True-amplitude CRS-based Kirchhoff time migration for AVO analysis

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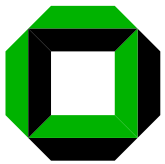


November 10, 2005

Overview

Motivation

- Principle
- Effect of migration aperture on amplitudes

Common-Reflection-Surface stack

Adapted workflow

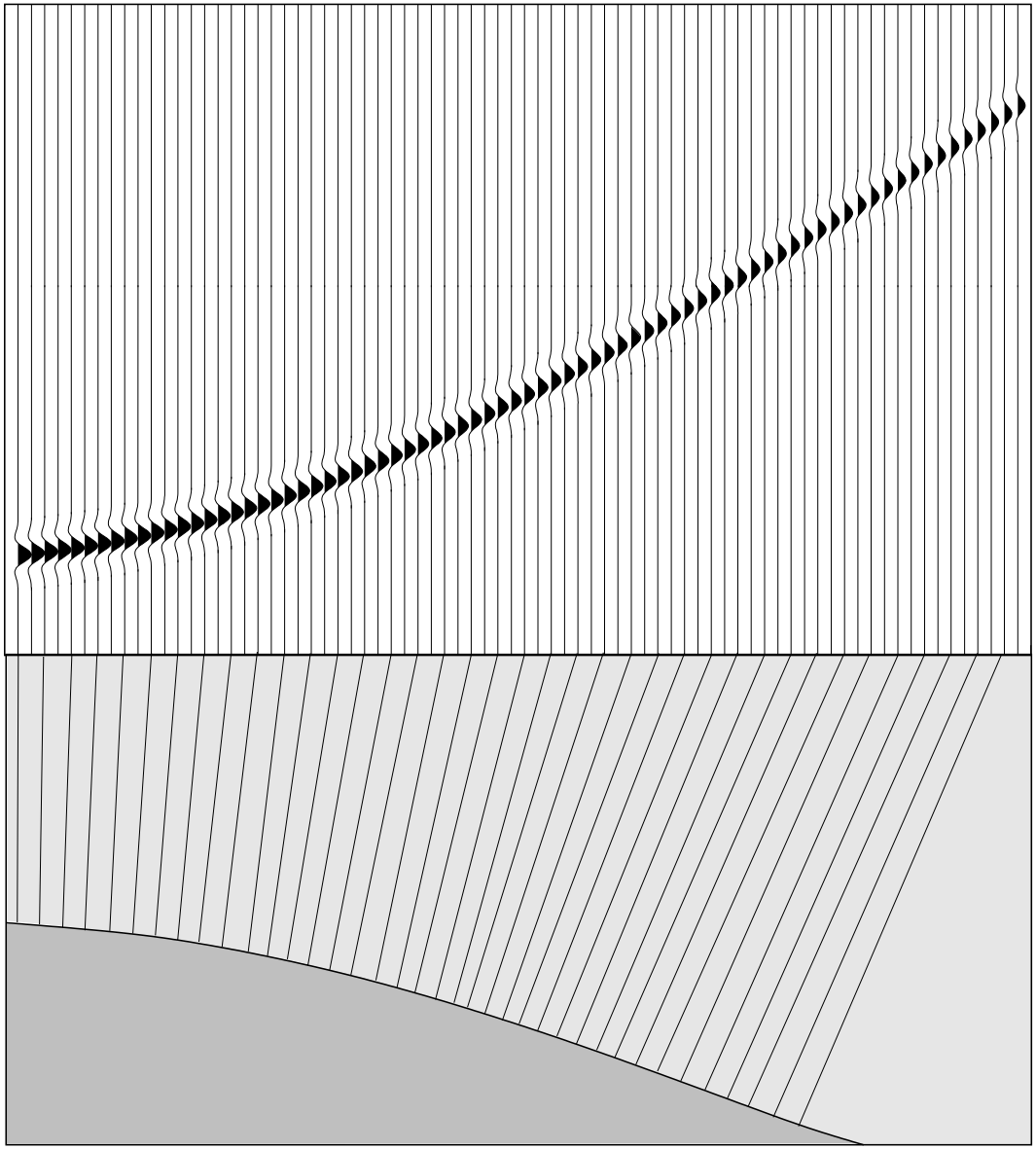
- Extraction of CRS attributes
- Velocity model determination
- Determination of migration attributes

Synthetic data example

Conclusions

Acknowledgments

Kirchhoff migration



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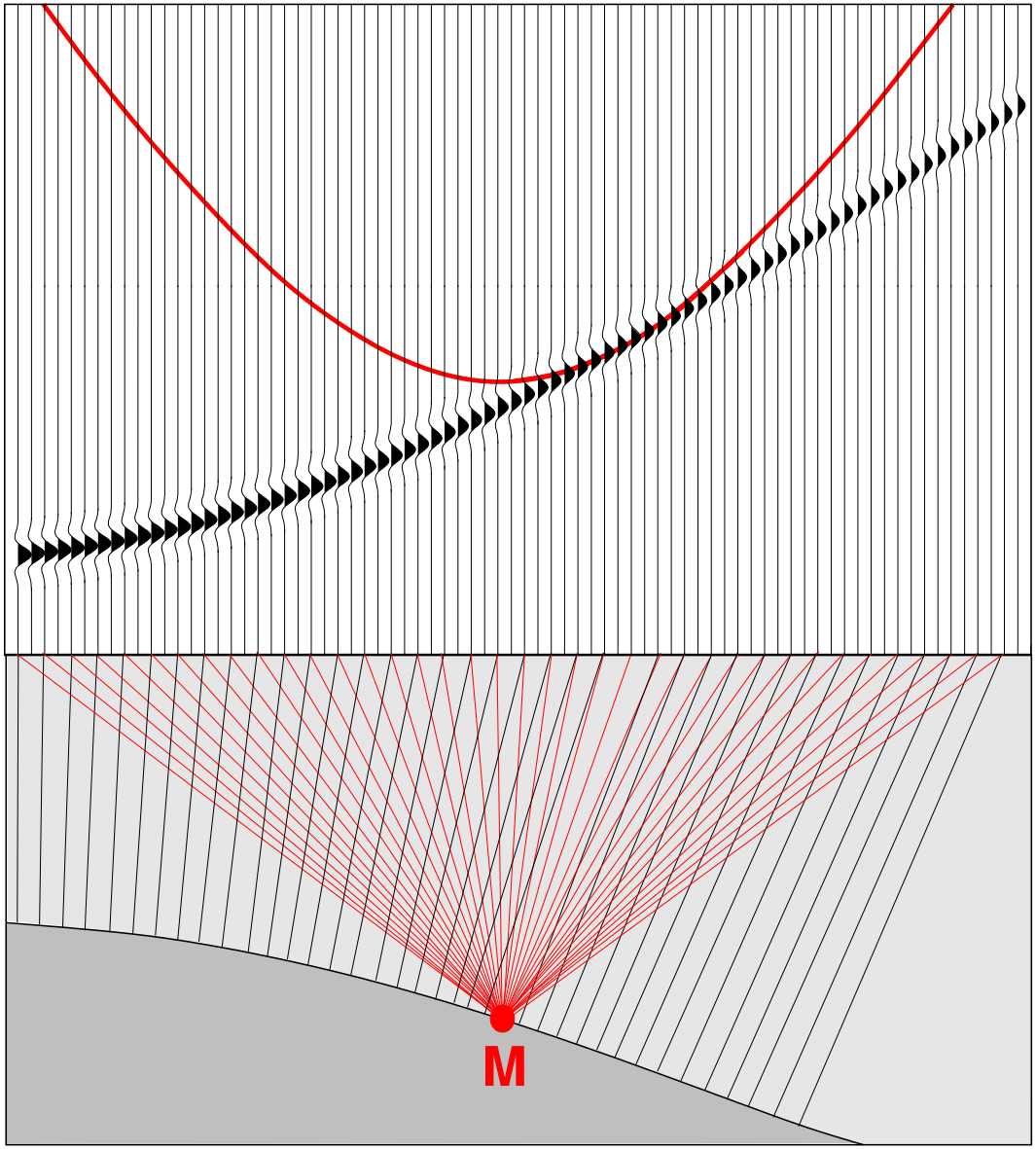
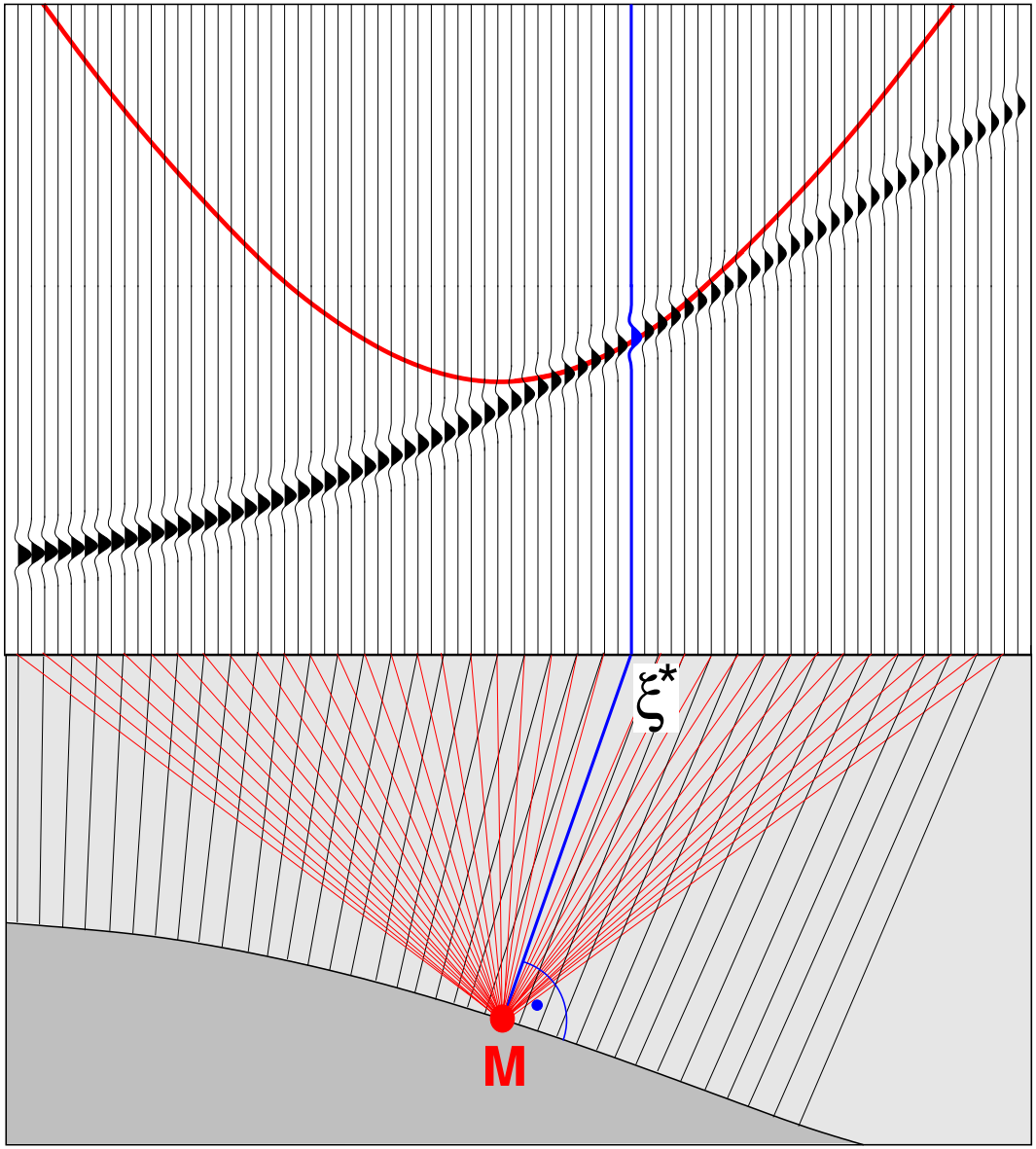
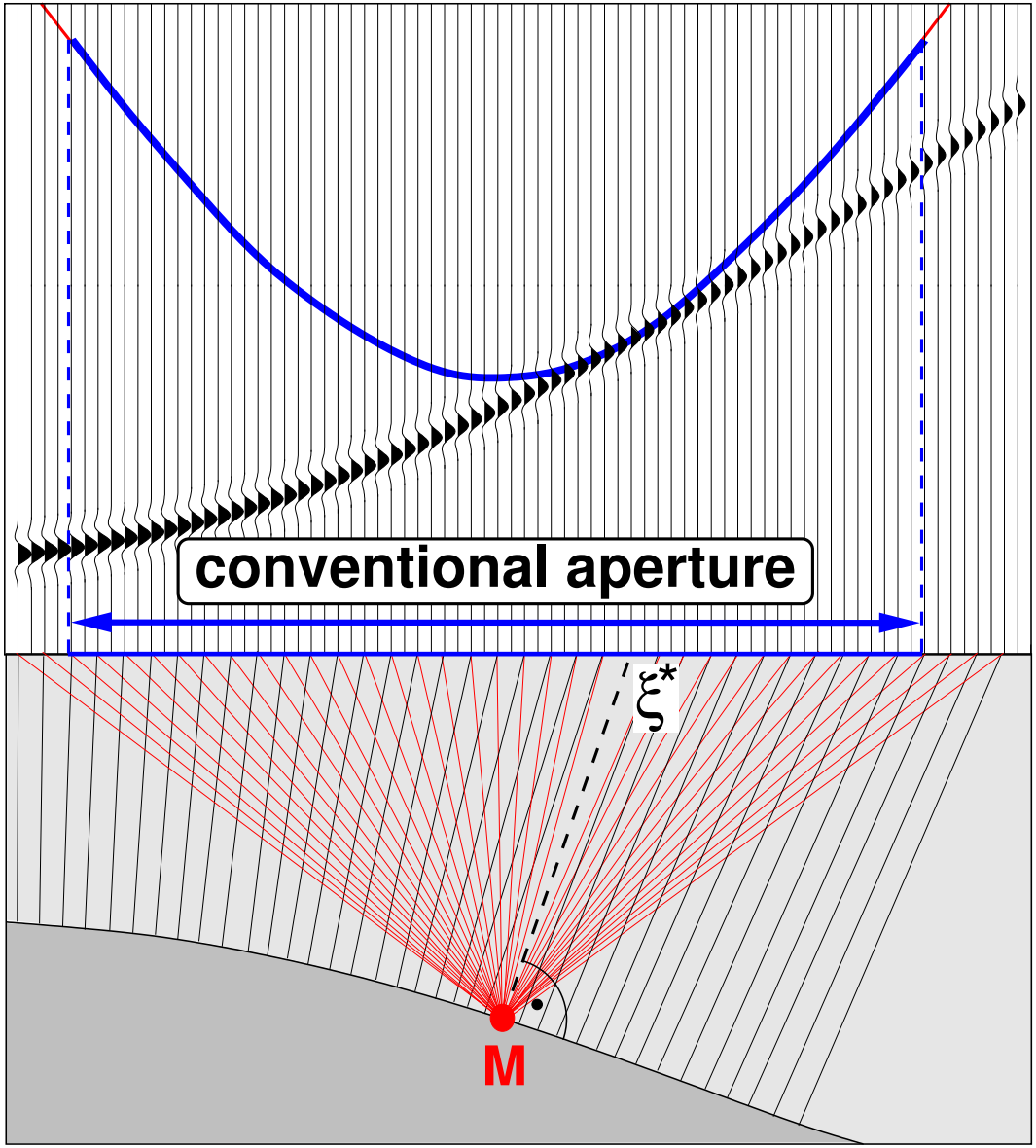


Kirchhoff migration: stationary point



Kirchhoff migration: conventional aperture



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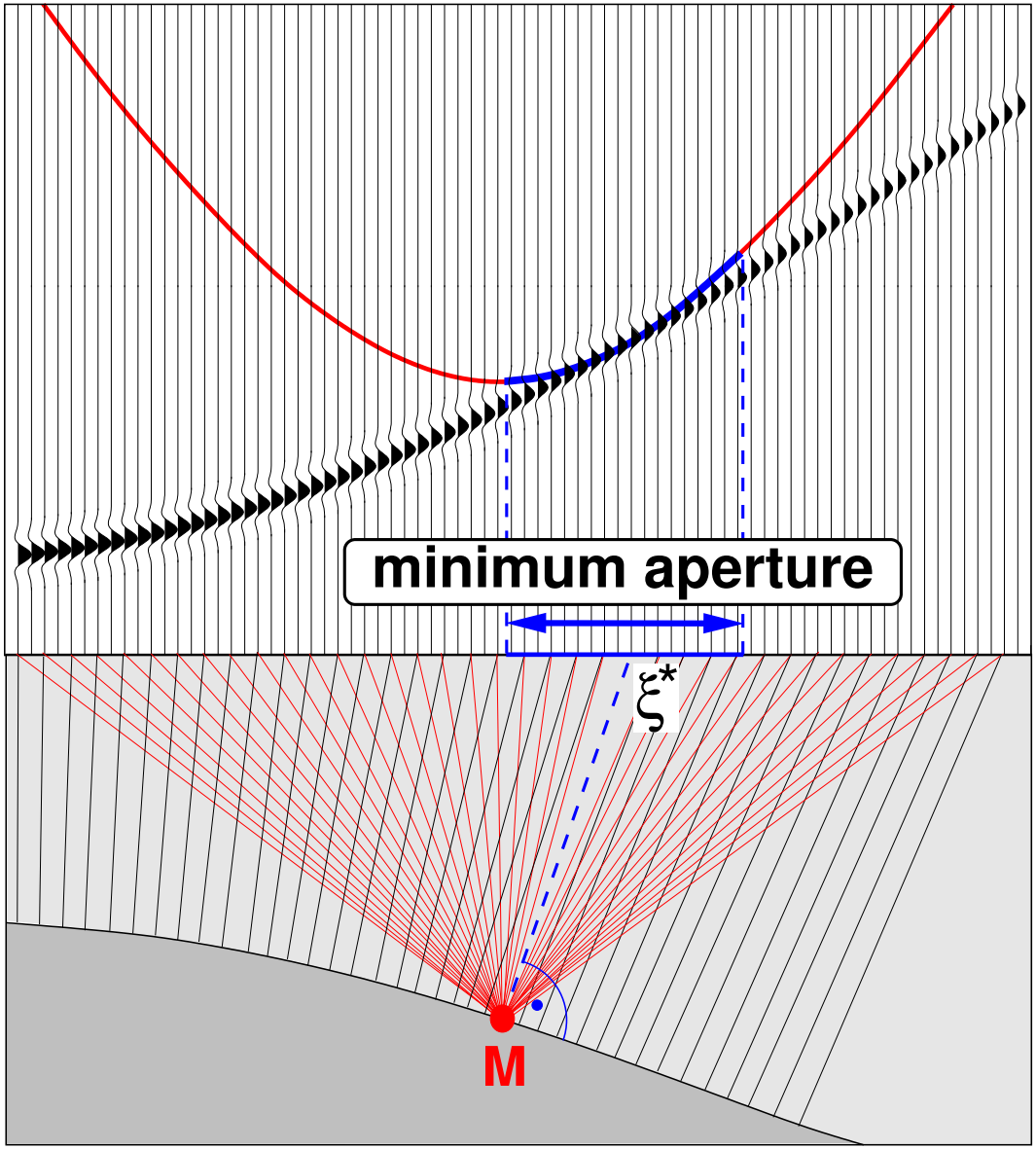

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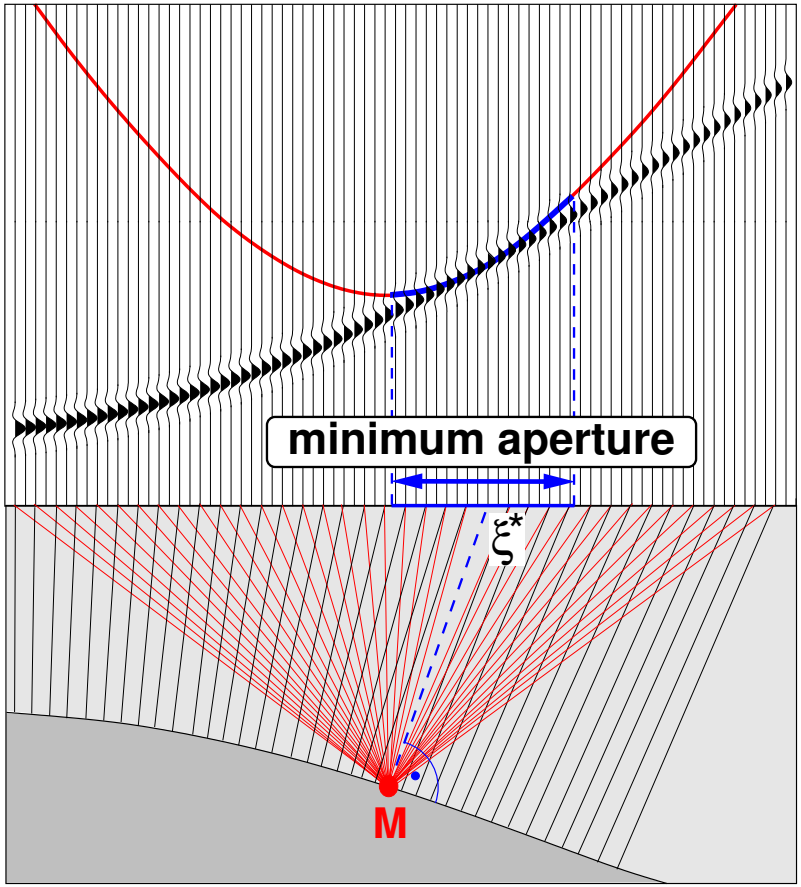

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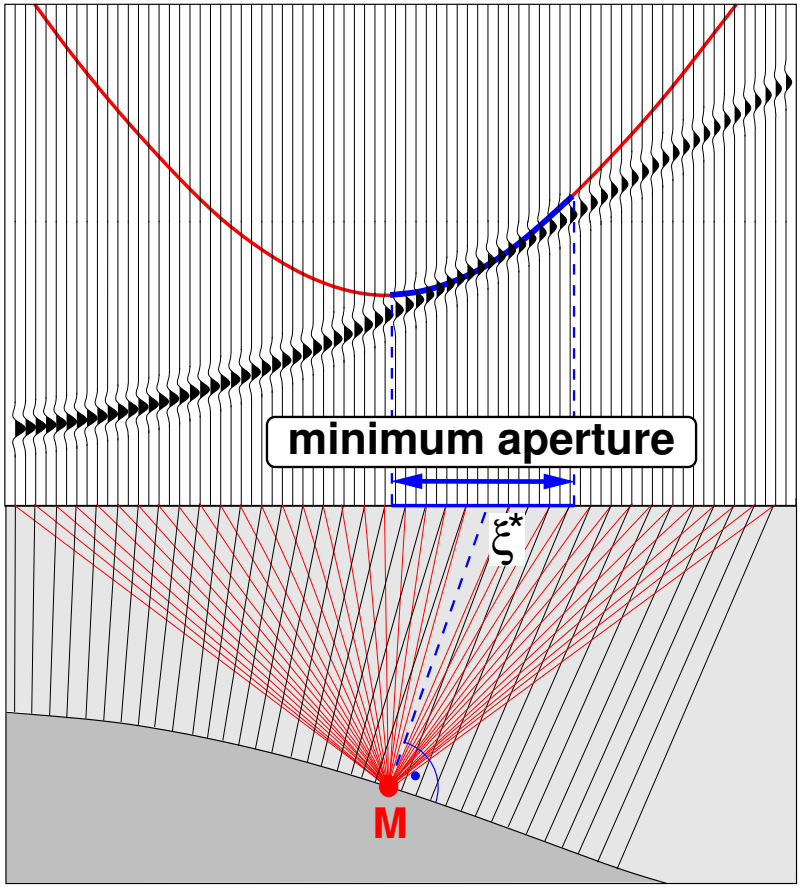

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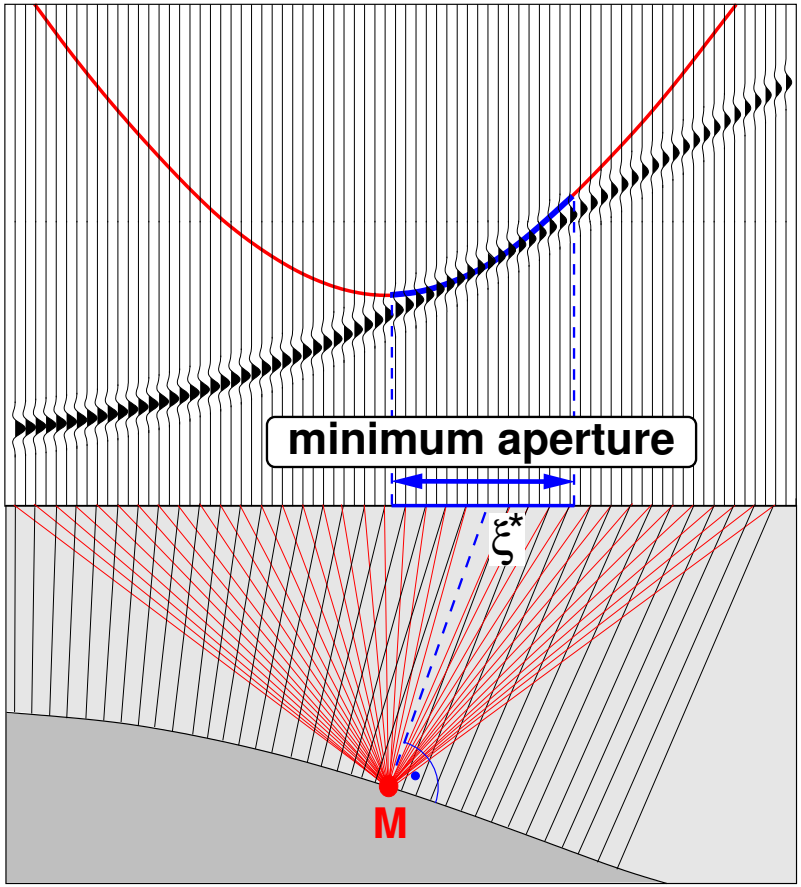

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Common-Reflection-Surface stack

- alternative to standard NMO/DMO/stack approach
- second-order approximation of reflection events in offset and midpoint direction
- spatial stacking operator
  - ↪ much more prestack traces used
  - ↪ enhanced signal/noise ratio
- fully automated coherence-based application
- output:
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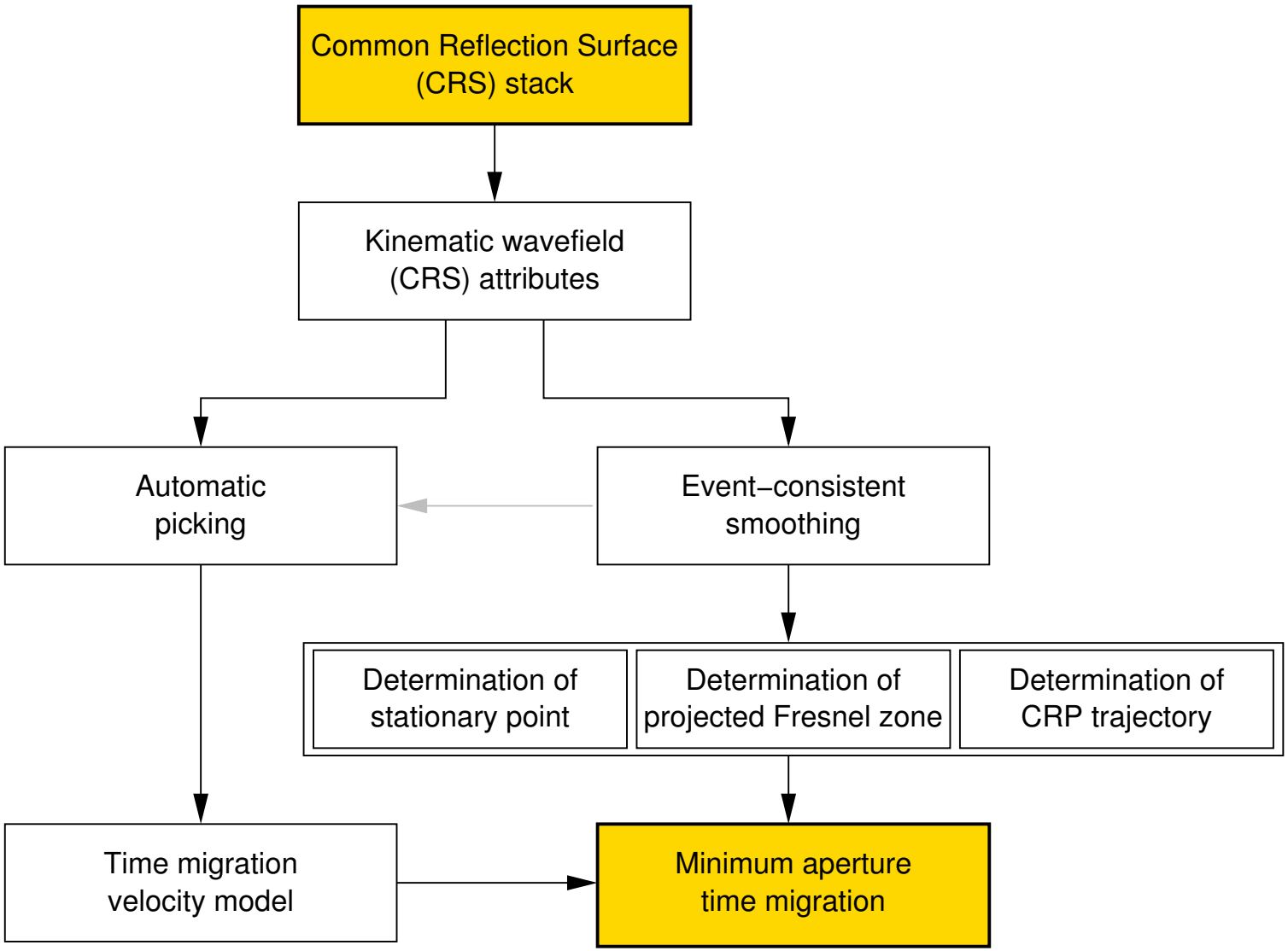
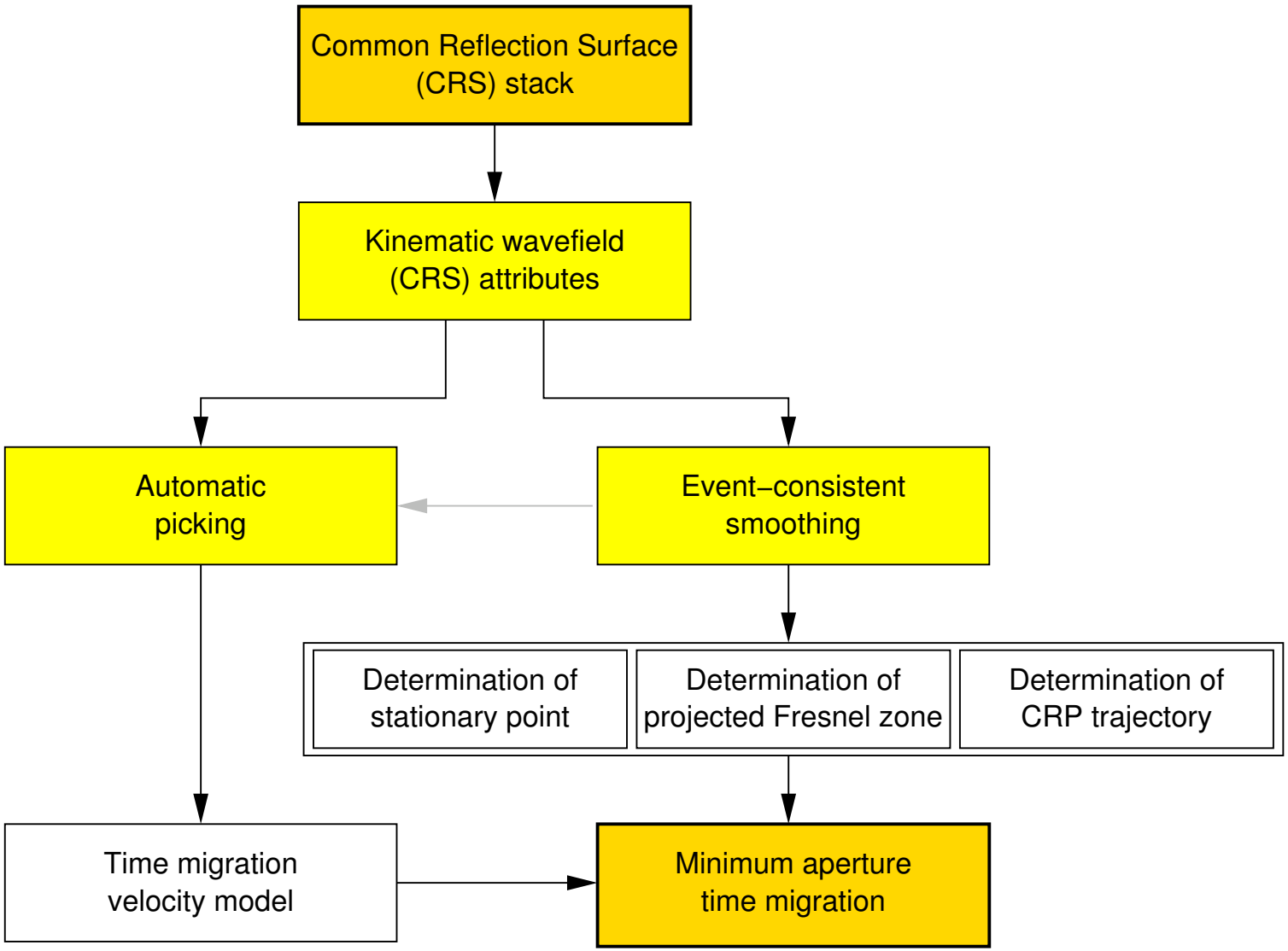
General workflow



Workflow: extraction of attributes



Workflow: extraction of attributes

CRS stack provides kinematic wavefield attributes for each sample

- meaningful only along reflection events
- subject to outliers
- subject to unphysical fluctuations

➥ attribute-based event-consistent smoothing

➥ smooth input for determination of PFZ and stationary point

➥ automated picking of locally coherent events

➥ input for velocity model determination

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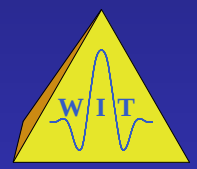

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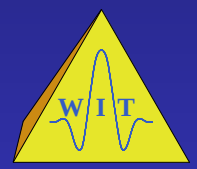

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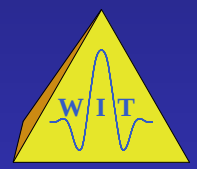

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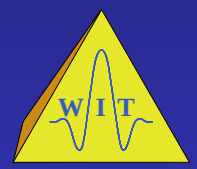

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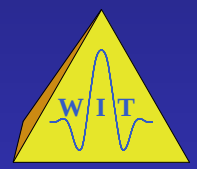

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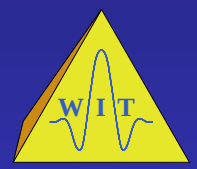

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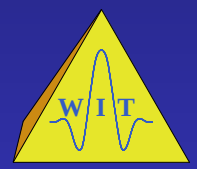

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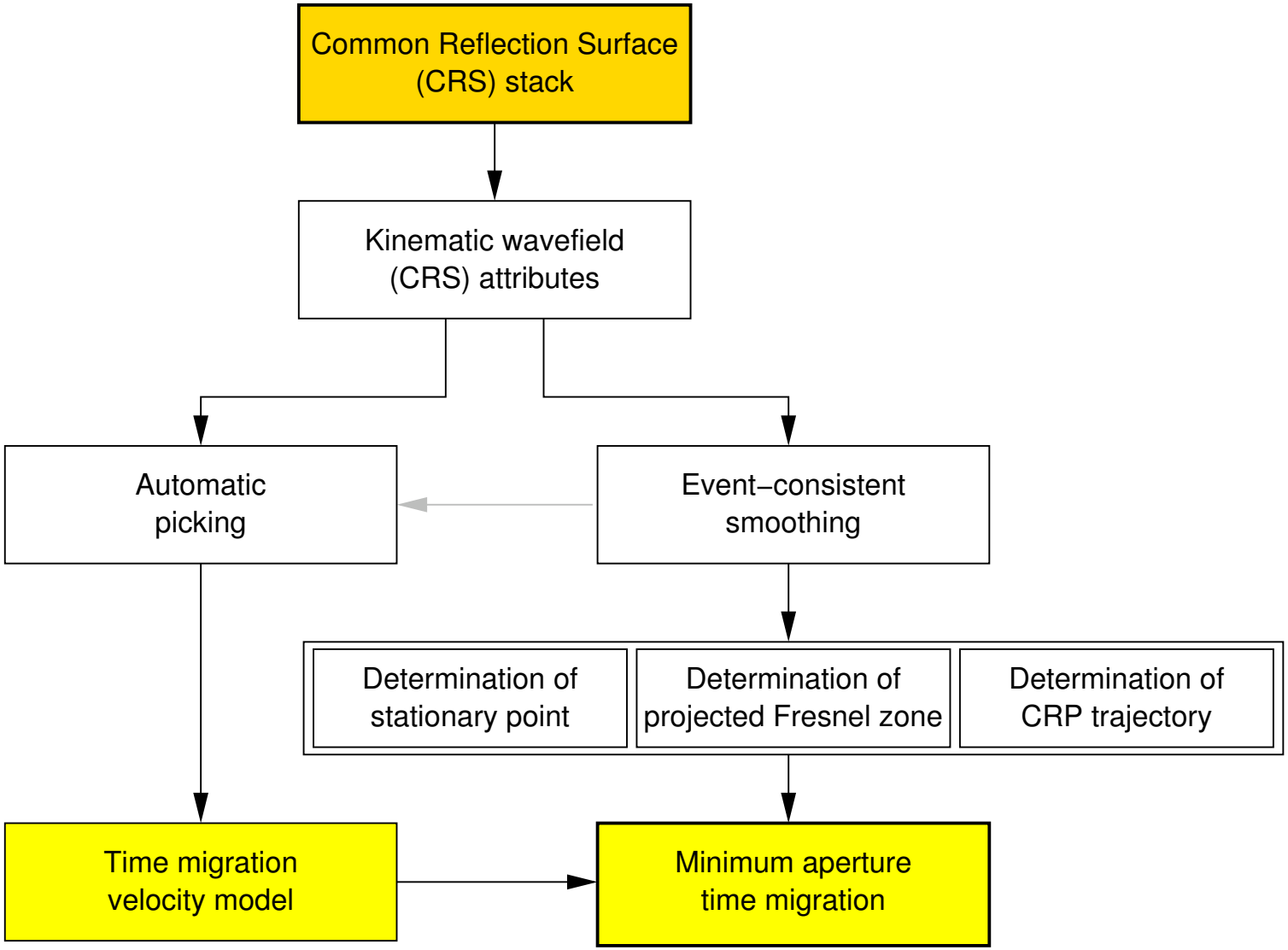

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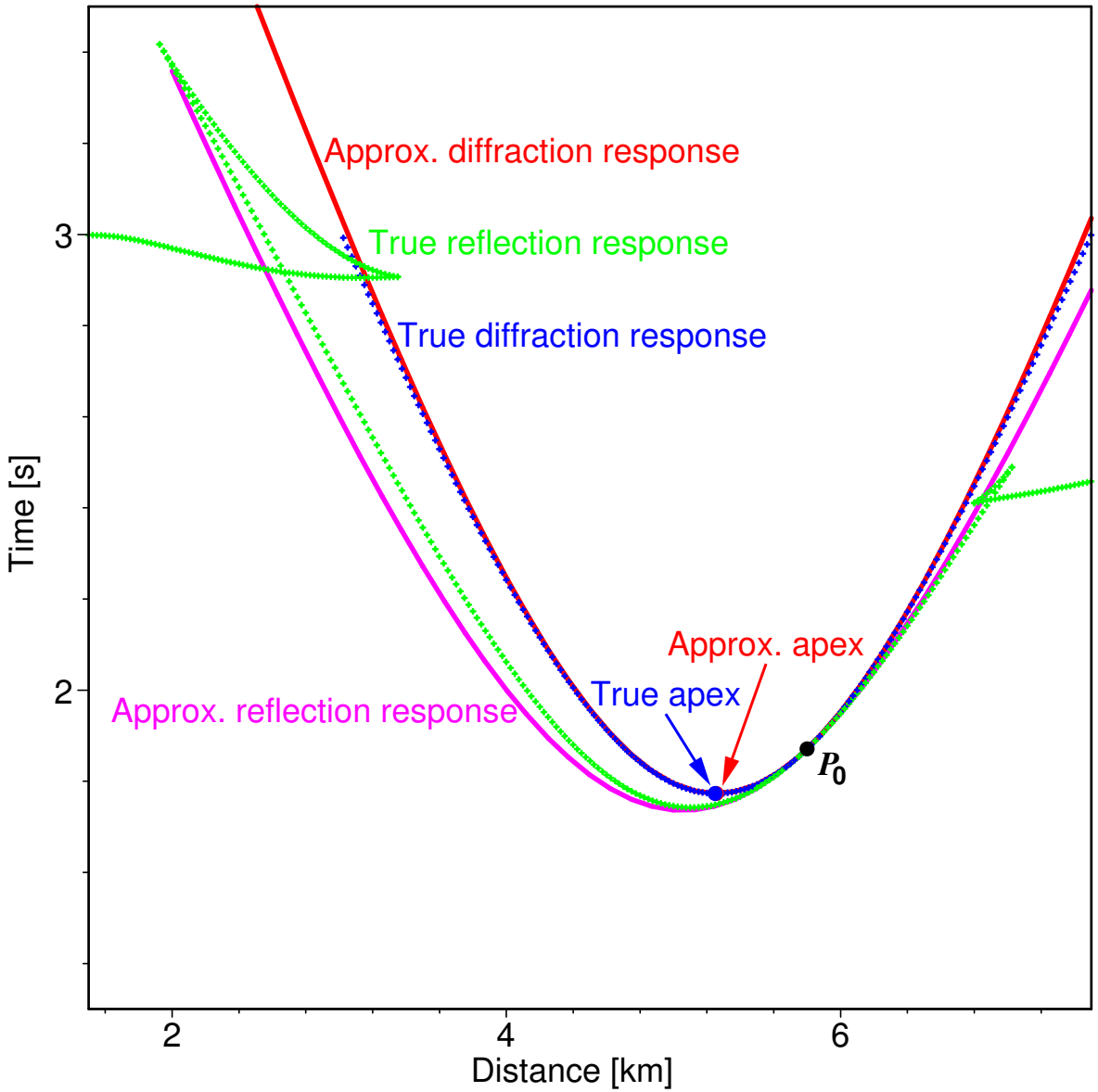

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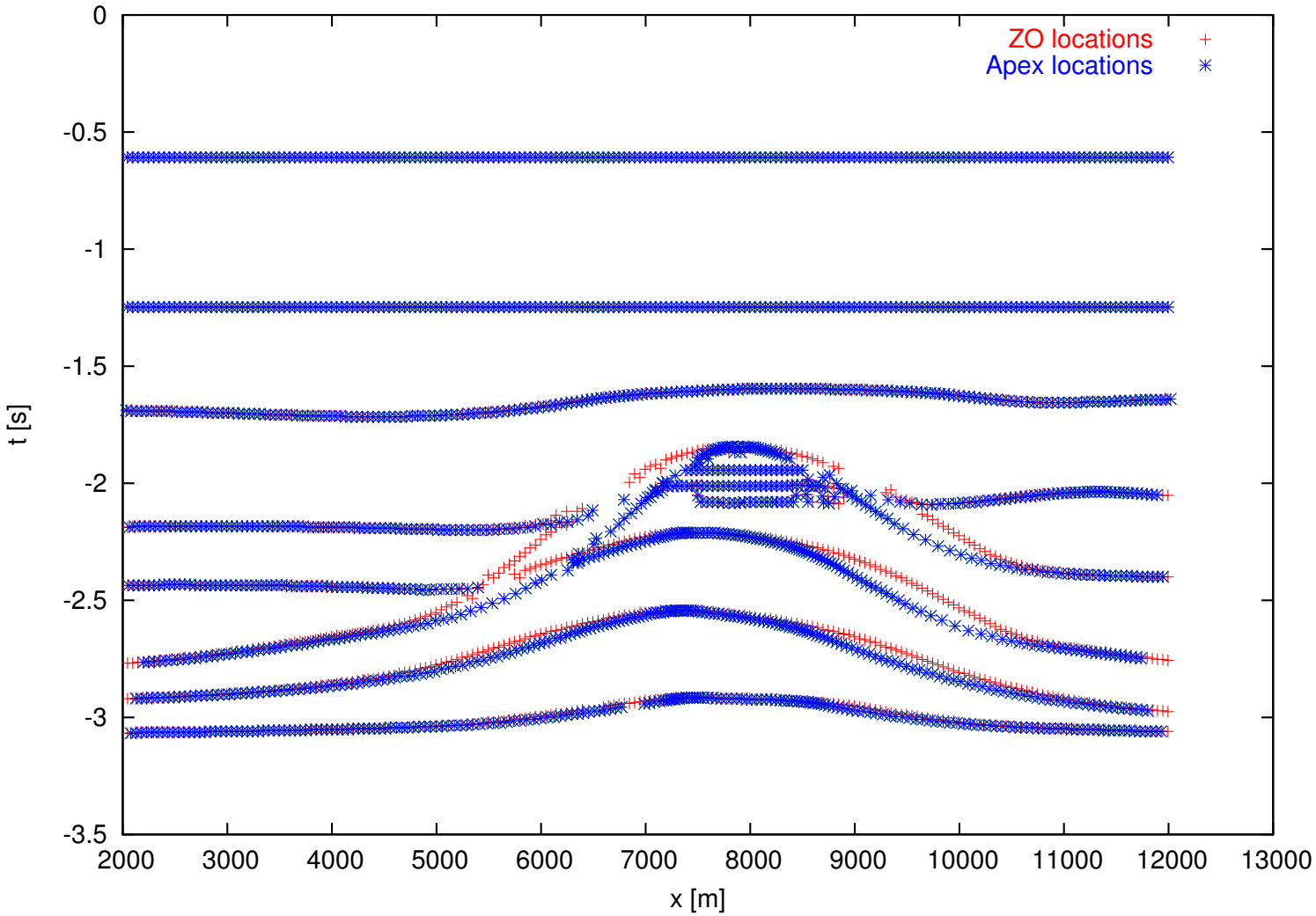

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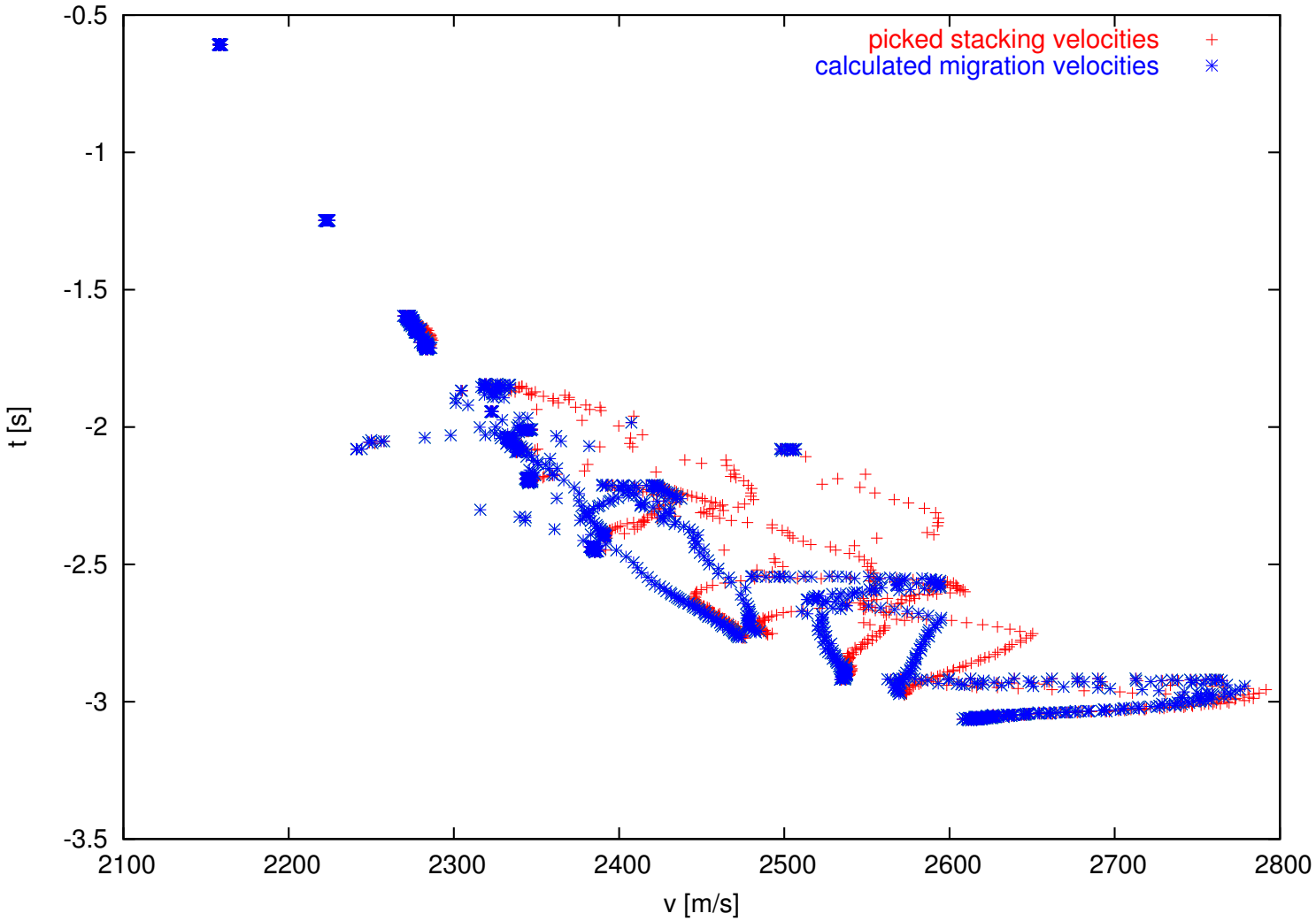

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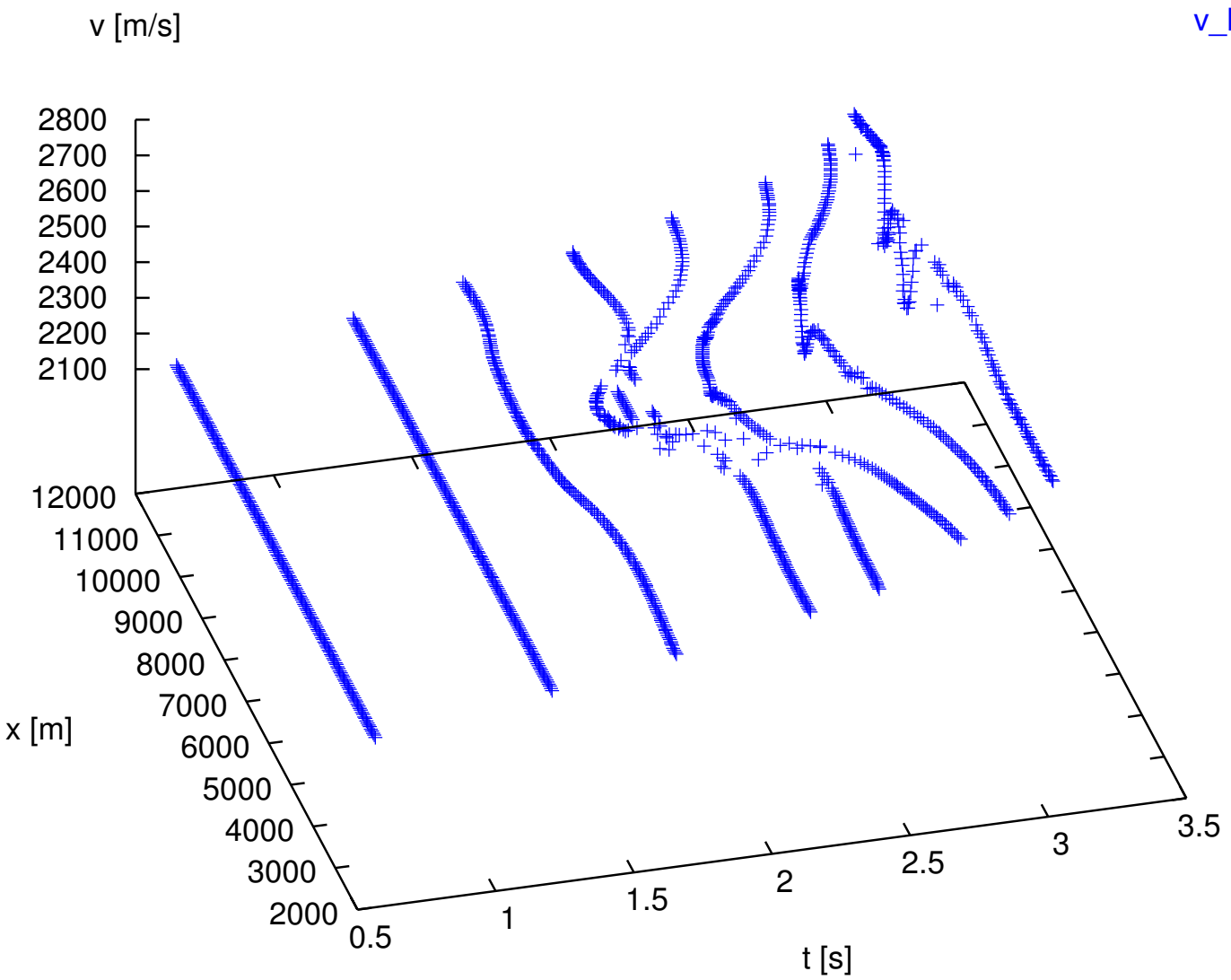

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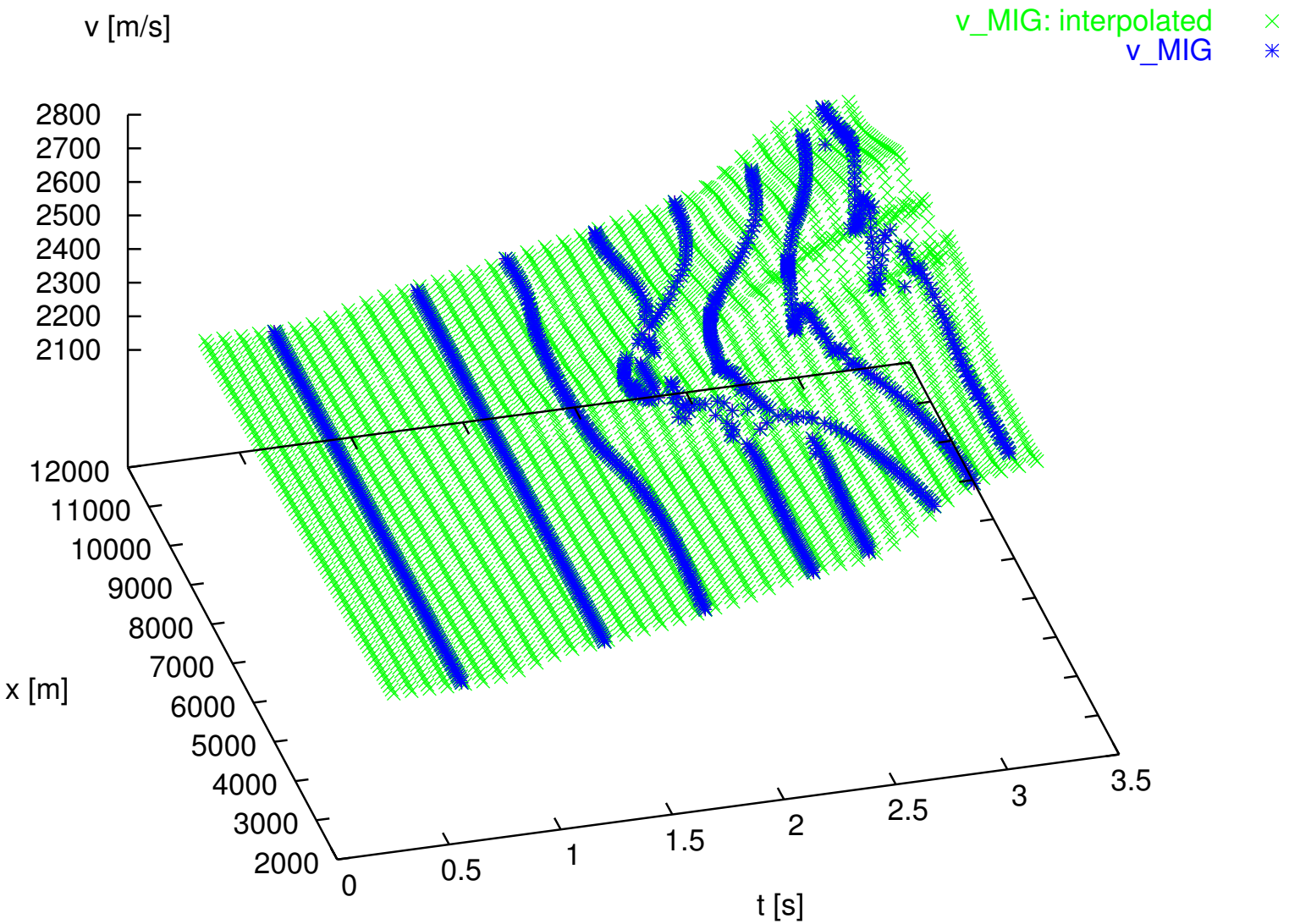
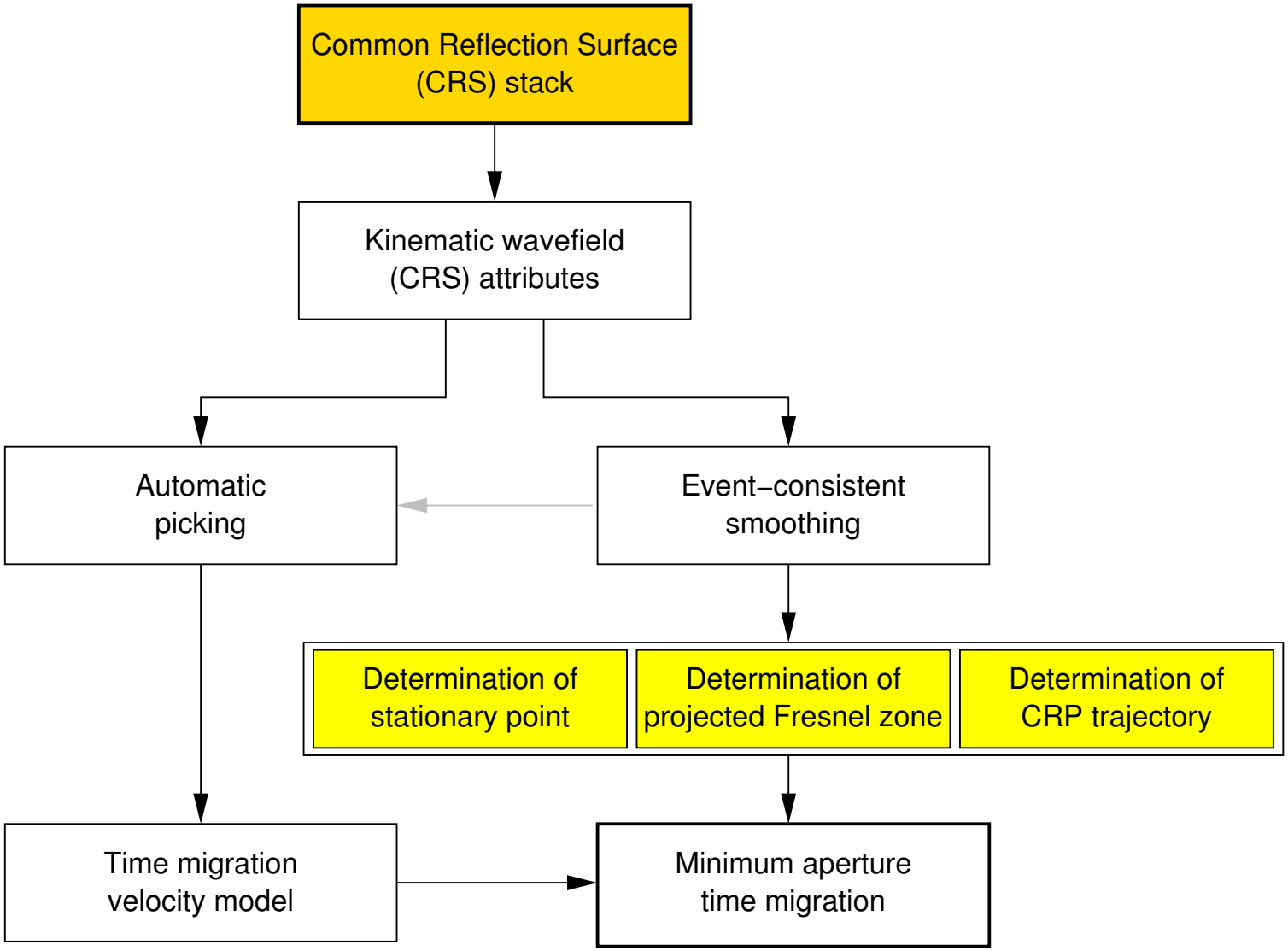


Workflow: migration attributes



PFZ & stationary point

Stationary point for ZO:

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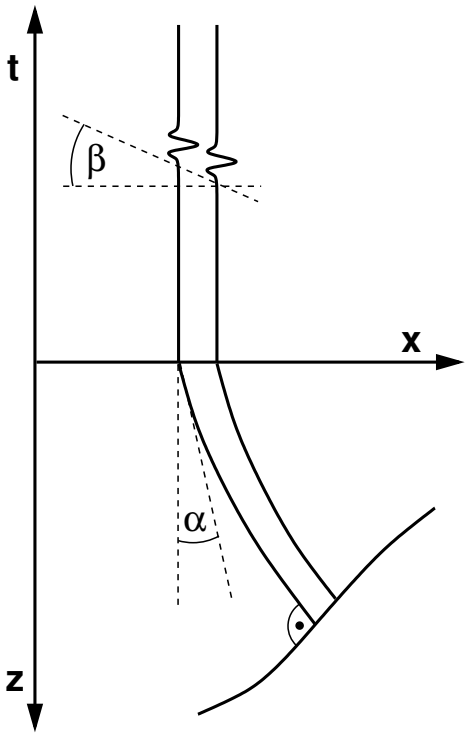

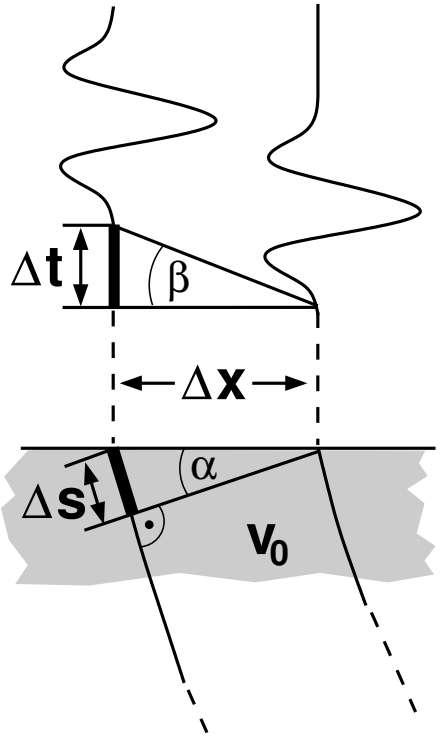

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Projected Fresnel zone for ZO:

➥ directly available from CRS attributes

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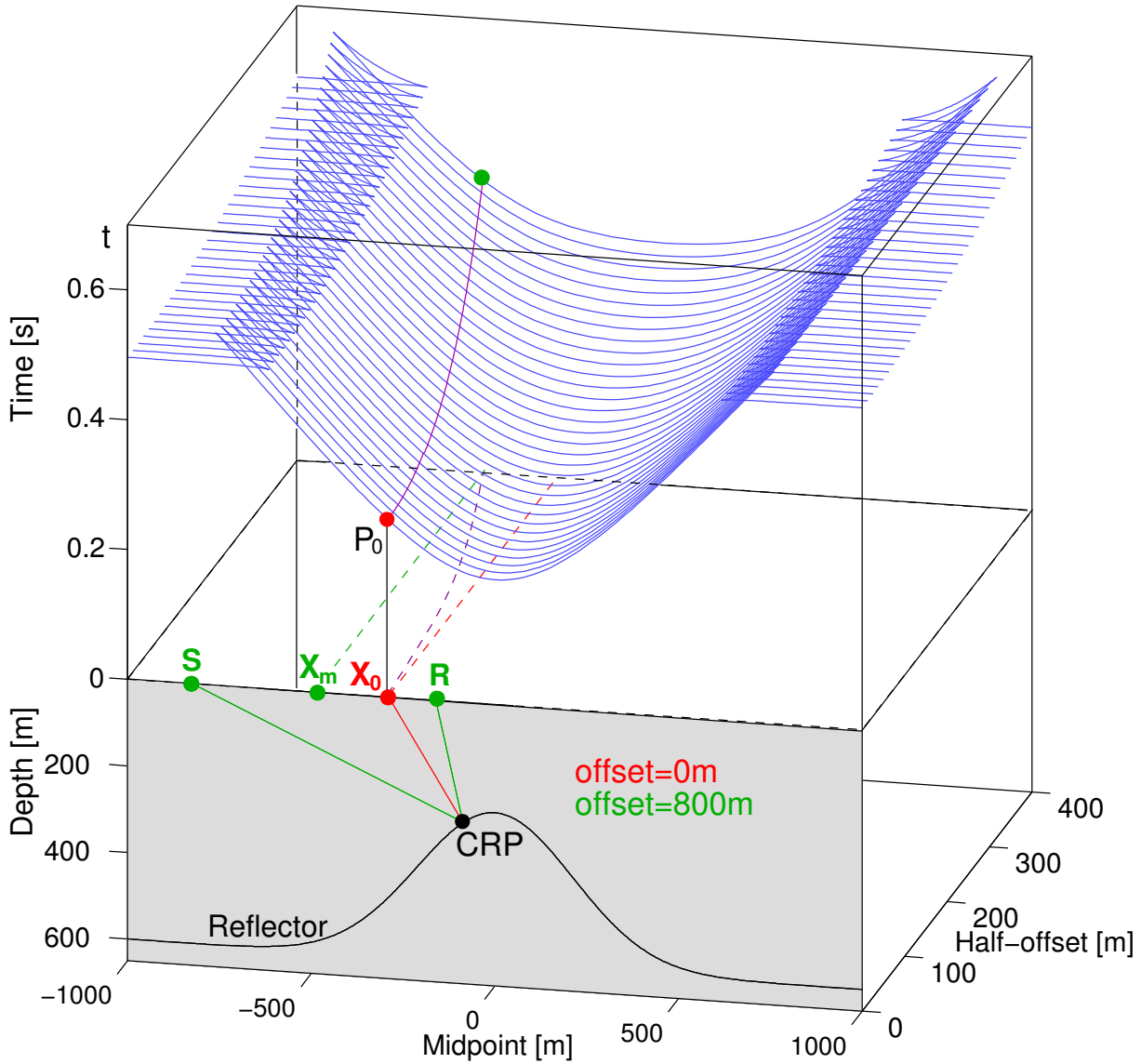
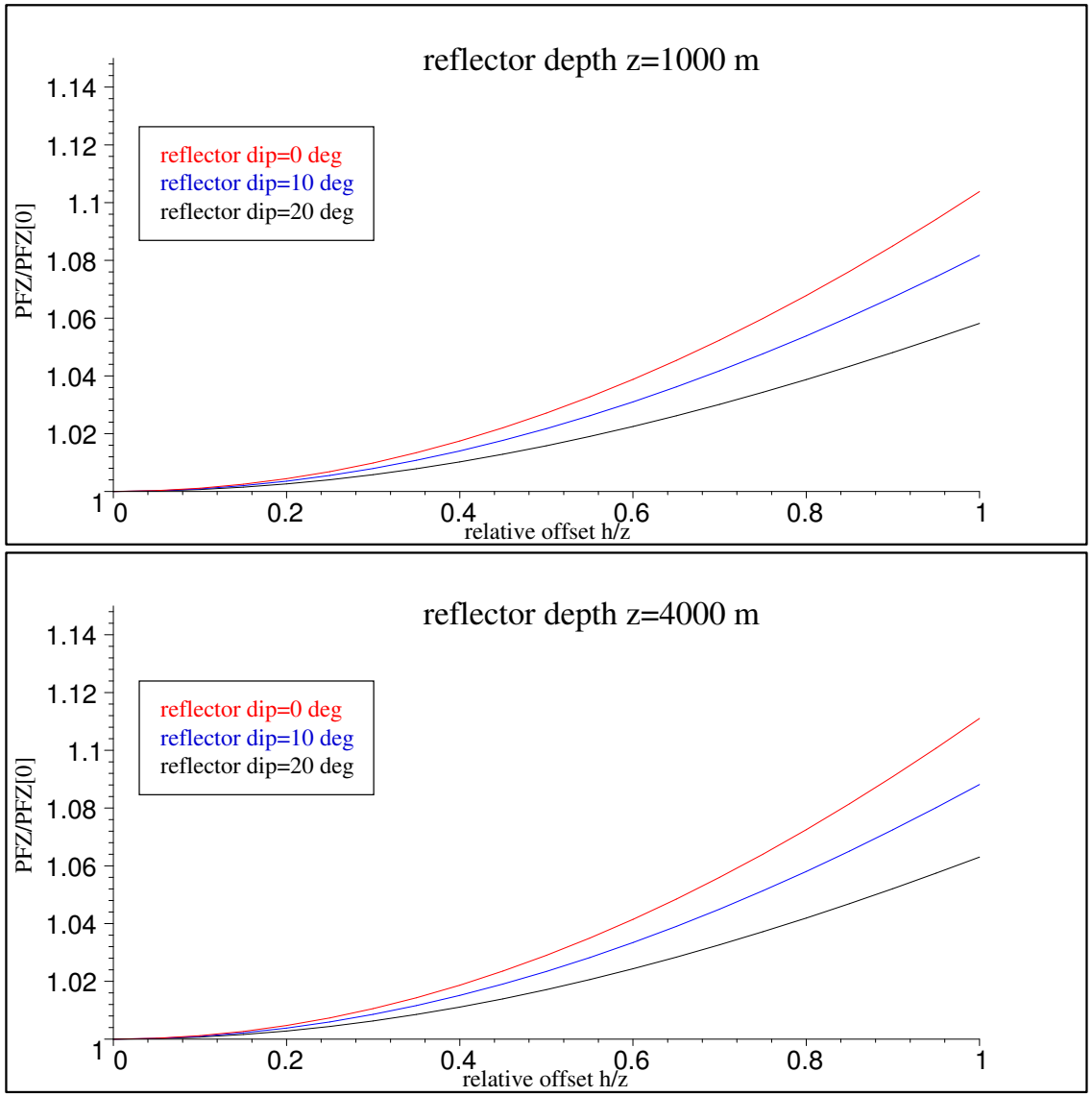
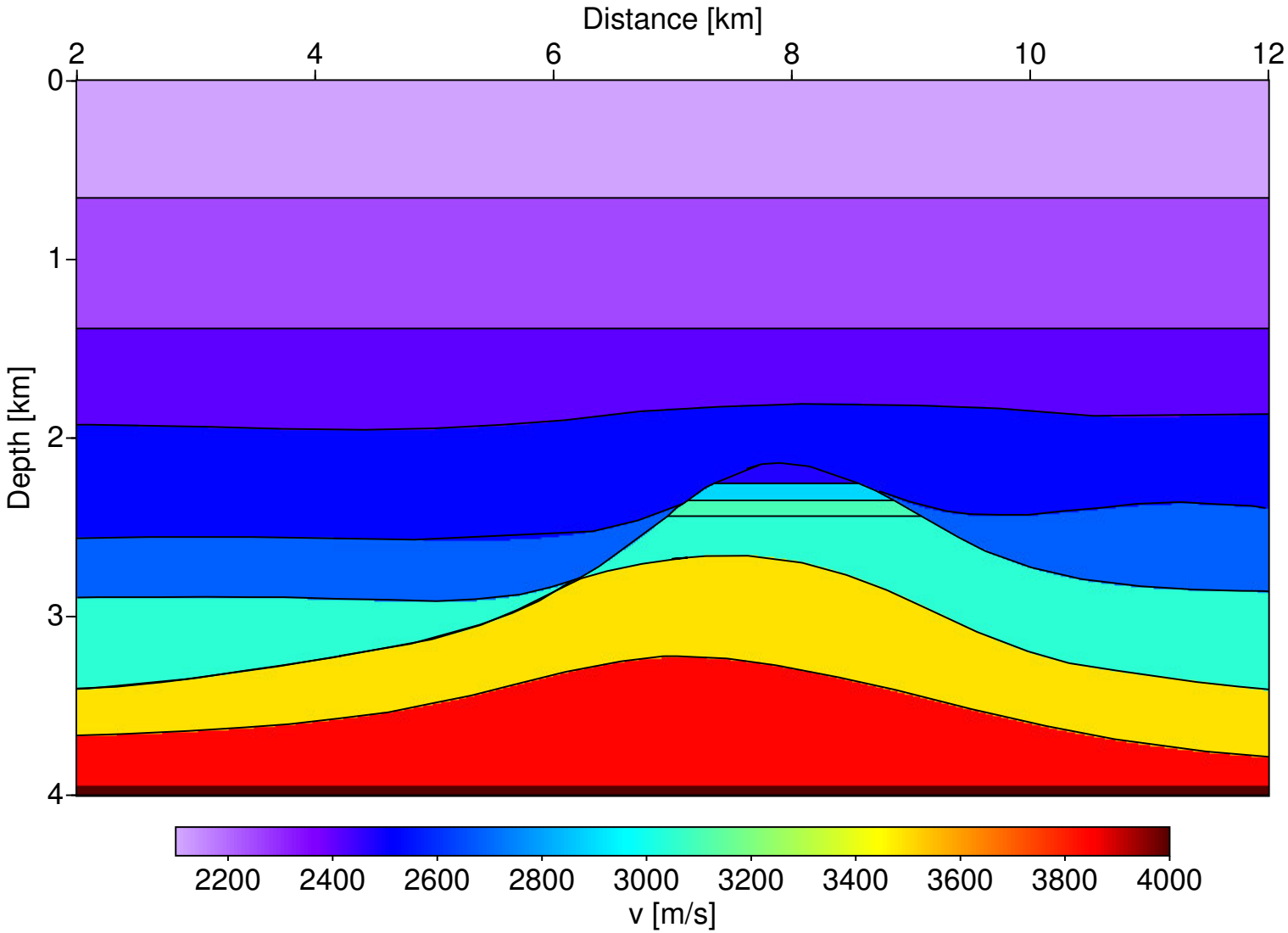


➥ extrapolation of stationary point to finite offset

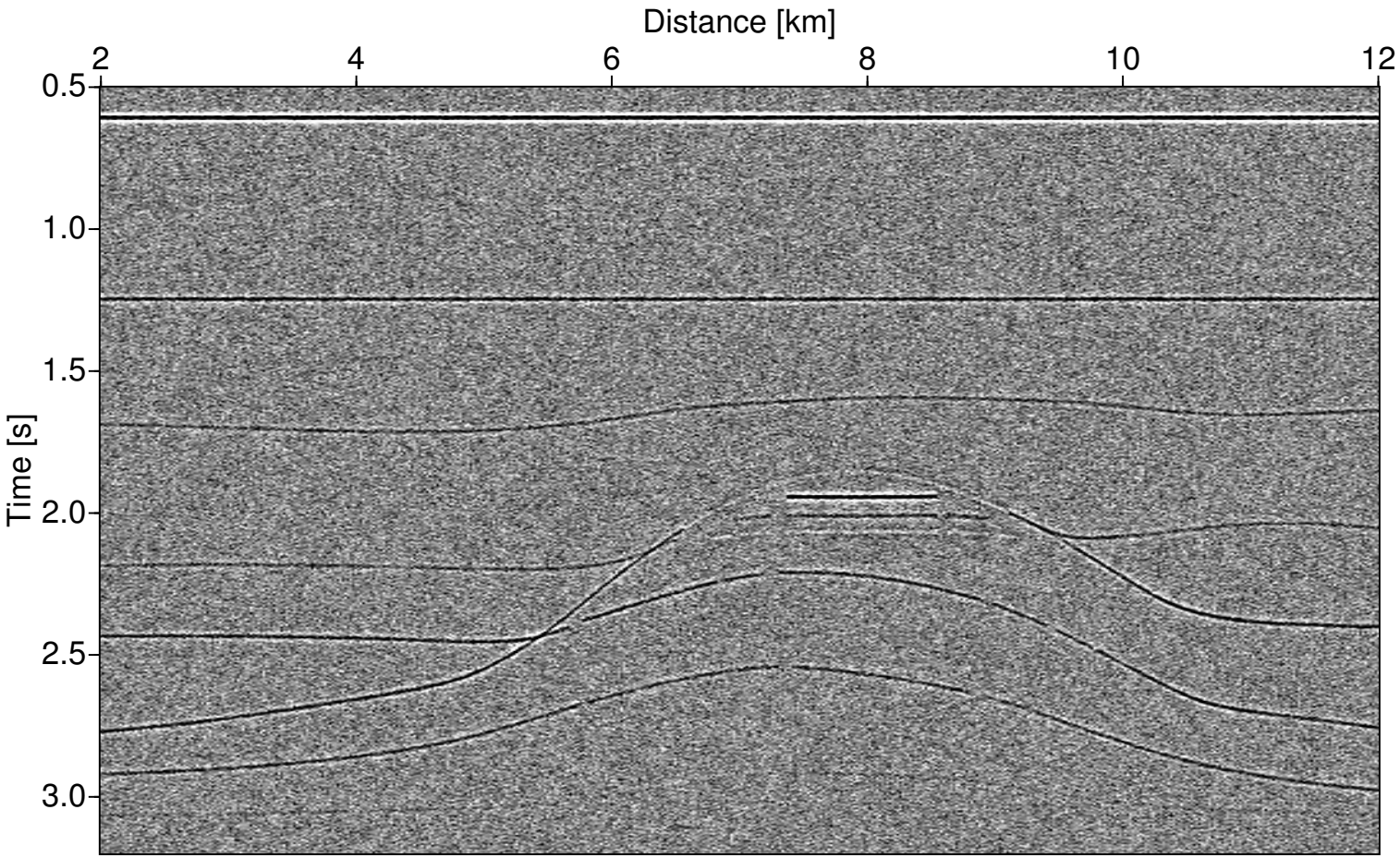
Widening of PFZ size with offset



Original model (v_P)



Zero-offset seismogram



Migration velocity model

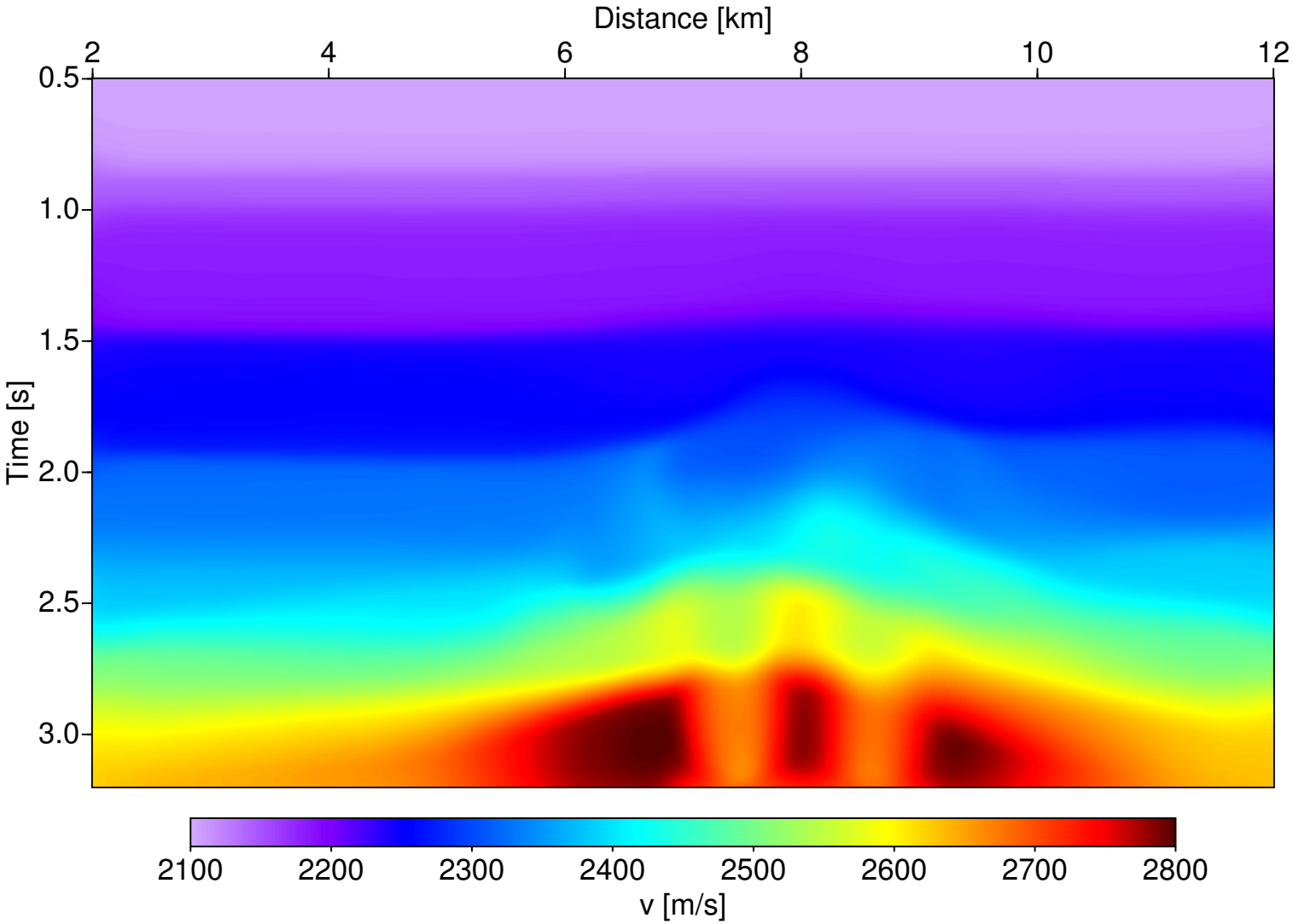
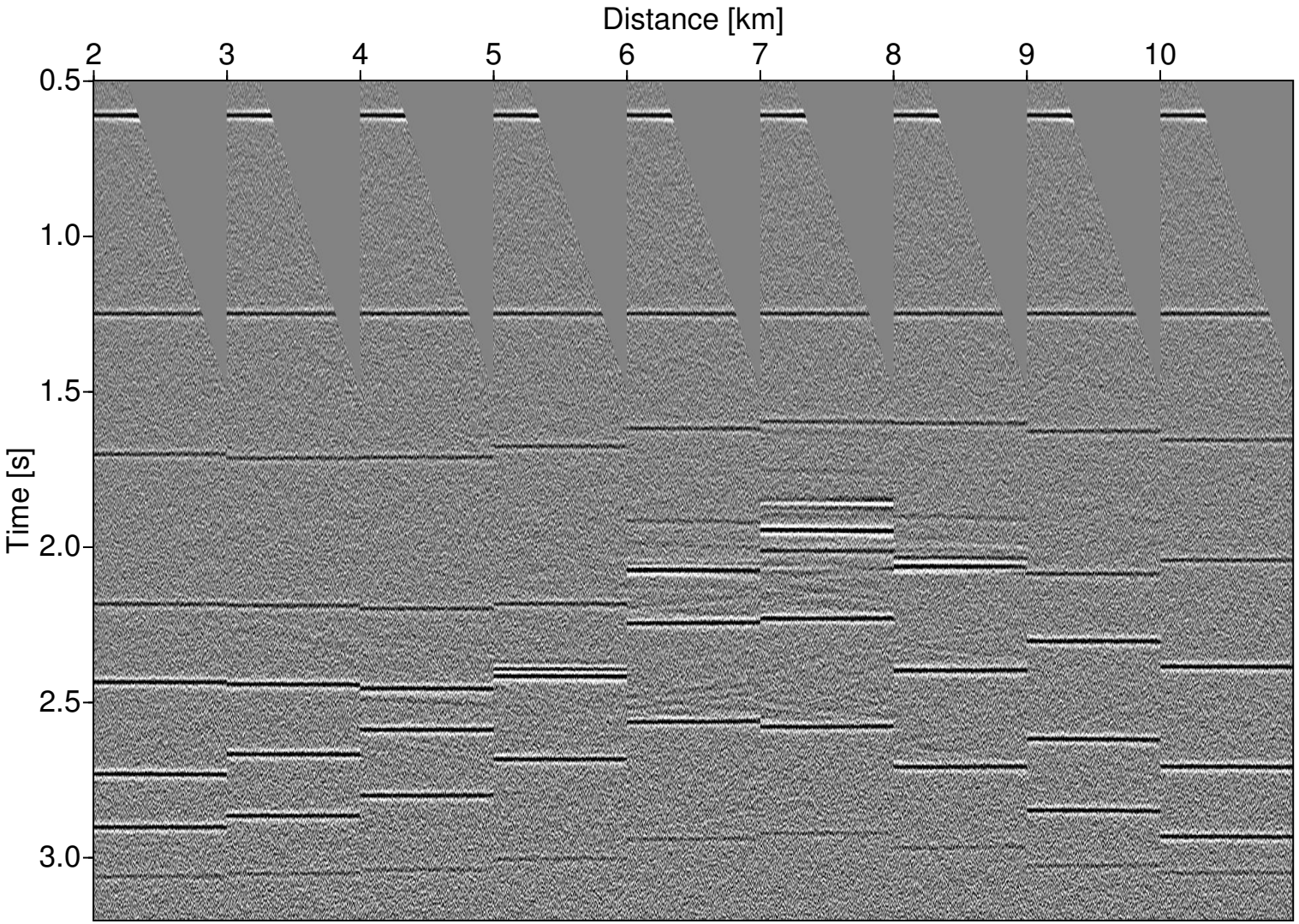
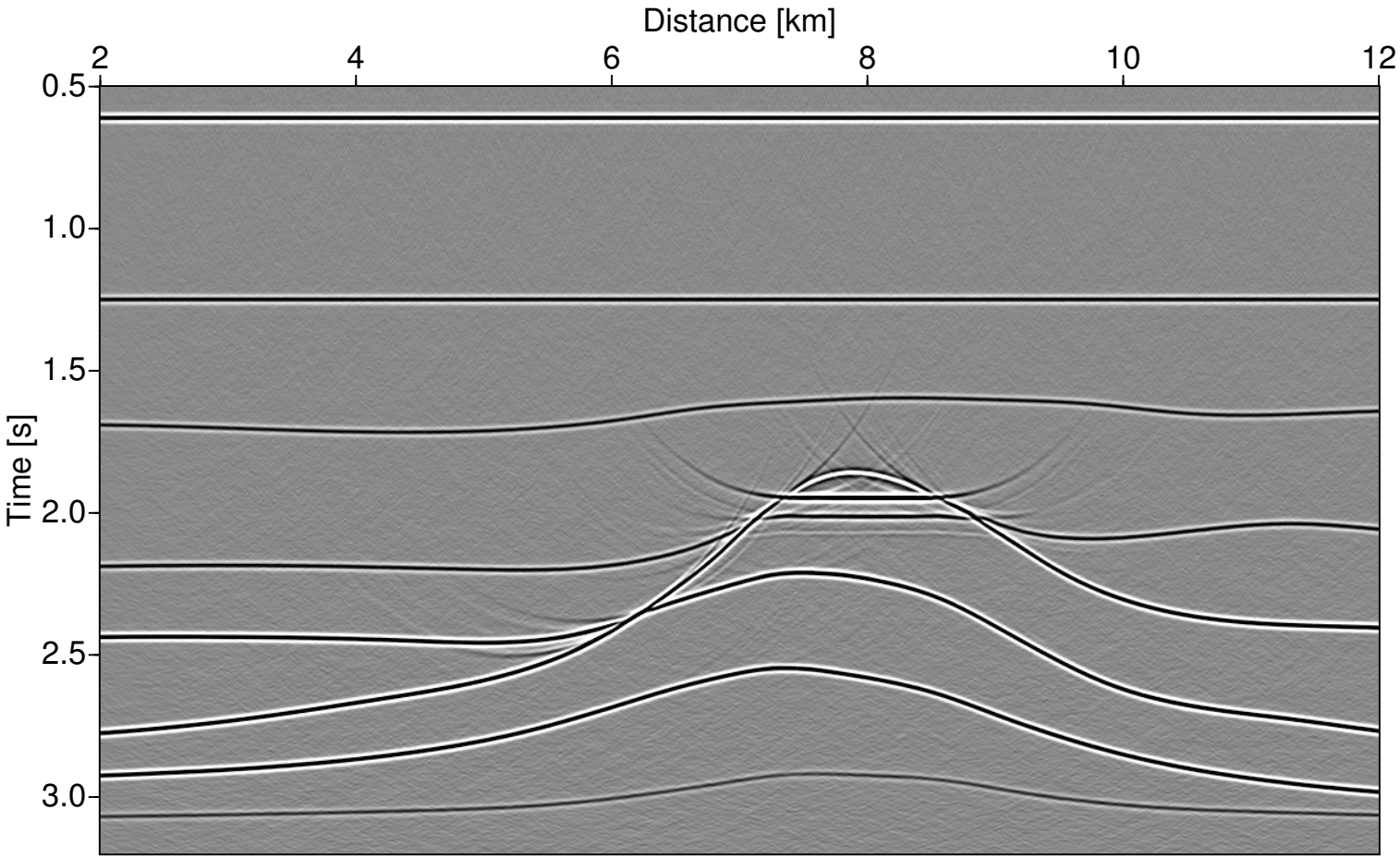


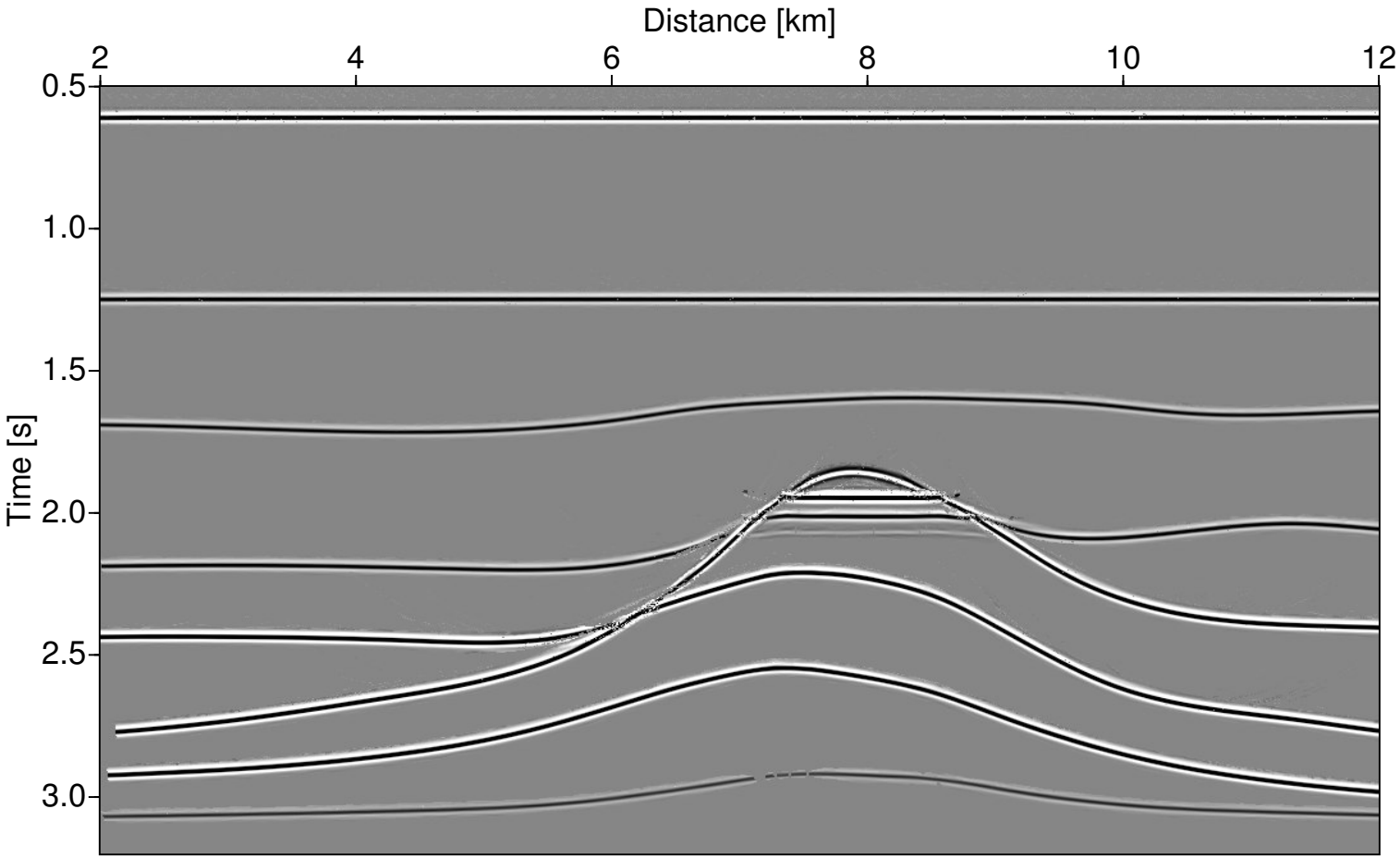
Image gather



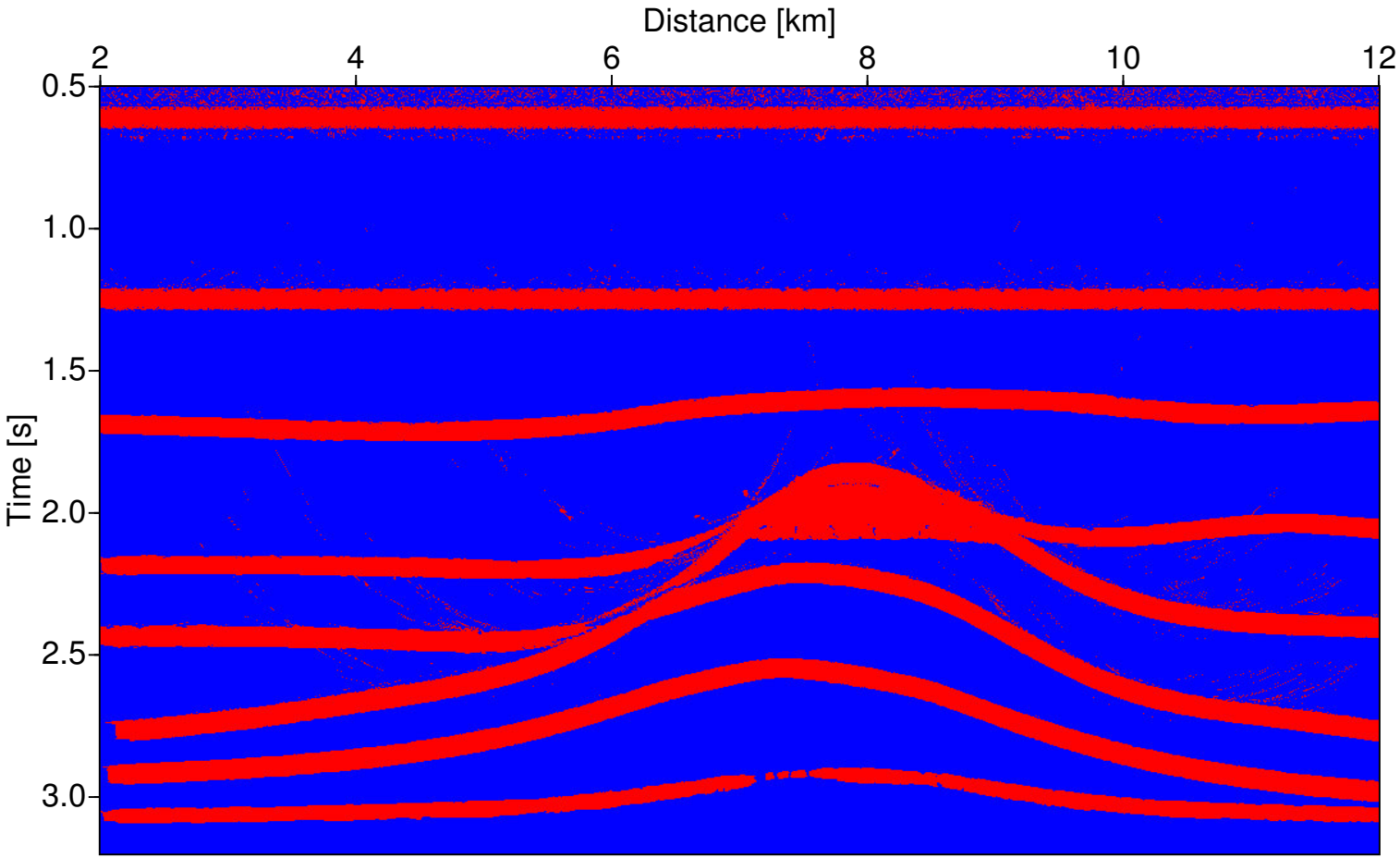
PreSTM stacked section (conventional)



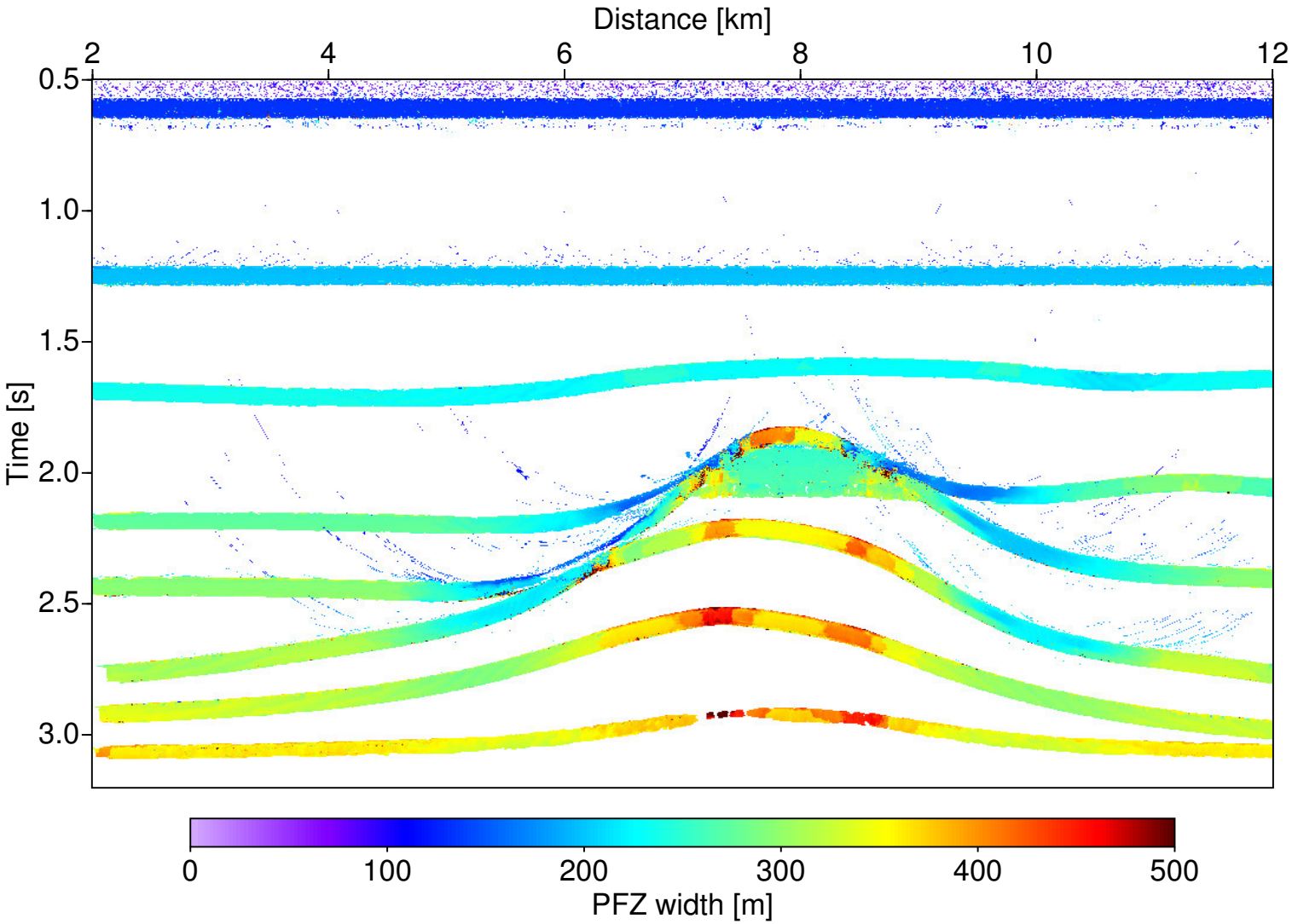
PreSTM stacked section (CRS-based)



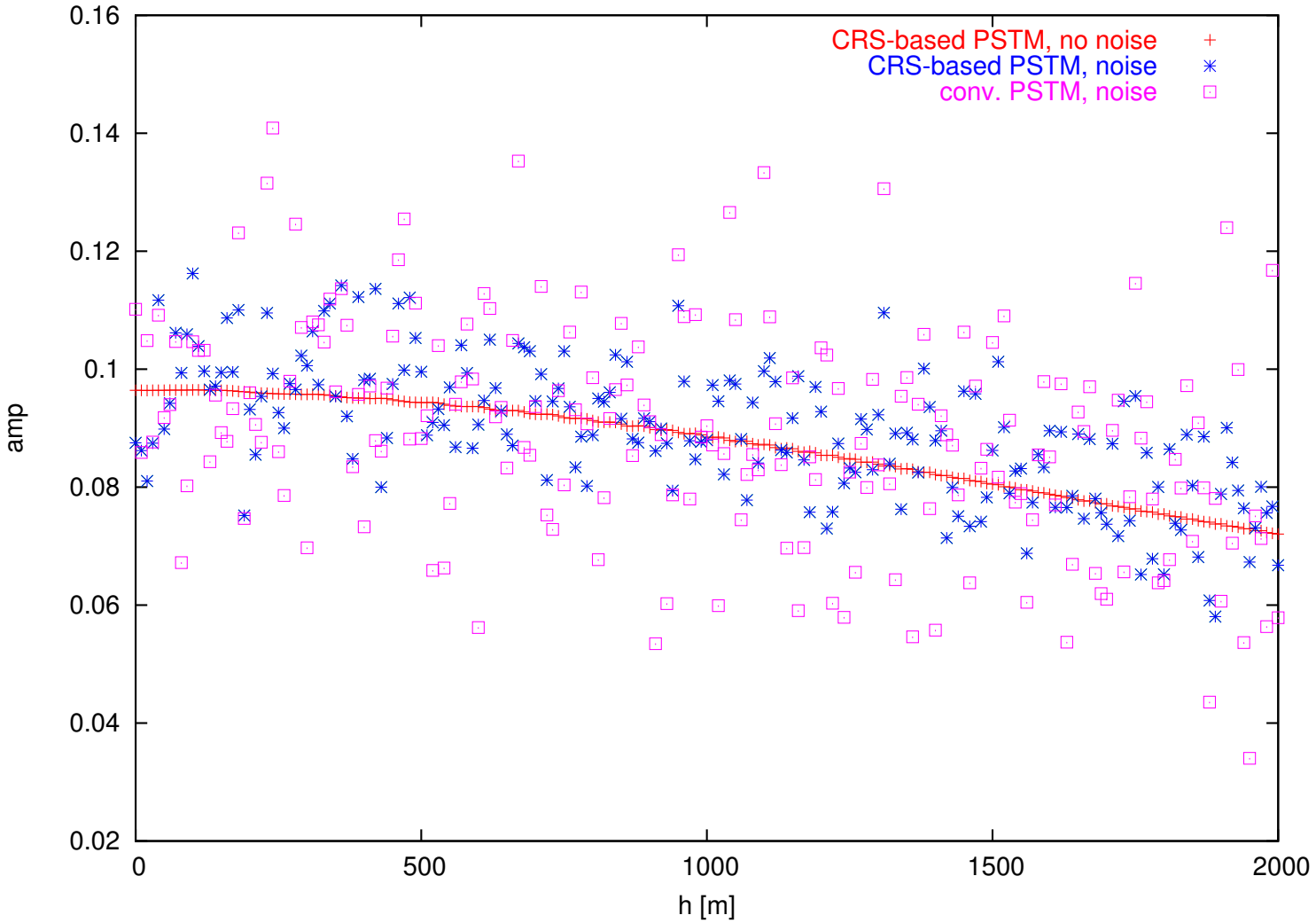
CRS-based stationary points



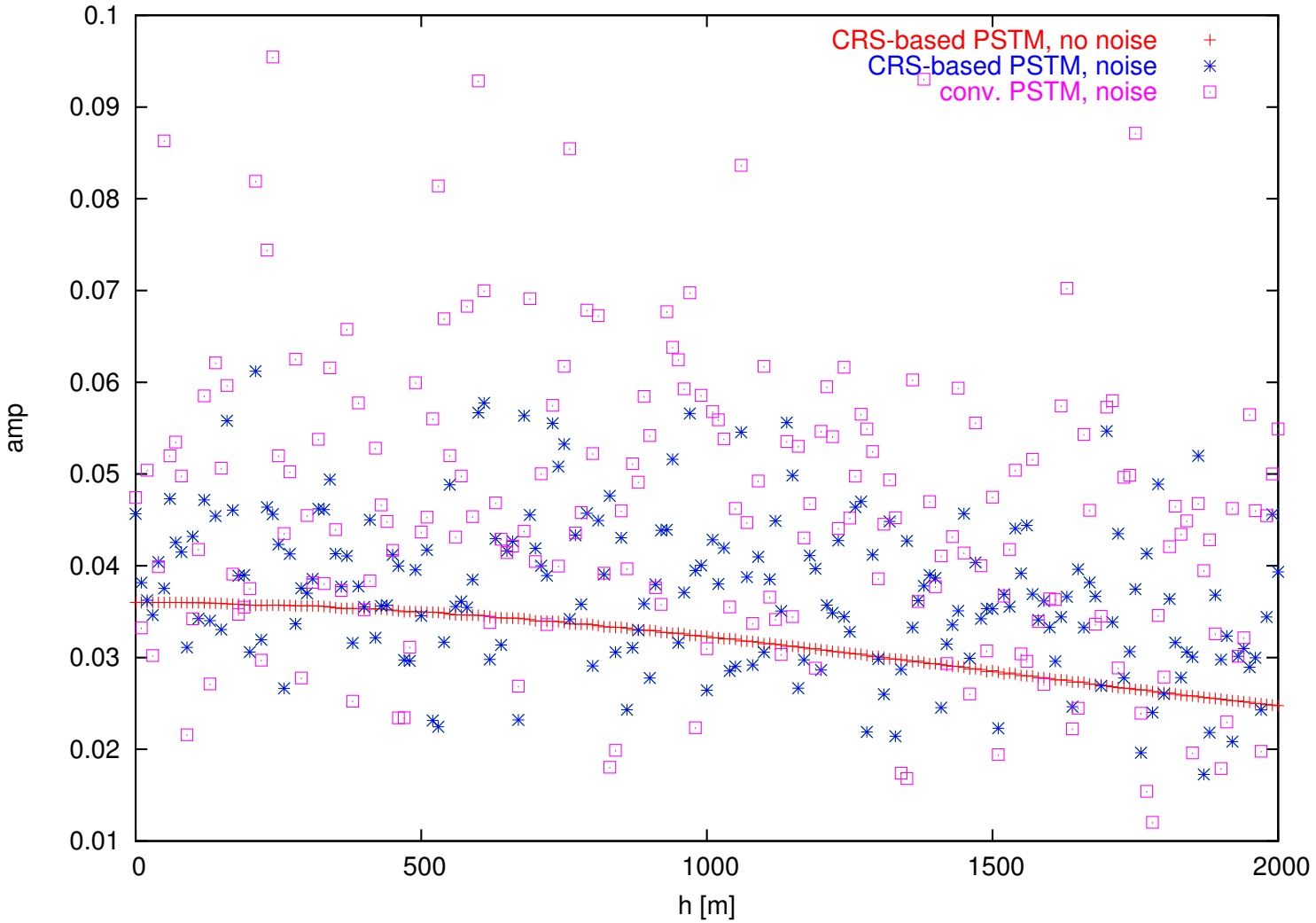
CRS-based ZO projected Fresnel zone



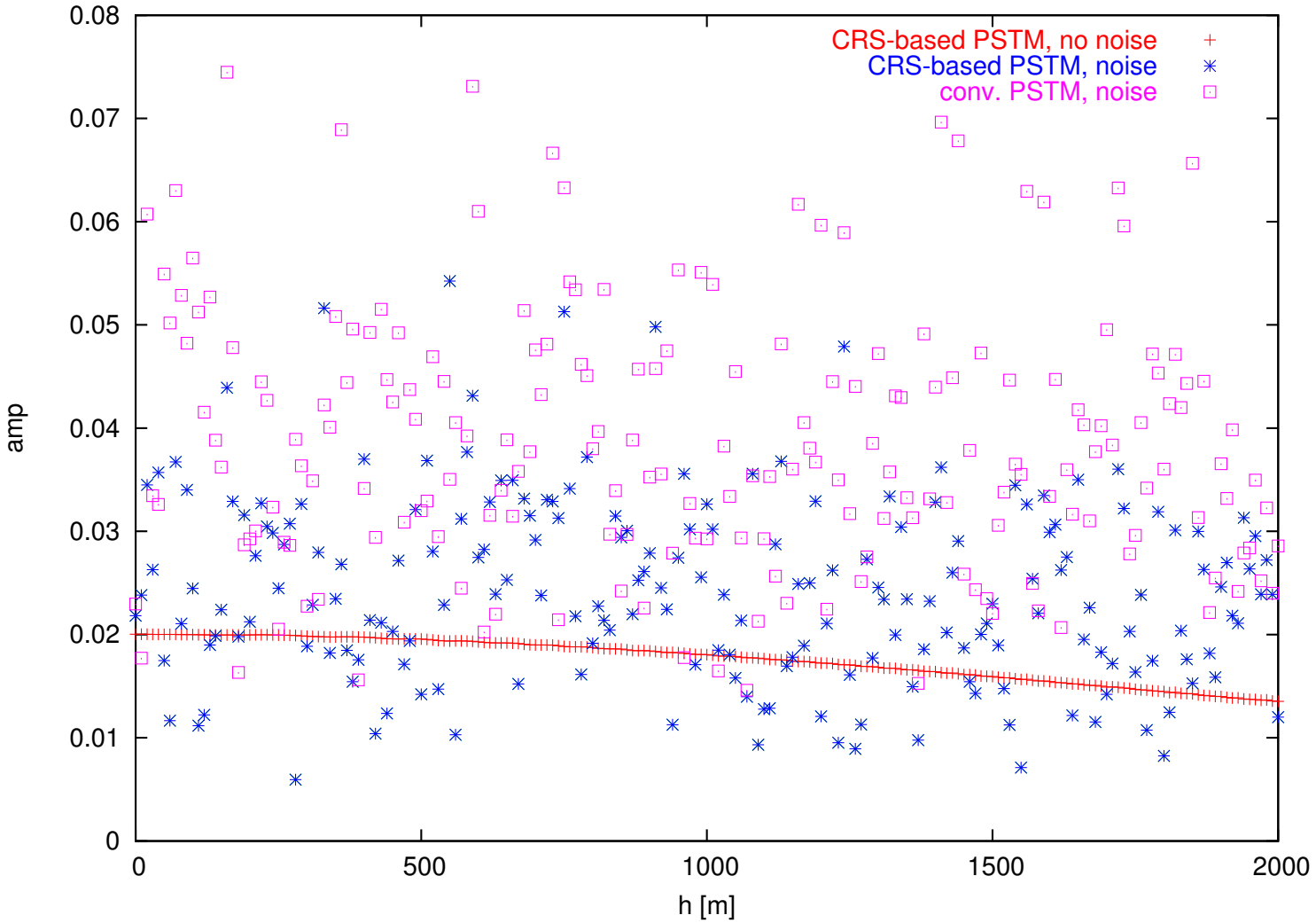
AVO (first target reflector)



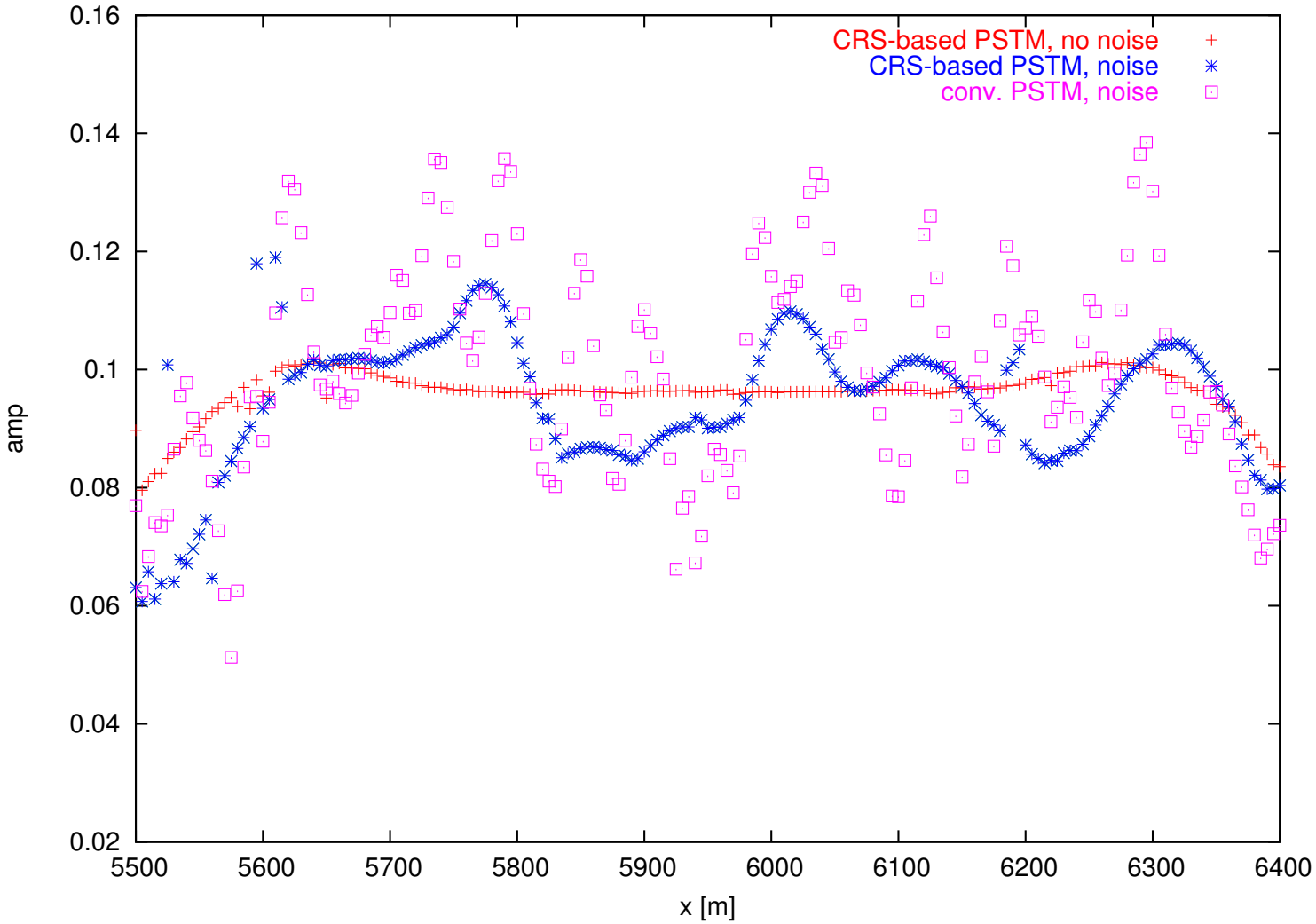
AVO (second target reflector)



AVO (third target reflector)



ZO amplitudes (first target reflector)



Conclusions

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- stationary point & minimum aperture from CRS attributes
  - ➥ clearer images
  - ➥ more reliable amplitudes

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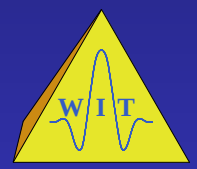

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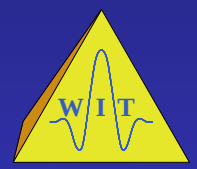

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Acknowledgments

This work was kindly supported by the sponsors of the Wave Inversion Technology (WIT) Consortium, Karlsruhe, Germany