

Ljubljana, 22.05.2025

Naročnik : Minervo d.o.o  
Letališka 27a,  
1000 Ljubljana

## P O R O Č I L O

o meritvah potresnih učinkov miniranja v kamnolomu Podgora – Šmartno ob Paki v letu 2024

Meritve opravil:

Jure Primožič  
Predrag Daničić

Izdelal:

Predrag Daničić, mag.inž.geotehnol.

Direktor Vibrolab d.o.o.

Matevž Turk, dipl. ekon.

## 1. UVOD

Podjetje Minervo d.o.o Ljubljana je od 16.01.2024 do 11.12.2024 opravilo več miniranj v kamnolomu Podgora – Šmartno ob Paki. Neposredno z minerskimi deli so bile opravljene seizmične meritve z naslednjim namenom:

- izmeriti in ovrednotiti stresanja in zračni nadpritisk povzročen zaradi miniranja
- kontrola izbranih vrtno minerskih parametrov glede na seizmično varnost
- kot dokaz pri morebitnih poškodbah na bližnjih objektih

Seizmične meritve je opravil izvajalec podjetja Vibrolab d.o.o

## 2. MERILNA INSTRUMENTACIJA

Uporabljen je bil naslednji digitalni seizmograf:

- INSTANTEL – MICROMATE 21812
- INSTANTEL – MICROMATE 21813

Senzor registrira stresanja v vertikalni, longitudinalni (radialni) ter transversalni smeri. Postavljen je bil na temelju stanovanjske hiše. Električne napetosti, ki so vzbujene zaradi vibracij, so zabeležene v spomin instrumenta. Računalniško obdelane rezultate instrument izpiše grafično in numerično.

Merilna območja instrumentov so naslednja:

- Hitrost vibracij :

- INSTANTEL – MICROMATE : 0,127 – 254 mm/s

- Zračni nadpritisk :

- INSTANTEL – MICROMATE : 2 Pa (100dB) – 0,512kPa (5,12mbar oz.148dB)

Instrument se avtomatično kalibrira ter izpiše kalibracijski diagram

### 3. IZBIRA MERSKIH MEST

Mersko mesto je bilo izbrano v soglasju z naročnikom meritev. Senzor, ki je registriral stresanje, je bil postavljen na temelju naslednjega objekta:

MM1 - Dobrič 30, temelj

Oddaljenost merskega mest do mesta miniranja je bila od 400 m do 530 m.



**Slika 1. Mersko mesto**

#### 4. REZULTATI MERITEV

Preglednica 1:

| Datum miniranja | Eksploz. poln. na čas.int. q [kg/ms] | Hitrost vibracij V (mm/s) |                |                |                | Zračni tlak [mBar] | Oddaljenost merskega mesta [m] | Mersko mesto |
|-----------------|--------------------------------------|---------------------------|----------------|----------------|----------------|--------------------|--------------------------------|--------------|
|                 |                                      | V <sub>r</sub>            | V <sub>v</sub> | V <sub>t</sub> | V <sub>r</sub> |                    |                                |              |
| 16.01.24        | 29,16                                | 1,01                      | 1,15           | 0,81           | 1,3            | 0,01               | 420                            | MM1          |
| 16.01.24        | 32,08                                | 0,42                      | 0,5            | 0,42           | 0,66           | 0,006              | 410                            | MM1          |
| 28.02.24        | 28,8                                 | 1,73                      | 1,55           | 0,96           | 1,74           | 0,005              | 400                            | MM1          |
| 07.03.24        | 26,08                                | 1,25                      | 1,1            | 1,0            | 1,71           | 0,07               | 510                            | MM1          |
| 07.03.24        | 36,16                                | 0,84                      | 0,88           | 0,65           | 0,94           | 0,04               | 530                            | MM1          |
| 13.03.24        | 49,16                                | 0,95                      | 1,77           | 1,43           | 1,9            | 0,03               | 420                            | MM1          |
| 26.03.24        | 36,33                                | 0,75                      | 0,64           | 0,7            | 0,92           | 0,04               | 500                            | MM1          |
| 22.04.24        | 32,08                                | 0,8                       | 1,27           | 0,87           | 1,41           | 0,04               | 480                            | MM1          |
| 08.05.24        | 11,04                                | 1,15                      | 1,63           | 1,0            | 1,64           | 0,004              | 480                            | MM1          |
| 08.05.24        | 54,58                                | 0,6                       | 0,85           | 0,85           | 0,99           | 0,22               | 500                            | MM1          |
| 10.05.24        | 29,58                                | 1,01                      | 1,24           | 1,28           | 1,56           | 0,04               | 500                            | MM1          |
| 10.05.24        | 32,08                                | 0,78                      | 1,17           | 1,36           | 1,53           | 0,07               | 530                            | MM1          |
| 27.05.24        | 28,08                                | 0,69                      | 1,08           | 1,26           | 1,42           | 0,03               | 490                            | MM1          |
| 27.05.24        | 68,16                                | 0,61                      | 1,27           | 1,16           | 1,44           | 0,14               | 510                            | MM1          |
| 19.06.24        | 32,16                                | 1,87                      | 2,14           | 1,08           | 2,19           | 0,04               | 470                            | MM1          |
| 27.06.24        | 36,16                                | 0,85                      | 0,9            | 0,74           | 1,05           | 0,04               | 510                            | MM1          |
| 10.07.24        | 62,08                                | 0,94                      | 1,32           | 1,09           | 1,53           | 0,08               | 480                            | MM1          |
| 17.07.24        | 12,5                                 | 0,61                      | 0,85           | 0,53           | 1,07           | 0,006              | 450                            | MM1          |
| 27.09.24        | 59,16                                | 1,57                      | 1,53           | 1,93           | 2,16           | 0,25               | 470                            | MM1          |
| 19.11.24        | 29,58                                | 1,07                      | 1,4            | 1,22           | 1,84           | 0,01               | 400                            | MM1          |
| <b>19.11.24</b> | <b>44,16</b>                         | <b>1,86</b>               | <b>2,63</b>    | <b>2,02</b>    | <b>3,64</b>    | <b>0,01</b>        | <b>480</b>                     | <b>MM1</b>   |



|          |       |      |      |      |      |      |     |     |
|----------|-------|------|------|------|------|------|-----|-----|
| 11.12.24 | 3,75  | <0,5 | <0,5 | <0,5 | <0,5 | -    | 400 | MM1 |
| 11.12.24 | 29,58 | 1,82 | 2,06 | 2,14 | 2,85 | 0,04 | 440 | MM1 |

$V_r$  ....hitrost nihanja v longitudinalni (radialni) smeri

$V_t$  ....hitrost nihanja v transverzalni smeri

$V_v$  ....hitrost nihanja v vertikalni smeri

$V_r$  ....rezultirajoča hitrost nihanja

**Opomba:** Vrednosti, ki so v razpredelnici krepko napisane, so največje izmerjene vrednosti na izbranem objektu oziroma merskem mestu (MM).

## 5. KOMENTAR

### A. KRITERIJI ZA PRESOJO STRESANJ-POTRESOV

Stresljaji (potresi) pri miniranju so v direktni zvezi s količino razstreliva, ki je trenutno inicirana, oz. ki je inicirana v nekem milisekundnem intervalu. Na jakost potresa vplivajo tudi drugi faktorji kot so : vrsta tal po katerih se potres prenaša, način miniranja, oddaljenost itd. Ker so ti faktorji v glavnem določeni, in jih ne moremo spreminjati, ostane edini faktor s katerim vplivamo na velikost potresa količina razstreliva na milisekundni časovni interval oziroma na vrtino.

Drugi važen podatek je dovoljena meja potresa, ki nastane pri miniranju. Žal domačih normativov, ki bi urejali to problematiko, še ni, zato bomo uporabili po našem mnenju in izkušnjah najprimernejše tuje. Praviloma izbiramo najstrožje kriterije. Za primerjavo bomo uporabili naslednje :

- nemški DIN 4150
- avstrijske ÖNORM S 9020

Dovoljene meje so prikazane v preglednici 2.

Preglednica 2:

| DIN 4150       |                                          | ÖNORM S 9020   |                                          |
|----------------|------------------------------------------|----------------|------------------------------------------|
| Razred objekta | Dovoljena hitrost vibracije $V_i$ (mm/s) | Razred objekta | Dovoljena hitrost vibracije $V_r$ (mm/s) |
| I              | 20 – 50*                                 | I              | 30                                       |
| II             | 5 – 20*                                  | II             | 20                                       |
| III            | 3 – 10*                                  | III            | 10                                       |
|                |                                          | IV             | 5                                        |

\*... odvisno od frekvence - višja frekvenca ( 50 - 100 Hz ) dopušča višjo hitrost vibracije

$V_r$  ... rezultirajoča hitrost nihanja

$V_i$  ... največja od treh komponent nihanja

Objekt na merskem mestu MM1 bomo razdelili v II razred po DIN 4150 in II razred po ÖNORM S 9020 (stanovanjski objekti).

Avstrijski standard ÖNORM S 9020 dovoljuje obremenitev  $V_r = 20$  mm/s kot seizmično varnost za tovrstne objekte.

Najstrožji kriterij (DIN 4150) dovoljuje obremenitev :

Preglednica 3:

| II Razred                             |               |
|---------------------------------------|---------------|
| Dovoljena hitrost vibracije ( $V_i$ ) | Pri frekvenci |
| 5 mm/s                                | 0-10 Hz       |
| 8 mm/s                                | 20 Hz         |
| 10 mm/s                               | 30 Hz         |
| 15 mm/s                               | 50 Hz         |
| 20 mm/s                               | 100 Hz        |

## B. DOLOČANJE VARNOSTNIH RAZDALJ ZA ZAŠČITO PRED DELOVANJEM ZRAČNEGA UDARNEGA VALA.

To področje podrobno obravnava Uradni list RS št.111/2003 z dne 13.11.2003, Pravilnik o zahtevah za zagotavljanje varnosti in zdravja pri delu in o tehničnih ukrepih za dela pri razstreljevanju, kadar gre za raziskovanje in izkoriščanje mineralnih surovin, izvajanje drugih rudarskih del in izvajanje razstreljevalnih del v drugih dejavnostih, 184.člen, str.15214.

(1) Največje dovoljeno povečanje zračnega tlaka na čelu udarnega vala izmerjeno v naseljenih krajih, je odvisno od pogostosti detonacij, ki se določi po preglednici 4.

*Preglednica 4:*

| Pogostost detonacij oziroma razstreljevanj                                          | Največje dovoljeno povečanje zračnega tlaka pri detonaciji |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|
| Vsakodnevno razstreljevanje in razstreljevanje do dvakrat na teden po več detonacij | do 1 milibar (0,1 kPa)                                     |
| Največ dve detonaciji na teden                                                      | do 2 milibara (0,2 kPa)                                    |
| Enkratna razstreljevanja                                                            | do 3 milibare (0,3 kPa)                                    |

(2) Največje pričakovano povečanje zračnega tlaka na čelu zračnega udara pri milisekundnem razstreljevanju s položenimi minami oziroma z razstrelivom na površini se določi po diagramu na risbi iz pravilnika. (diagram velja za gospodarska razstreliva).

(3) Največje pričakovano povečanje zračnega tlaka na čelu zračnega udara pri tehnično pravilno izvedenem razstreljevanju z zamašenimi minskimi vrtnami se prav tako določi z diagramom iz pravilnika, in sicer tako, da se kot odločilna masa eksplozivnega polnjenja vzame sto petdeseti del količine razstreliva, ki detonira v intervalu 100 milisekund. Tako dobljeni količini se še doda količina razstreliva v detonacijski vrvici na površini.

## 6. SKLEPI

Iz rezultatov seizmičnih meritev opravljenih v času od 16.01.2024 do 11.12.2024 sklepam :

- meritve stresanj so bile opravljene v prisotnosti lastnikov objektov oz. stanovalcev
- nastavljen prag občutljivosti in hkrati samosprožitve instrumenta je bil pri MM1 na najnižjem nivoju 0,5 mm/s;
- izvajalec vrtno minerskih del ni presegel najstrožjega seizmičnega kriterija (DIN 4150) za stanovanjske objekte (tč.5 A).
- največje izmerjene vrednosti na posameznem objektu oziroma merskem mestu (MM):

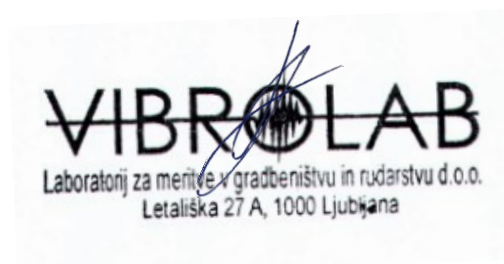
Preglednica 5:

| Datum miniranja | Merilno mesto           | Izmerjena hitrost nihanja (mm/s) | Izmerjena frekvenca (Hz) | Dovoljena hitrost nihanja, pri tej frekvenci (mm/s) | Izmerjena rezultanta (mm/s) | Dovoljena rezultanta (mm/s) |
|-----------------|-------------------------|----------------------------------|--------------------------|-----------------------------------------------------|-----------------------------|-----------------------------|
| 19.11.24        | MM1 – Dobrič 30, temelj | 2,63                             | 12,6                     | 5,7                                                 | 3,64                        | 20                          |

- pri analizi zračnega nadpritiska ugotavljam, da dopustne vrednosti, ki so navedene v veljavnih predpisih, niso bile presežene (tč.5 B). Največja izmerjena vrednost je bila **0,25 mbar**, pri navedeni pogostosti miniranja pa je dovoljena 1 mbar.
- za zmanjšanje motečih vplivov razstreljevanja (detonacija, tresenje tal) je bistvenega pomena predhodno obveščanje okoliškega prebivalstva, kajti če so ljudje pripravljeni na miniranje, ga občutijo mnogo bolj sprejemljivo
- glede na navedene ugotovitve sklepam, da miniranja niso povzročila nobenih poškodb in tudi drugače niso ogrožala ljudi in objektov.

Izdelal:

Predrag Daničić, mag.inž.geotehnol.





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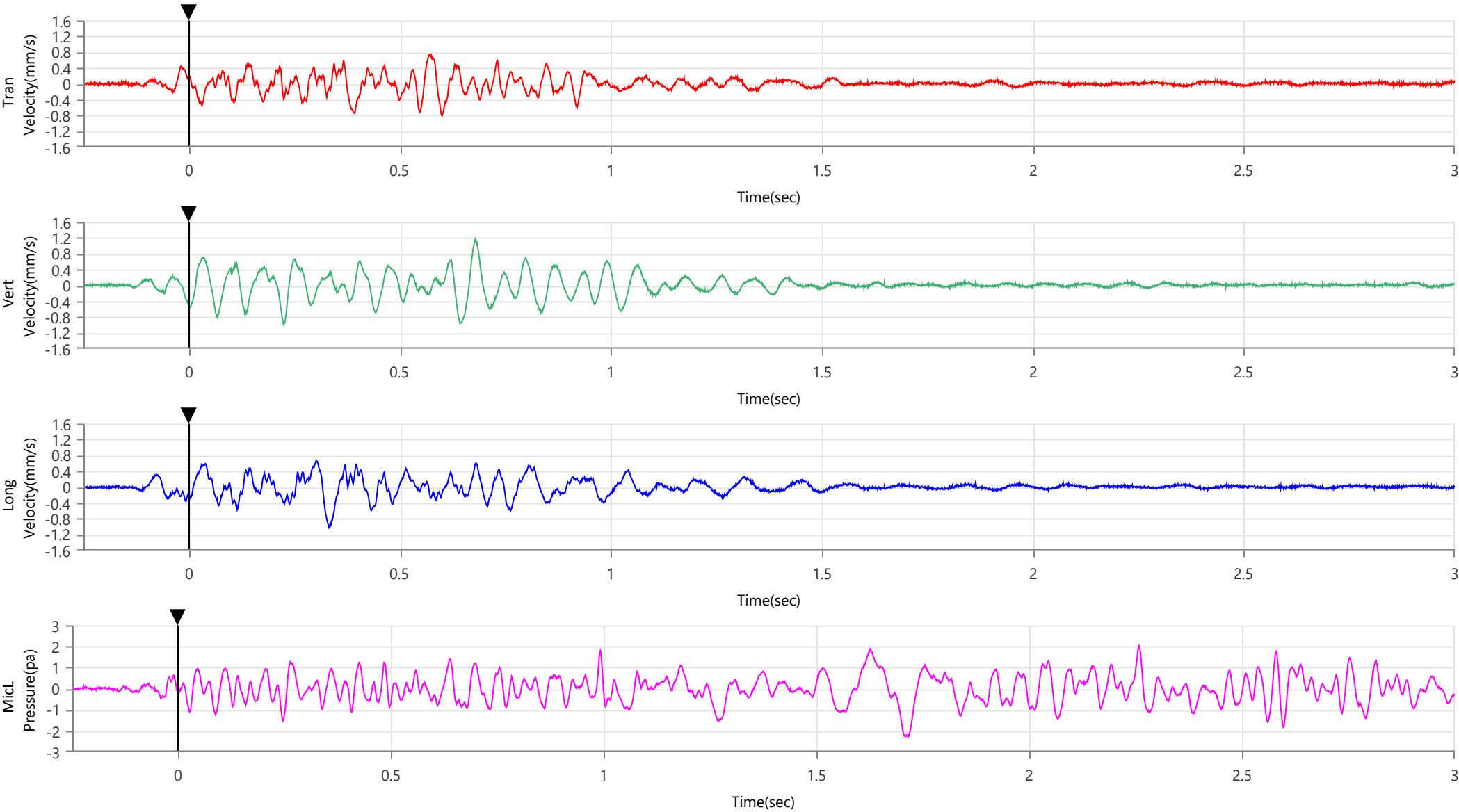
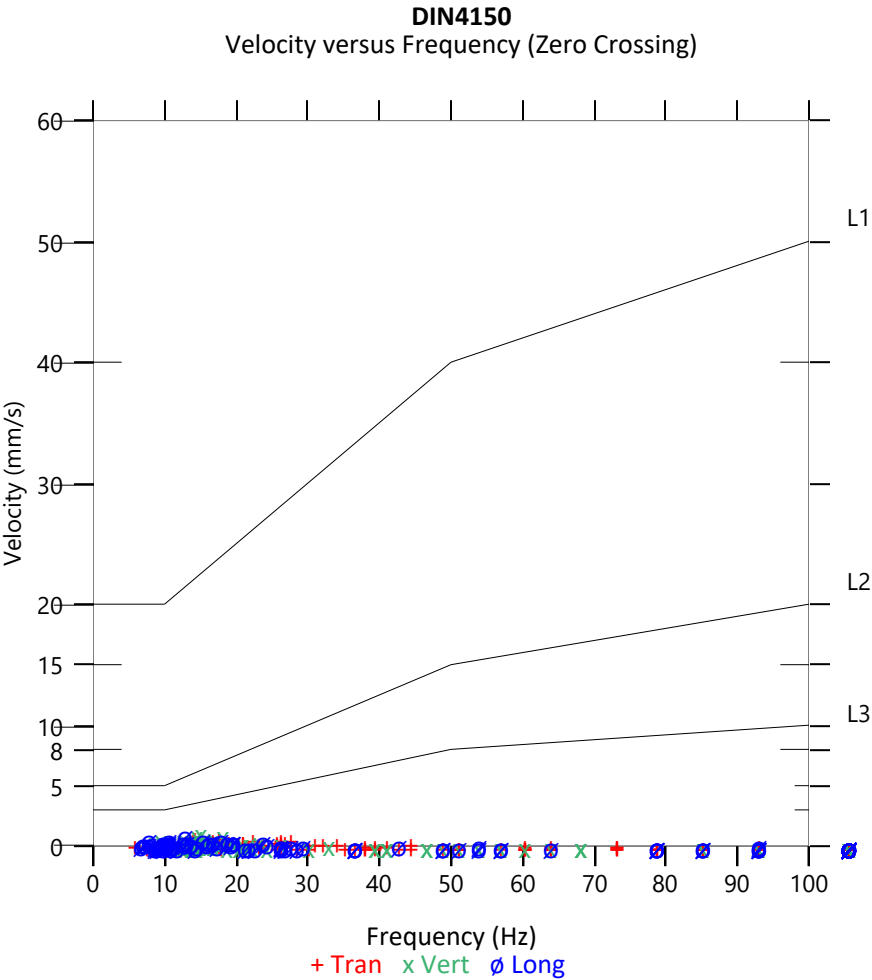
|                         |                                   |                    |                             |
|-------------------------|-----------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Vert at January 16, 2024 11:22:38 | Serial Number      | UM21812                     |
| Trigger Level(s)        | Geo 0.500 mm/s                    | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)            | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)          | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                          | Event File Name    | UM21812_20240116112238.IDFW |
| Setup File Name         | factory.MMB                       | USB Sensor Support | Disabled                    |
| Operator                | Predrag                           |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 420m/29,16kg/ Merilec: Jure Primožič

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 0.812 mm/s              | 1.159 mm/s | 1.017 mm/s |
| Zero Crossing Frequency    | 17.7 Hz                 | 15.1 Hz    | 13.0 Hz    |
| Time (Relative to Trigger) | 0.600 sec               | 0.679 sec  | 0.332 sec  |
| Peak Acceleration          | 0.021 g                 | 0.023 g    | 0.020 g    |
| Peak Displacement          | 0.008 mm                | 0.011 mm   | 0.012 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.3                     | 4.0        | 4.1        |
| Peak Vector Sum            | 1.301 mm/s at 0.679 sec |            |            |

|                            |             |
|----------------------------|-------------|
| ISEE Linear Microphone     |             |
| Peak Sound Pressure Level  | 2.27 pa     |
| Peak Sound Pressure Level  | 101.1 dB(L) |
| Time (Relative to Trigger) | 1.707 sec   |
| Zero Crossing Frequency    | 7.4 Hz      |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1526 mv     |





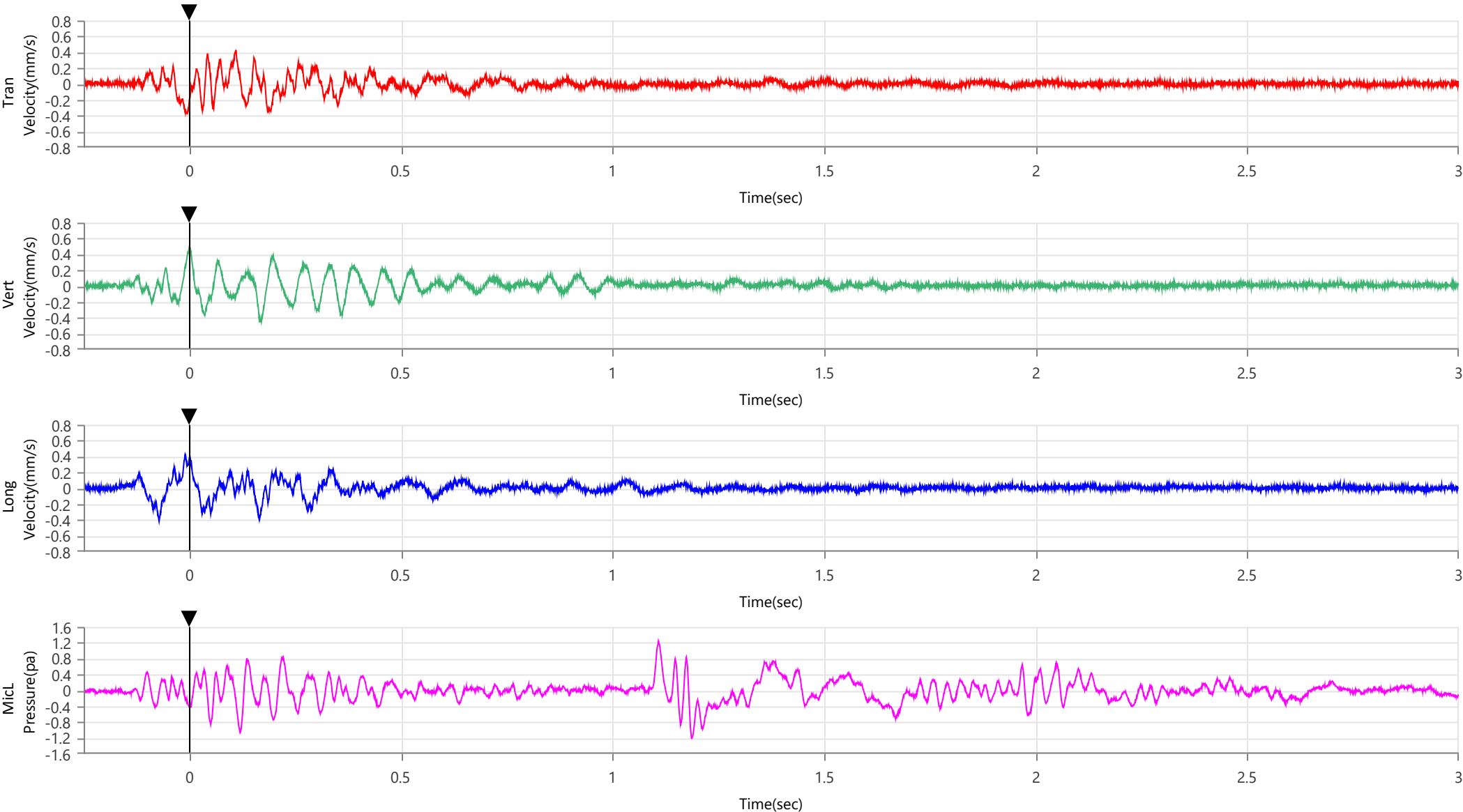
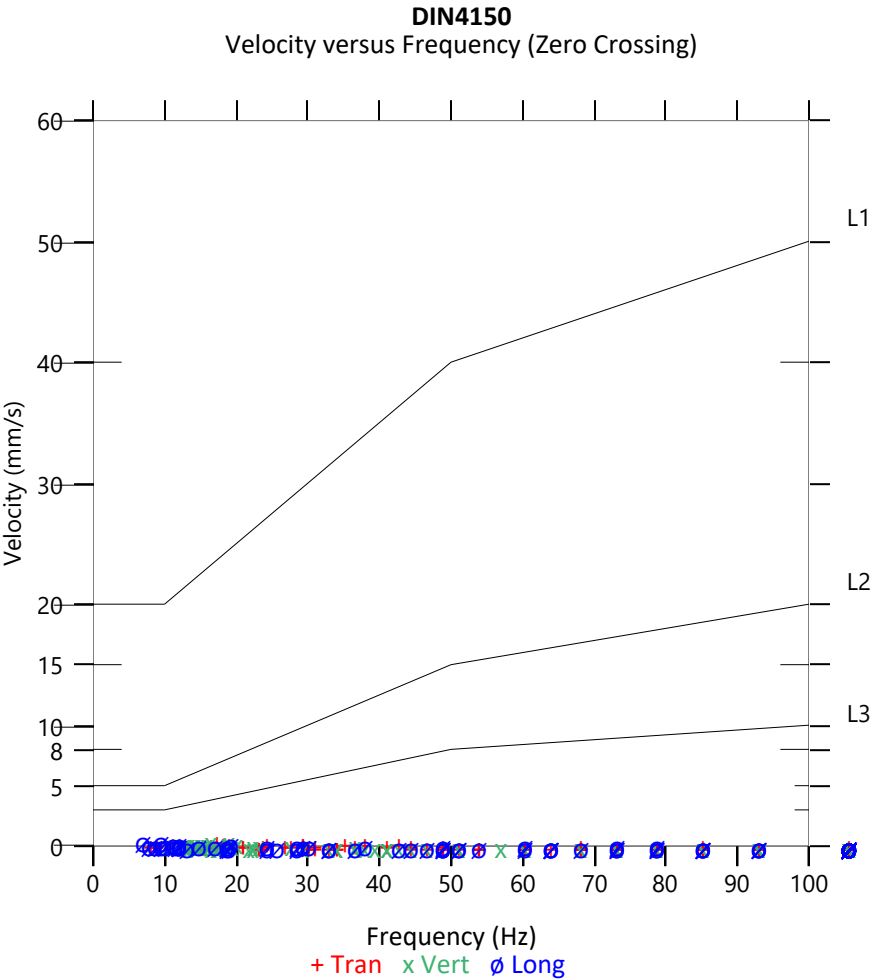
|                         |                                   |                    |                             |
|-------------------------|-----------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Vert at January 16, 2024 11:23:59 | Serial Number      | UM21812                     |
| Trigger Level(s)        | Geo 0.500 mm/s                    | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)            | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)          | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                          | Event File Name    | UM21812_20240116112359.IDFW |
| Setup File Name         | factory.MMB                       | USB Sensor Support | Disabled                    |
| Operator                | Predrag                           |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes   Lokacija: kamnolom Podgora/   Naročnik: Minervo d.o.o/   Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 410m/32,08kg/ Merilec: Jure Primožič

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 0.426 mm/s              | 0.504 mm/s | 0.426 mm/s |
| Zero Crossing Frequency    | 17.1 Hz                 | 16.8 Hz    | 7.2 Hz     |
| Time (Relative to Trigger) | 0.110 sec               | 0.000 sec  | -0.010 sec |
| Peak Acceleration          | 0.016 g                 | 0.015 g    | 0.015 g    |
| Peak Displacement          | 0.004 mm                | 0.004 mm   | 0.006 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.3                     | 4.0        | 4.1        |
| Peak Vector Sum            | 0.663 mm/s at 0.000 sec |            |            |

|                            |            |
|----------------------------|------------|
| ISEE Linear Microphone     |            |
| Peak Sound Pressure Level  | 1.24 pa    |
| Peak Sound Pressure Level  | 95.9 dB(L) |
| Time (Relative to Trigger) | 1.108 sec  |
| Zero Crossing Frequency    | 12.8 Hz    |
| Sensor Check               | ✓ Passed   |
| Frequency                  | 20.5 Hz    |
| Test Amplitude             | 1526 mv    |







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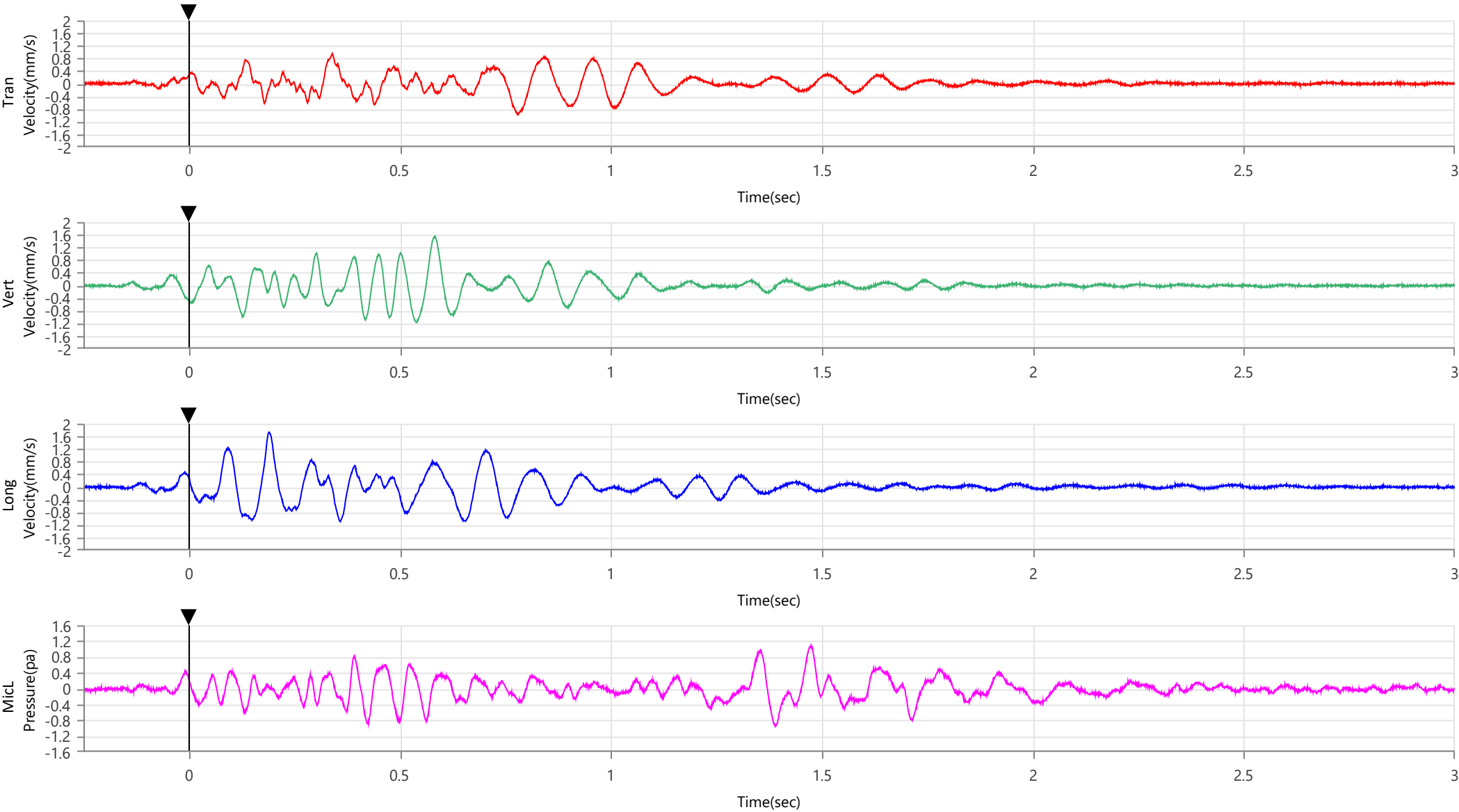
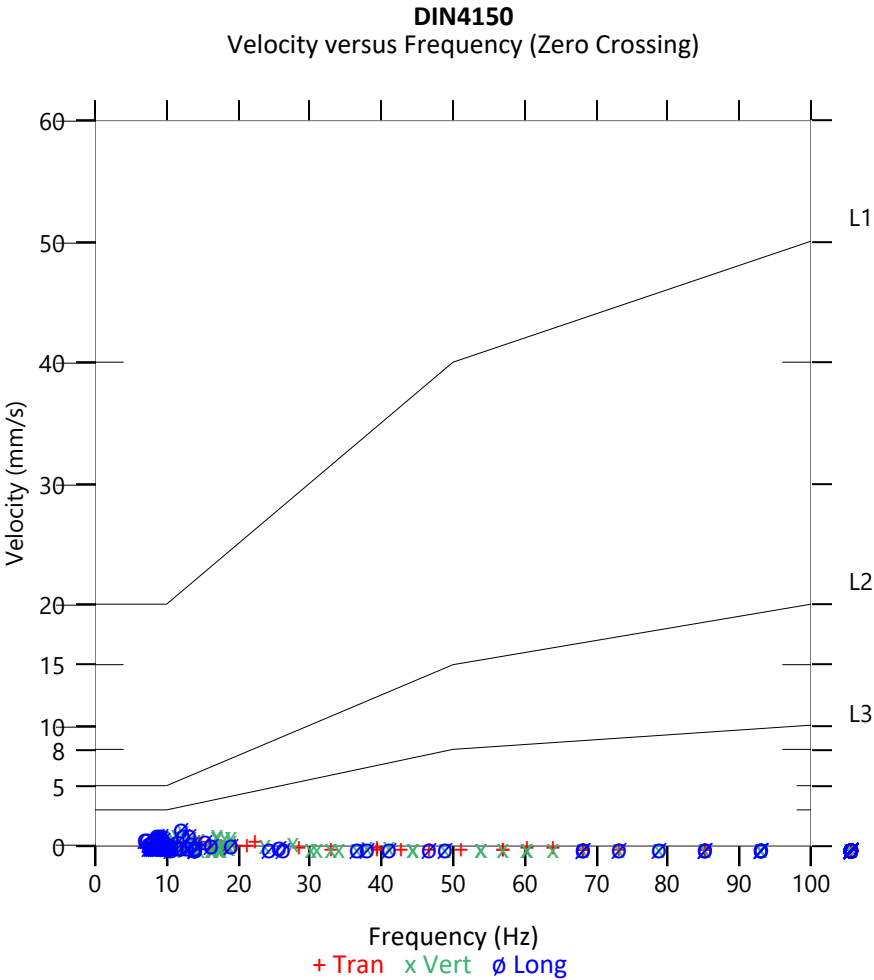
|                         |                                    |                    |                             |
|-------------------------|------------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Vert at February 28, 2024 10:09:53 | Serial Number      | UM21812                     |
| Trigger Level(s)        | Geo 0.500 mm/s                     | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)             | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)           | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                           | Event File Name    | UM21812_20240228100953.IDFW |
| Setup File Name         | factory.MMB                        | USB Sensor Support | Disabled                    |
| Operator                | Predrag                            |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes   Lokacija: kamnolom Podgora/   Naročnik: Minervo d.o.o/   Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 400m/28,8kg/ Merilec: Predrag Daničić

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 0.969 mm/s              | 1.553 mm/s | 1.734 mm/s |
| Zero Crossing Frequency    | 8.9 Hz                  | 12.2 Hz    | 12.0 Hz    |
| Time (Relative to Trigger) | 0.780 sec               | 0.583 sec  | 0.190 sec  |
| Peak Acceleration          | 0.020 g                 | 0.020 g    | 0.020 g    |
| Peak Displacement          | 0.016 mm                | 0.019 mm   | 0.022 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.3 Hz     |
| Overswing Ratio            | 4.3                     | 3.9        | 3.8        |
| Peak Vector Sum            | 1.745 mm/s at 0.190 sec |            |            |

|                            |            |
|----------------------------|------------|
| ISEE Linear Microphone     |            |
| Peak Sound Pressure Level  | 1.09 pa    |
| Peak Sound Pressure Level  | 94.7 dB(L) |
| Time (Relative to Trigger) | 1.475 sec  |
| Zero Crossing Frequency    | 12.5 Hz    |
| Sensor Check               | ✓ Passed   |
| Frequency                  | 20.5 Hz    |
| Test Amplitude             | 1424 mv    |





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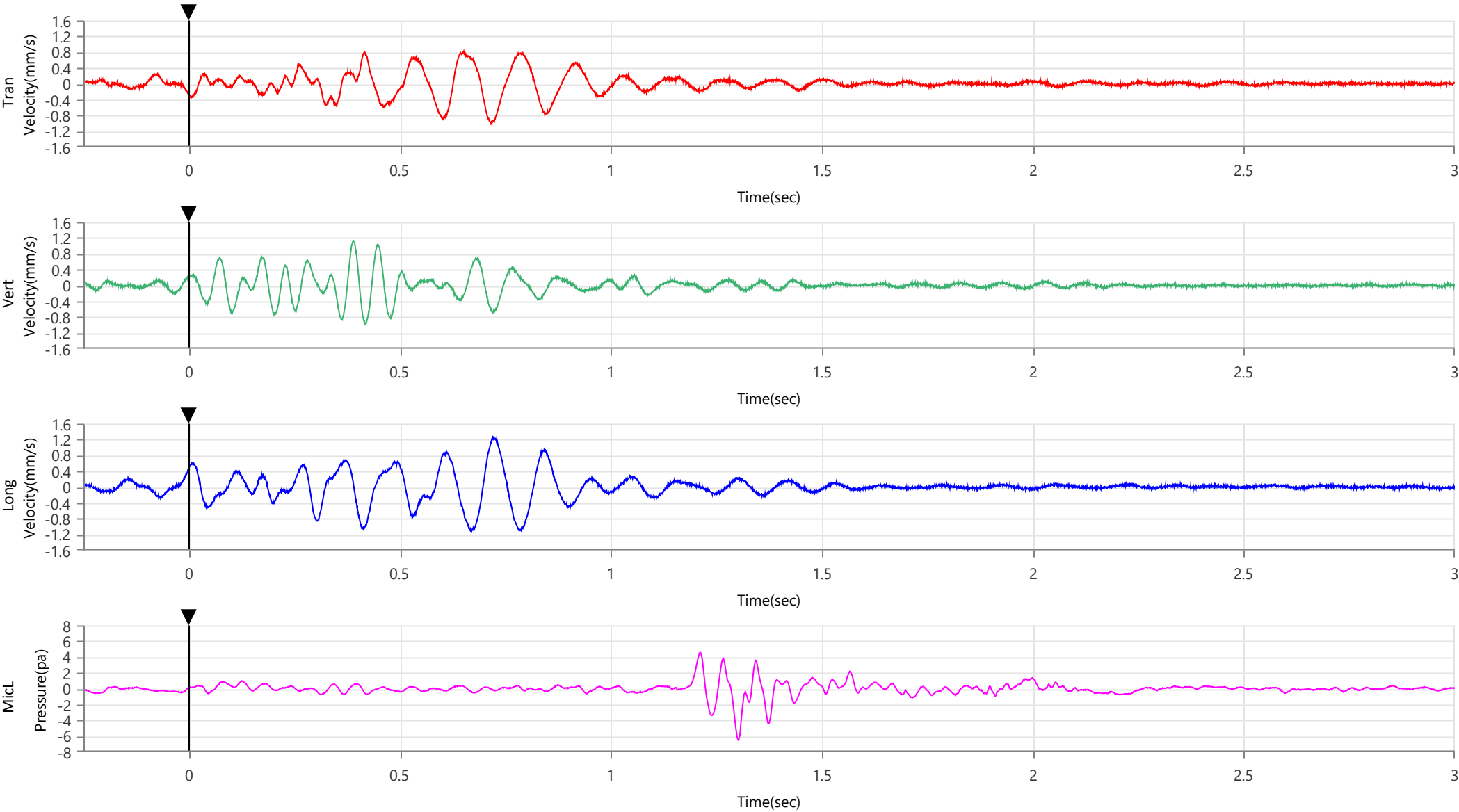
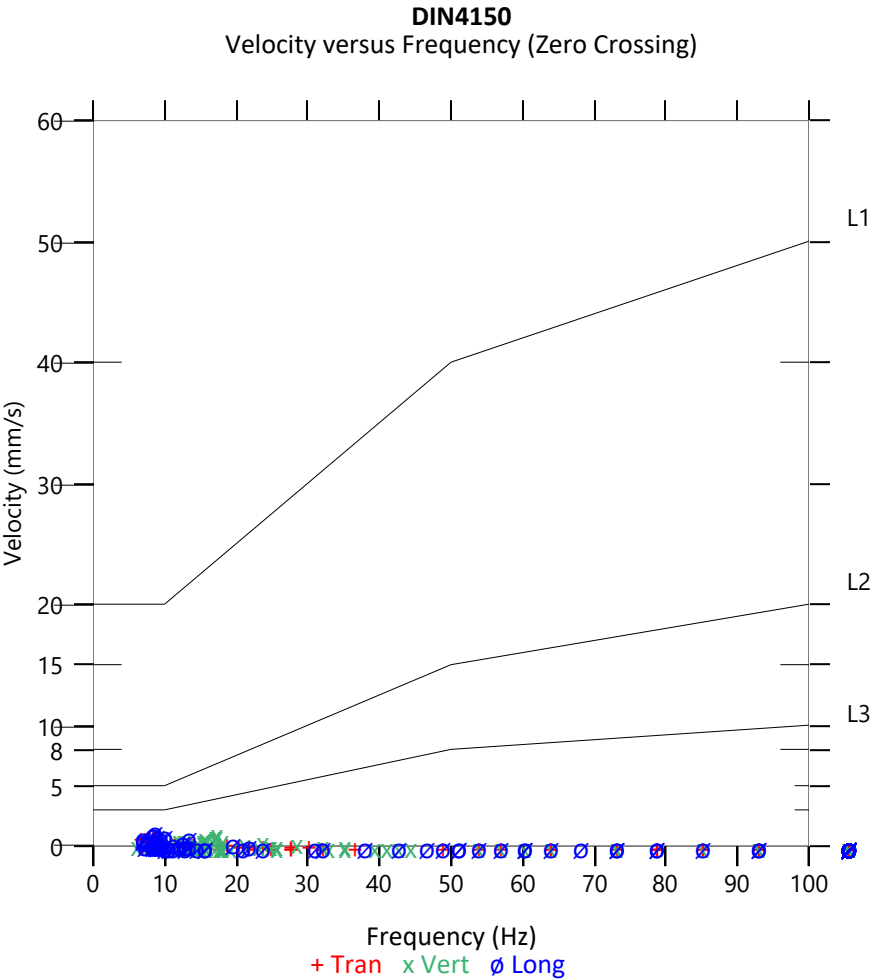
|                         |                                |                    |                             |
|-------------------------|--------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Long at March 7, 2024 11:41:58 | Serial Number      | UM21812                     |
| Trigger Level(s)        | Geo 0.500 mm/s                 | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)         | Battery Level      | 3.7 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)       | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                       | Event File Name    | UM21812_20240307114158.IDFW |
| Setup File Name         | factory.MMB                    | USB Sensor Support | Disabled                    |
| Operator                | Predrag                        |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes   Lokacija: kamnolom Podgora/   Naročnik: Minervo d.o.o/   Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 510m/26,08kg/   Merilec: Jure Primožič

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 1.009 mm/s              | 1.135 mm/s | 1.253 mm/s |
| Zero Crossing Frequency    | 8.7 Hz                  | 17.4 Hz    | 8.6 Hz     |
| Time (Relative to Trigger) | 0.716 sec               | 0.389 sec  | 0.721 sec  |
| Peak Acceleration          | 0.015 g                 | 0.020 g    | 0.016 g    |
| Peak Displacement          | 0.018 mm                | 0.010 mm   | 0.022 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.3                     | 4.0        | 4.1        |
| Peak Vector Sum            | 1.710 mm/s at 0.719 sec |            |            |

|                            |             |
|----------------------------|-------------|
| ISEE Linear Microphone     |             |
| Peak Sound Pressure Level  | 6.52 pa     |
| Peak Sound Pressure Level  | 110.3 dB(L) |
| Time (Relative to Trigger) | 1.302 sec   |
| Zero Crossing Frequency    | 10.1 Hz     |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1479 mv     |





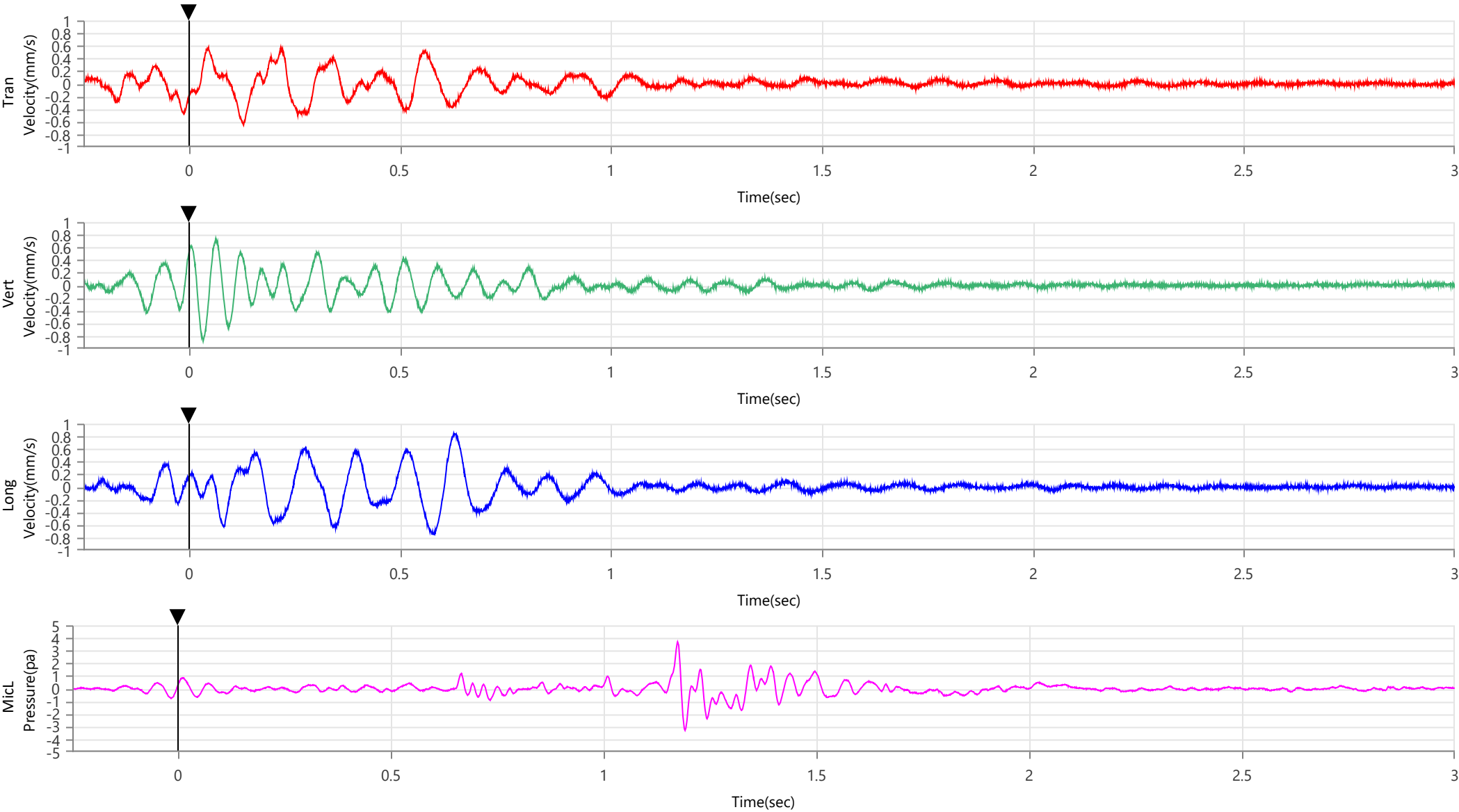
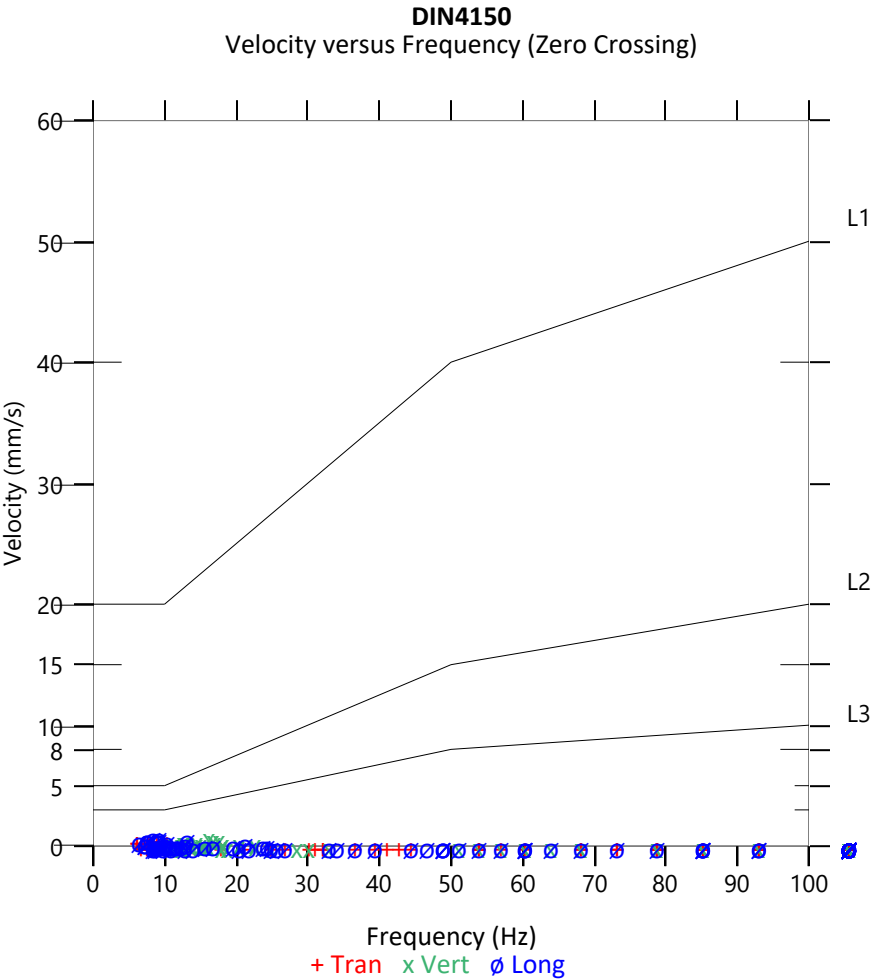
|                         |                                |                    |                             |
|-------------------------|--------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Vert at March 7, 2024 11:42:57 | Serial Number      | UM21812                     |
| Trigger Level(s)        | Geo 0.500 mm/s                 | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)         | Battery Level      | 3.7 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)       | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                       | Event File Name    | UM21812_20240307114257.IDFW |
| Setup File Name         | factory.MMB                    | USB Sensor Support | Disabled                    |
| Operator                | Predrag                        |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes   Lokacija: kamnolom Podgora/   Naročnik: Minervo d.o.o/   Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 530m/36,16kg/ Merilec: Jure Primožič

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 0.654 mm/s              | 0.883 mm/s | 0.843 mm/s |
| Zero Crossing Frequency    | 9.1 Hz                  | 16.5 Hz    | 9.4 Hz     |
| Time (Relative to Trigger) | 0.129 sec               | 0.034 sec  | 0.627 sec  |
| Peak Acceleration          | 0.013 g                 | 0.018 g    | 0.016 g    |
| Peak Displacement          | 0.011 mm                | 0.008 mm   | 0.014 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.3                     | 4.0        | 4.1        |
| Peak Vector Sum            | 0.943 mm/s at 0.034 sec |            |            |

|                            |             |
|----------------------------|-------------|
| ISEE Linear Microphone     |             |
| Peak Sound Pressure Level  | 3.69 pa     |
| Peak Sound Pressure Level  | 105.3 dB(L) |
| Time (Relative to Trigger) | 1.173 sec   |
| Zero Crossing Frequency    | 16.0 Hz     |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1479 mv     |





Vibrolab d.o.o

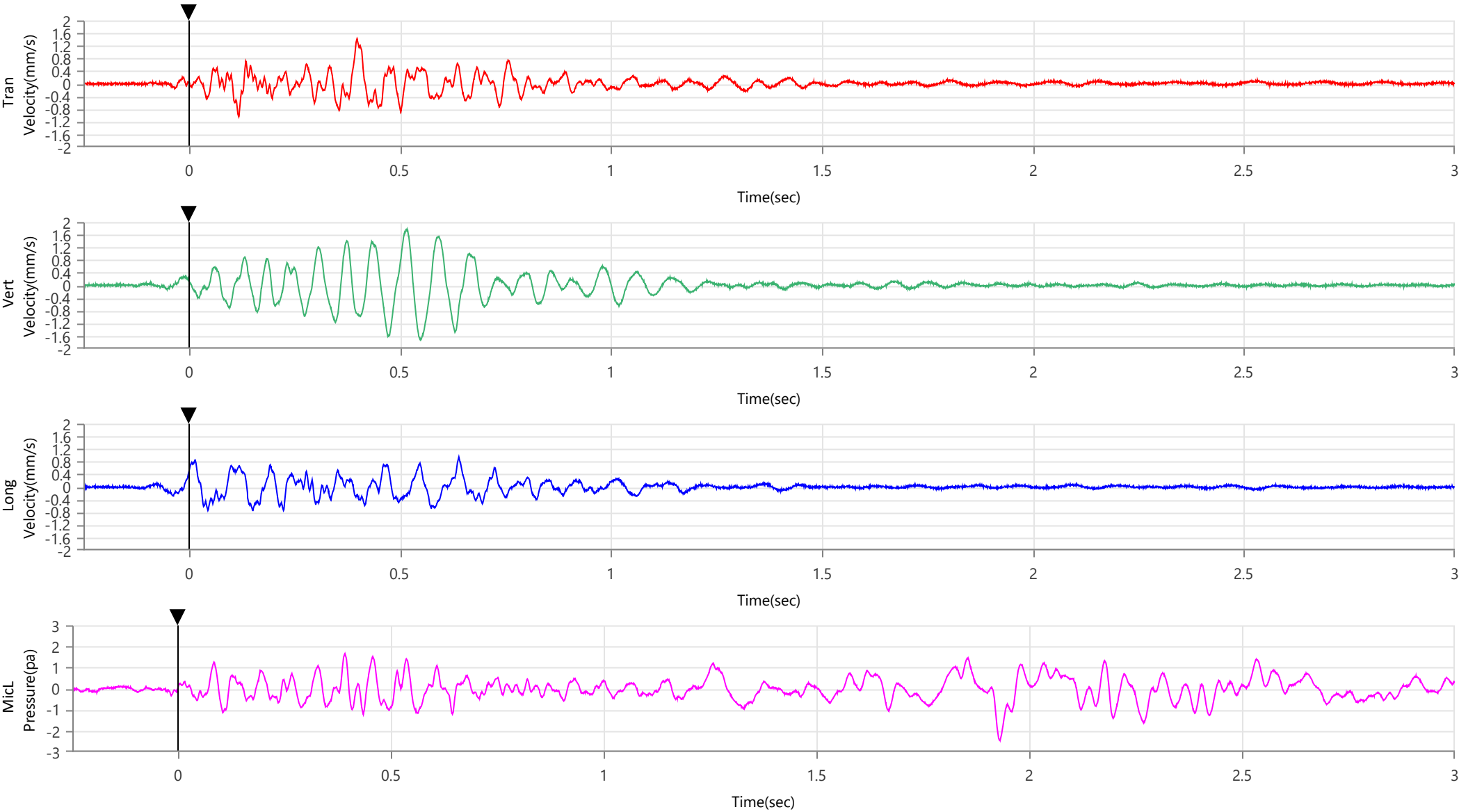
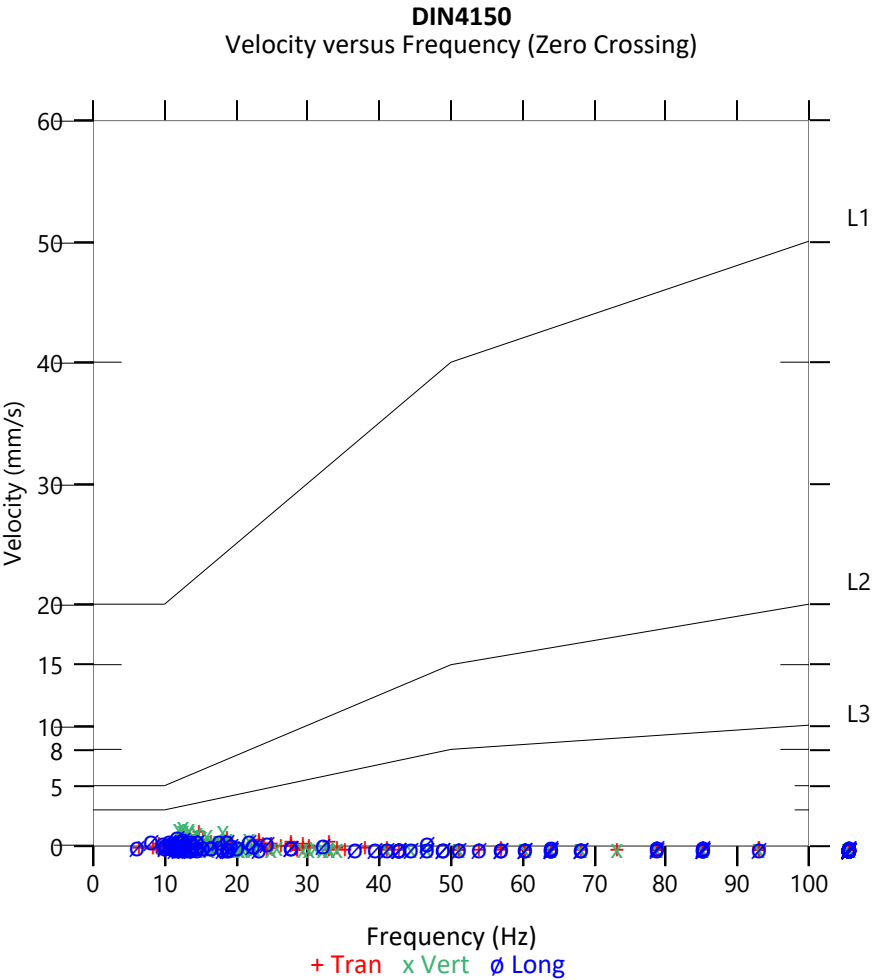
|                         |                                 |                    |                             |
|-------------------------|---------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Long at March 13, 2024 10:30:59 | Serial Number      | UM21812                     |
| Trigger Level(s)        | Geo 0.500 mm/s                  | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)          | Battery Level      | 3.7 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)        | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                        | Event File Name    | UM21812_20240313103059.IDFW |
| Setup File Name         | factory.MMB                     | USB Sensor Support | Disabled                    |
| Operator                | Predrag                         |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 500m/36,33kg/ Merilec: Predrag Daničić

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 1.427 mm/s              | 1.773 mm/s | 0.946 mm/s |
| Zero Crossing Frequency    | 15.1 Hz                 | 12.5 Hz    | 12.0 Hz    |
| Time (Relative to Trigger) | 0.398 sec               | 0.517 sec  | 0.640 sec  |
| Peak Acceleration          | 0.028 g                 | 0.035 g    | 0.036 g    |
| Peak Displacement          | 0.014 mm                | 0.022 mm   | 0.012 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.3                     | 3.9        | 4.0        |
| Peak Vector Sum            | 1.901 mm/s at 0.548 sec |            |            |

|                            |             |
|----------------------------|-------------|
| ISEE Linear Microphone     |             |
| Peak Sound Pressure Level  | 2.45 pa     |
| Peak Sound Pressure Level  | 101.8 dB(L) |
| Time (Relative to Trigger) | 1.931 sec   |
| Zero Crossing Frequency    | 9.3 Hz      |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1379 mv     |





Vibrolab d.o.o

Waveform Trigger Source  
Trigger Level(s)  
Trigger Level (Mic)  
Pre-Trigger/Record Time  
Sample Rate  
Setup File Name  
Operator

Tran at March 26, 2024 10:50:16  
Geo 0.500 mm/s  
Mic 2.00 pa, 100 dB(L)  
0.25 sec/3.0 sec (Fixed)  
2048 sps  
factory.MMB  
Predrag

Serial Number  
Model Number  
Battery Level  
Unit Calibration  
Event File Name  
USB Sensor Support

UM21812  
Micromate DIN 10.90GC  
3.6 volts  
July 14, 2023 by Instantel  
UM21812\_20240326105016.IDFW  
Disabled

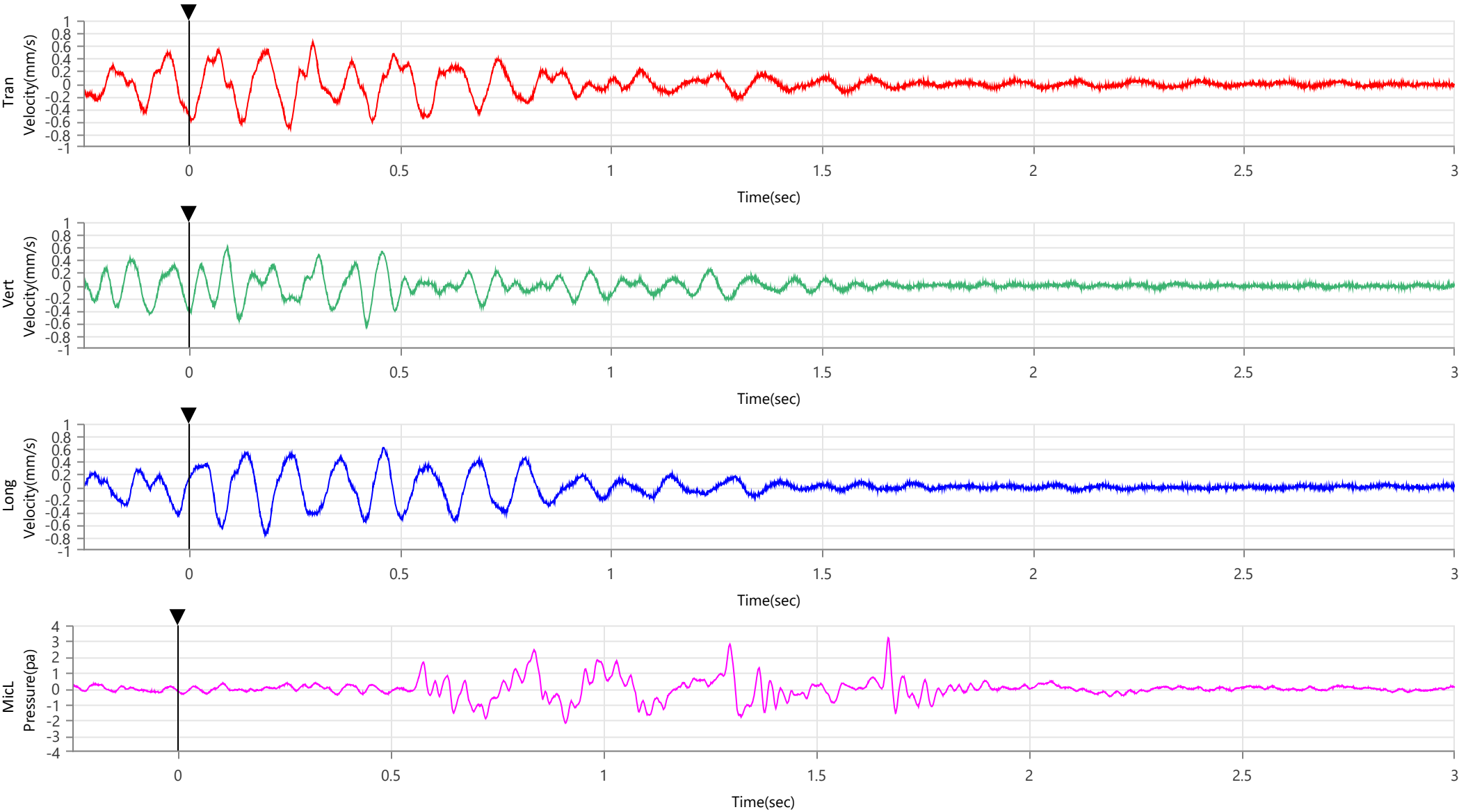
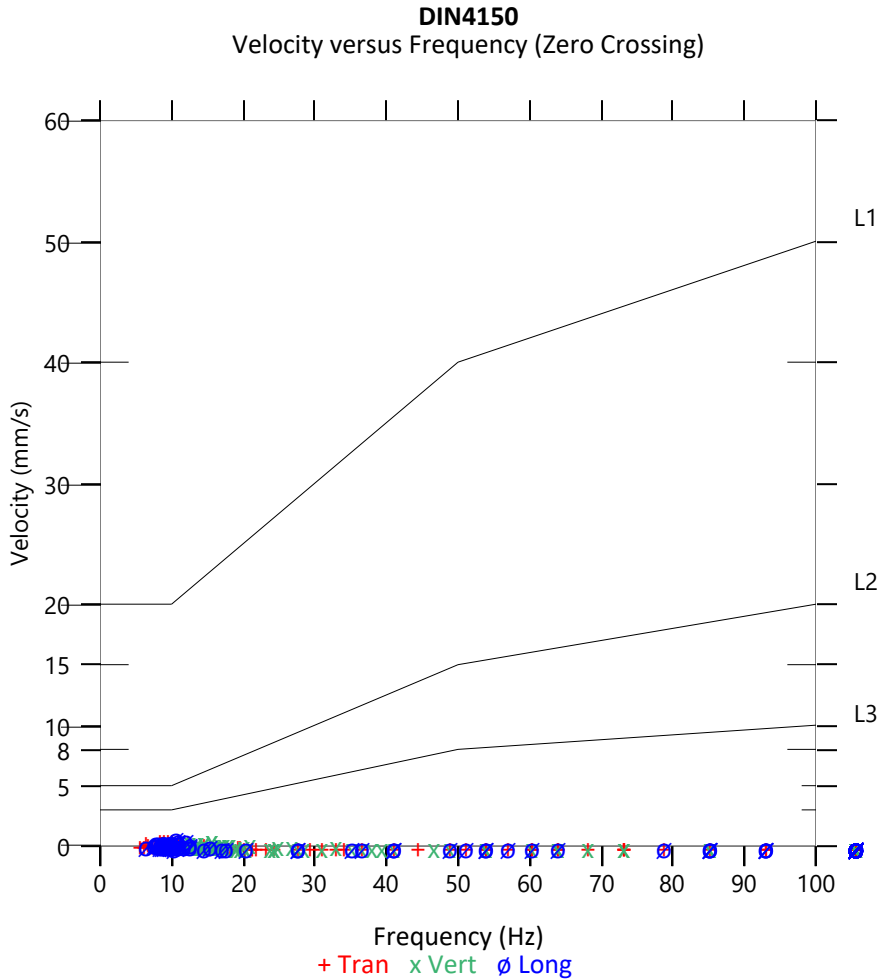
Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 480m/32,08kg/ Merilec: Jure Primožič

| Geophone                   | Tran                    | Vert       | Long       |
|----------------------------|-------------------------|------------|------------|
| Peak Particle Velocity     | 0.709 mm/s              | 0.646 mm/s | 0.757 mm/s |
| Zero Crossing Frequency    | 9.9 Hz                  | 15.8 Hz    | 10.7 Hz    |
| Time (Relative to Trigger) | 0.241 sec               | 0.421 sec  | 0.180 sec  |
| Peak Acceleration          | 0.015 g                 | 0.015 g    | 0.015 g    |
| Peak Displacement          | 0.010 mm                | 0.006 mm   | 0.010 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.3                     | 3.9        | 4.1        |
| Peak Vector Sum            | 0.919 mm/s at 0.184 sec |            |            |

ISEE Linear Microphone  
Peak Sound Pressure Level  
Peak Sound Pressure Level  
Time (Relative to Trigger)  
Zero Crossing Frequency  
Sensor Check  
Frequency  
Test Amplitude

3.21 pa  
104.1 dB(L)  
1.668 sec  
20.1 Hz  
✓ Passed  
20.5 Hz  
1438 mv







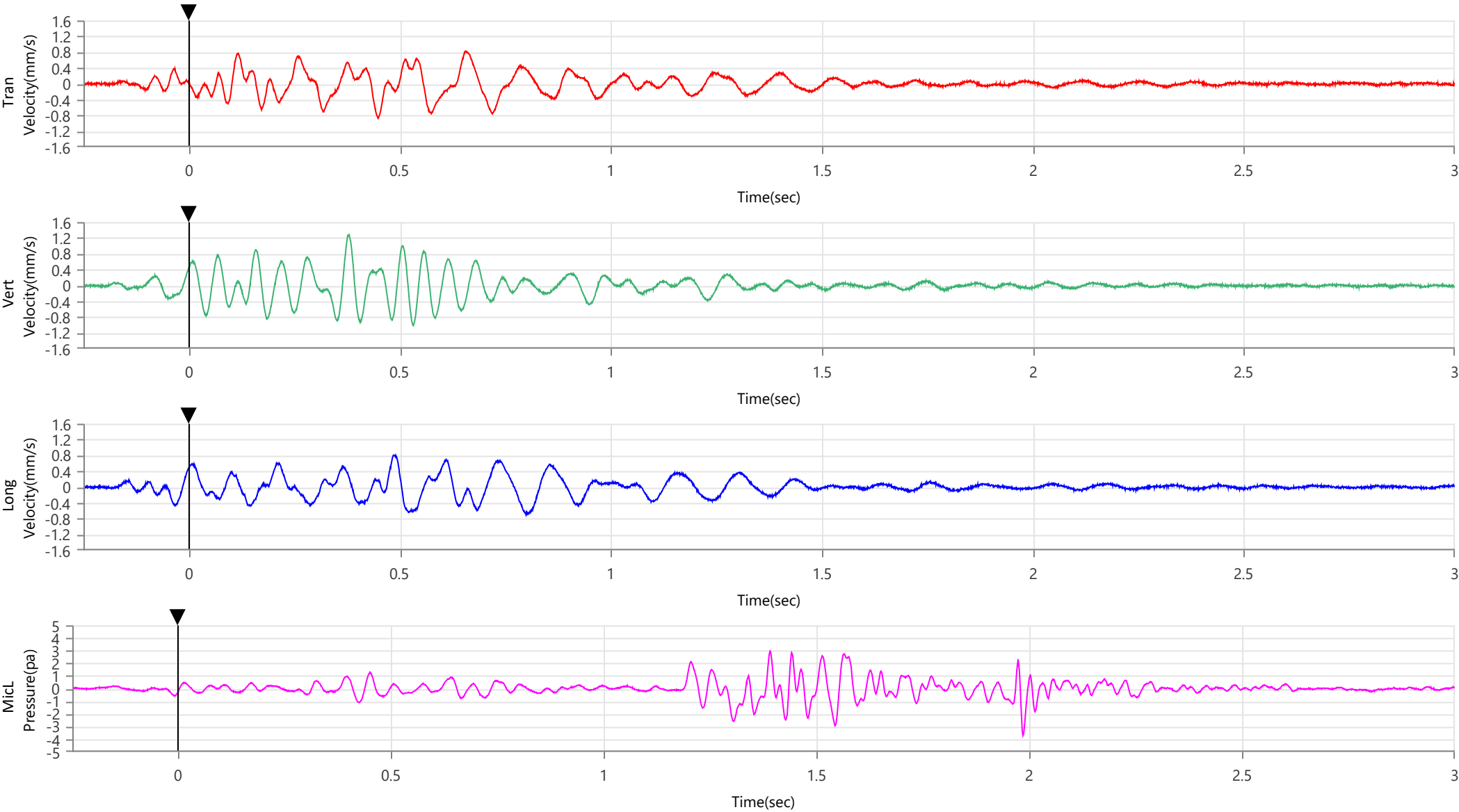
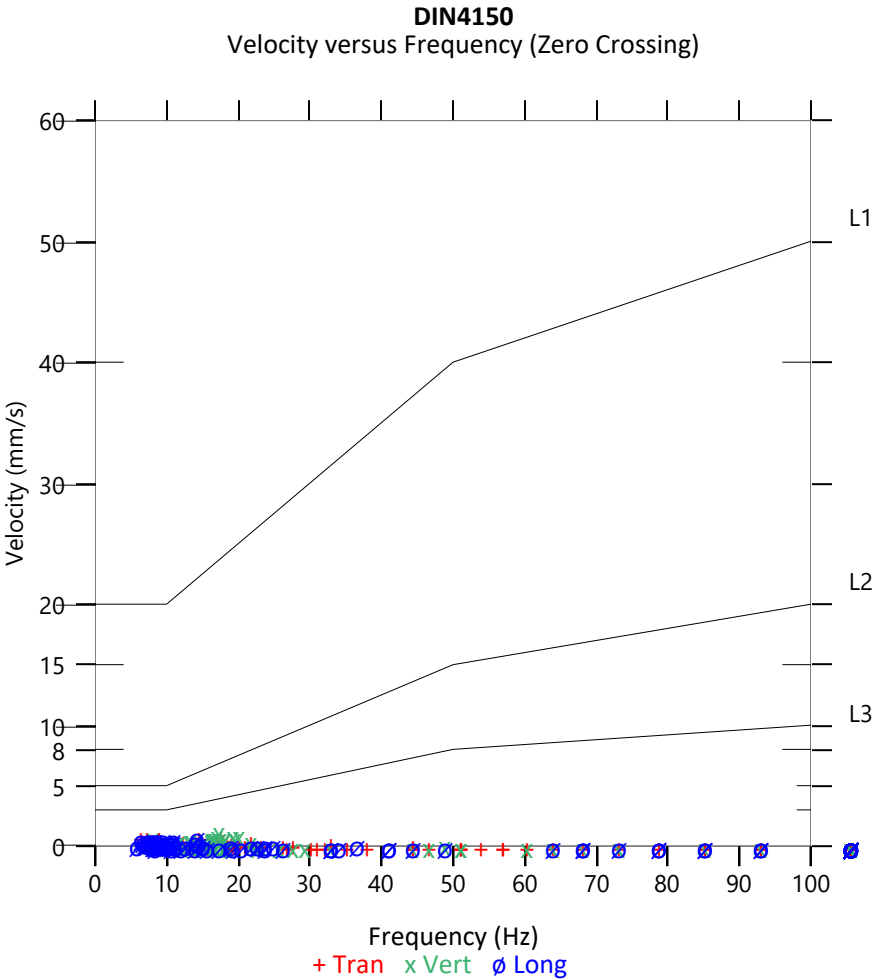
|                         |                                 |                    |                             |
|-------------------------|---------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Long at April 22, 2024 14:24:40 | Serial Number      | UM21812                     |
| Trigger Level(s)        | Geo 0.500 mm/s                  | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)          | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)        | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                        | Event File Name    | UM21812_20240422142440.IDFW |
| Setup File Name         | factory.MMB                     | USB Sensor Support | Disabled                    |
| Operator                | Predrag                         |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 480m/32,08kg/ Merilec: Jure Primožič

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 0.875 mm/s              | 1.277 mm/s | 0.804 mm/s |
| Zero Crossing Frequency    | 14.4 Hz                 | 17.4 Hz    | 14.4 Hz    |
| Time (Relative to Trigger) | 0.448 sec               | 0.378 sec  | 0.484 sec  |
| Peak Acceleration          | 0.020 g                 | 0.023 g    | 0.015 g    |
| Peak Displacement          | 0.013 mm                | 0.012 mm   | 0.013 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.4                     | 4.0        | 4.0        |
| Peak Vector Sum            | 1.407 mm/s at 0.377 sec |            |            |

|                            |             |
|----------------------------|-------------|
| ISEE Linear Microphone     |             |
| Peak Sound Pressure Level  | 3.71 pa     |
| Peak Sound Pressure Level  | 105.4 dB(L) |
| Time (Relative to Trigger) | 1.985 sec   |
| Zero Crossing Frequency    | 28.4 Hz     |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1489 mv     |





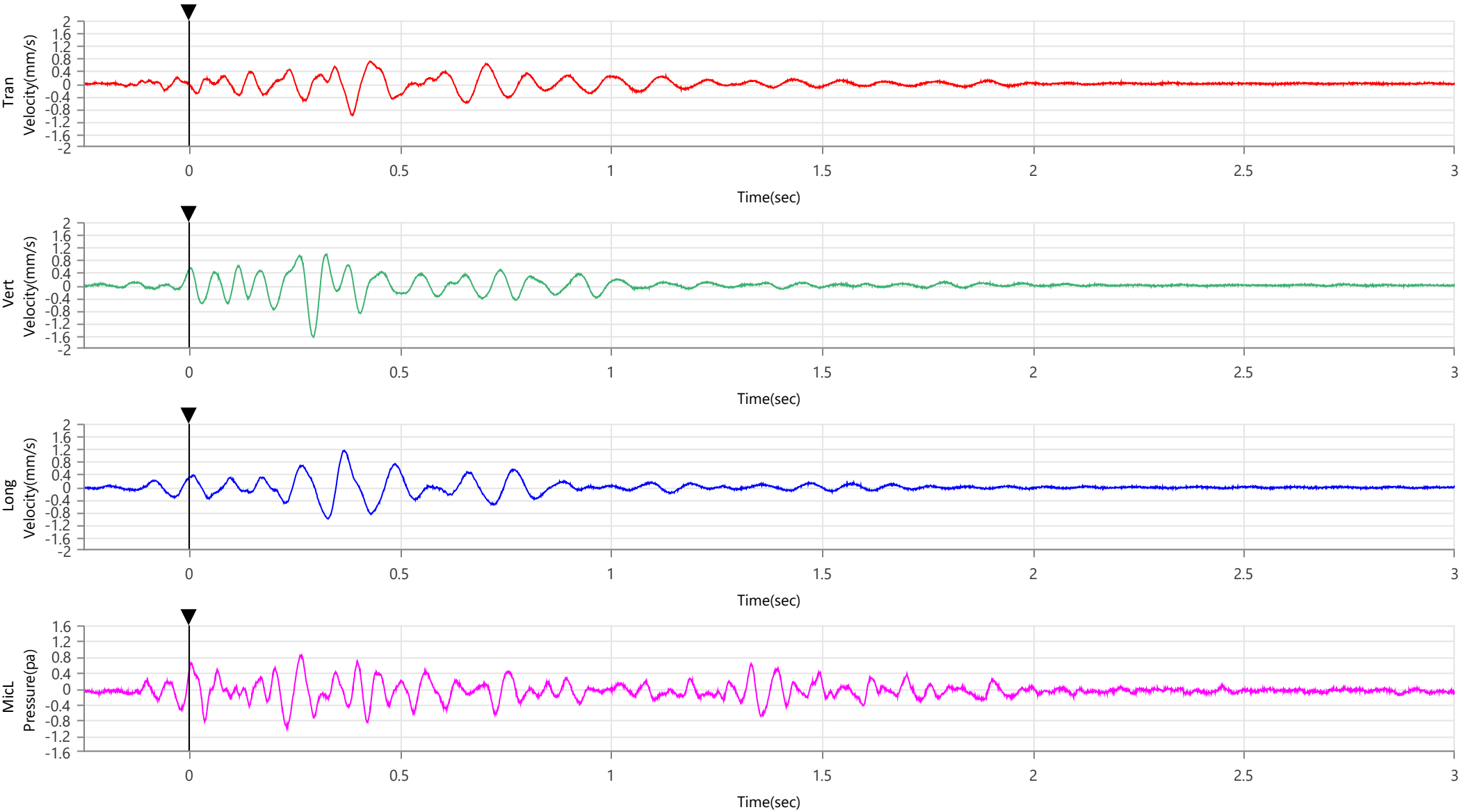
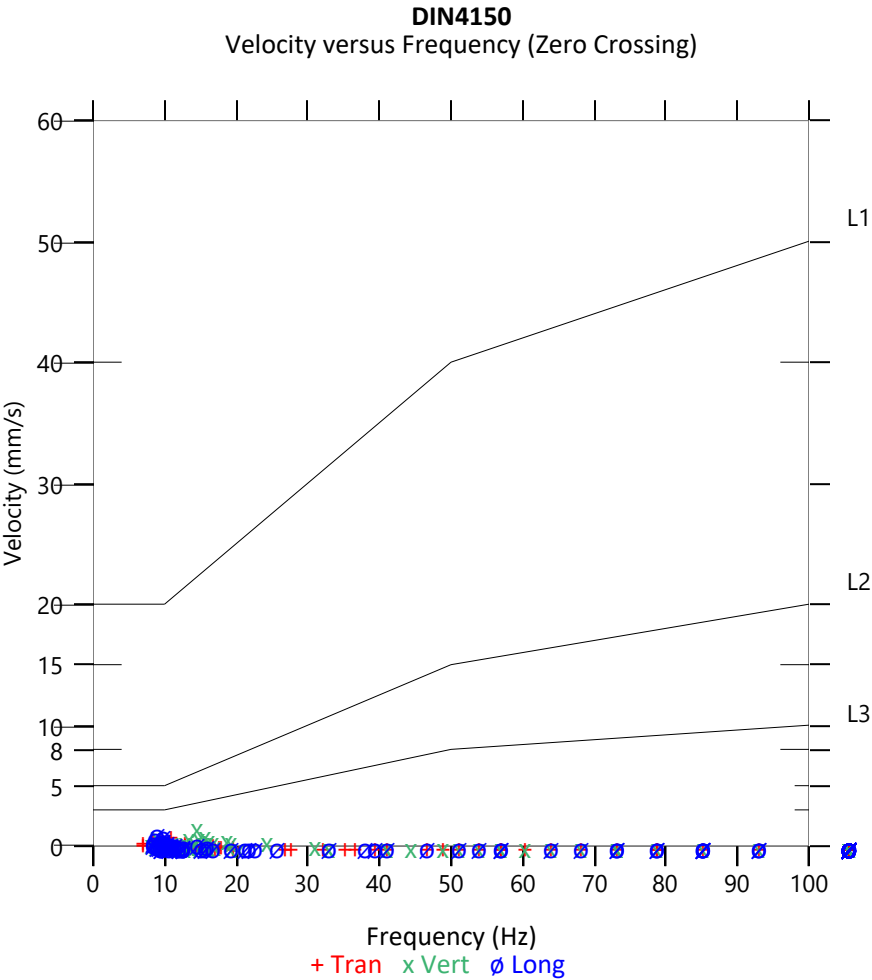
|                         |                              |                    |                             |
|-------------------------|------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Vert at May 8, 2024 12:53:34 | Serial Number      | UM21813                     |
| Trigger Level(s)        | Geo 0.500 mm/s               | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)       | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)     | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                     | Event File Name    | UM21813_20240508125334.IDFW |
| Setup File Name         | 05.MMB                       | USB Sensor Support | Disabled                    |
| Operator                | Predrag                      |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes   Lokacija: kamnolom Podgora/   Naročnik: Minervo d.o.o/   Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 480m/11,04kg/ Merilec: Jure Primožič

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 1.001 mm/s              | 1.639 mm/s | 1.151 mm/s |
| Zero Crossing Frequency    | 11.1 Hz                 | 14.4 Hz    | 9.2 Hz     |
| Time (Relative to Trigger) | 0.387 sec               | 0.295 sec  | 0.369 sec  |
| Peak Acceleration          | 0.016 g                 | 0.021 g    | 0.015 g    |
| Peak Displacement          | 0.013 mm                | 0.018 mm   | 0.017 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.3 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.3                     | 4.1        | 3.9        |
| Peak Vector Sum            | 1.644 mm/s at 0.295 sec |            |            |

|                            |            |
|----------------------------|------------|
| ISEE Linear Microphone     |            |
| Peak Sound Pressure Level  | 0.99 pa    |
| Peak Sound Pressure Level  | 93.9 dB(L) |
| Time (Relative to Trigger) | 0.232 sec  |
| Zero Crossing Frequency    | 14.4 Hz    |
| Sensor Check               | ✓ Passed   |
| Frequency                  | 20.5 Hz    |
| Test Amplitude             | 1415 mv    |





Waveform Trigger Source  
Trigger Level(s)  
Trigger Level (Mic)  
Pre-Trigger/Record Time  
Sample Rate  
Setup File Name  
Operator

Vert at May 8, 2024 12:56:01  
Geo 0.500 mm/s  
Mic 2.00 pa, 100 dB(L)  
0.25 sec/3.0 sec (Fixed)  
2048 sps  
05.MMB  
Predrag

Serial Number  
Model Number  
Battery Level  
Unit Calibration  
Event File Name  
USB Sensor Support

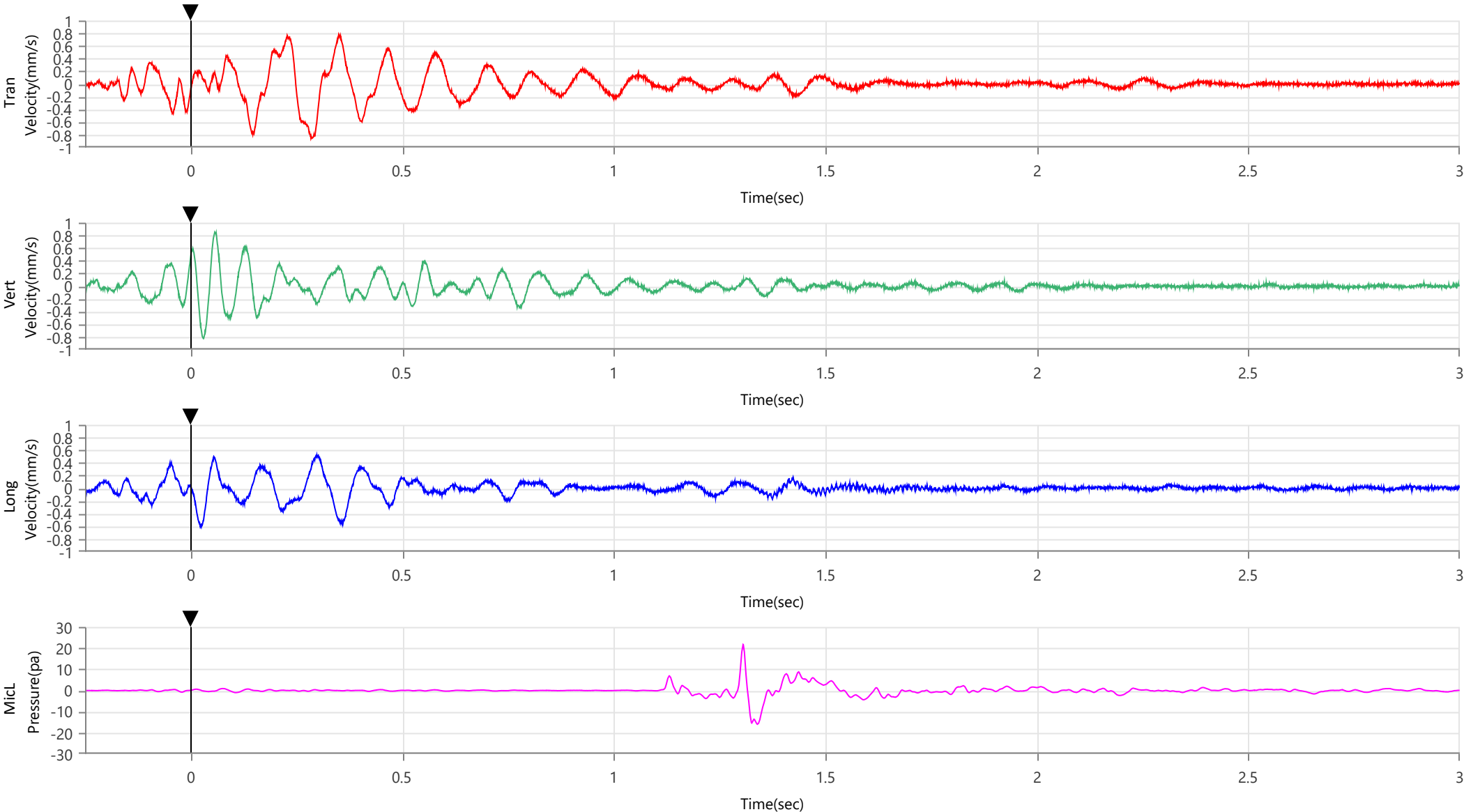
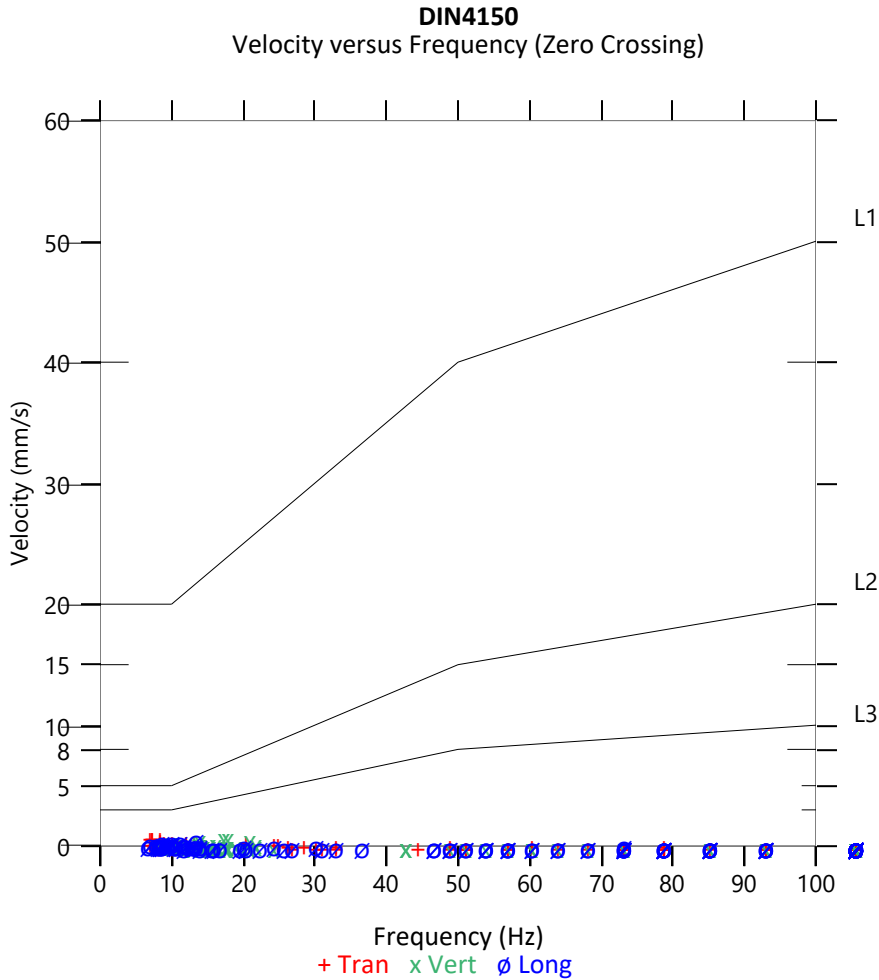
UM21813  
Micromate DIN 10.90GC  
3.8 volts  
July 14, 2023 by Instantel  
UM21813\_20240508125601.IDFW  
Disabled

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 500m/54,58kg/ Merilec: Jure Primožič

| Geophone                   | Tran                    | Vert       | Long       |
|----------------------------|-------------------------|------------|------------|
| Peak Particle Velocity     | 0.859 mm/s              | 0.851 mm/s | 0.607 mm/s |
| Zero Crossing Frequency    | 8.5 Hz                  | 18.0 Hz    | 13.3 Hz    |
| Time (Relative to Trigger) | 0.284 sec               | 0.057 sec  | 0.022 sec  |
| Peak Acceleration          | 0.016 g                 | 0.021 g    | 0.020 g    |
| Peak Displacement          | 0.017 mm                | 0.008 mm   | 0.008 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.3 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.3                     | 4.1        | 3.9        |
| Peak Vector Sum            | 0.994 mm/s at 0.057 sec |            |            |

| ISEE Linear Microphone     |             |
|----------------------------|-------------|
| Peak Sound Pressure Level  | 21.71 pa    |
| Peak Sound Pressure Level  | 120.7 dB(L) |
| Time (Relative to Trigger) | 1.306 sec   |
| Zero Crossing Frequency    | 21.3 Hz     |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1415 mv     |







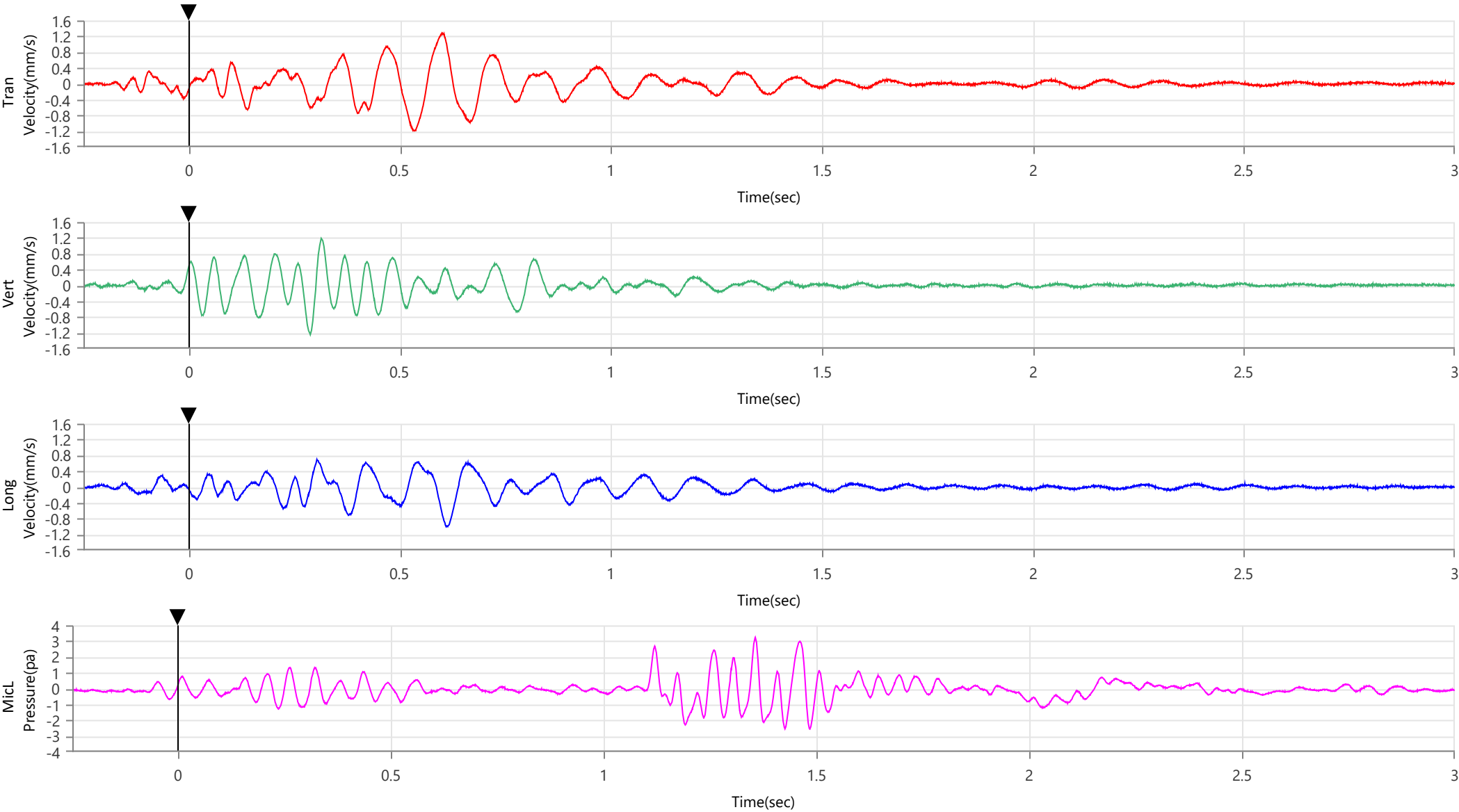
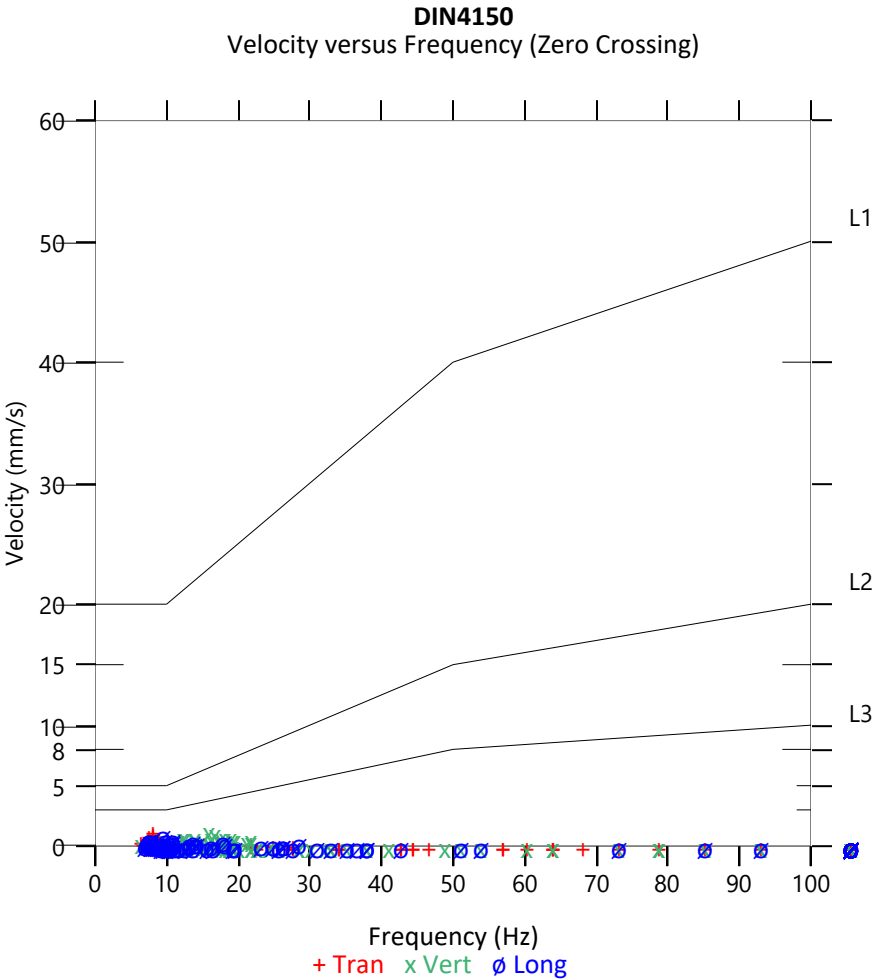
|                         |                               |                    |                             |
|-------------------------|-------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Vert at May 10, 2024 10:13:29 | Serial Number      | UM21813                     |
| Trigger Level(s)        | Geo 0.500 mm/s                | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)        | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)      | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                      | Event File Name    | UM21813_20240510101329.IDFW |
| Setup File Name         | 05.MMB                        | USB Sensor Support | Disabled                    |
| Operator                | Predrag                       |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 500m/29,58kg/ Merilec: Predrag Daničić

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 1.285 mm/s              | 1.245 mm/s | 1.001 mm/s |
| Zero Crossing Frequency    | 8.1 Hz                  | 16.0 Hz    | 9.7 Hz     |
| Time (Relative to Trigger) | 0.600 sec               | 0.288 sec  | 0.609 sec  |
| Peak Acceleration          | 0.015 g                 | 0.026 g    | 0.013 g    |
| Peak Displacement          | 0.025 mm                | 0.012 mm   | 0.015 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.3 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.0                     | 4.1        | 3.7        |
| Peak Vector Sum            | 1.567 mm/s at 0.606 sec |            |            |

|                            |             |
|----------------------------|-------------|
| ISEE Linear Microphone     |             |
| Peak Sound Pressure Level  | 3.24 pa     |
| Peak Sound Pressure Level  | 104.2 dB(L) |
| Time (Relative to Trigger) | 1.355 sec   |
| Zero Crossing Frequency    | 21.8 Hz     |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1400 mv     |





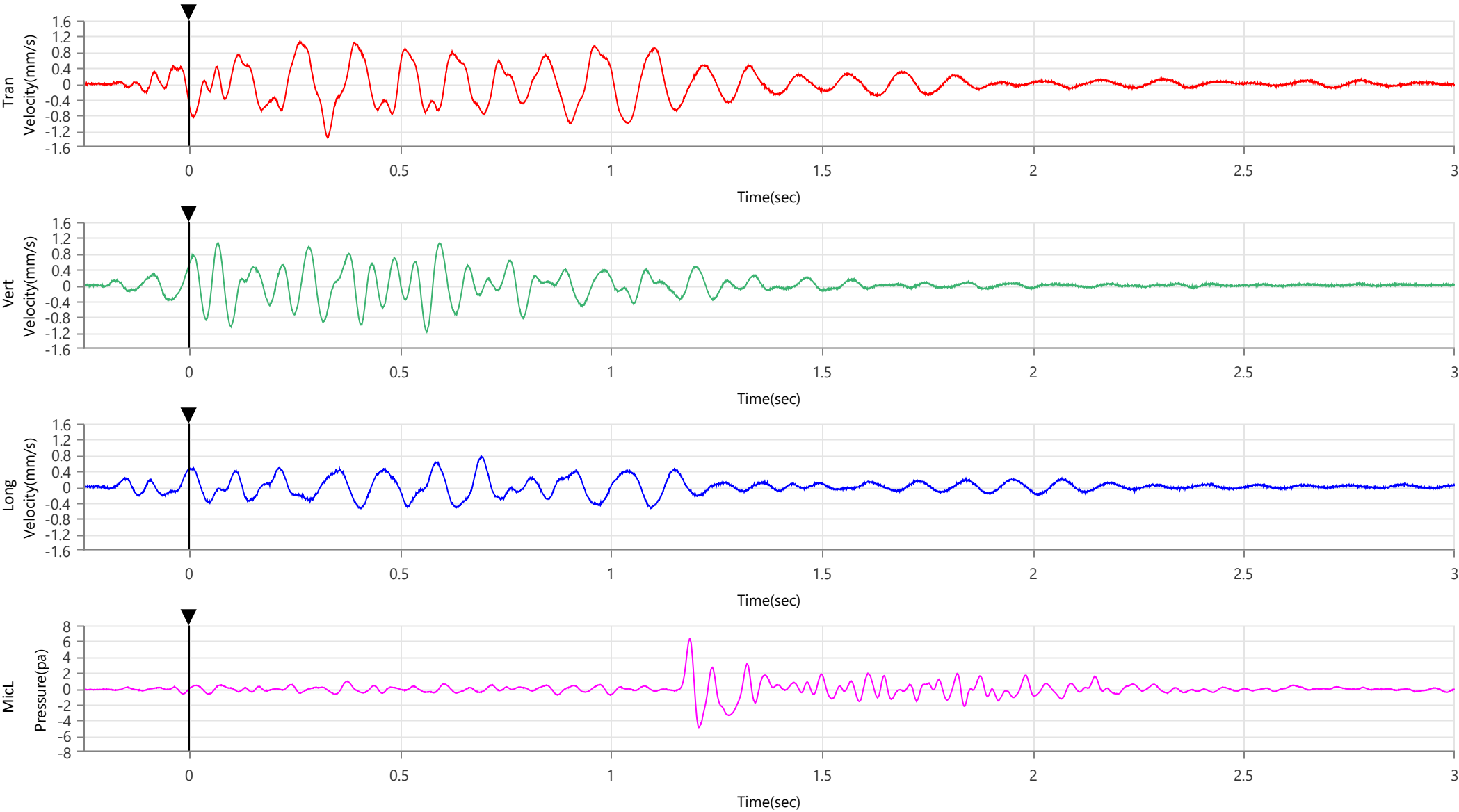
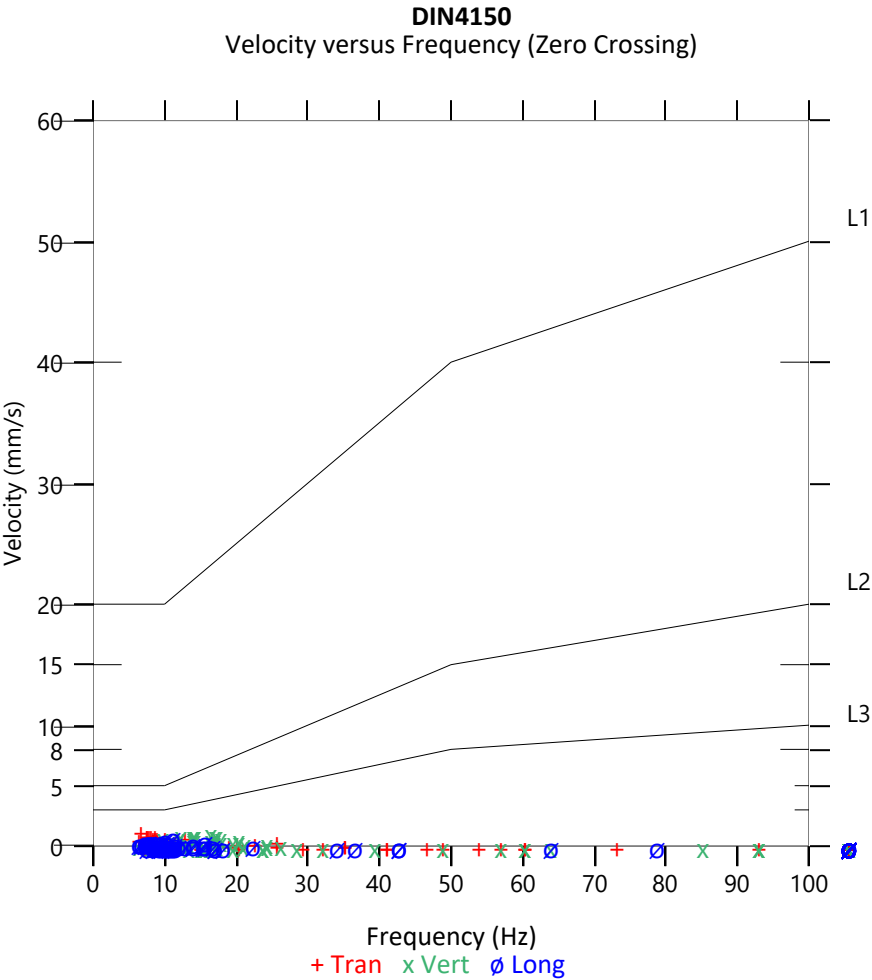
|                         |                               |                    |                             |
|-------------------------|-------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Vert at May 10, 2024 10:48:57 | Serial Number      | UM21813                     |
| Trigger Level(s)        | Geo 0.500 mm/s                | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)        | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)      | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                      | Event File Name    | UM21813_20240510104857.IDFW |
| Setup File Name         | 05.MMB                        | USB Sensor Support | Disabled                    |
| Operator                | Predrag                       |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 530m/32,08kg/ Merilec: Predrag Daničić

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 1.364 mm/s              | 1.174 mm/s | 0.780 mm/s |
| Zero Crossing Frequency    | 6.8 Hz                  | 16.5 Hz    | 11.1 Hz    |
| Time (Relative to Trigger) | 0.329 sec               | 0.563 sec  | 0.692 sec  |
| Peak Acceleration          | 0.018 g                 | 0.018 g    | 0.012 g    |
| Peak Displacement          | 0.022 mm                | 0.012 mm   | 0.010 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.3 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.0                     | 4.1        | 3.7        |
| Peak Vector Sum            | 1.534 mm/s at 0.326 sec |            |            |

|                            |             |
|----------------------------|-------------|
| ISEE Linear Microphone     |             |
| Peak Sound Pressure Level  | 6.31 pa     |
| Peak Sound Pressure Level  | 110.0 dB(L) |
| Time (Relative to Trigger) | 1.187 sec   |
| Zero Crossing Frequency    | 14.4 Hz     |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1400 mv     |





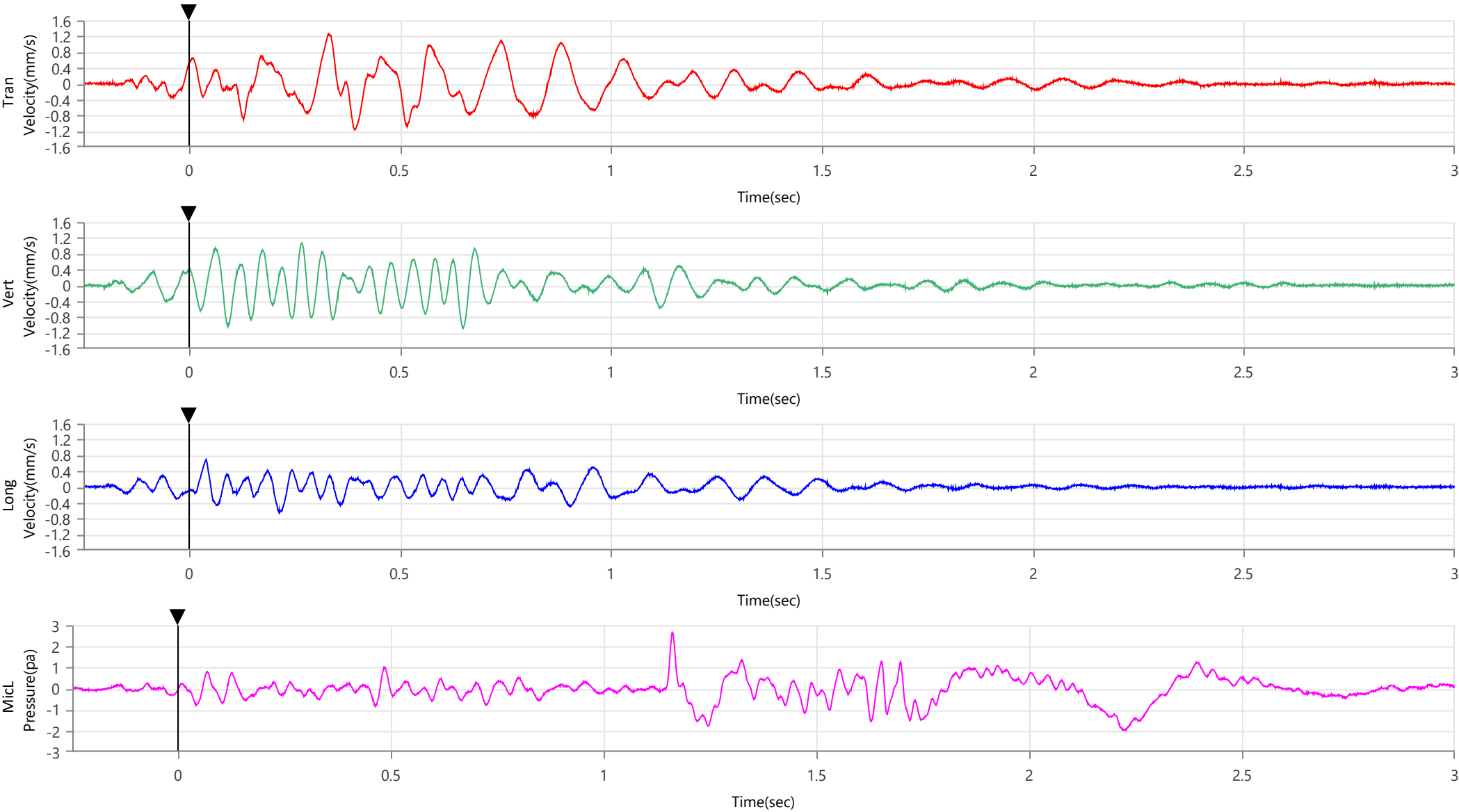
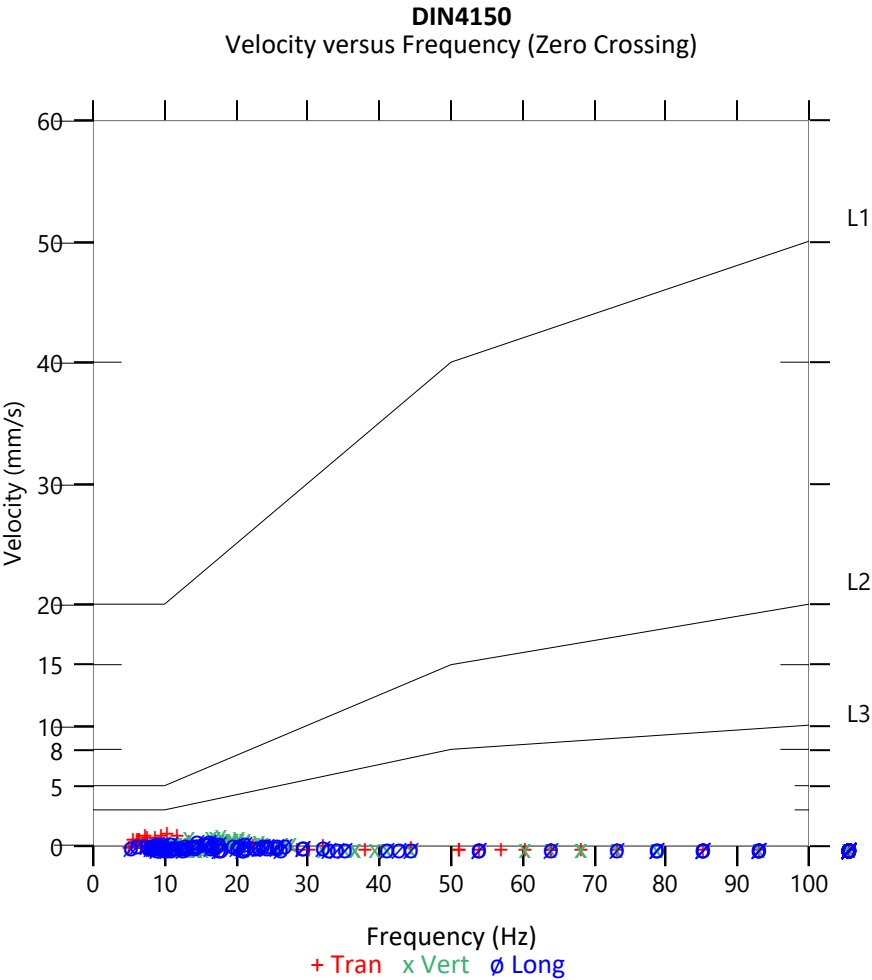
|                         |                               |                    |                             |
|-------------------------|-------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Tran at May 27, 2024 12:17:52 | Serial Number      | UM21813                     |
| Trigger Level(s)        | Geo 0.500 mm/s                | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)        | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)      | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                      | Event File Name    | UM21813_20240527121752.IDFW |
| Setup File Name         | 05.MMB                        | USB Sensor Support | Disabled                    |
| Operator                | Predrag                       |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 490m/28,08kg/ Merilec: Predrag Daničić

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 1.261 mm/s              | 1.080 mm/s | 0.694 mm/s |
| Zero Crossing Frequency    | 10.3 Hz                 | 18.0 Hz    | 16.0 Hz    |
| Time (Relative to Trigger) | 0.332 sec               | 0.650 sec  | 0.041 sec  |
| Peak Acceleration          | 0.018 g                 | 0.025 g    | 0.018 g    |
| Peak Displacement          | 0.023 mm                | 0.011 mm   | 0.008 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.3 Hz     | 7.3 Hz     |
| Overswing Ratio            | 4.3                     | 4.1        | 3.9        |
| Peak Vector Sum            | 1.423 mm/s at 0.336 sec |            |            |

|                            |             |
|----------------------------|-------------|
| ISEE Linear Microphone     |             |
| Peak Sound Pressure Level  | 2.67 pa     |
| Peak Sound Pressure Level  | 102.5 dB(L) |
| Time (Relative to Trigger) | 1.160 sec   |
| Zero Crossing Frequency    | 11.4 Hz     |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1385 mv     |



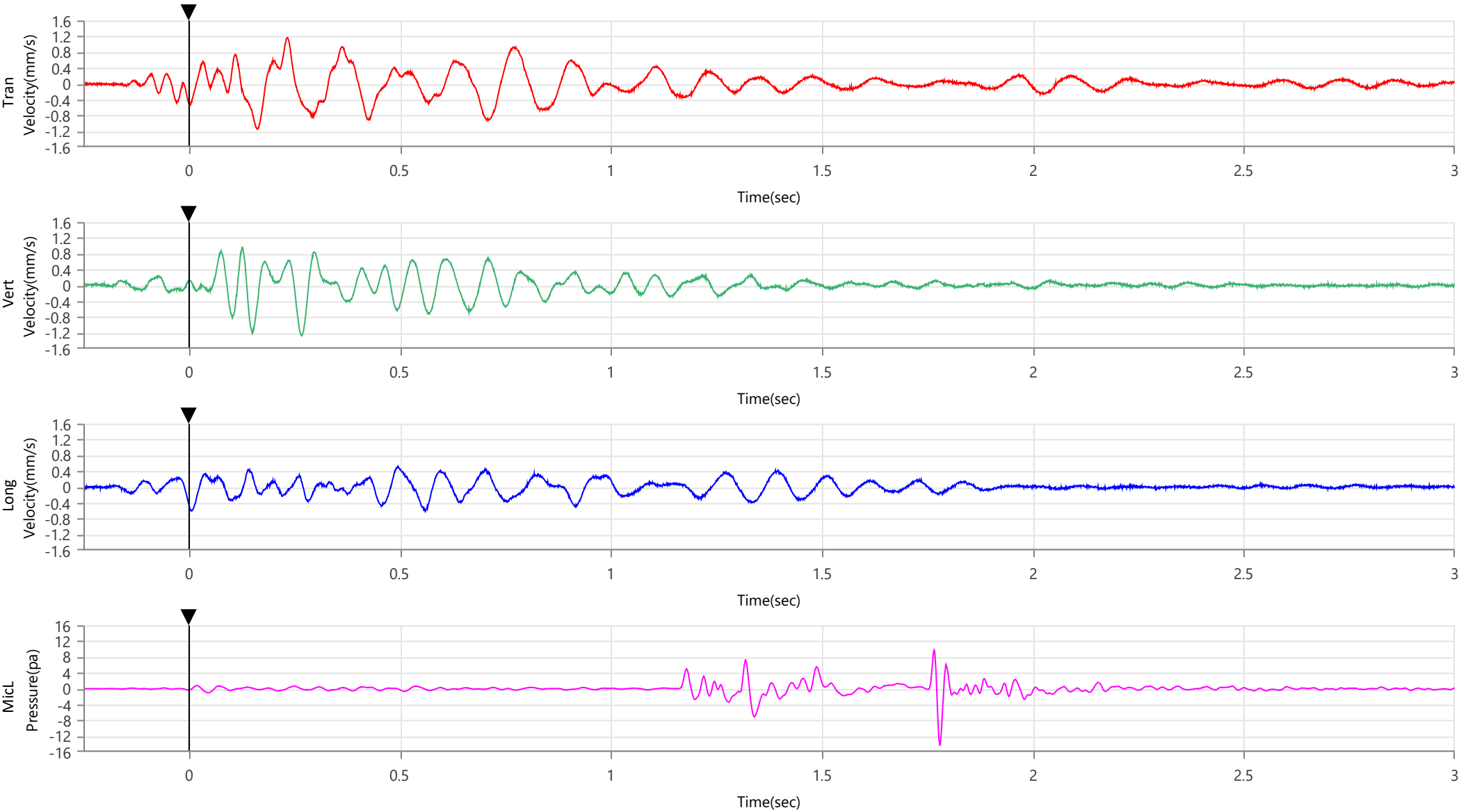
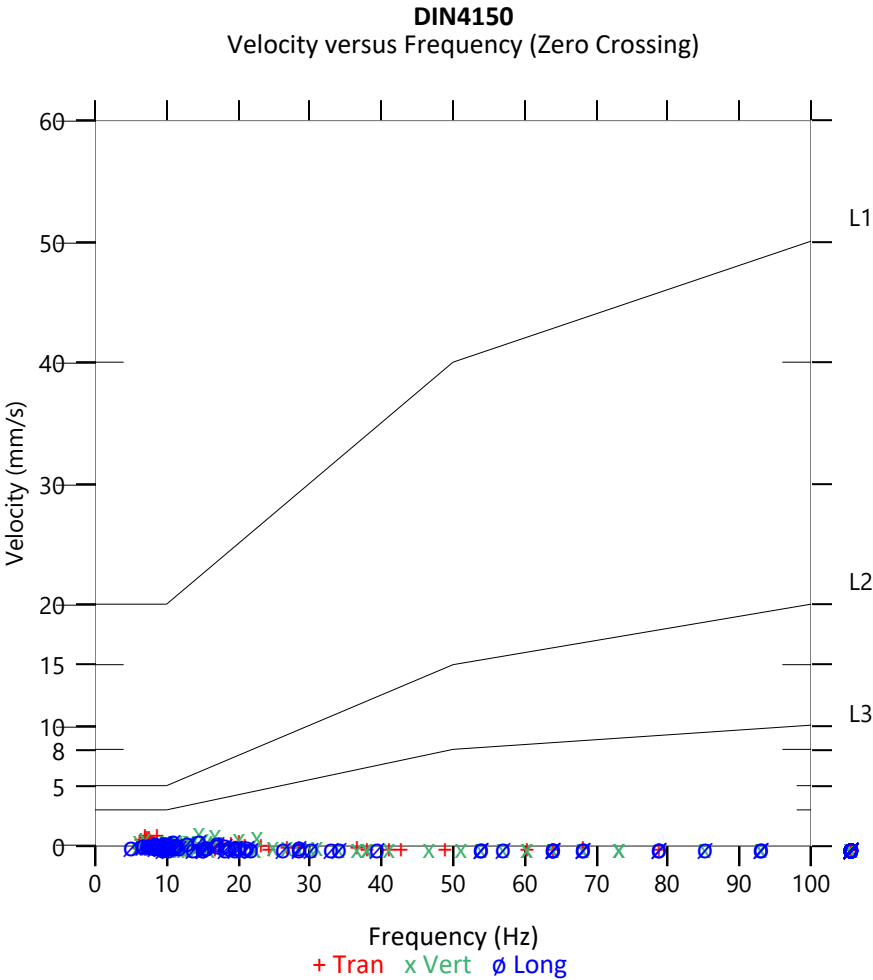
|                         |                               |                    |                             |
|-------------------------|-------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Tran at May 27, 2024 12:29:08 | Serial Number      | UM21813                     |
| Trigger Level(s)        | Geo 0.500 mm/s                | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)        | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)      | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                      | Event File Name    | UM21813_20240527122908.IDFW |
| Setup File Name         | 05.MMB                        | USB Sensor Support | Disabled                    |
| Operator                | Predrag                       |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 510m/68,16kg/ Merilec: Predrag Daničić

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 1.167 mm/s              | 1.277 mm/s | 0.615 mm/s |
| Zero Crossing Frequency    | 7.1 Hz                  | 14.6 Hz    | 10.9 Hz    |
| Time (Relative to Trigger) | 0.234 sec               | 0.267 sec  | 0.560 sec  |
| Peak Acceleration          | 0.018 g                 | 0.030 g    | 0.015 g    |
| Peak Displacement          | 0.020 mm                | 0.014 mm   | 0.008 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.3 Hz     | 7.3 Hz     |
| Overswing Ratio            | 4.3                     | 4.1        | 3.9        |
| Peak Vector Sum            | 1.443 mm/s at 0.151 sec |            |            |

|                            |             |
|----------------------------|-------------|
| ISEE Linear Microphone     |             |
| Peak Sound Pressure Level  | 14.26 pa    |
| Peak Sound Pressure Level  | 117.1 dB(L) |
| Time (Relative to Trigger) | 1.779 sec   |
| Zero Crossing Frequency    | 30.1 Hz     |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1385 mv     |



Waveform Trigger Source  
Trigger Level(s)  
Trigger Level (Mic)  
Pre-Trigger/Record Time  
Sample Rate  
Setup File Name  
Operator

Vert at June 19, 2024 10:43:07  
Geo 0.500 mm/s  
Mic 2.00 pa, 100 dB(L)  
0.25 sec/3.0 sec (Fixed)  
2048 sps  
05.MMB  
Predrag

Serial Number  
Model Number  
Battery Level  
Unit Calibration  
Event File Name  
USB Sensor Support

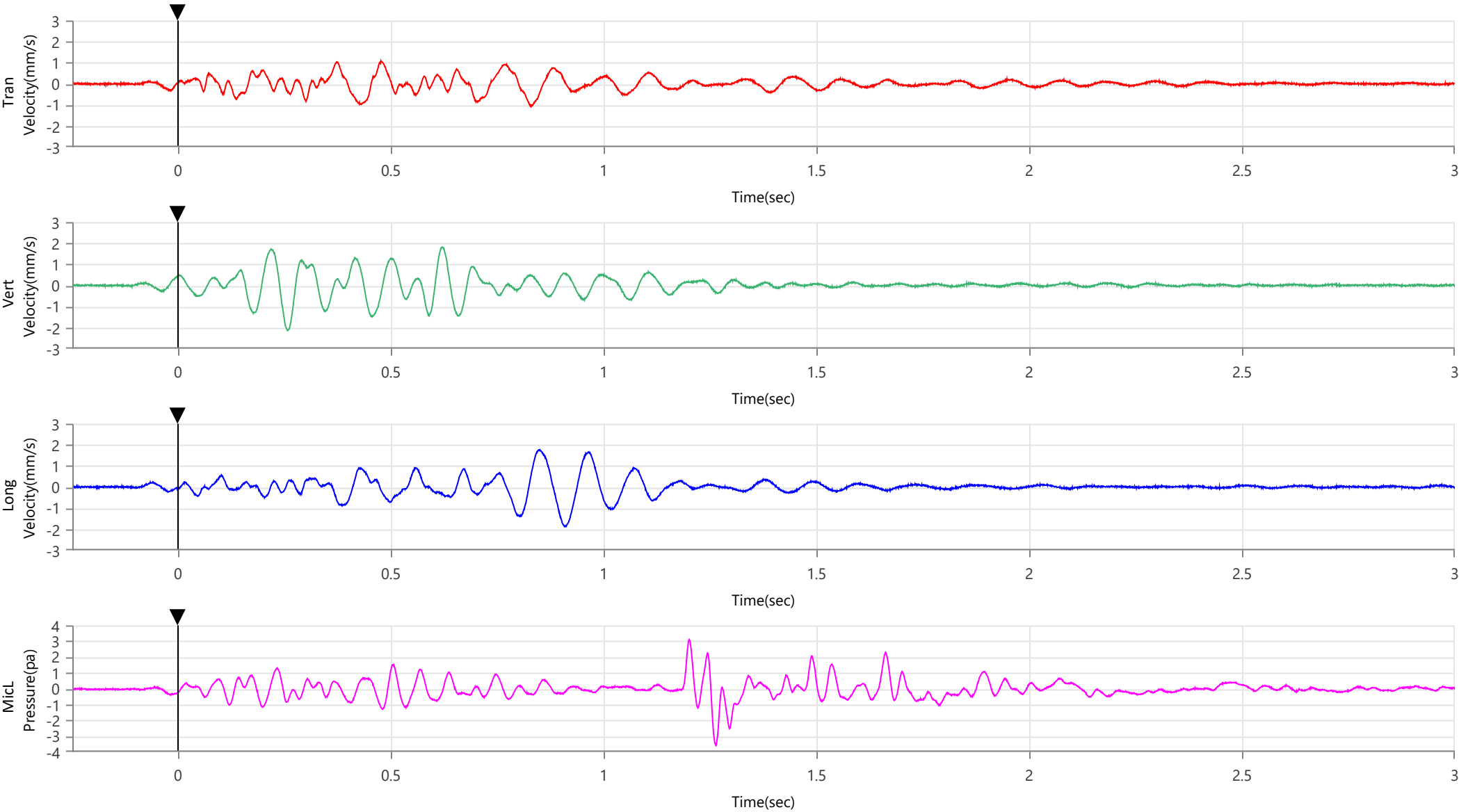
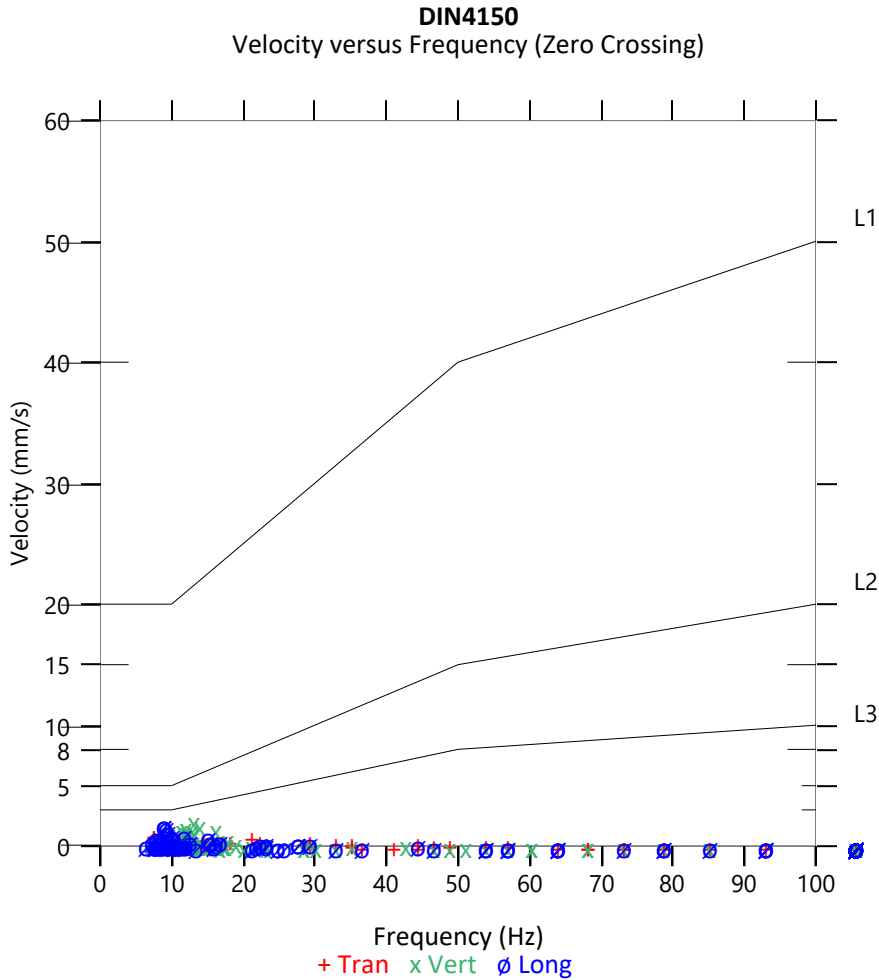
UM21813  
Micromate DIN 10.90GC  
3.8 volts  
July 14, 2023 by Instantel  
UM21813\_20240619104307.IDFW  
Disabled

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 470m/32,16kg/ Merilec: Jure Primožič

| Geophone                   | Tran                    | Vert       | Long       |
|----------------------------|-------------------------|------------|------------|
| Peak Particle Velocity     | 1.072 mm/s              | 2.144 mm/s | 1.876 mm/s |
| Zero Crossing Frequency    | 10.2 Hz                 | 13.3 Hz    | 8.9 Hz     |
| Time (Relative to Trigger) | 0.475 sec               | 0.255 sec  | 0.909 sec  |
| Peak Acceleration          | 0.020 g                 | 0.028 g    | 0.021 g    |
| Peak Displacement          | 0.018 mm                | 0.025 mm   | 0.032 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.2                     | 4.1        | 3.9        |
| Peak Vector Sum            | 2.193 mm/s at 0.256 sec |            |            |

| ISEE Linear Microphone     |             |
|----------------------------|-------------|
| Peak Sound Pressure Level  | 3.58 pa     |
| Peak Sound Pressure Level  | 105.1 dB(L) |
| Time (Relative to Trigger) | 1.263 sec   |
| Zero Crossing Frequency    | 20.1 Hz     |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1330 mv     |





Vibrolab d.o.o

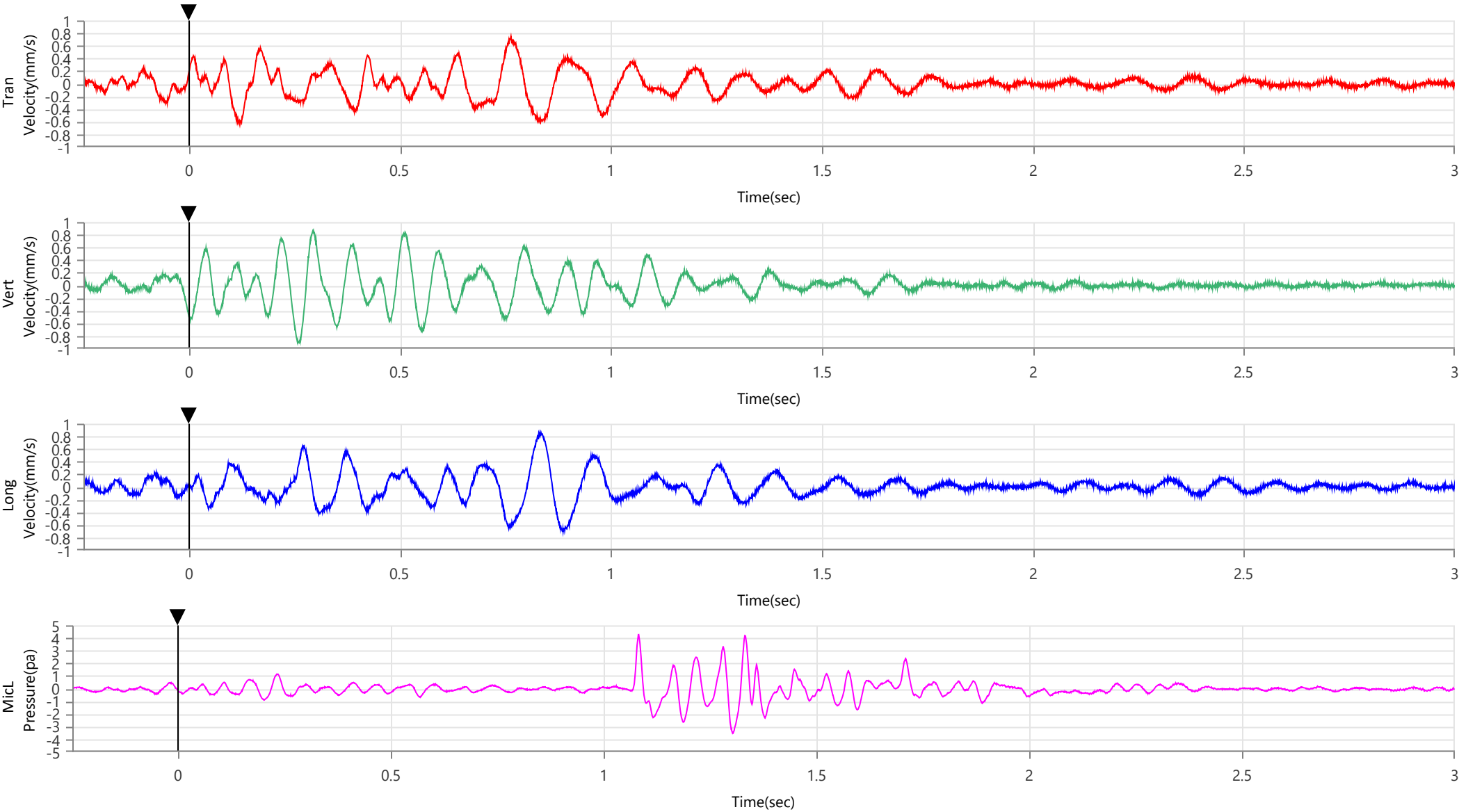
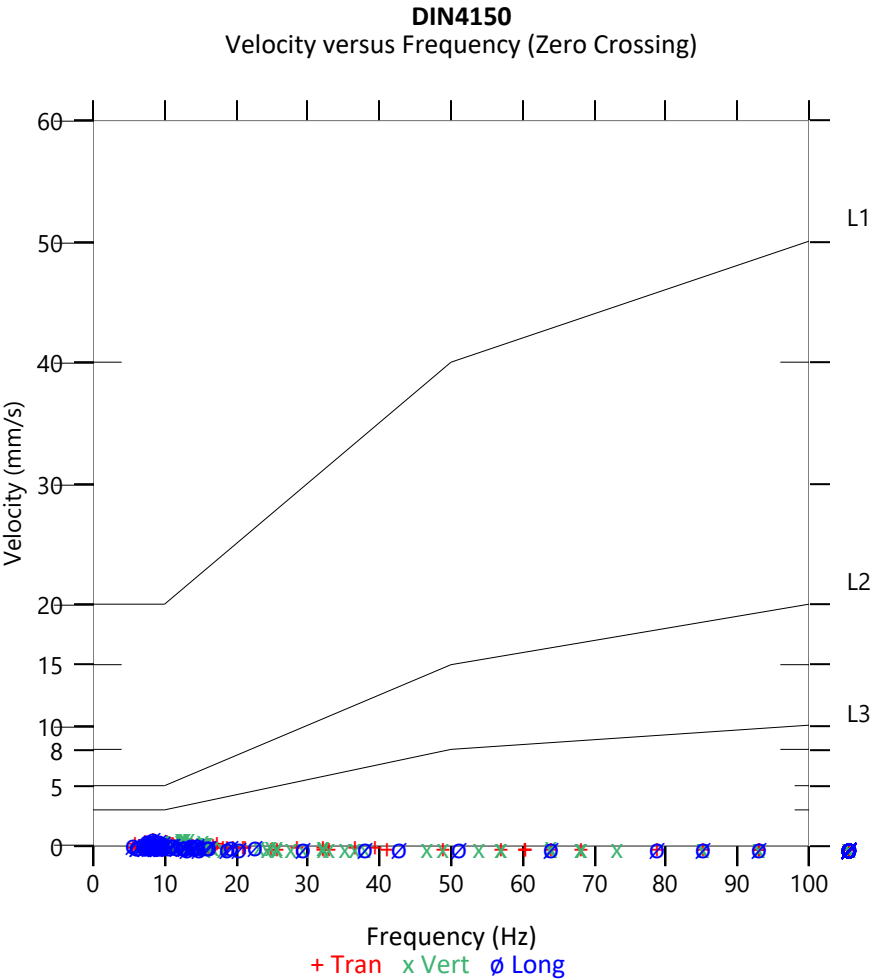
|                         |                                |                    |                             |
|-------------------------|--------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Vert at June 27, 2024 11:53:07 | Serial Number      | UM21813                     |
| Trigger Level(s)        | Geo 0.500 mm/s                 | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)         | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)       | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                       | Event File Name    | UM21813_20240627115307.IDFW |
| Setup File Name         | 05.MMB                         | USB Sensor Support | Disabled                    |
| Operator                | Predrag                        |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 510m/36,16kg/ Merilec: Jure Primožič

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 0.749 mm/s              | 0.906 mm/s | 0.859 mm/s |
| Zero Crossing Frequency    | 8.4 Hz                  | 13.0 Hz    | 8.4 Hz     |
| Time (Relative to Trigger) | 0.763 sec               | 0.259 sec  | 0.834 sec  |
| Peak Acceleration          | 0.015 g                 | 0.018 g    | 0.016 g    |
| Peak Displacement          | 0.014 mm                | 0.011 mm   | 0.016 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.3 Hz     |
| Overswing Ratio            | 4.2                     | 4.1        | 3.9        |
| Peak Vector Sum            | 1.051 mm/s at 0.758 sec |            |            |

|                            |             |
|----------------------------|-------------|
| ISEE Linear Microphone     |             |
| Peak Sound Pressure Level  | 4.24 pa     |
| Peak Sound Pressure Level  | 106.5 dB(L) |
| Time (Relative to Trigger) | 1.081 sec   |
| Zero Crossing Frequency    | 21.8 Hz     |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1340 mv     |





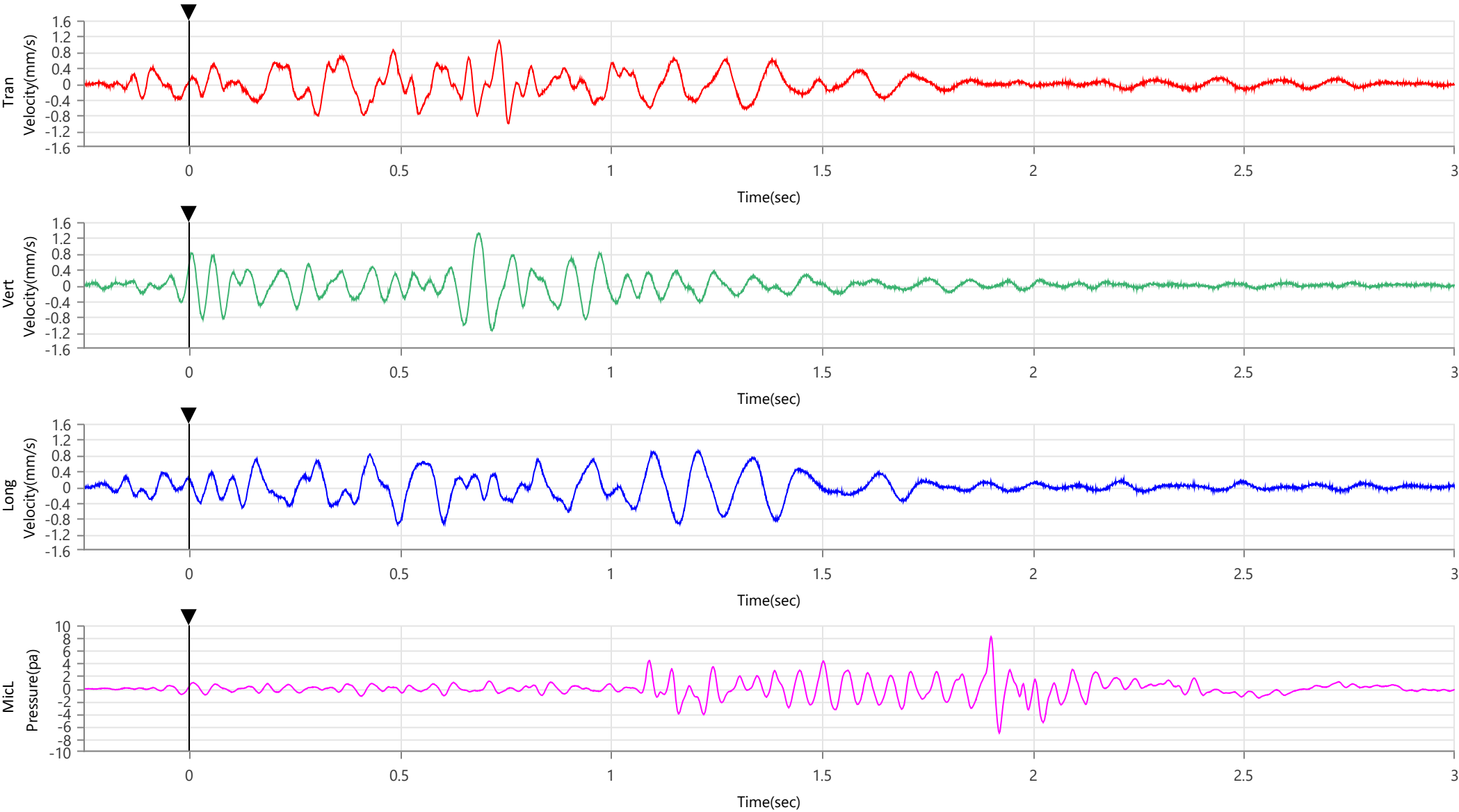
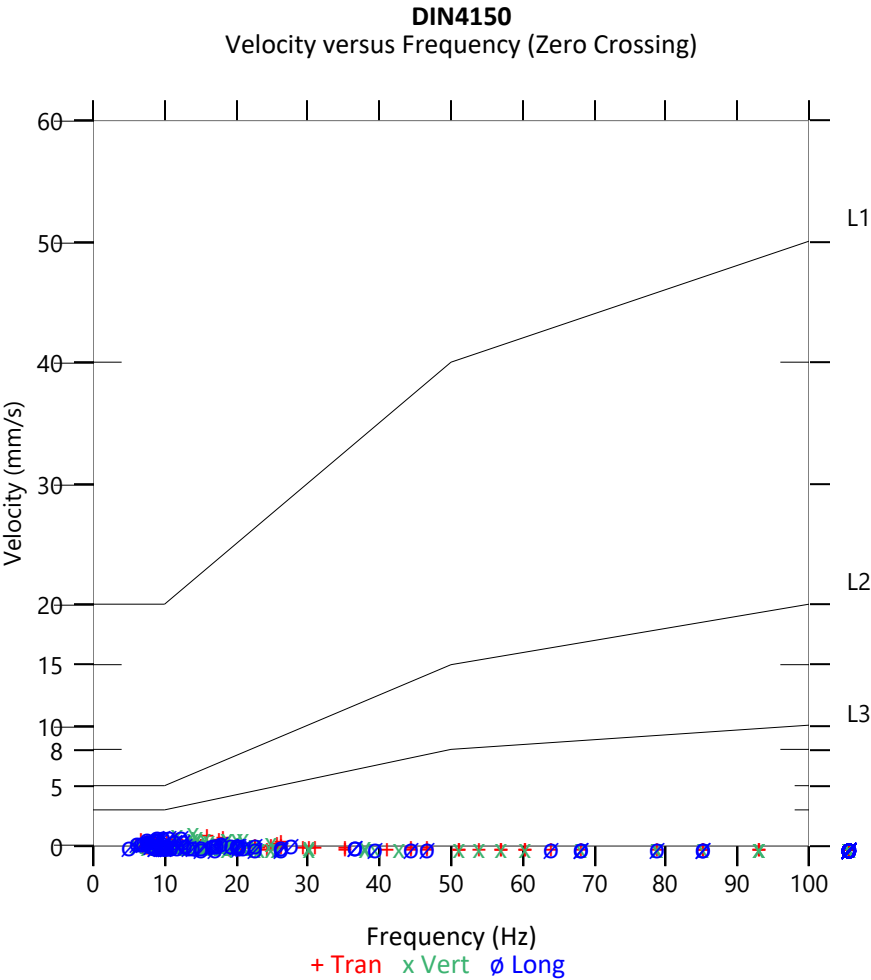
|                         |                                |                    |                             |
|-------------------------|--------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Vert at July 10, 2024 11:34:36 | Serial Number      | UM21813                     |
| Trigger Level(s)        | Geo 0.500 mm/s                 | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)         | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)       | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                       | Event File Name    | UM21813_20240710113436.IDFW |
| Setup File Name         | 05.MMB                         | USB Sensor Support | Disabled                    |
| Operator                | Predrag                        |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 450m/12,5kg/ Merilec: Jure Primožič

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 1.096 mm/s              | 1.324 mm/s | 0.946 mm/s |
| Zero Crossing Frequency    | 16.0 Hz                 | 13.8 Hz    | 10.7 Hz    |
| Time (Relative to Trigger) | 0.735 sec               | 0.686 sec  | 0.495 sec  |
| Peak Acceleration          | 0.025 g                 | 0.030 g    | 0.021 g    |
| Peak Displacement          | 0.014 mm                | 0.016 mm   | 0.015 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.2                     | 4.1        | 3.9        |
| Peak Vector Sum            | 1.534 mm/s at 0.684 sec |            |            |

|                            |             |
|----------------------------|-------------|
| ISEE Linear Microphone     |             |
| Peak Sound Pressure Level  | 8.19 pa     |
| Peak Sound Pressure Level  | 112.2 dB(L) |
| Time (Relative to Trigger) | 1.901 sec   |
| Zero Crossing Frequency    | 13.3 Hz     |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1312 mv     |







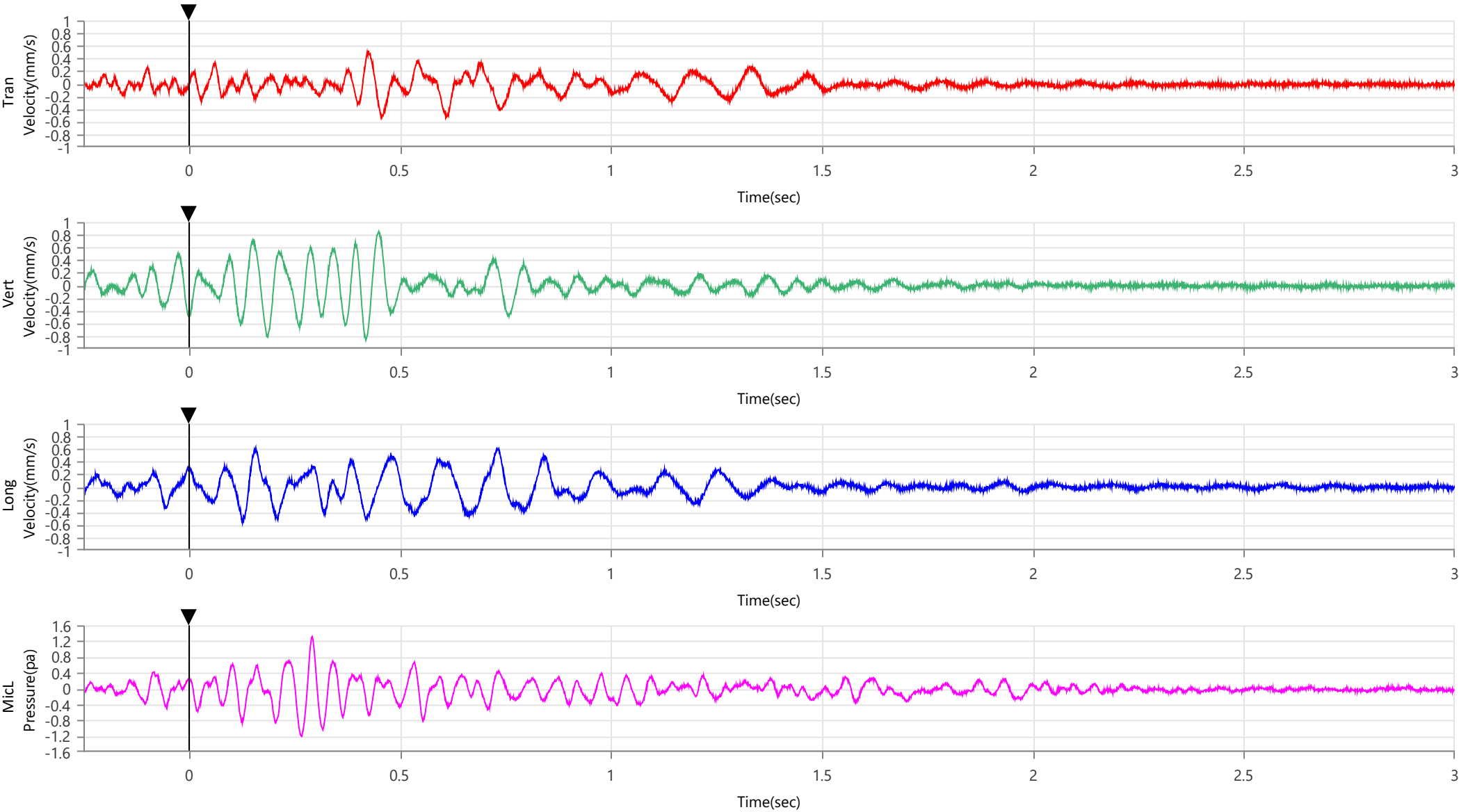
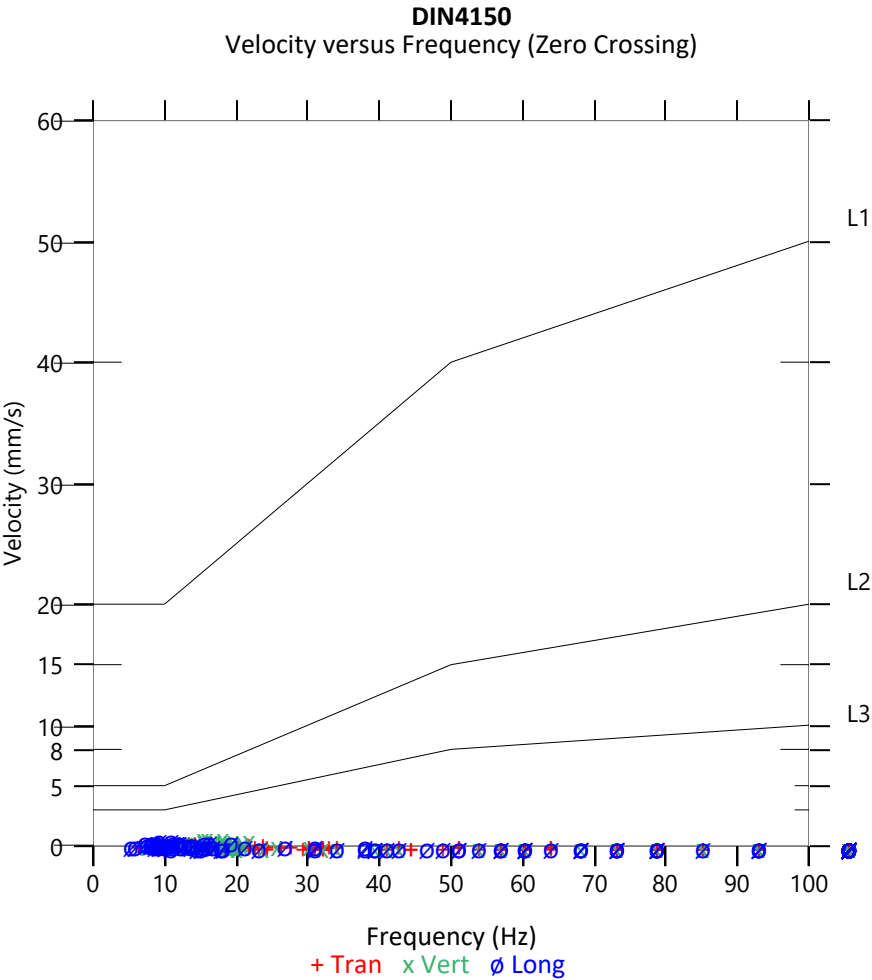
|                         |                                |                    |                             |
|-------------------------|--------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Vert at July 17, 2024 10:23:53 | Serial Number      | UM21813                     |
| Trigger Level(s)        | Geo 0.500 mm/s                 | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)         | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)       | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                       | Event File Name    | UM21813_20240717102353.IDFW |
| Setup File Name         | 05.MMB                         | USB Sensor Support | Disabled                    |
| Operator                | Predrag                        |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes   Lokacija: kamnolom Podgora/   Naročnik: Minervo d.o.o/   Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 470m/59,16kg/   Merilec: Jure Primožič

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 0.536 mm/s              | 0.859 mm/s | 0.615 mm/s |
| Zero Crossing Frequency    | 14.2 Hz                 | 18.3 Hz    | 11.3 Hz    |
| Time (Relative to Trigger) | 0.457 sec               | 0.419 sec  | 0.158 sec  |
| Peak Acceleration          | 0.016 g                 | 0.020 g    | 0.016 g    |
| Peak Displacement          | 0.006 mm                | 0.009 mm   | 0.009 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.2                     | 4.1        | 3.8        |
| Peak Vector Sum            | 1.070 mm/s at 0.420 sec |            |            |

|                            |            |
|----------------------------|------------|
| ISEE Linear Microphone     |            |
| Peak Sound Pressure Level  | 1.32 pa    |
| Peak Sound Pressure Level  | 96.4 dB(L) |
| Time (Relative to Trigger) | 0.292 sec  |
| Zero Crossing Frequency    | 21.3 Hz    |
| Sensor Check               | ✓ Passed   |
| Frequency                  | 20.5 Hz    |
| Test Amplitude             | 1308 mv    |





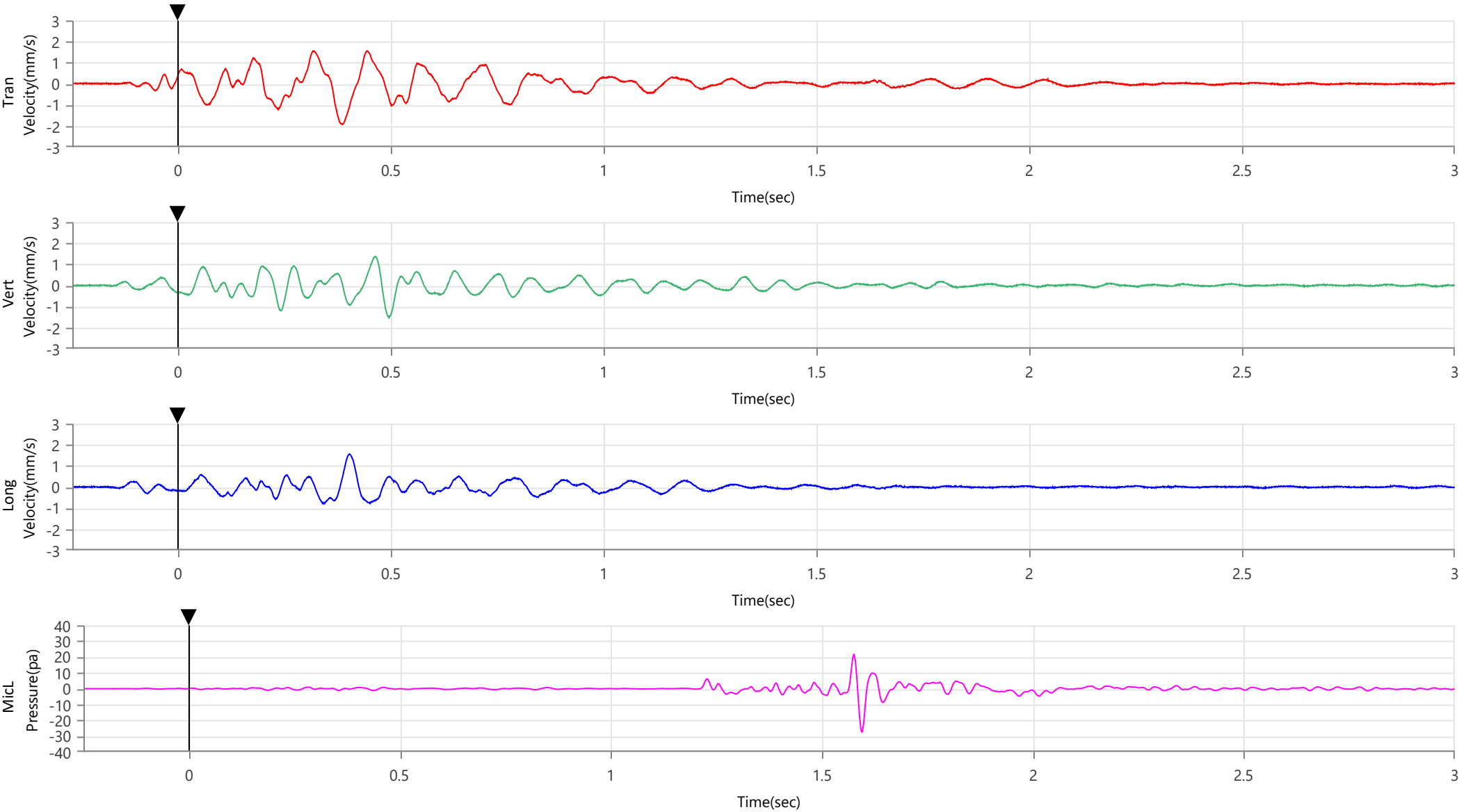
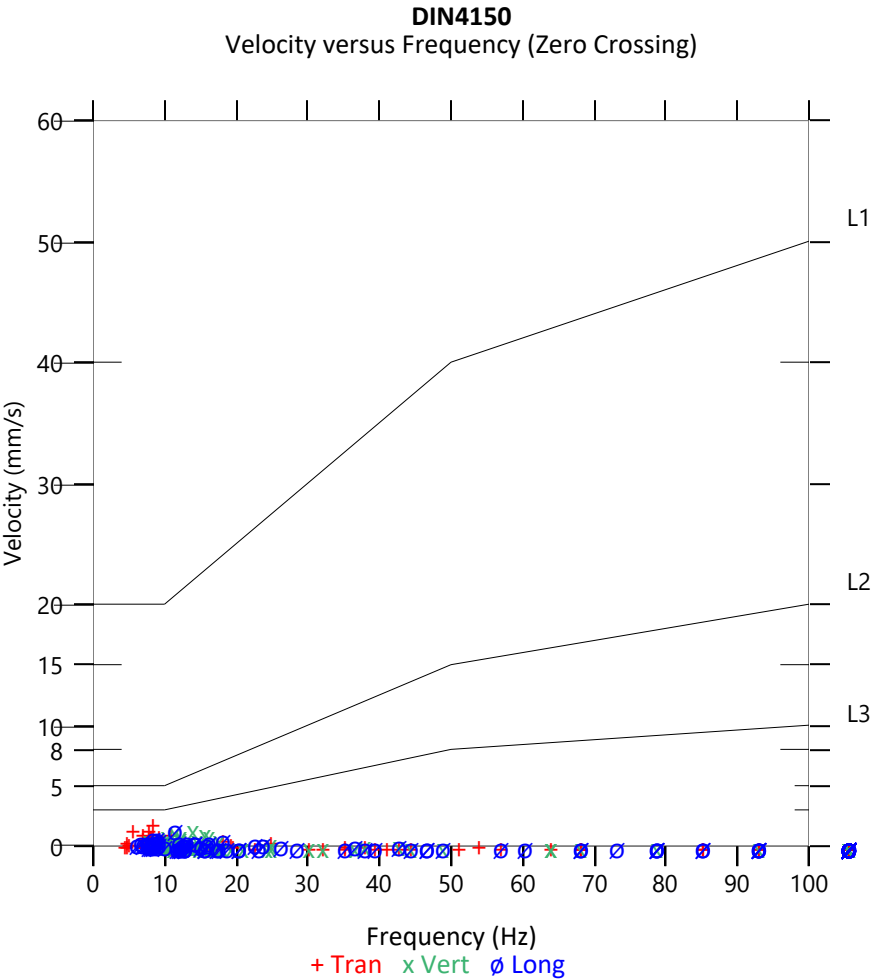
|                         |                                     |                    |                             |
|-------------------------|-------------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Tran at September 27, 2024 10:38:16 | Serial Number      | UM21813                     |
| Trigger Level(s)        | Geo 0.500 mm/s                      | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)              | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)            | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                            | Event File Name    | UM21813_20240927103816.IDFW |
| Setup File Name         | 05.MMB                              | USB Sensor Support | Disabled                    |
| Operator                | Predrag                             |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 470m/59,16kg/ Merilec: Predrag Daničić

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 1.931 mm/s              | 1.529 mm/s | 1.568 mm/s |
| Zero Crossing Frequency    | 8.4 Hz                  | 13.8 Hz    | 11.4 Hz    |
| Time (Relative to Trigger) | 0.385 sec               | 0.494 sec  | 0.401 sec  |
| Peak Acceleration          | 0.018 g                 | 0.031 g    | 0.018 g    |
| Peak Displacement          | 0.033 mm                | 0.017 mm   | 0.021 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.3                     | 4.1        | 3.9        |
| Peak Vector Sum            | 2.163 mm/s at 0.397 sec |            |            |

|                            |             |
|----------------------------|-------------|
| ISEE Linear Microphone     |             |
| Peak Sound Pressure Level  | 27.45 pa    |
| Peak Sound Pressure Level  | 122.7 dB(L) |
| Time (Relative to Trigger) | 1.595 sec   |
| Zero Crossing Frequency    | 22.8 Hz     |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1380 mv     |





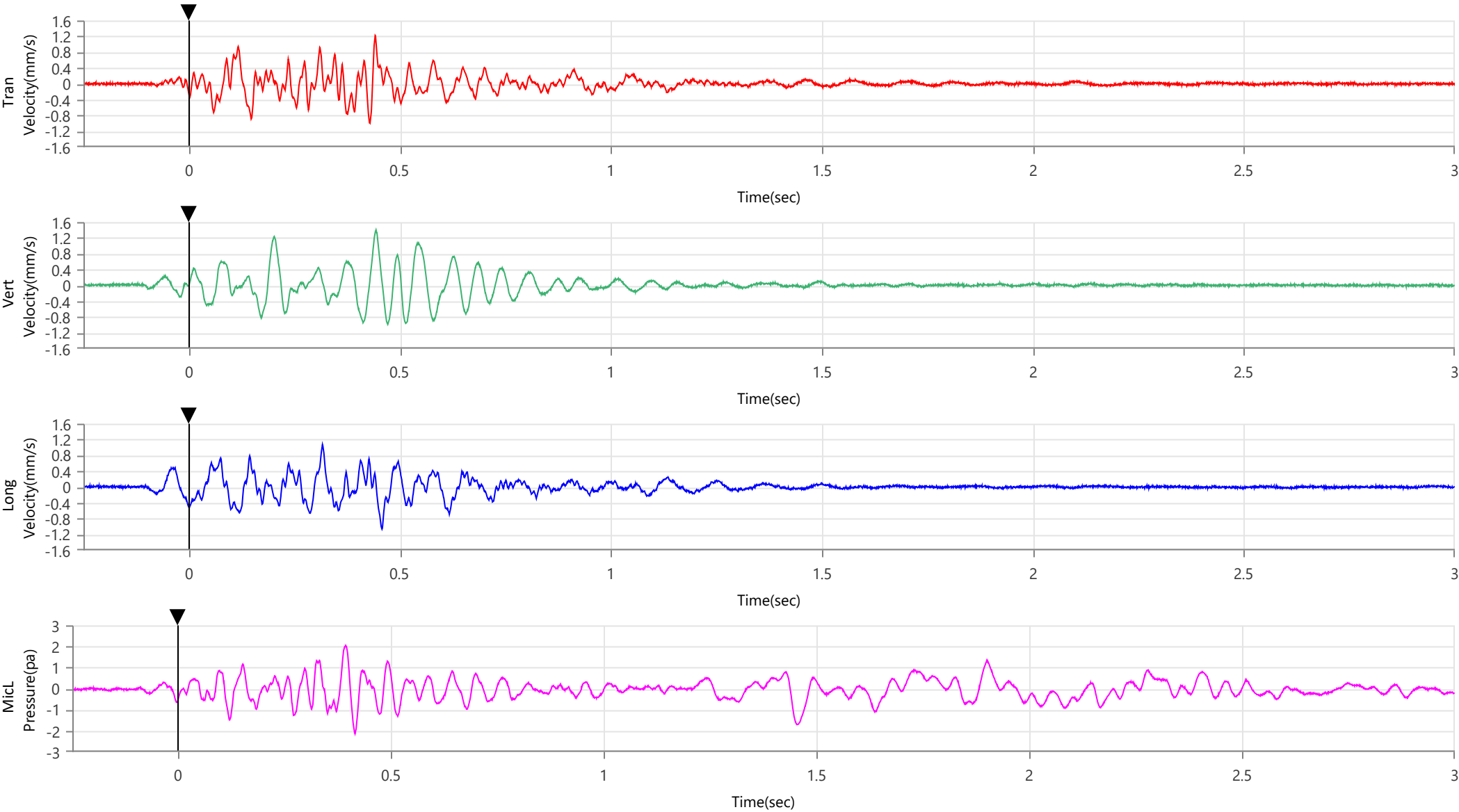
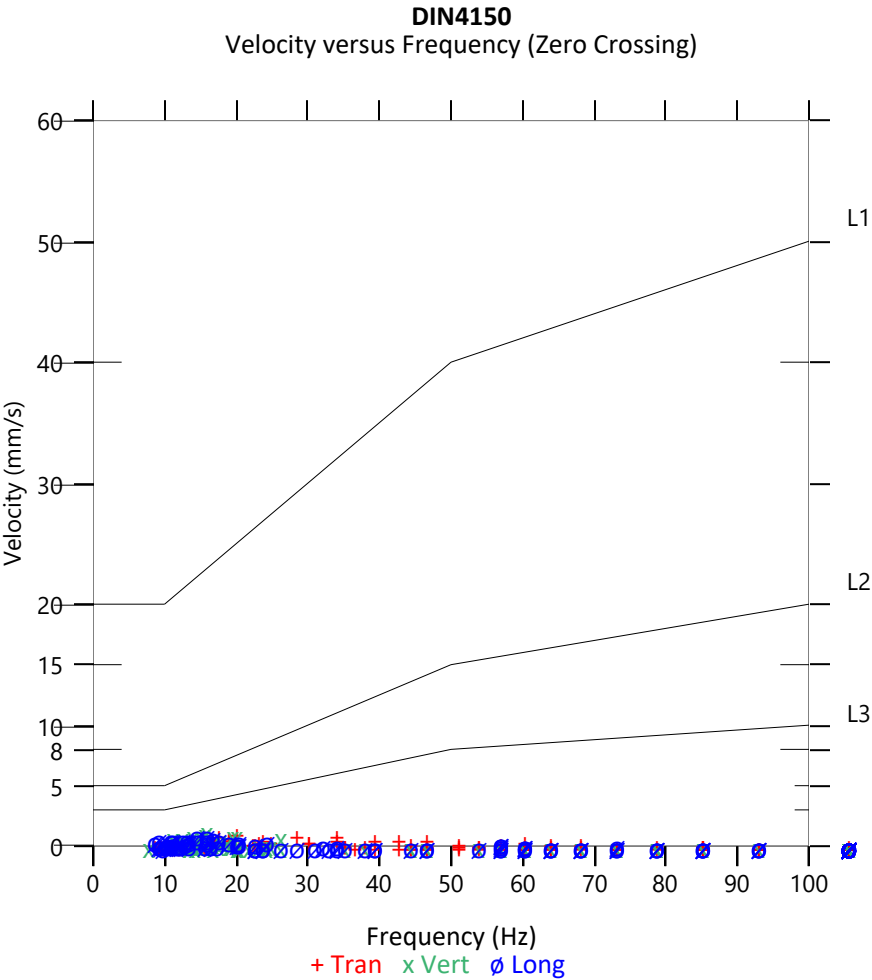
|                         |                                    |                    |                             |
|-------------------------|------------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Long at November 19, 2024 12:01:11 | Serial Number      | UM21812                     |
| Trigger Level(s)        | Geo 0.500 mm/s                     | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)             | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)           | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                           | Event File Name    | UM21812_20241119120111.IDFW |
| Setup File Name         | factory.MMB                        | USB Sensor Support | Disabled                    |
| Operator                | Predrag                            |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 400m/29,58kg/ Merilec: Predrag Daničić

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 1.222 mm/s              | 1.403 mm/s | 1.072 mm/s |
| Zero Crossing Frequency    | 20.5 Hz                 | 16.3 Hz    | 16.0 Hz    |
| Time (Relative to Trigger) | 0.441 sec               | 0.443 sec  | 0.316 sec  |
| Peak Acceleration          | 0.039 g                 | 0.026 g    | 0.025 g    |
| Peak Displacement          | 0.008 mm                | 0.013 mm   | 0.009 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.3                     | 3.9        | 4.0        |
| Peak Vector Sum            | 1.844 mm/s at 0.442 sec |            |            |

|                            |             |
|----------------------------|-------------|
| ISEE Linear Microphone     |             |
| Peak Sound Pressure Level  | 2.14 pa     |
| Peak Sound Pressure Level  | 100.6 dB(L) |
| Time (Relative to Trigger) | 0.415 sec   |
| Zero Crossing Frequency    | 23.3 Hz     |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1453 mv     |





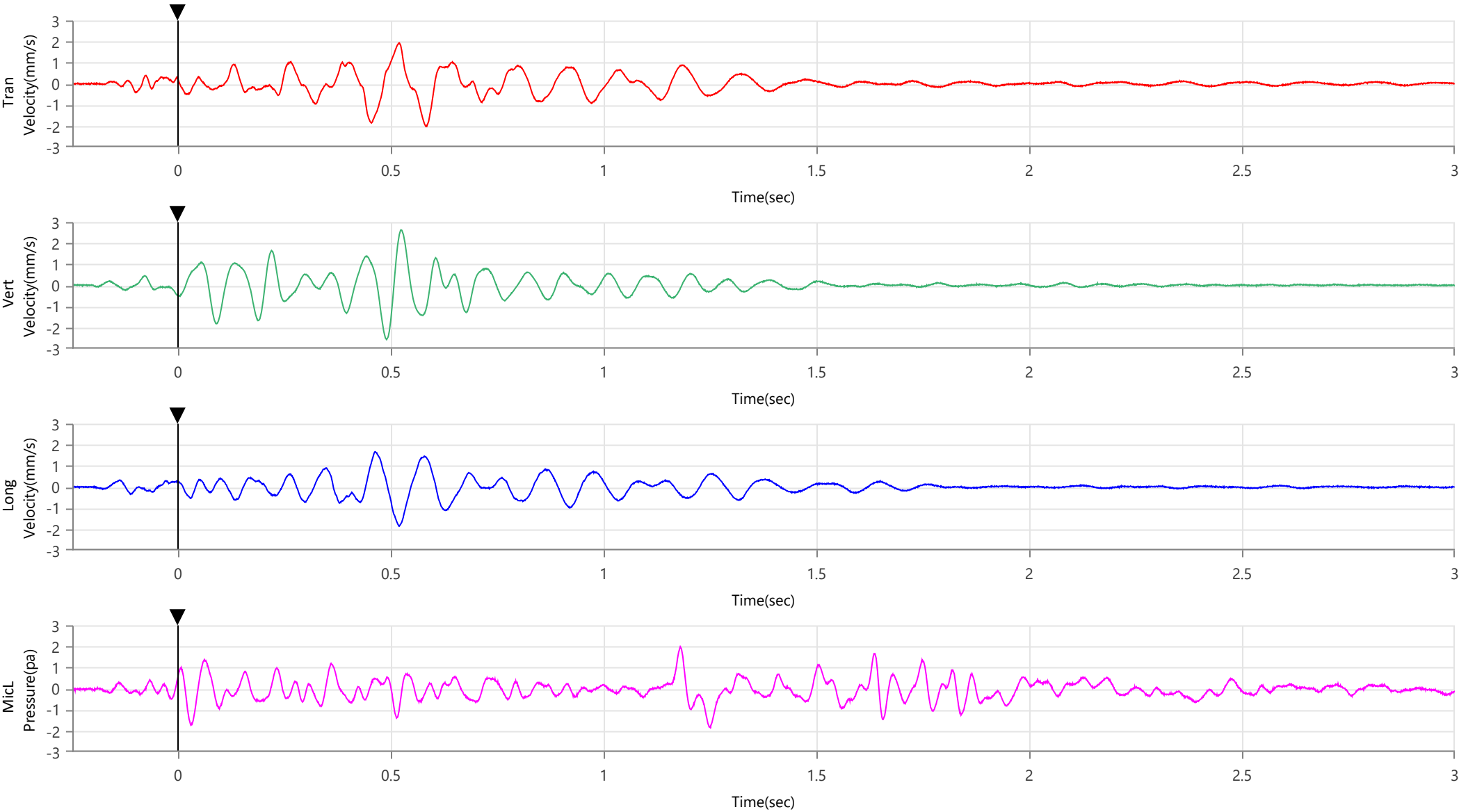
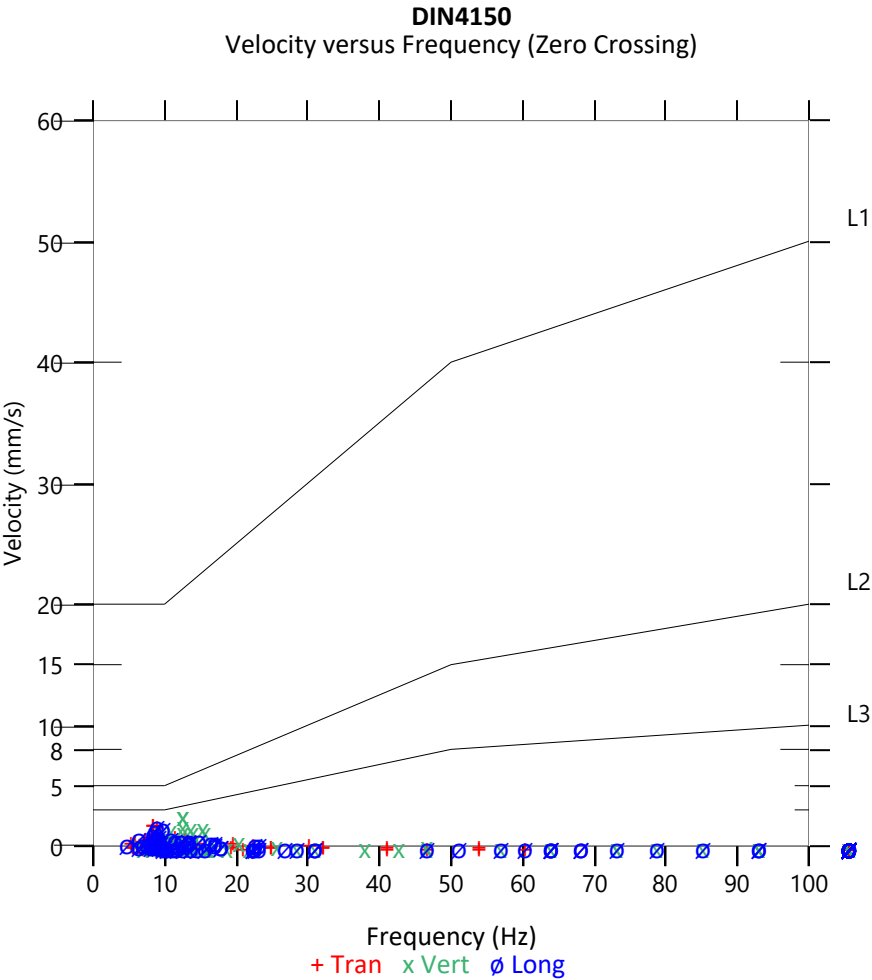
|                         |                                    |                    |                             |
|-------------------------|------------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Vert at November 19, 2024 12:02:43 | Serial Number      | UM21812                     |
| Trigger Level(s)        | Geo 0.500 mm/s                     | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)             | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)           | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                           | Event File Name    | UM21812_20241119120243.IDFW |
| Setup File Name         | factory.MMB                        | USB Sensor Support | Disabled                    |
| Operator                | Predrag                            |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 480m/44,16kg/ Merilec: Predrag Daničić

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 2.026 mm/s              | 2.633 mm/s | 1.860 mm/s |
| Zero Crossing Frequency    | 8.3 Hz                  | 12.6 Hz    | 9.1 Hz     |
| Time (Relative to Trigger) | 0.582 sec               | 0.522 sec  | 0.518 sec  |
| Peak Acceleration          | 0.023 g                 | 0.028 g    | 0.016 g    |
| Peak Displacement          | 0.031 mm                | 0.032 mm   | 0.029 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.3                     | 3.9        | 4.0        |
| Peak Vector Sum            | 3.645 mm/s at 0.521 sec |            |            |

|                            |            |
|----------------------------|------------|
| ISEE Linear Microphone     |            |
| Peak Sound Pressure Level  | 1.99 pa    |
| Peak Sound Pressure Level  | 99.9 dB(L) |
| Time (Relative to Trigger) | 1.179 sec  |
| Zero Crossing Frequency    | 8.1 Hz     |
| Sensor Check               | ✓ Passed   |
| Frequency                  | 20.5 Hz    |
| Test Amplitude             | 1453 mv    |



## Vibrolab d. o. o.

Lokacija: Kamnolom Podgora

Naročnik: Minervo d.o.o

Mersko mesto: Dobrič 30, temelj

Merilec: Jure Primožič

Datum: 11.12.2024

Čas: 12:17

Serijska številka instrumenta: 21813

Nastavljen nivo občutljivosti instrumenta (seismic trigger) 0,5 mm/s ni bil presežen.

Nastavljen nivo občutljivosti instrumenta (acoustic trigger) 100 dB ni bil presežen.

|                  |            |
|------------------|------------|
| Acoustic (A):    | < 100 dB   |
| Radial (R):      | < 0,5 mm/s |
| Vertical (V):    | < 0,5 mm/s |
| Transverse (T):  | < 0,5 mm/s |
| Vector Sum (VS): | < 0,5 mm/s |

|                         |                                    |                    |                             |
|-------------------------|------------------------------------|--------------------|-----------------------------|
| Waveform Trigger Source | Long at December 11, 2024 12:18:48 | Serial Number      | UM21813                     |
| Trigger Level(s)        | Geo 0.500 mm/s                     | Model Number       | Micromate DIN 10.90GC       |
| Trigger Level (Mic)     | Mic 2.00 pa, 100 dB(L)             | Battery Level      | 3.8 volts                   |
| Pre-Trigger/Record Time | 0.25 sec/3.0 sec (Fixed)           | Unit Calibration   | July 14, 2023 by Instantel  |
| Sample Rate             | 2048 sps                           | Event File Name    | UM21813_20241211121848.IDFW |
| Setup File Name         | 05.MMB                             | USB Sensor Support | Disabled                    |
| Operator                | Predrag                            |                    |                             |

Notes  
Location:  
Client:  
User Name:  
General:

Post Event Notes Lokacija: kamnolom Podgora/ Naročnik: Minervo d.o.o/ Mersko mesto: Dobrič 30, temelj/ Razdalja (kg/int): 440m/29,58kg/ Merilec: Jure Primožič

|                            |                         |            |            |
|----------------------------|-------------------------|------------|------------|
| Geophone                   | Tran                    | Vert       | Long       |
| Peak Particle Velocity     | 2.144 mm/s              | 2.065 mm/s | 1.829 mm/s |
| Zero Crossing Frequency    | 9.1 Hz                  | 11.1 Hz    | 8.3 Hz     |
| Time (Relative to Trigger) | 0.850 sec               | 0.472 sec  | 0.855 sec  |
| Peak Acceleration          | 0.018 g                 | 0.028 g    | 0.021 g    |
| Peak Displacement          | 0.035 mm                | 0.028 mm   | 0.036 mm   |
| Sensor Check               | ✓ Passed                | ✓ Passed   | ✓ Passed   |
| Frequency                  | 7.3 Hz                  | 7.5 Hz     | 7.5 Hz     |
| Overswing Ratio            | 4.3                     | 4.1        | 3.9        |
| Peak Vector Sum            | 2.854 mm/s at 0.852 sec |            |            |

|                            |             |
|----------------------------|-------------|
| ISEE Linear Microphone     |             |
| Peak Sound Pressure Level  | 3.93 pa     |
| Peak Sound Pressure Level  | 105.9 dB(L) |
| Time (Relative to Trigger) | 1.464 sec   |
| Zero Crossing Frequency    | 7.8 Hz      |
| Sensor Check               | ✓ Passed    |
| Frequency                  | 20.5 Hz     |
| Test Amplitude             | 1472 mv     |

