RD51 Mini Week

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THGEM charging up calculations

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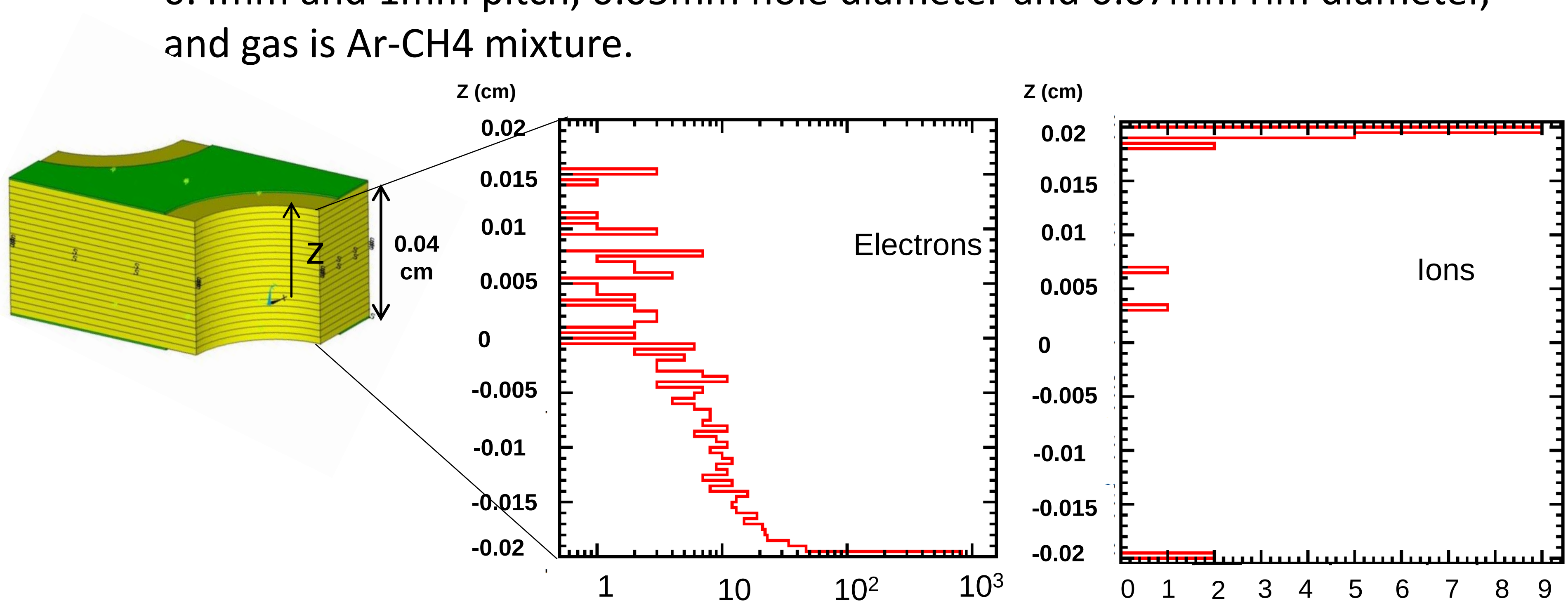
IMPORTANT TOPICS

- Dynamical step for Charging up calculations for **electrons and ions** on THGEM @ 1000V
- Effective gain, charges deposition distribution on z axis (comparison between methods)
- Conclusions and Future Work

THGEM CHARGING-UP SIMULATION

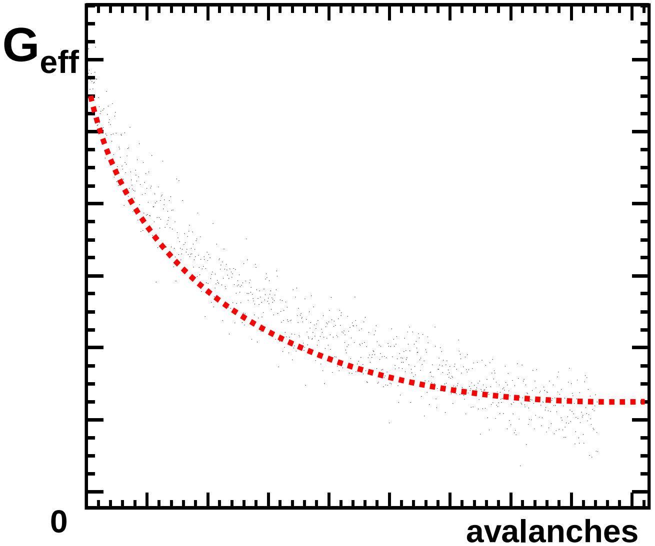
- First attempt to simulate Thick-GEM charging
- We extended the method for Thick-GEM with an insulator thickness of 0.4mm and 1mm pitch, 0.05mm hole diameter and 0.07mm rim diameter, and gas is Ar-CH4 mixture.

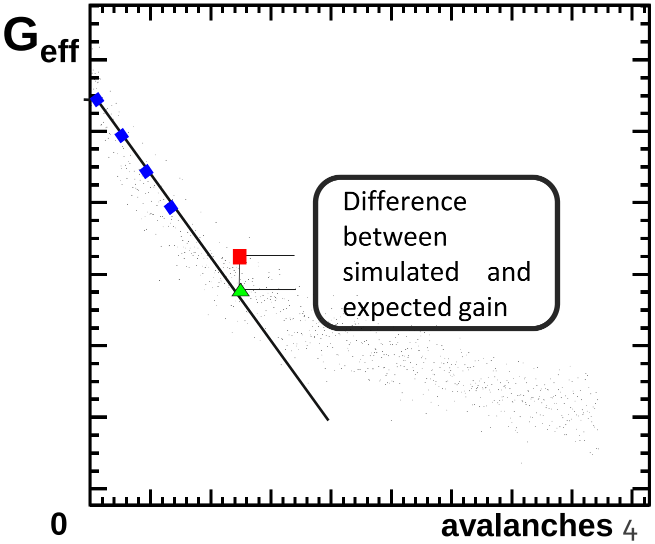


Number of charges deposited on insulator (hole surface) after 5000 avalanches

THGEM CHARGING-UP SIMULATION - METHOD

- The first plot is a representation of the gain as a function of number of avalanches, calculated with previous method of constant step (this plot is not a real simulation, only an example!)
- The second plot is an explanation of the new method, using an dynamical step (again only another example)
- First we simulate few points with very good statistic (blue points).
- Apply a linear extrapolation (first degree polynomial) to the previous 4 points, to know the **expected new point** (green triangle)
- The **simulated new point** is the red square



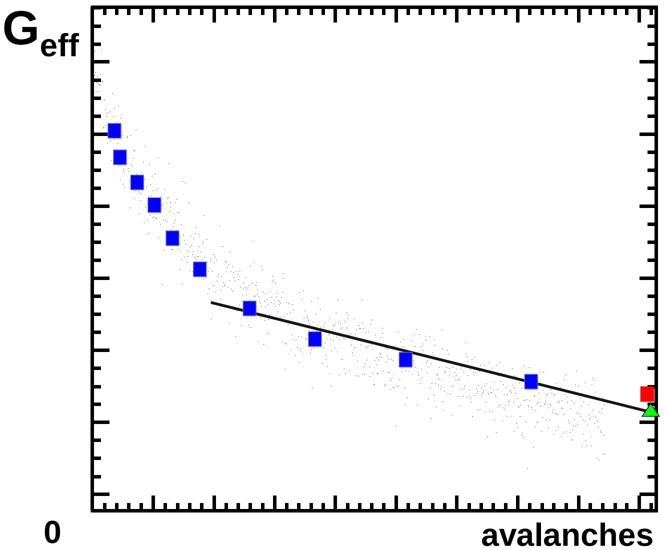


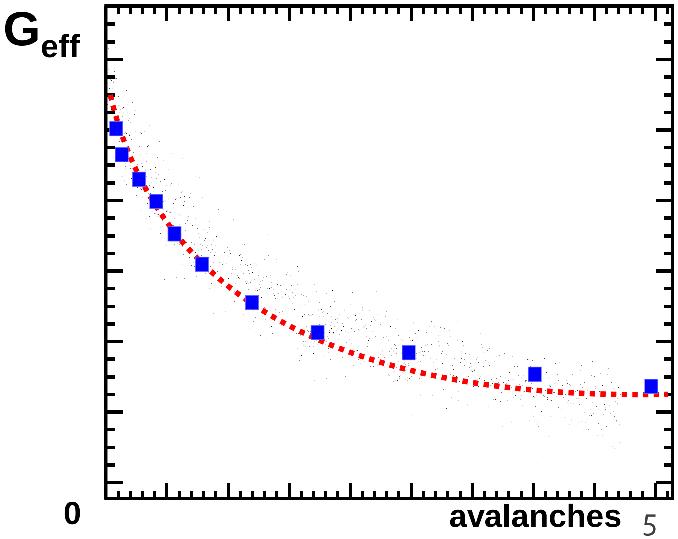
THGEM charging-up Simulation - Method

- If the simulated point is close to the expected point (10-15% difference), we assume the simulated point as correct and we continue the method (top plot), increasing the step. In negative case, we reduce the step and do again the simulation

- We can visually compare both methods in the bottom plot. Small red points are the standard method and blue squares are the dynamical method.

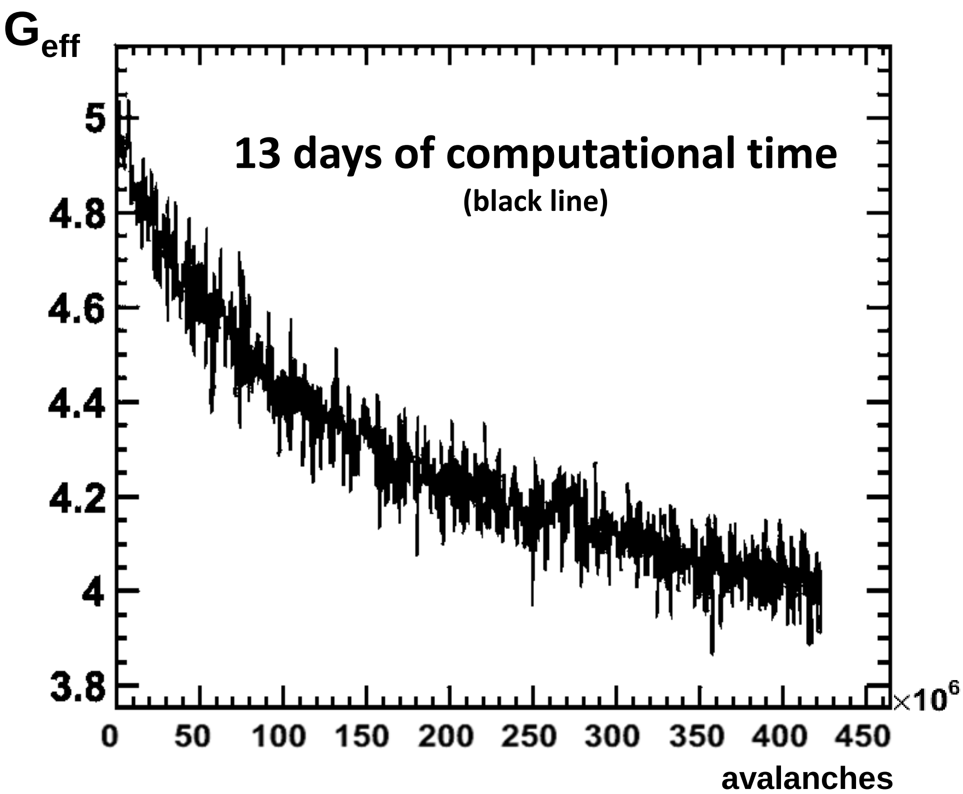
- The goal is to obtain the same information, with much less iterations (and consequently less computational time)



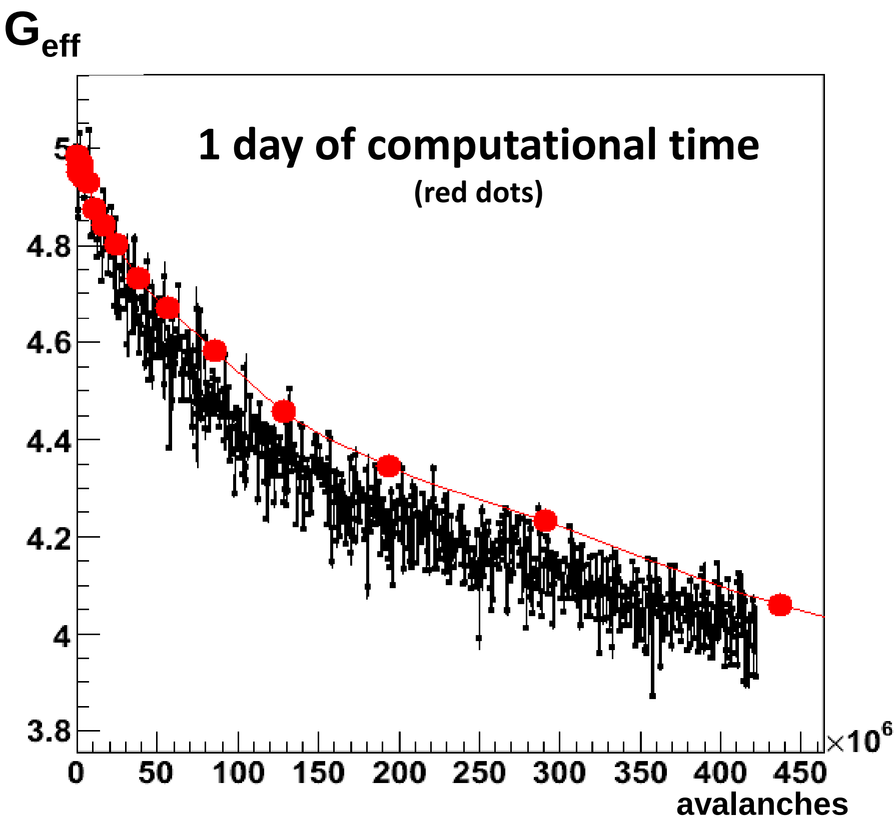


THGEM CHARGING-UP

EFF.GAIN FOR 1000V STANDARD VS DYNAMICAL STEP



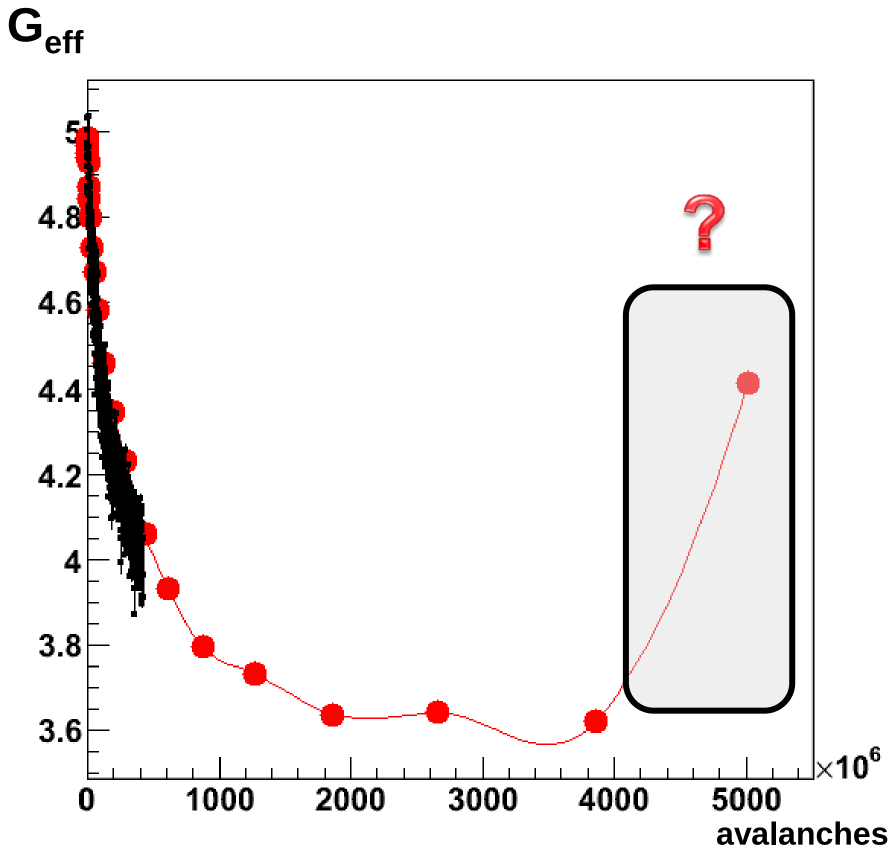
Standard method



- Red points represent the dynamical step – only 20 points are needed to represent the same information obtained before ≈ **1 day of computational time**
- Small deviation from previous results

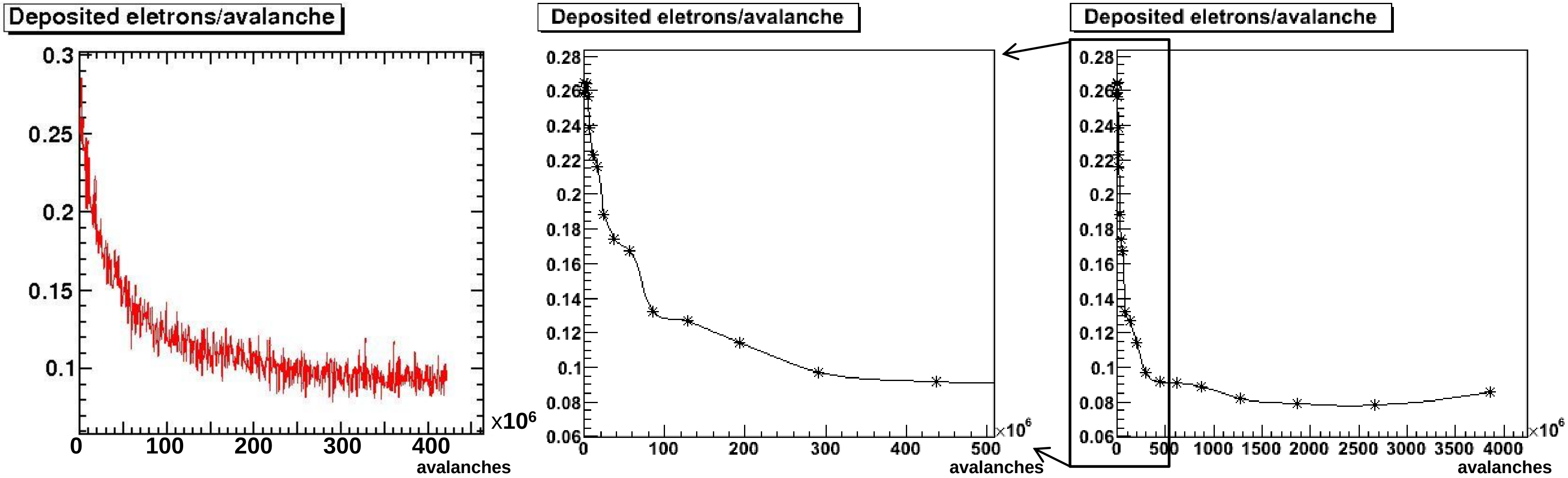
THGEM CHARGING-UP
DYNAMICAL STEP

- ❑ Standard method – black points
- ❑ Dynamical method – red points
- ❑ With more interactions the gain reaches a plateau (similar to experimental results)
- ❑ Some more iterations, but at some point the method start to vanish
- ❑ The problem could be related with simulation issues (something to check)



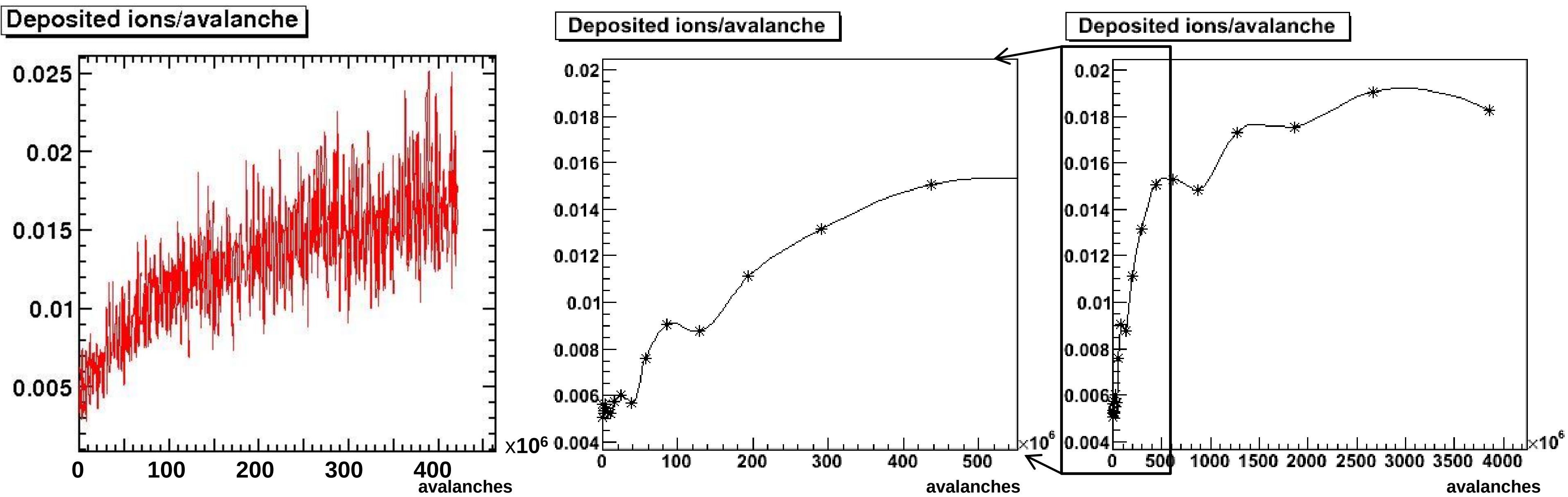
❑ The computational time is now much smaller, and apparently we get the same results

THGEM CHARGING-UP
DYNAMICAL STEP - ELECTRONS



- Deposited electrons per avalanche, standard method at left, dynamical at center and right
- Red – previous method ≈ 900 points
- Black – new method ≈ 20 points
- We can see the agreement between both methods

THGEM charging-up
Dynamical step - Ions



- Deposited ions per avalanche, standard method at left, dynamical at center and right
- Red – previous method ≈ 900 points
- Black – new method ≈ 20 points
- For later iterations with method, we can see stabilization on the values.

Conclusions and Future work

- The dynamic method (DM) seems to be efficient and more than 10 times faster than before
- Need to understand why the DM diverge at a certain point (converging conditions?)
- Apply the DM to GEMs and compare with previous simulation – validation (experimental and simulation)
- Experimental studies with Thick-GEMs on our lab – soon

END

- Thank you for your attention.
- Your comments/suggestions are welcome!