

**PROGETTO FOTOVOLTAICO ORDONA  
REPORT MISURE DI RESISTIVITA' TERMICA**



**DATA:** Marzo 2021

**COMMITTENTE:** *Architettura Sostenibile S.r.l.*  
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## **1. PREMESSA**

Su incarico dell'Arch. Giuseppe Todisco, Amm.re Unico della società a responsabilità limitata *Architettura Sostenibile*, con sede a Roma in Viale Ionio n.95 –cap. 00141, sono state eseguite delle misure di resistività termica in sette siti ricadenti in agro del Comune di Ortona .

A tale scopo sono state realizzate n.7 trincee spinte ad una profondità tale da superare il primo orizzonte di terreno alterato a suolo. Per ogni sito (Carta di ubicazione dei punti di misura) sono state effettuate tre misure; in tal modo è stato possibile valutare in maniera stabile ed accurata la conducibilità termica (attitudine del terreno a trasmettere il calore).

Le misure sono state effettuate ad elevata risoluzione di campionamento (24bit), con elaborazione aritmetica a 32 bit.

Questa tipologia di indagine viene realizzata, solitamente, prima della posa di cavidotti interrati, oppure prima della realizzazione di pozzi geotermici per il prelievo di calore dal terreno ad uso riscaldamento o condizionamento di edifici.

Le varie fasi di installazione e misure sono state eseguite sotto il controllo della DL (geol. Antonio Denapoli).

## **2. MISURE DI RESISTIVITA' TERMICA**

La conducibilità termica è una misura dell'attitudine di una sostanza a trasmettere calore e nei terreni è stata determinata mediante l'utilizzo di una Sonda Termica.

Il funzionamento della Sonda Termica è basato sul modello dell'ago termico proposto da De Vries e Peck (1958), che esegue la misura di conducibilità termica di un terreno in regime non stazionario, secondo il principio della diffusione radiale, da una sorgente termica lineare in un mezzo infinito e isotropo.

La sonda, infatti, è composta da un cavo riscaldante, che rappresenta una perfetta sorgente lineare e da un sensore termico in grado di misurare la temperatura della sorgente. La strumentazione utilizzata è costituita da una unità centrale di acquisizione (Fig.1) e da una sonda termica "**FTN01**" della **hukseflux**, che viene inserita nel terreno da indagare o mediante pressione dell'operatore o mediante prescavo/preforo (Fig.2).

Nell'unità centrale (fig.1) sono presenti il sistema di alimentazione (autonomo e da rete), il sistema di diagnostica e il sistema di acquisizione dotato di display per la



visualizzazione della curva sperimentale e di un supporto digitale SD per la memorizzazione dei dati acquisiti.



**Fig. 1** – Unità centrale



**Fig.2** - Strumentazione per misura di conducibilità termica

Dopo un breve periodo in cui il sistema sonda-terreno (Fig.3) raggiunge l'equilibrio termico, la temperatura aumenta, in funzione della potenza calorica ( $Q$ ), e della conducibilità termica del mezzo ( $\lambda$ ) secondo la seguente formula:

$$DT = (Q / 4 \pi \lambda) (\ln t + B)$$

Con  $T$  in °K;

$Q$  in W/m;

$\lambda$  in W/mK;

$t$  =tempo in s;

$B$  = Costante;

$T$  rappresenta la variazione di temperatura misurati tra due istanti ( $t_1$  e  $t_2$ ).

Riportando in un grafico semilogaritmico i valori di temperatura e tempo ottenuti in campo si osserva, che dopo un periodo transiente, il grafico si stabilizza ed assume un andamento lineare.

Scelti due istanti consecutivi  $t_1$  e  $t_2$ , ben distanziati, nel tratto di linearità della curva caratteristica, la conducibilità termica può essere calcolata con la seguente formula:

$$\lambda = (Q / 4 \pi T) \ln (t_2 / t_1).$$



Di seguito sono riportati i risultati delle misure di conducibilità termica eseguite su ciascuna trincea



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

Data misurazione 25/01/2021

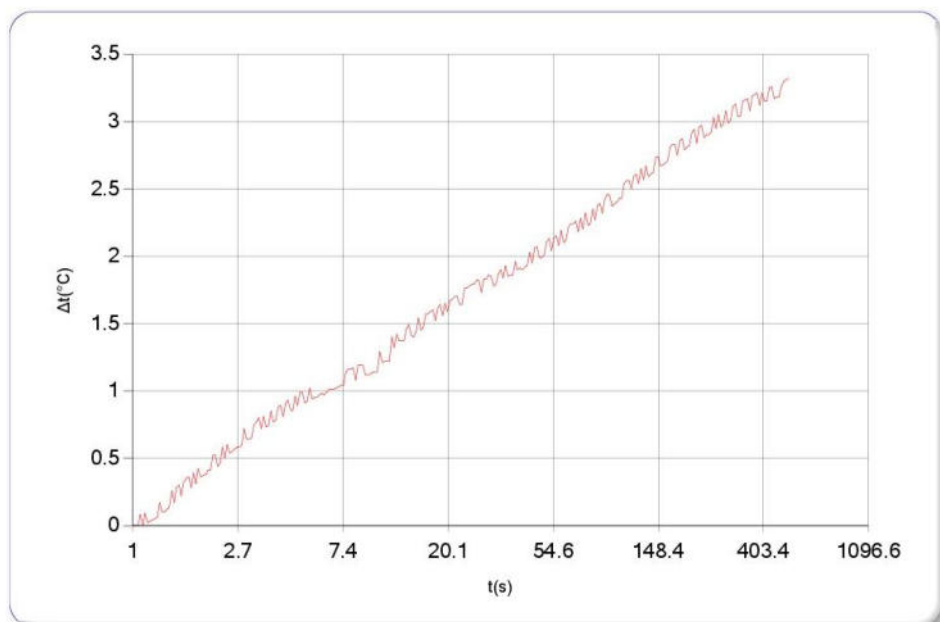
Luogo misurazione

TRINCEA 1

Osservazioni

PROVA 1  
PROFONDITA' = 1.50 m

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.5146	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	0.954	W/mK	Resistività termica	1.048	mK/W
Temperatura iniziale	11.48	°C	Temperatura finale	14.8	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

N. misurazione	0	1	2	3	4	5	6	7	8	9
$\Delta t(^{\circ}\text{C})$	0	0	0	0.08	0	0.09	0.02	0.03	0.04	0.05
t(s)	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.06	0.17	0.1	0.1	0.12	0.13	0.26	0.17	0.28	0.3	0.22	0.32
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.35	0.36	0.28	0.39	0.31	0.42	0.36	0.37	0.38	0.41	0.41	0.52
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.52	0.44	0.46	0.58	0.5	0.6	0.54	0.55	0.57	0.58	0.58	0.6
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.72	0.64	0.64	0.65	0.75	0.77	0.8	0.72	0.81	0.73	0.74	0.85
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.77	0.78	0.88	0.89	0.81	0.91	0.93	0.86	0.85	0.96	0.89	0.99
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.99	0.91	0.92	1.02	0.94	0.95	0.95	0.97	0.98	0.97	0.99	1.01
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1.01	1.01	1.02	1.03	1.04	1.04	1.14	1.16	1.16	1.17	1.08	1.19
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.19	1.19	1.12	1.12	1.12	1.14	1.14	1.14	1.29	1.21	1.22	1.22
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.22	1.4	1.32	1.42	1.37	1.37	1.37	1.46	1.49	1.41	1.4	1.44
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.54	1.45	1.47	1.57	1.57	1.59	1.6	1.52	1.62	1.64	1.56	1.65
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.59	1.67	1.68	1.7	1.7	1.64	1.64	1.76	1.76	1.78	1.79	1.79
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.82	1.82	1.73	1.83	1.83	1.86	1.85	1.78	1.79	1.87	1.9	1.84
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.93	1.85	1.86	1.86	1.96	1.9	1.91	1.9	1.92	1.93	2.03	1.95
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
2.06	2.07	1.99	1.99	2.01	2.11	2.13	2.04	2.14	2.15	2.08	2.19
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
2.1	2.12	2.22	2.24	2.24	2.26	2.18	2.28	2.2	2.32	2.23	2.24
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
2.35	2.27	2.38	2.39	2.32	2.42	2.46	2.45	2.37	2.39	2.4	2.43
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
2.43	2.54	2.56	2.56	2.5	2.59	2.61	2.54	2.65	2.57	2.67	2.59
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
2.61	2.62	2.73	2.74	2.67	2.68	2.69	2.71	2.81	2.83	2.83	2.75
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85





**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
2.86	2.87	2.79	2.81	2.82	2.92	2.94	2.84	2.96	2.97	2.88	2.9
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
2.9	2.92	3.03	2.95	3.05	2.96	2.98	3.08	2.99	3.01	3.11	3.13
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
3.04	3.04	3.15	3.16	3.17	3.08	3.19	3.2	3.21	3.12	3.21	3.15
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
3.15	3.25	3.26	3.17	3.18	3.18	3.26	3.3	3.31	3.32
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

**Data misurazione** 25/01/2021

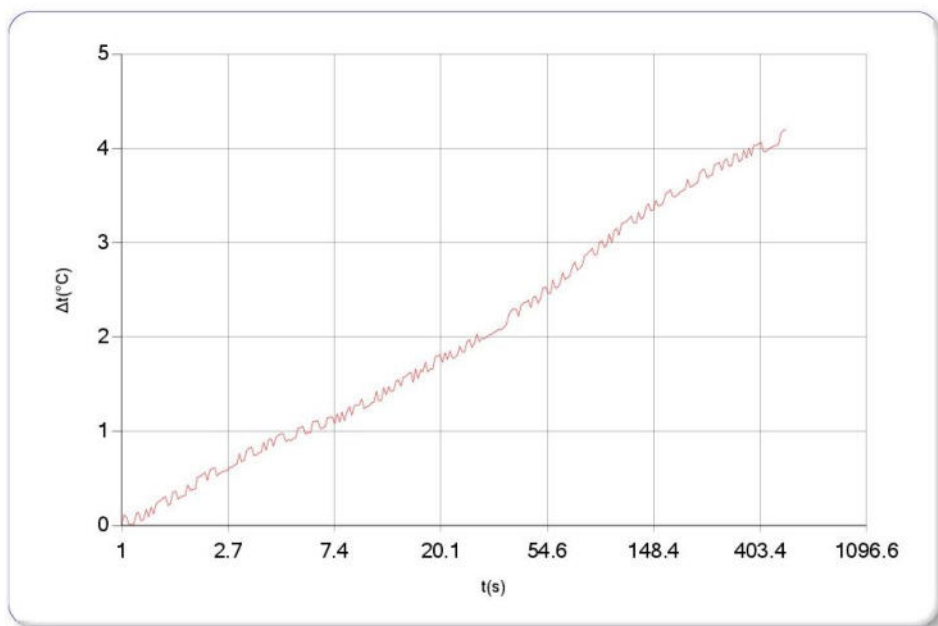
**Luogo misurazione**

TRINCEA 1

**Osservazioni**

PROVA 2  
PROFONDITA'= 1.00 m

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.5146	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	0.62	W/mK	Resistività termica	1.613	mK/W
Temperatura iniziale	10.32	°C	Temperatura finale	14.52	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

N. misurazione	0	1	2	3	4	5	6	7	8	9
$\Delta t(^{\circ}\text{C})$	0	0.11	0.08	0.01	0.01	0.01	0.12	0.14	0.05	0.06
t(s)	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.17	0.09	0.19	0.12	0.22	0.25	0.27	0.29	0.3	0.21	0.23	0.35
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.36	0.28	0.3	0.31	0.32	0.43	0.37	0.38	0.39	0.51	0.52	0.54
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.56	0.48	0.58	0.6	0.61	0.53	0.55	0.57	0.58	0.58	0.61	0.62
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.64	0.65	0.76	0.68	0.69	0.79	0.82	0.83	0.74	0.75	0.77	0.78
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.88	0.8	0.91	0.92	0.84	0.93	0.96	0.97	0.97	0.89	0.91	0.9
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.92	0.93	1.03	1.04	1.05	0.97	0.99	0.98	1.1	1.1	1.11	1.03
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1.03	1.05	1.14	1.15	1.15	1.08	1.18	1.1	1.2	1.11	1.21	1.26
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.17	1.27	1.27	1.28	1.34	1.24	1.26	1.27	1.3	1.31	1.42	1.32
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.33	1.46	1.39	1.47	1.42	1.43	1.53	1.54	1.48	1.57	1.58	1.61
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.62	1.52	1.66	1.56	1.65	1.63	1.73	1.63	1.66	1.66	1.79	1.8
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.81	1.73	1.83	1.76	1.85	1.78	1.78	1.81	1.9	1.84	1.84	1.95
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.97	1.89	1.93	2.03	1.95	1.98	1.98	2	2.02	2.03	2.05	2.06
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
2.08	2.08	2.1	2.13	2.23	2.28	2.3	2.29	2.22	2.33	2.36	2.37
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
2.39	2.31	2.42	2.43	2.36	2.41	2.52	2.53	2.47	2.46	2.6	2.52
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
2.53	2.57	2.68	2.61	2.63	2.65	2.75	2.79	2.71	2.73	2.76	2.86
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
2.88	2.91	2.94	2.87	2.88	3	3.02	2.95	2.98	3.09	3	3.13
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
3.15	3.08	3.2	3.21	3.23	3.25	3.28	3.21	3.21	3.32	3.25	3.27
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
3.38	3.41	3.34	3.35	3.45	3.39	3.4	3.42	3.52	3.54	3.56	3.49
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85



**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
3.49	3.51	3.54	3.55	3.57	3.67	3.59	3.6	3.62	3.64	3.74	3.77
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
3.77	3.69	3.71	3.72	3.83	3.84	3.85	3.77	3.87	3.89	3.81	3.82
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
3.94	3.94	3.86	3.88	3.98	3.9	4	3.92	4.03	4.03	4.05	4.06
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
3.97	3.97	3.99	4.01	4.02	4.03	4.04	4.16	4.19	4.2
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

Data misurazione 25/01/2021

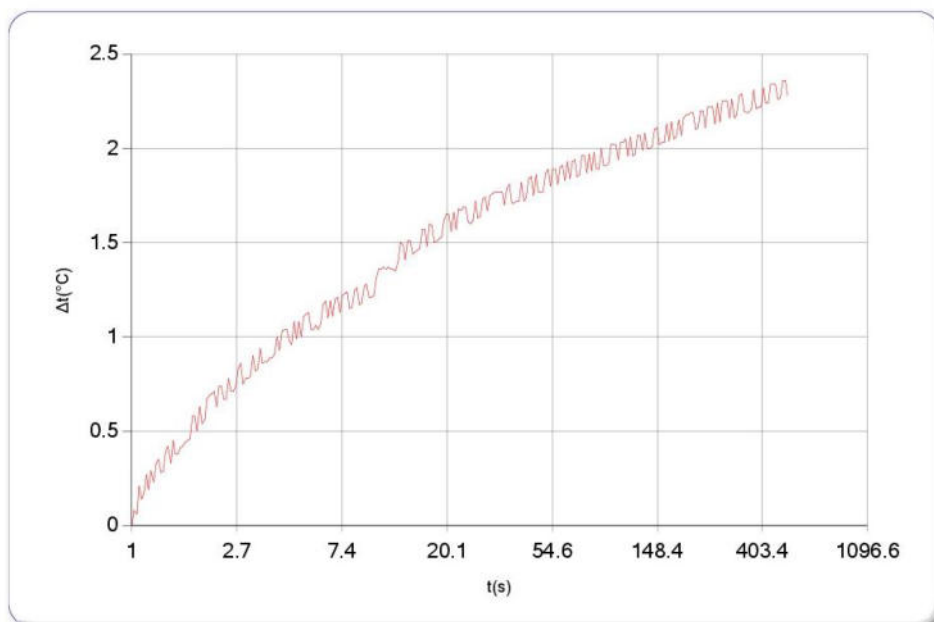
Luogo misurazione

TRINCEA 1

Osservazioni

PROVA 3  
PROFONDITA' = 0.50 m

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.5146	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	1.772	W/mK	Resistività termica	0.564	mK/W
Temperatura iniziale	9.14	°C	Temperatura finale	11.42	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

**Rapporto misurazioni**

<b>N. misurazione</b>	0	1	2	3	4	5	6	7	8	9
<b><math>\Delta t(^{\circ}\text{C})</math></b>	0	0.08	0.06	0.21	0.14	0.17	0.27	0.19	0.29	0.23
<b>t(s)</b>	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.33	0.35	0.28	0.29	0.39	0.42	0.33	0.45	0.38	0.38	0.41	0.42
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.44	0.45	0.46	0.58	0.58	0.5	0.63	0.54	0.56	0.67	0.69	0.7
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.71	0.63	0.74	0.74	0.67	0.67	0.78	0.71	0.71	0.74	0.83	0.86
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.75	0.78	0.78	0.79	0.9	0.82	0.83	0.94	0.86	0.87	0.87	0.89
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.89	0.91	1	0.93	1.03	1.04	1.04	0.98	0.96	1.08	0.99	1.08
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
1	1.11	1.12	1.13	1.04	1.04	1.06	1.04	1.07	1.17	1.19	1.1
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1.19	1.11	1.2	1.21	1.13	1.22	1.23	1.24	1.15	1.16	1.25	1.26
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.17	1.18	1.27	1.28	1.21	1.21	1.22	1.31	1.36	1.36	1.37	1.36
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.37	1.36	1.36	1.35	1.4	1.5	1.49	1.41	1.51	1.51	1.44	1.45
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.46	1.47	1.57	1.57	1.48	1.6	1.59	1.5	1.51	1.52	1.53	1.62
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.65	1.65	1.56	1.66	1.57	1.68	1.67	1.69	1.69	1.61	1.6	1.62
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.72	1.63	1.64	1.73	1.74	1.67	1.75	1.76	1.77	1.77	1.77	1.77
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.7	1.79	1.81	1.71	1.71	1.72	1.72	1.82	1.72	1.74	1.84	1.85
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
1.75	1.86	1.77	1.77	1.77	1.87	1.89	1.8	1.89	1.89	1.81	1.9
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
1.91	1.83	1.93	1.84	1.93	1.94	1.85	1.86	1.96	1.96	1.87	1.97
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
1.88	1.98	1.89	1.89	2	1.91	1.91	1.92	2.02	2.02	2.02	1.94
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
2.03	2.03	2.05	1.96	2.06	1.96	1.97	2.07	2.07	1.99	2.08	2
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
2	2.01	2.1	2.11	2.02	2.03	2.03	2.13	2.04	2.14	2.05	2.06
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85





**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
2.15	2.07	2.16	2.18	2.18	2.19	2.19	2.1	2.11	2.2	2.2	2.11
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
2.22	2.22	2.22	2.13	2.24	2.14	2.25	2.25	2.25	2.16	2.26	2.16
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
2.18	2.28	2.29	2.2	2.19	2.19	2.21	2.31	2.21	2.22	2.22	2.32
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
2.24	2.24	2.34	2.34	2.34	2.26	2.27	2.36	2.36	2.28
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

Data misurazione 25/01/2021

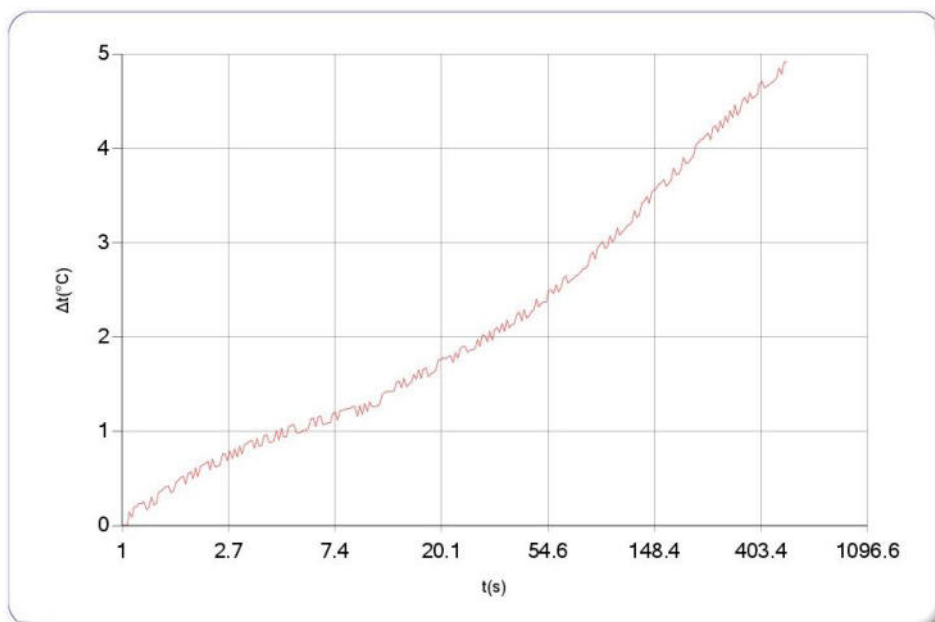
Luogo misurazione

TRINCEA 2

Osservazioni

PROVA 1  
PROFONDITA' = 1.50 m

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.5146	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	0.376	W/mK	Resistività termica	2.66	mK/W
Temperatura iniziale	12.36	°C	Temperatura finale	17.28	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

<b>N. misurazione</b>	0	1	2	3	4	5	6	7	8	9
<b><math>\Delta t(^{\circ}\text{C})</math></b>	0	0	0	0.14	0.09	0.19	0.2	0.23	0.23	0.25
<b>t(s)</b>	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.17	0.19	0.3	0.22	0.23	0.35	0.37	0.39	0.41	0.42	0.35	0.36
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.46	0.48	0.51	0.52	0.44	0.55	0.57	0.5	0.61	0.52	0.63	0.64
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.66	0.68	0.59	0.7	0.62	0.63	0.64	0.76	0.76	0.69	0.79	0.71
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.81	0.73	0.84	0.76	0.86	0.87	0.89	0.9	0.82	0.92	0.84	0.85
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.95	0.96	0.88	0.88	0.9	1	0.91	1.03	0.94	0.94	1.05	1.06
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
1.07	0.99	0.98	0.99	1.01	1.01	1.03	1.13	1.14	1.05	1.15	1.16
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1.07	1.08	1.09	1.09	1.19	1.2	1.12	1.22	1.22	1.23	1.24	1.24
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.26	1.26	1.16	1.27	1.18	1.29	1.21	1.31	1.26	1.26	1.27	1.28
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.38	1.41	1.42	1.42	1.42	1.43	1.52	1.53	1.46	1.56	1.47	1.5
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.52	1.6	1.55	1.65	1.56	1.66	1.67	1.58	1.61	1.62	1.65	1.75
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.76	1.78	1.77	1.79	1.8	1.73	1.83	1.78	1.88	1.9	1.9	1.84
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.86	1.86	1.88	1.97	1.9	2.02	2.01	1.95	2.06	1.97	2.08	2.1
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
2.05	2.14	2.06	2.18	2.1	2.13	2.14	2.24	2.26	2.17	2.29	2.2
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
2.22	2.27	2.29	2.4	2.32	2.36	2.37	2.37	2.49	2.5	2.46	2.55
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
2.48	2.52	2.62	2.65	2.57	2.6	2.62	2.65	2.66	2.69	2.72	2.73
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
2.76	2.87	2.9	2.83	2.95	2.98	3.01	2.94	2.96	3.07	3.01	3.05
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
3.15	3.08	3.12	3.14	3.18	3.19	3.22	3.34	3.27	3.29	3.42	3.44
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
3.49	3.42	3.54	3.56	3.58	3.62	3.64	3.67	3.6	3.63	3.67	3.79
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85



**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
3.72	3.73	3.78	3.9	3.84	3.85	3.89	3.92	4.03	4.06	4.09	4.1
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
4.14	4.16	4.09	4.22	4.24	4.18	4.29	4.22	4.34	4.28	4.4	4.33
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
4.46	4.35	4.4	4.51	4.54	4.48	4.59	4.53	4.55	4.57	4.68	4.71
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
4.64	4.66	4.68	4.7	4.72	4.75	4.85	4.79	4.91	4.92
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

Data misurazione 25/01/2021

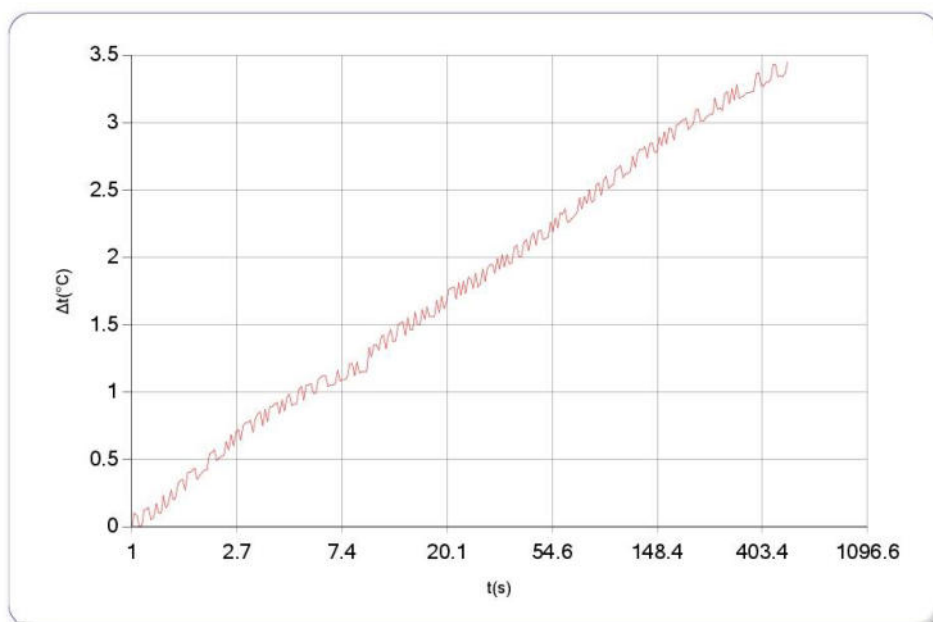
Luogo misurazione

TRINCEA 2

Osservazioni

PROVA 2  
PROFONDITA' = 1.00 m

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.5146	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	0.564	W/mK	Resistività termica	1.773	mK/W
Temperatura iniziale	10.45	°C	Temperatura finale	13.9	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

<b>N. misurazione</b>	0	1	2	3	4	5	6	7	8	9
<b><math>\Delta t(^{\circ}\text{C})</math></b>	0	0.1	0.08	0	0.01	0.12	0.13	0.14	0.05	0.07
<b>t(s)</b>	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.17	0.1	0.1	0.23	0.14	0.16	0.27	0.2	0.21	0.32	0.34	0.35
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.27	0.4	0.4	0.42	0.43	0.35	0.38	0.4	0.42	0.42	0.54	0.55
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.57	0.49	0.51	0.52	0.53	0.63	0.57	0.68	0.6	0.7	0.72	0.64
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.75	0.77	0.77	0.79	0.7	0.8	0.84	0.85	0.75	0.87	0.78	0.89
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.89	0.91	0.92	0.84	0.94	0.86	0.96	0.98	0.9	0.91	0.91	1.02
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
1.04	0.94	1.05	1.05	1.06	0.99	0.99	1.09	1.11	1.12	1.12	1.04
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1.05	1.05	1.06	1.16	1.08	1.09	1.09	1.11	1.21	1.21	1.12	1.22
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.14	1.15	1.15	1.15	1.33	1.26	1.35	1.35	1.31	1.41	1.42	1.32
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.42	1.46	1.37	1.38	1.5	1.51	1.52	1.42	1.55	1.46	1.46	1.59
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.5	1.5	1.61	1.54	1.63	1.56	1.56	1.56	1.68	1.59	1.71	1.62
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.66	1.76	1.77	1.78	1.69	1.81	1.72	1.82	1.73	1.85	1.84	1.77
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.88	1.78	1.8	1.91	1.82	1.92	1.94	1.94	1.88	1.99	1.91	2.02
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.93	2.02	1.95	1.96	2.07	2.09	2	2	2.11	2.13	2.05	2.15
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
2.18	2.09	2.19	2.2	2.13	2.14	2.15	2.26	2.19	2.29	2.22	2.33
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
2.32	2.36	2.26	2.27	2.29	2.31	2.33	2.44	2.36	2.45	2.4	2.5
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
2.41	2.42	2.54	2.55	2.46	2.57	2.6	2.51	2.53	2.54	2.65	2.66
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
2.68	2.59	2.62	2.62	2.64	2.75	2.67	2.77	2.8	2.8	2.82	2.74
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
2.84	2.85	2.78	2.78	2.89	2.83	2.93	2.84	2.96	2.95	2.87	2.98
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85





**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
2.99	3.01	3.02	3.03	2.95	2.97	2.99	3.09	3.1	3.01	3.01	3.03
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
3.05	3.06	3.06	3.18	3.1	3.11	3.09	3.21	3.23	3.14	3.25	3.17
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
3.28	3.18	3.19	3.2	3.22	3.22	3.23	3.23	3.36	3.37	3.28	3.27
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
3.3	3.3	3.32	3.43	3.43	3.34	3.35	3.34	3.37	3.45
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

Data misurazione 25/01/2021

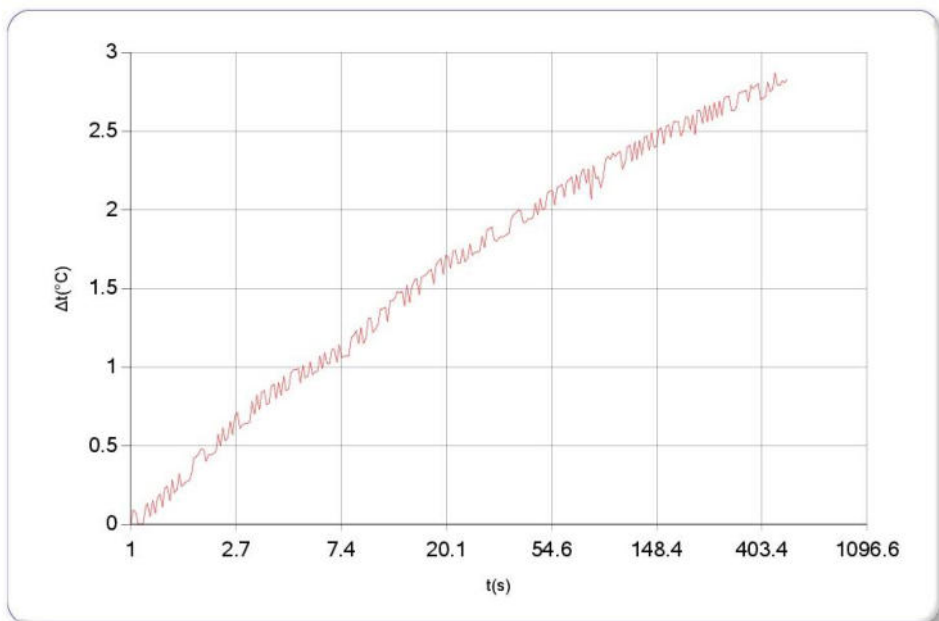
Luogo misurazione

TRINCEA 2

Osservazioni

PROVA 3  
PROFONDITA' = 0.50 m

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.5146	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	3.102	W/mK	Resistività termica	0.322	mK/W
Temperatura iniziale	9.07	°C	Temperatura finale	11.9	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

**Rapporto misurazioni**

<b>N. misurazione</b>	0	1	2	3	4	5	6	7	8	9
<b>Δt(°C)</b>	0	0.09	0.07	0	0	0	0.11	0.13	0.05	0.15
<b>t(s)</b>	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.07	0.17	0.19	0.11	0.23	0.24	0.15	0.28	0.2	0.22	0.32	0.24
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.26	0.27	0.28	0.32	0.42	0.43	0.45	0.48	0.47	0.4	0.44	0.44
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.45	0.46	0.57	0.5	0.61	0.53	0.55	0.65	0.57	0.69	0.71	0.61
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.63	0.64	0.64	0.65	0.78	0.7	0.82	0.73	0.84	0.85	0.76	0.77
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.88	0.89	0.8	0.9	0.82	0.94	0.85	0.86	0.96	0.98	0.98	0.99
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.9	1.01	0.93	0.94	1.03	0.95	0.97	0.97	1.07	0.99	1.09	1.02
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1.02	1.11	1.11	1.03	1.14	1.06	1.07	1.07	1.07	1.19	1.2	1.23
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.15	1.25	1.15	1.18	1.31	1.31	1.22	1.24	1.27	1.37	1.37	1.38
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.29	1.42	1.42	1.44	1.48	1.47	1.48	1.39	1.52	1.41	1.51	1.55
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.56	1.46	1.57	1.58	1.59	1.61	1.62	1.53	1.65	1.67	1.69	1.59
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.71	1.7	1.63	1.74	1.74	1.66	1.66	1.75	1.67	1.69	1.78	1.71
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.73	1.73	1.74	1.83	1.76	1.87	1.88	1.89	1.81	1.8	1.82	1.83
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.83	1.84	1.85	1.94	1.97	1.98	2	1.99	1.92	1.92	1.94	1.94
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
1.95	2.04	1.97	2.07	2	2.01	2.11	2.12	2.12	2.03	2.14	2.15
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
2.16	2.08	2.18	2.19	2.21	2.1	2.22	2.13	2.24	2.26	2.17	2.26
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
2.07	2.28	2.2	2.21	2.14	2.2	2.32	2.34	2.32	2.36	2.34	2.36
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
2.37	2.26	2.3	2.4	2.41	2.31	2.43	2.32	2.44	2.35	2.46	2.47
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
2.38	2.49	2.4	2.4	2.51	2.52	2.42	2.53	2.54	2.46	2.56	2.56
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85



**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
2.56	2.47	2.5	2.59	2.59	2.51	2.6	2.48	2.63	2.63	2.55	2.66
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
2.56	2.66	2.57	2.68	2.59	2.69	2.6	2.71	2.72	2.72	2.63	2.63
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
2.65	2.74	2.75	2.75	2.76	2.69	2.79	2.77	2.79	2.8	2.7	2.71
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
2.72	2.81	2.75	2.77	2.87	2.79	2.79	2.82	2.81	2.83
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

Data misurazione 25/01/2021

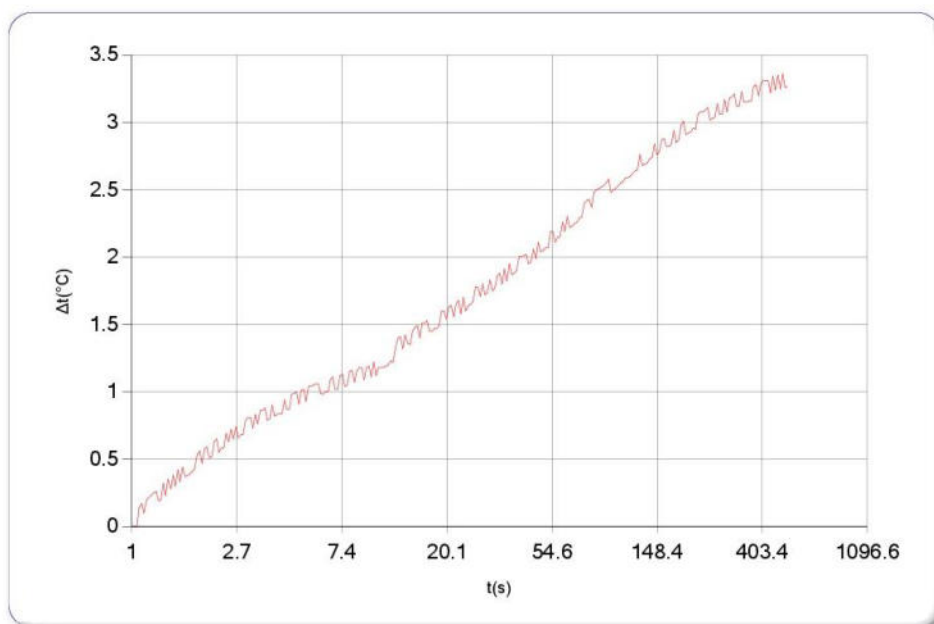
Luogo misurazione

TRINCEA 3

Osservazioni

PROVA 1  
PROFONDITA=1.50 m

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.5146	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	1.128	W/mK	Resistività termica	0.887	mK/W
Temperatura iniziale	11.02	°C	Temperatura finale	14.29	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

N. misurazione	0	1	2	3	4	5	6	7	8	9
$\Delta t(^{\circ}\text{C})$	0	0	0	0.14	0.17	0.1	0.2	0.21	0.23	0.25
t(s)	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.26	0.19	0.2	0.32	0.23	0.35	0.28	0.38	0.3	0.42	0.33	0.44
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.37	0.38	0.39	0.41	0.43	0.53	0.56	0.47	0.58	0.59	0.51	0.52
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.63	0.65	0.55	0.58	0.58	0.69	0.63	0.72	0.65	0.74	0.66	0.68
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.68	0.79	0.81	0.81	0.73	0.83	0.76	0.86	0.86	0.88	0.79	0.8
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.9	0.82	0.83	0.84	0.84	0.94	0.87	0.87	0.98	0.99	1	0.91
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
1.01	1.02	0.93	1.04	1.04	1.05	1.06	1.06	0.99	0.98	1	1
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1.09	1.11	1.02	1.02	1.12	1.13	1.04	1.05	1.15	1.16	1.07	1.16
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.18	1.18	1.09	1.18	1.19	1.11	1.22	1.12	1.18	1.18	1.18	1.19
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.2	1.23	1.22	1.33	1.4	1.41	1.32	1.42	1.36	1.35	1.45	1.48
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.49	1.4	1.51	1.51	1.53	1.45	1.45	1.47	1.47	1.49	1.6	1.6
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.54	1.63	1.64	1.56	1.65	1.68	1.58	1.7	1.6	1.64	1.65	1.67
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.78	1.78	1.71	1.8	1.72	1.74	1.83	1.75	1.77	1.86	1.88	1.8
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.91	1.82	1.95	1.87	1.88	1.9	2	2	2.01	2.02	1.95	1.97
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
2.06	1.99	2.11	2.04	2.05	2.07	2.07	2.19	2.19	2.11	2.15	2.15
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
2.26	2.19	2.3	2.22	2.23	2.25	2.26	2.29	2.3	2.4	2.42	2.43
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
2.37	2.48	2.5	2.51	2.52	2.53	2.55	2.58	2.48	2.5	2.51	2.53
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
2.55	2.56	2.59	2.59	2.6	2.62	2.64	2.65	2.76	2.68	2.69	2.7
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
2.73	2.74	2.84	2.76	2.78	2.87	2.88	2.82	2.82	2.84	2.94	2.85
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85





**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
2.87	2.98	3.01	2.91	2.92	2.93	2.96	2.95	3.06	3.08	3.08	3.09
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
3.11	3.02	3.03	3.04	3.14	3.06	3.06	3.17	3.08	3.18	3.19	3.21
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
3.12	3.12	3.23	3.15	3.15	3.16	3.16	3.27	3.28	3.2	3.29	3.31
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
3.31	3.31	3.22	3.34	3.24	3.35	3.25	3.36	3.26	3.27
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

Data misurazione 25/01/2021

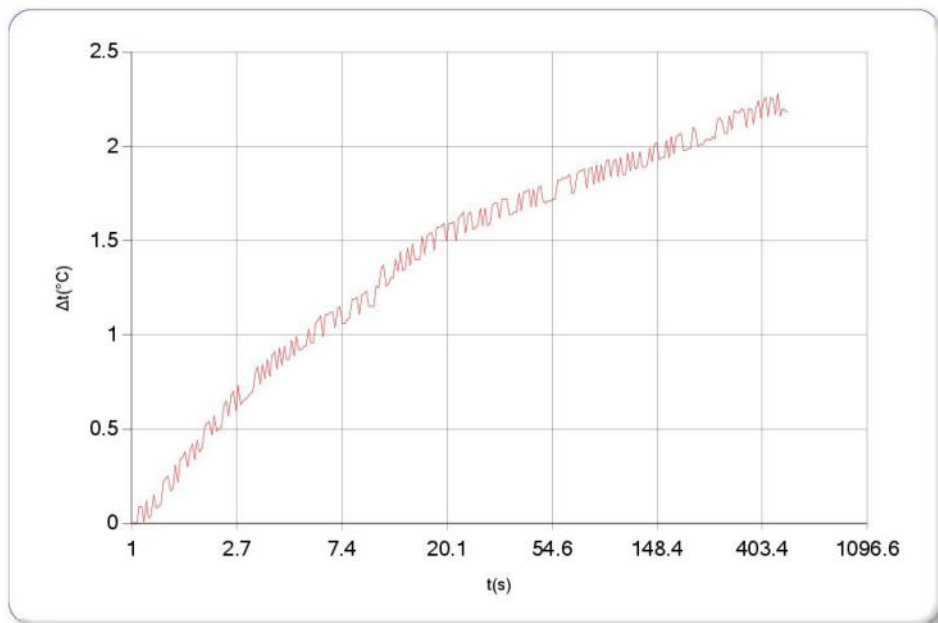
Luogo misurazione

TRINCEA 3

Osservazioni

PROVA 2  
PROFONDITA'= 1.0 m

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.5146	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	6.204	W/mK	Resistività termica	0.161	mK/W
Temperatura iniziale	10.56	°C	Temperatura finale	12.74	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

N. misurazione	0	1	2	3	4	5	6	7	8	9
$\Delta t(^{\circ}\text{C})$	0	0	0	0.09	0.09	0.01	0.12	0.03	0.04	0.15
t(s)	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.08	0.09	0.1	0.22	0.24	0.25	0.17	0.19	0.31	0.22	0.34	0.35
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.38	0.3	0.39	0.42	0.34	0.44	0.38	0.4	0.51	0.53	0.54	0.47
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.57	0.49	0.5	0.51	0.62	0.65	0.57	0.68	0.7	0.6	0.73	0.63
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.65	0.66	0.67	0.69	0.7	0.8	0.83	0.74	0.84	0.77	0.87	0.78
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.89	0.91	0.82	0.93	0.84	0.94	0.87	0.87	0.97	0.89	0.99	0.92
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.92	0.94	0.94	1.03	0.96	0.96	1.06	1.08	1.1	0.99	1.11	1.11
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1.12	1.12	1.04	1.14	1.15	1.06	1.06	1.08	1.09	1.19	1.19	1.2
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.11	1.21	1.22	1.23	1.15	1.15	1.15	1.26	1.25	1.35	1.37	1.26
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.27	1.3	1.3	1.4	1.34	1.44	1.34	1.35	1.46	1.37	1.48	1.4
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.4	1.4	1.52	1.43	1.52	1.54	1.54	1.45	1.57	1.57	1.58	1.59
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.5	1.59	1.59	1.6	1.5	1.62	1.63	1.65	1.54	1.64	1.65	1.56
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.57	1.58	1.67	1.58	1.67	1.58	1.59	1.69	1.7	1.7	1.62	1.72
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.72	1.72	1.64	1.64	1.65	1.65	1.75	1.66	1.76	1.76	1.77	1.68
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
1.77	1.68	1.78	1.79	1.71	1.7	1.71	1.71	1.72	1.72	1.82	1.82
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
1.83	1.83	1.84	1.85	1.75	1.76	1.85	1.87	1.87	1.88	1.78	1.88
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
1.89	1.8	1.9	1.81	1.9	1.82	1.92	1.93	1.84	1.92	1.93	1.84
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
1.94	1.85	1.85	1.96	1.87	1.97	1.88	1.89	1.97	1.89	1.89	1.9
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
1.99	1.92	2.01	2.02	1.93	1.94	1.94	2.03	1.94	2.05	1.96	2.05
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85



**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
2.06	2.07	1.98	1.98	1.99	1.99	2.1	2.08	2	2.01	2.01	2.03
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
2.04	2.03	2.05	2.04	2.14	2.15	2.13	2.07	2.07	2.16	2.09	2.19
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
2.18	2.18	2.2	2.19	2.1	2.2	2.2	2.12	2.21	2.24	2.15	2.24
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
2.26	2.16	2.26	2.25	2.17	2.28	2.16	2.2	2.19	2.18
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CT Lab

ADVANCED GEOPHYSICS INSTRUMENTS

Data misurazione 25/01/2021

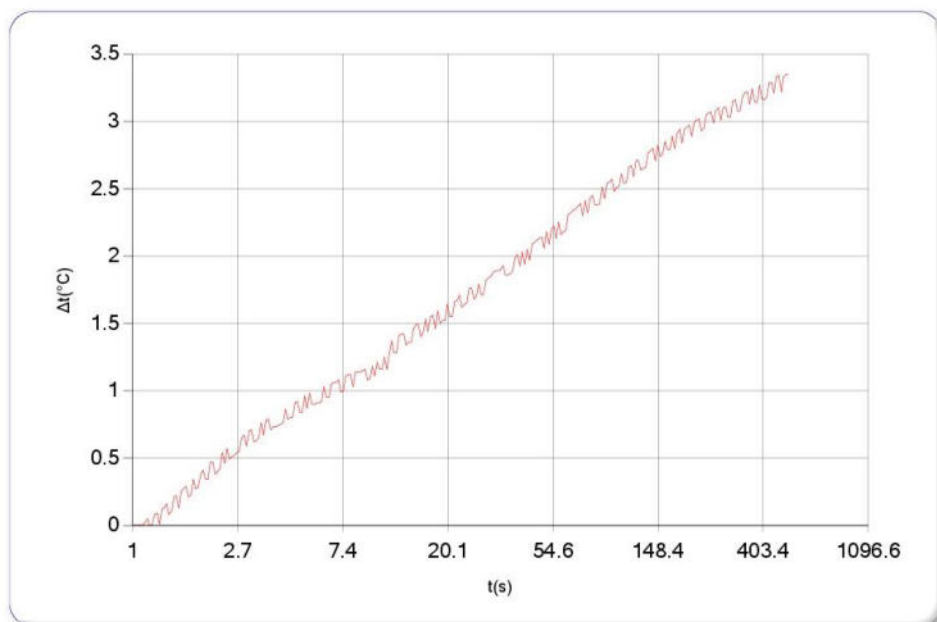
Luogo misurazione

TRINCEA 3

Osservazioni

PROVA 3  
PROFONDITA' = 0.50 m

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.5146	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	1.128	W/mK	Resistività termica	0.887	mK/W
Temperatura iniziale	9.3	°C	Temperatura finale	12.65	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

N. misurazione	0	1	2	3	4	5	6	7	8	9
$\Delta t(^{\circ}\text{C})$	0	0	0	0	0	0.02	0.05	0	0	0.08
t(s)	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.09	0.01	0.12	0.13	0.16	0.08	0.11	0.21	0.22	0.13	0.25	0.27
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.29	0.21	0.23	0.34	0.27	0.28	0.38	0.41	0.34	0.34	0.47	0.47
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.38	0.4	0.42	0.54	0.46	0.57	0.49	0.51	0.52	0.54	0.55	0.65
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.67	0.59	0.7	0.71	0.62	0.63	0.65	0.76	0.67	0.78	0.79	0.71
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.73	0.73	0.74	0.75	0.76	0.86	0.79	0.8	0.8	0.91	0.92	0.84
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.84	0.96	0.87	0.98	0.9	0.9	0.91	0.91	0.92	1.03	0.95	0.95
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1.05	1.06	1.06	1.08	0.99	1	1.11	1.12	1.12	1.03	1.14	1.14
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.14	1.15	1.16	1.08	1.09	1.18	1.11	1.21	1.16	1.16	1.25	1.16
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.27	1.37	1.28	1.28	1.41	1.42	1.42	1.34	1.36	1.36	1.46	1.49
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.49	1.4	1.43	1.53	1.44	1.55	1.56	1.46	1.59	1.5	1.52	1.52
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.64	1.55	1.55	1.66	1.67	1.71	1.62	1.64	1.65	1.76	1.76	1.68
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.7	1.79	1.71	1.72	1.82	1.84	1.85	1.88	1.89	1.89	1.9	1.93
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.86	1.86	1.87	1.89	1.99	2.01	1.93	2.03	1.94	2.05	1.97	2.09
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
2.1	2.12	2.13	2.14	2.06	2.18	2.09	2.2	2.22	2.13	2.25	2.16
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
2.18	2.19	2.31	2.32	2.34	2.35	2.37	2.39	2.3	2.41	2.32	2.43
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
2.45	2.38	2.38	2.39	2.51	2.43	2.54	2.55	2.57	2.48	2.51	2.52
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
2.61	2.54	2.55	2.66	2.67	2.59	2.71	2.71	2.64	2.65	2.66	2.77
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
2.78	2.8	2.71	2.82	2.74	2.76	2.85	2.79	2.79	2.89	2.8	2.91
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85





### Rapporto misurazioni

226	227	228	229	230	231	232	233	234	235	236	237
2.94	2.84	2.94	2.96	2.97	2.89	2.99	3.01	3.02	2.93	2.95	3.05
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
3.06	3.07	2.99	3.08	3.1	3.01	3.1	3.11	3.03	3.03	3.15	3.16
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
3.08	3.08	3.19	3.21	3.22	3.13	3.24	3.15	3.14	3.27	3.17	3.16
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
3.18	3.29	3.29	3.21	3.33	3.34	3.22	3.33	3.35	3.35
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

Data misurazione 25/01/2021

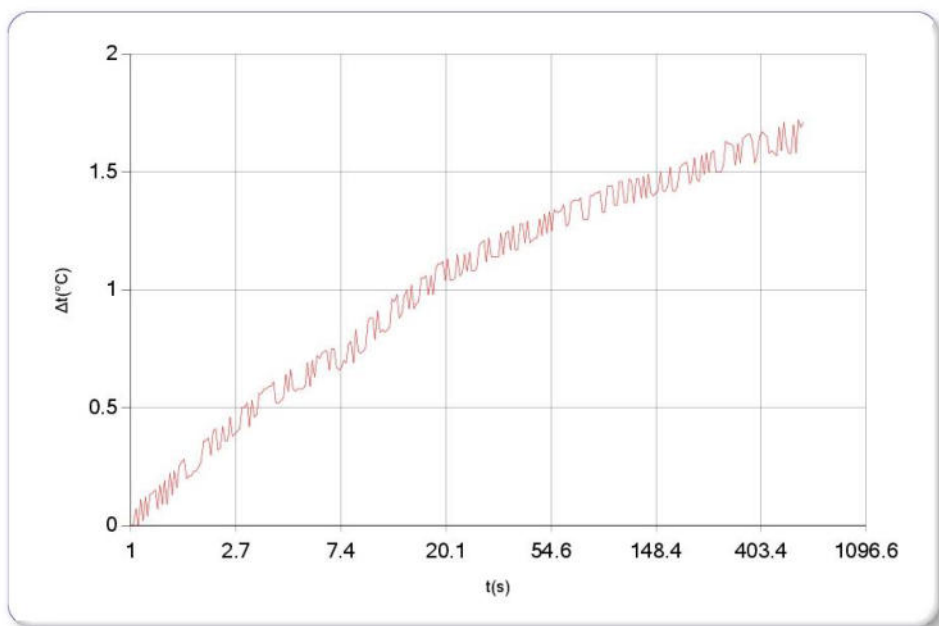
Luogo misurazione

TRINCEA 4

Osservazioni

PROVA 1  
PROFONDITA'= 1.50 m.

### Grafico



### Parametri misurazione

Resistenza sonda	89.16	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.72887	W/m	Durata misurazione	600	s

### Risultati

Conducibilità termica	1.024	W/mK	Resistività termica	0.977	mK/W
Temperatura iniziale	17.62	°C	Temperatura finale	19.33	°C
Num. misurazioni	278				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

N. misurazione

$\Delta t(^{\circ}\text{C})$

t(s)

0	1	2	3	4	5	6	7	8	9
0	0	0.07	0	0.11	0.02	0.12	0.04	0.13	0.14
1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.15	0.07	0.17	0.09	0.19	0.09	0.22	0.13	0.23	0.16	0.25	0.27
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.28	0.2	0.21	0.21	0.23	0.23	0.25	0.27	0.36	0.36	0.37	0.3
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.4	0.41	0.32	0.33	0.42	0.36	0.36	0.46	0.38	0.39	0.4	0.41
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.5	0.5	0.52	0.42	0.53	0.46	0.47	0.56	0.56	0.58	0.58	0.59
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.59	0.61	0.52	0.52	0.53	0.54	0.64	0.57	0.66	0.58	0.57	0.58
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.58	0.58	0.59	0.69	0.59	0.7	0.63	0.72	0.71	0.73	0.74	0.74
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
0.66	0.75	0.75	0.67	0.66	0.67	0.7	0.69	0.77	0.78	0.69	0.83
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
0.74	0.73	0.74	0.75	0.87	0.88	0.88	0.79	0.91	0.82	0.83	0.82
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
0.83	0.84	0.96	0.95	0.98	0.88	0.9	0.97	1	0.92	1.02	0.92
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
0.94	0.95	1.05	1.05	1.06	0.98	1.06	0.98	1.09	1.11	1.11	1.12
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.04	1.13	1.04	1.04	1.05	1.15	1.06	1.07	1.15	1.08	1.16	1.08
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.08	1.09	1.19	1.2	1.21	1.12	1.22	1.14	1.14	1.14	1.14	1.24
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.15	1.24	1.25	1.17	1.27	1.17	1.17	1.28	1.28	1.2	1.29	1.2
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
1.21	1.22	1.22	1.3	1.23	1.32	1.24	1.33	1.25	1.34	1.33	1.33
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
1.34	1.36	1.27	1.28	1.37	1.38	1.38	1.38	1.39	1.3	1.3	1.3
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
1.4	1.4	1.41	1.41	1.42	1.33	1.33	1.44	1.44	1.44	1.36	1.36
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
1.46	1.46	1.37	1.37	1.47	1.46	1.37	1.47	1.47	1.39	1.48	1.39
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
1.49	1.41	1.4	1.41	1.42	1.5	1.42	1.42	1.44	1.52	1.42	1.42
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85



**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
1.44	1.52	1.53	1.54	1.54	1.45	1.47	1.56	1.47	1.46	1.57	1.49
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
1.58	1.5	1.58	1.59	1.5	1.5	1.5	1.53	1.63	1.62	1.62	1.61
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
1.53	1.62	1.54	1.64	1.65	1.66	1.66	1.63	1.54	1.58	1.65	1.67
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271	272	273
1.66	1.65	1.58	1.59	1.58	1.57	1.69	1.59	1.71	1.62	1.58	1.58
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93	524.87	537.1

274	275	276	277	278
1.7	1.58	1.72	1.69	1.71
549.61	562.41	575.51	588.92	602.64



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

**Data misurazione** 25/01/2021

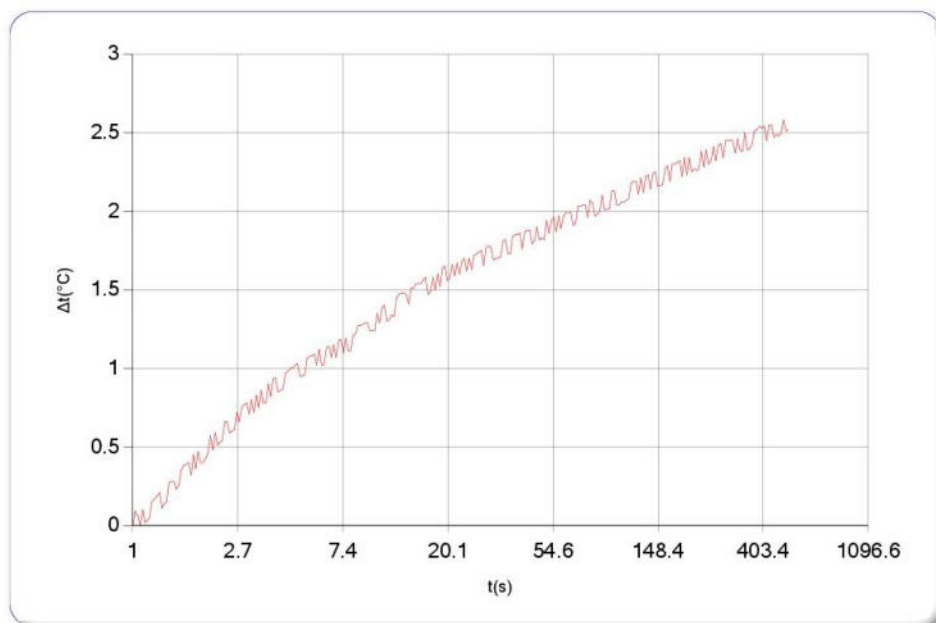
**Luogo misurazione**

TRINCEA 4

**Osservazioni**

PROVA 2  
PROFONDITA' = 1.00 m.

### Grafico



### Parametri misurazione

<u>Resistenza sonda</u>	85.12	Ohm/m	<u>Tensione riscaldatore</u>	4	V
<u>Potenza riscaldatore</u>	4.5146	W/m	<u>Durata misurazione</u>	510	s

### Risultati

<u>Conducibilità termica</u>	1.378	W/mK	<u>Resistività termica</u>	0.726	mK/W
<u>Temperatura iniziale</u>	9.82	°C	<u>Temperatura finale</u>	12.34	°C
<u>Num. misurazioni</u>	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

<b>N. misurazione</b>	0	1	2	3	4	5	6	7	8	9
<b><math>\Delta t(^{\circ}\text{C})</math></b>	0	0.09	0.06	0	0.1	0.02	0.03	0.05	0.15	0.17
<b>t(s)</b>	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.19	0.21	0.11	0.14	0.15	0.27	0.28	0.28	0.23	0.26	0.35	0.38
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.39	0.4	0.32	0.45	0.36	0.47	0.4	0.4	0.43	0.46	0.57	0.48
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.59	0.51	0.53	0.54	0.66	0.66	0.59	0.6	0.61	0.72	0.66	0.75
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.77	0.78	0.71	0.8	0.72	0.83	0.75	0.86	0.78	0.78	0.9	0.82
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.93	0.94	0.85	0.86	0.87	0.97	0.98	1	1	1.02	1.03	0.95
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.95	0.96	1.06	1.08	1.08	1.09	1.02	1.12	1.02	1.02	1.13	1.14
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1.07	1.15	1.07	1.18	1.18	1.1	1.19	1.11	1.11	1.21	1.22	1.27
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.27	1.28	1.29	1.29	1.24	1.24	1.24	1.35	1.29	1.39	1.4	1.3
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.31	1.34	1.33	1.45	1.47	1.48	1.48	1.47	1.41	1.51	1.51	1.54
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.54	1.54	1.56	1.58	1.47	1.49	1.58	1.5	1.6	1.52	1.64	1.65
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.56	1.57	1.66	1.59	1.67	1.6	1.68	1.7	1.62	1.7	1.63	1.72
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.73	1.74	1.75	1.65	1.77	1.78	1.77	1.69	1.7	1.7	1.71	1.81
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.82	1.73	1.73	1.84	1.85	1.85	1.86	1.76	1.87	1.88	1.88	1.79
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
1.81	1.9	1.82	1.83	1.82	1.94	1.86	1.94	1.96	1.87	1.97	1.89
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
1.97	1.99	1.99	1.99	1.91	1.92	2.03	2.03	2.04	2.04	1.96	2.07
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
2.05	1.97	1.98	2	2.1	2.01	2.01	2.02	2.13	2.13	2.04	2.04
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
2.06	2.06	2.07	2.08	2.18	2.19	2.19	2.11	2.21	2.12	2.22	2.23
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
2.14	2.24	2.25	2.16	2.16	2.17	2.27	2.29	2.19	2.3	2.3	2.31
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85





**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
2.32	2.22	2.34	2.23	2.34	2.25	2.27	2.26	2.27	2.38	2.28	2.39
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
2.3	2.32	2.41	2.32	2.42	2.43	2.34	2.45	2.45	2.45	2.45	2.37
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
2.46	2.39	2.38	2.5	2.39	2.4	2.43	2.51	2.52	2.54	2.53	2.54
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
2.45	2.55	2.55	2.47	2.49	2.48	2.5	2.58	2.51	2.52
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

**Data misurazione** 25/01/2021

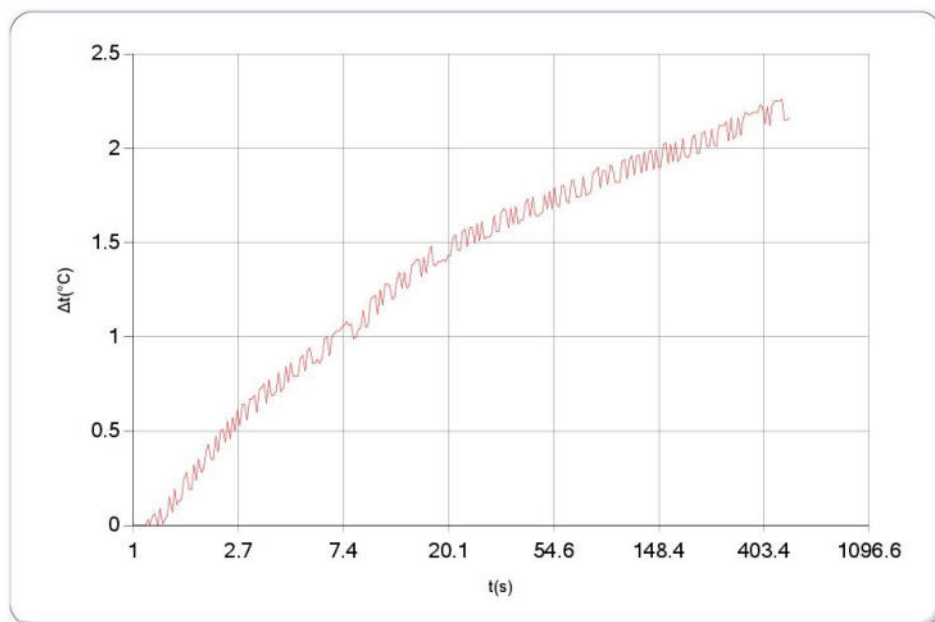
**Luogo misurazione**

TRINCEA 4

**Osservazioni**

PROVA 3  
PROFONDITA' = 0.50 m.

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.5146	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	4.136	W/mK	Resistività termica	0.242	mK/W
Temperatura iniziale	9.28	°C	Temperatura finale	11.44	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

N. misurazione	0	1	2	3	4	5	6	7	8	9
$\Delta t(^{\circ}\text{C})$	0	0	0	0	0	0	0.03	0	0.05	0.06
t(s)	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0	0.09	0.01	0.03	0.05	0.15	0.07	0.19	0.11	0.13	0.14	0.25
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.28	0.19	0.19	0.32	0.24	0.35	0.28	0.3	0.4	0.43	0.35	0.35
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.47	0.39	0.5	0.51	0.44	0.55	0.46	0.57	0.5	0.61	0.53	0.64
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.64	0.56	0.67	0.67	0.69	0.6	0.72	0.73	0.75	0.65	0.77	0.69
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.69	0.71	0.81	0.71	0.73	0.84	0.76	0.86	0.79	0.79	0.79	0.89
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.9	0.82	0.93	0.94	0.86	0.86	0.88	0.86	0.89	0.99	1	0.9
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1	1.02	1.03	1.03	1.05	1.06	1.08	1.06	1.07	0.99	1	1.04
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.05	1.14	1.05	1.06	1.2	1.21	1.22	1.12	1.25	1.17	1.28	1.28
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.27	1.2	1.21	1.31	1.34	1.26	1.34	1.26	1.27	1.38	1.39	1.41
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.41	1.32	1.42	1.34	1.43	1.48	1.38	1.38	1.4	1.4	1.41	1.4
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.43	1.43	1.52	1.54	1.46	1.46	1.56	1.57	1.48	1.58	1.58	1.5
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.6	1.51	1.61	1.52	1.53	1.53	1.54	1.64	1.56	1.56	1.66	1.68
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.67	1.58	1.68	1.6	1.69	1.6	1.62	1.62	1.71	1.73	1.64	1.74
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
1.65	1.64	1.65	1.66	1.75	1.68	1.77	1.68	1.79	1.7	1.69	1.8
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
1.8	1.72	1.71	1.83	1.83	1.74	1.74	1.75	1.85	1.75	1.76	1.77
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
1.87	1.88	1.9	1.79	1.88	1.88	1.81	1.91	1.9	1.82	1.82	1.82
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
1.93	1.94	1.84	1.94	1.96	1.86	1.96	1.96	1.87	1.98	1.88	1.98
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
1.99	1.89	1.99	1.9	1.9	2.02	2.03	1.92	2.02	1.93	2.03	1.93
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85



**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
1.95	2.05	1.96	1.95	1.96	2.06	2.07	1.97	1.98	2.08	2.09	2.01
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
2.01	2.1	2.02	2.01	2.12	2.12	2.12	2.14	2.04	2.16	2.05	2.07
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
2.16	2.07	2.16	2.19	2.18	2.18	2.19	2.19	2.19	2.23	2.22	2.13
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
2.22	2.12	2.23	2.25	2.25	2.25	2.26	2.15	2.15	2.16
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

Data misurazione 25/01/2021

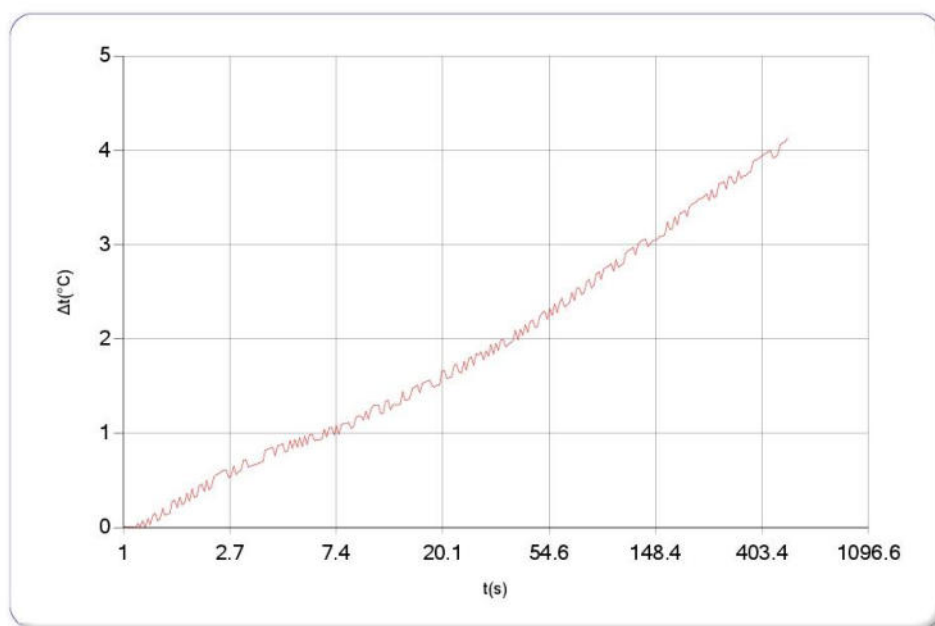
Luogo misurazione

TRINCEA 5

Osservazioni

PROVA 1  
PROFONDITA'= 1.50 m

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.5146	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	0.354	W/mK	Resistività termica	2.825	mK/W
Temperatura iniziale	11.08	°C	Temperatura finale	15.21	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

N. misurazione

$\Delta t(^{\circ}\text{C})$

t(s)

0	1	2	3	4	5	6	7	8	9
0	0.01	0	0.01	0	0	0.04	0	0.07	0
1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.09	0.03	0.13	0.15	0.07	0.09	0.2	0.13	0.14	0.15	0.27	0.29
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.21	0.32	0.24	0.26	0.36	0.28	0.41	0.32	0.33	0.44	0.46	0.38
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.5	0.4	0.43	0.53	0.56	0.57	0.59	0.61	0.61	0.53	0.54	0.65
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.56	0.59	0.6	0.71	0.72	0.64	0.65	0.66	0.67	0.68	0.69	0.7
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.82	0.83	0.84	0.85	0.76	0.87	0.87	0.89	0.8	0.81	0.92	0.84
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.93	0.85	0.95	0.86	0.97	0.88	0.98	0.99	0.92	0.93	0.93	0.94
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1.04	0.96	1.06	1.06	0.98	1.08	0.99	1.09	1.1	1.1	1.11	1.05
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.07	1.17	1.18	1.18	1.14	1.23	1.15	1.25	1.29	1.29	1.3	1.21
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.21	1.34	1.35	1.25	1.3	1.3	1.3	1.31	1.44	1.35	1.35	1.38
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.48	1.49	1.51	1.43	1.53	1.54	1.55	1.56	1.5	1.49	1.51	1.51
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.66	1.66	1.58	1.59	1.6	1.72	1.73	1.65	1.64	1.76	1.67	1.79
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.81	1.72	1.84	1.83	1.86	1.78	1.87	1.82	1.94	1.84	1.95	1.88
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.99	1.99	1.92	1.94	1.96	1.98	2.09	1.99	2.1	2.04	2.15	2.07
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
2.18	2.2	2.12	2.13	2.24	2.28	2.29	2.21	2.32	2.25	2.37	2.28
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
2.39	2.43	2.34	2.36	2.38	2.49	2.41	2.54	2.54	2.47	2.49	2.6
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
2.63	2.54	2.57	2.69	2.71	2.63	2.74	2.76	2.77	2.8	2.72	2.84
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
2.76	2.78	2.8	2.91	2.94	2.95	2.97	2.89	3.01	3.03	3.05	3.06
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
2.98	3.01	3.04	3.05	3.06	3.09	3.09	3.11	3.24	3.16	3.17	3.29
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85





**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
3.21	3.33	3.34	3.36	3.3	3.4	3.43	3.44	3.46	3.49	3.49	3.51
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
3.54	3.47	3.58	3.5	3.52	3.65	3.65	3.67	3.59	3.72	3.72	3.65
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
3.66	3.78	3.7	3.73	3.73	3.76	3.78	3.88	3.9	3.91	3.93	3.95
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
3.97	3.98	4	3.92	3.93	3.95	4.06	4.08	4.09	4.13
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

Data misurazione 25/01/2021

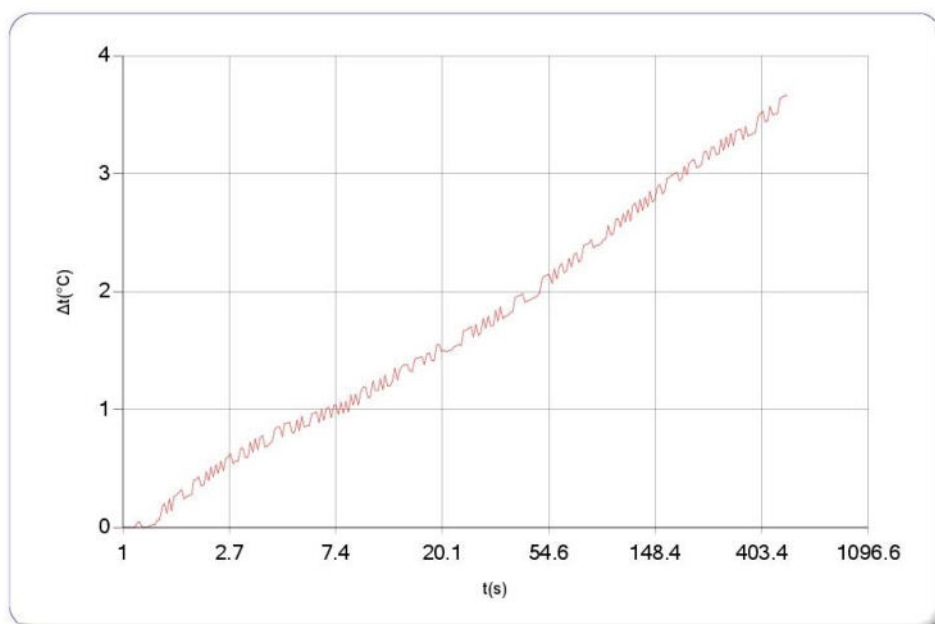
Luogo misurazione

TRINCEA 5

Osservazioni

PROVA 2  
PROFONDITA' = 1.00 m

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.5146	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	0.376	W/mK	Resistività termica	2.66	mK/W
Temperatura iniziale	10.08	°C	Temperatura finale	13.74	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

N. misurazione	0	1	2	3	4	5	6	7	8	9
$\Delta t(^{\circ}\text{C})$	0	0	0	0	0	0	0.04	0.05	0	0
t(s)	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0	0.01	0.02	0.02	0.06	0.06	0.18	0.2	0.12	0.24	0.14	0.26
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.28	0.3	0.32	0.24	0.26	0.27	0.28	0.4	0.41	0.43	0.35	0.36
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.47	0.4	0.51	0.43	0.53	0.46	0.56	0.48	0.58	0.6	0.62	0.54
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.56	0.56	0.67	0.67	0.59	0.6	0.72	0.64	0.75	0.66	0.76	0.78
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.68	0.69	0.71	0.73	0.83	0.85	0.85	0.77	0.88	0.88	0.89	0.8
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.8	0.91	0.82	0.94	0.85	0.86	0.86	0.96	0.97	0.98	0.89	1
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
0.91	1.01	1.02	0.93	1.03	1.04	0.96	1.06	0.97	1.07	0.98	1.12
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.04	1.13	1.04	1.14	1.19	1.19	1.1	1.11	1.24	1.16	1.16	1.26
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.17	1.29	1.2	1.2	1.24	1.35	1.25	1.34	1.37	1.38	1.38	1.33
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.32	1.42	1.44	1.44	1.45	1.38	1.47	1.48	1.41	1.41	1.55	1.55
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.49	1.5	1.49	1.5	1.5	1.53	1.54	1.55	1.54	1.67	1.67	1.69
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.7	1.62	1.72	1.63	1.65	1.77	1.69	1.79	1.71	1.71	1.84	1.75
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.87	1.77	1.79	1.8	1.82	1.83	1.95	1.96	1.97	1.98	1.91	1.92
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
1.93	1.94	1.95	1.96	1.99	2.11	2.13	2.14	2.14	2.07	2.19	2.11
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
2.21	2.24	2.16	2.18	2.28	2.21	2.31	2.33	2.25	2.28	2.39	2.4
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
2.41	2.44	2.37	2.39	2.39	2.41	2.44	2.45	2.56	2.48	2.49	2.61
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
2.62	2.55	2.66	2.59	2.69	2.6	2.73	2.75	2.67	2.78	2.69	2.8
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
2.72	2.85	2.76	2.78	2.89	2.91	2.83	2.85	2.96	2.97	2.99	3
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85



**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
3.01	2.94	2.96	3.06	2.99	3.09	3.11	3.12	3.05	3.06	3.08	3.18
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
3.19	3.12	3.22	3.23	3.16	3.17	3.29	3.2	3.31	3.23	3.34	3.24
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
3.36	3.37	3.38	3.29	3.4	3.32	3.33	3.34	3.35	3.48	3.51	3.53
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
3.44	3.45	3.57	3.5	3.51	3.51	3.64	3.65	3.66	3.66
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CT Lab

ADVANCED GEOPHYSICS INSTRUMENTS

Data misurazione 25/01/2021

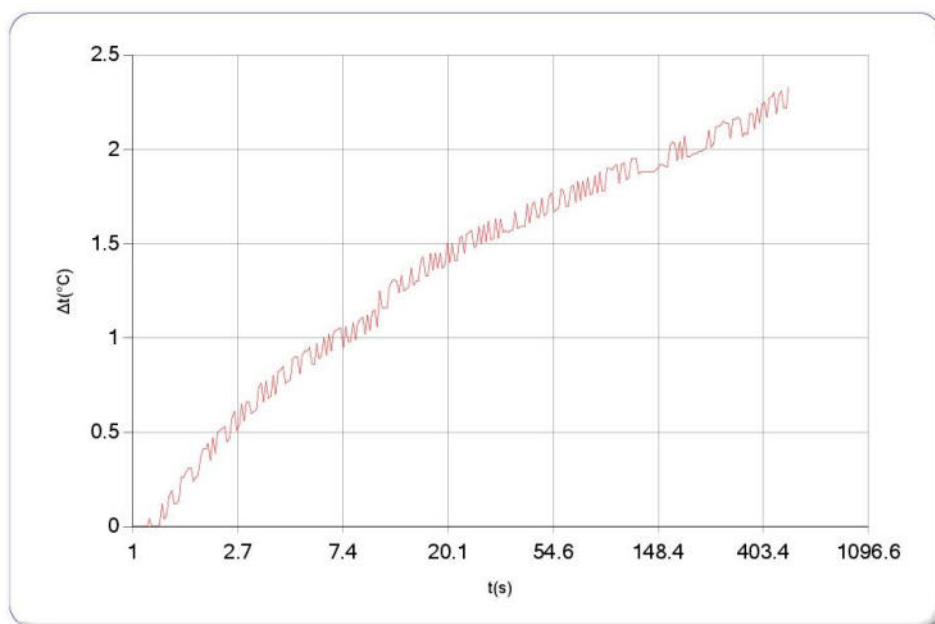
Luogo misurazione

TRINCEA 5

Osservazioni

PROVA 3  
PROFONDITA'= 0.50 m

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	2.21876	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	0.435	W/mK	Resistività termica	2.299	mK/W
Temperatura iniziale	8.77	°C	Temperatura finale	11.1	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

N. misurazione	0	1	2	3	4	5	6	7	8	9
$\Delta t(^{\circ}\text{C})$	0	0	0	0	0	0	0	0.04	0	0
t(s)	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0	0.01	0.12	0.04	0.06	0.16	0.19	0.12	0.12	0.14	0.26	0.26
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.29	0.31	0.31	0.24	0.26	0.27	0.37	0.41	0.41	0.44	0.35	0.47
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.39	0.5	0.51	0.52	0.53	0.45	0.47	0.58	0.61	0.51	0.54	0.65
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.56	0.66	0.66	0.6	0.61	0.62	0.74	0.76	0.66	0.77	0.68	0.69
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.8	0.7	0.82	0.83	0.85	0.76	0.77	0.78	0.89	0.9	0.9	0.81
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.91	0.93	0.93	0.95	0.86	0.86	0.97	0.89	0.91	1	0.91	1.02
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
0.93	1.03	1.04	1.05	1.05	0.95	1.06	0.98	0.98	1.08	0.99	1.08
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.1	1.11	1.02	1.12	1.04	1.14	1.15	1.06	1.25	1.16	1.16	1.16
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.27	1.3	1.31	1.3	1.24	1.33	1.25	1.26	1.27	1.37	1.28	1.3
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.3	1.41	1.43	1.33	1.33	1.45	1.36	1.45	1.37	1.45	1.37	1.39
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.5	1.4	1.5	1.41	1.41	1.53	1.54	1.45	1.55	1.56	1.57	1.48
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.49	1.59	1.5	1.6	1.51	1.62	1.52	1.53	1.63	1.53	1.63	1.56
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.57	1.56	1.57	1.57	1.67	1.58	1.59	1.59	1.59	1.71	1.61	1.71
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
1.72	1.64	1.64	1.74	1.65	1.66	1.75	1.77	1.67	1.68	1.69	1.79
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
1.78	1.7	1.7	1.8	1.81	1.72	1.83	1.73	1.83	1.75	1.85	1.76
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
1.77	1.86	1.77	1.88	1.78	1.78	1.9	1.9	1.89	1.91	1.92	1.82
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
1.92	1.93	1.84	1.85	1.95	1.95	1.95	1.87	1.88	1.88	1.88	1.88
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
1.88	1.88	1.89	1.9	1.92	1.92	1.91	1.91	2.02	2.04	2.03	1.94
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85





**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
2.04	1.95	2.07	1.96	1.96	1.97	1.98	1.98	1.99	1.99	2	2.01
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
2.1	2.01	2.03	2.12	2.12	2.13	2.15	2.14	2.14	2.06	2.16	2.16
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
2.17	2.16	2.07	2.09	2.08	2.19	2.19	2.11	2.22	2.14	2.24	2.25
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
2.17	2.27	2.28	2.3	2.19	2.29	2.31	2.22	2.22	2.33
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

Data misurazione 25/01/2021

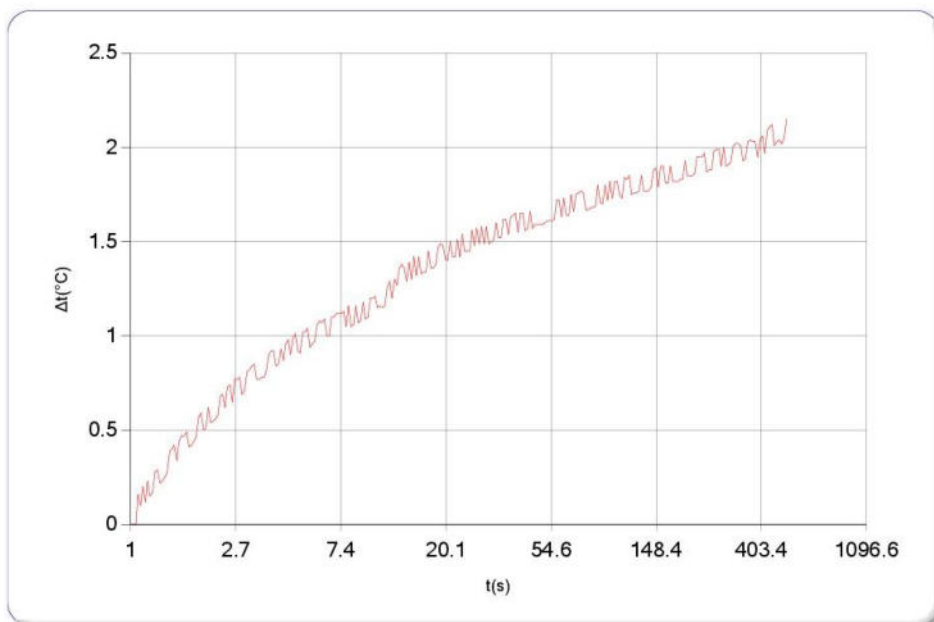
Luogo misurazione

TRINCEA 6

Osservazioni

PROVA 1  
PROFONDITA' = 1.50 m.

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.5146	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	1.128	W/mK	Resistività termica	0.887	mK/W
Temperatura iniziale	12.33	°C	Temperatura finale	14.48	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

N. misurazione

$\Delta t(^{\circ}\text{C})$

t(s)

0	1	2	3	4	5	6	7	8	9
0	0	0	0.16	0.1	0.2	0.12	0.23	0.15	0.17
1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.28	0.29	0.22	0.23	0.25	0.27	0.39	0.4	0.42	0.34	0.44	0.47
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.47	0.49	0.41	0.42	0.44	0.46	0.57	0.59	0.5	0.51	0.62	0.54
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.55	0.56	0.58	0.68	0.69	0.62	0.73	0.74	0.65	0.77	0.77	0.78
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.69	0.71	0.81	0.82	0.84	0.85	0.77	0.77	0.78	0.78	0.81	0.9
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.92	0.92	0.84	0.85	0.93	0.87	0.96	0.98	0.9	0.99	1.01	0.92
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.91	1.02	1.02	1.04	0.94	0.96	0.97	1.06	1.08	1.07	1.09	1
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1	1.1	1.1	1.12	1.12	1.12	1.13	1.05	1.16	1.05	1.06	1.16
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.07	1.08	1.18	1.09	1.1	1.2	1.2	1.21	1.15	1.16	1.15	1.16
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.26	1.29	1.2	1.3	1.27	1.36	1.38	1.36	1.29	1.39	1.3	1.42
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.32	1.42	1.33	1.34	1.34	1.45	1.36	1.36	1.38	1.47	1.49	1.48
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.41	1.4	1.5	1.42	1.42	1.51	1.42	1.54	1.45	1.45	1.45	1.56
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.48	1.57	1.49	1.58	1.49	1.58	1.49	1.5	1.51	1.6	1.52	1.52
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.62	1.62	1.54	1.63	1.64	1.65	1.55	1.65	1.65	1.56	1.57	1.66
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
1.57	1.59	1.59	1.59	1.59	1.6	1.61	1.61	1.61	1.62	1.72	1.72
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
1.63	1.73	1.64	1.64	1.75	1.66	1.75	1.76	1.77	1.76	1.67	1.67
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
1.68	1.68	1.69	1.8	1.71	1.7	1.8	1.72	1.82	1.73	1.82	1.82
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
1.75	1.73	1.84	1.83	1.85	1.75	1.76	1.76	1.77	1.85	1.77	1.77
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
1.77	1.79	1.88	1.89	1.79	1.9	1.9	1.81	1.81	1.9	1.82	1.82
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85



**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
1.82	1.83	1.83	1.93	1.85	1.85	1.85	1.86	1.95	1.95	1.95	1.97
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
1.87	1.88	1.88	1.98	1.99	1.99	1.9	2	1.9	1.91	1.92	2.01
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
2.02	2.02	2.01	1.93	1.94	2.03	2.04	2.03	2.03	1.95	2.04	2.06
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
1.97	2.09	2.11	2.12	2.01	2.03	2.04	2.02	2.05	2.15
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

Data misurazione 25/01/2021

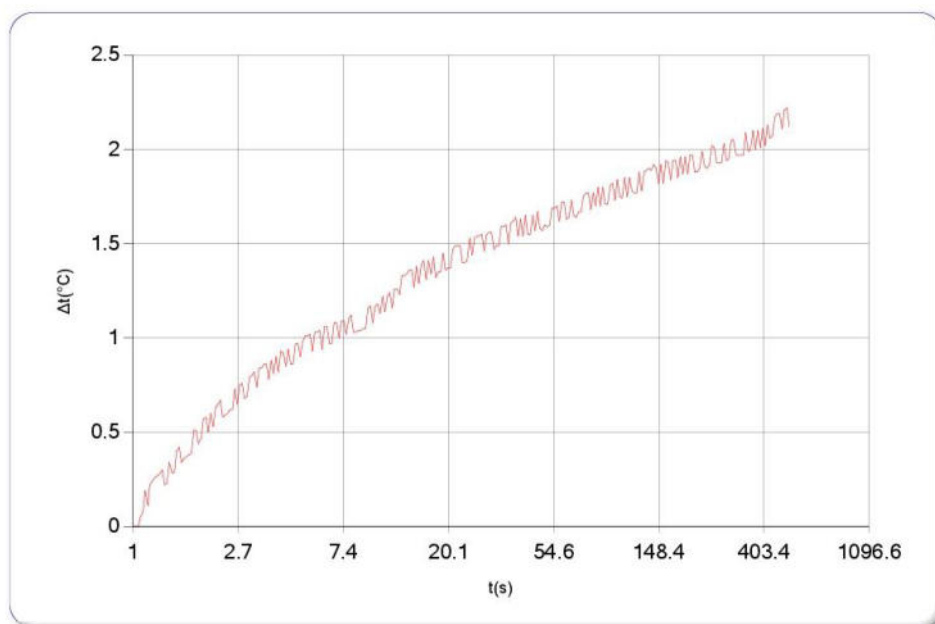
Luogo misurazione

TRINCEA 6

Osservazioni

PROVA 2  
PROFONDITA'= 1.00 m.

### Grafico



### Parametri misurazione

Resistenza sonda	85.12	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.5146	W/m	Durata misurazione	510	s

### Risultati

Conducibilità termica	6.204	W/mK	Resistività termica	0.161	mK/W
Temperatura iniziale	12.26	°C	Temperatura finale	14.38	°C
Num. misurazioni	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

N. misurazione	0	1	2	3	4	5	6	7	8	9
$\Delta t(^{\circ}\text{C})$	0	0	0	0.05	0.08	0.19	0.11	0.22	0.24	0.26
t(s)	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.27	0.28	0.3	0.22	0.23	0.34	0.28	0.29	0.4	0.42	0.34	0.36
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.37	0.38	0.39	0.51	0.51	0.44	0.47	0.57	0.58	0.5	0.6	0.53
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.63	0.65	0.67	0.58	0.59	0.6	0.62	0.62	0.73	0.65	0.75	0.76
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.68	0.69	0.79	0.8	0.82	0.74	0.84	0.84	0.86	0.86	0.78	0.88
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.81	0.9	0.82	0.93	0.92	0.85	0.94	0.86	0.86	0.97	0.97	0.9
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.98	1.01	1.01	1.02	0.93	1.03	1.03	1.04	0.94	1.06	1.06	0.97
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
0.97	1.08	1.08	1	1.09	1.09	1.02	1.1	1.12	1.03	1.03	1.04
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.04	1.05	1.05	1.16	1.17	1.08	1.17	1.18	1.13	1.22	1.14	1.22
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.24	1.16	1.26	1.26	1.23	1.33	1.33	1.34	1.36	1.36	1.27	1.38
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.29	1.39	1.41	1.31	1.41	1.34	1.43	1.32	1.35	1.35	1.45	1.36
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.37	1.37	1.47	1.49	1.49	1.49	1.4	1.4	1.41	1.53	1.44	1.53
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.54	1.54	1.55	1.46	1.55	1.56	1.56	1.47	1.49	1.49	1.59	1.59
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.6	1.5	1.61	1.62	1.64	1.54	1.63	1.54	1.65	1.55	1.55	1.65
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
1.57	1.67	1.58	1.57	1.6	1.59	1.6	1.69	1.69	1.7	1.62	1.72
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
1.72	1.63	1.64	1.73	1.65	1.64	1.67	1.67	1.75	1.77	1.77	1.68
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
1.77	1.7	1.8	1.7	1.8	1.71	1.71	1.81	1.82	1.73	1.84	1.75
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
1.74	1.85	1.75	1.85	1.78	1.77	1.77	1.88	1.78	1.88	1.89	1.9
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
1.89	1.92	1.9	1.82	1.92	1.82	1.94	1.93	1.84	1.94	1.94	1.85
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85





**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
1.96	1.87	1.96	1.87	1.97	1.97	1.88	1.88	1.9	1.99	1.91	1.9
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
1.92	2.02	2.01	1.93	1.93	1.93	2.03	1.94	1.95	2.05	2.05	1.97
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
1.97	1.97	1.97	2.09	1.99	2	2.1	2	2.1	2.01	2.11	2.02
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
2.13	2.06	2.07	2.17	2.19	2.19	2.11	2.21	2.22	2.12
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CTLab

ADVANCED GEOPHYSICS INSTRUMENTS

**Data misurazione** 25/01/2021

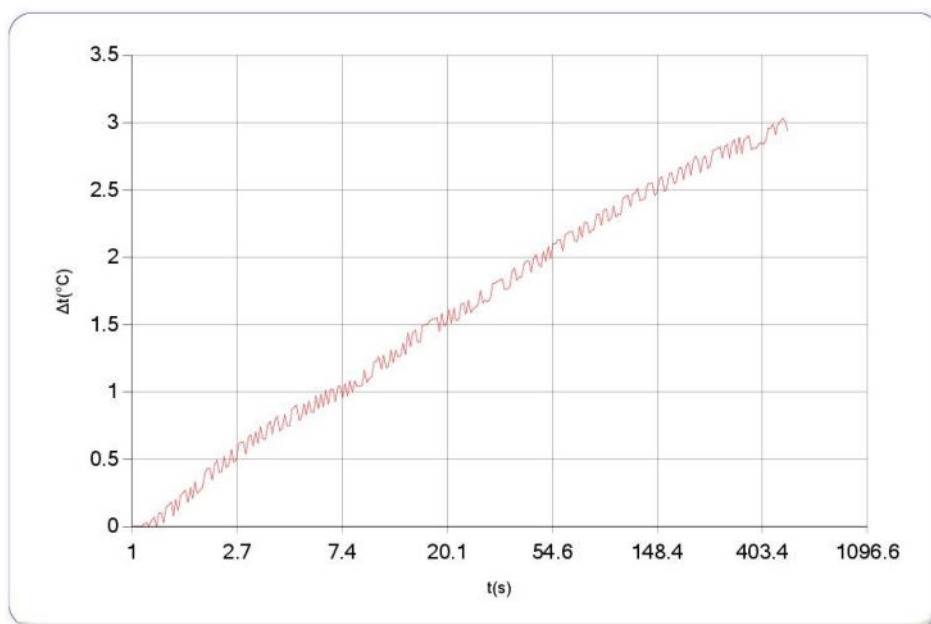
**Luogo misurazione**

TRINCEA 6

**Osservazioni**

PROVA 3  
PROFONDITA' = 0.50 m.

### Grafico



### Parametri misurazione

<u>Resistenza sonda</u>	85.12	Ohm/m	<u>Tensione riscaldatore</u>	4	V
<u>Potenza riscaldatore</u>	4.5146	W/m	<u>Durata misurazione</u>	510	s

### Risultati

<u>Conducibilità termica</u>	0.886	W/mK	<u>Resistività termica</u>	1.129	mK/W
<u>Temperatura iniziale</u>	9.39	°C	<u>Temperatura finale</u>	12.33	°C
<u>Num. misurazioni</u>	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

N. misurazione	0	1	2	3	4	5	6	7	8	9
$\Delta t(^{\circ}\text{C})$	0	0	0	0	0	0.02	0.03	0	0.04	0.07
t(s)	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0	0.1	0.1	0.03	0.14	0.16	0.18	0.08	0.2	0.12	0.23	0.25
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.27	0.18	0.29	0.21	0.33	0.25	0.27	0.29	0.4	0.43	0.43	0.35
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.46	0.49	0.4	0.41	0.52	0.44	0.46	0.57	0.48	0.5	0.61	0.63
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.63	0.54	0.66	0.68	0.6	0.7	0.62	0.74	0.65	0.65	0.75	0.78
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.69	0.79	0.82	0.71	0.73	0.83	0.75	0.75	0.87	0.89	0.9	0.79
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.81	0.91	0.83	0.93	0.85	0.85	0.97	0.88	0.98	0.89	1.01	0.91
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1.02	1.02	0.93	1.04	1.04	0.96	1.06	0.97	1.08	1	1.08	1.04
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.04	1.05	1.16	1.07	1.1	1.11	1.22	1.23	1.26	1.17	1.27	1.18
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.19	1.31	1.22	1.31	1.26	1.27	1.36	1.28	1.44	1.34	1.44	1.46
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.37	1.37	1.49	1.5	1.5	1.53	1.54	1.54	1.55	1.45	1.58	1.49
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.51	1.61	1.51	1.62	1.53	1.54	1.65	1.66	1.58	1.68	1.59	1.62
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.63	1.65	1.75	1.66	1.68	1.67	1.69	1.81	1.81	1.82	1.83	1.84
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.76	1.76	1.78	1.89	1.92	1.83	1.85	1.85	1.95	1.97	1.97	1.89
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
1.99	2.02	1.95	1.93	2.04	1.97	2.08	1.99	2.1	2.1	2.13	2.13
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
2.05	2.16	2.18	2.19	2.19	2.12	2.12	2.23	2.15	2.26	2.26	2.18
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
2.2	2.21	2.32	2.32	2.24	2.35	2.36	2.27	2.29	2.38	2.3	2.32
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
2.32	2.44	2.45	2.46	2.38	2.47	2.48	2.51	2.42	2.43	2.44	2.54
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
2.55	2.55	2.46	2.48	2.58	2.6	2.49	2.51	2.62	2.63	2.55	2.56
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85



**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
2.66	2.67	2.58	2.68	2.7	2.61	2.72	2.75	2.72	2.63	2.74	2.75
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
2.66	2.68	2.79	2.8	2.81	2.82	2.74	2.82	2.84	2.74	2.85	2.87
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
2.77	2.89	2.77	2.87	2.89	2.9	2.8	2.81	2.81	2.84	2.85	2.84
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
2.87	2.96	2.96	2.99	2.91	2.99	3.01	3.03	3.01	2.94
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CT Lab

ADVANCED GEOPHYSICS INSTRUMENTS

**Data misurazione** 25/01/2021

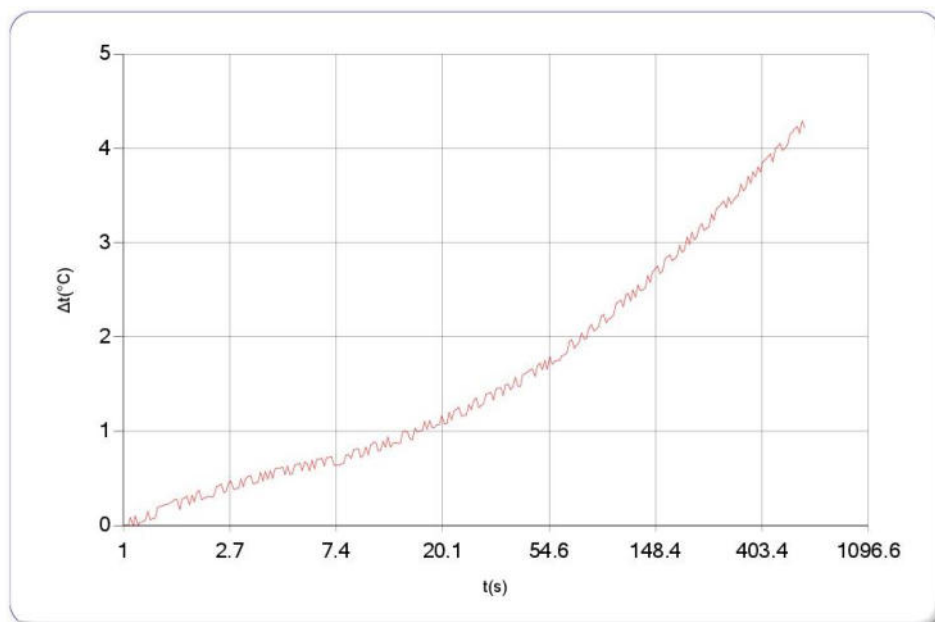
**Luogo misurazione**

TRINCEA 7

**Osservazioni**

PROVA 1  
PROFONDITA'= 1.50 m.

### Grafico



### Parametri misurazione

Resistenza sonda	89.16	Ohm/m	Tensione riscaldatore	4	V
Potenza riscaldatore	4.72887	W/m	Durata misurazione	600	s

### Risultati

Conducibilità termica	0.312	W/mK	Resistività termica	3.205	mK/W
Temperatura iniziale	16.29	°C	Temperatura finale	20.51	°C
Num. misurazioni	278				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

<b>N. misurazione</b>	0	1	2	3	4	5	6	7	8	9
<b><math>\Delta t(^{\circ}\text{C})</math></b>	0	0	0	0.08	0	0.1	0	0.03	0.04	0.05
<b>t(s)</b>	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.15	0.06	0.07	0.08	0.19	0.2	0.21	0.22	0.22	0.24	0.25	0.27
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.27	0.17	0.28	0.29	0.31	0.22	0.32	0.25	0.35	0.37	0.27	0.29
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.3	0.31	0.3	0.31	0.41	0.42	0.44	0.35	0.36	0.45	0.47	0.38
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.39	0.39	0.49	0.41	0.5	0.52	0.53	0.44	0.45	0.46	0.56	0.47
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.57	0.49	0.58	0.5	0.6	0.61	0.61	0.62	0.54	0.63	0.54	0.55
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.64	0.65	0.66	0.58	0.67	0.66	0.58	0.69	0.6	0.7	0.7	0.71
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
0.63	0.72	0.72	0.73	0.64	0.64	0.64	0.65	0.66	0.75	0.75	0.71
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
0.8	0.81	0.81	0.72	0.75	0.83	0.75	0.85	0.88	0.88	0.79	0.8
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
0.89	0.83	0.94	0.83	0.87	0.88	0.87	0.87	0.99	1	0.99	0.92
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
0.91	1.03	0.99	1	1	1.1	1.02	1.11	1.04	1.04	1.07	1.07
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.16	1.08	1.08	1.2	1.12	1.22	1.23	1.25	1.16	1.17	1.17	1.28
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.23	1.32	1.35	1.25	1.27	1.29	1.39	1.4	1.41	1.33	1.44	1.46
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.46	1.38	1.49	1.5	1.44	1.47	1.57	1.48	1.48	1.6	1.61	1.63
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
1.65	1.66	1.58	1.69	1.72	1.65	1.75	1.66	1.79	1.71	1.74	1.75
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
1.75	1.8	1.81	1.83	1.95	1.97	1.88	1.91	1.94	2.04	1.98	1.98
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
2.1	2.13	2.06	2.08	2.11	2.22	2.24	2.15	2.19	2.2	2.23	2.35
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
2.37	2.39	2.32	2.44	2.46	2.38	2.5	2.42	2.55	2.49	2.5	2.52
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
2.65	2.58	2.69	2.72	2.75	2.67	2.7	2.82	2.85	2.87	2.81	2.83
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85





**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
2.86	2.97	2.9	2.92	3.06	2.98	3.11	3.03	3.06	3.16	3.2	3.13
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
3.15	3.17	3.3	3.24	3.36	3.38	3.41	3.44	3.37	3.48	3.41	3.45
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
3.48	3.5	3.62	3.55	3.58	3.7	3.63	3.75	3.7	3.8	3.75	3.86
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271	272	273
3.88	3.91	3.94	3.86	3.99	4.02	4.05	3.98	4	4.04	4.15	4.17
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93	524.87	537.1

274	275	276	277	278
4.21	4.23	4.16	4.29	4.22
549.61	562.41	575.51	588.92	602.64



**MAE** CT Lab

ADVANCED GEOPHYSICS INSTRUMENTS

**Data misurazione** 25/01/2021

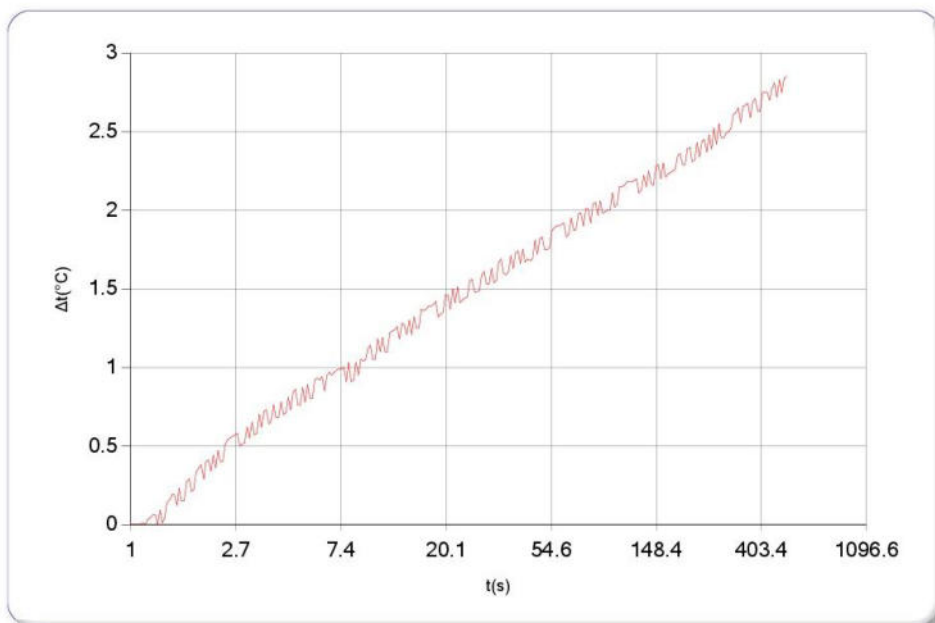
**Luogo misurazione**

TRINCEA 7

**Osservazioni**

PROVA 2  
PROFONDITA'= 1.00 m.

### Grafico



### Parametri misurazione

<u>Resistenza sonda</u>	85.12	Ohm/m	<u>Tensione riscaldatore</u>	4	V
<u>Potenza riscaldatore</u>	4.5146	W/m	<u>Durata misurazione</u>	510	s

### Risultati

<u>Conducibilità termica</u>	0.477	W/mK	<u>Resistività termica</u>	2.096	mK/W
<u>Temperatura iniziale</u>	10.86	°C	<u>Temperatura finale</u>	13.71	°C
<u>Num. misurazioni</u>	271				



ADVANCED GEOPHYSICS INSTRUMENTS

**Rapporto misurazioni**

<b>N. misurazione</b>	0	1	2	3	4	5	6	7	8	9
<b>Δt(°C)</b>	0	0	0	0	0	0.01	0	0.03	0.04	0.06
<b>t(s)</b>	1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0.06	0	0.09	0.01	0.04	0.14	0.16	0.19	0.19	0.12	0.23	0.15
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.15	0.27	0.29	0.21	0.22	0.33	0.36	0.38	0.29	0.4	0.41	0.34
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.44	0.36	0.47	0.4	0.4	0.51	0.54	0.55	0.56	0.57	0.58	0.5
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.51	0.52	0.62	0.55	0.65	0.57	0.58	0.7	0.62	0.72	0.73	0.64
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.66	0.76	0.68	0.68	0.78	0.7	0.71	0.81	0.73	0.84	0.86	0.76
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.76	0.87	0.78	0.89	0.8	0.8	0.92	0.93	0.92	0.94	0.85	0.95
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
0.97	0.95	0.97	0.98	0.99	0.99	1	0.91	1.03	0.91	0.92	1.03
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
0.95	1.05	1.04	1.05	1.12	1.14	1.05	1.05	1.18	1.1	1.19	1.1
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.1	1.22	1.23	1.24	1.26	1.18	1.28	1.27	1.21	1.3	1.21	1.32
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.25	1.25	1.37	1.36	1.37	1.39	1.39	1.4	1.42	1.32	1.34	1.35
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.46	1.46	1.37	1.5	1.41	1.51	1.41	1.43	1.44	1.45	1.55	1.56
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.48	1.48	1.49	1.59	1.61	1.53	1.53	1.63	1.54	1.55	1.67	1.69
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.6	1.59	1.61	1.71	1.63	1.73	1.74	1.66	1.75	1.67	1.69	1.68
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
1.69	1.81	1.72	1.82	1.83	1.75	1.75	1.76	1.87	1.89	1.9	1.9
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
1.91	1.92	1.83	1.85	1.95	1.87	1.88	1.98	1.98	1.9	2.01	2.01
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
1.92	2.04	2.05	1.97	2.06	1.98	1.99	2	2	2.11	2.02	2.04
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
2.15	2.15	2.16	2.18	2.18	2.18	2.19	2.2	2.11	2.13	2.22	2.15
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
2.25	2.17	2.16	2.28	2.29	2.2	2.3	2.21	2.23	2.24	2.25	2.26
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85



### Rapporto misurazioni

226	227	228	229	230	231	232	233	234	235	236	237
2.35	2.36	2.29	2.29	2.39	2.4	2.31	2.32	2.43	2.34	2.44	2.45
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
2.37	2.48	2.39	2.52	2.42	2.55	2.46	2.46	2.49	2.5	2.52	2.61
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
2.62	2.65	2.56	2.66	2.67	2.68	2.59	2.69	2.71	2.63	2.63	2.75
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
2.75	2.75	2.7	2.78	2.81	2.72	2.83	2.75	2.84	2.85
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



**MAE** CT Lab

ADVANCED GEOPHYSICS INSTRUMENTS

**Data misurazione** 25/01/2021

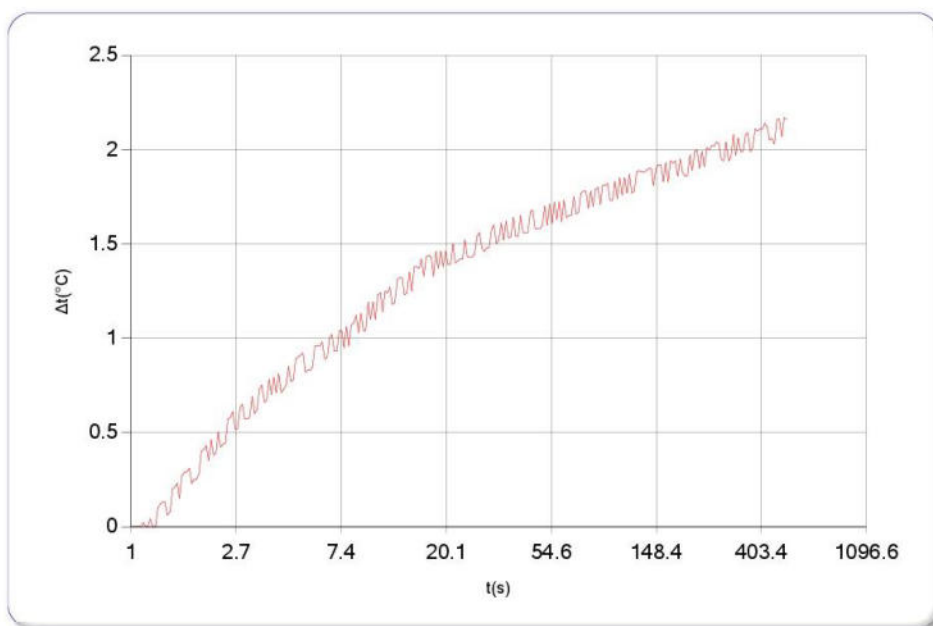
**Luogo misurazione**

TRINCEA 7

**Osservazioni**

PROVA 3  
PROFONDITA' = 0.50 m.

### Grafico



### Parametri misurazione

<u>Resistenza sonda</u>	85.12	Ohm/m	<u>Tensione riscaldatore</u>	4	V
<u>Potenza riscaldatore</u>	4.5146	W/m	<u>Durata misurazione</u>	510	s

### Risultati

<u>Conducibilità termica</u>	0.729	W/mK	<u>Resistività termica</u>	1.372	mK/W
<u>Temperatura iniziale</u>	8.64	°C	<u>Temperatura finale</u>	10.8	°C
<u>Num. misurazioni</u>	271				



ADVANCED GEOPHYSICS INSTRUMENTS

### Rapporto misurazioni

N. misurazione

$\Delta t(^{\circ}\text{C})$

t(s)

0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0.02	0	0	0.04	0
1	1.02	1.05	1.07	1.1	1.12	1.15	1.17	1.2	1.23

10	11	12	13	14	15	16	17	18	19	20	21
0	0.1	0.12	0.13	0.13	0.06	0.08	0.2	0.21	0.23	0.15	0.27
1.26	1.29	1.32	1.35	1.38	1.41	1.45	1.48	1.51	1.55	1.58	1.62

22	23	24	25	26	27	28	29	30	31	32	33
0.29	0.29	0.31	0.23	0.25	0.25	0.28	0.4	0.41	0.43	0.35	0.46
1.66	1.7	1.74	1.78	1.82	1.86	1.91	1.95	2	2.04	2.09	2.14

34	35	36	37	38	39	40	41	42	43	44	45
0.38	0.39	0.5	0.42	0.44	0.44	0.57	0.58	0.61	0.52	0.52	0.63
2.19	2.24	2.29	2.34	2.4	2.45	2.51	2.57	2.63	2.69	2.75	2.82

46	47	48	49	50	51	52	53	54	55	56	57
0.65	0.57	0.57	0.58	0.69	0.6	0.62	0.73	0.75	0.66	0.67	0.78
2.88	2.95	3.02	3.09	3.16	3.24	3.31	3.39	3.47	3.55	3.63	3.72

58	59	60	61	62	63	64	65	66	67	68	69
0.7	0.79	0.71	0.81	0.71	0.73	0.75	0.85	0.77	0.78	0.89	0.9
3.8	3.89	3.98	4.07	4.17	4.27	4.37	4.47	4.57	4.68	4.79	4.9

70	71	72	73	74	75	76	77	78	79	80	81
0.91	0.92	0.82	0.83	0.83	0.85	0.96	0.96	0.96	0.98	0.89	0.9
5.01	5.13	5.25	5.37	5.5	5.62	5.75	5.89	6.03	6.17	6.31	6.46

82	83	84	85	86	87	88	89	90	91	92	93
1	1.02	0.93	0.93	1.04	1.04	0.95	1.06	0.96	1.07	1.08	1.12
6.61	6.76	6.92	7.08	7.24	7.41	7.59	7.76	7.94	8.13	8.32	8.51

94	95	96	97	98	99	100	101	102	103	104	105
1.03	1.13	1.04	1.04	1.19	1.1	1.19	1.1	1.23	1.24	1.14	1.25
8.71	8.91	9.12	9.33	9.55	9.77	10	10.23	10.47	10.72	10.97	11.22



**Rapporto misurazioni**

106	107	108	109	110	111	112	113	114	115	116	117
1.24	1.27	1.18	1.19	1.31	1.32	1.32	1.23	1.24	1.35	1.25	1.38
11.48	11.75	12.02	12.3	12.59	12.88	13.18	13.49	13.8	14.13	14.46	14.79

118	119	120	121	122	123	124	125	126	127	128	129
1.38	1.37	1.42	1.33	1.43	1.44	1.43	1.33	1.46	1.37	1.46	1.38
15.14	15.49	15.85	16.22	16.6	16.98	17.38	17.78	18.2	18.62	19.06	19.5

130	131	132	133	134	135	136	137	138	139	140	141
1.46	1.39	1.39	1.5	1.4	1.41	1.42	1.42	1.52	1.43	1.43	1.43
19.95	20.42	20.89	21.38	21.88	22.39	22.91	23.44	23.99	24.55	25.12	25.71

142	143	144	145	146	147	148	149	150	151	152	153
1.45	1.54	1.56	1.48	1.46	1.48	1.48	1.58	1.6	1.5	1.52	1.61
26.3	26.92	27.54	28.19	28.84	29.51	30.2	30.91	31.62	32.36	33.12	33.89

154	155	156	157	158	159	160	161	162	163	164	165
1.52	1.62	1.53	1.54	1.64	1.54	1.54	1.65	1.56	1.56	1.56	1.67
34.68	35.48	36.31	37.16	38.02	38.91	39.81	40.74	41.69	42.66	43.65	44.67

166	167	168	169	170	171	172	173	174	175	176	177
1.68	1.58	1.58	1.58	1.6	1.7	1.6	1.71	1.61	1.72	1.63	1.72
45.71	46.78	47.87	48.98	50.12	51.29	52.48	53.71	54.96	56.24	57.55	58.89

178	179	180	181	182	183	184	185	186	187	188	189
1.62	1.73	1.64	1.65	1.65	1.75	1.66	1.67	1.77	1.78	1.78	1.69
60.26	61.66	63.1	64.57	66.07	67.61	69.19	70.8	72.45	74.14	75.86	77.63

190	191	192	193	194	195	196	197	198	199	200	201
1.78	1.7	1.79	1.8	1.71	1.81	1.81	1.82	1.73	1.73	1.83	1.74
79.44	81.29	83.18	85.12	87.1	89.13	91.21	93.33	95.51	97.73	100.01	102.34

202	203	204	205	206	207	208	209	210	211	212	213
1.85	1.76	1.85	1.77	1.87	1.77	1.78	1.88	1.89	1.88	1.88	1.89
104.72	107.16	109.66	112.21	114.83	117.5	120.24	123.04	125.9	128.84	131.84	134.91

214	215	216	217	218	219	220	221	222	223	224	225
1.9	1.9	1.81	1.9	1.92	1.92	1.83	1.93	1.83	1.94	1.93	1.94
138.05	141.27	144.56	147.93	151.37	154.9	158.51	162.2	165.98	169.84	173.8	177.85





**Rapporto misurazioni**

226	227	228	229	230	231	232	233	234	235	236	237
1.86	1.95	1.88	1.86	1.86	1.97	1.89	1.99	2	1.9	1.99	1.91
181.99	186.23	190.57	195.01	199.55	204.2	208.95	213.82	218.8	223.9	229.11	234.45

238	239	240	241	242	243	244	245	246	247	248	249
2.01	2	2.02	2.02	2.04	2.03	1.95	1.94	2.04	1.94	1.96	2.08
239.91	245.5	251.22	257.07	263.06	269.18	275.45	281.87	288.44	295.15	302.03	309.07

250	251	252	253	254	255	256	257	258	259	260	261
1.97	2.06	1.99	1.99	2.08	2.09	1.99	2.01	2.11	2.1	2.11	2.11
316.26	323.63	331.17	338.88	346.78	354.86	363.12	371.58	380.23	389.09	398.16	407.43

262	263	264	265	266	267	268	269	270	271
2.14	2.12	2.05	2.06	2.03	2.16	2.16	2.07	2.17	2.16
416.92	426.63	436.57	446.74	457.14	467.79	478.69	489.84	501.25	512.93



### 3. DOCUMENTAZIONE FOTOGRAFICA



**FOTO 1 – MISURE DI RESISTIVITÀ TERMICA TRINCEA 1**



**FOTO 2 – MISURE DI RESISTIVITÀ TERMICA TRINCEA 2**



**FOTO 3 – MISURE DI RESISTIVITÀ TERMICA TRINCEA 3**



**FOTO 4 – MISURE DI RESISTIVITÀ TERMICA TRINCEA 4**



**FOTO 5 – MISURE DI RESISTIVITÀ TERMICA TRINCEA 5**



**FOTO 6 – MISURE DI RESISTIVITÀ TERMICA TRINCEA 6**



**FOTO 7 – MISURE DI RESISTIVITÀ TERMICA TRINCEA 7**



**UBICAZIONE DEI PUNTI DI MISURE DI RESISTIVITA' TERMICA**





**UBICAZIONE DEI PUNTI DI MISURE DI RESISTIVITA' TERMICA**

