MicroMesh Transparency

Short Update

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4th RD51 meeting - WG4 Simulation

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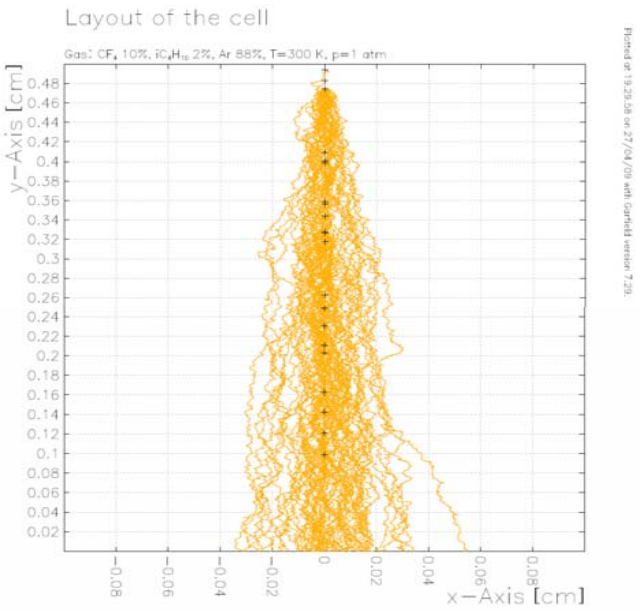
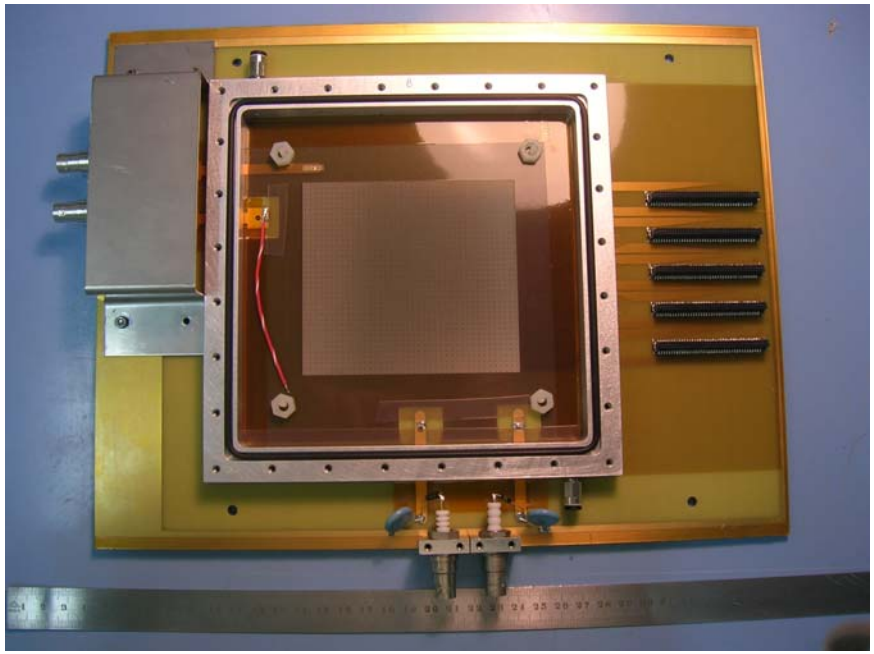


Micromegas Mesh Transparency

Aim is to understand the micromesh transparency for electrons by comparing experiment measurements to simulations

→ First results shown in 3rd RD51 meeting in June



For this study a “standard” (10 cm x 10 cm) chamber has been used.

Basic chamber characteristics:

- “T2K” mesh

450 line/inch = 56.4 μm pitch (calendered)

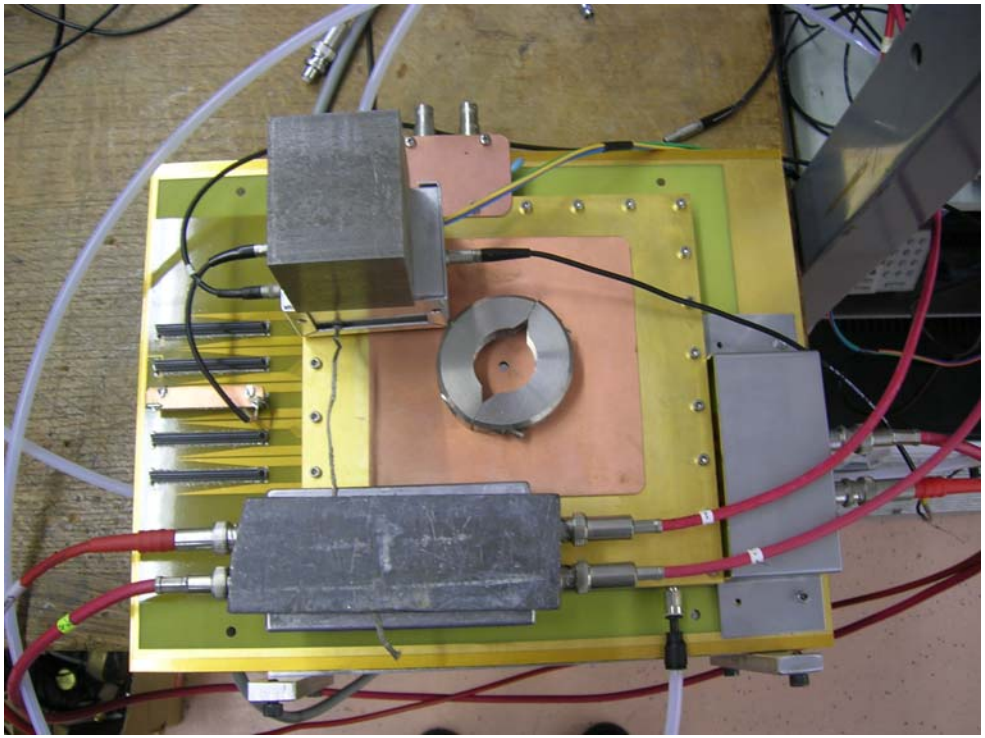
18 μm wire diameter

128 μm amplification gap

Segmented mesh

- Drift distance = 2.0 mm
- Ar 85% CO_2 15%

Measurement Set-up



Measurements with ^{55}Fe / ^{241}Am and long integration time (1 μs)

Sum signal of strips to observe total charge.

Gas gain and electron transparency measurements

→ The latter to be considered here.

Simulation

- Use ANSYS to calculate field maps for different electric field configurations

→ Both rectangular and cylindrical mesh wires used

→ Assume mesh wires pass through one another at the intersections

(reasonable approximation since calendered mesh used)

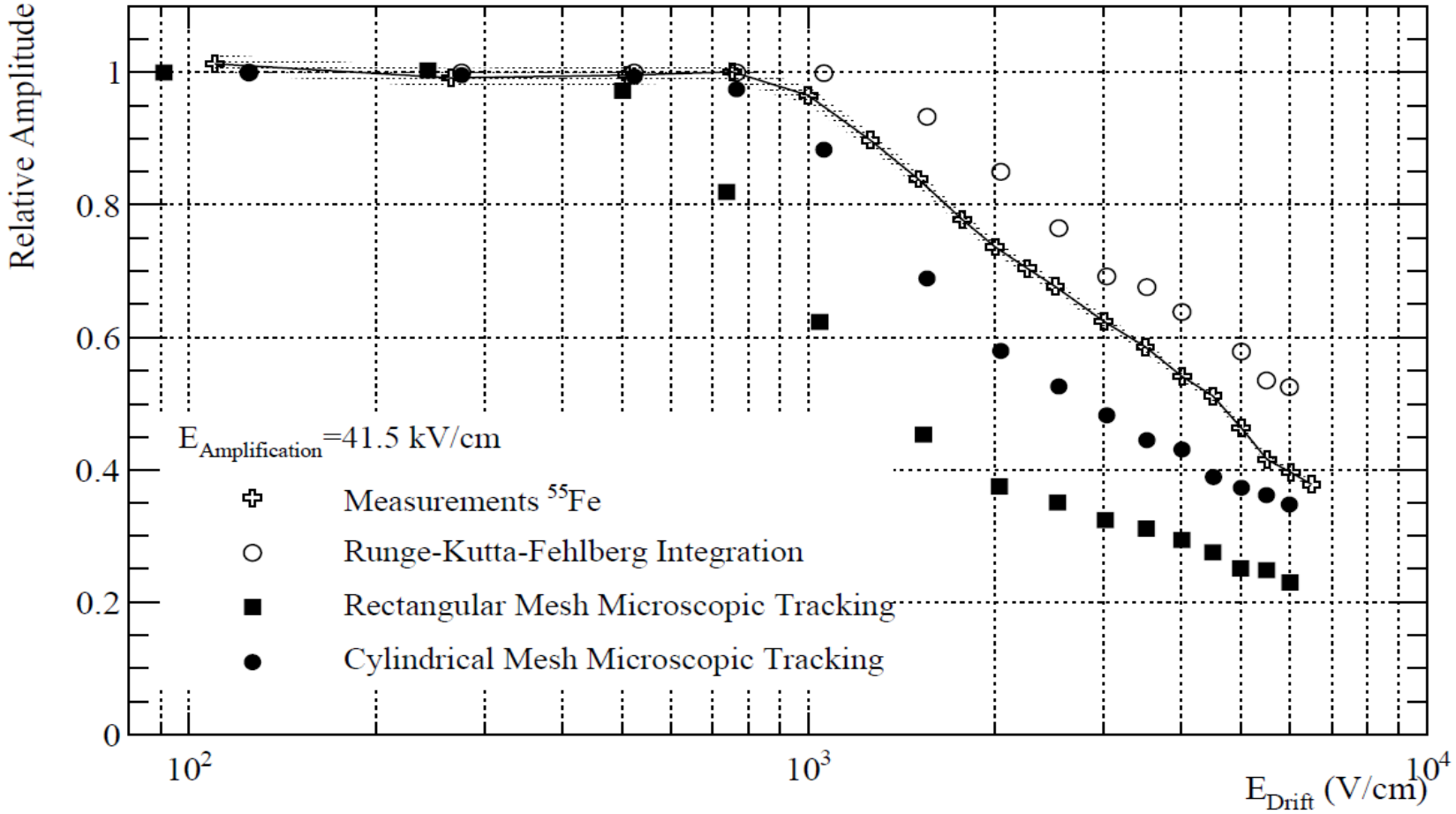
- Use GARFIELD/MAGBOLTZ microscopic tracking

to produce monte-carlo experiments

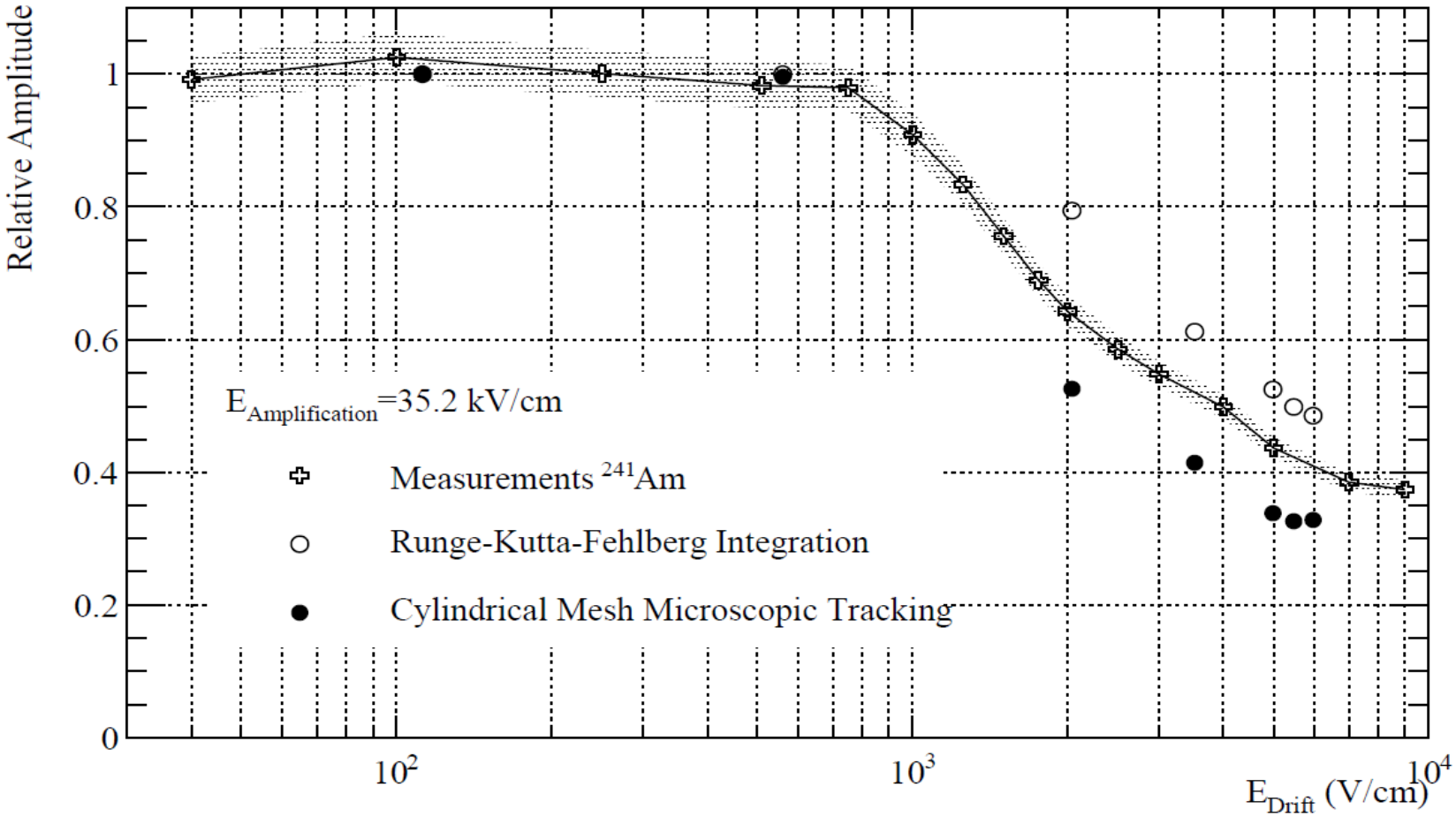
→ Take into account diffusion/attachment

- Compare with Runge-Kutta-Fehlberg integration

Results for 5.9 keV photons



Results for 5.5 MeV alphas



Results with the cylindrical grid approximation

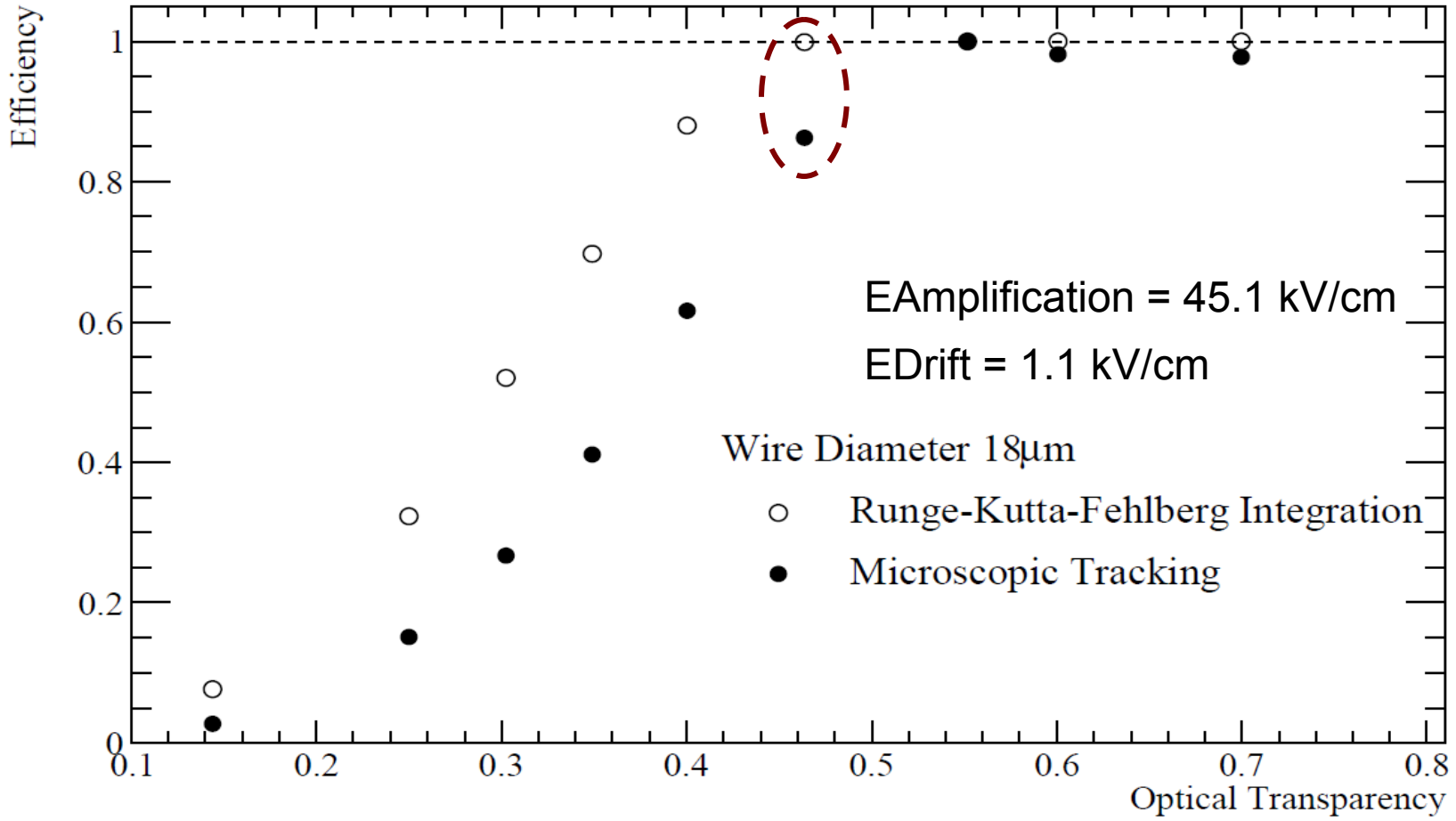
→Clearly, the rectangular mesh is not a good approximation.

→The cylindrical mesh does a much better job, correctly describing the point where the efficiency starts decreasing.

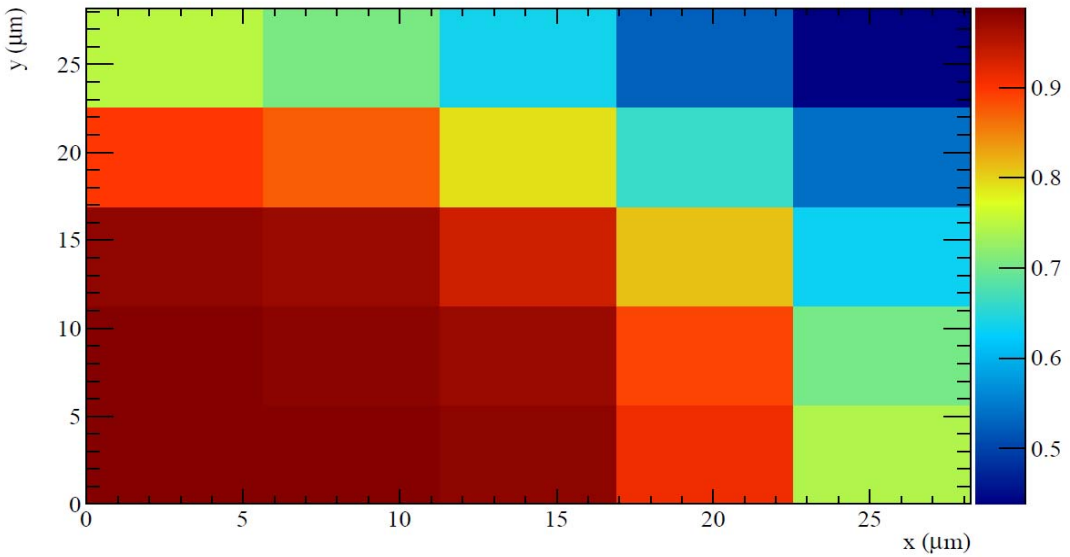
→The RKF integration, which practically counts the fraction of flux lines entering the amplification region, overestimates the efficiency, as expected (no diffusion taken into account)

Effect of Wire Pitch @ Constant Wire Diameter

Nominal mesh geometry



Effect of initial position of the electron

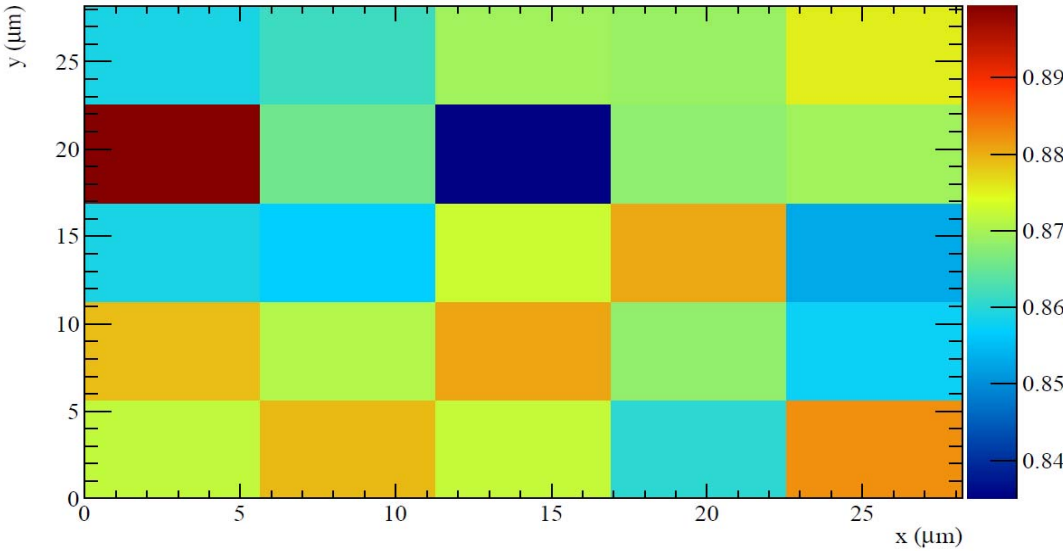


Electron released

5μm above the mesh

Electron released

100μm above the mesh



100 μm (or even 50 μm) of drift smear any possible correlation between the efficient collection in the amplifcation region and initial position of the electron

Summary

The micromegas mesh electron transparency has been studied.

→The rectangular approximation of the mesh wires was found not to be adequate.

→The RKF integration and the microscopic tracking give similar discrepancies wrt the measurement but with opposite sign.

→If one is constrained on the field voltages to use (eg double stage micromegas) the geometrical parameters of the mesh can be tuned to keep high transparency

→Due to the very small size of the Micromesh cell, practically no correlation between the initial position of the electron the efficiency to pass in the amplification region is observed

Many thanks to **Rob Veenhof** for all the discussions and help.