

Santiago de Compostela, 09.10.2017

J. F., M. Faul, J. Förtsch, C. Höhne, T. Kunz , S. Lebedev, J. Michel, C. Pauly, V. Patel, D. Pfeifer, E. Schwab, M. Traxler , A. Weber, P. Zumbruch

## Executive Summary:

Readout Electronics 

We`re behind schedule 



# Status Update (10.17)

TUM

- ✓ 1000 MAPMTs @ Wuppertal
- ✓ 12 MAPMTs @ Detector
  - Single Photon Spectra J. Förtsch
- ✓ DiRICH & BP production
- ✓ HV & LV, Slow Control
  - Cabling & Cooling
- ✓ B – Shield & Laser Monitor J. F.
- ✓ Software
  - Geo., DB, Sim. S. Lebedev
- DAQ
- Assembly Tools

## ~~$\mu$ - Metal foils~~

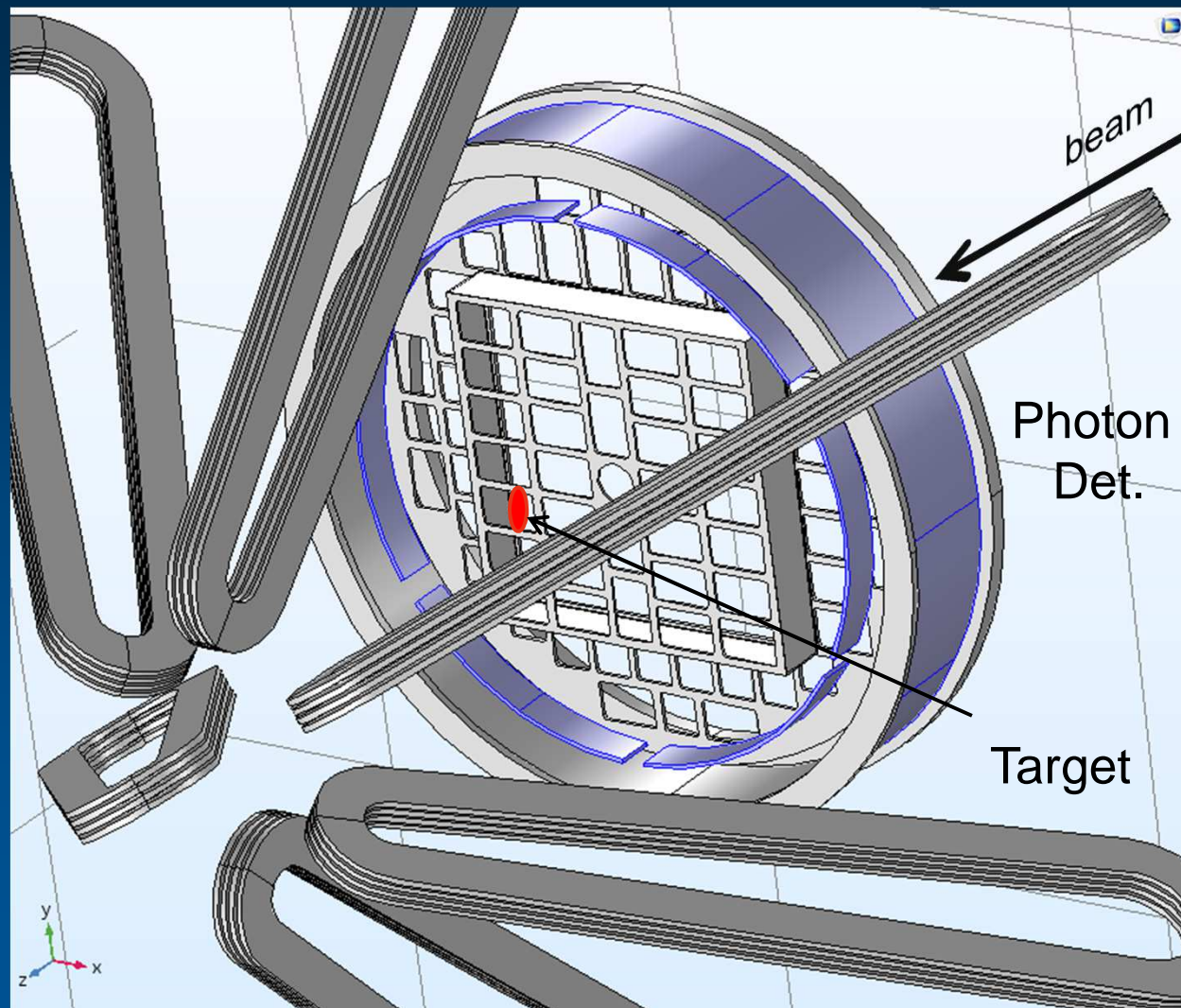
- ~~☹ Individual shields for  $\sim 100$  MAPMTs~~
- ~~☹ Optical shadows~~
- ~~☹ Shield factor  
SF  $\sim 5 - 8$~~
- ~~☹ Needed:  
SF  $\sim 10$~~

## Soft iron:

$$d = 10 \text{ mm}$$

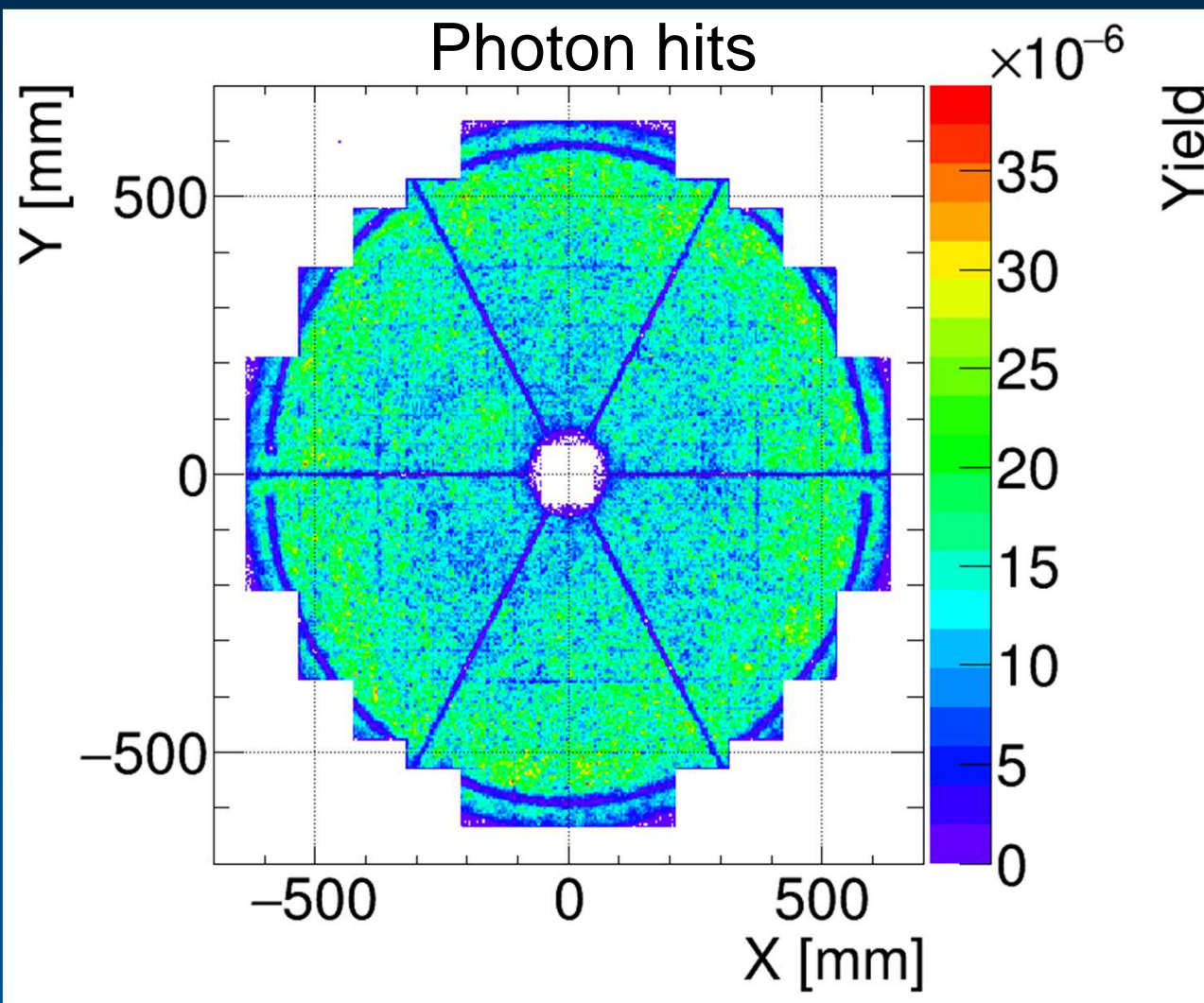
$$\mu_r = 500$$

$$B_{\text{sat}} = 2.1 \text{ T}$$

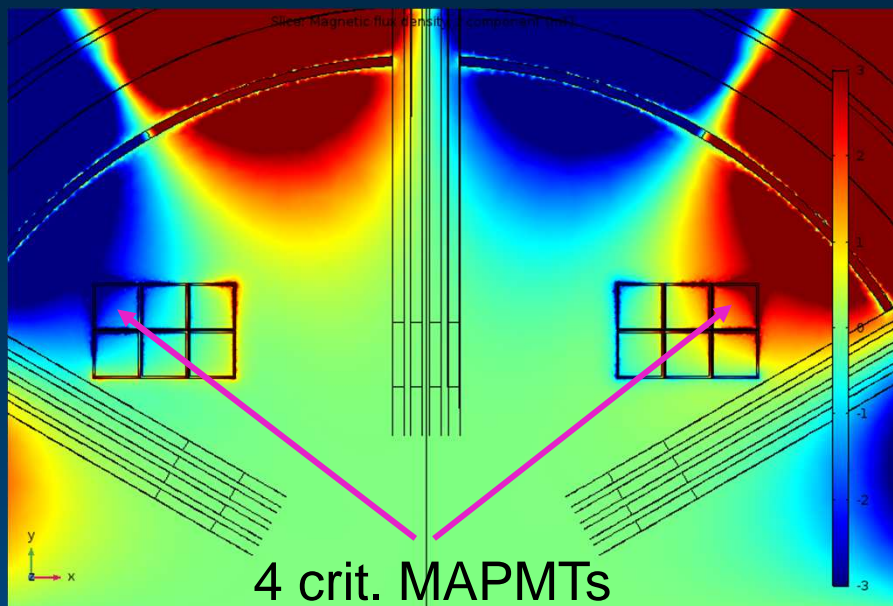


## Simulation with new geometry

S. Lebedev

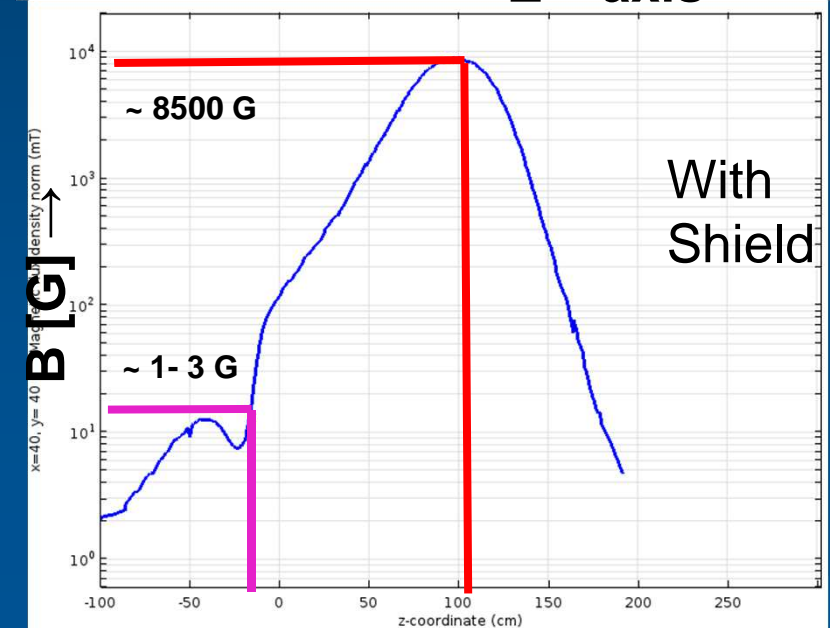
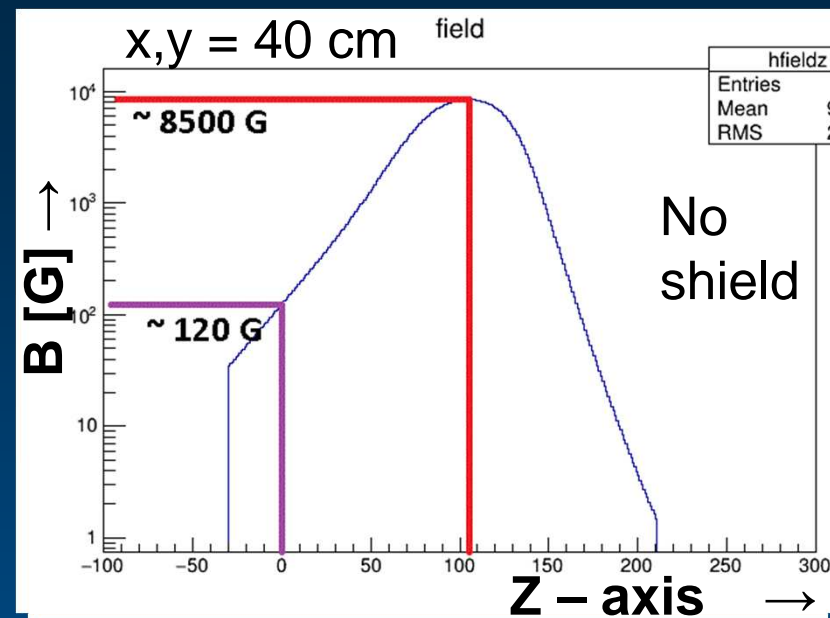


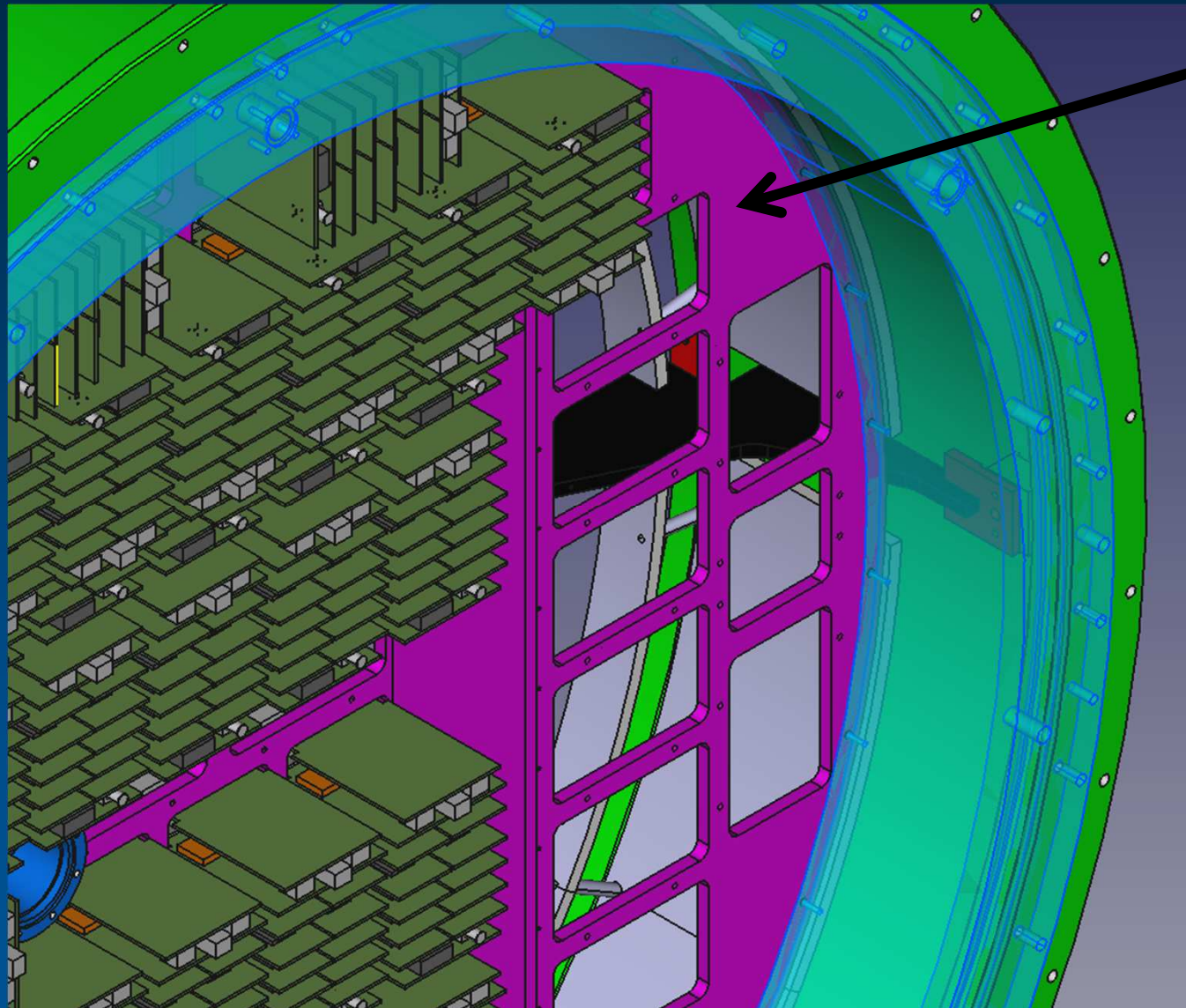
- Negligible acceptance loss ( $\sim 10^{-2}$ )
- Inner shield removable



@ MAPMT  
Cathode plane !

$z = -11$  (-25) cm  
 $x, y = +40$  cm  
 $B < \pm 3$  mT





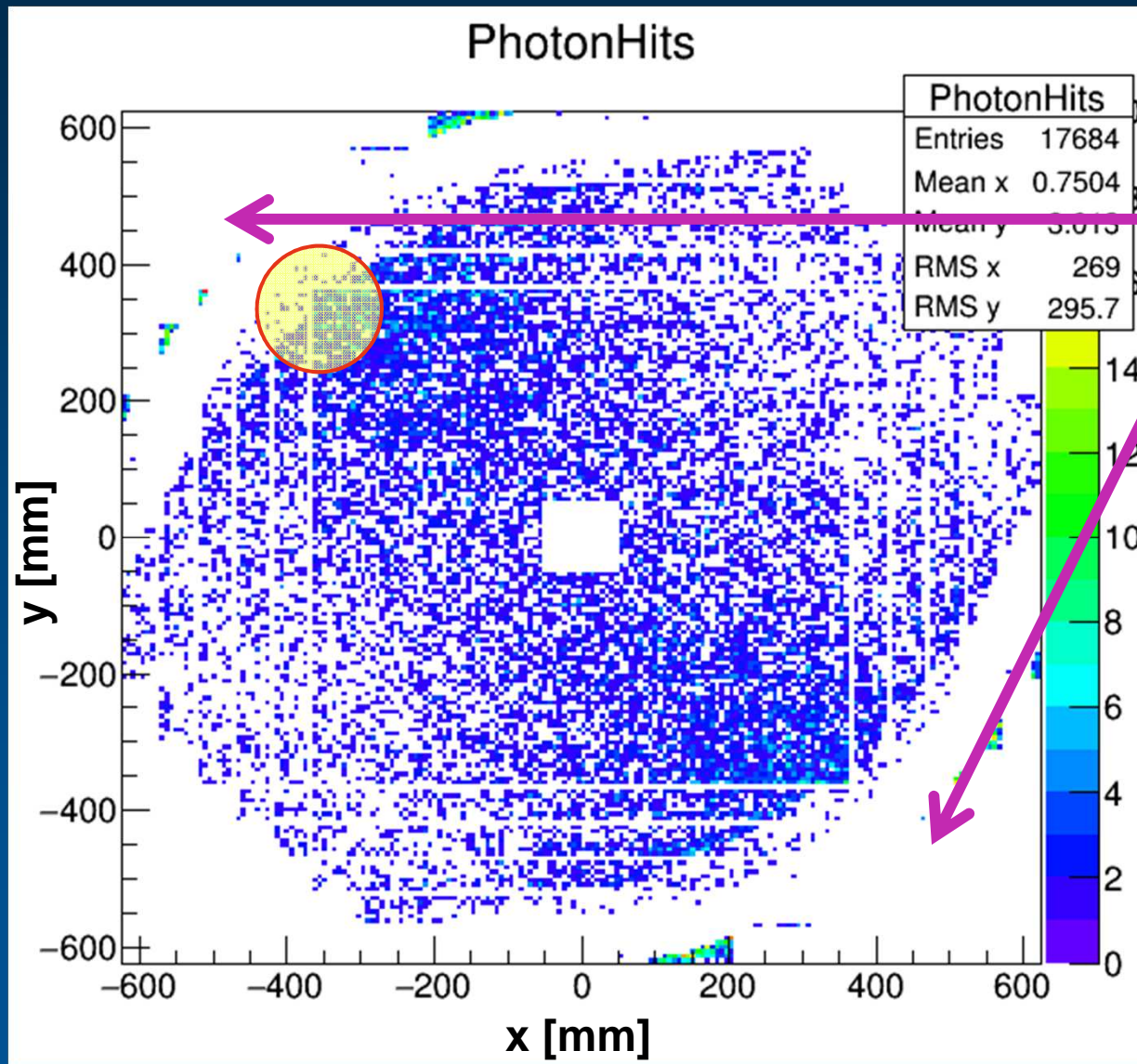
Fiber input:

Pico-sec.  
Diodenlaser

$\lambda = 405 \text{ nm}$   
 $f = 20 \text{ MHz}$   
 $\delta T = 40 \text{ ps}$

+  
 MM(SM?) Fiber  
 +  
 2 - 8 splitter

## Photon hits on pad plane



Fiber input:

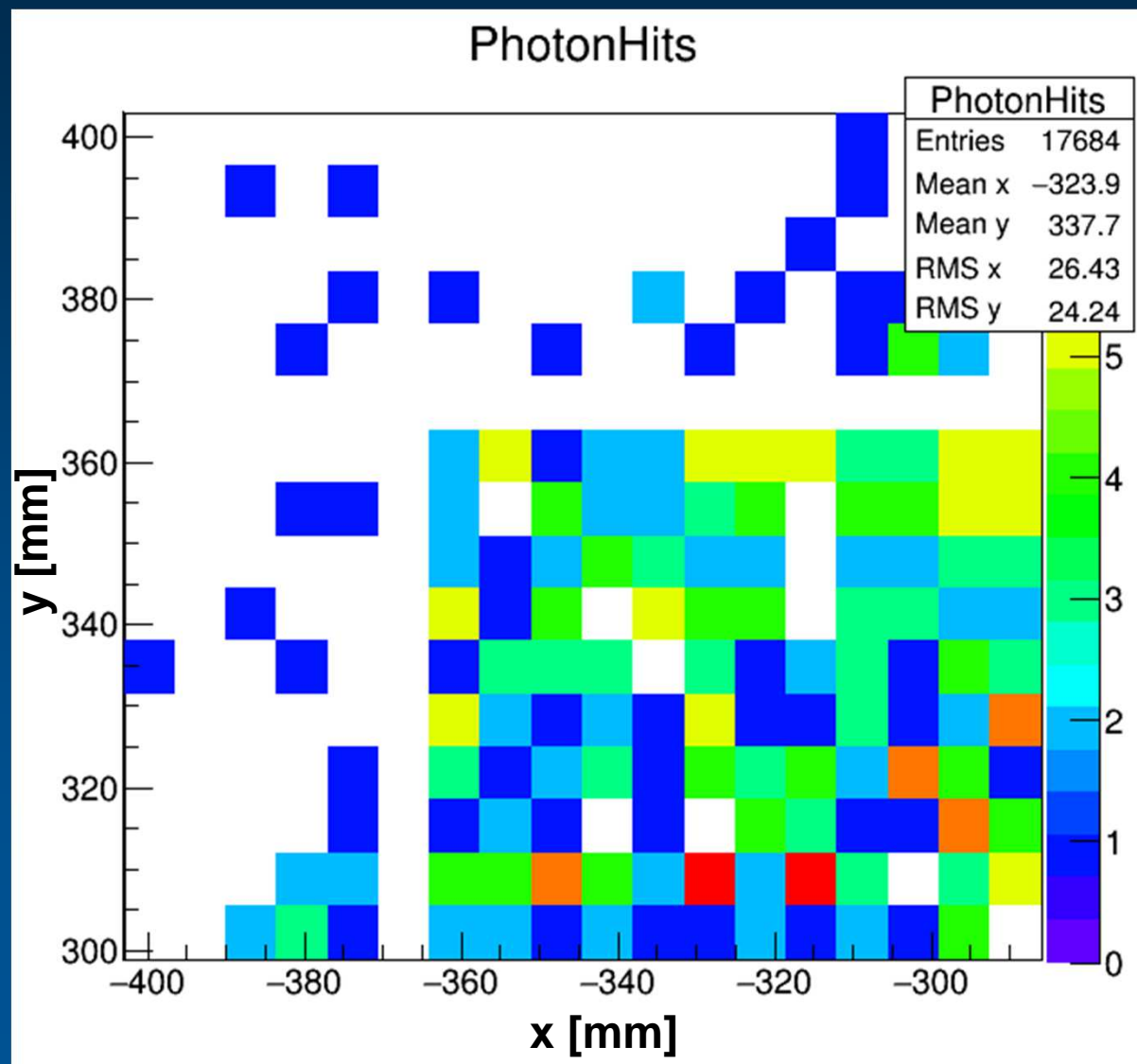
Op. angle  $\Omega$   
Incl. angle  $\Theta$

$$\Theta = 40^\circ$$

$$\Omega = 60^\circ$$

$$\lambda = 405 \text{ nm}$$

## Photon hits on pad plane - zoom to corner



3\*3 pixel

=

1 pad





# Schedule Sep. 16

TUM

Project	15	16	17
Simulations with Hydra			
Test chamber			
Detector design			
Detector production			
PCB routing, production			
MAPMT tests			
MAPMT assembly & tests			
DiRICH design & prototype			
Readout tests			
Test chamber assembly			
Lamp measurements			
DiRICH mass production			
Full system tests			
RICH installation			



# Schedule March 17

TUM

Project	15	16	17
Simulations with Hydra			
Test chamber			
Detector design			
Detector production			
PCB routing, production			
MAPMT tests			
MAPMT assembly & tests			
DiRICH design & prototype			
Readout tests			
Test chamber assembly			
Lamp measurements			
DiRICH mass production			?
Full system tests			
RICH installation			?
HV, LV, Slow Control			
Shield Design & Installation			



# Schedule Oct. 17

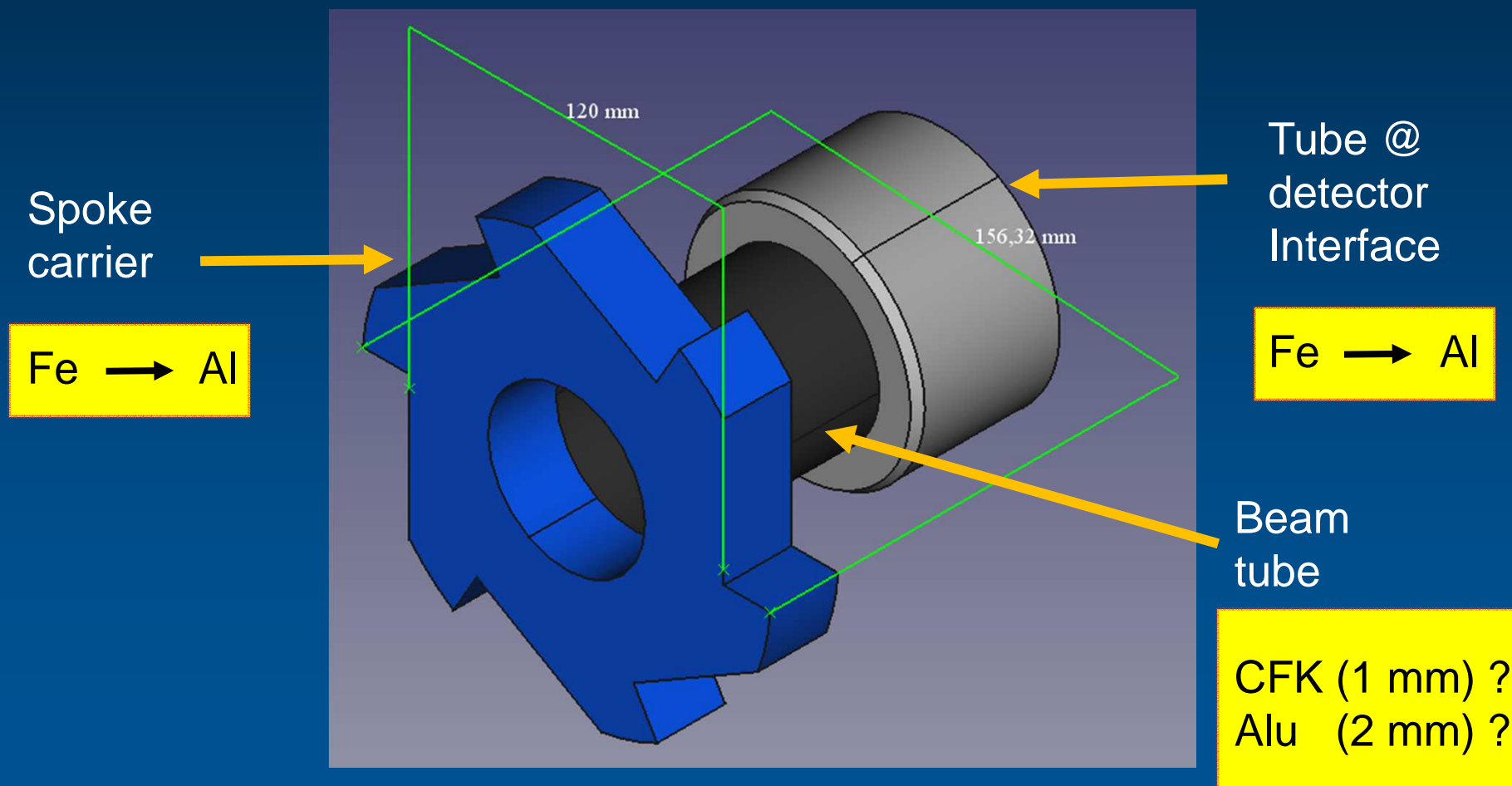
TUM

Project	15	16	17
Simulations with Hydra			
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Test chamber assembly			
Lamp measurements			
DiRICH mass production			?
Full system tests			
RICH installation			?
HV, LV, Slow Control			
Shield Design & Installation			

# Thank You

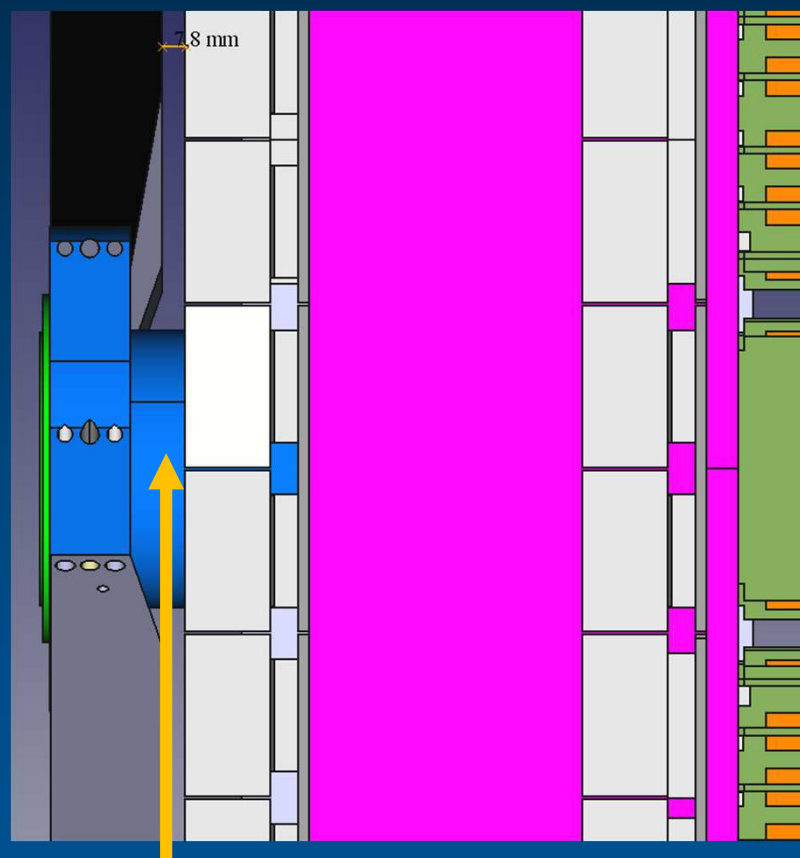
Reduce

pair conversion & mult. scatt.



Future ?

Si-detector: Mult., p-PID, Vertexing



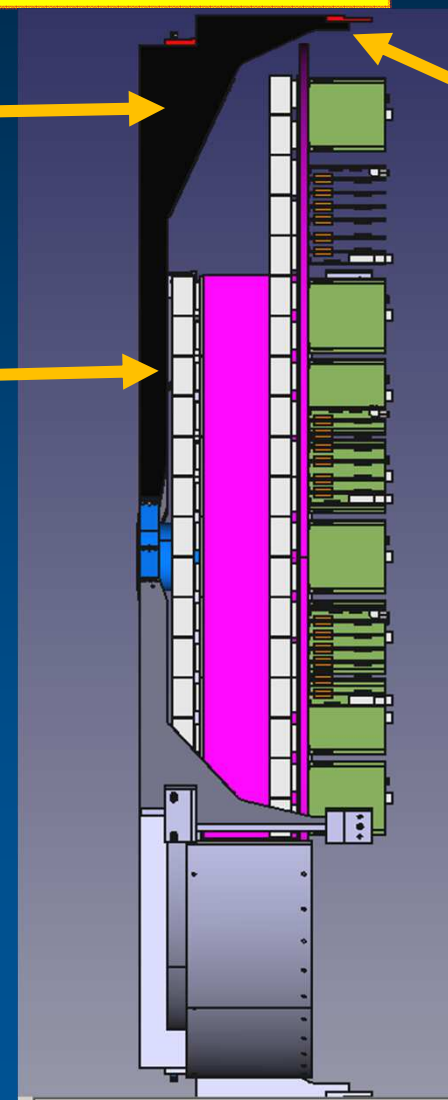
ADCM

flat  
cables

Feed-  
Throughs

HV (6\*)  
LV (3\*)  
Trig (1\*)  
Sig (1\*)

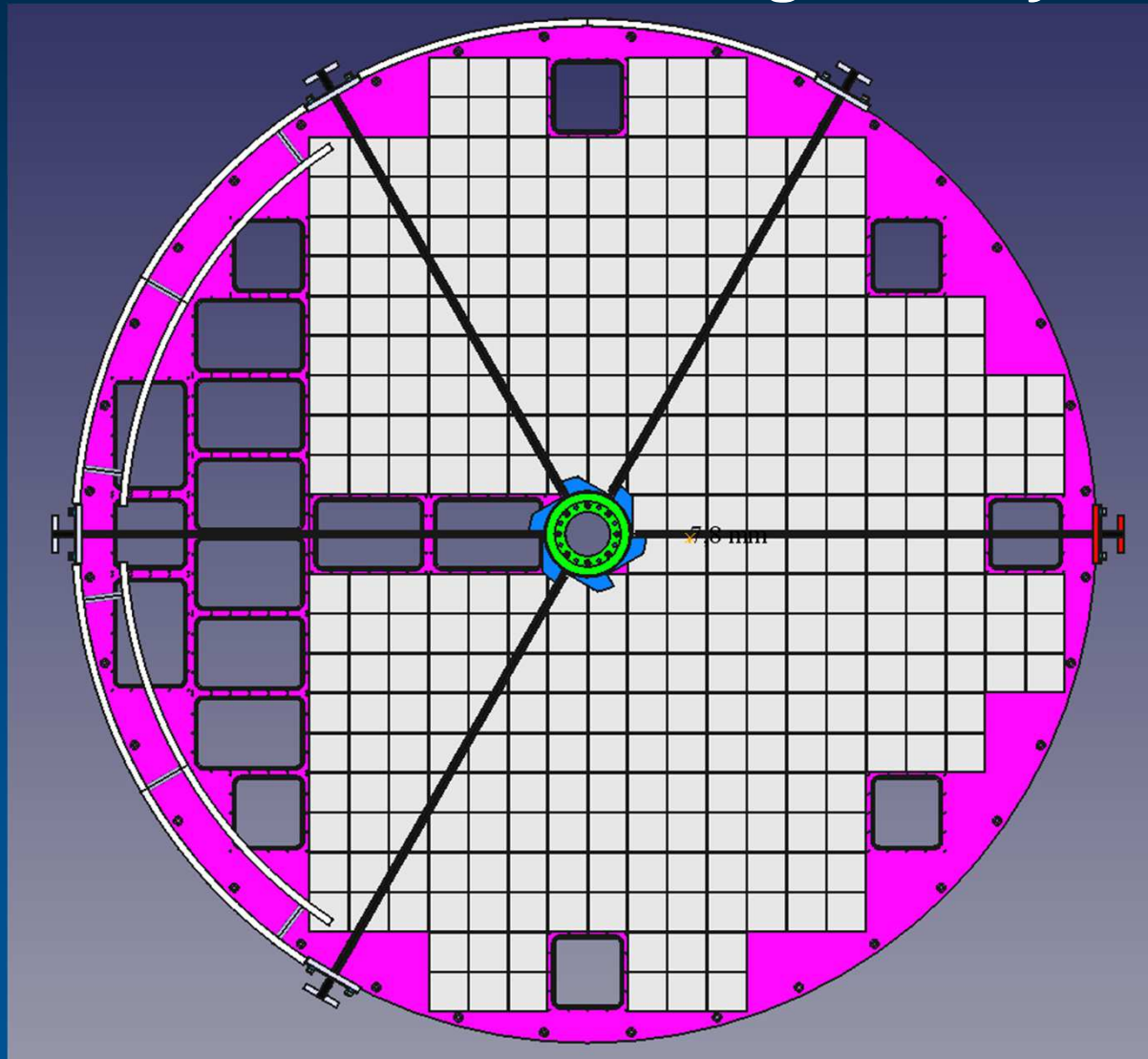
Si – barrel : 6 (12) \* 128 strips (0.5 mm)  
6 (12) APV + 1 (2) ADCM + TRB3



# Backup

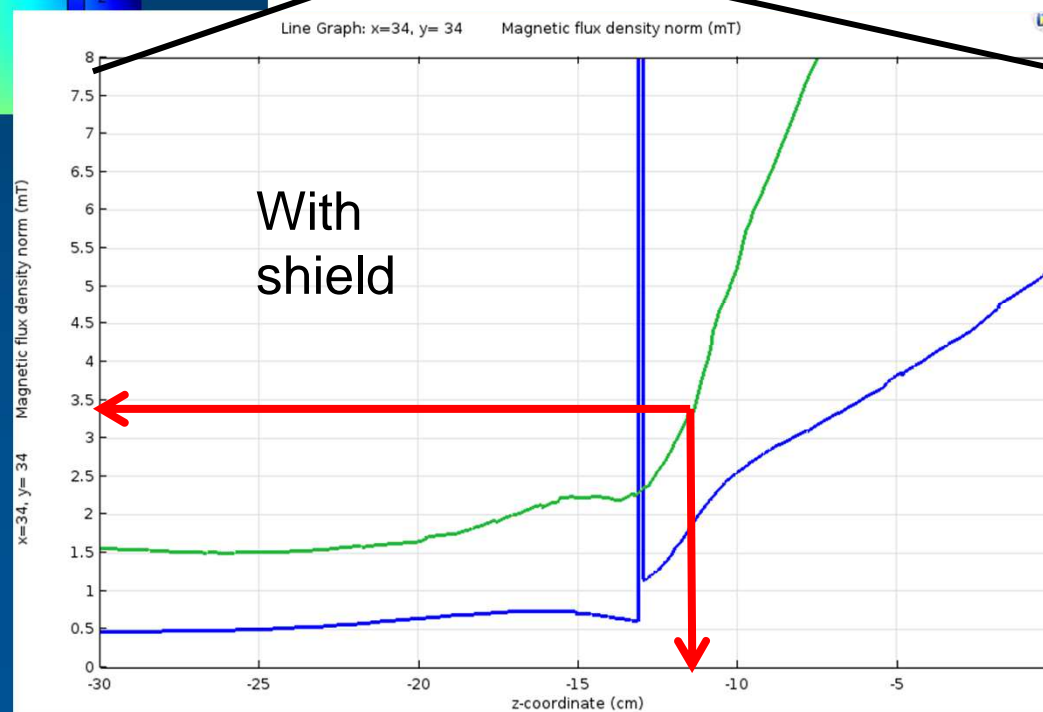
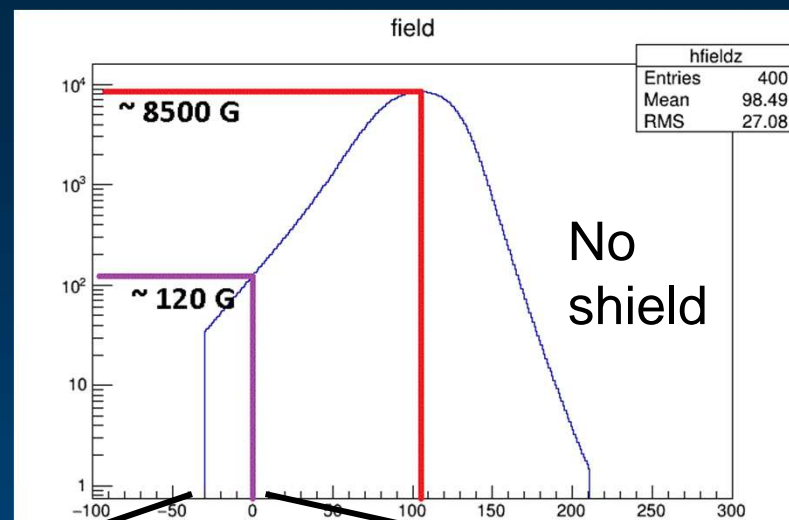
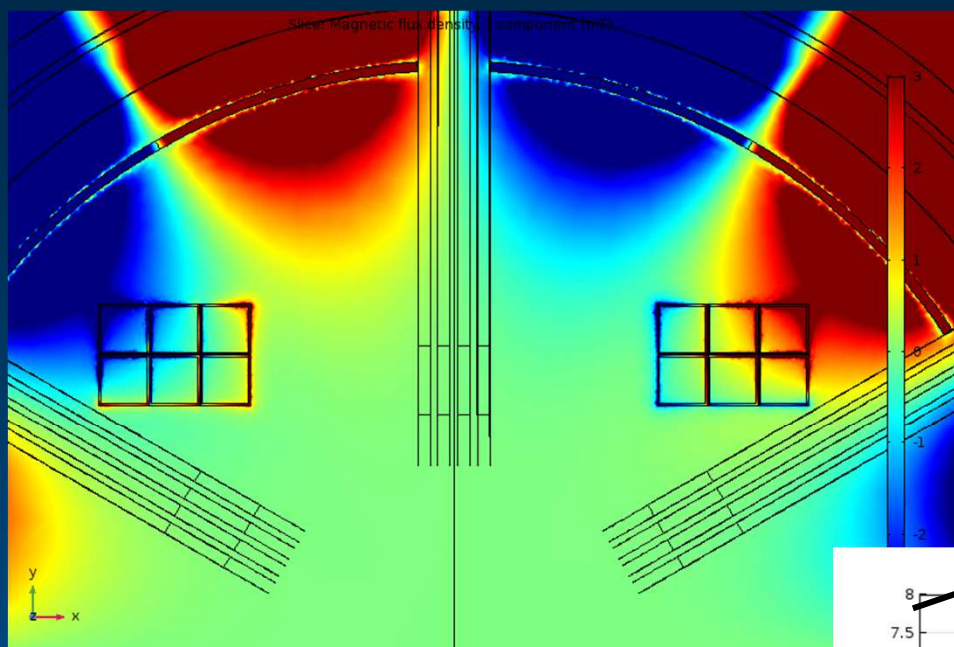
## Simulation with new geometry

S. Lebedev



- Negligible acceptance loss ( $\sim 10^{-2}$ )
- Inner shield removable





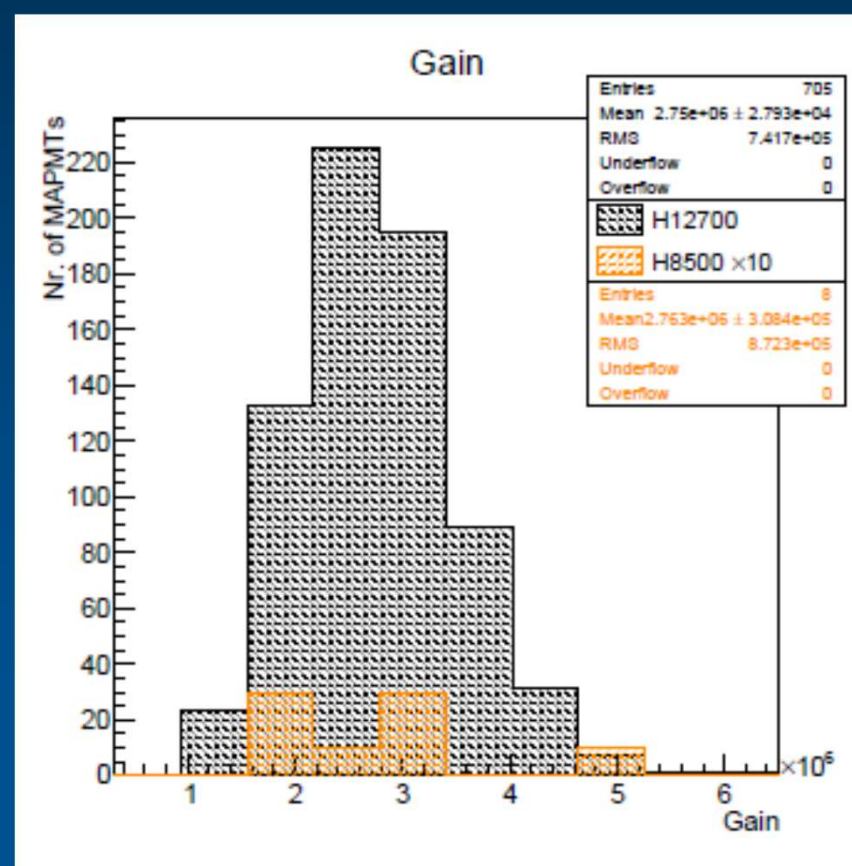
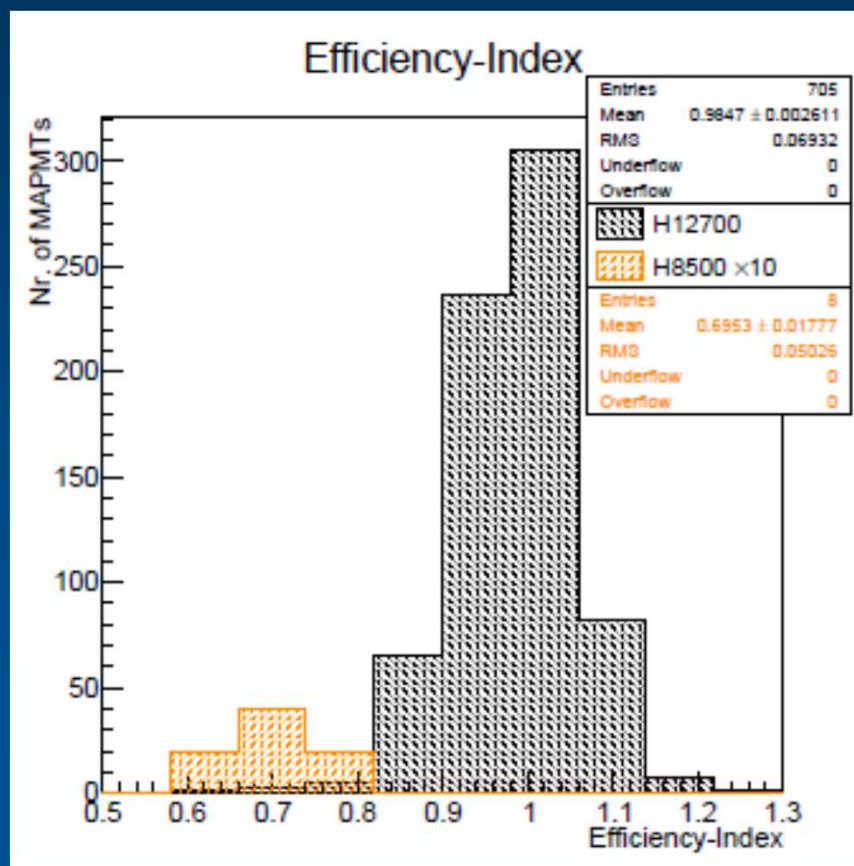
**@ MAPMT**  
Cathode plane !

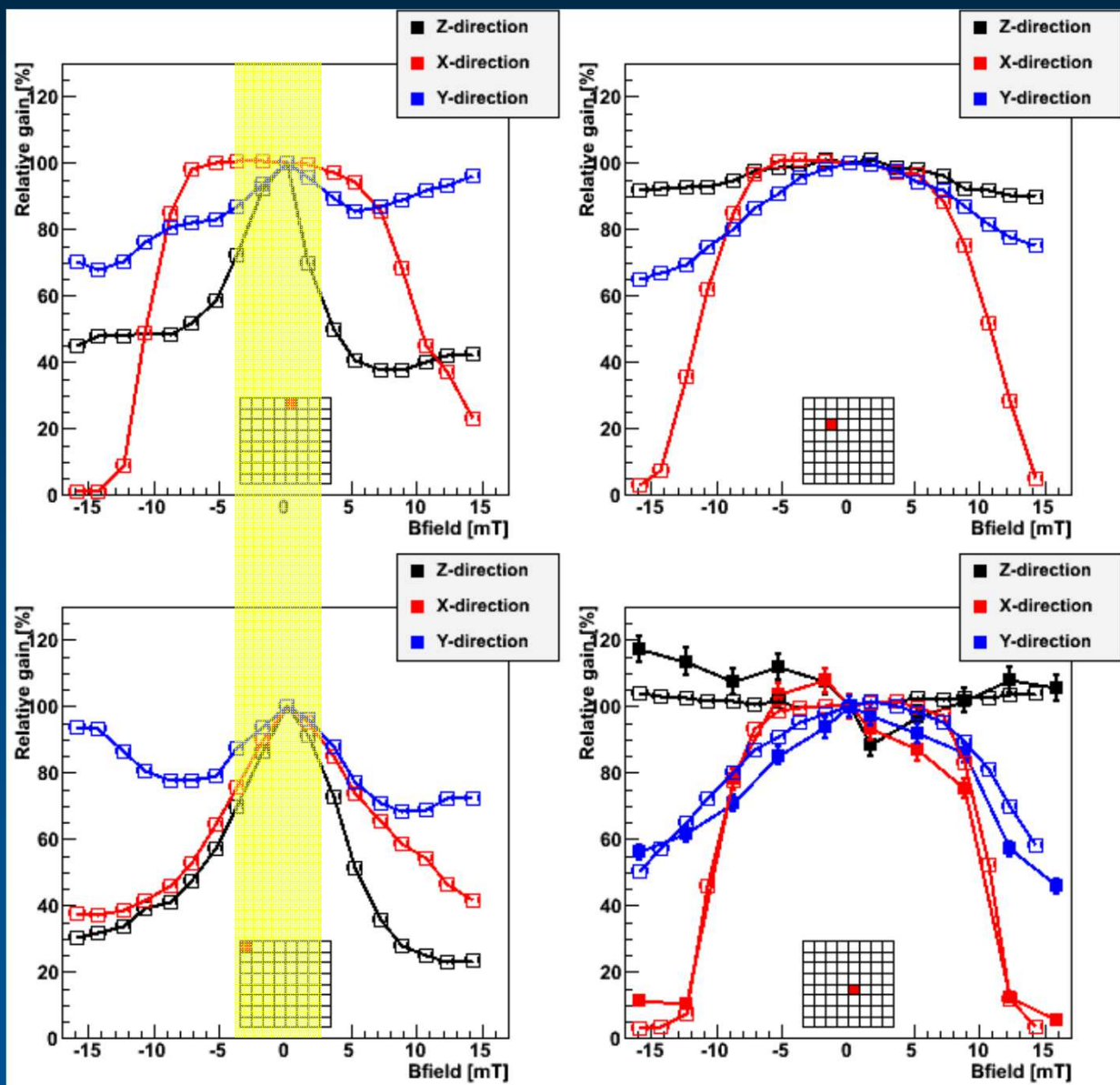
$z = -11$  (-25) cm  
 $x, y = +40$  cm  
 $B < \pm 3$  mT

$\langle \text{Eff.} \rangle @ \lambda = 405 \text{ nm}$   
 $\sim 1.4 * \text{H8500}$

$\langle \text{Skew.} \rangle \sim 0.95$

$\langle \text{Gain} \rangle \sim 2 * 10^6$



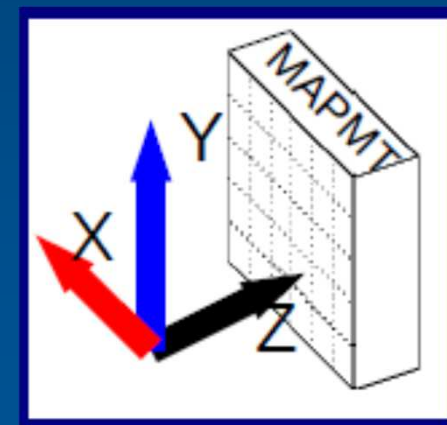


H8500C

op.: amplitude  
cls.: efficiency

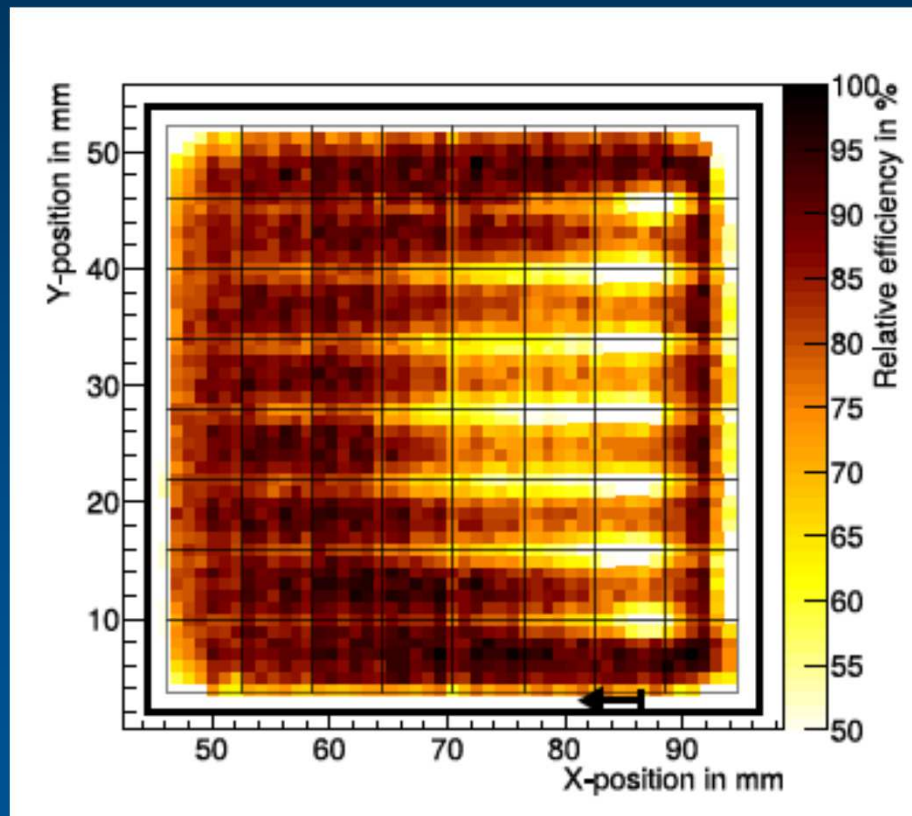
C. Pauly et al., DPG 2011

**$B_z < 30 \text{ G} = 3 \text{ mT} !!$**

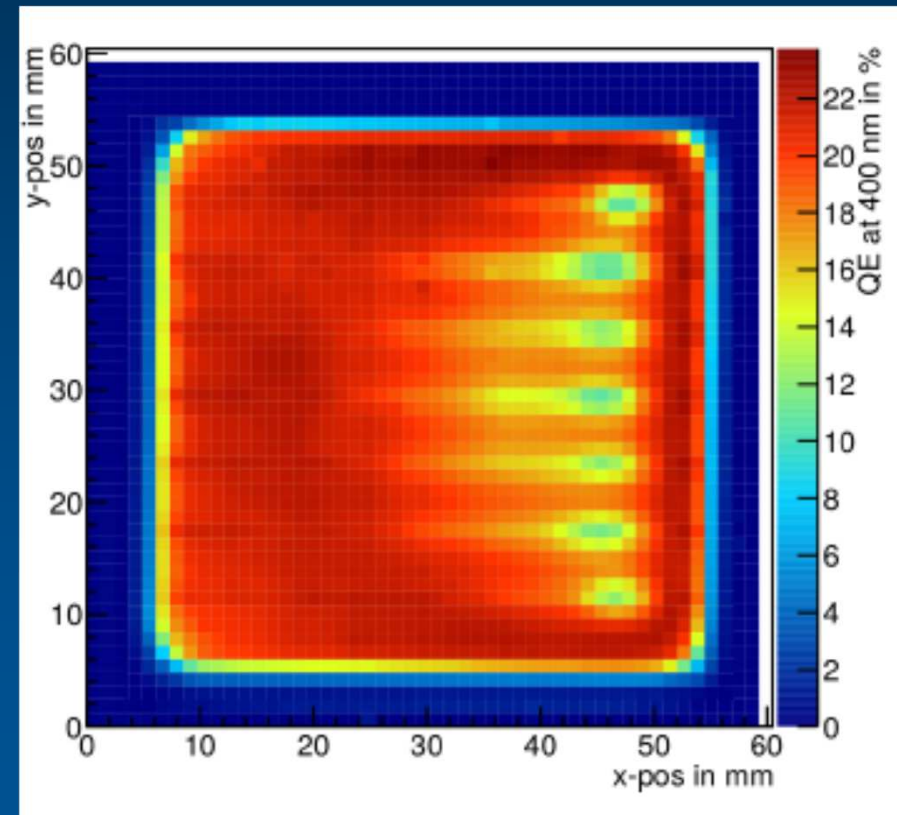


Bad guy

Relative efficiency



Absolute QE



→ LV Supply (TDK Lambda 60-40) @ GSI

→ HV Supply (ISEG) @ GSI

✓ Software uploaded & tested

Sensors:	inside	outside
	<b>B, T, P</b>	<b>rH, T, P, (B)</b>

→ TRB3 T readout

✓ EPICS *DeviceSupport* works

✓ Additional status variables available

→ rel. Hum.: HDC1000 (-20...60 °C,  $\delta rH = \pm 3\%$ )

→  $B_{xyz}$ , T: MLX30393 ( $\pm 70$  mT, -20...85 °C)

✓ I<sup>2</sup>C prot., A0 + A1 → 4 Sensors per line

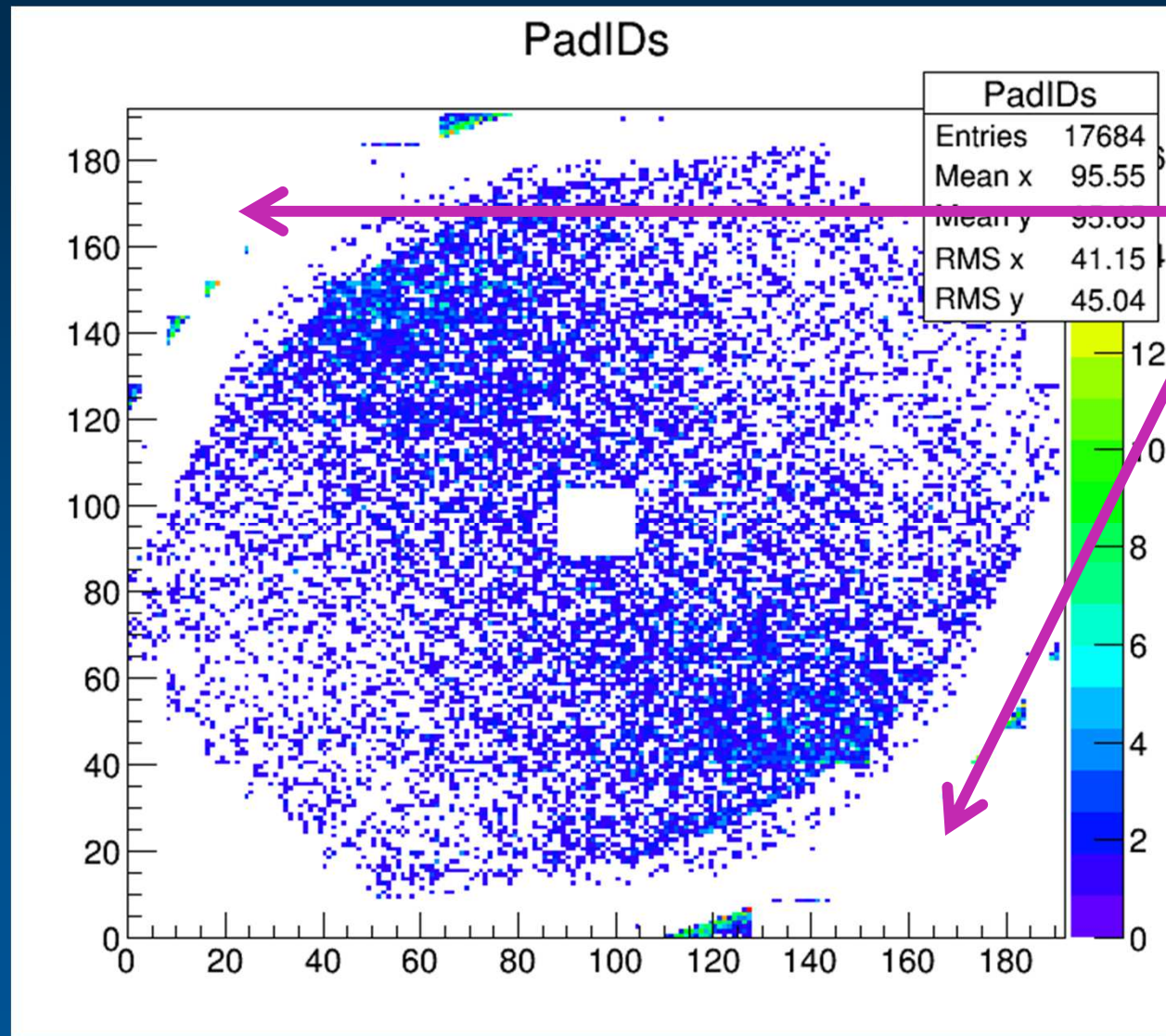


Adrian W. & Peter Z.

New  
board

Jan M.

## Photon hits on pad plane



Fiber input:

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Incl. angle  $\Theta$

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