Multipacting simulation summary

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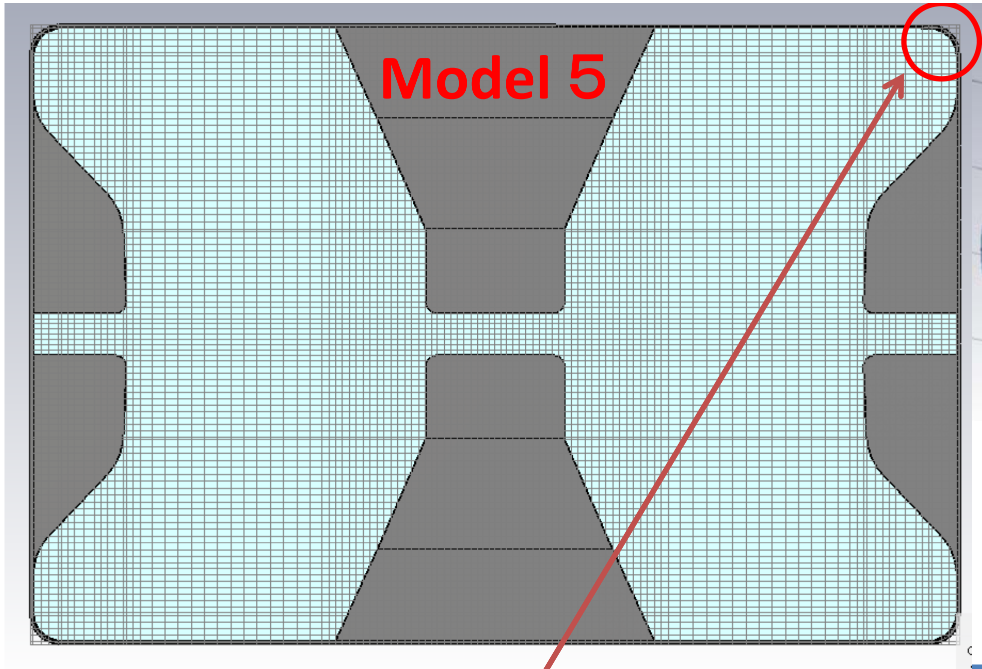
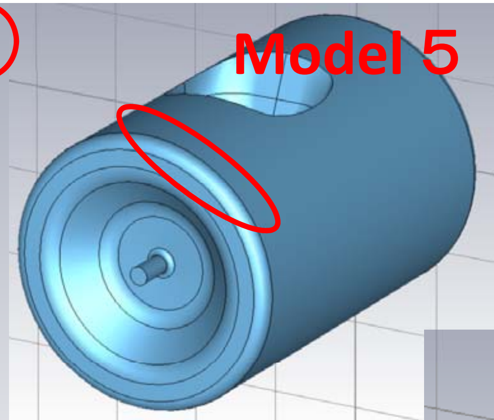
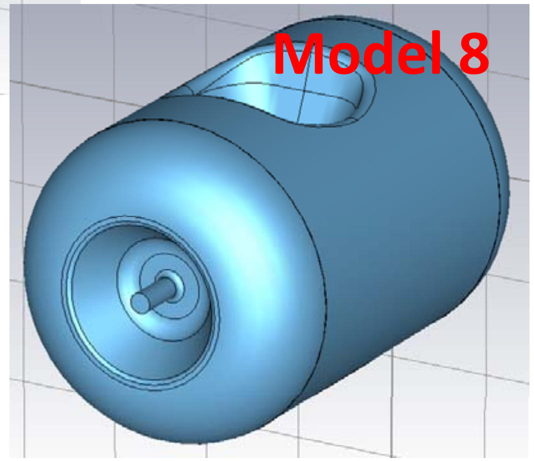
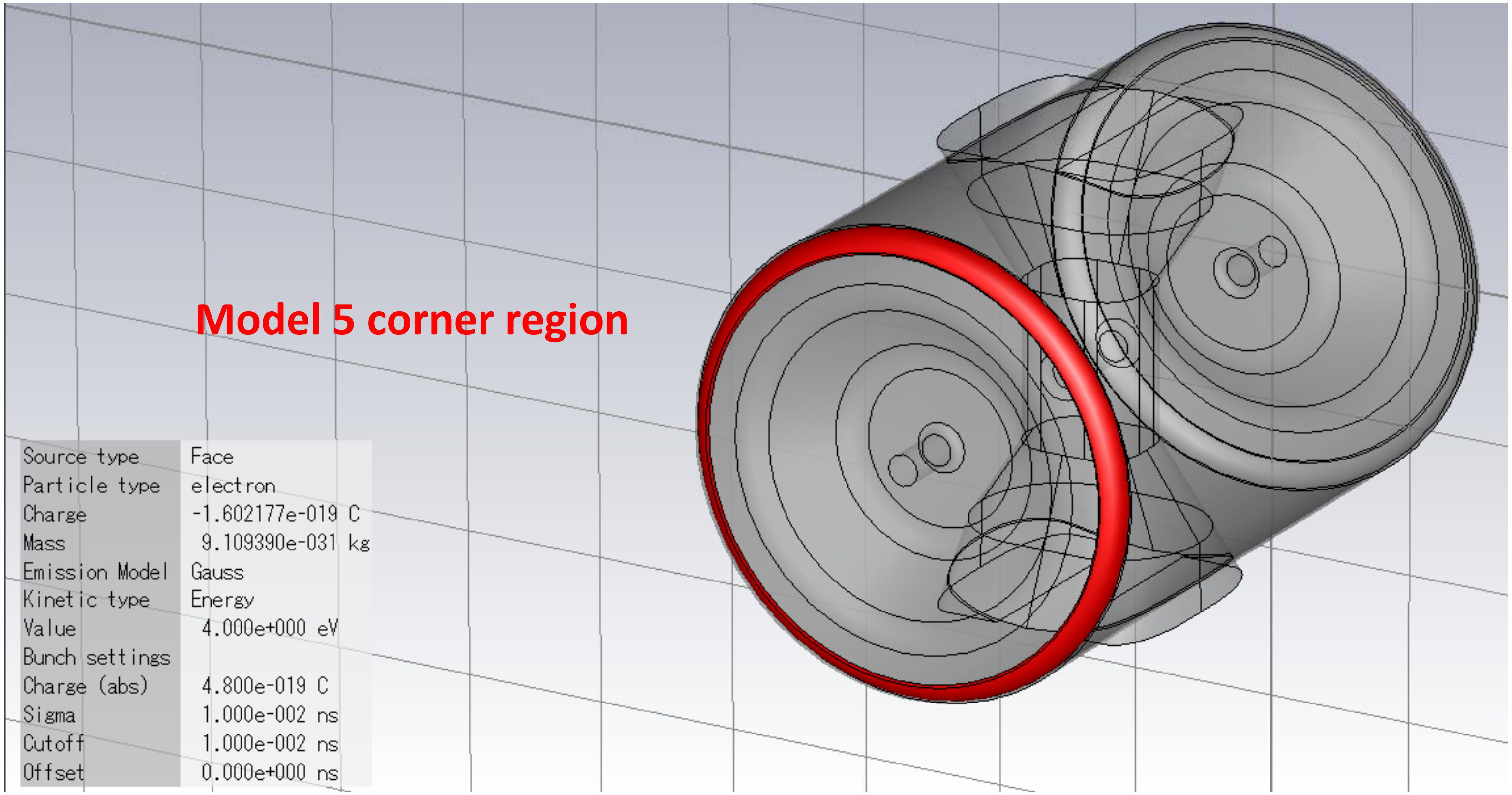
JPARC



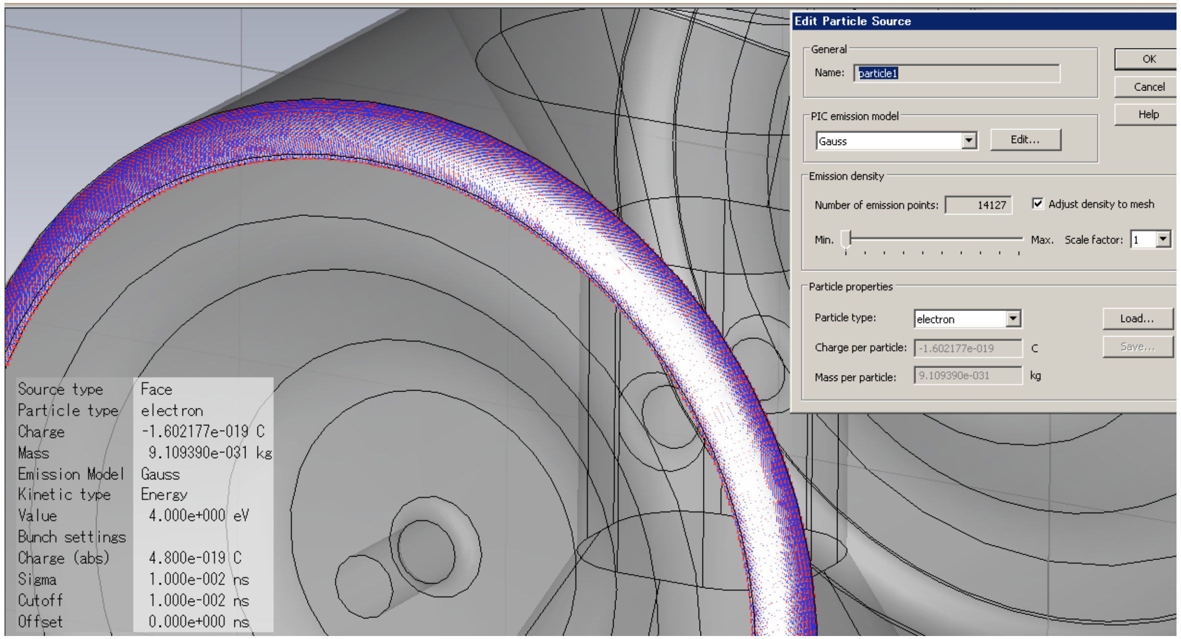


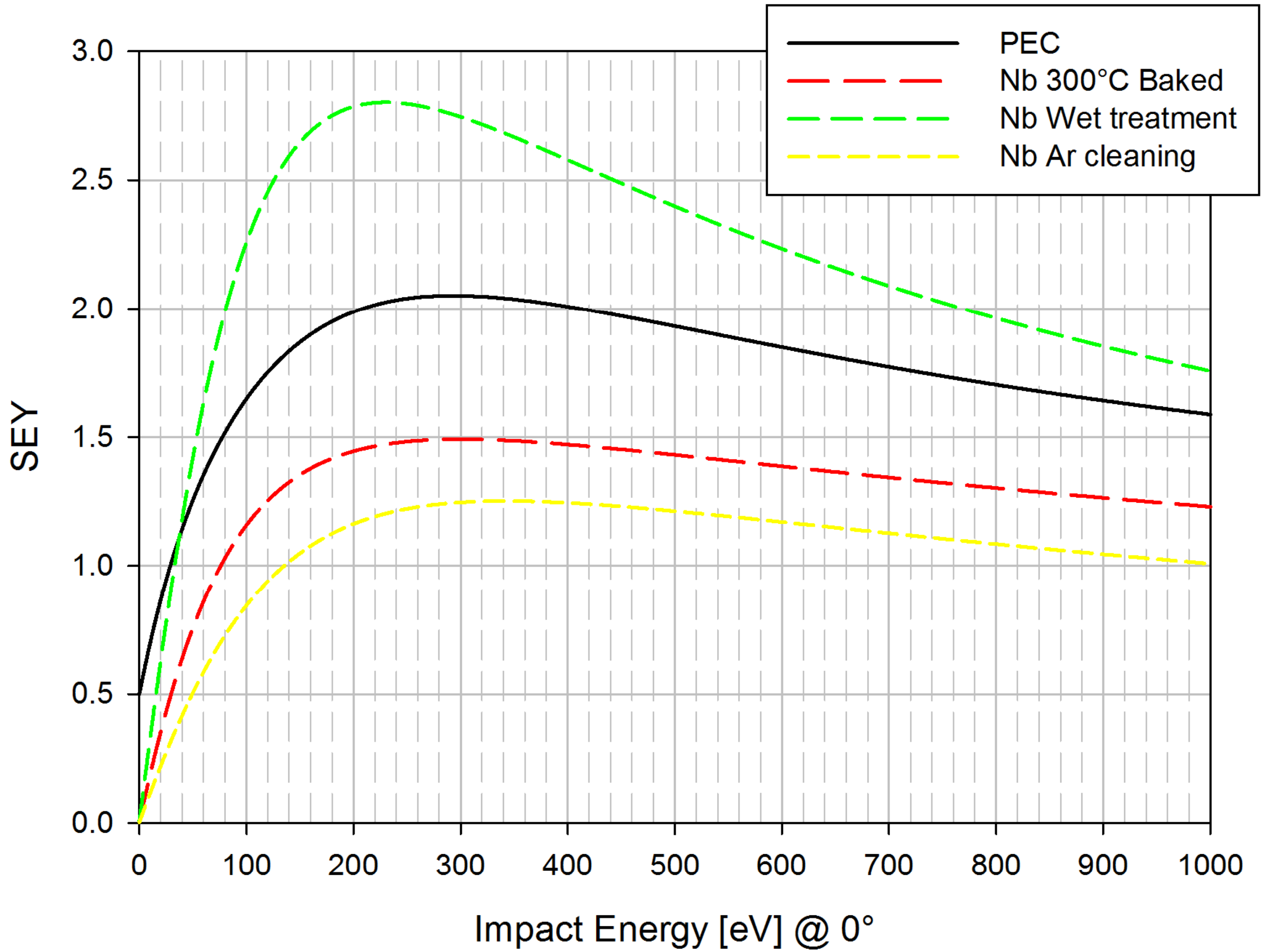


Model	Corner radius [mm]	Accelerating mode Freq. [MHZ]
1	2.8	326.5
2	10	
3	15	326.7
4	20.1	323.9
5	25	323.9
6	100	326.2
7	120	328.3
8	140	327.5



- 10^4 sources
- 10^6 meshcells
- 30ns duration*
- Sweep from 0.5 to 25MV/m
- Material:
    - Nb baked out at 300°C
    - Nb Ar discharge cleaning

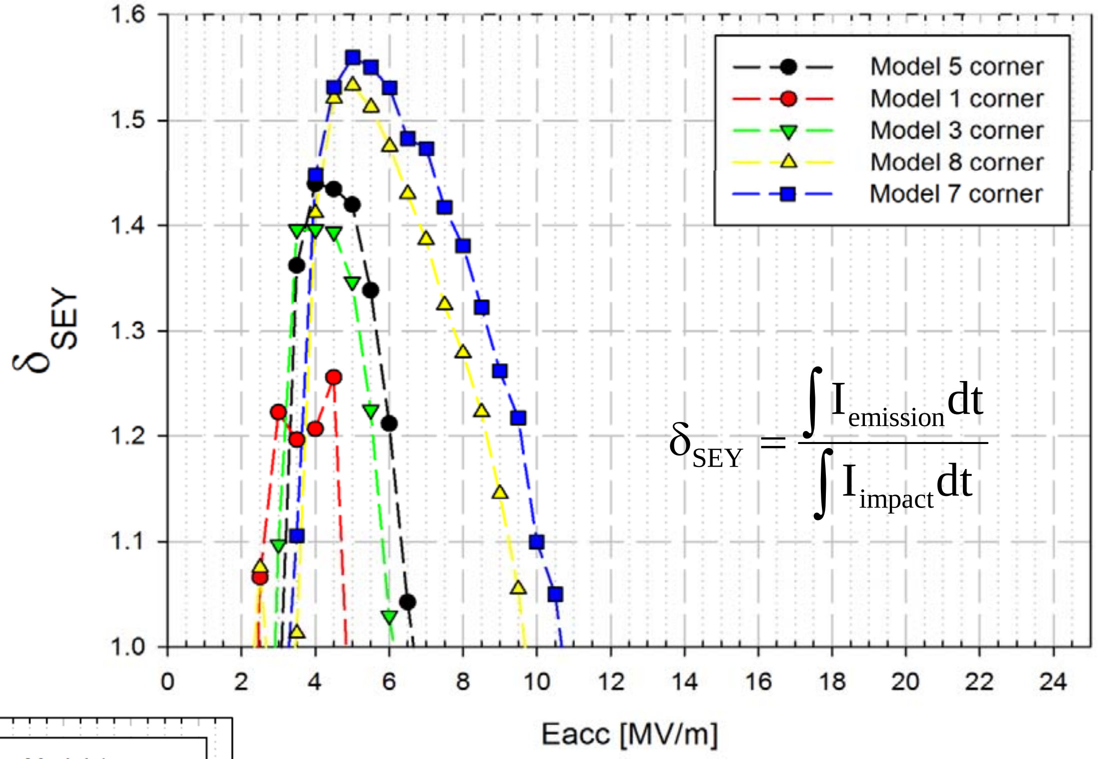


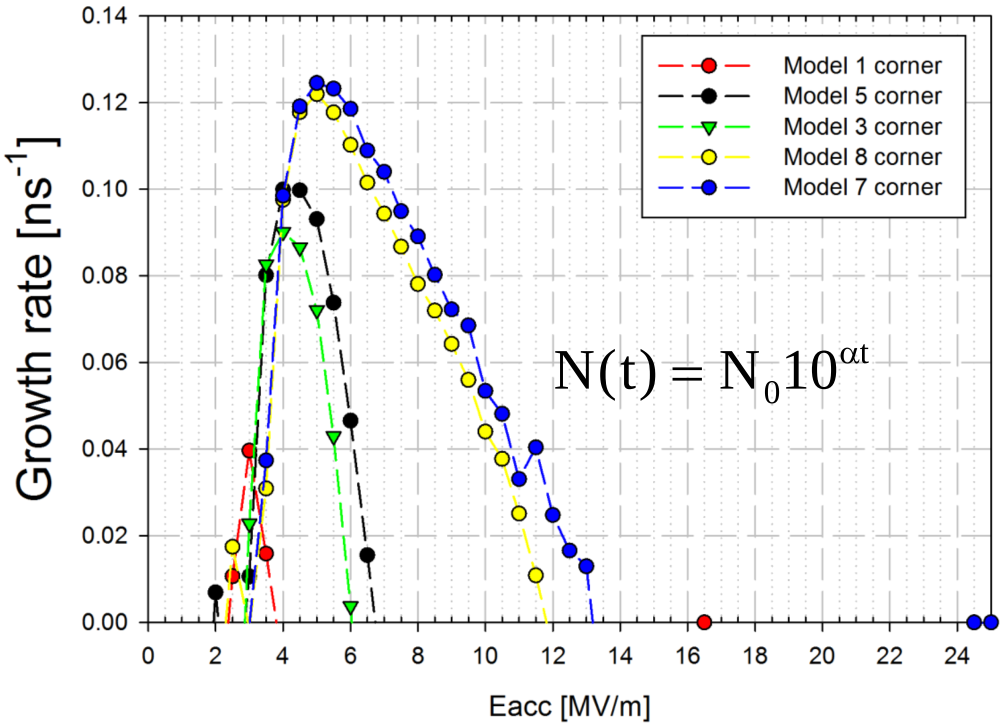


PEC
Nb 300°C Baked
Nb Wet treatment
Nb Ar cleaning
SEY
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
100
200
300
400
500
600
700
800
900
1000
Impact Energy [eV] @ 0°

Growth rate and δ_{SEY}

(PIC SOLVER)
Nb 300°C baked

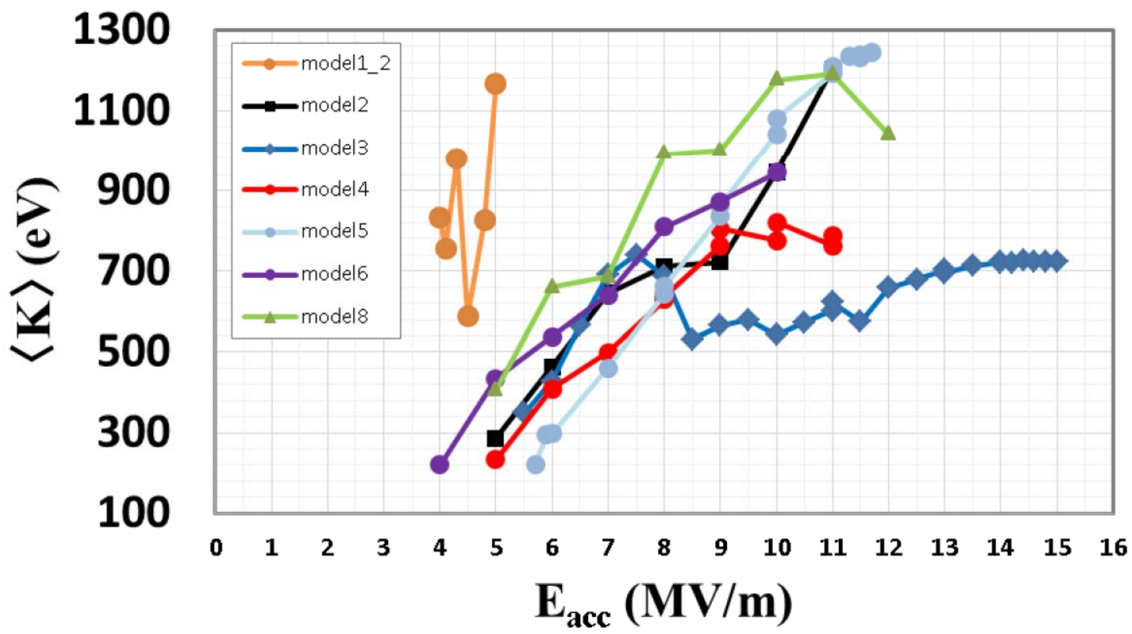


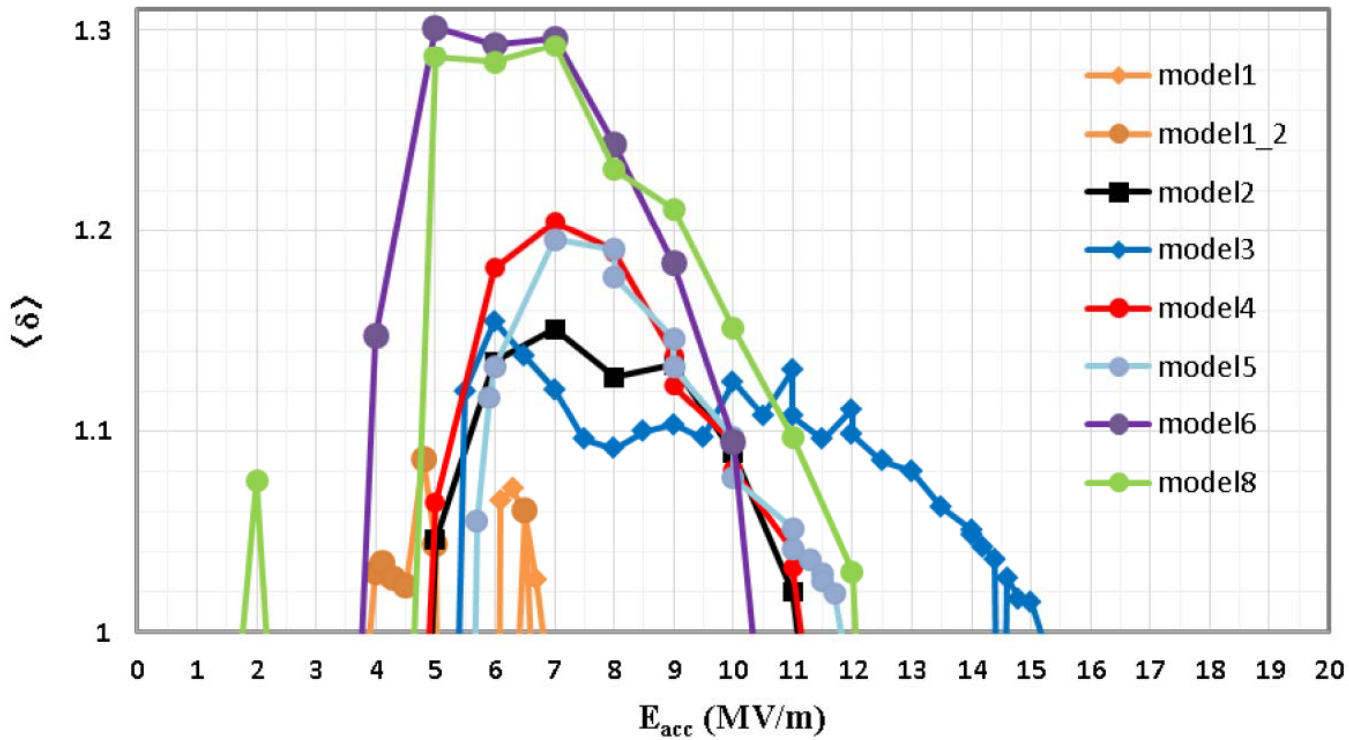


δ_{SEY} and average impact energy

(TRK SOLVER)

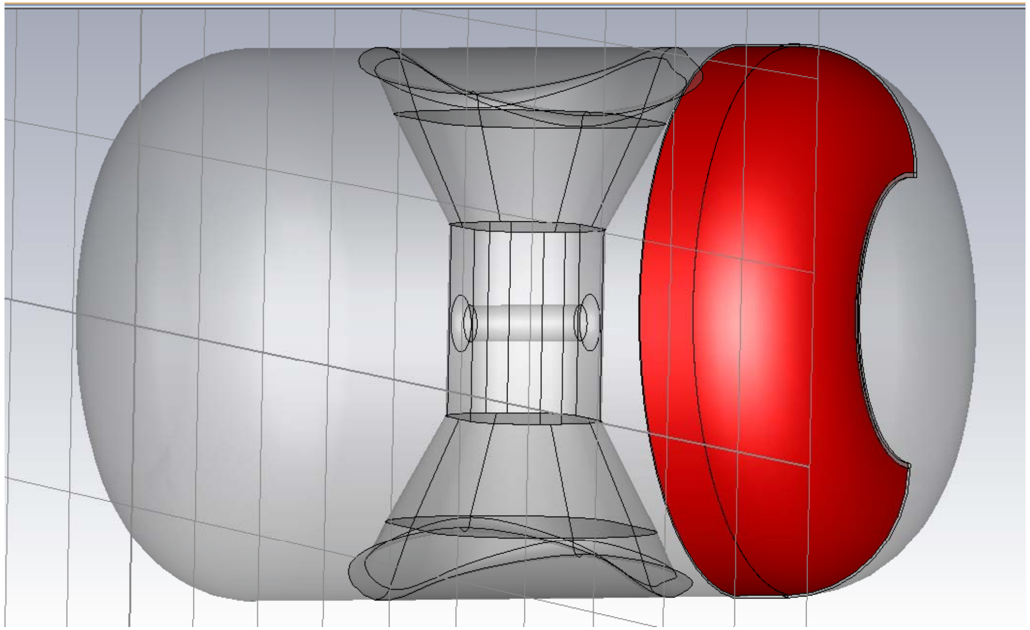
Nb Ar discharge cleaned



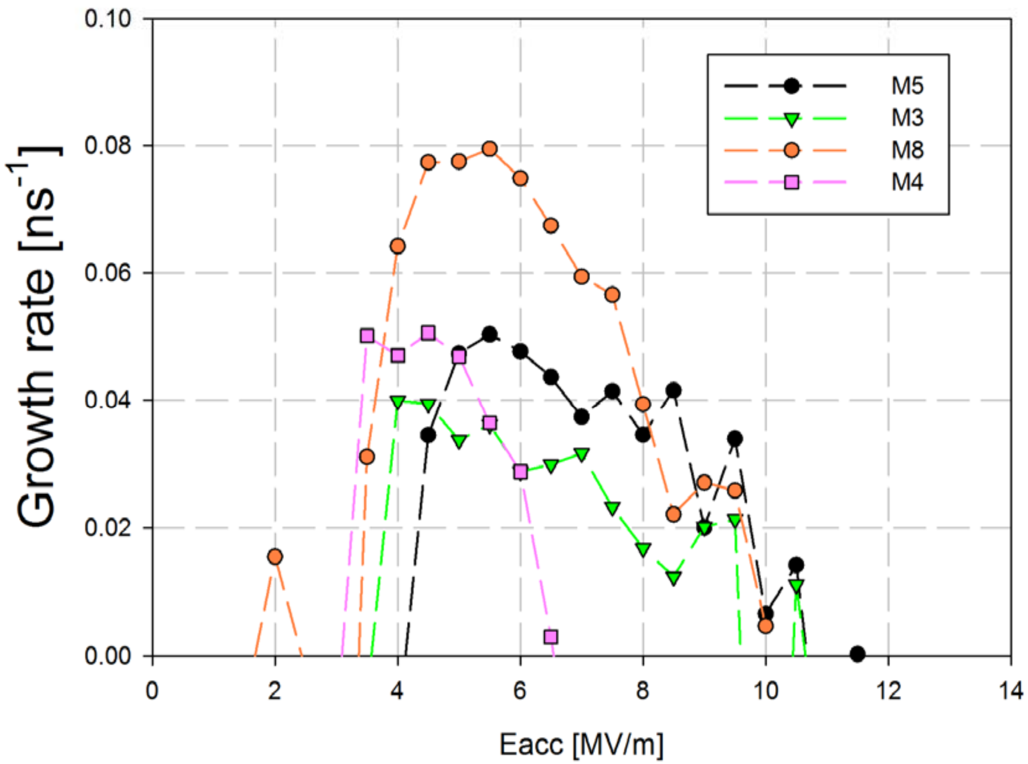


$$E_{avg} = \frac{\int P_{impact} dt}{\int I_{impact} dt}$$

Growth rate
(PIC SOLVER)
Nb Ar discharge cleaning

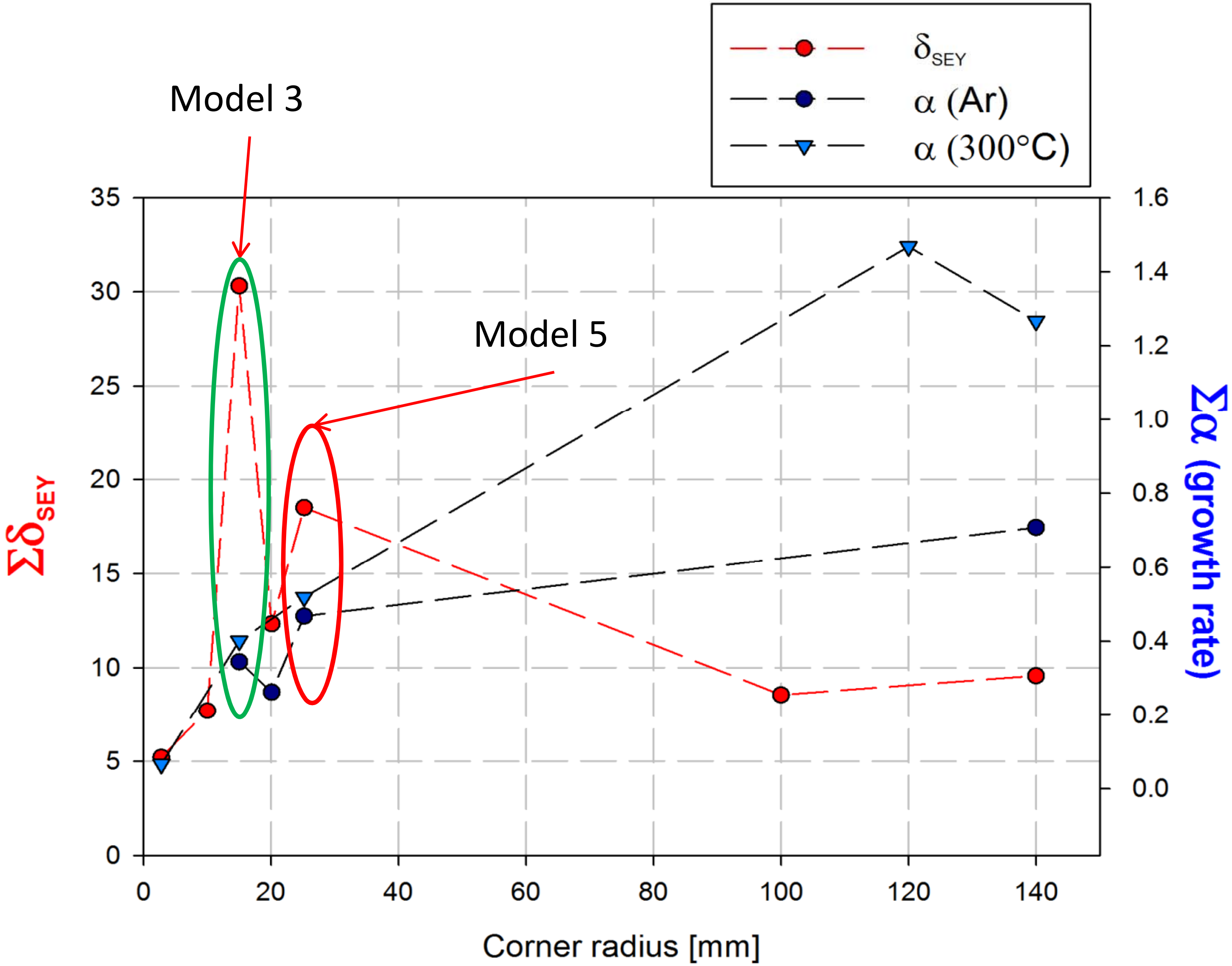


Ar discharge 60ns



Growth rate and δ_{SEY}

(Summation)



Multipacting order

1 point nth order multipacting: One-point occurs when the time of flight of the electron between two impacts is an **integer** (n) number of **RF cycles** and the electron's impact site is approximately the same as its ejection site.

$$\tau = nT_{RF}$$

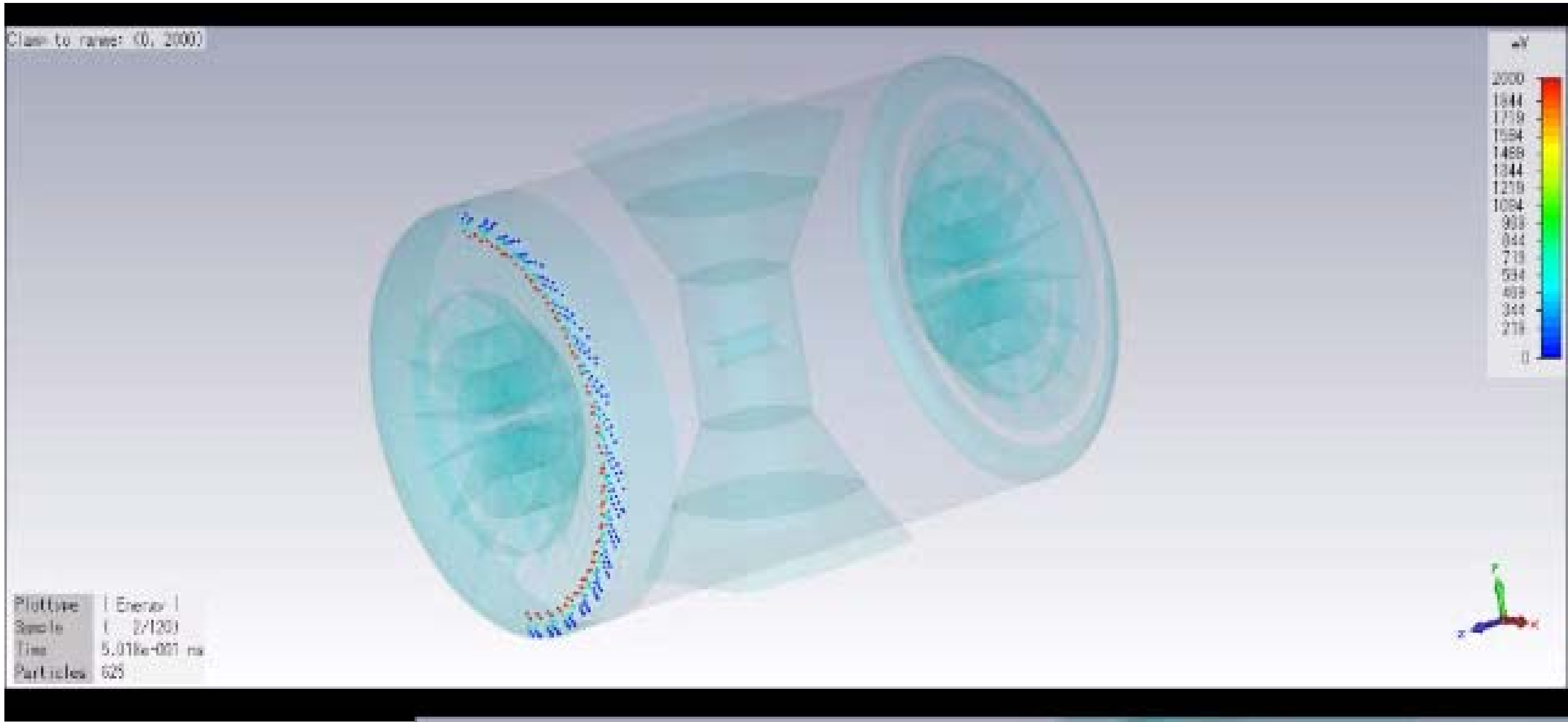
2 point nth order multipacting: Two-point occurs when the time of flight is an **odd number** of **half rf cycles** and the impact site is not the same as the ejection site.

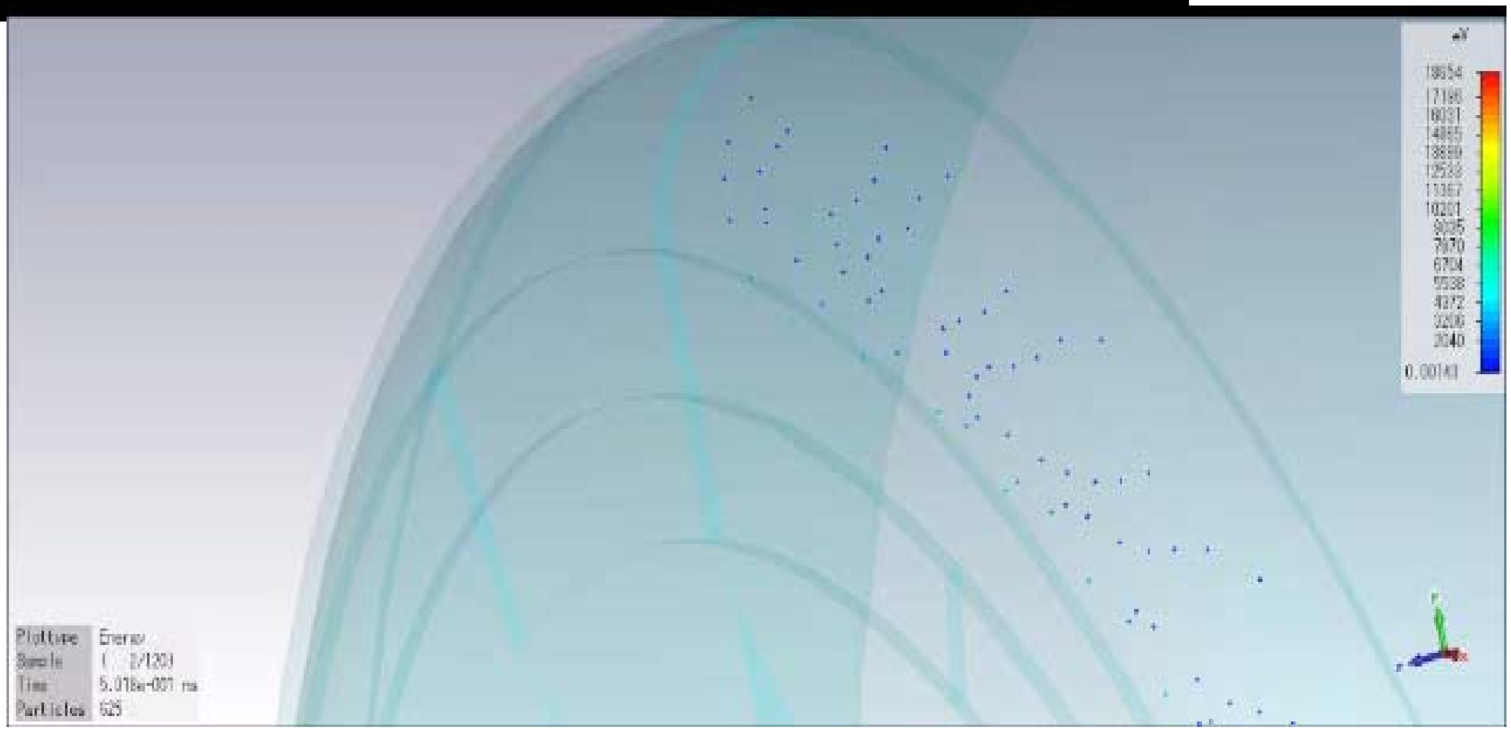
$$\tau = (2n-1)\frac{T_{RF}}{2}$$

With f_0=324MHz the expected time of flight for electrons in the multipacting region are:

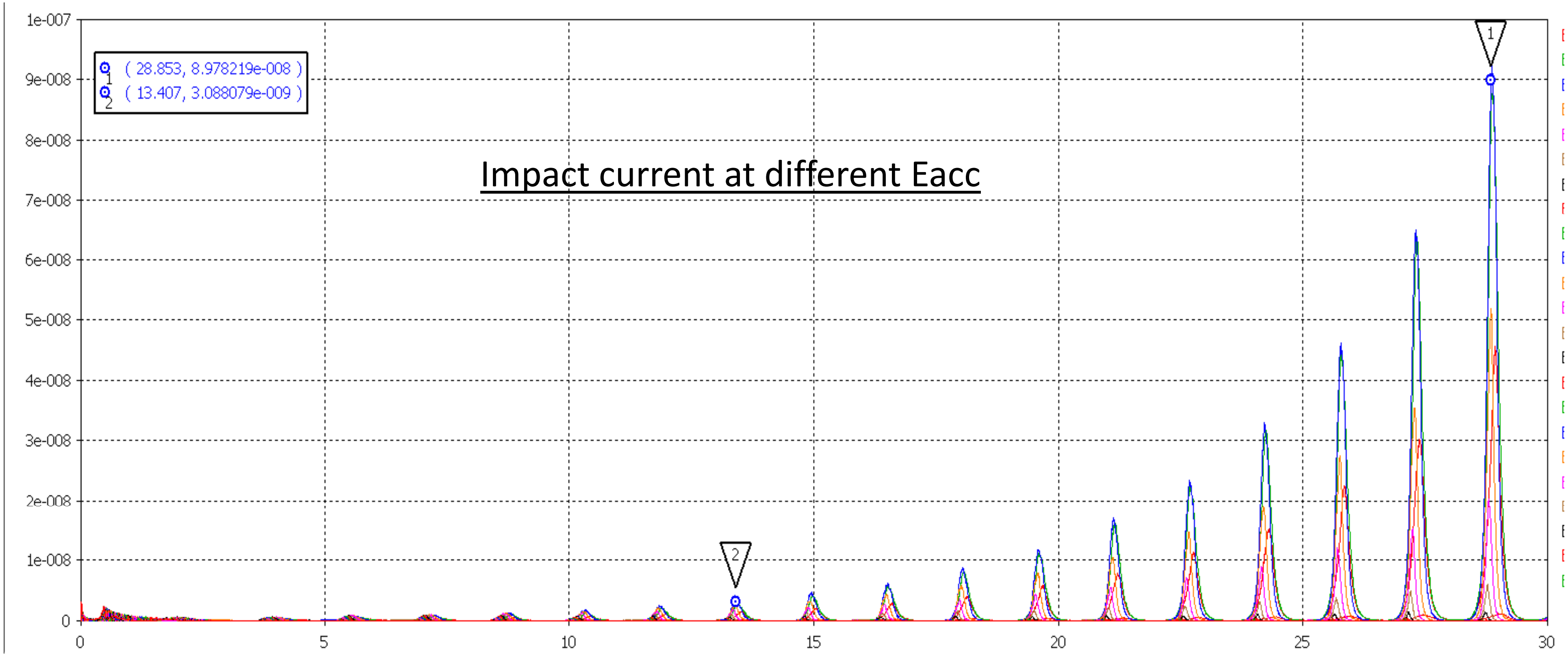
nth order	1 Point [ns]	2 Point [ns]
1	**3.09**	**1.54**
2	6.17	4.63
3	9.26	7.72
4	12.35	10.80

Most stable$\Rightarrow$ Dangerous


eV
2000
0
Plottype
Sample
Time
Particles
625


eV
Plottype
Energy
Sample
Time
Particles
625

MP order



Model 5 <u>ΔT≈ 1.53ns</u> is 2 point first order MP

Summary

$$N(t) = N_0 10^{\alpha t}$$

Number of electrons after t seconds, when growth rate is α

$$N_0 \approx E_{surf}^2 e^{-\frac{C}{E_{surf}}}$$

Starting number of electrons depends on the electric field on the surface and emitter geometry

Best choice should be to reduce the MP band as long as the electric field on the surface where MP is expected.