Electron-muon identification

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1. Starting point

a) Sample 4256 electrons (from P. Janot)

10000 muons from the simulation of a cooling channel

Relative normalization of electrons vs muons ?

b) Previous presentation on May 02

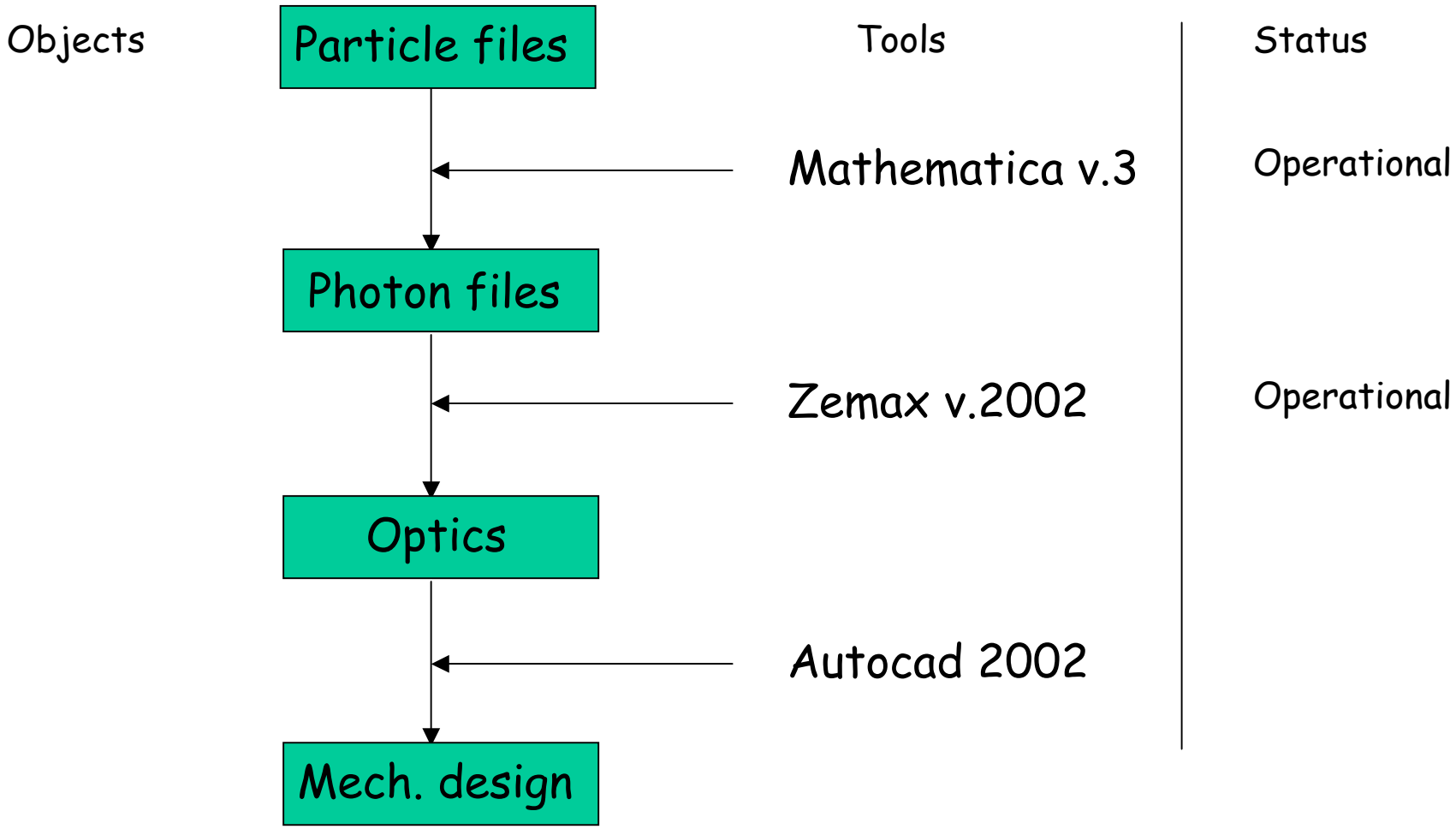
http://www.fynu.ucl.ac.be/themes/he/mice/LLN02_05_02.pdf

2. Development of tools to study the optical system

3. First trial: study of a simple design

4. Conclusion

Tools and strategy



General features

1. Do not put photomultipliers in the particle beam

generation of spurious photons in glas window of photodetector !

↪ « folded » optical system

2. Influence of stray magnetic field

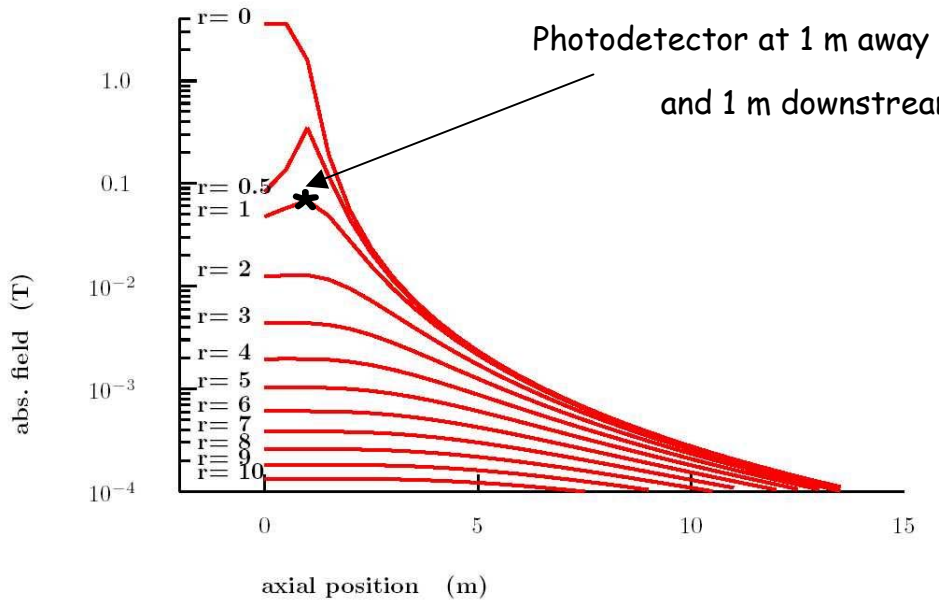
↪ efficient shielding needed

3. Detection of a small number of photons with $\lambda \sim 400$ nm

+ matching emission spectrum with photodetector response

↪ photomultipliers

Magnetic stray field



Photodetector at 1 m away from the beam axis

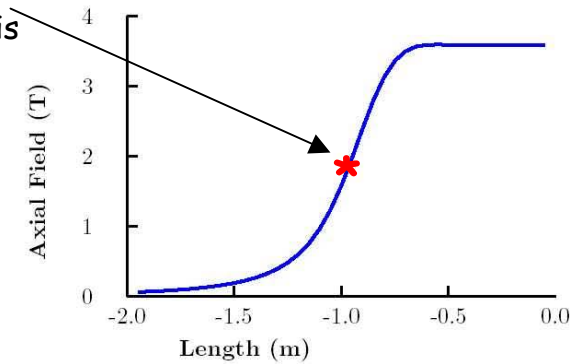
and 1 m downstream from end of solenoid

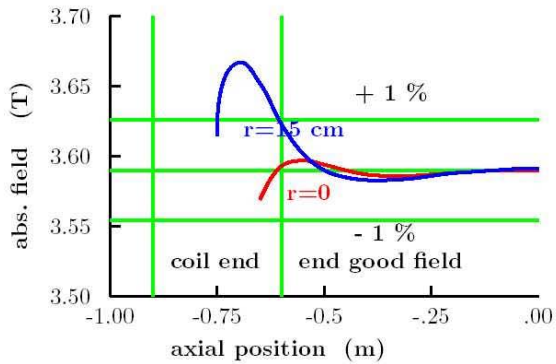
Ref. R.B. Palmer, R. Fernow

Collaboration meeting
27.10.2001

Confirmed by our own calculations with TOSCA

Photodetector
at 1 m on the beam axis

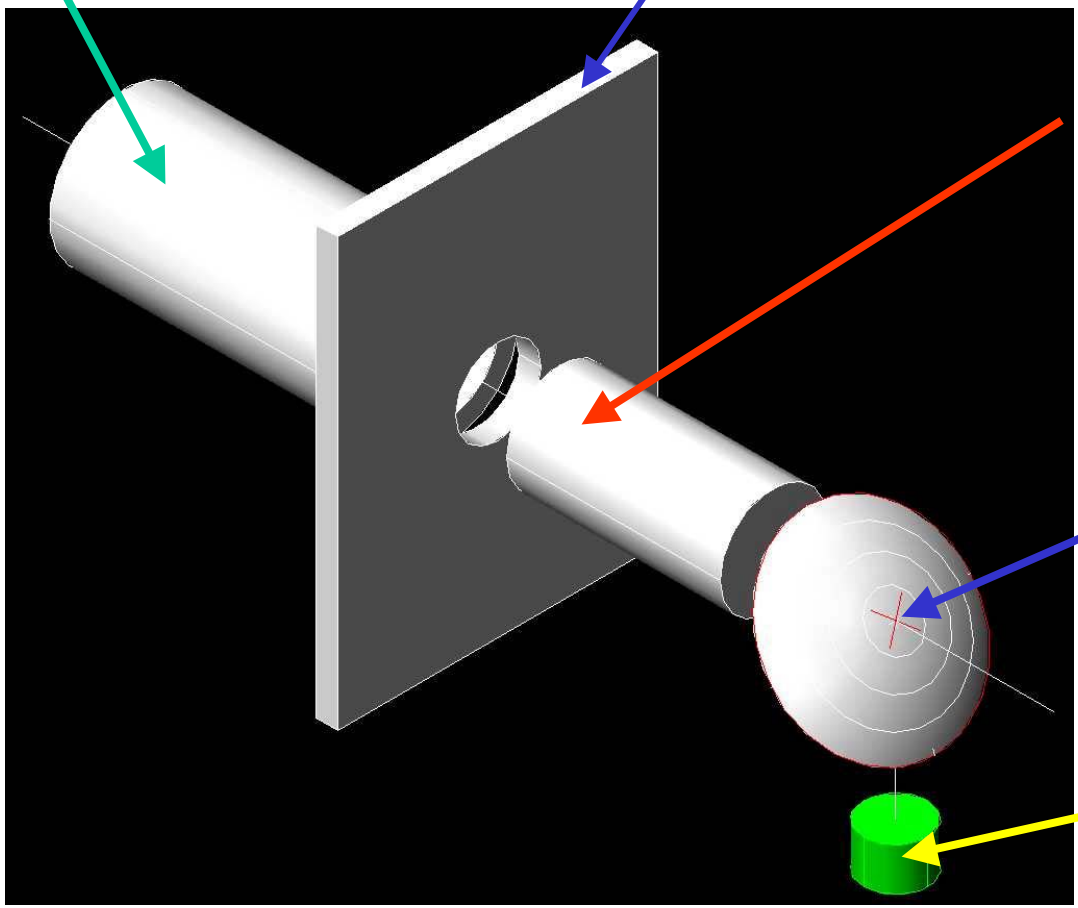




Case study

End of solenoid
(4 Tesla – inner diam. 500 mm)

Magn. shielding
(central opening diam. 400)



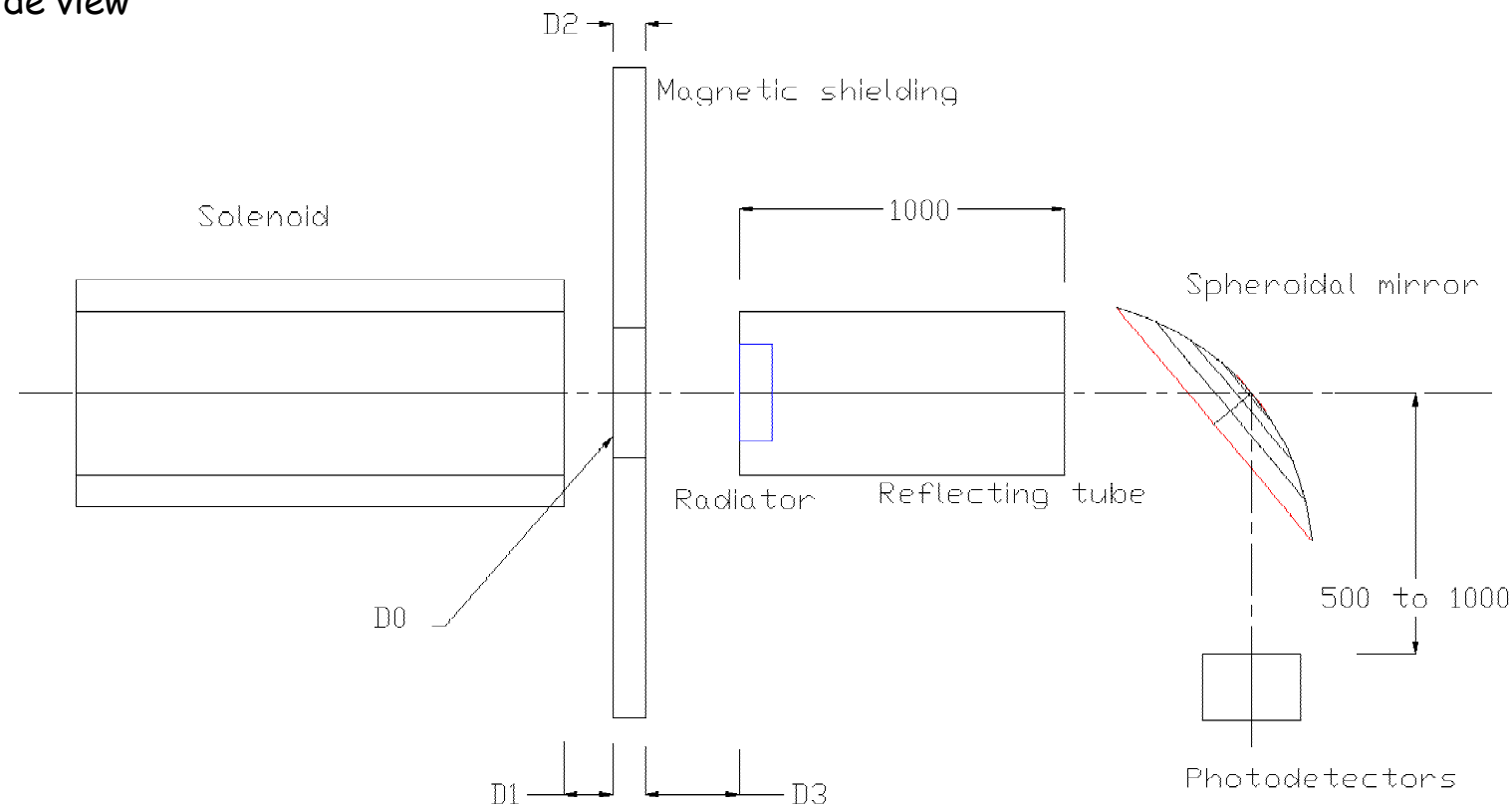
Aerogel radiator n=1.06
300 mm x 300 mm 10 mm
inside a tube with
reflective inner walls

Spheroidal mirror

Photodetector(s)

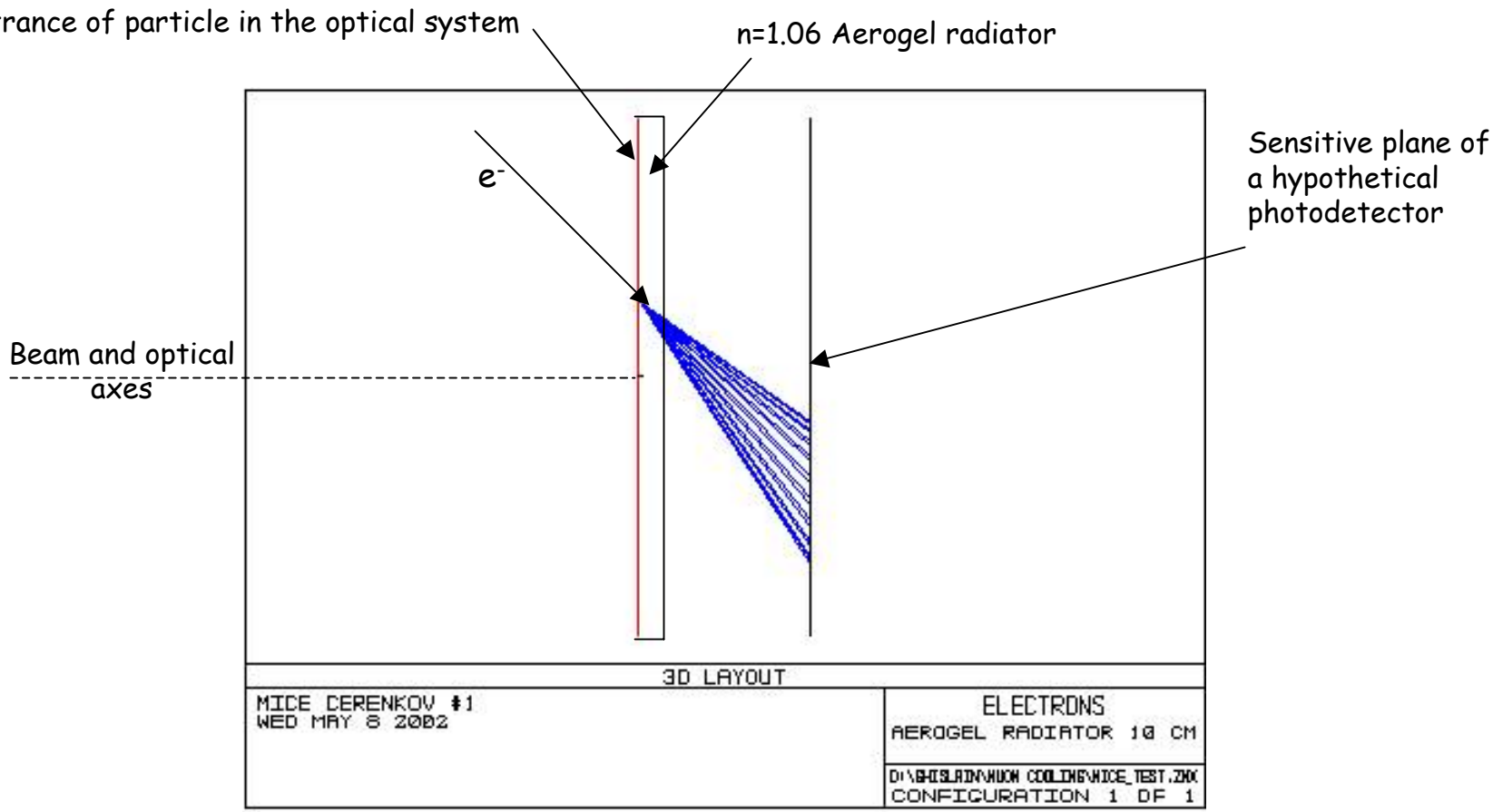
Parameters

Side view



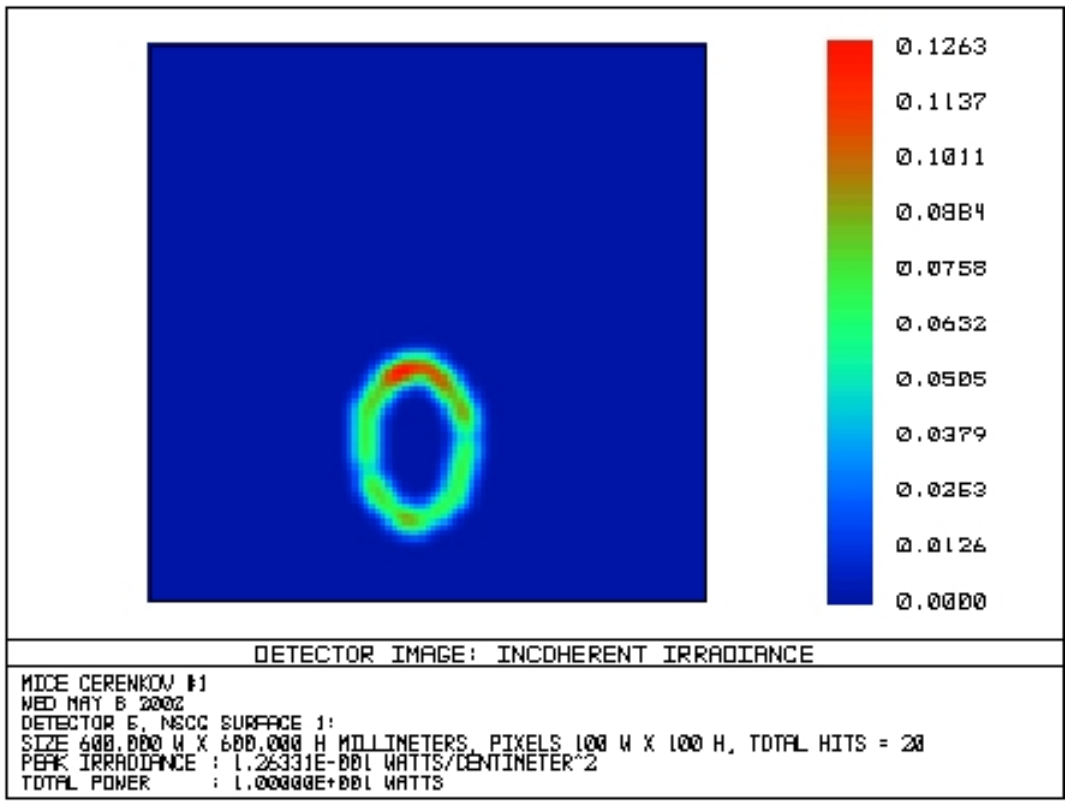
A simple case

An single electron producing 20 photoelectrons distributed on a conical surface!

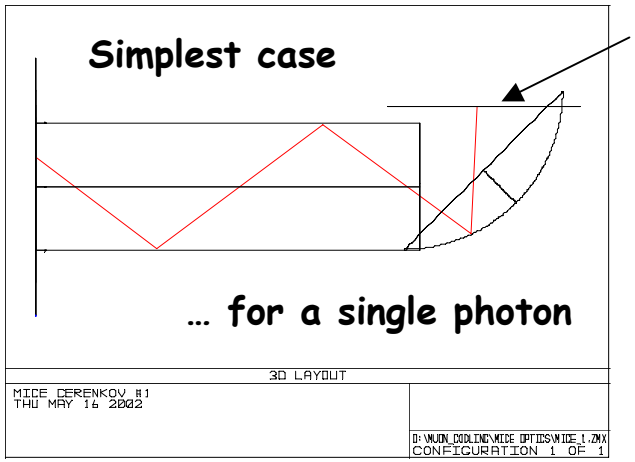


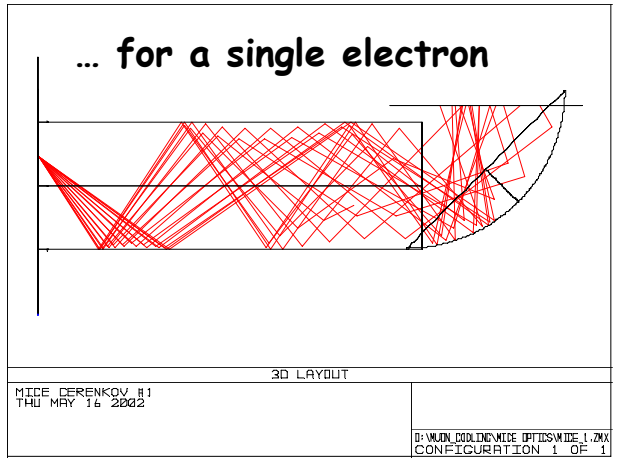
Intensity distribution

Intensity distribution on a detection plane perpendicular to optical axis
(for the simple case shown before)

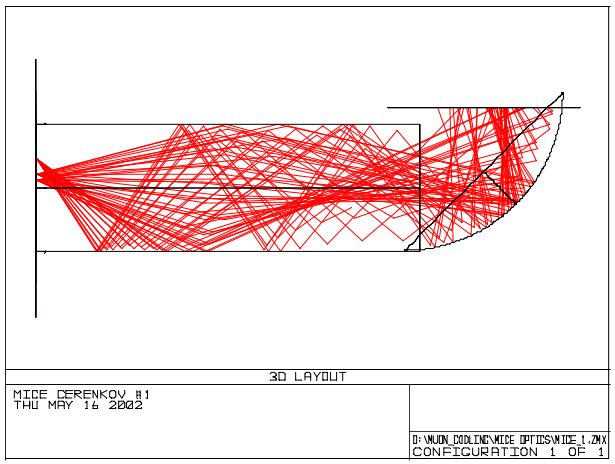


Tracking of photons

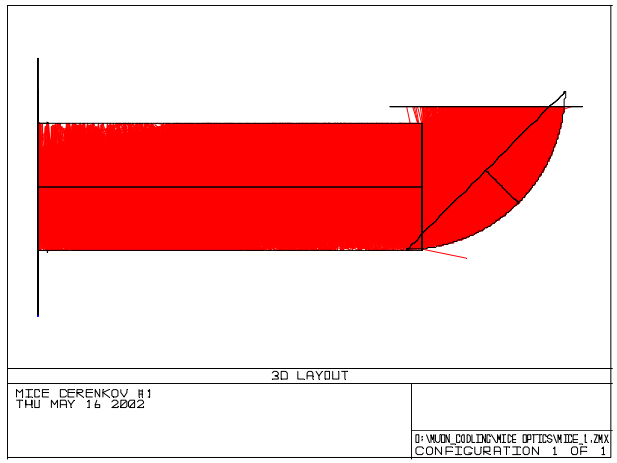




… for 3 electrons



… for the complete sample (4256 electrons)



Light collection efficiency

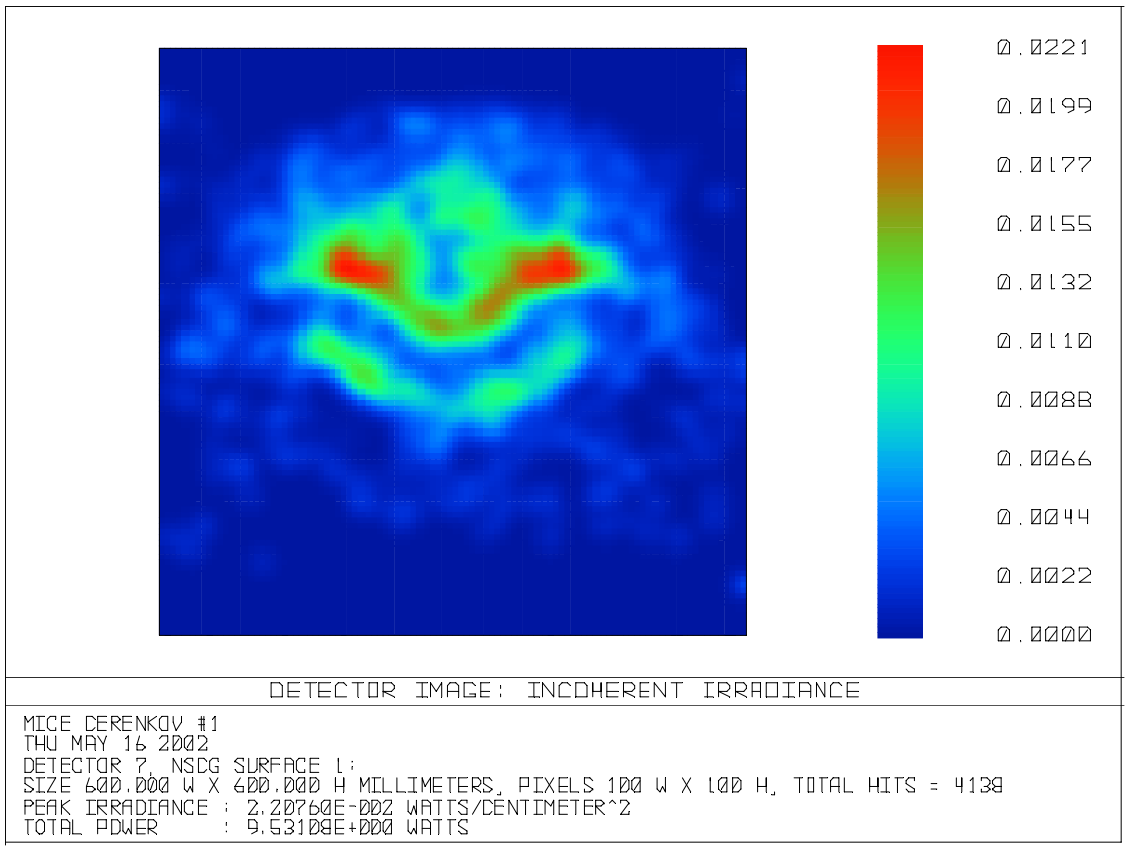
Light intensity distribution in a detection plane 150 mm from beam axis

Notes.

1. **Surface of blue square = 600 mm x 600 mm**

2. **No optimization at all !**
   - **spherical mirror**
   - **detector plane not at a focal point …**

3. **Light collection efficiency = 95 %**



Conclusions

Every aspect needs comments and criticisms !

To be studied further optimisation !

Typical Zemax output