Which target for the field/field slope with HTS dipoles

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Scope of the study

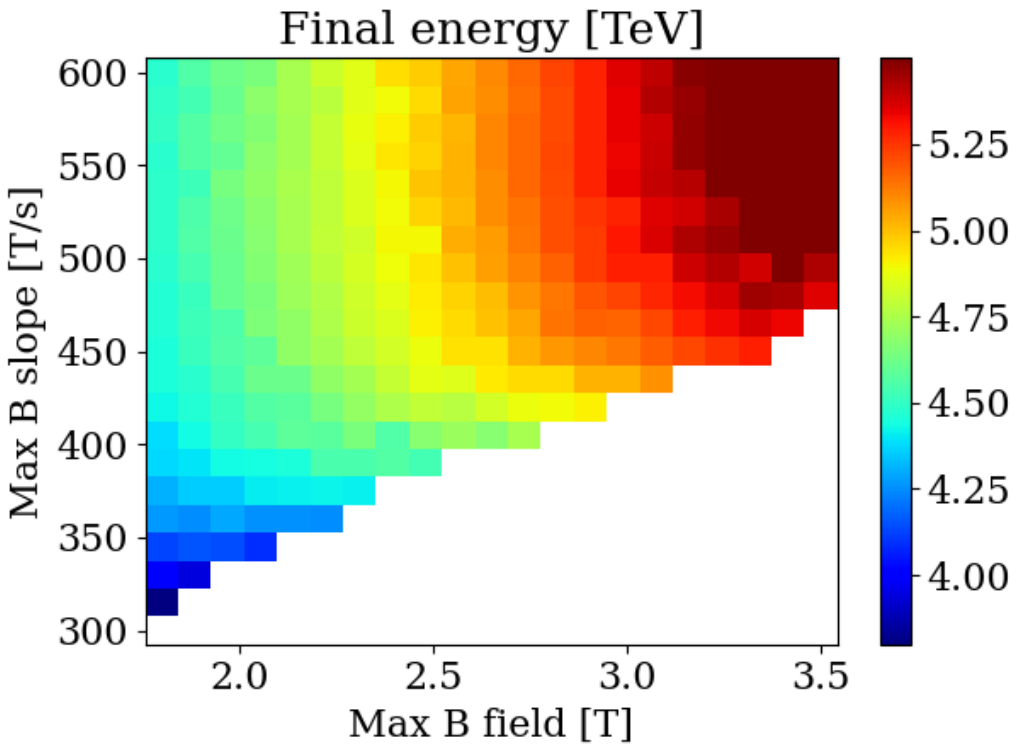
- Consideration of the scenario with 3 RCS:
- 1 Normal RCS in the SPS: circumference of 6912 m (NC dipole: 1.8 T).
- 1 Normal RCS in the LHC: circumference of 26659 m (HTS dipole).
- 1 Hybrid RCS in the LHC: circumference of 26659 m (SC dipole: 10 T).

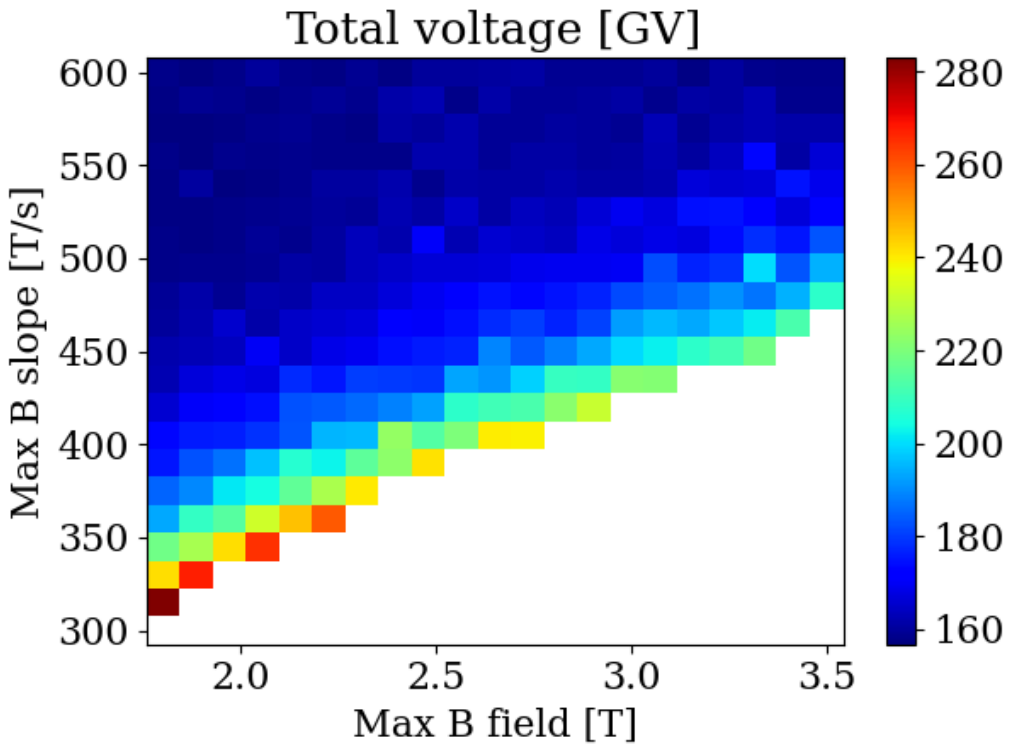
- The maximum field slope in NC dipole is 5000 T/s.
- We consider HTS dipoles instead of NC dipoles for RCS2.

Optimization tool

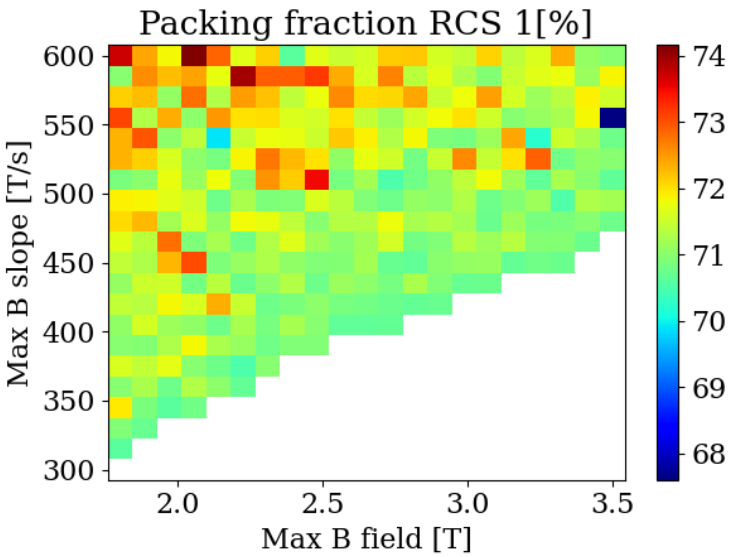
- Use of the python script developed by David Amorim with some modifications:
- Optimization strategy. We consider 2 approaches:
  - TotalVoltage. We minimize the total voltage of the RCS chain by keeping the survival rate above some value (0.9^3=73%). The final energy is a free parameter to be maximized.
  - TotalSurvival. We fix the final energy to 5 TeV and we minimize the total voltage and maximize the total survival.
- In both cases, we calculate the total length of the RF cavities (linked to the total voltage) and we calculate the maximum allowed packing factor of the dipoles by assuming a maximum filling of the arcs (90% here, to be refined).

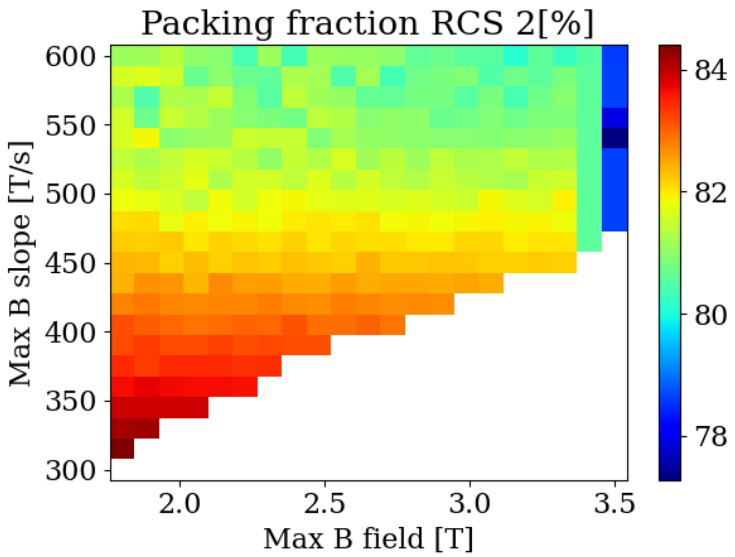
Optimization: Total Voltage
Energy and voltage

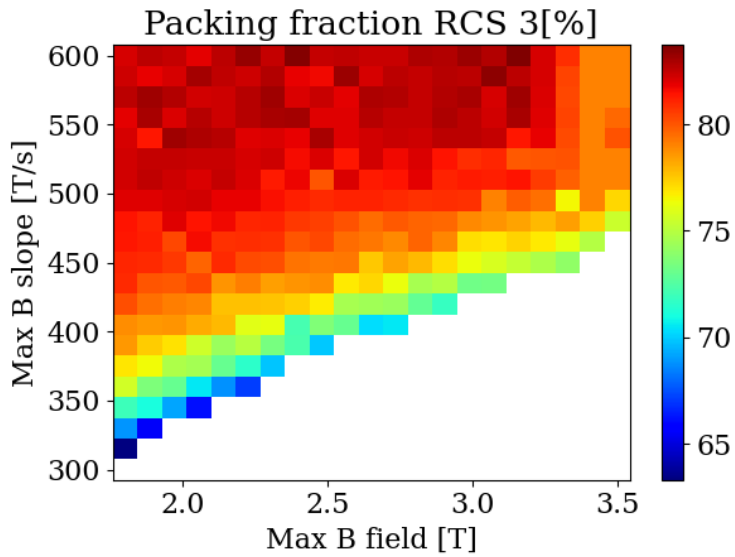




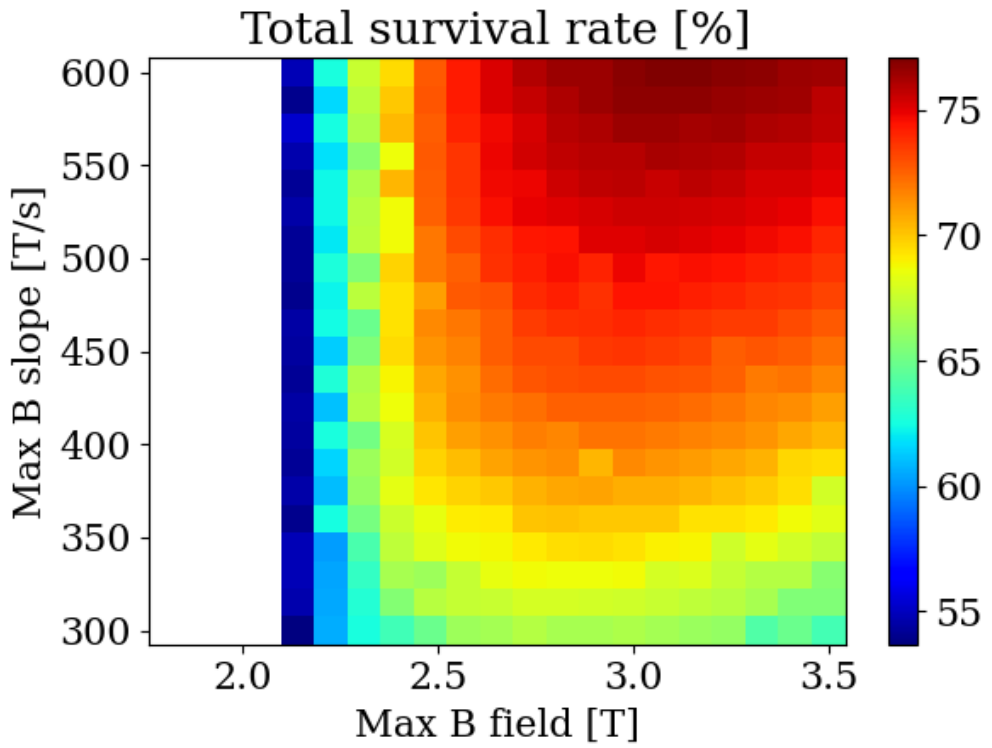
Optimization: Total Voltage Packing fraction

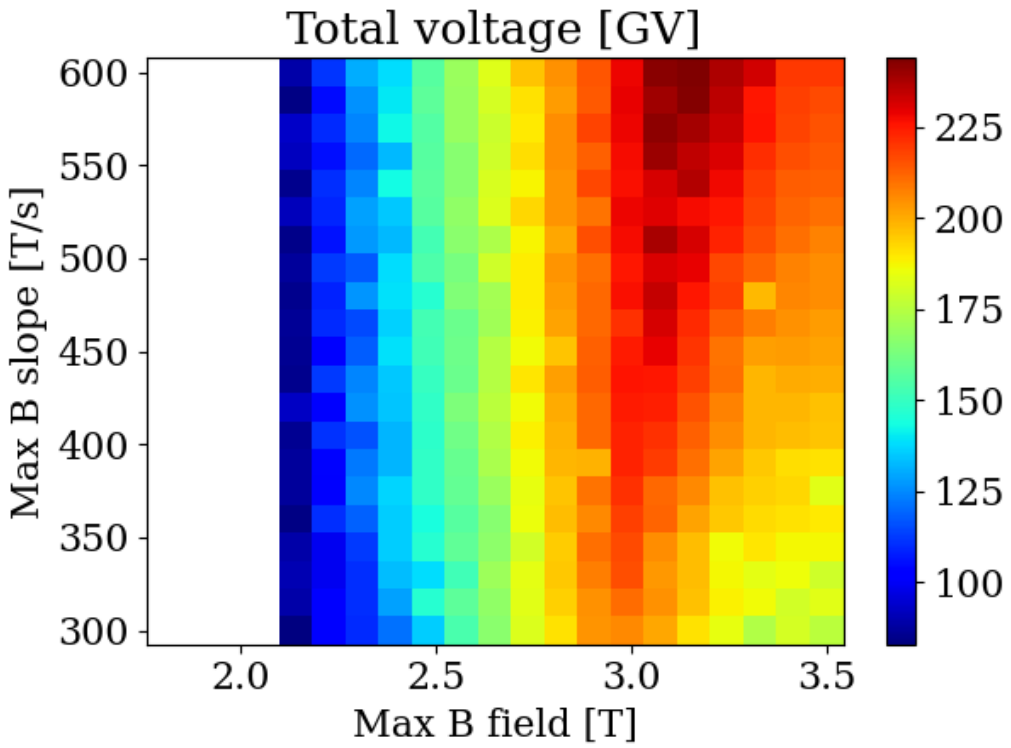




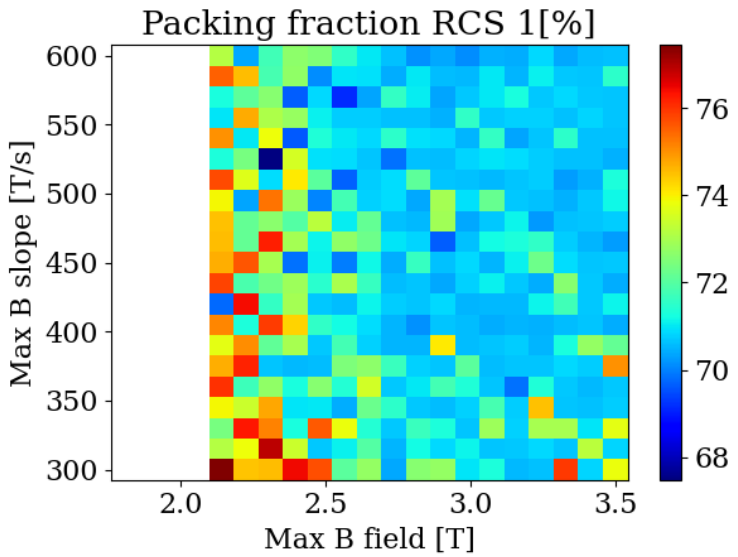


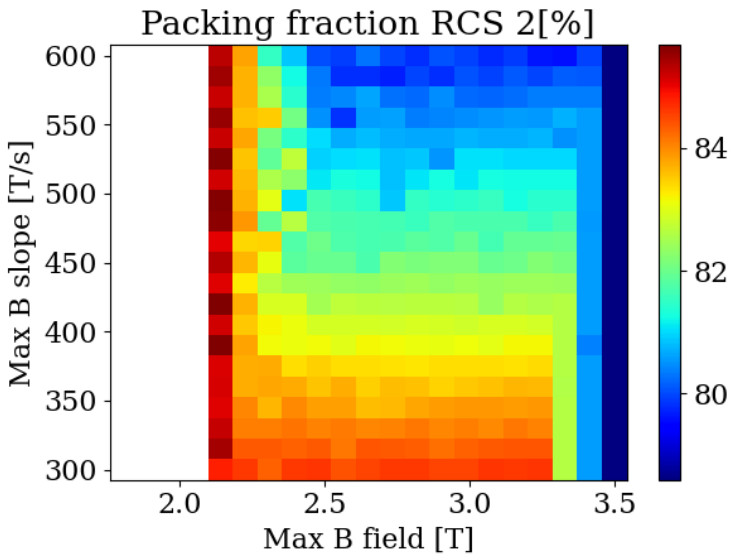
Optimization: Total Survival
Survival and voltage

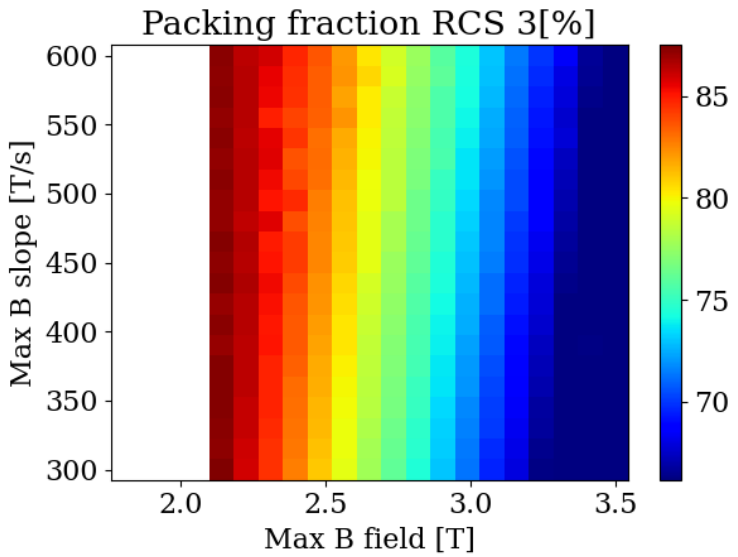




Optimization: Total Survival
Packing fraction







Conclusion

- To reach a final energy of 5 TeV, we need a field above 2.2 T.
- To reach a survival above 70%, we need a field slope above 400 T/s.
- To have at the same time a total voltage below 200 GV, a final energy of 5 TeV, and a survival above 70%, we should aim at a value in the HTS of 2.8T and a field slope of 450-500 T/s.