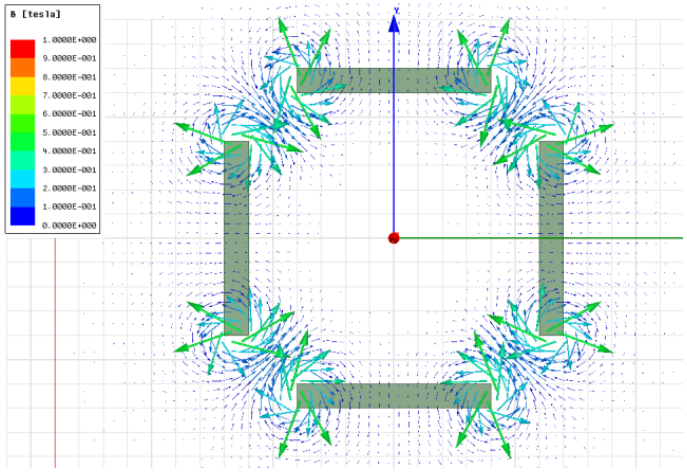
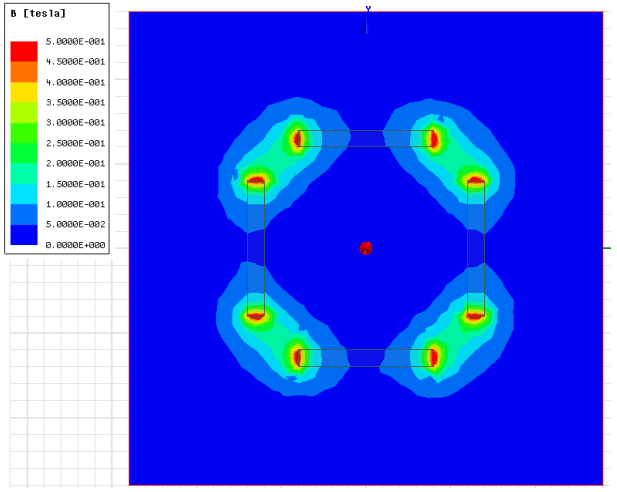
Maxwell 2D Magnetostatic

(Parallel Magnetization)

Overview

- **해석 모델 : 막대 영구자석 (Permanent Magnet)**
  - 영구자석 4개가 회전하면서 등간격 배치
- **해석 목적**
  - Rectangle 형태의 자석 4개 Modeling
  - 영구자석의 착자 방법 중에 하나인 Parallel 착자 방법
  - Face CS를 이용한 영구자석의 착자 방법 설명
  - Fields의 Legend 설정 변경 설명
- **해석 솔버 : Maxwell 2D Magnetostatic(정자계 해석) Cartesian, XY**
- **해석 결과**
  - Field of B_vector
  - Field of mag_B

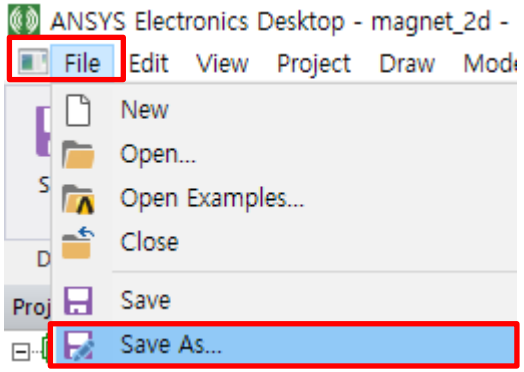




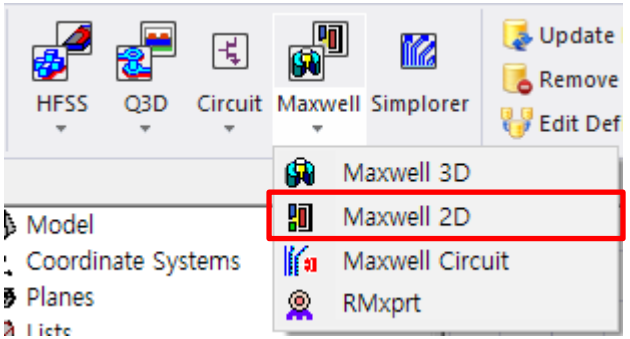
Permanent Magnet (Parallel 착자)

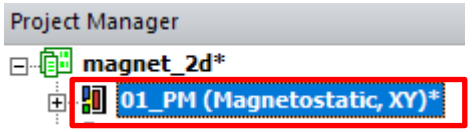
- **ANSYS Electronics Desktop 실행**

- **File > Save As… > “magnet_2d”로 저장**



- **Insert Maxwell 2D Design 클릭**
- **Maxwell2DDesign1 이름 변경 > “01_PM”**

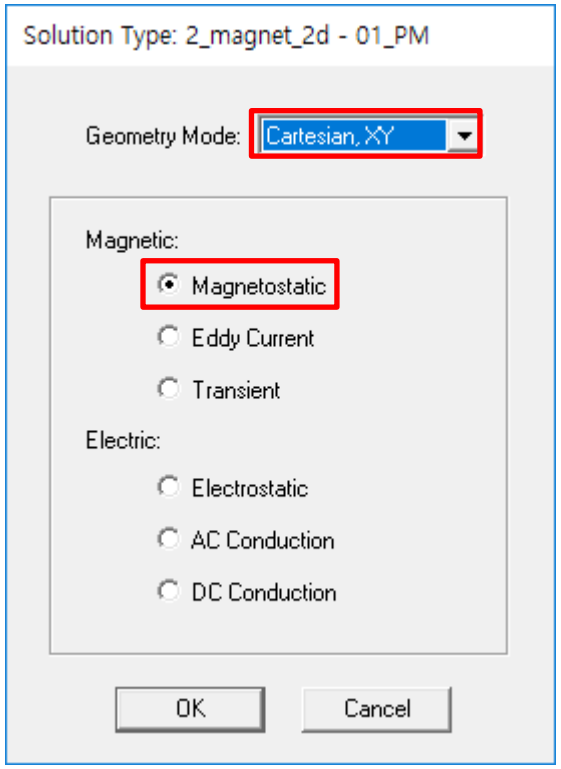




Permanent Magnet (Parallel 착자)

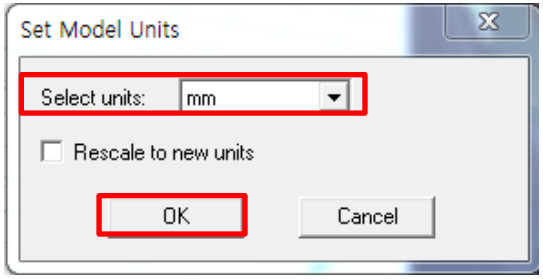
1. **상단 메뉴 Maxwell 2D → Solution Type... 클릭**

   Geometry Mode : Cartesian, XY
   Magnetic : Magnetostatic
   OK



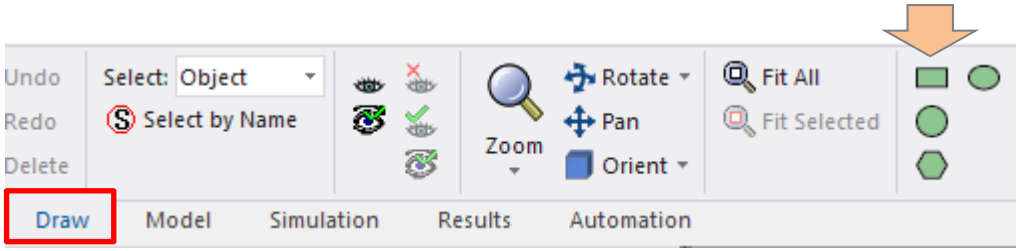
2. **상단메뉴 Modeler → Units 클릭**

   Select units : mm
   OK



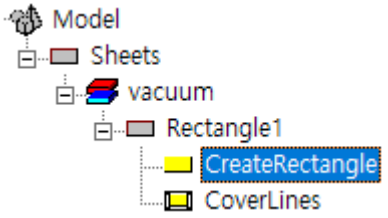
Permanent Magnet (Parallel 착자)

1. 상단메뉴 Draw → Rectangle 클릭

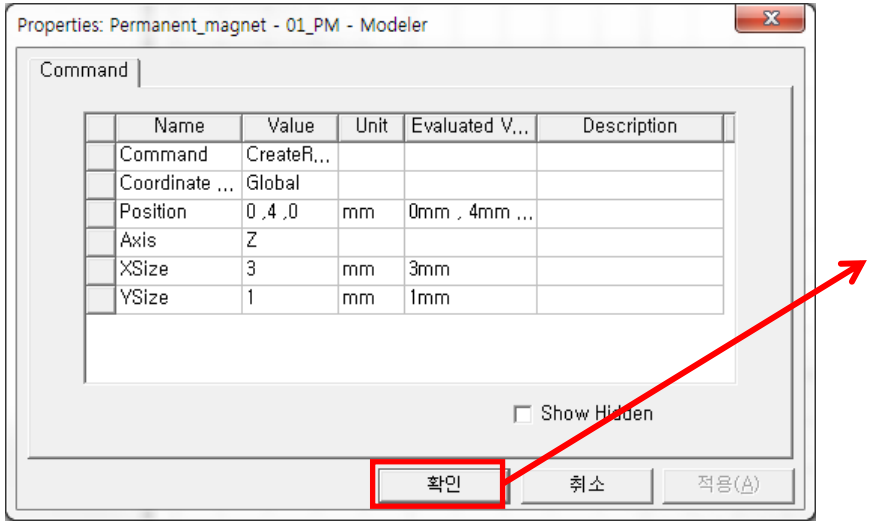


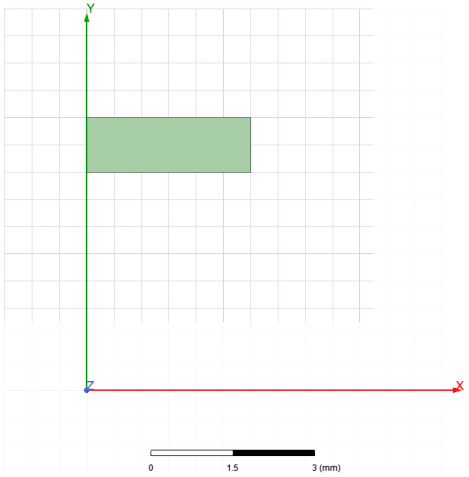
2. 임의의 지점에 사각형 생성

3. History tree → Rectangle1 → CreateRectangle 더블클릭



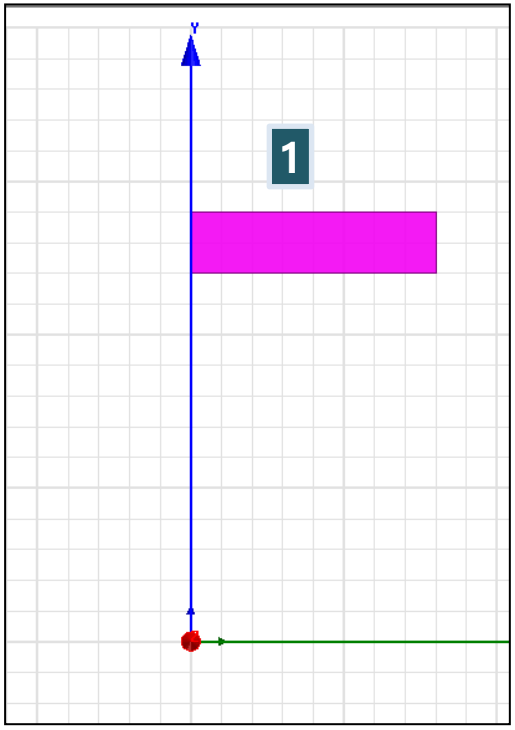
4. 아래와 같이 값 변경 후 "확인"

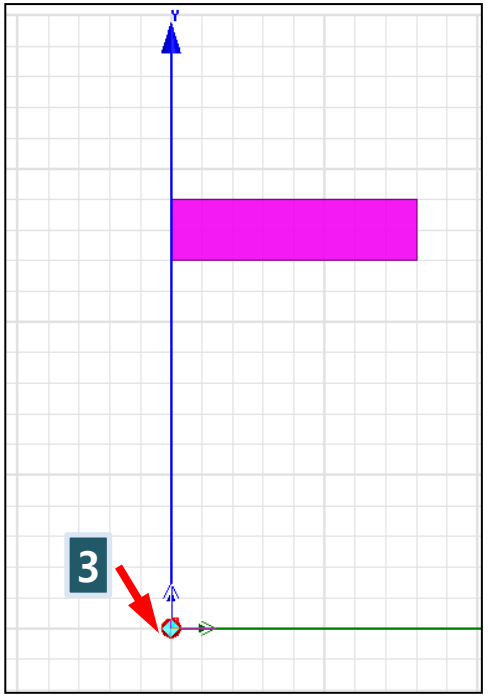


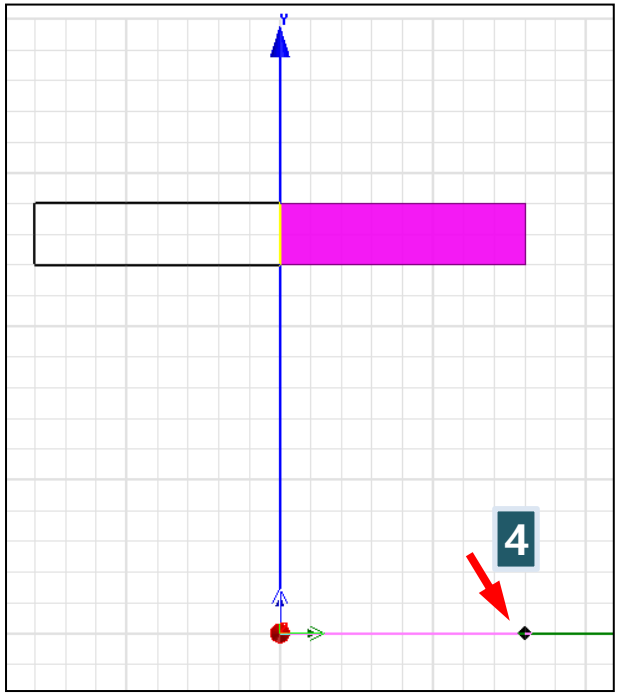


Permanent Magnet (Parallel 착자)

1. 사각형을 클릭
2. Edit >Duplicate > Mirror 클릭
3. 원점 클릭
4. X축 아무곳이나 클릭



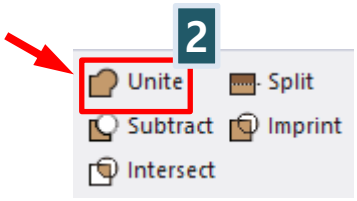


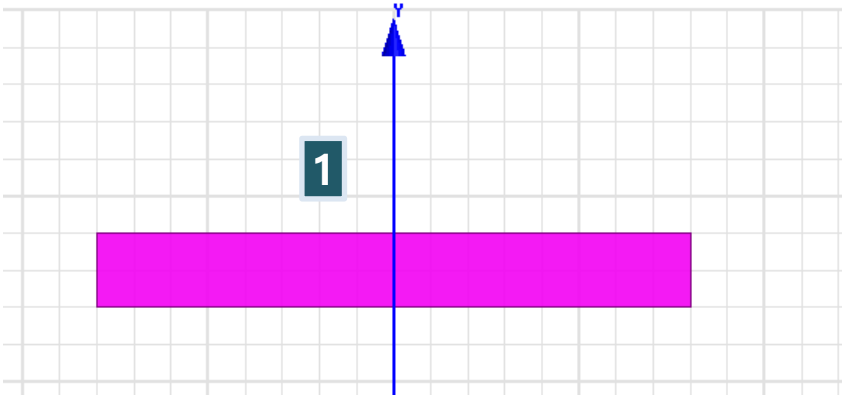


Permanent Magnet (Parallel 착자)

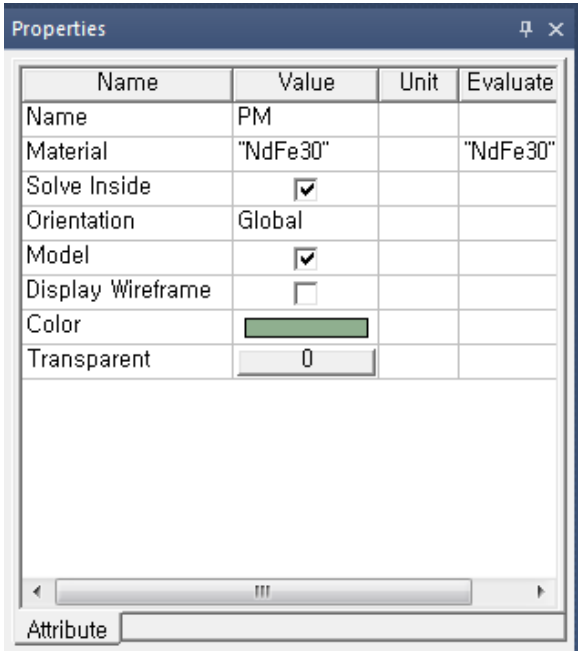
1. 2개의 사각형 클릭

2. Modeler > Boolean > Unite

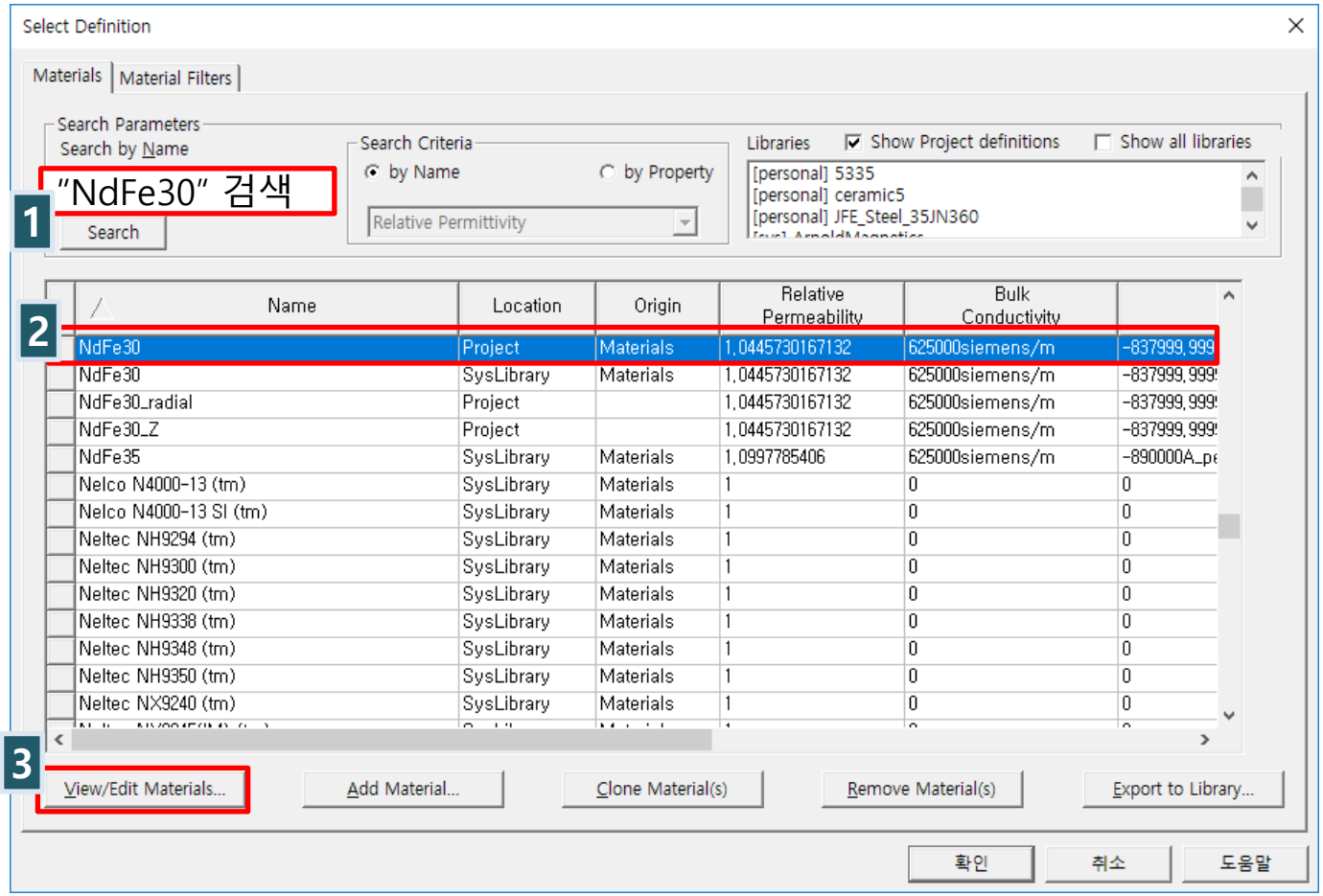




3. Properties
   Name : PM
   Material : Edit (Next page 설명)
   Color : free



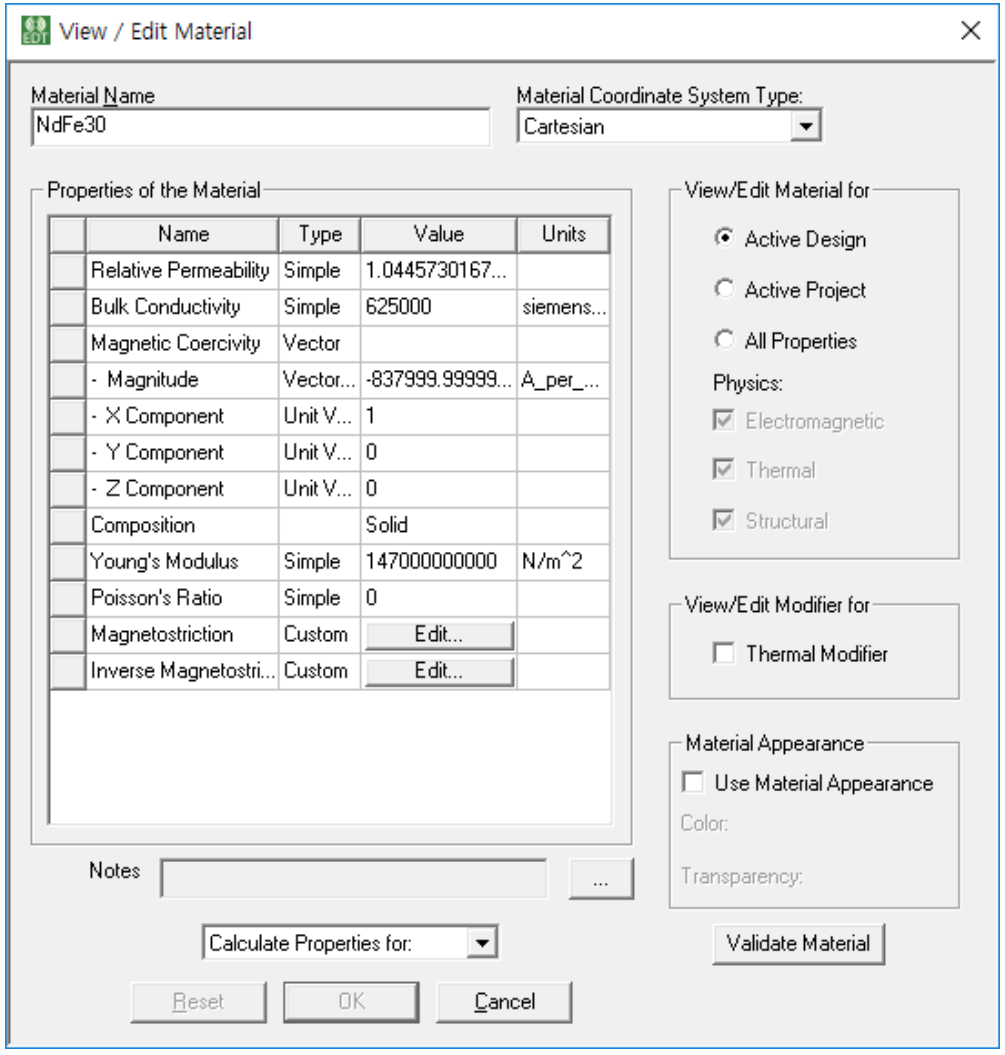
Permanent Magnet (Parallel 착자)



1. 검색창에 "NdFe30" 검색

2. NdFe30 클릭 > View/Edit Materials 클릭

Permanent Magnet (Parallel 착자)



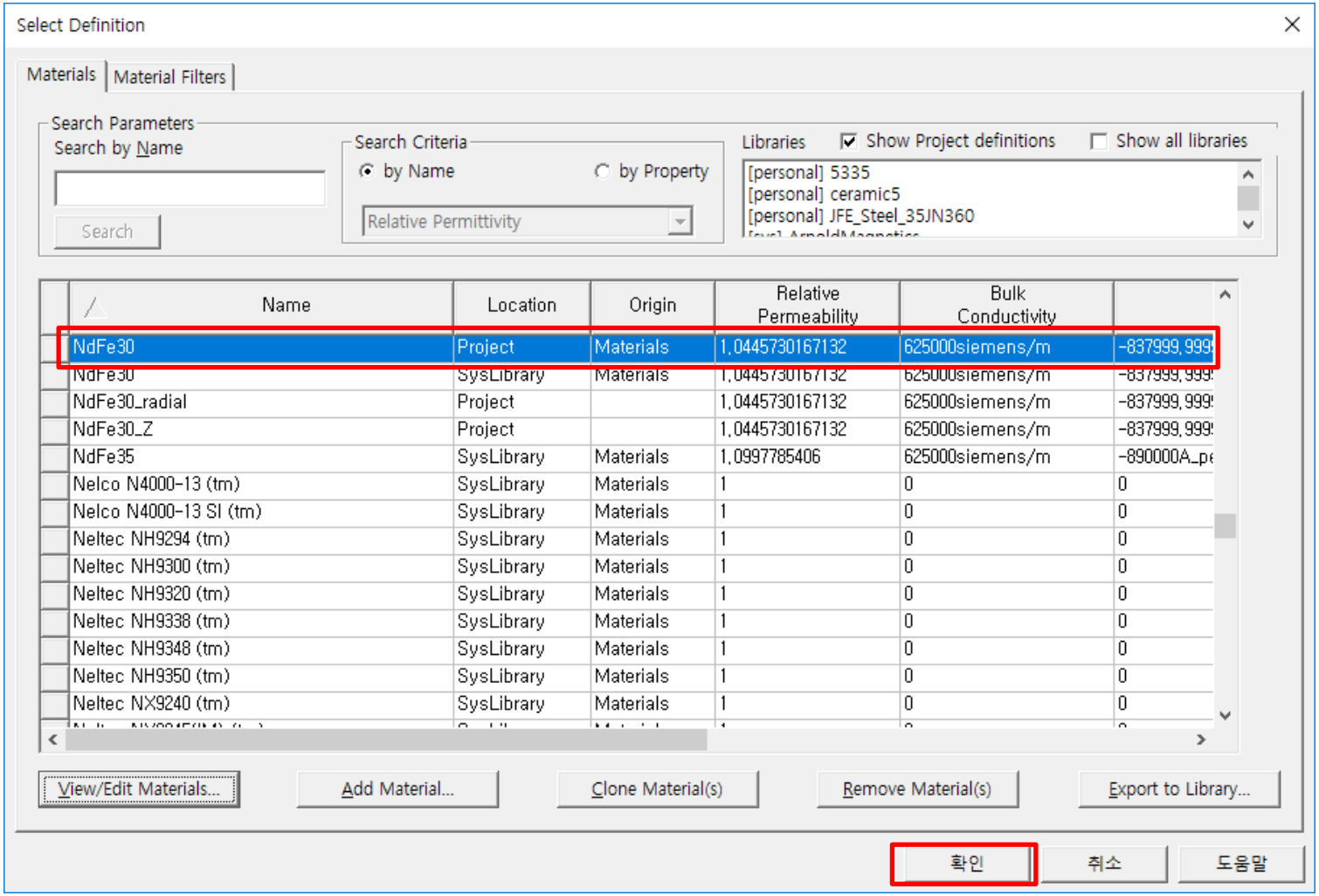
1. Relative Permeability(비투자율)
   : 1.044573

2. Bulk Conductivity(도전율)
   : 625000 s/m

3. X Component : 1
   Y Component : 0
   Z Component : 0
   (자화 방향 설정. 위의 경우 +X방향으로 N극이 생긴다는 의미임.)

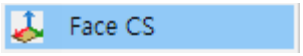
4. 위의 값들 확인 하고 "Cancel"

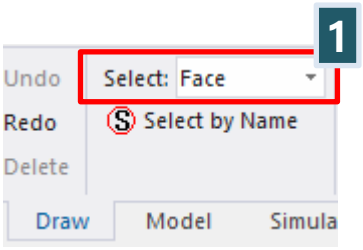
Permanent Magnet (Parallel 착자)

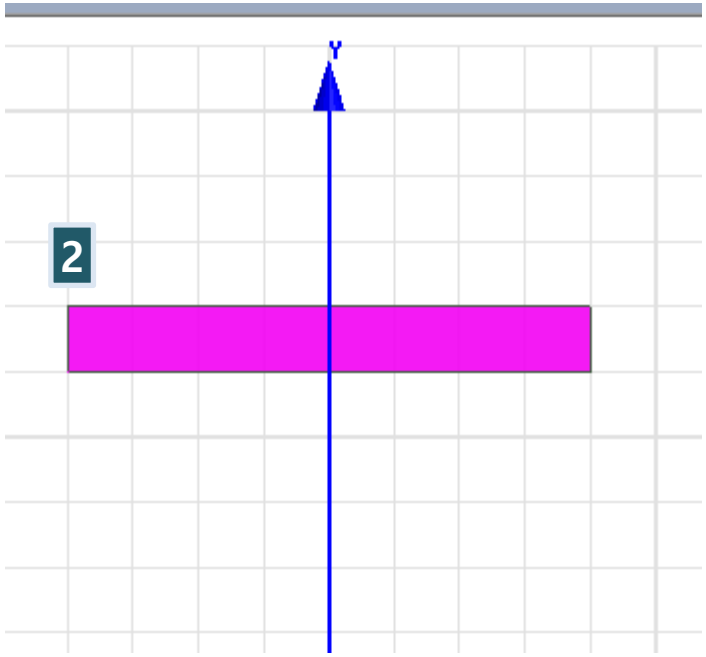


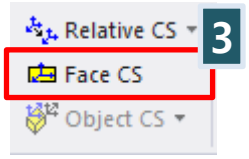
1. "NdFe30" 클릭 한 후 "확인"

Permanent Magnet (Parallel 착자)

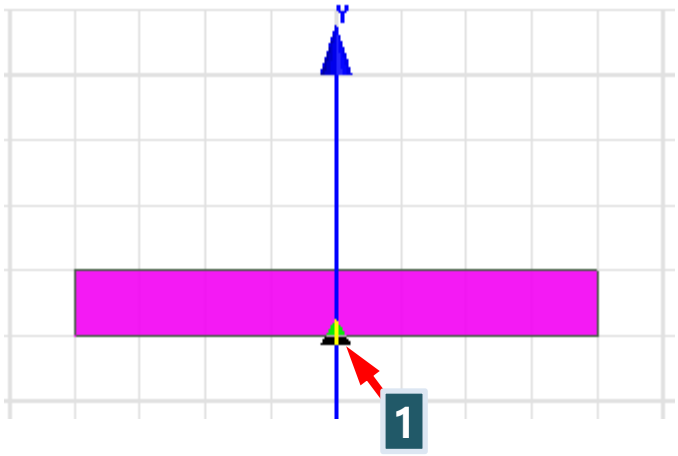
1. Edit > Selection Mode > Faces
2. "PM" 클릭
3. Modeler > Coordinate System > Create > Face CS 

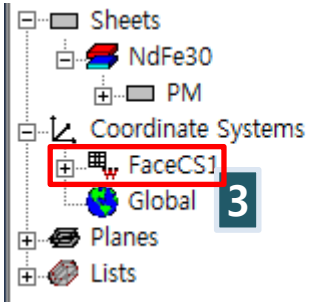


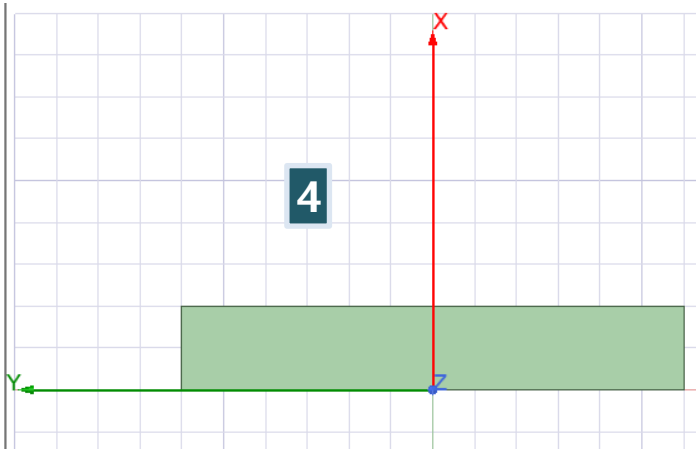


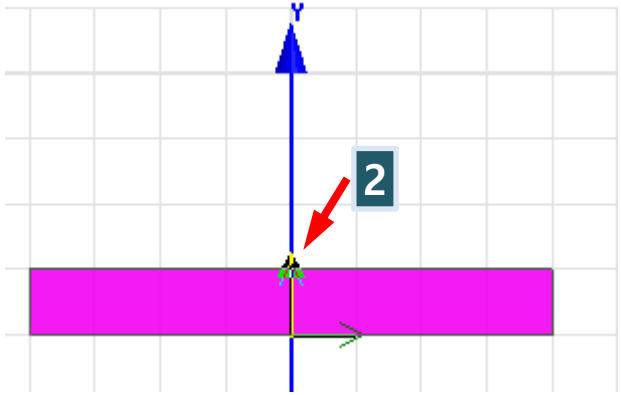


Permanent Magnet (Parallel 착자)



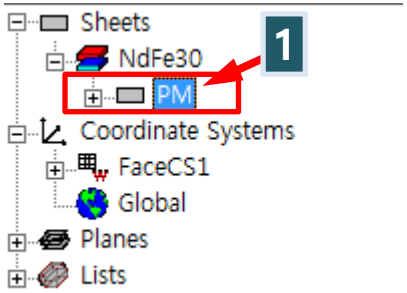


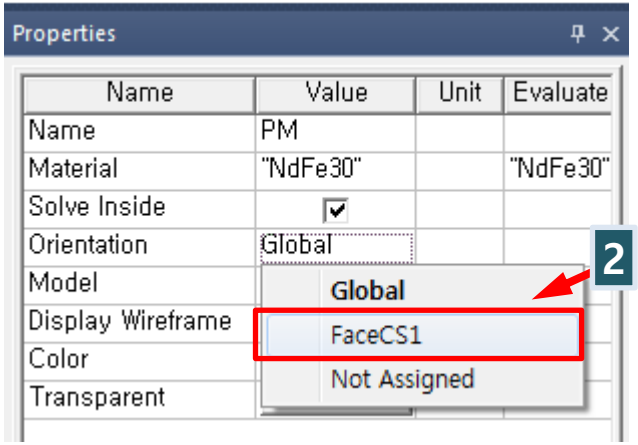


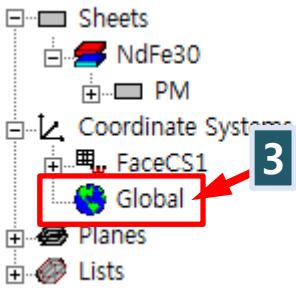


1. PM의 가운데 밑에 클릭 (정삼각형이 뜨면 중앙을 의미)
2. PM의 가운데 위를 클릭 (정삼각형이 뜨면 중앙을 의미)
3. History tree를 보면 "FaceCS1"이 생성된 걸 확인.
4. 도면에는 x축이 위로가는 새로운 좌표계가 생성됨.

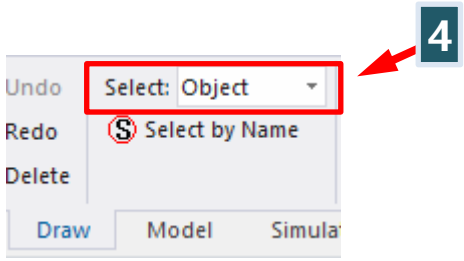
Permanent Magnet (Parallel 착자)





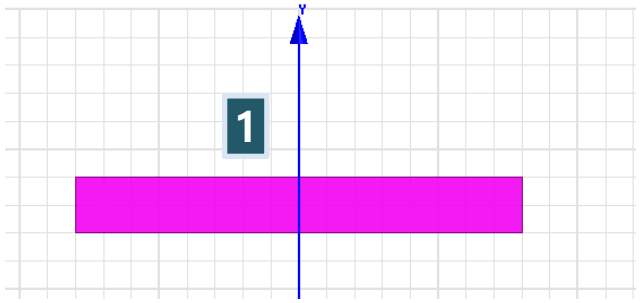


1. History tree → PM클릭
2. Properties → Orientation : FaceCS1으로 변경
3. History tree → Coordinate Systems → Global 클릭
4. Draw tab > "Object"로 다시 변경



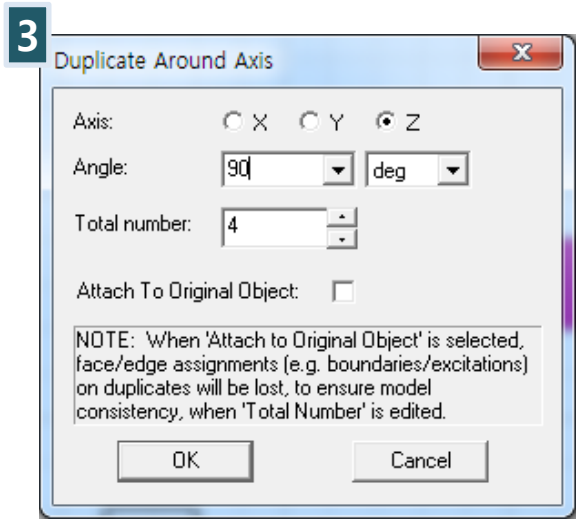
Permanent Magnet (Parallel 착자)

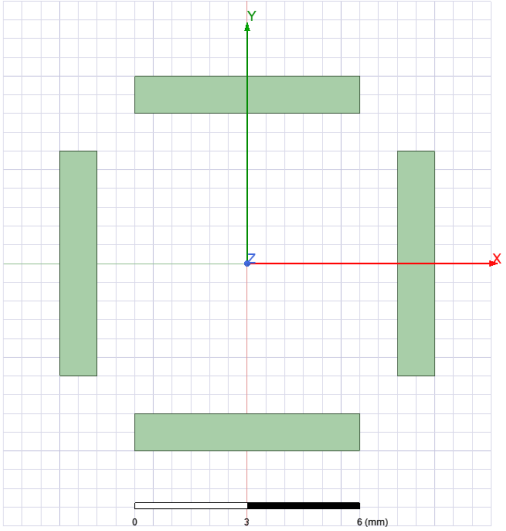
1. Historytree → PM 클릭



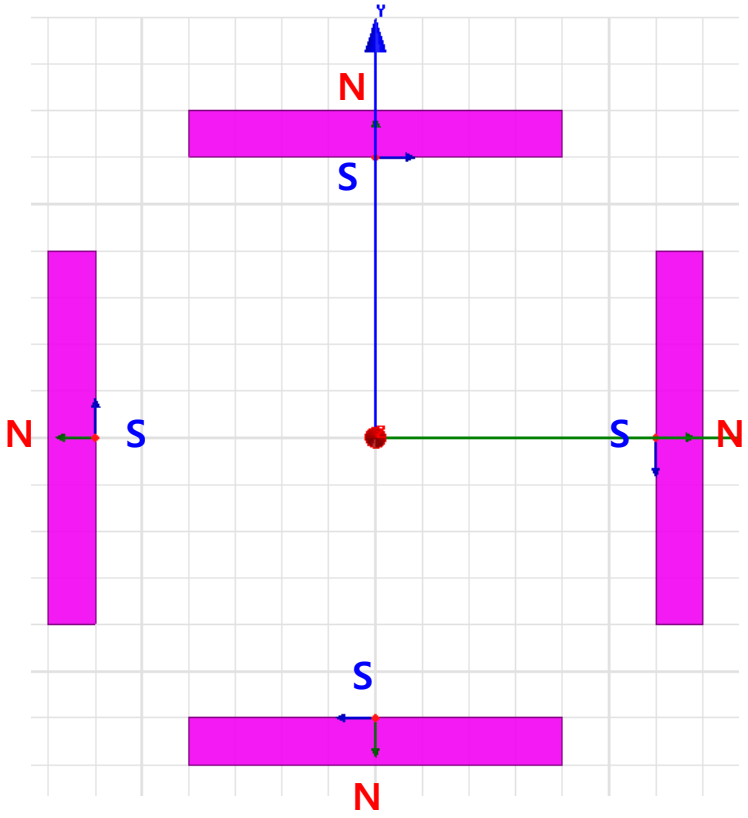
2. 상단 Draw tab > Around Axis 클릭

3. Duplicate Around Axis
   Axis : Z축
   Angle : 90deg
   Total number : 4
   "OK"



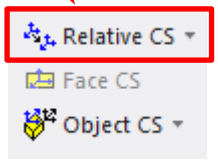


Permanent Magnet (Parallel 착자)



1. 4개의 사각형을 드래그 해보면 작은 좌표축이 보임.
   이 좌표축의 x축이 가리키는 방향이 N극

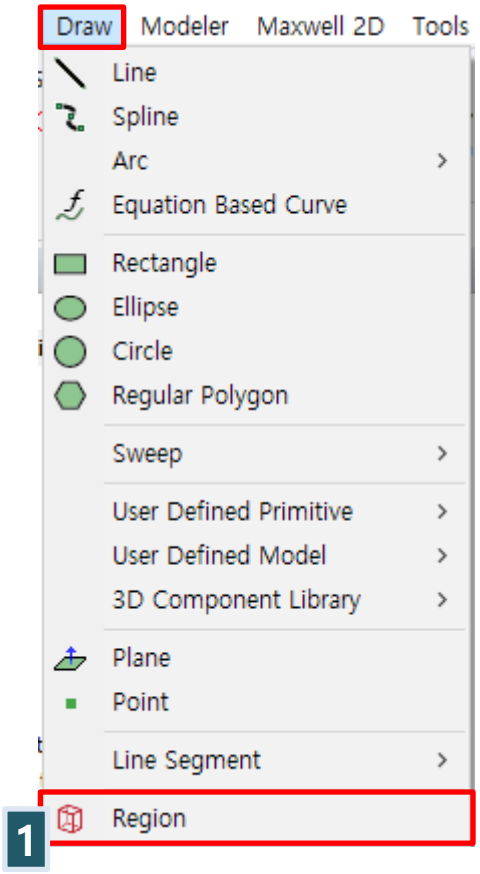
Note : "Create relative CS"로 좌표 축을 만들 수 있지만 본 예제와 같이 자석이 방사형태로 배치된 경우에는 Object CS를 이용해야 복제 했을 때 좌표축도 복제 축 기준으로 만들어짐.

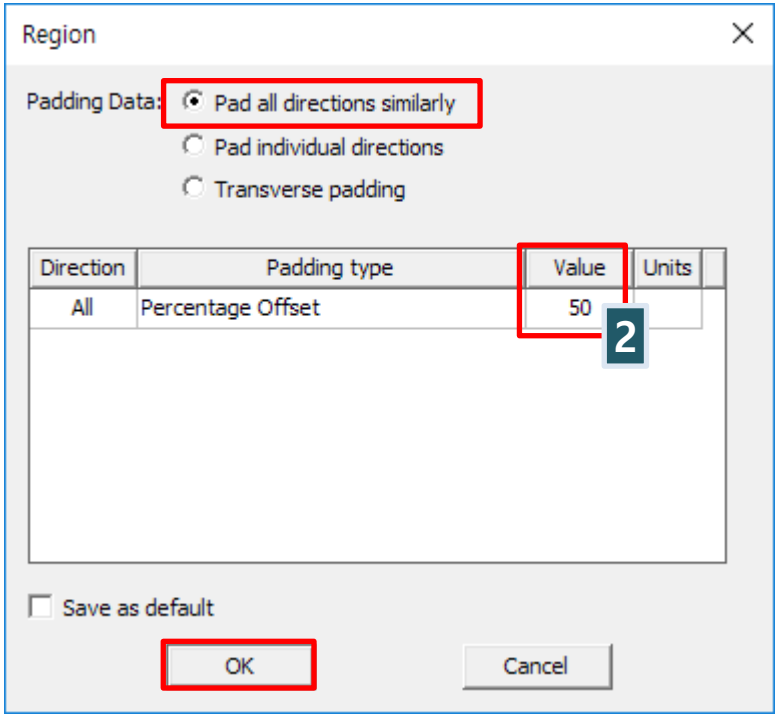


Permanent Magnet (Parallel 착자)

1. 상단 메뉴 Draw > Region 클릭

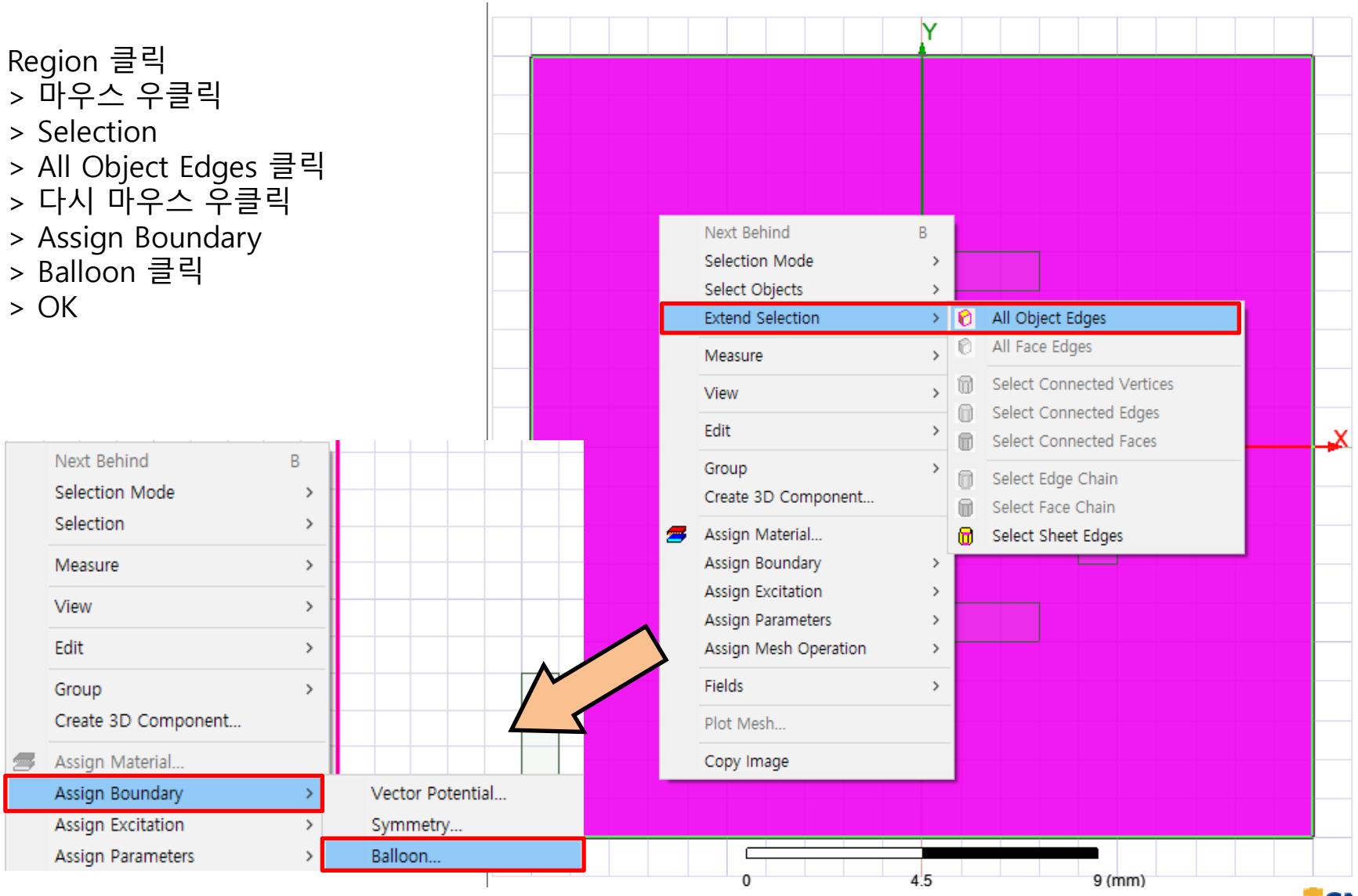
2. Region
   Pad all directions similarly 체크
   Value : 50
   "OK:



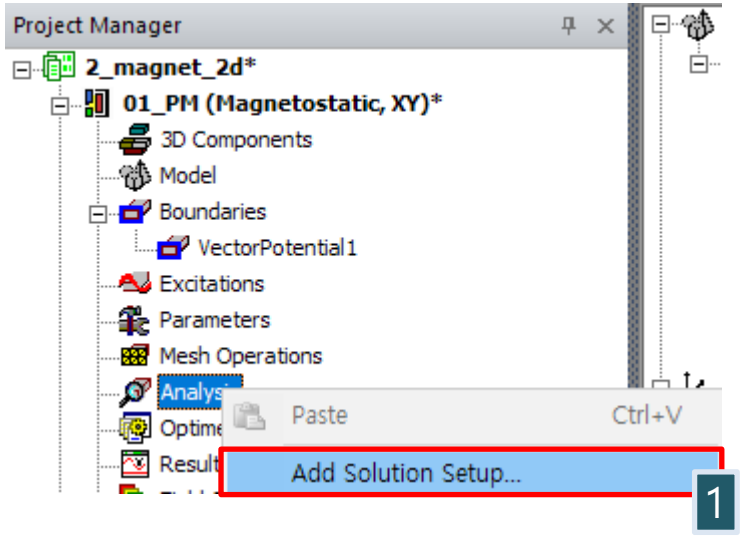


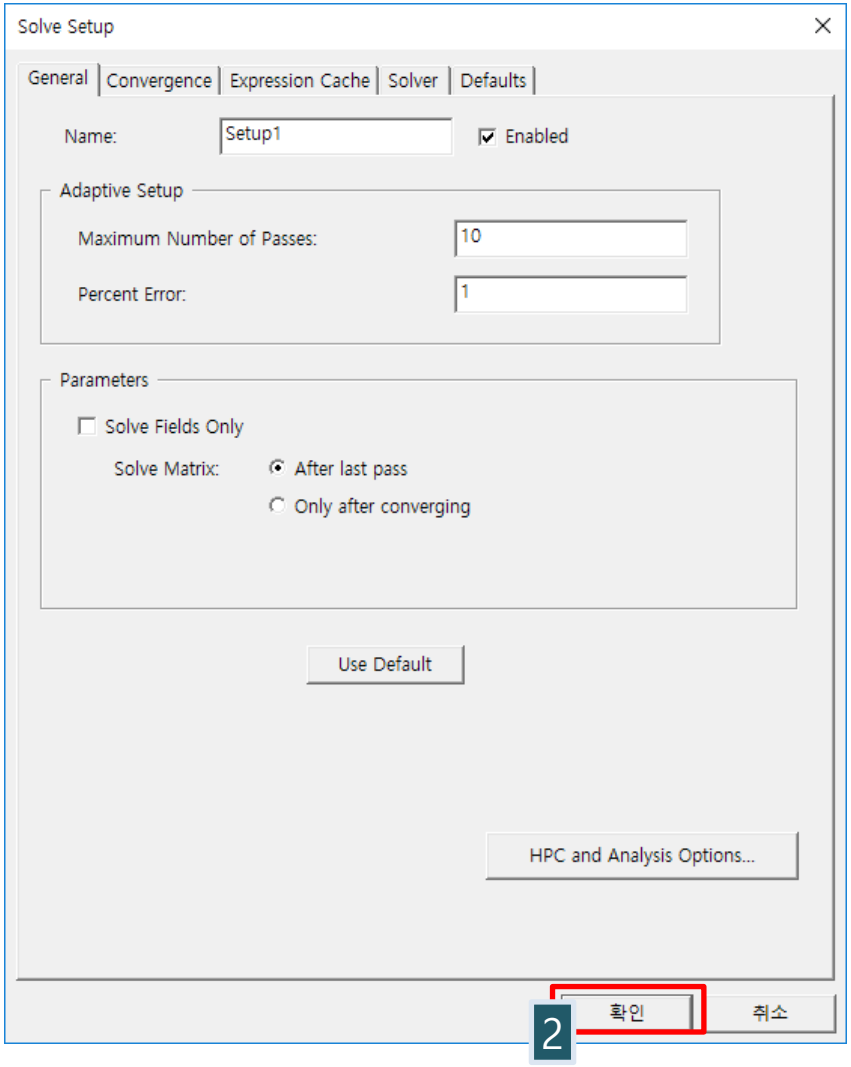
Permanent Magnet (Parallel 착자)

- Region 클릭
  > 마우스 우클릭
  > Selection
  > All Object Edges 클릭
  > 다시 마우스 우클릭
  > Assign Boundary
  > Balloon 클릭
  > OK



Permanent Magnet (Parallel 착자)

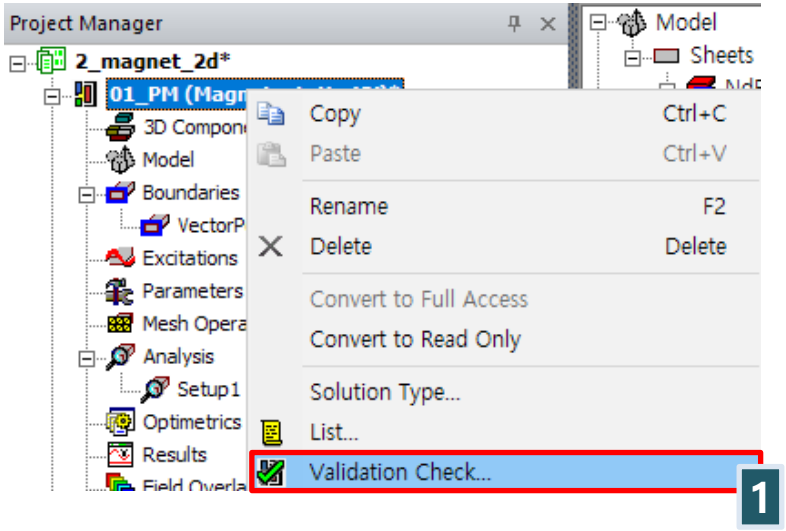


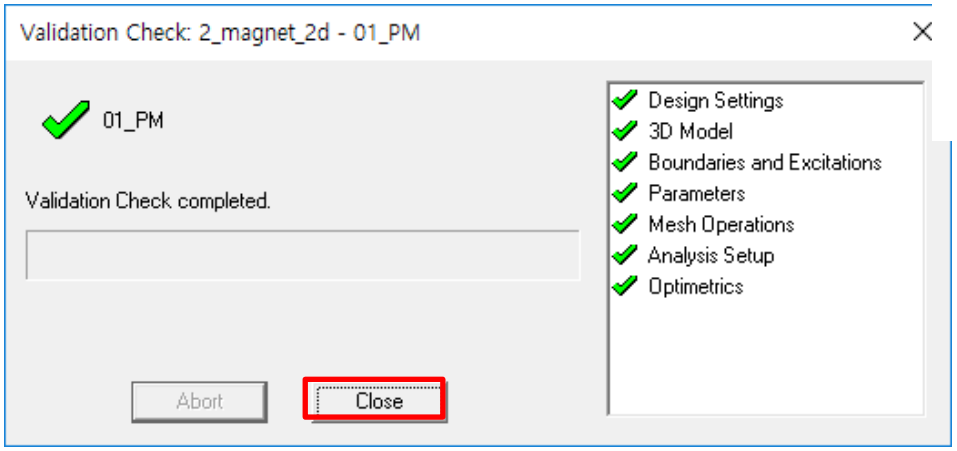


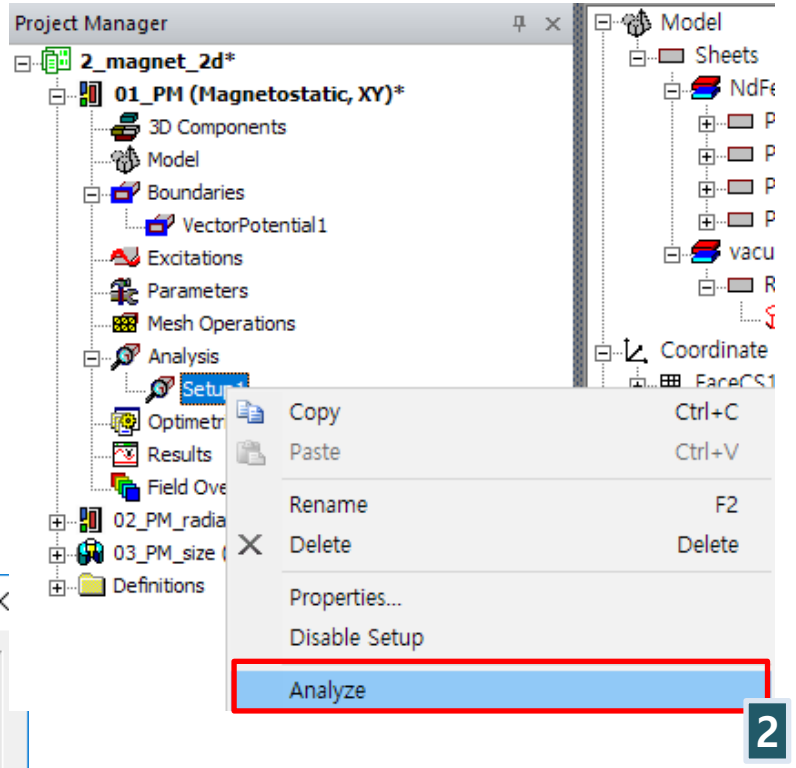
1. Project Manager > 01_PM > Analysis > Add Solution Setup... 클릭

2. Default 상태로 확인

Permanent Magnet (Parallel 착자)



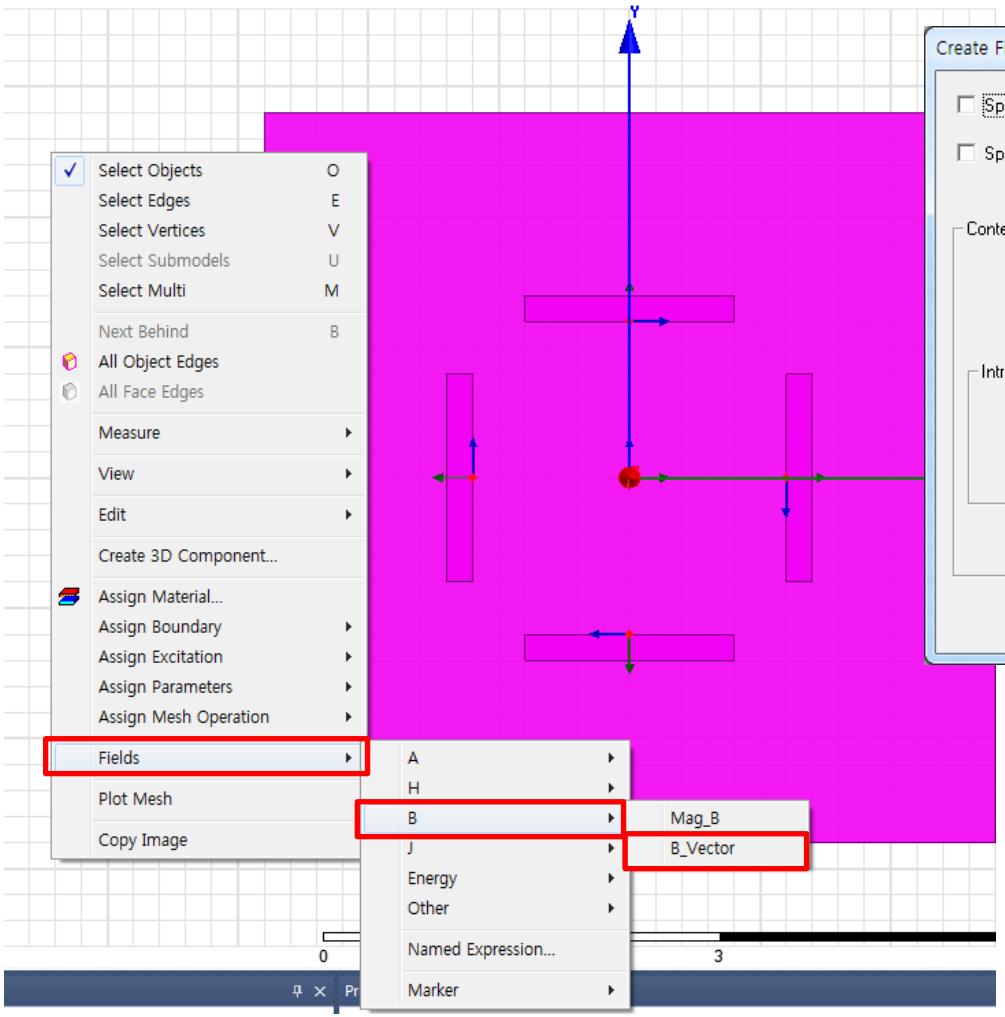


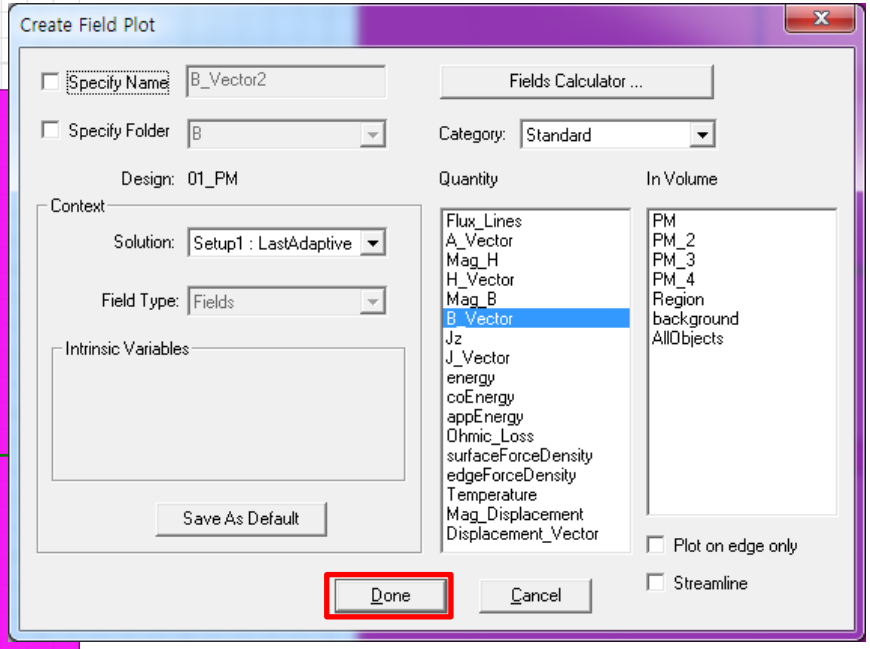


1. Project Manager > 01_PM 우클릭 > Validation Check 클릭 > 확인 후 "Close"

2. Project Manager > 01_PM > Analysis > Setup1 우클릭 > Analyze 클릭

Permanent Magnet (Parallel 착자)



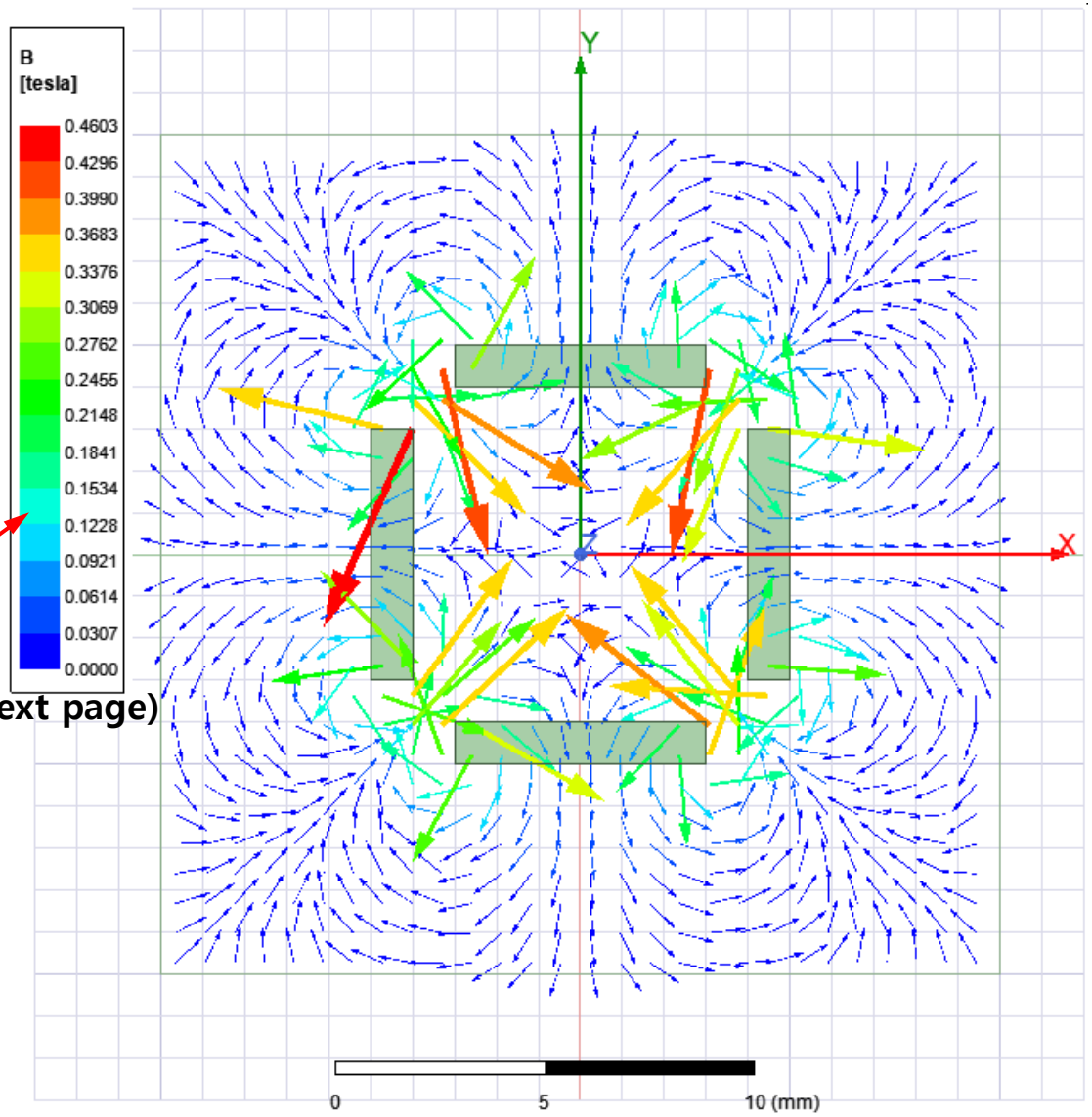


1. 도면에서 Ctrl + A

2. 마우스 우클릭
   > Fields
   > B
   > B_Vector 클릭

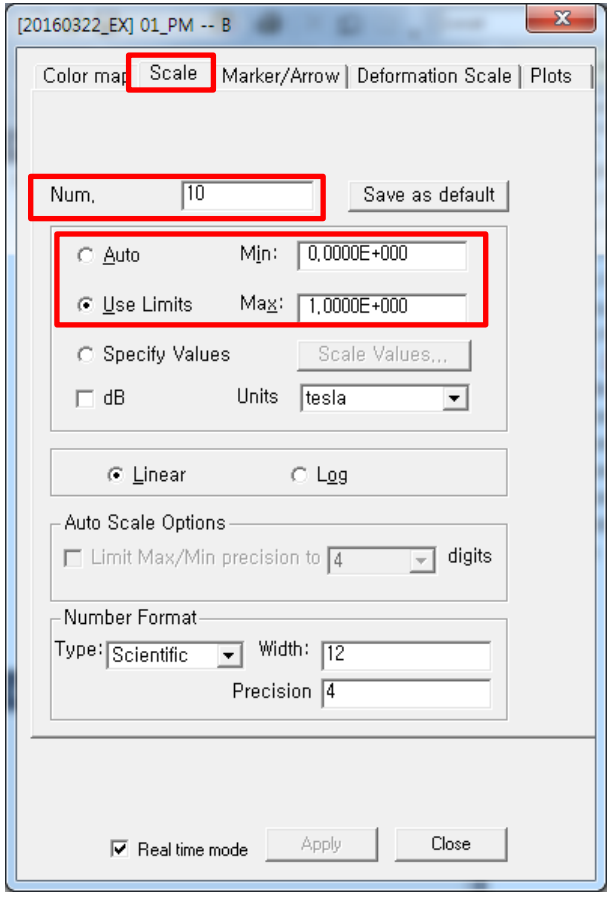
3. 다른 설정 없이 "Done"

Permanent Magnet (Parallel 착자)

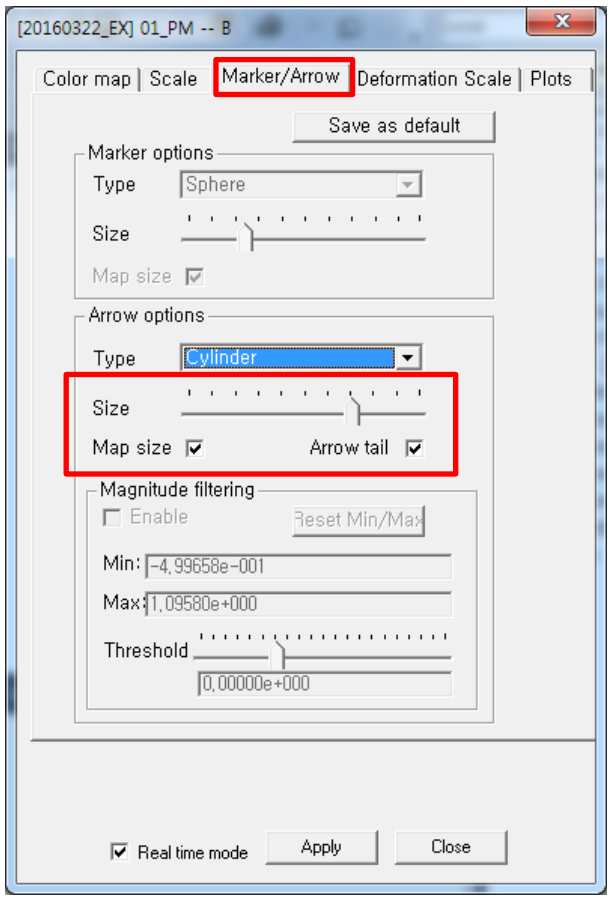


Legend 더블 클릭 (Next page)

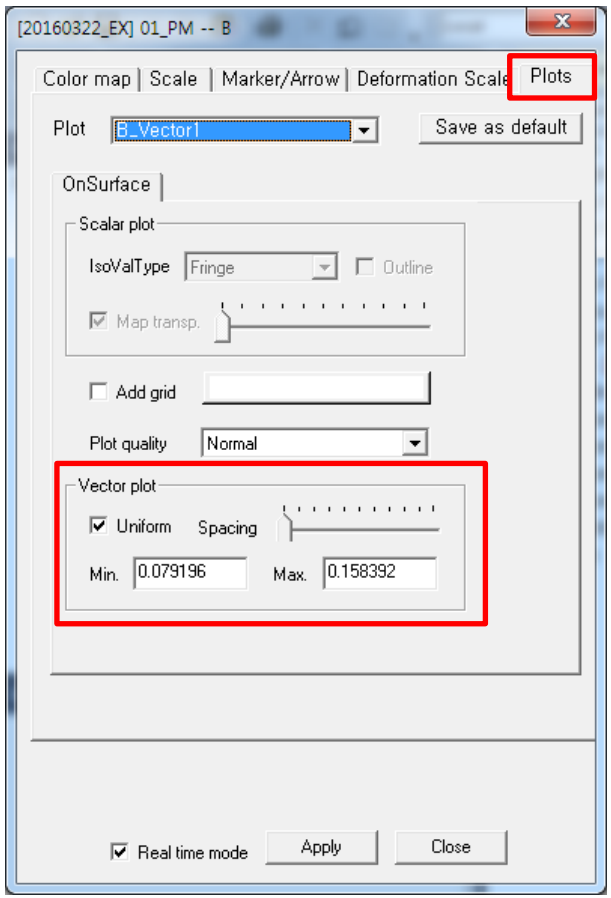
Permanent Magnet (Parallel 착자)



1. Scale 탭
   > Num. 10
   > Use Limits 체크
   > Min : 0
   > Max : 1



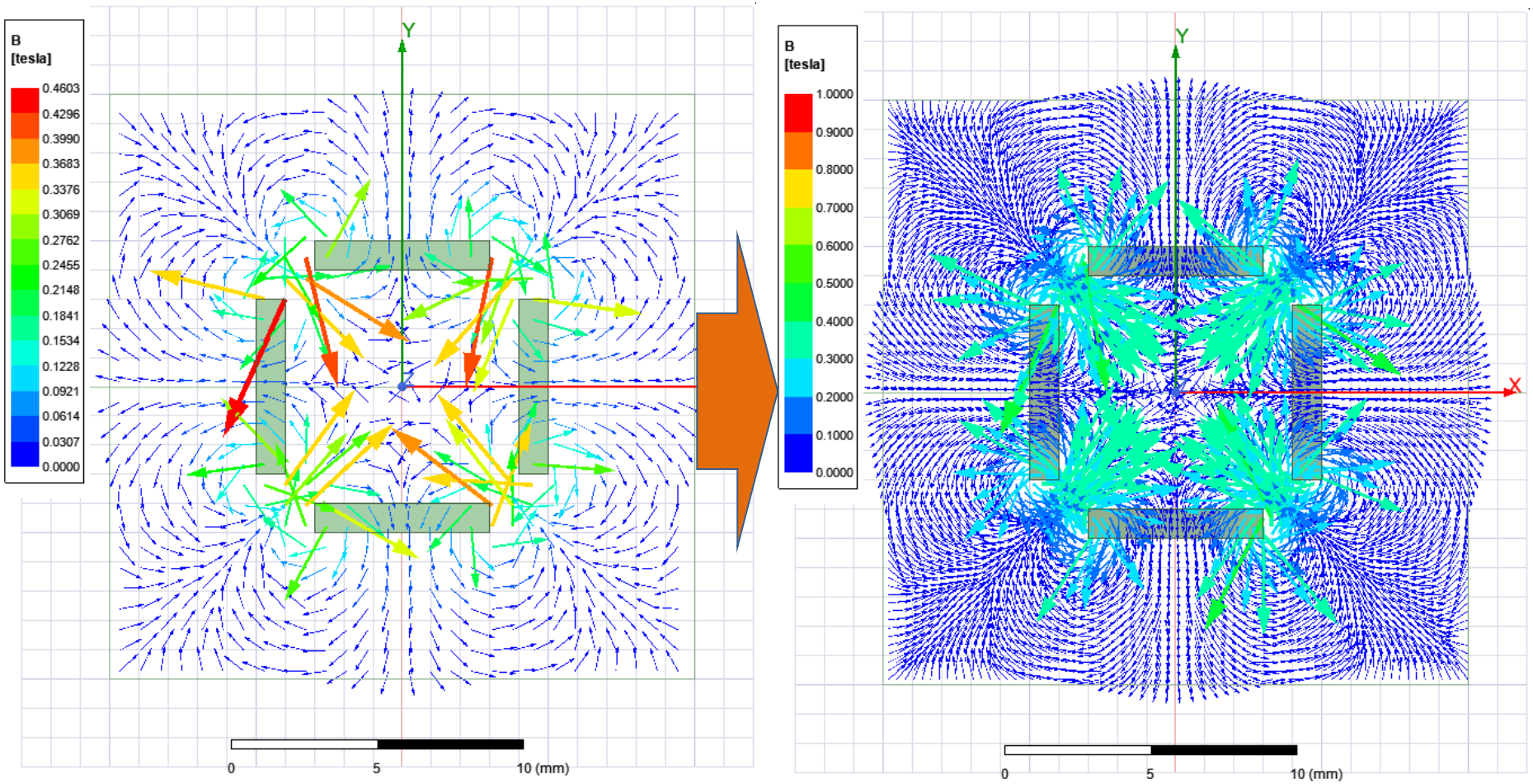
2. Marker/Arrow 탭
   > Arrow options > Size
   (원하는 화살표 사이즈 변경)



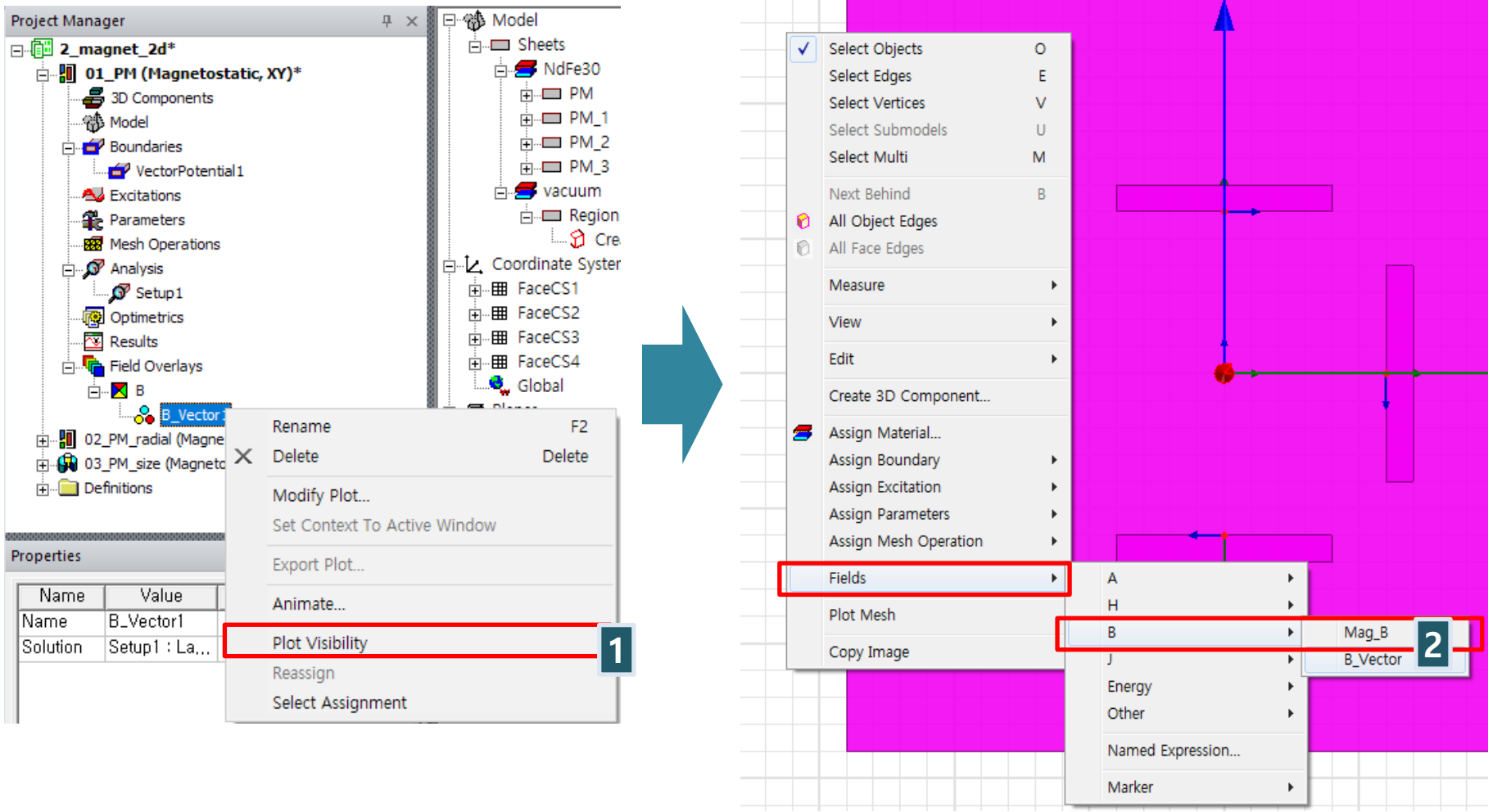
3. Plots 탭
   > Vector plot > Spacing
   (화살표 개수 변경)

Permanent Magnet (Parallel 착자)

- **Legend 변환 후**

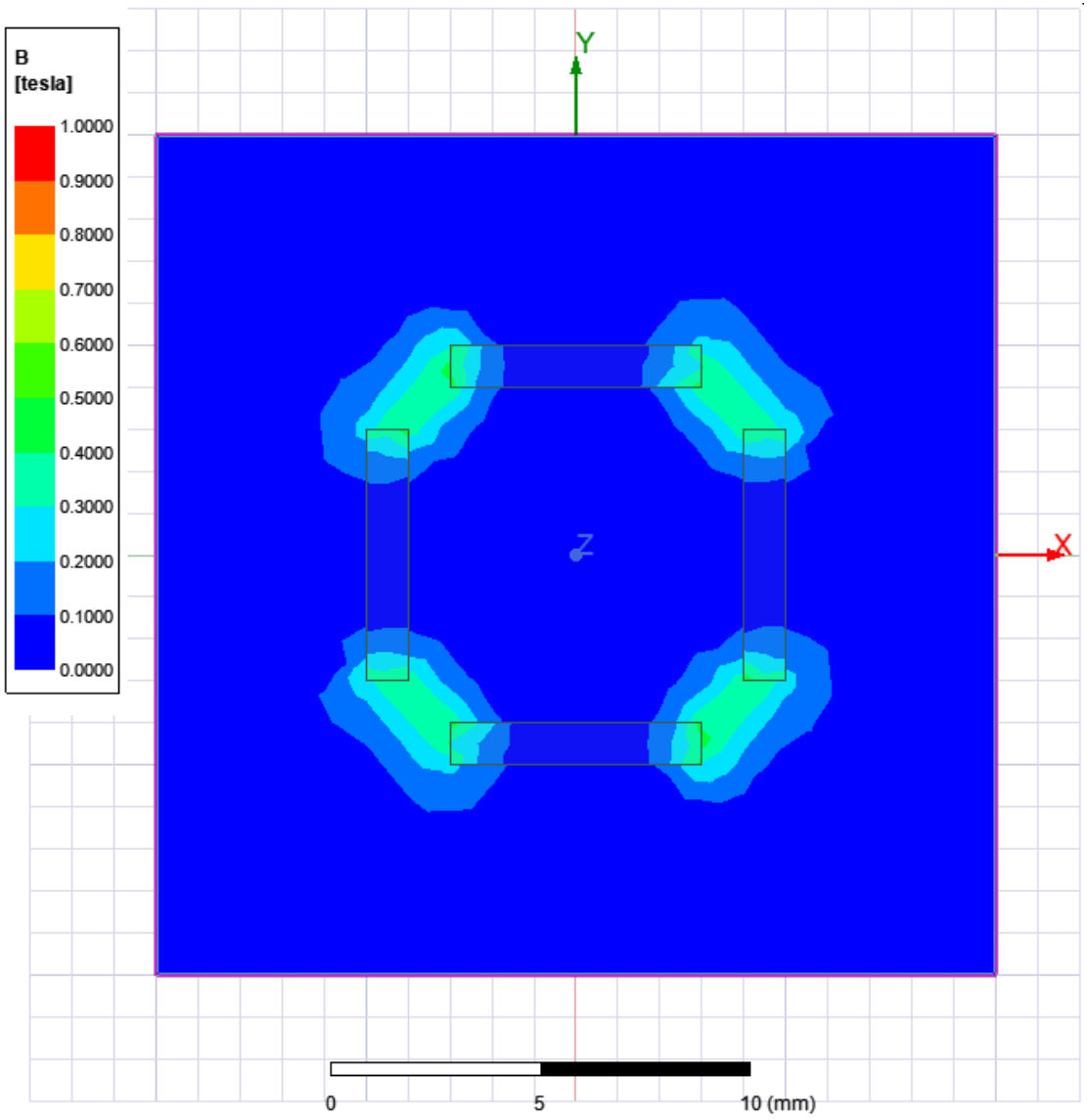


Permanent Magnet (Parallel 착자)



1. Project Manager > Field Overlays > B > B_Vector1 우클릭 > Plot Visibility 해제
2. 도면에서 Ctrl + A > 우클릭 > Fields > B > Mag_B

Permanent Magnet (Parallel 착자)



감사합니다.