

DYNAMIC INTEGRATED PLATFORM FOR MULTI- DIMENSIONAL PROPAGATION DATA ANALYSIS

Tokyo Institute of Technology

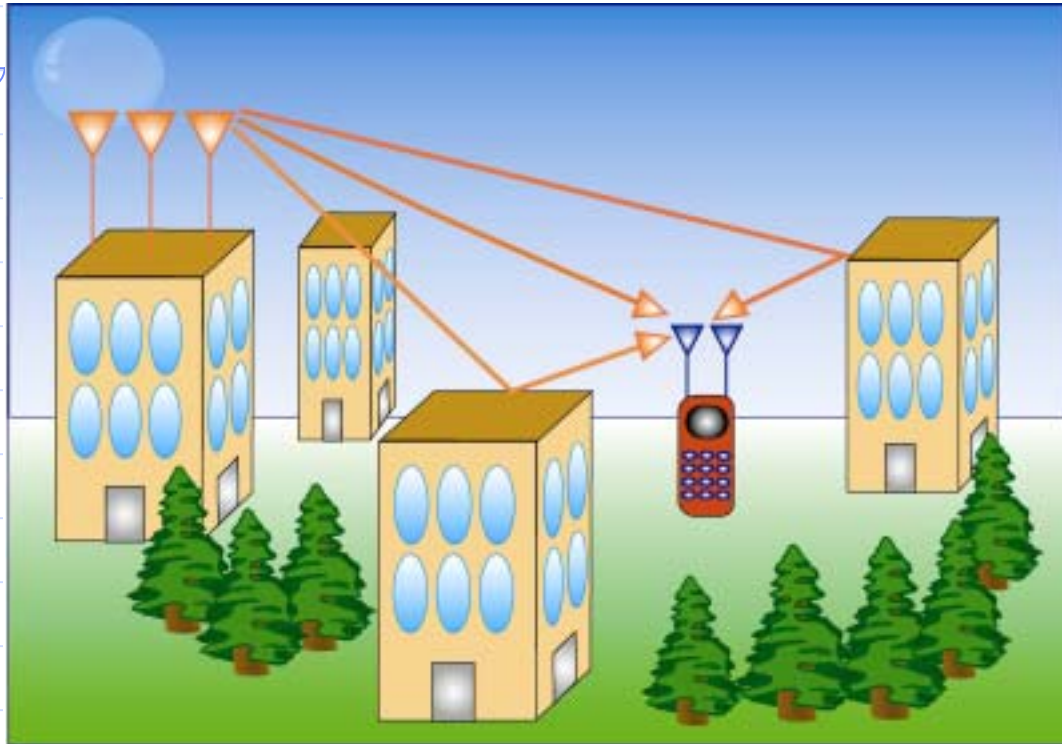
Graduate School of Science and Engineering

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Presentation Outline

- ◆ Background
- ◆ Objective
- ◆ Dynamic Integrated Platform for Multi-Dimensional Data Analysis, **DINO**
- ◆ Propagation Data Analysis
- ◆ System Planning
- ◆ Conclusion

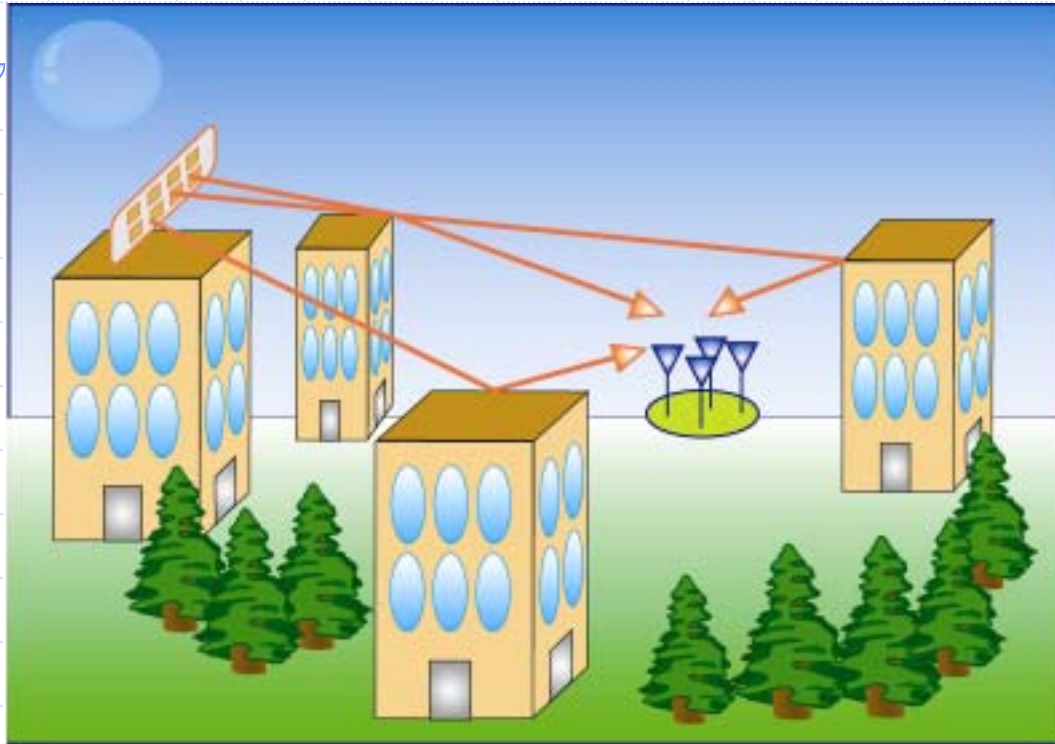
Background I



**MIMO
COMMUNICATION
SYSTEM**

- ◆ Promising candidate for future mobile communication systems
- ◆ Accurate and objective performance evaluation is necessary

Background II

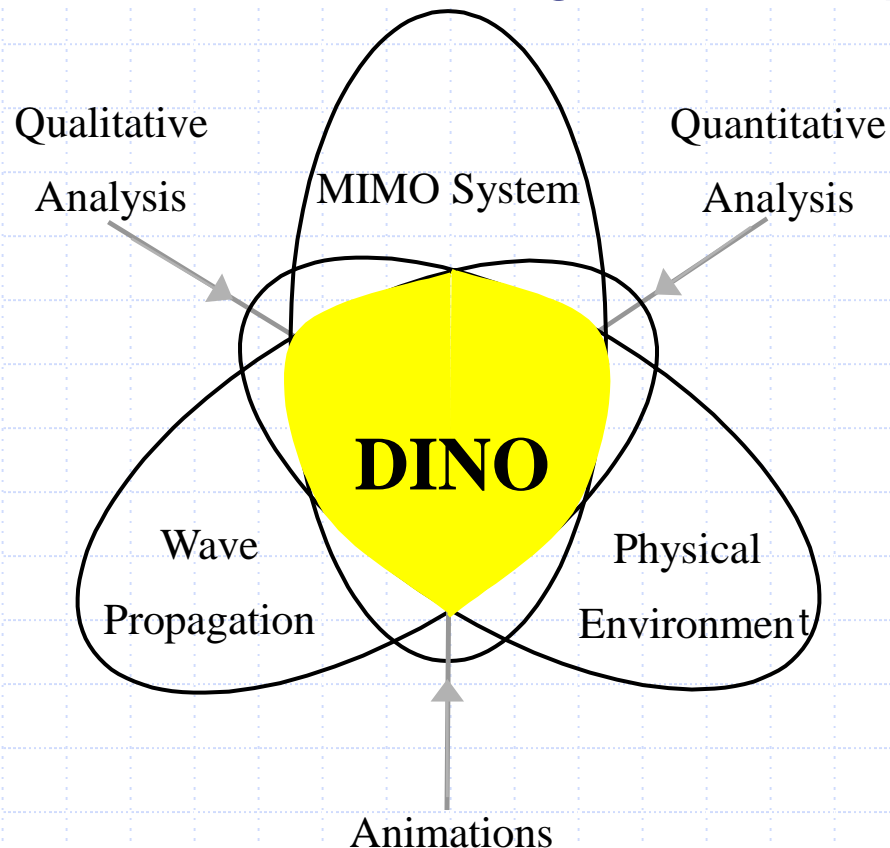


**MIMO
CHANNEL
SOUNDER**

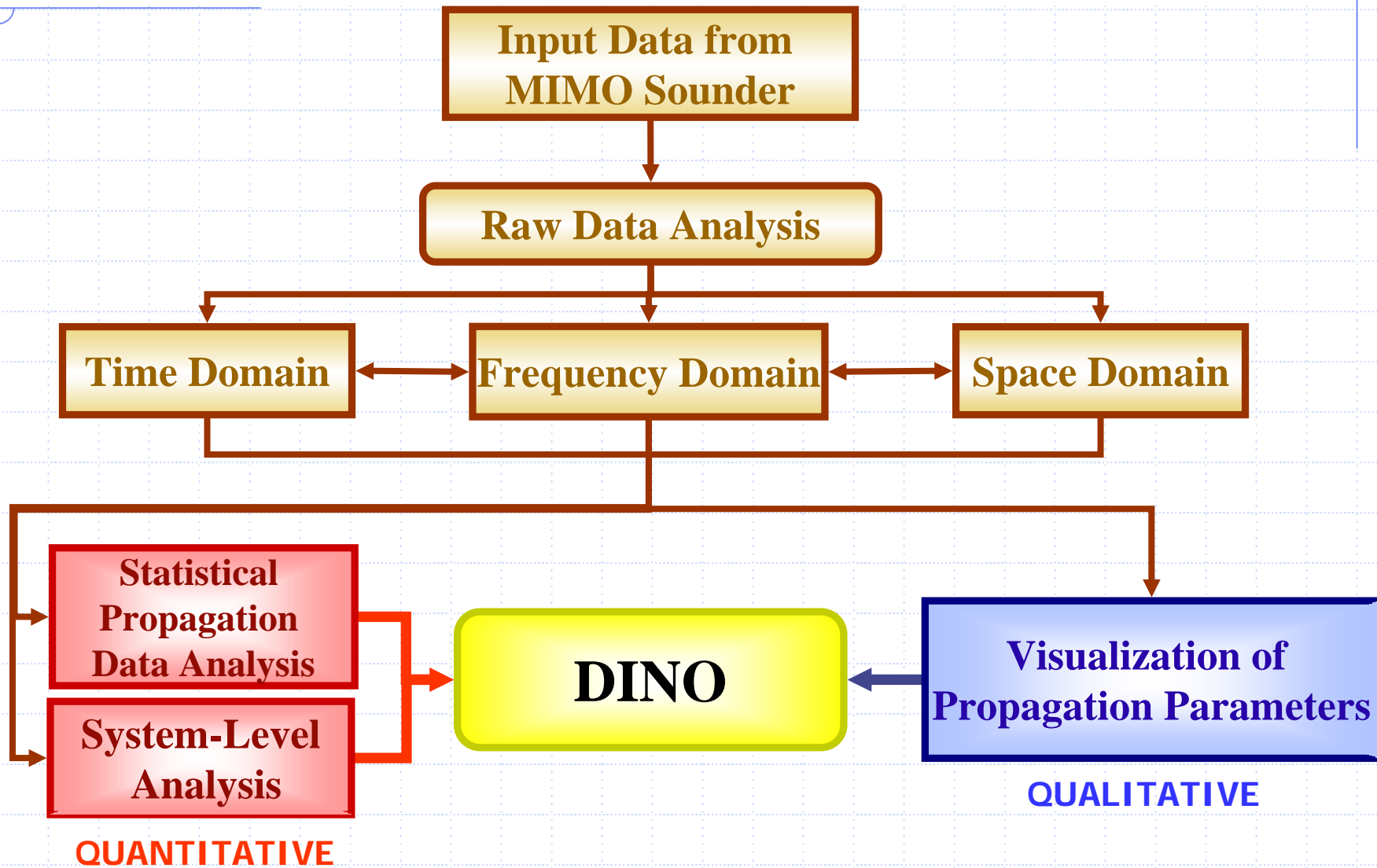
- ◆ **MIMO channel sounding is necessary**
- ◆ **How should we analyze and process the enormous amount of data from the channel sounder ?**

Objective

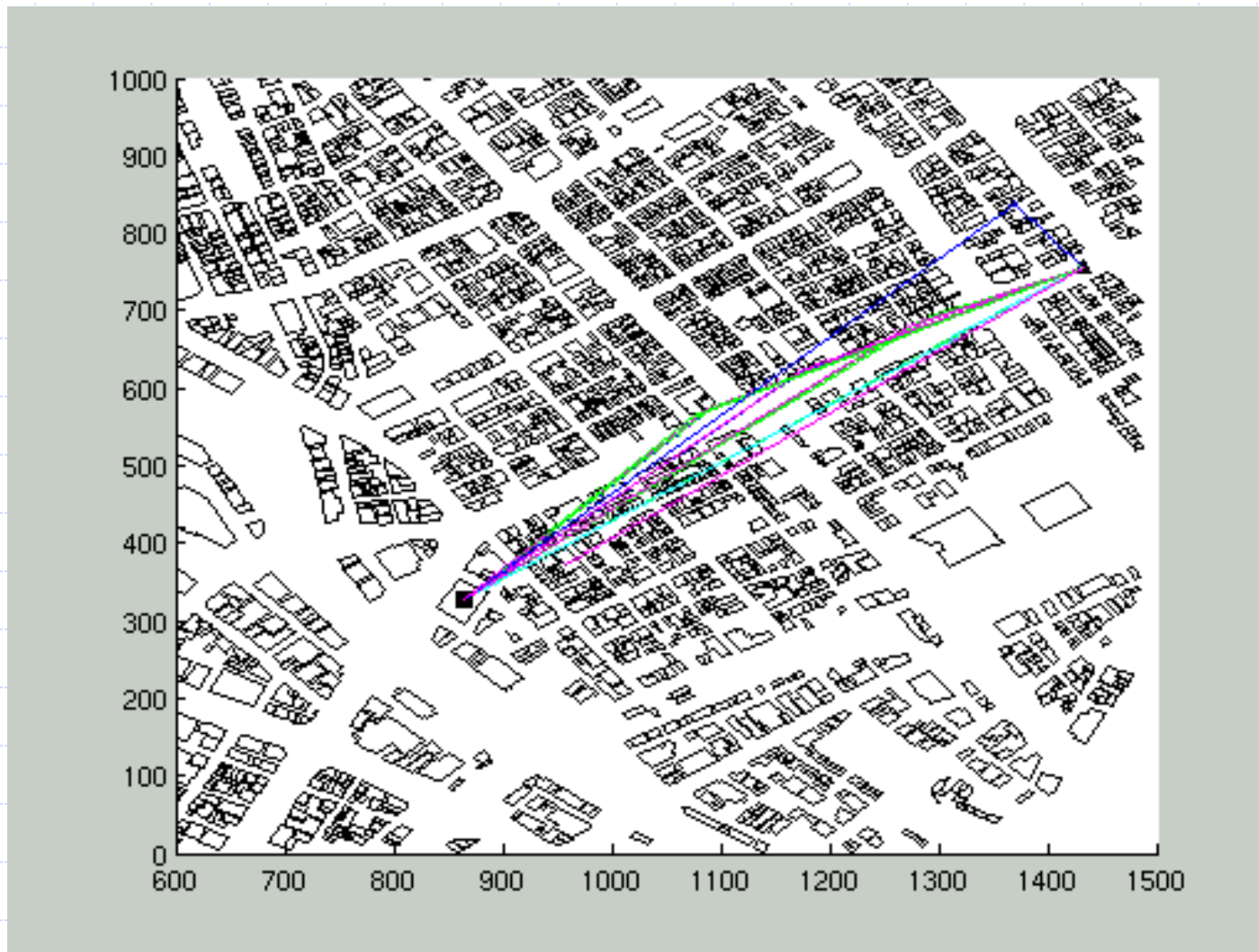
- ◆ Create an efficient platform for multi-dimensional data analysis and processing



DINO



Visualization of Propagation Parameters Module



R

M

B

G

C

Dynamic range=60dB
Decreasing Power

Statistical Propagation Data Analysis Module

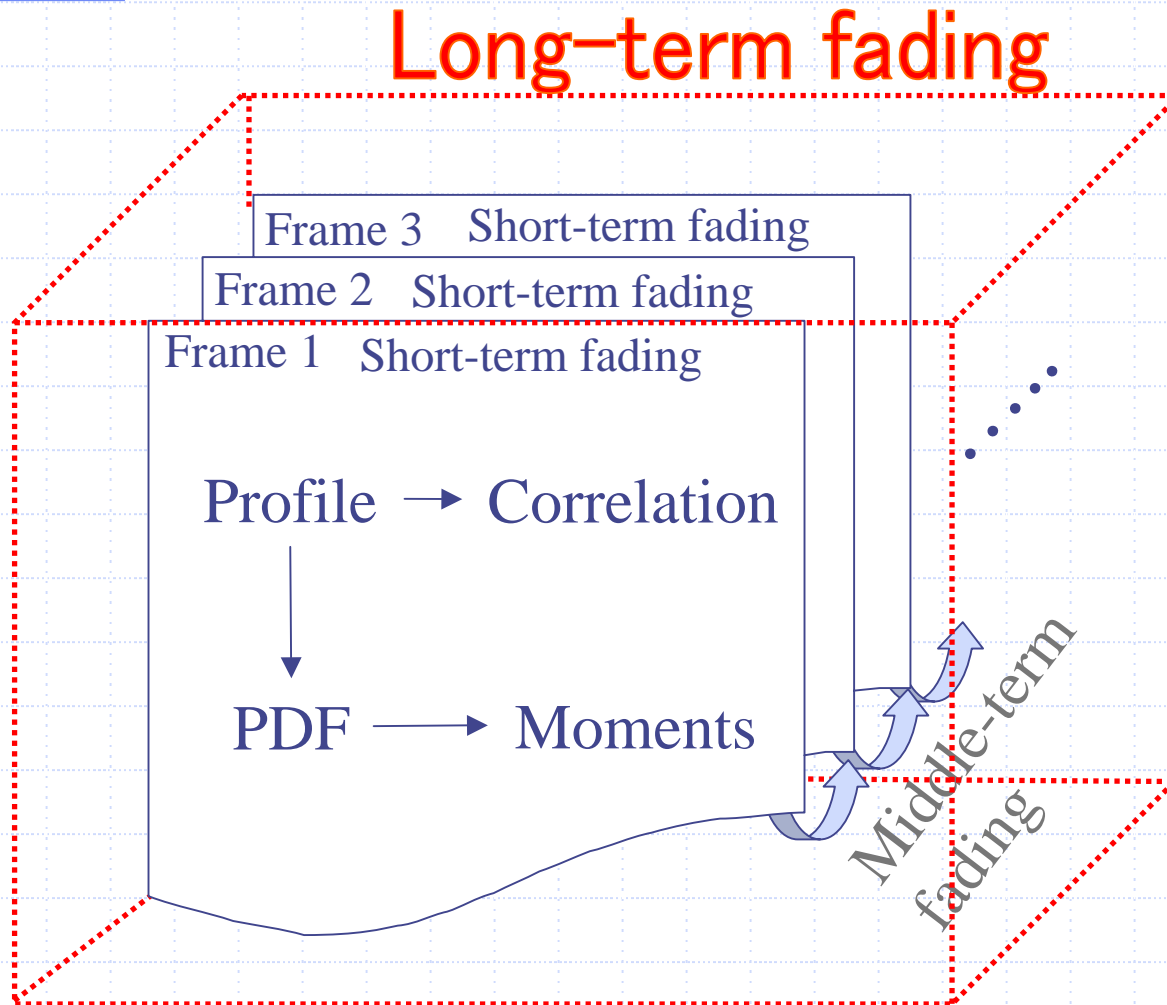
Instantaneous Data Analysis

	DTOA	DF	ADOA	EDOA	ADOD	EDOD	XP
DTOA		O	O	O	O	O	O
DF			O	O	O	O	O
ADOA				O	O	O	O
EDOA					O	O	O
ADOD						O	O
EDOD							O
XP	XP:Cross Polarization Power						

O : applicable

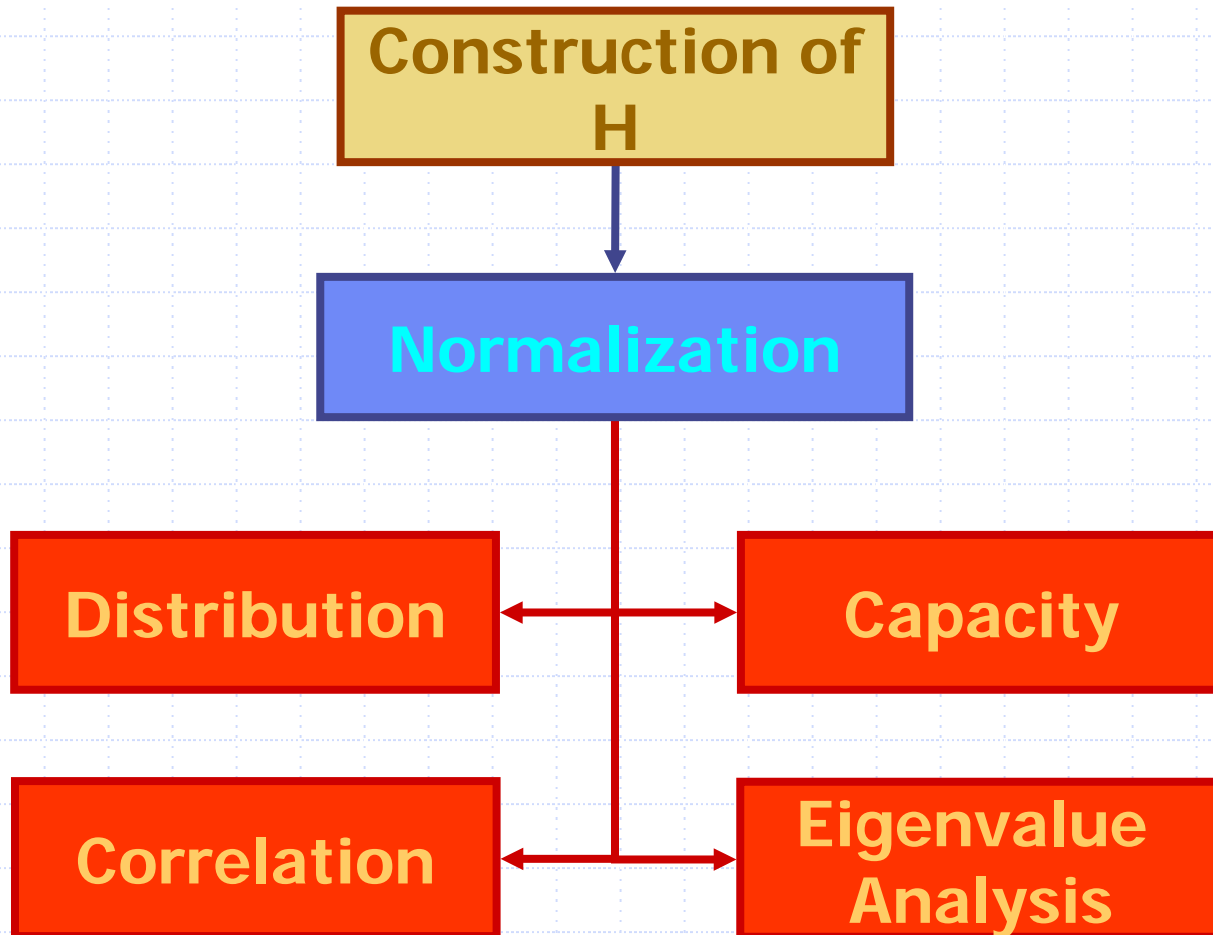
Shaded area : not applicable

Statistical Propagation Data Analysis Module

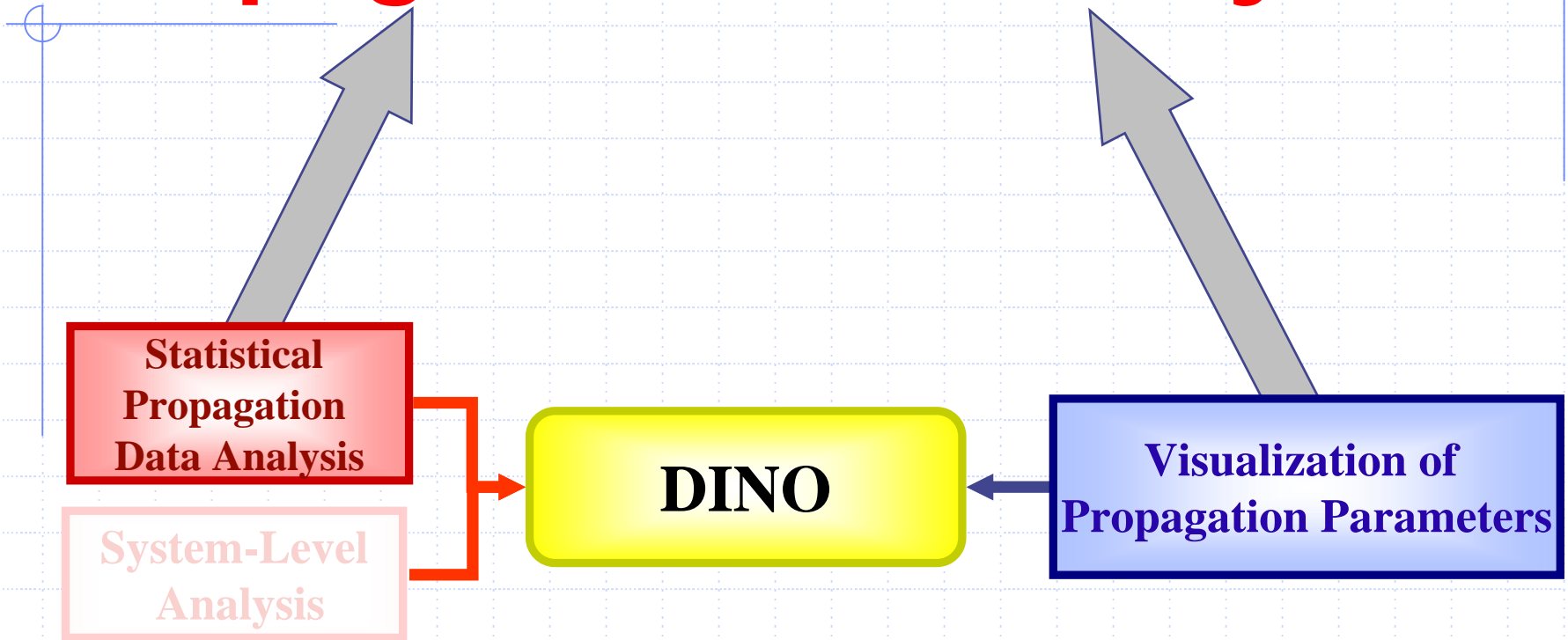


ANIMATION

System-Level Analysis Module



Utilization of DINO for Propagation Data Analysis

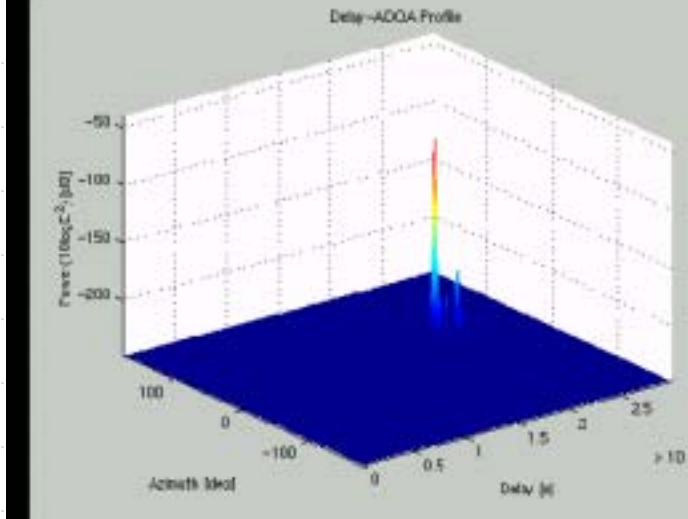
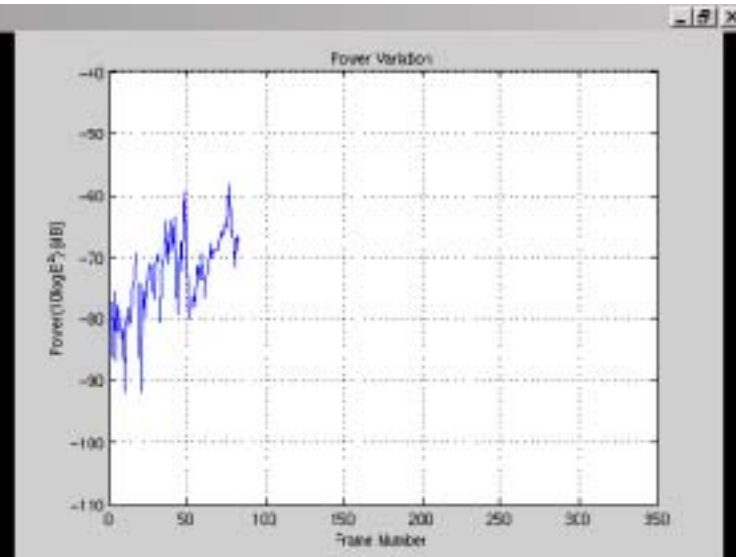
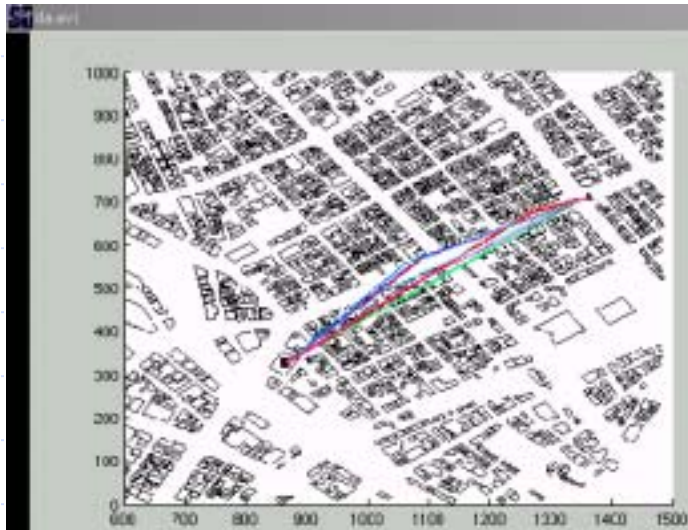


Utilization of DINO for **Propagation Data Analysis**

◆ Simulation I: Propagation Data Analysis

Environment	Macrocell / Nihonbashi, Tokyo
System	6D Unitary ESPRIT MIMO sounder 3 X 3 URA (Tx & Rx)
Frequency	3.35GHz
Transmitter Height (MS)	2m
Receiver Height (BS)	45m
Max. no. of reflections and diffractions	2

animation

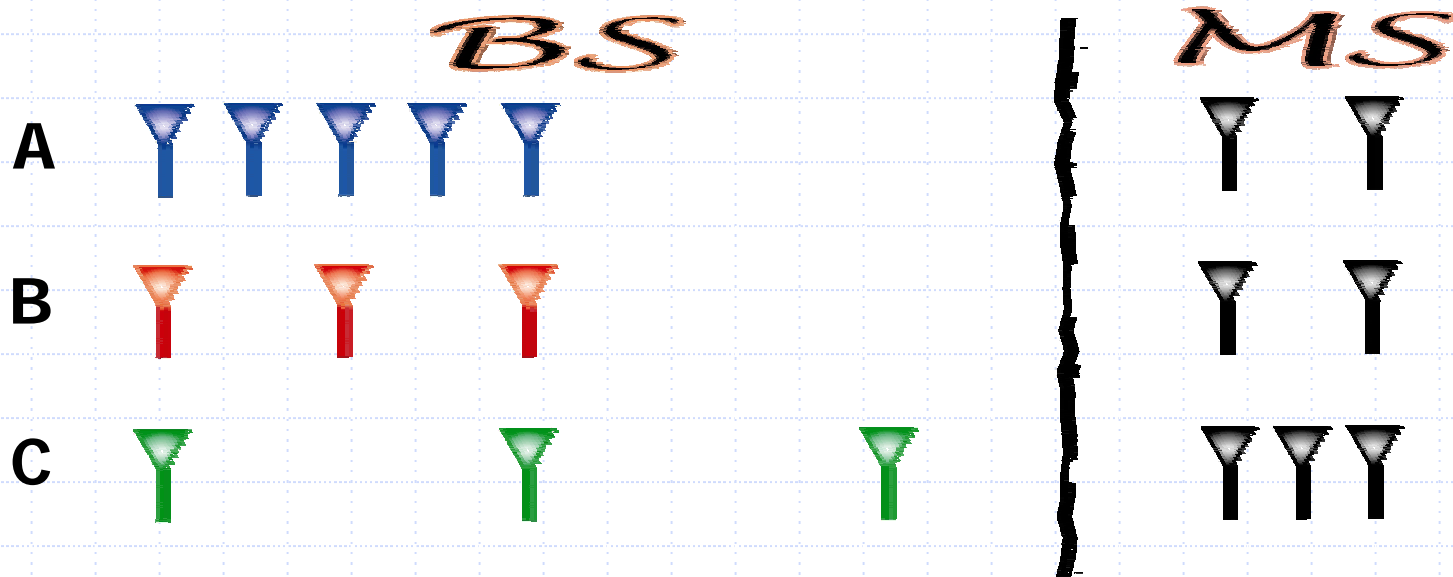


A screenshot of a software control window titled "MCBST da.avi". The window contains several control elements:

- Buttons: "Main Control", "Grid", "Stop", "2347.22", "81 / 199", "Rate", "A-B", "Repeat", "Window Control", "X", "Y", "But", "Width", "Height", "240", "Bsize".
- Sliders: A slider for "Rate" and a "Vol" control.
- Text: "Main Control 05, Grid 03, Stop, 2347.22", "Version 0.434", "©#DOOCUNE 1#line#フスケ#Nasa#nob", "Vol 100% Rate 100% Start 0 End 199".
- Buttons at the bottom: "Load", "Save", "Ac", "I", "H", "Op".

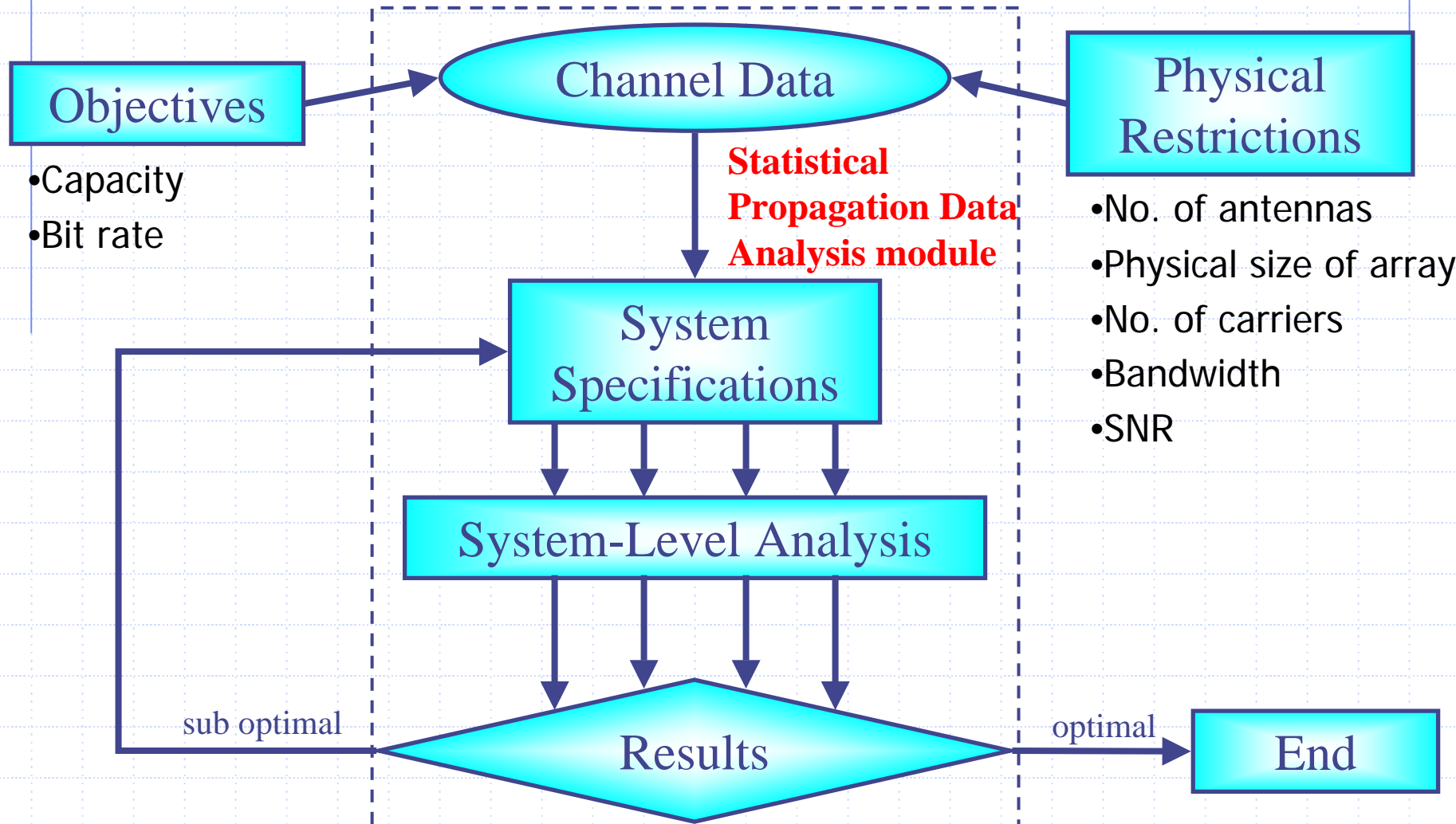
Utilization of DINO for **System Planning**

- ◆ Fundamental problems in system planning:
 - Number of antennas at BS and MS
 - Antenna spacing at BS and MS

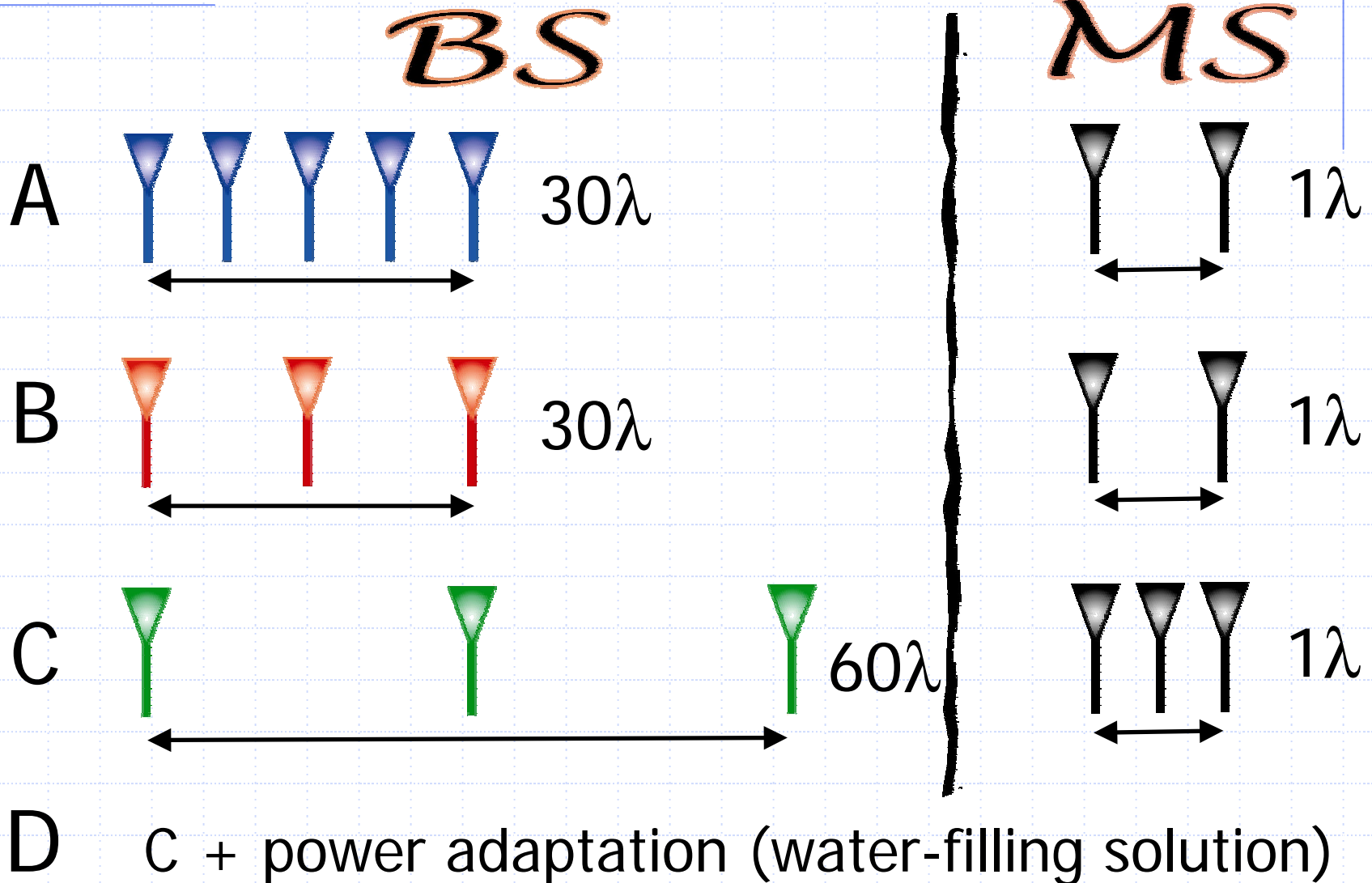


Utilization of DINO for System Planning

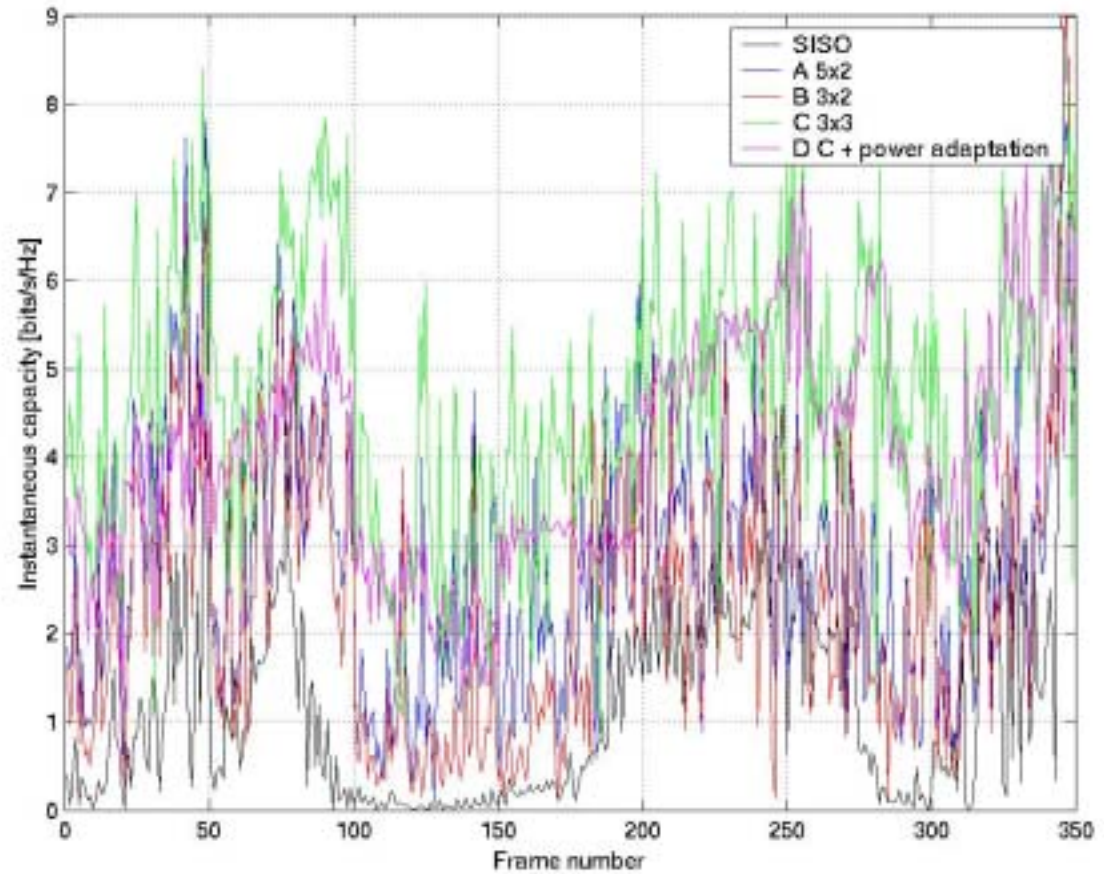
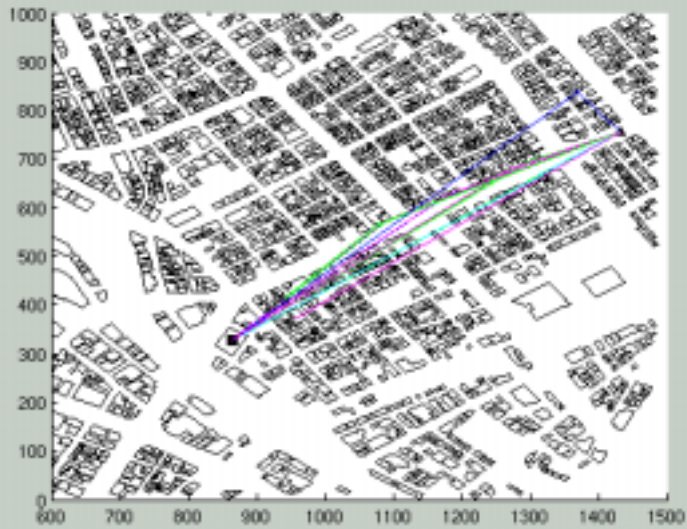
DINO



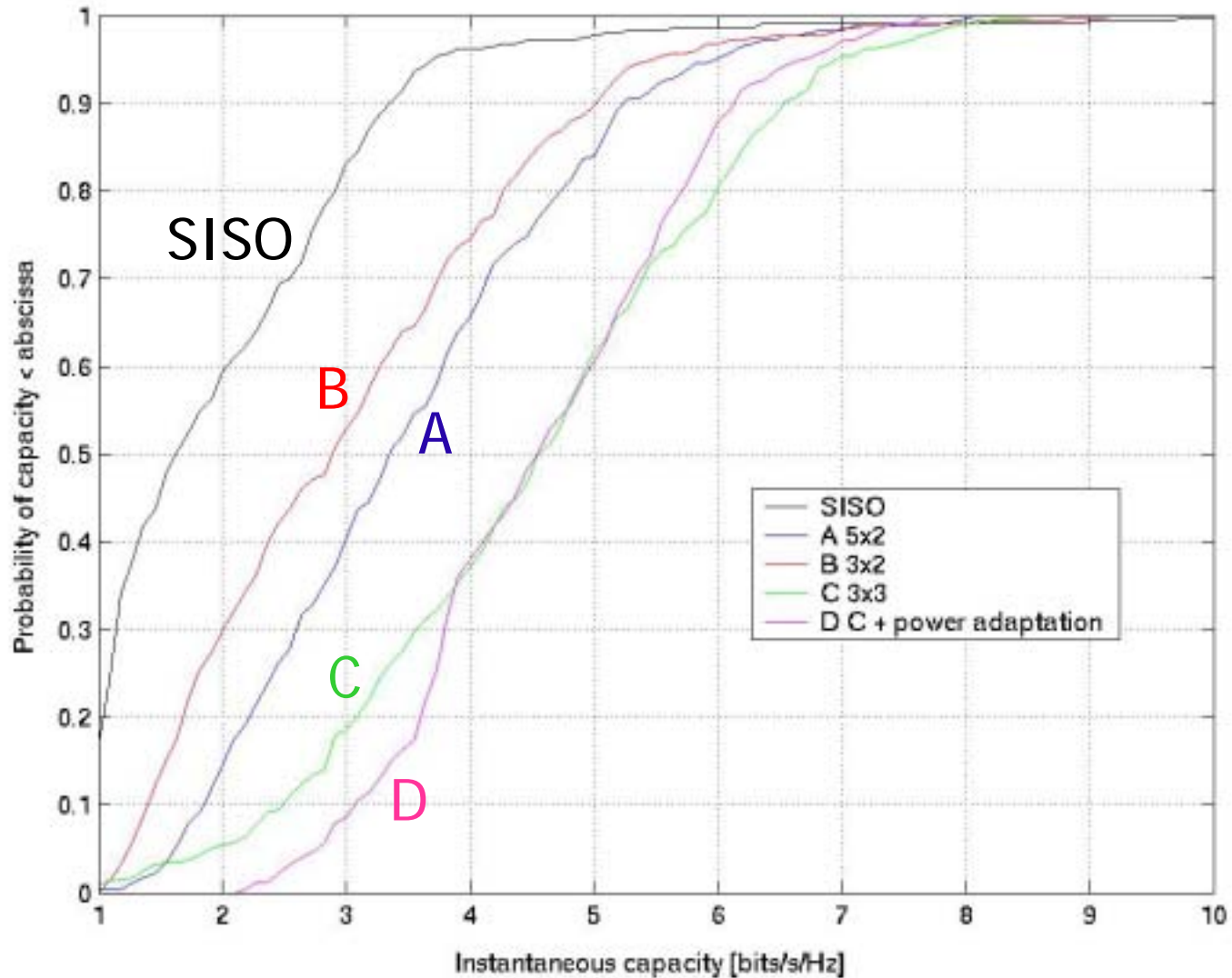
Utilization of DINO for System Planning



Capacity Variation



CDF for Capacity



Results

MIMO System	Base Station		Mobile Station		Bandwidth (100Mbps at 10% outage probability)
	No. of antennas	Antenna size	No. of antennas	Antenna size	
A	5	30λ	2	λ	0.8β MHz
B	3	30λ	2	λ	β MHz
C	3	60λ	3	λ	0.6β MHz
D	C + power adaptation				0.4β MHz

Conclusion

- ◆ A management flow and platform for multi-dimensional data analysis is proposed
- ◆ Through the simulations, the advantages derived from visualization in data analysis are confirmed
- ◆ DINO be used as a platform for
 - Propagation data analysis
 - MIMO system design and evaluation
- ◆ For future work,
 - MIMO channel model
 - Optimization of MIMO communication systems