On the Good Locations for RS Deployment

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Purpose:
To clarify the propagation modeling requirements for different usage models and use cases

Introduction and Background

- For the usage scenario of in-cell coverage hole, the random dropped RS node deployed by the user is compared with the planned deployment by the operator
- We show the planned deployment can achieve the required coverage improvement by selecting good RS locations

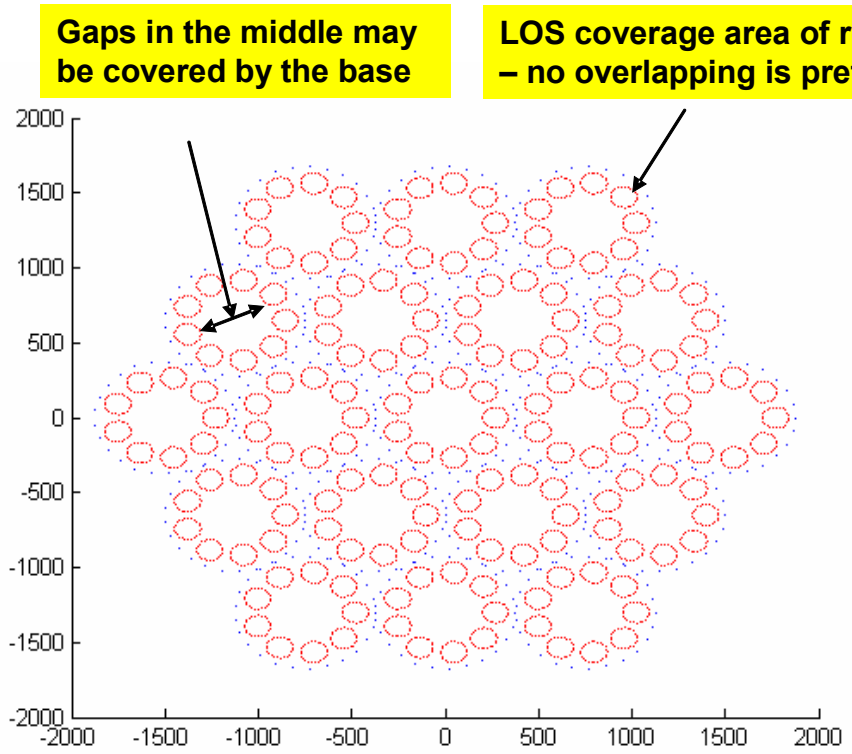
Relay Positioning for Optimum Coverage

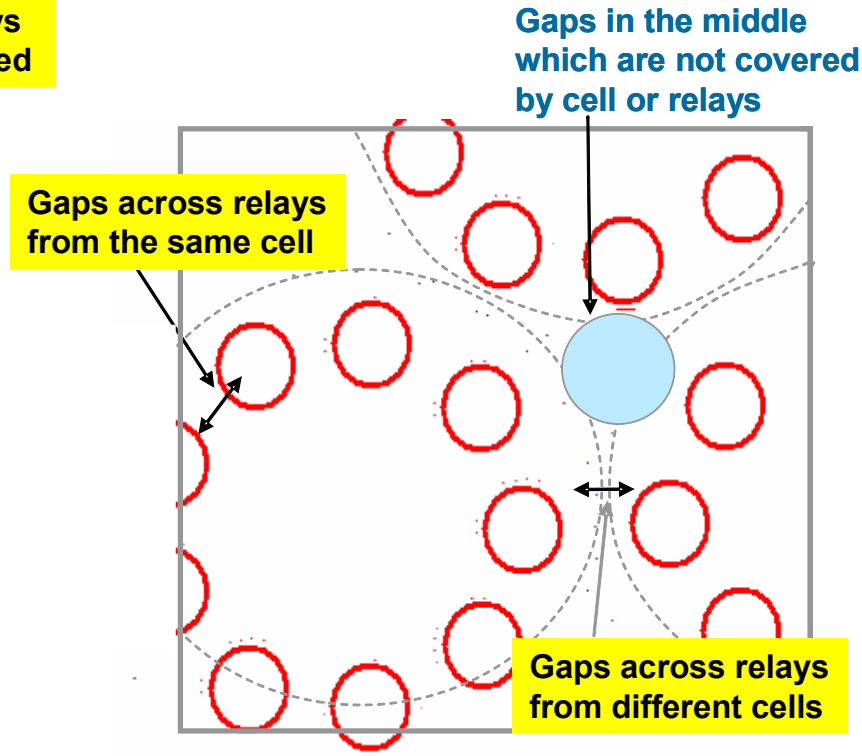
- **Relay path loss models have a LOS component and a NLOS component which can be used for effective isolation among relays in relay position planning.**
- **Relay height impacts LOS distance of the relay and relay path loss model.**
- **The following parameters may be carefully selected to provide best coverage**
  - Base to relay distance (d_r),
  - LOS distance (d_los) and NLOS distance (d_Nlos) of the relay (if this is controllable, i.e., by changing relay height)
  - Number of relays (Nr)
- **Objective is to find above numbers when cell-radius is given**
  - Minimize gaps which are not covered by the bases
  - Minimize overlapping of relay coverage area

Note: If number of relays are equal to number of sectors, relay can be placed either middle of the sector or in the sector boundary. The cell overlapping conditions are very close in either situation as some of the relays might be placed face to face in the base to base line and some will not. In this analysis the worst case scenario where relays and base centers are placed in a straight line

Example for Relay Location

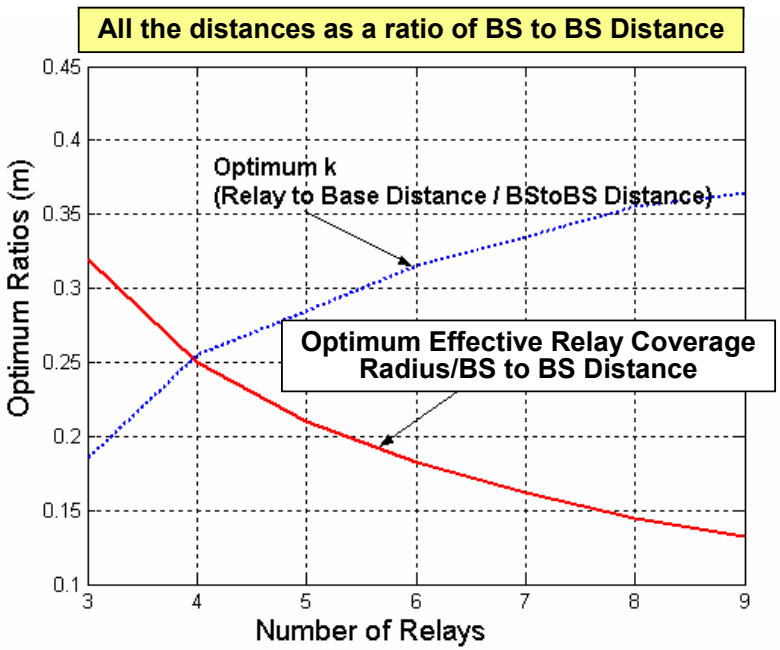
Example: d_relay = 275 m, r = 70 m; (B2B distance/2 = 375 m)



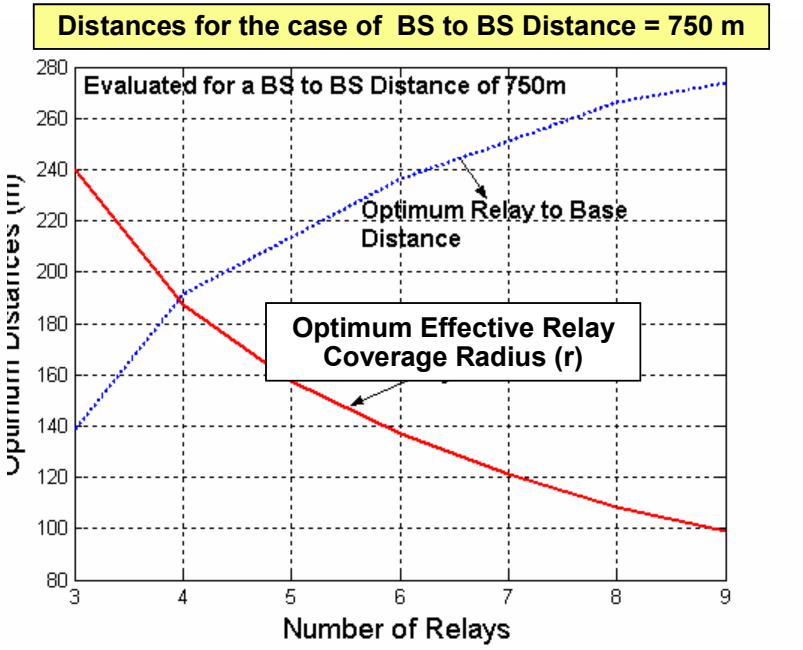


Increasing relay coverage (if controllable) would reduce the gaps in the relay boundaries. That can however cause excessive interference among relays, if LOS areas are overlapped.

Good RS Location



For 9 relays, optimum ratios are:
d/x = 0.365m, r/x = 0.133



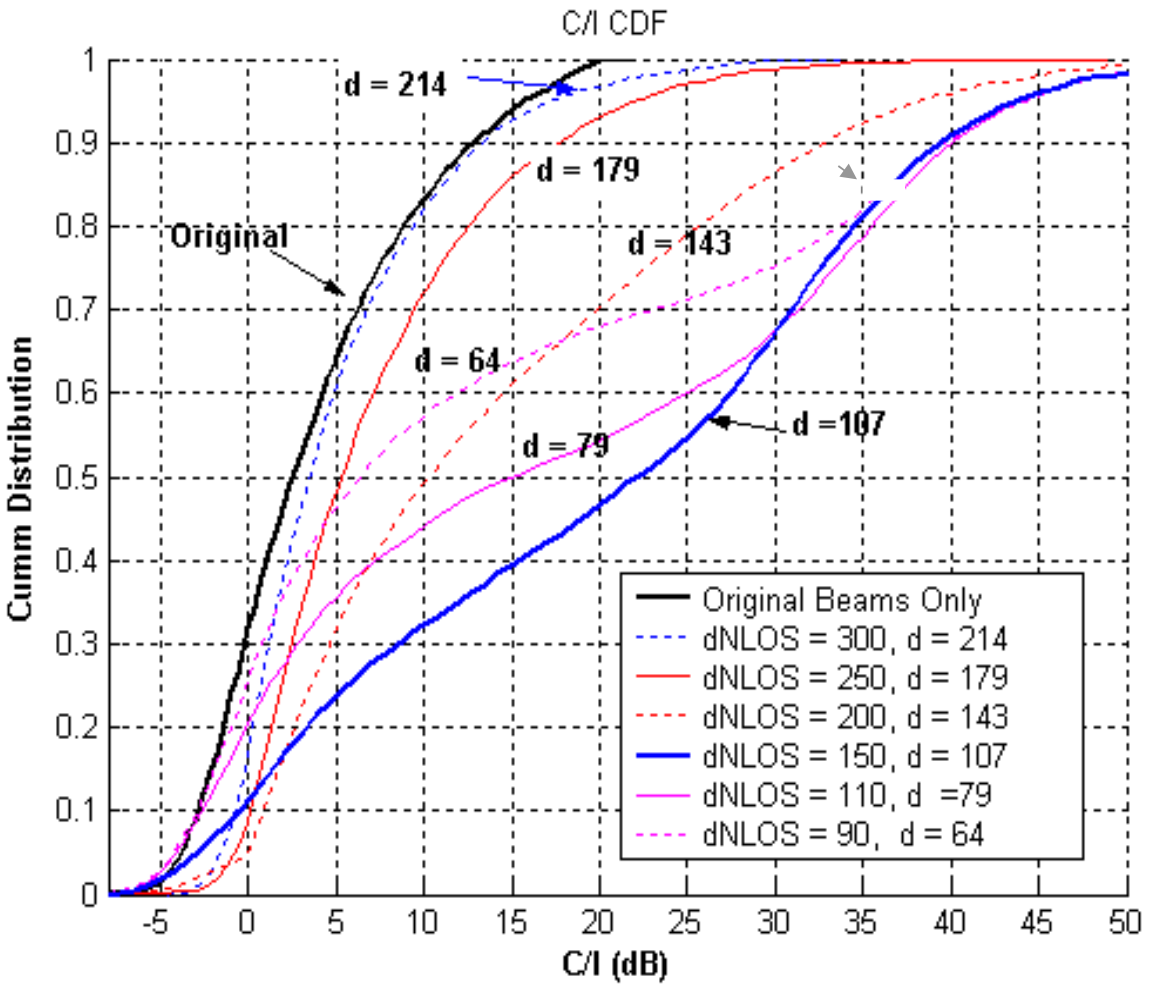
For 9 relays, optimum distances are:
d = 275 m, Effective Relay Coverage radius = 100m

- **Figures show optimum relay distance for a given number of relays (equally spaced) and the optimum effective coverage distance.**
- **If there is freedom to choose LOS/NLOS distances of relays (e.g. by choosing a proper relay height), they can be choose to obtain r closer to the optimum.**
- **Valuable as a guidance to decide relay height, # of relays and relay to base distance**
- **Simulation results show that the optimum relay to base distance is close to the values obtained from the above analysis**

Impact of Propagation Models/Parameters

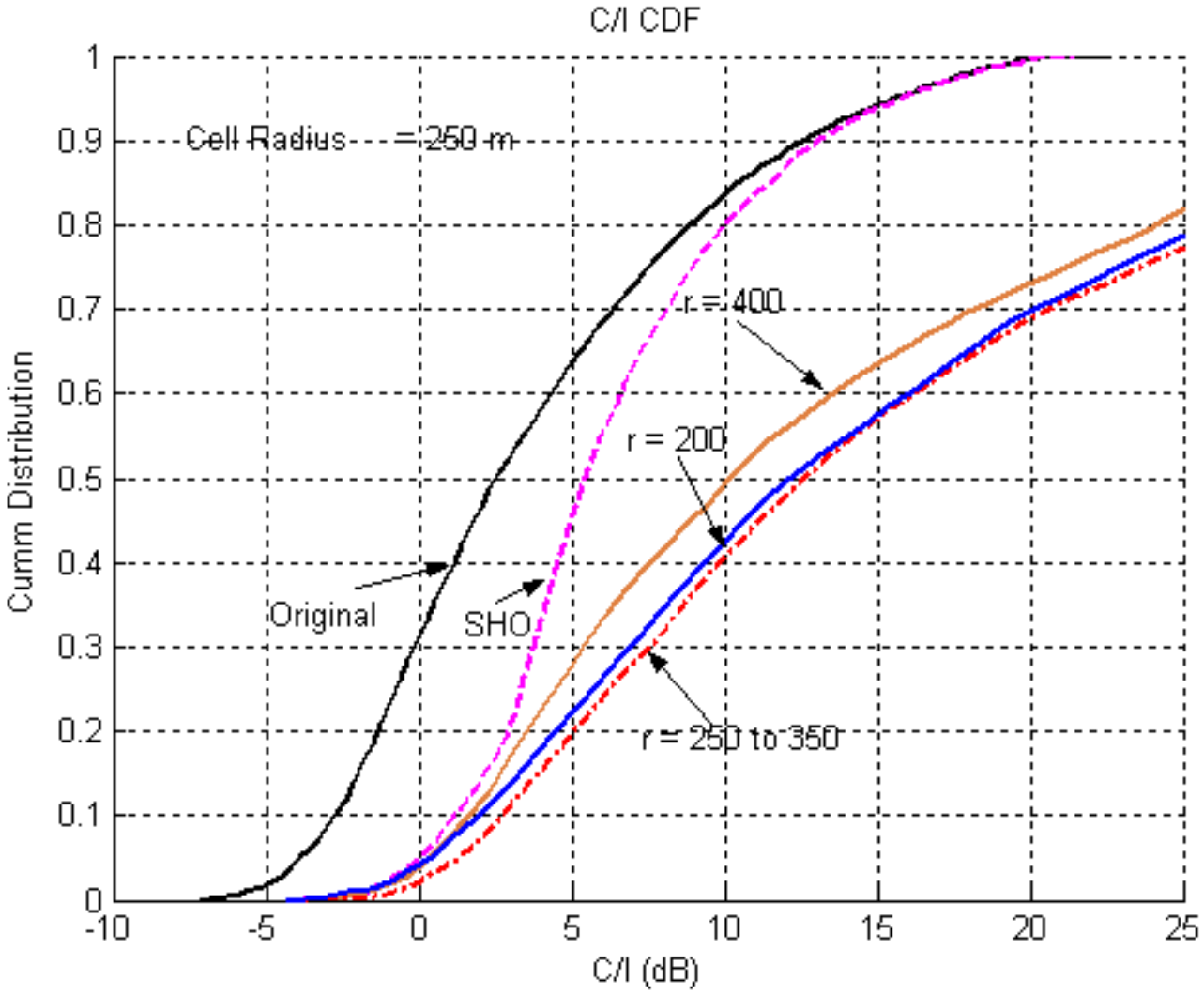
Impact of d1 and d2 with shadowing

CDF Curves for Relay only case



Coverage Impact from Relay to BS Distance

Relay in the cell boundary (Edge Relay)



Cell Radius = 250 m
BS to BS Distance = 750 m
Edge Relay
d1 = 50 m, d2 = 70 m

Best Relay Position
r = 250 to 350 m