

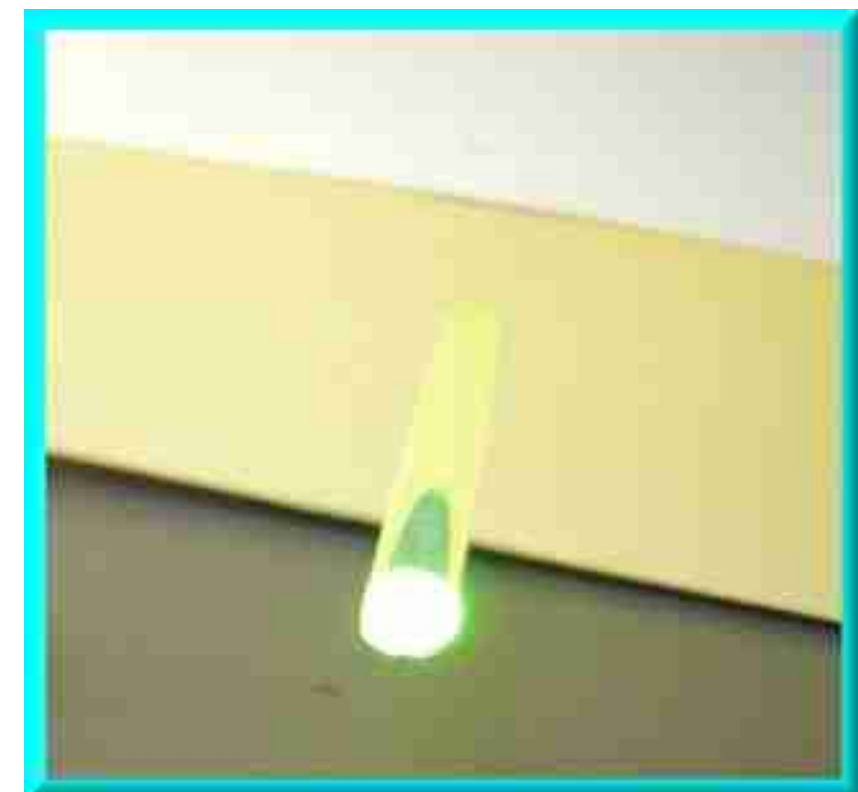
Telescopio/Totem a Toledo

Analisi ed elaborazione dati

Paolo Mastroserio

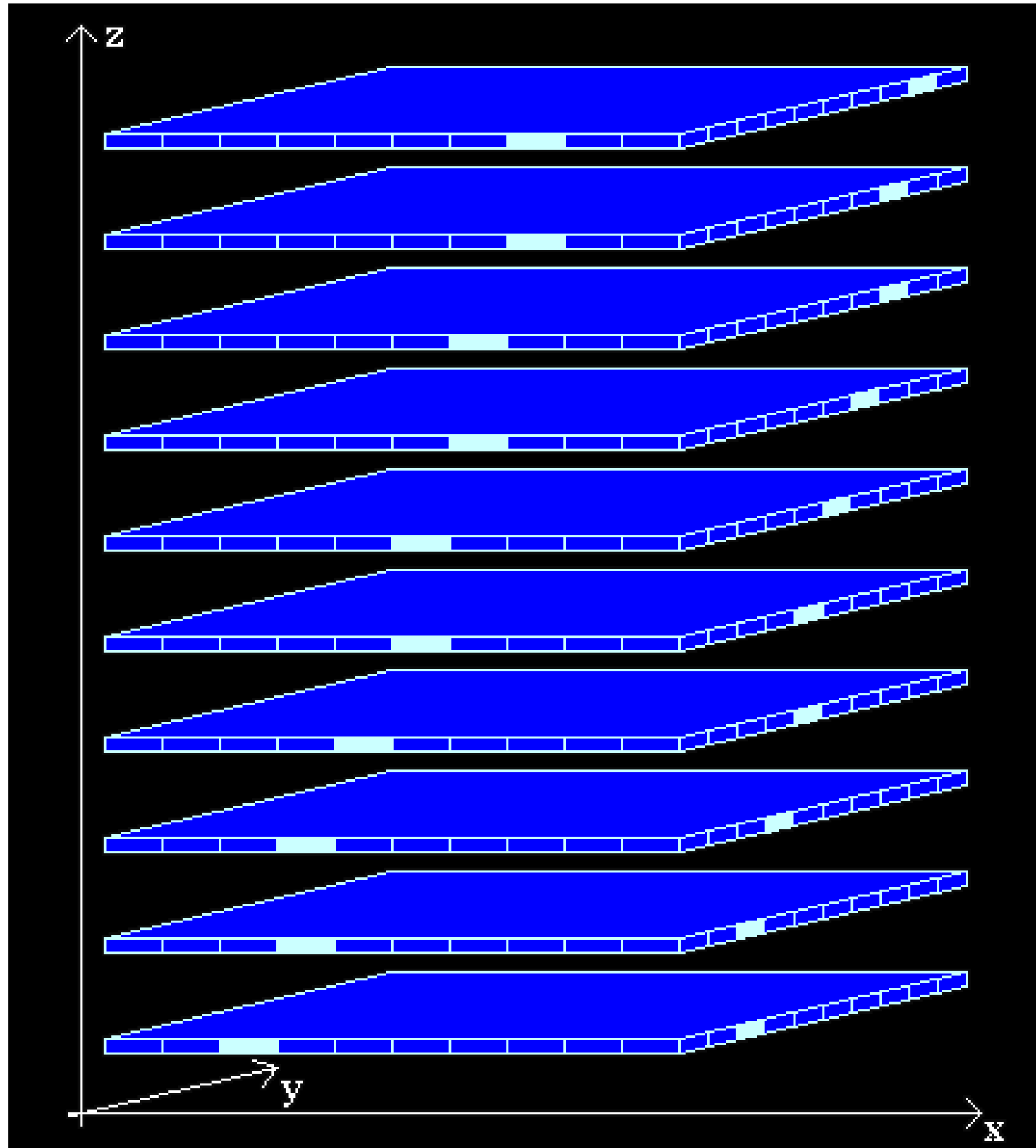


L'hardware del telescopio

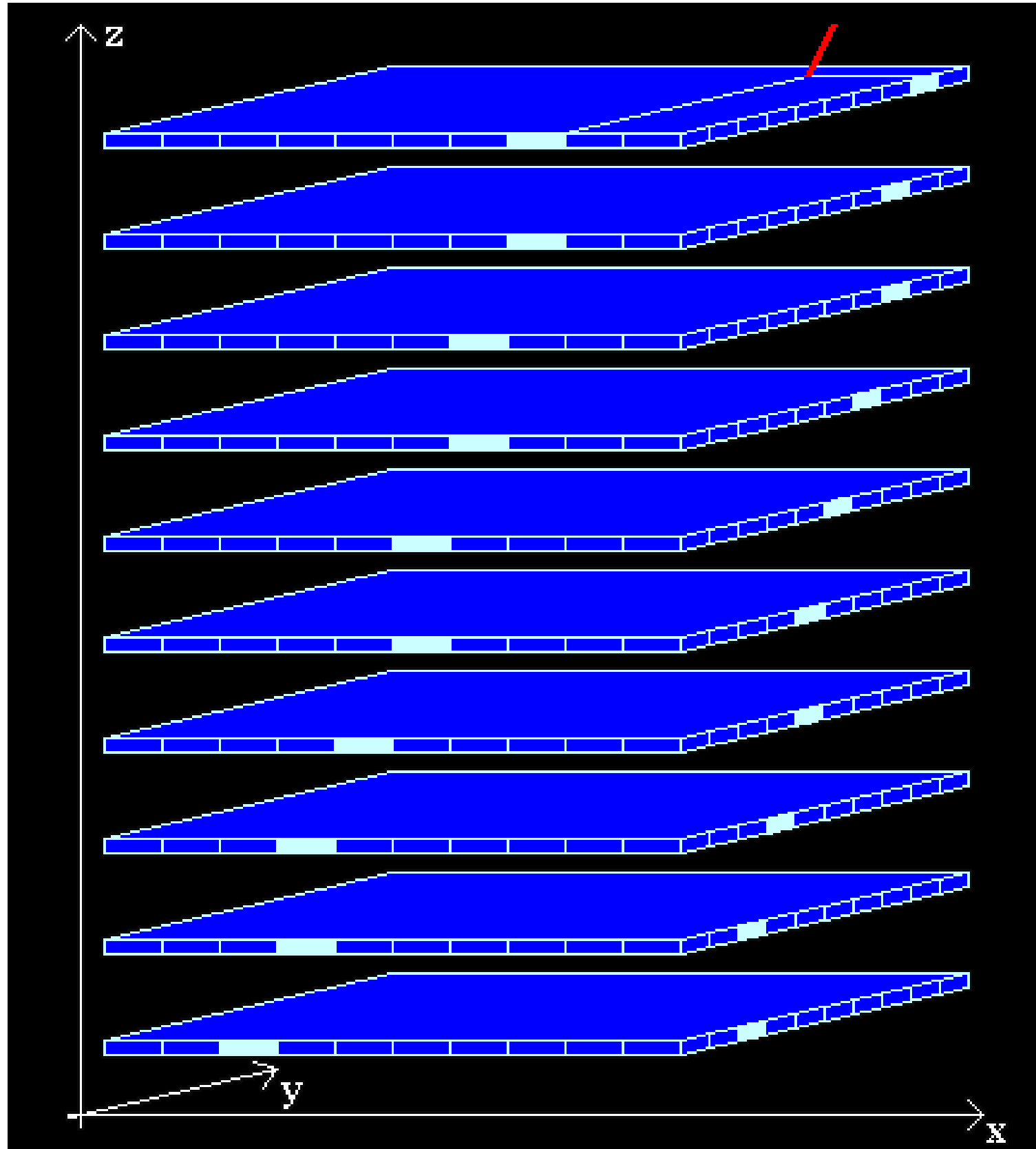


**Una delle cose da realizzare è una
visualizzazione in 3D dell'evento acquisito**

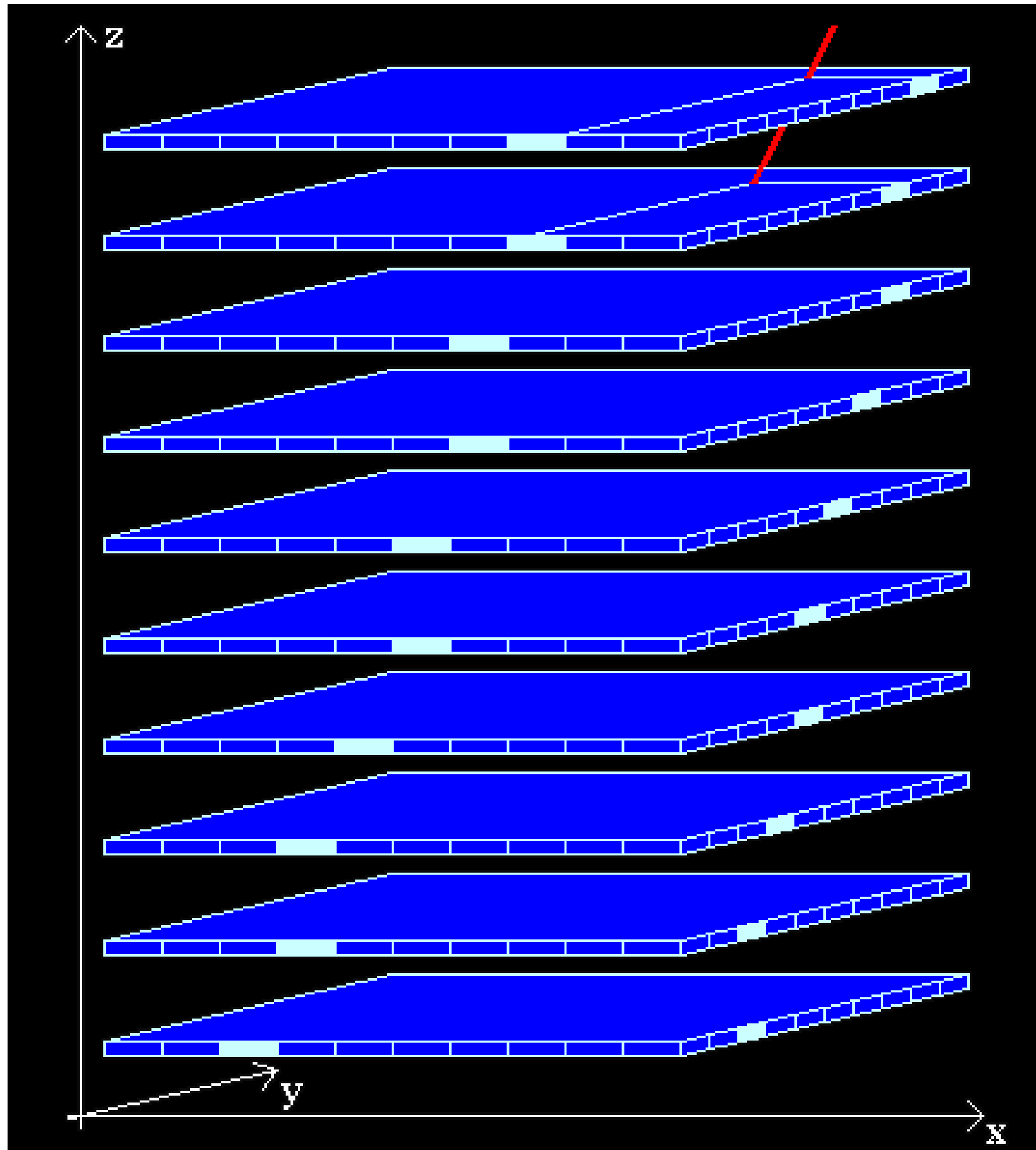
Visualizzazione in 3D



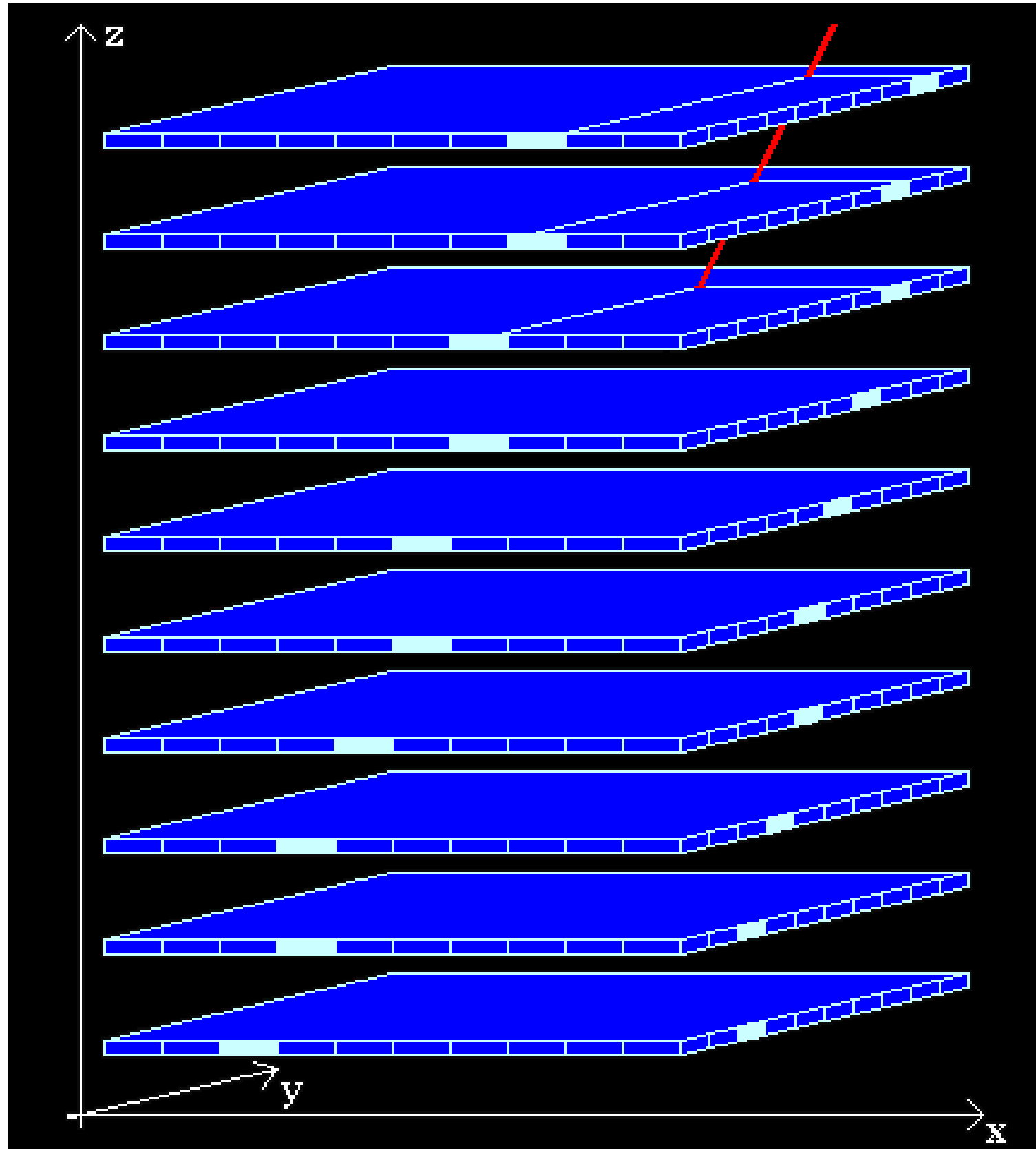
Visualizzazione in 3D



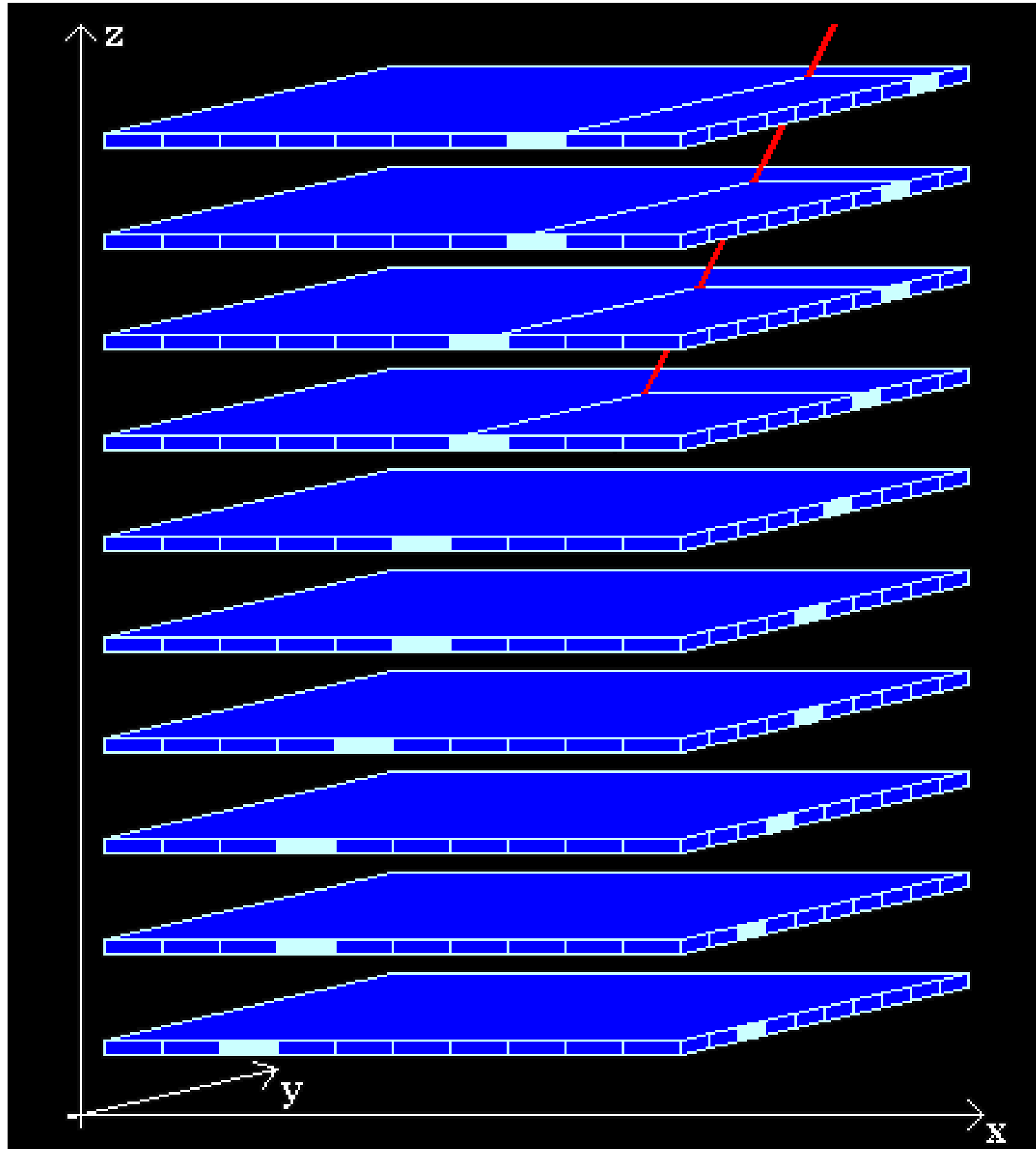
Visualizzazione in 3D



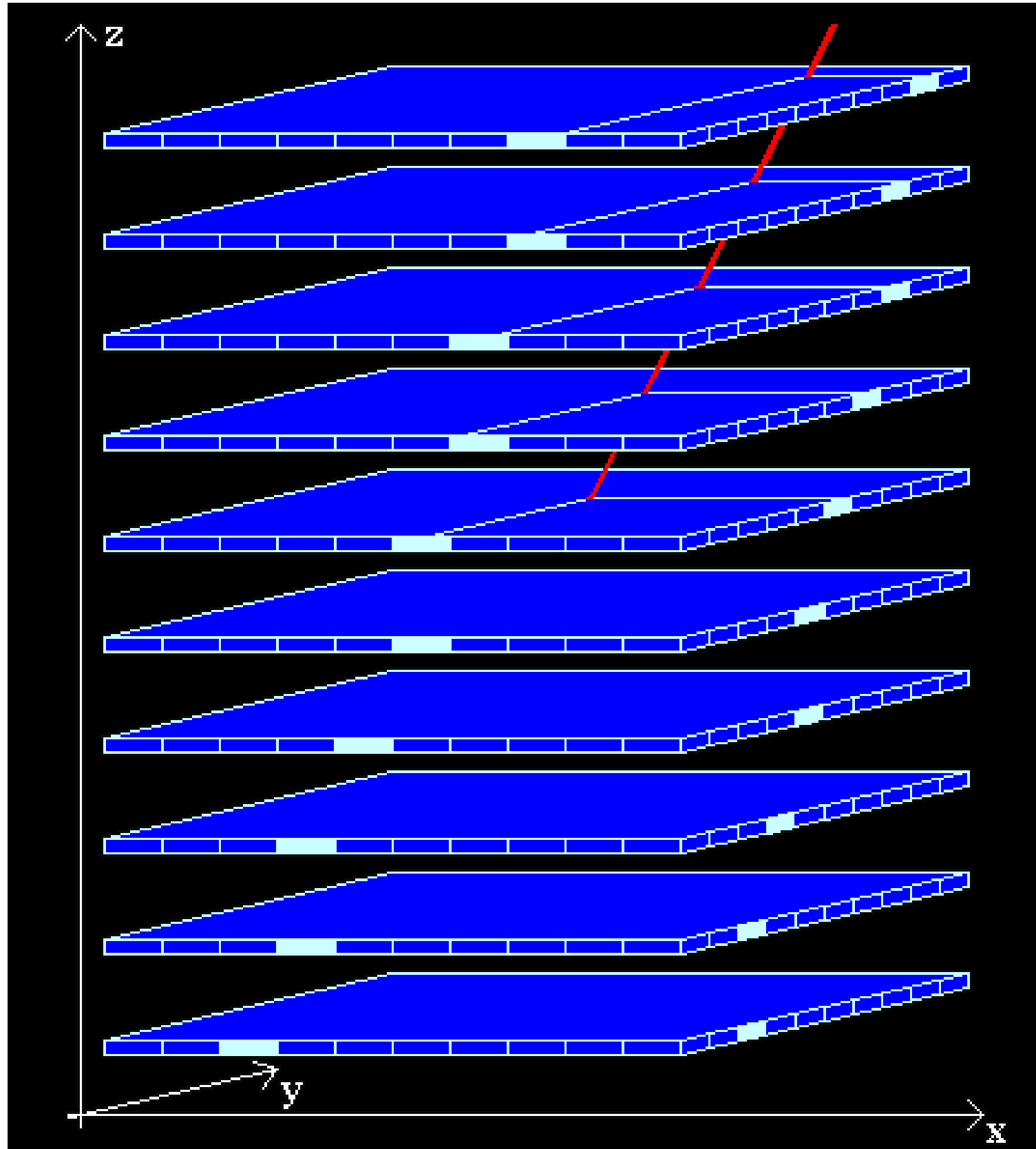
Visualizzazione in 3D



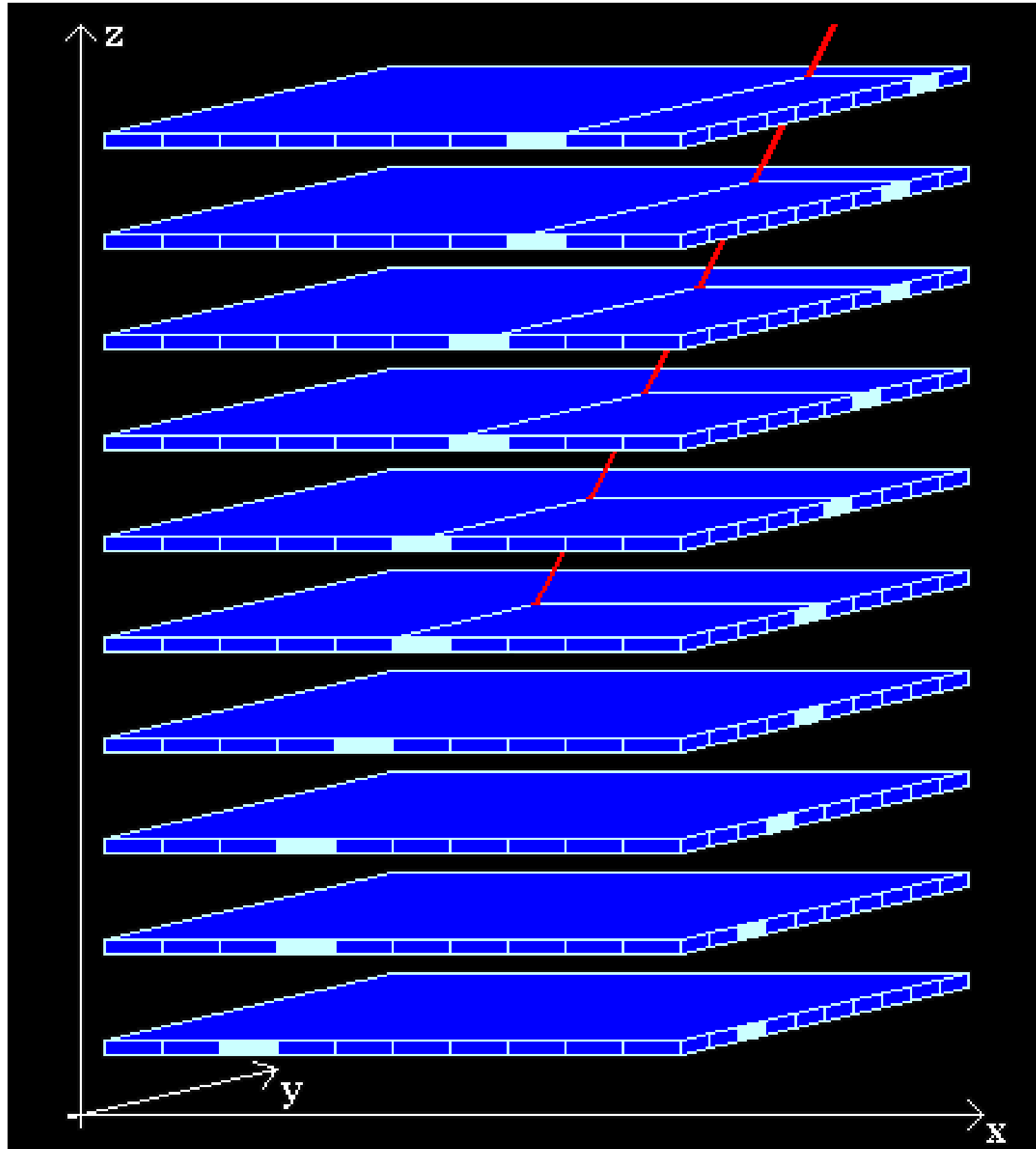
Visualizzazione in 3D



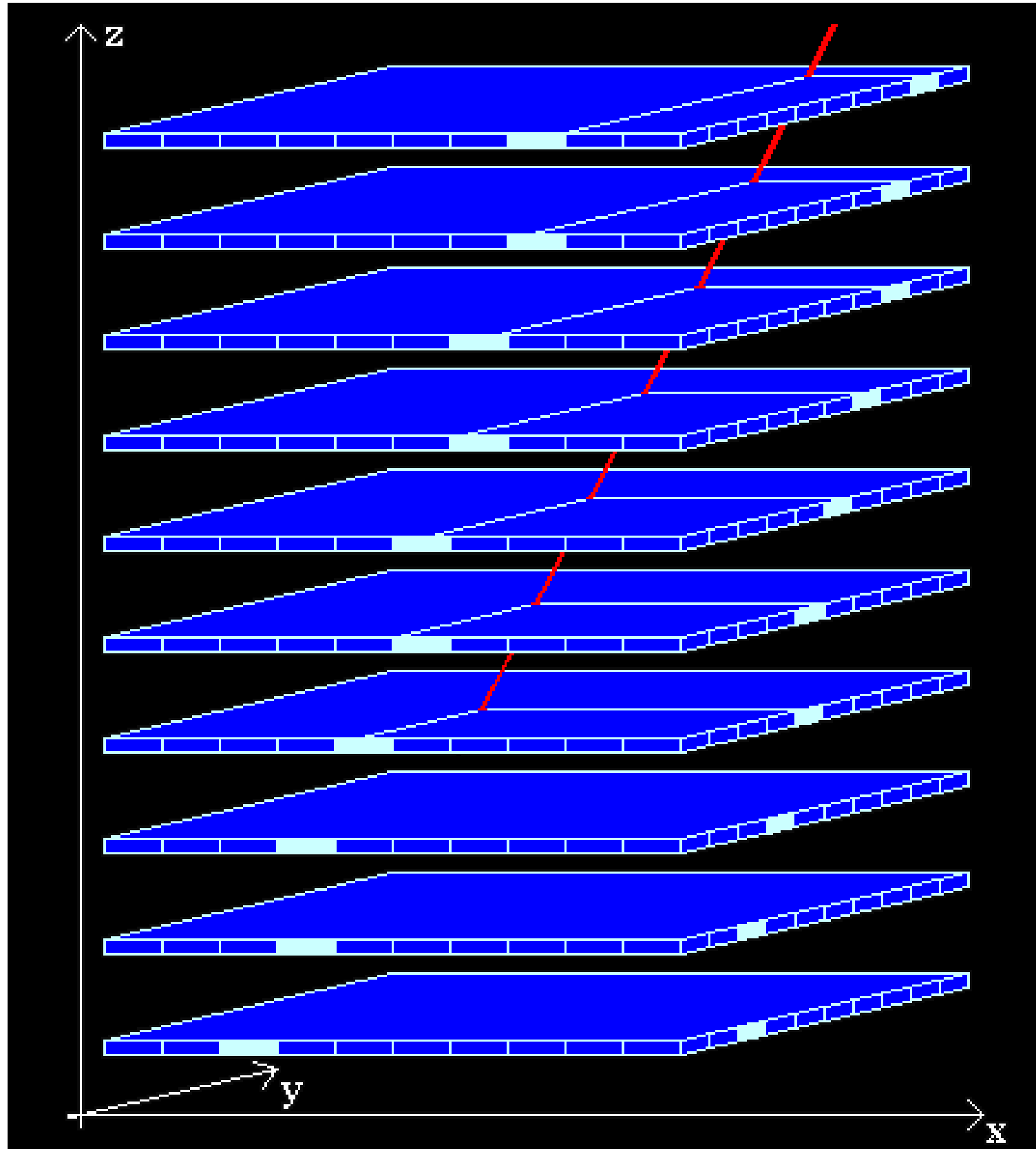
Visualizzazione in 3D



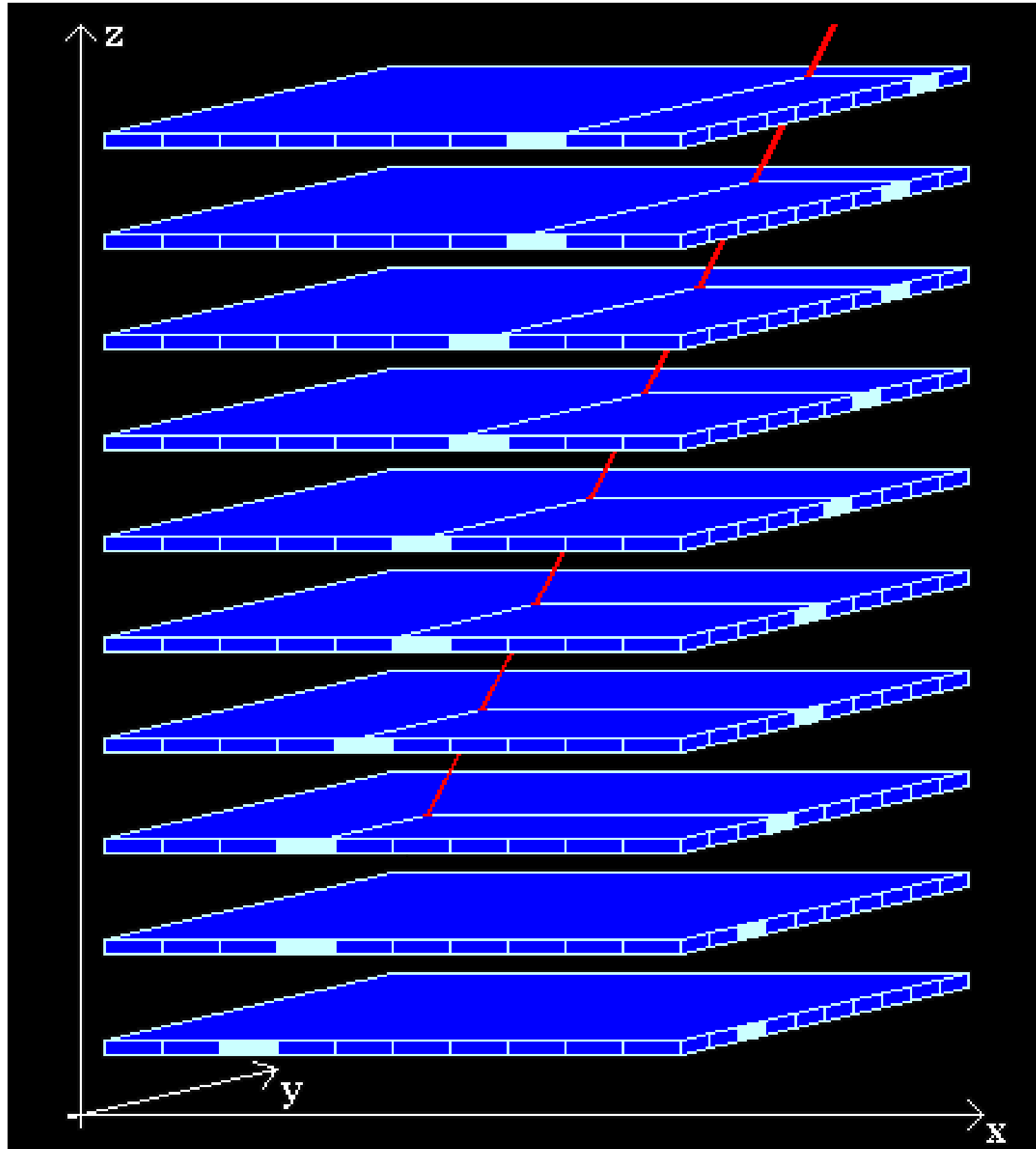
Visualizzazione in 3D



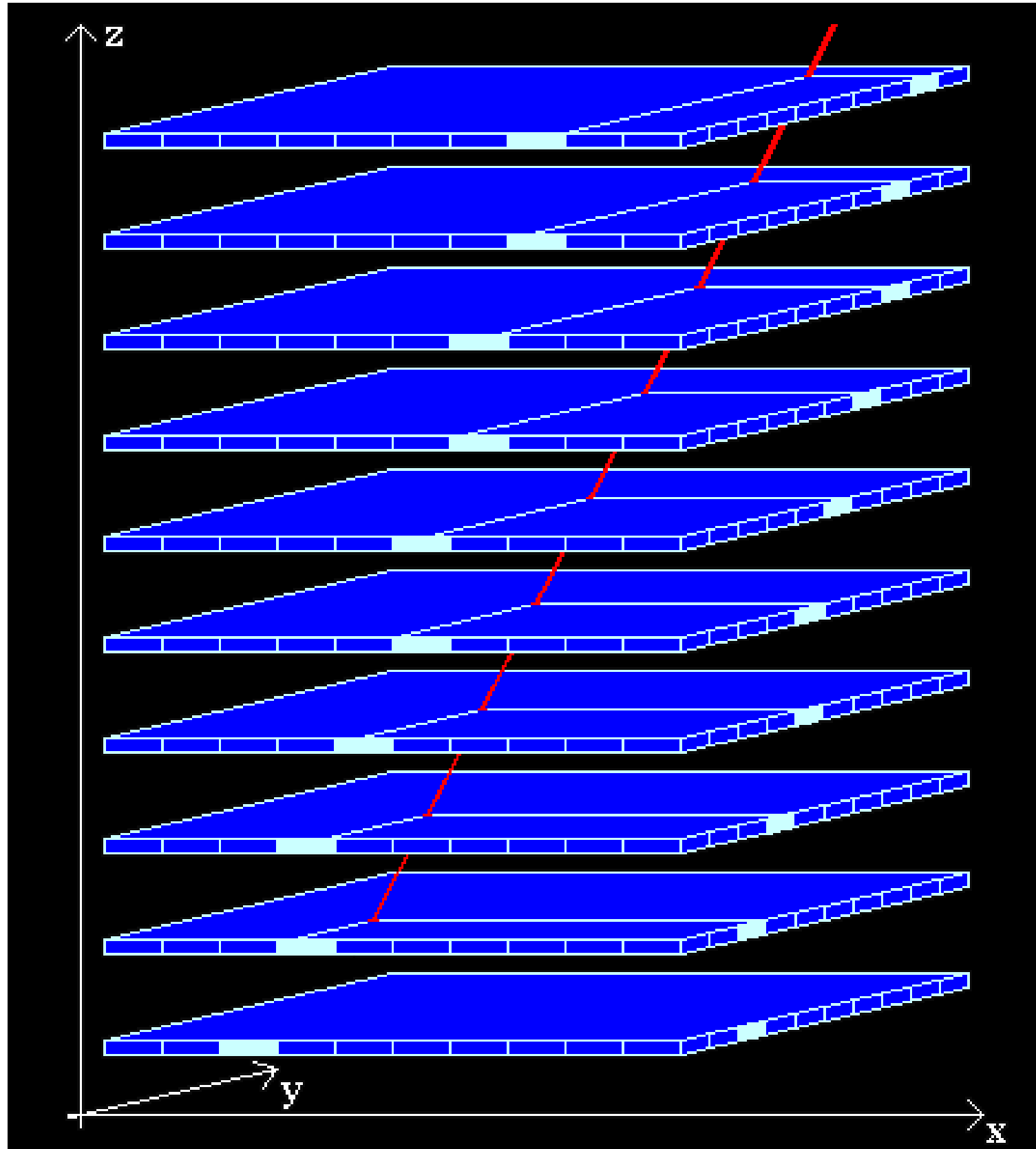
Visualizzazione in 3D



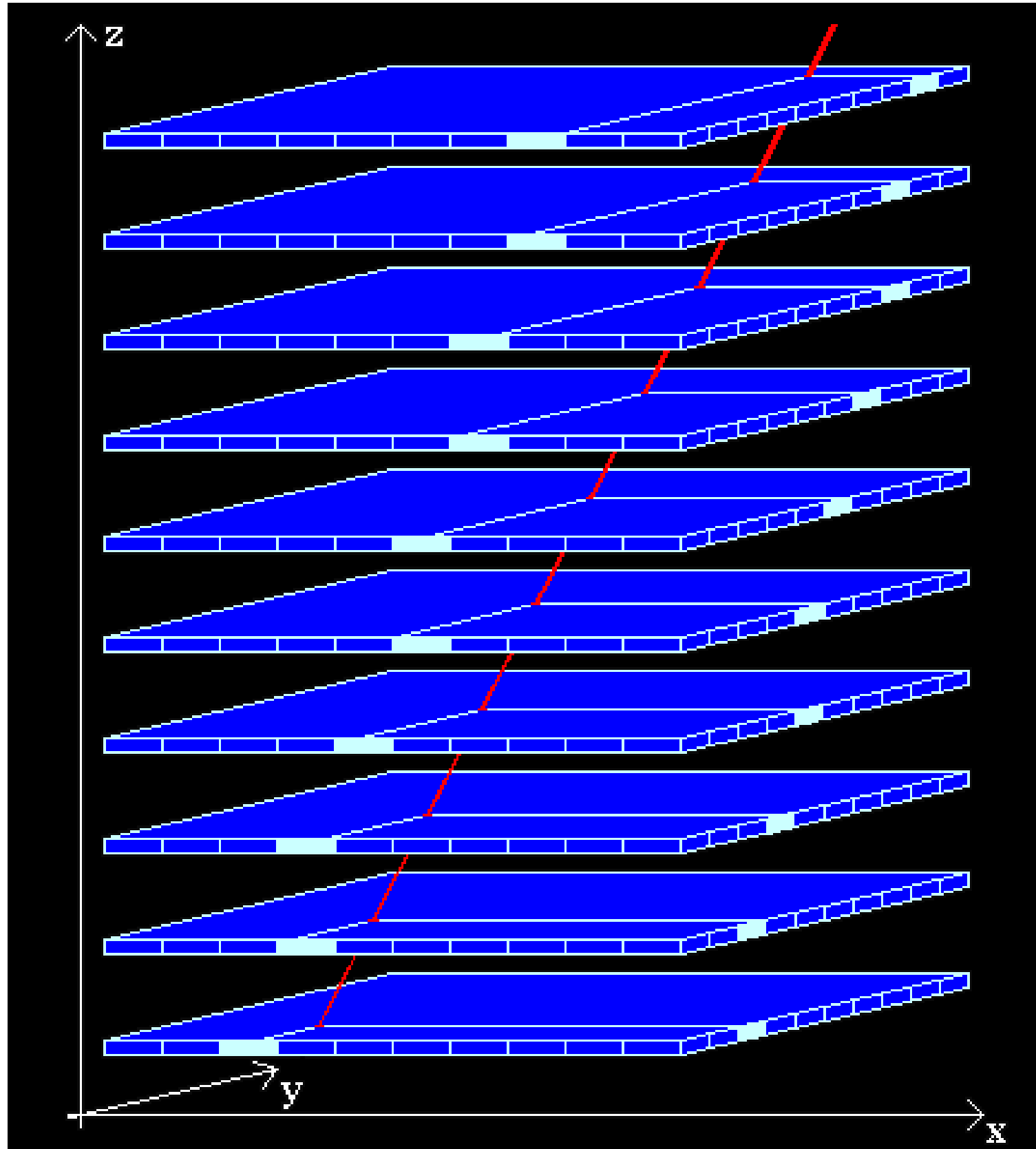
Visualizzazione in 3D



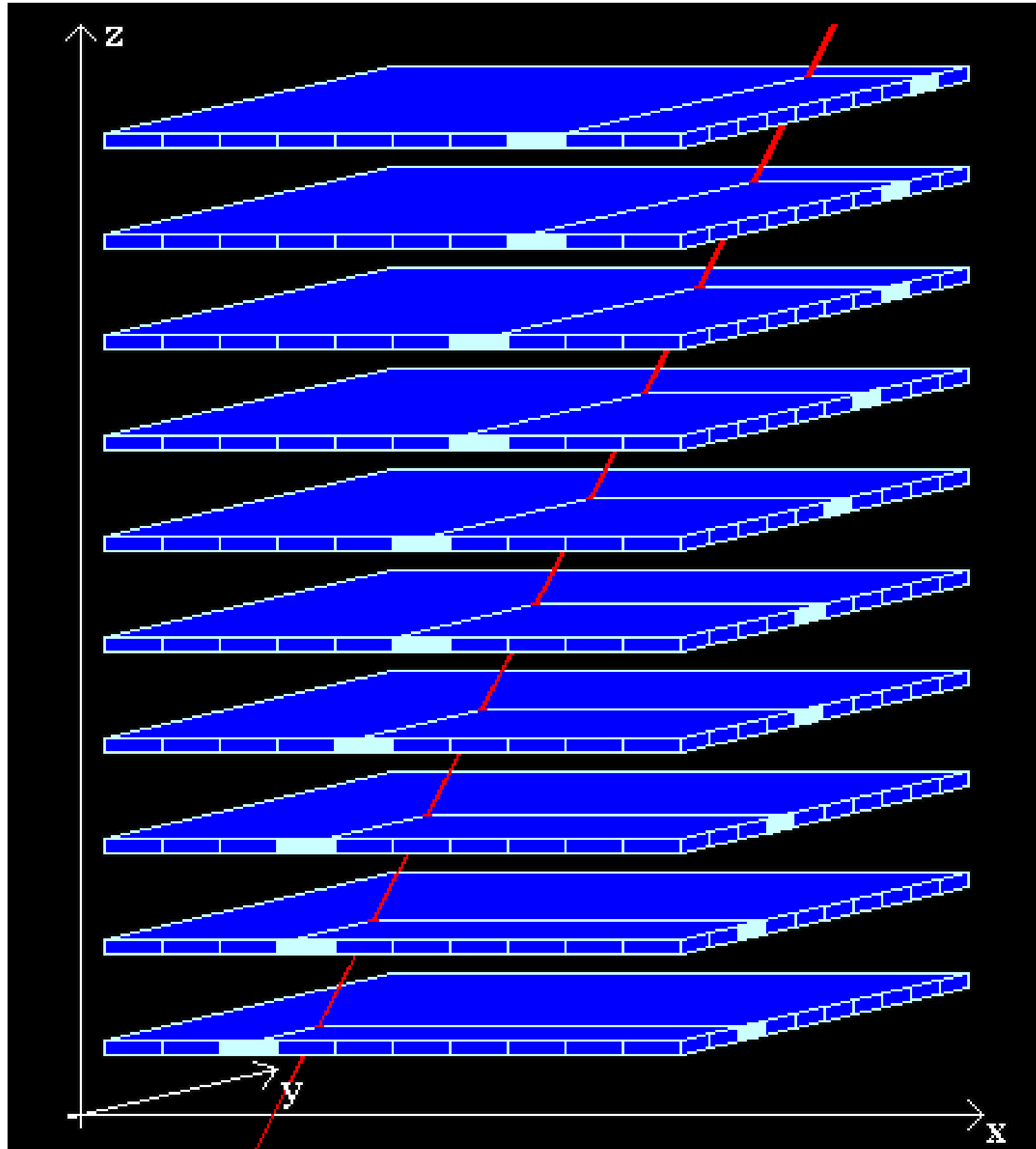
Visualizzazione in 3D



Visualizzazione in 3D



Visualizzazione in 3D



I dati prodotti dal telescopio

ST07EE
0100000120080200602200A0160100

00400402401

ST07EF

00000200400

00000100100

ST07F1

00100200400

04004804004

ST07F2

00000001001

00020030000

STA92C

20000020020

00004002004

STA92D

00000102002

10008004002

STA92E

00010010010

04004002801

STA931

00020020020

20000010020

STA932

000000003008010020040100000000

0001003002002002002000000000

STA935

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200100100080080040040020020000

STA936

200200200200200200100000000100

001002002004004008008010000000

ST07F3

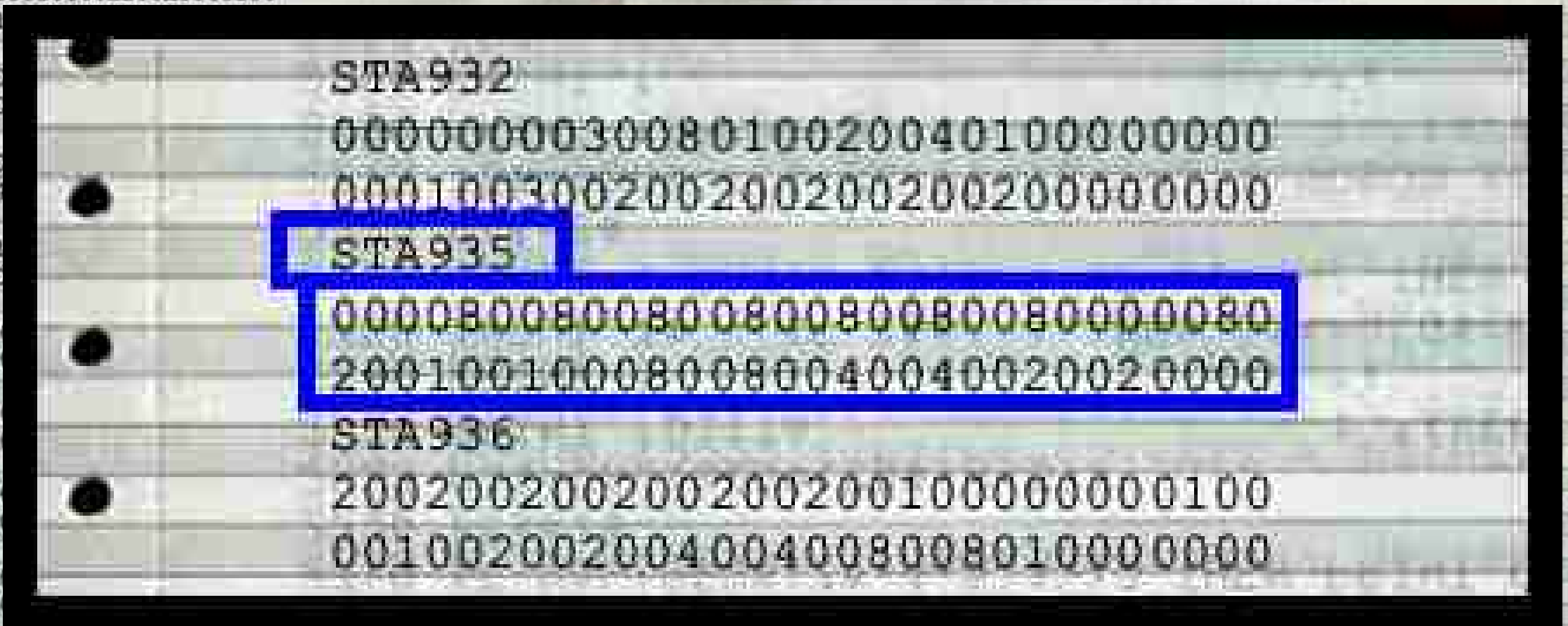
000002002002002002004000000000

000040020020010008004002001000

ST07F4

008208104100080040040000000000

022022001001008008004004000000



STA932

000000003008010020040100000000

0001003002002002002000000000

STA935

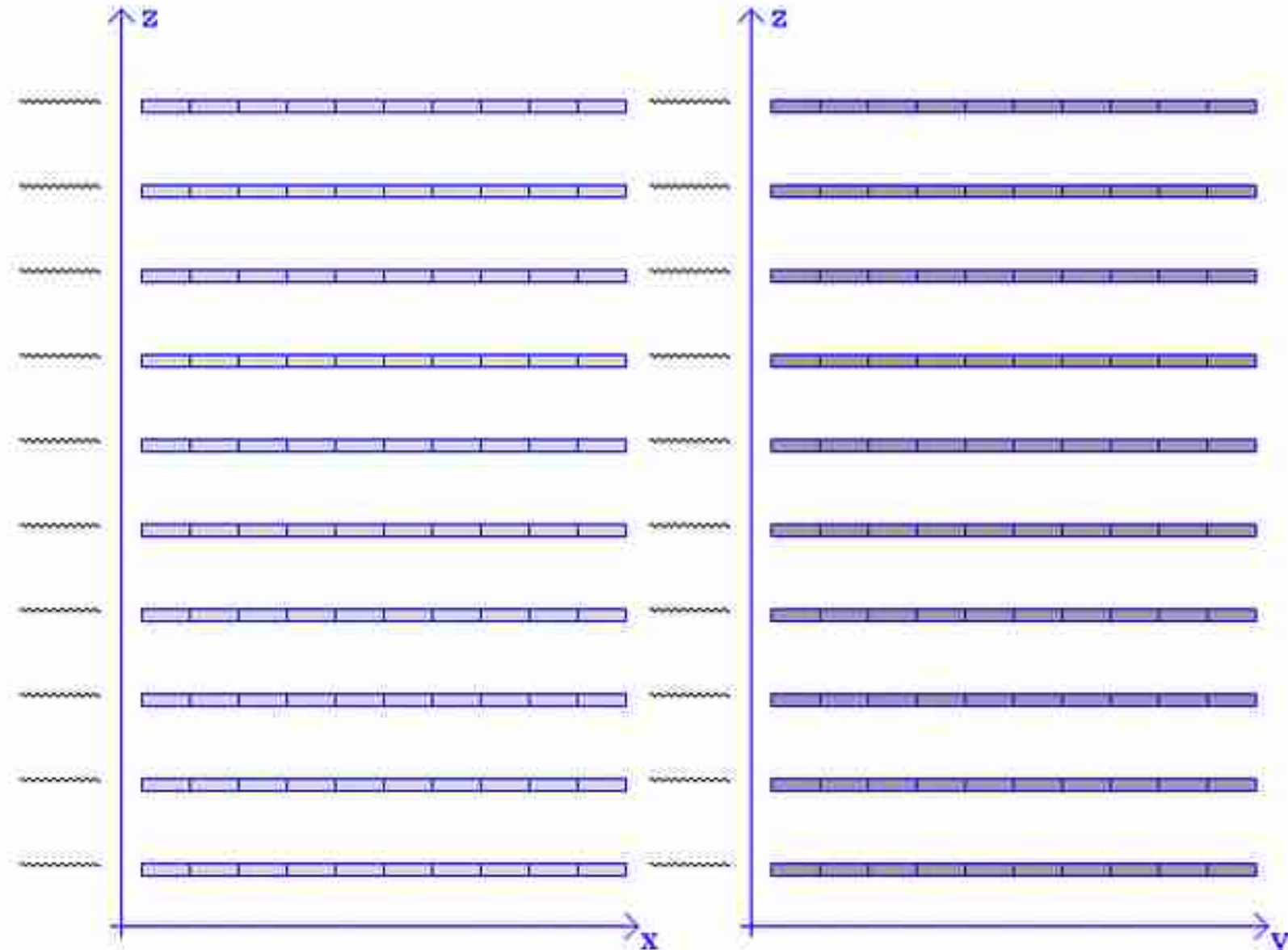
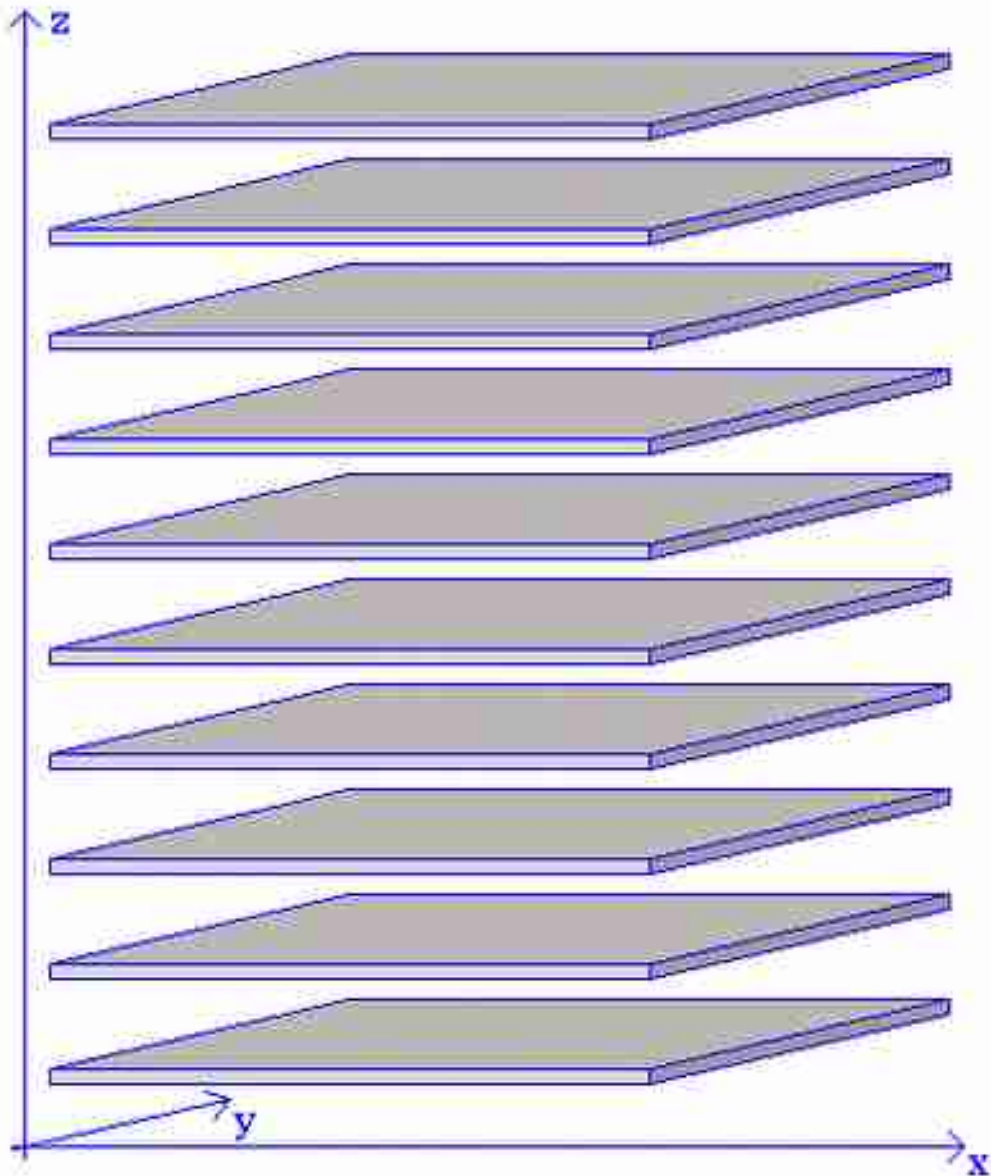
0000800800800800800800000080

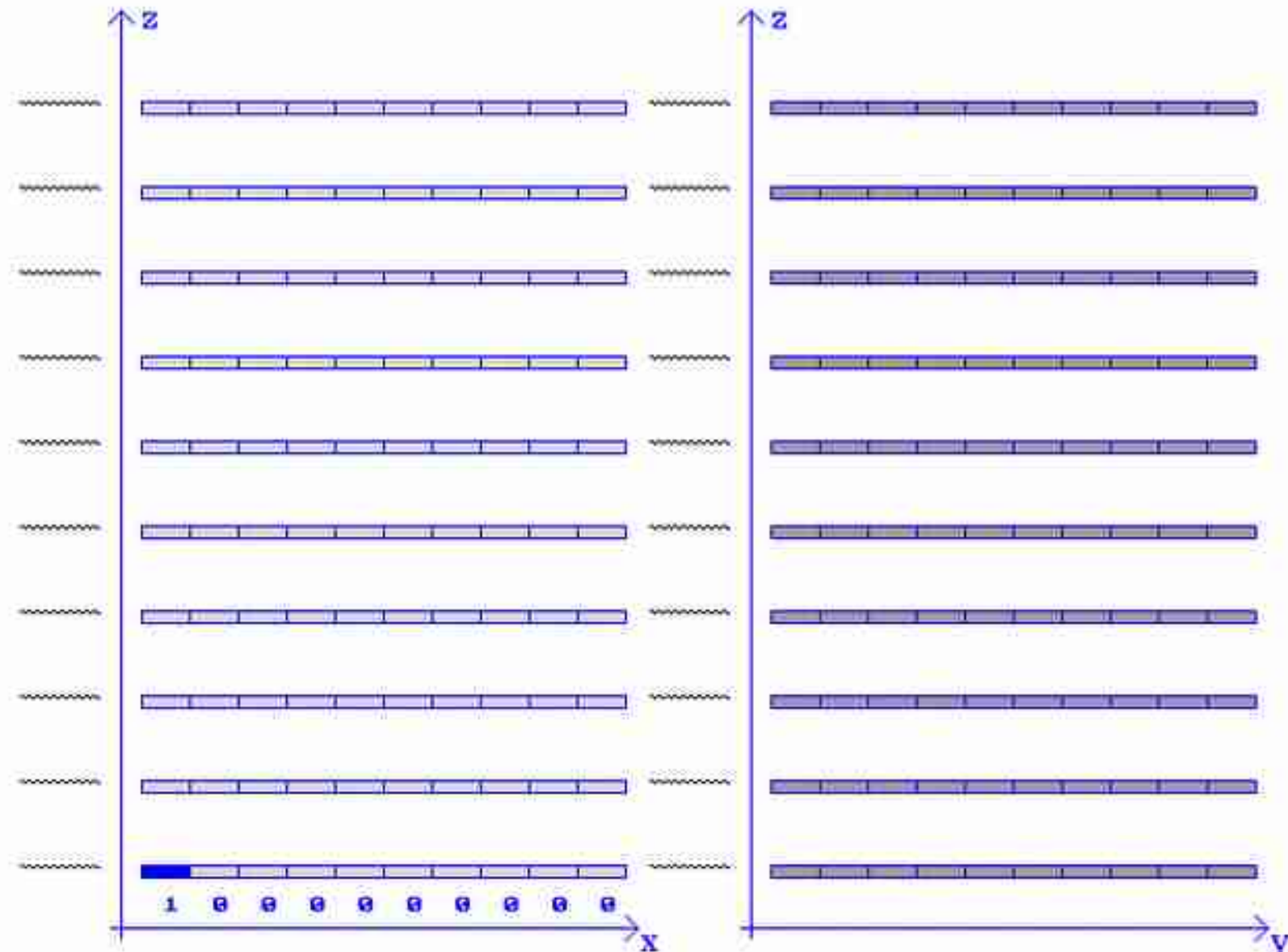
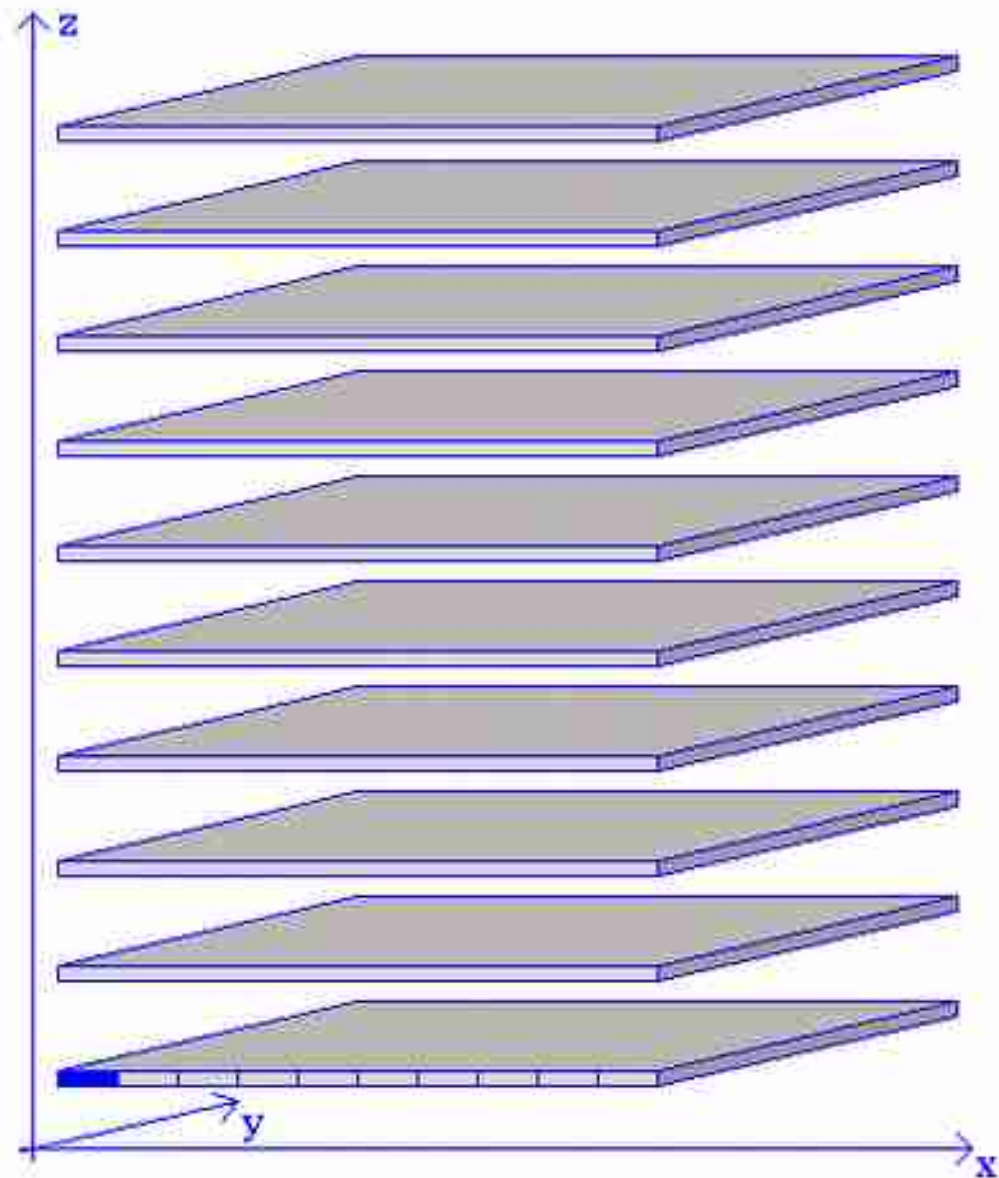
200100100080080040040020020000

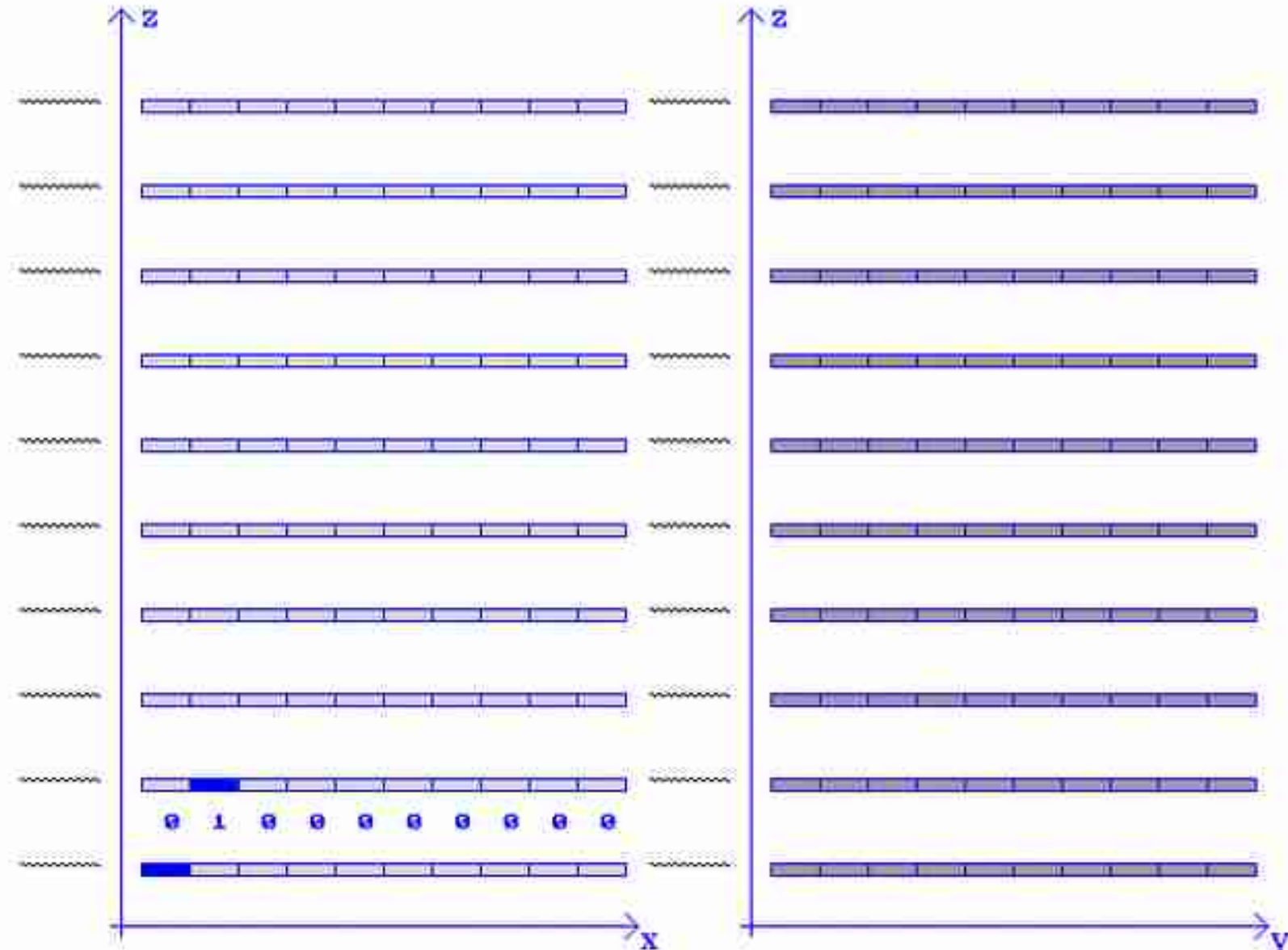
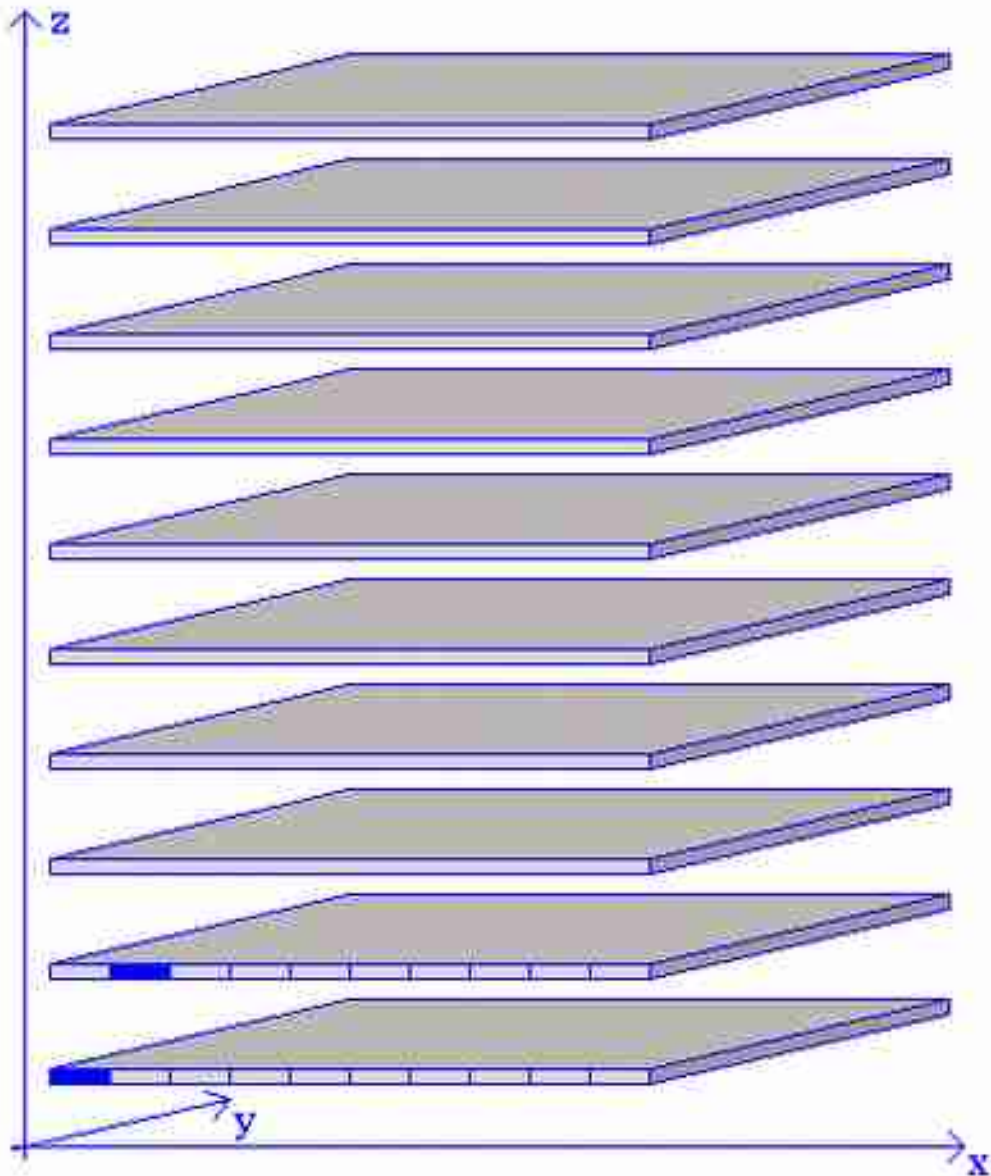
STA936

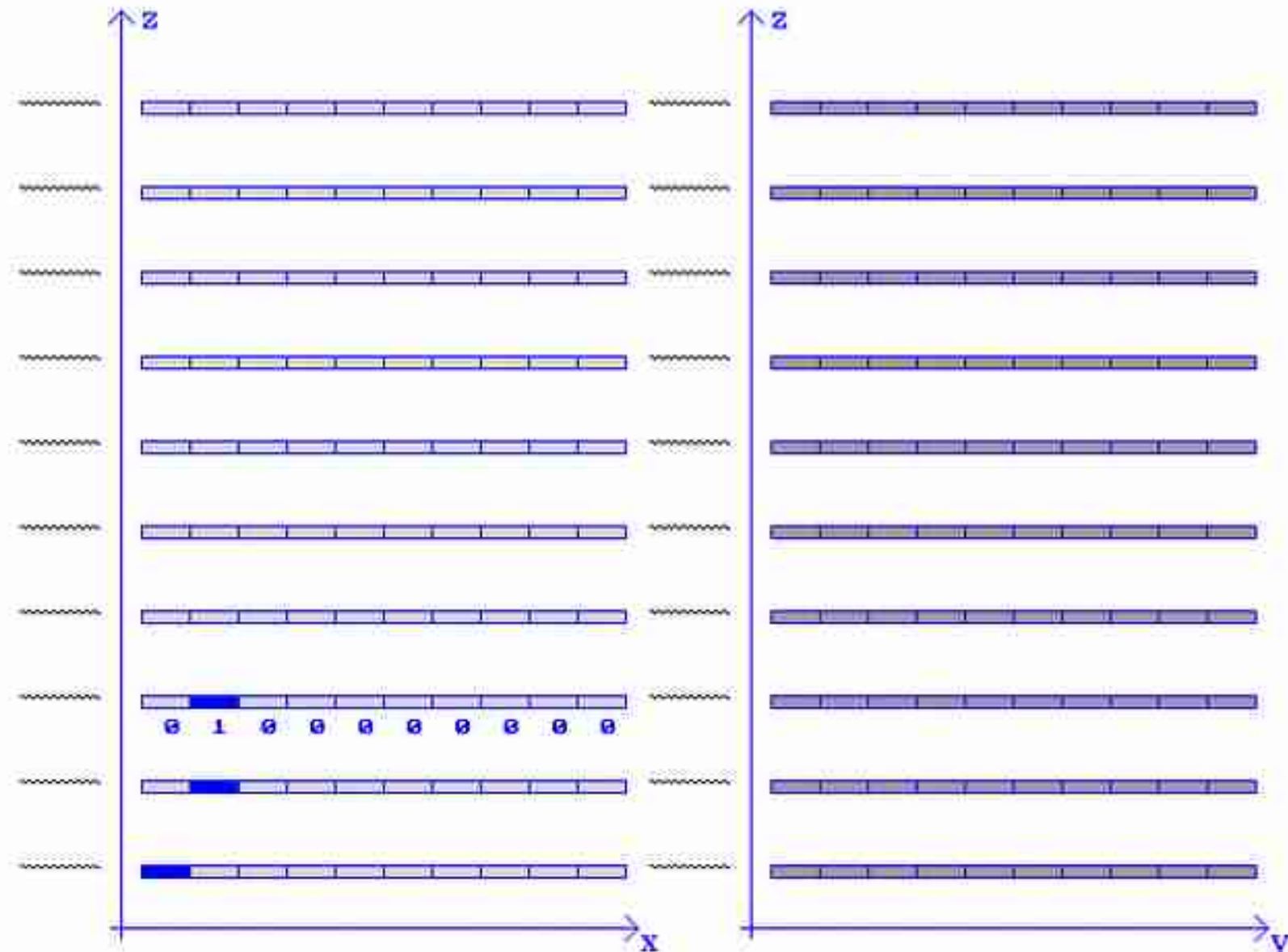
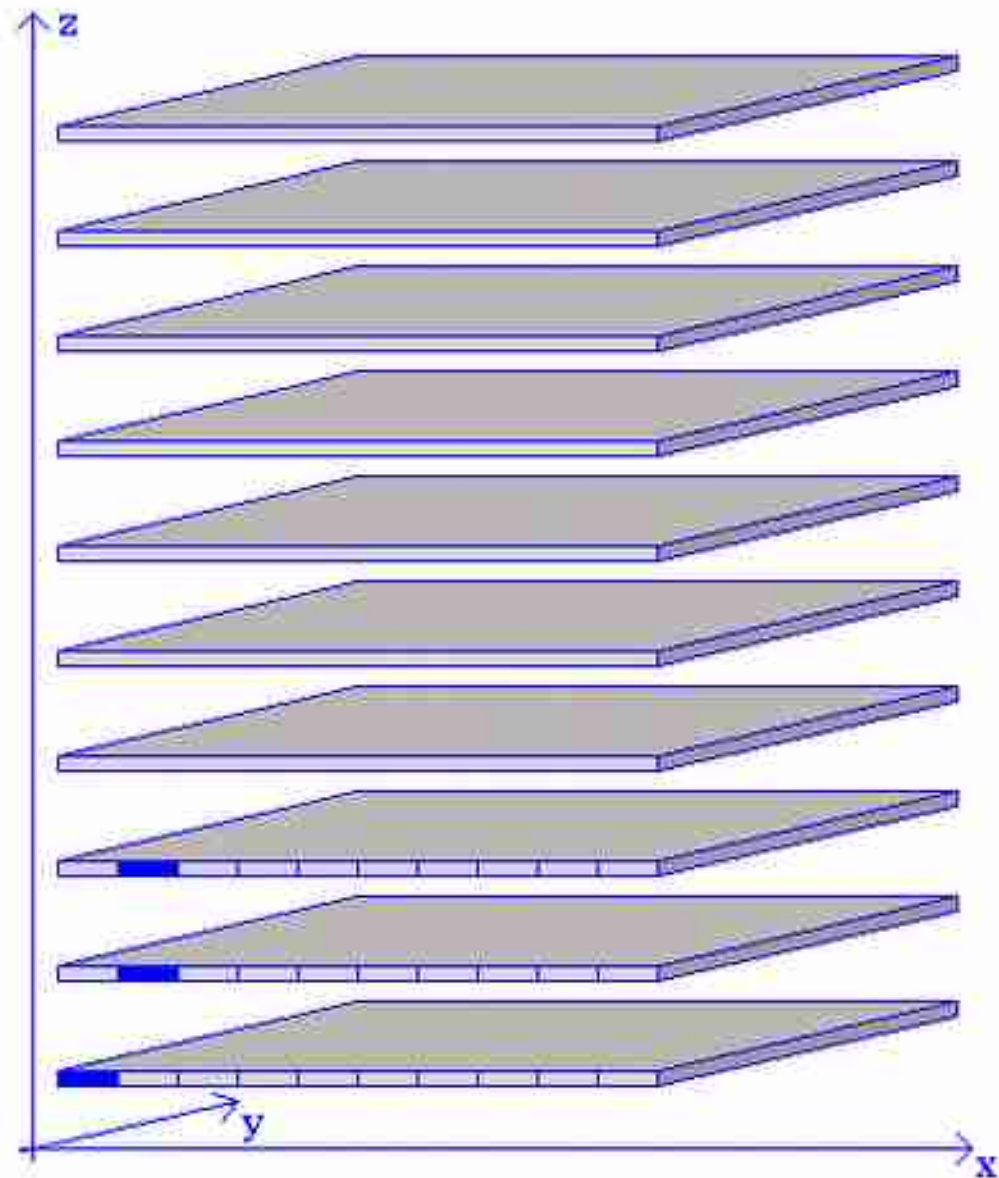
200200200200200200100000000100

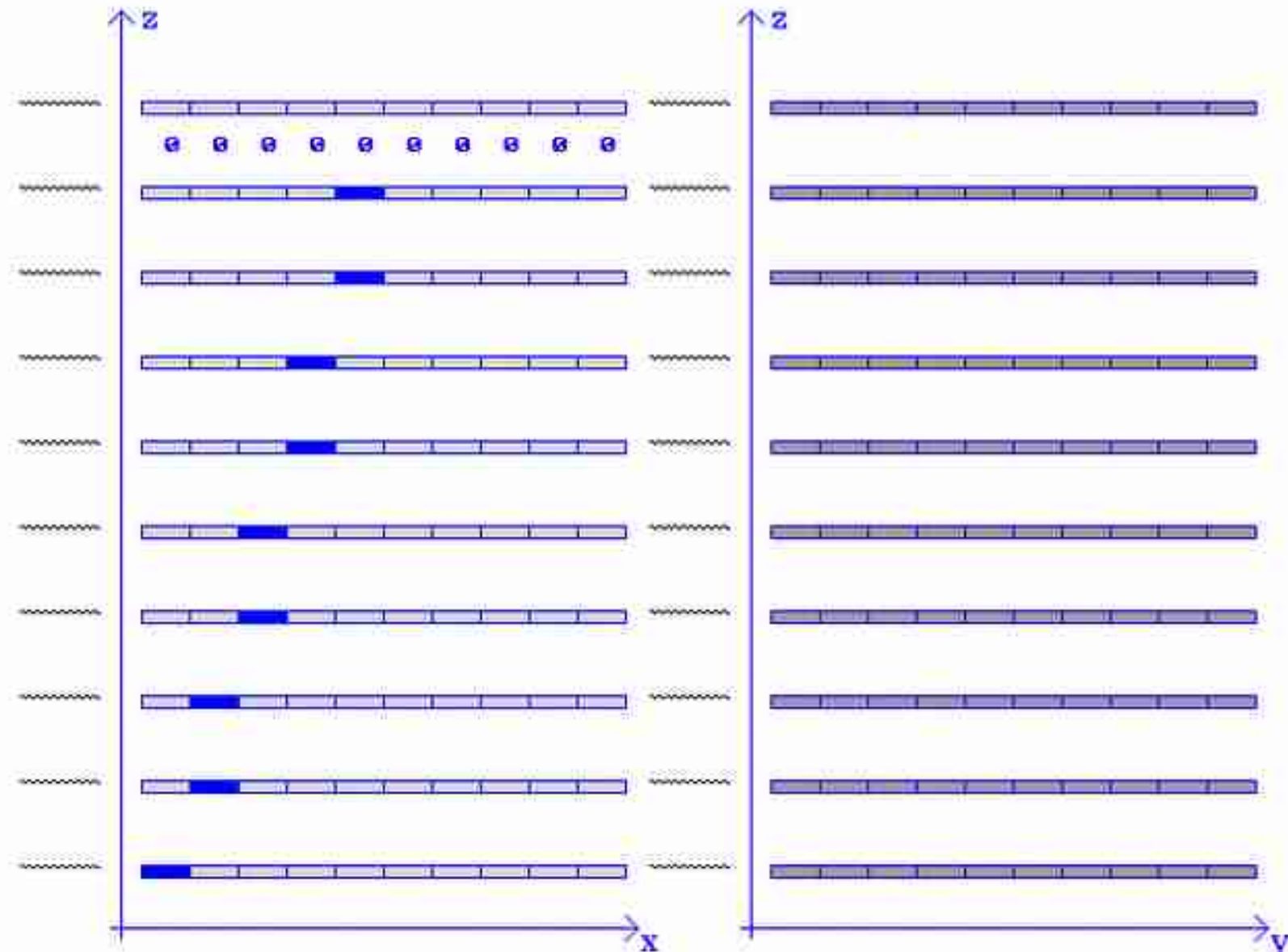
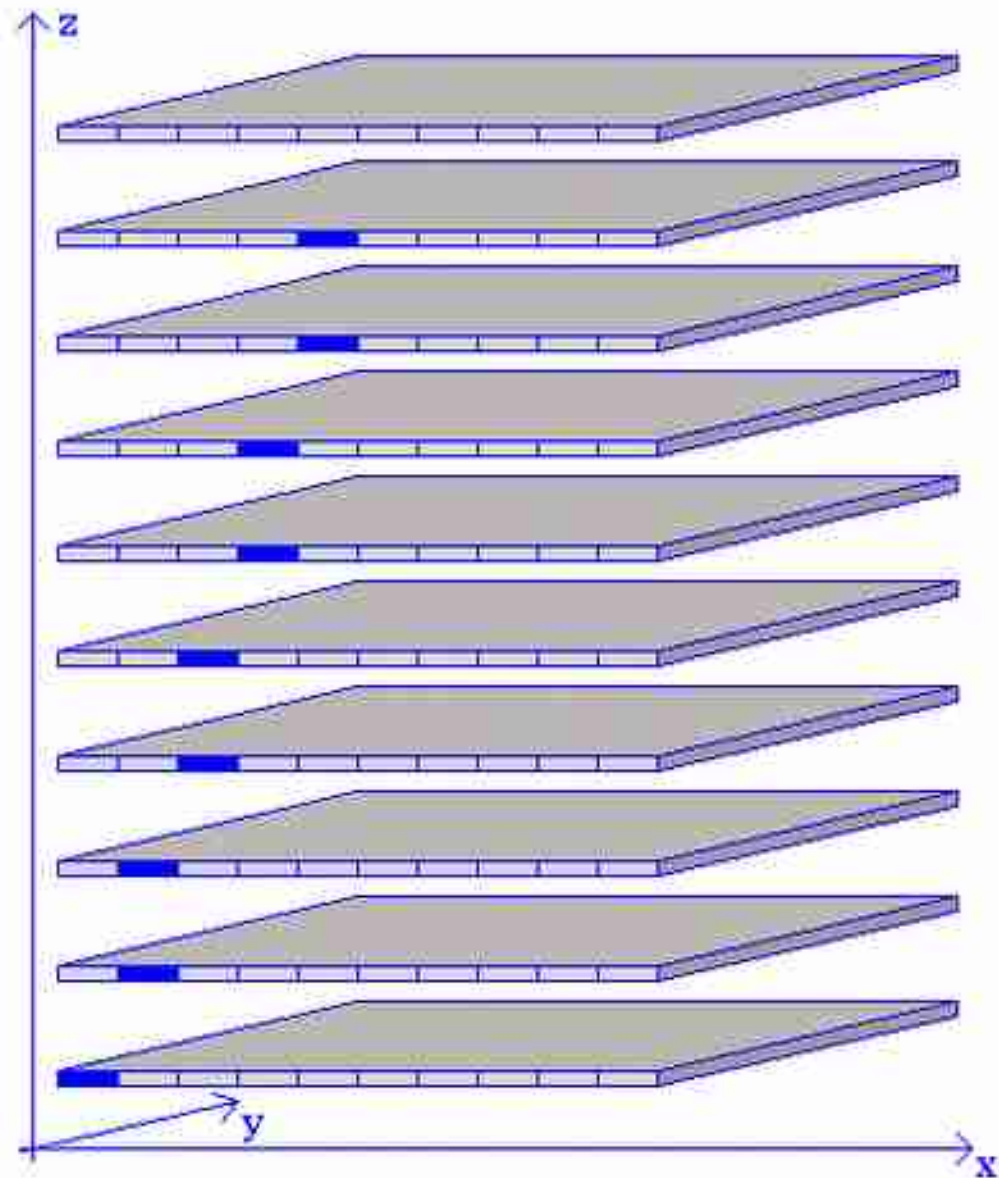
001002002004004008008010000000



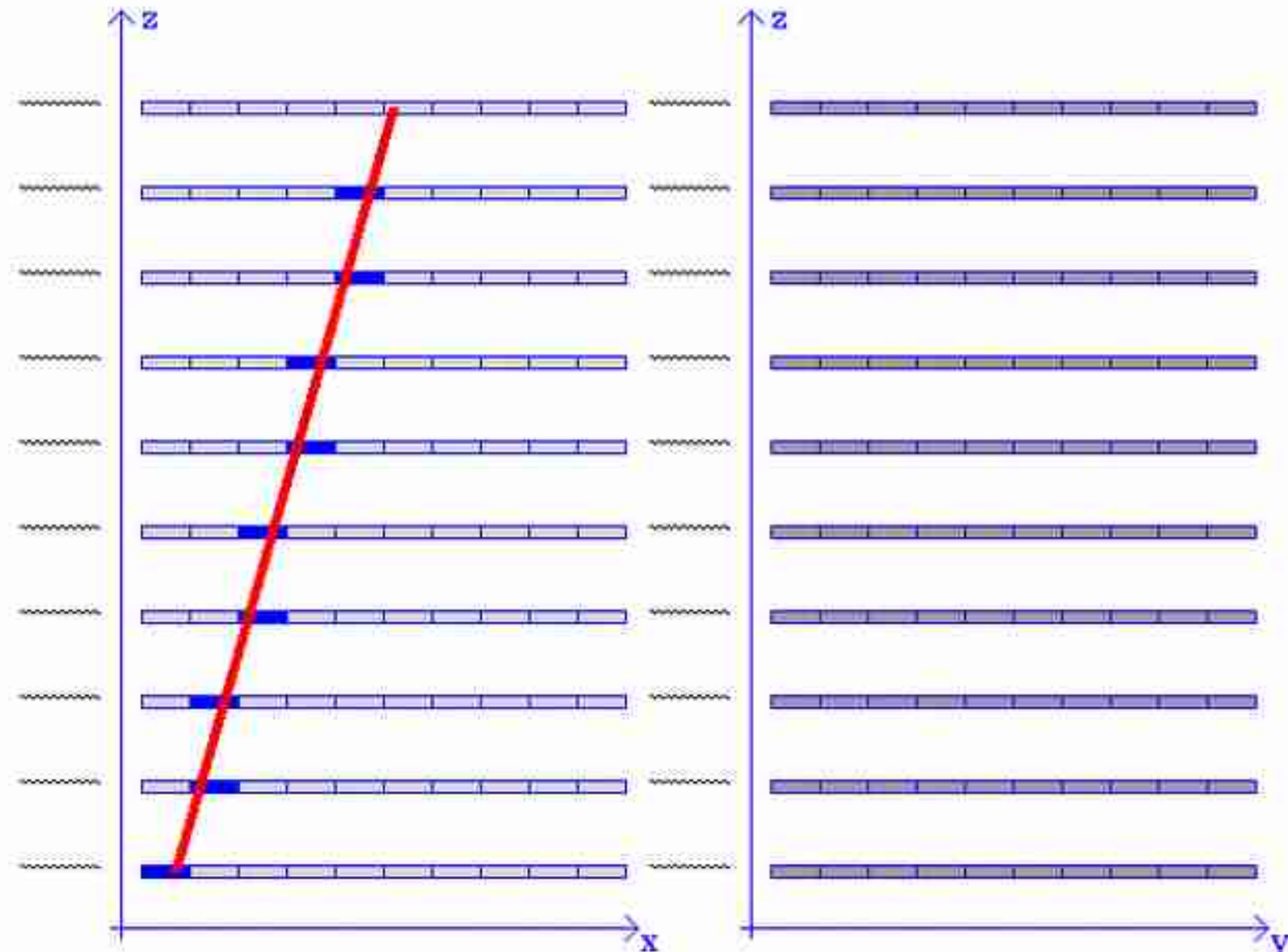
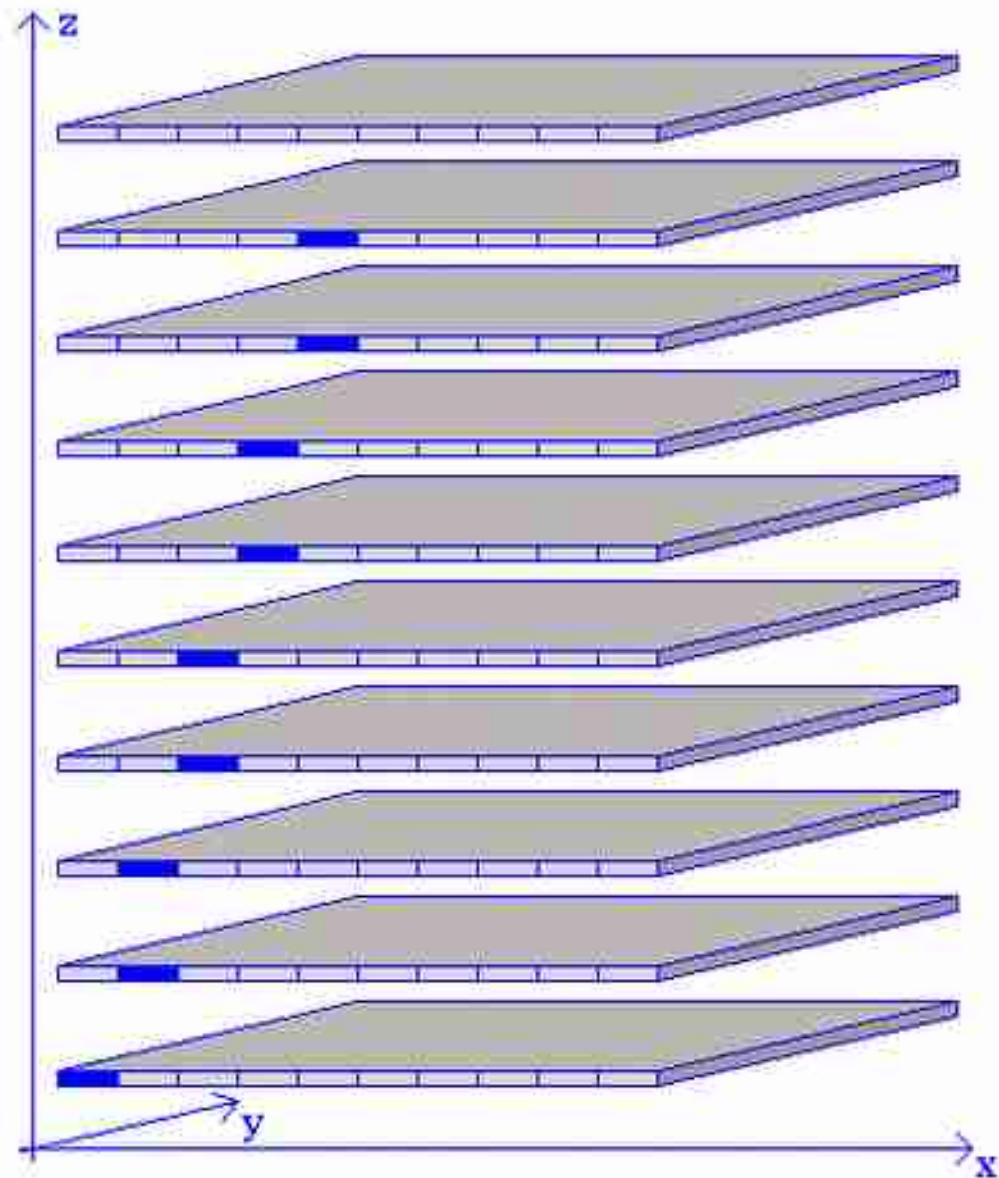




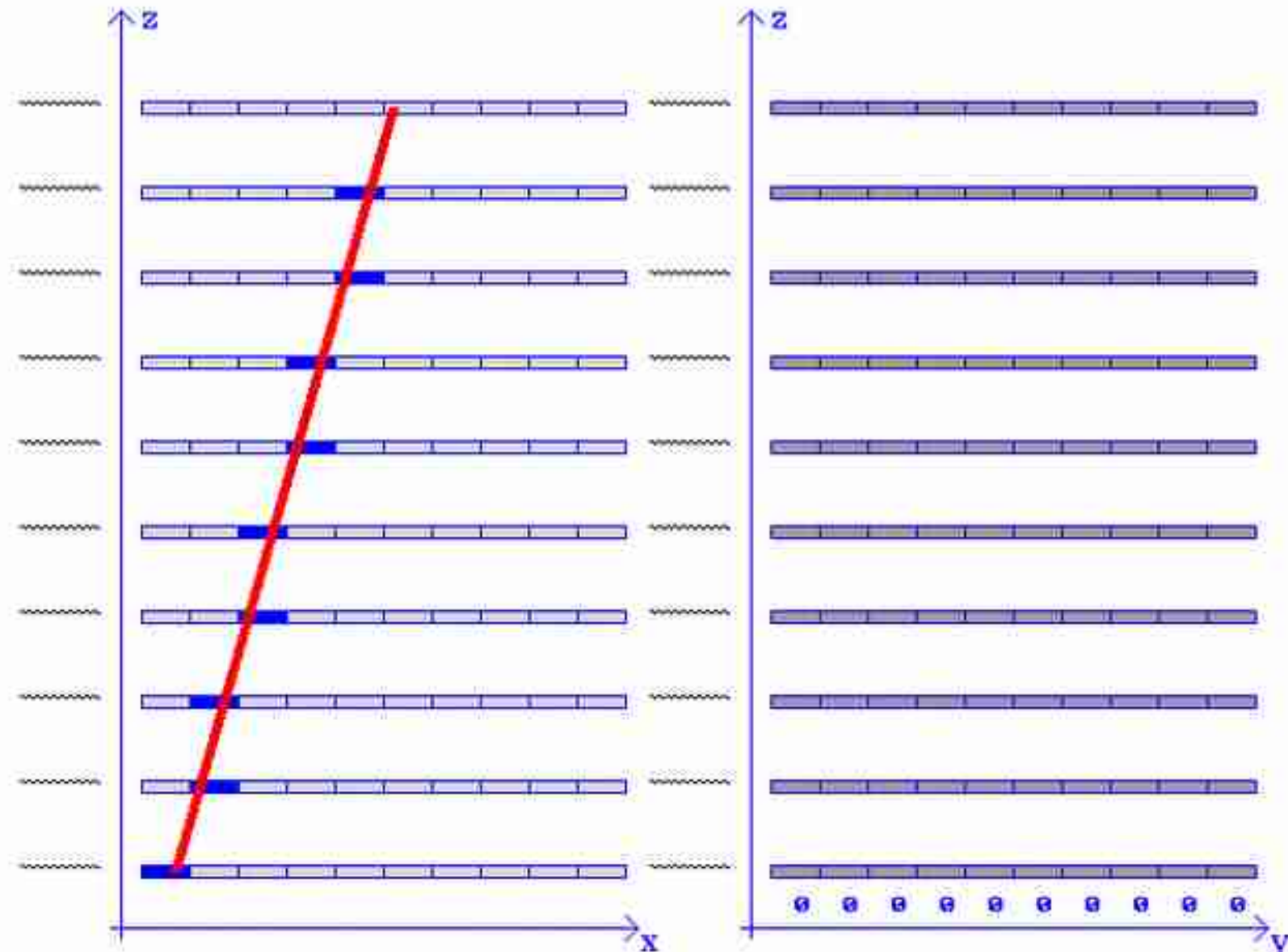
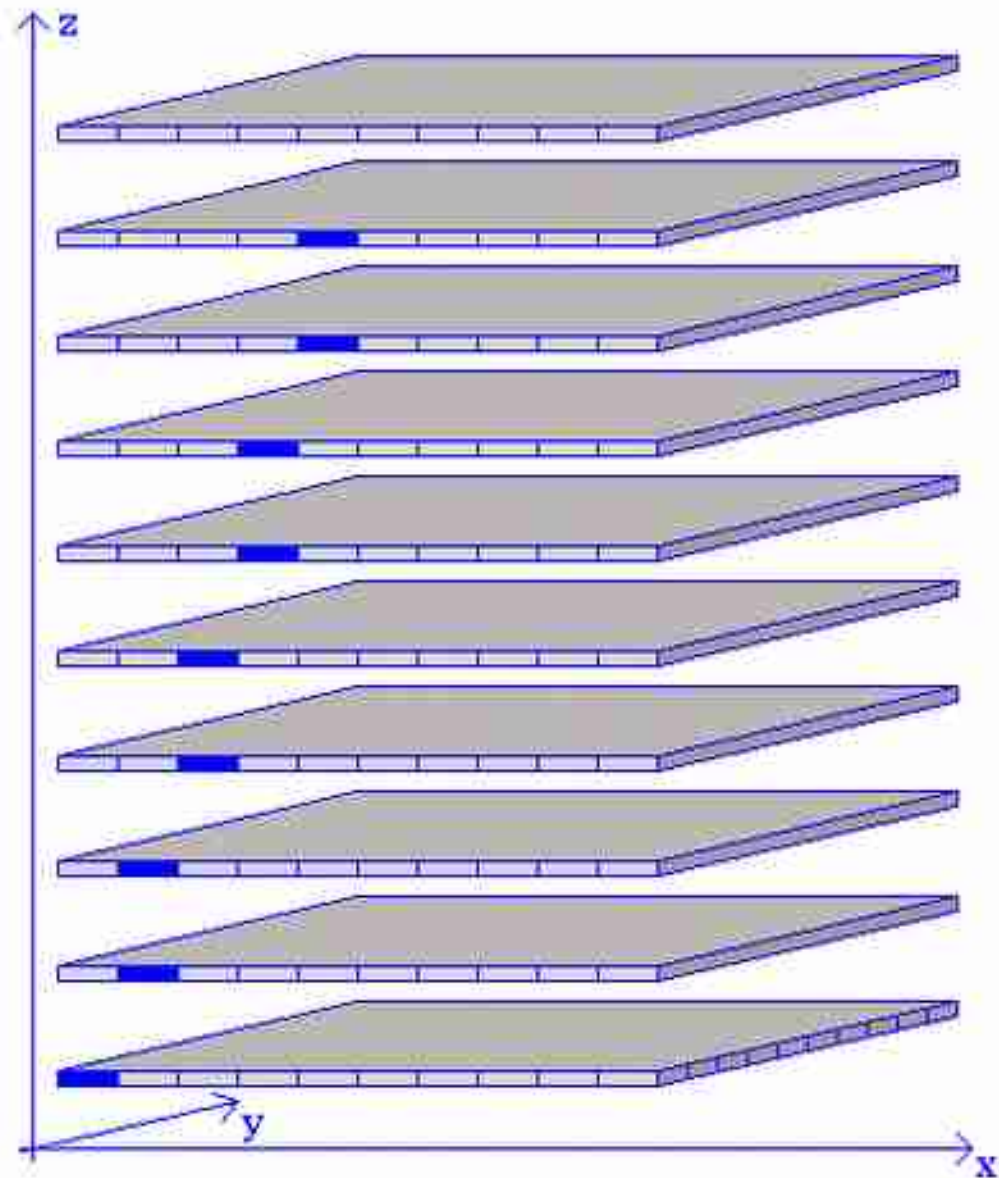


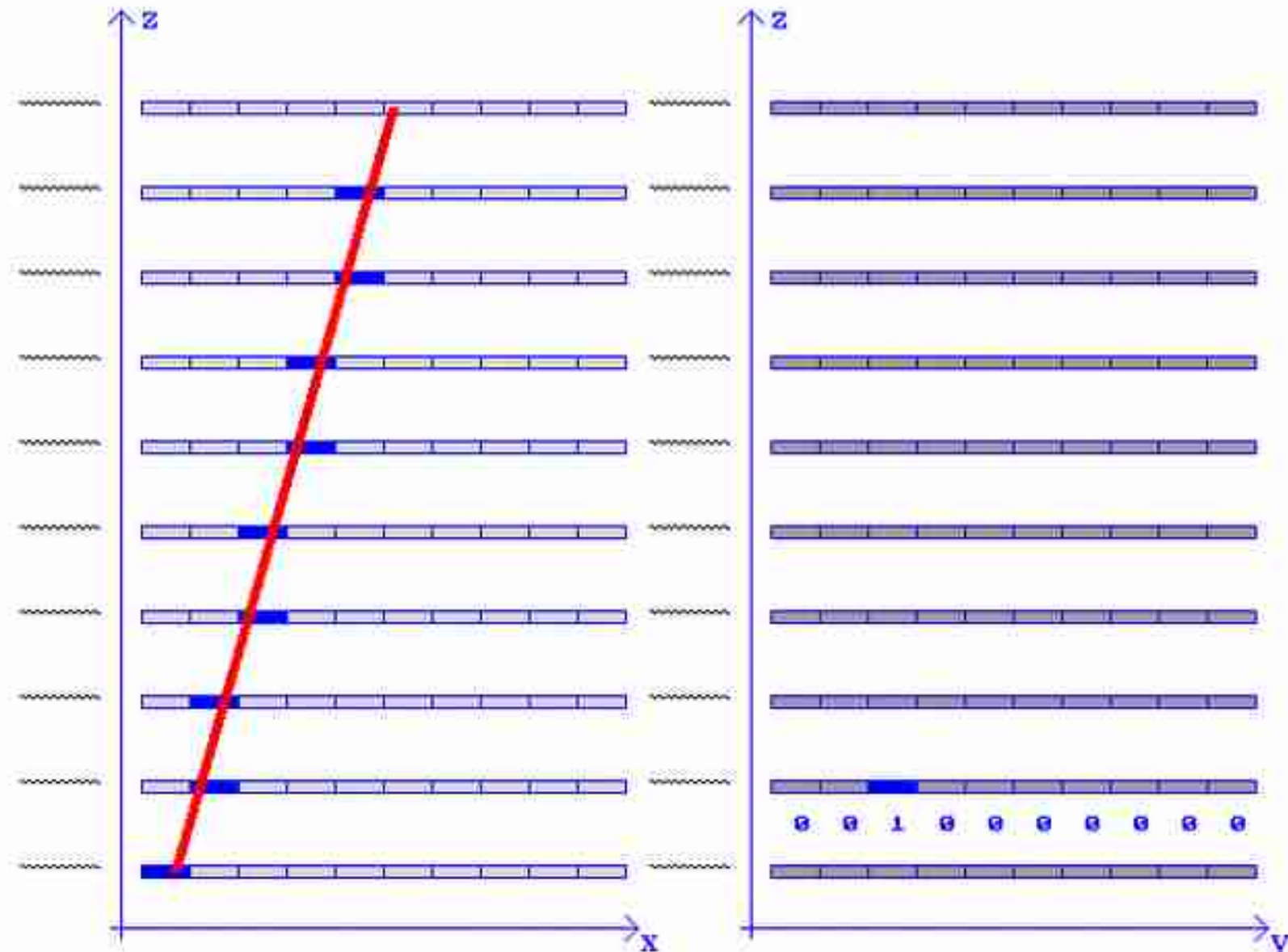
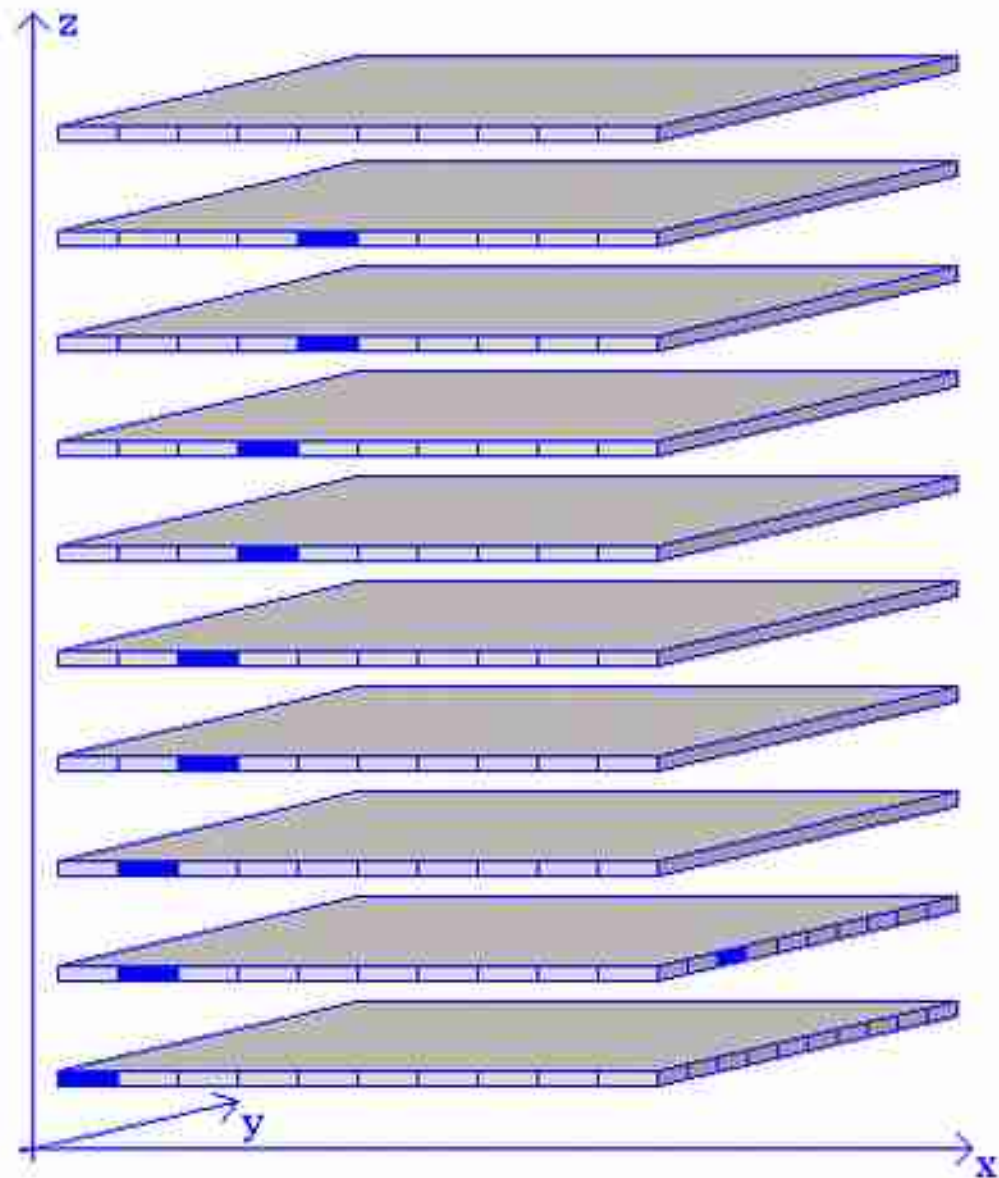


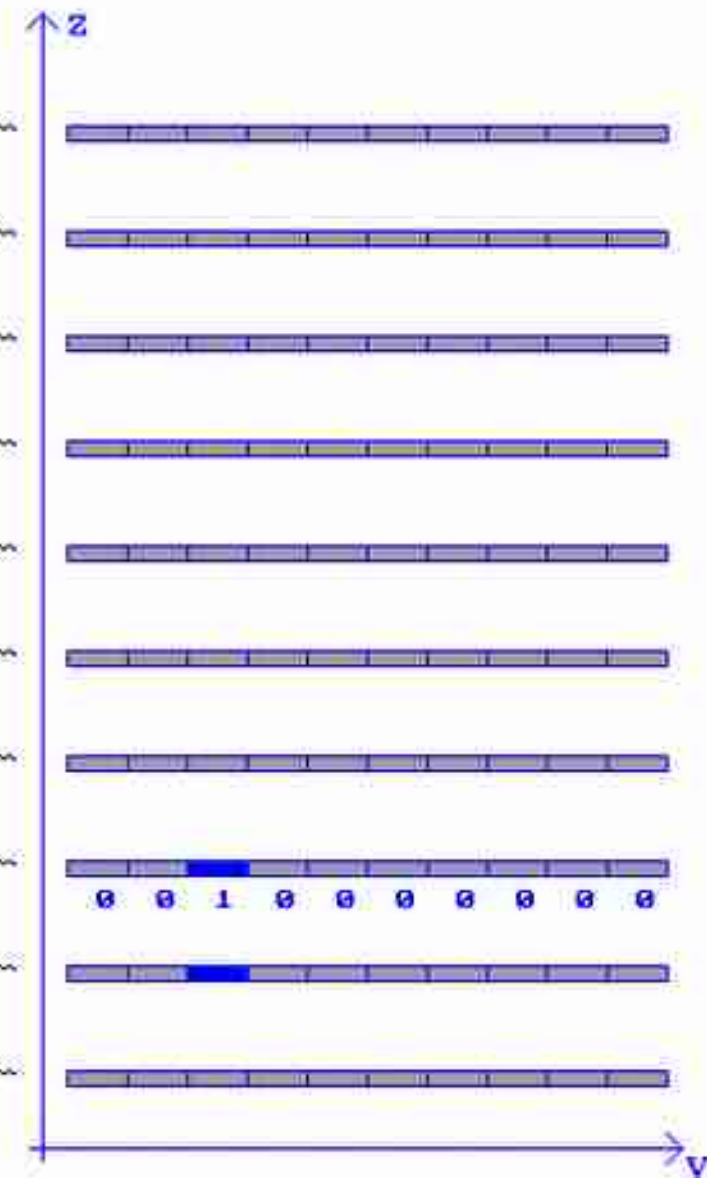
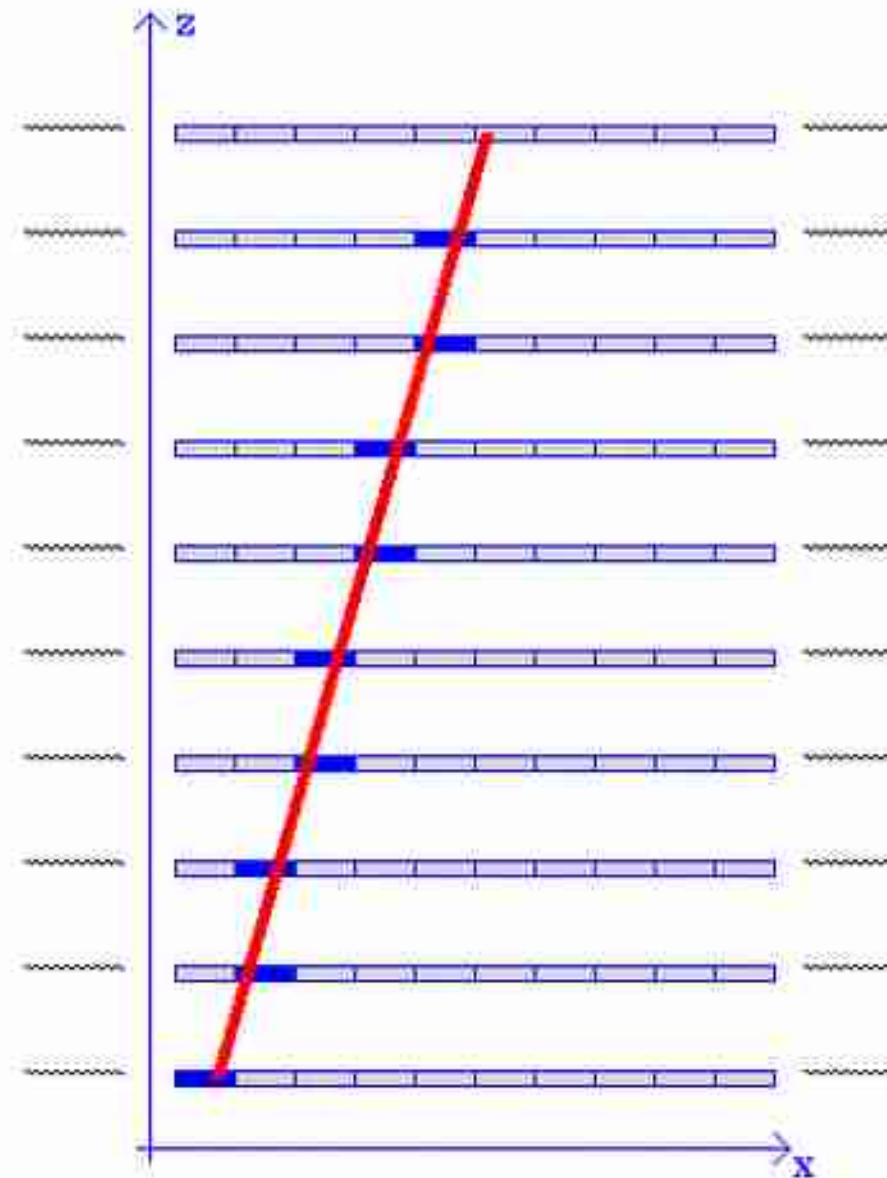
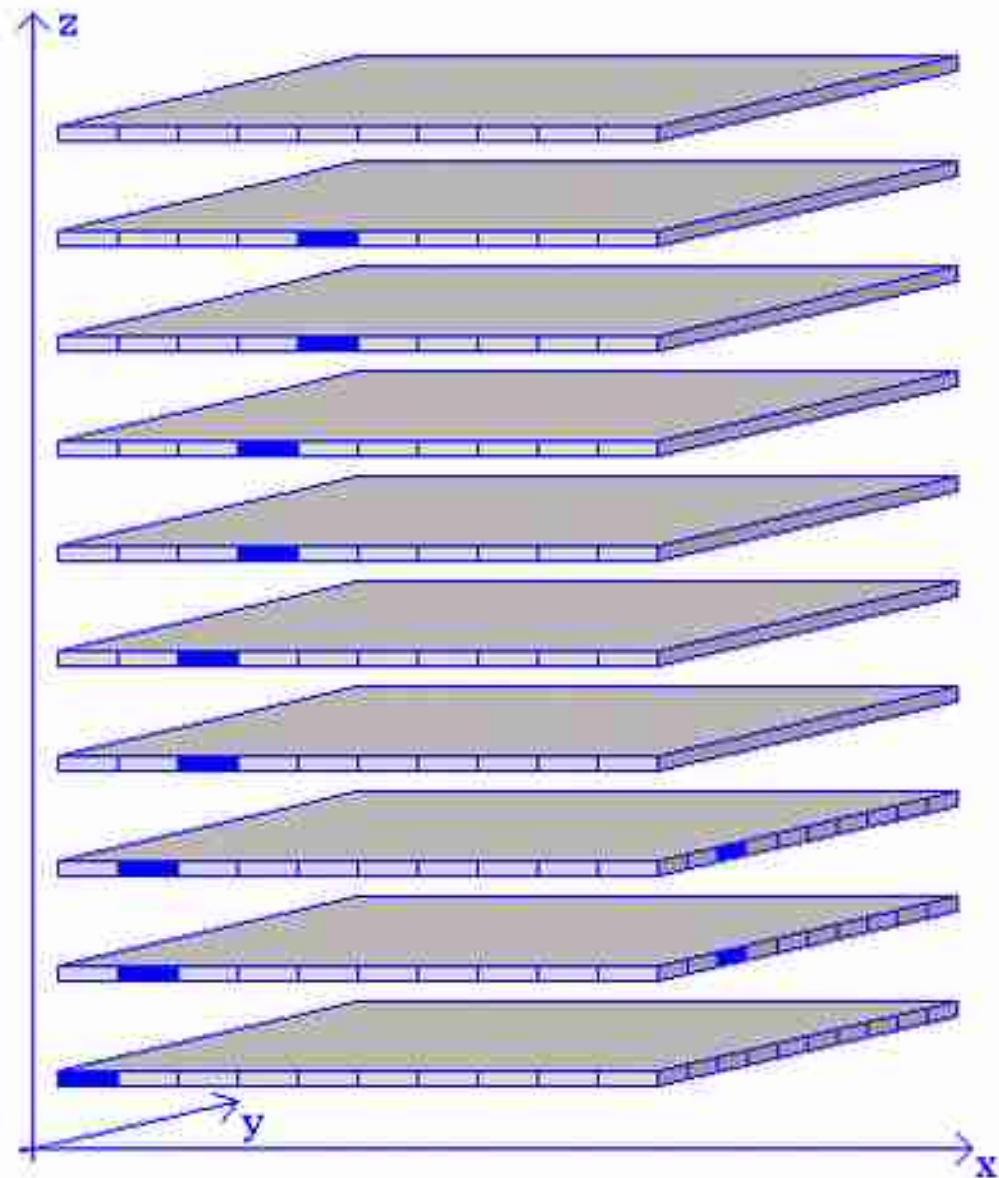
**Ora bisogna calcolare la retta che meglio
approssimi i punti appena ricavati**

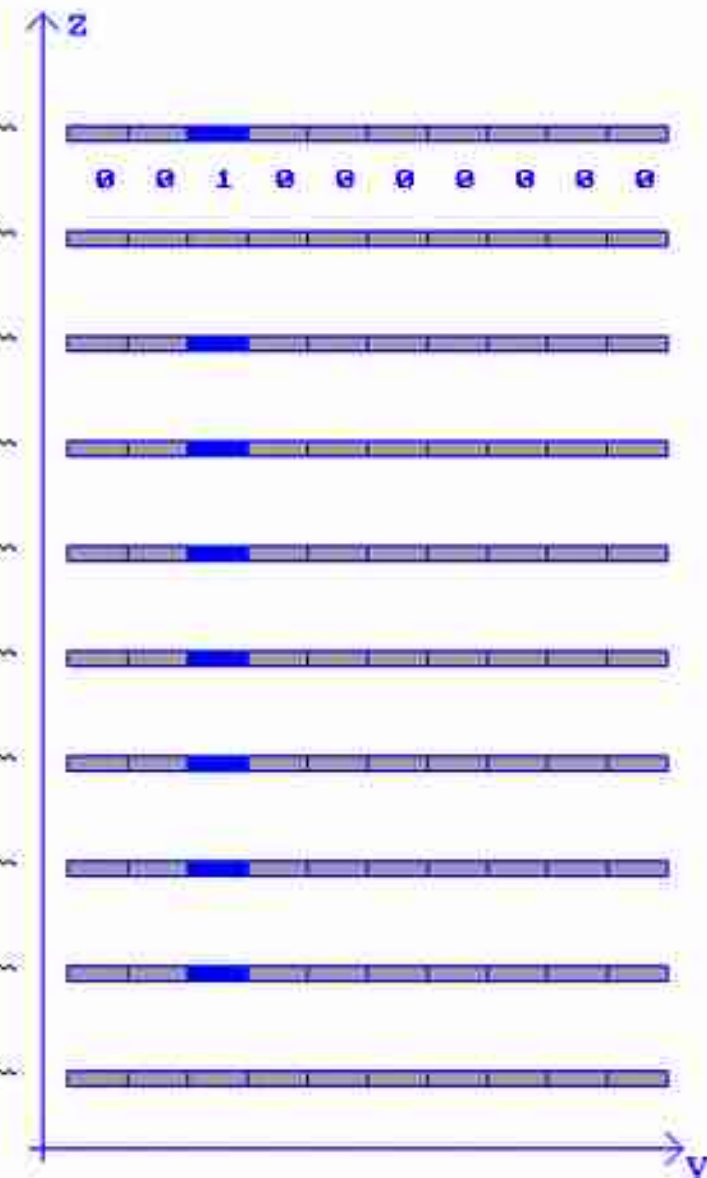
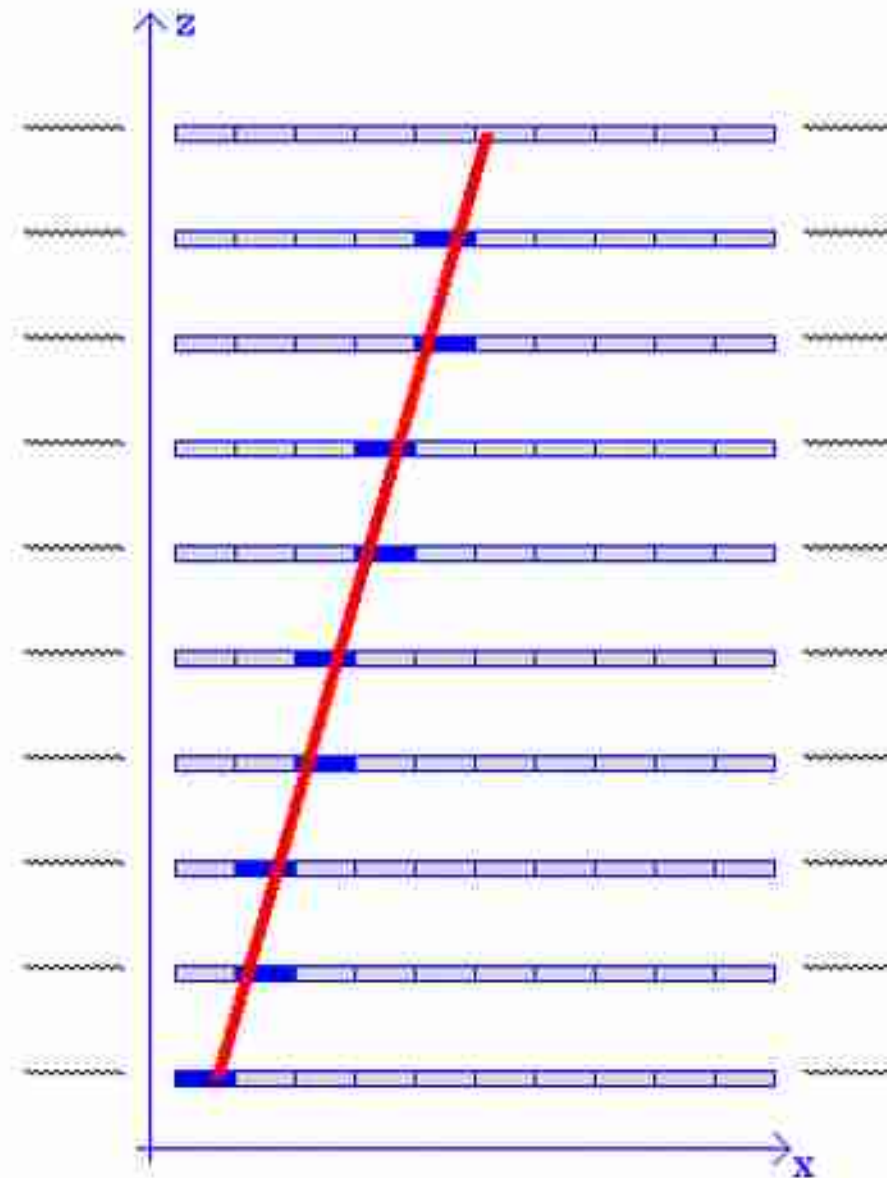
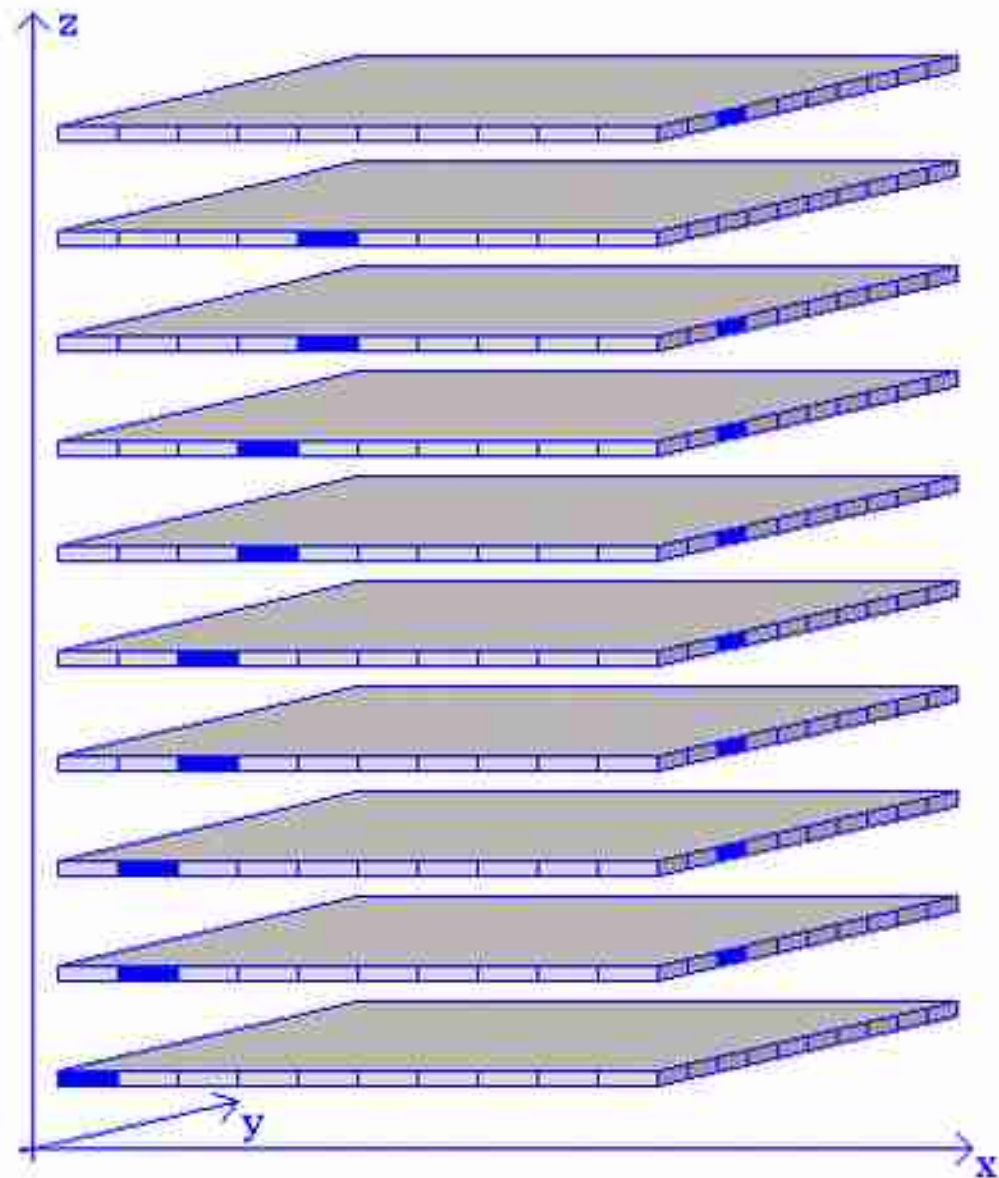


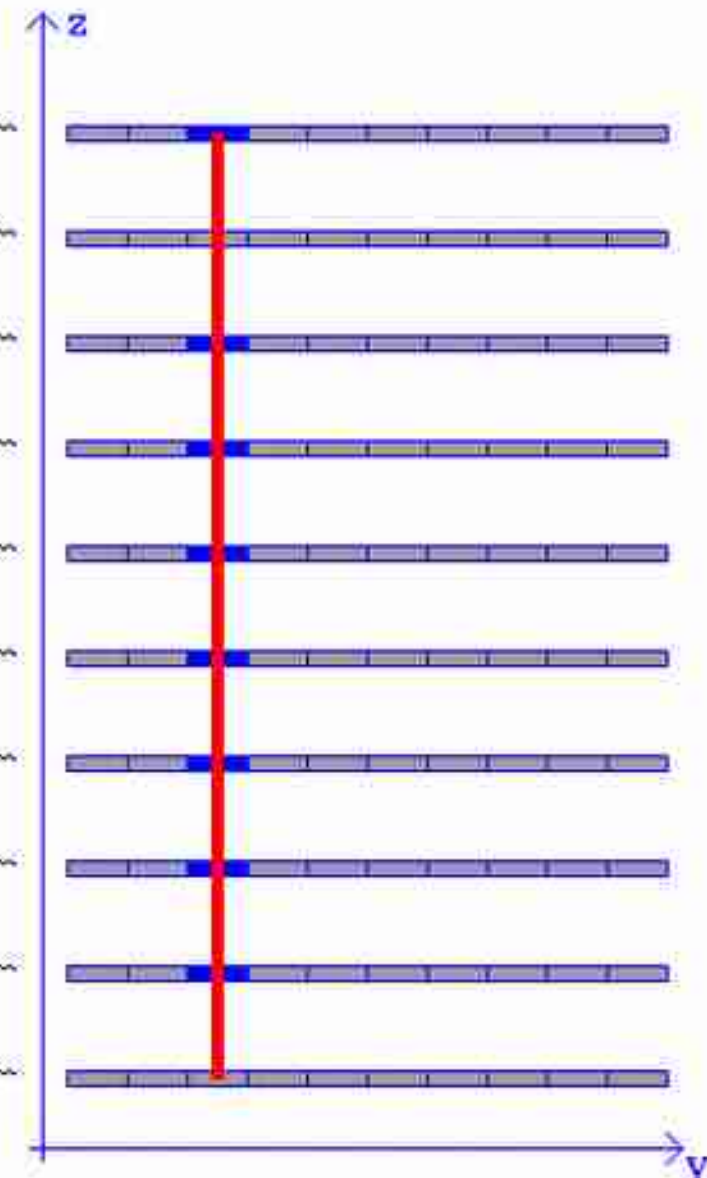
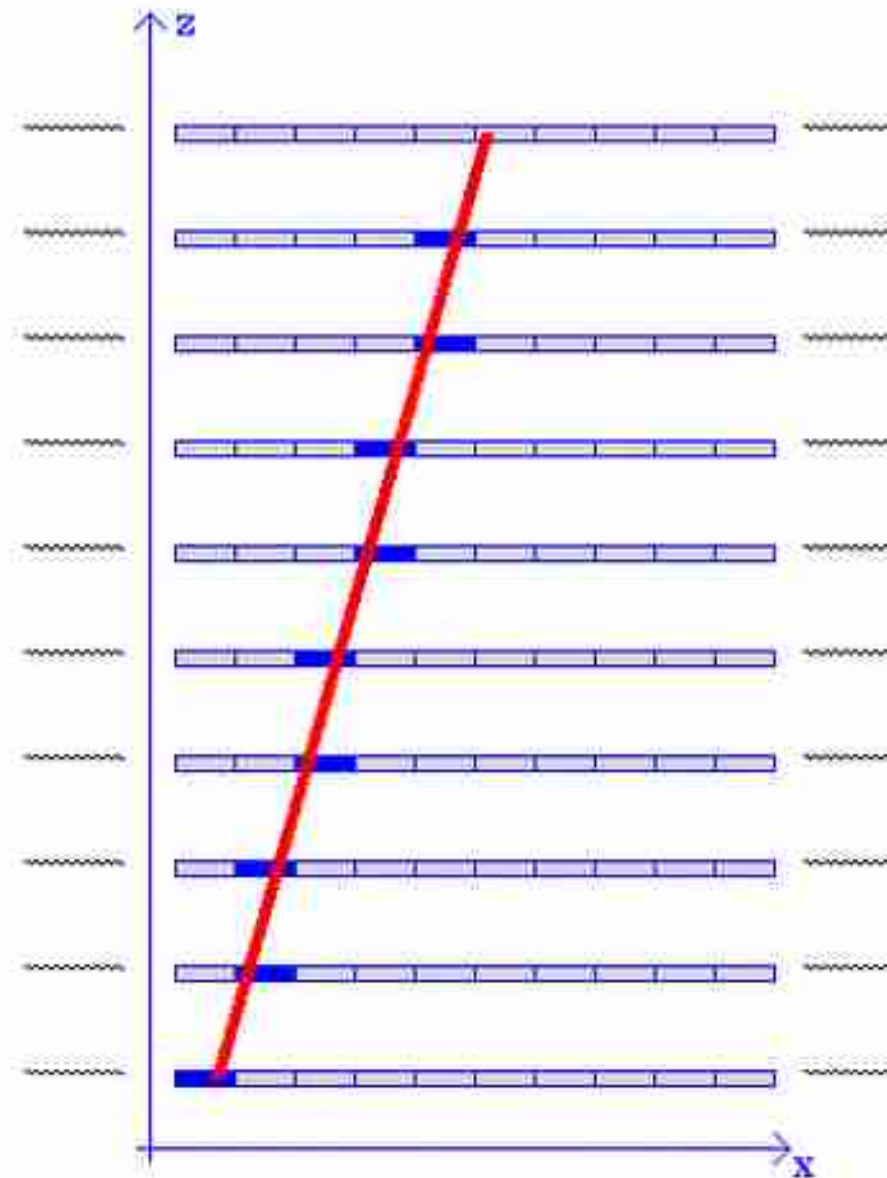
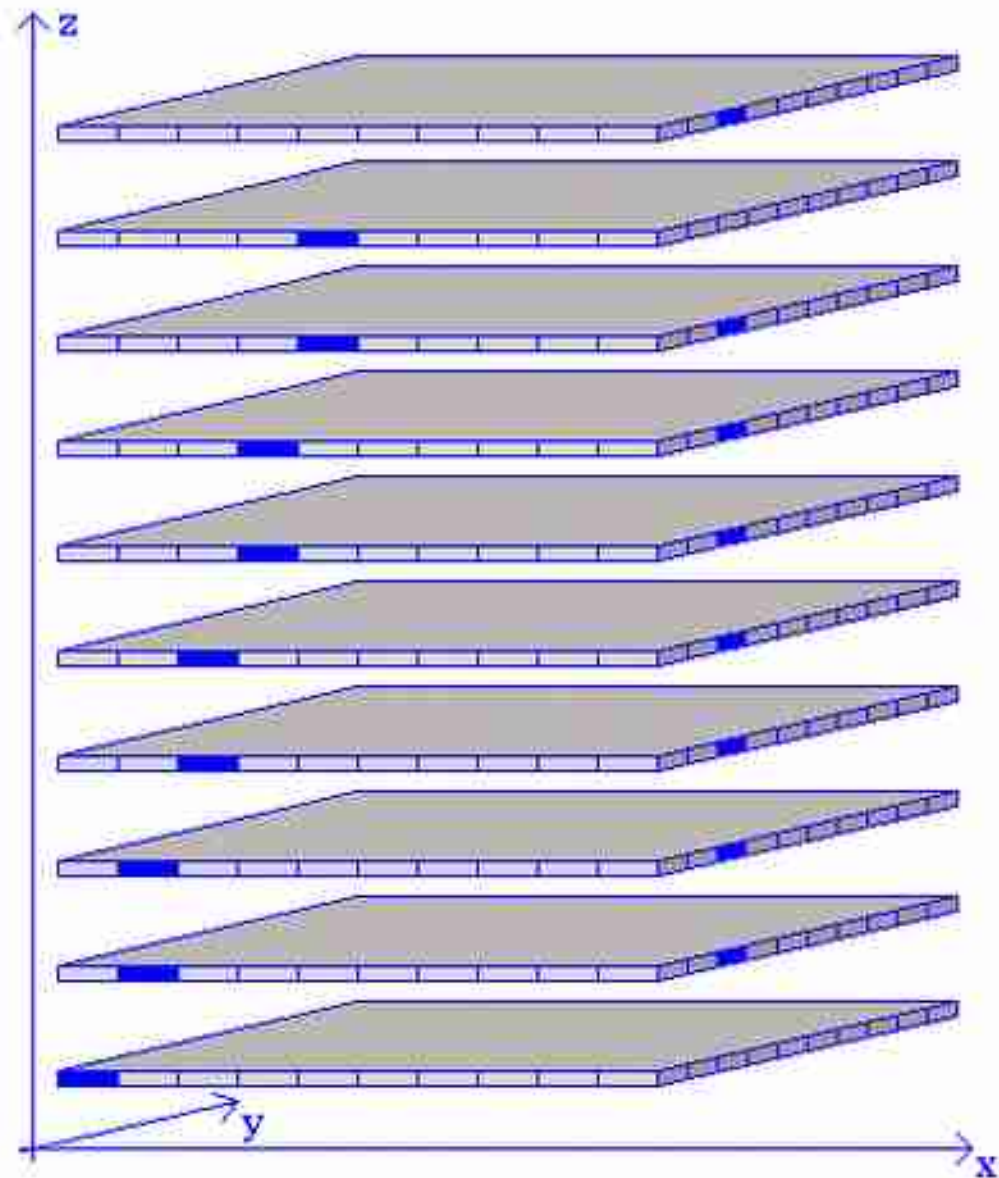
**Quindi bisogna fare lo stesso lavoro
con l'altra faccia del telescopio**

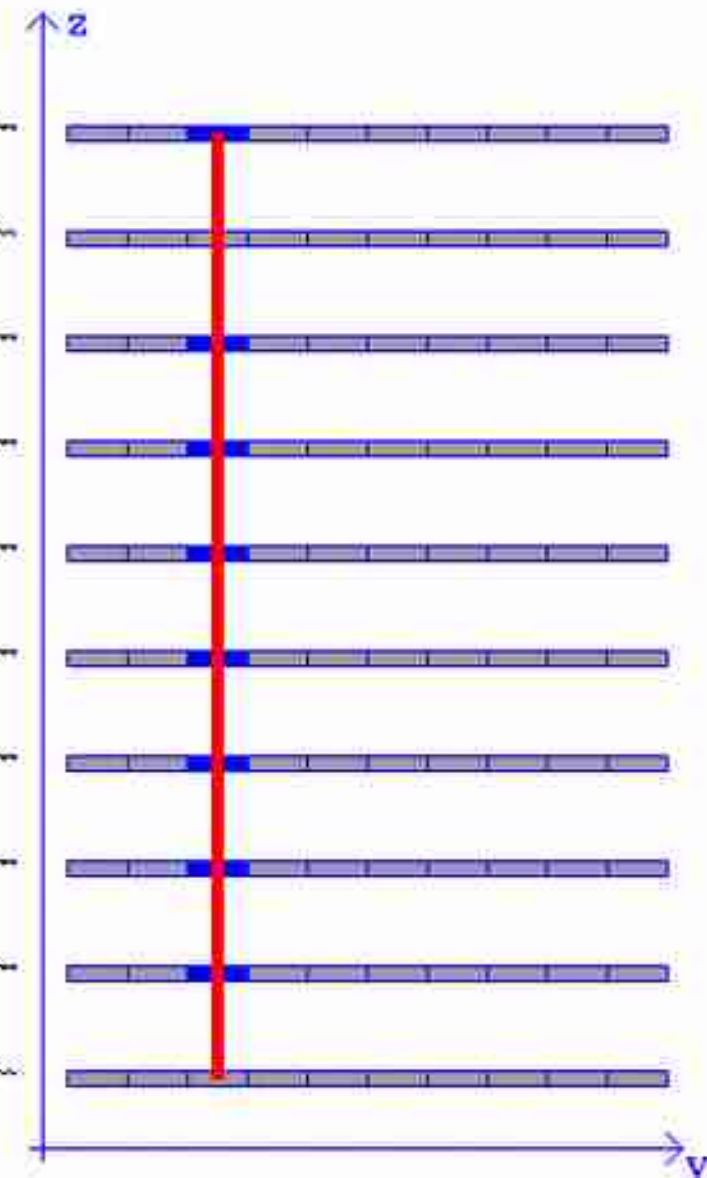
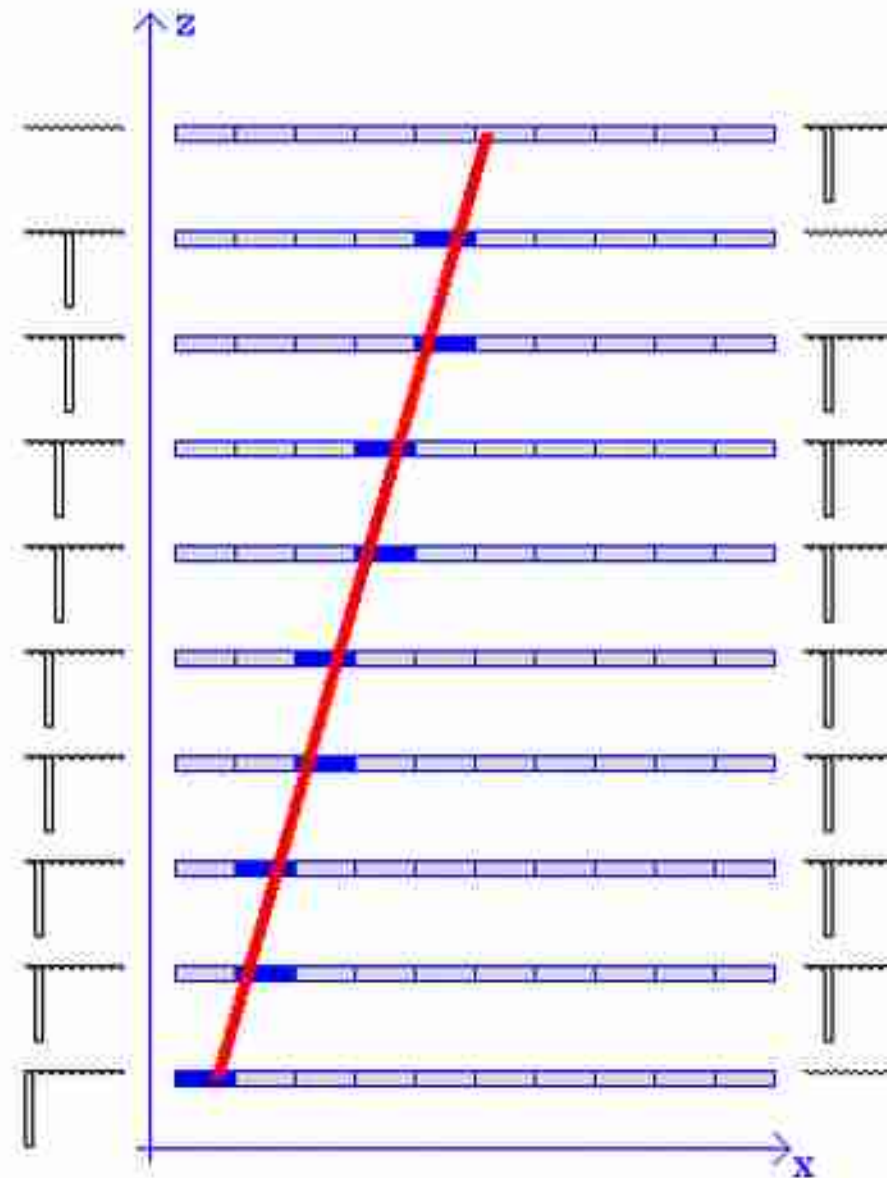
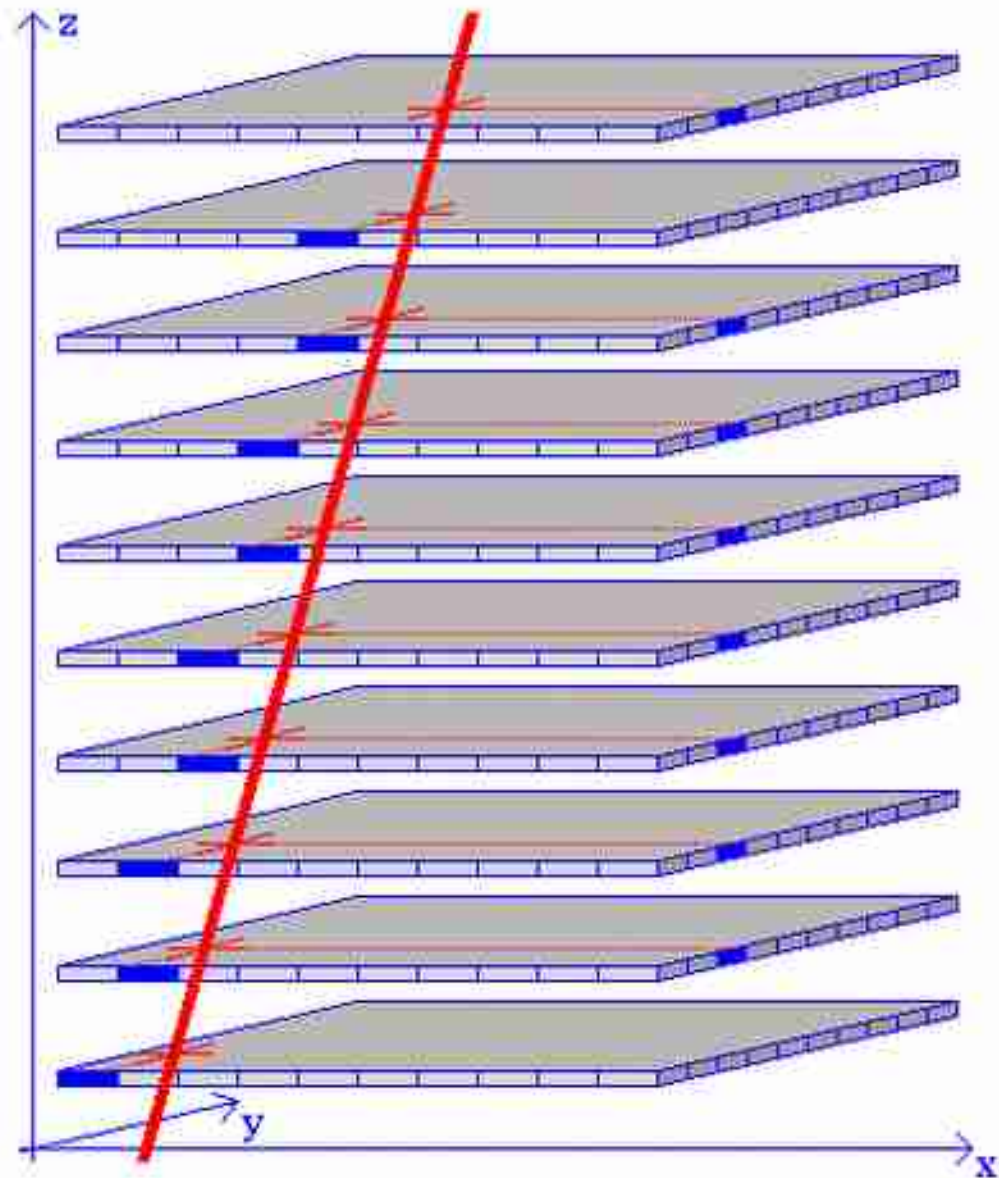


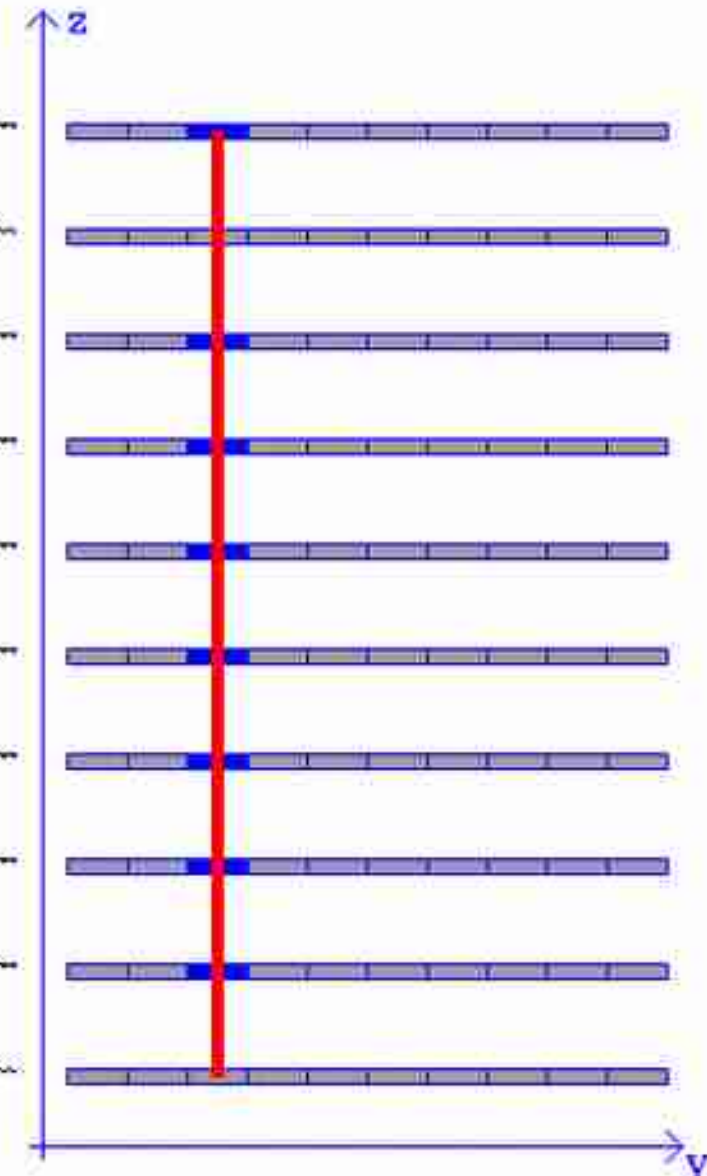
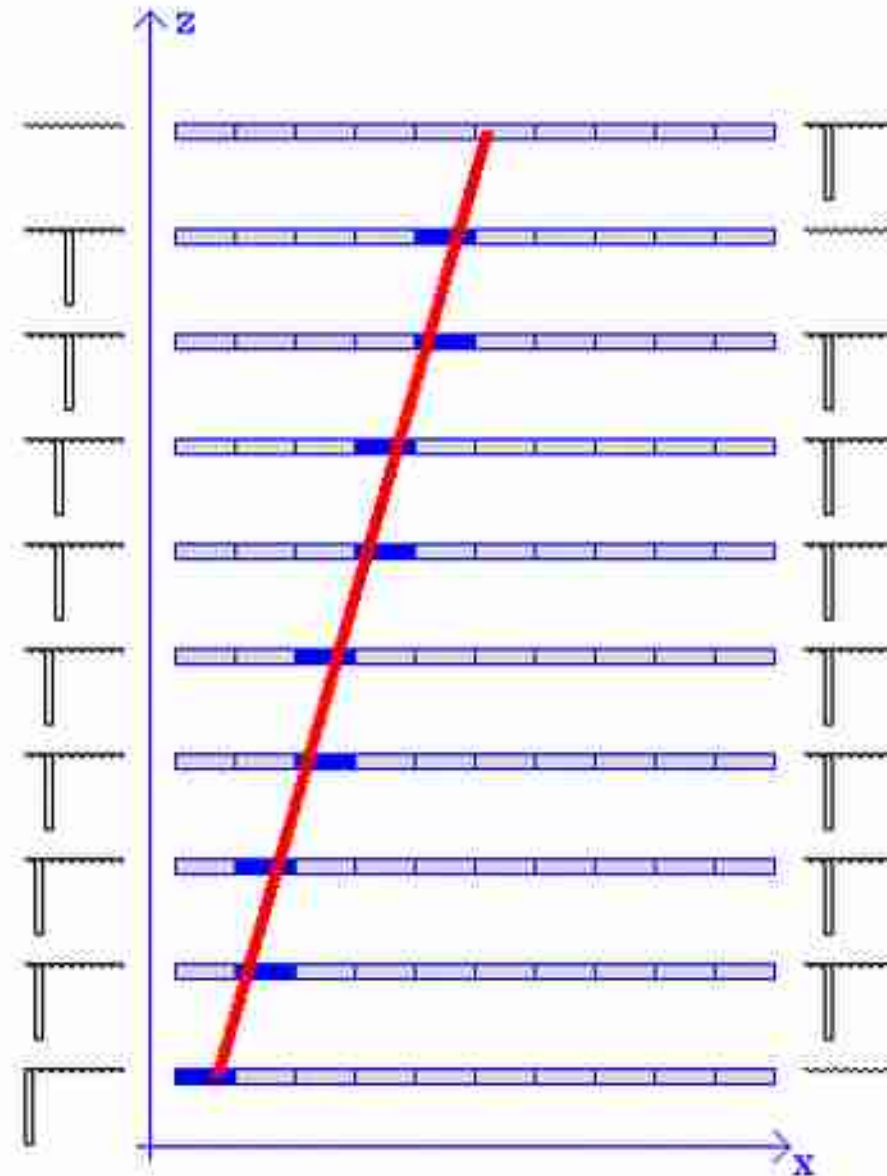
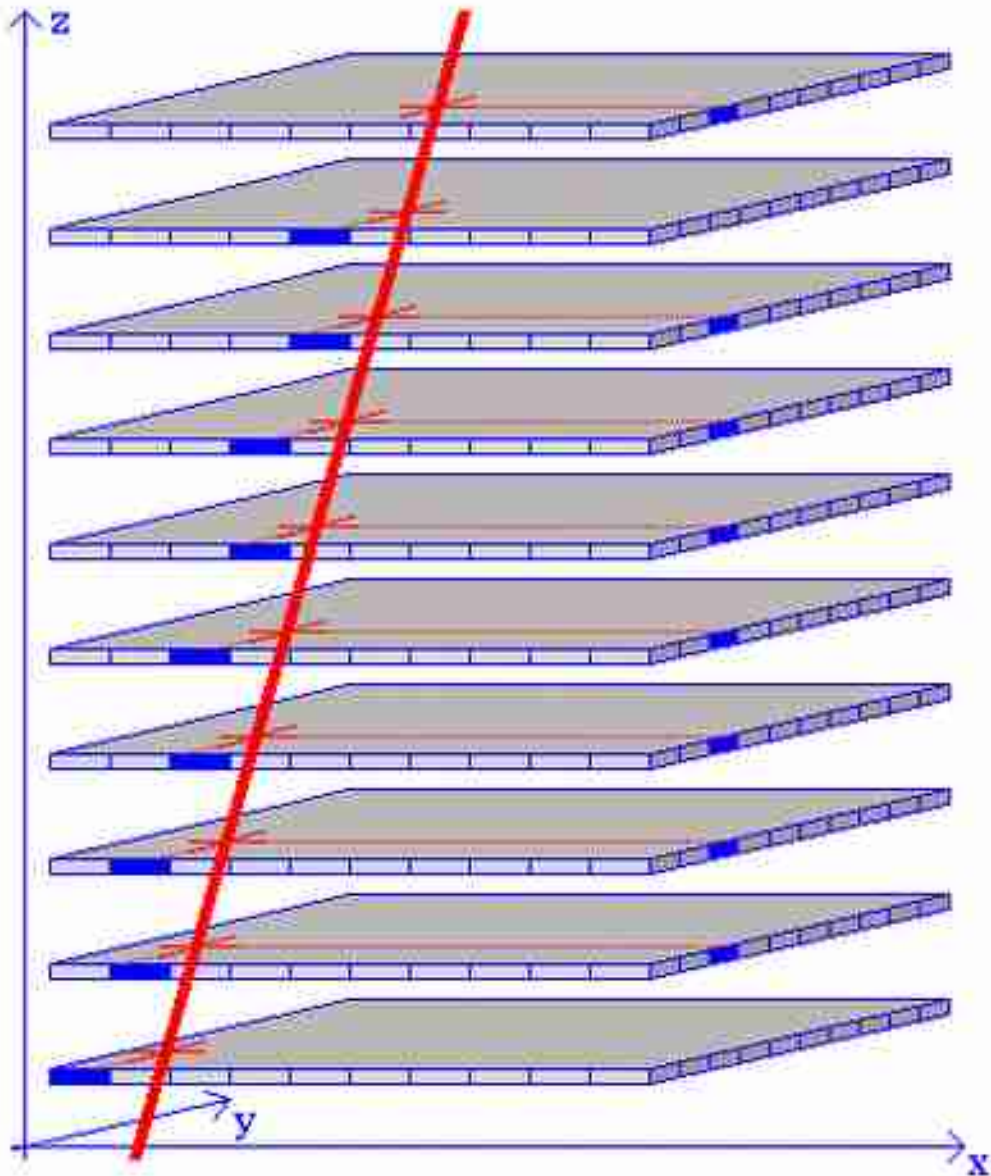
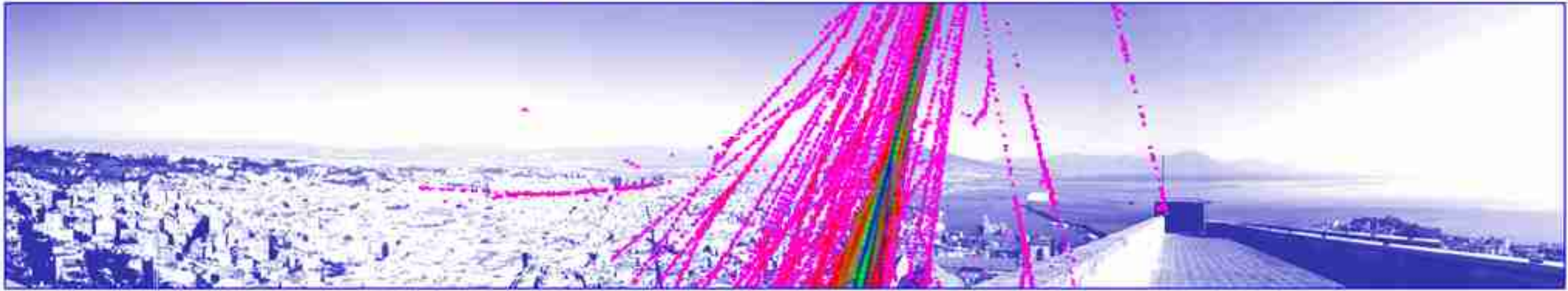














Pagina web per video e dati

people.na.infn.it/totem



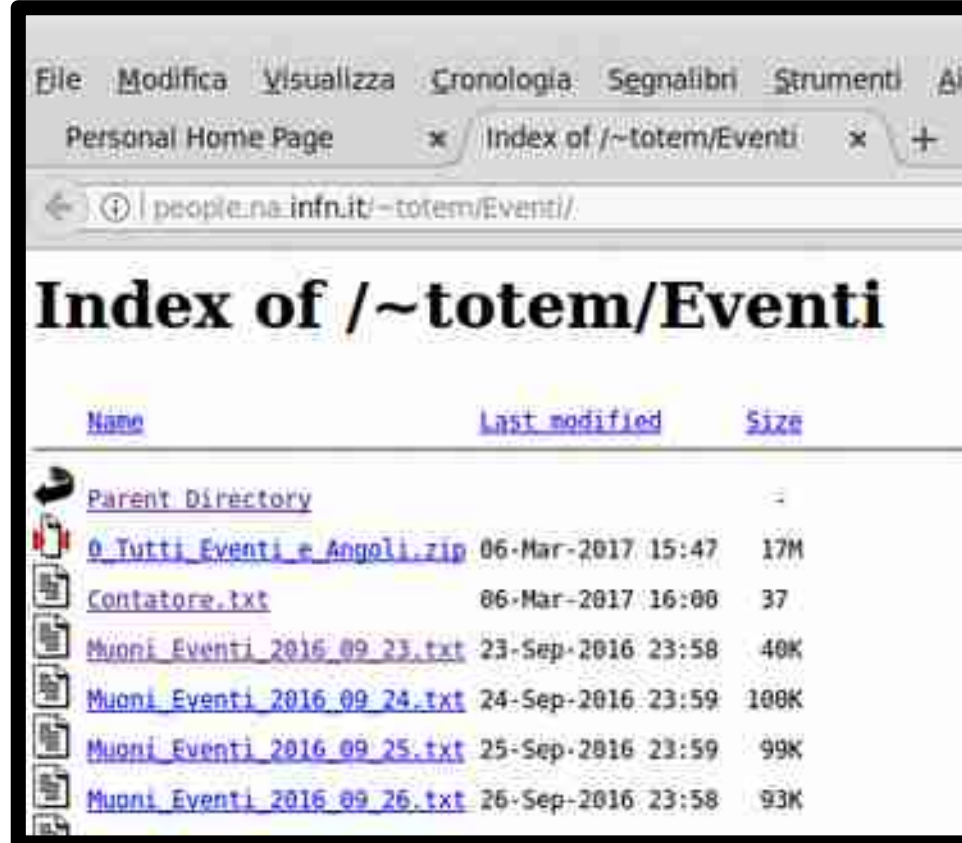
Come prelevare i dati acquisiti

File contenente tutti i file giornalieri: *0_Tutti_eventi_e_Angoli.zip*

File giornalieri dei dati acquisiti
Muoni_Eventi_AAAA_MM_GG.txt

File giornalieri con orario e angoli
Muoni_Orario_AAAA_MM_GG.txt

```
ST07EE
0100000120080200602200A0160100
00400402401001200800A006006005
ST07EF
000002004004008008010000000000
000001001001001002002002002002
ST07F1
00100200400400C010010020040000
0400480400400C0080180100100000
ST07F2
000000010010020020040040000000
0002003000C0020008004002000000
ST07F3
000002002002002002004000000000
000040020020010008004002001000
ST07F4
008208104100080040040000000000
022022001001008008004004000000
ST07F5
01A01F0C708F08F2AF17717F017287
2C203715F27F23F17E3EE3FA3D83E8
ST07F6
000000020020060100300000000000
200200304200200300100000000000
ST07F7
000060010010010008004000002000
300380140040020010008004004002
ST07F8
```



Muoni_Eventi_2017_03_05.txt	05-Mar-2017 23:59	155K
Muoni_Eventi_2017_03_06.txt	06-Mar-2017 16:00	121K
Muoni_Orario_2016_09_23.txt	23-Sep-2016 23:58	28K
Muoni_Orario_2016_09_24.txt	24-Sep-2016 23:59	70K
Muoni_Orario_2016_09_25.txt	25-Sep-2016 23:59	69K
Muoni_Orario_2016_09_26.txt	26-Sep-2016 23:58	65K
Muoni_Orario_2016_09_27.txt	27-Sep-2016 23:59	65K
Muoni_Orario_2016_09_28.txt	28-Sep-2016 13:06	34K
Muoni_Orario_2016_09_30.txt	30-Sep-2016 23:58	20K

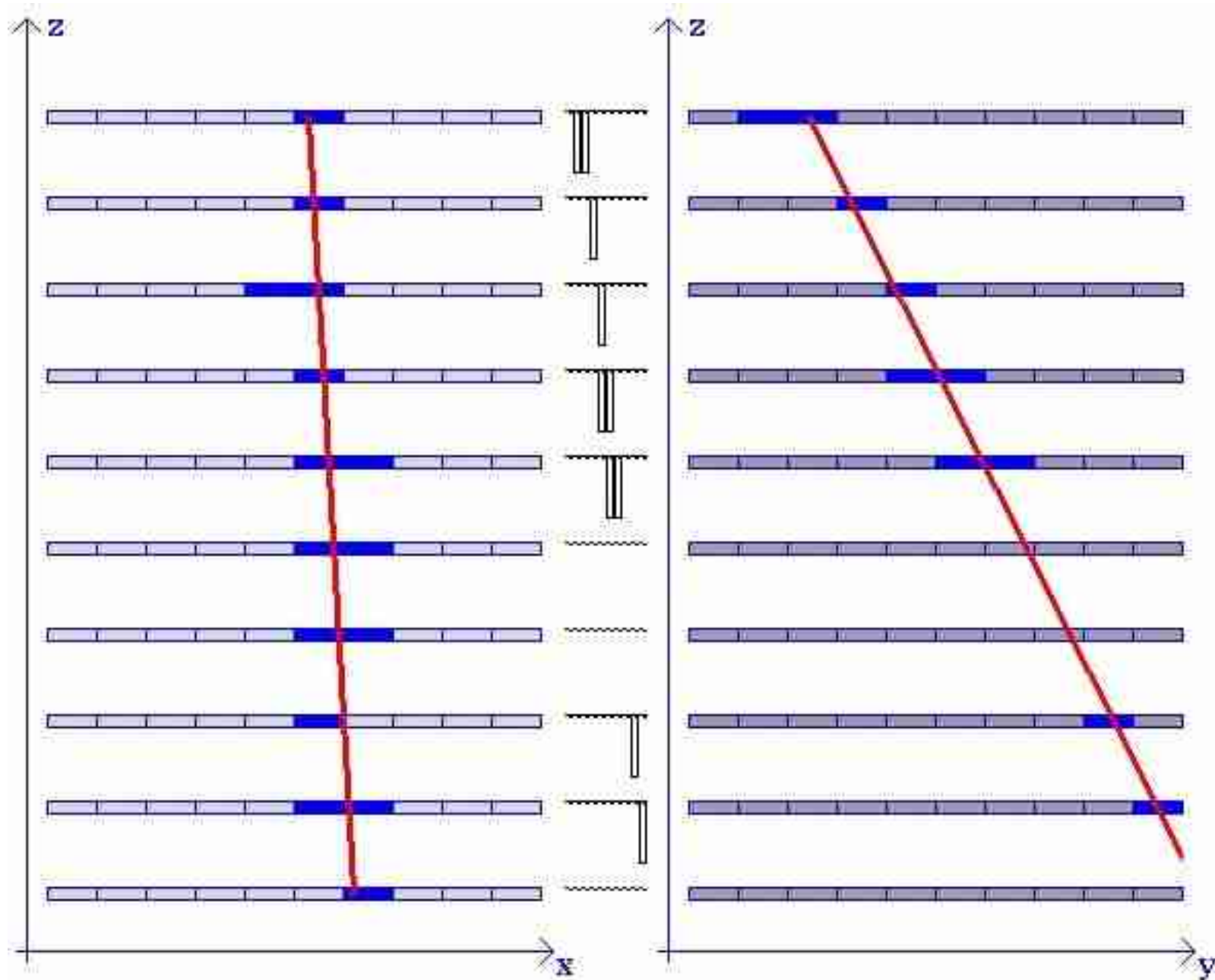
Nome	Ora	Angolo θ	Angolo ϕ
ST07EE	10:46:30	10.7	-23.05
ST07EF	10:47:21	-7.24	-28.31
ST07F1	10:40:30	-14.77	-22.21
ST07F2	10:40:57	30.90	-15.95
ST07F3	10:49:41	26.56	-10.79
ST07F4	10:50:05	26.56	-17.67
ST07F5	10:50:21	-25.09	-17.67
ST07F6	10:50:53	-25.09	-33.77
ST07F7	10:52:10	20.83	20.1
ST07F8	10:53:05	-42.10	25.33
ST07F9	10:53:29	-45.46	-15.10
ST07FA	10:53:53	20.14	-41.24
ST0805	11:02:10	7.84	-13.4
ST0806	11:02:42	40.1	-12.40
ST0807	11:03:06	21.77	25.05
ST0808	11:03:30	25.30	-12.80
ST0809	11:03:53	29.74	37.35
ST080A	11:04:35	26.94	11.80
ST080B	11:04:59	6.90	10.64
ST080C	11:06:53	-11.03	29.74
ST080D	11:08:02	0.64	-16.67
ST080E	11:09:44	20.99	-10.79
ST080F	11:10:00	-30.36	-10.79
ST080H	11:10:50	-9.20	10.78
ST080I	11:11:17	15	17.95
ST080J	11:12:00	-45.34	-26.2
ST080K	11:14:04	-45.34	42.07
ST080L	11:14:23	32.72	-11.27
ST080M	11:14:47	16.90	-13.99
ST080N	11:15:11	12.04	-18.11
ST080P	11:17:50	40.33	-21.77
ST080Q	11:18:33	40.33	23.6
ST080R	11:18:51	27.91	-11.58
ST080A	11:19:58	-10.57	-16.95
ST080H	11:20:22	-10.79	17.09
ST080C	11:20:46	11.09	-10.11
ST080D	11:21:24	-10.26	-13.99

I dati acquisiti

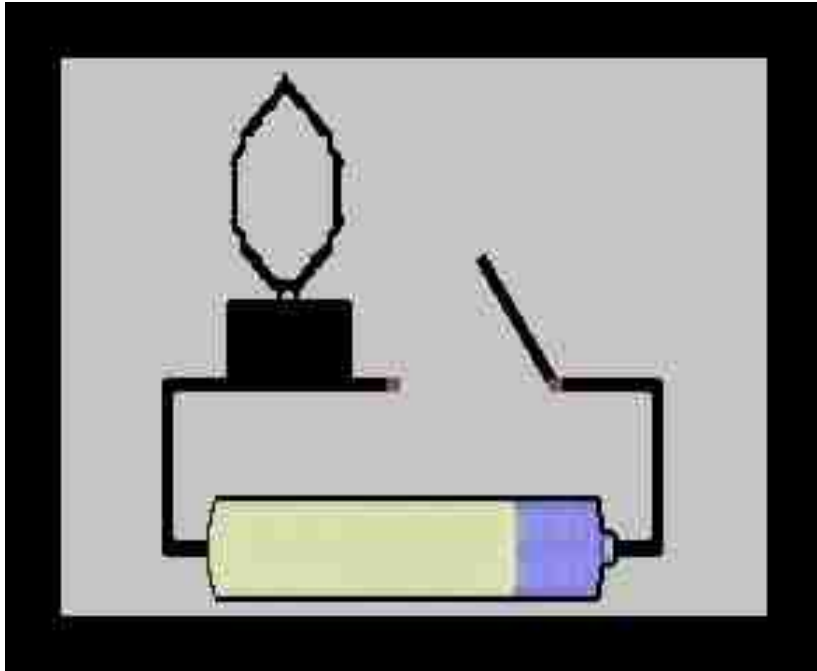
STF337 ← codice dell'evento

00000100200F00C018030020040180 ← faccia a destra

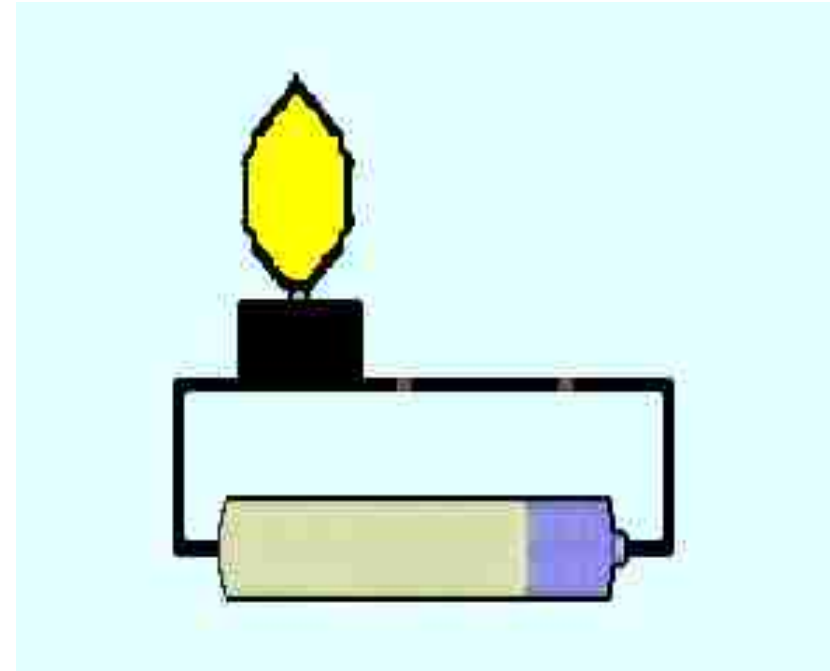
008018010018018018010030010010 ← faccia a sinistra



Esempio di bit



0



1

Come è fatto un Byte?

Un Byte è fatto di 8 bit

bit si scrive con la “b minuscola”

Byte si scrive con la “B maiuscola”

Un bit:



Un Byte:



Notazione decimale e notazione binaria

Cifra Decimale	Cifra Binaria
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111

1 posizione

2 posizioni





3 posizioni

4 posizioni

Notazione decimale e binaria

Notazione
decimale

Notazione binaria (con 8 bit si possono avere 256 combinazioni diverse)

0	0000 0000	
1	0000 0001	
2	0000 0010	
3	0000 0011	
4	0000 0100	
5	0000 0101	
6	0000 0110	
7	0000 0111	
8	0000 1000	
9	0000 1001	
...		
255	1111 1111	

I codici ASCII

American Standard Code for Information Interchange

Decimal	Hex	Character	Decimal	Hex	Character	Decimal	Hex	Character	Decimal	Hex	Character
0	0	NUL	32	20	space	64	40	@	96	60	'
1	1	SOH	33	21	!	65	41	A	97	61	a
2	2	STX	34	22	"	66	42	B	98	62	b
3	3	ETX	35	23	#	67	43	C			
4	4	EOT	36	24	\$	68	44	D			
5	5	ENO	37	25	%	69	45	E			
6	6	ACK	38	26	&	70	46	F			
7	7	BEL	39	27	'	71	47	G			
8	8	BS	40	28	(72	48	H			
9	9	TAB	41	29)	73	49	I			
10	A	LF	42	2A	*	74	4A	J			
11	B	VT	43	2B	+	75	4B	K			
12	C	FF	44	2C	,	76	4C	L			
13	D	CR	45	2D	-	77	4D	M			
14	E	SO	46	2E	.	78	4E	N			
15	F	SI	47	2F	/	79	4F	O			
16	10	DLE	48	30	0	80	50	P			
17	11	DC1	49	31	1	81	51	Q			
18	12	DC2	50	32	2	82	52	R			
19	13	DC3	51	33	3	83	53	S			
20	14	DC4	52	34	4	84	54	T			
21	15	NAK	53	35	5	85	55	U			
22	16	SYN	54	36	6	86	56	V			
23	17	ETB	55	37	7	87	57	W			
24	18	CAN	56	38	8	88	58	X			
25	19	EM	57	39	9	89	59	Y			
26	1A	SUB	58	3A	:	90	5A	Z			
27	1B	ESC	59	3B	;	91	5B	[
28	1C	FS	60	3C	<	92	5C	\	124	7C	
29	1D	GS	61	3D	=	93	5D]	125	7D	}
30	1E	RS	62	3E	>	94	5E	^	126	7E	~
31	1F	US	63	3F	?	95	5F	_	127	7F	DEL

Decimal	Hex	Character
64	40	@
65	41	A
66	42	B
67	43	C
68	44	D
69	45	E
70	46	F

Per scrivere un carattere occorre un Byte

proviamo a scrivere "PAOLO"

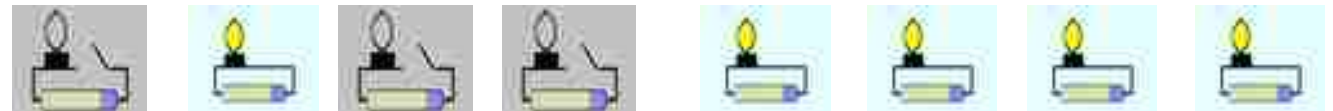
P **80** **0101 0000**



A **65** **0100 0001**



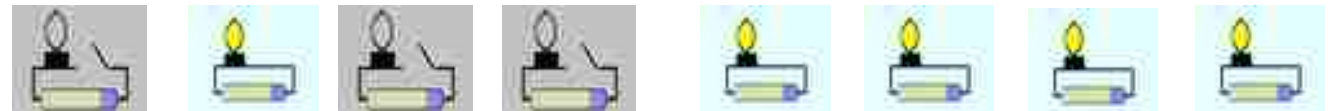
O **79** **0100 1111**



L **76** **0100 1100**



O **79** **0100 1111**



Decodifica dei dati

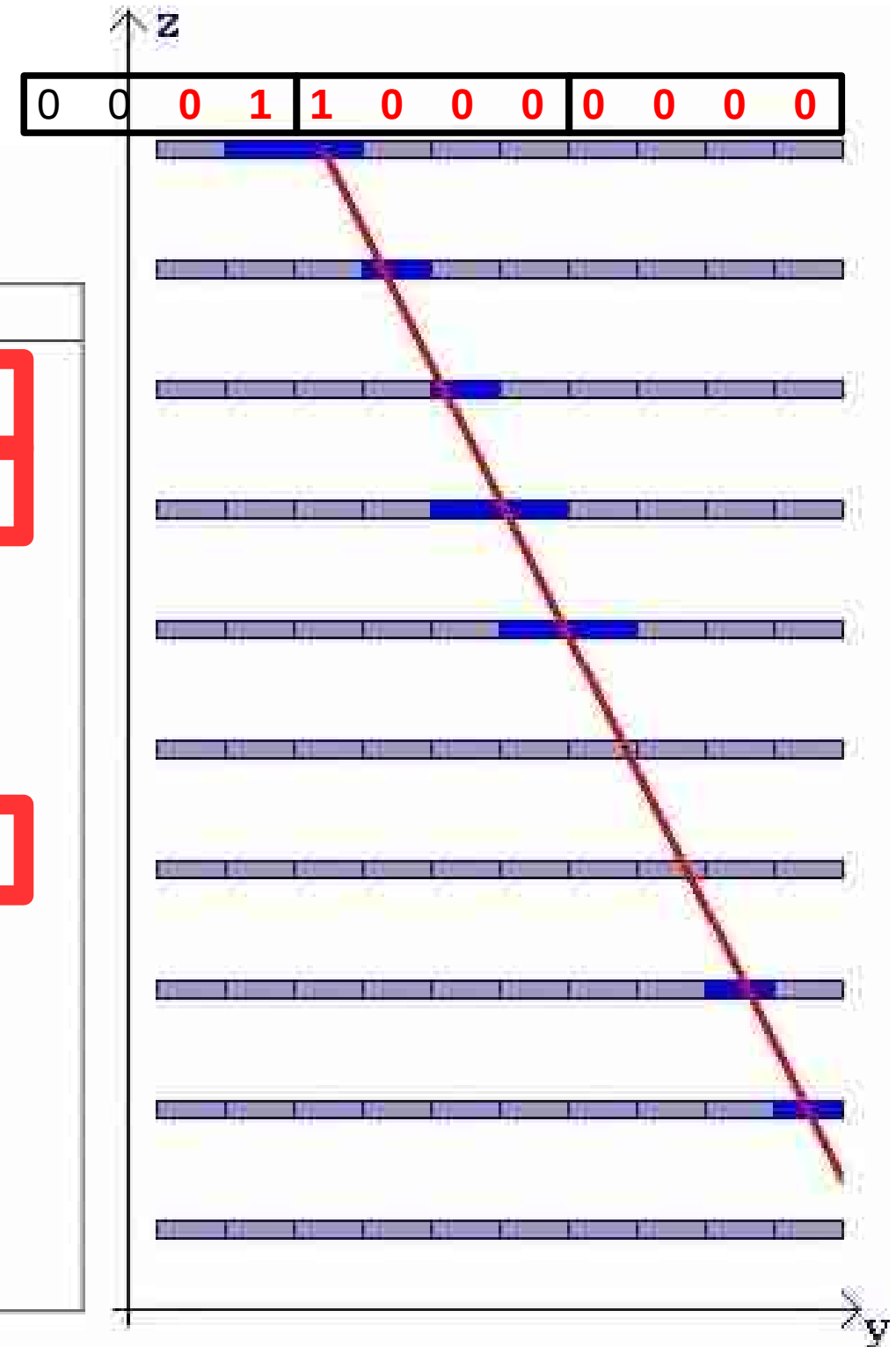
STF337

00000100200F00C018030020040180
008018010018018018010030010010

180

TABELLA DI CONVERSIONE DECIMALE-ESADECIMALE-BINARIO

DECIMALE	ESADECIMALE	BINARIO
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111



Decodifica della stringa esadecimale

```
For Faccia = 1 to 2                                ' 1 = faccia destra
                                                    ' 2 = faccia sinistra

    Piano = 0
    For i = 28 to 1 step -3                          ' si visualizza dal basso verso l'alto
        l = 0
        Piano = Piano + 1
        For k = 0 to 2
            l = l + 1
            if l > 1 then
                ' prendere tutti e quattro i bit
                Dummy = str(Bin(Val(mid(Evento(Faccia), i + k, 1))), 4))
                For j = 1 to 4
                    Led(Faccia, Piano, 2 + 4 * (k - 1) + j) = val(mid(Dummy, j, 1))
                Next j
            else
                ' prendere solo i due bit a destra
                Dummy = str(Bin(Val(mid(Evento(Faccia), i + k, 1))), 2))
                Led(Faccia, Piano, 1) = val(left(Dummy, 1))
                Led(Faccia, Piano, 2) = val(right(Dummy, 1))
            end if
        next k
    Next i

next Faccia
```

Retta di interpolazione statistica

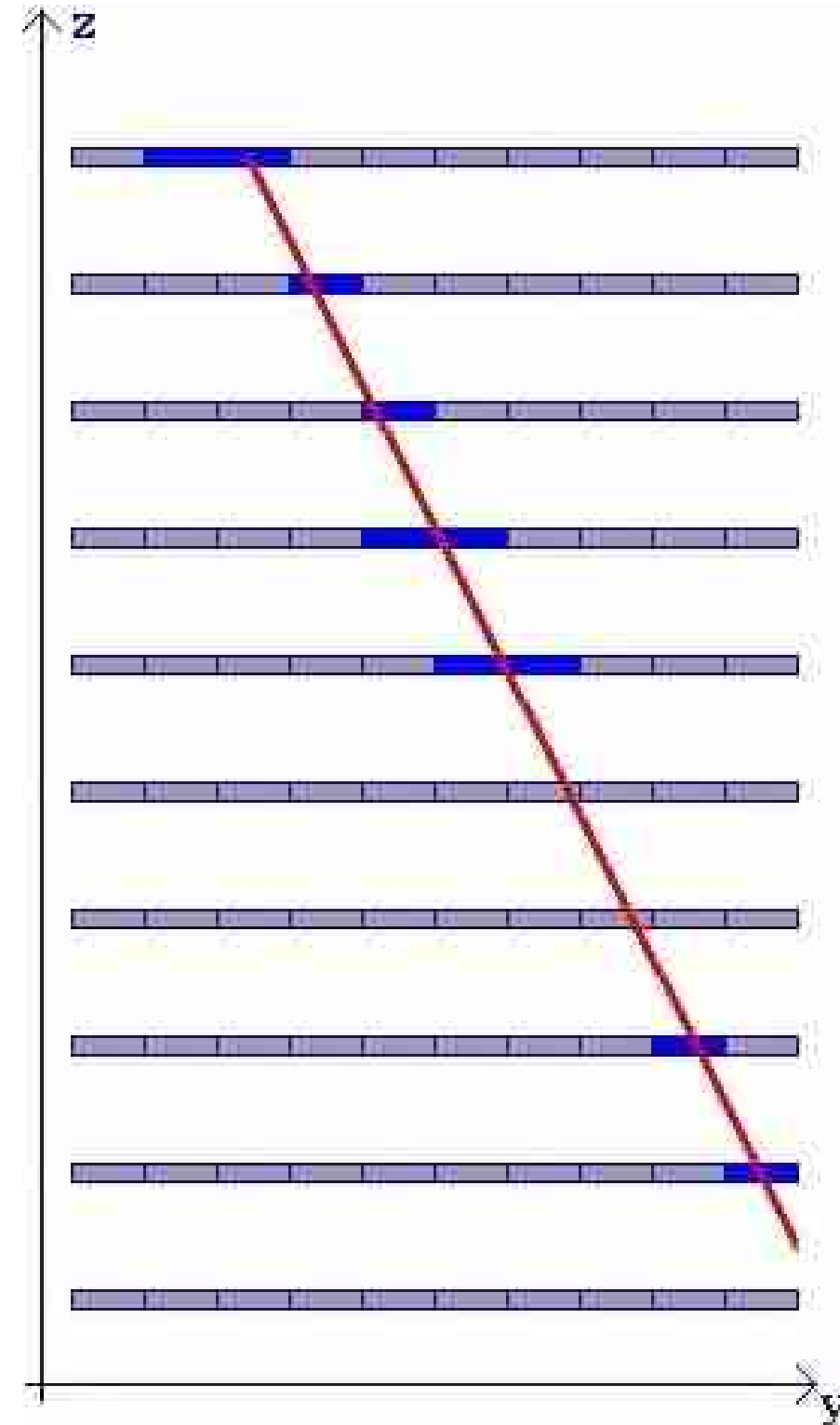
$$y = a + bx$$

$$b = \frac{\sum_i [x_i - M(x)][y_i - M(y)]}{\sum_i [x_i - M(x)]^2}$$

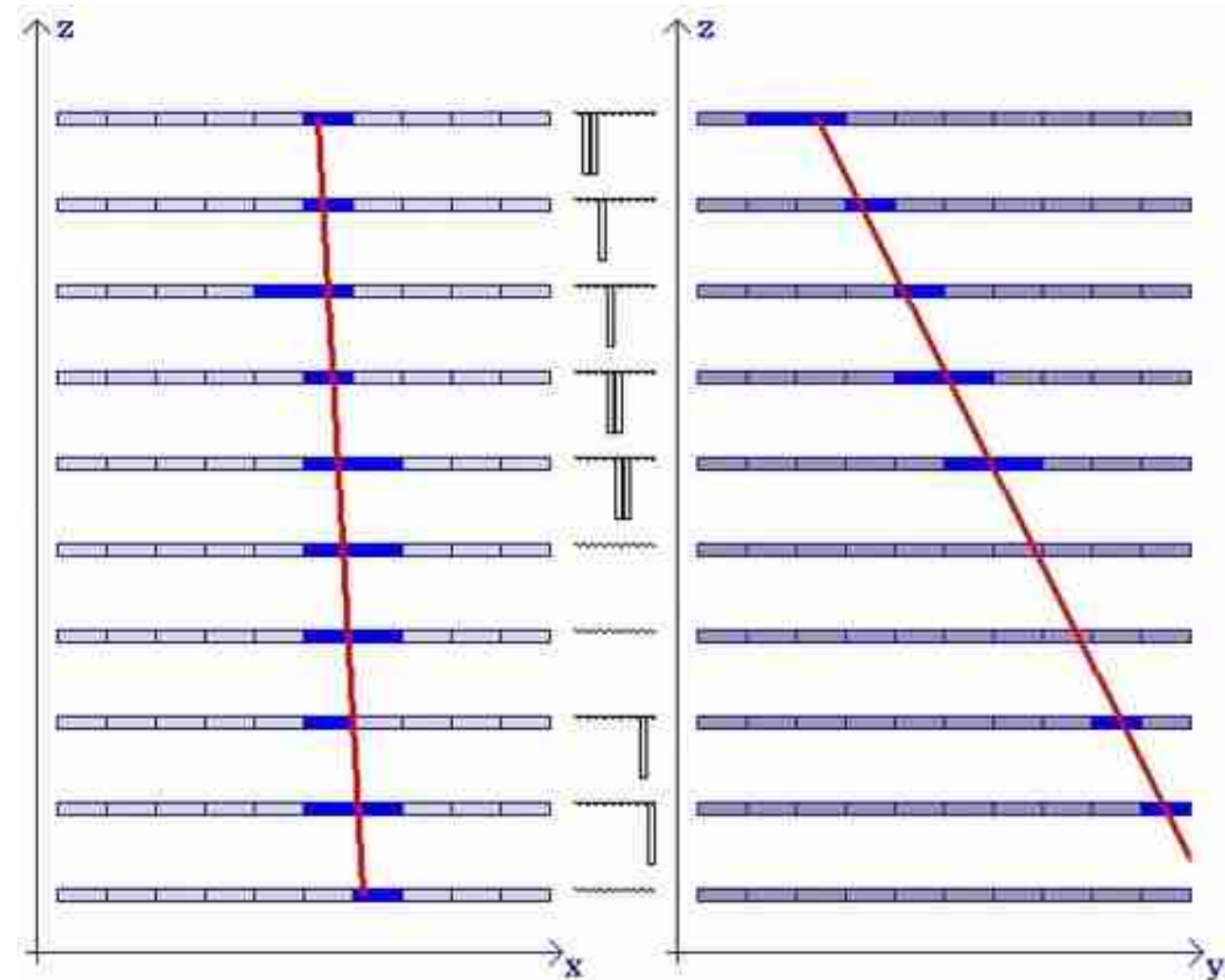
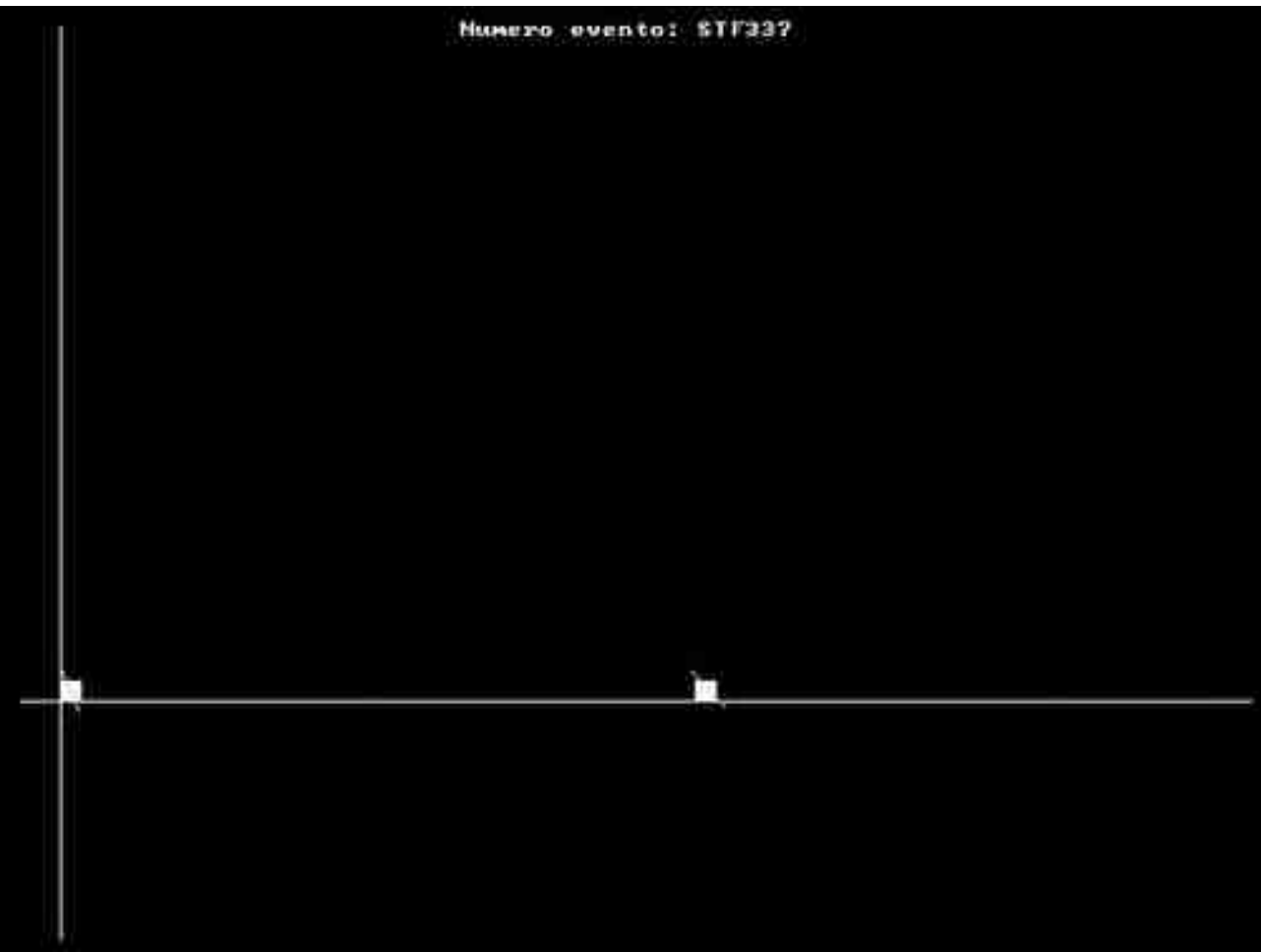
$$a = M(y) - b \cdot M(x)$$

Dove:

- $M(x)$ la media dei valori di x_i ,
- $M(y)$ la media dei valori di y_i

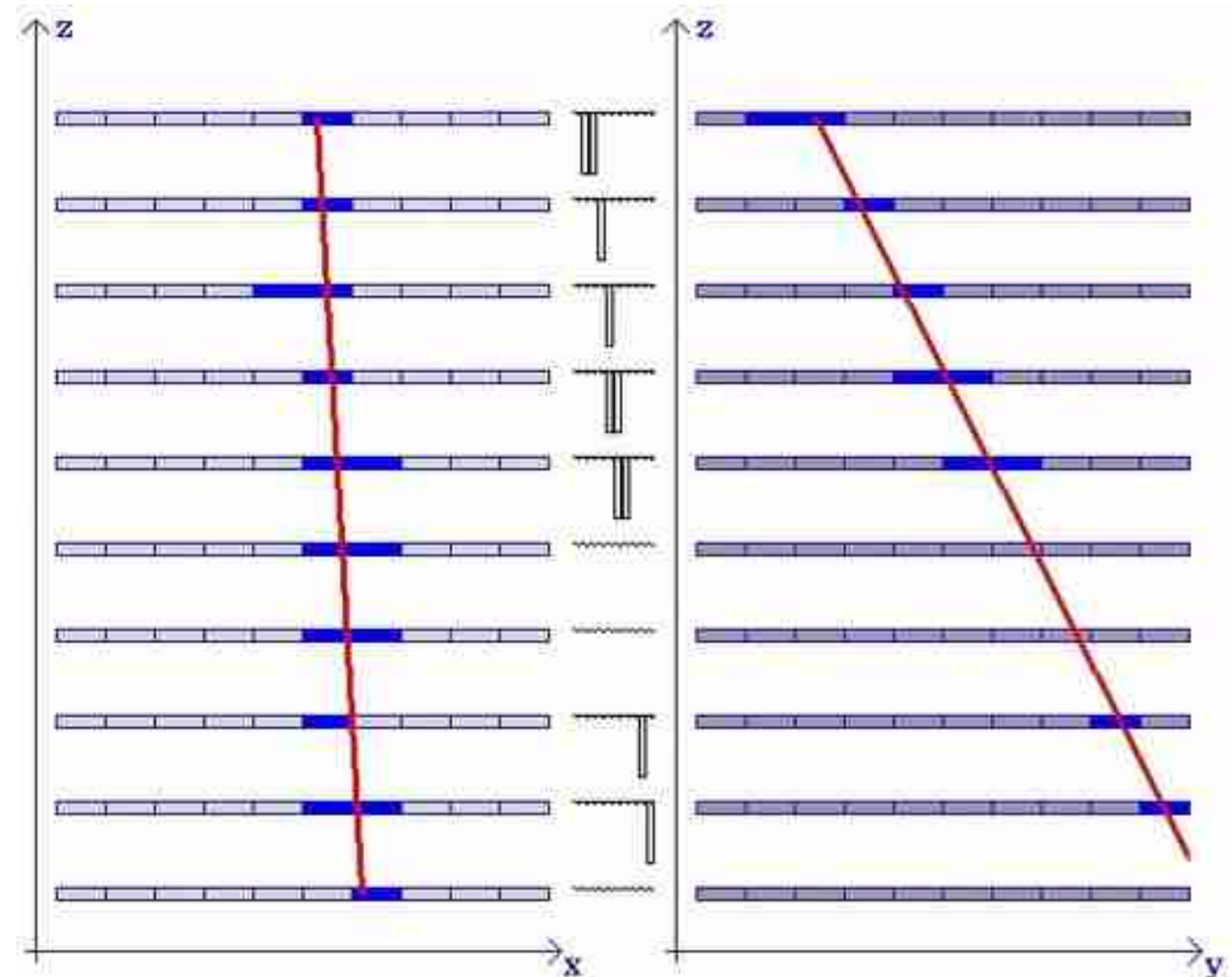
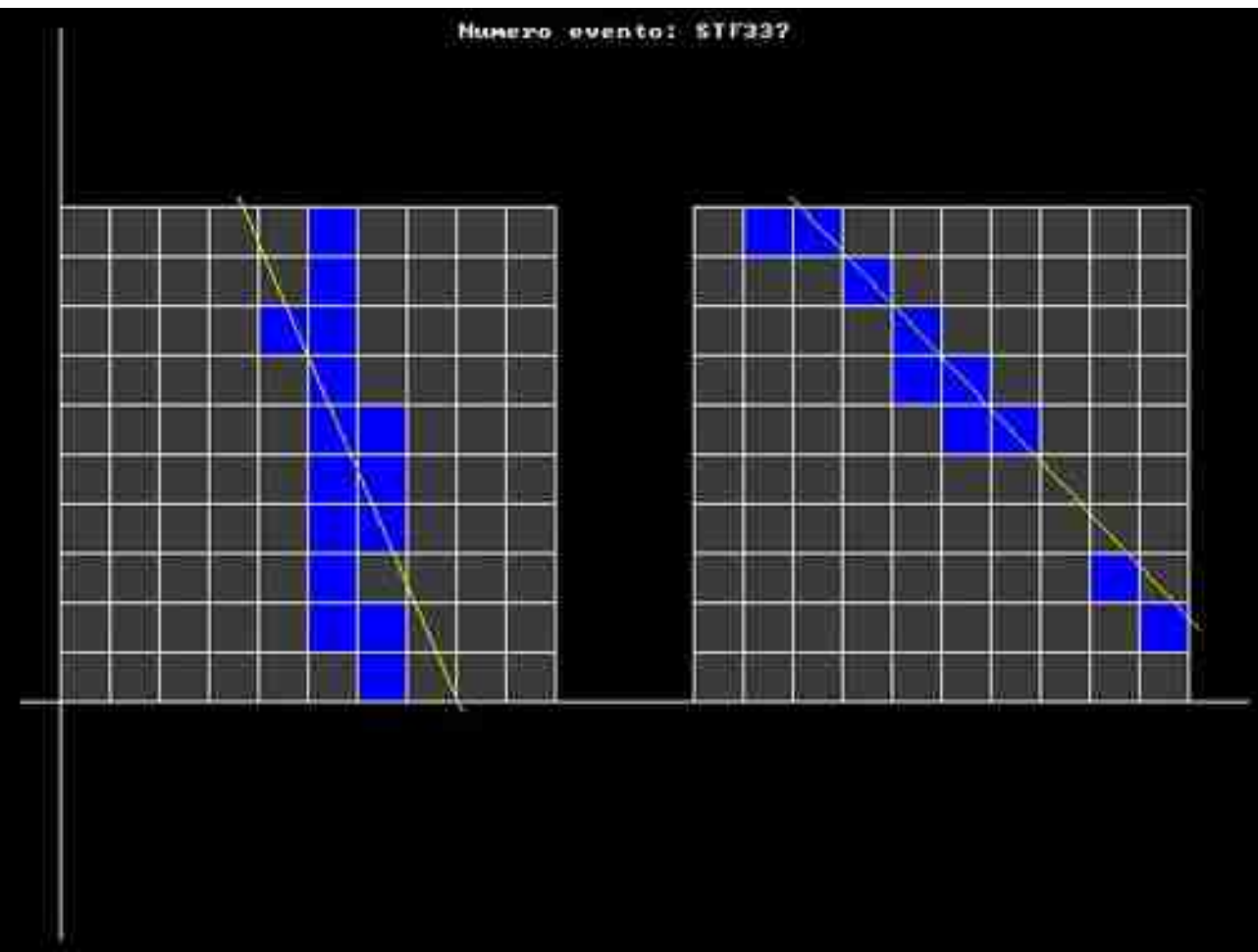


Problemi di visualizzazione



Non va scelto il singolo pixel come unità di misura

Qui l'unità di misura è posta a 25 pixel

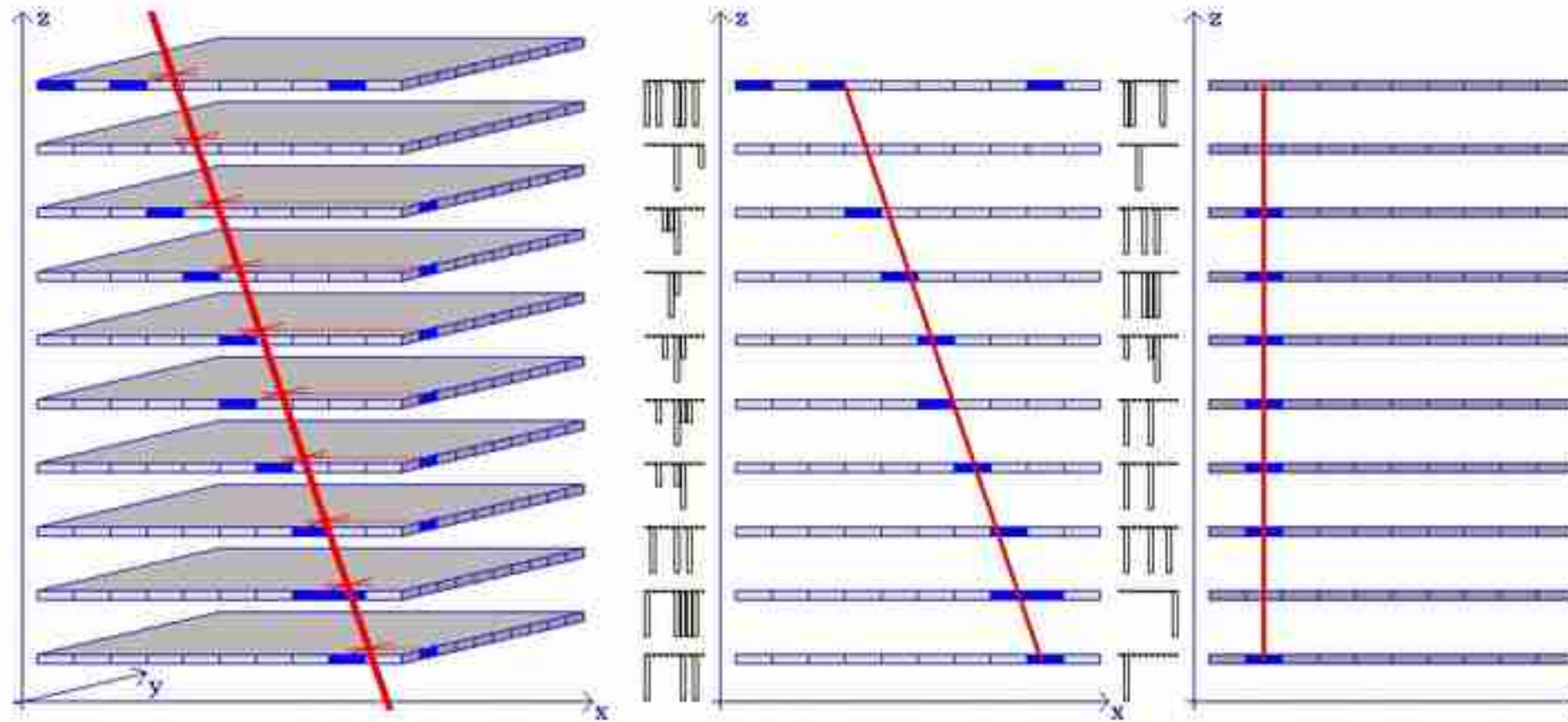


Si tenga conto che per il computer i valori dell'ordinata sono capovolti. Cambiando le unità di misura per le ascisse e per le ordinate cambiano gli angoli delle rette

Diagnostica

(solo alcuni esempi)

Evento: STF339 n. 756 del ven 27 gen 2017, 16.10.09, CET - Data inizio conteggio: 23/09/2016



Alcuni
(troppi)

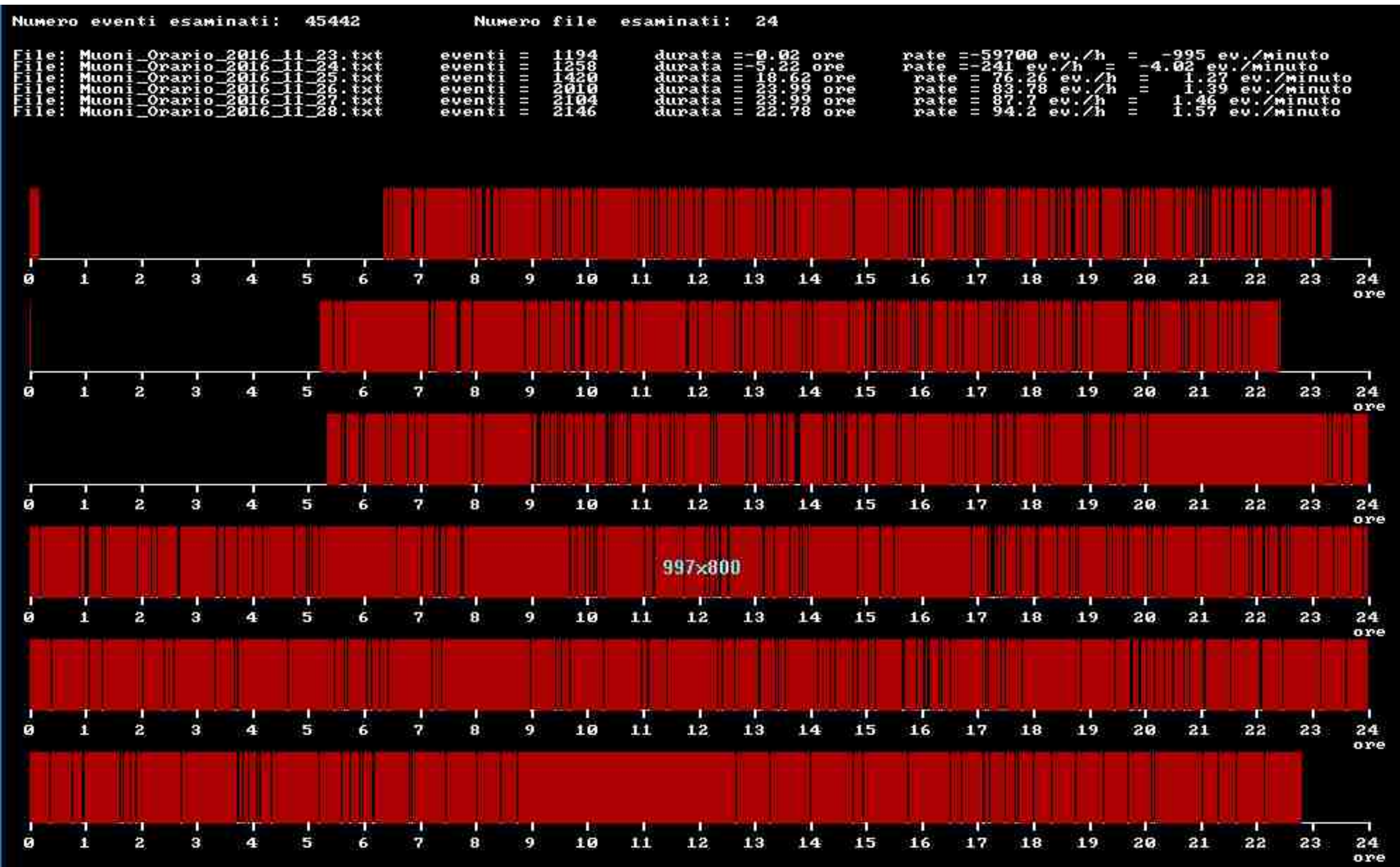
LED

(non)

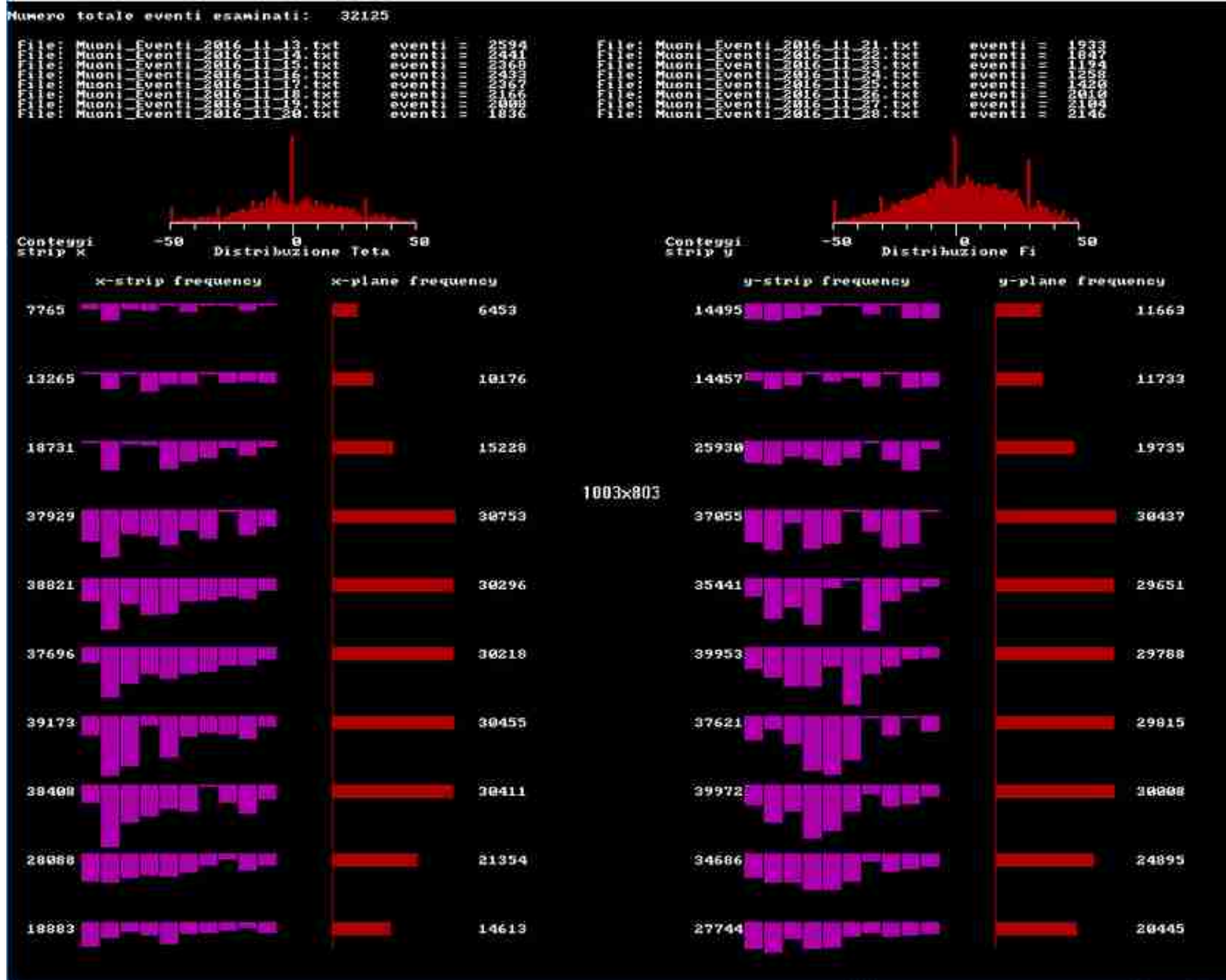
si accendono

Presenza di rumore di fondo

Che problemi ci sono?



Insomma, ma che problemi ci sono?



Un rivelatore artigianale di muoni ...



Telescopio/Totem a Toledo

Analisi ed elaborazione dati

Paolo Mastroserio

Domande?