

UCL

Gh. Grégoire Feb 25, 2007

## Magnetic shields for TOF1 & TOF2

17th MICE collaboration meeting, CERN, Feb. 22 to 25, 2007







### What hole size ?







Longitudinal sections

YZ (vertical)

XZ (horizontal)







# Material properties \_\_\_\_\_ UCL





2D computations



In fact for pure 2D computations, the field components represent worst case situations since a real 3D situation is a much more « magnetically closed » geometry for the PMTs.







Radial component for middle PMT

Longitudinal component for middle PMT

Central hole diameter = 600 mm

1-mm mumetal + 5-mm low carbon steel



Central hole diameter = 600 mm

1-mm mumetal + 5-mm low carbon steel



1-mm mumetal only

More field lines penetrating inside mumetal shield !





Radial component for middle PMT

It is seen that:

Longitudinal component for middle PMT

- The radial component remains very weak since the cage structure did already the whole job
  - The **mumetal alone** is clearly not sufficient to get an acceptable **longitudinal** component.

Central hole diameter = 600 mm 1-mm mumetal only









1-mm mumetal only



YZ (vertical)

## Side views of TOF2



XZ (horizontal)











## Conclusions (1)



FactsThe scintillating bars for TOF1 have already been ordered.The active TOF1 area is thus 42 cm x 42 cm.Let's assume it cannot be changed ...

Results

1. Upstream shielding cage with a central hole of 600 mm

 $\cdot$  Advantage of being similar to the downstream cage (within the present knowledge of acceptable beam scraping)

• But, the PMTs of TOF1 have to be shielded locally with a **double** layer of 5-mm iron + 1-mm mumetal.

A single layer of mumetal is clearly not sufficient to keep very low stray fields for PMTs.

- 2. Upstream shielding cage with a central hole of 420 mm
  - It makes the whole MICE setup not « upstream/downstream » symmetric
  - But, the shielding of the PMTs could be slightly simpler in principle ...
- 3. Main conclusion: the hole(s) in the shield must be inscribed in the active area of the TOFs



## TOF maintenance









# Shield opening mechanism





#### Intermediate extracted position



#### Fully open position







### TOF1 maintenance



Fixed length guide tubes

- 85-cm wide permanent extension of guide tubes outside shield
- Straightforward to construct
- Perfect stability at all positions
- Everything in aluminium or plastic
- Guide tubes Aluminium diam 40×4 mm
- Plastic gliders (Lexan + fiberglass)









## Conclusions



- 1. Protection against stray magnetic field
  - $\boldsymbol{\cdot}$  The holes in the shield must be inscribed in the active area
  - $\cdot$  The holes of the upstream and downstream shields do not have the same diameters
  - A double layer local shield around each PMT guarantees very low field components

#### 2. Shield construction

- The « Virostek » shields are identical but need minor modifications (screws and recess)
- $\cdot$  The split rings, the 2<sup>nd</sup> shields, the  $\ll$  doors  $\gg$  are identical upstream/downtream
- $\cdot$  The access mechanisms to TOF1 and TOF2 are identical but require external guide rails
- $\boldsymbol{\cdot}$  There is still freedom to have larger holes downstream