

→ 6th ESA ADVANCED TRAINING COURSE ON LAND REMOTE SENSING

PolSARpro v5.0



→ POLSARPRO V. 5.0

r SAR Data Processing and Educational Tor

TOOLBOX



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Eric POTTIER

14-18 September 2015 | University of Agronomic Science and Veterinary Medicine Bucharest | Bucharest, Romania



PolSARpro v5.0 SOFTWARE A Bit Of History



PolSARpro

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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.

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A BIT OF HISTORY



→ 6th ESA ADVANCED TRAINING COURSE ON LAND REMOT20021(v4.0) - 2011 (v4.2) 14-18 September 2015 | University of Agronomic Science and Veterinary Medicine Bucharest | Bucharest, Romania eesa



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



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



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



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PolSARpro v5.0 SOFTWARE

MODULAR STRUCTURE

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Each element of the Software (a function) can be extracted and incorporated individually into users' own processing software.



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PolSARpro v5.0 SOFTWARE

MODULAR STRUCTURE



Users can easily add their own functions and components, as PolSARpro v5.0 Software is conceived as a flexible and open software environment.







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OPEN SOURCE DEVELOPMENT

PolSARpro v5.0 Software is made available following the:

Open Source Software Development (OSSD)

approach, and follows the:

GNU General Public License v2 – June 1991.

PolSARpro v5.0 Software runs today on:

Windows 98+, Windows 2000, Windows NT 4.0, Windows XP, Windows 7 and Linux I386







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OPEN SOURCE DEVELOPMENT

The Tool is free download on the Internet from the ESA Web Portal (Earthnet) at : https://earth.esa.int/web/polsarpro

Data Sources + Overview + Download and Installation + Do	cumentation + Results & News +
You are here Home	🛃 Share 1 👎 🖬 🗔
- PolSARpro Version 4.2	- Latest News
The Polarimetric SAR Data Processing and Educational Tool aims to facilitate the accessibilit multi-polarised SAR datasets including those from ESA Third Party Missions (ALOS PALSAR Alternating Polarisation mode products, RADARSAT-2 and TerraSAR-X. A wide-range of tutorials and comprehensive documentation provide a grounding in polarime interferometry necessary to stimulate research and development of scientific applications that techniques; the toolbox of processing functions offers users the capability to implement them PolSARpro is developed under contract with ESA, a consortium <u>IETR Institut d'électronique s</u> t <u>élécommunications de Rennes</u>) in conjunction with the <u>University of Rennes 1, DLR Microway Institute (HR) of DLR</u> and AEL Consultants, together with Dr Mark Williams. The initiative is a recommendations made at the <u>POLINSAR Workshops</u> held at ESRIN since January 2003. All elements of the PolSARpro project are distributed by ESA free of charge, including the sourthis website provides details of the project, giving users access to the tutorial material and s about sources of multi-polarised data and recently obtained results of POLINSAR studies. Na	ity and exploitation of). Envisat ASAR New PolSARpro version 4.2 released New PolSARpro version 4.1.5 released New PolSARpro version 4.0 Beta 1.3 released New PolSARpro version 4.0 Beta 1.5 released PolSARpro version 4.0 Beta 1 released for PolSARpro version 4.0 Beta 1 released for PolSARpro version 4.0 Beta 1 released Polsarburget Polsarburget Download PolSARpro 4.2 Release Notes Polarimetry Tutorial

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PolSARpro v5.0 Team & Contributorsesa

Universities

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(C. Lopez Martinez)



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Pol-SAR Sensors

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

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ALOS – PALSAR

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COSMO - SKYMED

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TANDEM-X

SENTINEL 1A

New!



ALOS-2 – PALSAR



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🦧 SENTINEL1 Input Data File		
Input Directory		
D:/S1A_IW_SLC1SDV_20140826T170517_20140826T170544_002114_0021B6_D3F2.SAFE		
- Output Directory		
D:/S1A_IW_SLC1SDV_20140826T170517_20140826T170544_002114_0021B6_D3F2.SAFE		
Mission S1A Acquisition IW Product SLC Level 1 Polarisation pp2		
Swath Burst / Slice		
Azimut Pixel Spacing 13.92 Range Pixel Spacing 2.32 Incidence Angle 39.08		
- Input Data File (Co - Pol)		
D:/S1A_IW_SLC1SDV_20140826T170517_20140826T170544_002114_0021B6_D3F2.SAFE		
- Input Data File (X - Pol)		
D:/S1A_IW_SLC1SDV_20140826T170517_20140826T170544_002114_0021B6_D3F2.SAFE		
Initial Number of Rows 15138 Final Number of Rows 1459		
Initial Number of Cols 24888 Final Number of Cols 24440		
OK Q Cancel		

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Selection of the burst to be processed (can also process ALL the bursts of a swath)

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SLC - IW : Swath 2 – Burst 4





Slant range (no geocoding)

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Software – General Presentation

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- PolSARpro v5.0 - Run Trace

Open Window Polarimetric Data Format Close Window Polarimetric Data Format rosa

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aculator v1.0	
Op #1 (Op#1) Operator (Op#2) Op #2	Operator : File C (file) + value C (file) - value C (file) * value C (file) / value C (file) + (file) C (file) - (file) C (file) .* (file) C (file) ./ (file) C (file) .+ (file) C (file) (file) C (file) .* (file) C (file) ./ (file) C . real (.) C . imag (.) C . ads (.) C . conj (.) OK C . acos (.) C . asin (.) C . atan (.) C . boxcar (?x?) OK
Operand #1 File Mat S / M 2x2 mat 3x3 mat 4x4 mat STO RCL MC AC	O. sqrt (.) O. (.)^2 O. (.)^3 O. (.)^(?) O. log (.) O. ln (.) O. 10^(.) O. exp (.) O. 10log (.) O. 20log (.) O. (.) < (?)
Input File Data Format Init Row End Row Init Col End Col OK Input Matrix Data Format Init Row End Row Init Col End Col OK	Operator : Sinclair Matrix : S2 C [S] + value C [S] - value C [S] * value C [S] / value C [S] + value C [S] - value C [S] / value C [S] / value C [S] + (file) C [S] . (file) C [S] . / (file) C [S] . / (file) C [S] . + [S'] C [S] . + [mat] C [S] . * [S'] C [S] . * [mat] C [S] . * [S] * C [U] t . * [S] . * [U] C C C . coni [S] C . tr [S] C . det [S] C . inv [S] C . eig1 [S] C . eig2 [S] C . eig1 [G] C . eig2 [G]
Input Value Type C Complex Value O Float Value O Integer Value N x N Matrix O Complex O Float O Hermitian O Special Unitary OK 011 00 012 00 00 00 00 00 00 00 00	Operator : Hermitian Matrix : C2, C3, C4, T2, T3, T4 O [M] + value O [M] - value O [M] / value O [M] + value O [M] - value O [M] / value O [M] + (file) O [M] (file) O [M] ./ (file) O [M] .+ (file) O [M] (file) O [M] ./ (file) O [M] .+ [M'] O [M] .+ [mat] O . inv [M] O [U] .* [M] .* inv[U] O . coni [M] O . tr [M] O . det [M] O tr (inv [mat] .* [M]) O . eig1 [M] O . eig2 [M] O . eig3 [M] O . eig4 [M]
m11 +i m12 +i m13 +i m14 +i m21 +i m22 +i m23 +i m24 +i Load m31 +i m32 +i m33 +i m34 +i Save m41 +i m42 +i m43 +i m44 +i Save Output Value Exec Save Save Exit Exit	Operator : Complex / Hermitian / Float / Special Unitary NxN Matrix O [mat] + value O [mat] - value O [mat] * value O [mat] / value O [mat].+[mat'] O [mat][mat'] O [mat].*[mat'] O [mat]./[mat'] O . det [mat] O . tr [mat] O . conj [mat] O . inv [mat] O . eig1 [mat] O . eig2 [mat] O . eig3 [mat] O . eig4 [mat]

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External Softwares

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GNU Image Manipulation Program Open Source GNU License (Win, Linux, Unix)

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IMAGE MAGICK





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IMAGE MAGICK





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GOOGLE EARTH



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S.R.T.M - ASTER





ASTER Advanced Splaceborne Thermal Emission and Reflection Radiometer

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ASTER



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MAP READY









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KML File generation



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Speckle Filtering Polar. Decomposition Unsupervised Segmentation

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Learning / Training Next P.I Generations

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Educational Tools

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Polarimetric Sub				75 H - Meni

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POLSARPRO V3.0 - LECTURE NOTES

BASIC CONCEPTS IN RADAR POLARIMETRY

Wolfgang-Martin BOERNER

UIC-ECE Communications, Sensing & Navigation Laboratory 500 W. Taylor St., SEL (507) W-4210, M/C 134, CHICAGO IL/USA-66607-7018 Email: bosmer@ece.uk.edu

1	Inte	oduction: A Review of Polarimetry	4
- 2	The	Electromagnetic Vector Wave and Polarization Descriptors	6
	2.1	Polarization Vector and Complex Polarization Ratio	
	2.2	The Polarization Ellipse and its Parameters.	7
	2.3	The Jones Vector and Changes of Polarization Bases	9
	2.4	Complex Polorization Ratio in Different Polorization Bases	12
	2.4.	 Complex Polarization Ratio in the Linear Basis (H V) 	13
	-2.40	2 Complex Polarization Ratio in the Circular Basis {L R}	14
	2.4.	3 Complex Polarization Ratio in the Linear Basis {45° 135°}	15
	2.5	The Stokes Parameters	
	2.5.	 The Stokes vector for the completely polarized wave	16
	2.5.	2 The Stokes vector for the partially polarized wave	16
	2.6	The Poincaré Polonization Sphere	18
	2.6.	 The polarization state on the Poincaré sphere for the (H V) basis 	19
	2.63	2 The polarization ratio on the Princové sphere for different polarization bases	
	2.63	3 The relationship between the Stokes vector and the polarization ratio for different	t
	pola	erization bases	
	2.6.	4 The Poincaré polarization sphere and complex polarization ratio plane	
	2.7	Wave Decomposition Theorems	25
	2.8	The Wave Dichotomy of Partially Polarized Waves	
	2.9	Polarimetric Wave Entropy	26
	2.10	Alternate Fermulations of the Polorization Properties of Electromagnetic Vector Wav	es 26
3	The	Electromagnetic Vector Scattering Operator and the Polarimetric Scattering Matrices	28
	3.1	The Scattering Scenario and the Scattering Coordinate Framework	
	3.2	The 2x2 Jones Forward [J] versus 2x2 Sinchir [S] Back Scattering Matrices	
	3.3	Basis Transformations of the 2x2 Sinclair Scattering Matrix [3]	31
	3,4	The 4x4 Mueller (Forward Scattering) [M] and the 4x4 Kennaragh (Back-Scattering) [K.]
	Power	Danaily Mahisaa	
	3.5	The 2x2 Graves Polarization Power Scattering Matrix [G].	
	3.6	Co/Conse-Polm Backsrattering Power Decomposition for the One-Antenna (Transceiv	ser)
	and the	e Matched Two-Antenna (Quasi Monostatic) Cases	
	3.7	The Scattering Feature Vectors : The Lexicographic and the Pauli Feature Vectors	
	3.8	The Unitary Transformations of the Festure Vectors	
	3.9	The Polanmeine Covanaice Matrix	
	3.10	The Monostatic Reciprocal Back-Scattering Cases	10
	3.11	Co Cross-polar Power Density and Phase Correlation Representations	-41
	3.12	Alternate Matrix Representations	43

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Direct access to the Tutorial while using **PolSARpro facilities**

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About

Quit

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The Tutorial is made available in PDF format.

• Recent Advances in Radar Polarimetry and Polarimetric SAR Interferometry W.M. Boerner – 31 pages Basic Concepts in Radar Polarimetry W.M. Boerner – 100 pages Advanced Concepts E. Pottier, J.S. Lee, L. Ferro-Famil – 65 pages • POL-InSAR Training Course S.R. Cloude – 44 pages • PCT Training Course S.R. Cloude – 55 pages

Jose Wind

PolSARpr Open Wind

T3

Educational Tools

/ PolSAR-ap Showcase : Agriculture
Input Directory
D:/My_Data_Directory/T3
Output Directory
D:/My_Data_Directory
Init Row 1 End Row 1544 Init Col 1 End Col 928 Decomposition Inc Ang Unit
C Degrees • Hadians
Surface Soil Moisture Inversion
Soil Dielectric Constant Max 40
Dihedral Soil Moisture Inversion
Sol Dielectric Constant May
Increment Angle of the Incidence Angle LUT (deg)
2D-Incidence Angle File
Enter 2D Incidence Angle File
Enter (showcase_agri_mask.bin) file
Polarimetric Decomposition fs File
Enter (showcase_agri_fs.bin) file
Polarimetric Decomposition Beta File
Enter (showcase_agri_beta.bin) file
- Vertical Rougness Indicator (ks) File (optional)
Output Soil Moisture File
D:/My_Data_Directory/showcase_agri_surf_mv_soil.bin
- Output Soil Dielectric Constant File
D:/My_Data_Directory/showcase_agri_surf_dc_soil.bin
Output Trunk Dielectric Constant File
Run Z Exit

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PolSAR-an Showcase : Ocean
- Input Directory
D:/My_Data_Directory/T3
Output Directory
D:/Mu Data Directoru
Init Row 1 End Row 1544 Init Col 1 End Col 928
Window Size - Train Window Size - Test
Row 51 Col 51 Row 9 Col 9
Geometric Perturbation Filter
Threshold 0.98 Reduction Ratio (RedR) 0.0025
Output Coherence File
D:/My_Data_Directory/ocean_coherence.bin
Output Mask File
D:/My_Data_Directory/ocean_mask.bin
D:/My_Data_Directory/ocean_mask.bin Run Image: Control of the second secon
D:/My_Data_Directory/ocean_mask.bin Run Image: Contract of the second seco
D:/My_Data_Directory/ocean_mask.bin Run Exit
D:/My_Data_Directory/ocean_mask.bin Run Exit
D:/My_Data_Directory/ocean_mask.bin Run Exit
D:/My_Data_Directory/ocean_mask.bin Run Exit
D:/My_Data_Directory/ocean_mask.bin Run Exit
D:/My_Data_Directory/ocean_mask.bin Run Exit
D:/My_Data_Directory/ocean_mask.bin Run Exit

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Educational Tools

PolSAR-ap Showcase : Cryosphere Input Master - Slave Directory	×	
D:/My_Data_Directory/Master_Dir_Slave_Dir		
Output Master - Slave Directory		
D:/My_Data_Directory/Master_Dir_Slave_Dir /		
Init Row 1 End Row 900 Init Col 1 End Col	1024	
Decomposition Inc Ang Unit Median Filter		PolSAR-ap Showcase : Urban Input Master - Slave Directory
Window Size (Row) C Degrees Window Size Window Size (Col) Image: Redians Max Nb of Iterations	3	D:/My_Data_Directory/Master_Slave_Dir/T6
		Output Master - Slave Directory
Polarization Channel Ice Dielectric Constant 2.8 Threshold	40	D:/My_Data_Directory/Master_Slave_Dir
● HH C HV C VV Bange Pixel Spacing (optional) opt		Init Row 1 End Row 900 Init Col 1
2D Incidence Angle File		Complex Coherence File
Enter 2D Incidence Angle file	- 골	
2D Kz File		Output File
Enter 2D Ko file	- 2	
Surface to Volume Batio File		
Enter (showcase, orug, sty, ratio, HH bin) file	- 🖂	Bun
Complex Coherence File		
Enter (cmoly, coh, HH bin) file	- 🖂	
SNP Decorrelation File (optional)		
Every CNR Decorrelation (in (Optional)		
Prider SNR Deconeration file (Optional)		
Dutput Extinction Coefficient File (kappa)		
Output Penetration Depth File		
D:/My_Data_Directory/Master_Dir_Slave_Dir/showcase_cryo_depth_HH.bin		
Run 😰		

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End Col

Exit



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ata Sources +	Overview	Download and Installation	Documentation +	Results & News +
u are here Home				Share 🗗 🖬 📾 💀
- PolSARp	ro Version	4.2		- Latest News
multi-polarised SAR d Alternating Polarisatio A wide-range of tutoria interferometry necess techniques; the toolbo PolSARpro is develops d feiceommunications d natitute (HR) of DLR a recommendations ma	atasets including those n mode products, RAD Is and comprehensive any to stimulate resear x of processing function ed under contract with i <u>(e Rennes)</u> in conjuncti und AEL Consultants, tr. ide at the <u>POLINSAR W</u>	e from ESA Third Party Missions (ALOS PA) ARSAT-2 and TerraSAR-X. documentation provide a grounding in pol- h and development of scientific applications is offers users the capability to implement ESA, a consortium JETR (Institut d'électron on with the <u>University of Rennes 1, DLR Mi</u> orgether with Dr Mark Williams. The initiative orischoos held at ESRIN since January 20	LSAR), Envisat ASAR arimetry and polarimetric is that utilise such them. aue et de crowaves and Radar e is a direct result of D3.	New PolSARpro version 4.1.5 released New PolSARpro version 4.0 Beta 1.3 released PolSARpro 4.40 beta 1 training course - PolSARpro version 4.0 beta 1 released for Veseful Links Home Data Surres
All elements of the Pol	ISARpro project are dis	tributed by ESA free of charge, including th	e source code.	• Overview
This website provides about sources of multi pages using the menu	details of the project, g -polarised data and re u on the left.	iving users access to the tutorial material cently obtained results of POLInSAR studie	and software, information s. Navigate between	Download PolsAkpro 4.2 Release Notes Polarimetry Tutorial Technical Documentation Results & News

- Details of the project
- Access to the tutorial and software
- Information about status of the development

Demonstration Sample Datasets

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Practical – Part 1





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ALOS : Advanced Land Observing Satellite PALSAR : Phase Array L-Band SAR



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PolSARpro v5.0 SOFTWARE

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

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PolSARpro v5.0 – MAP READY SOFTWARES



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

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PROCESSING CHAIN



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[T3] ELEMENTS

T11_dB

T22_dB

T33_dB

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[T3] ELEMENTS

span_dB



T12_pha



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PROCESSING CHAIN



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DECOMPOSITION PARAMETERS

Entropy

Anisotropy

Alpha

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DECOMPOSITION PARAMETERS

H (1-A)



HA



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DECOMPOSITION PARAMETERS

(1-H) A



(1-H) (1-A)

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PROCESSING CHAIN



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Practical – Part 2





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EIGENVALUE SET PARAMETERS

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Pauli Yamaguchi Y40



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Pauli Yamaguchi Y4R







Pauli Yamaguchi S4R



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Pauli Yamaguchi G4U1

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E.F. Bentije (26945)4)







Pauli Yamaguchi G4U2

E.F. Bentije (2645)4)







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