GFE Resources Ltd

WELL COMPLETION REPORT

LANGLEY-1

PPL 1

OTWAY BASIN, VICTORIA

compiled by

. *Kevin Lanigan*

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VOLUME 3

ENCLOSURES

Level 6, 6 Riverside Quay, Southbank, Victoria 3006 Telephone: (03) 9684-4888   Facsimile: (03) 9684-4897

PE600757

This is an enclosure indicator page.
The enclosure PE600757 is enclosed within the
   container PE900951 at this location in this
   document.

The enclosure PE600757 has the following characteristics:
        ITEM_BARCODE = PE600757
   CONTAINER_BARCODE = PE900951
                NAME = Composite well log
               BASIN = OTWAY
              PERMIT = PPL/1
                TYPE = WELL
             SUBTYPE = COMPOSITE_LOG
         DESCRIPTION = Composite well log (enclosure from WCR
                       vol.3) for Langley-1
             REMARKS =
        DATE_CREATED = 9/06/94
       DATE_RECEIVED =
                W_NO = W1099
           WELL_NAME = Langley-1
          CONTRACTOR = GFE Resources
         CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE600759

This is an enclosure indicator page.
The enclosure PE600759 is enclosed within the
   container PE900951 at this location in this
   document.

The enclosure PE600759 has the following characteristics:
         ITEM_BARCODE = PE600759
    CONTAINER_BARCODE = PE900951
                 NAME = Formation Evaluation Log
                BASIN = OTWAY
               PERMIT = PPL/1
                 TYPE = WELL
              SUBTYPE = MUD_LOG
          DESCRIPTION = Formation Evaluation Log/Mud Log
                        (enclosure from WCR vol.3) for
                        Langley-1
              REMARKS =
         DATE_CREATED = 2/06/94
        DATE_RECEIVED =
                 W_NO = W1099
            WELL_NAME = Langley-1
           CONTRACTOR = Baker Hughes Inteq
         CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE600761

This is an enclosure indicator page.
The enclosure PE600761 is enclosed within the
   container PE900951 at this location in this
   document.

The enclosure PE600761 has the following characteristics:
       ITEM_BARCODE = PE600761
  CONTAINER_BARCODE = PE900951
               NAME = Well log - DLL-MSFL-GR-SP-CALS
              BASIN = OTWAY
             PERMIT = PPL/1
               TYPE = WELL
            SUBTYPE = WELL_LOG
        DESCRIPTION = Well log - DLL-MSFL-GR-SP-CALS, Run#1,
                      1:200 (enclosure from WCR vol.3) for
                      Langley-1
            REMARKS =
       DATE_CREATED = 3/06/94
      DATE_RECEIVED =
               W_NO = W1099
          WELL_NAME = Langley-1
         CONTRACTOR = Schlumberger
       CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE600762

This is an enclosure indicator page.
The enclosure PE600762 is enclosed within the
    container PE900951 at this location in this
    document.

    The enclosure PE600762 has the following characteristics:
          ITEM_BARCODE = PE600762
     CONTAINER_BARCODE = PE900951
                  NAME = Well log - DLL-MSFL-GR-SP-CALS
                 BASIN = OTWAY
                PERMIT = PPL/1
                  TYPE = WELL
               SUBTYPE = WELL_LOG
           DESCRIPTION = Well log - DLL-MSFL-GR-SP-CALS, Run#1,
                         1:500, (enclosure from WCR vol.3) for
                         Langley-1
               REMARKS =
          DATE_CREATED = 3/06/94
         DATE_RECEIVED =
                  W_NO = W1099
             WELL_NAME = Langley-1
            CONTRACTOR = Schlumberger
          CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE600763

This is an enclosure indicator page.
The enclosure PE600763 is enclosed within the
    container PE900951 at this location in this
    document.

The enclosure PE600763 has the following characteristics:
         ITEM_BARCODE = PE600763
    CONTAINER_BARCODE = PE900951
                 NAME = Wel log- AS-GR-SO-CALS
                BASIN = OTWAY
               PERMIT = PPL/1
                 TYPE = WELL
              SUBTYPE = WELL_LOG
          DESCRIPTION = Wel log- AS-GR-SO-CALS, Run#1, 1:200,
                        (enclosure from WCR vol.3) for
                        Langley-1
              REMARKS =
         DATE_CREATED = 3/06/94
        DATE_RECEIVED =
                 W_NO = W1099
            WELL_NAME = Langley-1
           CONTRACTOR = Schlumberger
          CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE600764

This is an enclosure indicator page.
The enclosure PE600764 is enclosed within the
  container PE900951 at this location in this
  document.

The enclosure PE600764 has the following characteristics:
        ITEM_BARCODE = PE600764
   CONTAINER_BARCODE = PE900951
                NAME = Well log- AS-GR-SP-CALS
               BASIN = OTWAY
              PERMIT = PPL/1
                TYPE = WELL
             SUBTYPE = WELL_LOG
         DESCRIPTION = Well log- AS-GR-SP-CALS, Run#1, 1:500,
                       (enclosure from WCR vol.3) for
                       Langley-1
             REMARKS =
        DATE_CREATED = 3/06/94
       DATE_RECEIVED =
                W_NO = W1099
           WELL_NAME = Langley-1
          CONTRACTOR = Schlumberger
        CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE600765

This is an enclosure indicator page.
The enclosure PE600765 is enclosed within the
   container PE900951 at this location in this
   document.

The enclosure PE600765 has the following characteristics:
        ITEM_BARCODE = PE600765
   CONTAINER_BARCODE = PE900951
                NAME = Well log- LDL-CNL-GR-CALI
               BASIN = OTWAY
              PERMIT = PPL/1
                TYPE = WELL
             SUBTYPE = WELL_LOG
         DESCRIPTION = Well log- LDL-CNL-GR-CALI, Run#1,
                       1:200, (enclosure from WCR vol.3) for
                       Langley-1
             REMARKS =
        DATE_CREATED = 3/06/94
       DATE_RECEIVED =
                W_NO = W1099
           WELL_NAME = Langley-1
          CONTRACTOR = Schlumberger
        CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE604709

This is an enclosure indicator page.
The enclosure PE604709 is enclosed within the
    container PE900951 at this location in this
    document.

The enclosure PE604709 has the following characteristics:
        ITEM_BARCODE = PE604709
   CONTAINER_BARCODE = PE900951
                NAME = Well Log
               BASIN = OTWAY
              PERMIT = PPL1
                TYPE = WELL
             SUBTYPE = WELL_LOG
         DESCRIPTION = LDL-CNL-GR-CALI Log, 1:500,(enclosure
                       from WCR vol.3) for Langley-1
             REMARKS =
        DATE_CREATED = 3/06/94
       DATE_RECEIVED = 31/01/96
                W_NO = W1099
           WELL_NAME = LANGLEY-1
          CONTRACTOR = SCHLUMBERGER
        CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE600766

This is an enclosure indicator page.
The enclosure PE600766 is enclosed within the
  container PE900951 at this location in this
  document.

The enclosure PE600766 has the following characteristics:
```
       ITEM_BARCODE = PE600766
  CONTAINER_BARCODE = PE900951
               NAME = Well log- SHDT-GR
              BASIN = OTWAY
             PERMIT = PPL/1
               TYPE = WELL
            SUBTYPE = WELL_LOG
        DESCRIPTION = Well log- SHDT-GR, Run#1, 1:200,
                      (enclosure fom WCR vol.3) for Langley-1
                                                 REMARKS =
       DATE_CREATED = 5/06/94
      DATE_RECEIVED =
               W_NO = W1099
          WELL_NAME = Langley-1
         CONTRACTOR = Schlumberger
       CLIENT_OP_CO = GFE Resources Ltd
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE600767

This is an enclosure indicator page.
The enclosure PE600767 is enclosed within the
   container PE900951 at this location in this
   document.

The enclosure PE600767 has the following characteristics:
        ITEM_BARCODE = PE600767
   CONTAINER_BARCODE = PE900951
                NAME = Well log- HP-RFT-GR
               BASIN = OTWAY
              PERMIT = PPL/1
                TYPE = WELL
             SUBTYPE = WELL_LOG
         DESCRIPTION = Well log- HP-RFT-GR, Run#1, (enclosure
                       from WCR vol.3) for Langley-1

             REMARKS =
        DATE_CREATED = 5/06/94
       DATE_RECEIVED =
                W_NO = W1099
           WELL_NAME = Langley-1
          CONTRACTOR = Schlumberger
        CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE600768

This is an enclosure indicator page.
The enclosure PE600768 is enclosed within the
  container PE900951 at this location in this
  document.

The enclosure PE600768 has the following characteristics:
        ITEM_BARCODE = PE600768
   CONTAINER_BARCODE = PE900951
                NAME = Log Analysis (CPI)
               BASIN = OTWAY
              PERMIT = PPL/1
                TYPE = WELL
             SUBTYPE = WELL_LOG
         DESCRIPTION = Log Analysis/CPI (enclosure from WCR
                       vol.3) for Langley-1
             REMARKS =
        DATE_CREATED = 18/01/98
       DATE_RECEIVED =
                W_NO = W1099
           WELL_NAME = Langley-1
          CONTRACTOR =
        CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE900952

This is an enclosure indicator page.
The enclosure PE900952 is enclosed within the
    container PE900951 at this location in this
    document.

The enclosure PE900952 has the following characteristics:
        ITEM_BARCODE = PE900952
   CONTAINER_BARCODE = PE900951
                NAME = RFT - Pressure Test Report Sheet
               BASIN = OTWAY
              PERMIT = PPL/1
                TYPE = WELL
             SUBTYPE = RFT
         DESCRIPTION = RFT - Pressure Test report sheet
                       (enclosure from WCR vol.3) for
                       Langley-1
             REMARKS =
        DATE_CREATED = 5/06/94
       DATE_RECEIVED =
                W_NO = W1099
           WELL_NAME = Langley-1
          CONTRACTOR =
        CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE900953

This is an enclosure indicator page.
The enclosure PE900953 is enclosed within the
   container PE900951 at this location in this
   document.

The enclosure PE900953 has the following characteristics:
         ITEM_BARCODE = PE900953
    CONTAINER_BARCODE = PE900951
                 NAME = Check Shot Survey
                BASIN = OTWAY
               PERMIT = PPL/1
                 TYPE = WELL
              SUBTYPE = VELOCITY_CHART
          DESCRIPTION = Check Shot Survey (enclosure from WCR
                        vol.3) for Langley-1

              REMARKS =
         DATE_CREATED = 4/06/94
        DATE_RECEIVED =
                 W_NO = W1099
            WELL_NAME = Langley-1
           CONTRACTOR = Schlumberger
         CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE900954

This is an enclosure indicator page.
The enclosure PE900954 is enclosed within the
    container PE900951 at this location in this
    document.

The enclosure PE900954 has the following characteristics:
        ITEM_BARCODE = PE900954
   CONTAINER_BARCODE = PE900951
                NAME = Sidewall cores
               BASIN = OTWAY
              PERMIT = PPL/1
                TYPE = WELL
             SUBTYPE = LOG
         DESCRIPTION = Sidewall cores Log, Run#1, (enclosure
                       from WCR vol3) for Langley-1
             REMARKS =
        DATE_CREATED = 5/06/94
       DATE_RECEIVED =
                W_NO = W1099
           WELL_NAME = Langley-1
          CONTRACTOR = Schlumberger
         CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE900955

This is an enclosure indicator page.
The enclosure PE900955 is enclosed within the
   container PE900951 at this location in this
   document.

The enclosure PE900955 has the following characteristics:
        ITEM_BARCODE = PE900955
   CONTAINER_BARCODE = PE900951
                NAME = Stratigraphic Dipmeter Computation
               BASIN = OTWAY
              PERMIT = PPL/1
                TYPE = WELL
             SUBTYPE = WELL_LOG
         DESCRIPTION = Stratigraphic Dipmeter Computation/Mean
                       Square Dip, SHDT-GR, 1:200, (enclosure
                       from WCR vol.3) for Langley-1
             REMARKS =
        DATE_CREATED = 16/06/94
       DATE_RECEIVED =
                W_NO = W1099
           WELL_NAME = Langley-1
          CONTRACTOR = Schlumberger
        CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE900956

This is an enclosure indicator page.
The enclosure PE900956 is enclosed within the
   container PE900951 at this location in this
   document.

The enclosure PE900956 has the following characteristics:
        ITEM_BARCODE = PE900956
   CONTAINER_BARCODE = PE900951
                NAME = Stratigraphic Dipmeter Computation
               BASIN = OTWAY
              PERMIT = PPL/1
                TYPE = WELL
             SUBTYPE = WELL_LOG
         DESCRIPTION = Stratigraphic Dipmeter Computation/Mean
                       Square Dip, SHDT-GR, 1:500, (enclosure
                       from WCR vol.3) for Langley-1
             REMARKS =
        DATE_CREATED = 16/06/94
       DATE_RECEIVED =
                W_NO = W1099
           WELL_NAME = Langley-1
          CONTRACTOR = Schlumberger
        CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE900957

This is an enclosure indicator page.
The enclosure PE900957 is enclosed within the
   container PE900951 at this location in this
   document.

The enclosure PE900957 has the following characteristics:
         ITEM_BARCODE = PE900957
    CONTAINER_BARCODE = PE900951
                 NAME = Slowness Time Coherence Log
                BASIN = OTWAY
               PERMIT = PPL/1
                 TYPE = WELL
              SUBTYPE = WELL_LOG
          DESCRIPTION = Slowness Time Coherence Log (STC),
                        Melbourne Log Interpretation Centre,
                        Using Array Sonic Waveforms (enclosure
                        from WCR vol.3) for Langley-1

              REMARKS =
         DATE_CREATED = 15/06/94
        DATE_RECEIVED =
                 W_NO = W1099
            WELL_NAME = Langley-1
           CONTRACTOR = Schlumberger
         CLIENT_OP_CO = GFE Resources Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

Schlumberger

GFE RESOURCES LTD

Array Sonic Waveforms
STC Processing Report
LANGLEY - 1

FIELD	:	EXPLORATION
COUNTRY	:	AUSTRALIA
COORDINATES	:	038 35' 51.089" S
	:	142 56' 10.625" E
DATE OF SURVEY	:	15 JUNE 1994
REFERENCE NO.	:	SYJ.260400
INTERVAL	:	2000 - 1340 M

CONTENTS

PAGE

1. INTRODUCTION

The Acoustic Array Sonic Waveforms were recorded using a Sonic Digital Tool (SDT) at the **LANGLEY-1** well on the 15 June 1995.

The survey was acquired from 2000.0 M to 1340.0 M measured depth below KB.

Slowness Time Coherence (STC) was performed to find the slownesses of the compressional, shear and stoneley over zone 2000.0-1340.0 m . Plot 1 depicts all the results from STC computation while Plot 2 shows detailed coherency planes as well as filtered waveforms 1.

1.1 Digital Sonic Application

Present application of the Acoustic Waveforms processing include :

- Better ΔT measurement
- High Resolution
- Mechanical Properties (sanding, wellbore stability)
- Gas Detection
- Fracture Detection
- AVO Constrains
- Shear Synthetic Seismogram
- OVSP/WSP Constrains
- Pseudo Permeability
- Pseudo Fracture Width

1.2 Open Hole

Three main events can be identified in open hole waveforms :

- The compressional arrival
- The shear arrival, when $V_{shear} > V_{mud}$
- The stoneley arrival

The shear headwave is only present in the formation when the formation shear velocity is greater than the mud velocity, however, a pseudo shear can be generated by using the $\Delta T_{Stoneley}$.

The stoneley velocity is a complex function of the formation shear modulus, formation bulk density, borehole diameter, and borehole rigidity. 　 ＿

3

2. FIELD EQUIPMENT AND SURVEY PARAMETERS

Elevation KB	: 69.7 M
Elevation DF	: 69.3 M
Elevation GL	: 64.0 M
Tool Used	: Sonic Digital Tool (SDT)
Frequency Range	: 5 - 18 KHZ.
Sonic Array Used	: Long Spacing Linear Array (LLA)
Transmitter to Nearest -	
Receiver Distance	: 3.048 M (120 inches)
Tool Length	: 10.8 M
Tool Weight	: 271.25 Kg
Sampling Interval	: 10 μsec

The SDT Tool has an 8-receiver array with a receiver spacing of 15.24 cm (6 inches). The well was logged in an open hole with the Digital Sonic Tool in Long Linear mode (LLA) using a sampling rate of 10 μsec and a full recording time of 0 - 5000 μsec.

The 10 μsec sampling rate satisfies alias constrains and allows up to 5000 μsec of wavetrain to be recorded. Recording was made on the Schlumberger Cyber Service Unit (CSU) using LIS format.

3. SLOWNESS TIME PROCESSING

The objective of Slowness Time Coherence (STC) processing is to find the slownesses of all coherent non-dispersive propagating waves exited in the borehole as they pass of sonic receivers.

STC computes a peak vector of all the arrivals of the sonic waveform data from Array Sonic Tools. This peak vector of a wave component consists of eight elements associated with a peak coherence values in the slowness-time plane. Three main steps are carried out in the STC technique:

3.1   Pre-Processing

The SDT tool has 8 bit resolution. It outputs two types of waveform, one channel with normal gain applied, the other channel has a higher gain applied before the 8 bit truncation is performed. The high gain waveform channels and low gain channels are combined to enhance the dynamic range. Any DC level and t_0 were also removed in this processing.

4

3.2 Semblance   Processing

The Slowness Time Coherence processing is also known as Semblance Processing, see Figure 2 for the illustration of this method. At this stage, all the semblance coherence values are plotted in Slowness/Time (S/T) plane. Contours of coherence are formed within this plane and a number of peaks arise having the highest local coherence. The most coherent peaks give the Slowness and Time coordinates of an arrival; see Figure 3.

STC processing is also performed on the waveforms stored at the same depth but with different transmitter spacing as illustrated in Figure 4. This is so called *transmitter   mode*   which gives independent S/T planes.

3.3 Labelling

The coherence peaks are identified in the Slowness/Time planes as casing, compressional, shear, or stoneley events. A sophisticated tracking algorithm is invoked which recognises consistent data.
An independent ΔT is derived for both receiver and transmitter modes. Using the average permits a *borehole   correction* for tool tilt and rugose hole.

4. STC   RESULT

Reliable ΔTcomp., ΔT *shear* , ΔT*ston,* Poisson's Ratio and Vp/Vs are obtained over the whole processed interval.   The all STC results are displayed with the depth referred to measured depth.

4.1 STC   Display

The STC derived ΔTcomp., ΔT *shear*, ΔT*ston* including the results from the transmitter and receiver modes are displayed in the track 3 of the STC Plot 1. The gamma ray is also displayed in the second track, and the depth track contain caliper bit size curves.

The first track contains the Vp/Vs and the Poisson's Ratio determined from the compressional and shear slowness.

The second part of the Plot 1 is a quality control plots for both compressional-shear and stoneley arrivals are displayed at the bottom of the STC plot. These plots are only for the receiver mode.

The last track contains colour coded Variable Density Logs (VDL) of the filtered (5-15 kHz) first waveform. The middle track contains a plot of the STC planes calculated for every 15 m. The tracks contain S/T Projection results are the projection of the high coherence slownesses appear as hot colour and low coherence appear as cold colour.
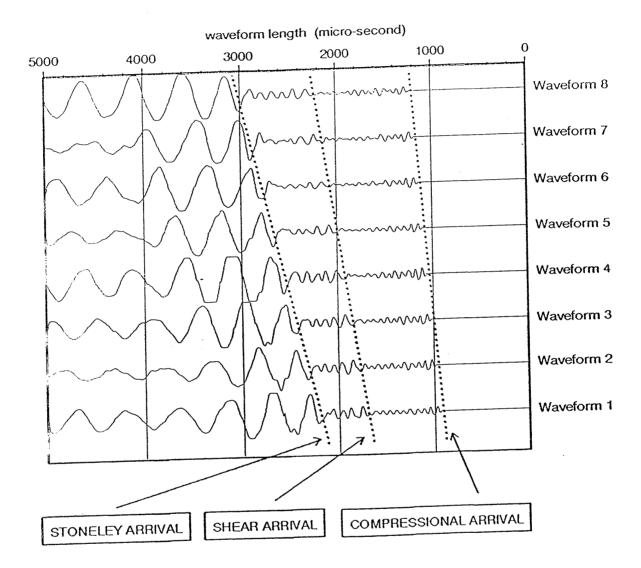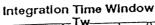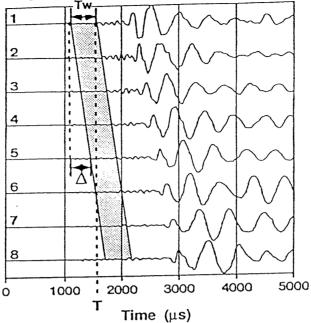
5

Figure 1 : Array Sonic Waveforms

Integration Time Window

Array Waveforms

Time (μs)

$$\text{"Semblance"} \qquad \sigma = \sqrt{\frac{1}{n} \cdot \frac{E_c(T,\Delta)}{E_i(T,\Delta)}}$$

where $E_i(T,\Delta)$ is the Incoherent Energy defined as:

$$E_i(T,\Delta) = \sum_{i=1}^{n} \int_{0}^{Tw} [\, x_i(t - [T + \Delta(z_i - z_1)]) \,]^2 \cdot dt$$

and $E_c(T,\Delta)$ is the Coherent Energy defined as:

$$E_c(T,\Delta) = \int_{0}^{Tw} [\, \sum_{i=1}^{n} x_i(t - [T + \Delta(z_i - z_1)]) \,]^2 \cdot dt$$

n is the number of receivers, $x_i(t)$ are the samples from waveform i, and z_i are the waveform depths.
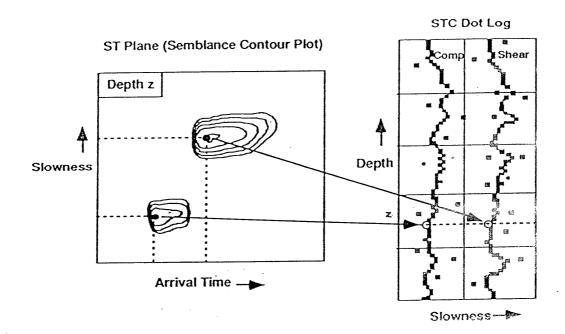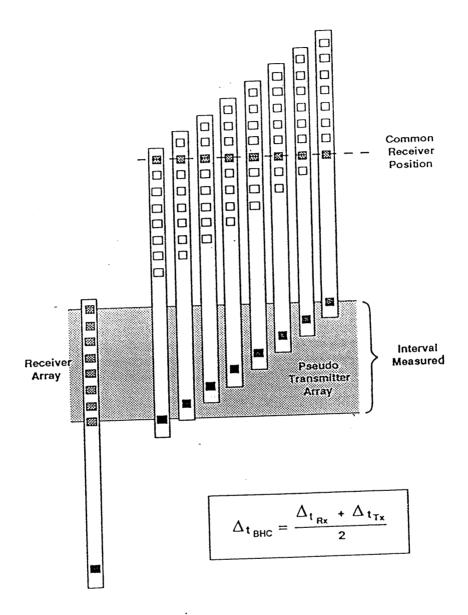
Figure 2 : Principle of STC *Semblance* Processing

ST Plane (Semblance Contour Plot)

STC Dot Log

Depth z

Slowness

Arrival Time ➤

Comp

Shear

Depth

z

Slowness ➤

Figure 3 : Coherency Peaks Display

$$\Delta t_{BHC} = \frac{\Delta t_{Rx} + \Delta t_{Tx}}{2}$$

Figure 4 : Bore Hole Compensation Mode