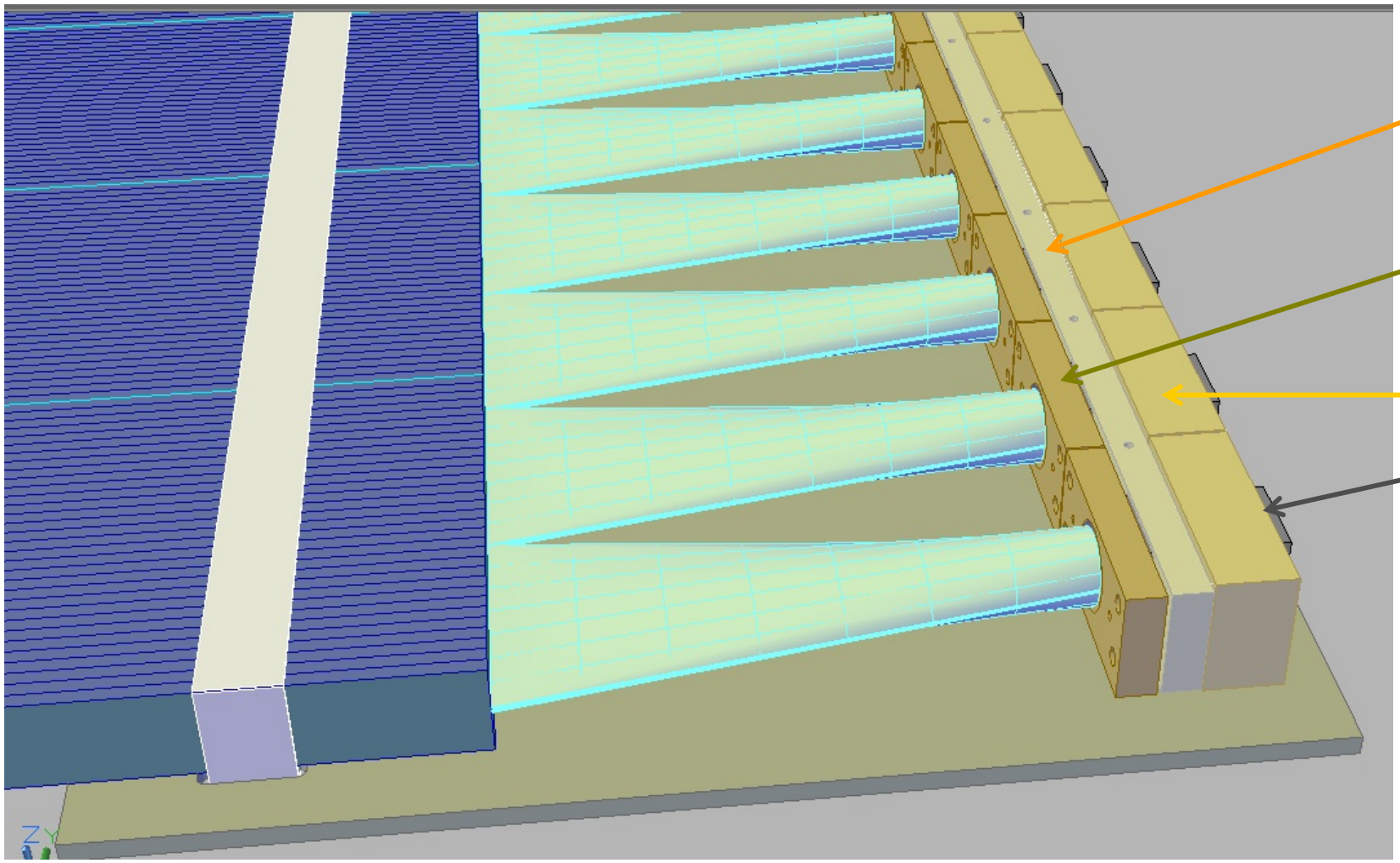
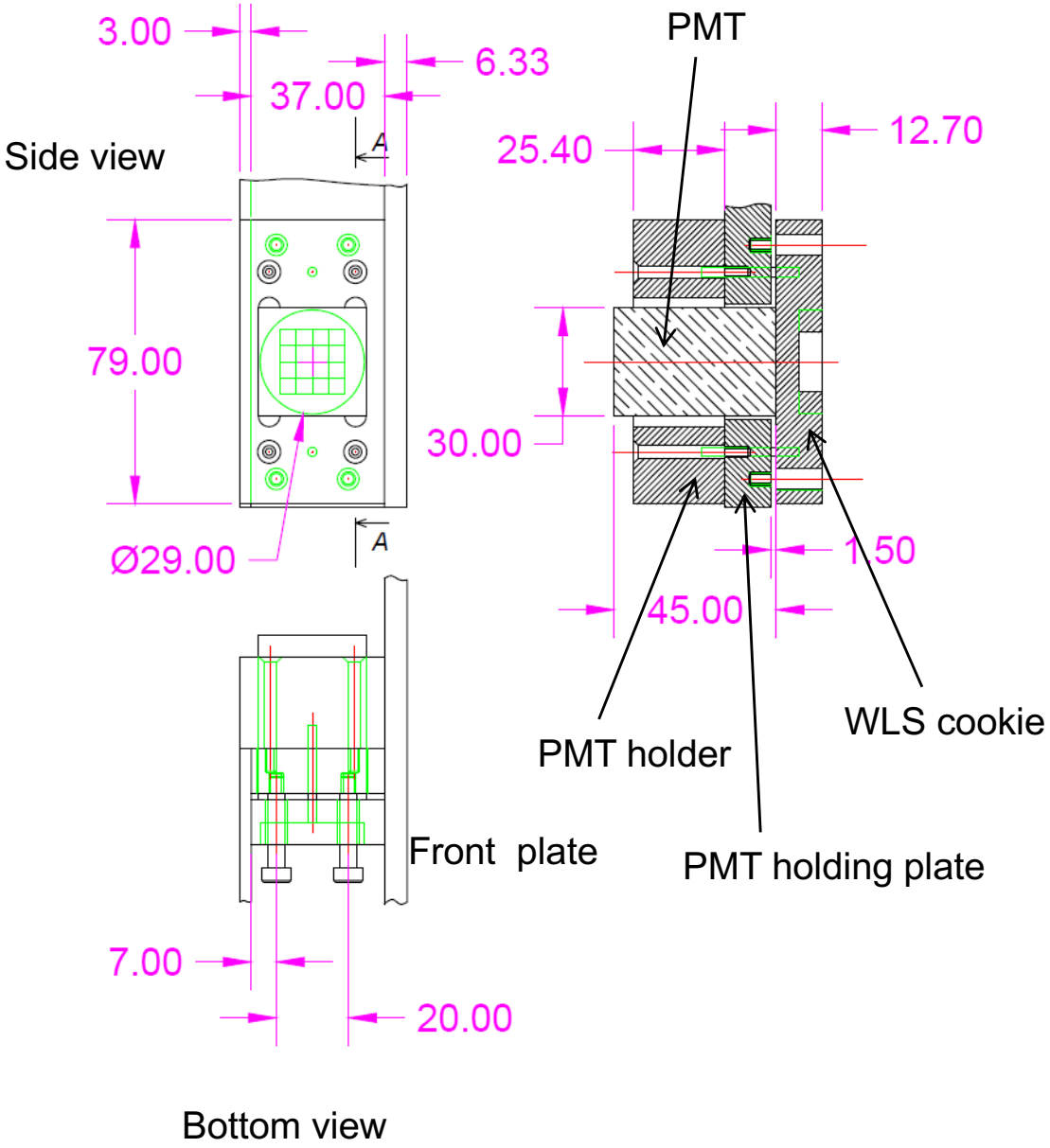
Coordinate Detector magnetic field aspects

Fibers to PMT connections

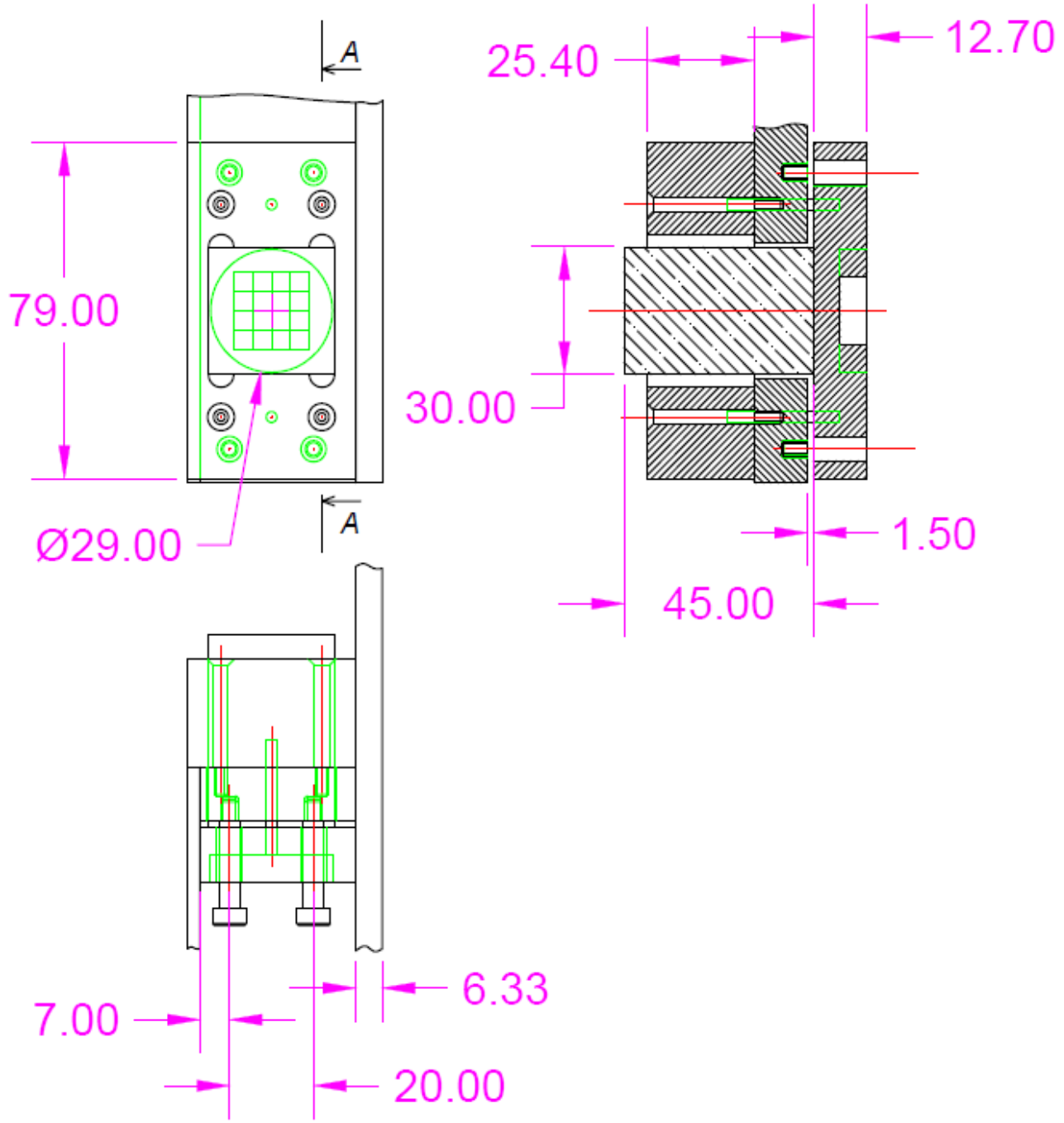


- **Cross-bar** (1/2” Al) attached to front plate
- **Cookies** with 16 holes in which fibers are glued
- **PMT holders** with **PMTs** glued to them

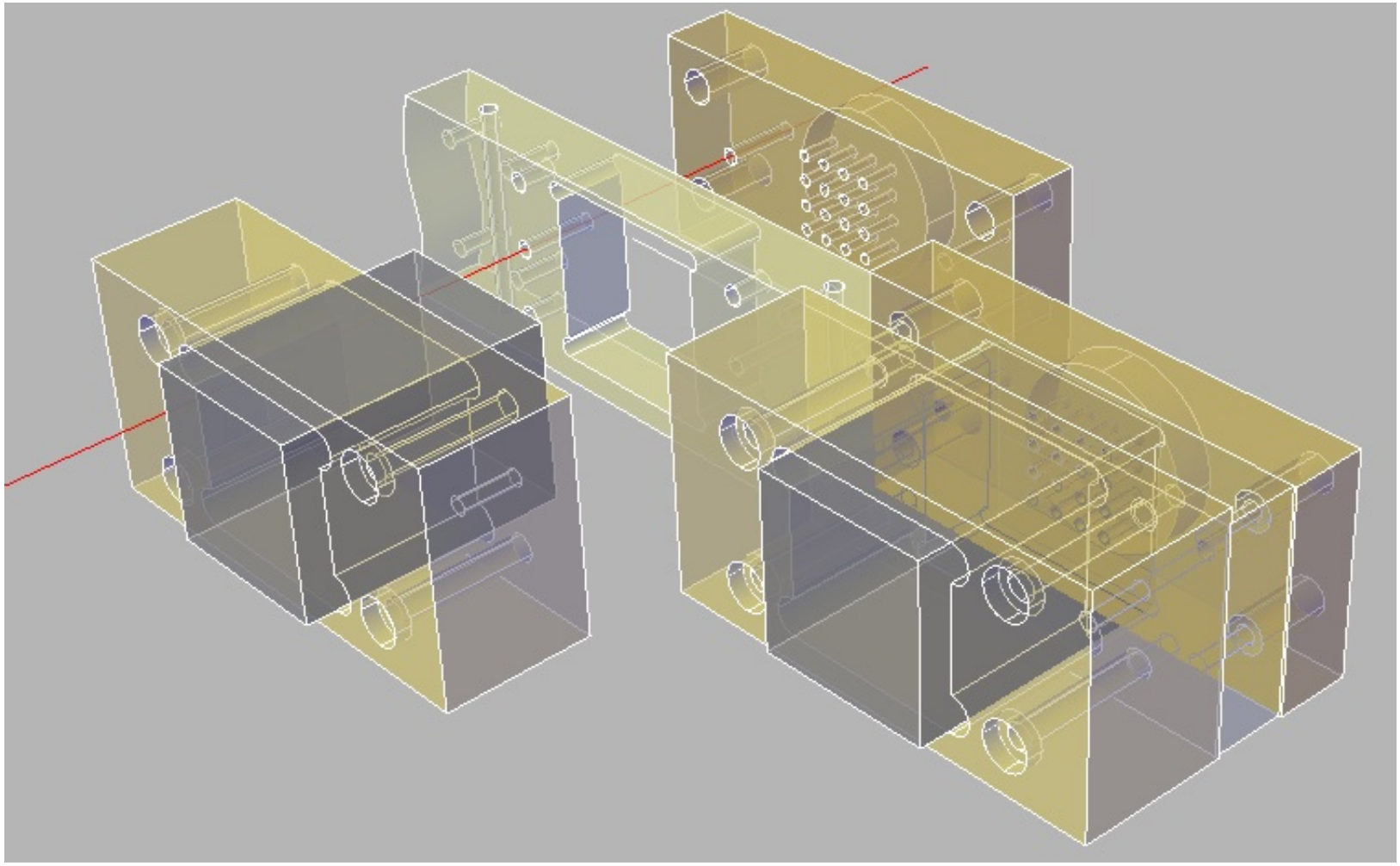
PMT to WLS connection



- Key element in the design, defines the thickness of one CDET section, light sealing, etc.
- PMT is glued in a plastic PMT holder
- PMT holder is firmly attached with screws to the front plate while the PMT goes through a hole sticking outside few mm
- The WLS (not shown) are glued in the “cookie” inside holes
- The cookie is attached to the front plate with springs
- Aluminum plate (3mm) covers the back side of the detector
- Dowel pins in the front plate center the positions of the PMT holder and the cookie
- All dimensions in mm

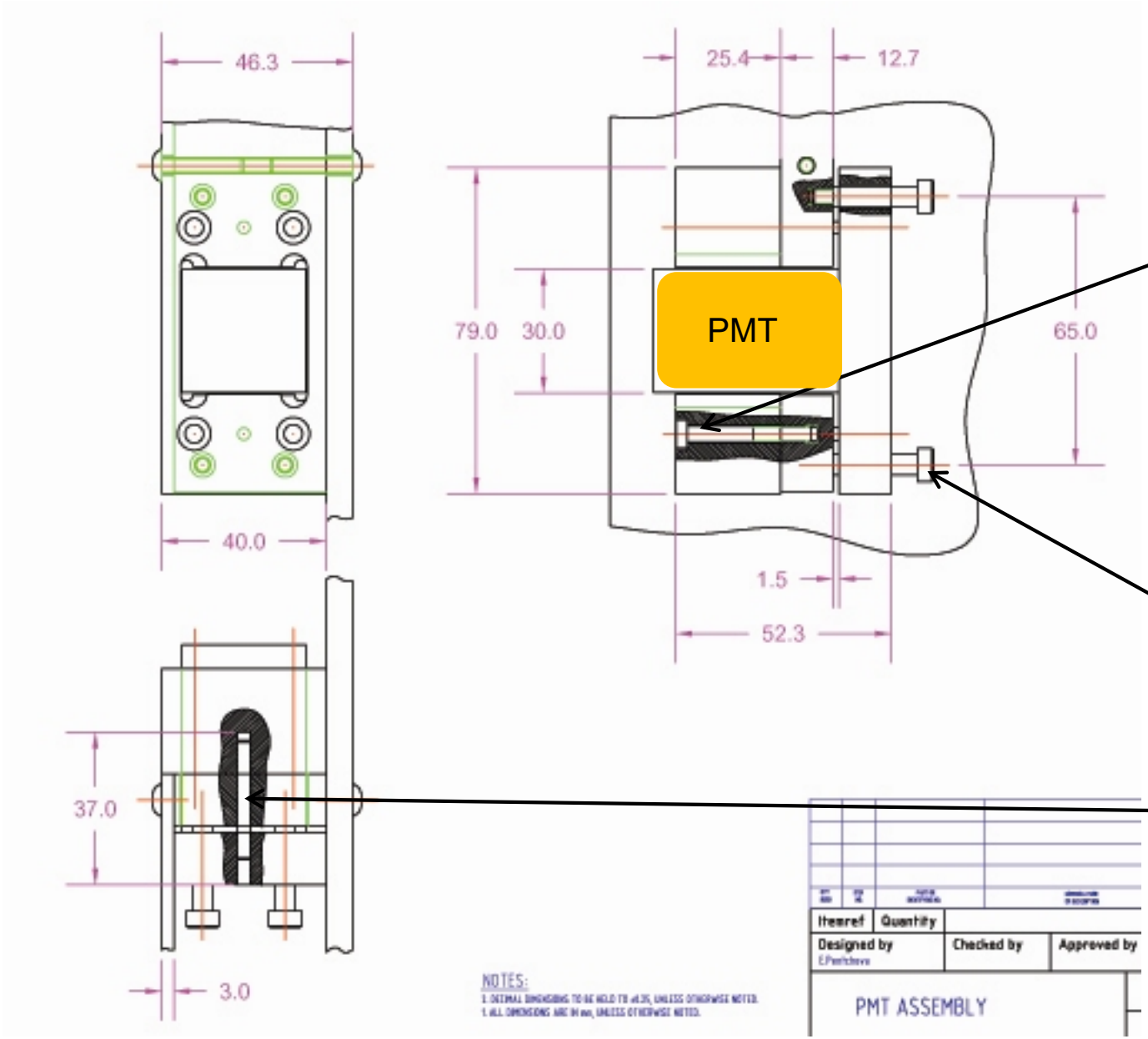

A
79.00
Ø29.00
A
25.40
12.70
30.00
1.50
45.00
7.00
6.33
20.00

Cookie and PMT holder attachment



- PMT is glued in a plastic PMT holder
- PMT holder is firmly attached with four screws to the cross bar while the PMT goes through a hole sticking outside of the cross-bar by 1.5 mm
- The WLS (not shown) are glued in the cookie inside 16 holes
- The cookie is attached to the front plate with four screws with springs (not shown)
- Two dowel pins in the cross bar center the positions of the PMT holder and the cookie (along red line)

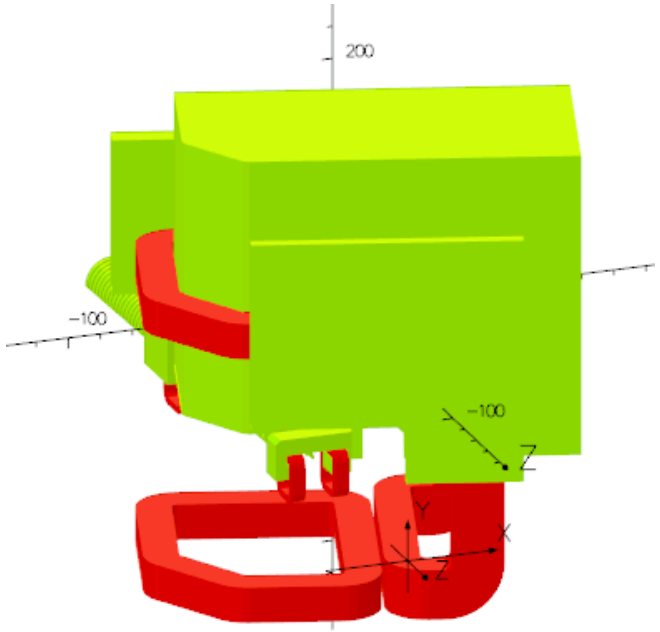
Cookie and PMT holder attachment

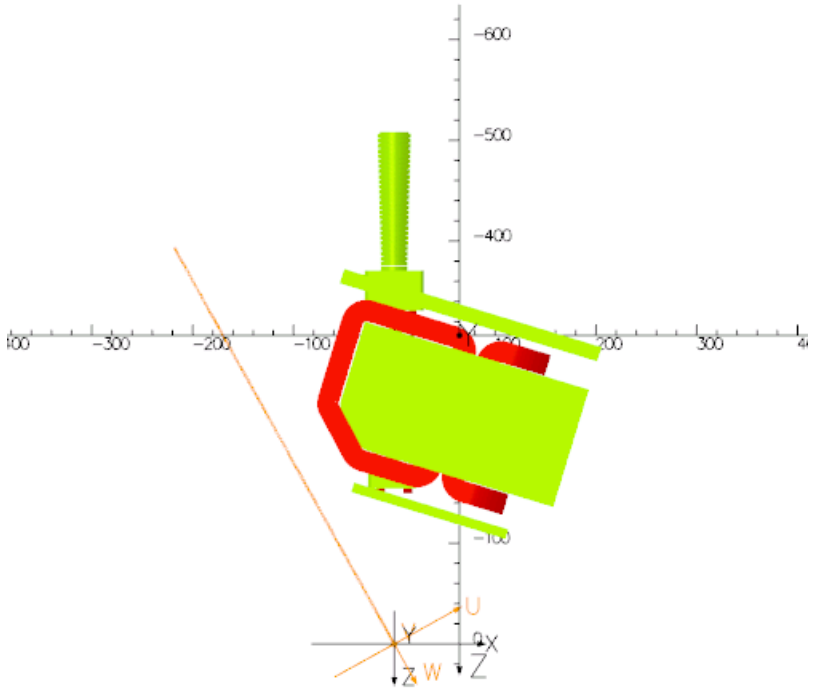


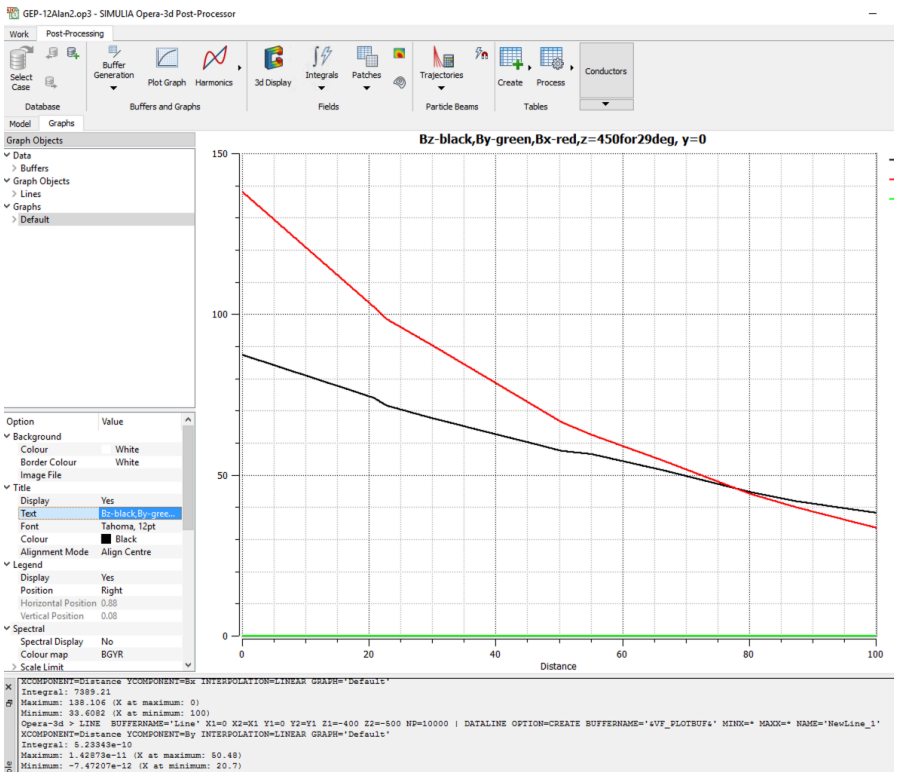
- PMT holder is firmly attached with four screws to the cross bar while the PMT goes through a hole sticking outside of the cross-bar by 1.5 mm

- The cookie is attached to the front plate with four screws with springs (not shown)

- Two dowel pins in the cross bar center the positions of the PMT holder and the cookie


200
-100
-100
Z
Y
X
Z


-600
-500
-400
-100
400
-300
-200
-100
200
300
U
Y
X
Z
W
Z


GEP-12Alan2.op3 - SIMULIA Opera-3d Post-Processor
Work
Post-Processing
Select Case
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Harmonics
Buffers and Graphs
3d Display
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Process
Tables
Conductors
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Graph Objects
Data
Buffers
Graph Objects
Lines
Graphs
Default
Option
Value
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Colour
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Border Colour
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Image File
Title
Display
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Text
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Colour
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Align Centre
Legend
Display
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Position
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Horizontal Position
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Vertical Position
0.08
Spectral
Spectral Display
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Colour map
BGYR
Scale Limit
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100
50
0
0
20
40
60
80
100
Distance
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Minimum: 33.6092 (X at minimum: 100)
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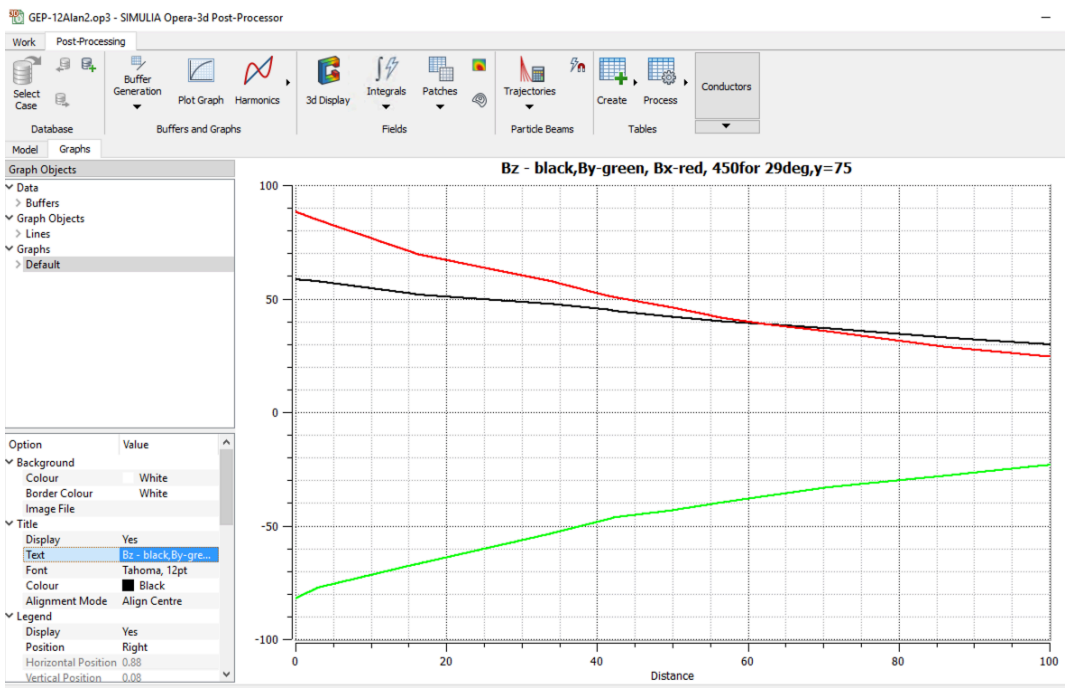
Minimum: -7.47207e-12 (X at minimum: 20.7)


GEP-12Alan2.op3 - SIMULIA Opera-3d Post-Processor
Work
Post-Processing
Select Case
Database
Buffer Generation
Plot Graph
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3d Display
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Graphs
Graph Objects
Data
Buffers
Graph Objects
Lines
Graphs
Default
Option
Value
Background
Colour
White
Border Colour
White
Image File
Title
Display
Yes
Text
Bz - black,By-gre...
Font
Tahoma, 12pt
Colour
Black
Alignment Mode
Align Centre
Legend
Display
Yes
Position
Right
Horizontal Position
0.88
Vertical Position
0.08
Bz - black,By-green, Bx-red, 450for 29deg,y=75
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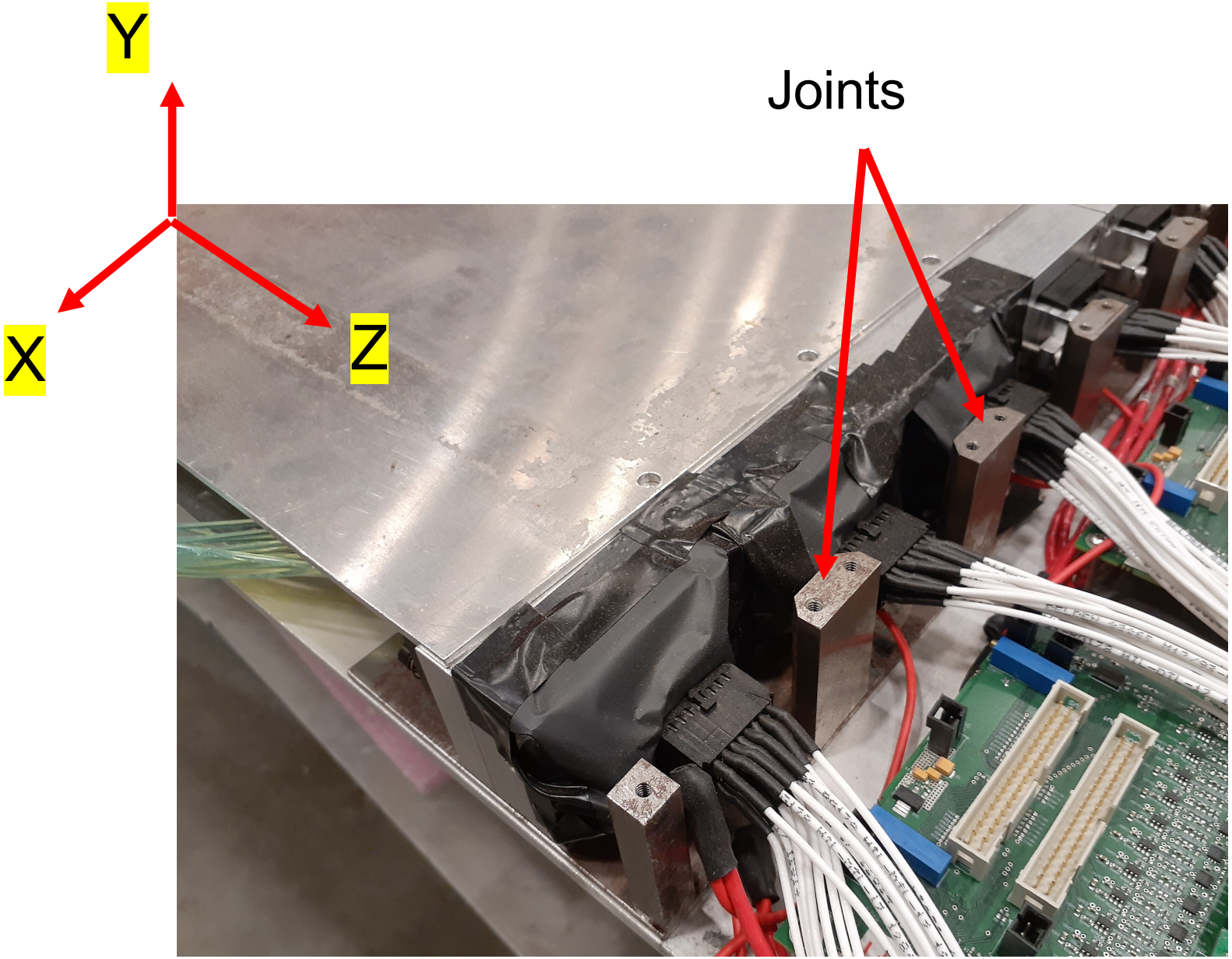
0
-50
-100
0
20
40
60
80
100
Distance


Y
X
Z
Joints

Original PMT plan

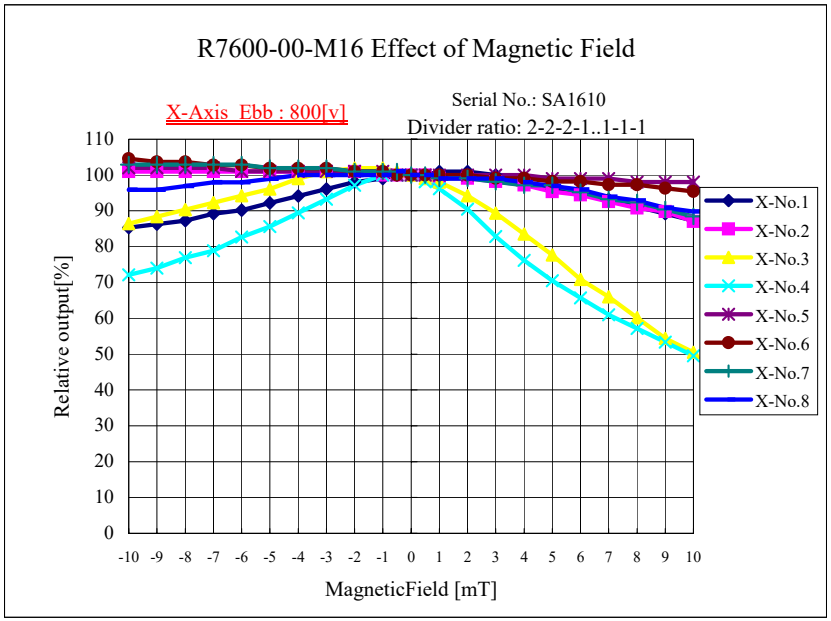
R7600-00-M16

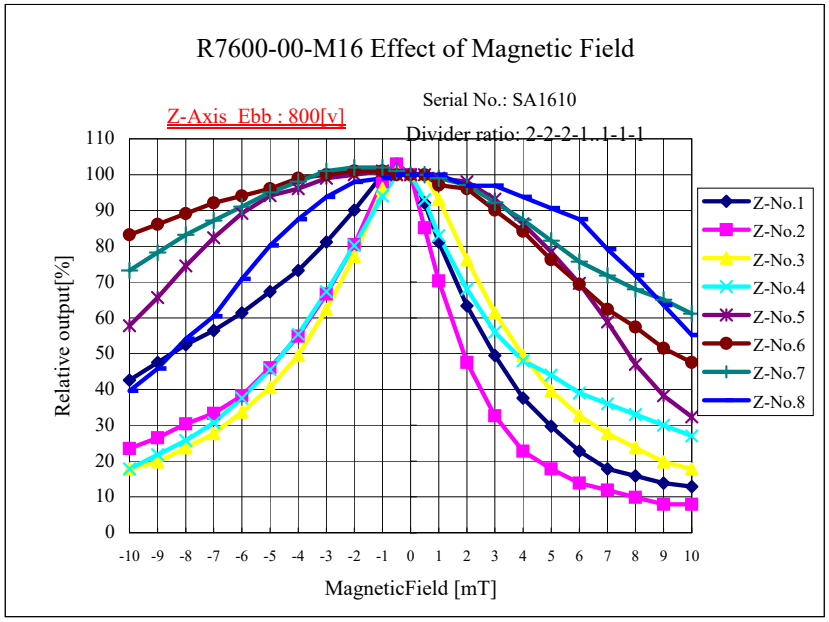
A total of 186 H8711 and 416 R5900-M16 Hamamatsu PMTs from the CDF calorimeter were donated by FNAL to JLab in 2012. The PMTs have 16

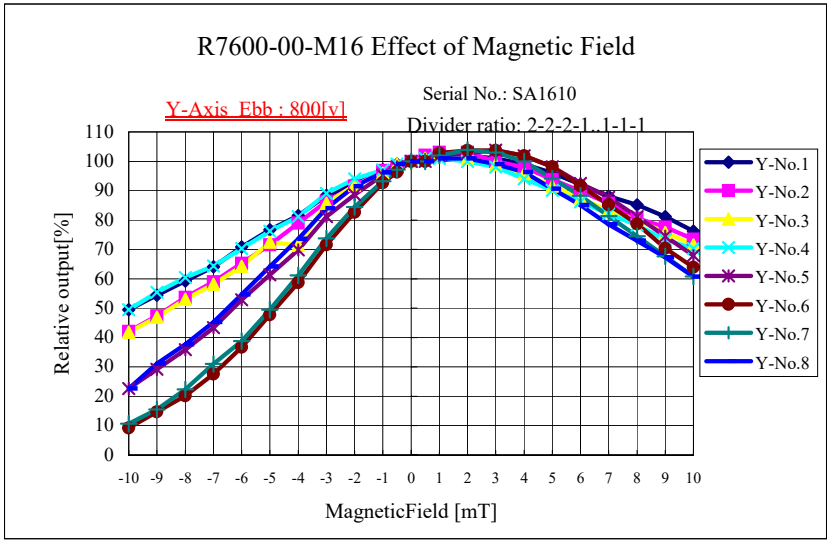
These PMTs are relatively insensitive to the external magnetic field. According to the report [10] the 30-40 Gauss field caused reduction of the gain by 5-10%. At location of the detector in the GEP and GMN/GEN experiments the projected value of the magnetic field is of 10 Gauss or less. Because the field is mostly in horizontal direction a proper orientation of the PMT will allow to reduce impact of the field even more.

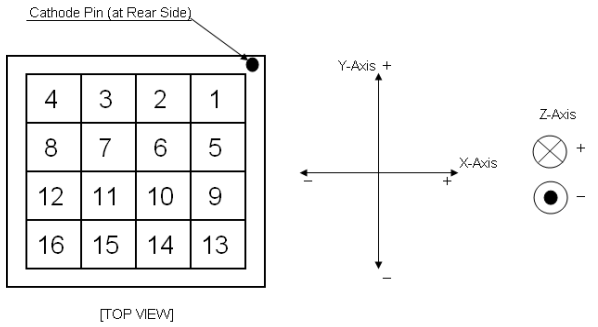
Hamamatsu measurements had shown the effects depend on the direction of the magnetic field. In the coordinate system defined in Figure 8.3, a field in the positive y direction had given the largest effect, resulting in a gain loss of about 3%, 12%, 23%, 35% and 50% for fields of 10, 20, 30, 40 and 50 Gauss, respectively. This was measured with a 64-pixel version of the MA-PMT. Therefore, we do not expect significant effects from the field in practice.

R7600-00-M16









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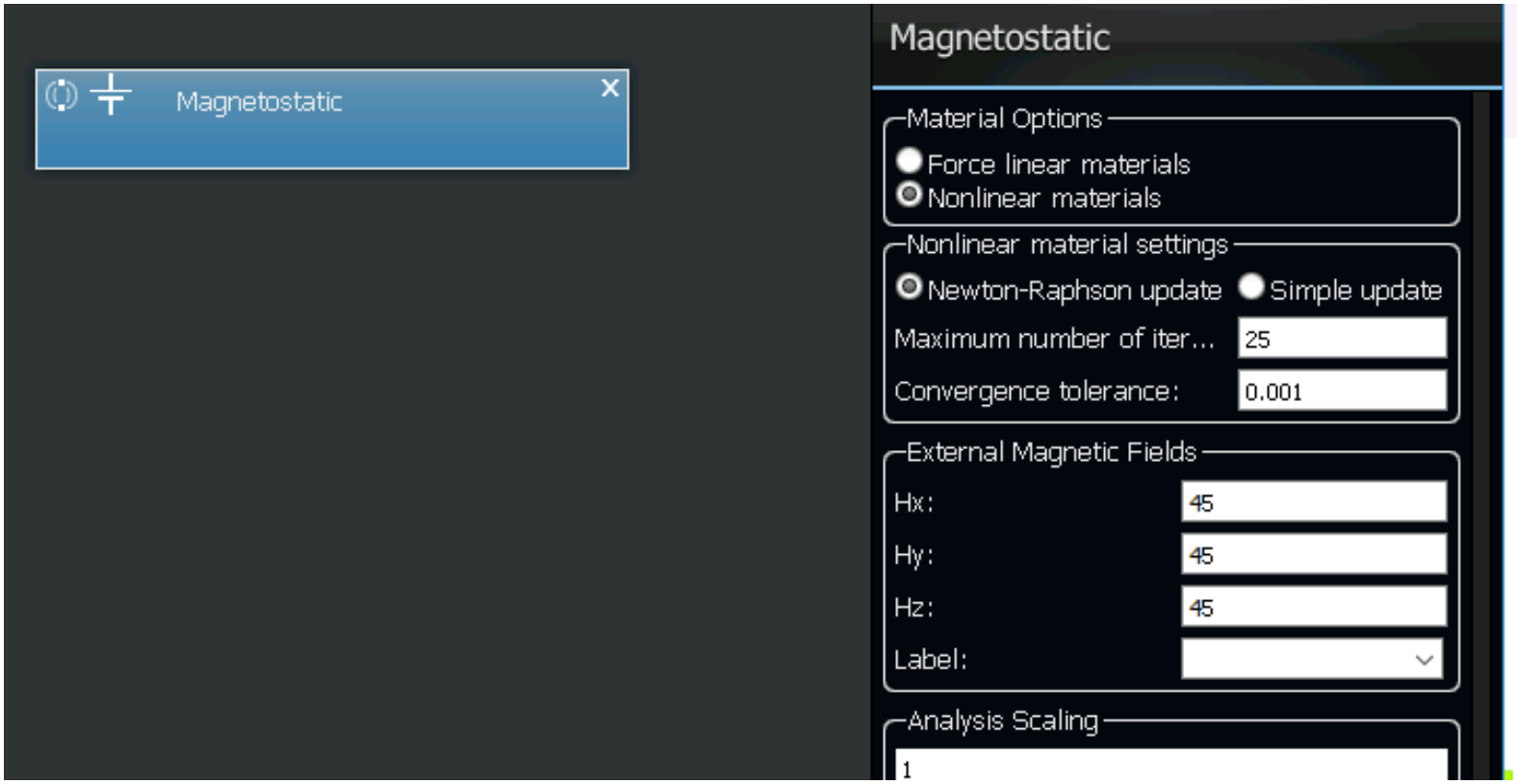
HAMAMATSU
HAMAMATSU PHOTONICS K.K. Electron Tube Division

Opera with the external field



Current scheme

CDET-1b.op3 - SIMULIA Opera-3d Post-Processor

Work | Post-Processing

Select Case | Database

Buffer Generation | Plot Graph | Harmonics | Buffers and Graphs

3d Display | Integrals | Patches | Fields

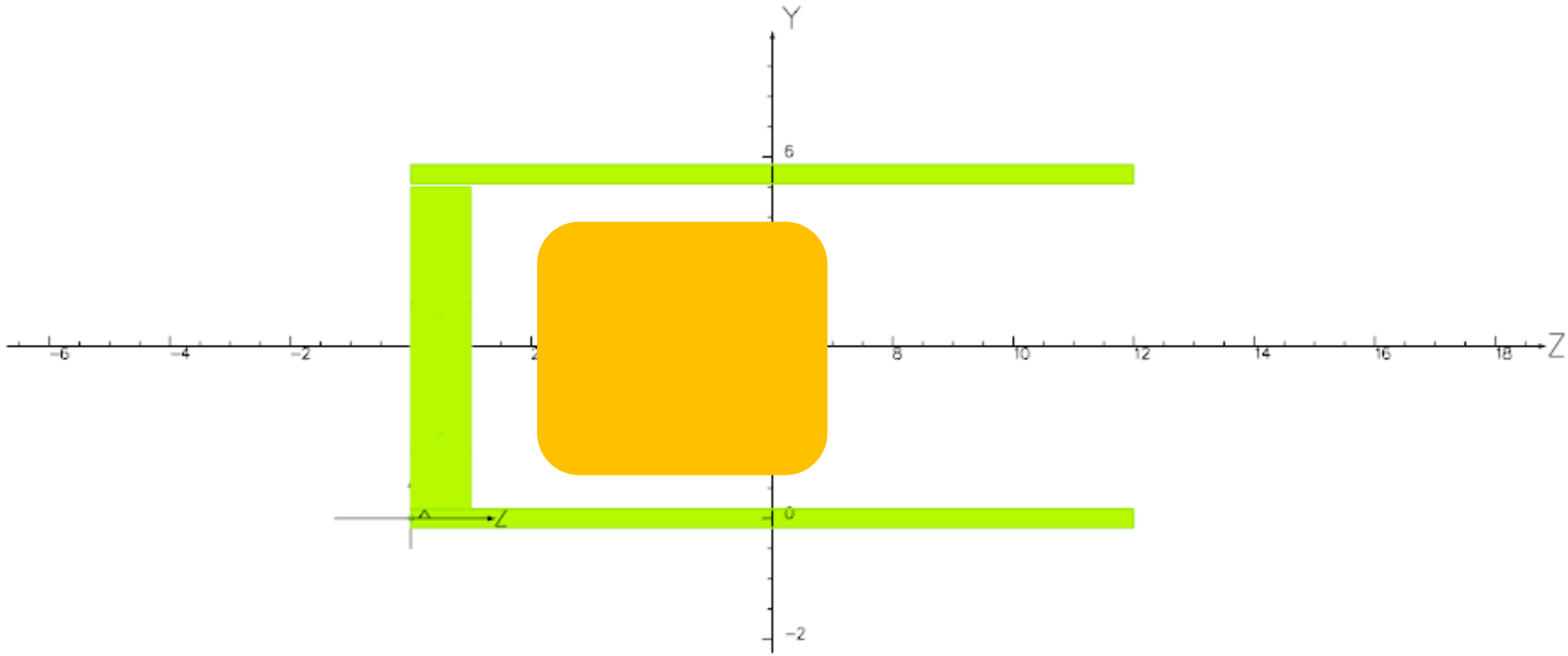
Trajectories | Particle Beams

Create | Process | Tables

Circuit Editor | Create | Toggle Picking | Modify Selected | List Data | Erase Selected | Conductors

Model | Graphs

16/Jul/2022 18:08:54




```
Unit of Current Density  : A/cm^2          | Unit of Power           : W
Unit of Force            : N              | Unit of Energy          : J
Unit of Electric Field   : V/cm           | Unit of Elec Flux Density: C/cm^2
Unit of Mass             : g              | Unit of Pressure        : Pa
Unit of Charge Density   : C/cm^3         | Unit of Electric Pot    : volt
Opera-3d > THREED OPTION=GETVIEW
Opera-3d > THREED TYPE=SURFACE VECTOR=NO XORIGIN=0.75 YORIGIN=2.8575 ZORIGIN=6 ROTX=20 ROTY=20 ROTZ=0 XASPECT=1 YASPECT=1 ZASPECT=1 SIZE=50.75 FACETANG
LINECOLOUR=YES USEOUTERELEM=NO OPTION=SETVIEW
Opera-3d > THREED OPTION=GETVIEW | THREED OPTION=SETVIEW ROTX=0.0001 ROTY=90 ROTZ=0.0001
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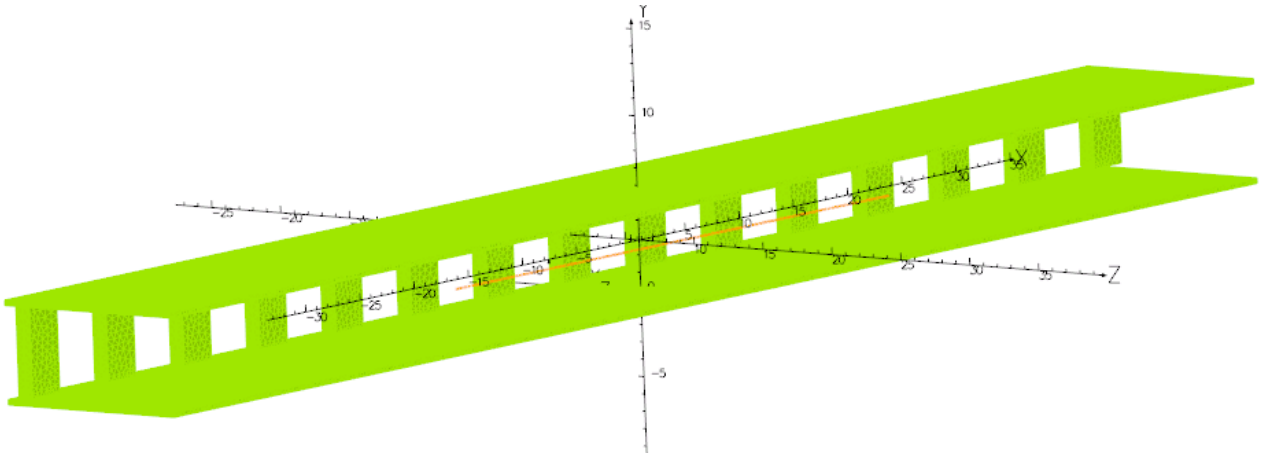

CDET-1b.op3 - SIMULIA Opera-3d Post-Processor

Work | Post-Processing

Select Case | Database

Buffer Generation | Plot Graph | Harmonics | Buffers and Graphs

3d Display | Integrals | Patches | Fields

Trajectories | Particle Beams

Create | Process | Tables

Circuit Editor | Create | Toggle Picking | Modify Selected | List Data | Erase Selected | Conductors

Model | Graphs

Graph Objects

- Data
  - Buffers
- Graph Objects
  - Lines
- Graphs
  - Default
    - NewLine
    - NewLine_1
    - NewLine_2

Option	Value
Background	
Colour	White
Border Colour	White
Image File	
Title	
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Legend	
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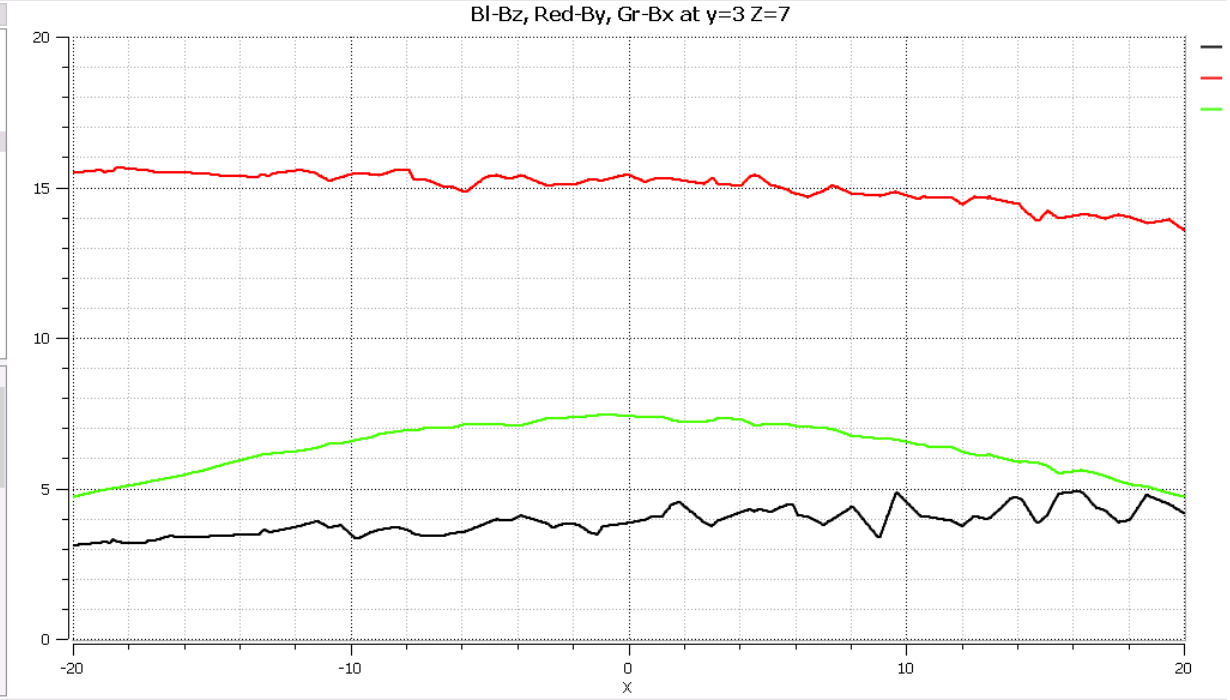
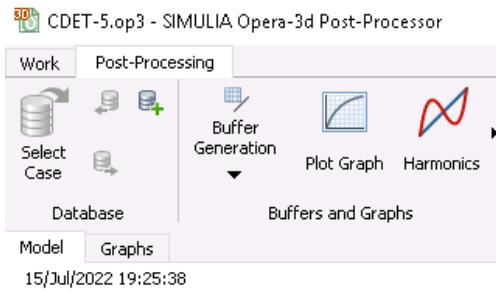
Position	Right
Horizontal Position	0.88
Vertical Position	0.08

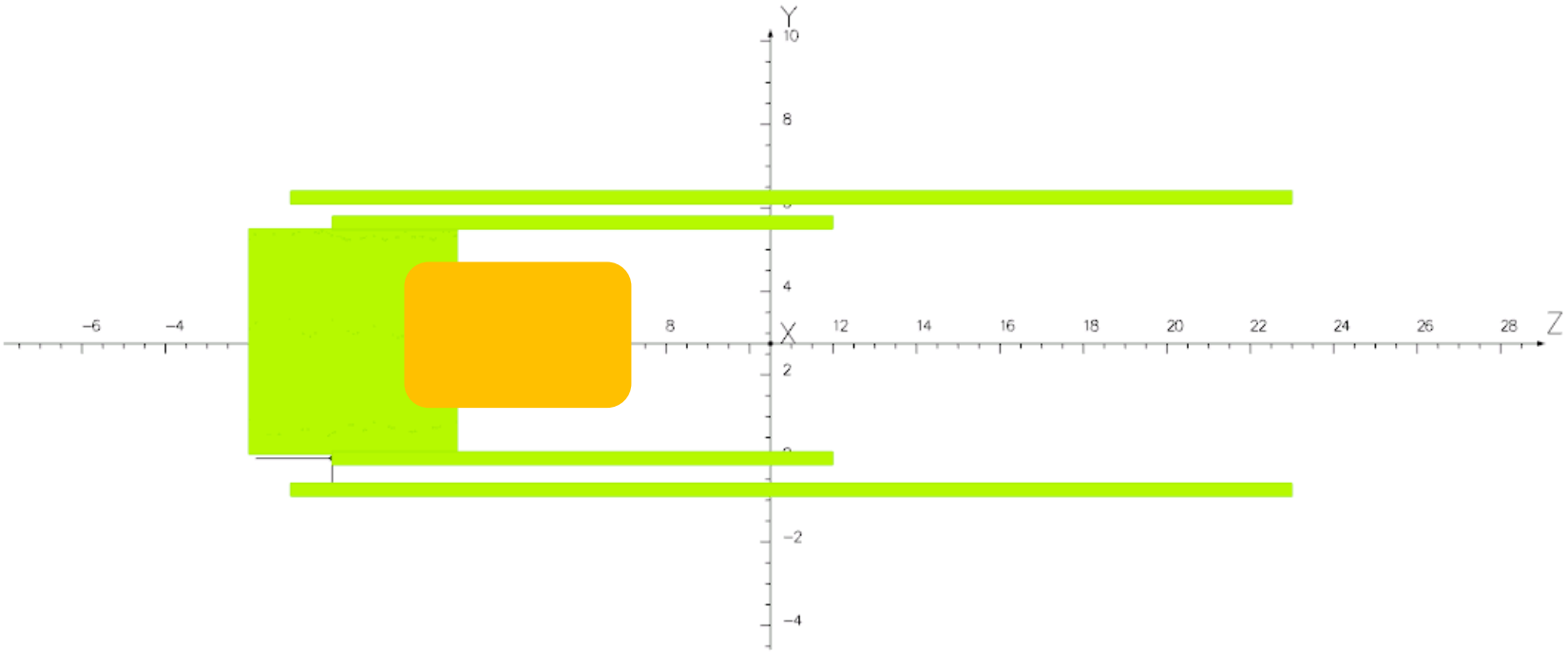


Opera-3d > LINE BUFFERNAME='Line' X1=-20 Y1=3 Y2=Y1 Z1=7 Z2=Z1 X2=20 NP=10000 | DATALINE OPTION=CREATE BUFFERNAME='&VF_PLOTBUF&' MINX=* MAXX=* NAME='NewLine_2' XCOMPONENT=X YCOMPONENT=Bx INTERPOLATION=LINEAR GRAPH='Default'

Integral: 255.774

Proposed complete scheme






```
Opera-3d > LINE  BUFFERNAME='Line' X1=-20 Y1=3 Y2=Y1 Z1=7 Z2=Z1 X2=20 NP=10000 | DATALINE OPTION=CREATE BUFFERNAME='&VF_PLOTBUF&' MINX=* MAXX=* NAME='NewLine' XCOMPONENT=X YCOMPONENT=
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Maximum: 1.06811 (X at maximum: -2.344)
Minimum: 0.987302 (X at minimum: -20)
Opera-3d > LINE  BUFFERNAME='Line' X1=-20 Y1=3 Y2=Y1 Z1=7 Z2=Z1 X2=20 NP=10000 | DATALINE OPTION=CREATE BUFFERNAME='&VF_PLOTBUF&' MINX=* MAXX=* NAME='NewLine_1' XCOMPONENT=X YCOMPONEN
Integral: 51.757
Maximum: 1.39176 (X at maximum: -2.004)
Minimum: 1.1243 (X at minimum: -19.512)
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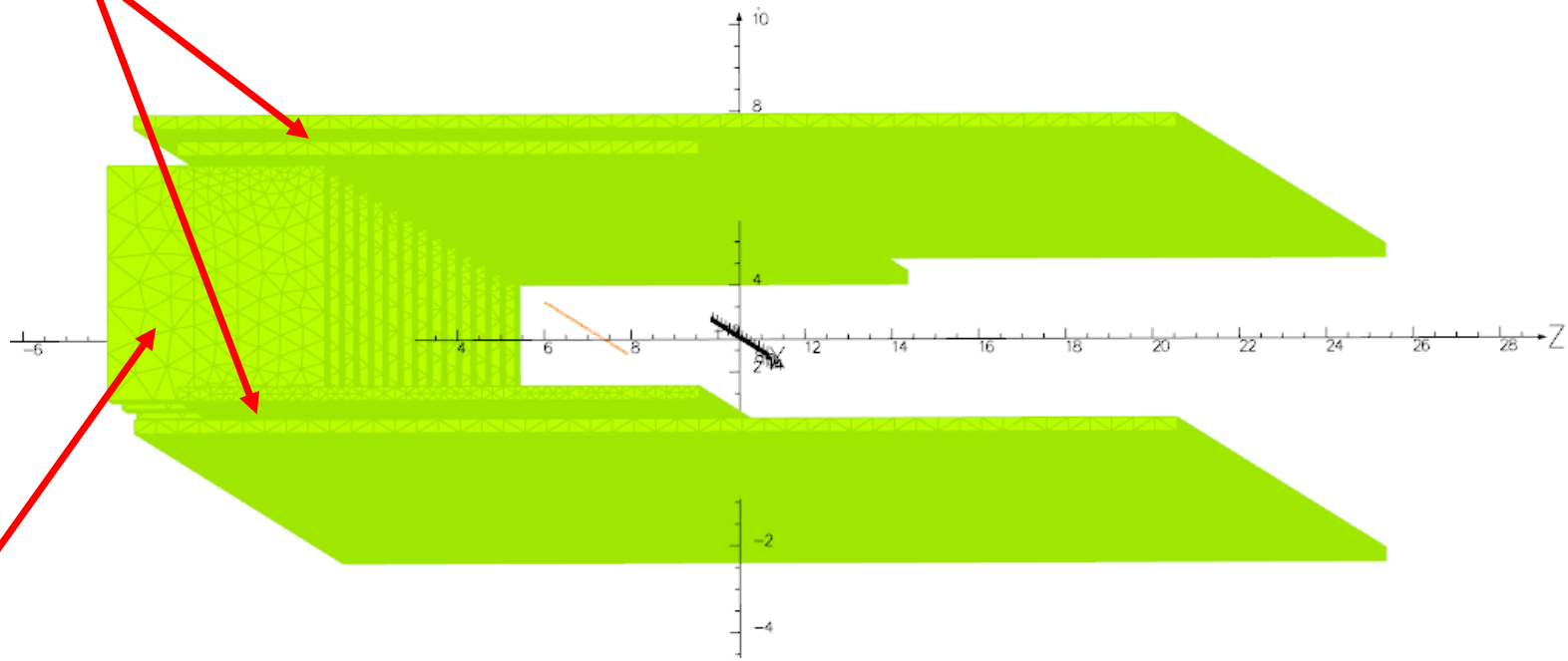
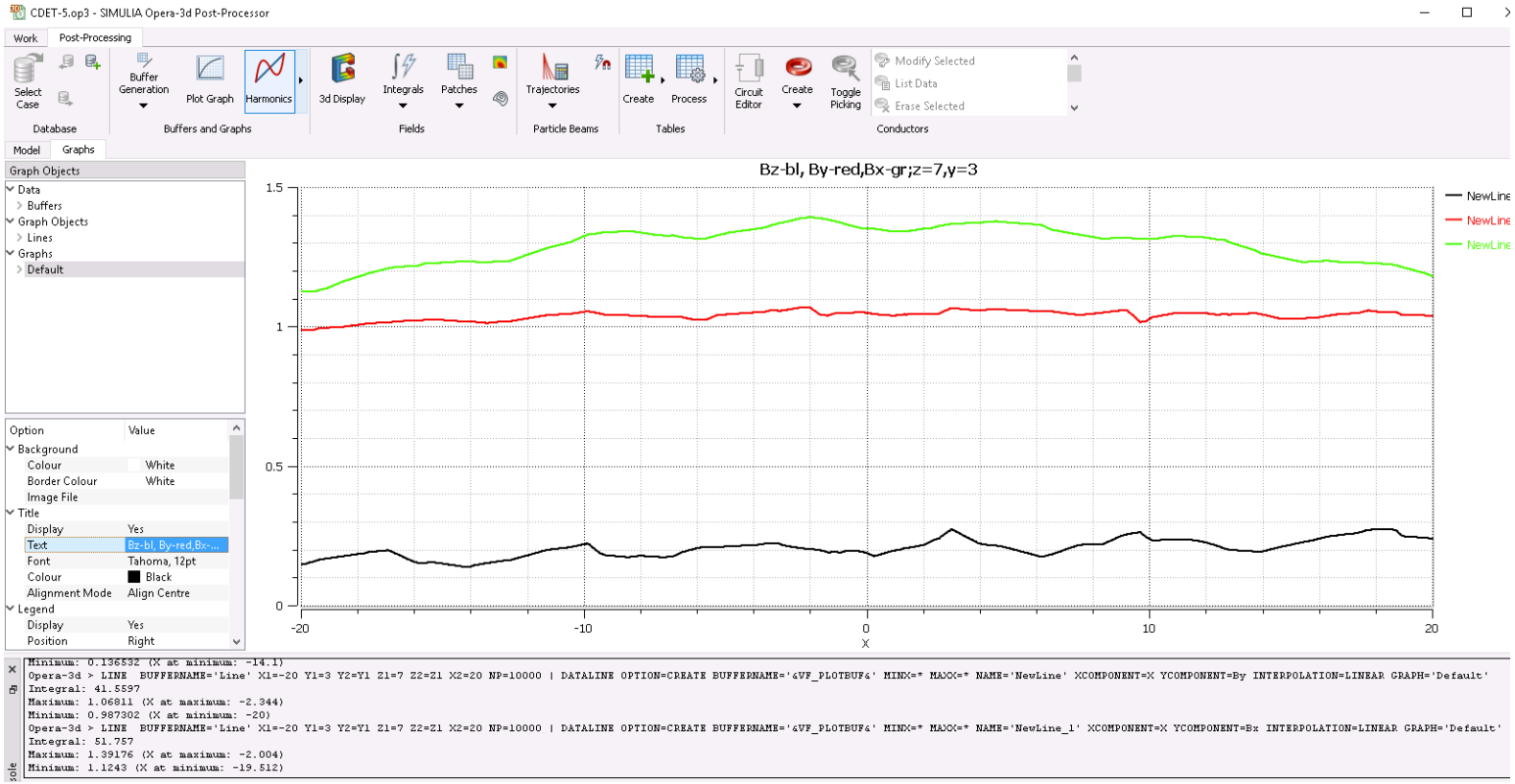
New plates

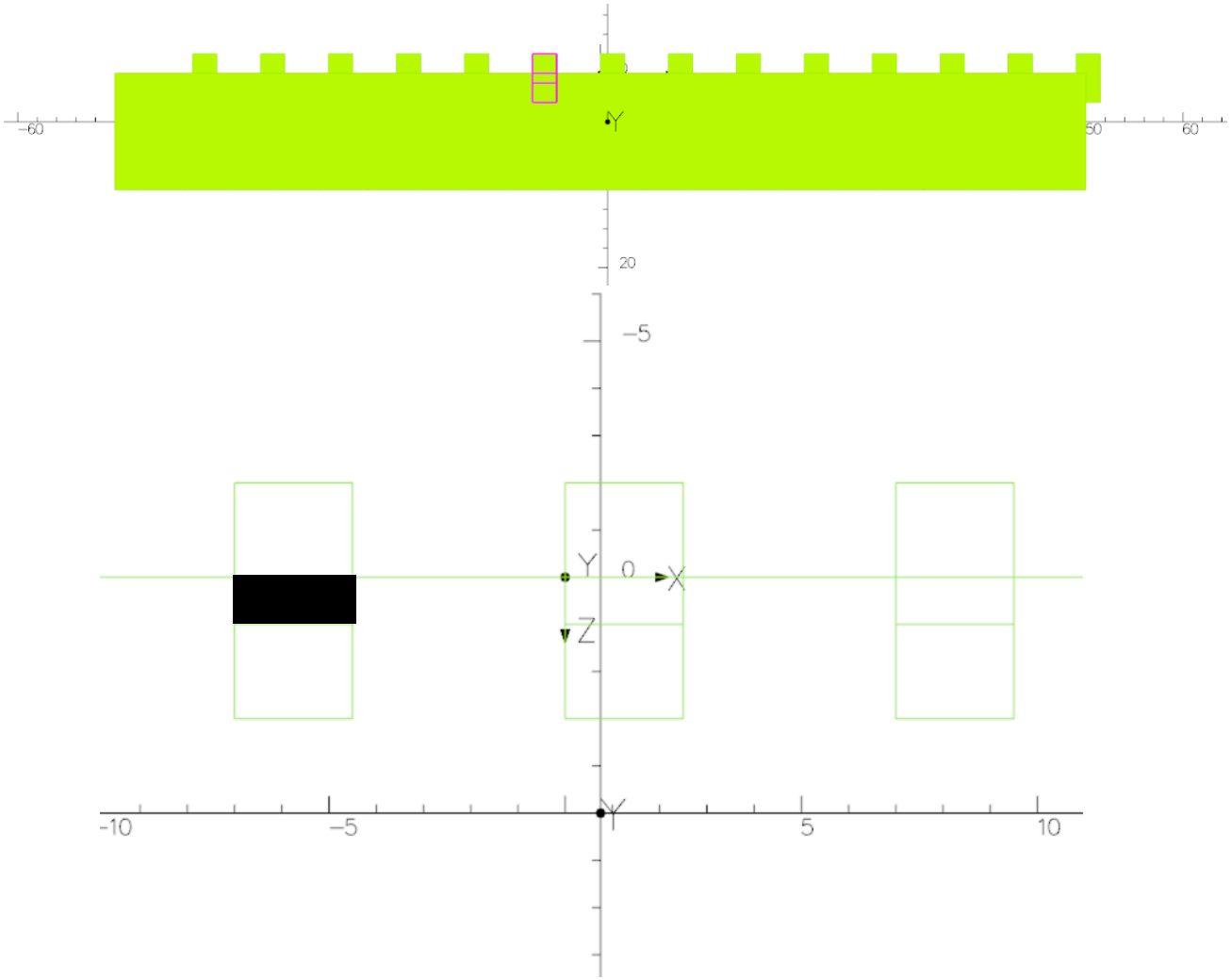


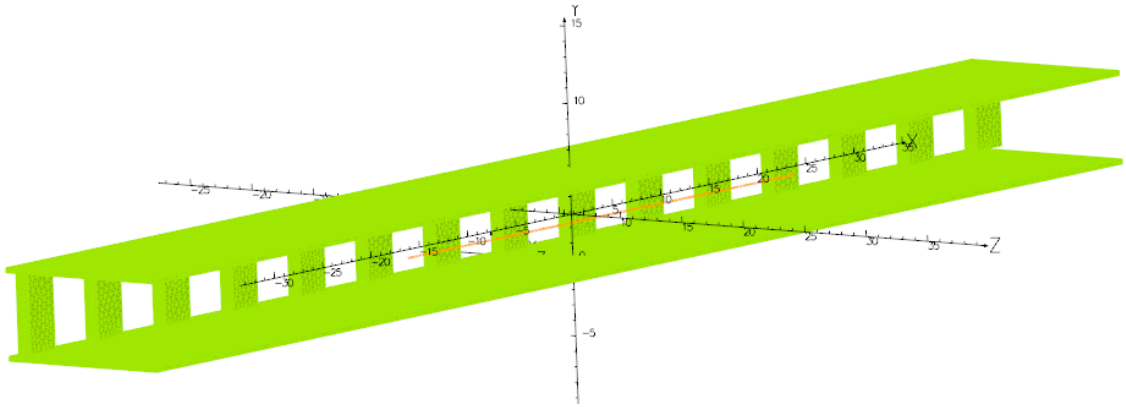
Wider and longer joint

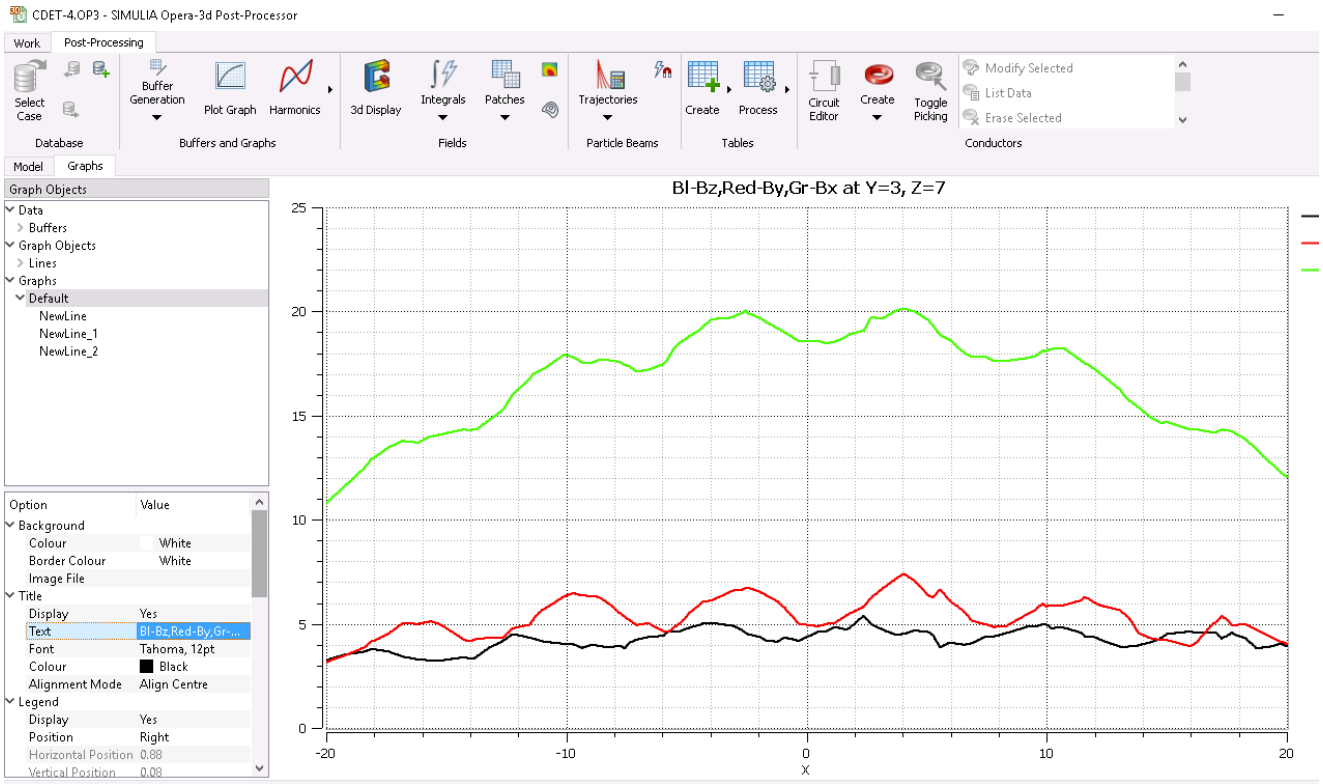
Resulting magnetic field on PMT



Proposed replacement of joints with 1006 and wider




Y
15
10
X
Z
-5


CDET-4.OP3 - SIMULIA Opera-3d Post-Processor
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Post-Processing
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Buffers and Graphs
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Particle Beams
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Modify Selected
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Erase Selected
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Graphs
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NewLine_2
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Vertical Position
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