# TIKIM –
# DYNAMICS and KINEMATICS

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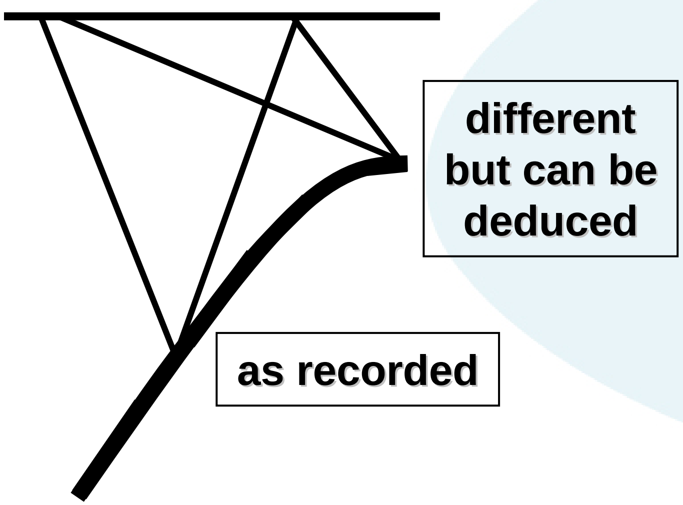
- Straight Ray
- Curved (Bent) Ray
- Ray tracing
- A+ (Anelliptic)
- Velocity picking

# Dynamics and Kinematics

## DYNAMICS

*the attributes of the output trace*

what the sample, trace etc. looks like once it materialises at the migrated position



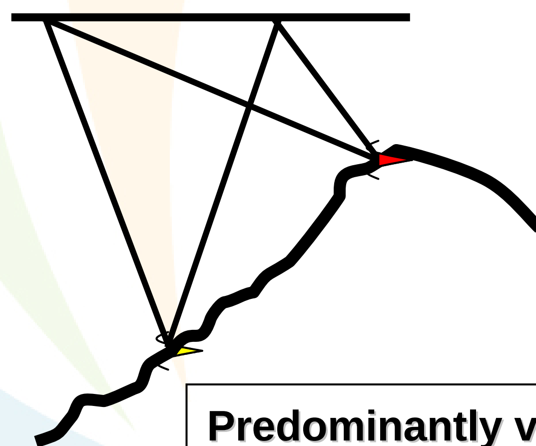

## KINEMATICS

*the mechanics of migration*

how the sample, trace etc.

is imagined to be moved to final migrated position

essentially the shape of the operator



**Predominantly velocity ….**
**but maybe ± anisotropy**
**& / or ± topography**
**& / or ± lateral velocity**
**& / or ± aperture etc. etc.**

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# Dynamics

TIKIM incorporates 3 considerations that handle the amplitude, phase and frequency characteristics of the migrated position.

Pre-Migration concerning the sample

Angle Dependent Amplitude also known as the ‘obliquity factor’ or ‘directivity factor’

Spherical Divergence or spreading factor along the diffraction curve

Post-Migration concerning the wavelet

Wavelet shaping filter ….a built-in filter is applied to restore the wavelet

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**TIKIM offers a choice of *kinematics*….**

**…that is, different ways to compute the travel times.**

**There are three main options to choose from…**

- ✓ **Straight rays**
- ✓ ~~**Bent rays**~~
- ✓ **Ray tracing**

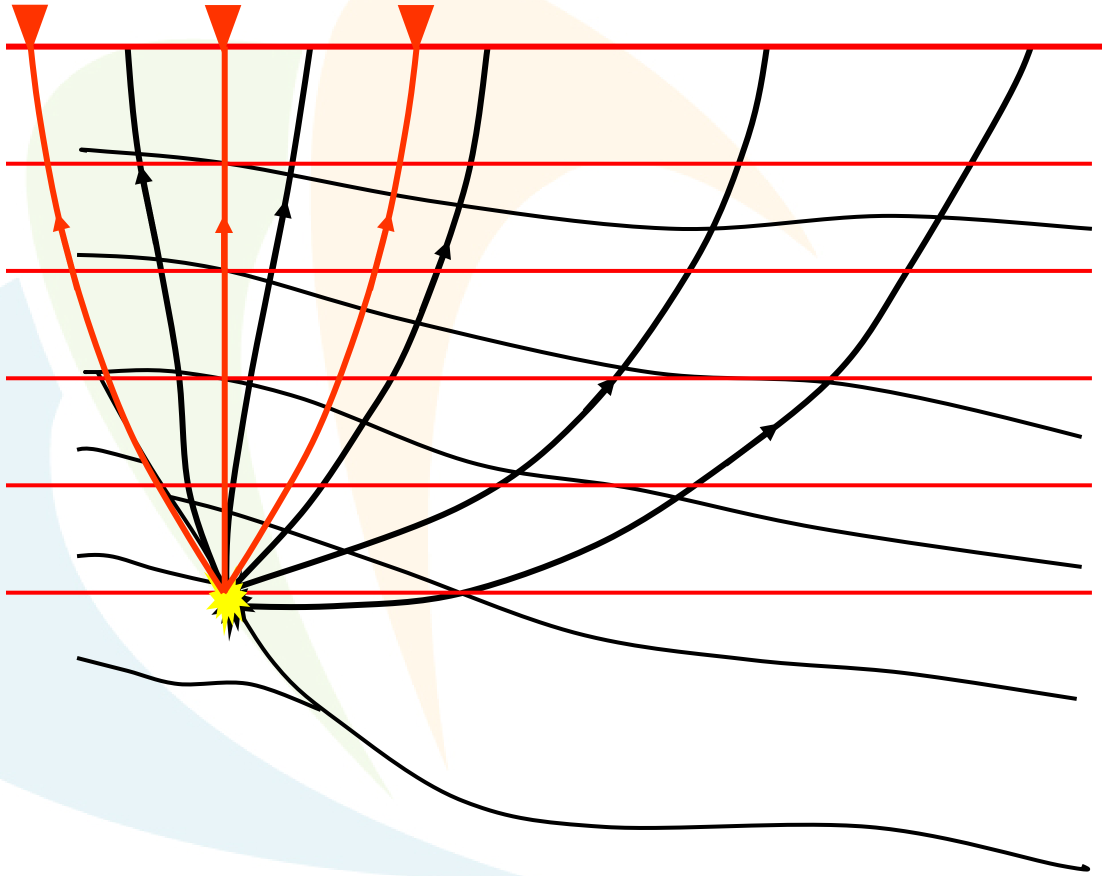
**Each carries its own strengths and weaknesses.**

# 1D Assumption

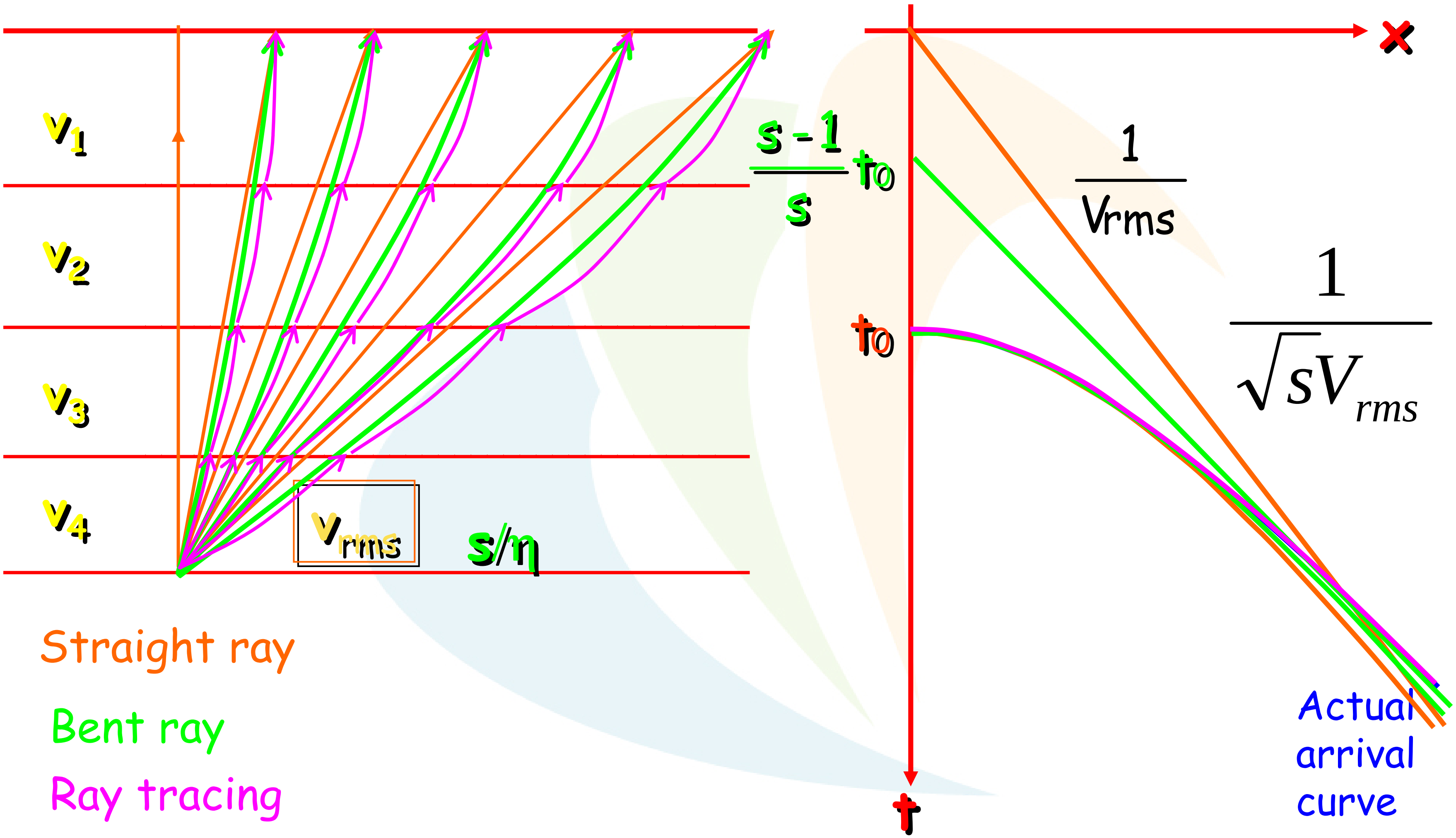
**We are facing a real world with possibly complex raypaths and diffraction curves. We try to model it using simple assumption.**

Starting from a subsurface characterized by complex interfaces and spatially variant velocity (in black)

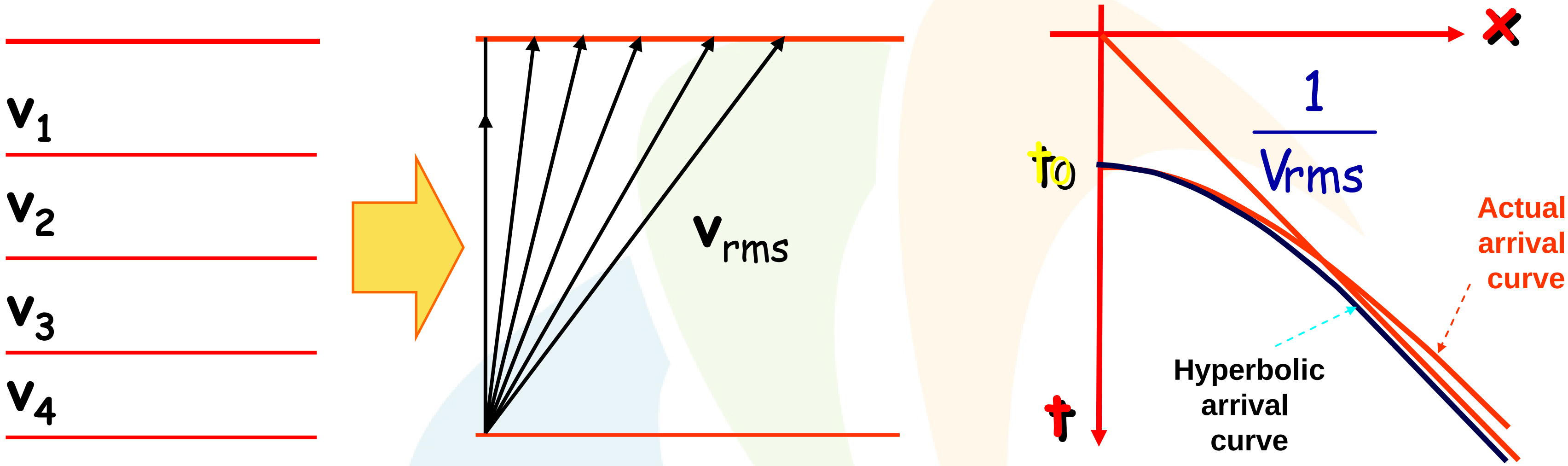
We try to derive an equivalent *locally* 1D medium (in red) that allows to approximate the kinematics of the rays.



**Three of the methods are illustrated graphically…**



## Straight Ray Method description…




- It replaces the layered medium by a constant effective velocity ($V_{RMS}$) that fits the short spread moveout (x<z).
- Its moveout corresponds to a perfect hyperbola.

# TIKIM Kinematics Straight Ray coding

**The straight ray approach is the default one.**

**All is required is a LIBRI VI.**

# Straight Ray Method

**Straight ray is a proven method and very robust**
**for not too/highly structured data**

**Advantage: Very fast to run.**

**Disadvantage: Limit offsets by using a 30º ~ 40º mute**

**• Assumes hyperbolic condition. Derivation of operator shape easy to understand.**

**•In complex environment may be used as initial step to give an initial velocity field.**

# TIKIM Kinematics Applicability

## ➢ Straight rays

**Straight ray is a proven method and very robust**

- ✓ **robust for not too/highly structured data**
- ✓ **fast velocity picking cycle**
- ✓ **limited range of dip and offsets**
- ✓ **robust to velocities**

# Kinematics computation: Method 2

## Bent Ray Method

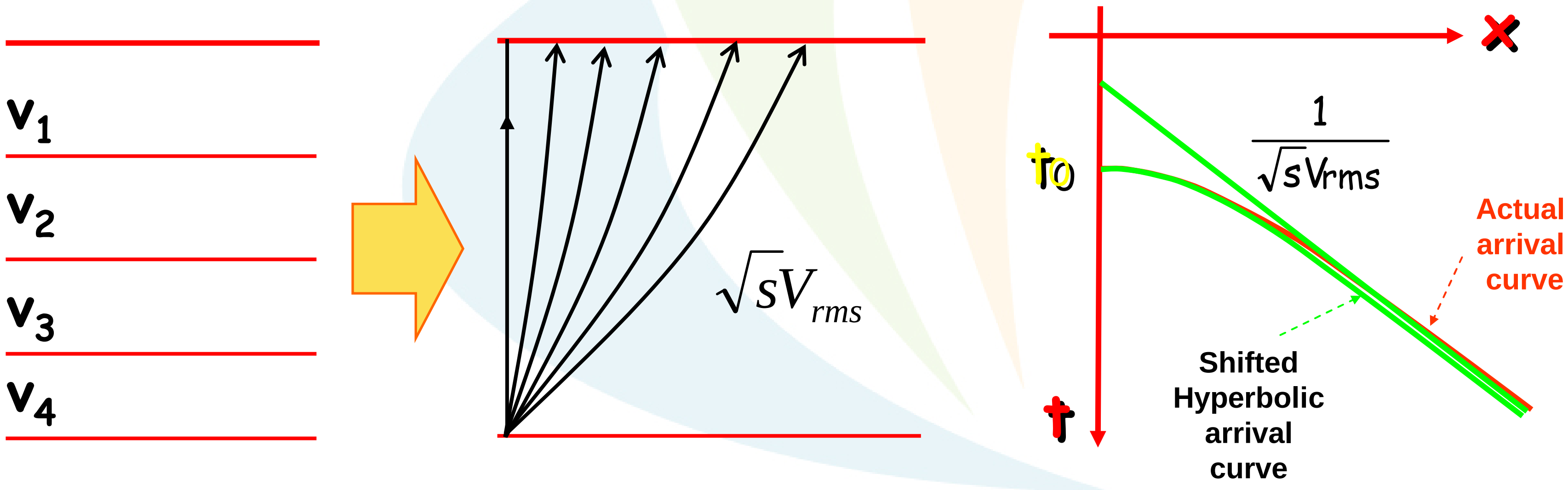
**Method 2 is designed to better take into account the ray bending effects *when X becomes at least as large as z.***

- **It takes into account the layering and intrinsic anisotropic effects**
- **Delivers correct time for large dips up to a 50º mute.**
- **Designed for use in areas with long offsets and strong anisotropic effects**

## Bent Ray Method description…

- This second method is a more accurate variant of the straight ray method

- It makes use of an additional parameter, SH that describes the shift in the asymptote origin of the curve.

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# TIKIM Kinematics Ray bend coding

**The ray bending approach is triggered by the coding of an additional LIBRI SH (shift parameters)**

**As an alternative to supplying SH values parameter RAYBEND generates the layering anisotropy term.**

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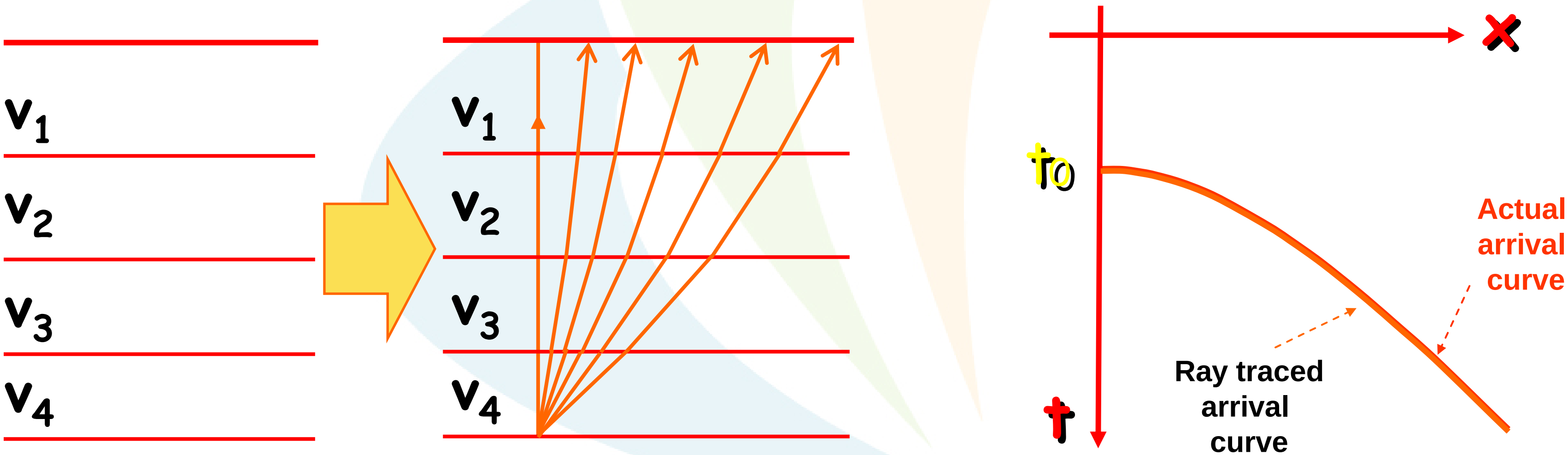
## Ray Tracing Method

- **Method 3 is more elaborate than the first two methods.**
- **It gives the exact travel time of a 1D layered media with no limitation in offset.**
- **Delivers correct time for a 180 degree dip (turning waves)**
- **Optionally an intrinsic anisotropy trend can also be input,**

**Method used to establish final TIKIM migration velocities.**
**Used with a wide angle mute.**

## Ray Tracing Method description….

- Rays are back-traced to the surface through constant velocity layers.
- It requires a knowledge of the interval velocities (derived from $V_{RMS}$).



## Ray Tracing Method methodology.

- Full ray tracing is triggered by parameters RAYTRACE and VTREND
  - Requires input of a 1D velocity compaction trend (a single interval velocity function).
  - This is used as a reference model for ray tracing for the long offsets.

- Optionally a trend of intrinsic anisotropy values can also be input (ATREND option).

- Trend functions should be
  - Representative of values measured at several well locations.
  - Smoothly changing in time and without discontinuities.