# SPD Magnetic System (1)

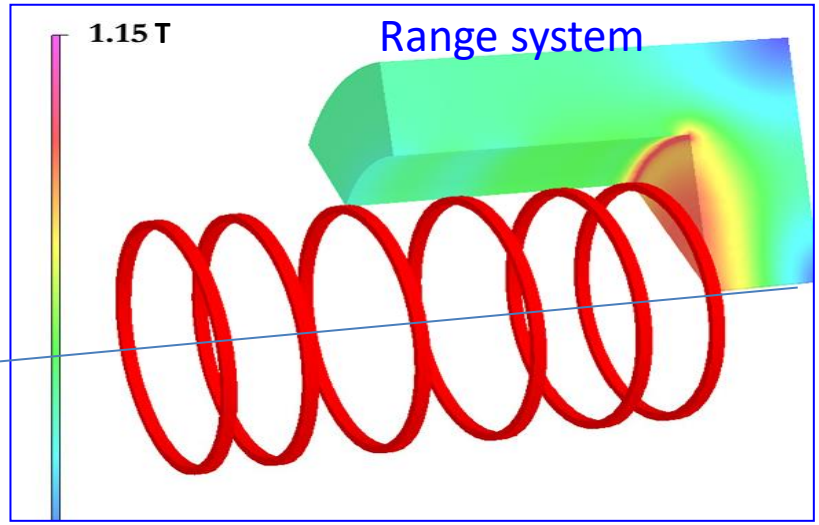
BASIC CRITERIA for choice

- universality
- minimization the MS material inside SPD
- field integral of 1 T·m along a track
- minimization of the SPD weight and sizes

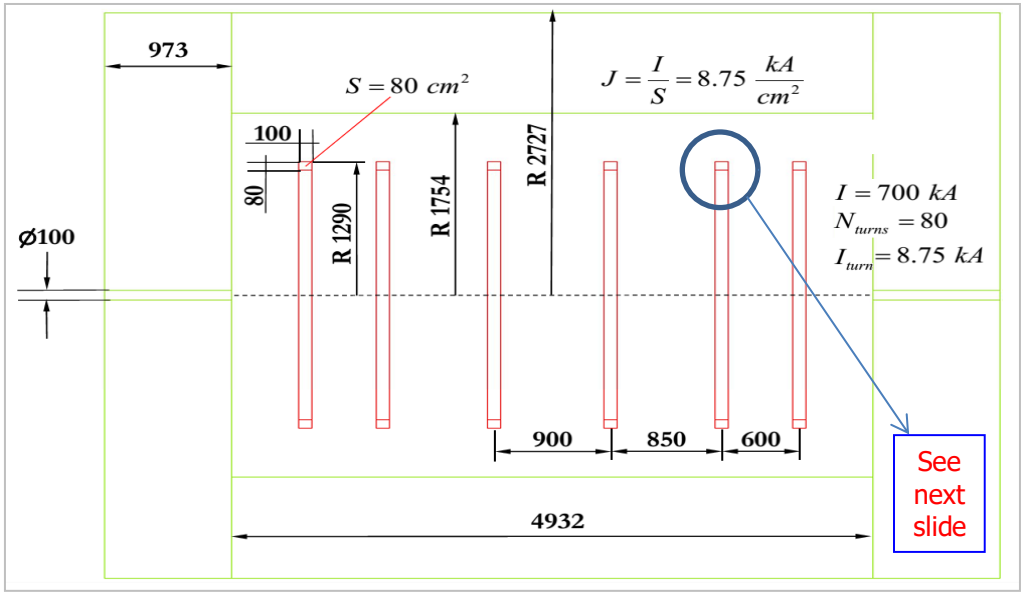
## Considered options:

- Solenoid (placed outside ECal);
- Toroid (inside ECal): 1) ***barrel part***, 2) ***barrel+2 end parts***, 3) ***warm coils***, 4) ***superconducting coils;***
- 4 separate coils inside the ECal;
- Combination of the toroid and 2 pairs of the coils inside the ECal.

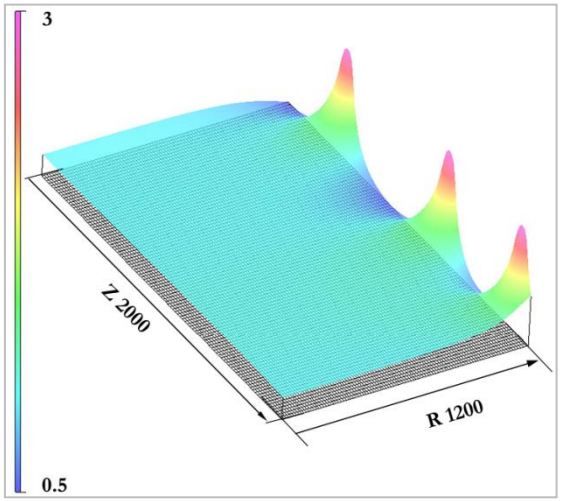
## 6-coils have been chosen:

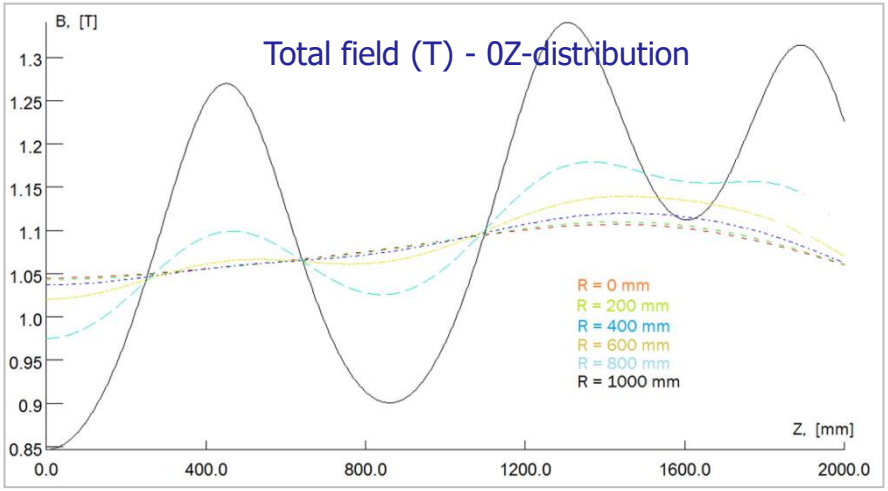


# SPD Magnetic System (2)




Total field (T) - RZ-distribution



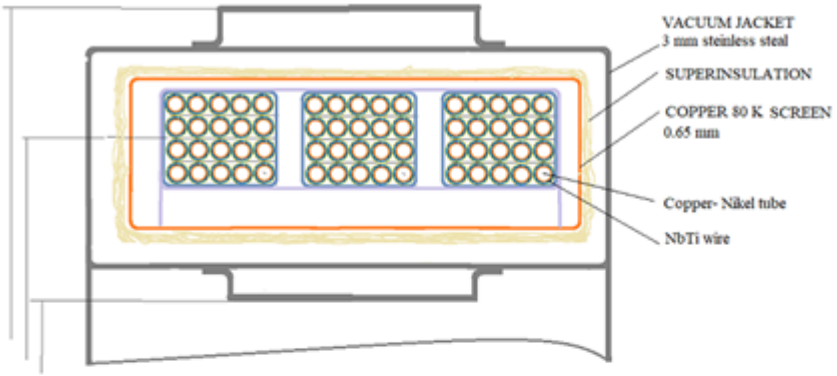




- SC coils minimize material inside SPD;
- 1T on the axis is reached at 800 kA·turn;
- Further optimization of distances between coils will provide better field uniformity;
- Cost saving factor can be reached also.

# SPD Magnetic System (3)

Параметры СП-катушки СПД

| nn | Parameter | Unit | Value | | |
|---|---|---|---|---|---|
| | | | Var.1 | Var.2 | |
| 1 | Wire diameter | mm | 0.805 | | |
| 2 | Supply current | kA | 10.0 | | |
| 3 | Operating temperature | K | 4.4-4.5 | | |
| 4 | Wire critical current | A | | | |
| 5 | Ampere-turns | kA•turn | ~ 600 | | |
| 6 | Number of turns | | 60 | | |
| 7 | Turns configuration | | 4v/15h | | |
| 8 | Peak field at the coil | T | 3.5 | | |
| 9 | Wire operating current | A | 500 | | |
| 10 | Number of wires | | 20 | | |
| 11 | Cryostat outer diam. | m | 2x1.29 | | |
| 12 | Cryostat inner diam. | m | 2x1.09 | | |
| 13 | Cryostat radial size | mm | 200 | | |
| 14 | Cryostat length | mm | | | |
| 15 | Centre coil radius | m | 1.19 | | |
| 16 | Cable cross section, h/v | mm / mm | ~ 10/10 | | |
| 17 | Coil cross section | mm/mm | ~ 40/80 | | |
| 18 | Turn average length | m | 6.845 | | |
| 19 | Total cable length | m | ~411 | | |
| 20 | Total wire length | km | ~ 8.25 | | |
| | | | | | |
| 21 | Cable type | | Hollow tube | | |
| 22 | Sections per coil | | 3 | | |
| 23 | Turns per section | | 20 | | |
| 24 | Cable per section | m | ~150 | | |
| 25 | Wire per section | km | ~ 3 | | |
| 26 | Wire weight 1m. (s= 0.005 $cm^2$, v = 0.5 $cm^3$ ρ=9 $g/cm^3$. | g | 4.5 | | |




- cryostat weght - 200 kg;
- 80K screen - 50 kg;
- NbTiCu cable - 100 kg/section
- Total coil weight- 550 kg

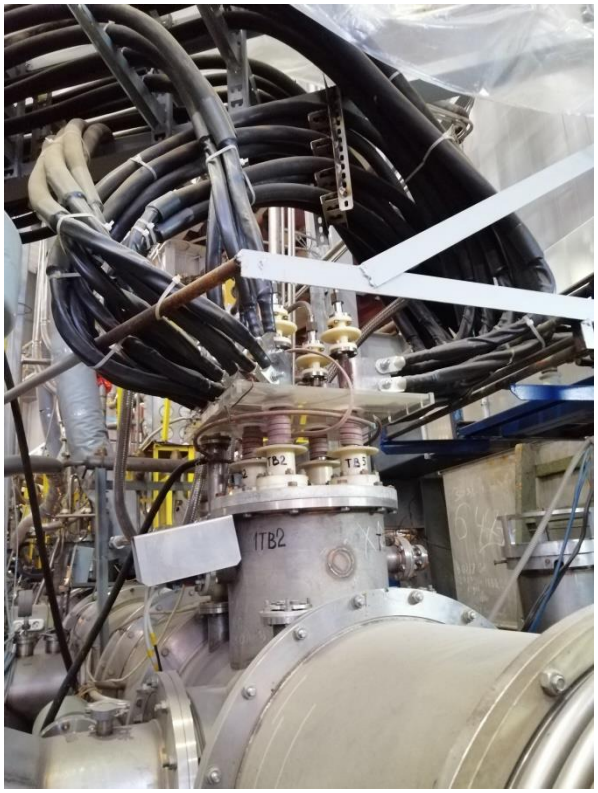
MS total coil weght - 3.5 t.

The data are preliminary. It will be used as input for the system technical design

# SPD Magnetic System (4)

## Experience from NICA Booster & Nuclotron

10 kA supply current is used. Superconducting technology similar to that may be the cheapest and effective way for the SPD MS




A. Kovalenko, SPD hardware meeting, JINR Dubna, Feb. 18th, 2021.

# SPD Magnetic System (5)

**It seems, we could be ready to start manufacturing the first test coil consisting of one section of SC winding in 2022**