TIKIM

The Basics

University
Learning for Development

Part 3: Contents

TIKIM Basics:

- What it does!
- Basic Tenets
  - Use of Header words
- Main features
  - Migration aperture
  - Acquisition irregularity handling
- Basic run time issues

TIKIM : What it does! BASIC

- TIKIM performs Kirchhoff Time Migration
  - On pre-stack 2D or 3D data.
  - Outputs can be

Migrated traces corresponding to different offsets as gathers (e.g. CMPs)

Migrated traces corresponding to different velocity perturbations (can be stacked to provide velocity scans)

For use in structural velocity analysis or AVO studies.

Stack of all the individual migrated traces generated by the algorithm. → **Migrated stacked volume**

TIKIM in Context: PreSTM sequences

TIKIM

One Pass

Kirchhoff migration using 3D V_{RMS} velocity field

At first sight the fact that TIKIM is a 'one-pass' solution indicates a simpler job flow.

However the abilities of TIKIM to act as a velocity analysis tool, and to handle anisotropy mean that the job flows can be complex - with several (typically 3) runs of TIKIM being applied.

TIKIM : What it does! 3 STEPS or ALL in 1

- How TIKIM works…

  There are three main steps…..

  1. Input of seismic data, with associated datasets (Libris)
  2. Distribution of data to the processing CPUs and *migration computation*
  3. Output of the migrated data

  TIKIM can run all of these steps in one job, for instance in 2D or, especially where large 3D surveys are concerned, in separate jobs

TIKIM : What it does! FAST TURNAROUND

- **For fast turnaround TIKIM can be run simultaneously on numerous processors**
  - **Either on ‘clusters’ or traditional multi-CPU machines.**

- **The *output* data are split into ‘Chunks’.**

TIKIM: Basic Tenets

Some basic principles of TIKIM parameterisation are fundamentally different to that normally used in Geocluster.

The definition of the data to be processed by TIKIM is referenced to the OUTPUT, not the INPUT.

3D TIKIM DOES NOT use the input data header words associated with the processing grid (4 and 19).

If the parameter DCDP is coded, TIKIM performs a 2D migration. The trace position is defined according to the content of word 4.

TIKIM DOES refer to Word 6 (mutes)

This is used as a start time for migration

TIKIM: Pre-TIKIM QC

When reprocessing data obtained from other contractors be aware that the provided 'topographic references' may be different to CGG convention.

At the start of the pre-processing stage….

It is strongly recommended (or mandatory!) to re-compute the relevant trace header words from Source/receiver co-ordinates.

TIKIM Main Features

Let us now review most of the major features of TIKIM….

- Input requirements
- Hyperbolic move-out assumptions and “migration aperture”
- Full pre-stack time migration
- Acquisition irregularities compensation

TIKIM : Inputs

Processing inputs are *pre-NMO* traces (corrected for spherical divergence).

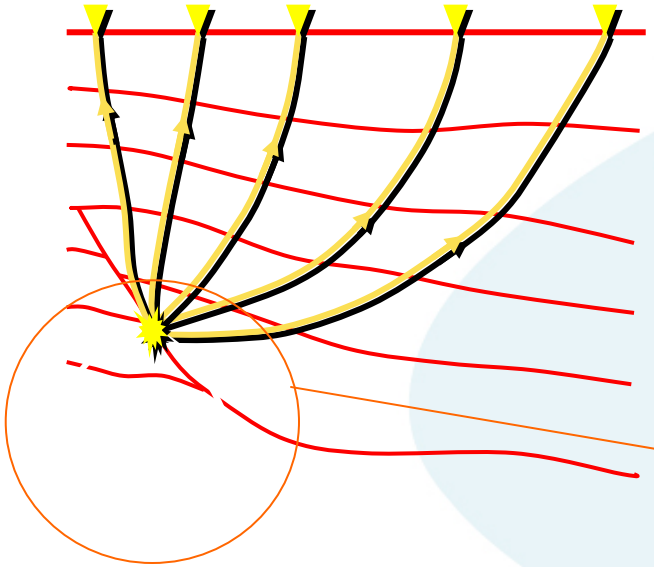
Their input sort order is of no importance to TIKIM.

- **It is therefore usually determined by the requirements of the pre-TIKIM processing flow**

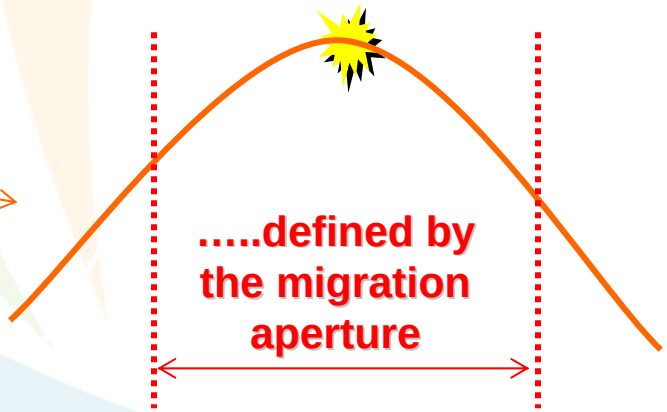
Hyperbolic Moveout : Migration Aperture

- TIKIM a Kirchhoff Diffraction Summation Method migration …. works by summing along locally defined hyperbola.

– if the velocitis above the diffractor are not isotropic the diffraction will not be truly hyperbolic



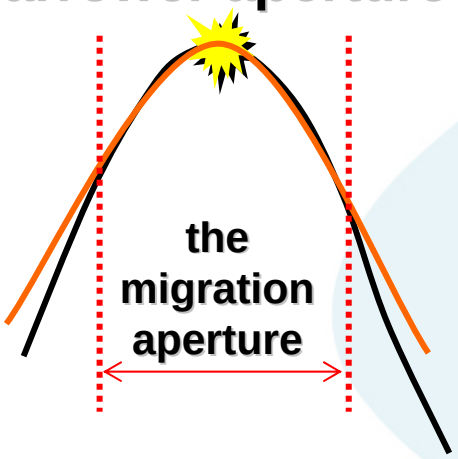
• We assume a limited approximation to a hyperbola ….



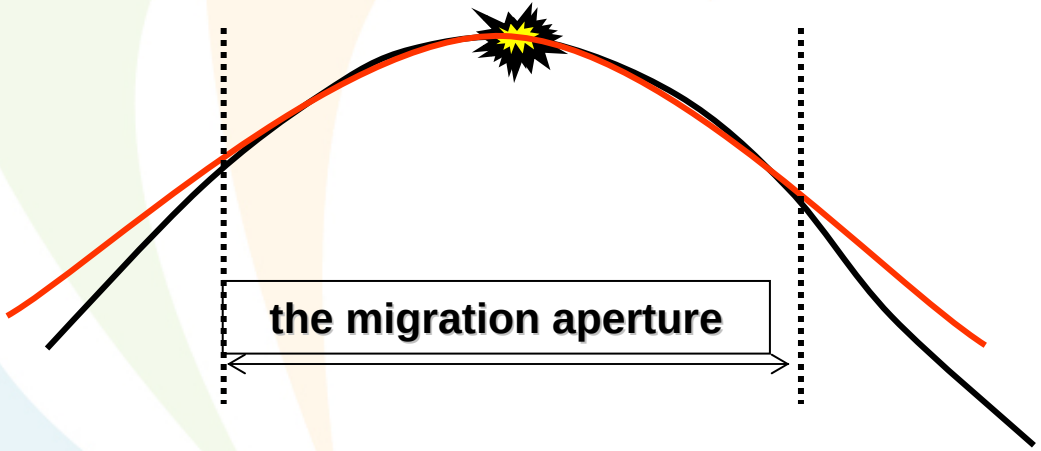
Hyperbolic Moveout : Migration Aperture

- **The migration aperture is chosen in conjunction with the velocity - large enough to encompass the dip but small enough to be unperturbed by lateral velocity variations**

- **Slow velocities = narrower aperture**

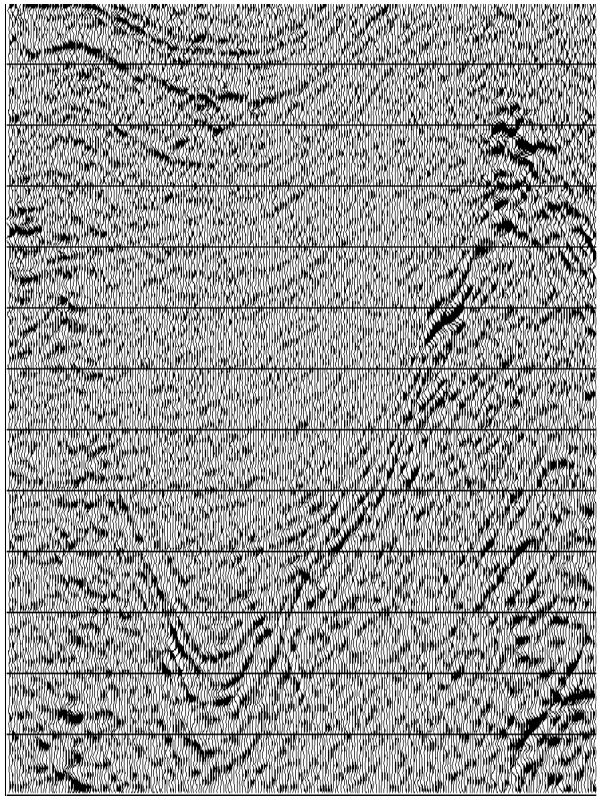


Fast velocities = wider aperture

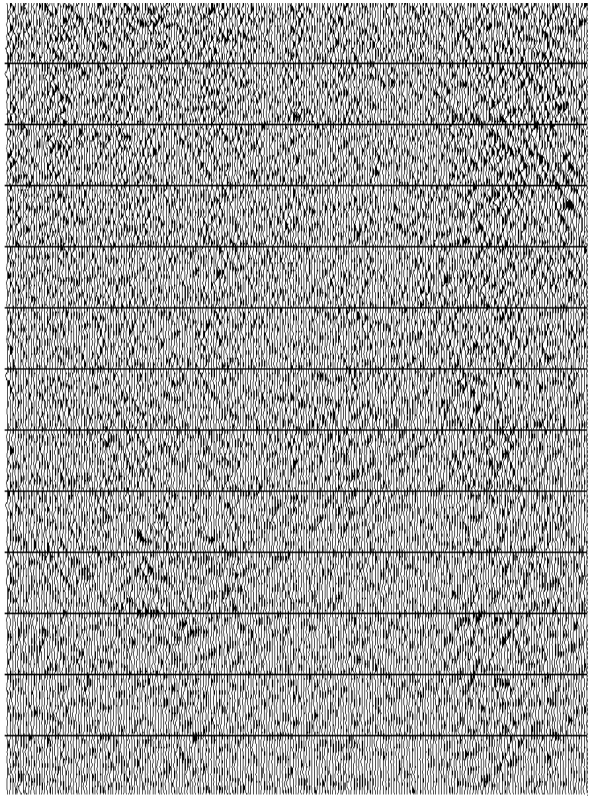


- **Lateral variations to V_{rms} are permitted and result in variations to the hyperbola from place to place….however, there are constraints and laterally smooth velocity fields are preferred**

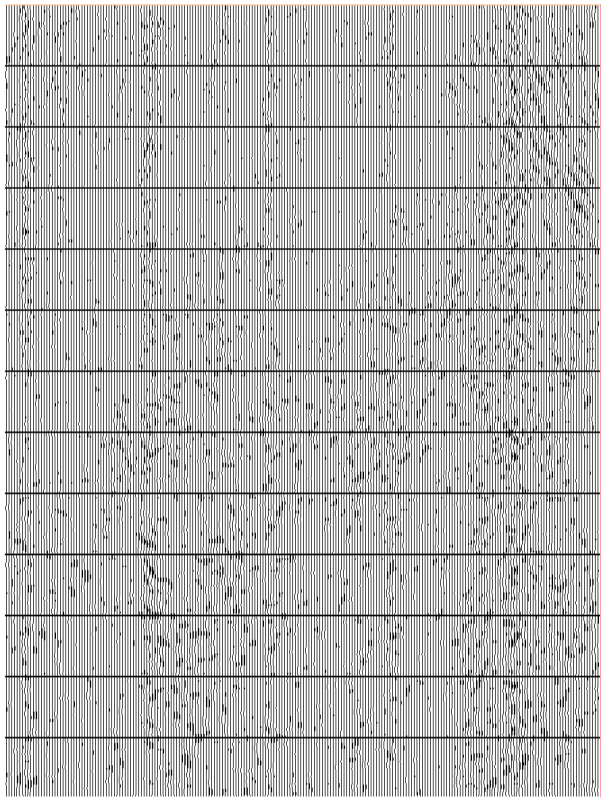
Acquisition Irregularity Compensation



TIKIM input offsets 150m-250m



Difference when only using 50 % of the input traces



Difference after random noise removal

Conclusion: TIKIM is robust in that certain acquisition irregularities can be compensated for without significant loss of quality.

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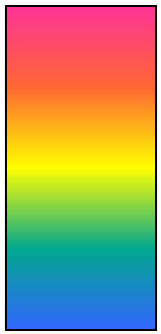
TIKIM : Outputs

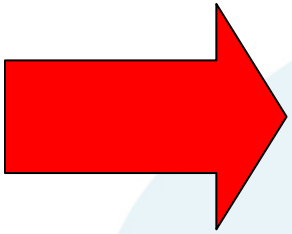
- TIKIM can output migrated gathers or stacks.
- TIKIM can be used as a migration velocity scanning tool…
  Percentage Velocity Scanning giving the so called *Perturbed velocity scans (structural velocity analysis)*

The output sort order can be the same as the input, or different from the input

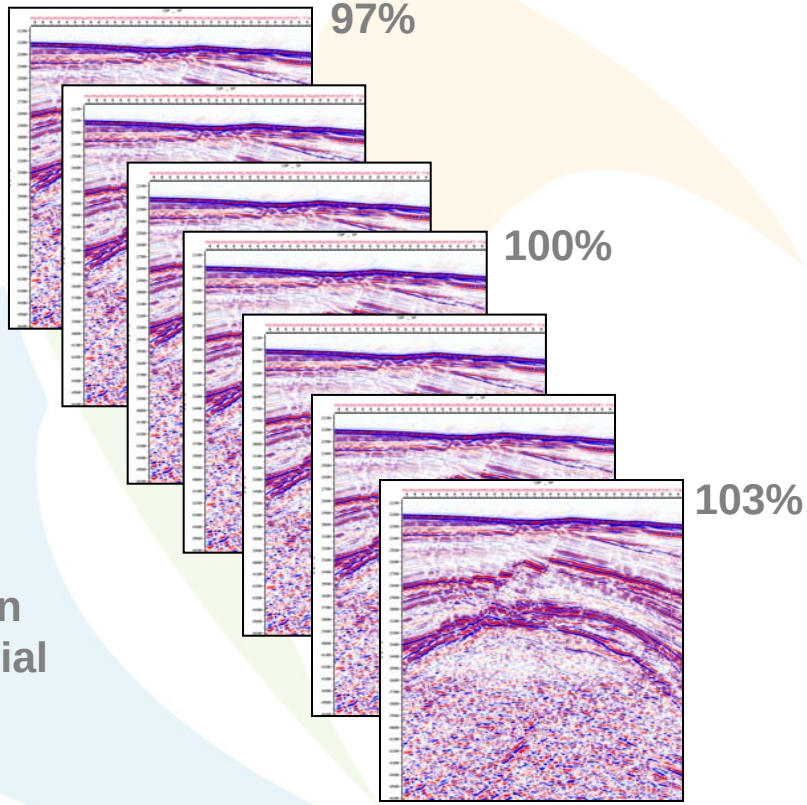
TIKIM velocity scans



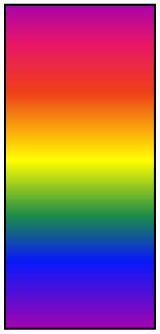
Initial velocity model



TIKIM velocity scan using perturbed initial velocity model

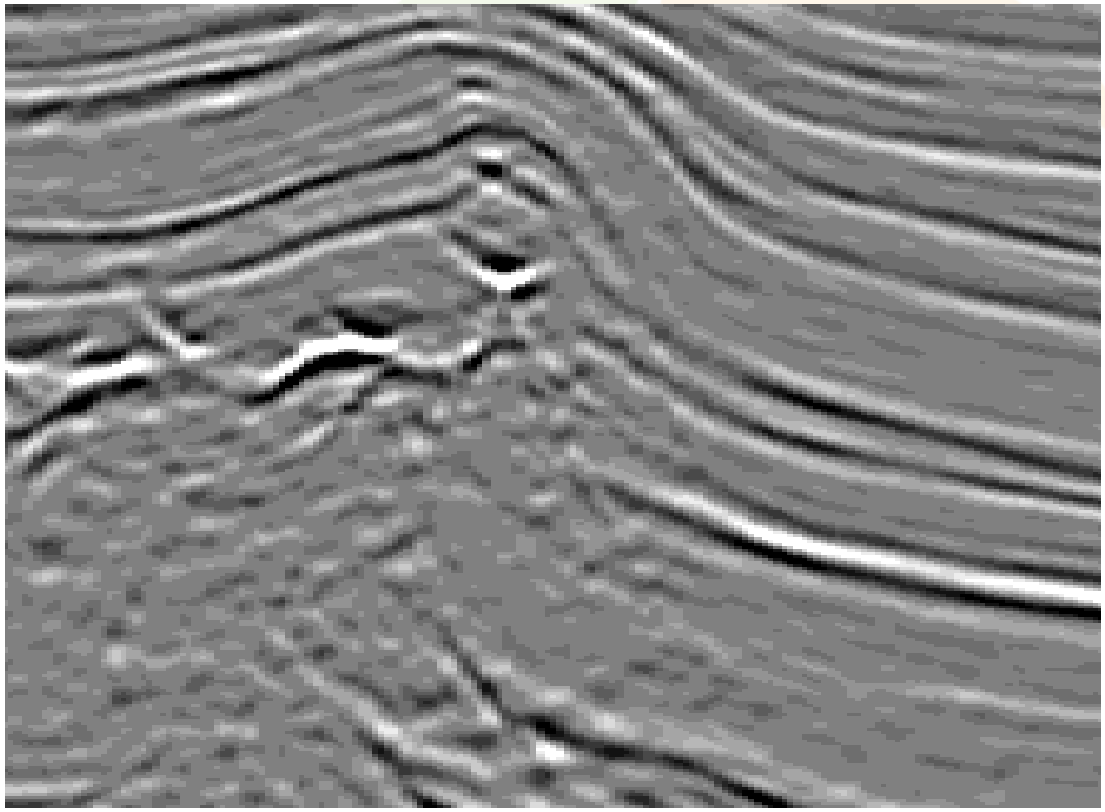


Velocity picking on the resulting velocity scans



Final velocity model for production run

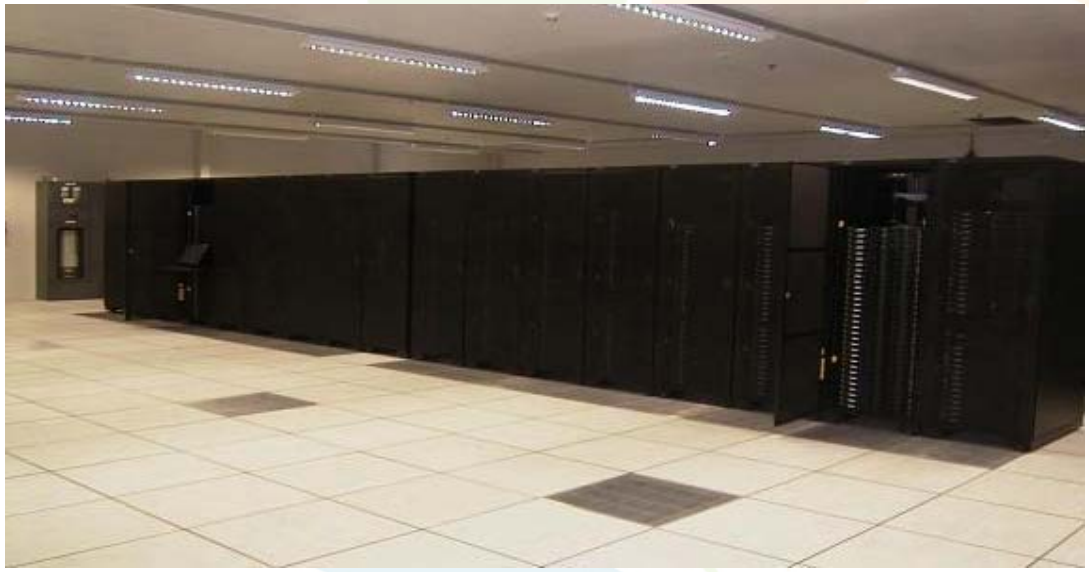
Full Kirchhoff PSTM – TIKIM



106%

TIKIM : Cluster/Parallel Implementation

- TIKIM has been designed to efficiently use large ‘PC clusters to allow processing of the many millions of output traces created during the migration of large 3D surveys.



- **TIKIM can also be run on ‘conventional’ multi-CPU machines or, for very small surveys (probably 2D lines) on single CPU machines.**

TIKIM status: Run Time Issues

Run time issues

Total run time may be conveniently regarded as due to two components…

- **Actual CPU computation time**
  - **May be influenced by user by choice of parameters (e.g. aperture size)**
- **I/O (Overhead trace transfer) time**
  - **May be influenced by user by choice of data handling method (e.g. use of TIKIM IN)**

For the programmers these are interrelated:
A program change to decrease computation time may cause an increase in I/O time!

Summary

TIKIM

- **No sorting actually needed**
  - **although *sorting may be advisable for best machine use / and crash job recovery / restarts***
- **Coherent NMO & migration velocity field**
- **Handles reasonable velocity variations**
- **Target oriented**
- **Flexible algorithm**
  - **elevations, converted waves, anisotropy**