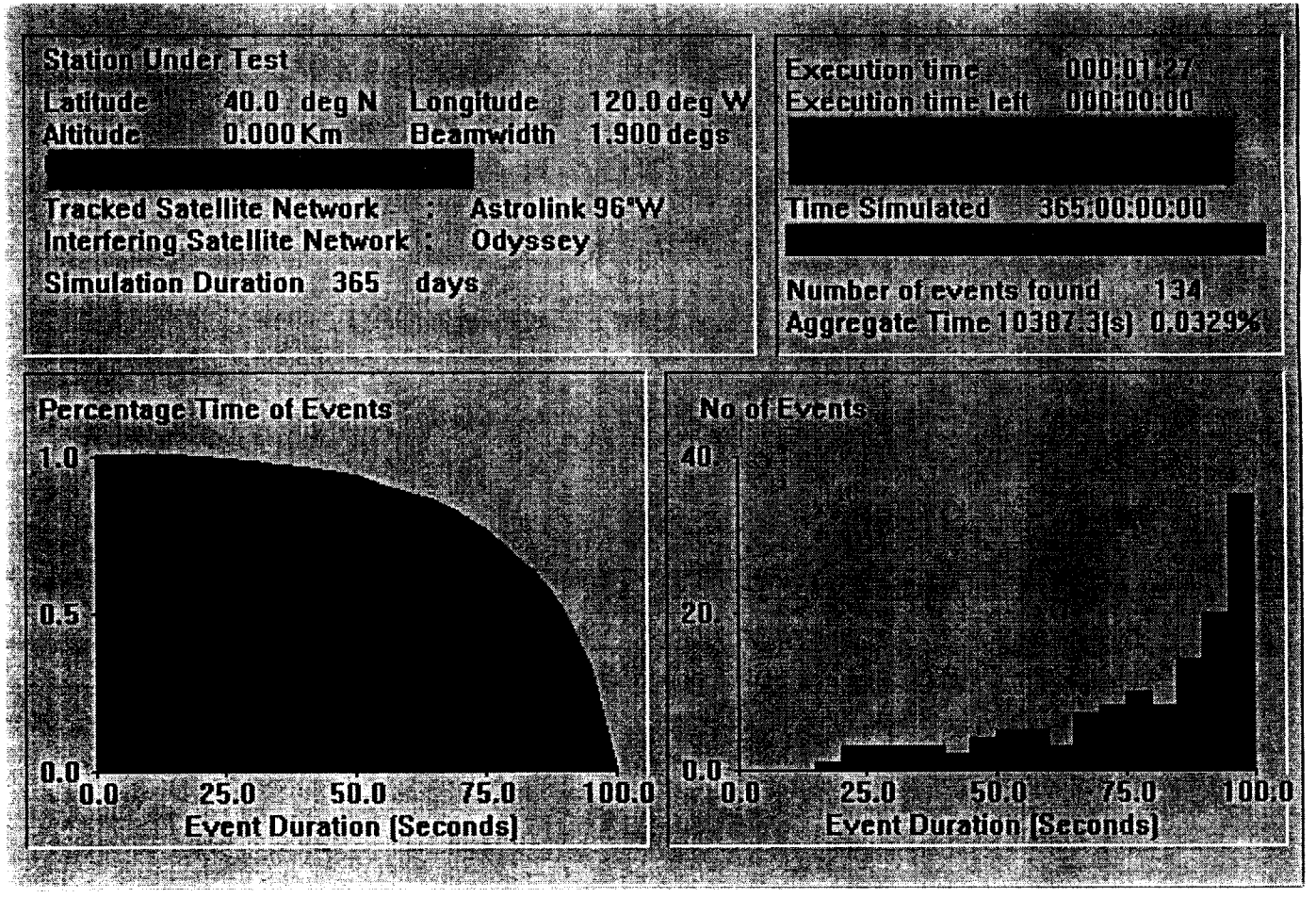
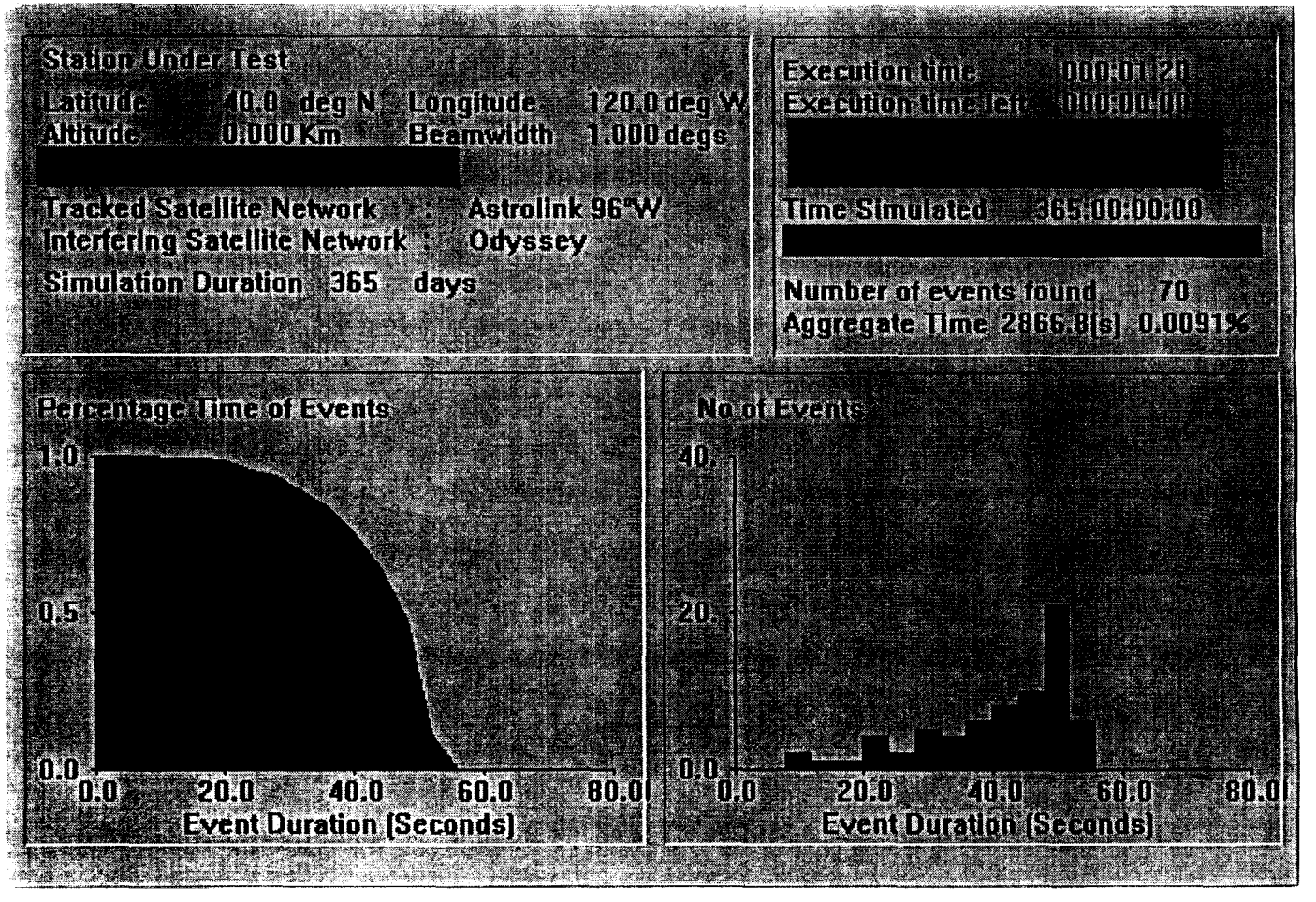
Simulation Results (I_0/N_0 = 2.98)



Simulation Results (I_0/N_0 = 14.8)



Summary of Results

CPM criteria (95/118)			Simulation Results	
% time not to be exceeded	I_0/N_0 (linear)	I_0/N_0 (dB)	% time occurred	Δ relative to criteria
0.87	0.06	-12.22	0.8733	+0.0033%
0.119	0.78	-1.08	0.1034	-0.0156%
0.0294	2.98	+4.74	0.0329	+0.0035%
0.0004	14.8	+11.70	0.0091	+0.0087%

Interference or Outage?

- Typical Ka-band uplink will operate with 10 dB power margin to overcome rain fades
- Probability of simultaneous deep rain fade and Odyssey interference event is very small
- Uplink power control may alternatively be used to overcome interference
- If this power margin is used to overcome interference, link will still be operational with I_0/N_0 as high as ~+10 dB
- Using this technique, link availability could still be maintained as high as 99.99%, under assumed worst case conditions

Sun Outage Comparison

Sun Outages for 1993

Ground Station Data	
Longitude (+East)	5
Latitude (+North)	40
Antenna Beamwidth	3

Spacecraft Data	
Longitude (+East)	-41
Deadband (+/- degs)	0.15

Spring Sun Outage Season

Date	Start	End	Dur
27-Feb-93	0:00:00	0:00:00	0:00:00
28-Feb-93	15:13:15	15:21:05	0:07:50
1-Mar-93	15:11:11	15:22:45	0:11:34
2-Mar-93	15:09:57	15:23:36	0:13:39
3-Mar-93	15:09:07	15:23:59	0:14:52
4-Mar-93	15:08:38	15:24:01	0:15:23
5-Mar-93	15:08:29	15:23:44	0:15:15
6-Mar-93	15:08:38	15:23:06	0:14:28
7-Mar-93	15:09:11	15:22:05	0:12:54
8-Mar-93	15:10:16	15:20:30	0:10:14
9-Mar-93	15:12:47	15:17:30	0:04:43
10-Mar-93	0:00:00	0:00:00	0:00:00

Autumn Sun Outage Season

Date	Start	End	Dur
2-Oct-93	0:00:00	0:00:00	0:00:00
3-Oct-93	14:50:23	14:56:45	0:06:22
4-Oct-93	14:47:50	14:58:41	0:10:51
5-Oct-93	14:46:21	14:59:35	0:13:14
6-Oct-93	14:45:21	15:00:01	0:14:40
7-Oct-93	14:44:44	15:00:02	0:15:18
8-Oct-93	14:44:25	14:59:48	0:15:23
9-Oct-93	14:44:28	14:59:14	0:14:46
10-Oct-93	14:44:50	14:58:20	0:13:30
11-Oct-93	14:45:41	14:56:57	0:11:16
12-Oct-93	14:47:23	14:54:47	0:07:24
13-Oct-93	0:00:00	0:00:00	0:00:00

For 3° beamwidth:

- Outages as long as 15 minutes each event
- Annual aggregate outage of 4 hours or 0.045%

Other Mitigating Factors

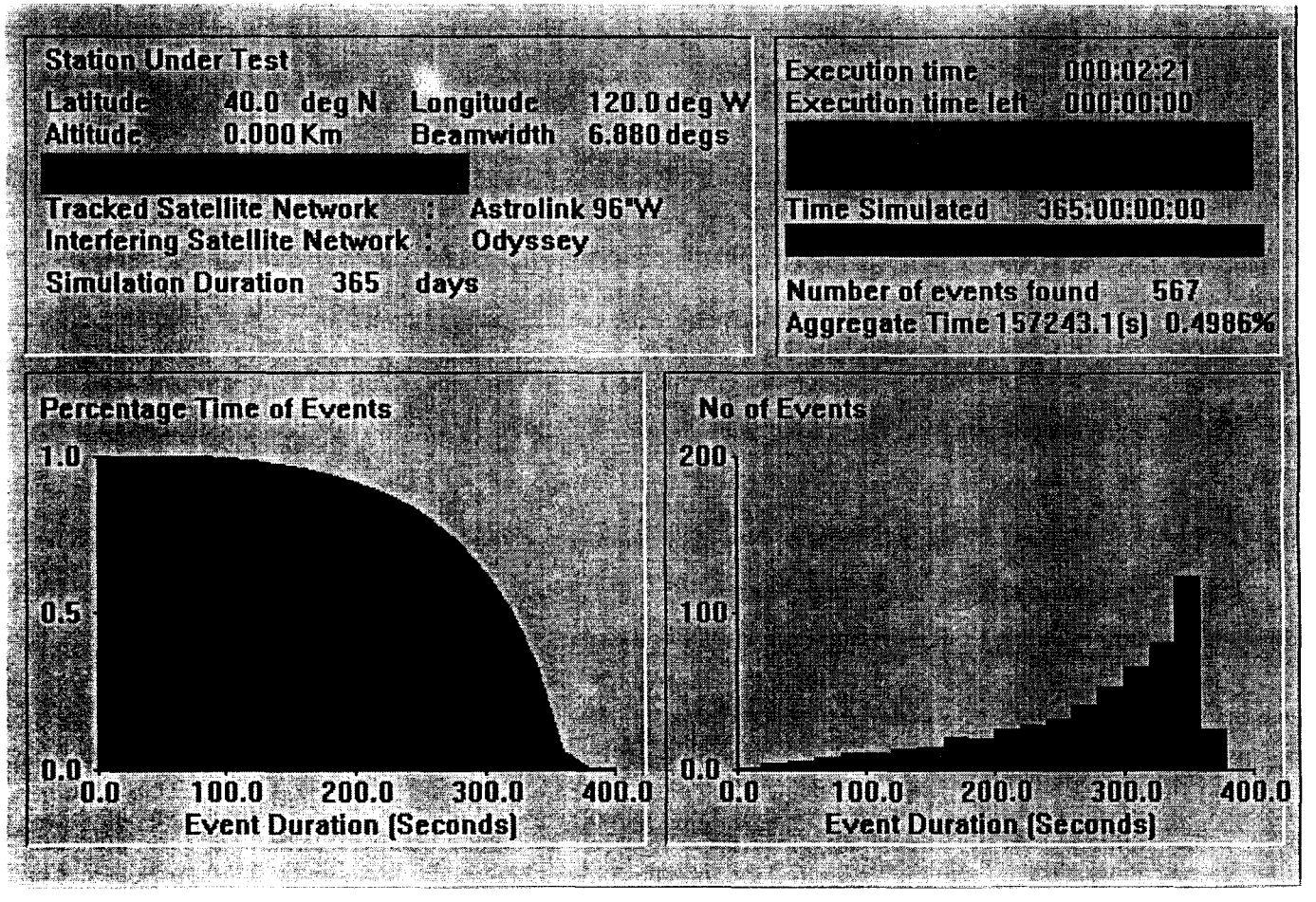
- Lower satellite receive gain
- Pointing of receive antenna away from Odyssey feeder link earth station
- Partial overlap of Odyssey feeder link band (e.g., wideband links occupying 250 MHz)
- Use of opposite polarization
- Lower traffic loading of Odyssey feeder link

Satellite Rx Gain Reduced by 3 dB

CPM criteria (95/118)			Computed isolation requirements for interference threshold	
% time not to be exceeded	I_0/N_0 (linear)	I_0/N_0 (dB)	Off-axis isolation	Off-axis angle $29-25\log(\theta)$
0.87	0.06	-12.22	**49.23 dB**	**3.44°**
0.119	0.78	-1.08	**38.09 dB**	**1.23°**
0.0294	2.98	+4.74	**32.27 dB**	**0.72°**
0.0004	14.8	+11.70	**25.31 dB**	**0.38°**

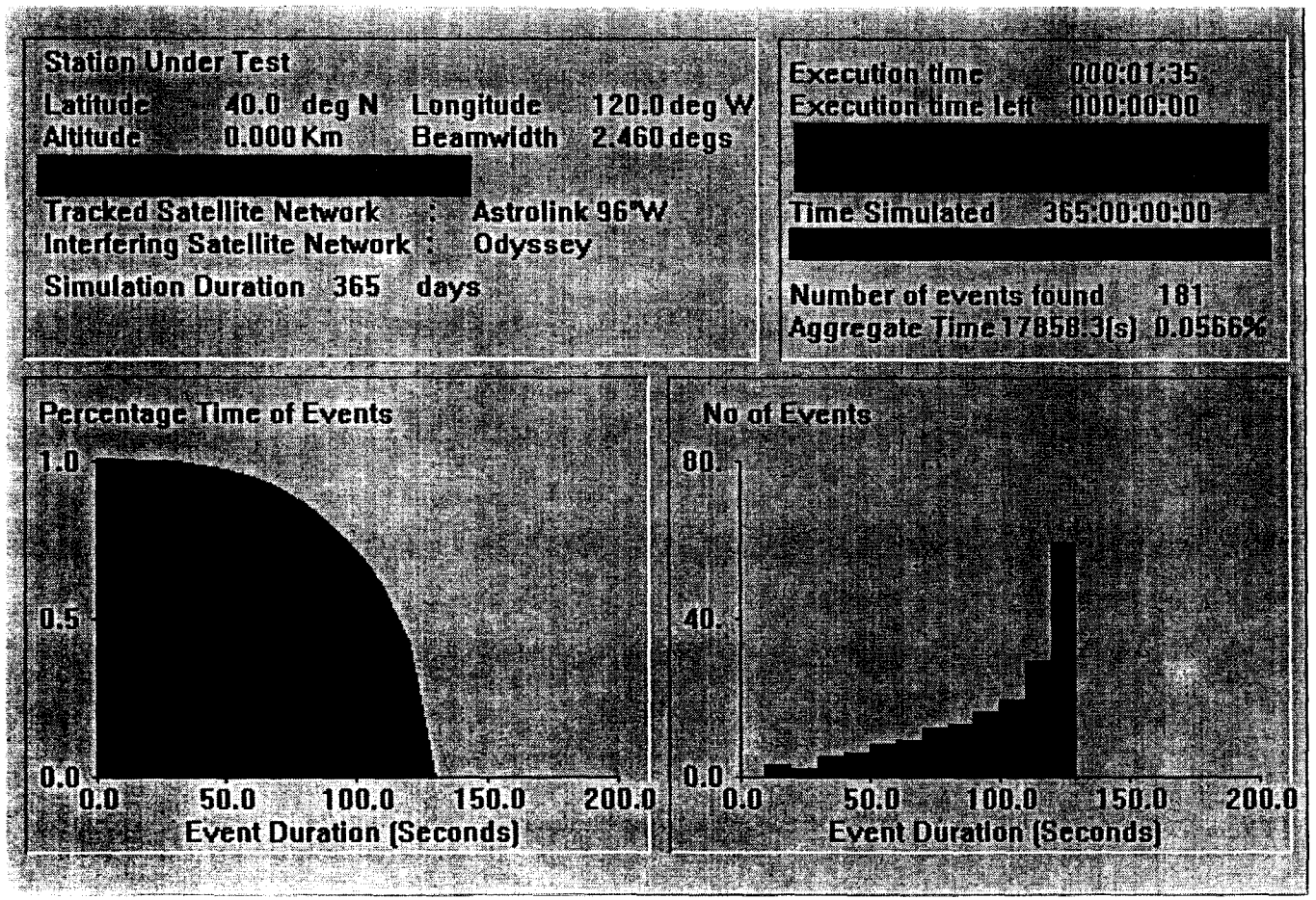
Simulation Results (I_0/N_0 = 0.06)

(Satellite Rx Gain Reduced by 3 dB)



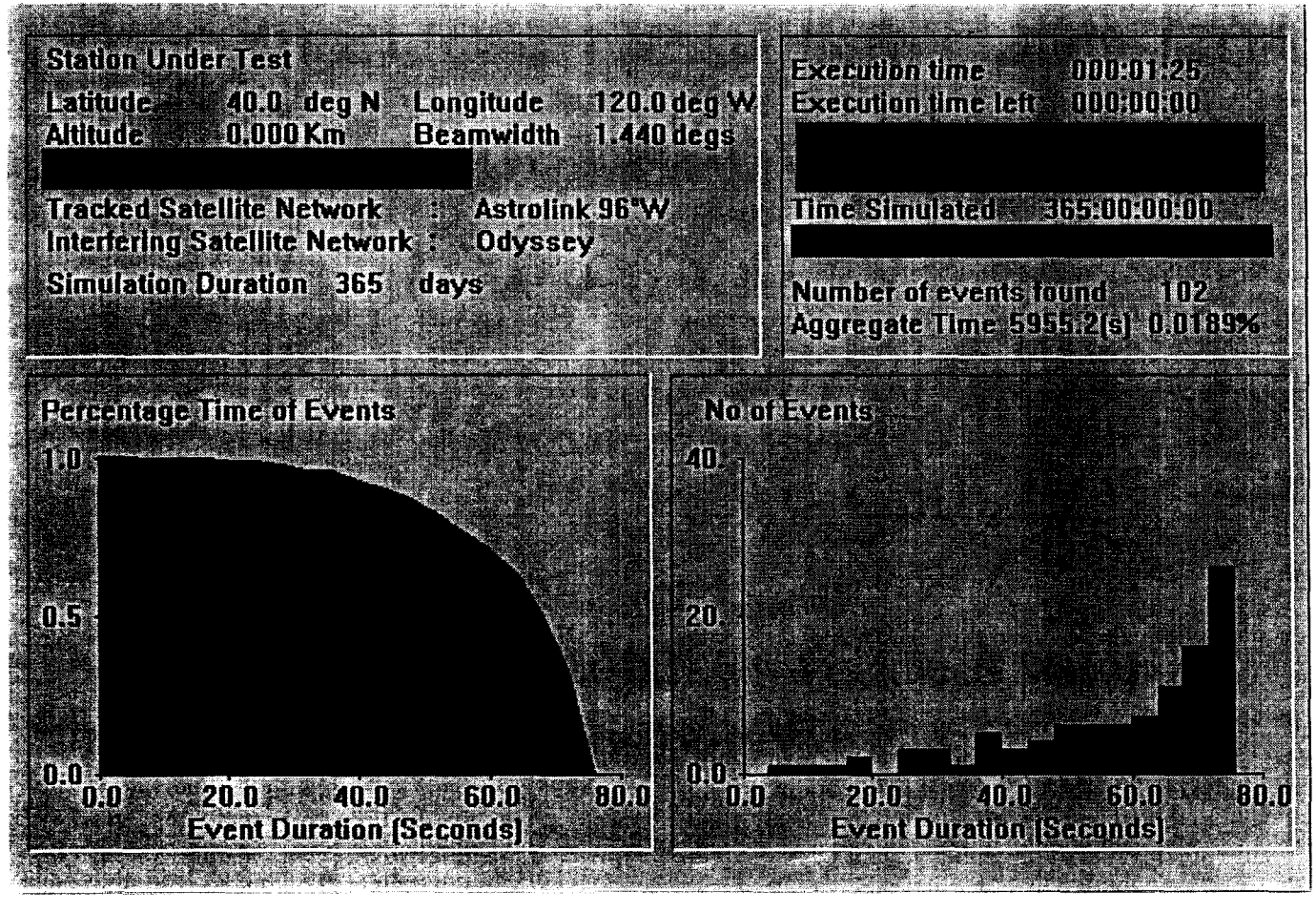
Simulation Results (I_0/N_0 = 0.78)

(Satellite Rx Gain Reduced by 3 dB)



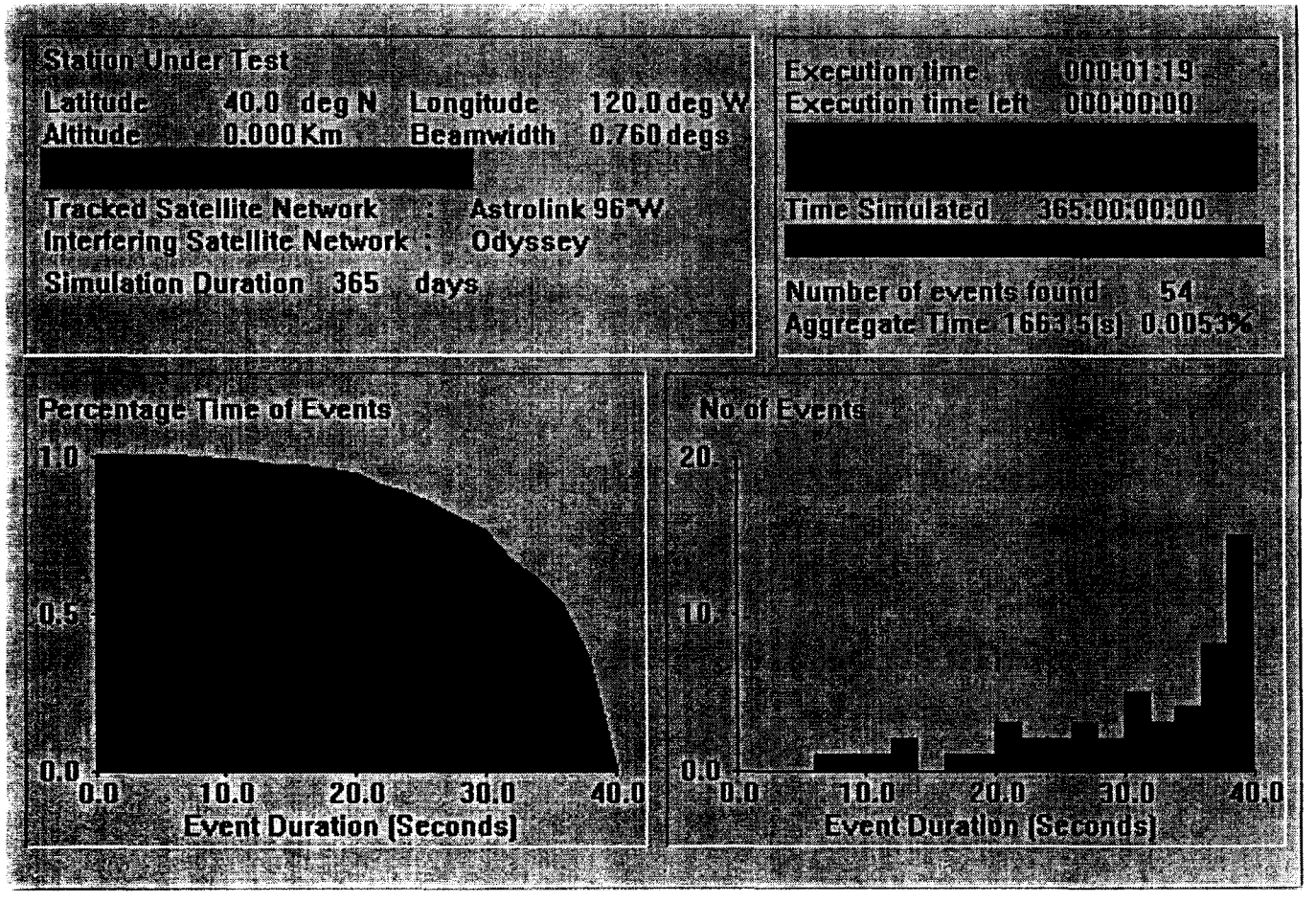
Simulation Results (I_0/N_0 = 2.98)

(Satellite Rx Gain Reduced by 3 dB)



Simulation Results (I_0/N_0 = 14.8)

(Satellite Rx Gain Reduced by 3 dB)



Summary of Results

Satellite Rx Gain Reduced by 3 dB

CPM criteria (95/118)			Simulation Results	
% time not to be exceeded	I_0/N_0 (linear)	I_0/N_0 (dB)	% time occurred	Δ relative to criteria
0.87	0.06	-12.22	0.4986	-0.3714 %
0.119	0.78	-1.08	0.0866	-0.0324 %
0.0294	2.98	+4.74	0.0189	-0.0105 %
0.0004	14.8	+11.70	0.0053	+0.0049 %