

**ALLEGATO 18**  
**VERIFICHE DI STABILITÀ INTERFERENZA 30**  
**SEZIONE A-A' - RELAZIONI DI CALCOLO**

**VERIFICA DI STABILITÀ PRE-OPERAM IN ASSENZA DI FALDA ACQUIFERA**

**Analisi di stabilità dei pendii con BISHOP**

Numero di strati	4.0
Numero dei conci	50.0
Coefficiente di sicurezza [R2]	1.1
<b>Superficie di forma circolare</b>	

**Maglia dei Centri**

Ascissa vertice sinistro inferiore xi	-6.16 m
Ordinata vertice sinistro inferiore yi	227.48 m
Ascissa vertice destro superiore xs	43.76 m
Ordinata vertice destro superiore ys	262.64 m
Passo di ricerca	10.0
Numero di celle lungo x	10.0
Numero di celle lungo y	10.0

**Coefficienti sismici [N.T.C.] 2018**

**Dati generali**

Descrizione:	
Latitudine:	41.75
Longitudine:	15.05
Tipo di costruzione:	2 - Opere ordinarie
Classe d'uso:	Classe IV
Vita nominale:	50.0 [anni]
Vita di riferimento:	100.0 [anni]

**Parametri sismici su sito di riferimento**

Categoria sottosuolo:	C
Categoria topografica:	T1

S.L. Stato limite	TR Tempo ritorno [anni]	ag [m/s <sup>2</sup> ]	F0 [-]	TC* [sec]
S.L.O.	60.0	0.81	2.48	0.3
S.L.D.	101.0	1.04	2.49	0.32
S.L.V.	949.0	2.64	2.44	0.35
S.L.C.	1950.0	3.42	2.43	0.36

**Coefficienti sismici orizzontali e verticali**

Opera: Stabilità dei pendii

S.L. Stato limite	amax [m/s <sup>2</sup> ]	beta [-]	kh [-]	kv [sec]
S.L.O.	1.215	0.2	0.0248	0.0124
S.L.D.	1.56	0.24	0.0382	0.0191
S.L.V.	3.4475	0.28	0.0984	0.0492
S.L.C.	4.0749	0.28	0.1164	0.0582

Coefficiente azione sismica orizzontale 0.0984  
 Coefficiente azione sismica verticale 0.0492

**Vertici profilo**

N	X m	y m
1	0.0	192.0
2	6.21	192.5
3	9.57	193.0
4	12.25	193.5
5	14.55	194.0
6	16.71	194.5
7	18.66	195.0
8	20.56	195.5
9	22.34	196.0
10	24.11	196.5
11	25.8	197.0
12	27.46	197.5
13	29.08	198.0
14	30.67	198.5
15	32.24	199.0
16	33.82	199.5
17	35.39	200.0
18	36.98	200.5
19	38.54	201.0
20	40.16	201.5
21	41.79	202.0
22	43.49	202.5
23	45.22	203.0
24	47.0	203.5
25	48.86	204.0
26	50.79	204.5
27	52.83	205.0
28	55.07	205.5
29	57.46	206.0
30	60.14	206.5
31	63.18	207.0
32	66.69	207.5
33	70.78	208.0
34	75.51	208.5
35	80.79	209.0
36	86.27	209.5
37	92.75	210.0
38	106.12	210.5

**Vertici strato .....1**

N	X m	y m
1	0.0	187.8
2	7.94	188.86
3	16.02	190.51
4	27.46	193.3
5	38.64	197.11
6	48.71	201.07
7	53.66	202.72
8	58.1	204.26
9	62.81	205.89

10	65.42	206.74
11	63.18	207.0
12	66.69	207.5
13	70.78	208.0
14	75.51	208.5
15	80.79	209.0
16	86.27	209.5
17	92.75	210.0
18	106.12	210.5

#### Vertici strato .....2

N	X m	y m
1	0.0	187.8
2	7.94	188.86
3	16.02	190.51
4	27.46	193.3
5	38.64	197.11
6	48.71	201.07
7	53.66	202.72
8	58.1	204.26
9	62.81	205.89
10	65.42	206.74
11	65.42	206.74
12	71.12	206.53
13	75.82	206.18
14	84.25	205.78
15	90.74	205.52
16	106.12	205.5

#### Vertici strato .....3

N	X m	y m
1	0.0	185.0
2	34.1	191.36
3	74.06	198.26
4	106.12	202.0

#### Stratigrafia

c: coesione; Fi: Angolo di attrito; G: Peso Specifico; Gs: Peso Specifico Saturo

Strato	c (kg/cm <sup>2</sup> )	Fi (°)	G (Kg/m <sup>3</sup> )	Gs (Kg/m <sup>3</sup> )	Litologia
1	0.1	16.6	1917	1947	
2	0	30.3	1900	1940	
3	0.21	19.2	1923	1954	
4	0.26	18.2	1968	1998	

#### Risultati analisi pendio [A2+M2+R2]

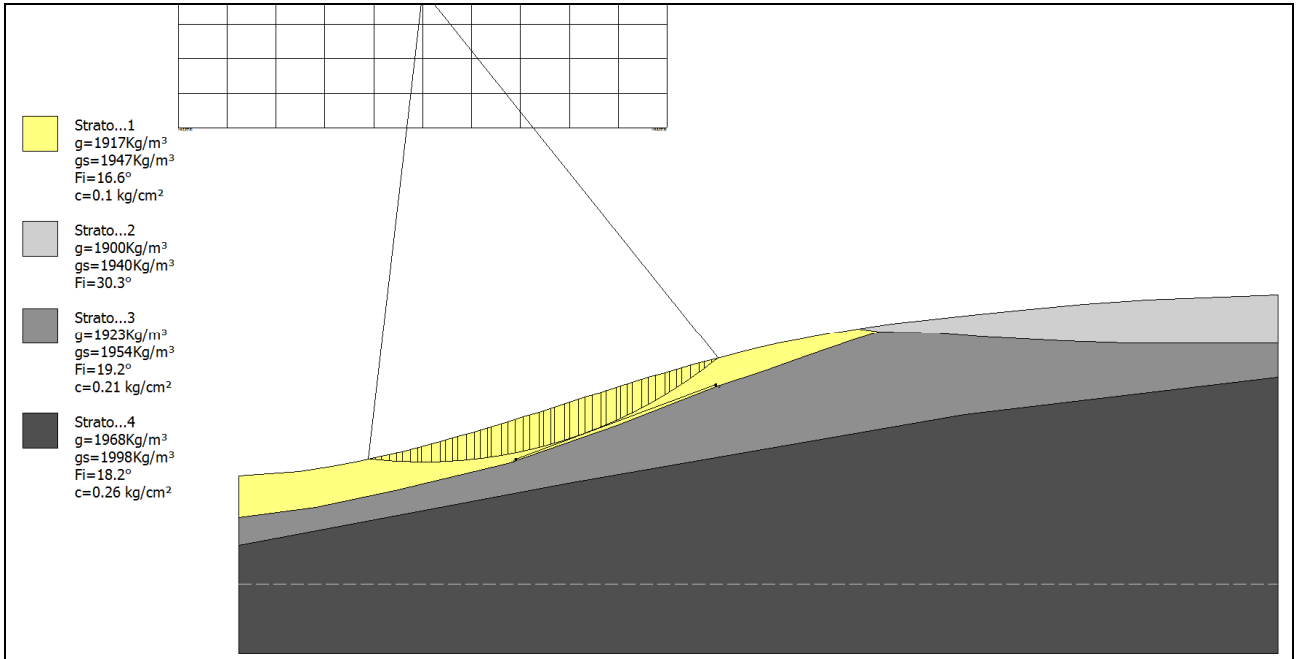
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Fs minimo individuato          1.07
Ascissa centro superficie      18.8 m
Ordinata centro superficie     241.55 m
Raggio superficie              48.14 m
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**Analisi dei conchi. Superficie...xc = 18.804 yc = 241.545 Rc = 48.14 Fs=1.0689**

Nr.	B m	Alfa (°)	Li m	Wi (Kg)	Kh•Wi (Kg)	Kv•Wi (Kg)	c (kg/cm <sup>2</sup> )	Fi (°)	Ui (Kg)	N'i (Kg)	Ti (Kg)
1	0.71	-6.2	0.72	160.79	15.82	7.91	0.08	13.4	0.0	225.2	587.7
2	0.56	-5.4	0.56	344.02	33.85	16.93	0.08	13.4	0.0	393.7	508.8
3	0.87	-4.6	0.87	905.02	89.05	44.53	0.08	13.4	0.0	977.1	869.6
4	0.71	-3.6	0.72	1072.22	105.51	52.75	0.08	13.4	0.0	1123.9	786.1
5	0.58	-2.8	0.58	1074.61	105.74	52.87	0.08	13.4	0.0	1109.7	680.9
6	0.85	-2.0	0.85	1914.08	188.34	94.17	0.08	13.4	0.0	1952.4	1071.8
7	0.71	-1.1	0.71	1911.2	188.06	94.03	0.08	13.4	0.0	1929.3	964.9
8	0.39	-0.4	0.39	1144.66	112.63	56.32	0.08	13.4	0.0	1148.5	545.6
9	1.04	0.4	1.04	3454.91	339.96	169.98	0.08	13.4	0.0	3443.0	1547.5
10	0.86	1.6	0.86	3233.48	318.17	159.09	0.08	13.4	0.0	3197.3	1356.4
11	0.57	2.4	0.57	2325.57	228.84	114.42	0.08	13.4	0.0	2287.9	936.7
12	0.71	3.2	0.72	3121.23	307.13	153.56	0.08	13.4	0.0	3058.2	1217.5
13	0.5	3.9	0.5	2299.62	226.28	113.14	0.08	13.4	0.0	2245.2	873.9
14	0.93	4.8	0.93	4567.86	449.48	224.74	0.08	13.4	0.0	4442.8	1690.2
15	0.84	5.8	0.84	4389.61	431.94	215.97	0.08	13.4	0.0	4251.2	1580.0
16	0.59	6.7	0.59	3221.45	316.99	158.5	0.08	13.4	0.0	3110.3	1137.4
17	0.71	7.5	0.72	4061.12	399.61	199.81	0.08	13.4	0.0	3910.9	1411.5
18	0.39	8.1	0.39	2270.15	223.38	111.69	0.08	13.4	0.0	2181.8	779.9
19	1.04	9.0	1.05	6304.41	620.35	310.18	0.08	13.4	0.0	6044.9	2136.9
20	0.62	10.0	0.63	3889.14	382.69	191.35	0.08	13.4	0.0	3719.9	1301.0
21	0.81	10.8	0.82	5203.95	512.07	256.03	0.08	13.4	0.0	4968.2	1724.2
22	0.81	11.8	0.83	5366.62	528.08	264.04	0.08	13.4	0.0	5114.0	1762.0
23	0.62	12.7	0.63	4148.3	408.19	204.1	0.08	13.4	0.0	3947.4	1353.1
24	0.97	13.7	1.0	6682.68	657.58	328.79	0.08	13.4	0.0	6350.3	2167.3
25	0.45	14.5	0.47	3150.85	310.04	155.02	0.08	13.4	0.0	2991.0	1018.0
26	0.71	15.3	0.74	5001.41	492.14	246.07	0.08	13.4	0.0	4744.3	1612.4
27	0.4	16.0	0.42	2837.18	279.18	139.59	0.08	13.4	0.0	2689.7	913.5
28	1.03	16.8	1.07	7257.17	714.11	357.05	0.08	13.4	0.0	6875.3	2335.7
29	0.55	17.8	0.58	3930.75	386.79	193.39	0.08	13.4	0.0	3721.7	1266.5
30	0.87	18.7	0.92	6170.45	607.17	303.59	0.08	13.4	0.0	5839.8	1992.9
31	0.7	19.7	0.74	4894.79	481.65	240.82	0.08	13.4	0.0	4630.8	1587.3
32	0.73	20.6	0.78	5081.39	500.01	250.0	0.08	13.4	0.0	4805.8	1656.7
33	0.86	21.6	0.92	5880.08	578.6	289.3	0.08	13.4	0.0	5559.3	1932.2
34	0.57	22.5	0.62	3822.0	376.08	188.04	0.08	13.4	0.0	3612.4	1266.8
35	0.99	23.6	1.08	6508.45	640.43	320.22	0.08	13.4	0.0	6149.1	2181.4
36	0.44	24.5	0.48	2787.8	274.32	137.16	0.08	13.4	0.0	2632.4	946.2
37	0.71	25.2	0.79	4438.93	436.79	218.4	0.08	13.4	0.0	4188.4	1525.2
38	0.47	26.0	0.52	2829.5	278.42	139.21	0.08	13.4	0.0	2667.2	986.3
39	0.96	27.0	1.08	5520.4	543.21	271.6	0.08	13.4	0.0	5194.9	1963.6
40	0.67	28.1	0.76	3646.84	358.85	179.42	0.08	13.4	0.0	3421.9	1333.4
41	0.76	29.0	0.86	3849.84	378.82	189.41	0.08	13.4	0.0	3598.4	1449.9
42	0.94	30.2	1.09	4386.89	431.67	215.83	0.08	13.4	0.0	4071.3	1726.0
43	0.48	31.2	0.57	2047.83	201.51	100.75	0.08	13.4	0.0	1883.3	843.3
44	0.71	32.0	0.84	2755.43	271.13	135.57	0.08	13.4	0.0	2506.1	1189.3
45	0.53	32.9	0.63	1834.37	180.5	90.25	0.08	13.4	0.0	1640.9	840.8
46	0.9	33.9	1.08	2624.08	258.21	129.1	0.08	13.4	0.0	2277.5	1315.7
47	0.88	35.2	1.08	1977.08	194.54	97.27	0.08	13.4	0.0	1596.6	1166.6
48	0.54	36.3	0.67	884.46	87.03	43.52	0.08	13.4	0.0	624.9	643.5
49	0.71	37.2	0.9	752.24	74.02	37.01	0.08	13.4	0.0	372.4	753.8
50	0.71	38.3	0.91	259.17	25.5	12.75	0.08	13.4	0.0	-175.7	641.3



## VERIFICA DI STABILITÀ PRE-OPERAM IN PRESENZA DI FALDA ACQUIFERA

### Analisi di stabilità dei pendii con BISHOP

Numero di strati	4.0
Numero dei conci	50.0
Coefficiente di sicurezza [R2]	1.1
<b>Superficie di forma circolare</b>	

### Maglia dei Centri

Ascissa vertice sinistro inferiore xi	-6.16 m
Ordinata vertice sinistro inferiore yi	227.48 m
Ascissa vertice destro superiore xs	43.76 m
Ordinata vertice destro superiore ys	262.64 m
Passo di ricerca	10.0
Numero di celle lungo x	10.0
Numero di celle lungo y	10.0

### Coefficienti sismici [N.T.C.] 2018

#### Dati generali

Descrizione:	
Latitudine:	41.75
Longitudine:	15.05
Tipo di costruzione:	2 - Opere ordinarie
Classe d'uso:	Classe IV
Vita nominale:	50.0 [anni]
Vita di riferimento:	100.0 [anni]

#### Parametri sismici su sito di riferimento

Categoria sottosuolo:	C
Categoria topografica:	T1

S.L. Stato limite	TR Tempo ritorno [anni]	ag [m/s <sup>2</sup> ]	F0 [-]	TC* [sec]
S.L.O.	60.0	0.81	2.48	0.3
S.L.D.	101.0	1.04	2.49	0.32
S.L.V.	949.0	2.64	2.44	0.35
S.L.C.	1950.0	3.42	2.43	0.36

#### Coefficienti sismici orizzontali e verticali

Opera: Stabilità dei pendii

S.L. Stato limite	amax [m/s <sup>2</sup> ]	beta [-]	kh [-]	kv [sec]
S.L.O.	1.215	0.2	0.0248	0.0124
S.L.D.	1.56	0.24	0.0382	0.0191
S.L.V.	3.4475	0.28	0.0984	0.0492
S.L.C.	4.0749	0.28	0.1164	0.0582

Coefficiente azione sismica orizzontale	0.0984
Coefficiente azione sismica verticale	0.0492

**Vertici profilo**

N	X m	y m
1	0.0	192.0
2	6.21	192.5
3	9.57	193.0
4	12.25	193.5
5	14.55	194.0
6	16.71	194.5
7	18.66	195.0
8	20.56	195.5
9	22.34	196.0
10	24.11	196.5
11	25.8	197.0
12	27.46	197.5
13	29.08	198.0
14	30.67	198.5
15	32.24	199.0
16	33.82	199.5
17	35.39	200.0
18	36.98	200.5
19	38.54	201.0
20	40.16	201.5
21	41.79	202.0
22	43.49	202.5
23	45.22	203.0
24	47.0	203.5
25	48.86	204.0
26	50.79	204.5
27	52.83	205.0
28	55.07	205.5
29	57.46	206.0
30	60.14	206.5
31	63.18	207.0
32	66.69	207.5
33	70.78	208.0
34	75.51	208.5
35	80.79	209.0
36	86.27	209.5
37	92.75	210.0
38	106.12	210.5

**Falda**

Nr.	X m	y m
1	0.0	192.0
2	6.21	192.5
3	9.57	193.0
4	12.25	193.5
5	14.55	194.0
6	16.71	194.5
7	18.66	195.0
8	20.56	195.5
9	22.34	196.0
10	24.11	196.5
11	25.8	197.0
12	27.46	197.5
13	29.08	198.0
14	30.67	198.5

15	32.24	199.0
16	33.82	199.5
17	35.39	200.0
18	36.98	200.5
19	38.54	201.0
20	40.16	201.5
21	41.79	202.0
22	43.49	202.5
23	45.22	203.0
24	47.0	203.5
25	48.86	204.0
26	50.79	204.5
27	52.83	205.0
28	55.07	205.5
29	57.46	206.0
30	60.14	206.5
31	63.18	207.0
32	66.69	207.5
33	70.78	208.0
34	75.51	208.5
35	80.79	209.0
36	86.27	209.5
37	92.75	210.0
38	106.12	210.5

**Vertici strato .....1**

N	X m	y m
1	0.0	187.8
2	7.94	188.86
3	16.02	190.51
4	27.46	193.3
5	38.64	197.11
6	48.71	201.07
7	53.66	202.72
8	58.1	204.26
9	62.81	205.89
10	65.42	206.74
11	63.18	207.0
12	66.69	207.5
13	70.78	208.0
14	75.51	208.5
15	80.79	209.0
16	86.27	209.5
17	92.75	210.0
18	106.12	210.5

**Vertici strato .....2**

N	X m	y m
1	0.0	187.8
2	7.94	188.86
3	16.02	190.51
4	27.46	193.3
5	38.64	197.11
6	48.71	201.07
7	53.66	202.72
8	58.1	204.26
9	62.81	205.89



10	65.42	206.74
11	65.42	206.74
12	71.12	206.53
13	75.82	206.18
14	84.25	205.78
15	90.74	205.52
16	106.12	205.5

### Vertici strato .....3

N	X m	y m
1	0.0	185.0
2	34.1	191.36
3	74.06	198.26
4	106.12	202.0

### Stratigrafia

c: coesione; Fi: Angolo di attrito; G: Peso Specifico; Gs: Peso Specifico Saturo

Strato	c (kg/cm <sup>2</sup> )	Fi (°)	G (Kg/m <sup>3</sup> )	Gs (Kg/m <sup>3</sup> )	Litologia
1	0.1	16.6	1917	1947	
2	0	30.3	1900	1940	
3	0.21	19.2	1923	1954	
4	0.26	18.2	1968	1998	

### Risultati analisi pendio [A2+M2+R2]

Fs minimo individuato	0.73
Ascissa centro superficie	18.8 m
Ordinata centro superficie	241.55 m
Raggio superficie	48.14 m

B: Larghezza del concio; Alfa: Angolo di inclinazione della base del concio; Li: Lunghezza della base del concio; Wi: Peso del concio ; Ui: Forze derivanti dalle pressioni neutre; Ni: forze agenti normalmente alla direzione di scivolamento; Ti: forze agenti parallelamente alla superficie di scivolamento; Fi: Angolo di attrito; c: coesione.

### Analisi dei concii. Superficie...xc = 18.804 yc = 241.545 Rc = 48.14 Fs=0.7256

Nr.	B m	Alfa (°)	Li m	Wi (Kg)	Kh•Wi (Kg)	Kv•Wi (Kg)	c (kg/cm <sup>2</sup> )	Fi (°)	Ui (Kg)	N'i (Kg)	Ti (Kg)
1	0.71	-6.2	0.72	163.31	16.07	8.03	0.08	13.4	117.5	171.5	848.1
2	0.56	-5.4	0.56	349.41	34.38	17.19	0.08	13.4	320.5	236.7	698.0
3	0.87	-4.6	0.87	919.18	90.45	45.22	0.08	13.4	544.0	539.0	1137.1
4	0.71	-3.6	0.72	1089.0	107.16	53.58	0.08	13.4	783.5	592.7	983.5
5	0.58	-2.8	0.58	1091.43	107.4	53.7	0.08	13.4	969.4	572.5	826.5
6	0.85	-2.0	0.85	1944.03	191.29	95.65	0.08	13.4	1175.3	989.9	1262.6
7	0.71	-1.1	0.71	1941.11	191.01	95.5	0.08	13.4	1396.5	964.7	1104.3
8	0.39	-0.4	0.39	1162.58	114.4	57.2	0.08	13.4	1544.6	569.7	613.5
9	1.04	0.4	1.04	3508.98	345.28	172.64	0.08	13.4	1730.9	1693.5	1704.7
10	0.86	1.6	0.86	3284.08	323.15	161.58	0.08	13.4	1964.1	1557.7	1459.3
11	0.57	2.4	0.57	2361.96	232.42	116.21	0.08	13.4	2132.0	1107.7	992.0
12	0.71	3.2	0.72	1541.89	151.72	75.86	0.08	13.4	2280.7	1473.3	1272.6
13	0.5	3.9	0.5	2335.61	229.82	114.91	0.08	13.4	2413.2	1076.8	903.3
14	0.93	4.8	0.93	4639.34	456.51	228.26	0.08	13.4	2560.3	2120.4	1726.7
15	0.84	5.8	0.84	4458.3	438.7	219.35	0.08	13.4	2728.2	2017.2	1593.2
16	0.59	6.7	0.59	3271.86	321.95	160.98	0.08	13.4	2855.6	1469.2	1136.2

17	0.71	7.5	0.72	4124.67	405.87	202.93	0.08	13.4	2967.5	1840.2	1398.7
18	0.39	8.1	0.39	2305.68	226.88	113.44	0.08	13.4	3055.1	1023.2	768.0
19	1.04	9.0	1.05	6403.07	630.06	315.03	0.08	13.4	3161.7	2822.8	2088.9
20	0.62	10.0	0.63	3950.0	388.68	194.34	0.08	13.4	3273.1	1728.6	1262.1
21	0.81	10.8	0.82	5285.38	520.08	260.04	0.08	13.4	3359.9	2298.9	1662.7
22	0.81	11.8	0.83	5450.6	536.34	268.17	0.08	13.4	3447.4	2354.9	1688.8
23	0.62	12.7	0.63	4213.22	414.58	207.29	0.08	13.4	3514.4	1809.8	1290.8
24	0.97	13.7	1.0	6787.27	667.87	333.93	0.08	13.4	3578.1	2896.9	2057.7
25	0.45	14.5	0.47	3200.16	314.9	157.45	0.08	13.4	3624.1	1358.2	963.0
26	0.71	15.3	0.74	5079.68	499.84	249.92	0.08	13.4	3654.6	2145.9	1521.2
27	0.4	16.0	0.42	2881.58	283.55	141.77	0.08	13.4	3676.4	1211.8	860.0
28	1.03	16.8	1.07	7370.74	725.28	362.64	0.08	13.4	3692.6	3081.5	2193.9
29	0.55	17.8	0.58	3992.26	392.84	196.42	0.08	13.4	3696.0	1657.9	1187.5
30	0.87	18.7	0.92	6267.02	616.67	308.34	0.08	13.4	3687.0	2586.0	1866.3
31	0.7	19.7	0.74	4971.4	489.19	244.59	0.08	13.4	3663.4	2036.3	1485.6
32	0.73	20.6	0.78	5160.91	507.83	253.92	0.08	13.4	3627.1	2098.6	1550.7
33	0.86	21.6	0.92	5972.1	587.66	293.83	0.08	13.4	3570.0	2406.9	1810.3
34	0.57	22.5	0.62	3881.81	381.97	190.98	0.08	13.4	3506.5	1550.9	1188.6
35	0.99	23.6	1.08	6610.31	650.45	325.23	0.08	13.4	3424.5	2613.1	2051.4
36	0.44	24.5	0.48	2831.43	278.61	139.31	0.08	13.4	3332.6	1106.8	892.5
37	0.71	25.2	0.79	4508.4	443.63	221.81	0.08	13.4	3243.5	1743.8	1443.4
38	0.47	26.0	0.52	2873.78	282.78	141.39	0.08	13.4	3142.2	1097.9	937.2
39	0.96	27.0	1.08	5606.79	551.71	275.85	0.08	13.4	3005.8	2104.6	1877.1
40	0.67	28.1	0.76	3703.92	364.47	182.23	0.08	13.4	2831.2	1356.3	1285.4
41	0.76	29.0	0.86	3910.09	384.75	192.38	0.08	13.4	2657.0	1392.1	1410.7
42	0.94	30.2	1.09	4455.54	438.42	219.21	0.08	13.4	2423.8	1516.4	1702.9
43	0.48	31.2	0.57	2079.88	204.66	102.33	0.08	13.4	2208.8	671.6	844.1
44	0.71	32.0	0.84	2798.55	275.38	137.69	0.08	13.4	2013.4	850.1	1207.8
45	0.53	32.9	0.63	1863.08	183.33	91.66	0.08	13.4	1797.1	517.0	869.2
46	0.9	33.9	1.08	2665.15	262.25	131.13	0.08	13.4	1528.9	624.2	1394.8
47	0.88	35.2	1.08	2008.02	197.59	98.79	0.08	13.4	1165.8	286.5	1288.0
48	0.54	36.3	0.67	898.3	88.39	44.2	0.08	13.4	849.5	-2.2	741.9
49	0.71	37.2	0.9	764.02	75.18	37.59	0.08	13.4	549.7	-226.6	913.5
50	0.71	38.3	0.91	263.22	25.9	12.95	0.08	13.4	189.4	-498.3	838.7

