ETH *zürich*

Reflection seismic 1
script

Educational Material

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Overview

Fundamentals

Introduction
Seismic waves: Propagation Velocity and Amplitudes
Seismogram

Measurement systems

Sources, receivers, Acquisition strategies

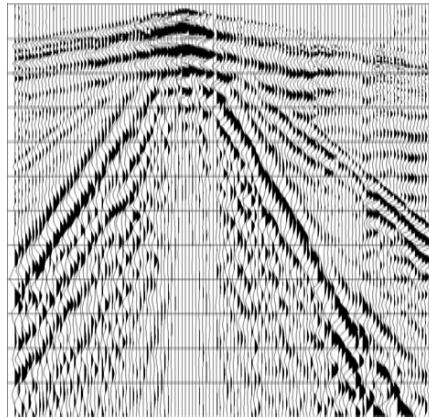**Data processing**

"Pre-processing"
Filter und Deconvolution

Velocity anlysis and Stacking
Migration
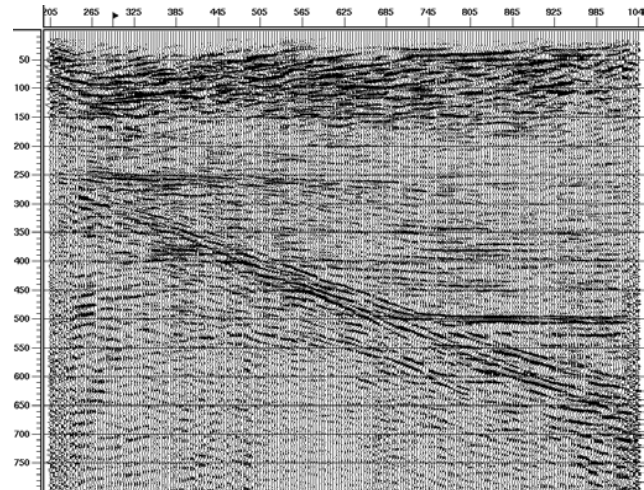Interpretation

Processing of reflection data

- To improve the signal to noise ratio
- Isolation of the wanted signals (Reflections isolated from multiples and surface waves)
- To obtain a higher resolution by adapting the waveform of the signals
- To obtain a realistic image by geometrical correction
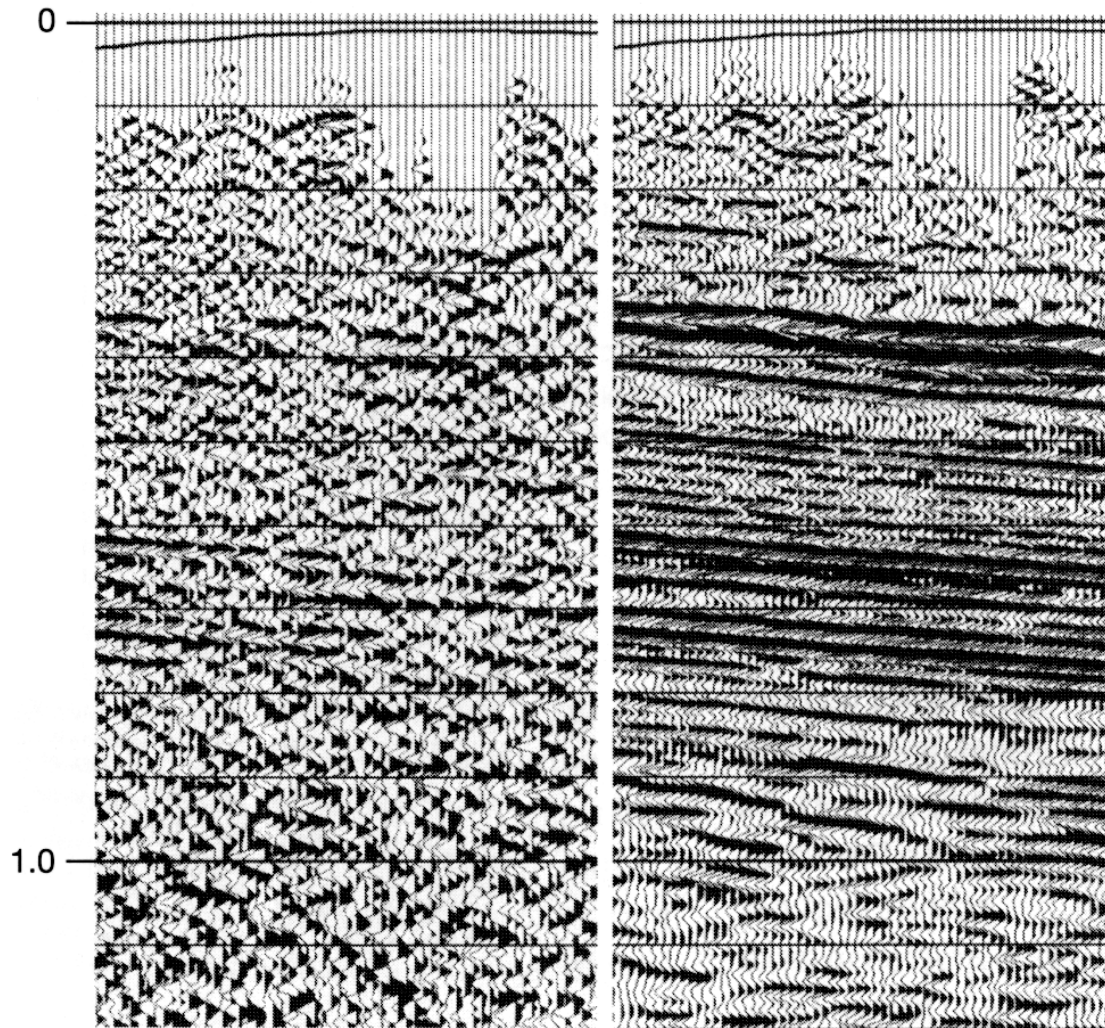- To obtain information about the subsurface
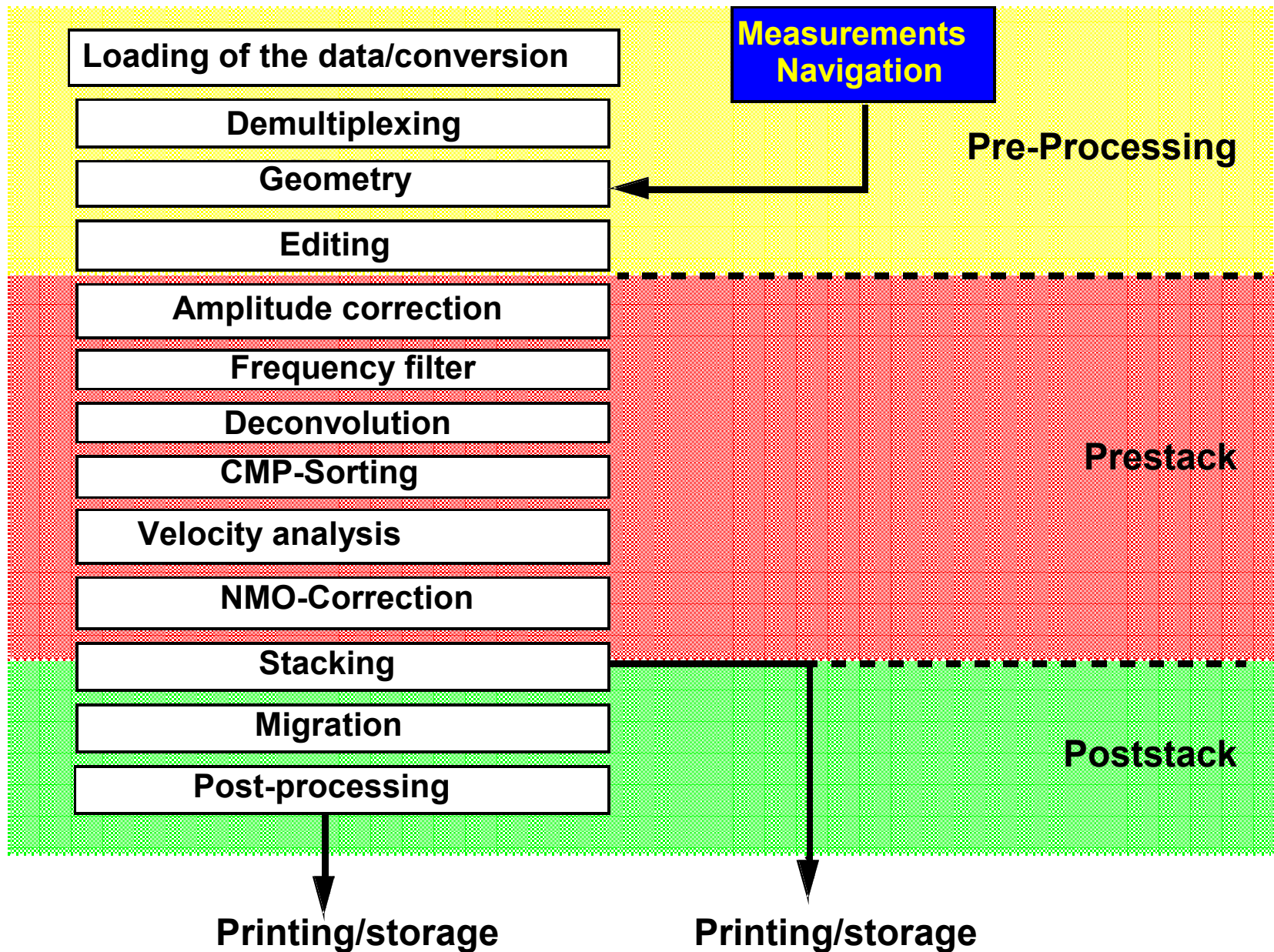
Raw data
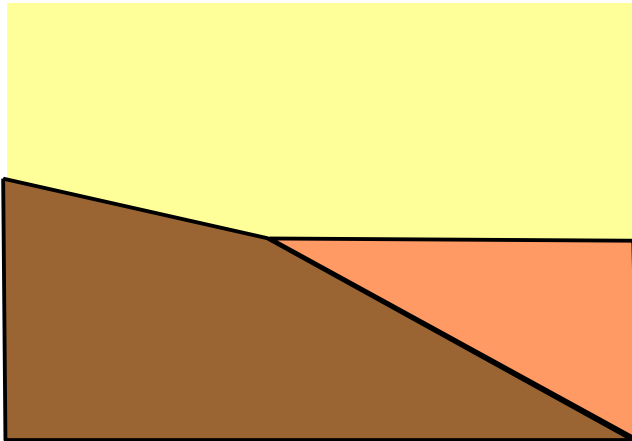
Geology

Seismic section

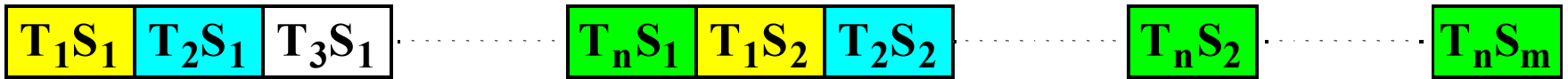# Result of processing of data

Raw data   Processed(migrated) data
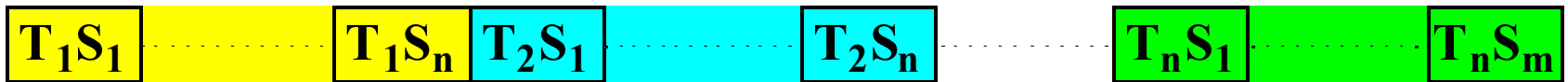
Basic scheme of the seismic data processing

| Loading of the data/conversion | **Measurements Navigation** | **Pre-Processing** |

- Loading of the data/conversion
- Demultiplexing
- Geometry
- Editing
- Amplitude correction
- Frequency filter
- Deconvolution
- CMP-Sorting
- Velocity analysis
- NMO-Correction
- Stacking
- Migration
- Post-processing

Measurements Navigation

Pre-Processing

Prestack

Poststack

Printing/storage   **Printing/storage**

Demultiplexing

Sorting of data by sampling time:

| T_1S_1 | T_2S_1 | T_3S_1 | ⋯ | T_nS_1 | T_1S_2 | T_2S_2 | ⋯ | T_nS_2 | ⋯ | T_nS_m |

T_i = Trace i; S_j = Sample j

Sorting of the data by traces

| T_1S_1 | ⋯ | T_1S_n | T_2S_1 | ⋯ | T_2S_n | ⋯ | T_nS_1 | ⋯ | T_nS_m |

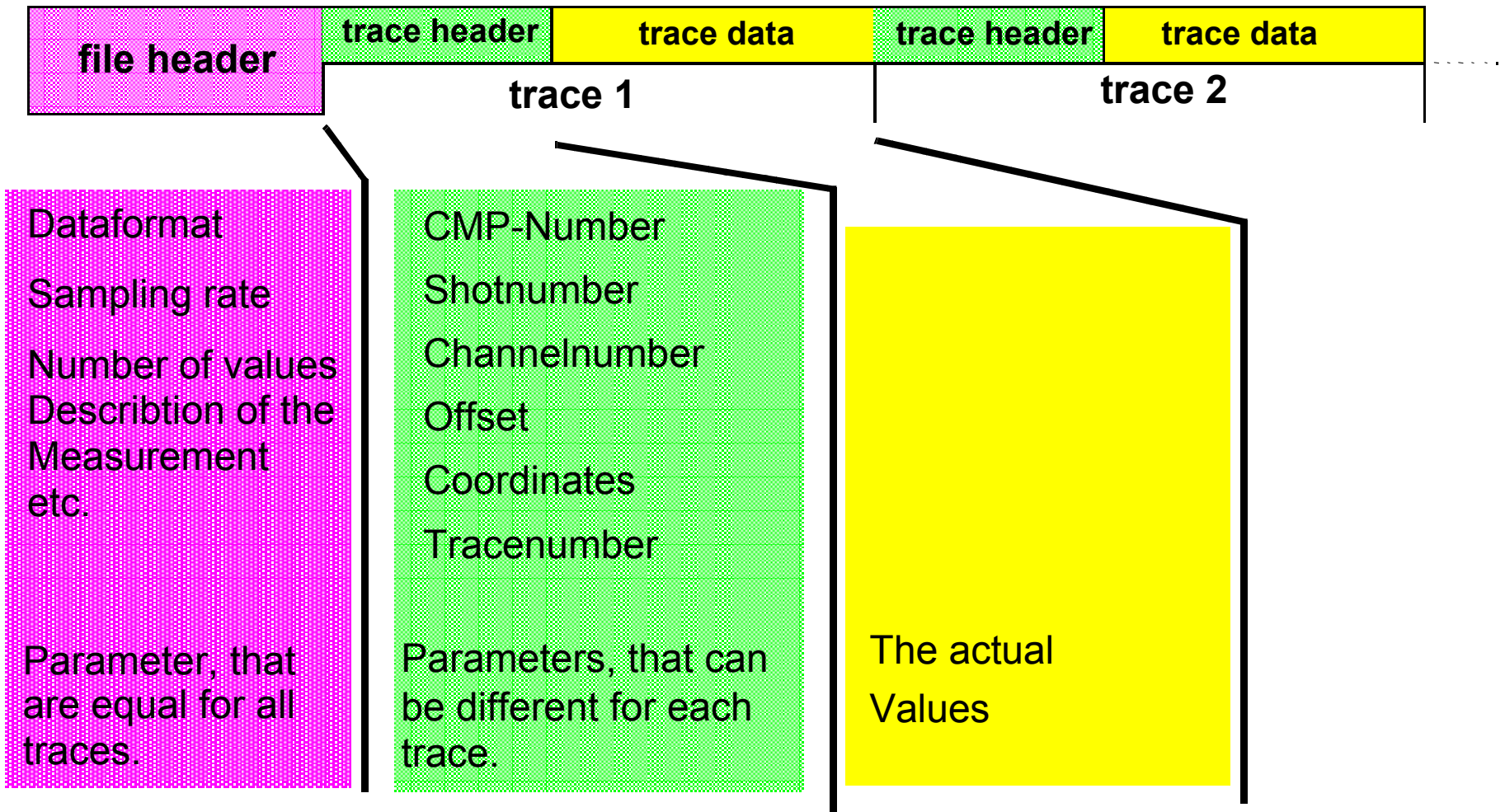T_i = Trace i; S_j = Sample j

Dataformats

- SEG-D:
- SEG-2:   multiplexed time sequential form

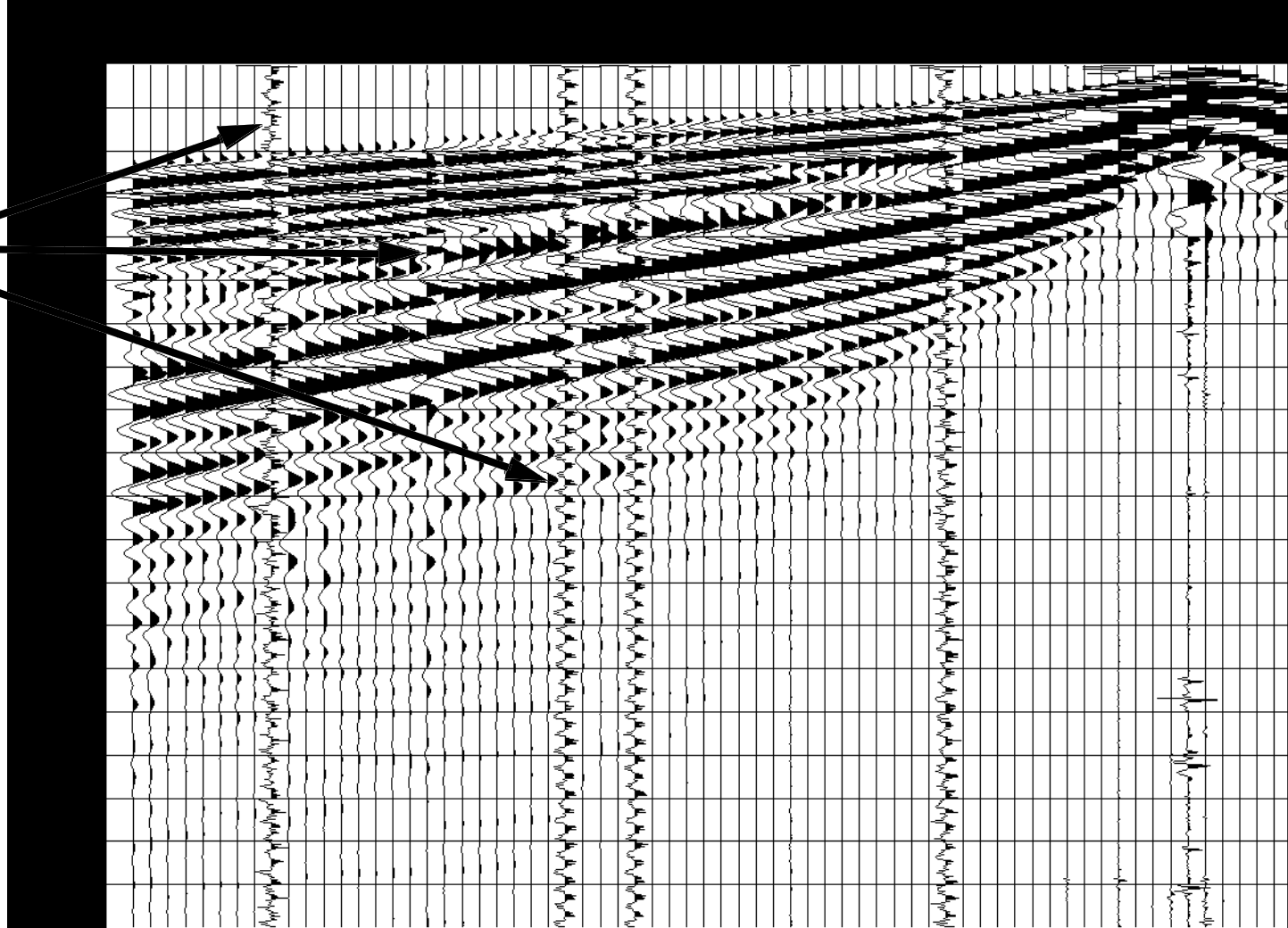- SEG-Y: demultiplexed trace sequential form

Digital storage:
• IBM Real (4-Byte floating point, standard)
• IEEE (4-Byte floating point)
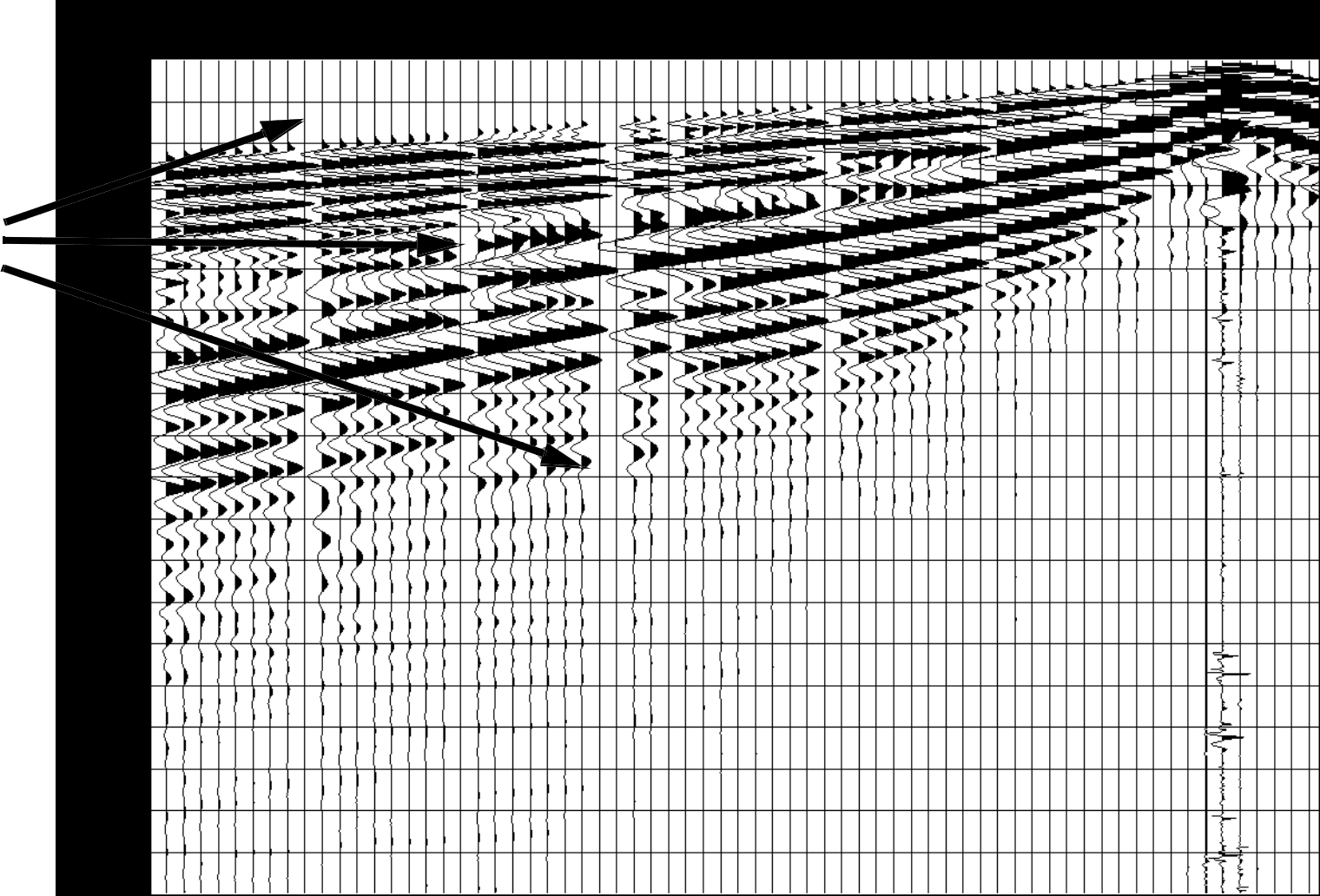• 4-Byte Integer

SEGY-Format

file header	trace header	trace data	trace header	trace data

trace 1 — trace 2

file header

Dataformat

Sampling rate

Number of values
Describtion of the
Measurement
etc.

Parameter, that
are equal for all
traces.

trace header

CMP-Number

Shotnumber

Channelnumber

Offset

Coordinates

Tracenumber

Parameters, that can
be different for each
trace.

trace data

The actual
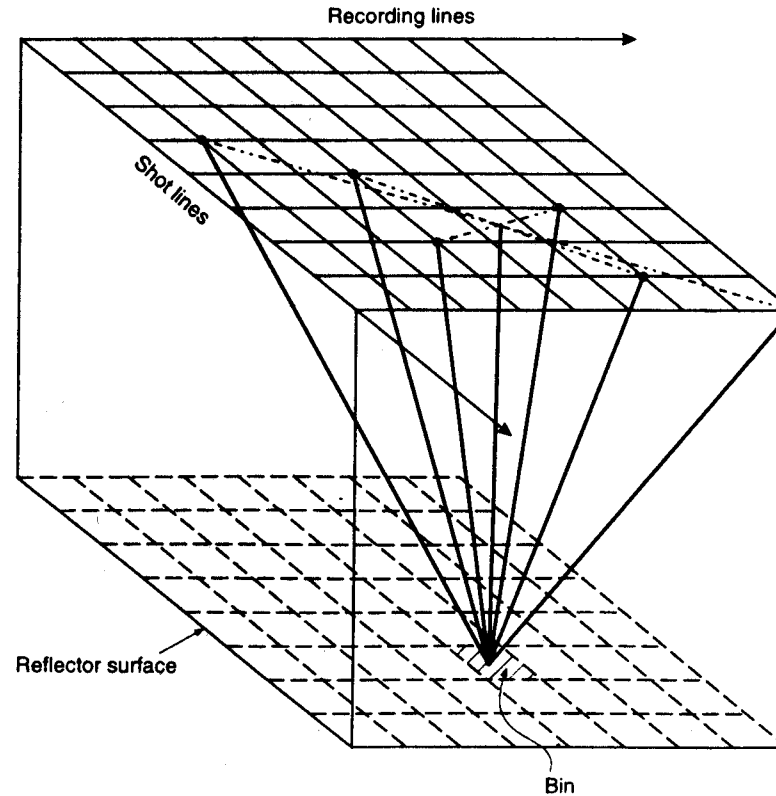Values

Editing

dead or
corrupted traces

Editing

Erased traces

Geometry

- Determine Source and receiver position for measured data
- Calculate CMP position
- Specify a certain **BIN** in which the measured trace belongs

Raypaths for a given bin

From Reynolds, 1997

Statics

Correction for Topography

"Uphole"-Statics using shots in Borehole

Refraction-Statics

Methods to determine the corrections

Delay-Time

GRM ("generalised reciprocal method")

DRM ("diminishing residual matrices")

surface consistent statics

Subdivision of time shift
  for source and Receiver

All traces with equal source are corrected for the time shift
  of the specific source

All traces with equal receiver are corrected for the time shift
  of the specific receiver

The statics correction is
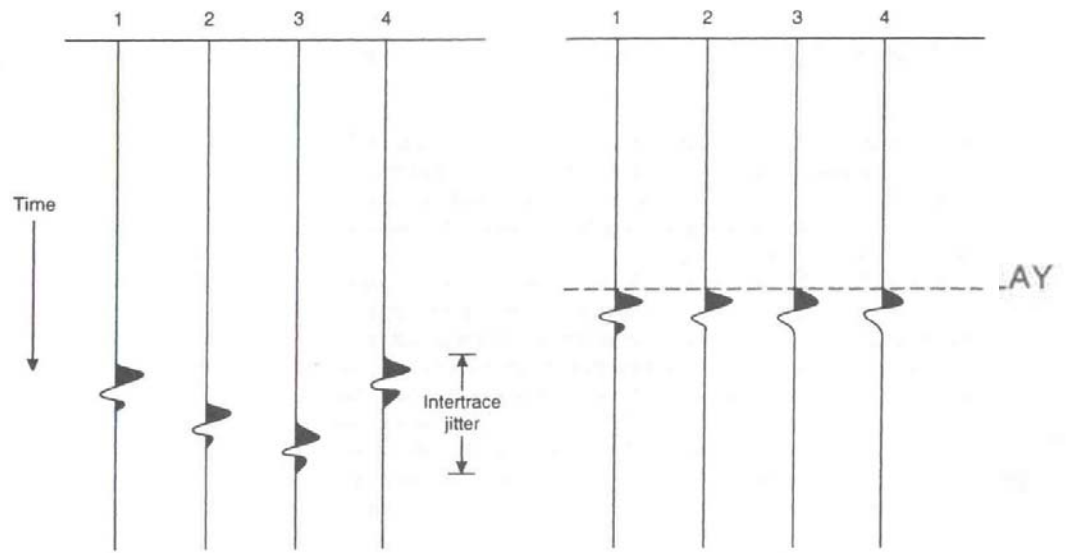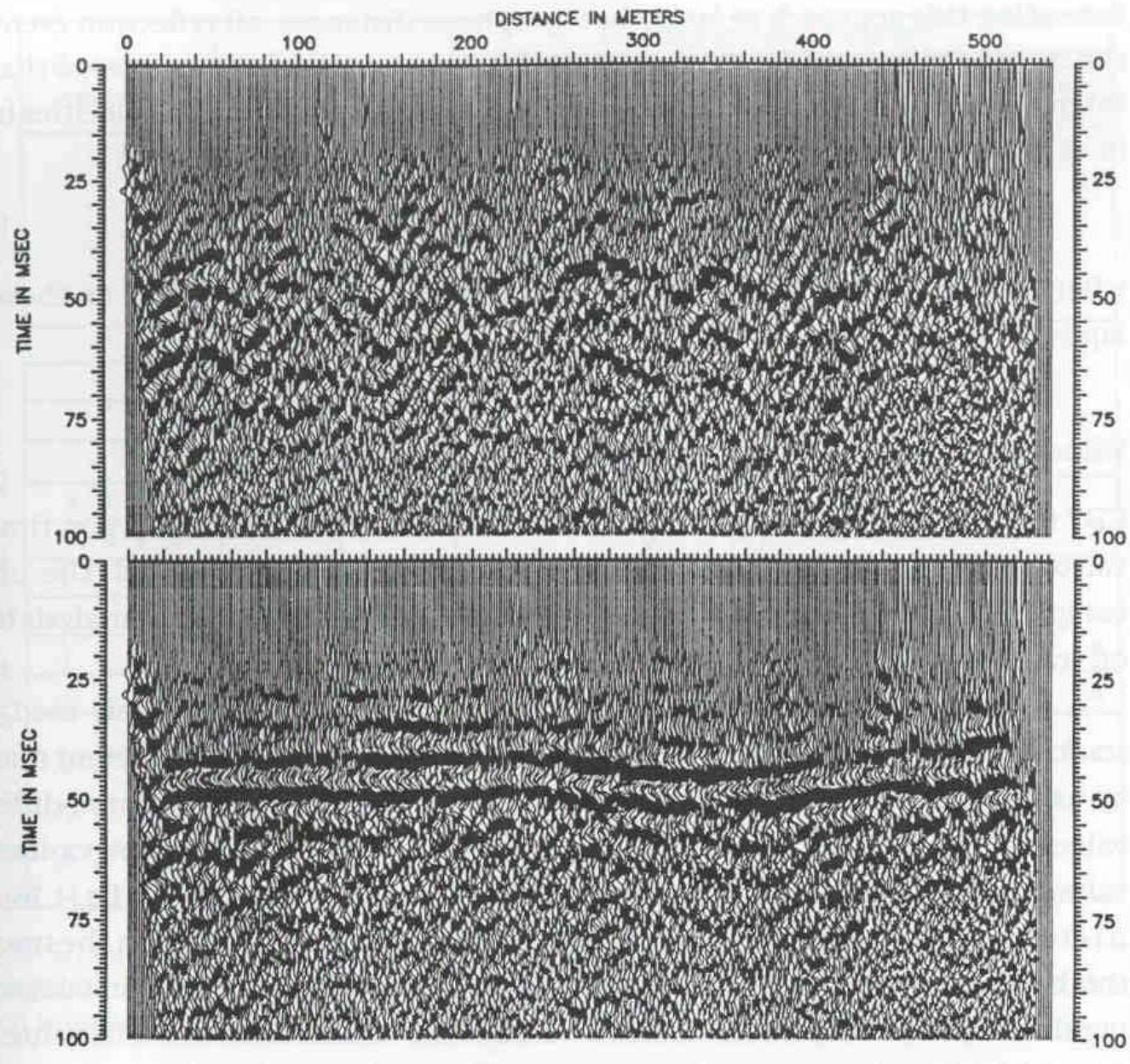 **The sum of the corrections for appropriate**
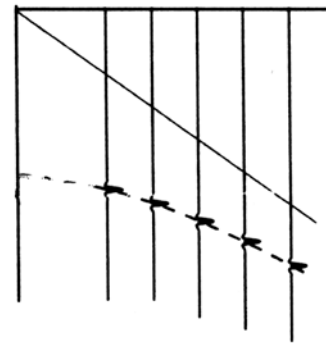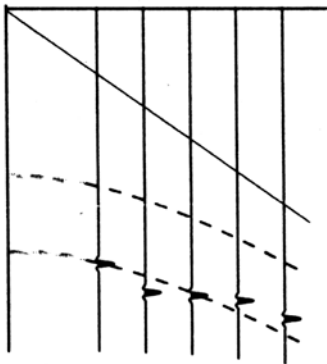 **source and receiver**

Datuming

DISTANCE IN METERS
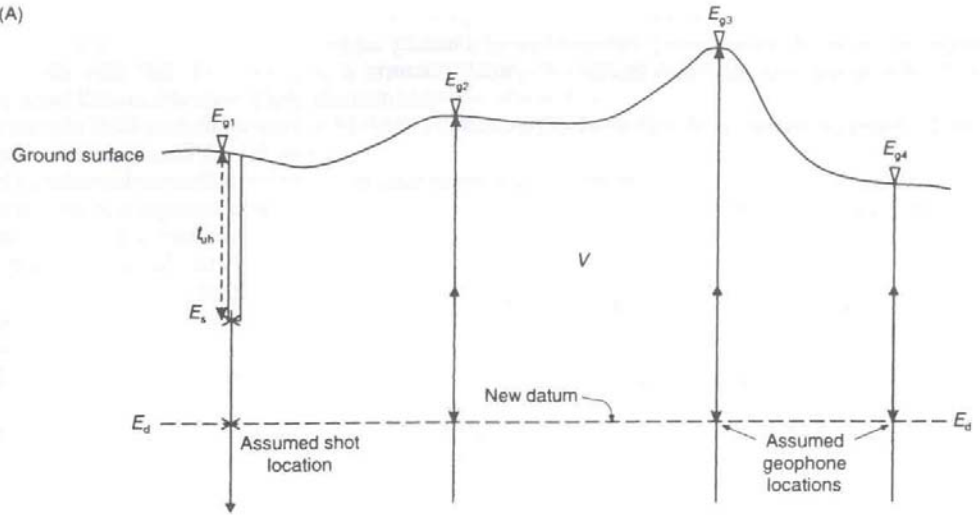
Static corrections

Muting of events