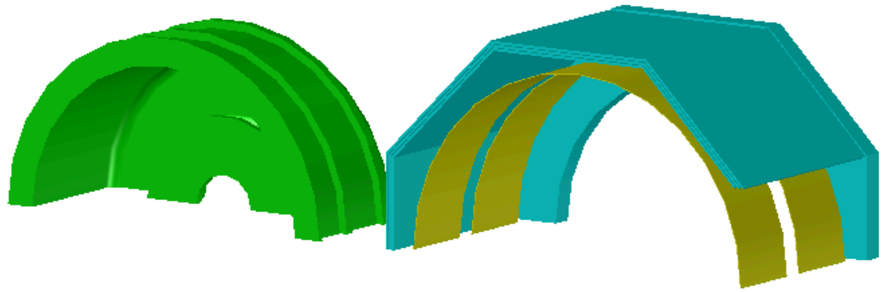
# SPY@DND new yoke: September update

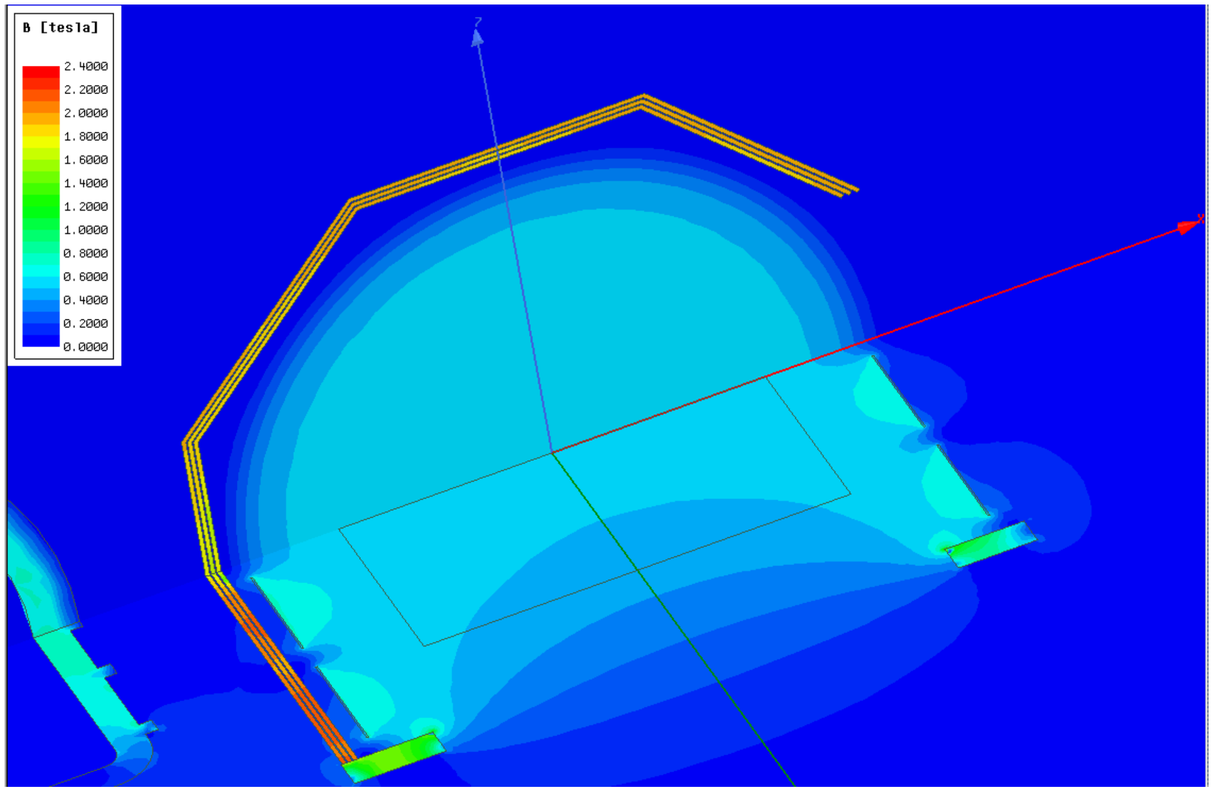
Andrea Bersani

INFN Sezione di Genova
Istituto Nazionale di Fisica Nucleare

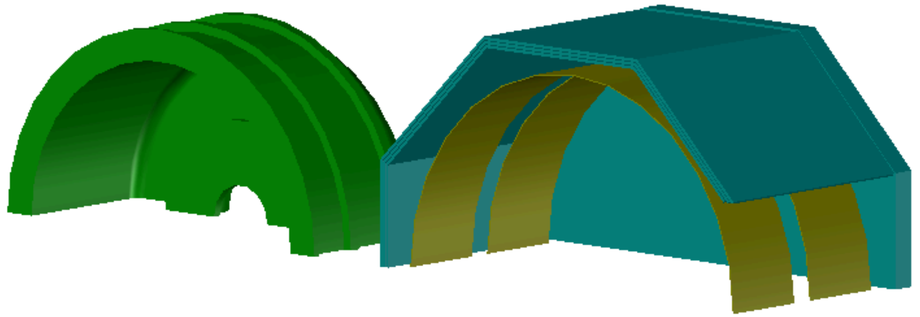
# Reference design: SPYDND06



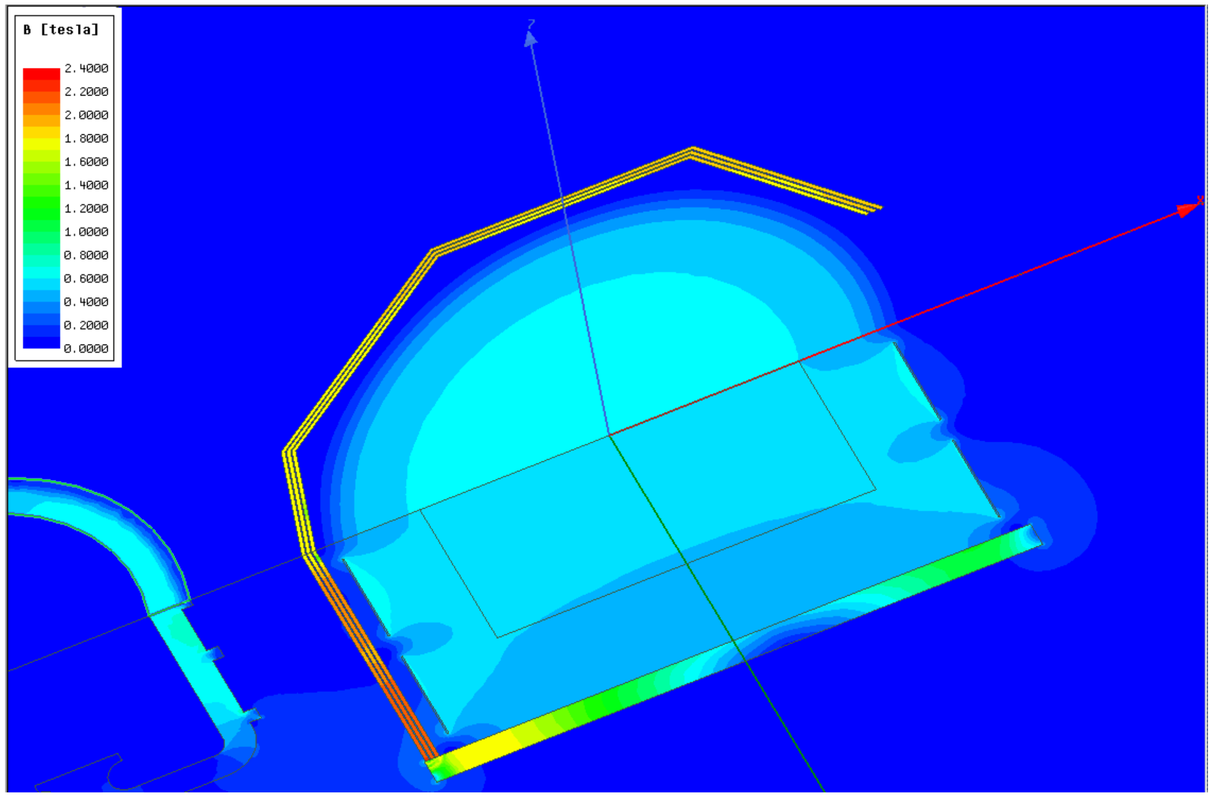
- Window only towards LArTPC
- "Thin" iron yoke
- Wide hole on end-caps



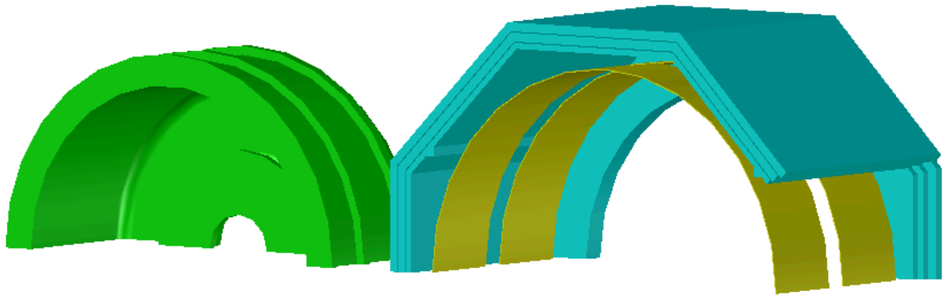
# Closed end-caps: SPYDND07



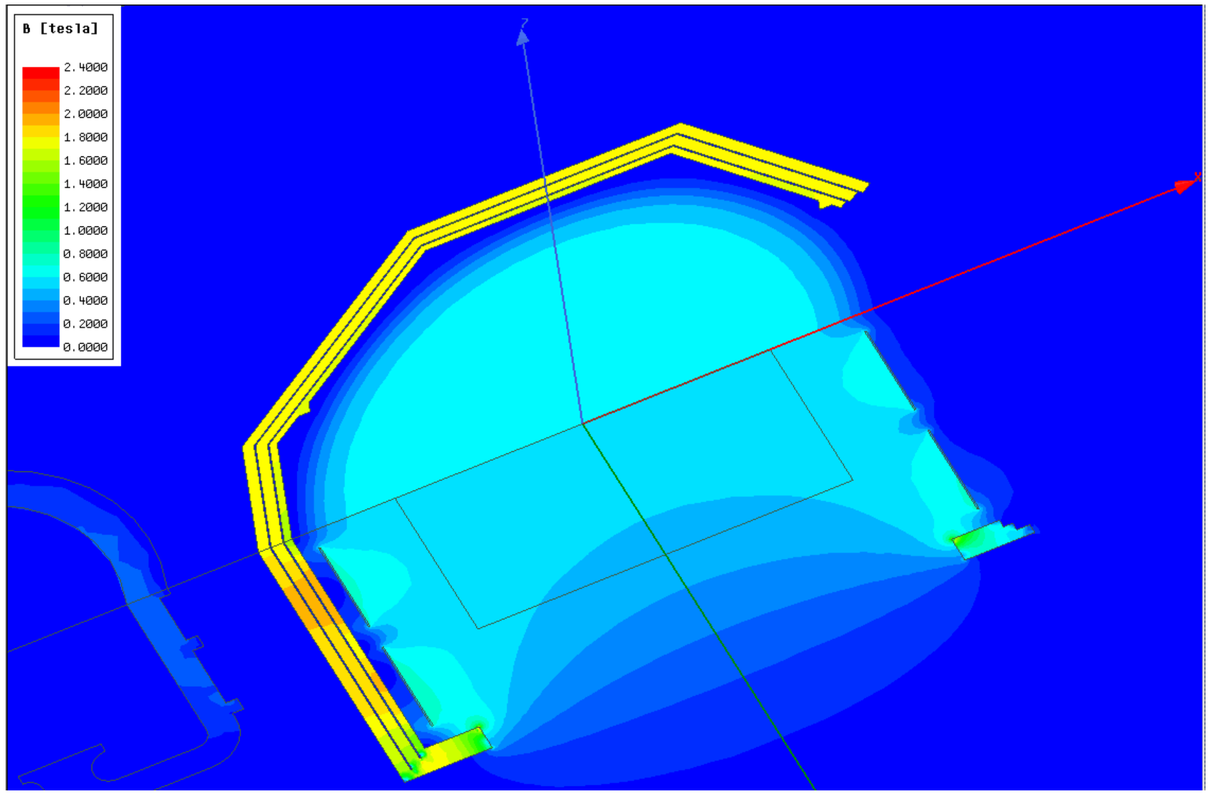
- Window only towards LArTPC
- "Thin" iron yoke
- No hole on end-caps



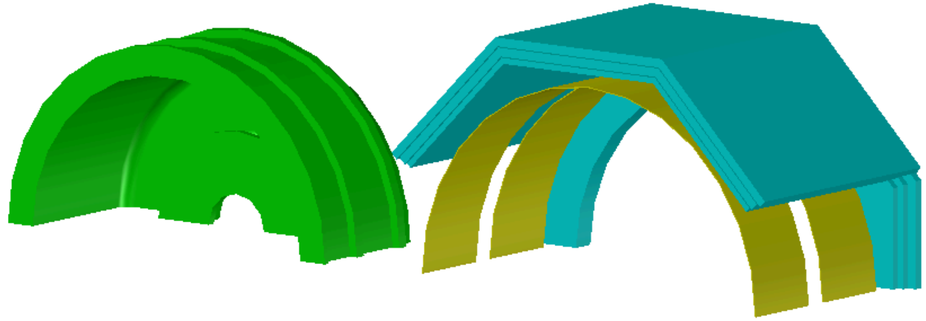
# Thick iron yoke: SPYDND08



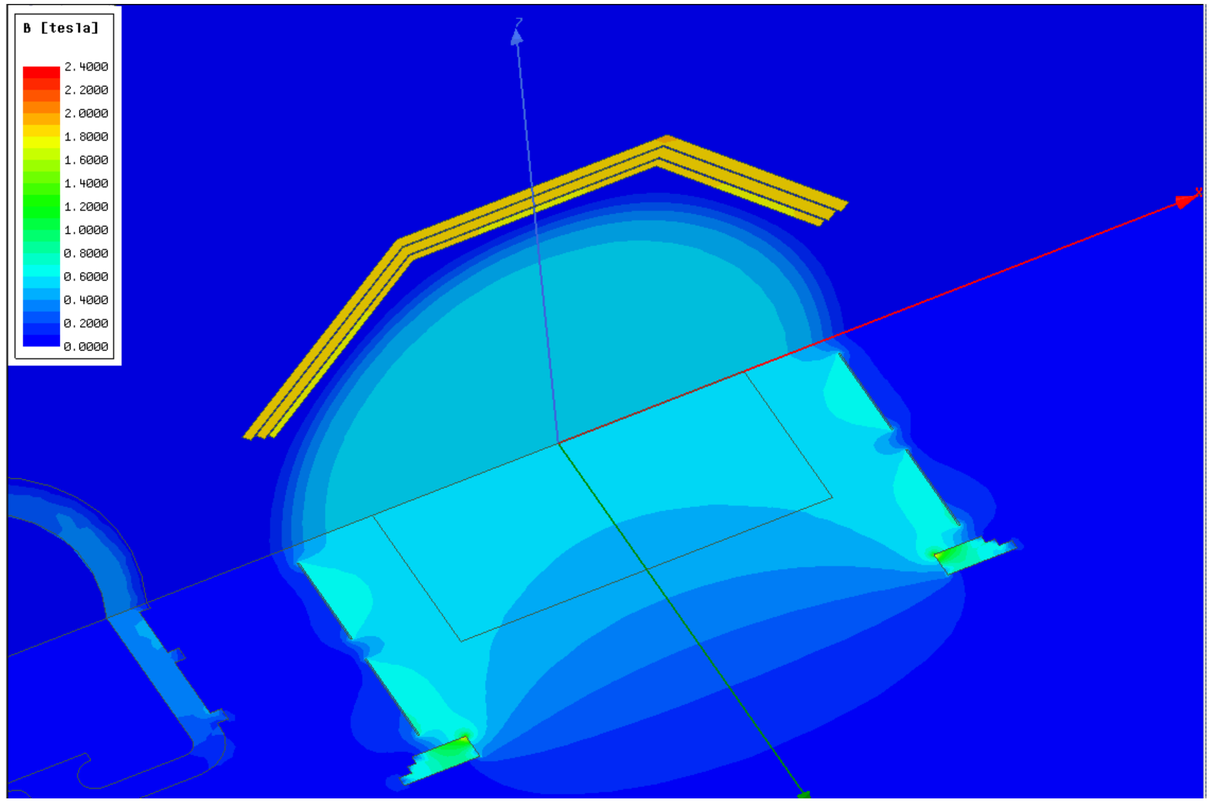
- Window only towards LArTPC
- "Thick" iron yoke
- Wide hole on end-caps



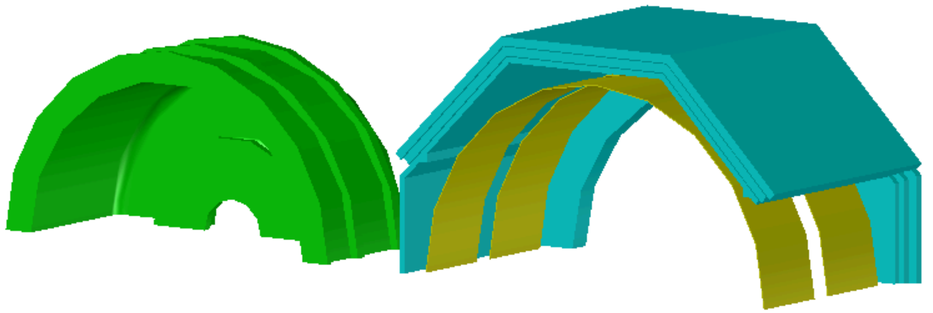
# Thick yoke, two windows: SPYDND09



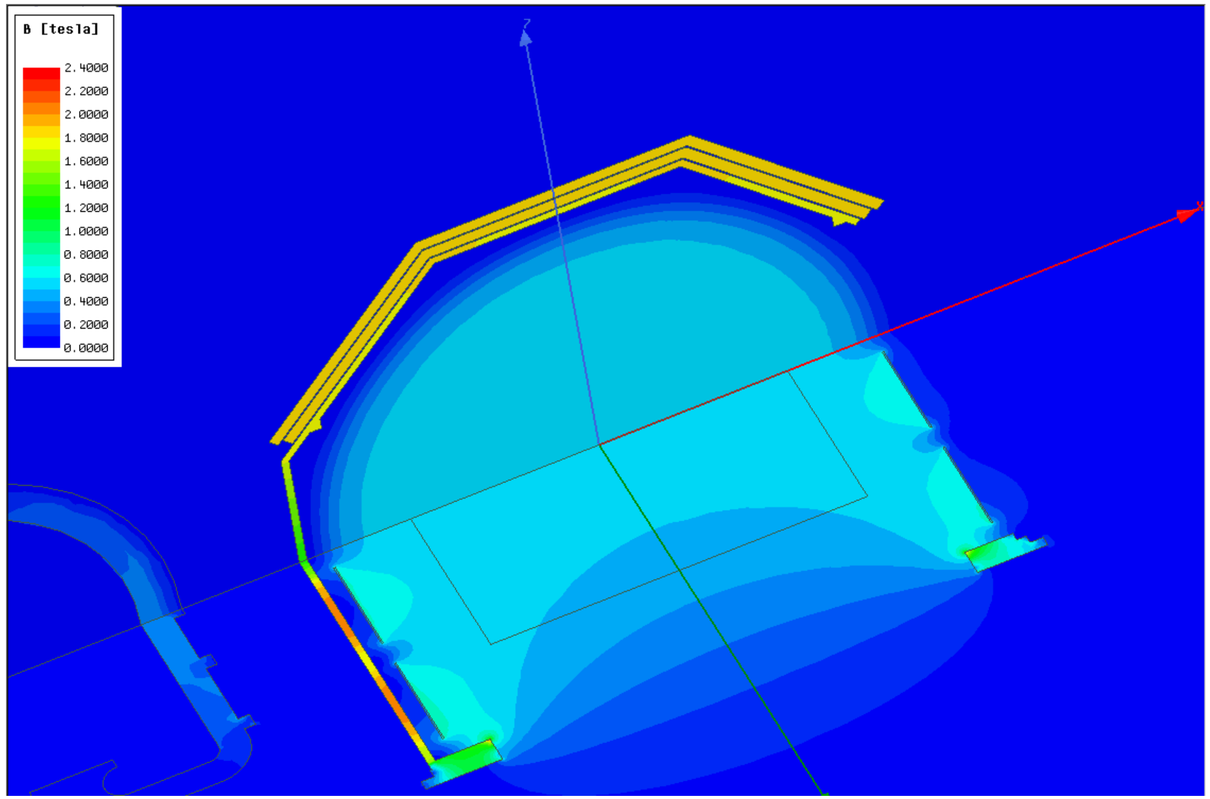
- Window towards LArTPC
- Window towards SAND
- "Thick" iron yoke
- Wide hole on end-caps



# Thick/thin yoke: SPYDND10

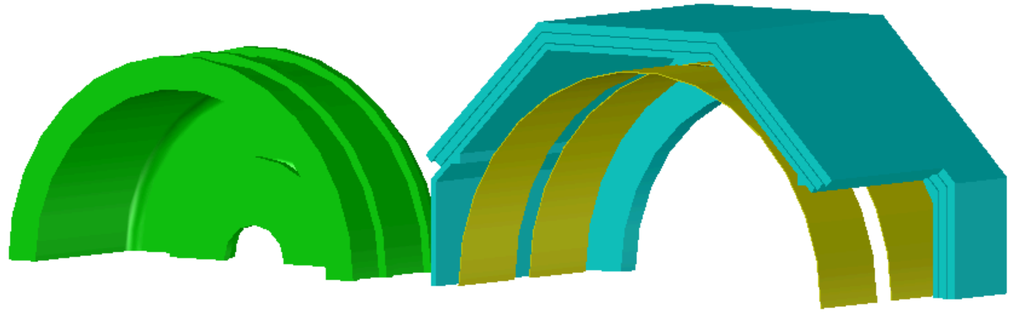


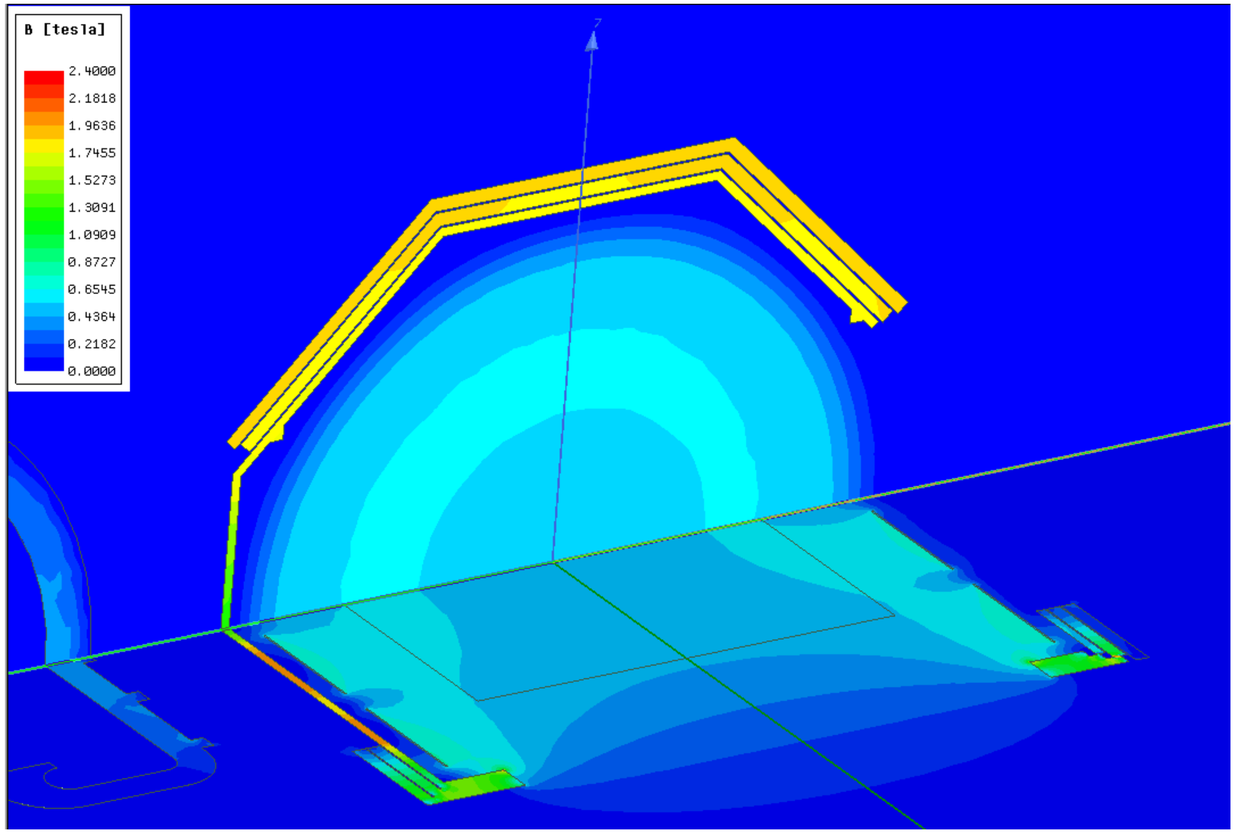
- Window towards LArTPC
- Thin yoke towards SAND
- Thick iron yoke elsewhere
- Wide hole on end-caps



# Thick/thin yoke, end rings: SPYDND11

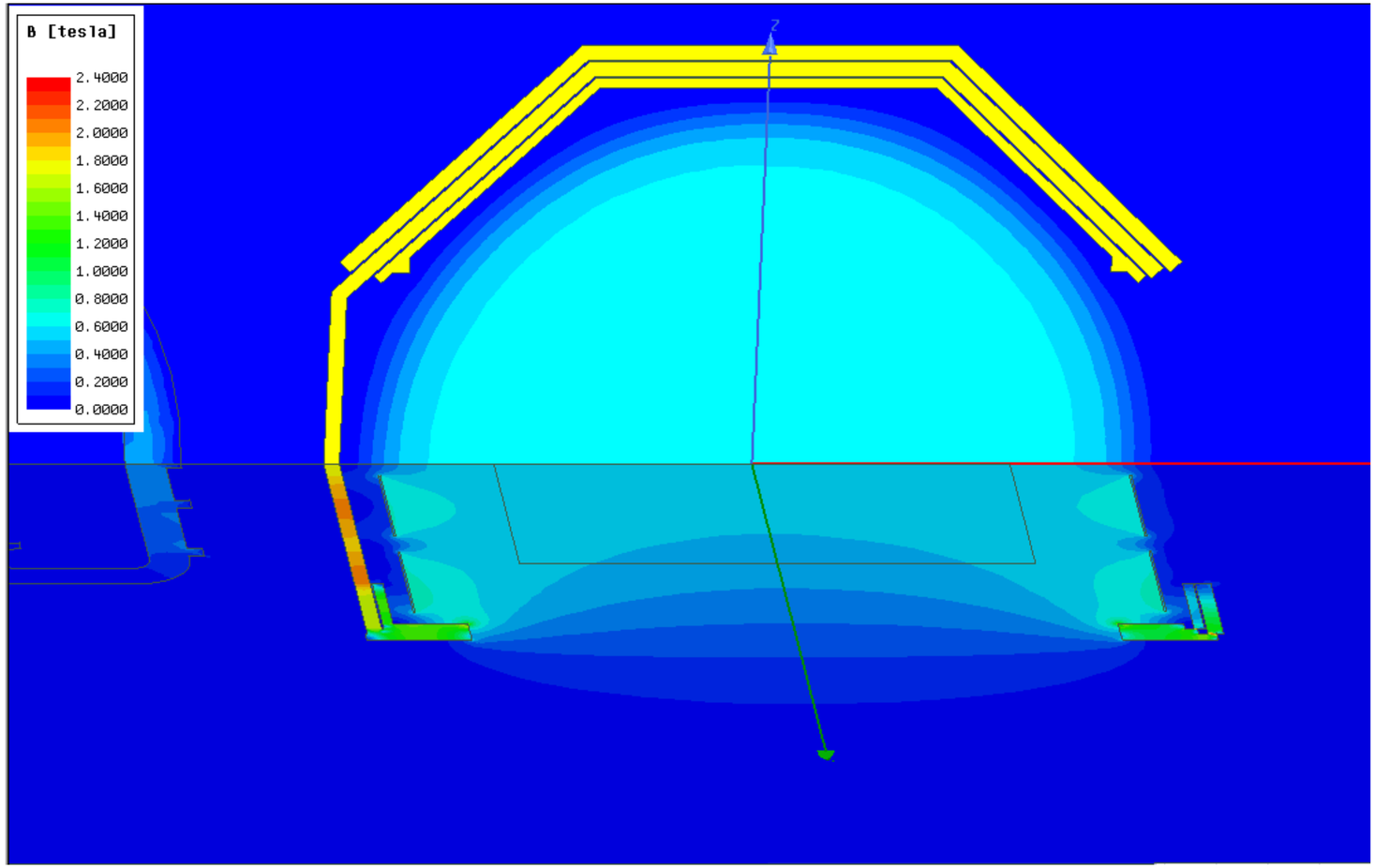
- Window towards LArTPC
- Thin yoke towards SAND
- Thick iron yoke elsewhere
- Wide hole on end-caps
- "Rings" around the window





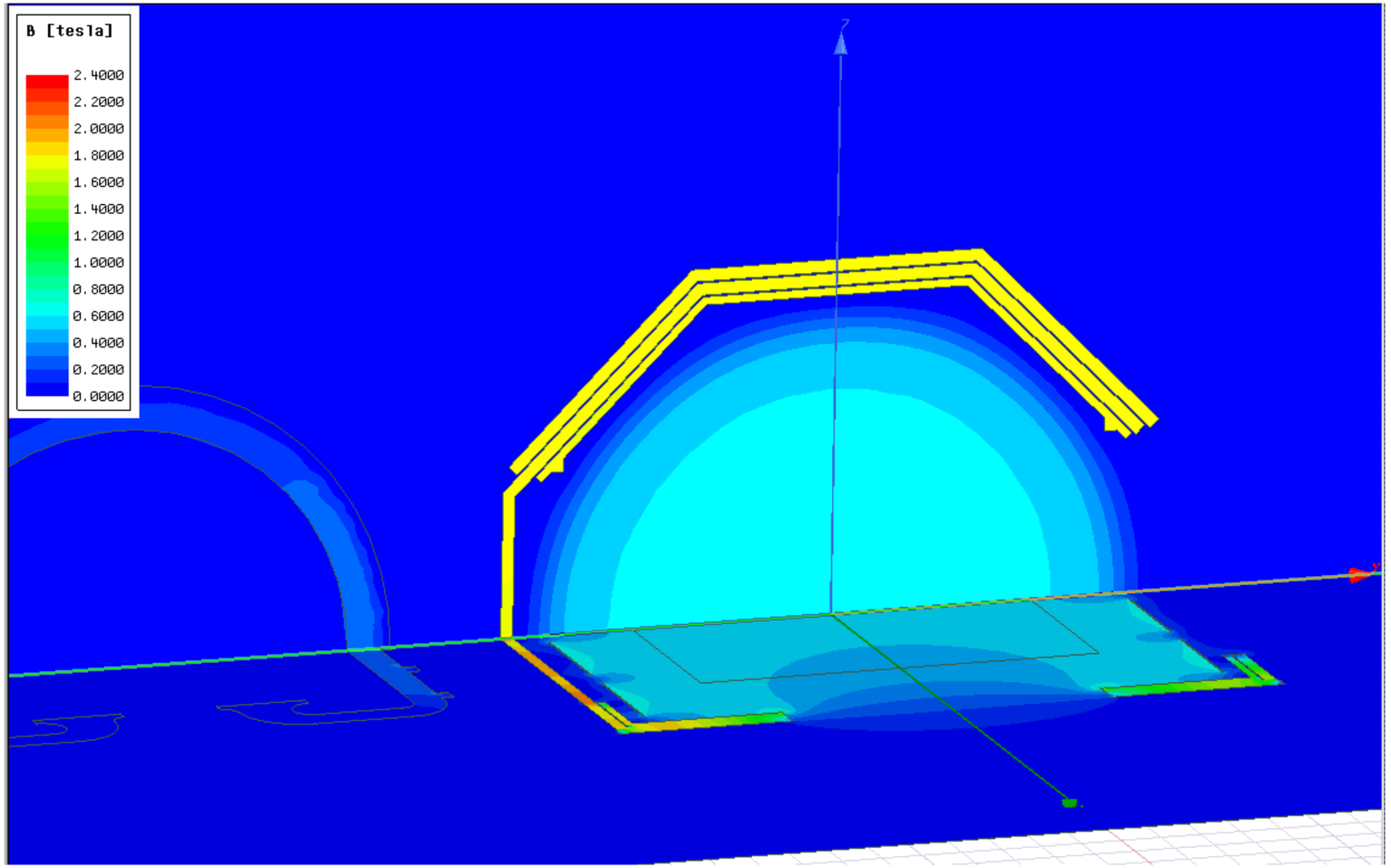
# Thick/thin yoke, end rings, v2: SPYDND12

- Window towards LArTPC
- Thin yoke towards SAND
  - second layer kept
- Thick iron yoke elsewhere
- Wide hole on end-caps
- "Rings" around the window



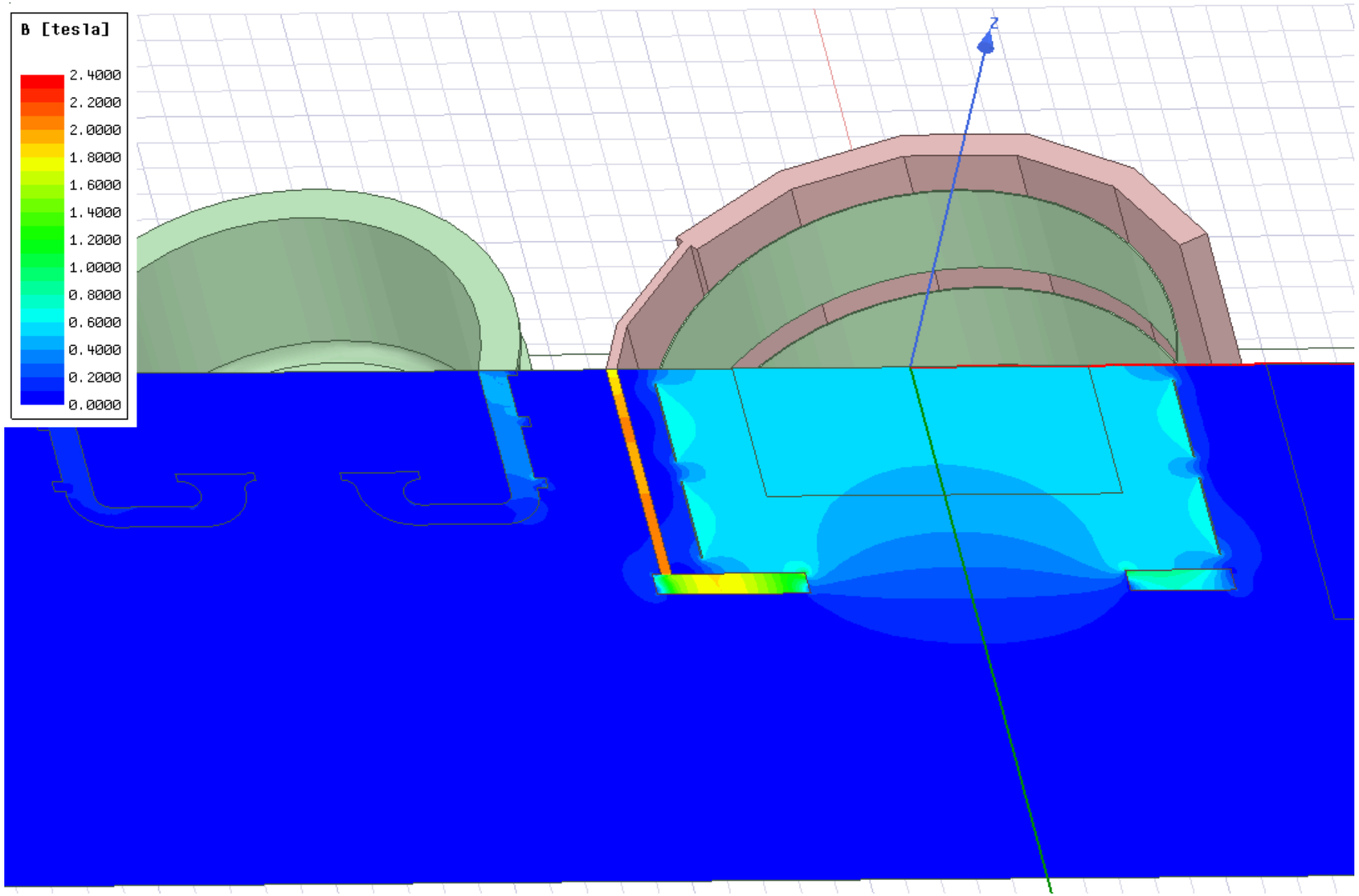
# Thick/thin yoke, end rings, small hole: SPYDND12b

- Window towards LArTPC
- Thin yoke towards SAND
  - second layer kept
- Thick iron yoke elsewhere
- Smaller hole on end-caps
- "Rings" around the window



# Solid yoke, 16 sides: SPYDND13

- Window towards LArTPC
- Thin yoke towards SAND
  - second layer kept
- Thick iron yoke elsewhere
- Smaller hole on end-caps
- Non laminated yoke



# Parameters comparison

| | SPYDND 06 | SPYDND 07 | SPYDND 08 | SYDNDo 9 | SPYDND 10 | SPYDND 11 | SPYDND 12 | SPYDND 12b | SPYDND 13 |
|---|---|---|---|---|---|---|---|---|---|
| **Bmin on TPC** | 0.4454 T | 0.4981 T | 0.4580 T | 0.4499 T | 0.4522 T | 0.4540 T | 0.4543 T | 0.4596 T | 0.4689 T |
| **Bmax on TPC** | 0.5588 T | 0.5238 T | 0.5781 T | 0.5614 T | 0.5675 T | 0.5682 T | 0.5687 T | 0.5326 T | 0.5497 T |
| **Force along beam** | 160 kN | 100 kN | 460 kN | 60 kN | 260 kN | 124 kN | 132 kN | 84 kN | 102 kN |
| **Force along axis** | 2.15 MN | 0.95 MN | 2.15 MN | 2.1 MN | 2.1 MN | 2 MN | 2 MN | 0.52 MN | 0.94 MN |
| **Current per coil** | 1.05 MA | 0.95 MA | 1 MA | 1 MA | 1 MA | 1 MA | 1 MA | 0.9 MA | 0.95 MA |
| **Stored energy** | 46.6 MJ | 41 MJ | 46 MJ | 45 MJ | 45.5 MJ | 45.2 MJ | 45.5 MJ | 48 MJ | 42.8 MJ |
| **Force on SAND** | 120 kN | 104 kN | 12 kN | 32 kN | 24 kN | 28 kN | 23 kN | 18 kN | 36 kN |

- Force along beam: force felt by the 4 coils pointing towards SAND
- Force along axis: force felt by 2 coils pointing towards the other 2 coils
- Force on SAND: force felt by SAND yoke, generated by stray field

# Comments

- The most promising design is the "thin yoke towards SAND"
  - second layer works better than first
- The introduction of a "ring" close to the end caps seems advantageous
  - the length of the ring still needs optimisation
- The optimisation of this design is still ongoing
- Partially losed end-caps are being investigated
  - reducing hole radius from 3 to 2 metres has a dramatic effect