Effectiveness study on inter-system signaling/messaging

IEEE 802.16 Presentation Submission Template (Rev. 9)

Document Number:

IEEE S802.16h-07/0xx

Date Submitted:

2007-09-07

Source:

Wu Xuyong
Huawei
Huawei Industry Base, Bantian, Shenzhen
Shenzhen, Guangdong, P. R. China 518129

Voice: +86-755-28976776
E-mail: wuxuyong@huawei.com

Venue:

802.16h-D2c

Base Contribution:

None.

Purpose:

Give priority on different approach on inter-system signaling/messaging approach on different scenario.

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Why we need inter-system signaling/messaging over the air

- Inter-system collaborative approaches enable better performance than non-collaborative approaches
- Get to know your neighbor is the first step and the ENABLER of *collaborative mechanism*
- For wireless systems, interference happen ONLY in the air

When we need inter-system signaling/messaging over the air

- When part of one system impact other system or was impacted by other system, i.e. *harmful interference* happen inter systems, the ***victim*** and only the ***victim*** will know the event.
- Only when the ***victim*** can identify the ***source***, the collaborative relationship can be build up.

So when *harmful interference* happened between collaboration ready systems, the interference signal need to carry distinct information of the ***interference source***.

Such distinct information should be easily used by the ***victim*** to find out the way to contact the ***source***.

Method of following simulation(1)

Assumptions:

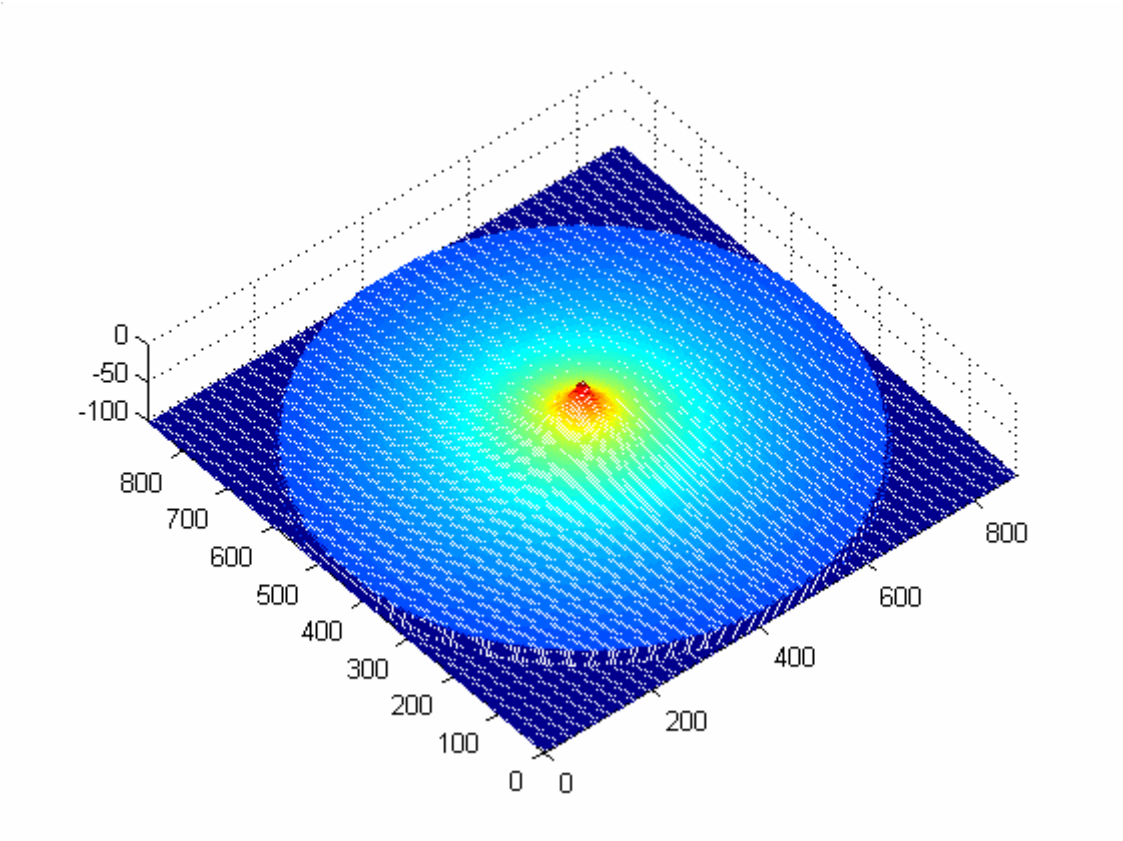
- NLOS Microcell Pass Loss Model[8]
- OFDMA QPSK1/2 requirement for messaging: SINR>5dB [1][2]
- Interference Margin: 2dB [8]
  - (2 dB interference margin allow -2.3dB INR need 79.4us CSI effective duration) [5][6]

Method of following simulation(2)

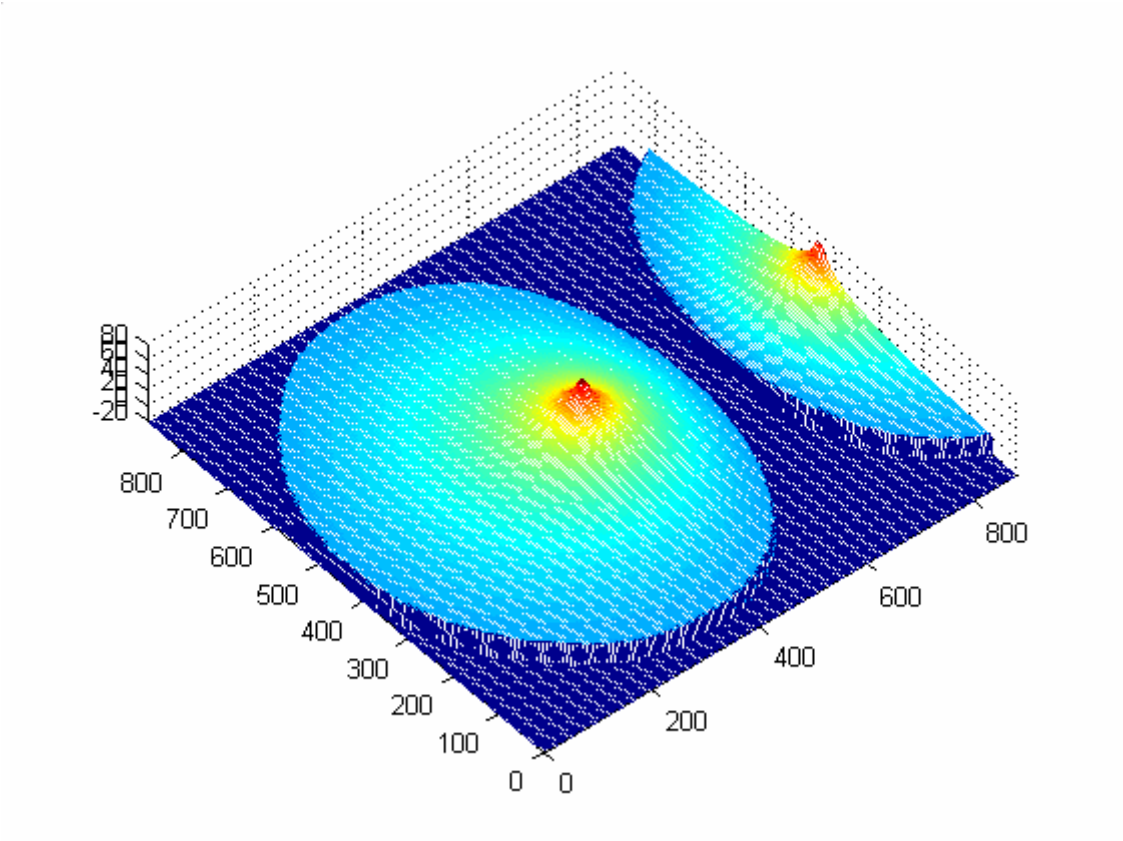
Steps in simulation:

- Set up BS1 and calculate the effective coverage area
- Set up BS2 nearby and calculate the effective coverage shrinkage (i.e. area with *harmful interference*)
- Calculate the area where the SS can receive messaging from BS2 within area with *harmful interference*
- Calculate the area where the SS can receive messaging from BS2 within area with *harmful interference*
- Change the distance between BS1/BS2 and recirculate

(1) Original Coverage of System1

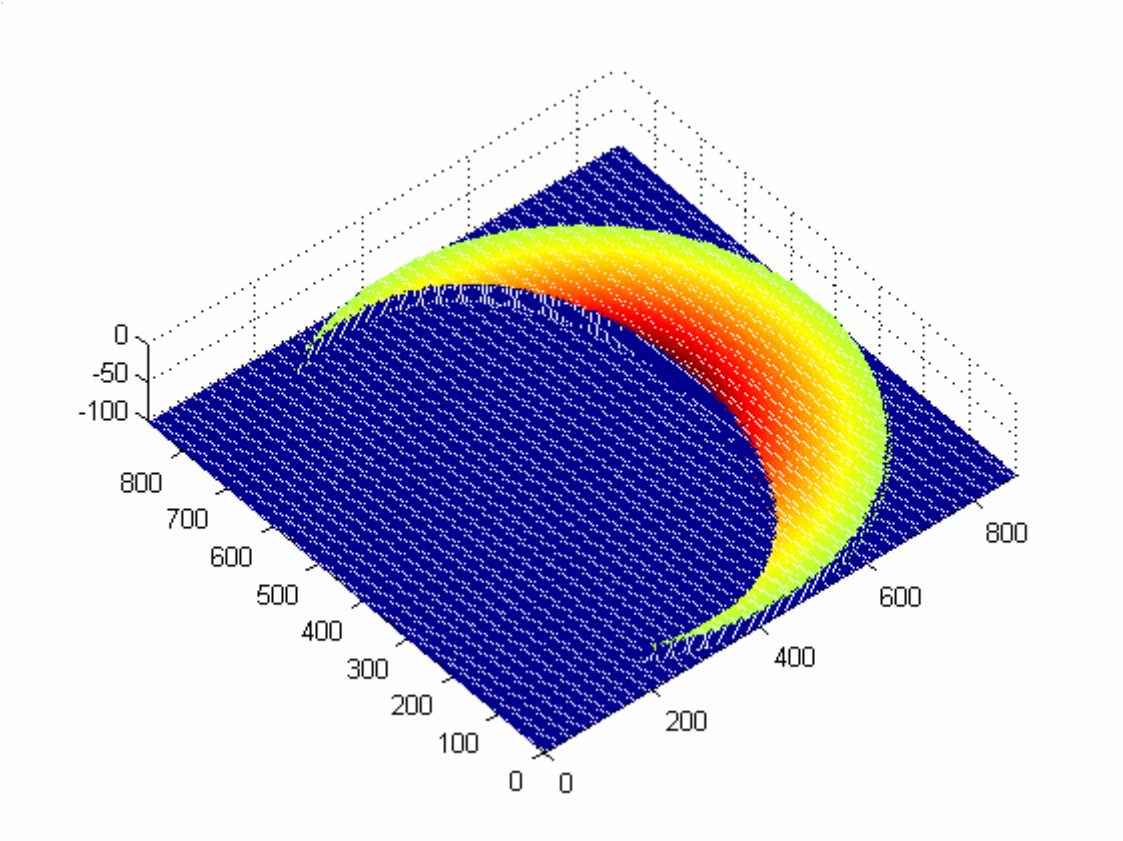


(2) Coverage after BS2 entering co-channel



(3) Shrunk part of BS1 Coverage

(*Area with harmful interference*)



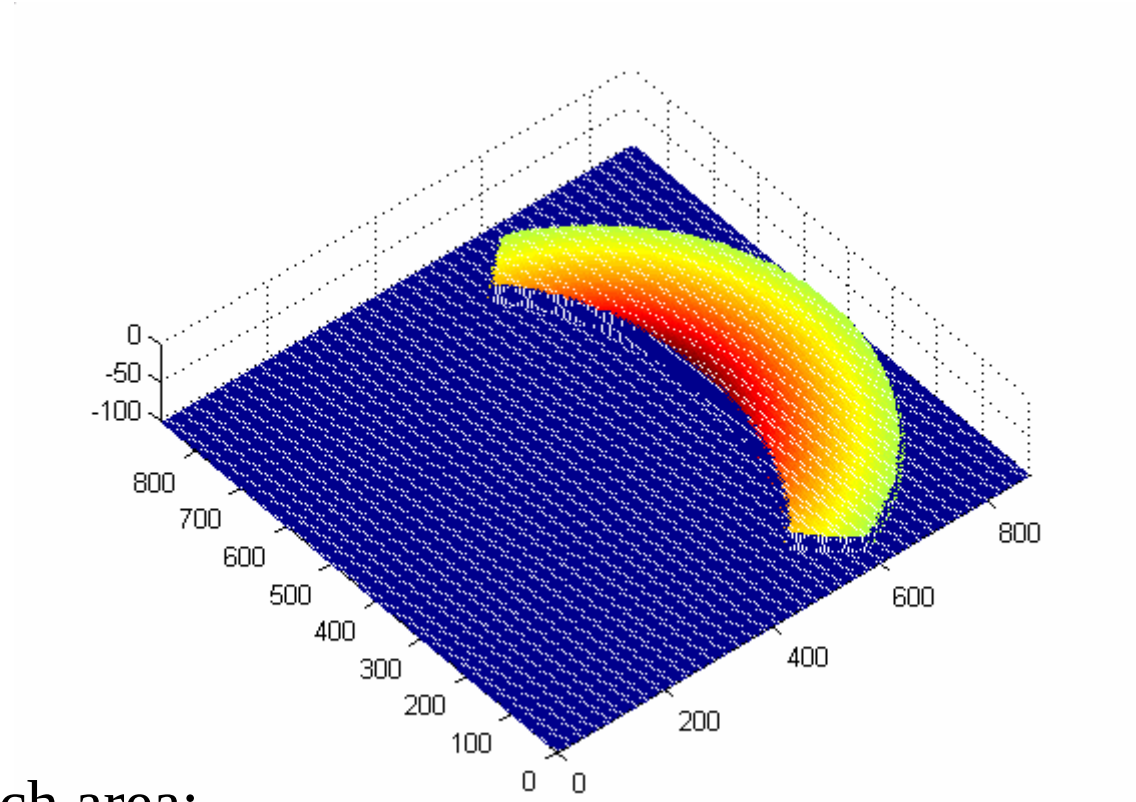
*within such area:

SS can communicate BS1 without interference from system2

While can not communicate BS1 with interference from system2

(4) Message effective part within shrunk part

(*Area where victim can decode BS2 message*)



*within such area:

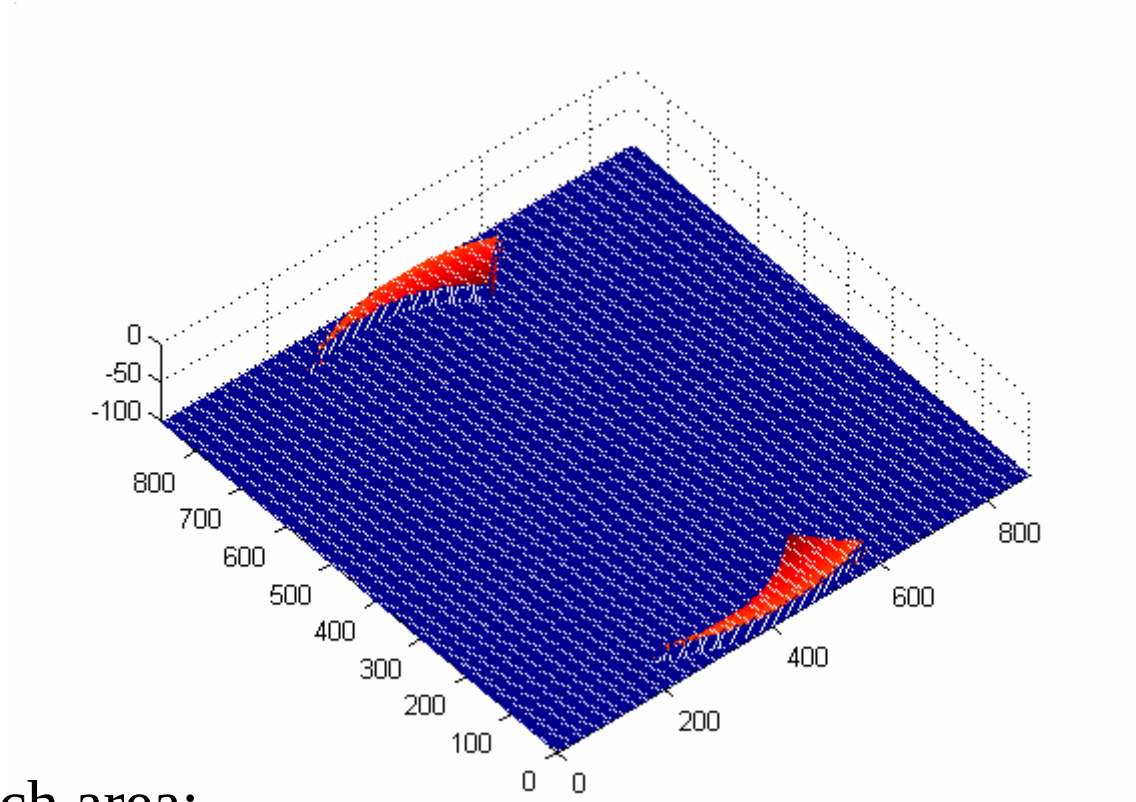
SS can communicate BS1 without interference from system2

While can not communicate BS1 with interference from system2

and can communicate BS2 using MAC message

(5) Message fault area within shrunk part

(*Area where victim can not decode BS2 message*)



*within such area:

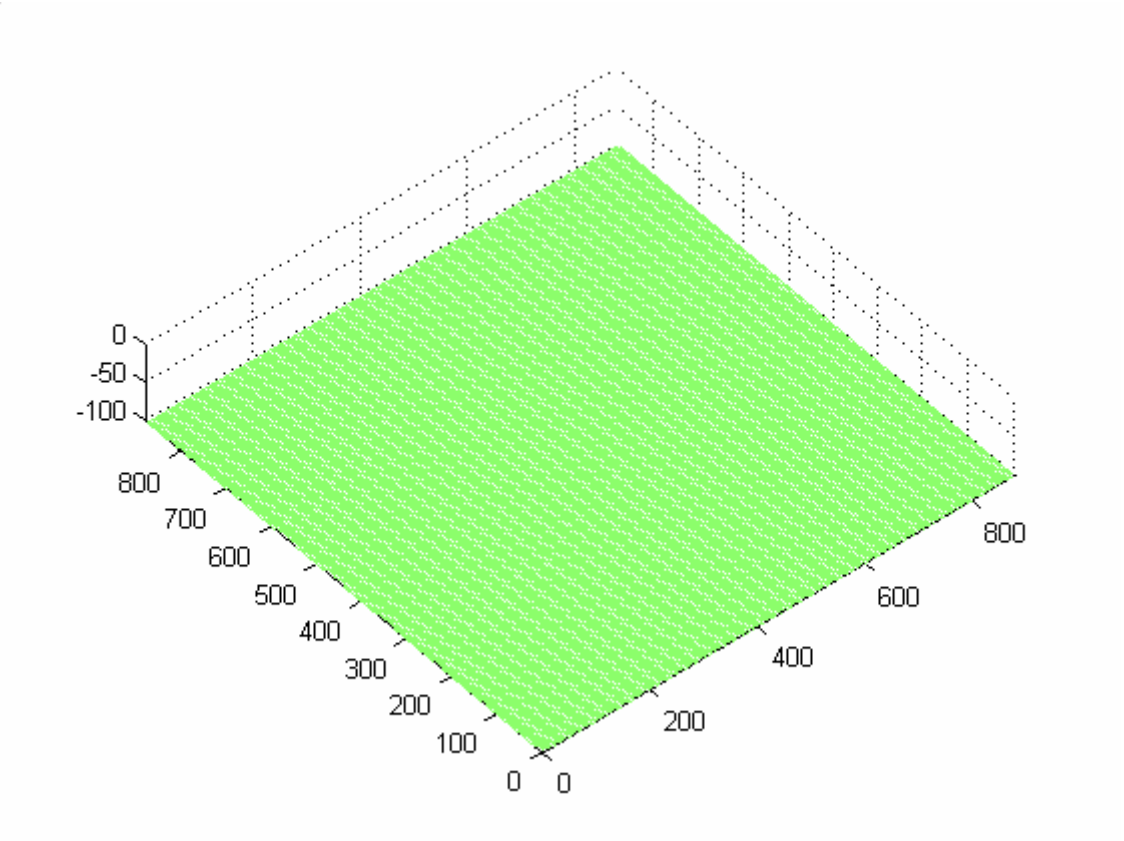
SS can communicate BS1 without interference from system2

While can not communicate BS1 with interference from system2

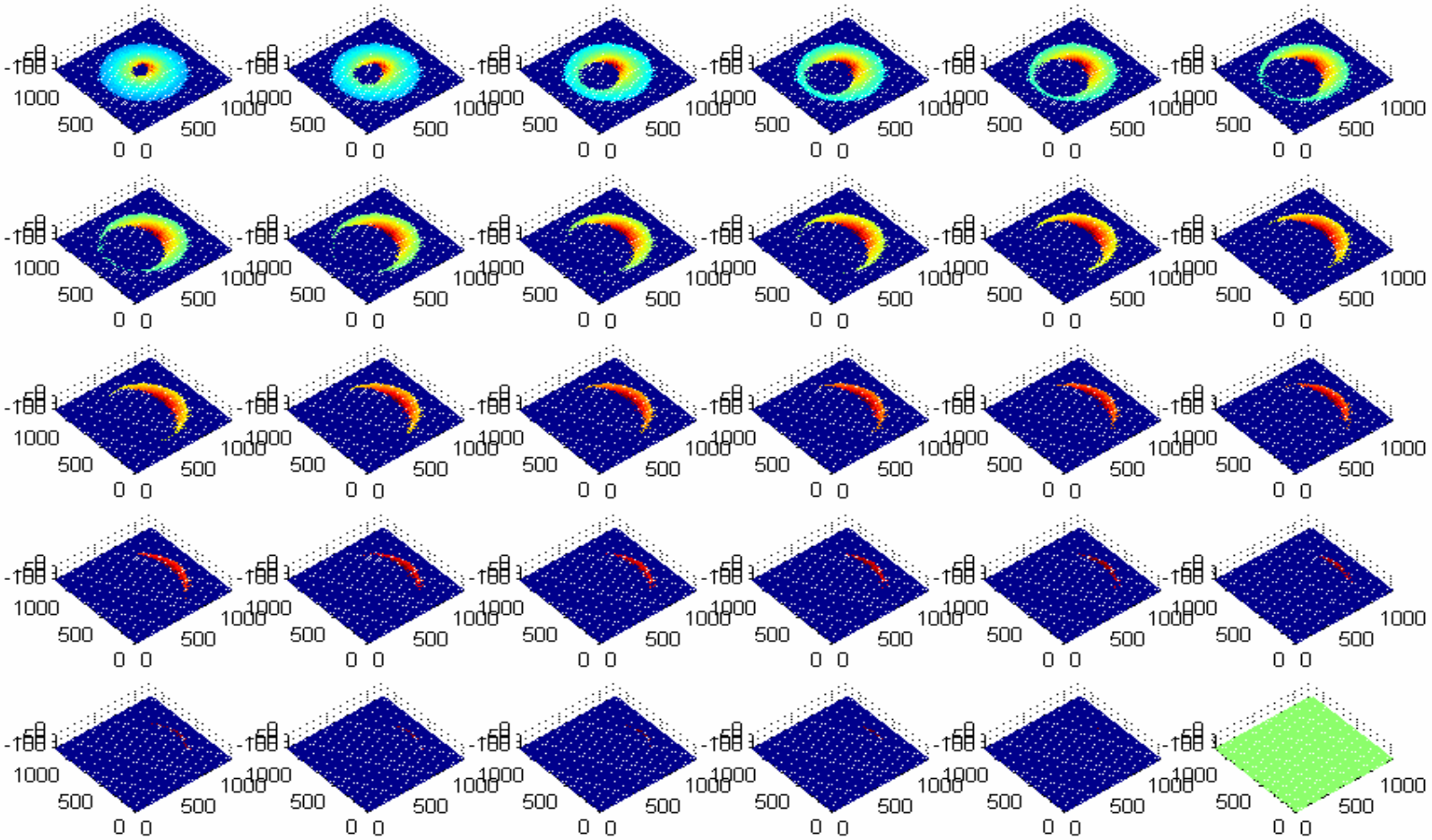
and can **NOT** communicate BS2 using MAC message

(6) No fault within victim area for signaling

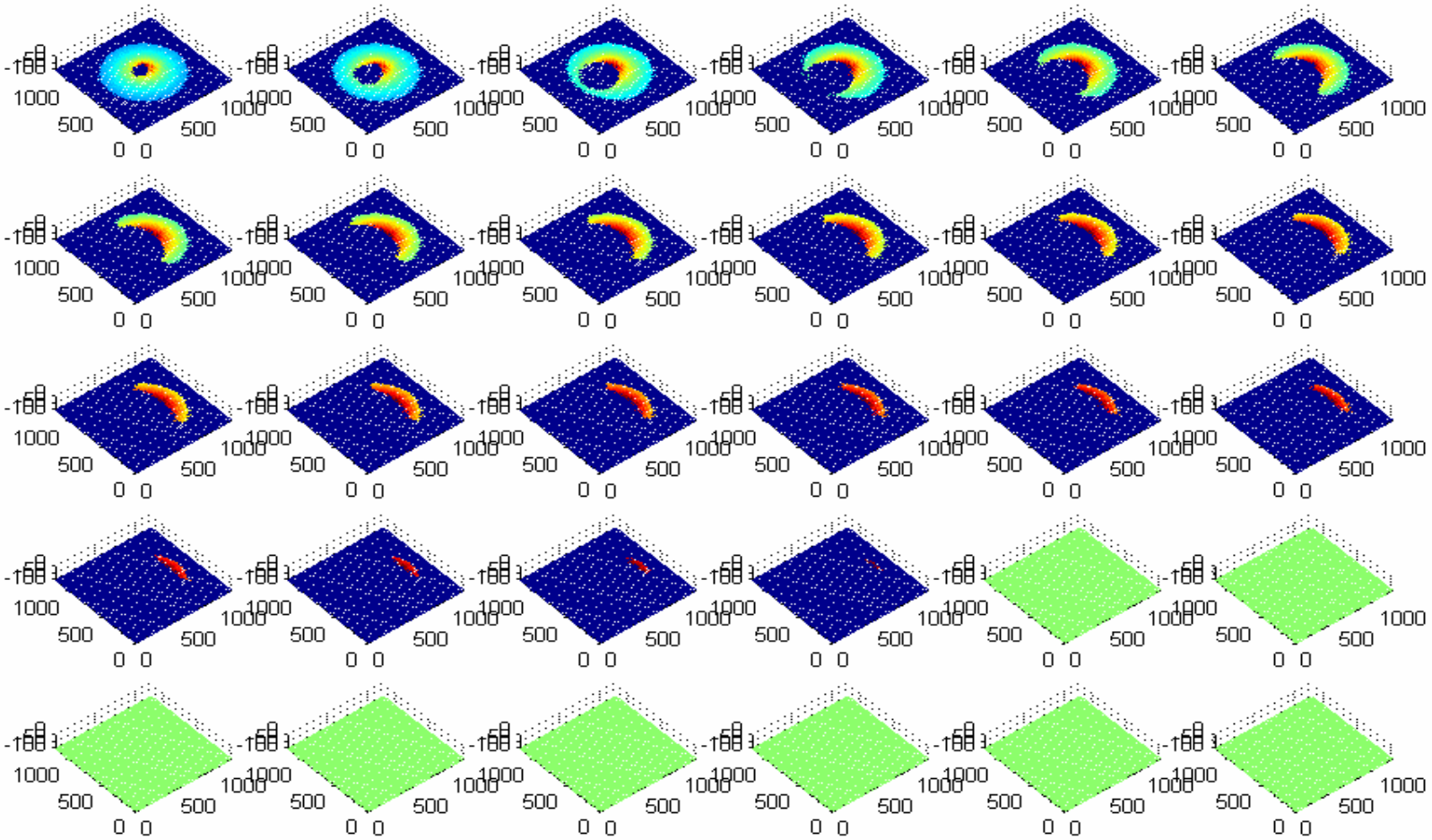
(*Victim always capable to decode signaling*)



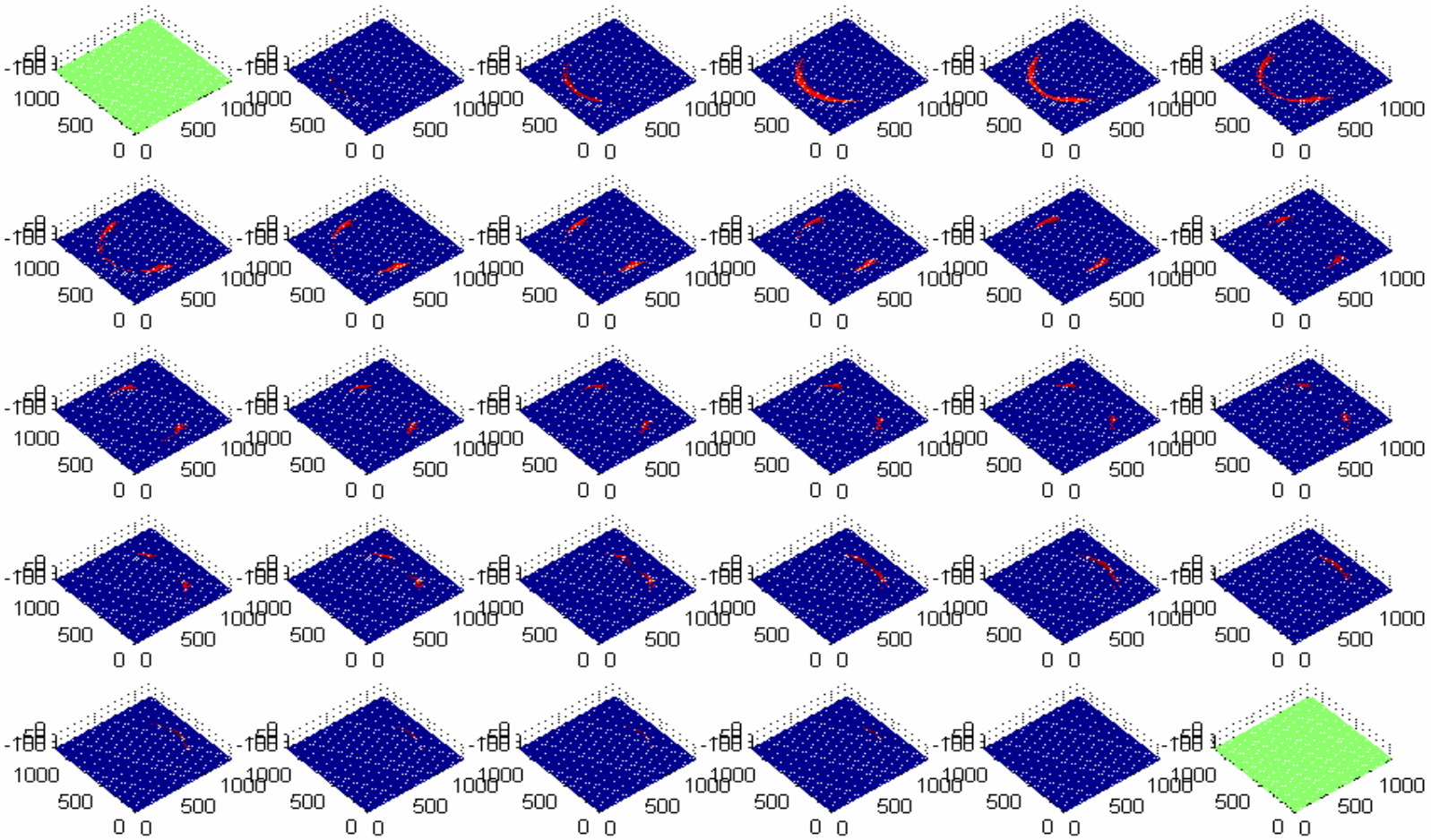
(7) Victim area varies with different distance between BSs



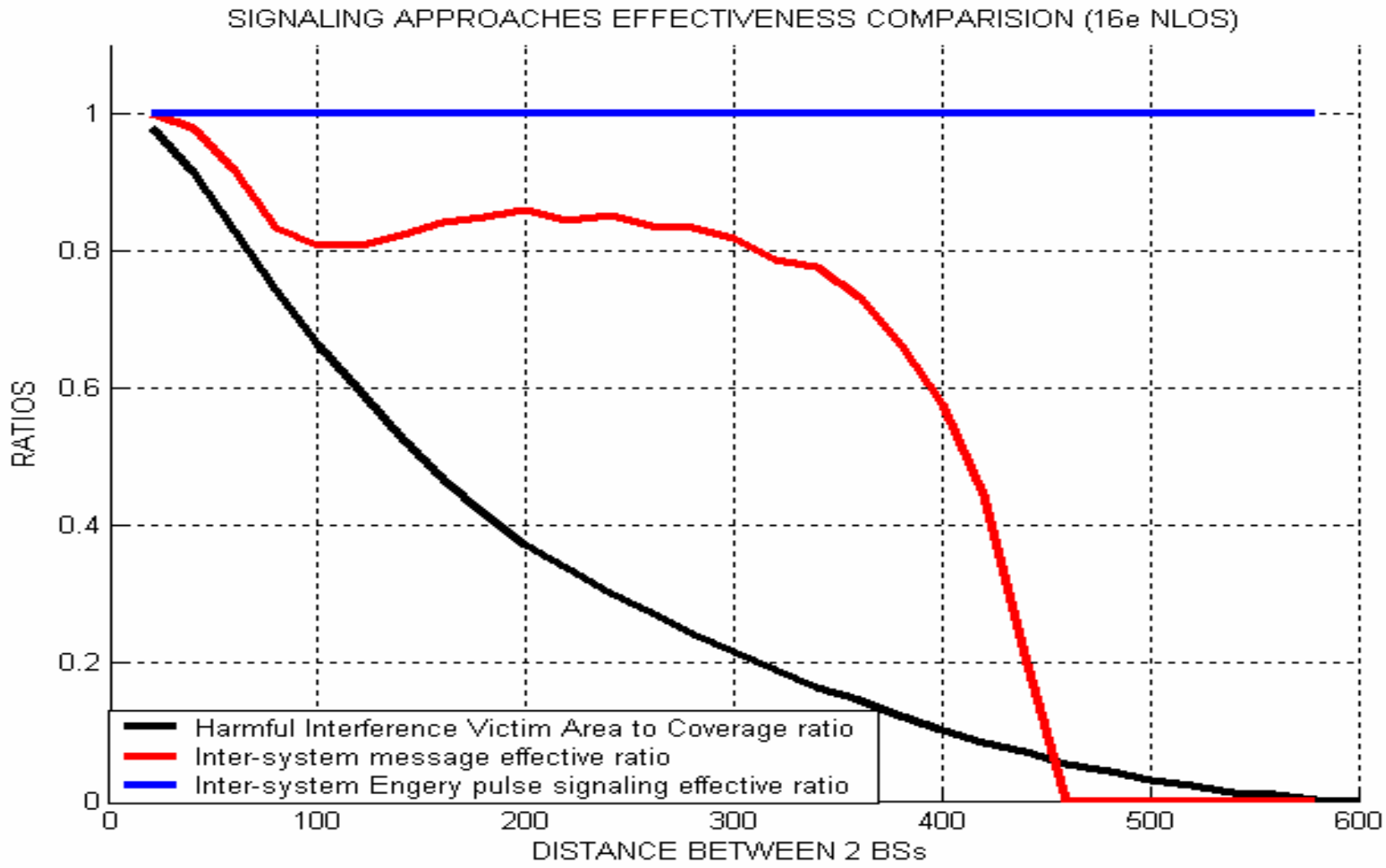
(8) Message effective portion within varying victim area



(9) Message fault portion within varying victim area



(10) Effective comparison between inter-system message and signaling



Summarization on the simulation

- We form a general interference situation between 2 co-channel 16e systems
- We study the effectiveness ratio of inter-system air transaction between the interference source BS and victim SS
- The simulation shows that energy pulse in time domain[3] is always effective, while the MAC messaging method is not reliable for such a usage.

Additional Comparison Information

Capability \ Methods	Inter-system MAC Messaging	Inter-system Energy Pulse Signaling
Effectiveness for necessary radio transaction between 16e systems (same PHY)[3]	**<100% (NOT always effective)**	**=100% (Always effective)**
***Feasibility for radio transaction between systems using different PHY[3]**	**NOT Support**	**SUPPORT**
*Speed of carrying information[3]	**High (may up to Mbps)**	**Low (<200bps)**

Conclusion and Further Work

- In order to discover the identification of the interference source when harmful interference happens, a reliable method is needed for the victim to get inter-system information over the air.
- For collaborative mechanism reliability, we shall use the *signaling* as the default approach of essential inter-system air transaction with requirement of reliability.
- For other transaction with not requirement of high reliability and with requirement of carrying timely mass information, we shall choose the MAC *messaging* using modulated data.

- TEXT consolidation for 16h draft is needed accordingly.

Reference

[1] IEEE 802.16e-2005

[2] IEEE 802.16-2004

[3] P80216h_D2c

[4] IEEE C802.16h-07/002 Backward Compatibility of CSI Mechanism (Wu Xuyong; 2007-01-07)

[5] IEEE 802.16h-06/082: Using energy pulses for interference identification between 802.16 systems. (Wu Xuyong 2006-08-08)

[6] Calculating the Sensitivity of an ASK Receiver (Larry Burgess Maxim /Dallas 2003-11-05)

[7] IEEE C802.16h-06/054 Discussion on implementing the energy pulse (Wu Xuyong 2006-07-10)

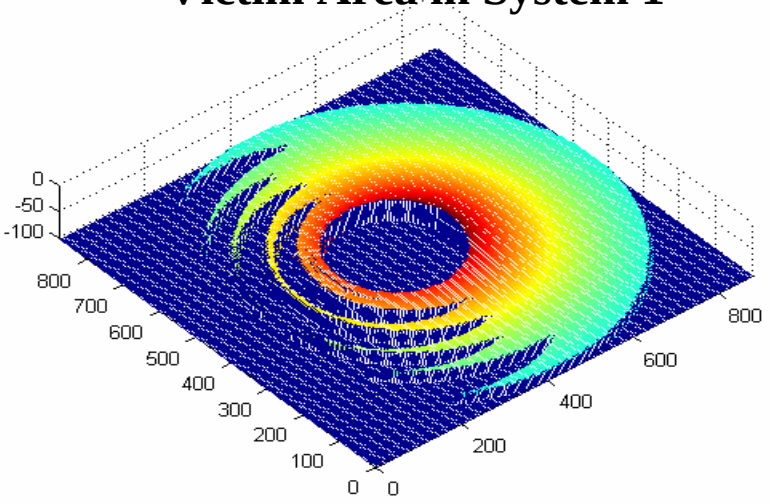
[8] Mobile WiMAX – Part I: A Technical Overview and Performance Evaluation (April, 2006)

[9] IEEE 802.19-07/0010r1Clear Channel Assessment Energy Detection (CCA-ED) in 802.11y (Steve Shellhammer 2007-05-29)

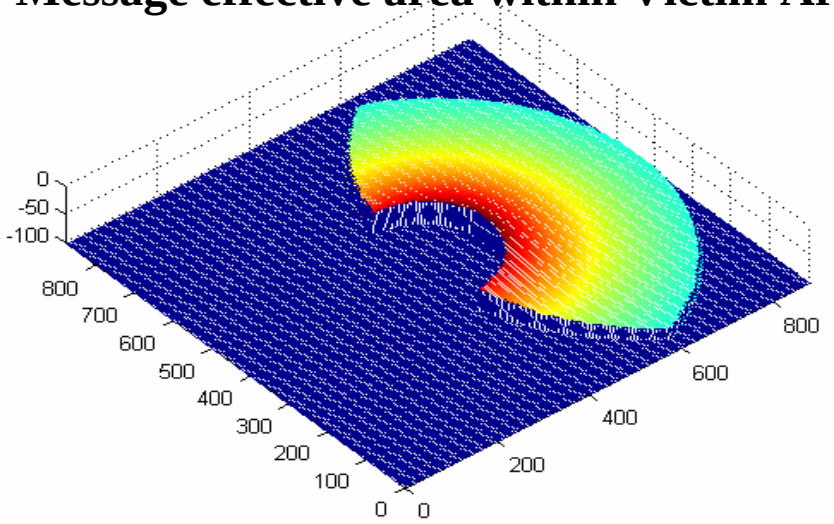
- **BACKUP**

Simulation for multiple MC system
（6 MCS）

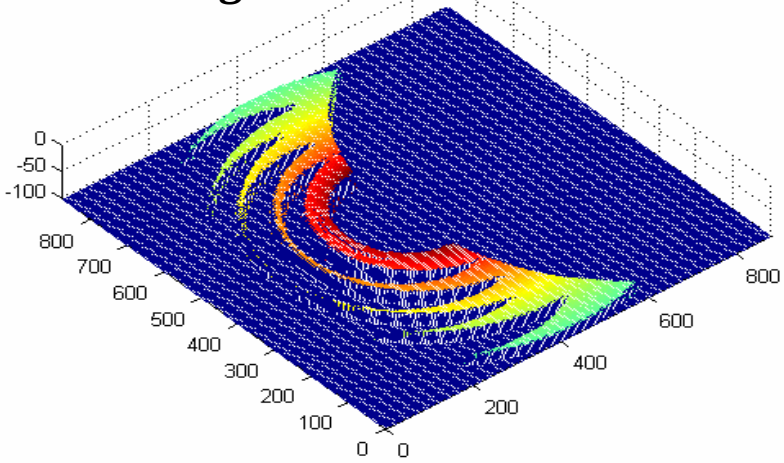
Victim Area in System 1



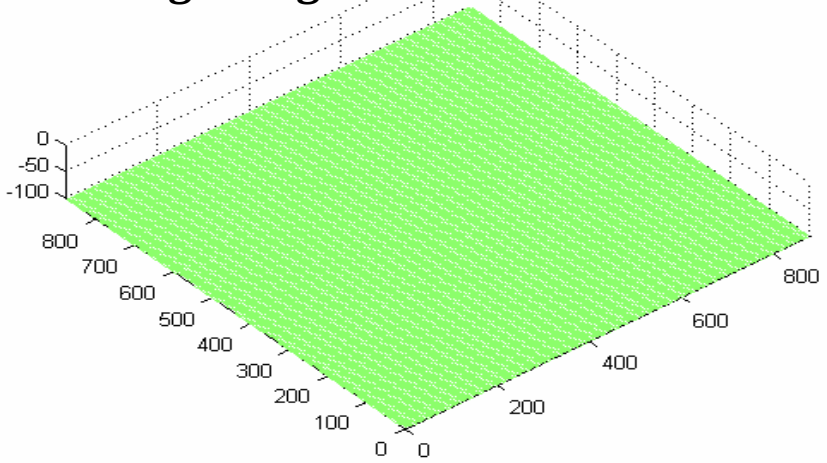
Message effective area within Victim Area



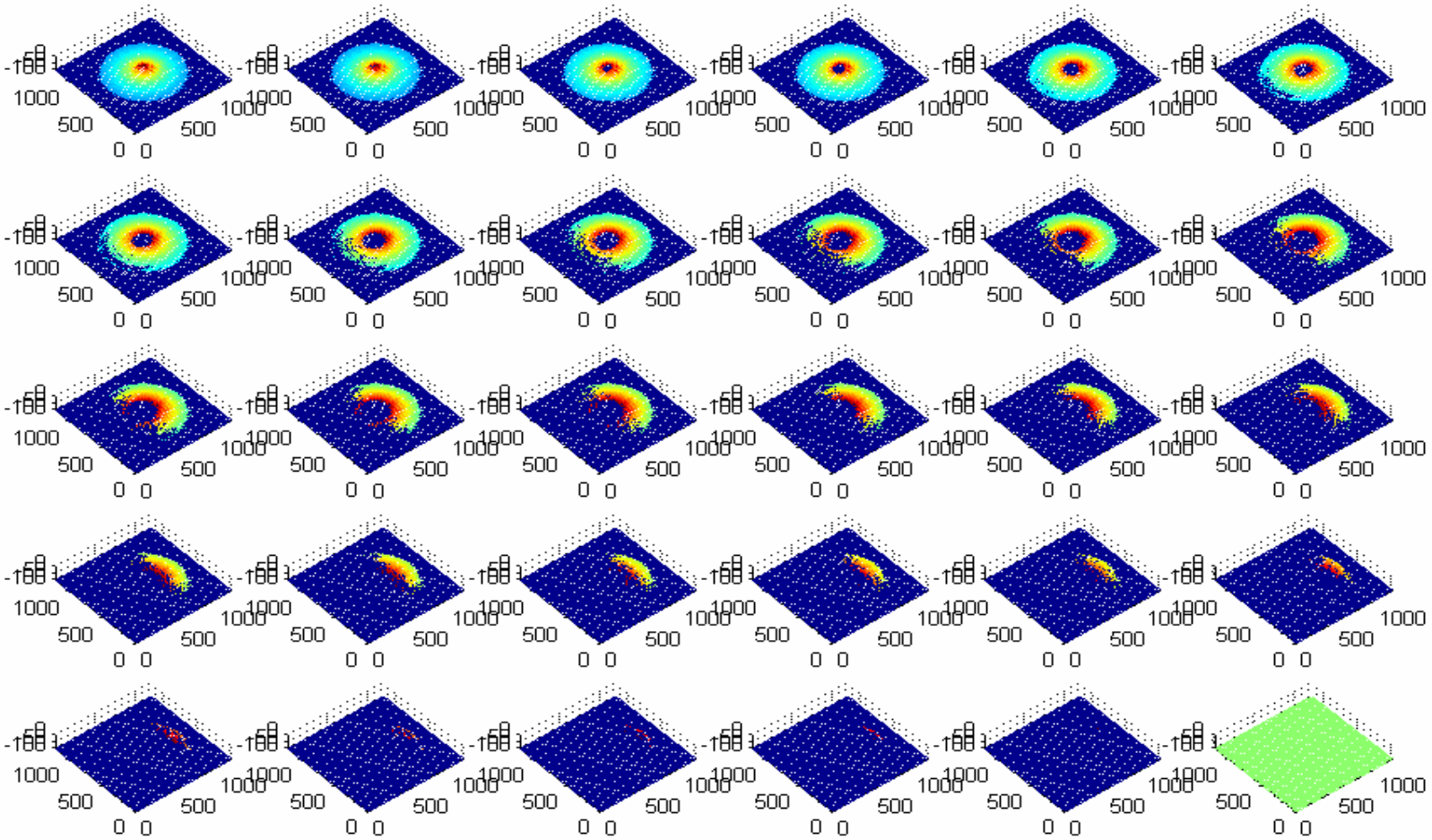
Message fault area within Victim Area



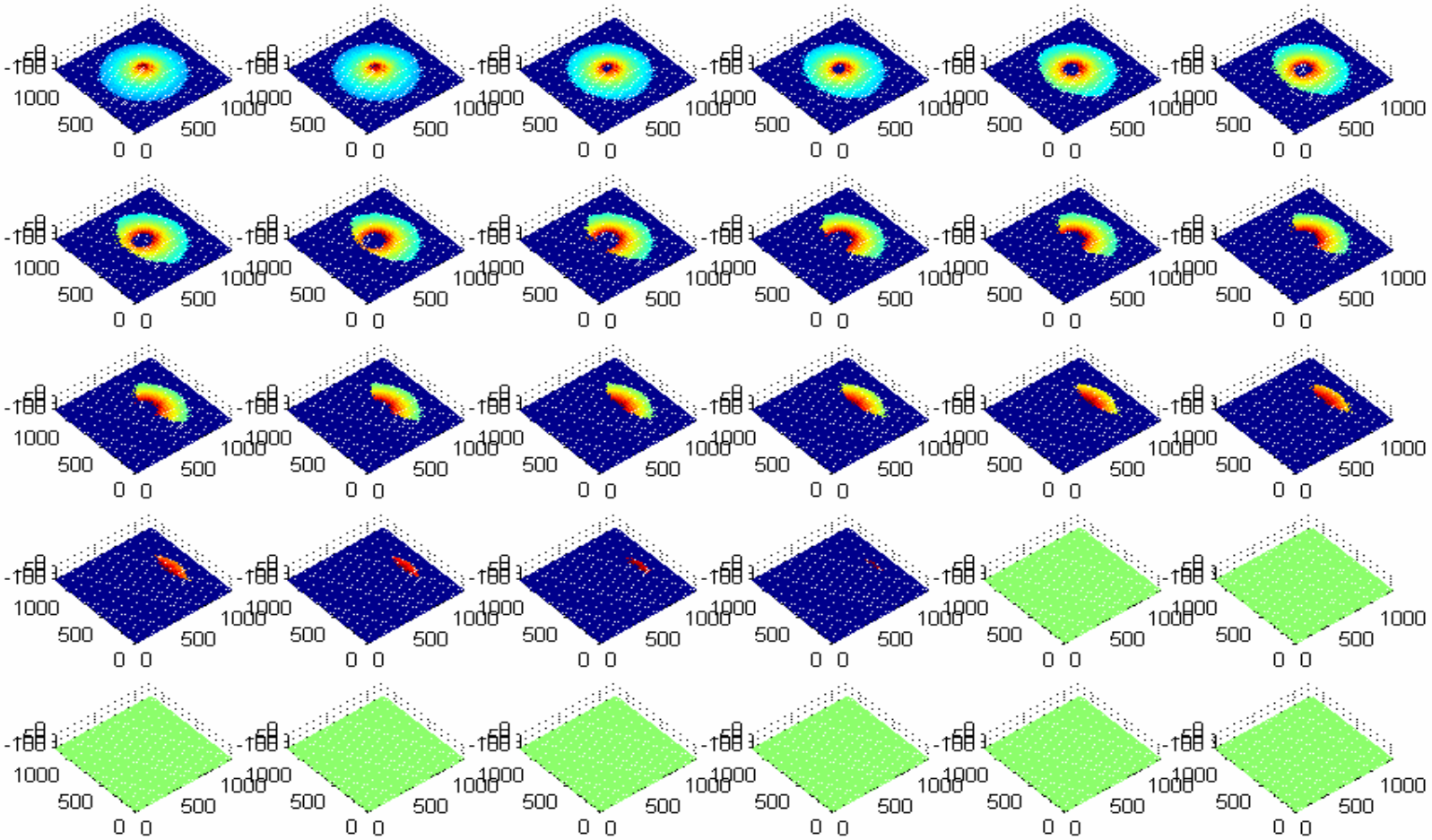
No signaling fault within Victim Area



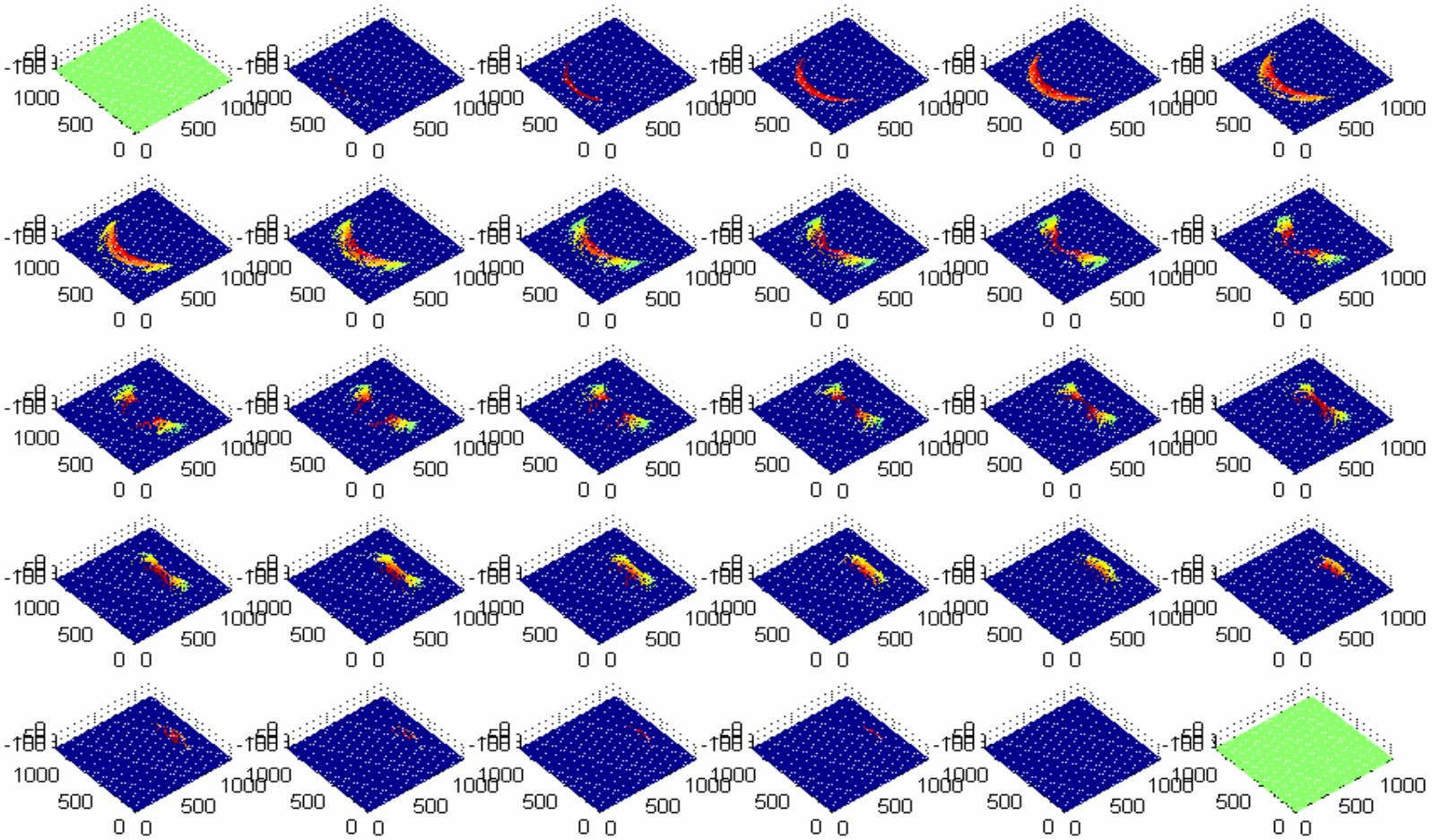
Victim area varies with different distance between BSs （6 MCS）



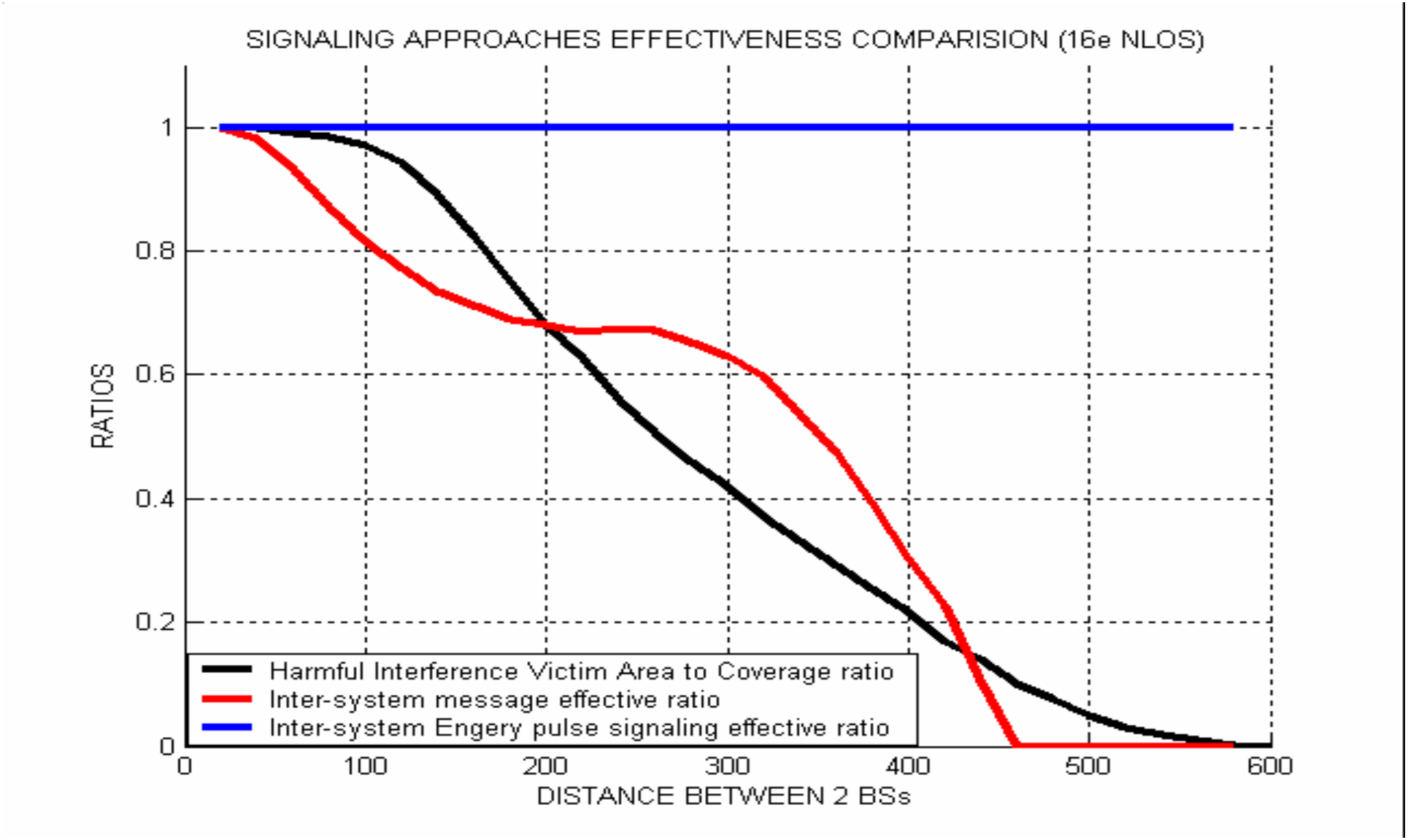
Message effective portion within varying victim area （6 MCS）



Message fault portion within varying victim area（6 MCS）



Effective comparison for Multiple MC （6 MCS）



Effective comparison for Multiple MC （6 MCS)
（& Lower Messaging SINR requirement to 3dB）