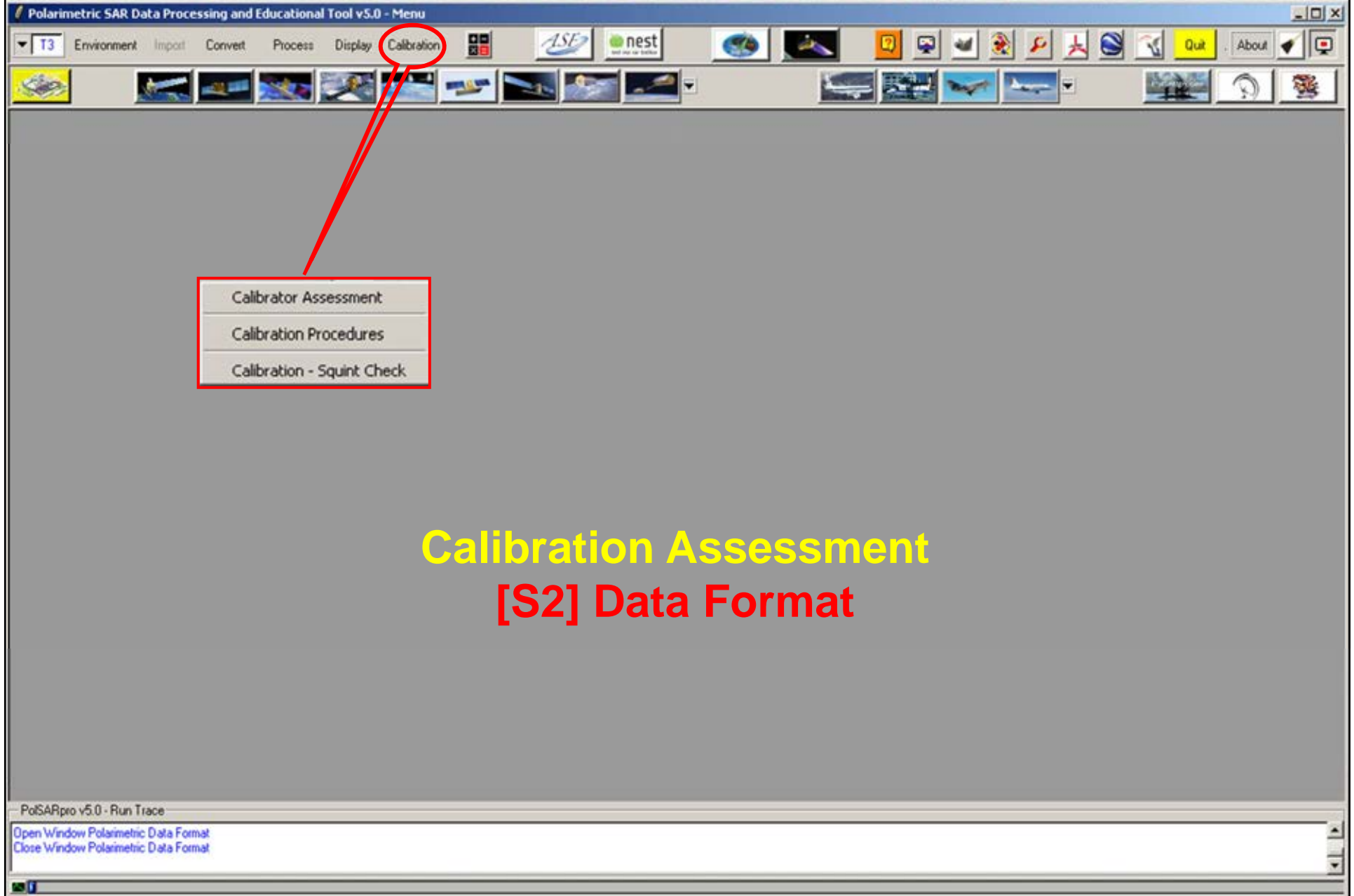


PoISARpro v5.0 SOFTWARE



NEW FUNCTIONALITIES

PoISARpro v5.0 SOFTWARE



Calibration Assessment [S2] Data Format

Calibration Assessment



New!

Calibration : Squint Check

Input Directory: C:/DataDirectory

Output Directory: C:/DataDirectory

Init Row: 1 End Row: 18432 Init Col: 1 End Col: 1248

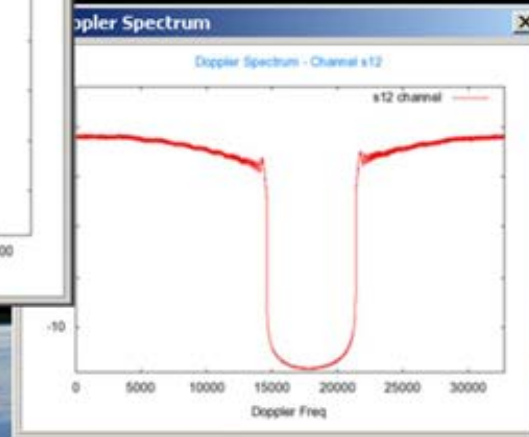
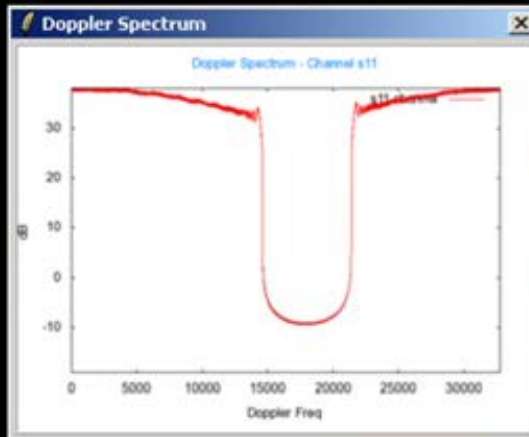
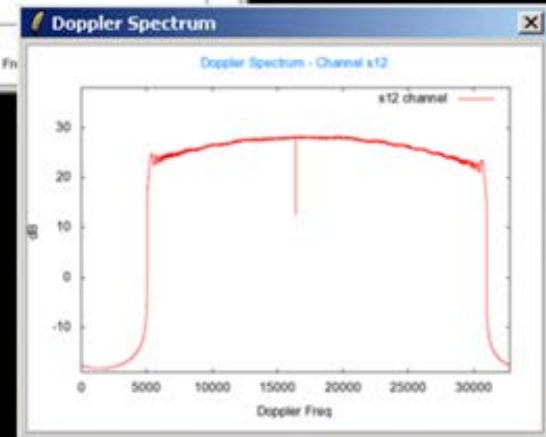
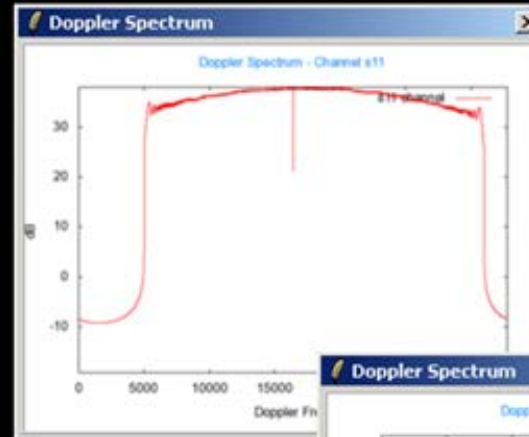
Azimuth / Range Orientation:
 Azimut = Row / Range = Col
 Azimut = Col / Range = Row

Check Doppler Spectrum

Channel: s11

Raw Spectrum
 Avg Spectrum

Buttons: Check, Plot, Close, Exit



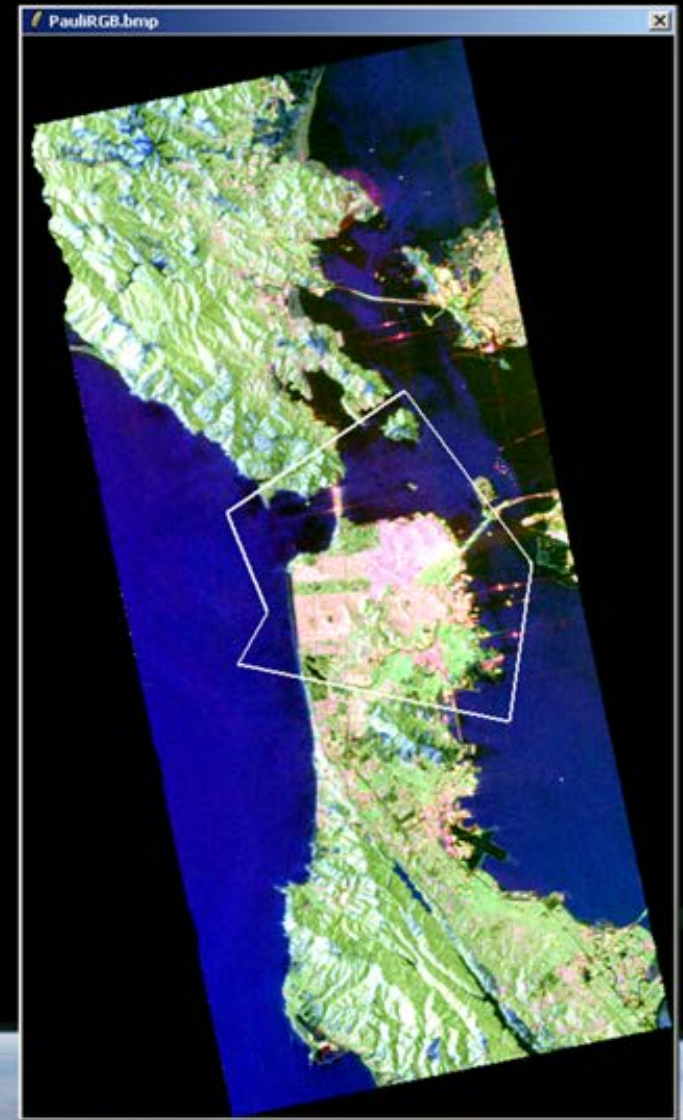
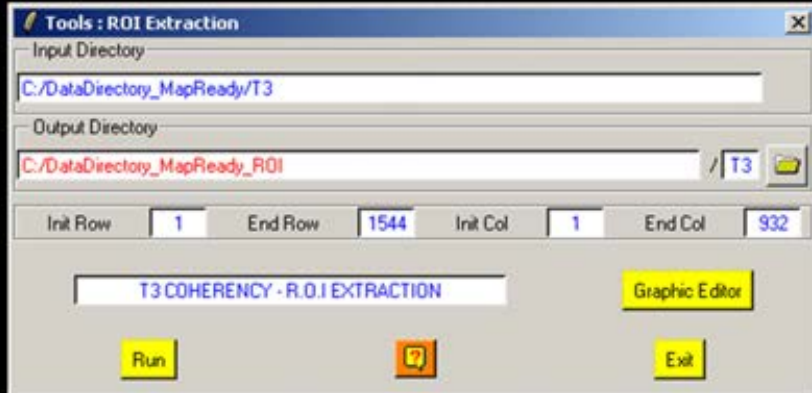
PoISARpro v5.0 SOFTWARE



Tools Interface offers different Data Files management and transformation facilities

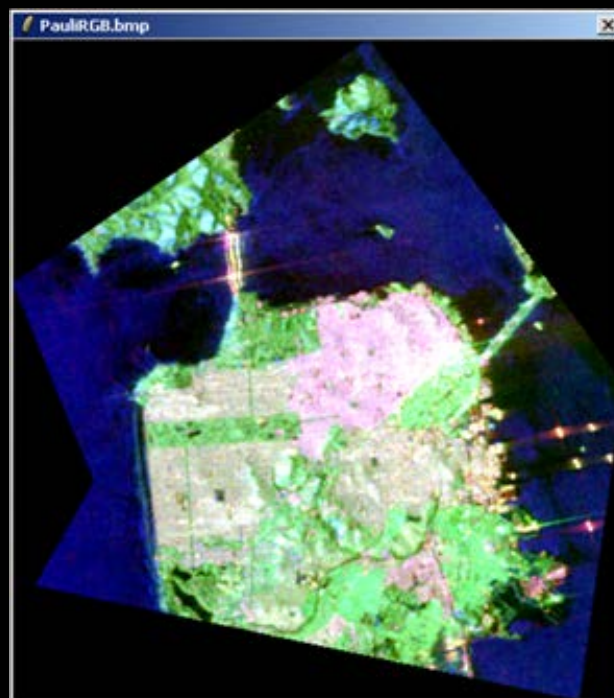


R.O.I Extraction Functionality

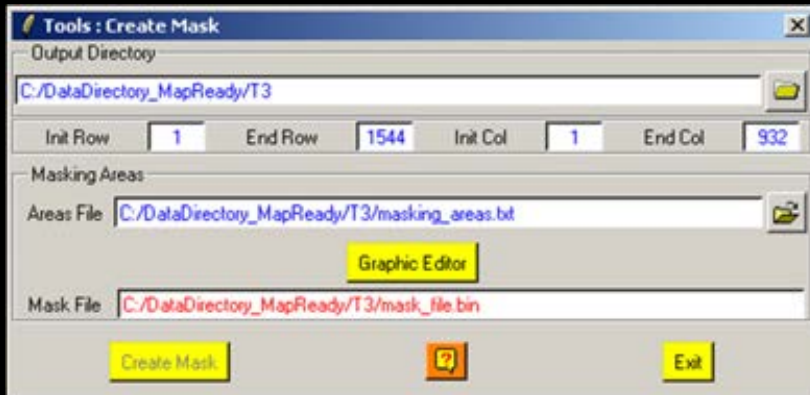


New!

R.O.I Extraction Functionality

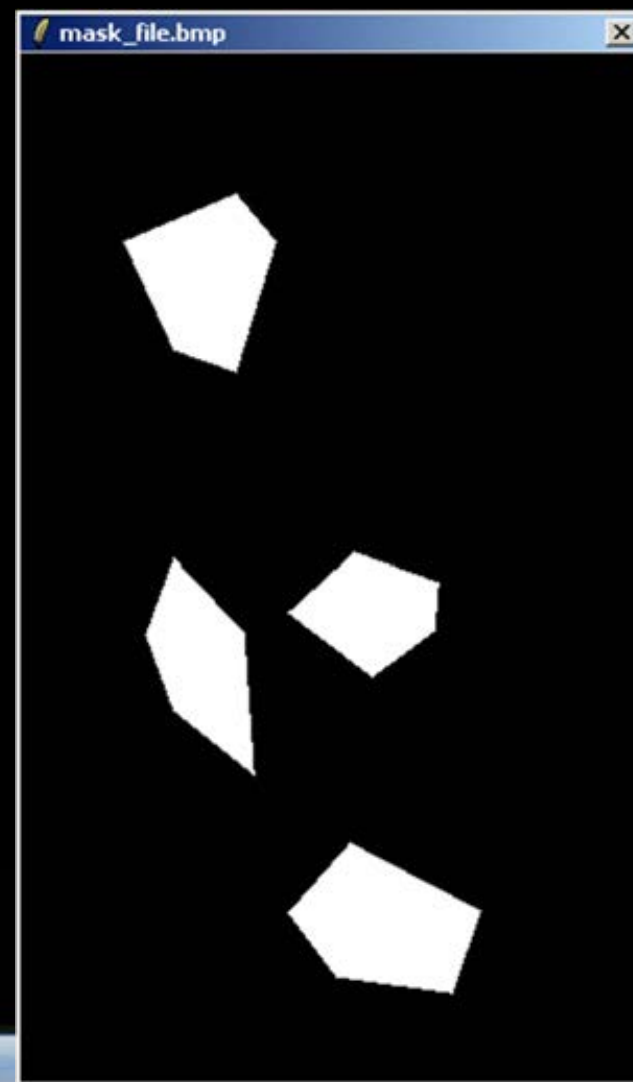
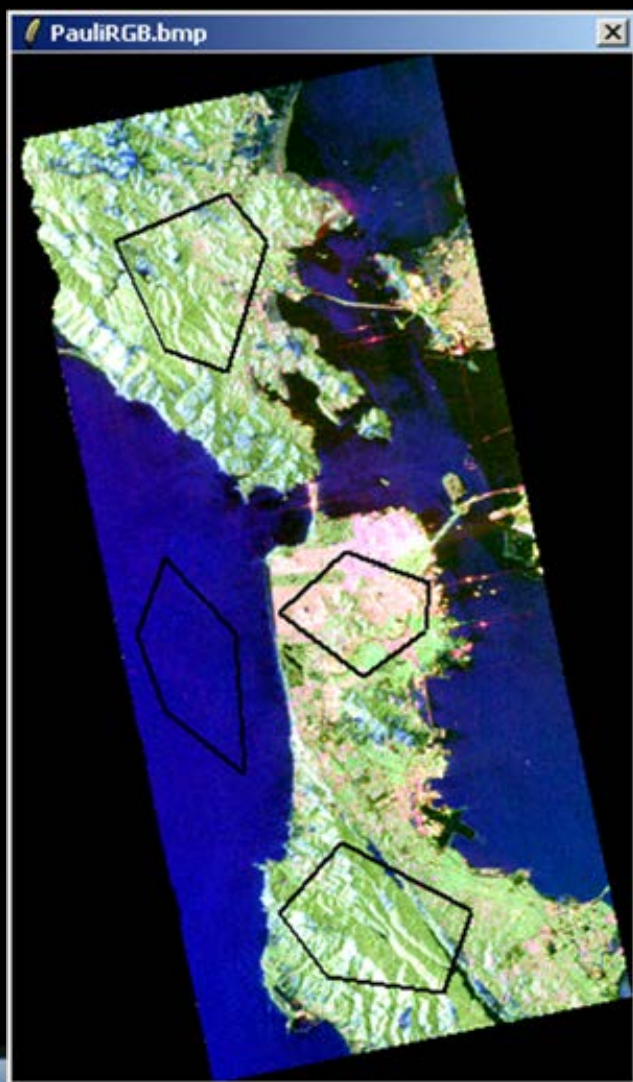


Mask Functionality



New!

Create Mask Functionality



Create Gray & Color BMP File



Polarimetric SAR Data Processing and Educational Tool v5.0 - Menu

Environment Import Convert Process **Display** Calibration

LSF nest

Out About

Display

- Create BMP File
- Create RGB File
- Create HSL File
- Create KML File
- Create Gray & Color BMP File
- BMP Viewer

New!

Create Gray & Color BMP File

Input 8-bits BMP Gray Scale File
C:/DataDirectory_MapReady/T3/span_db.bmp
N Row 1544 N Col 932 N Color 256

Input 8-bits BMP Color Scale File
C:/DataDirectory_MapReady/T3/entropy.bmp
N Row 1544 N Col 932 N Color 256

Input Mask File
C:/DataDirectory_MapReady/T3/mask_file.bin
N Row 1544 N Col 932 Invert Mask

Check Files

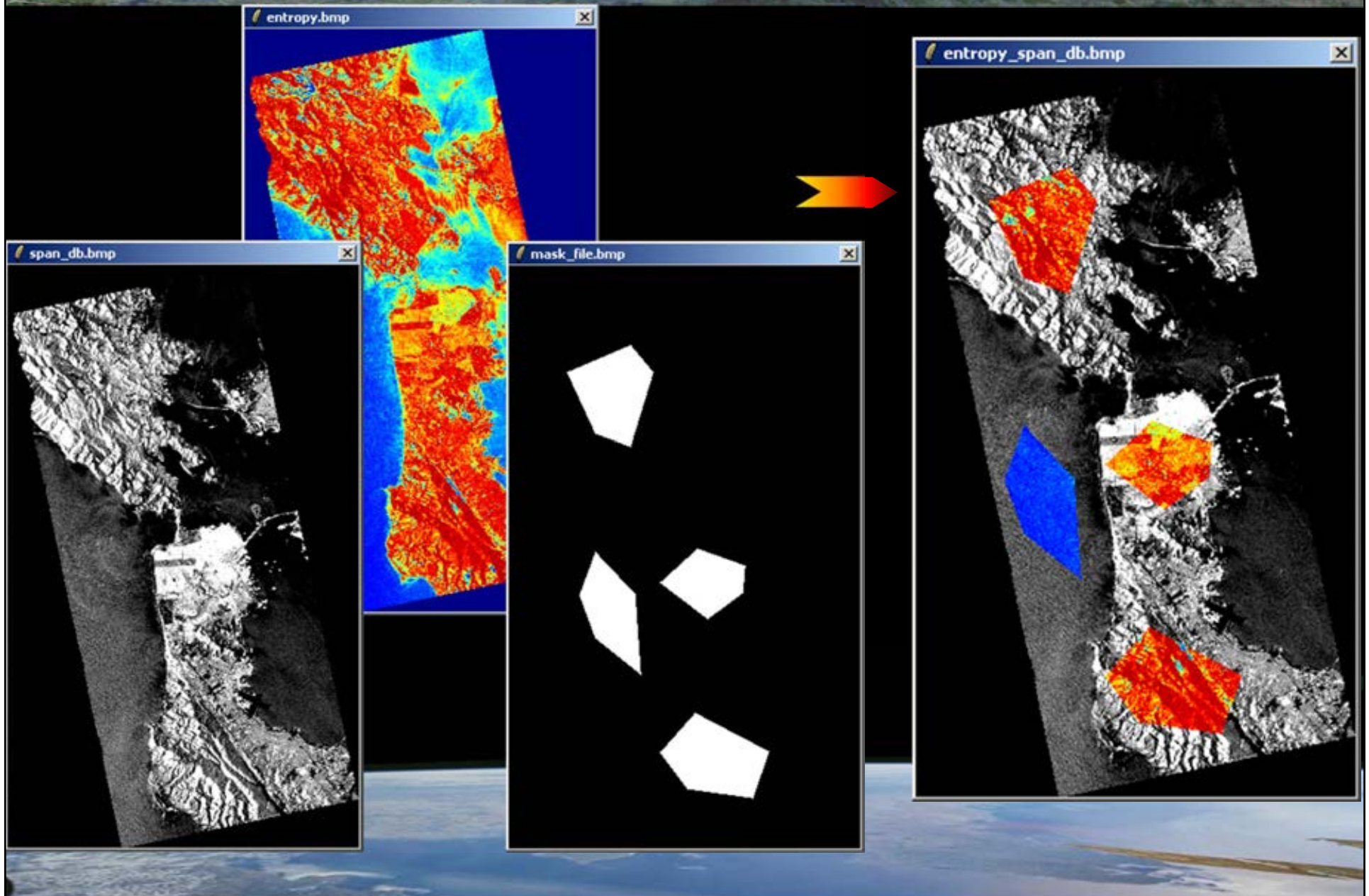
Output BMP Directory
C:/DataDirectory_MapReady/T3

Output BMP File
C:/DataDirectory_MapReady/T3/entropy_span_db.bmp

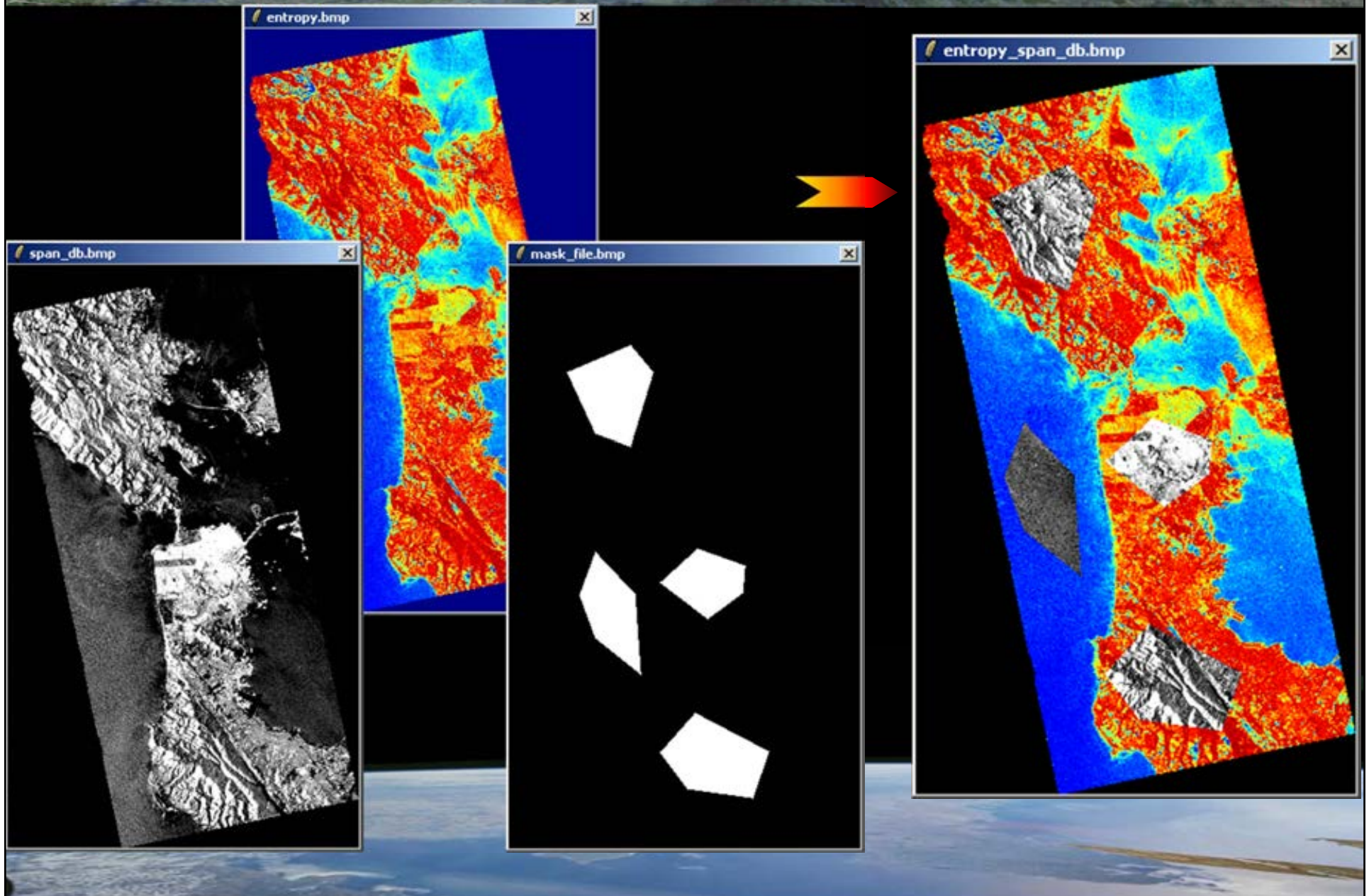
Run Exit

entropy_span_db.bmp

Create Gray & Color BMP File



Create Gray & Color BMP File



PoISARpro v5.0 SOFTWARE



WHAT ELSE ?

MODEL BASED DECOMPOSITION



J. J. Van Zyl, M. Arii, Y. Kim, “Model-Based Decomposition of Polarimetric SAR Covariance Matrices Constrained for Nonnegative Eigenvalues” IEEE TGRS, vol. 49, n°9, Sept. 2011.

M. Arii, J. J. Van Zyl, Y. Kim, “Adaptative Model-Based Decomposition of Polarimetric SAR Covariance Matrices” IEEE TGRS, vol. 49, n°9, Sept. 2011.

Three-Component Model-Based Decomposition for Polarimetric SAR Data
W. An, Y. Cui, J. Yang
IEEE TGRS, vol. 48, 2010

Four-Component Decomposition of Polarimetric SAR Images With Deorientation
W. An, C. Xie, X. Yuan, Y. Cui, J. Yang
IEEE GRSL, vol. 8, 2011

Improved Four-Component Model-Based Target Decomposition for Polarimetric SAR Data
Z. Shan, C. Wang, H. Zhang, W. An
IEEE GRSL, vol. 9, 2012

MODEL BASED DECOMPOSITION



Yamaguchi Y., Yajima Y. and Yamada H., “A Four-Component Decomposition of POLSAR Images Based on the Coherency Matrix”, IEEE GRSL, vol. 3, no. 3, July 2006.

Y. Yamaguchi, A. Sato, W.M. Boerner, R. Sato, H. Yamada, 4-component scattering power decomposition with rotation of coherency matrix IEEE TGRS vol. 49, no. 6, June 2011.

A. Sato, Y. Yamaguchi, G. Singh, and S.-E. Park, “4-component scattering power decomposition with extended volume scattering model”, IEEE GRSL, vol. 9, no. 2, Mar. 2012.

G. Singh, Y. Yamaguchi, S.E. Park, « General Four-Component Scattering Power Decomposition With Unitary Transformation of Coherency Matrix » IEEE TGRS in press

G. Singh, Y. Yamaguchi, S.E. Park, Y. Cui, H. Kobayashi, « Hybrid Freeman/Eigenvalue Decomposition Method With Extended Volume Scattering Model » IEEE GRSL, vol. 10, no. 1, Jan. 2013

COMPACT POLARIMETRY



The m-chi decomposition of hybrid dual-polarimetric data
Raney, R.K.; Cahill, J.T.S.; Patterson, G.W.; Bussey, D.B.J.
IGARSS 2012

Hybrid-Quad-Pol SAR
Raney, R.K.
IGARSS 2008

Hybrid-Polarity SAR Architecture
Raney, R.K.
IEEE TGRS, Vol 45 , 2007

Compact decomposition theory for L-band satellite radar applications
Cloude, S.R.; Goodenough, D.G.; Chen, H.
IGARSS 2012

Compact Decomposition Theory
Cloude, S.R.; Goodenough, D.G.; Chen, H.
IEEE TGRS, Vol 9, 2012

TIME-SERIES ANALYSIS



A test statistic in the complex Wishart distribution and its application to change detection in polarimetric SAR data

**Conradsen, K.; Nielsen, A.A.; Schou, J.; Skriver, H.
IEEE TGRS, vol 41, 2003**

A new statistical similarity measure for change detection in multitemporal SAR Images and its extension to multiscale change analysis

**Inglada, J.; Mercier, G.
IEEE TGRS, vol 45, 2007**

Restoration of polarimetric SAR images using simulated annealing

**Schou, J.; Skriver, H.
IEEE TGRS, vol 39, 2001**

CFAR edge detector for polarimetric SAR images

**Schou, J.; Skriver, H.; Nielsen, A.A.; Conradsen, K.
IEEE TGRS, vol 41, 2003**

A Test Statistic in the Complex Wishart Distribution and Its Application to Change Detection in Polarimetric SAR Data

**K. Conradsen, A. A. Nielsen, J. Schou, H. Skriver
IEEE TGRS, Vol 41, 2003**

POLARIMETRIC FUNCTIONALITIES



Optimal Parameter Estimation in Heterogeneous Clutter for High-Resolution Polarimetric SAR data (SIRV Model)

**Vasile, G.; Pascal, F.; Ovarlez, J.-P.; Formont, P.; Gay, M.
IEEE GRSL, vol 8, 2011**

Detecting Depolarized Targets using a New Geometrical Perturbation Filter

**Marino, A.; Cloude, S.R.; Woodhouse, I.H.
IEEE TGRS, vol 50, 2012**

J. Chen, Y. Chen, W. An, Y. Cui, J. Yang,

Nonlocal Filtering for Polarimetric SAR Data: A Pretest Approach

IEEE TGRS, vol 49, 2011

J.S. Lee, D.L. Schuler, T.L. Ainsworth, M.R. Grunes, E Pottier, L. Ferro-Famil,

"Scattering Model Based Speckle Filtering of Polarimetric SAR Data"

IEEE TGRS, vol 1, 2006

J.S. Lee, M.R. Grunes, E. Pottier and L. Ferro-Famil,

Segmentation of polarimetric SAR images that preserves scattering mechanisms

Proceedings of EUSAR2002

PoISARpro v5.0 SOFTWARE



Polarimetric SAR Data Processing and Educational Tool v5.0 - Menu

Environment Import Convert **Process** Display Calibration

Linear (+45 / -45)
Circular (L / R)
Elliptical (phi, tau)

- Box Car Filter
- Box Car - Edge Filter
- C. Lopez Filter
- Gaussian Filter
- IDAN Filter
- J.S. Lee Refined Filter
- J.S. Lee Sigma Filter
- P.W.F Filter
- Edge Detector

Decomposition Parameters
Eigenvector Set Parameters
Eigenvalue Set Parameters

- JRH : Huynen Decomposition
- RMB1 : Barnes 1 Decomposition
- RMB2 : Barnes 2 Decomposition
- SRC : Cloude Decomposition
- WAH1 : Holm 1 Decomposition
- WAH2 : Holm 2 Decomposition
- HAA : H / A / Alpha Decomposition
- FRE2 : Freeman 2 Components Decomposition
- FRE3 : Freeman 3 Components Decomposition
- VZ3 : Van Zyl 3 Components Decomposition
- YAM3 : Yamaguchi 3 Components Decomposition
- YAM4 : Yamaguchi 4 Components Decomposition
- NEU : Neumann 2 Components Decomposition
- KRO : Krogager Decomposition
- CAM : Cameron Decomposition
- TSVM : Touzi Decomposition

- Matrix Elements
- Correlation Coefficients
- Elliptical Basis Change
- Polarimetric Speckle Filter
- H / A / Alpha Decomposition
- Polarimetric Decompositions
- Polarimetric Functionalities - 1
- Polarimetric Functionalities - 2
- Polarimetric Segmentation
- Polarimetric Data Analysis
- Polarimetric Data Clustering
- Batch Process

- H / A / Alpha Classification
- H / A / Alpha - Wishart Classification
- Fuzzy - H / Alpha Classification
- Wishart Supervised Classification
- Rule-Based Hierarchical Classification
- Basic Scattering Mechanism Identification
- SVM Supervised Classification

- Data Statistics
- Data Histograms
- Data Profiles
- Histogram Based Statistics
- Texture Analysis

- Clustering Process
- Parameter Averaging
- Data Sets Averaging

- Faraday Rotation Estimation
- Conformity Coefficient
- Scattering Predominance
- Scattering Diversity
- Degree of Purity
- Depolarisation Index
- Alpha Approximation (Praks & Colin)
- Entropy Approximation (Praks & Colin)
- Scattering Mechanism Entropy (Freeman)
- Scattering Mechanism Entropy (Van Zyl)
- Kozlov Anisotropy
- Lueneburg Anisotropy
- Polarized Point Scatterer Detection
- Reflectivity Ratio
- Differential Reflectivity (ZDR)

- Polarisation Synthesis
- Polarimetric Signature
- Stokes Parameters
- Compact Polarimetric Mode
- O.P.C.E
- R.C.S Max
- Surface Inversion
- RVOG PoISAR Inversion
- Sub-Aperture Analysis
- DEM Estimation
- Polarisation Orientation Compensation

Decomposition Applications

Dual – PoISAR (Spp, C2)

Quad – PoISAR (S2, C3, C4, T3, T4)

Open Window Polarimetric Data Format
Close Window Polarimetric Data Format

PoISARpro v5.0 SOFTWARE



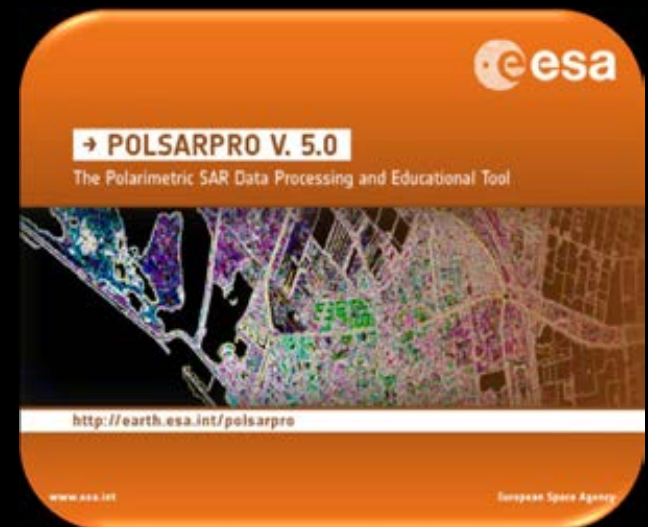
Learning / Training Next P.I Generations



PoISARpro v5.0 SOFTWARE



PoISAR-Ap

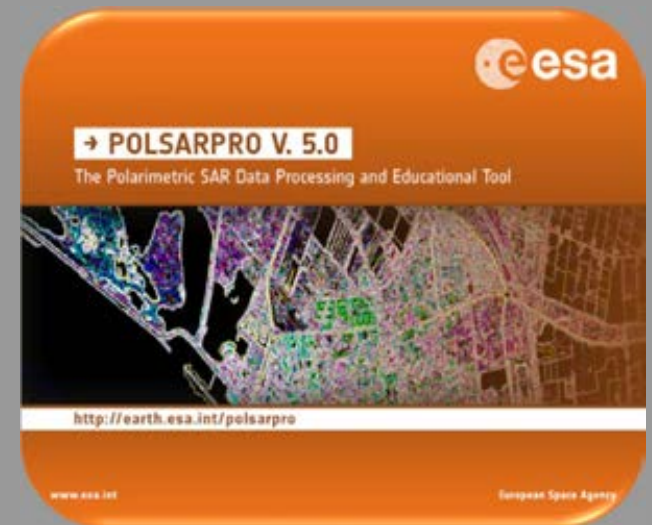


PoISARpro

Educational Tools



PolSAR-Ap Project



WP260 : Implementation of Selected Applications (E. Pottier, C. Lopez Martinez)

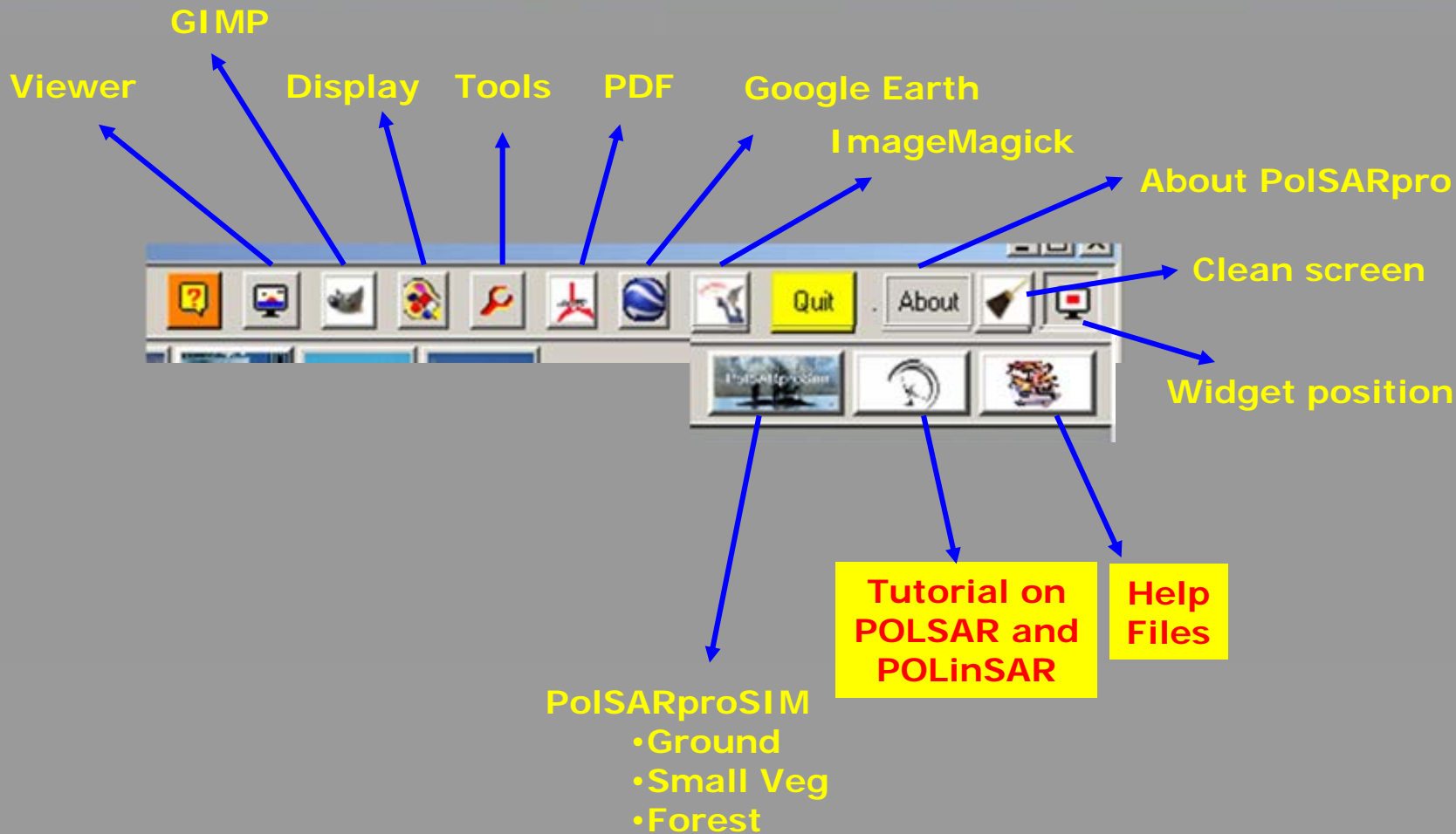


PolSARpro v5.0 - Run Trace
Open Window Polarmetric Data Format
Close Window Polarmetric Data Format

PoISARpro v5.0 SOFTWARE



Polarimetric SAR Data Processing and Educational Tool v5.0 - Menu



PoISARpro v5.0 - Run Trace

Open Window Polarimetric Data Format
Close Window Polarimetric Data Format

Educational Tools



PolSAR-Ap Project



WP360 : Review and update of the Basic Principles and Applications
(E. Pottier, C. Lopez Martinez)



Tutorials
Do It Yourself
Lecture Notes
Slides
Technical Documentation
Help Files.



PolSARpro v5.0 SOFTWARE



<http://earth.esa.int/polsarpro>

The Web Site provides

The screenshot shows the PolSARpro website interface. At the top, there is an orange header with the ESA logo, the text 'polsarpro', and 'The Polarimetric SAR Data Processing and Educational Tool' and 'European Space Agency'. Below the header, there is a navigation menu on the left with items like 'Home', 'Download and Install', 'Release notes', 'Background and overview', 'Airborne Data Sources', 'Spaceborne Data Sources', 'Simulated Data Sources', 'Polarimetry Tutorial', 'Course slides material', 'Training Courses', 'Technical documentation', 'Exploitation Results and News'. The main content area displays 'version 4.2 (January 2011)' and a description of the tool's purpose and availability. At the bottom, there are links for 'Higher level', 'Print version', and 'Last modified: 23-Dec-2011'.

- Details of the project
- Access to the tutorial and software
- Information about status of the development
- **Demonstration Sample Datasets**

Version 5 soon available on the PolSARpro website!