

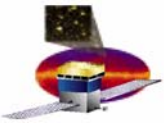
Tracker Alignment

Michael Kuss

INFN Pisa

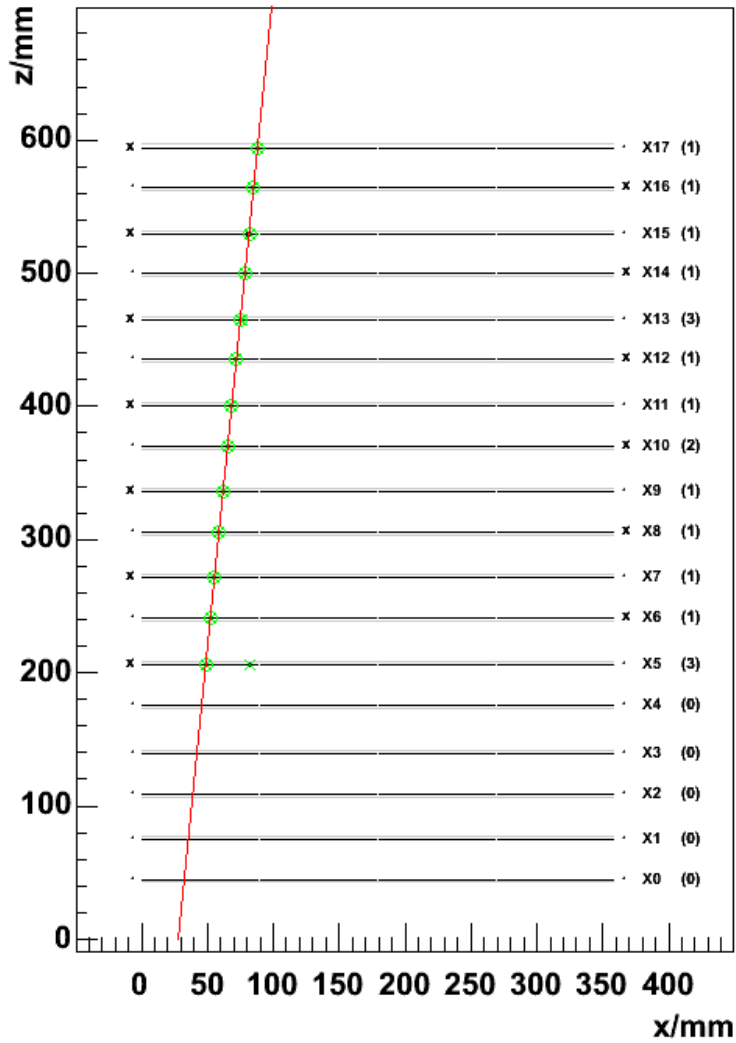
Analysis Group Meeting

20 June 2005

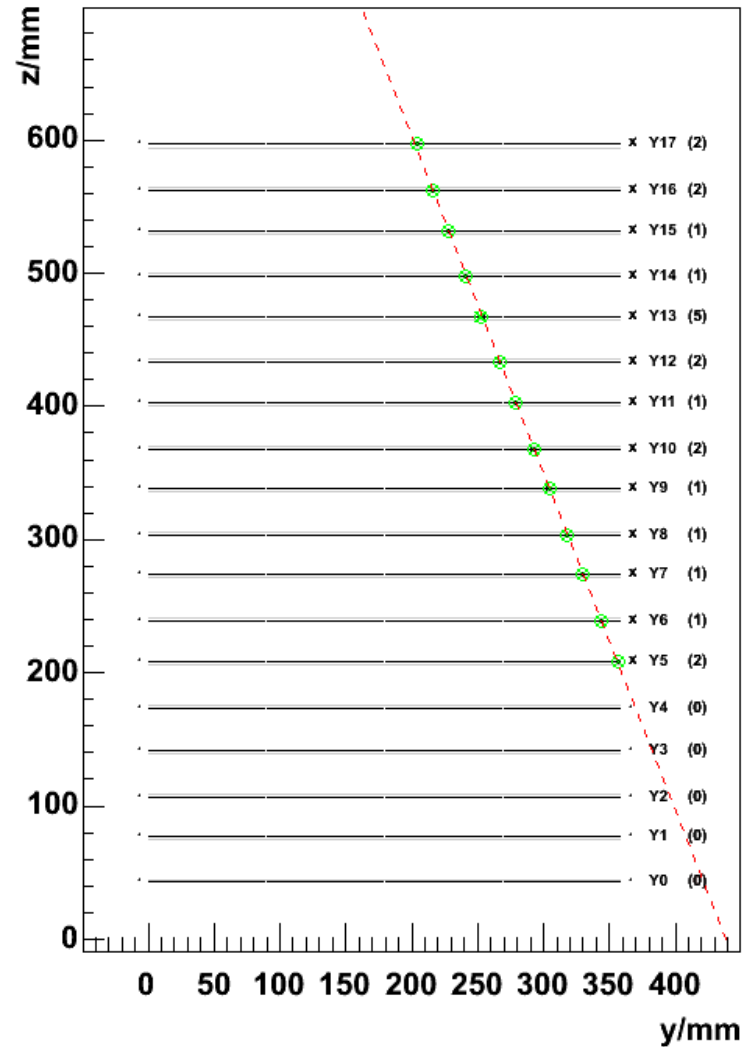


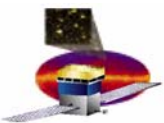
selecting tracks

XZ



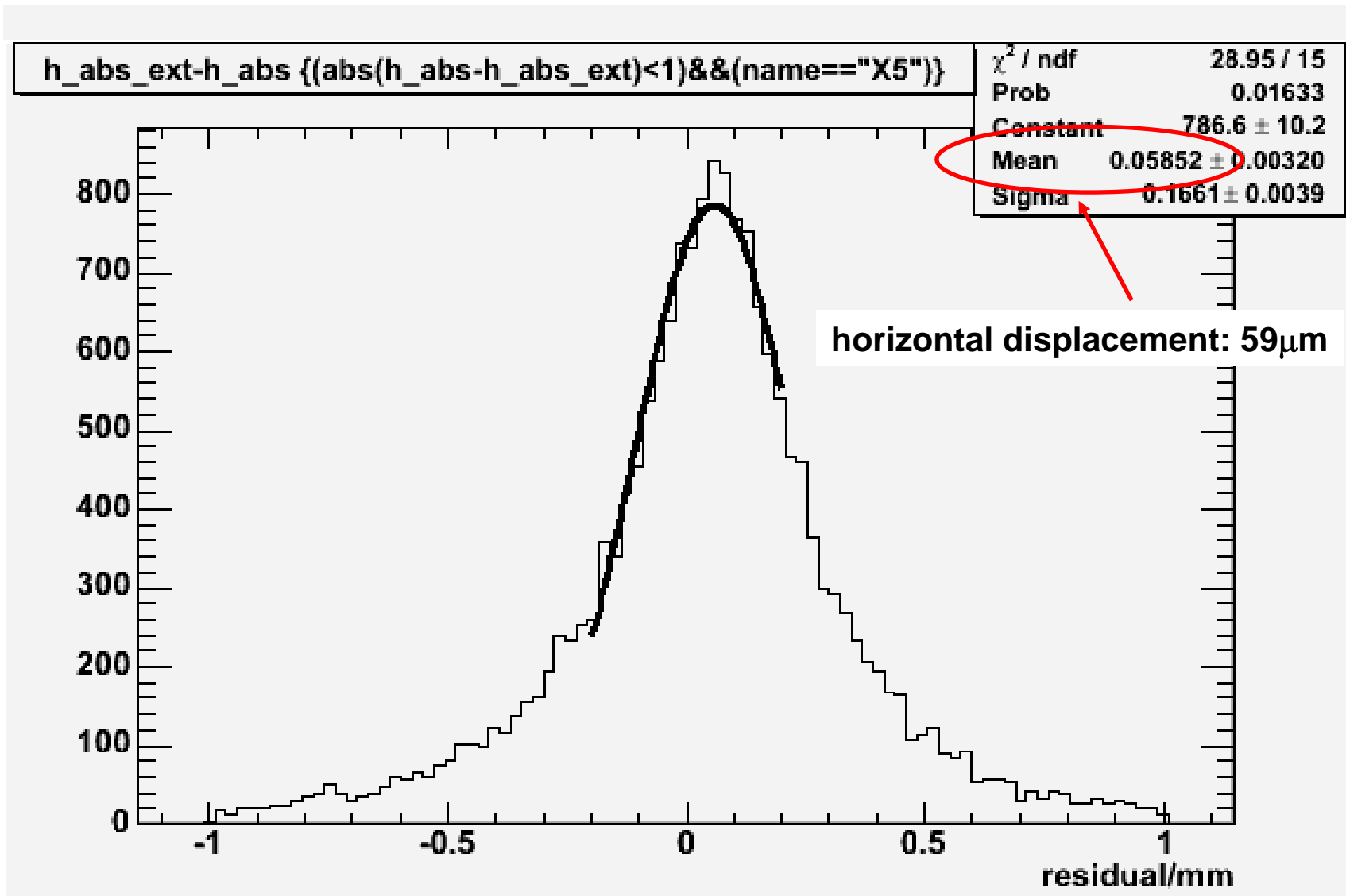
yz





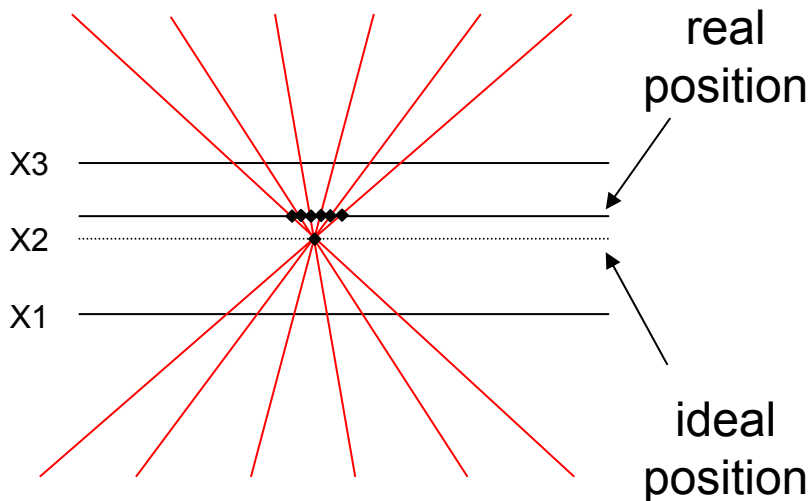
Residual

```
r->DrawResidual("X5", "abs(h_abs-h_abs_ext)<1")
```



Residuals vs. slope (horizontal and vertical alignment)

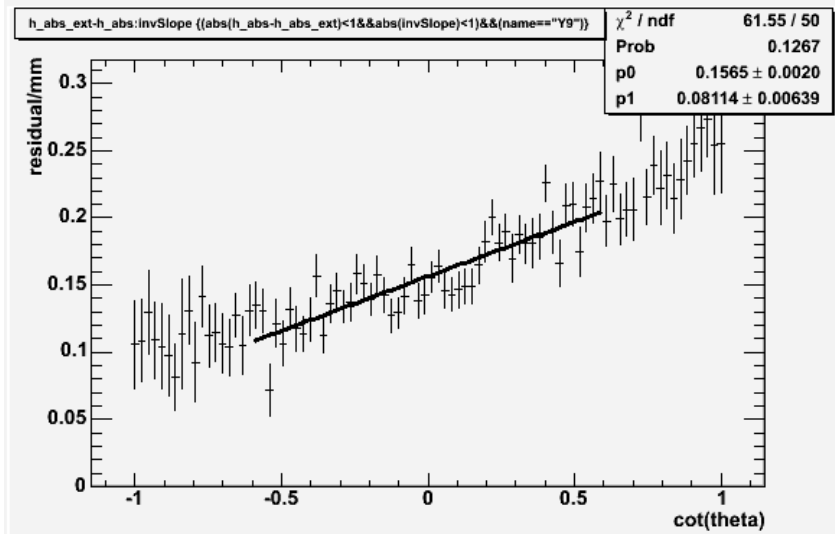
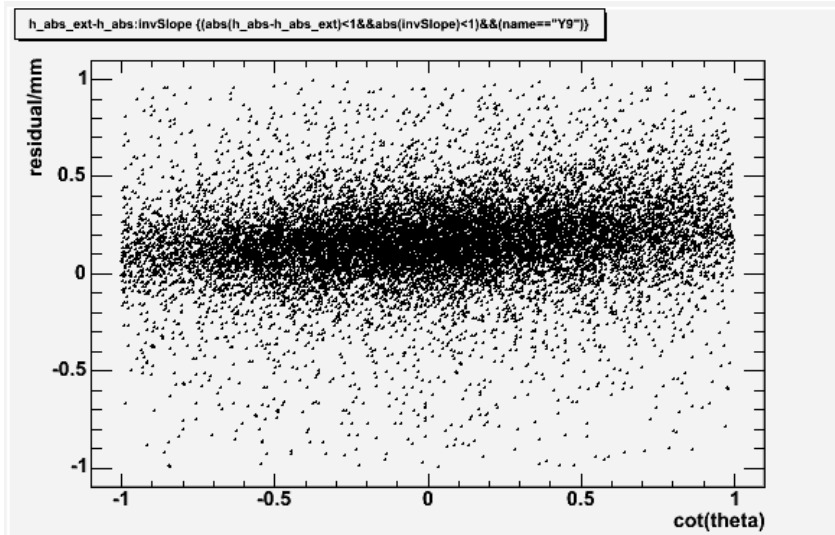
```
r->DrawResSlope("Y9", "abs(h_abs-h_abs_ext)<1&&abs(invSlope)<1")
```

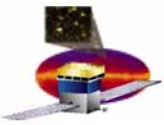


$$\text{res} = \Delta x + \Delta z \cdot \cot(\alpha)$$

Aligns:

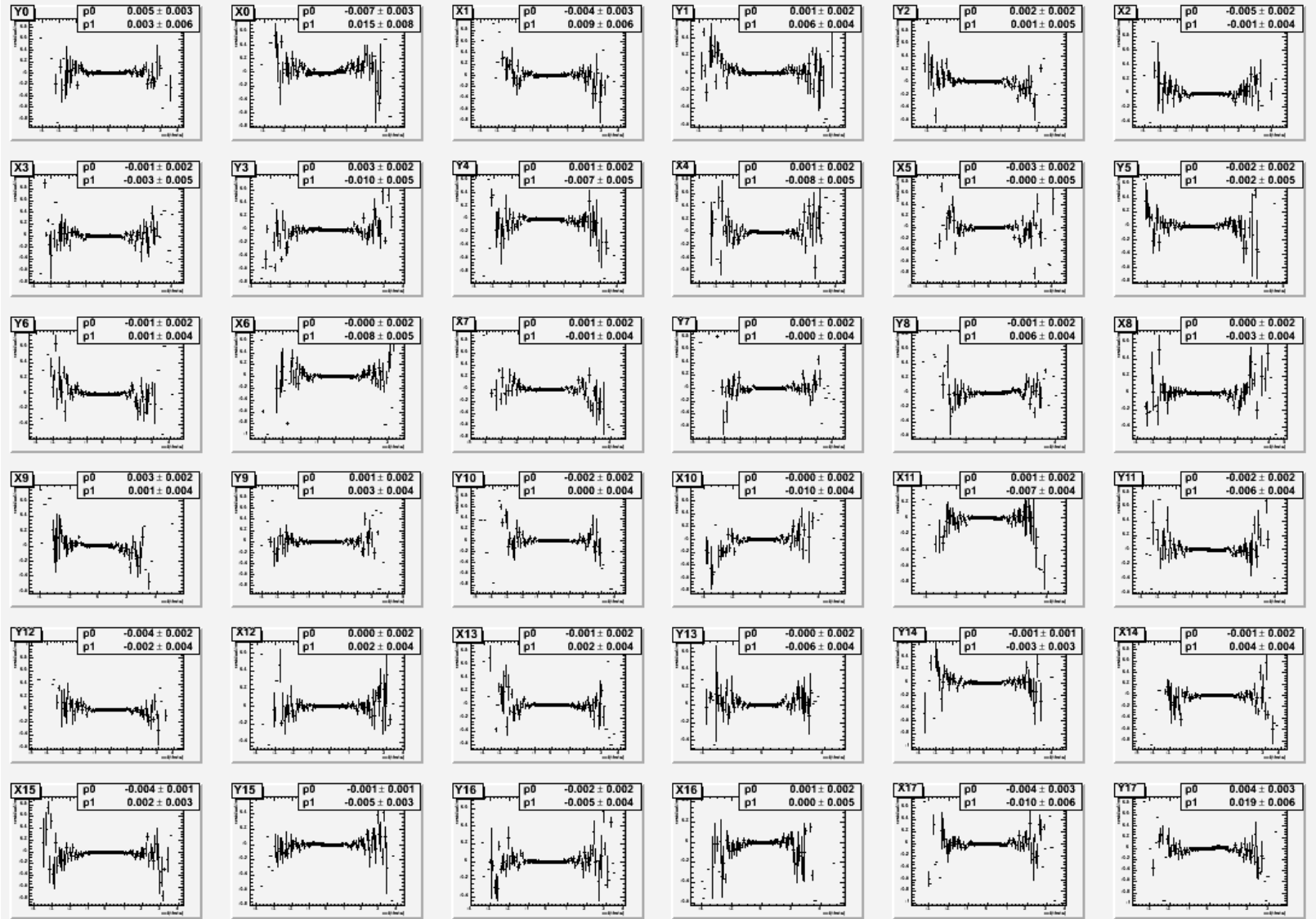
- horizontal (\perp to strips)
- vertical

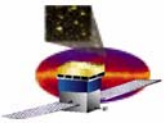




Residuals vs. slope of track (all planes)

r->DrawResSlopeAll()

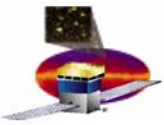




How To Align

Alignment is an iterative (and before RA v8r4 time consuming) process.

- run with 10k events till convergence (how do I know it converged?)
- run with 20k events till convergence
- run with 50k events till convergence
- run with 100k events till convergence. Usually, about 5 iterations are needed, each 6min CPU (before: 1h).



Alignment Blindness

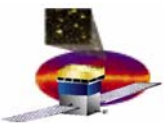
Attention

Alignment is blind versus:

- translation
- shearing
- vertical scaling (horizontal is fixed by strip dimensions)
- rotation
- twist (?)
- translation of one view vs. the other
- rotation of one view vs. the other

After every iteration, separately in each view, I “correct” for:

- $\sum \text{pos}_h = 0$ (horizontal translation)
- $\sum \text{pos}_h^2$ min. (shearing)
- $\sum (\text{pos}_v - \text{pos}_{v,\text{ref}}) = 0$ (vertical translation)
- $\sum (\text{pos}_v - \text{pos}_{v,\text{ref}})^2$ min. (vertical scaling)
- $\sum \text{rot}_z = 0$ (rotation around z)



Alignment results

plane	vertical position z / mm			dz / mm	tray height / mm			type
	Gleam v5r8	LAT TD	soft alignment	soft-Gleam	Gleam	LAT TD	soft alignment	
Y0	42.32	42.42	42.53	0.21				bottom
X0	44.77	44.52	44.63	-0.13				
X1	74.34	74.30	74.41	0.07	29.57	29.78	29.78	no converter
Y1	76.87	76.63	76.75	-0.11				
Y2	106.44	106.41	106.46	0.02	29.57	29.78	29.71	no converter
X2	108.97	108.74	108.94	-0.02				
X3	139.54	139.52	139.69	0.15	30.57	30.78	30.75	heavy
Y3	142.07	141.94	141.99	-0.08				
Y4	172.64	172.73	172.69	0.05	30.57	30.79	30.70	heavy
X4	175.17	175.05	175.12	-0.04				
X5	205.74	205.83	205.74	0.00	30.57	30.78	30.62	heavy
Y5	208.27	208.15	208.25	-0.01				
Y6	238.84	238.94	238.82	-0.02	30.57	30.79	30.56	heavy
X6	241.37	241.24	241.30	-0.07				
X7	271.14	271.25	271.19	0.05	29.78	30.01	29.90	regular
Y7	273.67	273.55	273.56	-0.10				
Y8	303.44	303.56	303.54	0.10	29.78	30.01	29.98	regular
X8	305.97	305.86	305.88	-0.09				
X9	335.74	335.87	335.80	0.06	29.78	30.01	29.92	regular
Y9	338.27	338.17	338.11	-0.16				
Y10	368.04	368.18	368.08	0.04	29.78	30.01	29.97	regular
X10	370.57	370.48	370.54	-0.02				
X11	400.34	400.49	400.41	0.07	29.78	30.01	29.87	regular
Y11	402.87	402.79	402.77	-0.10				
Y12	432.64	432.80	432.70	0.06	29.78	30.01	29.93	regular
X12	435.17	435.10	435.13	-0.04				
X13	464.94	465.11	465.15	0.20	29.78	30.01	30.02	regular
Y13	467.47	467.41	467.39	-0.07				
Y14	497.24	497.42	497.36	0.12	29.78	30.01	29.97	regular
X14	499.77	499.72	499.60	-0.17				
X15	529.54	529.73	529.62	0.08	29.78	30.01	30.02	regular
Y15	532.07	532.03	532.03	-0.04				
Y16	561.84	562.04	561.87	0.03	29.78	30.01	29.84	regular
X16	564.37	564.34	564.17	-0.19				
X17	594.14	594.35	594.23	0.09	29.78	30.01	30.06	regular
Y17	596.67	596.62	596.72	0.06				top