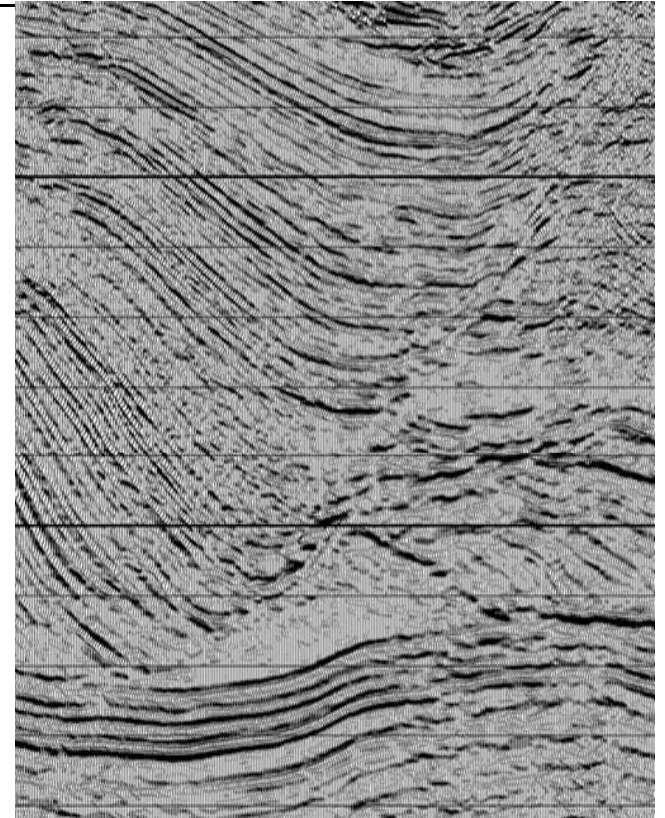

TIKIM

“Kirchhoff pre-stack time migration”

Overview



(Jean-Claude LANCELOT)

Meeting **EGEODE** Massy

December 10th 2007

Software Product Management
Massy

1

TIKIM overview

Limited to 2D Marine Processing

-
- ✓ **Part1:** Introduction to time imaging (*reminder*)
 - ✓ **Part2:** Migration method (Kirchhoff)
 - ✓ **Part3:** Kirchhoff PreSTM in real life: TIKIM
 - ✓ **Part4:** Software / Hardware issues

TIKIM overview

TIKIM part 1

“Introduction to Time Imaging”

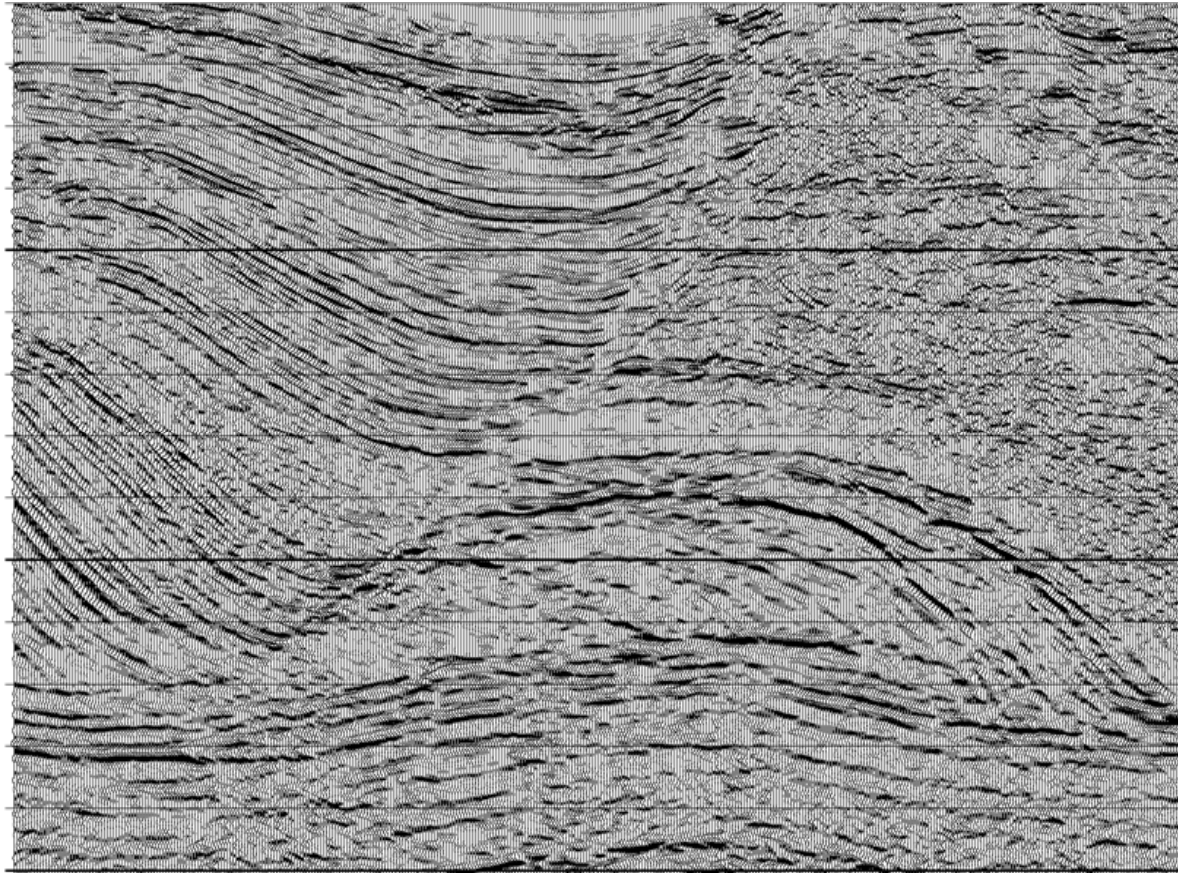
Reminder

The need for pre-stack migration

- **“Transformation to Zero Offset” sequence does not provide optimum focusing**
 - ✓ **diffracted events are not preserved** in the stacking process
 - ✓ **crossing events** may generate **velocity conflicts**
 - ✓ **velocities** are **not picked at migrated position**

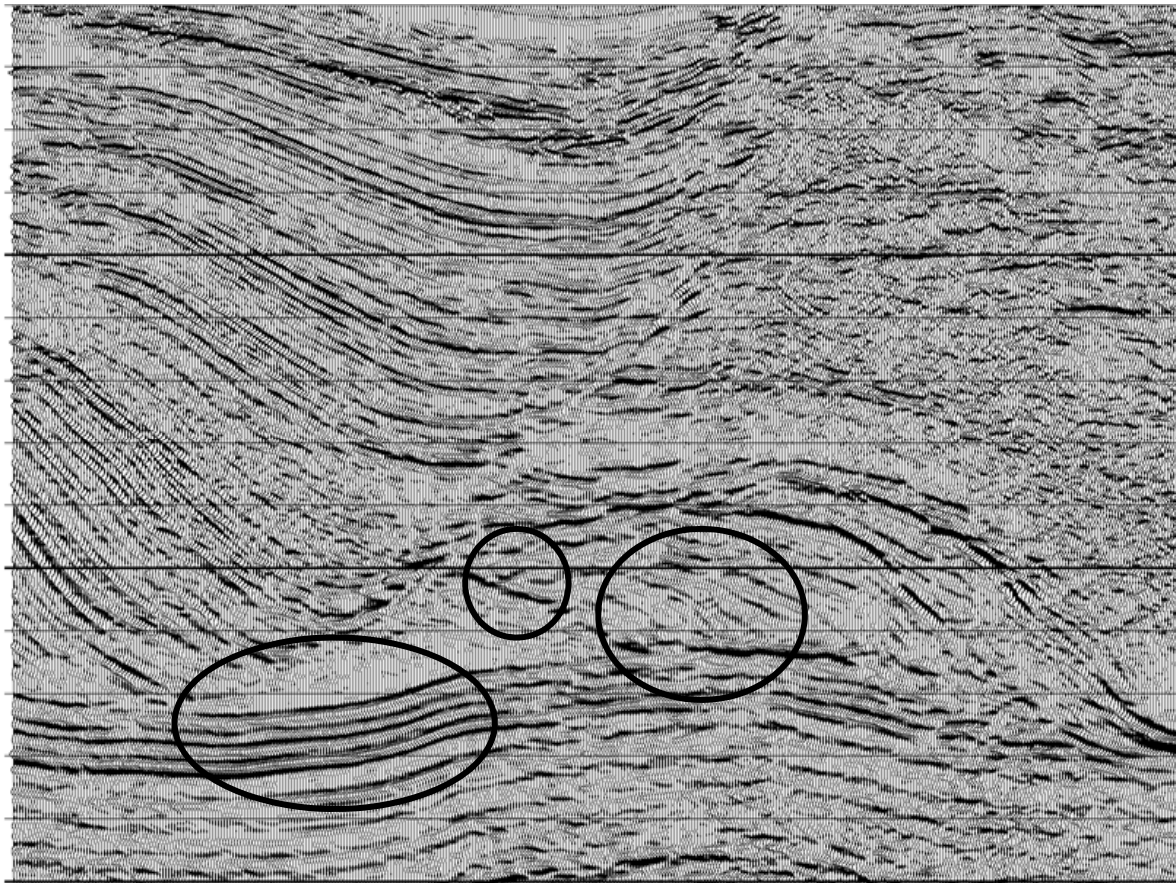
Migrating the data before stack is the best solution

Post stack imaging



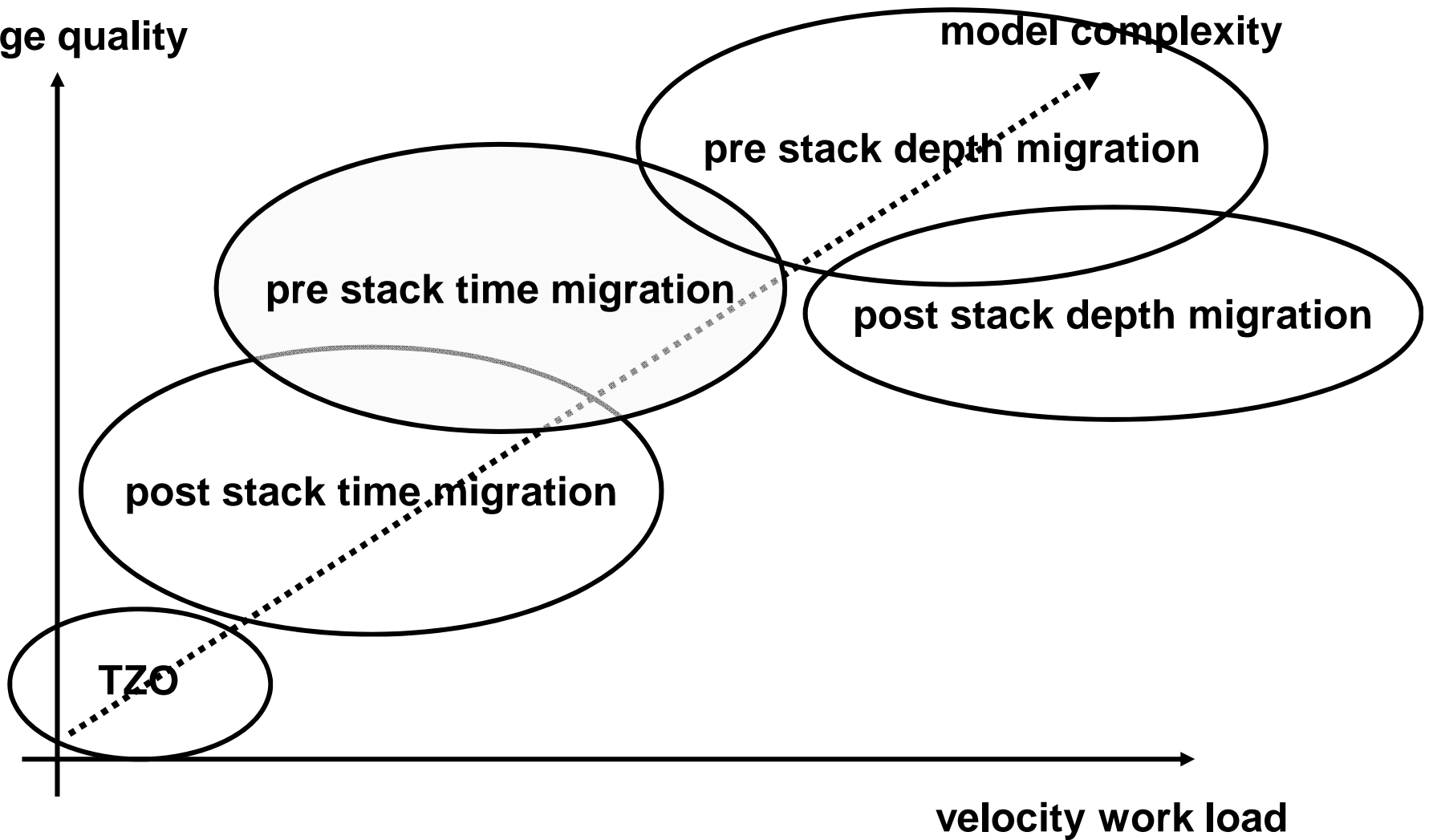
Post Stack Time Migration

Pre stack imaging



Pre Stack Time Migration

image quality



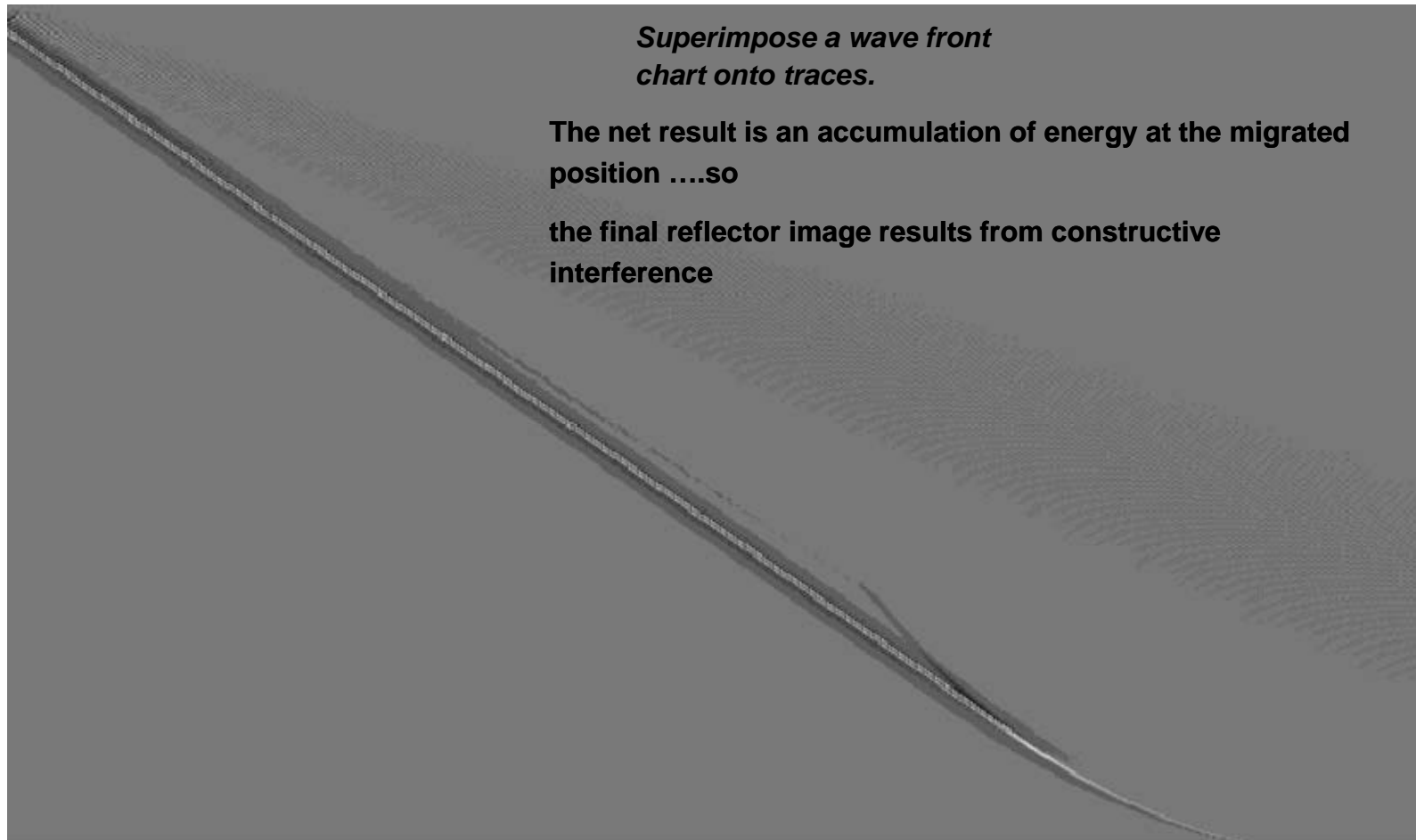
TIKIM overview

TIKIM part 2
“Migration Methods”

Kirchhoff Migration principle:

**Constructive and destructive interferences will
recreate the image**

Superposition principle



TIKIM overview

TIKIM part 3
PSTM and TIKIM

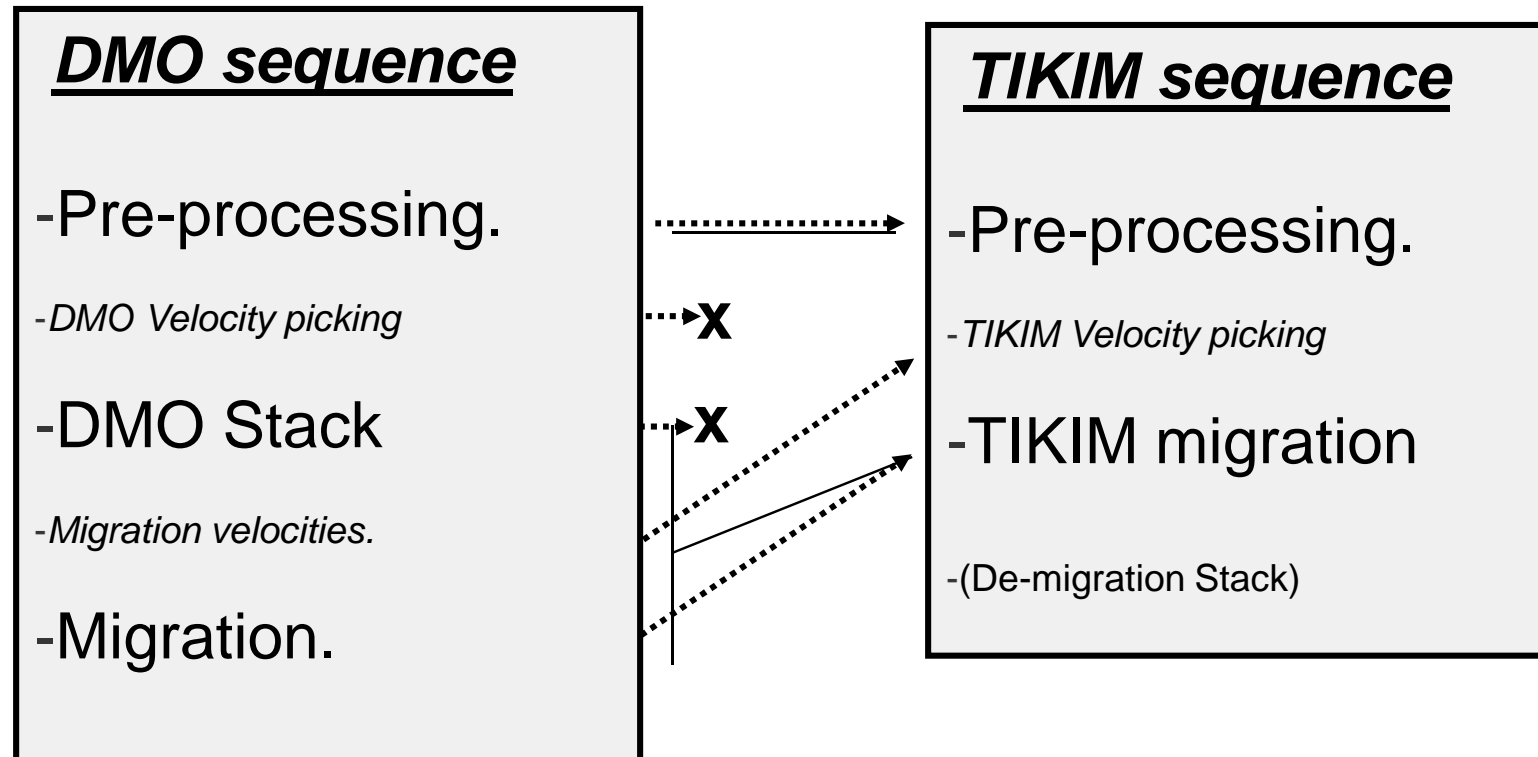
Warning: *Things to have in mind about TIKIM:*

- The **output** of TIKIM is **Migrated** data!
 - The **picking** of velocities after TIKIM is **on migrated data** (migrated gathers), i.e. direct picking of Migration velocities (very interpretative picking, so need of Client input).
 - There is no “Stack” output in the TIKIM sequence, but only the Migration. A De-migration can be proposed to obtain an un-migrated stack.

- **Tikim:**
 - needs **only the output target** definition
 - **does not** care about the input geometry

- **Tikim 2D:** just **based on** Word 4 (**CDP**) and Word 20 (**Offset**)

**Schematic Comparison between
DMO and TIKIM processing sequences:**



Target definition - 2D

```
* TIKIM      ==      02  TRAFILE=2003,NUMTRA1,IDTRA=me,REWRITE
                    NPE64,MACHINE=PC,DISTRIB ,BIMG02
                    {
                    DCDP12.5
                    IMAGE=(FCDP151,LCDP600)
                    OFFSETS=(D150,ID100,XRM5800,XRP50)
                    N0,
                    LMU2,MUTE2
                    APERCDP5000
                    DIPLIM=(T400D20,T800D40,T4000D40,T4500D0)
                    NOALIAS=(FMAX75)
                    LVI1
```

Only definition
of the **output** target!

Offset class definition

```
* TIKIM      ==      02  TRAFILE=2003,NUMTRA1,IDTRA=me,REWRITE
                    NPE64,MACHINE=PC,DISTRIB ,BIMG02
                    DCDP12.5
                    IMAGE=(FCDP151,LCDP600)
                    OFFSETS=(D150,ID100,XRM5800,XRP50)
                    N0,
                    LMU2,MUTE2
                    APERCDP5000,
                    DIPLIM40
                    NOALIAS=(FMAX75)
                    LVI1
```


➤ migration parameters

Dip related parameters

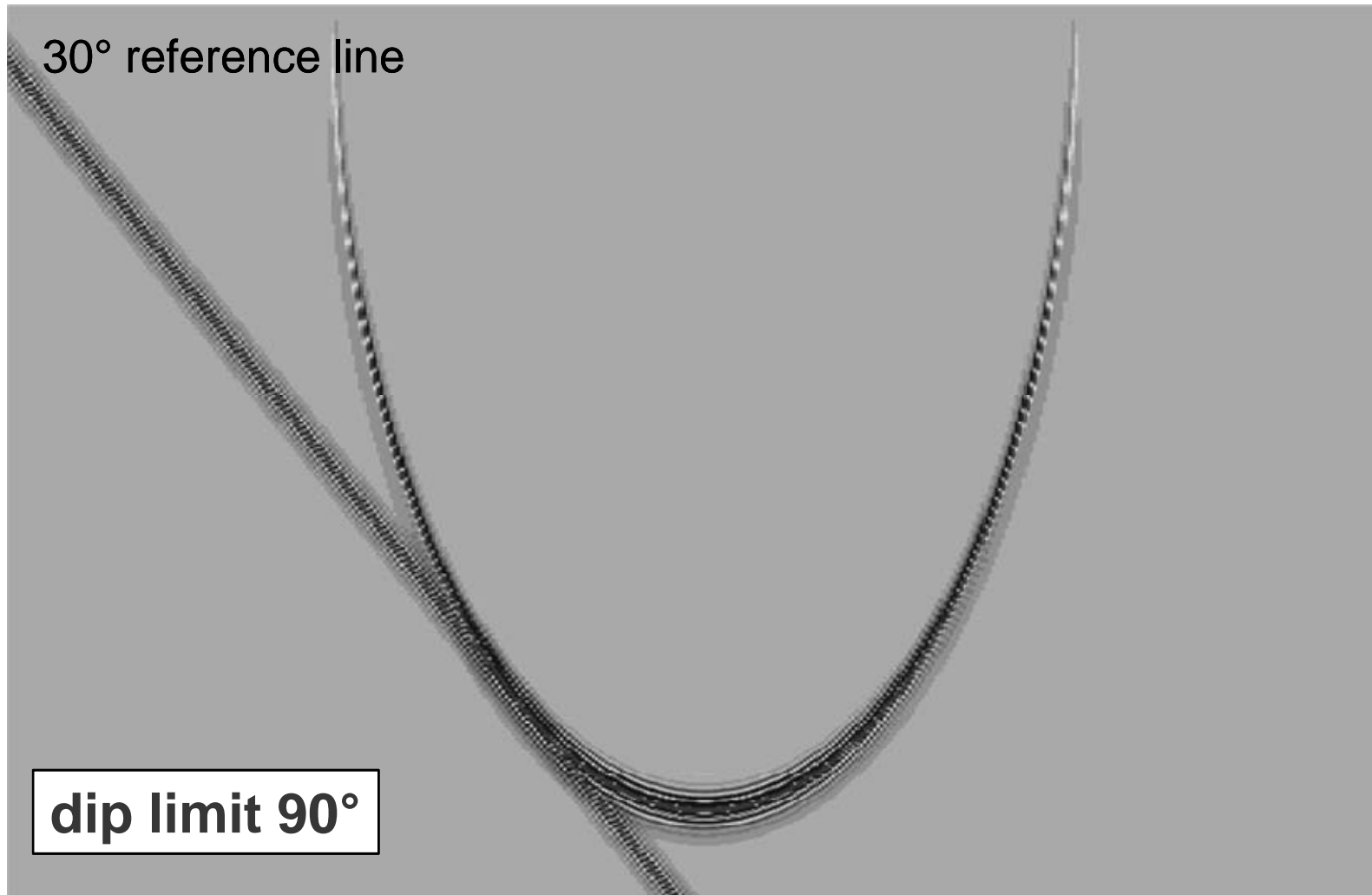
geological dip in degrees

```
* TIKIM      ==      02  TRAFILE=2003,NUMTRA1,IDTRA=me,REWRITE
                   NPE64,MACHINE=PC,DISTRIB ,BIMG02
                   DCDP12.5
                   IMAGE=(FCDP151,LCDP600)
                   OFFSETS=(D150,ID100,XRM5800,XRP50)
                   N0,
                   LMU2,MUTE2
                   APERCDP5000,
                   DIPLIM40
                   NOALIAS=(FMAX75)
                   LVI1
```

Time variant dip limit

```
* TIKIM      ==      02  TRAFILE=2003,NUMTRA1,IDTRA=me,REWRITE
                    NPE64,MACHINE=PC,DISTRIB ,BIMG02
                    DCDP12.5,
                    IMAGE=(FCDP151,LCDP600)
                    OFFSETS=(D150,ID100,XRM5800,XRP50)
                    N0
                    LMU2,MUTE2
                    APERCDP5000,
                    DIPLIM=(T40D15,T300D45,T6000D20,T8000D30)
                    NOALIAS=(FMAX75)
                    LVI1
```

Dip limit value



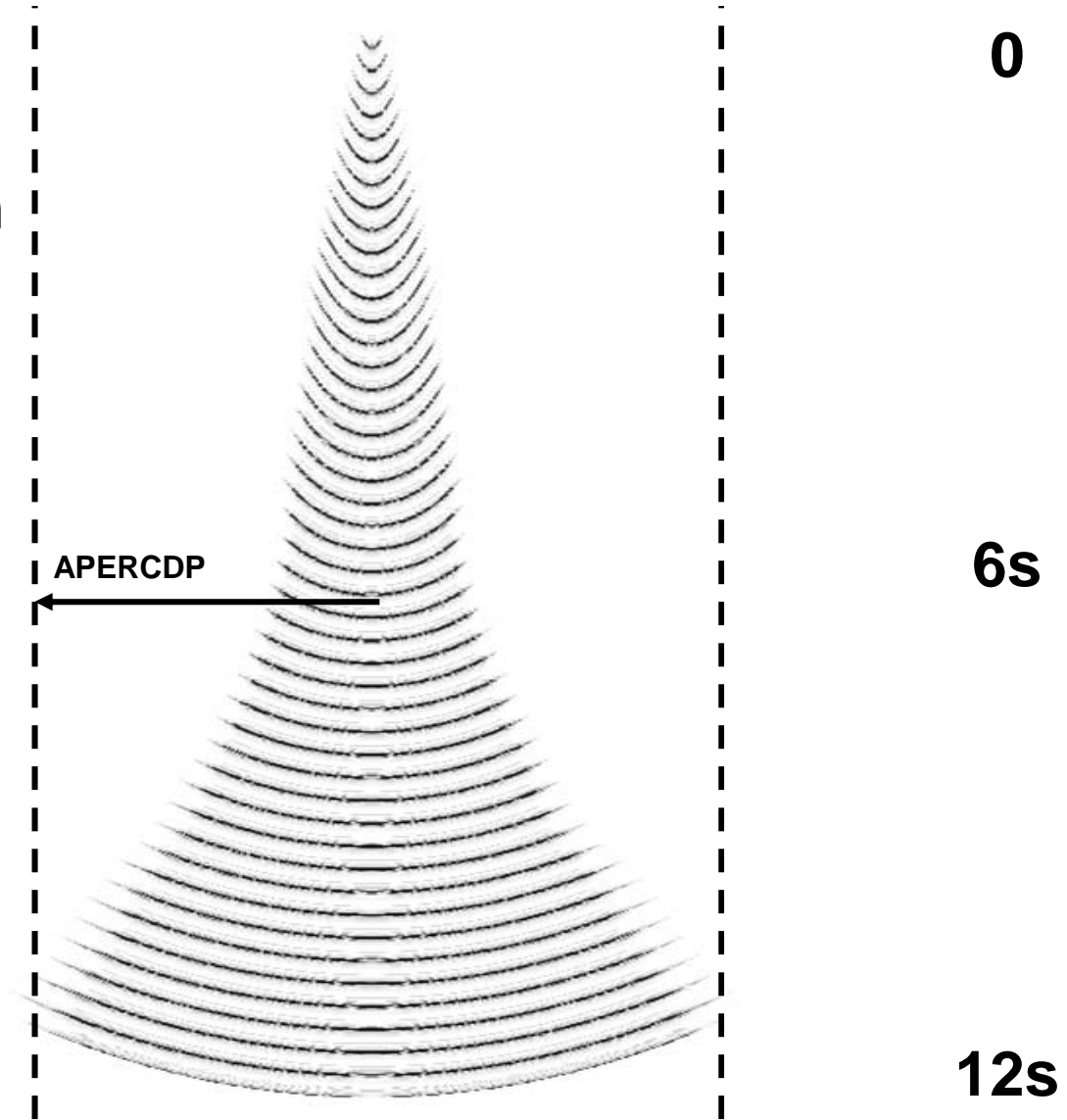
Aperture limitation

half-width of the migration smile

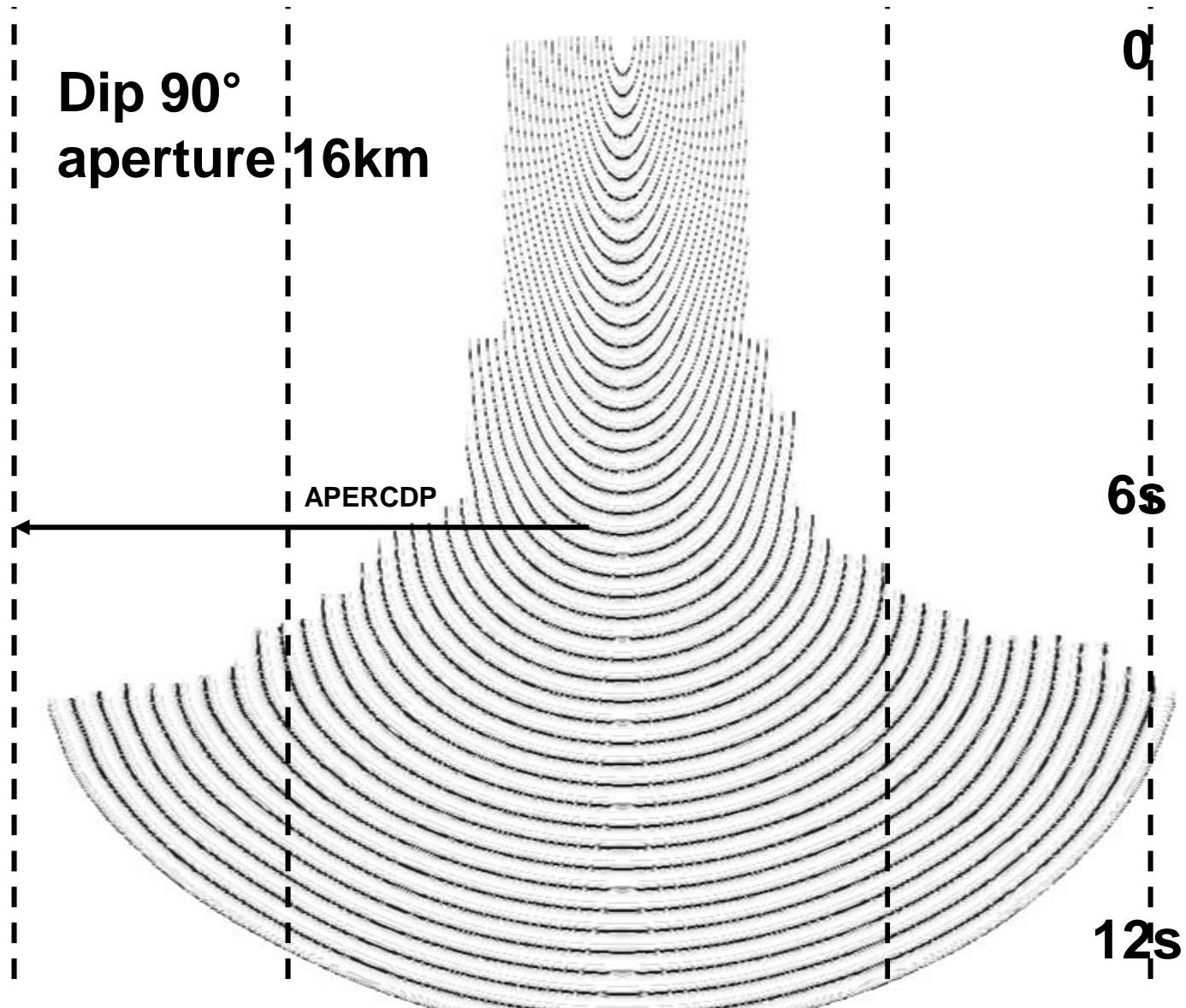
```
* TIKIM      ==      02  TRAFILE=2003,NUMTRA1,IDTRA=me,REWRITE
                    NPE64,MACHINE=PC,DISTRIB ,BIMG02
                    DCDP12.5,IMAGE=(FCDP151,LCDP600)
                    OFFSETS=(D150,ID100,XRM5800,XRP50)
                    N0,
                    LMU2,MUTE2
                    APERCDP5000
                    DIPLIM40
                    NOALIAS=(FMAX75)
                    LVI1
```

Aperture limitation

**Dip 30°
aperture 9km**



Aperture limitation



➤ **noise attenuation**

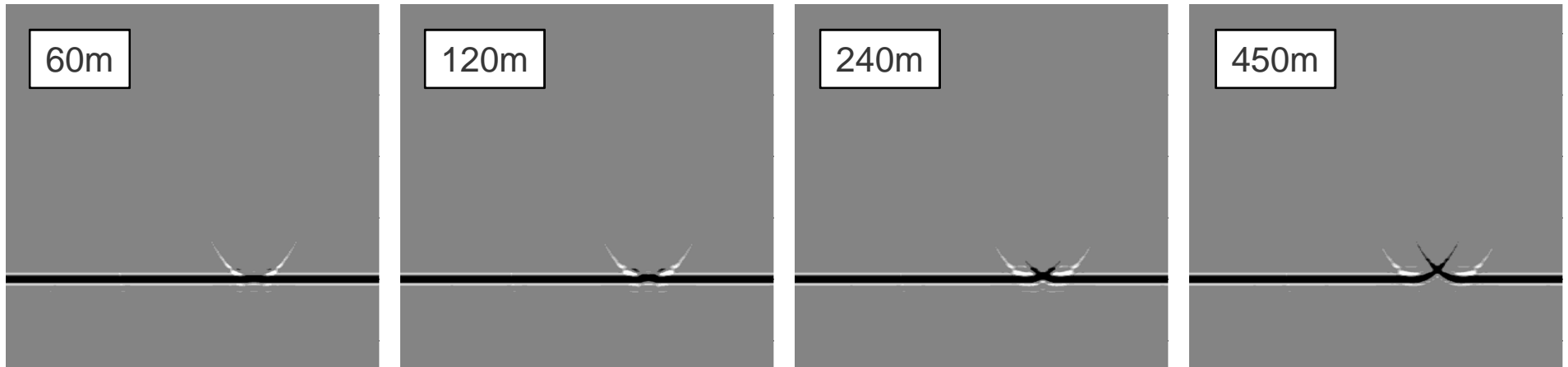
- **input noise** (*addressed by the Pre-Processing*)
 - ✓ coherent noise
 - ✓ random noise
 - ✓ irregular amplitudes

- **acquisition irregularities** (*addressed by the regularization*)
 - ✓ offset/fold

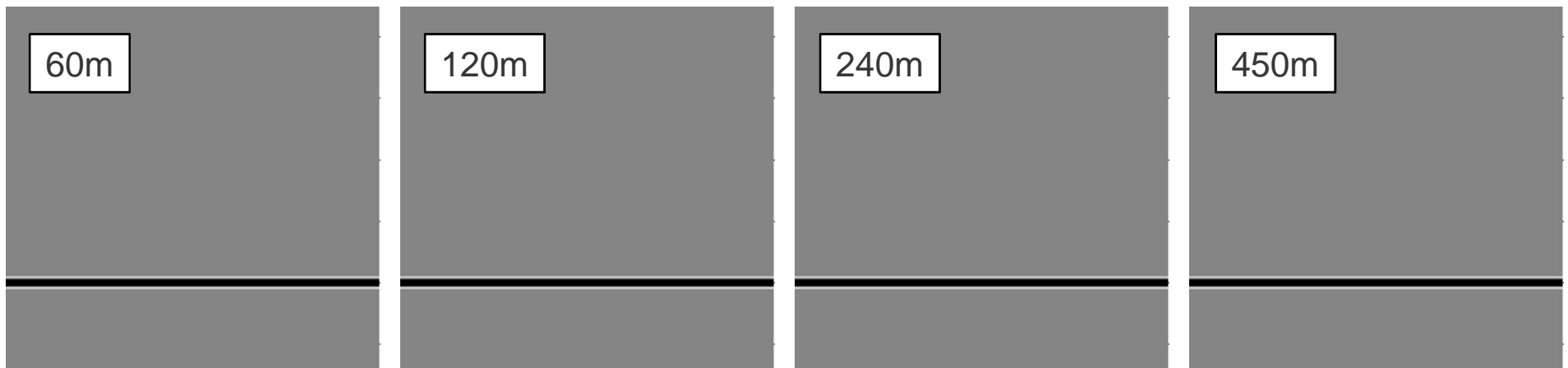
- **migration noise** (*addressed by the Migration Parameters*)
 - ✓ operator muting
 - ✓ aliasing

Regularization: missing traces on event

Missing or irregular data

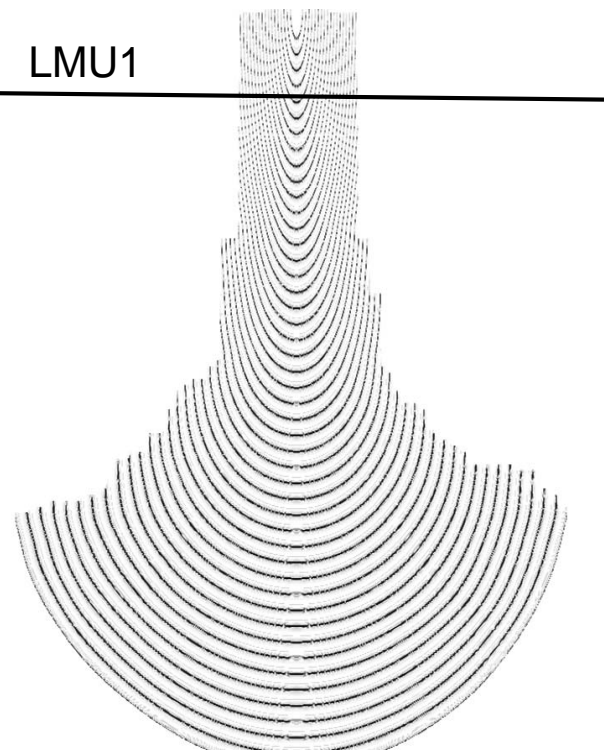


Regularized data



Migration operator mute coding

* TIKIM == 02 TRAFILE=2003,NUMTRA1,IDTRA=me,REWRITE
NPE64,MACHINE=PC,DISTRIB ,BIMG02
DCDP12.5
LMU1
IMAGE=(FCDP151,LCDP600)
OFFSETS=(D150,ID100,XRM5800,XRP50)
N0
MUTE1,LMU1,
APERCDP5000,
DIPLIM40
NOALIAS=(FMAX75)
LVI1



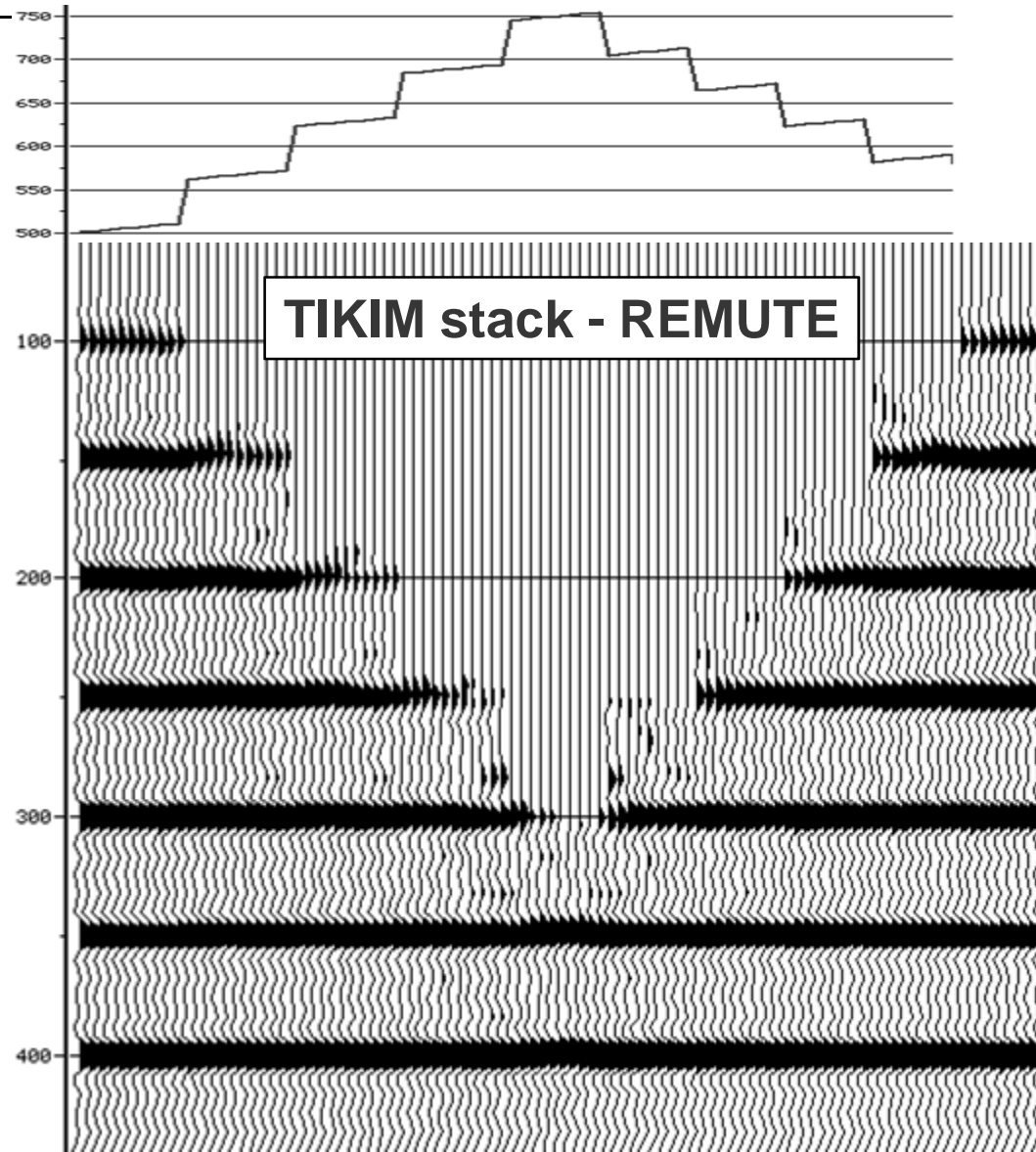
Post-migration mute

```
* TIKIM      ==      02  TRAFILE=2003,NUMTRA1,IDTRA=me,REWRITE
                    NPE64,MACHINE=PC,DISTRIB ,BIMG02
                    DCDP12.5
                    IMAGE=(FCDP151,LCDP600)
                    N0
                    LMU2,MUTE2
                    APERCDP5000,
                    DIPLIM40
                    NOALIAS=(FMAX75)
                    LVI1
                    REMUTE
```



Based on Word6 input trace

Poststack mute

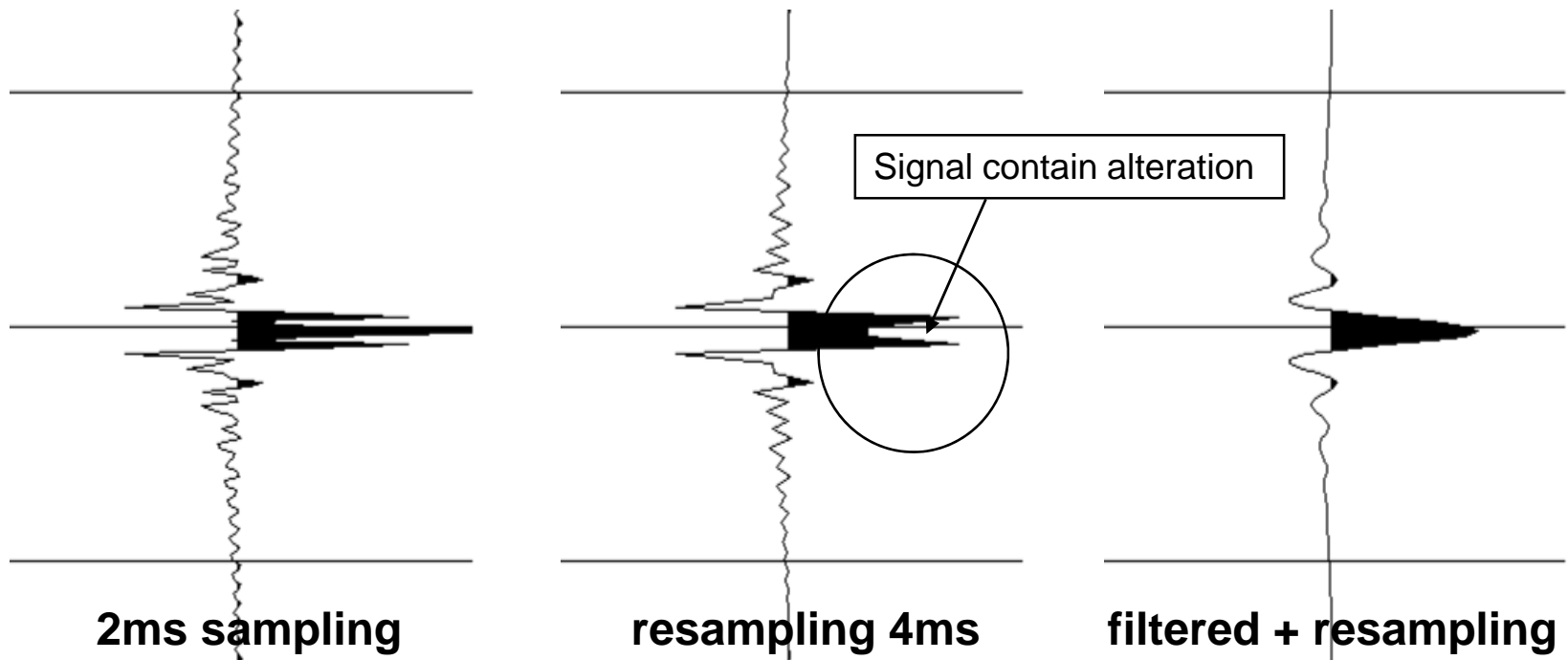


Aliasing

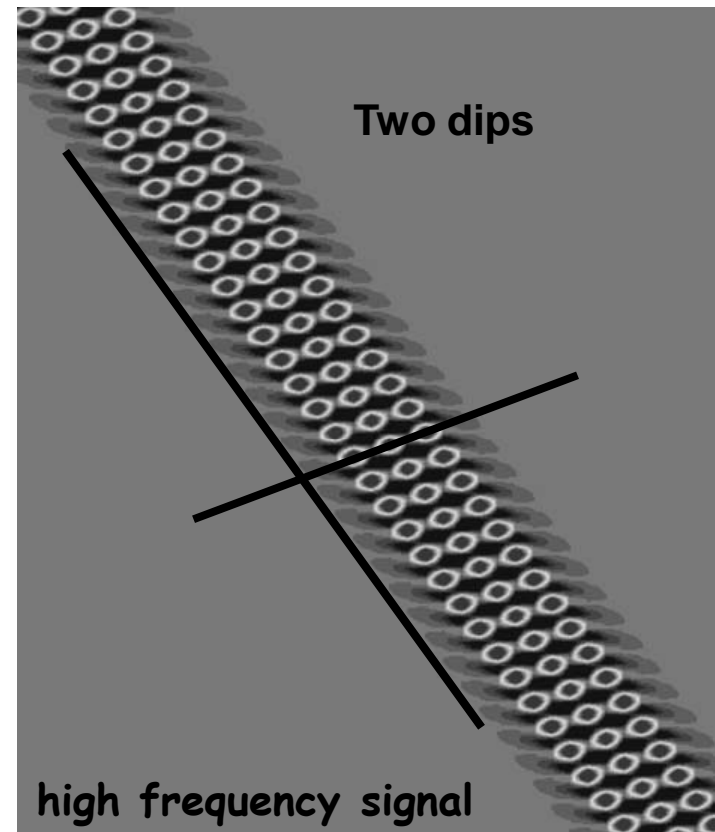
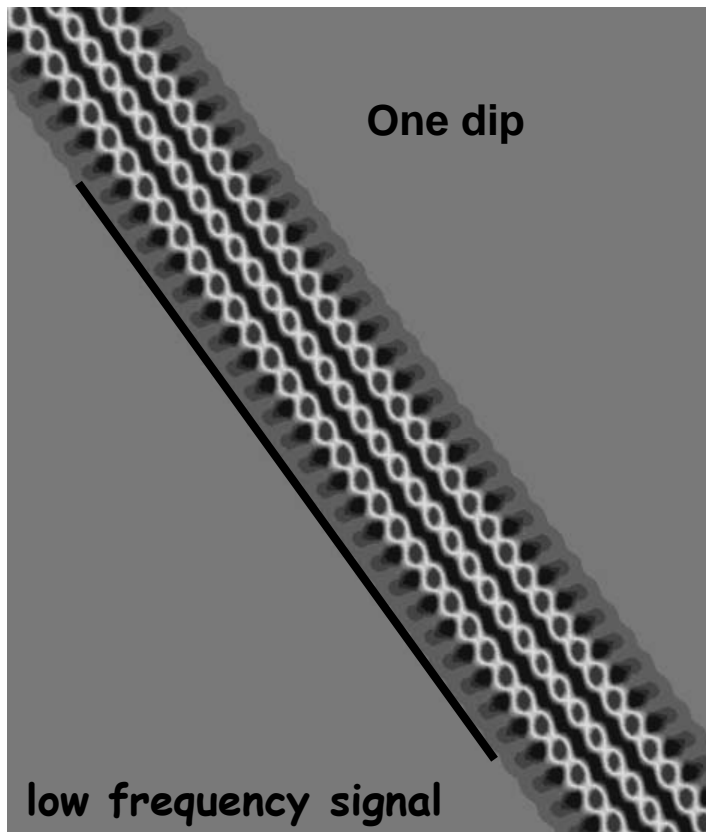
- **what is aliasing ?**
- **dip aliasing**
- **aliasing noise in Kirchhoff migration**

Aliasing

aliasing occurs when a signal is undersampled in time, or spatially

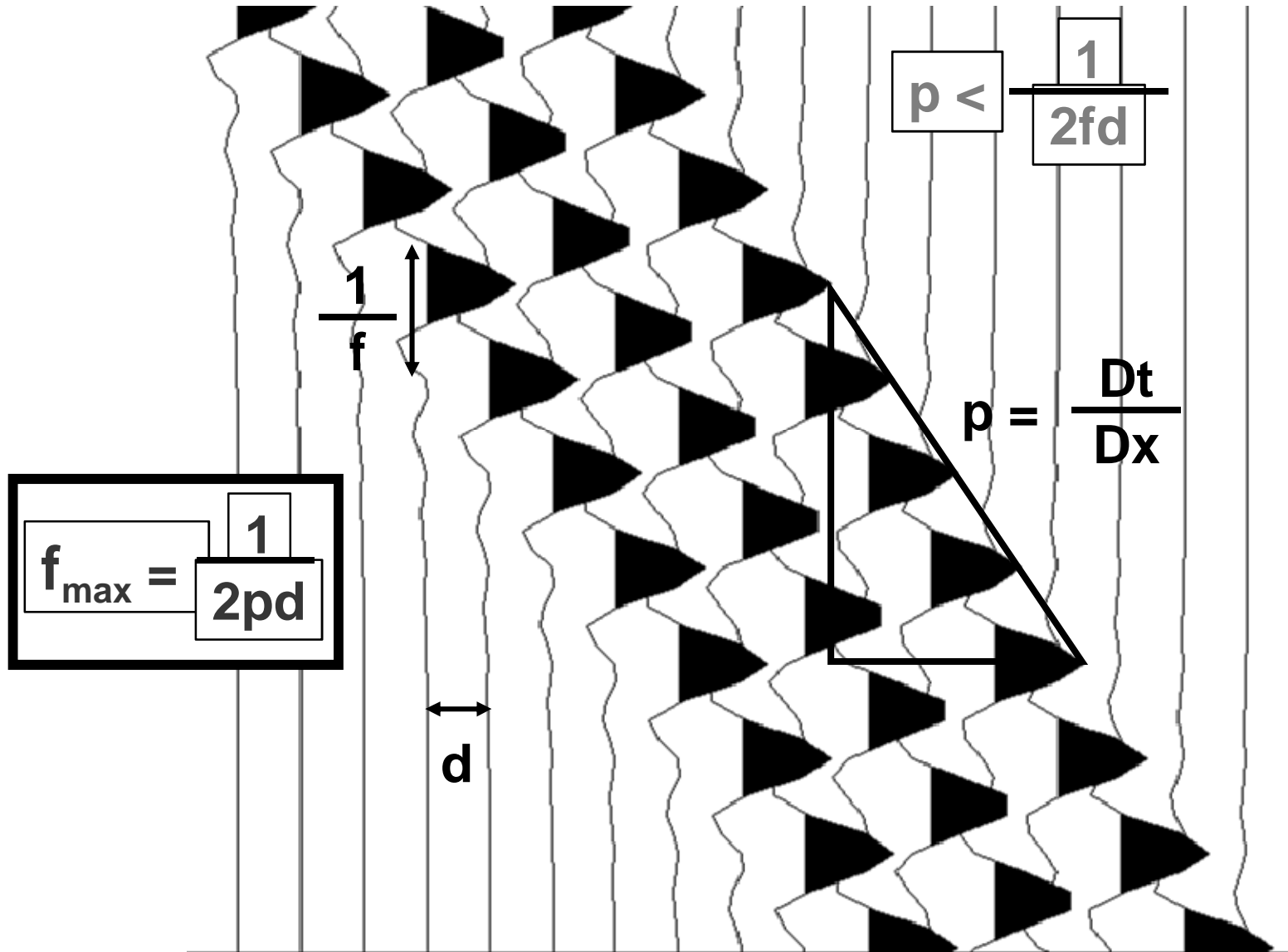


Dip aliasing



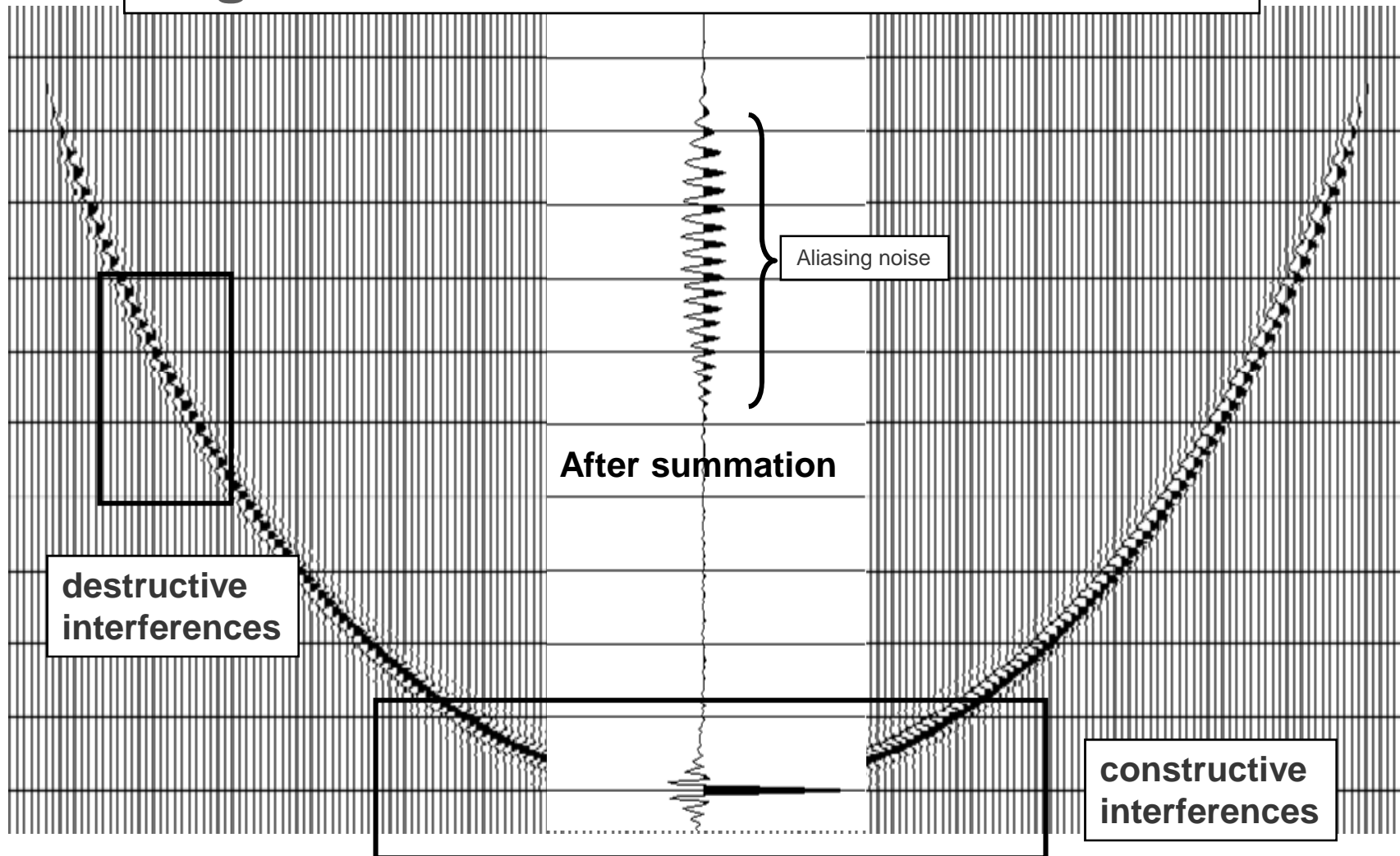
a dipping event will be aliased because of spatial undersampling

Aliasing condition in 2D



Aliasing noise in Kirchhoff migration

migration contributions to a flat event



Noalias coding

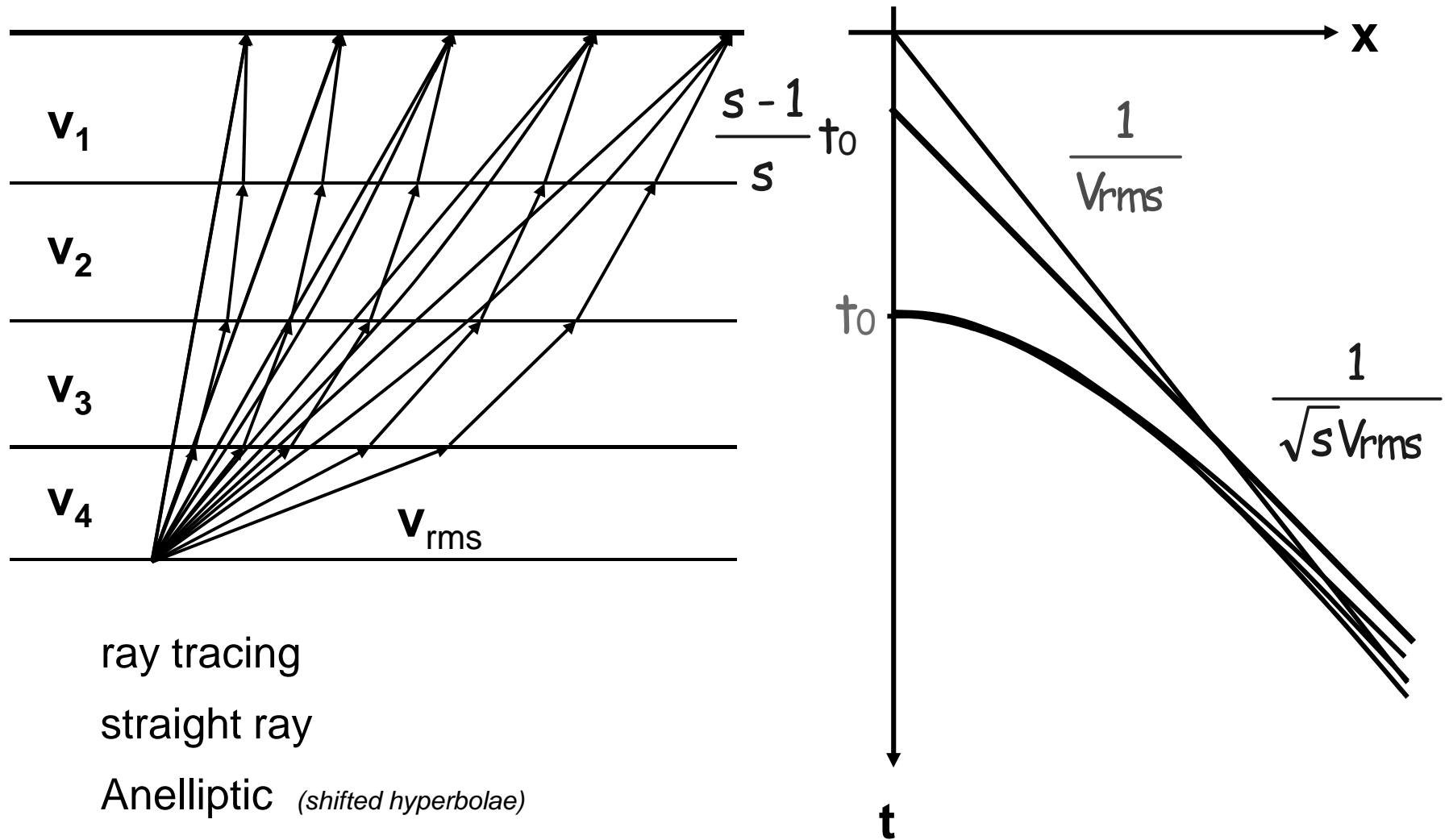
```
* TIKIM    ==    02  TRAFILE=2003,NUMTRA1,IDTRA=me,REWRITE
                NPE64,MACHINE=PC,DISTRIB ,BIMG02
                DCDP12.5
                IMAGE=(FCDP151,LCDP600)
                OFFSETS=(D150,ID100,XRM5800,XRP50)
                N0
                LMU2,MUTE2
                APERCDP5000,
                DIPLIM=(T400D20,T800D40,T4000D40,T4500D0)
                NOALIAS=(FMAX75)
                LVI1
```

➤ **3 options of TIKIM** (*velocity definitions*)

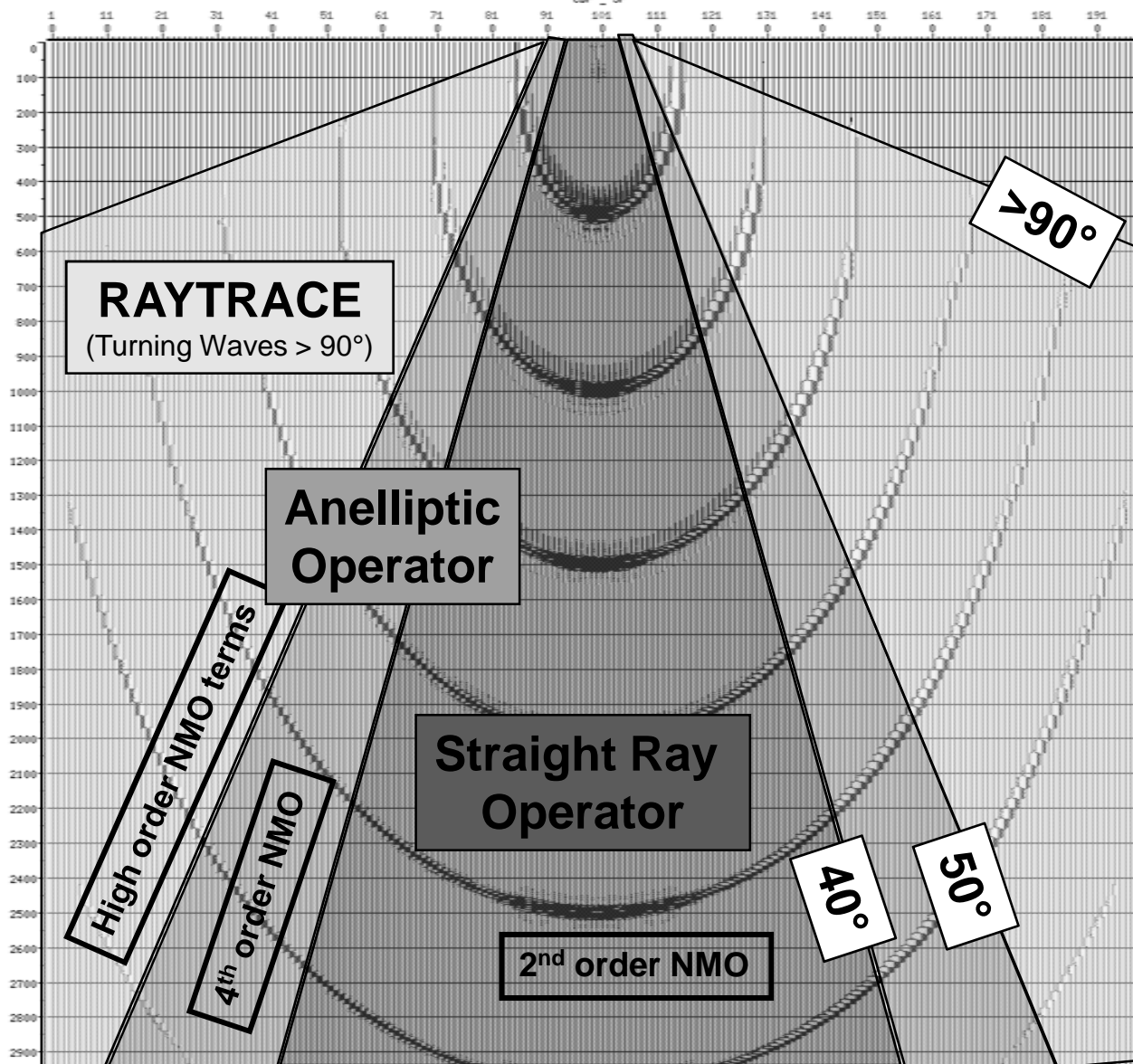
➤ **3 options in TIKIM: kinematics:**

- ✓ **straight ray (default)**
- ✓ **anelliptic**
- ✓ **raytracing (standard processing)**

Ray kinematics



New ray tracing : anisotropic & Turning-waves Kinematics

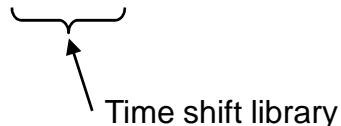


Straight Rays *(up to 40 degrees)*

```
* TIKIM      ==      02  TRAFILE=2003,NUMTRA1,IDTRA=me,REWRITE
                    NPE64,MACHINE=PC,DISTRIB ,BIMG02
                    DCDP12.5
                    IMAGE=(FCDP151,LCDP600)
                    OFFSETS=(D150,ID100,XRM5800,XRP50)
                    N0
                    LMU2,MUTE2
                    APERCDP5000,
                    DIPLIM40
                    NOALIAS=(FMAX75)
                    LVI1
```

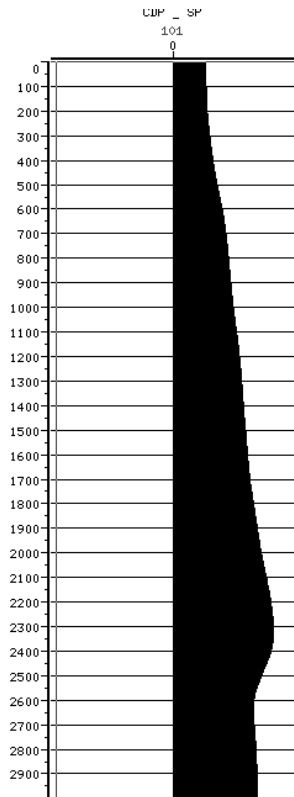

Anelliptic *(up to 50 degrees)*

```
* TIKIM      ==      02  TRAFILE=2003,NUMTRA1,IDTRA=me,REWRITE
                        NPE64,MACHINE=PC,DISTRIB ,BIMG02
                        DCDP12.5
                        IMAGE=(FCDP151,LCDP600)
                        OFFSETS=(D150,ID100,XRM5800,XRP50)
                        N0
                        LMU2,MUTE2
                        APERCDP5000,
                        DIPLIM50
                        NOALIAS=(FMAX75)
                        LVI1,LSH1
```

Time shift library

Ray Tracing *(more than 50 degrees)* (standard processing)

```
* TIKIM == 02 TRAFILE=2003,NUMTRA1,IDTRA=me,REWRITE
           NPE64,MACHINE=PC,DISTRIB ,BIMG02
           DCDP12.5
           IMAGE=(FCDP151,LCDP600)
           OFFSETS=(D150,ID100,XRM5800,XRP50)
           N0
           LMU2,MUTE2
           APERCDP5000,
           DIPLIM=(T0,D150,T3500,D120,T6000,D40),
           NOALIAS=(FMAX75)
           LVI1,LSH1,RAYTRACE,
           TREND=local:/trendfile.cst
```



← Smoothed trend

Velocities in TIKIM

➤ **velocity analysis**

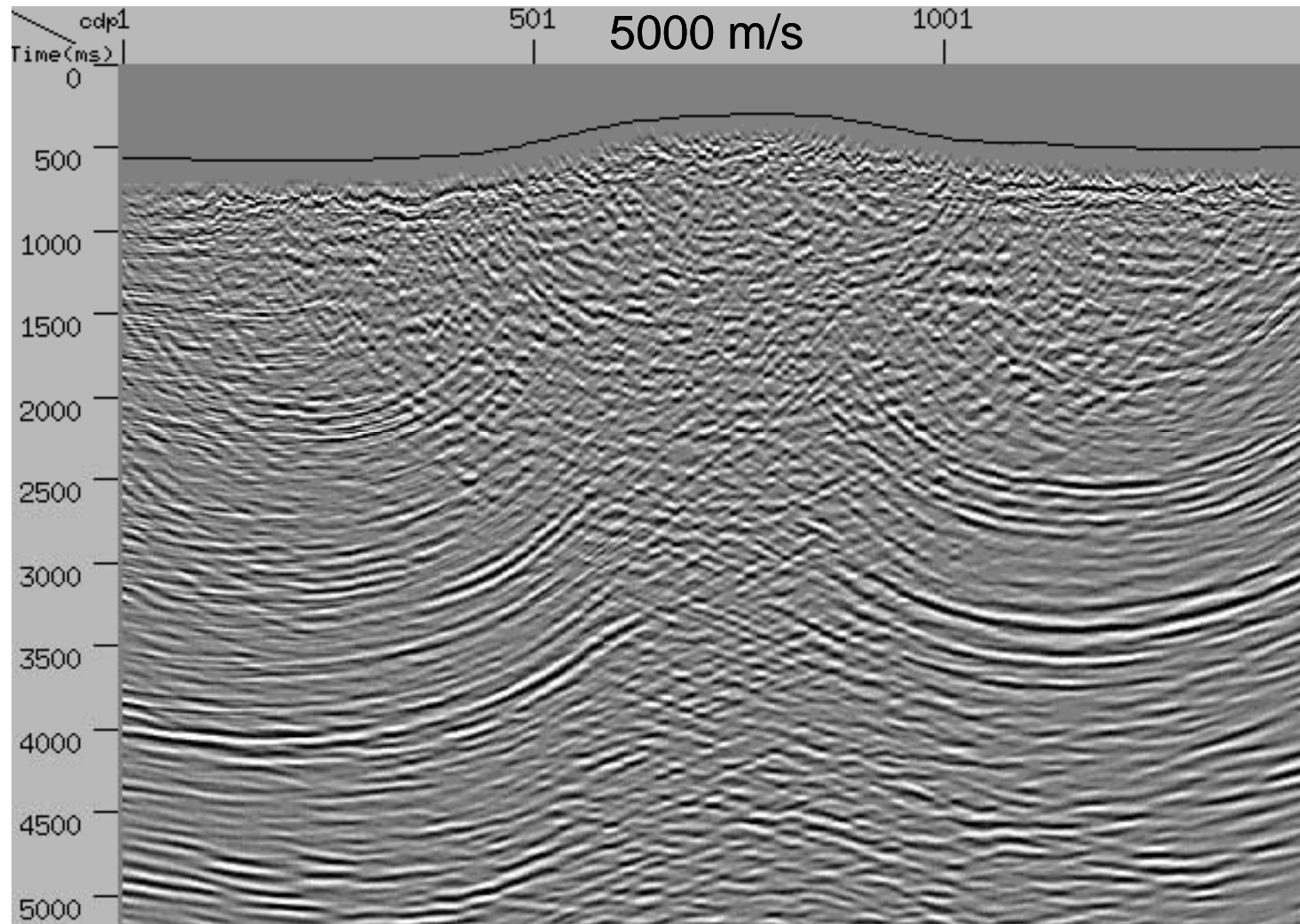
✓ **coding**

✓ **methodology**

complex 2D geology with no velocity a priori

```
* TIKIM      ==      02  TRAFILE=2003,NUMTRA1,IDTRA=me,REWRITE
                    NPE64,MACHINE=PC,DISTRIB ,BIMG02
                    DCDP12.5
                    IMAGE=(FCDP151,LCDP600)
                    OFFSETS=(D150,ID100,XRM5800,XRP50)
                    N0
                    LMU2,MUTE2
                    APERCDP5000
                    DIPLIM=(T400D20,T800D40,T4000D40,T4500D0)
                    NOALIAS=(FMAX75)
                    ATTRIBUT=VELOCITY,
                    CSTSCAN=(3000,3400,....,4600,5000)
```

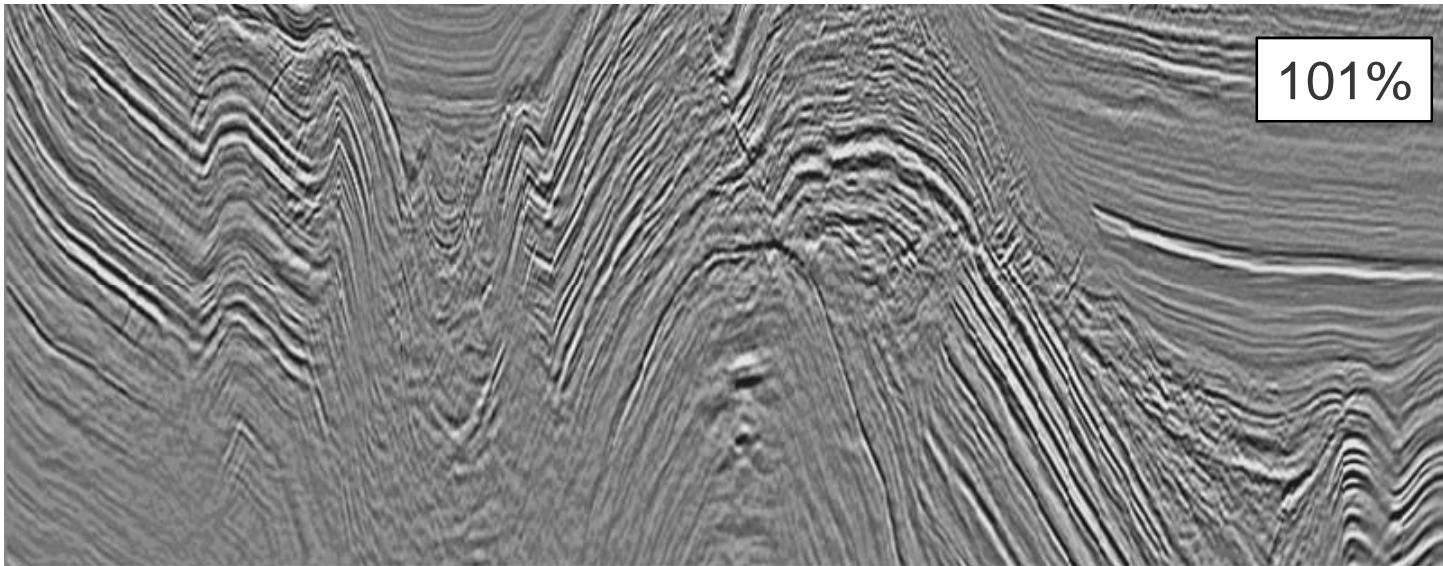
Constant velocity scan



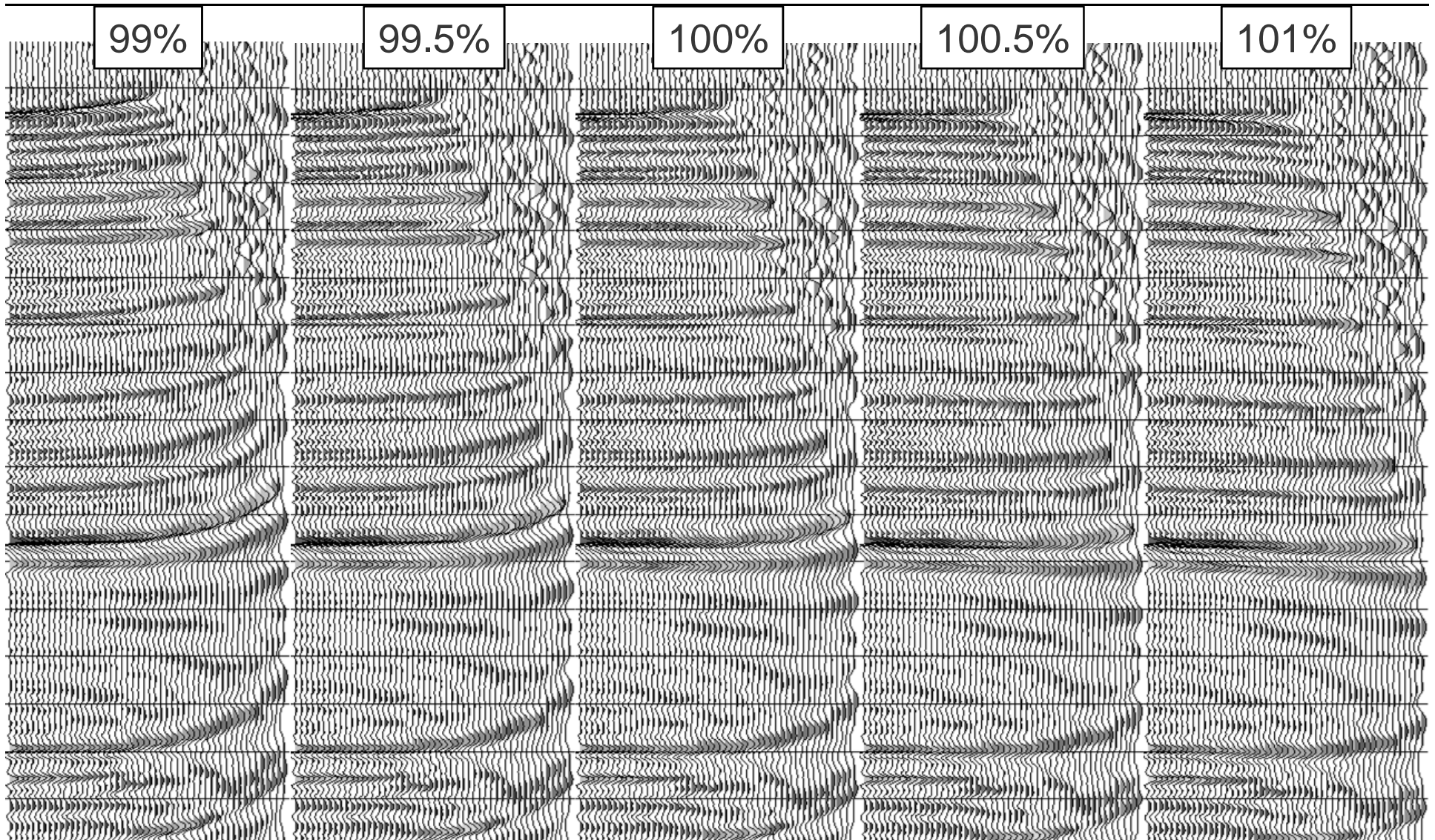
Percentage velocity scan

```
* TIKIM      ==      02  TRAFILE=2003,NUMTRA1,IDTRA=me,REWRITE
                        NPE64,MACHINE=PC,DISTRIB ,BIMG02
                        DCDP12.5
                        IMAGE=(FCDP151,LCDP600,ICDP2)
                        OFFSETS=(D150,ID100,XRM5800,XRP50)
                        N0
                        LMU2,MUTE2
                        APERCDP5000,
                        DIPLIM40
                        NOALIAS=(FMAX75)
                        LVI1
                        ATTRIBUT=VELOCITY,
                        PERSCAN=(91,94,97,100,103,106,109,112)
```

Percentage velocity scan on stack



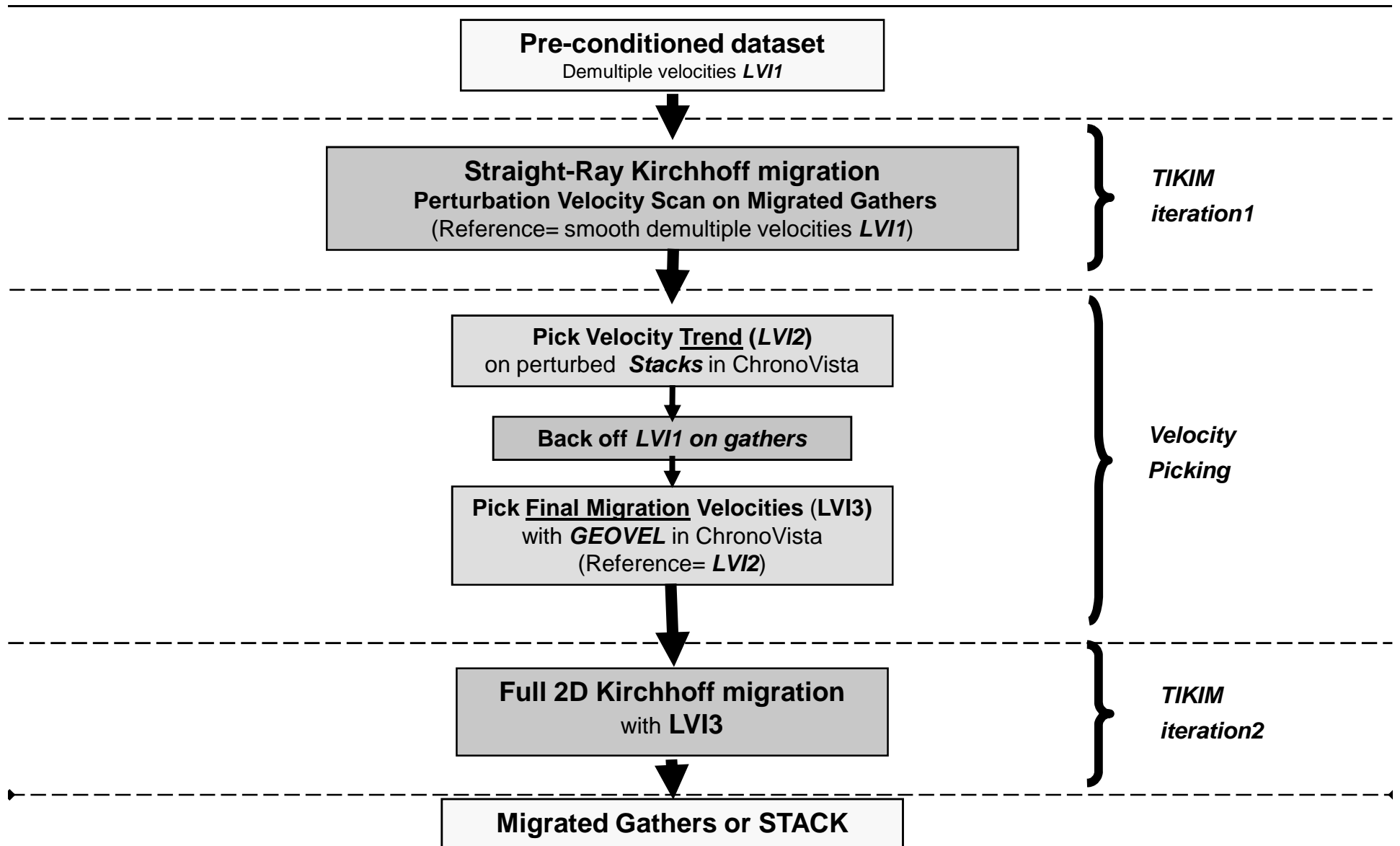
Velocity percentage scan on gathers



Velocity picking - a word of advice

- Picking tool: **ChronoVista**
 - **Start from a smooth model**
 - ✓ easier to pick the trends
 - ✓ Kirchhoff migrations like it smooth

TIKIM ISOTROPIC Simplified 2D Velocity Model Building Flow



TIKIM overview

TIKIM part 4

Software / Hardware issues

➤ Mandatory parameters (2D TIKIM – “blank option”):

➤ TRAFILE=..., NUMTRA..., IDTRA=..., *Job run parameters*

➤ DCDP *Gridding of the Image*

➤ DIPLIM *Dip limitation*

➤ N or NP *Weighting (fold compensation)*

➤ (LVI) *Velocity Model*

➤ NOALIAS=(FMAX) *Anti-aliasing filter*

➤ IMAGE=(FCDP,LCDP) *Output Image*

➤ BIMG *Output loop number*

Coding TIKIM on cluster (*"blank option"*)

Scratch disk address

```
** GVRPA@ setenv gvr_local /scr/myproj
* DLOOP      01
* INPTR      ++
* TIKIM      == 02  TRAFILE=2003,NUMTRA1,IDTRA=me,REWRITE
                NPE64,MACHINE=PC,DISTRIB ,BIMG02
                DCDP12.5
                IMAGE=(FCDP151,LCDP600)
                OFFSETS=(D150,ID100,XRM5800,XRP50)
                N0
                LMU2,MUTE2
                APERCDP5000
                DIPLIM=(T400D20,T800D40,T4000D40,T4500D0)
                NOALIAS=(FMAX75)
                LVI1
* DLOOP      02
* OUTBD      ==      LBD1
* PROCS      X(B1)
```

End

End
of the presentation