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Dip-Guided Auto-tracker for Seismic Interpretation

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About the Author



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Biography

- PhD Electrical Engineering with 7 years experience at Chevron
- Professional Interests: Seismic Interpretation, Computational Geometry, Static Reservoir Modeling, Software Engineering, Artificial Intelligence



Acknowledgements

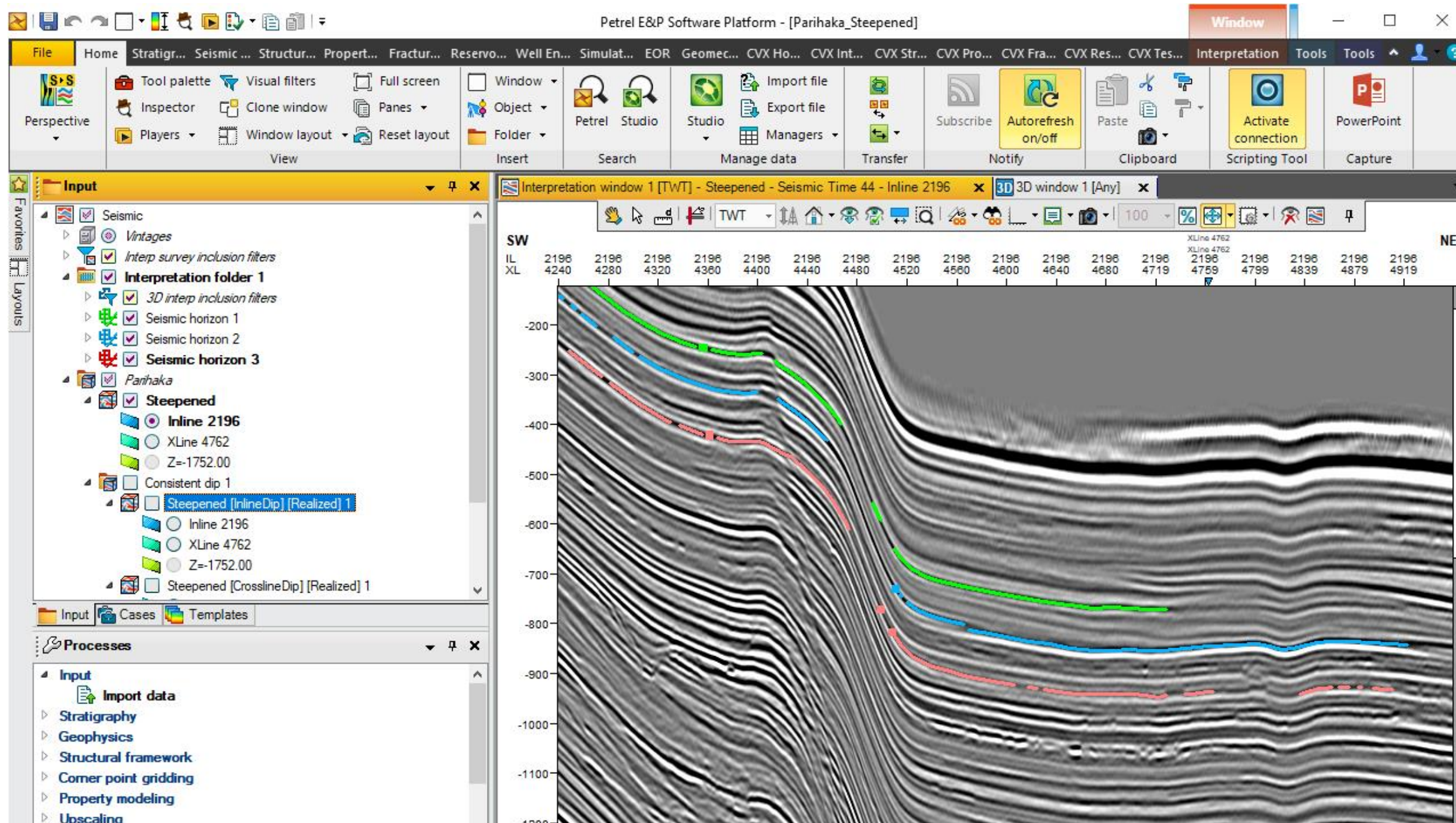
- Project team members
 - Barton Payne, Anne Dutranois-Coumont, Bin Qiu
- Feature advice and feedback:
 - Barton Payne, Anne Dutranois-Coumont, Steve Holdaway, Eric Stromboe, Antonio Nocioni, and many others
- Petrel plugin deployment team: Fred Xu, Sarah Vitel, Edmund Ing
- MathWorks

Motivation

- MATLAB's efficient language structure, mathematical libraries, and flexible visualizations are powerful tools for rapidly designing algorithms
- Quality of algorithm designs depends on the variety of test datasets
- The easiest way to get feedback and testing from busy interpreters is to bring your algorithm conveniently to their environment
- MATLAB provides flexible capabilities to deploy algorithms directly into Petrel plugins for rapid iterative improvement and deployment.



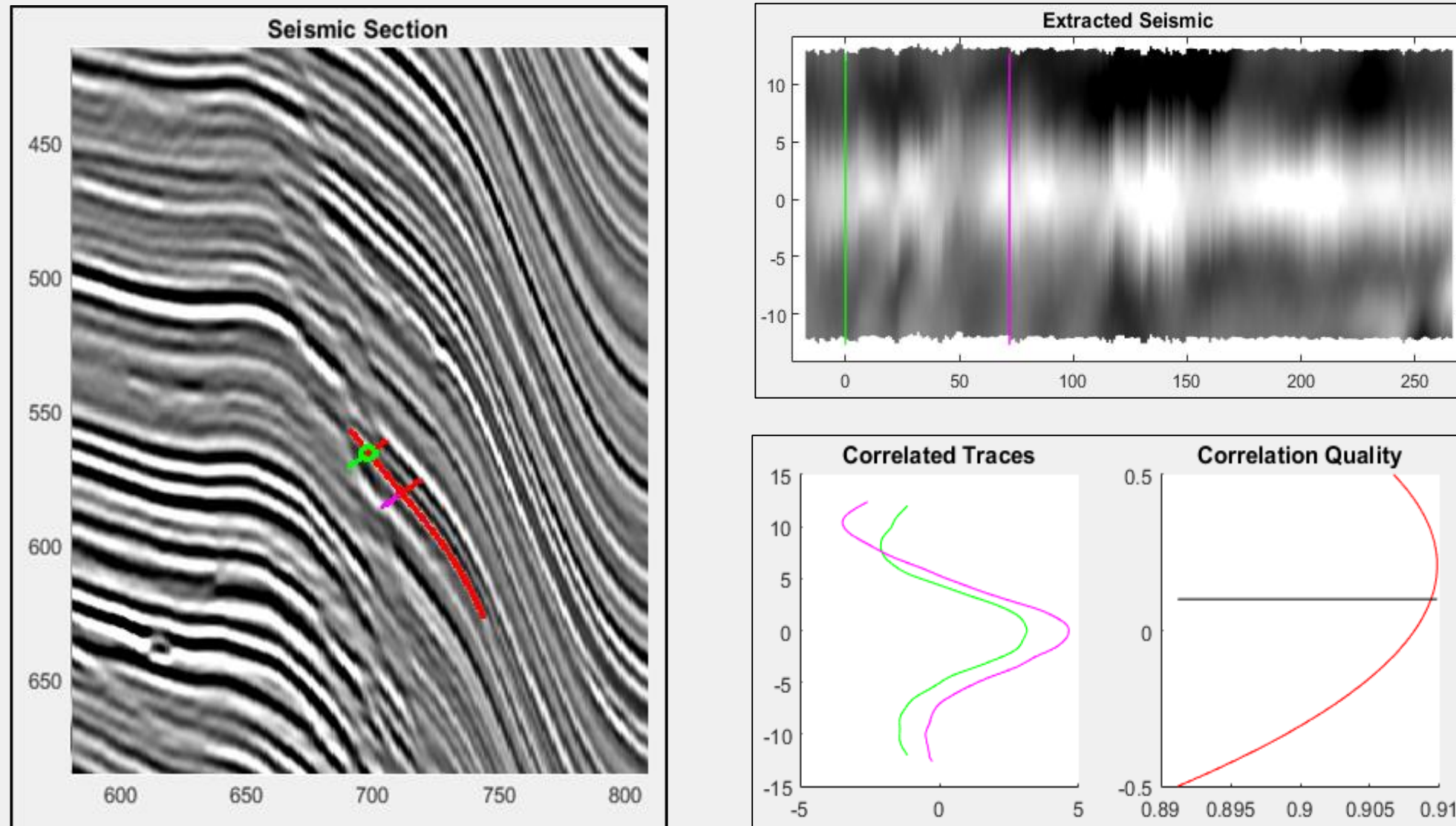
Conventional Horizon Auto-tracking



'The Parihaka seismic data shown is courtesy of the Government of New Zealand Petroleum and Minerals'



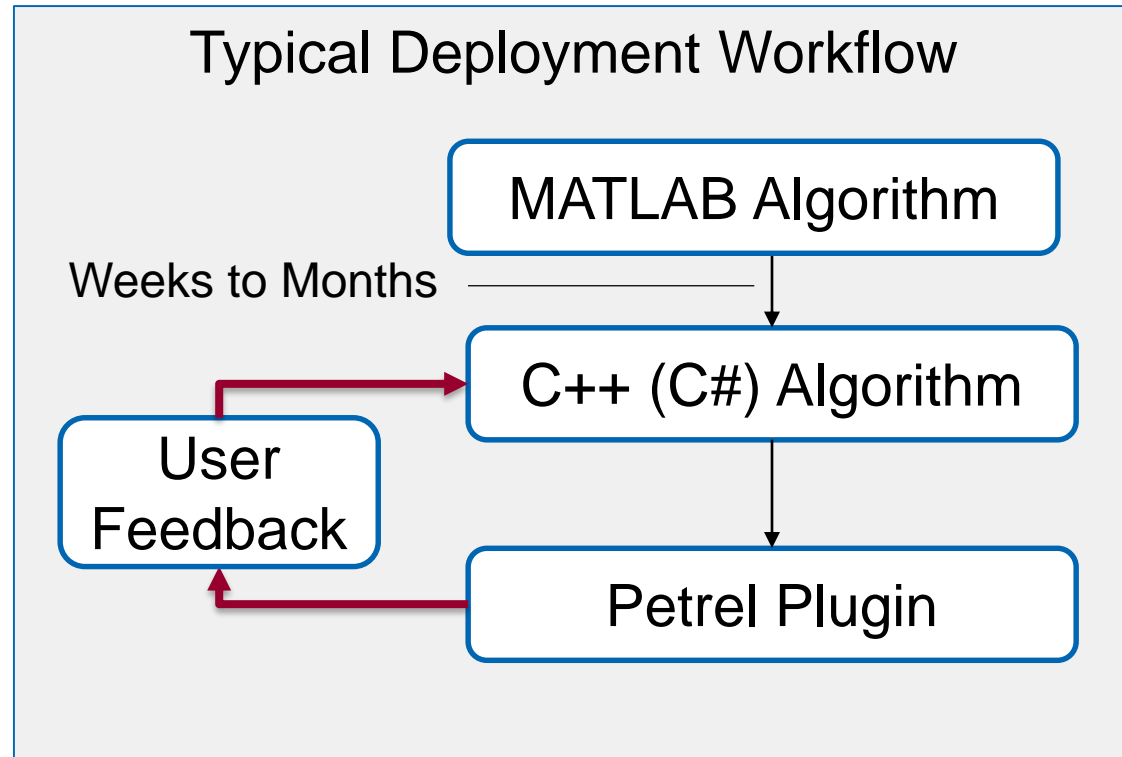
Simple/flexible visualization tools



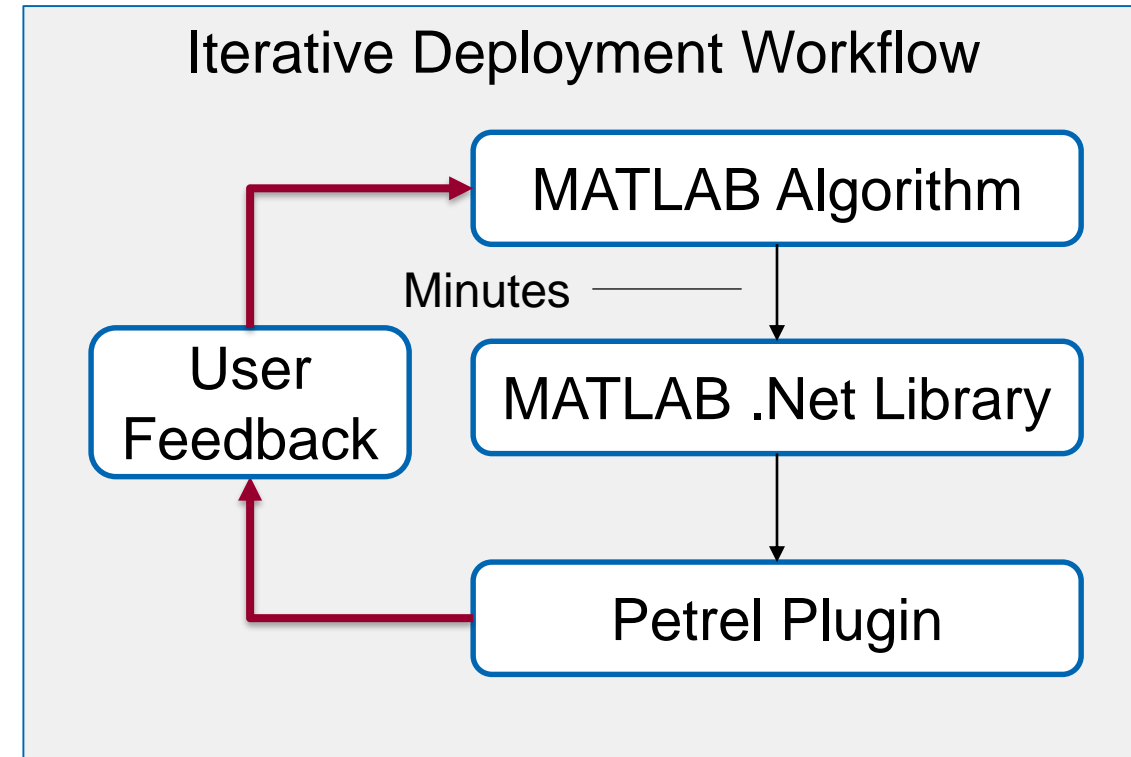
- MATLAB's visualization libraries allow for rapid prototyping and algorithm analysis



Algorithm Deployment Workflow



- User feedback starts when the algorithm is in Petrel

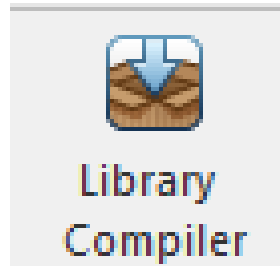


- Easier to iteratively improve to MATLAB implementation

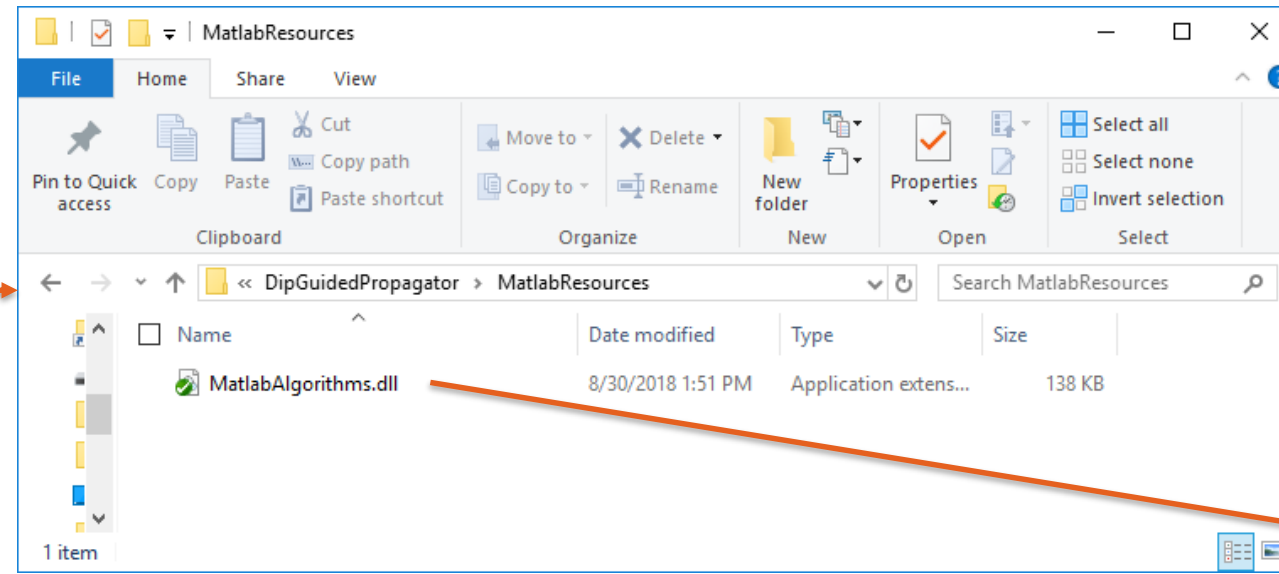
Algorithm Deployment Workflow

MATLAB function

Compiler SDK

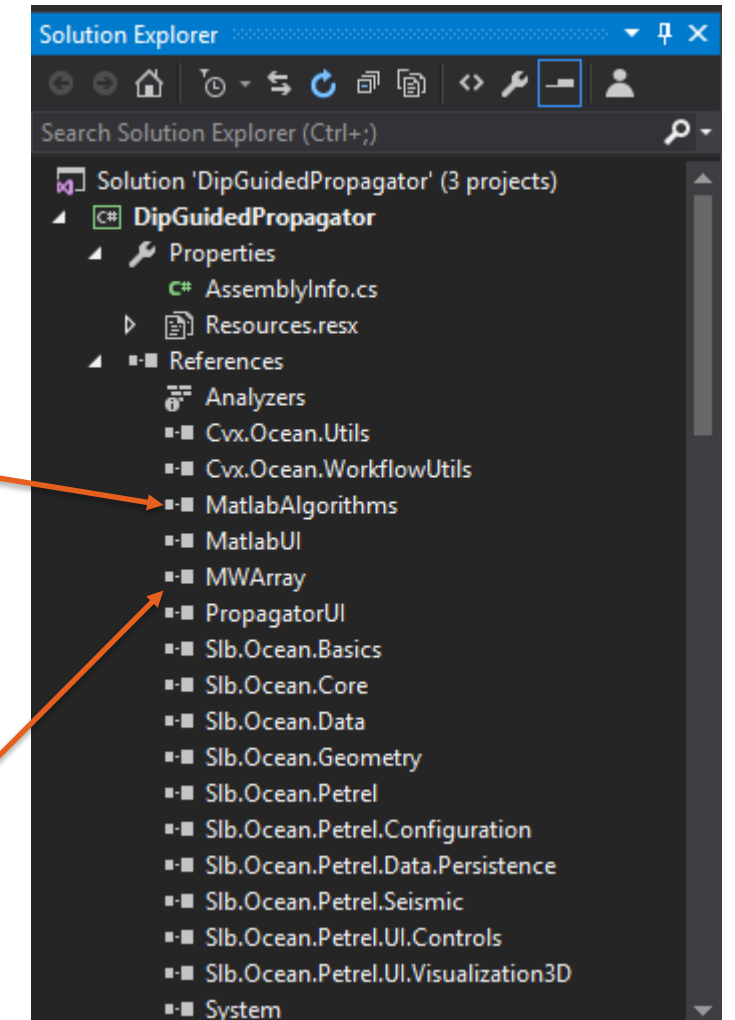


MATLAB or MATLAB Runtime Installation



Properties

MWArray Reference Properties	
(Name)	MWArray
Aliases	global
Copy Local	False
Culture	
Description	MATLAB array wrapper classes for .NET
Embed Interop Type	False
File Type	Assembly
Identity	MWArray
Path	C:\Program Files\MATLAB\R2017a\toolbox\dotnetbuilder\bin\win64\v4.0\MWArray.dll
Resolved	True



Solution Explorer

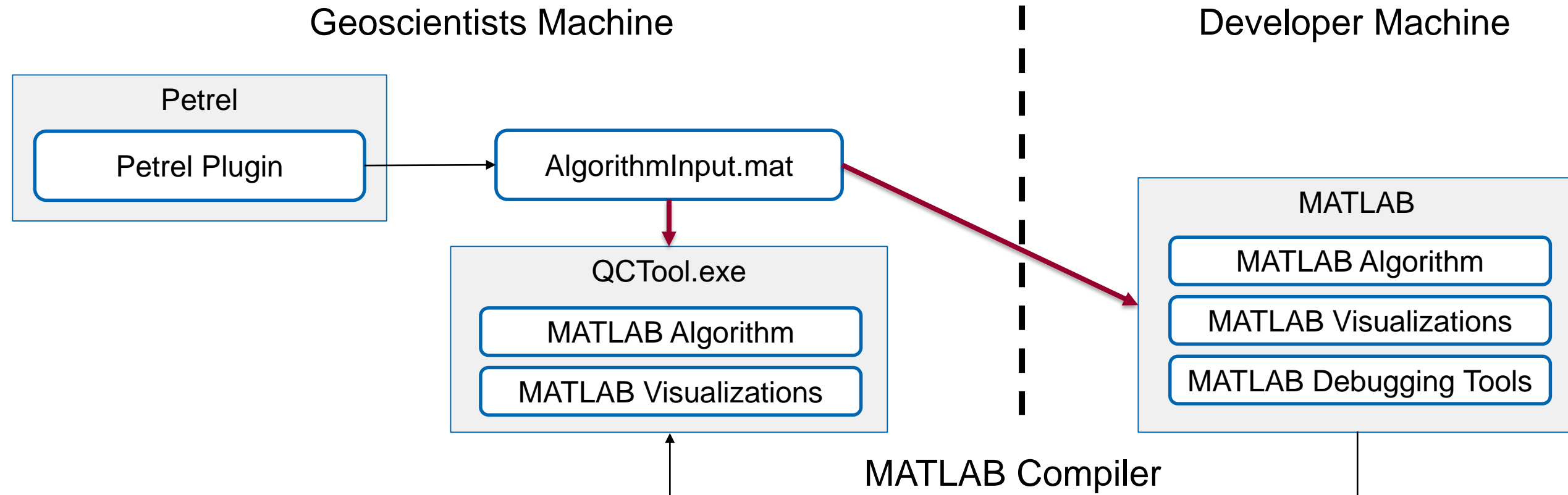
Solution 'DipGuidedPropagator' (3 projects)

- DipGuidedPropagator
 - Properties
 - C# AssemblyInfo.cs
 - Resources.resx
 - References
 - Analyzers
 - Cvx.Ocean.Utils
 - Cvx.Ocean.WorkflowUtils
 - MatlabAlgorithms
 - MatlabUI
 - MWArray
 - PropagatorUI
 - Slb.Ocean.Basics
 - Slb.Ocean.Core
 - Slb.Ocean.Data
 - Slb.Ocean.Geometry
 - Slb.Ocean.Petrel
 - Slb.Ocean.Petrel.Configuration
 - Slb.Ocean.Petrel.Data.Persistence
 - Slb.Ocean.Petrel.Seismic
 - Slb.Ocean.Petrel.UI.Controls
 - Slb.Ocean.Petrel.UI.Visualization3D
 - System

- Adding MATLAB libraries to Petrel plugins is simple and well documented

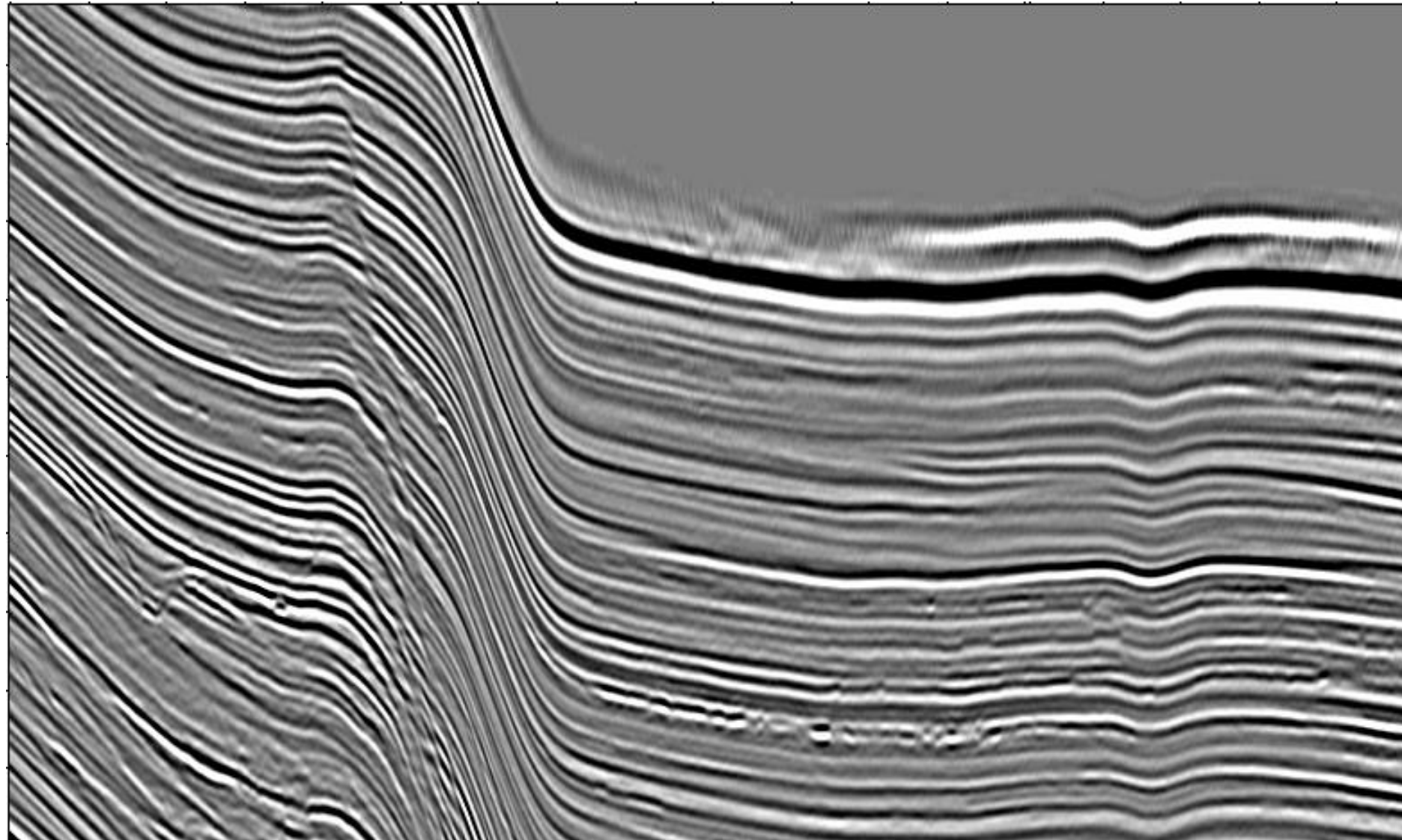


Algorithm Enhancement and QC Workflow



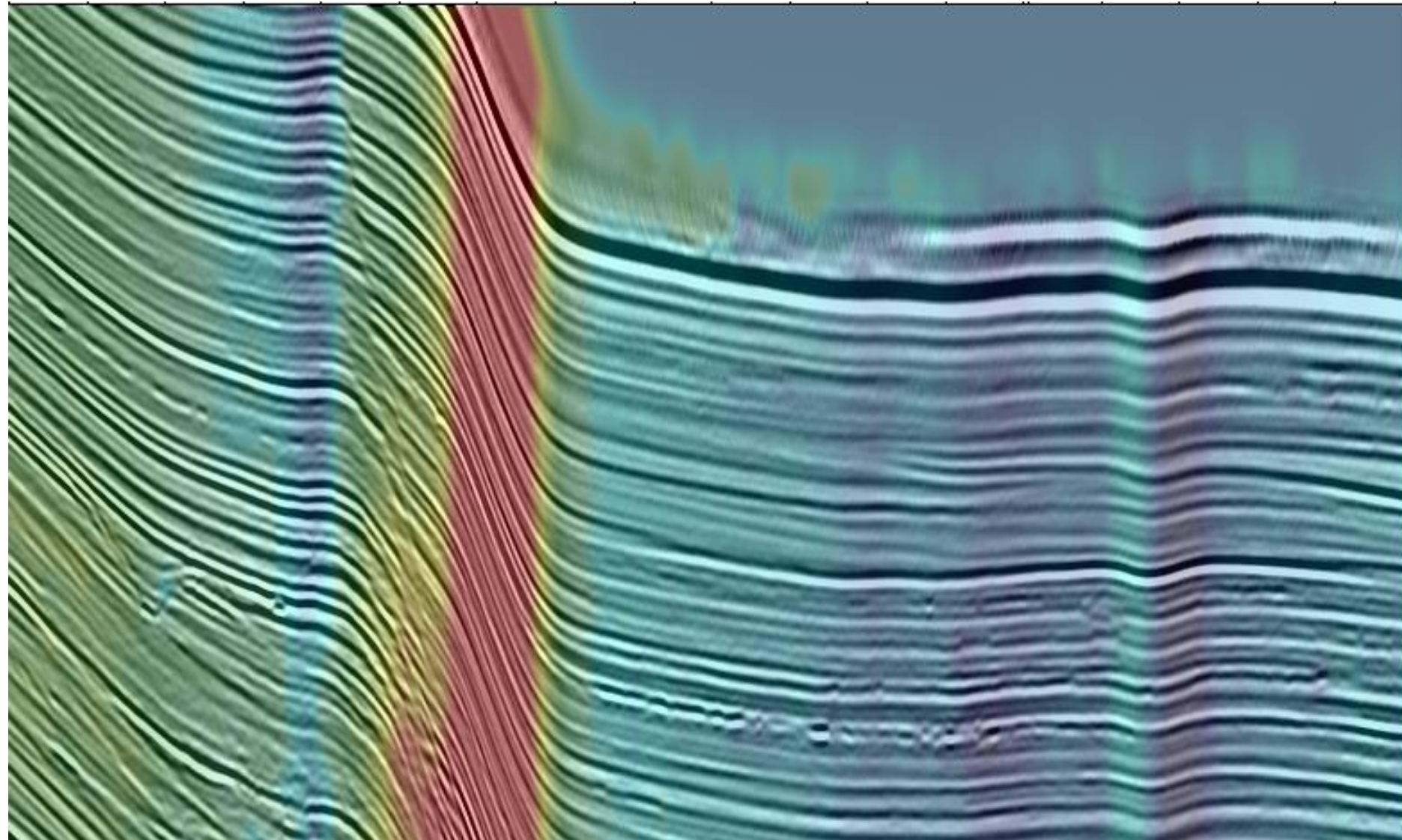
- Several algorithm changes were enabled by this rapid prototyping process:
 - More flexible geometry of auto-correlation input
 - Corrections for seismic amplitude clipping / quantization
 - Include horizon-based dip in addition to precomputed seismic dip volumes
 - Numerous additional stopping conditions (e.g. horizon curvature)

Dip QC



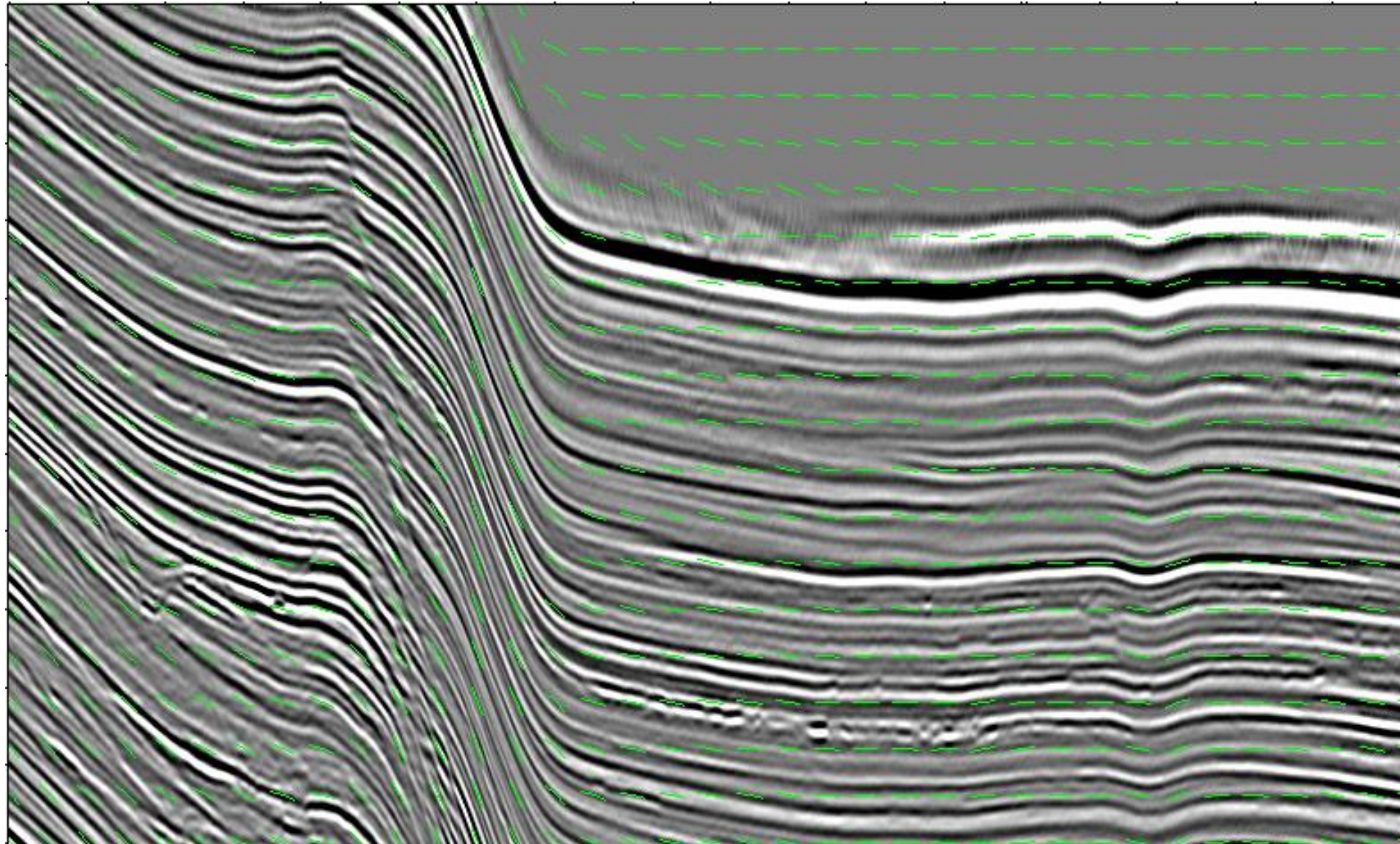
- There are a variety of seismic dip estimators and representations.

Dip QC



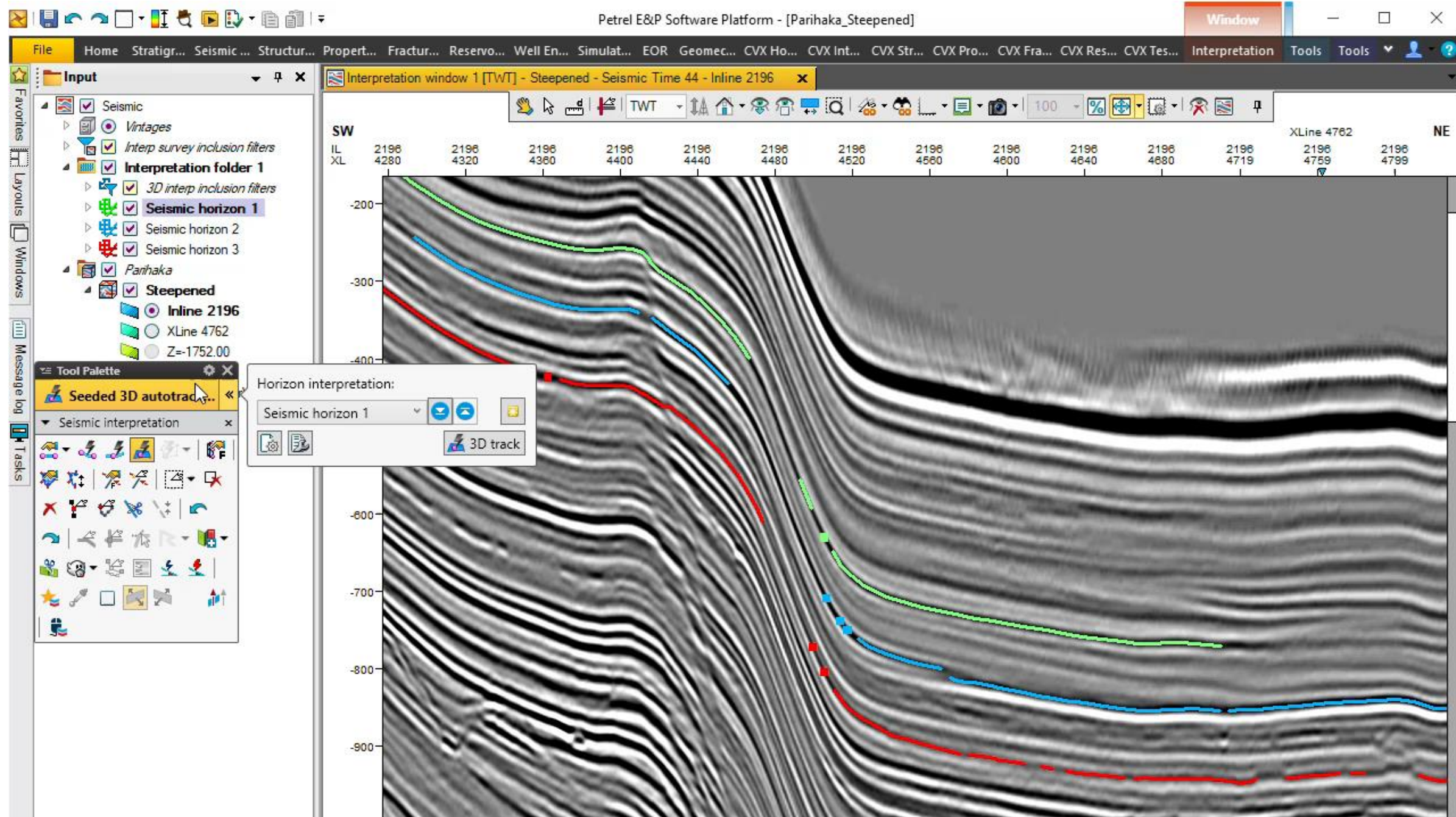
- Typically seismic dip is QC'd by co-rendering dip with seismic amplitude

Dip QC



- Geoscientists requested that we incorporate out dip QC visualization direction into Petrel

Dip-guided Auto-tracking



Conclusions

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