教育部「5G行動寬頻人才培育跨校教學聯盟計畫」
5G行動網路協定與核網技術聯盟中心

課程: 5G系統層模擬技術

第四週：實驗一 WiSE系統層模擬器安裝與測試

國立中正大學
National Chung Cheng University

大綱

- 實驗目的
- 技術介紹
- 實驗方法與步驟
- 實驗紀錄與問題討論

OK! 實驗正確執行畫面

實驗目的

- 了解SLS原理
- 安裝Wise GUI
- 成功執行WiSE GUI及出現結果

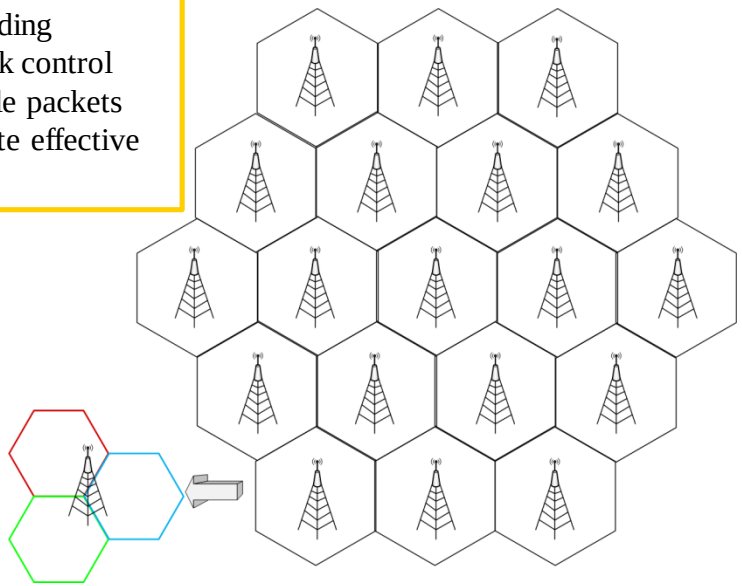
技術介紹(1/2)

- What is System Level Simulation (SLS)
  - System level simulators model the entire network, while link level simulations are used to model the link between the base and mobile stations. In order to predict the accurate performance of cellular network, a system level simulator, which includes the performance of the link between each base and mobile station, should be used, but this is computationally prohibitive. So to reduce the complexity caused by the system level simulato, PHY abstraction from the link level simulations to system level simulation can be used.

技術介紹(2/2)

- SLS with LLS

- Generate network topology
- Calculate macroscopic fading
- Generate small-scale fading
- Network control
- Schedule packets
- Calculate effective SINR



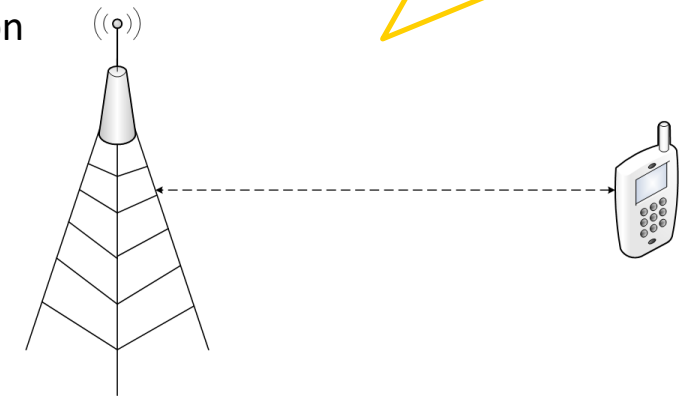
PHY abstraction

Effective SINR

BLER

Link level simulation (LLS)

- Map Effective SINR to BLER



	Macro cell	Small cell
Layout	Hexagonal grid, 3 sectors per site, case 1 Both 19 Macro sites and 7 Macro sites can be used. Companies should indicate whether 19 or 7 sites are used when presenting the results.	Clusters uniformly random within macro geographical area; small cells uniformly random dropping within cluster area
System bandwidth per carrier	10MHz	10MHz
Carrier frequency	2.0GHz	2.0GHz
Carrier number	1	1
Total BS TX power (Ptotal per carrier)	46dBm	30 dBm, Optional: 24dBm, 37dBm
Distance-dependent path loss	ITU UMa[referring to Table B.1.2.1-1 in TR36.814], with 3D distance between an eNB and a UE applied. Working assumption is that 3D distance is also used for: break point distance	ITU Umi [referring to Table B.1.2.1-1 in TR36.814] with 3D distance between an eNB and a UE applied Working assumption is that 3D distance is also used for: break point distance
Penetration	For outdoor UEs:0dB For indoor UEs: 20dB+0.5d_{in} (d_{in} : independent uniform random value between [0, min(25,d)] for each link)	For outdoor UEs:0dB For indoor UEs: 20dB+0.5d_{in} (d_{in} : independent uniform random value between [0, min(25,UE-to-eNB distance)] for each link)
Shadowing	ITU UMa according to Table A.1-1 of 36.819 Working assumption is that 3D distance is used for shadowing correlation distance	ITU UMi[referring to Table B.1.2.1-4 in TR36.814] Working assumption is that 3D distance is used for shadowing correlation distance
Antenna pattern	3D, referring to TR36.819	2D Omni-directional is baseline; directional antenna is not precluded
Antenna Height:	25m	10m
UE antenna Height	1.5m	
Antenna gain + connector loss	17 dBi	5 dBi
Antenna gain of UE	0 dBi	
Fast fading channel between eNB and UE	ITU UMa according to Table A.1-1 of 36.819	ITU Umi
Antenna configuration	2Tx2Rx in DL, Cross-polarized	
Number of clusters/buildings per macro cell geographical area	1, 2, optional of 4	
Number of small cells per cluster	4, 10	
Number of small cells per Macro cell	[4,10]*Number of clusters per macro cell geographical area	
Number of UEs	60 UEs per macro cell geographical area are recommended when FTP model 3 is used	
UE dropping	Baseline: 2/3 UEs randomly and uniformly dropped within the clusters, 1/3 UEs randomly and uniformly dropped throughout the macro geographical area. 20% UEs are outdoor and 80% UEs are indoor.	
Radius for small cell dropping in a cluster	50m	
Radius for UE dropping in a cluster	70m	
Minimum distance (2D distance)	Small cell-small cell: 20m Small cell-UE: 5m Macro –small cell cluster center: 105m Macro – UE : 35m cluster center-cluster center: 2*Radius for small cell dropping in a cluster	
Traffic model	FTP1 or FTP3	
UE receiver	MMSE-IRC as baseline	
UE noise figure	9dB	
UE speed	3km/h	
Cell selection criteria	Baseline: RSRP for intra-frequency and RSRQ for inter-frequency, with cell common bias if CRE is applied.	

實驗方法與步驟

- 完成程式安裝與執行
  - WiSE GUI

安裝 → 介面 → 執行 → 拓樸 → 結果

Wise GUI(1/14)

安裝 介面 執行 拓樸 結果

- WiSE GUI r15.0.0.1 setup.exe點開安裝即可

WiSE GUI r15.0.0.1 setup.exe	2018/10/4 上午 0...	應用程式	36,386 KB

- 安裝完後在對應的資料夾底下如右圖所示。
- 執行檔為WiSE_GUI.exe

名稱	修改日期	類型	大小
Examples	2019/7/26 下午 0...	檔案資料夾	
Languages	2019/7/26 下午 0...	檔案資料夾	
Link	2019/7/26 下午 0...	檔案資料夾	
eee.txt	2019/7/29 下午 0...	文字文件	4 KB
hasp_rt.exe	2016/9/7 下午 02...	應用程式	1,403 KB
hasp_windows_111410.dll	2017/10/31 下午 ...	應用程式擴充	4,060 KB
hasp_windows_x64_111410.dll	2017/9/14 下午 0...	應用程式擴充	4,577 KB
haspdnert.dll	2015/7/20 上午 1...	應用程式擴充	589 KB
haspdnert_x64.dll	2015/7/20 上午 1...	應用程式擴充	323 KB
HASPUserSetup.exe	2017/7/14 下午 0...	應用程式	19,354 KB
haspvlib_111410.dll	2017/10/31 下午 ...	應用程式擴充	732 KB
temporary	2018/10/3 下午 0...	檔案	1 KB
unins000.dat	2019/7/26 下午 0...	DAT 檔案	6 KB
unins000.exe	2019/7/26 下午 0...	應用程式	709 KB
WiSE GUI r15.0.0.1 Manual.pdf	2018/10/4 上午 0...	Adobe Acrobat ...	1,164 KB
WiSE_GUI.exe	2018/10/4 上午 0...	應用程式	649 KB

Wise GUI(2/14)

安裝 介面 執行 拓樸 結果

- 打開後畫面如下圖
  - 可在Language調整語言(Chinene中文、English英文)

Wise GUI(3/14)

安裝 介面 **執行** 拓樸 結果

- 打開WiSE GUI(WiSE_GUI.exe)然後選擇**設定**

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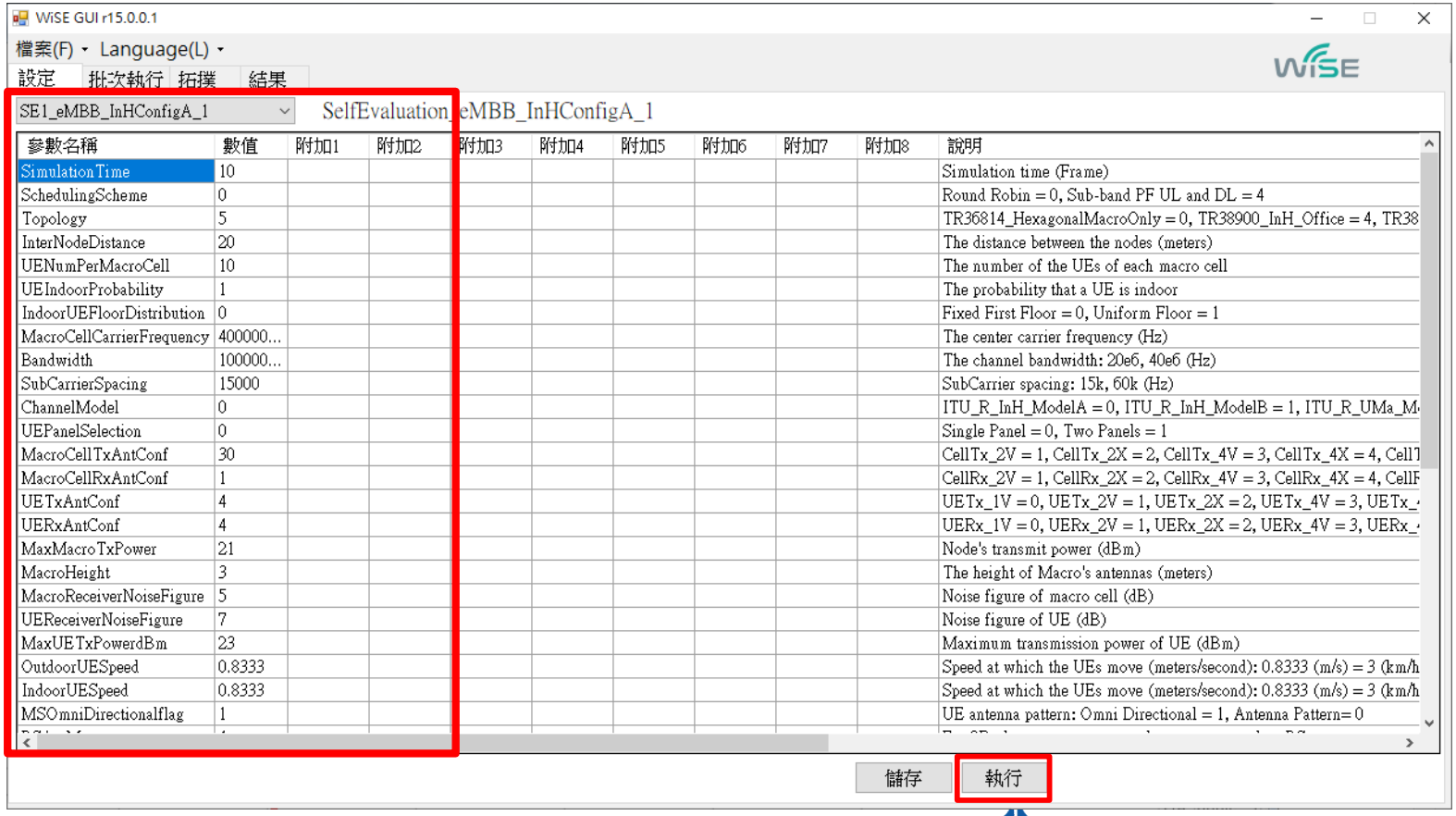
Wise GUI(4/14)

- 從下拉式選單選擇一個模擬場景

Wise GUI(5/14)

- 選擇完場景後(可在紅框內調整參數)，然後點選執行

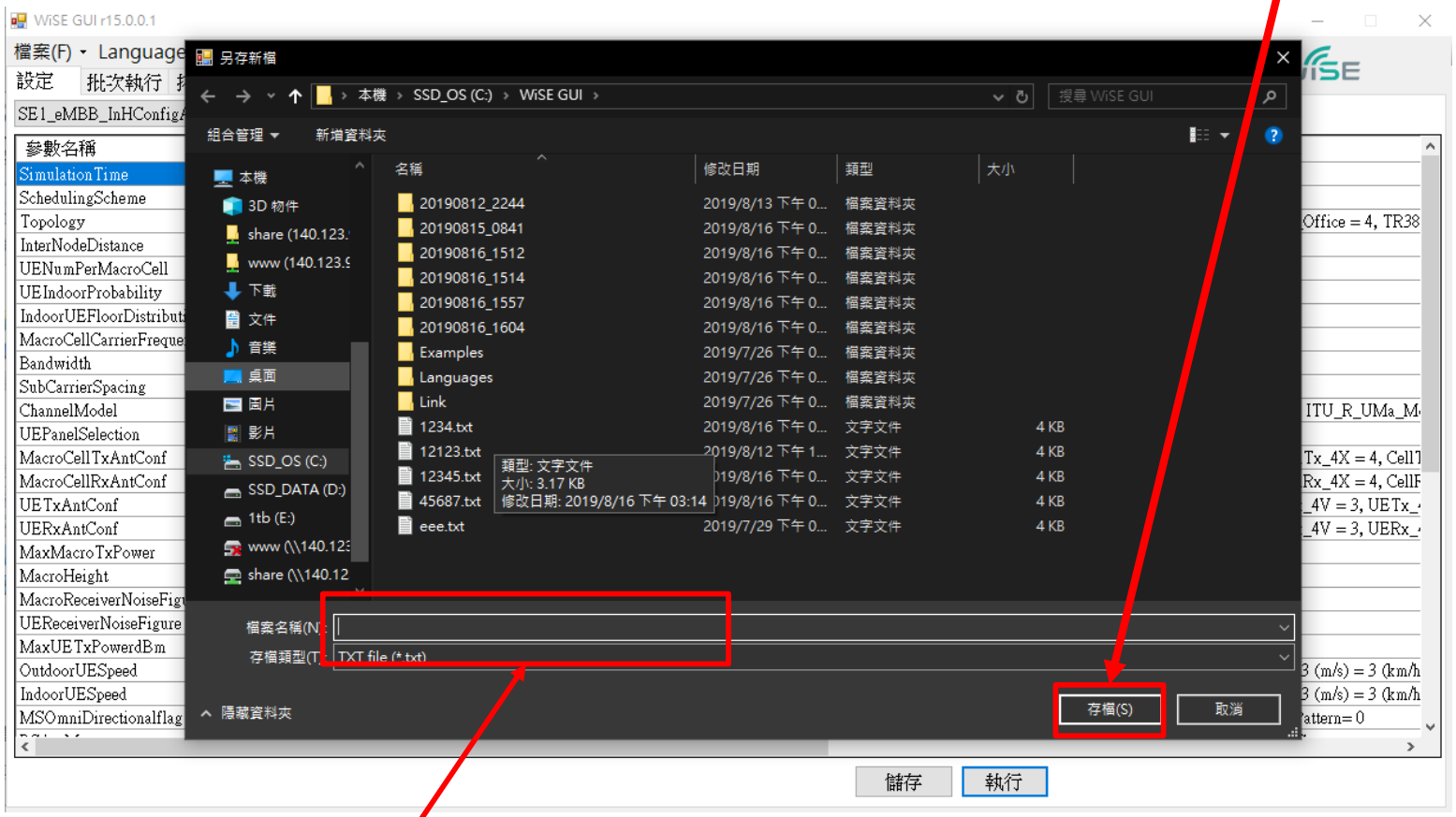


參數名稱	數值	附加1	附加2	附加3	附加4	附加5	附加6	附加7	附加8	說明
SimulationTime	10									Simulation time (Frame)
SchedulingScheme	0									Round Robin = 0, Sub-band PF UL and DL = 4
Topology	5									TR36814_HexagonalMacroOnly = 0, TR38900_InH_Office = 4, TR38
InterNodeDistance	20									The distance between the nodes (meters)
UENumPerMacroCell	10									The number of the UEs of each macro cell
UEIndoorProbability	1									The probability that a UE is indoor
IndoorUEFloorDistribution	0									Fixed First Floor = 0, Uniform Floor = 1
MacroCellCarrierFrequency	400000...									The center carrier frequency (Hz)
Bandwidth	100000...									The channel bandwidth: 20e6, 40e6 (Hz)
SubCarrierSpacing	15000									SubCarrier spacing: 15k, 60k (Hz)
ChannelModel	0									ITU_R_InH_ModelA = 0, ITU_R_InH_ModelB = 1, ITU_R_UMa_M
UEPanelSelection	0									Single Panel = 0, Two Panels = 1
MacroCellTxAntConf	30									CellTx_2V = 1, CellTx_2X = 2, CellTx_4V = 3, CellTx_4X = 4, Cell
MacroCellRxAntConf	1									CellRx_2V = 1, CellRx_2X = 2, CellRx_4V = 3, CellRx_4X = 4, Cell
UETxAntConf	4									UETx_1V = 0, UETx_2V = 1, UETx_2X = 2, UETx_4V = 3, UETx_
UERxAntConf	4									UERx_1V = 0, UERx_2V = 1, UERx_2X = 2, UERx_4V = 3, UERx_
MaxMacroTxPower	21									Node's transmit power (dBm)
MacroHeight	3									The height of Macro's antennas (meters)
MacroReceiverNoiseFigure	5									Noise figure of macro cell (dB)
UEReceiverNoiseFigure	7									Noise figure of UE (dB)
MaxUETxPowerdBm	23									Maximum transmission power of UE (dBm)
OutdoorUESpeed	0.8333									Speed at which the UEs move (meters/second): 0.8333 (m/s) = 3 (km/h
IndoorUESpeed	0.8333									Speed at which the UEs move (meters/second): 0.8333 (m/s) = 3 (km/h
MSOmniDirectionalflag	1									UE antenna pattern: Omni Directional = 1, Antenna Pattern= 0

Wise GUI(6/14)

- 將模擬的參數設置存檔

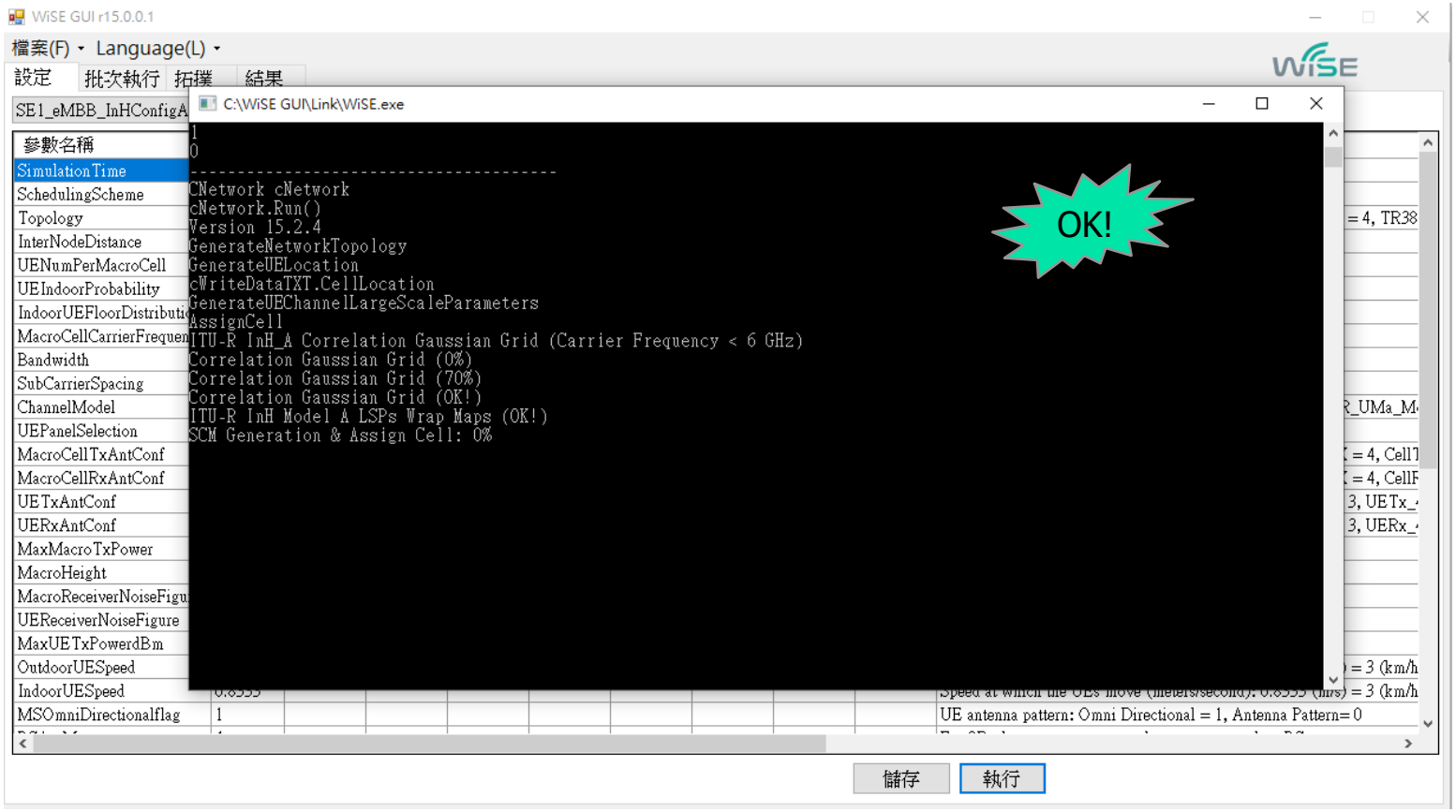
2.點下存檔



1. 檔名可自由輸入

Wise GUI(7/14)

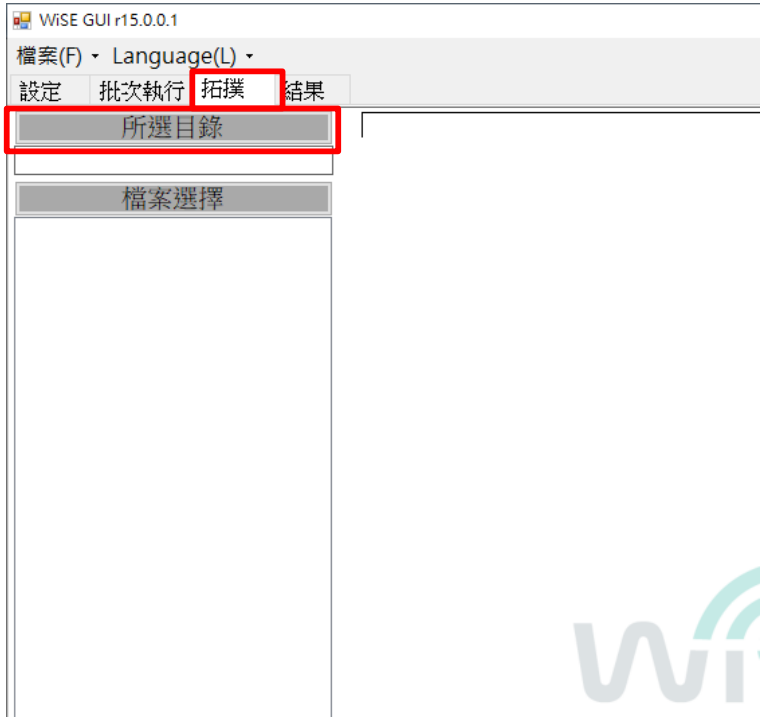
- 等待執行完畢



Wise GUI(8/14)

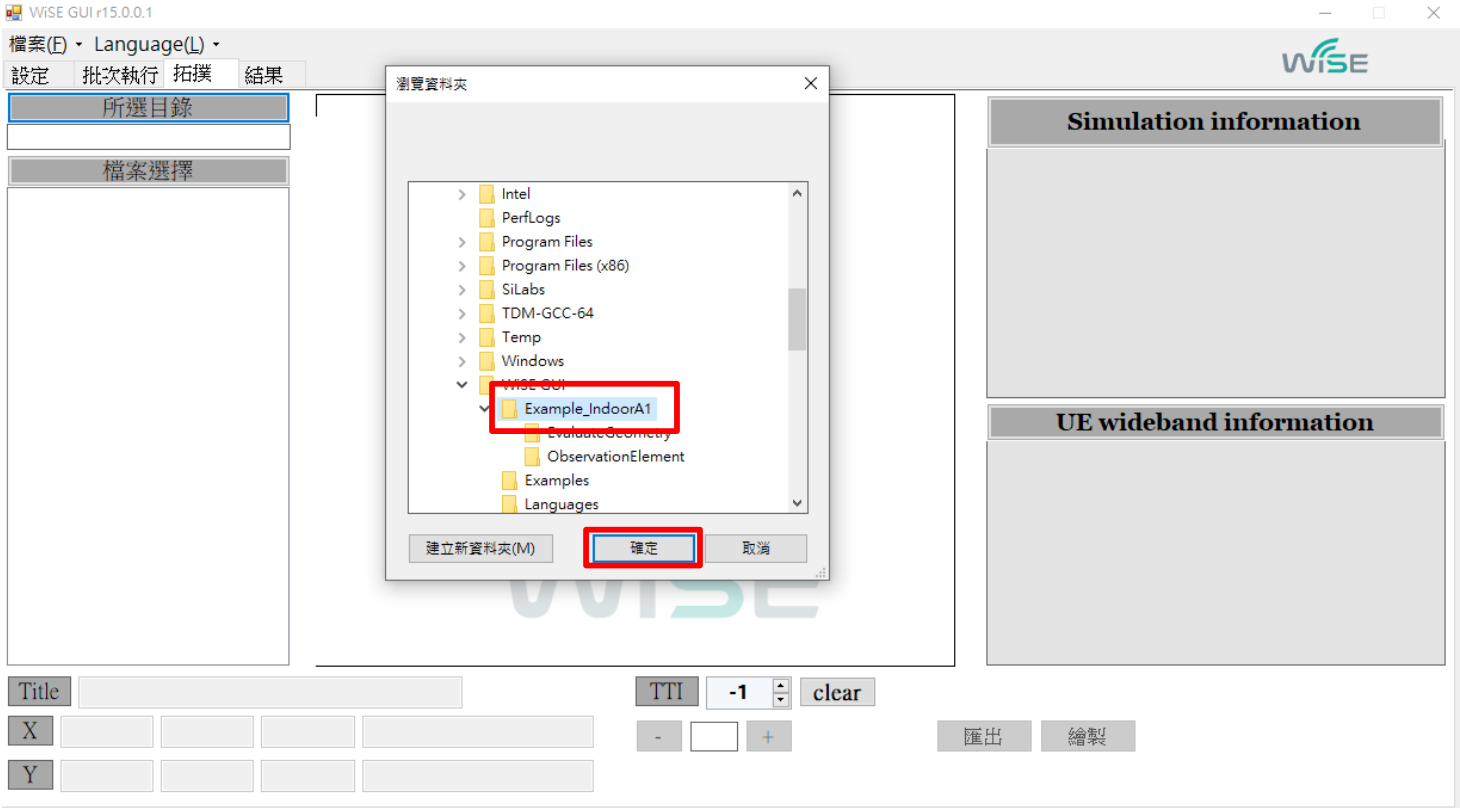
安裝 介面 執行 拓樸 結果

- 在WiSE GUI選擇**拓樸**，然後點選**所選目錄**



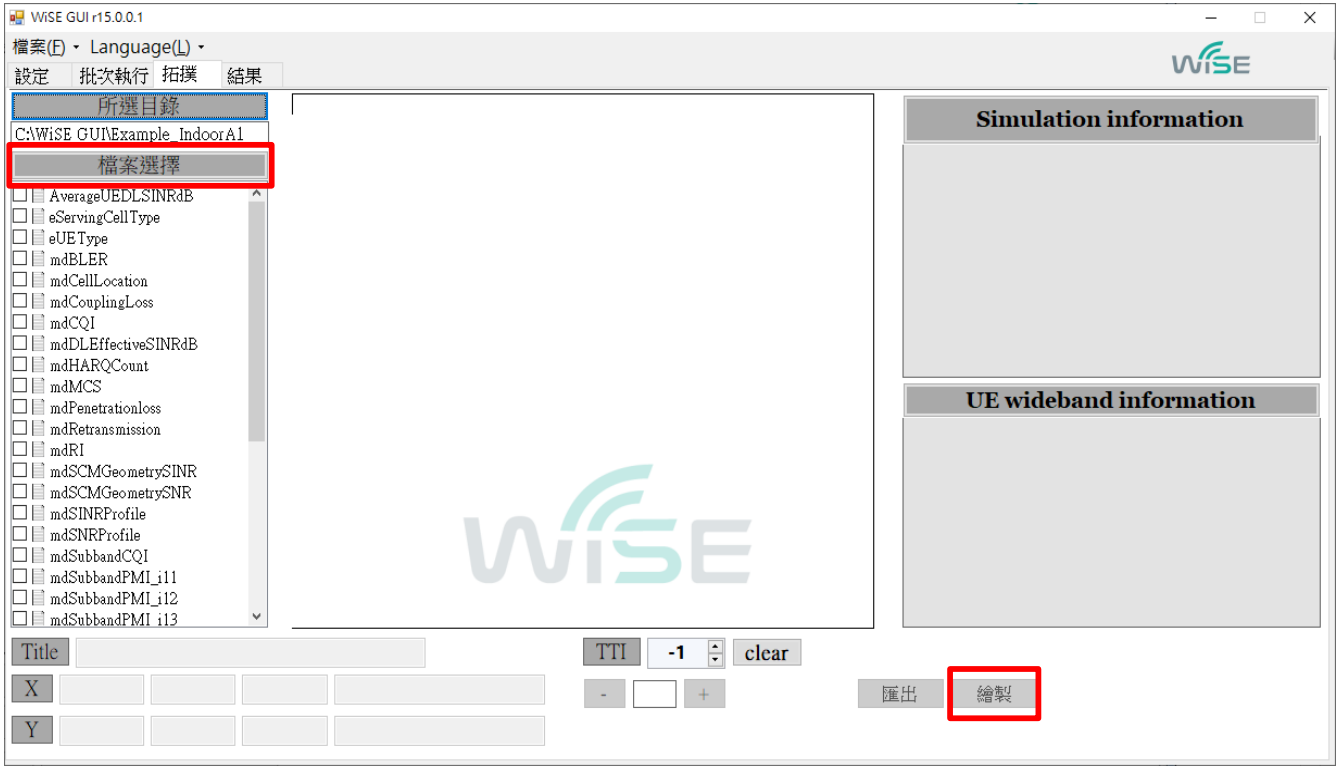
Wise GUI(9/14)

- 選擇執行結果後的資料夾(範例：Example_IndoorA1)然後按下確定



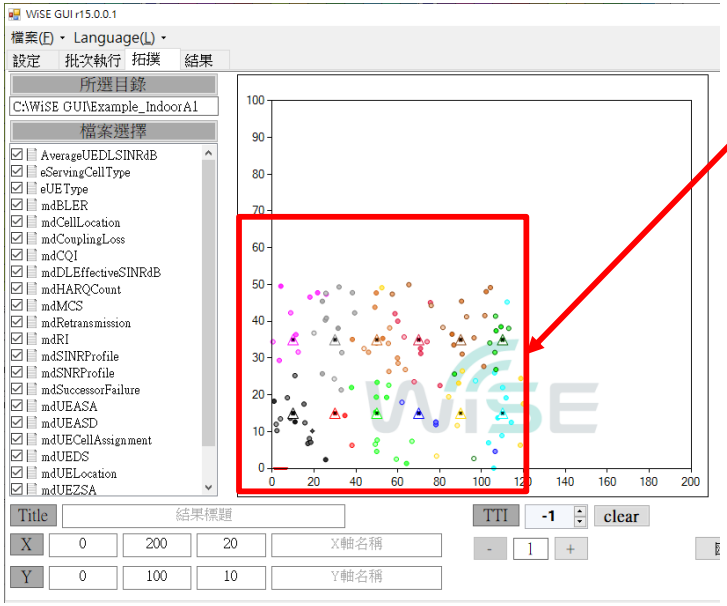
Wise GUI(10/14)

- 點選**檔案選擇**(會自動選擇全部的檔案)
- 點選繪製

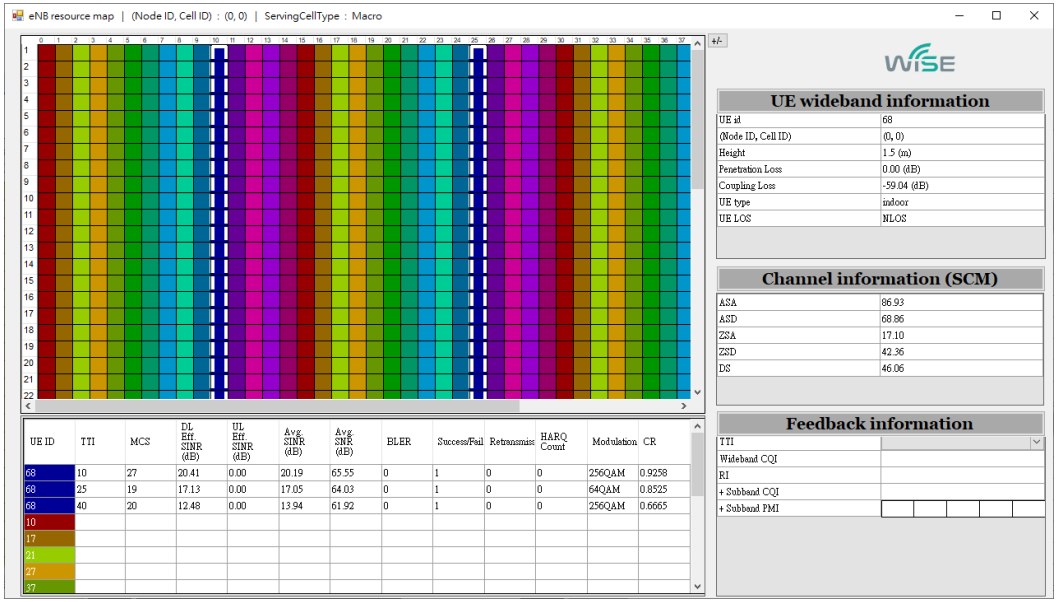


Wise GUI(11/14)

- 可點選任意UE來看它的資訊(右下圖所示)



點選紅框內任意圓點



OK!

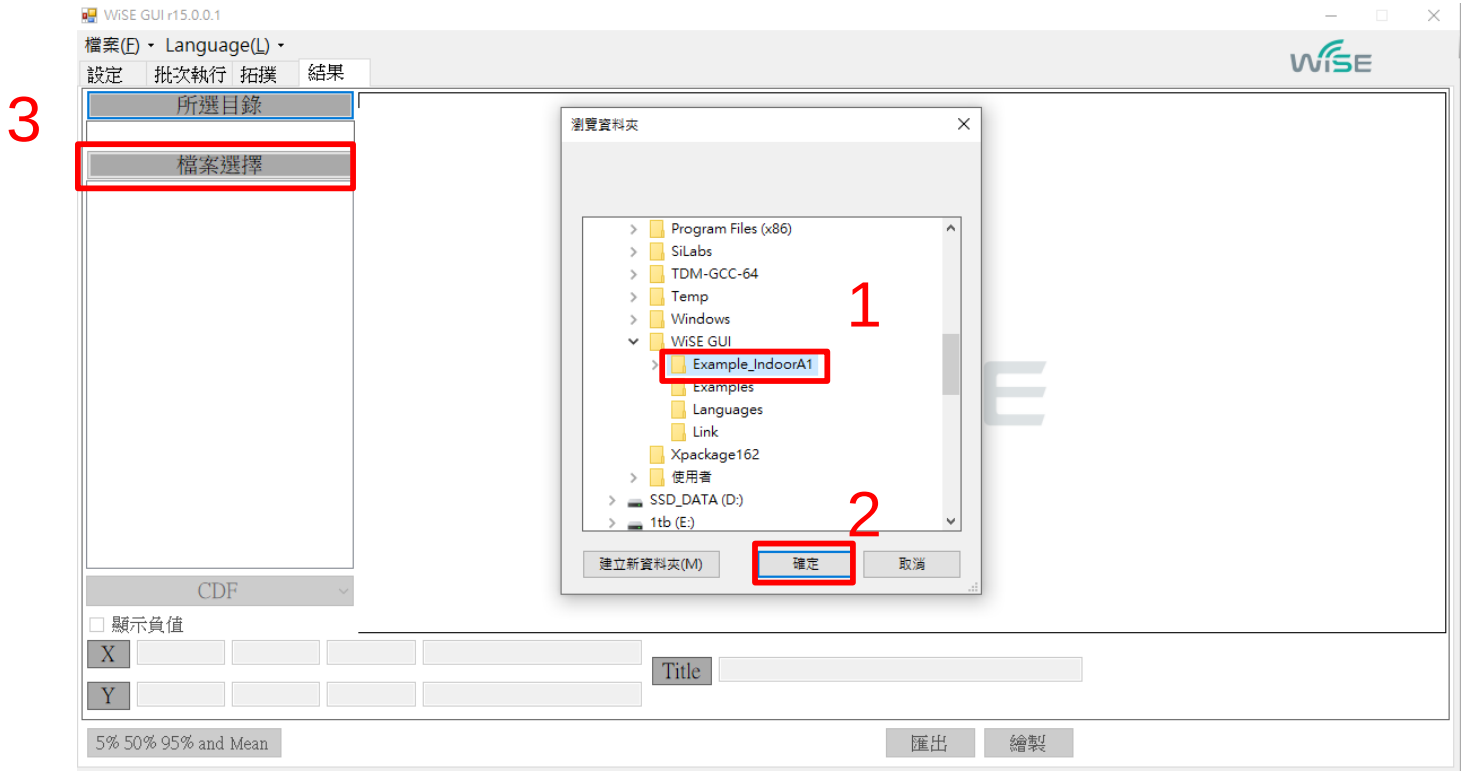
Wise GUI(12/14)

安裝 介面 執行 拓樸 結果

- 點選**結果**，接著選擇**所選目錄**

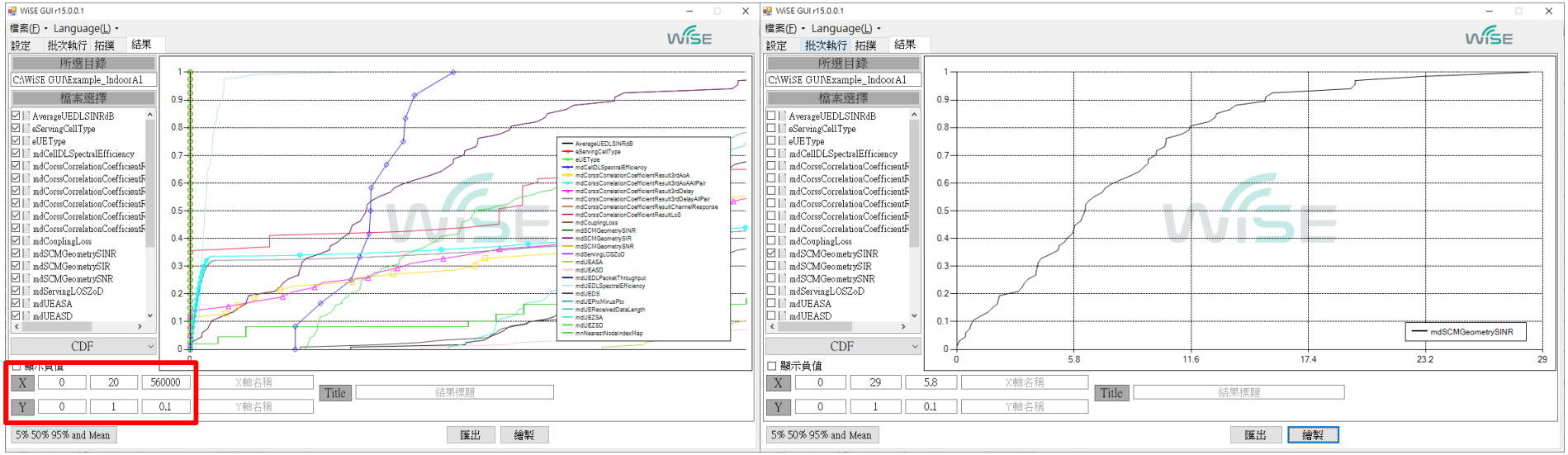
Wise GUI(13/14)

- 和拓樸一樣，選擇目錄資料夾(ex:Example_IndoorA1)點選確定，在點下檔案選擇(會自動全部打勾)會出現全部的圖



Wise GUI(14/14)

- 可調整範圍來看線圖(左圖紅框)或是只點一個檔案來做圖(右圖)



OK!

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實驗紀錄與問題討論

- 請說明SLS與LLS之間的關係 (10%)
- 請說明SLS系統的重要性 (10%)
- 完成安裝WiSE GUI (20%)
- 在WiSE GUI上執行(40%)
  - 有出現第14、18、21的畫面即為成功
- 請描述安裝與執行程式時所遭遇的困難與解法 (20%)