

# Using X-T plane distortions for wavefield separation

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## • Introduction

- When processing seismic data, it is often desirable to **enhance** or **isolate** a particular **wave mode** from the recorded wavefield. We demonstrate here several simple **geometric distortions** that can be applied to the X-T plane in which seismic trace ensembles are usually represented. These distortions, which we term '**mapping transforms**' serve to provide **greater separation** of desired wavefield components from the background, based on simple geometrical characteristics of the components.

## • Properties of **mapping transforms**

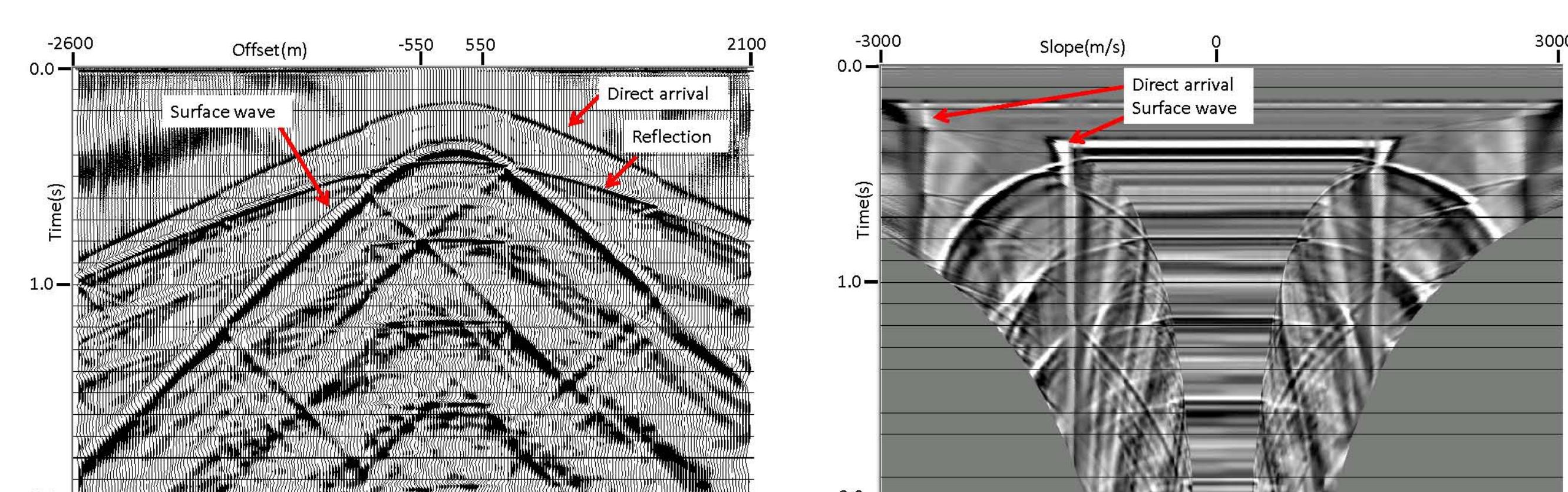
- Defined by **simple geometric formulae**
- **Interpolation** **intrinsic** to most mapping transforms
- Can be **inverted** almost **exactly**
- Can be applied to complete or **partial** X-T domain

## • Familiar transforms

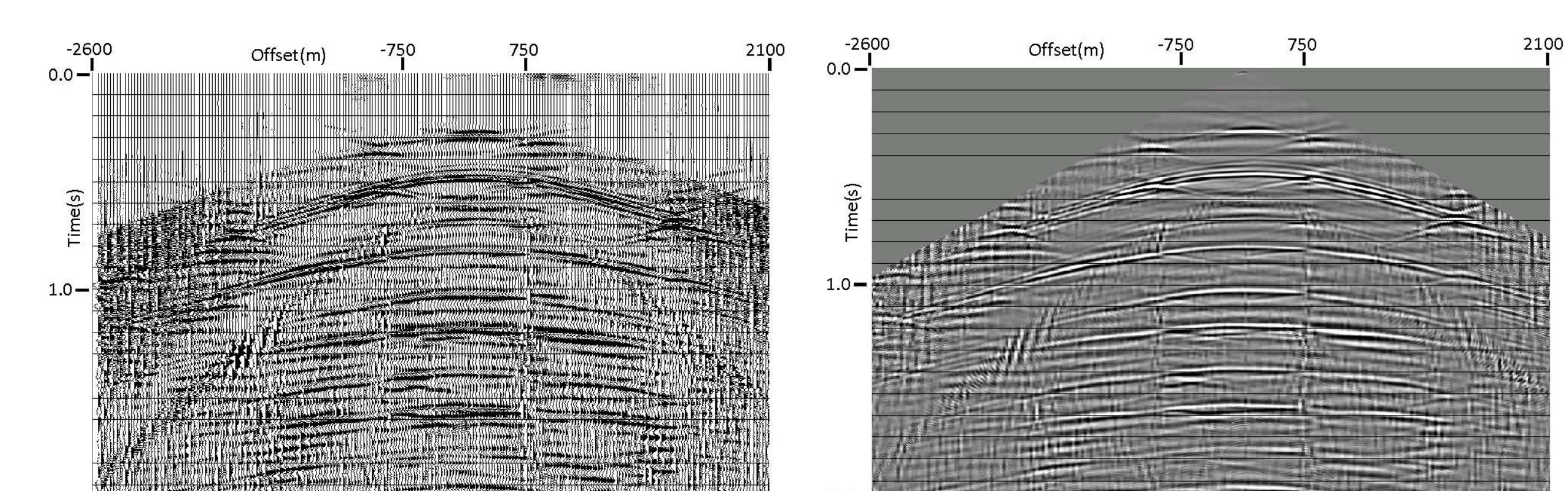
- **NMO transform**—maps amplitude values from X-T plane to  $X-T_0$  plane, interpolates in **T direction**
- **LMO transform**—maps amplitude values from X-T plane to  $X-T+\delta T$  plane, interpolates in **T direction**
- **Radial trace (RT) transform**—maps amplitude values from X-T plane to V-T plane, interpolates in **X direction**
- **T<sup>2</sup>-X<sup>2</sup> transform**—maps amplitude values from X-T plane to  $T^2-X^2$  plane, interpolates in **X and T directions**
- **Interpolation and regularization**—used to infill a sparse X-T data array to form a dense X-T array, applied along **either X or T direction, or both**

## • Examples

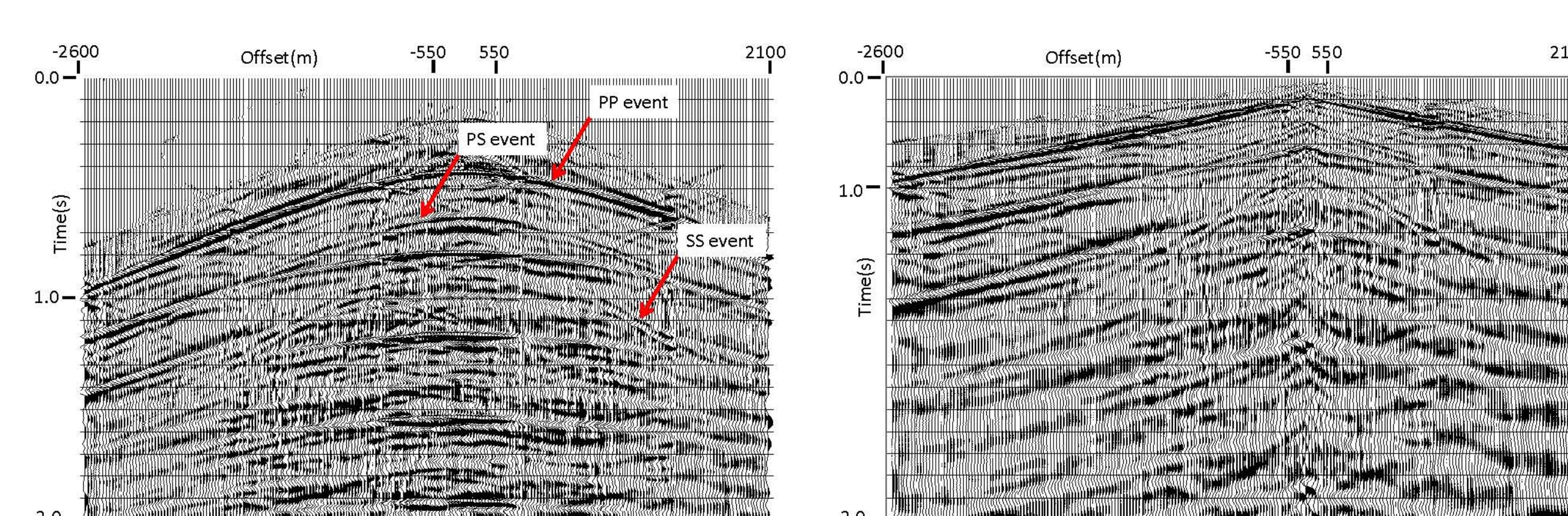
### – RT transform



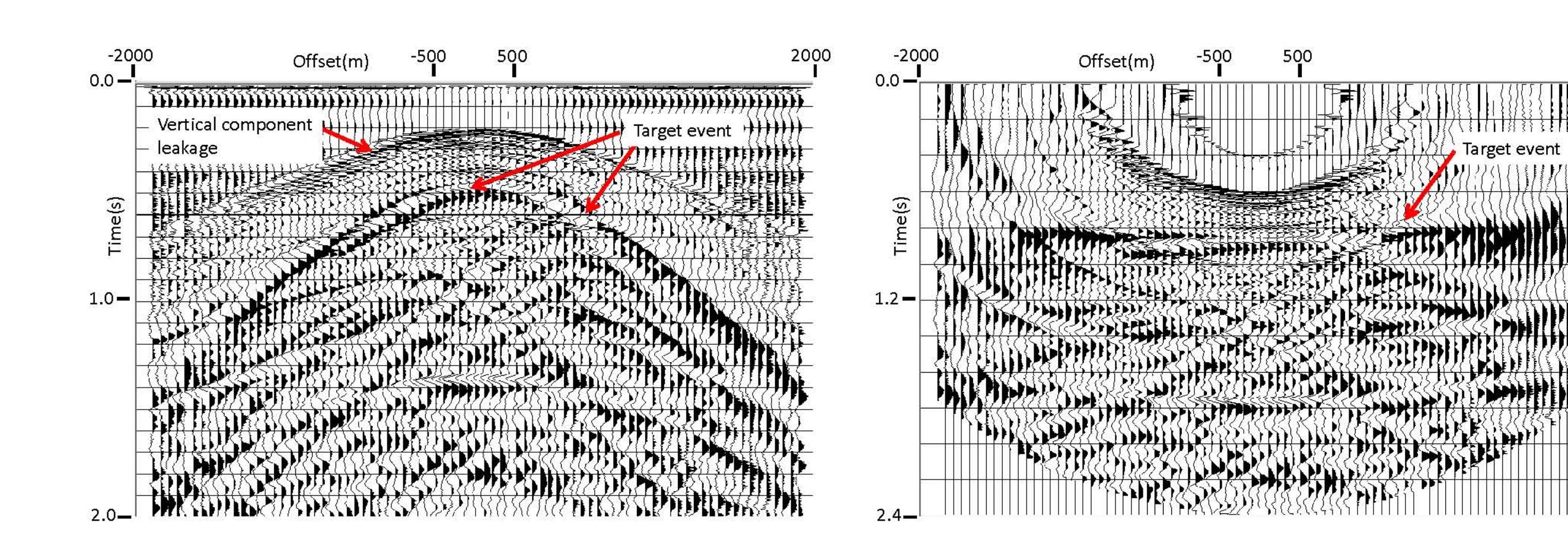
### – Interpolation



### – T<sup>2</sup>-X<sup>2</sup> transform

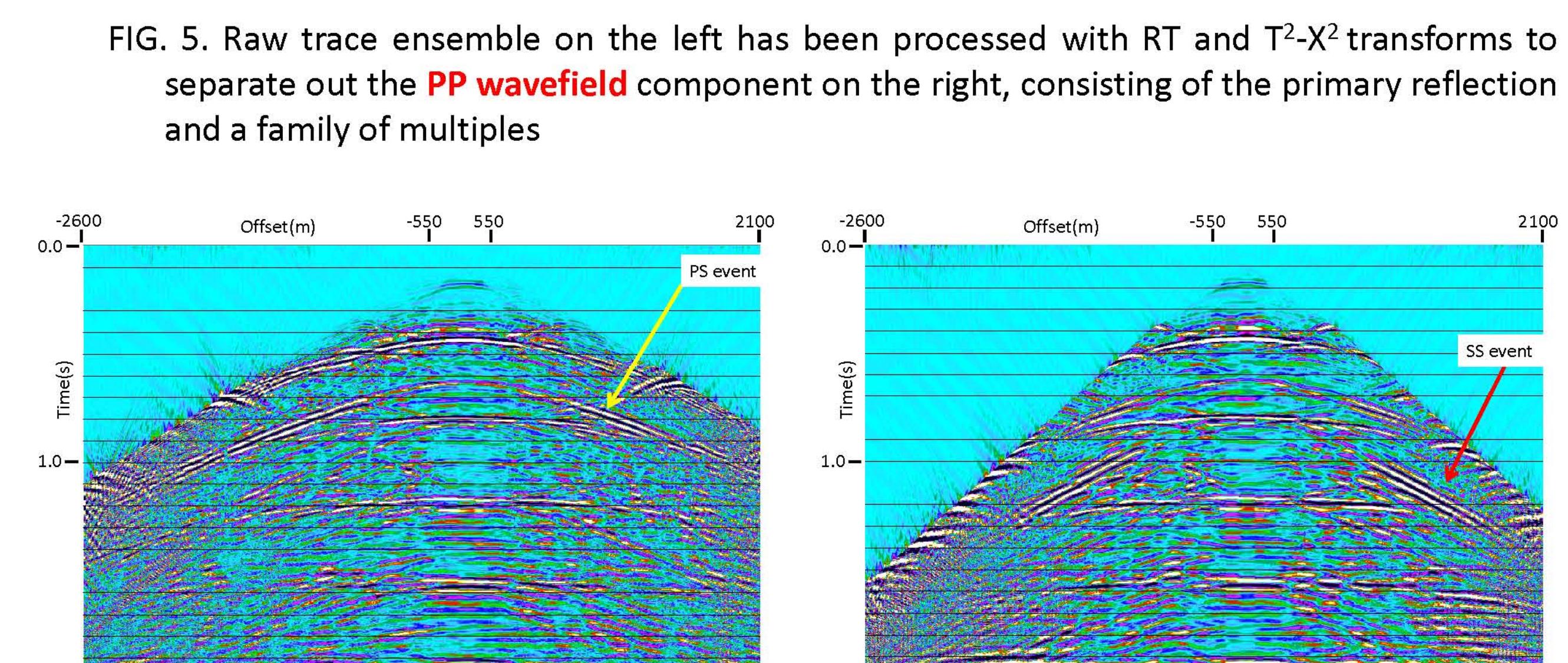
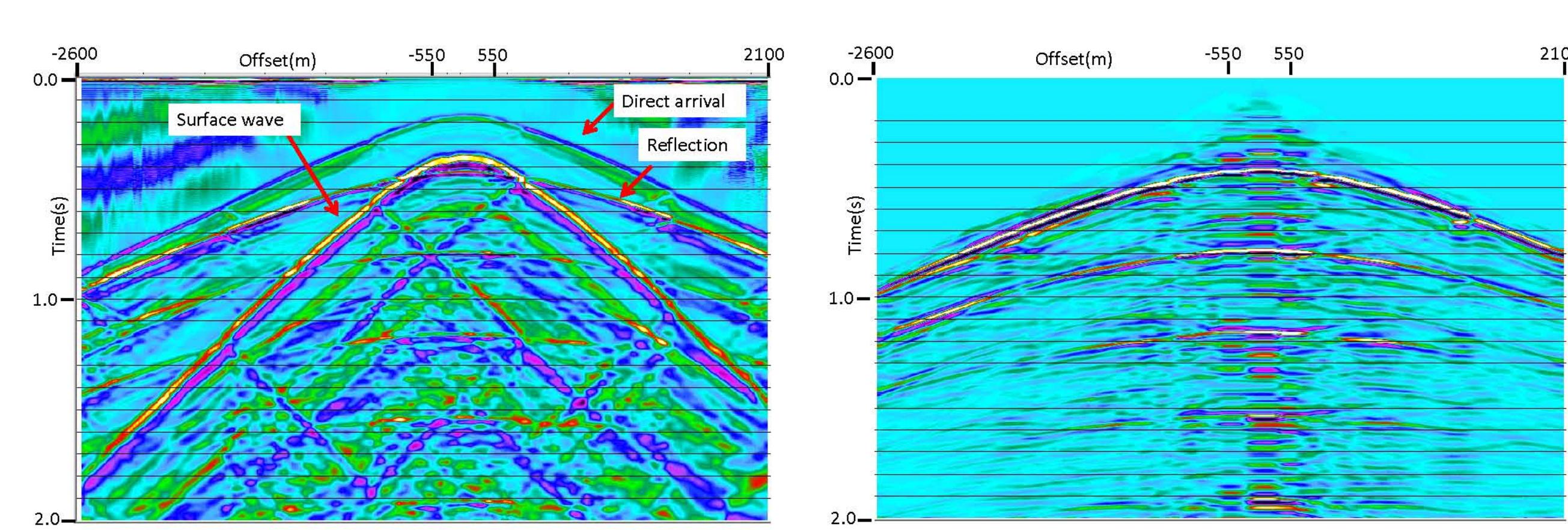


### – NMO transform



## • Examples of wavefield separation on physical model data

### – 3D receiver line gather over an orthorhombic layer



### – Radial component gather from orthorhombic layer transmission survey

#### • Major steps shown...

