A few words on source setup simulation + charge spread

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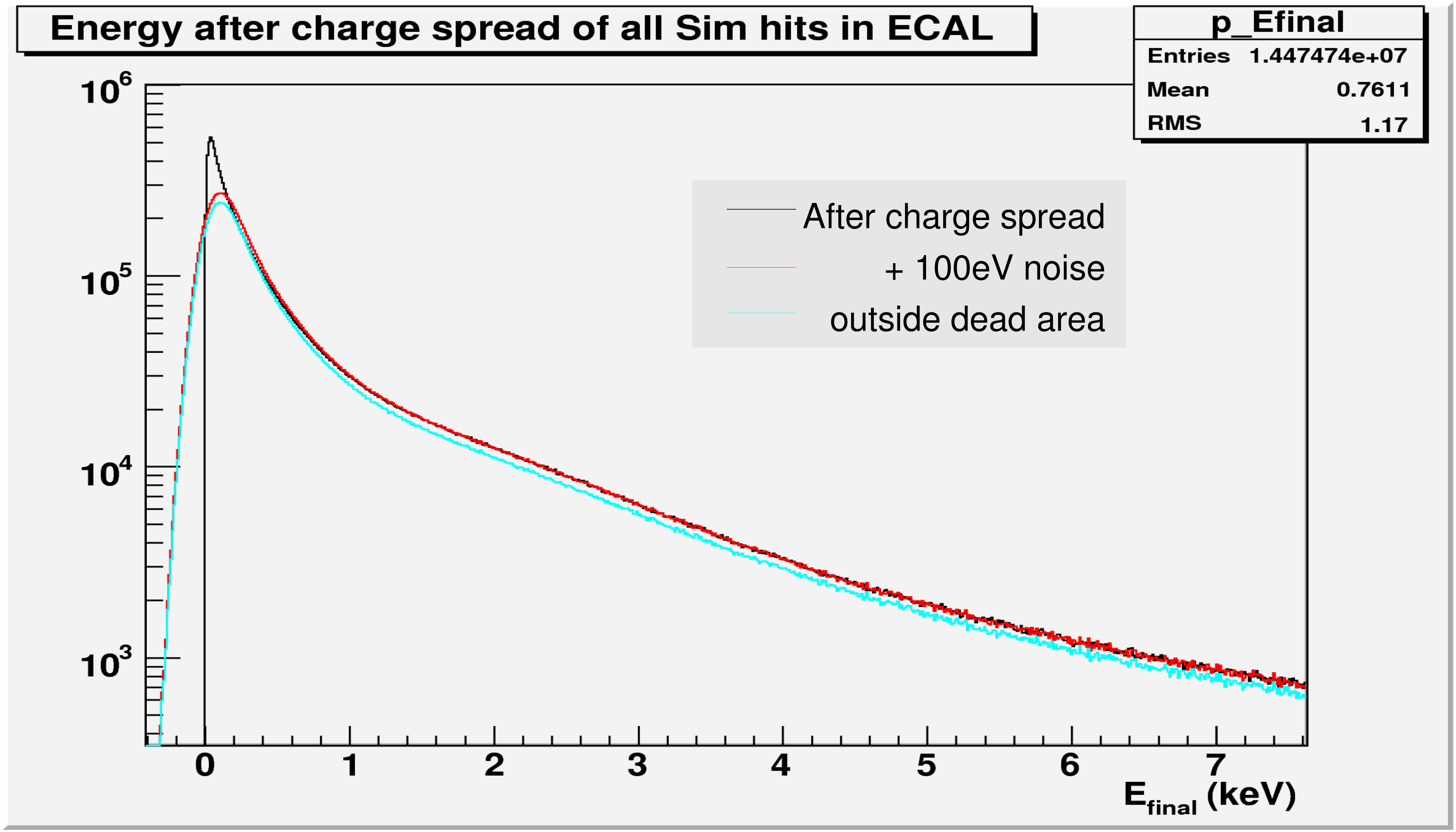
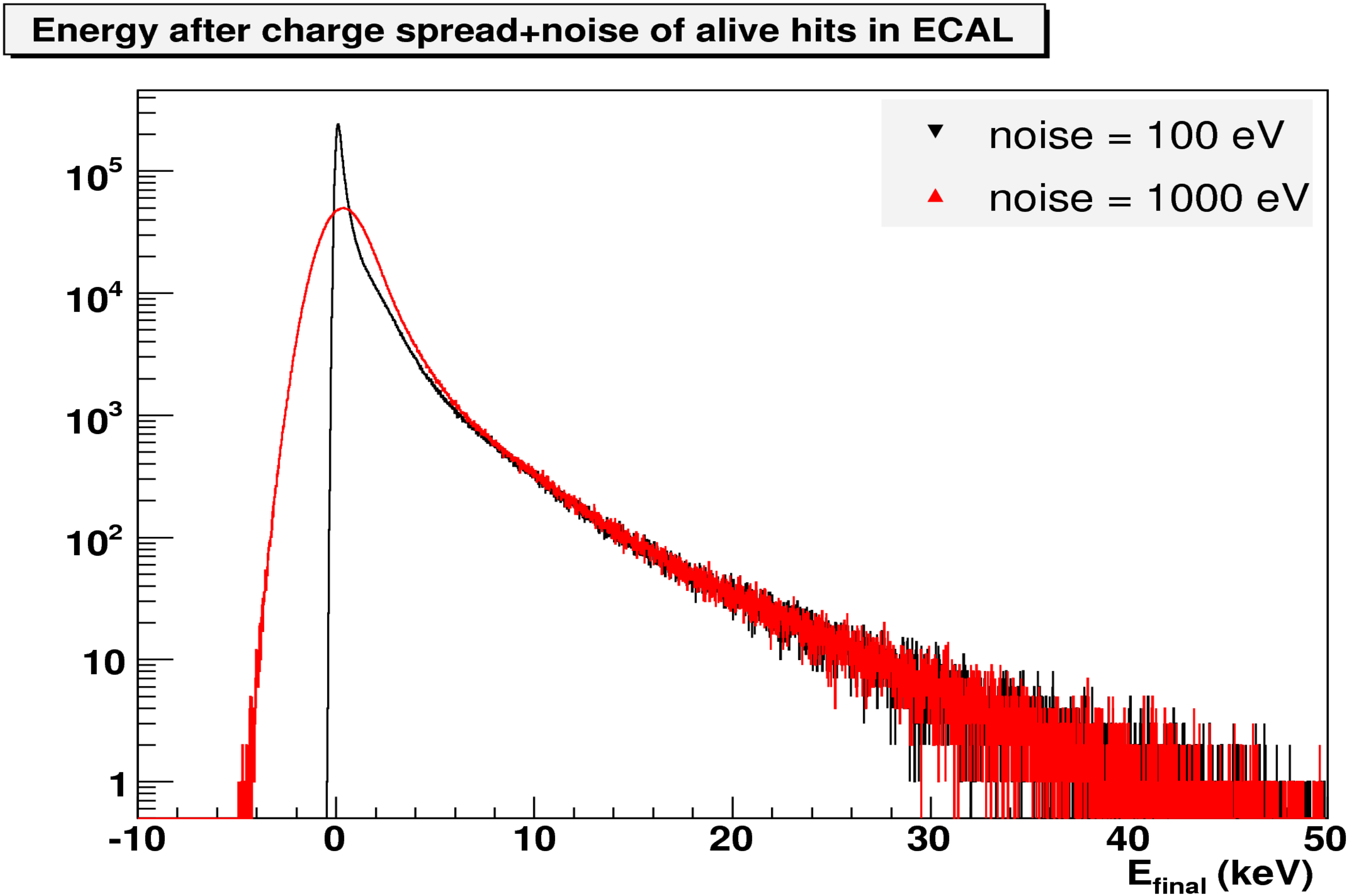
Introduction

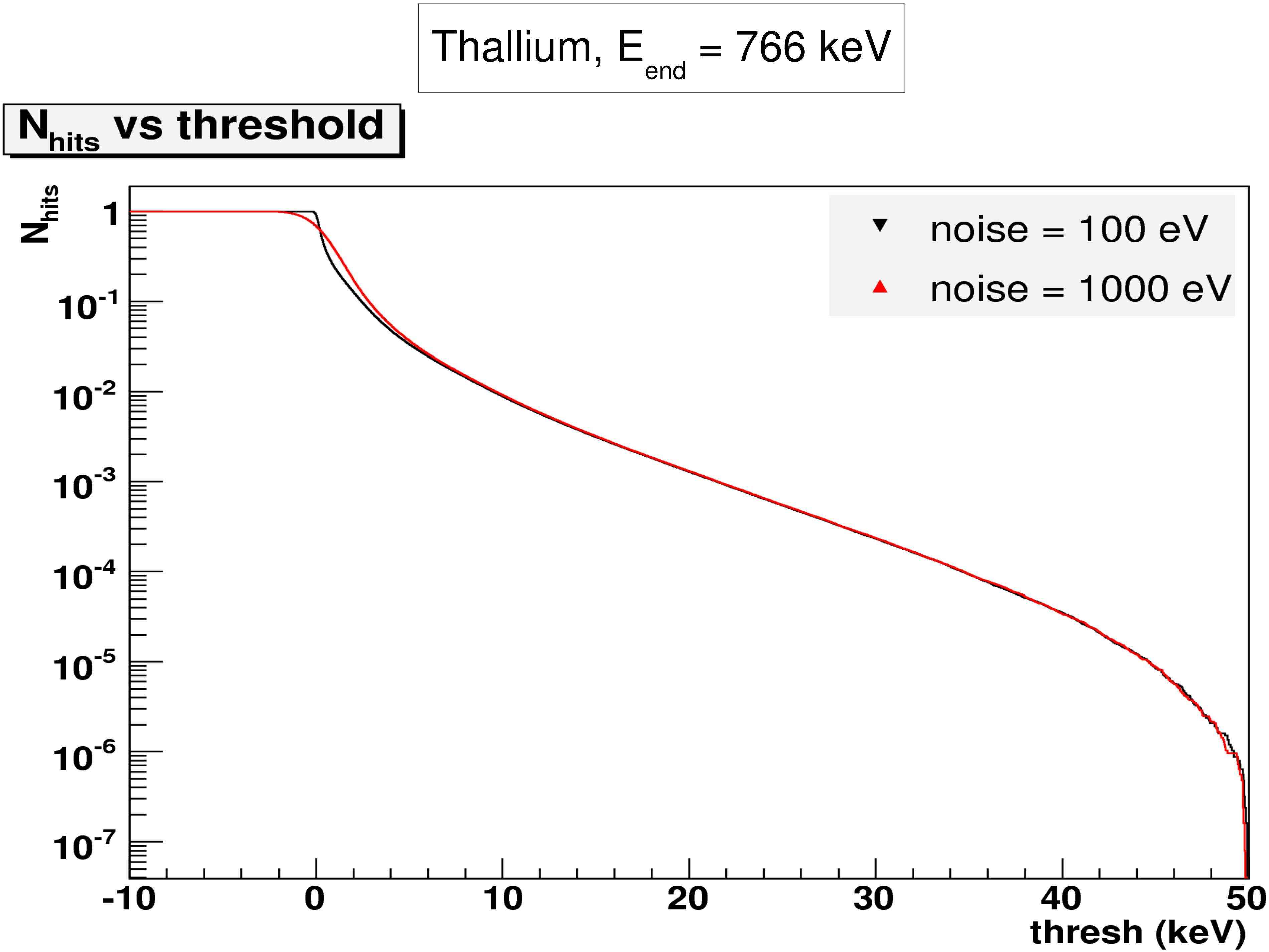
- Very simple implementation within Mokka
- “Hacking” the CGAGeometryManager to accept hardcoded geometry (and not through the database....)
- Adapted digiMAPS => digiTB, but LCIO is not appropriate like it is now to create easely BunchTrains.
- TB setup is also roughly there....
- Idea started to add properly noise only hits/BX: create a RootTree with BunchTrains containing BX containing hits (+MC hits when applicable) => would be the basis of an analysis framework also for real data.

Thallium, E_{end} = 766 keV

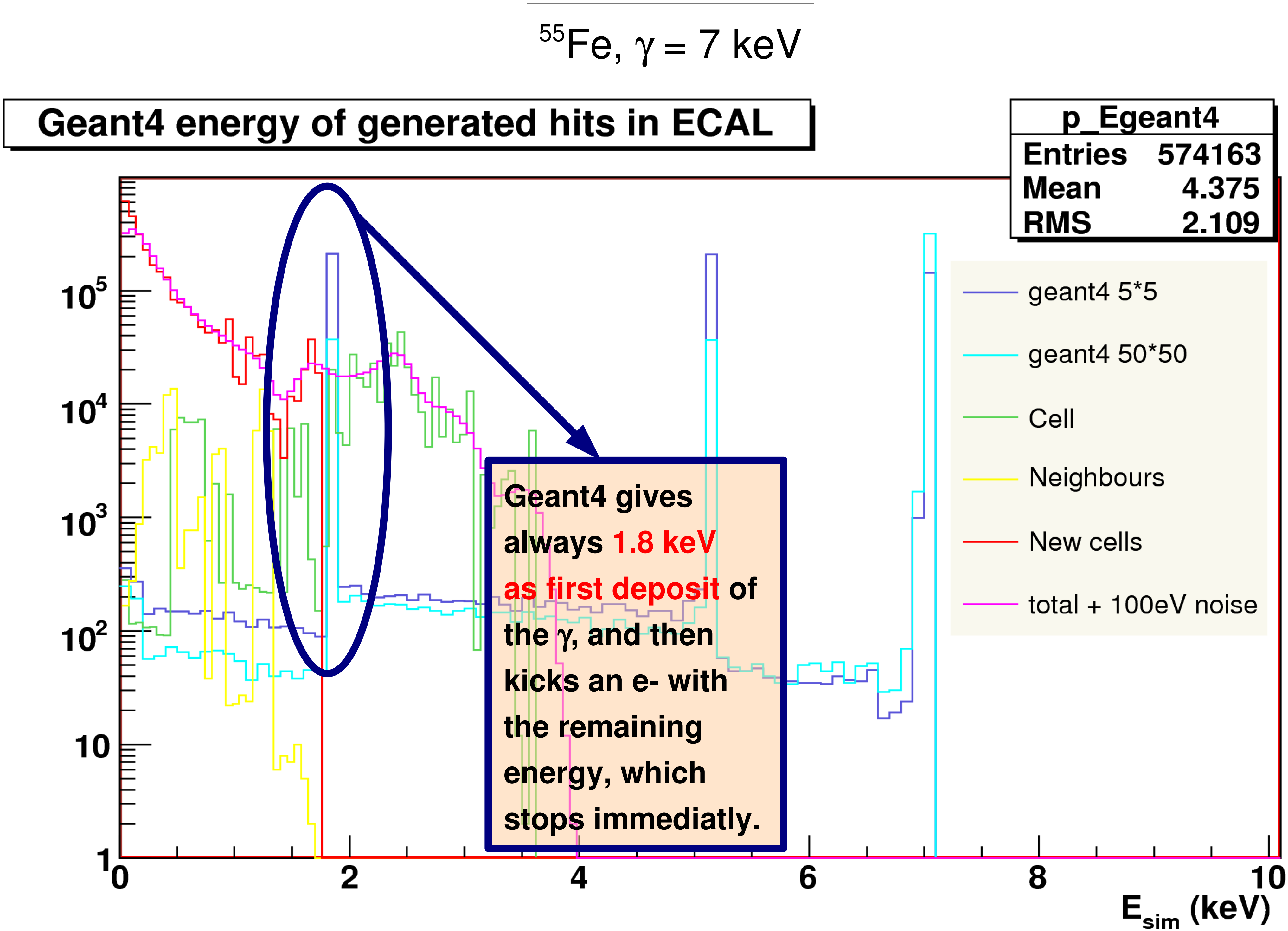


Thallium, E_{end} = 766 keV

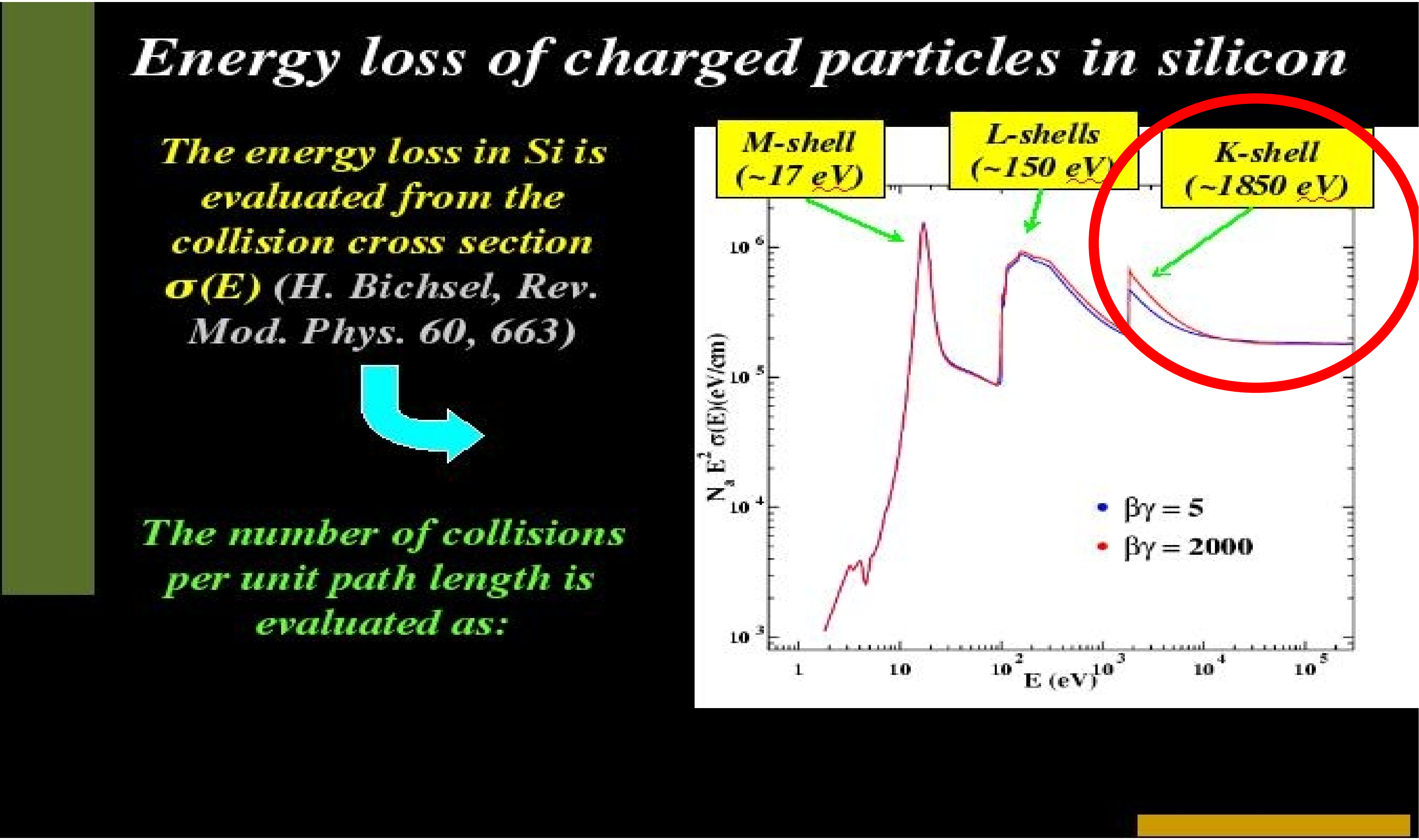




Thallium, E end = 766 keV
N hits vs threshold
N hits
1
10-1
10-2
10-3
10-4
10-5
10-6
10-7
noise = 100 eV
noise = 1000 eV
-10
0
10
20
30
40
50
thresh (keV)

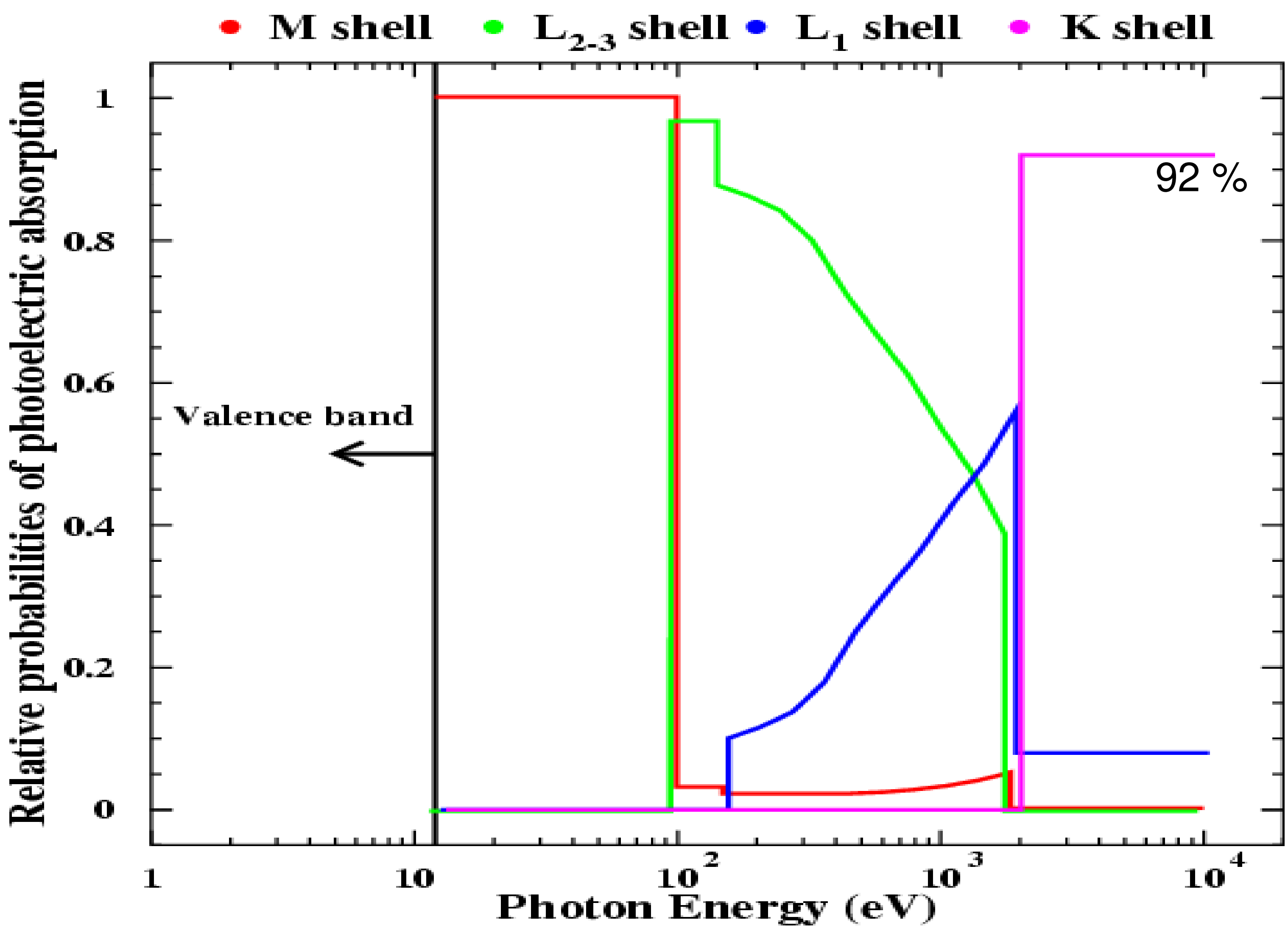


^{55}Fe, γ = 7 keV
Geant4 energy of generated hits in ECAL
p_Egeant4
Entries 574163
Mean 4.375
RMS 2.109
geant4 5*5
geant4 50*50
Cell
Neighbours
New cells
total + 100eV noise
Geant4 gives always 1.8 keV as first deposit of the γ, and then kicks an e- with the remaining energy, which stops immediatly.
10^5
10^4
10^3
10^2
10
1
0
2
4
6
8
10
E_{sim} (keV)



From F. Loparco, 9th Topical Seminar on Innovative Particle and Radiation Detectors May 23-26, 2004- Siena, Italy,

"A full Monte Carlo simulation code for silicon strip detectors"



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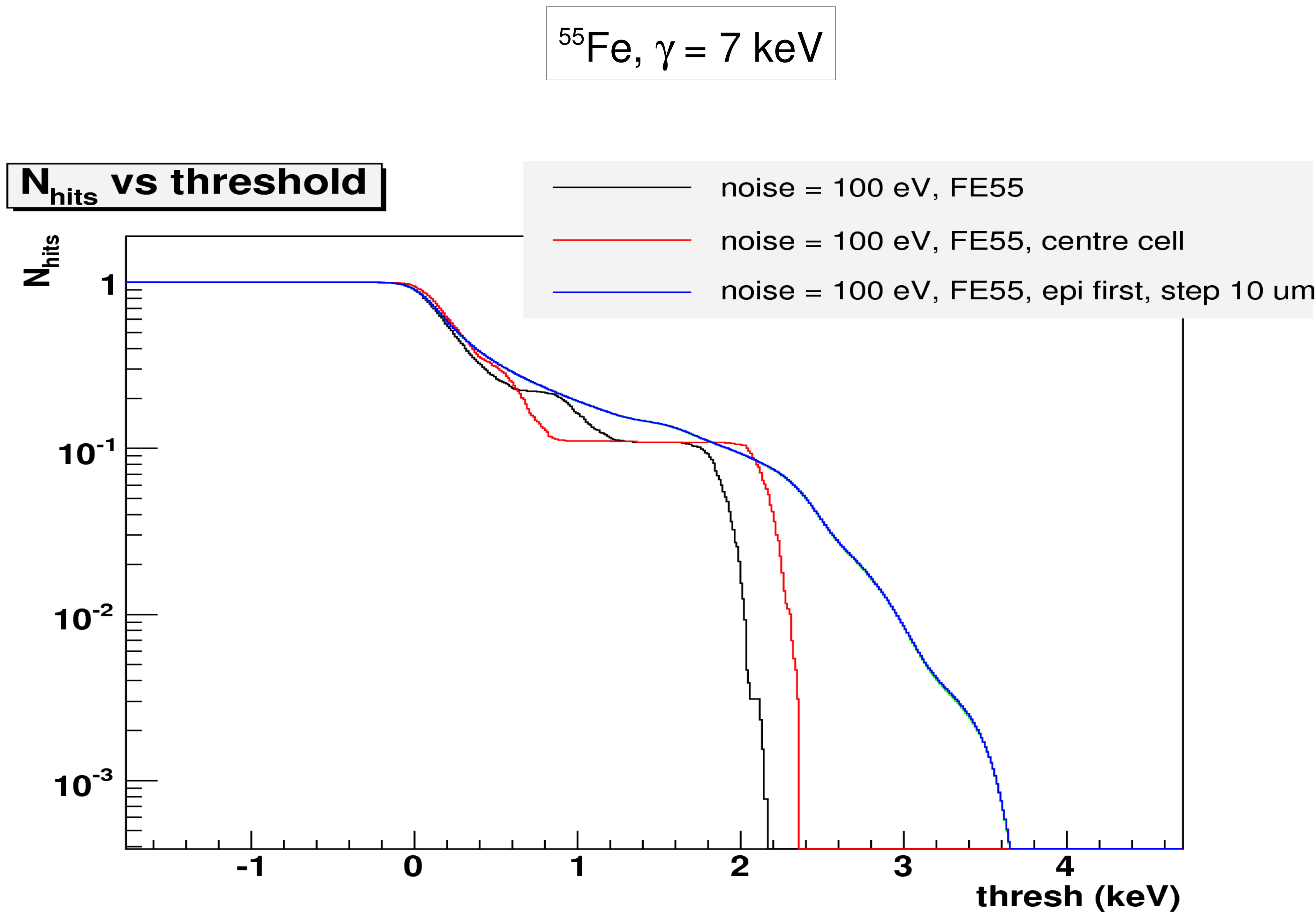
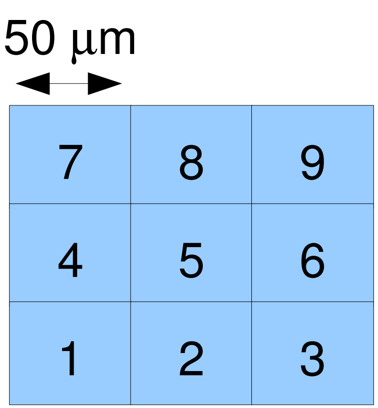


55Fe, γ = 7 keV
Nhits vs threshold
noise = 100 eV, FE55
noise = 100 eV, FE55, centre cell
noise = 100 eV, FE55, epi first, step 10 um
Nhits
1
10-1
10-2
10-3
-1
0
1
2
3
4
thresh (keV)

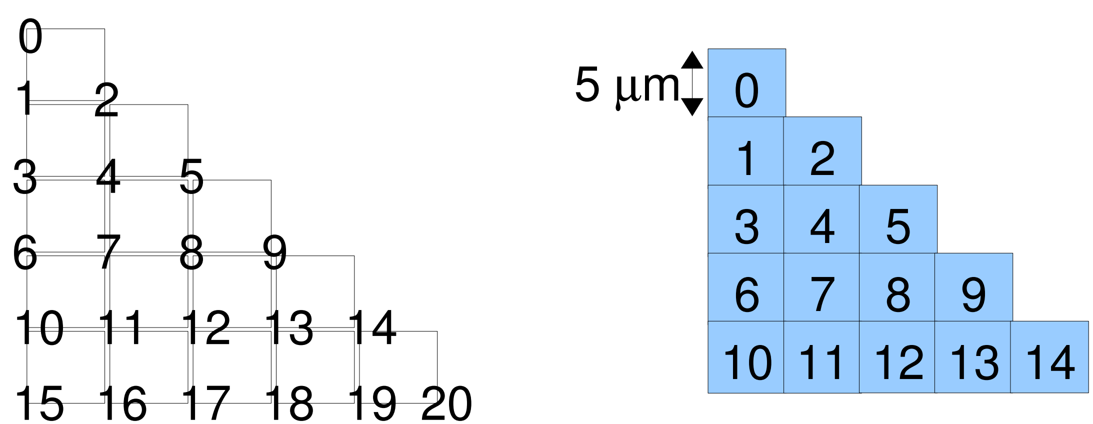
Charge spread : last results from Giulio in terms of what will be applied to Geant4 deposits

- N-well simple = first simulation of n-well with a simple model.
- Perfect p-well = assuming n-well is completely screened by p-well=inexistant. Rest of the pixel is GDS
- No DPW = GDS file with full n-well simulation, no DPW, array of 3*3 but only middle cell simulated.
- DPW = GDS with full simulation of everything, array of 3*3 but only middle cell simulated.

Cell indexing

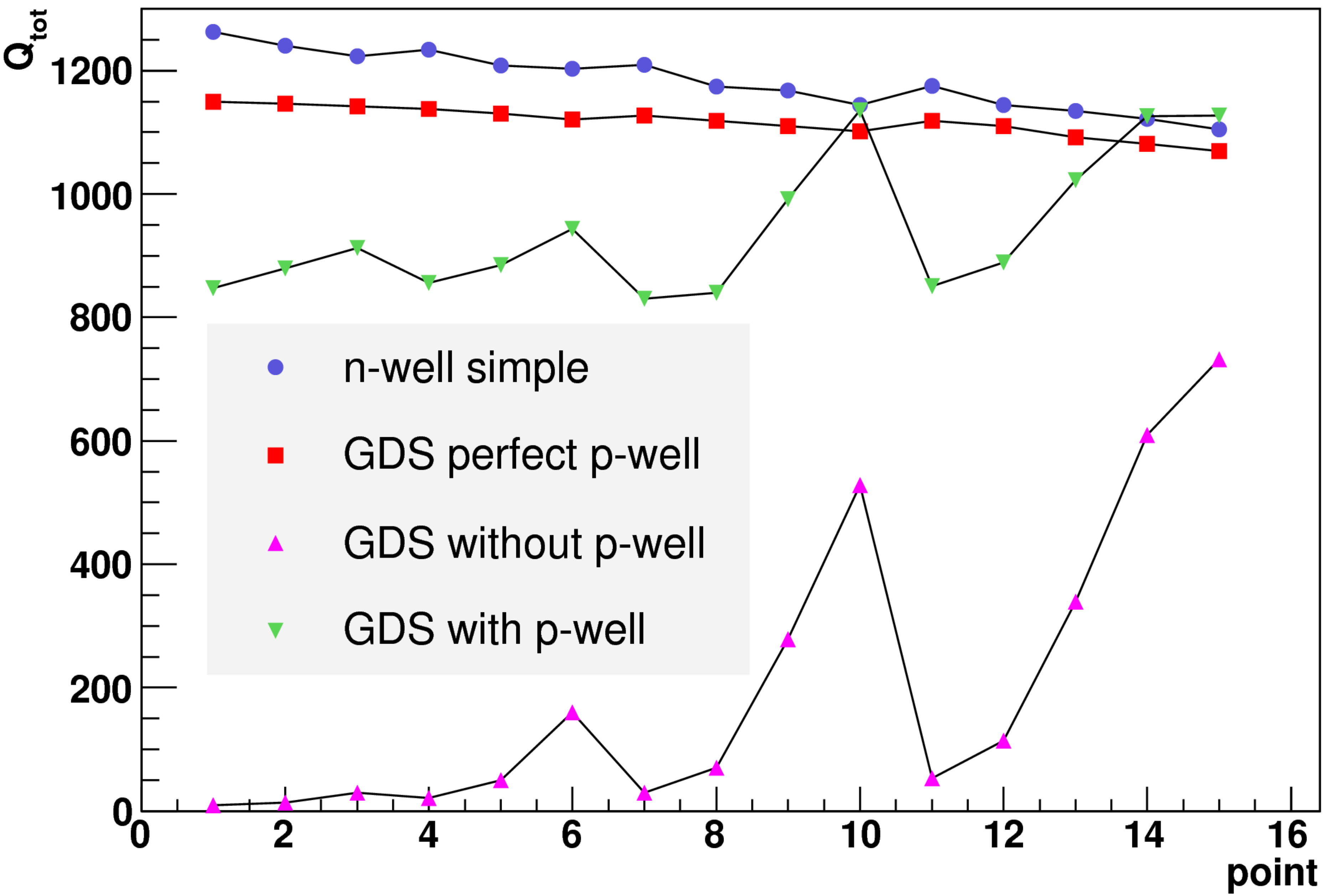


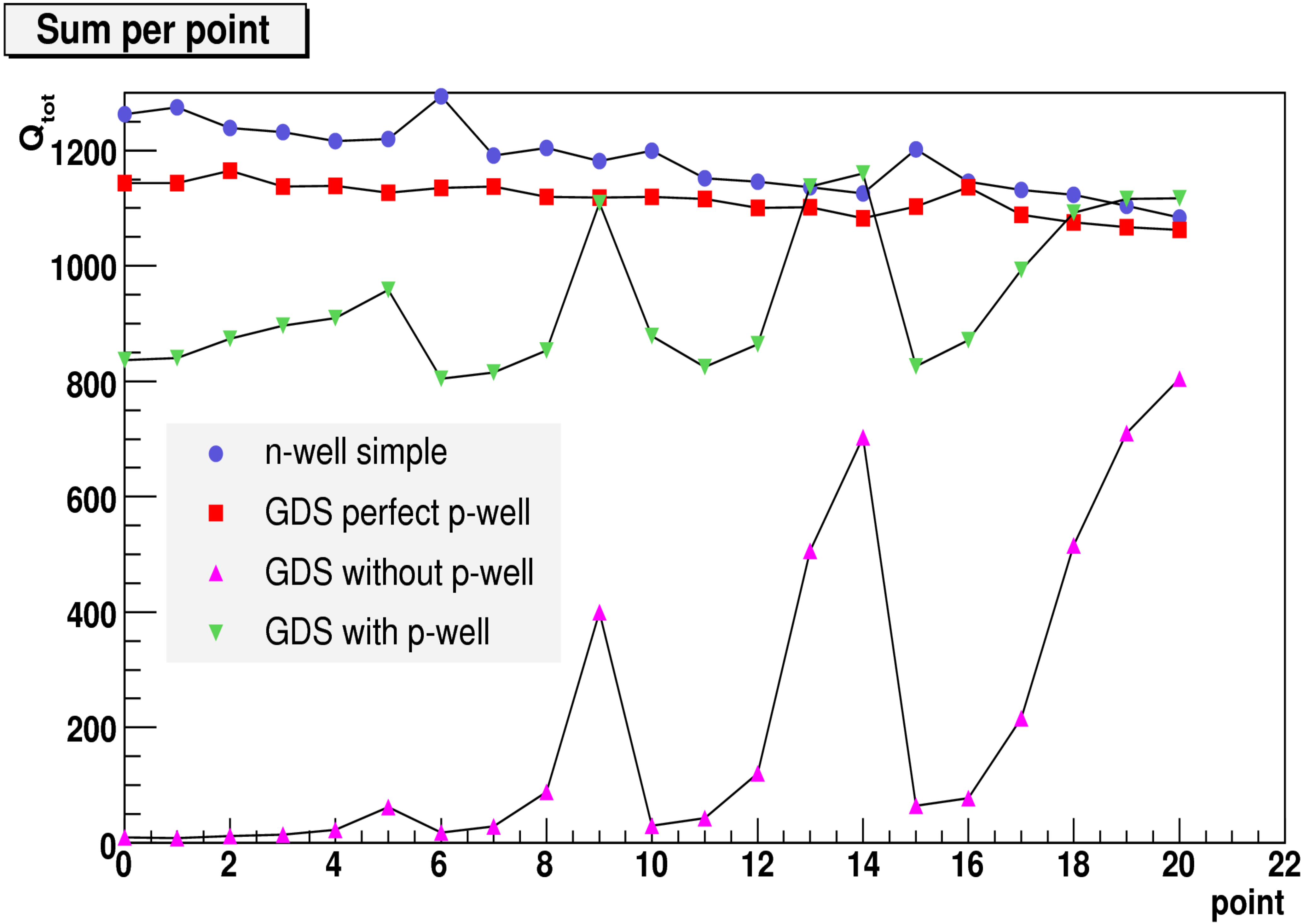
Point indexing



Sum per point

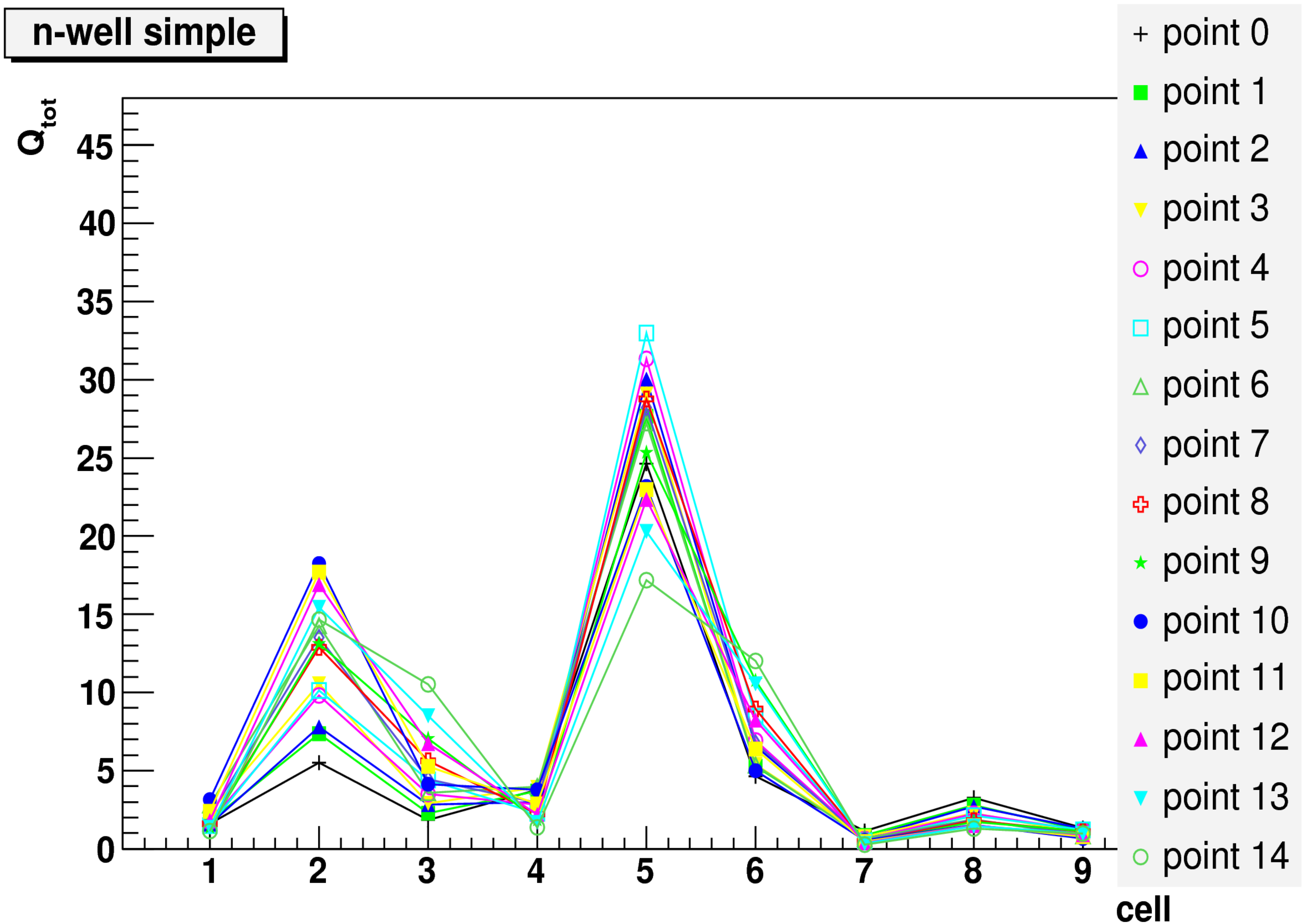
Just summing over the whole 3*3 cells the charge collected according to the position of the input MIP.

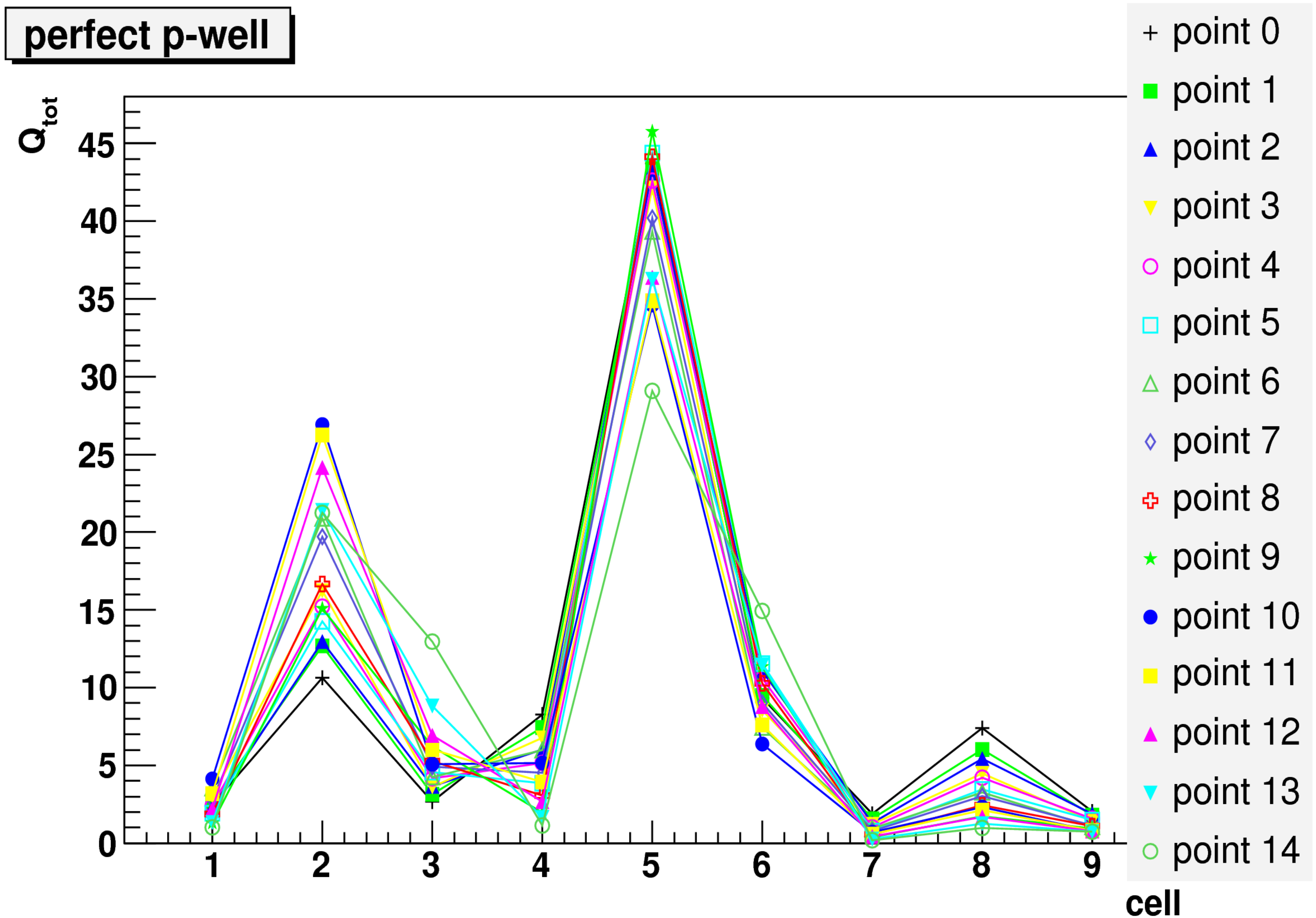


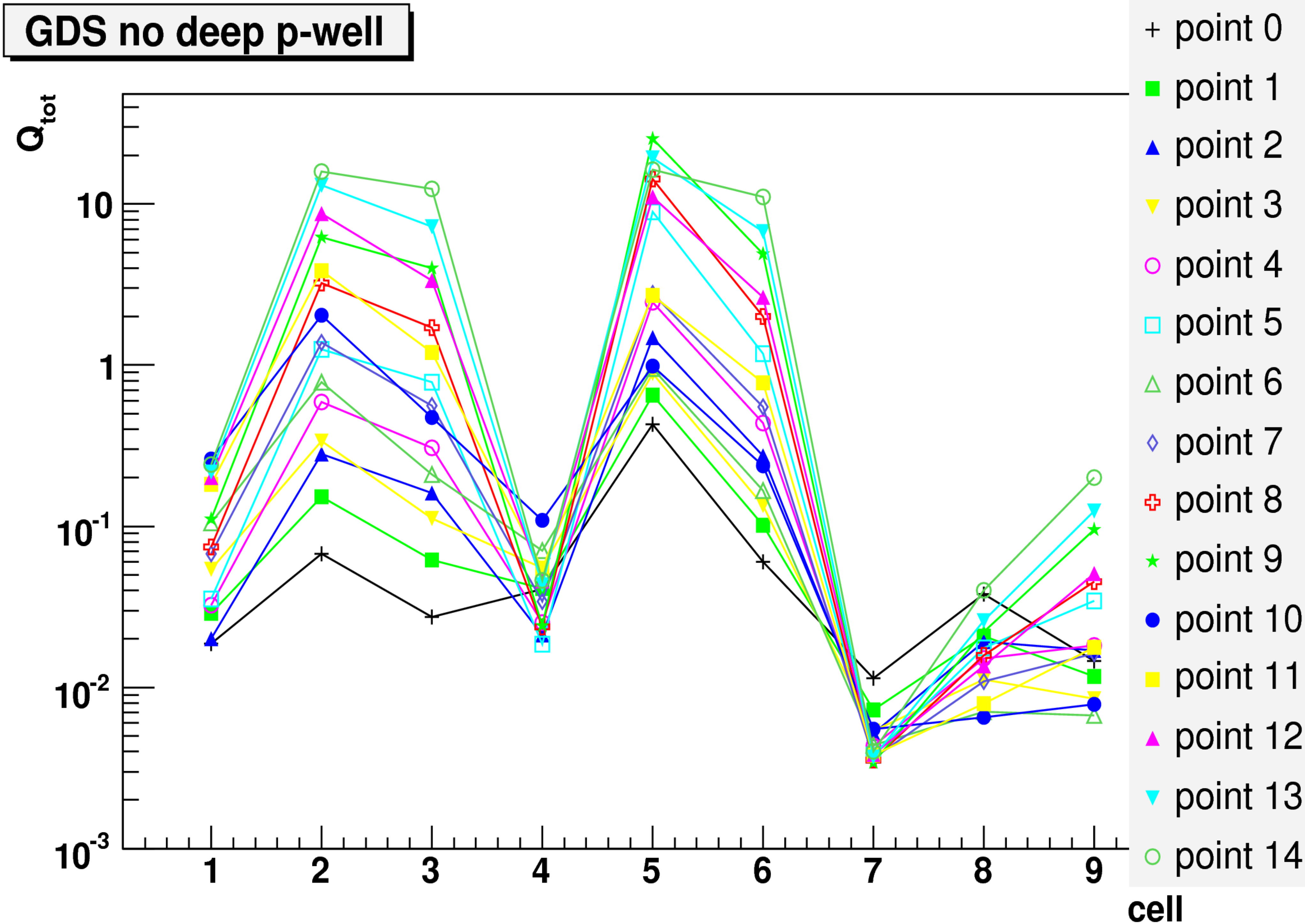

Sum per point
Q_tot
1200
1000
800
600
400
200
0
0
2
4
6
8
10
12
14
16
18
20
22
point
n-well simple
GDS perfect p-well
GDS without p-well
GDS with p-well

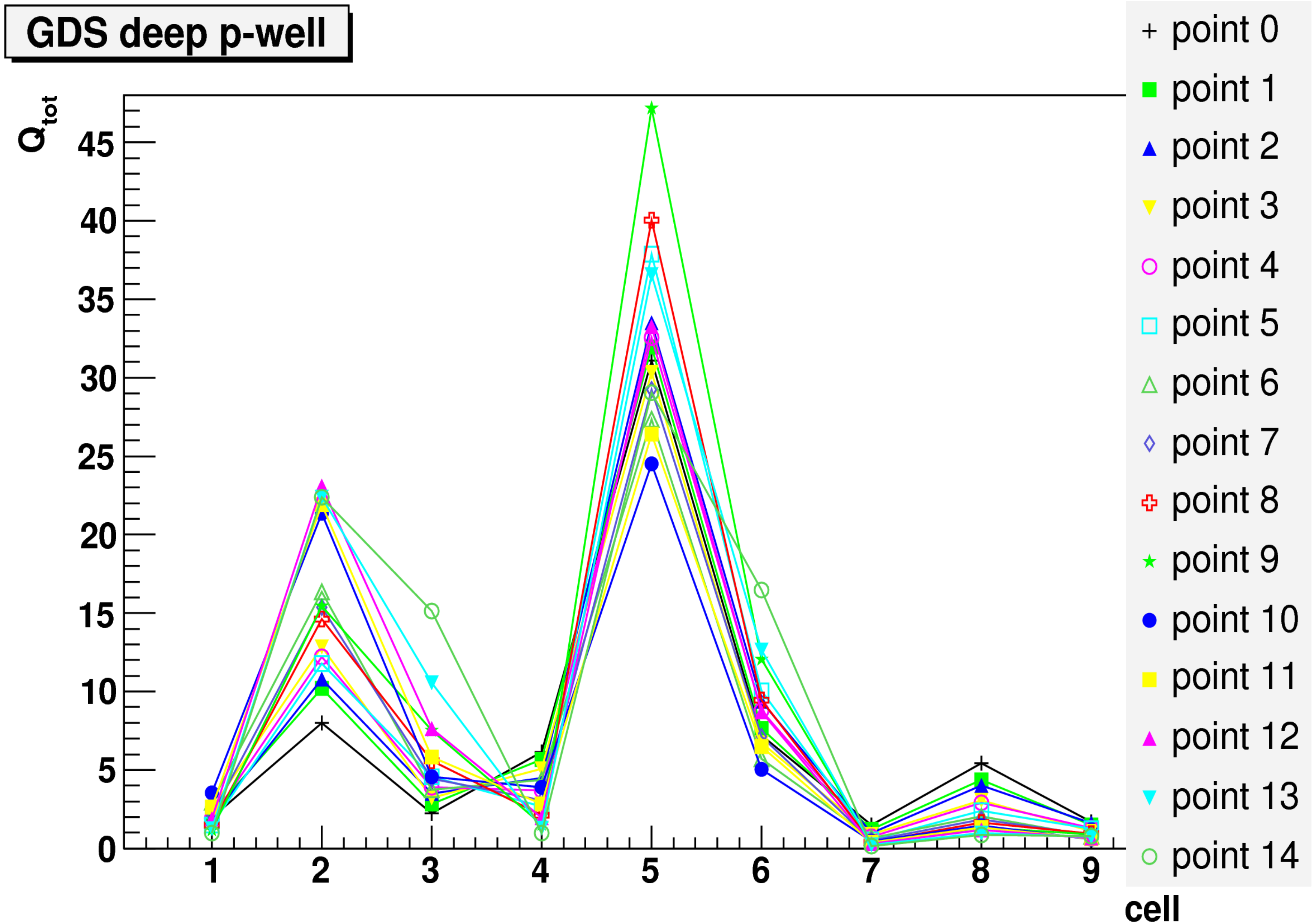
Slide 5 – 6 – 7 – 8 : distribution of the sum over the 4 diodes, as a function of the cell index, for each of the 15 points.
Slide 9 – 10 – 11 – 12 : same, but as a function of the point index, for each of the 9 cells.
Slide 13 – 14 – 15 – 16 – 17 : with 21 points

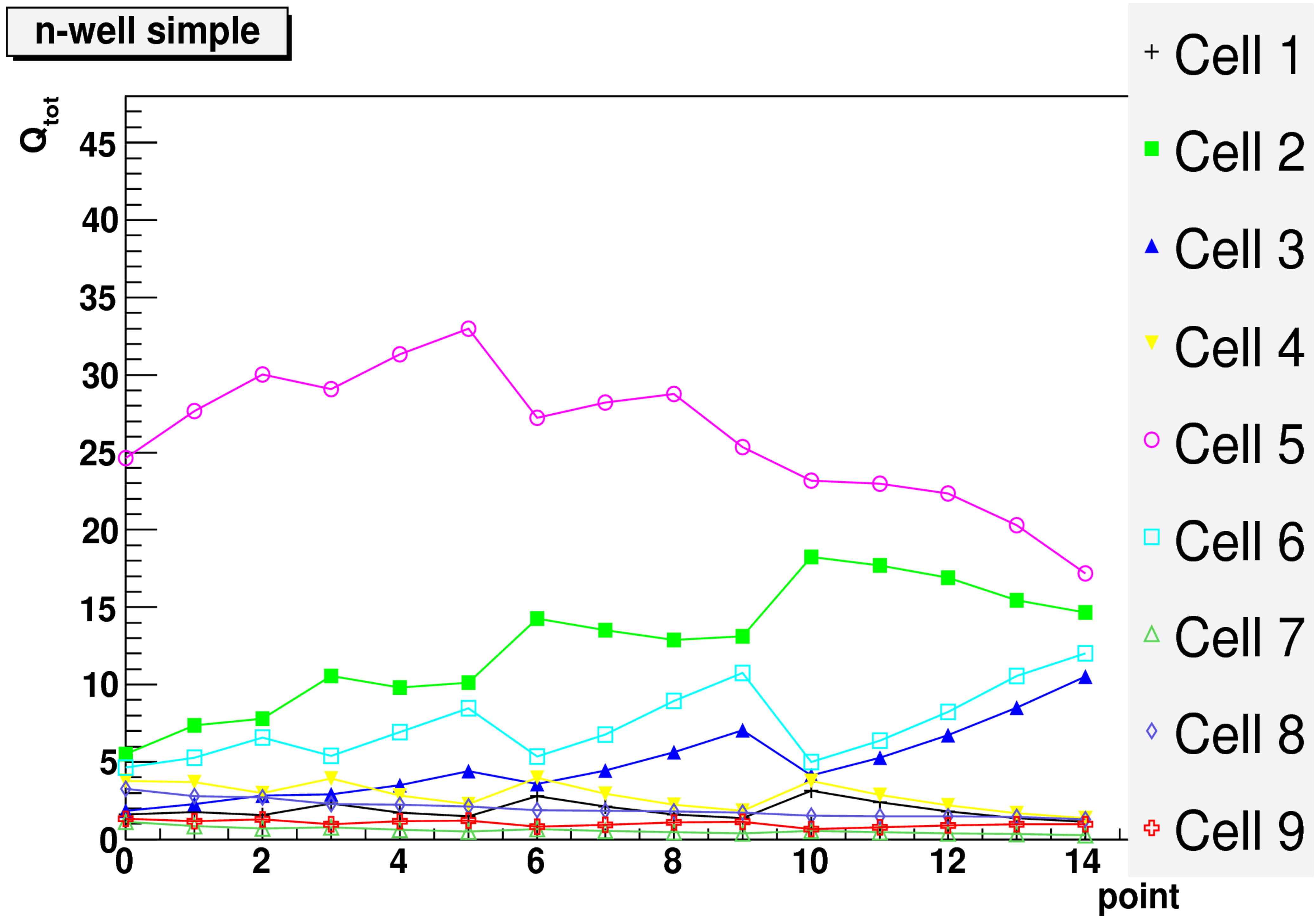
N.B.: the points are averaged compared to the 21 points given by Giulio to have the result in the center of a 5*5 cell...
So each “new point” = (sum_(4 corners)/4)
This implies the last point (#14) is biased towards the middle cell, and hence cell #5 collects more charge than the others.
However, cells #2 and 6 should be equivalent: they are not.

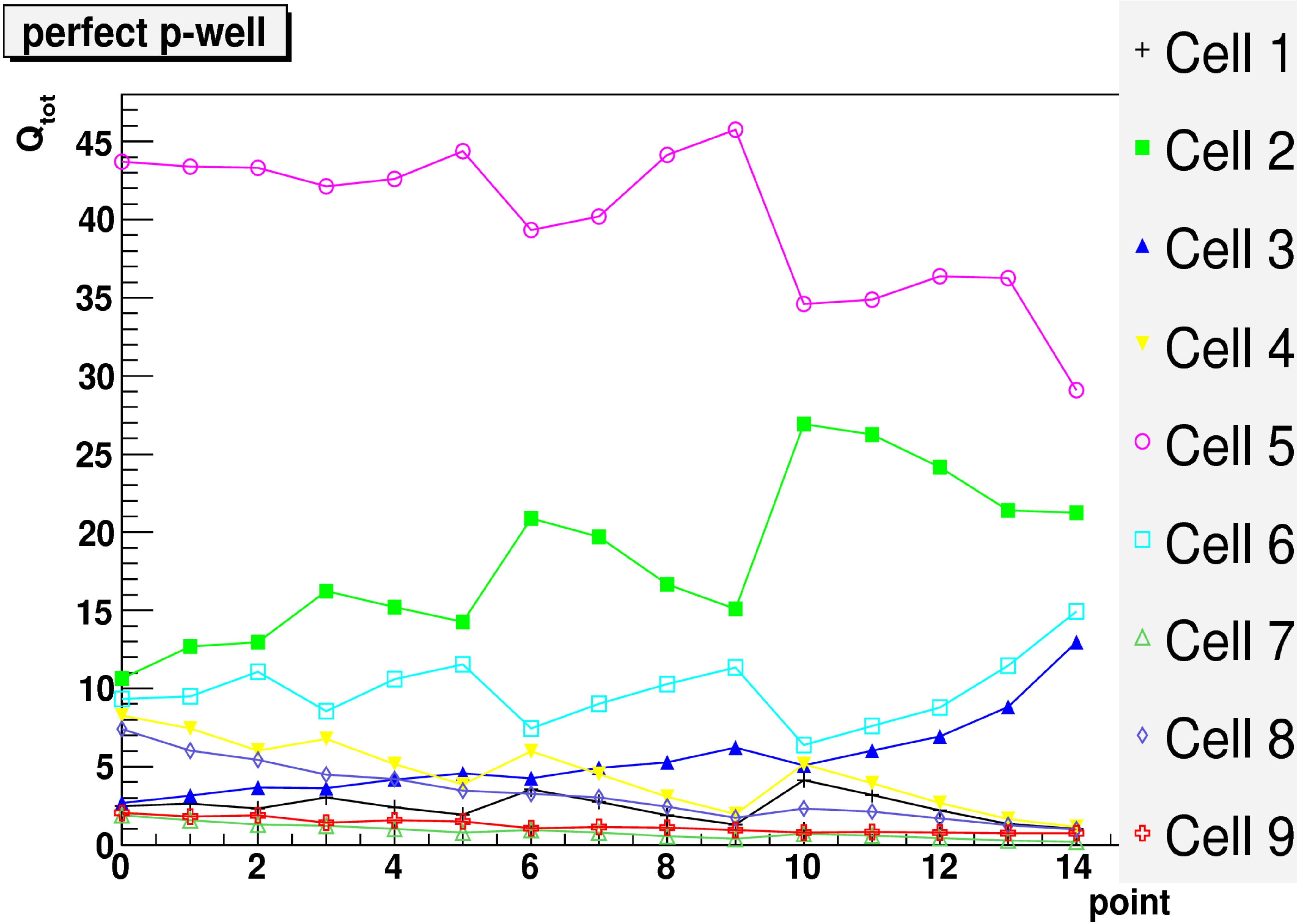

n-well simple
Q_tot
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
8
9
cell
point 0
point 1
point 2
point 3
point 4
point 5
point 6
point 7
point 8
point 9
point 10
point 11
point 12
point 13
point 14


perfect p-well
Q_{tot}
0
5
10
15
20
25
30
35
40
45
1
2
3
4
5
6
7
8
9
cell
point 0
point 1
point 2
point 3
point 4
point 5
point 6
point 7
point 8
point 9
point 10
point 11
point 12
point 13
point 14

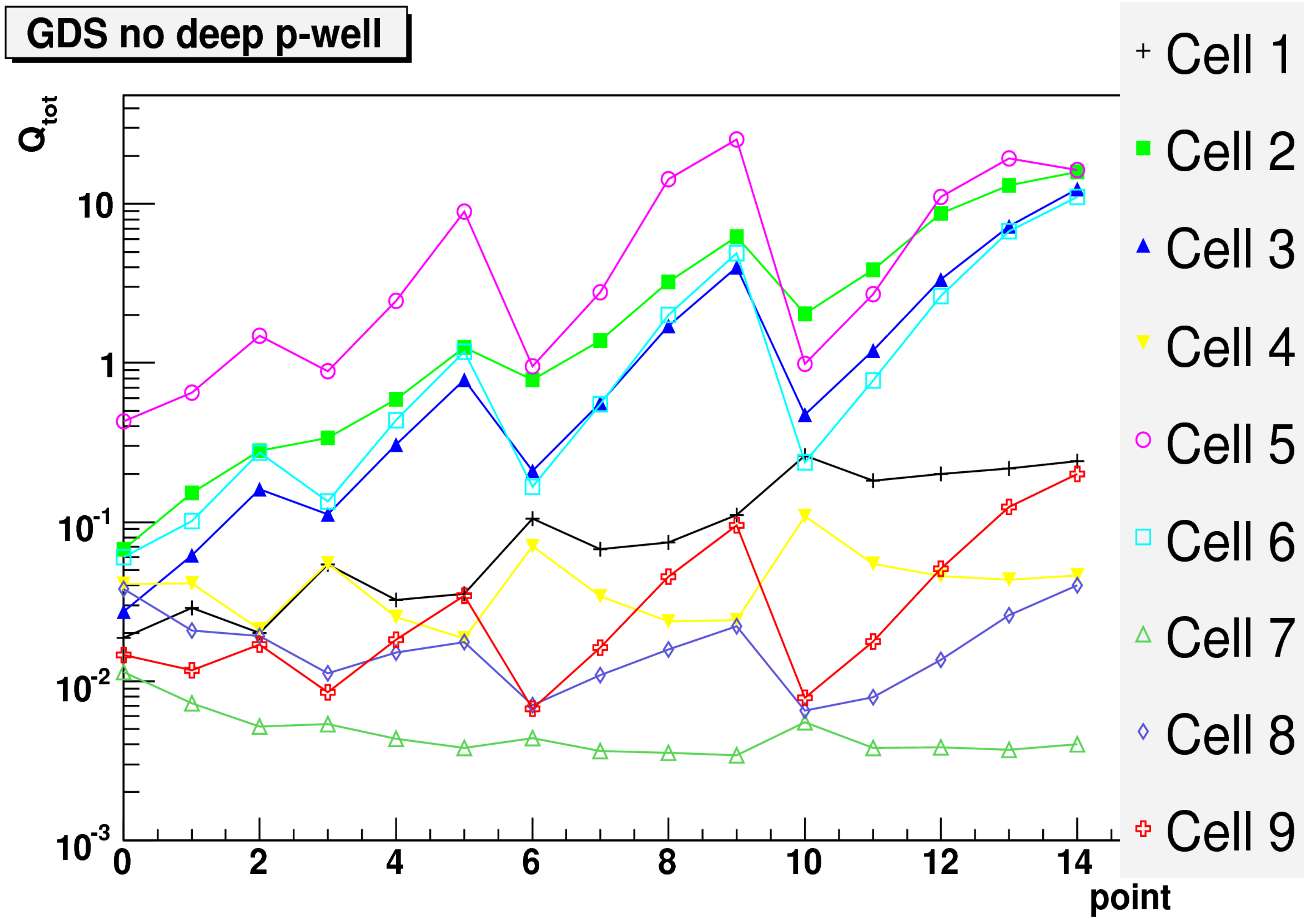

GDS no deep p-well
Q_{tot}
10
1
10^{-1}
10^{-2}
10^{-3}
1
2
3
4
5
6
7
8
9
cell
point 0
point 1
point 2
point 3
point 4
point 5
point 6
point 7
point 8
point 9
point 10
point 11
point 12
point 13
point 14

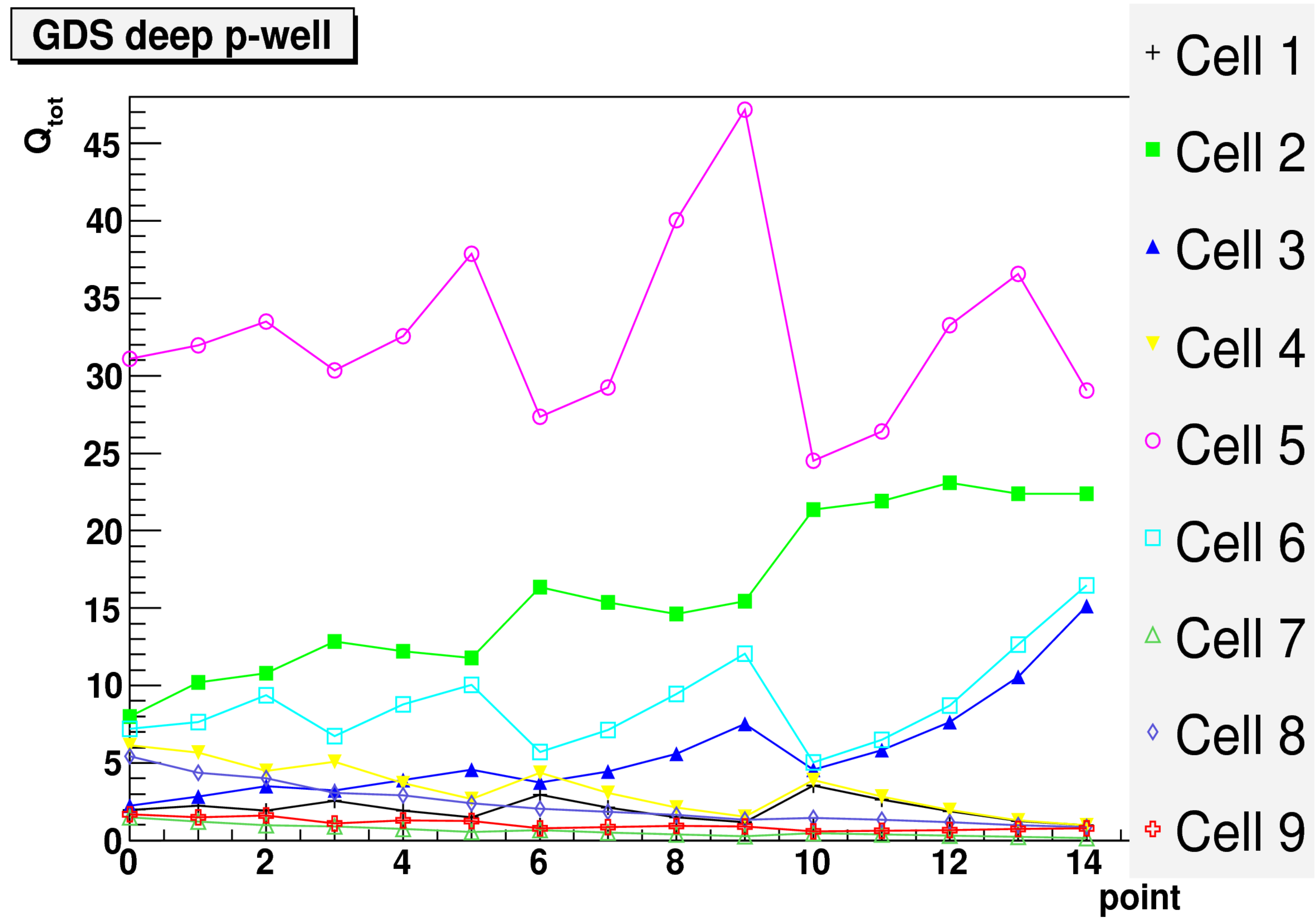

GDS deep p-well
Q_{tot}
0
5
10
15
20
25
30
35
40
45
1
2
3
4
5
6
7
8
9
cell
point 0
point 1
point 2
point 3
point 4
point 5
point 6
point 7
point 8
point 9
point 10
point 11
point 12
point 13
point 14


n-well simple
Q_{tot}
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
point
Cell 1
Cell 2
Cell 3
Cell 4
Cell 5
Cell 6
Cell 7
Cell 8
Cell 9

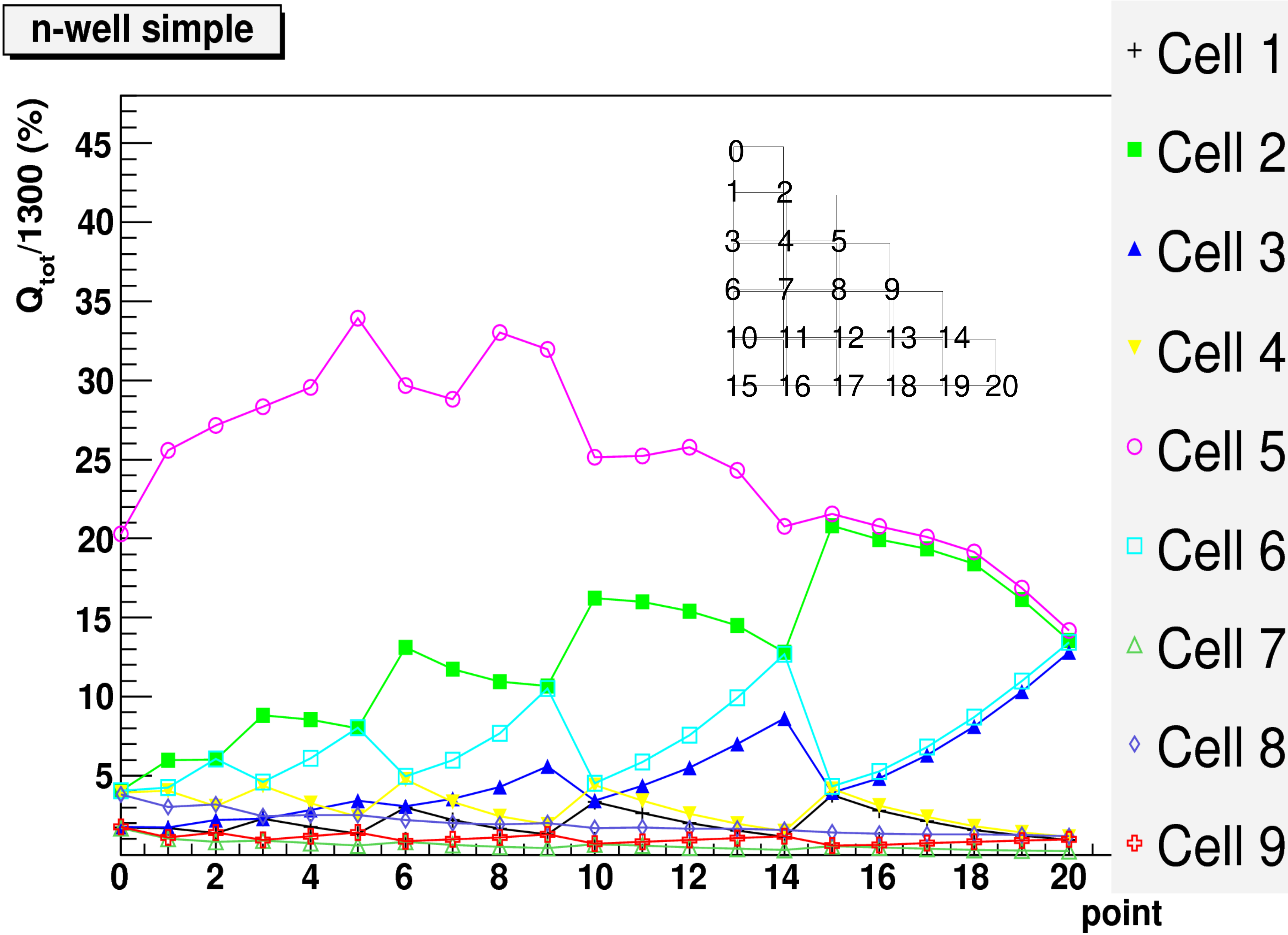


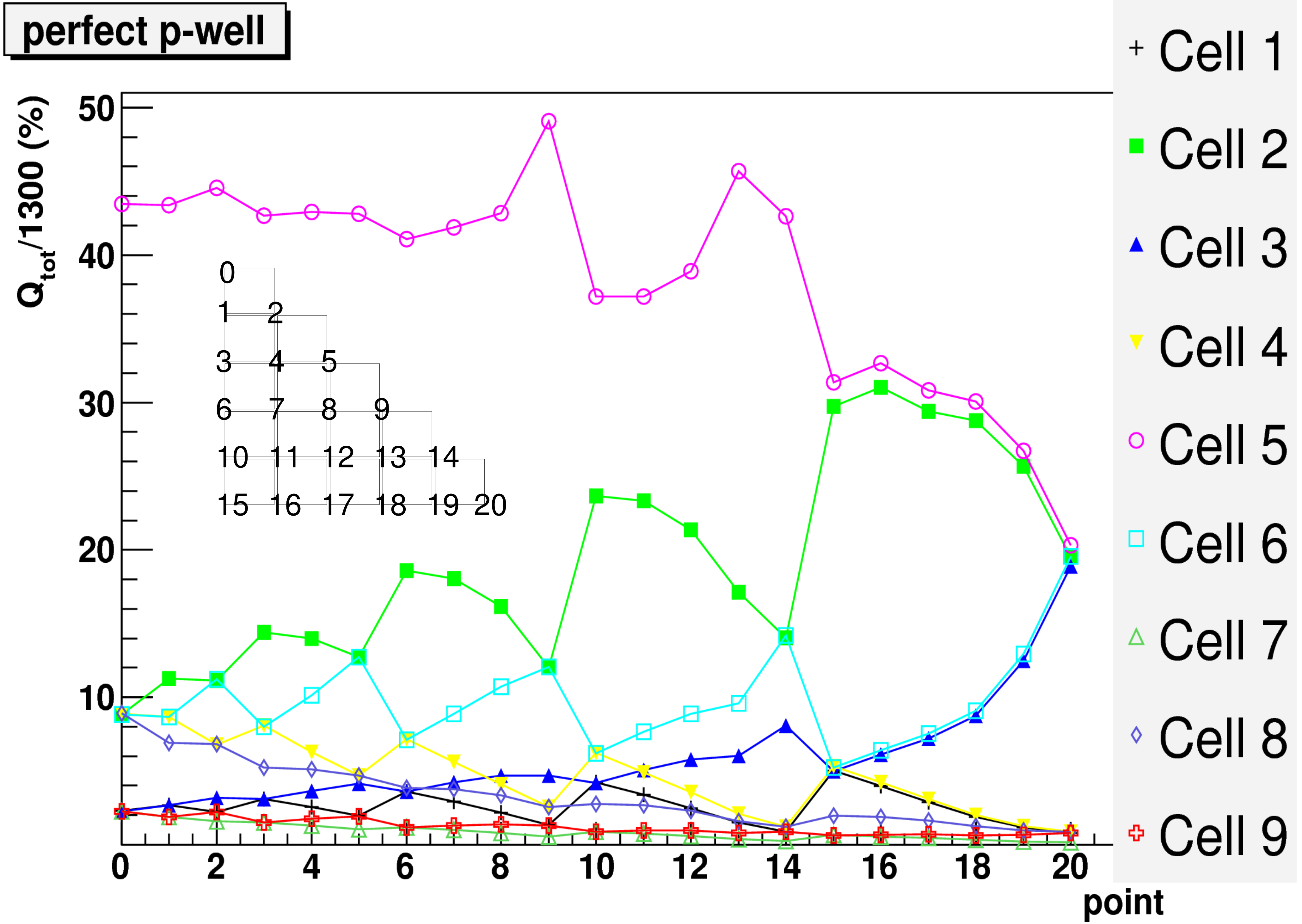
perfect p-well
Q_{tot}
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
point
Cell 1
Cell 2
Cell 3
Cell 4
Cell 5
Cell 6
Cell 7
Cell 8
Cell 9


GDS no deep p-well
Q_{tot}
10
1
10^{-1}
10^{-2}
10^{-3}
0
2
4
6
8
10
12
14
point
Cell 1
Cell 2
Cell 3
Cell 4
Cell 5
Cell 6
Cell 7
Cell 8
Cell 9

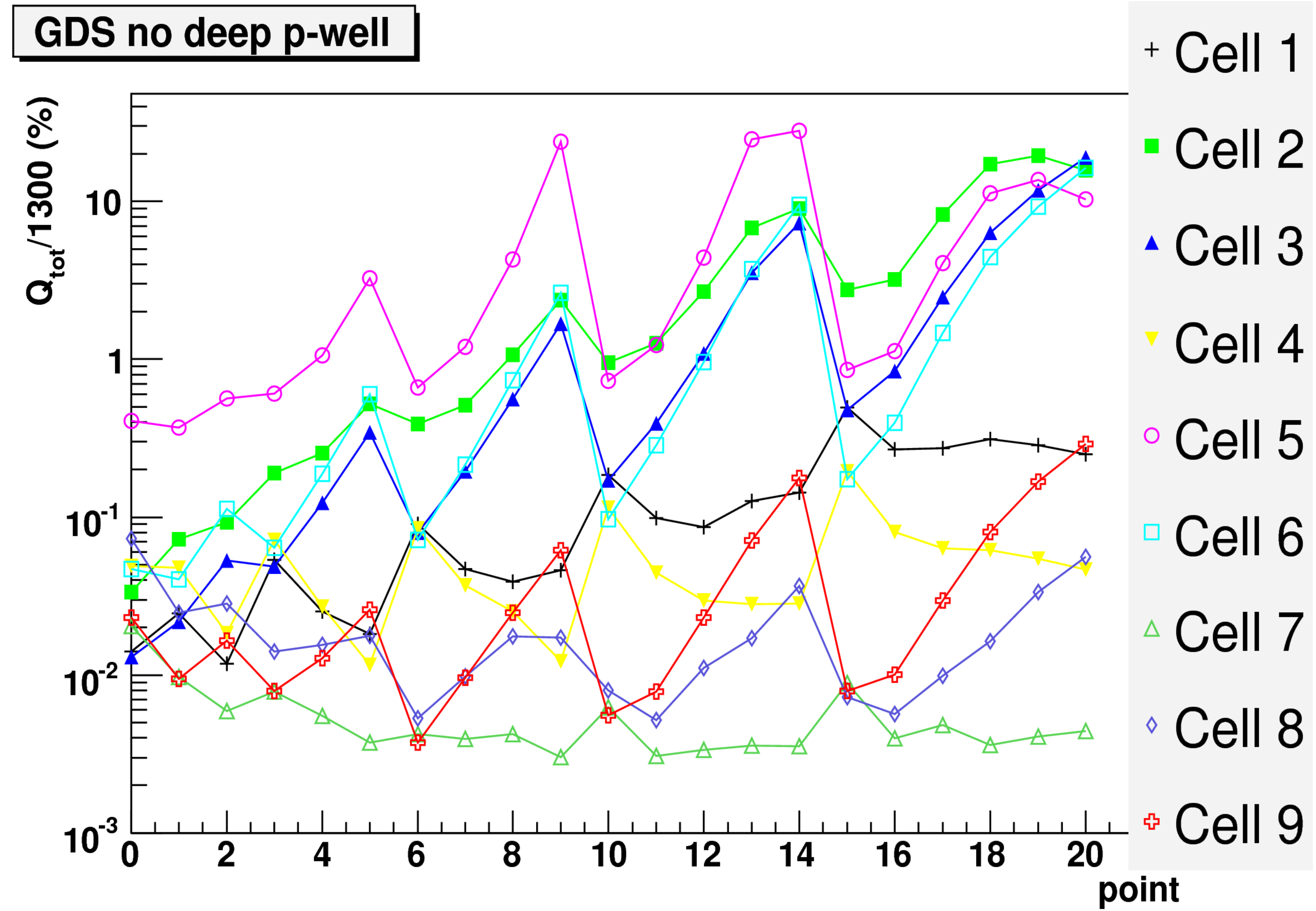


GDS deep p-well
Q_{tot}
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
point
Cell 1
Cell 2
Cell 3
Cell 4
Cell 5
Cell 6
Cell 7
Cell 8
Cell 9

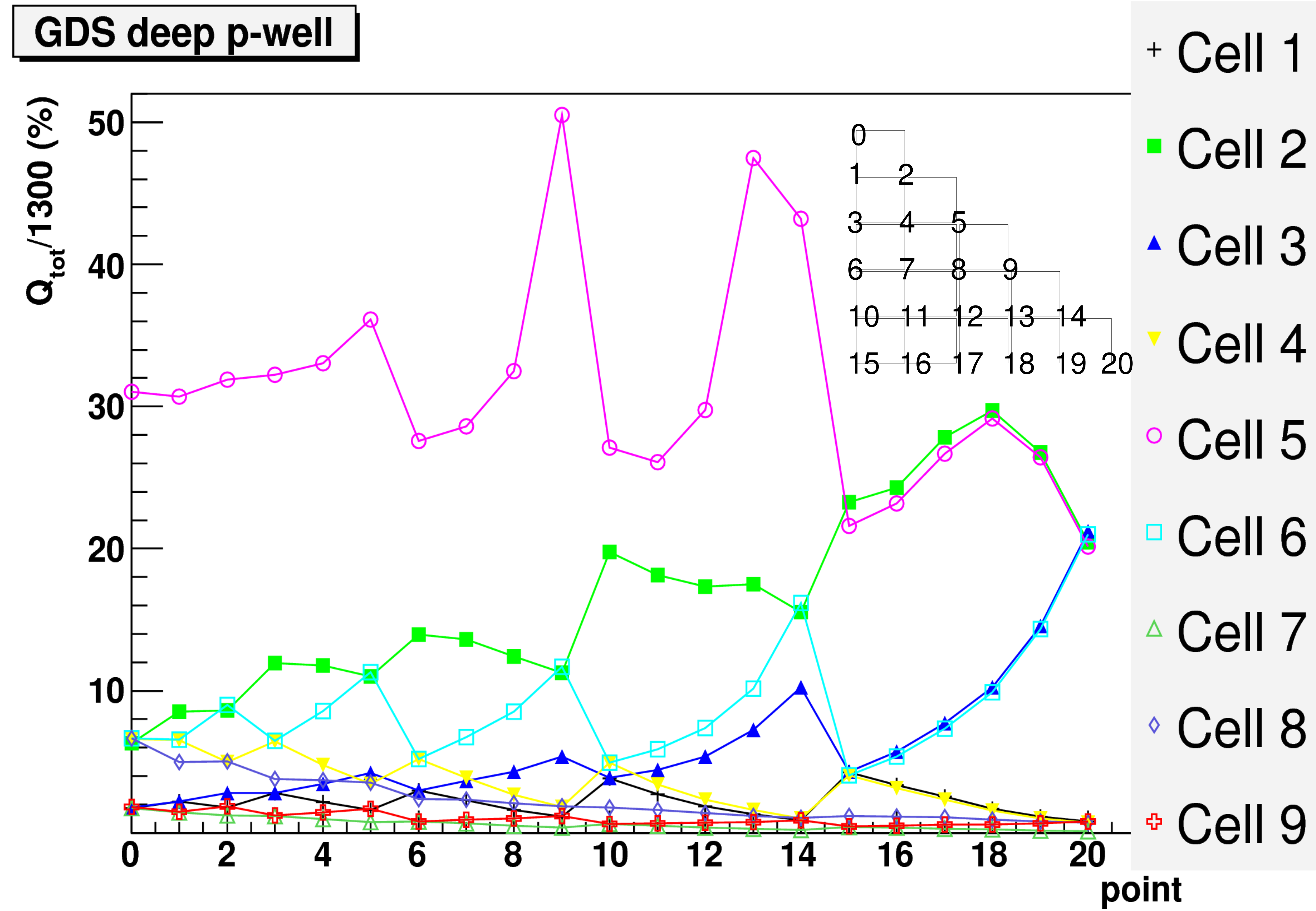

n-well simple
Q_{tot}/1300 (%)
point
Cell 1
Cell 2
Cell 3
Cell 4
Cell 5
Cell 6
Cell 7
Cell 8
Cell 9
0
1 2
3 4 5
6 7 8 9
10 11 12 13 14
15 16 17 18 19 20

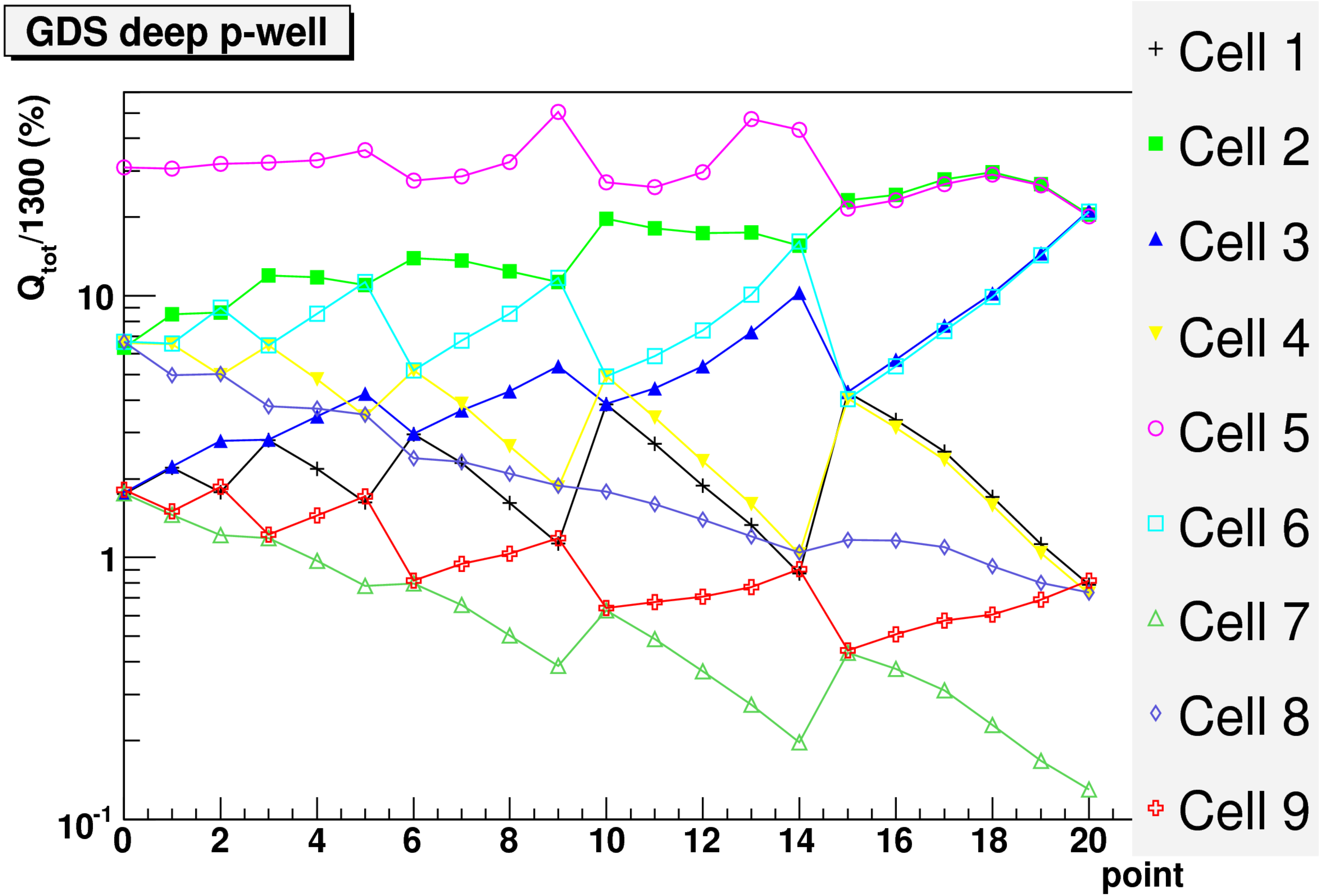


perfect p-well
Q_{tot}/1300 (%)
50
40
30
20
10
0
2
4
6
8
10
12
14
16
18
20
point
0
1 2
3 4 5
6 7 8 9
10 11 12 13 14
15 16 17 18 19 20
Cell 1
Cell 2
Cell 3
Cell 4
Cell 5
Cell 6
Cell 7
Cell 8
Cell 9



GDS no deep p-well
Q_{tot}/1300 (%)
10
1
10^{-1}
10^{-2}
10^{-3}
0
2
4
6
8
10
12
14
16
18
20
point
Cell 1
Cell 2
Cell 3
Cell 4
Cell 5
Cell 6
Cell 7
Cell 8
Cell 9


GDS deep p-well
Q_tot/1300 (%)
point
Cell 1
Cell 2
Cell 3
Cell 4
Cell 5
Cell 6
Cell 7
Cell 8
Cell 9
0
1 2
3 4 5
6 7 8 9
10 11 12 13 14
15 16 17 18 19 20


GDS deep p-well
Q_{tot}/1300 (%)
10
1
10^{-1}
0
2
4
6
8
10
12
14
16
18
20
point
Cell 1
Cell 2
Cell 3
Cell 4
Cell 5
Cell 6
Cell 7
Cell 8
Cell 9