



Gh. Grégoire
May 17, 2002

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 ?

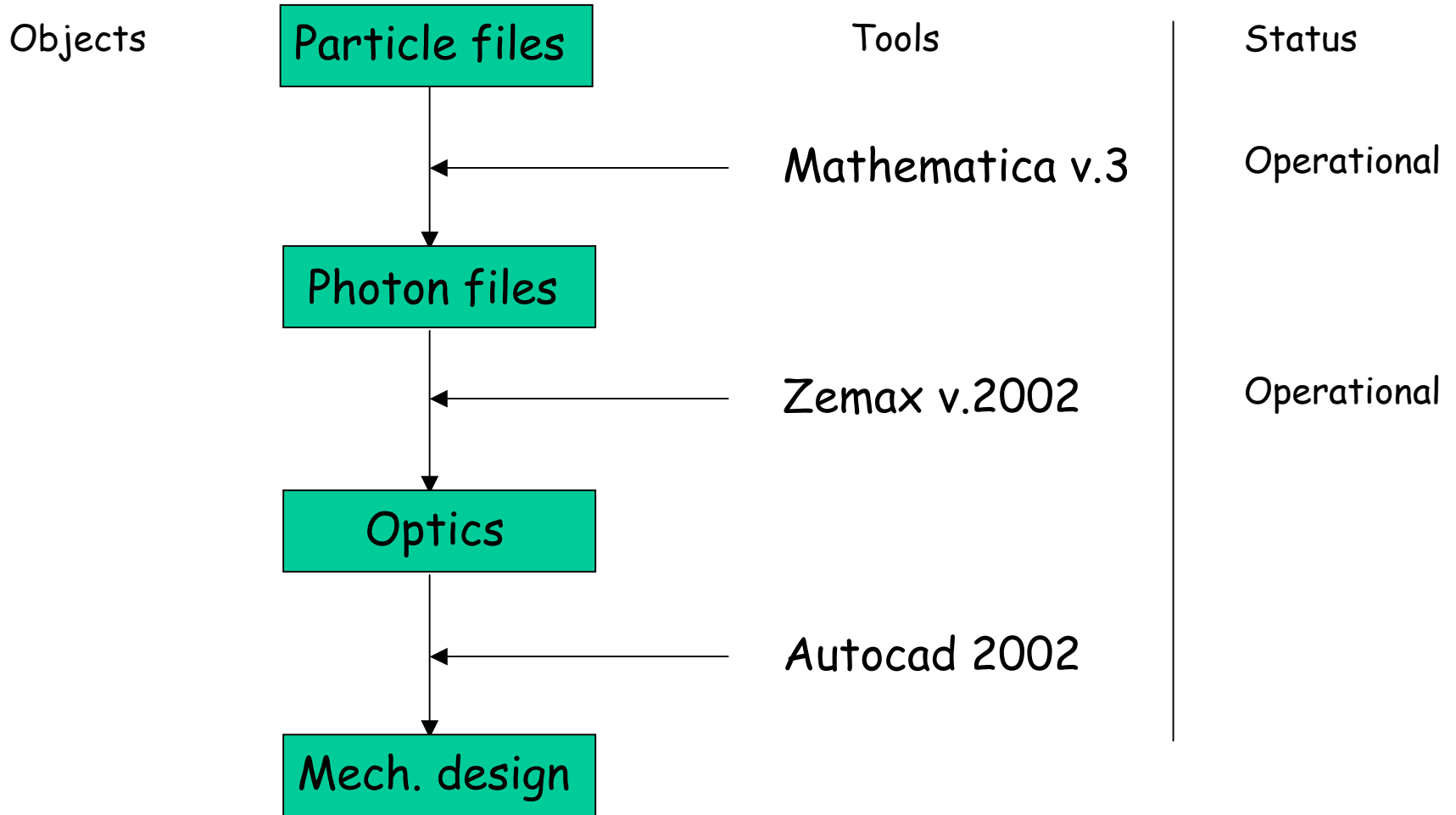
- b) Previous presentation on May 02

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



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



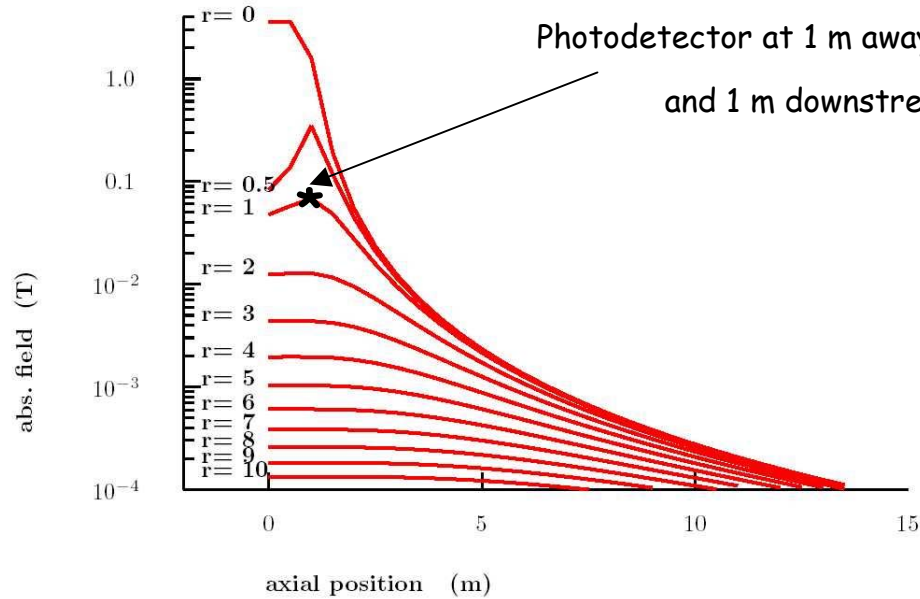
efficient shielding needed

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

+ matching emission spectrum with photodetector response

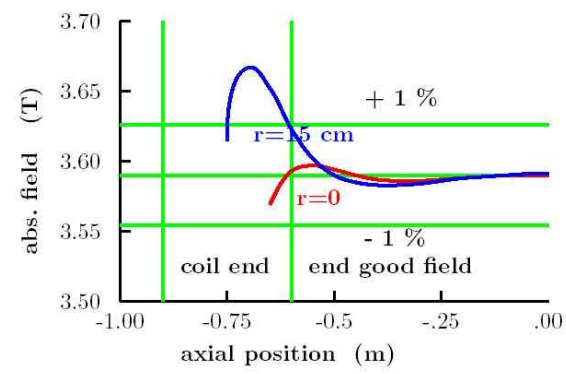
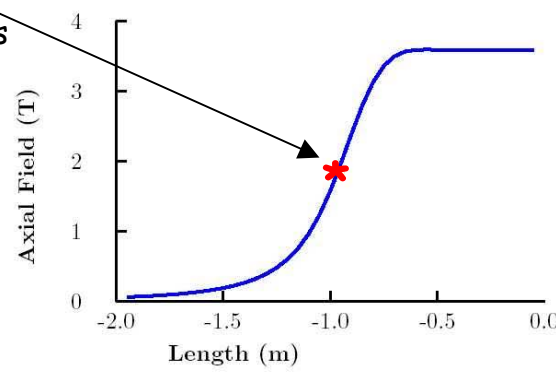


photomultipliers



Ref. R.B. Palmer, R. Fernow
 Collaboration meeting
 27.10.2001
 Confirmed by our own calculations
 with TOSCA

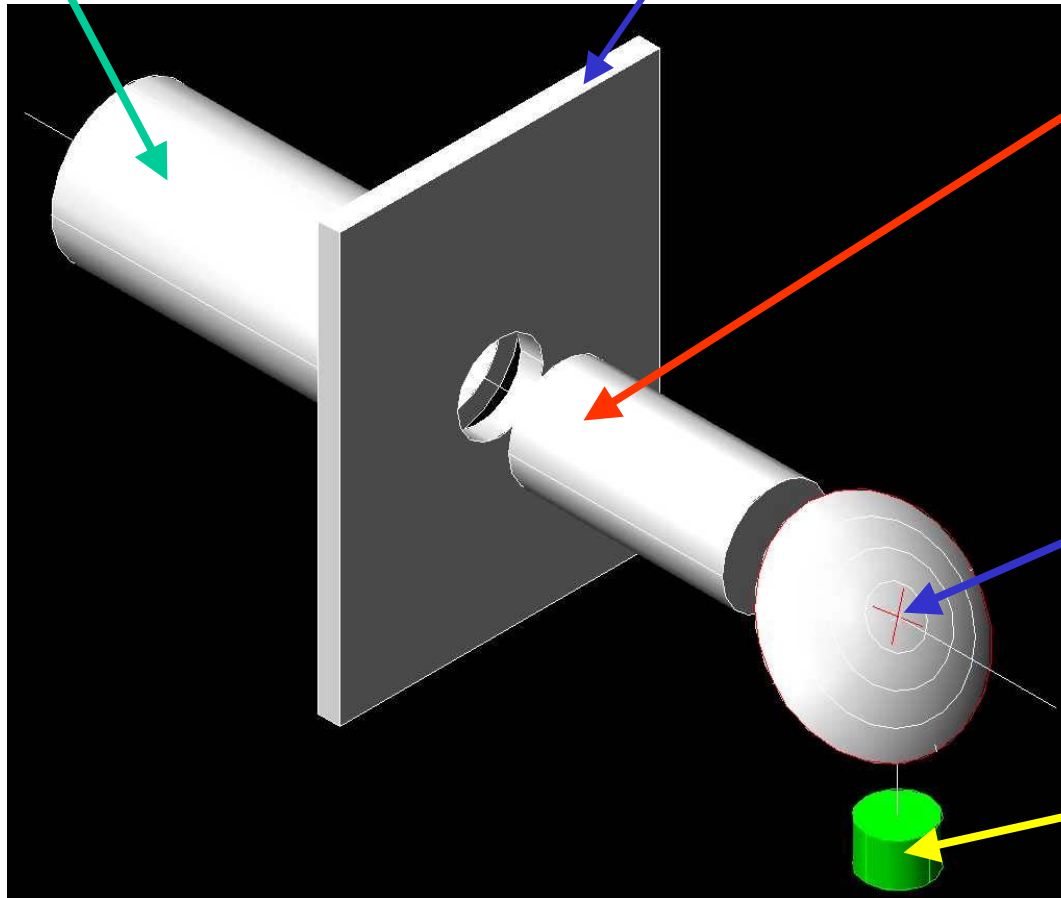
Photodetector
at 1 m on the beam axis



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

Magn. shielding
(central opening diam. 400)

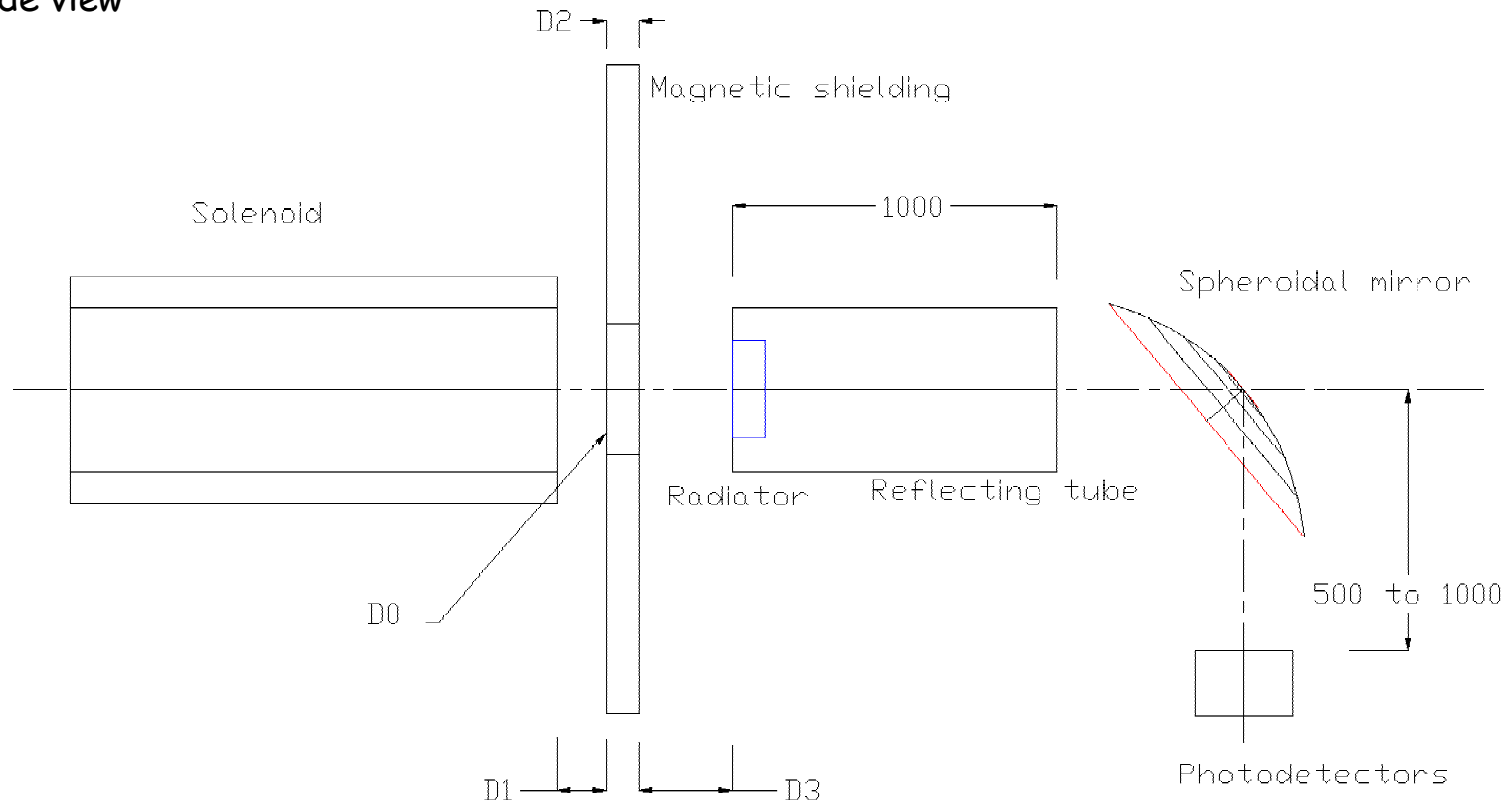
Aerogel radiator $n=1.06$
300 mm x 300 mm 10 mm
inside a tube with
reflective inner walls



Spheroidal mirror

Photodetector(s)

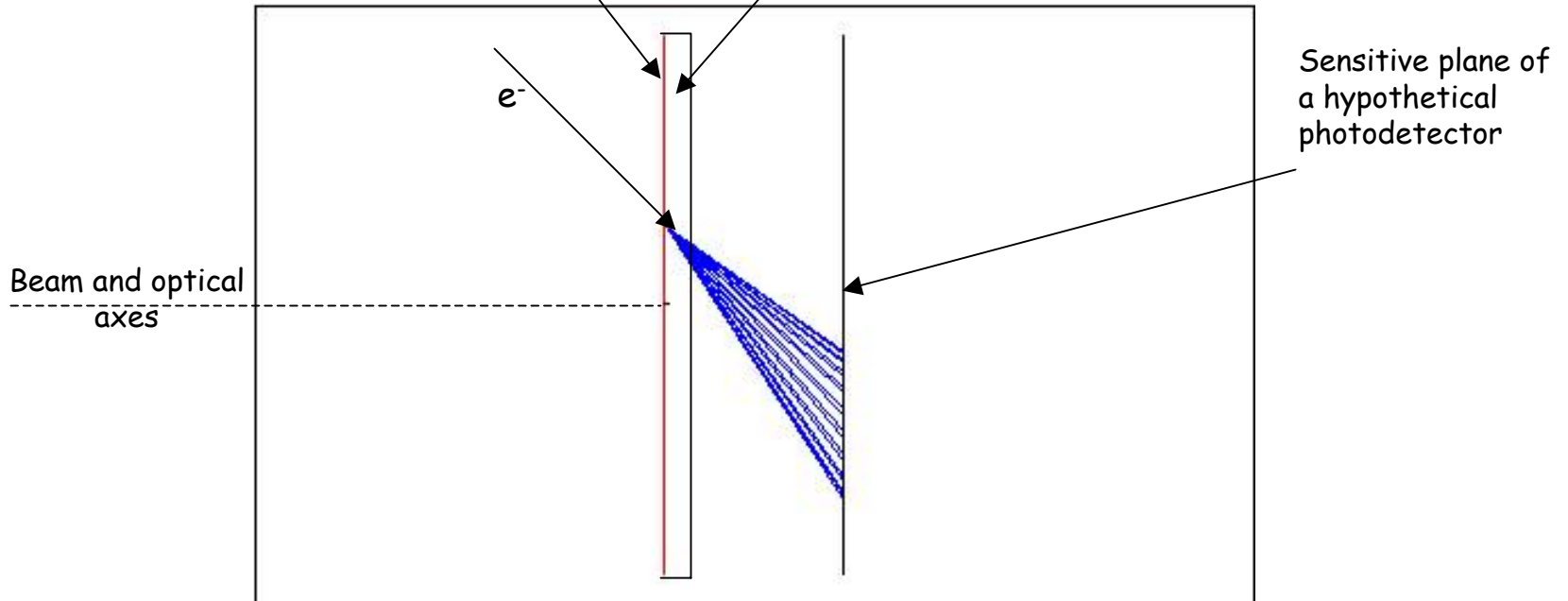
Side view



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

Entrance of particle in the optical system

$n=1.06$ Aerogel radiator



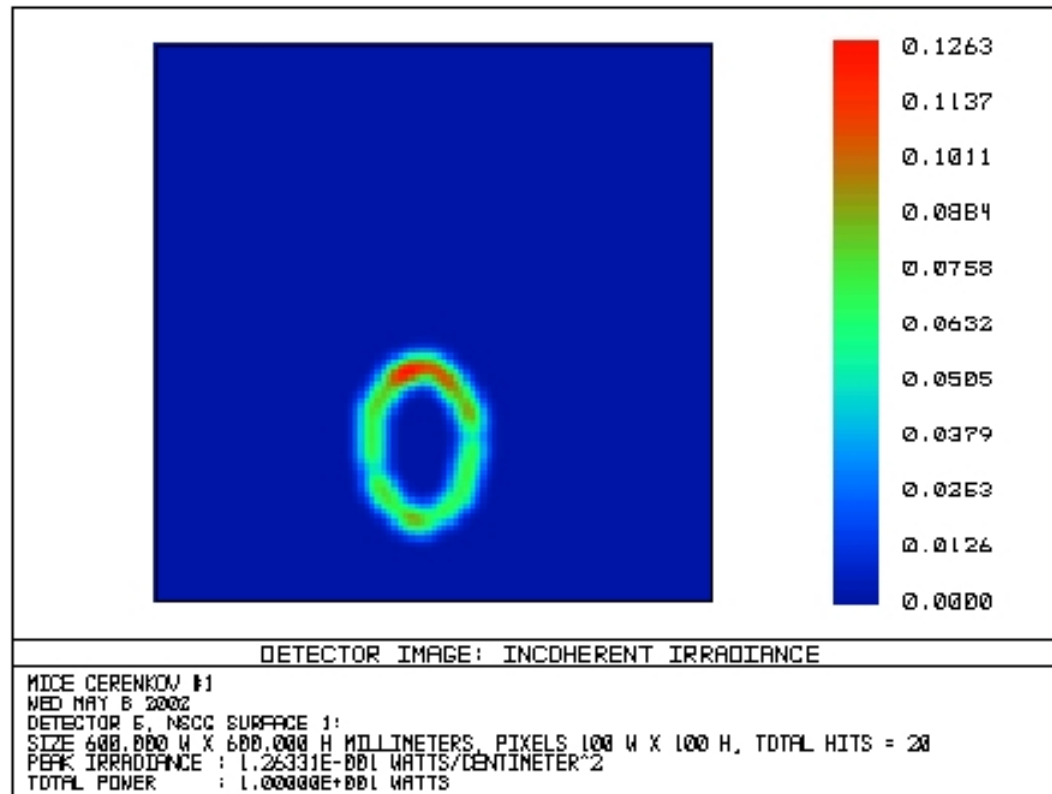
3D LAYOUT

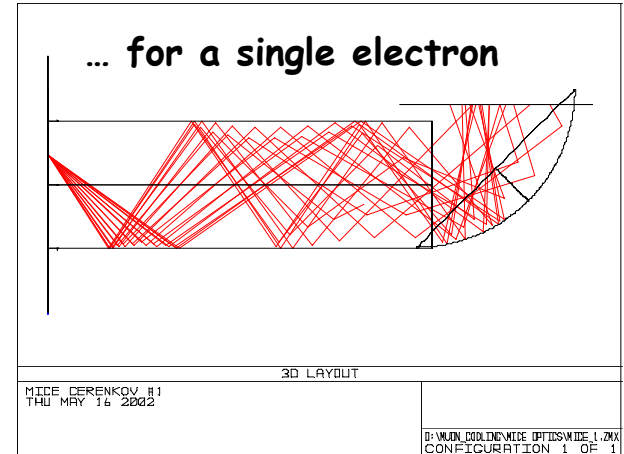
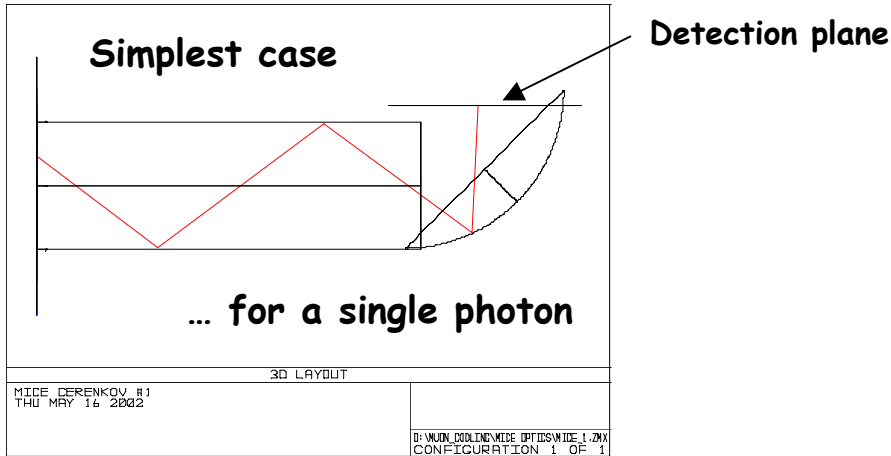
MICE CERENKOV #1
WED MAY 8 2002

ELECTRONS
AEROGEL RADIATOR 10 CM

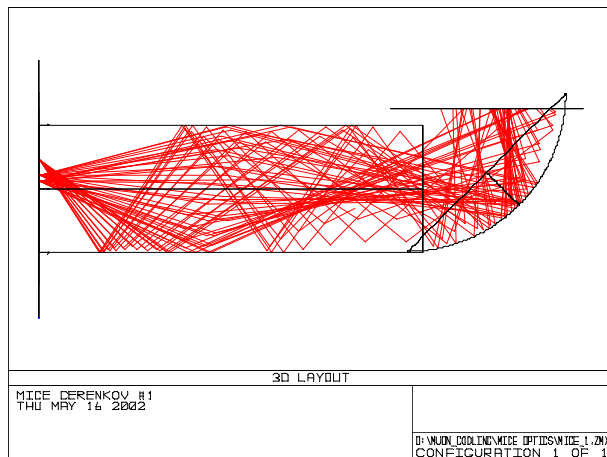
D:\BIBSLA\IN\WUOH COOLING\WICE_TEST.ZOX
CONFIGURATION 1 DF 1

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

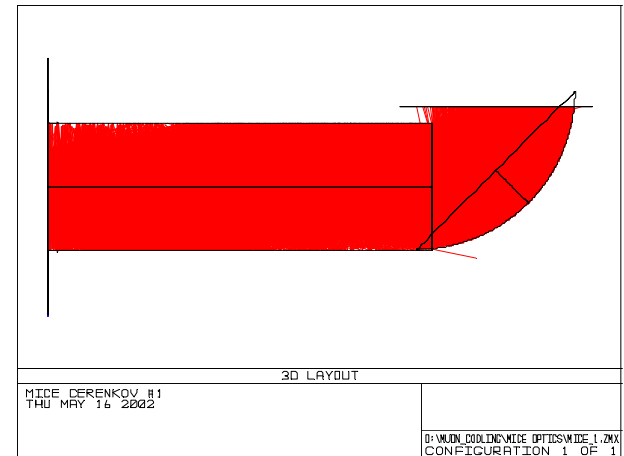




... for 3 electrons



... for the complete sample (4256 electrons)



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

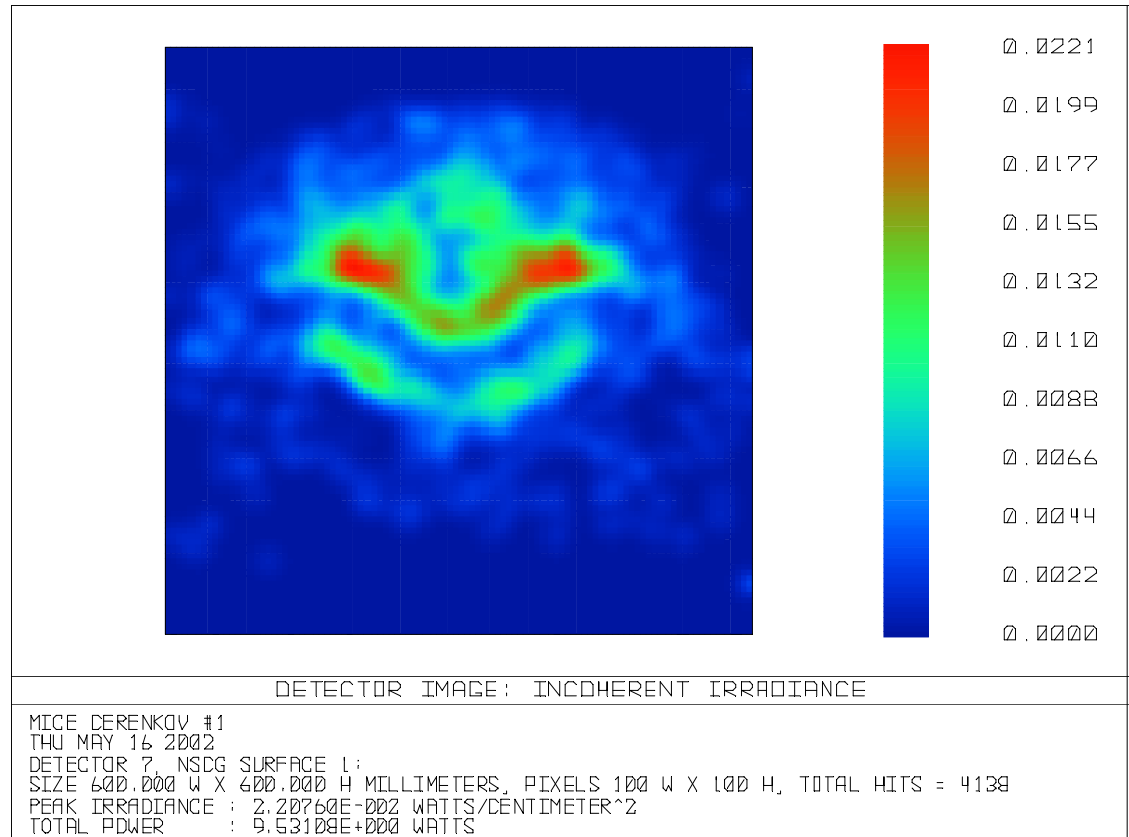
Notes.

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 %



Every aspect needs comments and criticisms !

To be studied further optimisation !



Typical Zemax output



ZEMAX-EE - D:\Muon_cooling\Mice Optics\mice_1.ZMX

File Editors System Analysis Tools Reports Macros Extensions Window Help

New Ope Sev Sas Upd Gen File Wav Lay L3d Ray Opd Fcd Spt Mff Fps Enc Opt Ham Tol Gla Len Sys Pre

Lens Data Editor

Surf. Type	Comment	Radius	Thickness	Glass	Semi-Diameter	Conic	Par 0 (unused)	Par 1 (unused)	Par 2 (unused)	Par 3 (unused)
OBJ*	Standard	Infinity	1.000000		0.000000	0.000000				
STO	NonSeqComp	Infinity	-		0.001000	0.000000	0	0.000000	0.000000	0.000000
IMA	Standard	Infinity		-	4000.000000	0.000000				

Non-Sequential Component Editor: Component Group on Surface 1

Object Type	X Position	Y Position	Z Position	Tilt About X	Tilt About Y	Tilt About Z	Material	# Layout Rays	# Analysis Rays	Power (Watts)
1 Source Point	0.000000	600.000000	0.000000	0.000000	0.000000	0.000000	-	0	0	1.000000
2 Rectangle	0.000000	400.000000	0.000000	0.000000	0.000000	0.000000	MIRROR	300.000000	300.000000	
3 Source Point	0.000000	200.000000	0.000000	0.000000	0.000000	0.000000	-	0	0	1.000000
4 Source File	0.000000	400.000000	1.000000	0.000000	0.000000	0.000000	-	4256	4256	10.000000
5 Cylinder Pipe	0.000000	400.000000	0.000000	0.000000	0.000000	0.000000	MIRROR	200.000000	1200.000000	200.000000
6 Standard Su..	0.000000	350.000000	1500.000000	45.000000	0.000000	0.000000	MIRROR	-500.000000	0.000000	350.000000
7 Detector Rect	0.000000	650.000000	1400.000000	90.000000	0.000000	0.000000	ABSORB	300.000000	300.000000	100

2: Detector Viewer

Update Settings Print Window Text Zoom

DETECTOR IMAGE: INCOHERENT IRRADIANCE

MICE CERENKOV #1
THU MAY 16 2002
DETECTOR 7, NSCC SURFACE 1:
SIZE 600.000 W X 600.000 H MILLIMETERS, PIXELS 100 W X 100 H, TOTAL HITS = 4138
PEAK IRRADIANCE : 2.20740E+002 WATTS/CENTIMETER^2
TOTAL POWER : 9.53188E+000 WATTS

1: 3D Layout

Update Settings Print Window Text Zoom

3D LAYOUT

MICE CERENKOV #1
THU MAY 16 2002

D:\MUON_COOLING\MICE OPTICS\MICE 1.ZMX
CONFIGURATION 1 OF 1

MICE Cerenkov #1 EFFL: 1e+010 WFNO: 5.73686 ENPD: 0.174977 TOTR: 0