

# HPS Coordinate System

HPS Software meeting

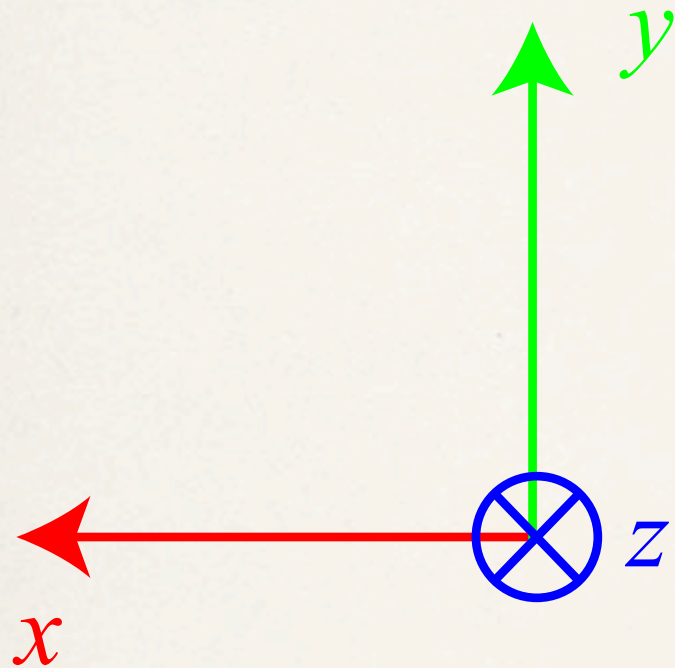
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*June 9, 2011*

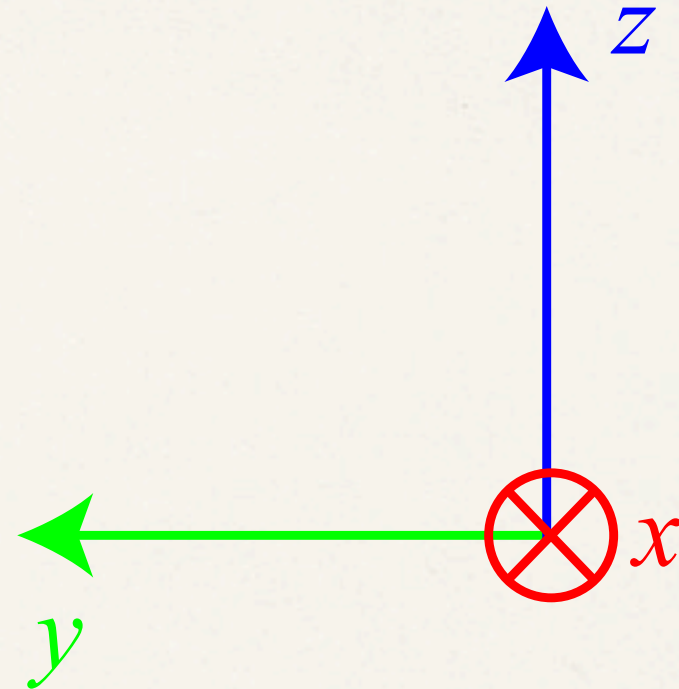
# Current Coordinate Systems

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LAB Frame Coordinates:



SLIC Coordinates:

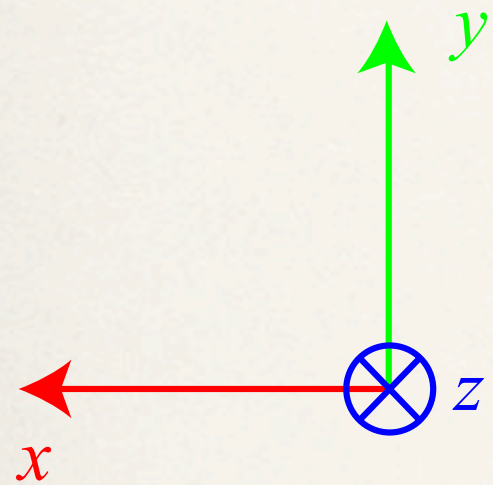


Beam in  $z$  direction  
Magnetic field in  $-y$  direction  
Electrons bend left to  $-x$  direction.

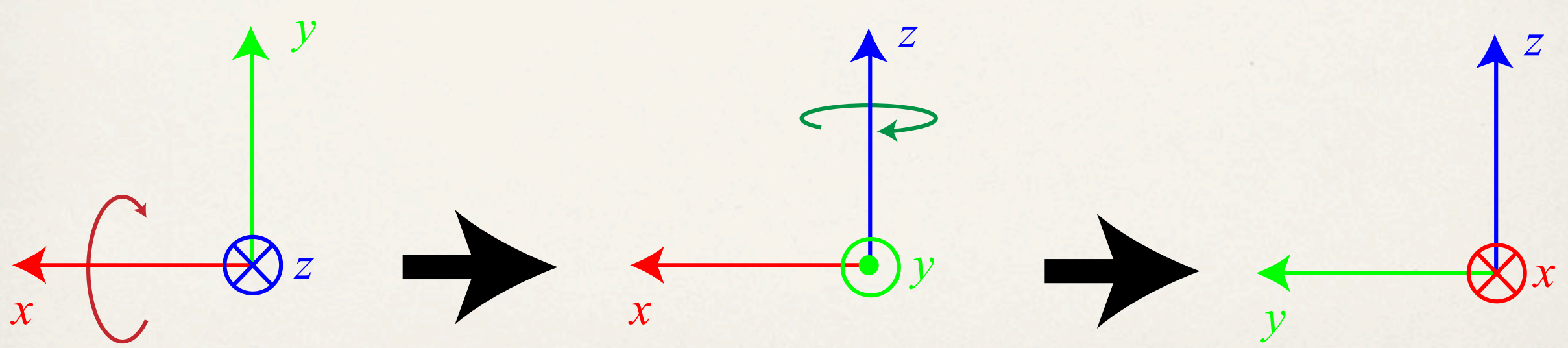
Beam in the  $+x$  direction  
Magfield in the  $-z$  direction  
Electrons bend to  $-y$  direction



# Transformation from LAB to SLIC



Rotation of the axes.  
-  $\pi/2$  around  $x$  then  
-  $\pi/2$  around  $y$  (new  $z'$ )



# Required Transformations

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Lab Frame to Slic Frame:  $\begin{pmatrix} 0 & 0 & -1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix} \cdot \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & -1 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{pmatrix}$

Rotation of the axes.

-  $\pi/2$  around  $x$  then

-  $\pi/2$  around  $y$  (new  $z'$ )

Inverse:

$$\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{pmatrix}^{-1} = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}$$

Vector transforms as:

$$\begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} z \\ x \\ y \end{pmatrix}'$$

“Pseudo Code”:

tmpx = x

x = z

z = y

y = tmpx



# Required Transformations

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Slic Frame to Lab Frame: 
$$\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}' = \begin{pmatrix} y \\ z \\ x \end{pmatrix}$$

“Pseudo Code”:

```
tmpx = x  
x = y  
y = z  
z = tmpx
```

# Where do we transform?

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All geometry is in SLIC frame - tracking stays the same.

All geometry is in LAB frame - tracking needs rotations.

Needed work to go to LAB frame:

- 1) Geometry Converter changes. -- Need input from Norman, Jeremy
- 2) Tracking related changes. -- Need input from Rich

**Alternative:** Do everything in SLIC frame. Rotate the vectors before writing out the DST.