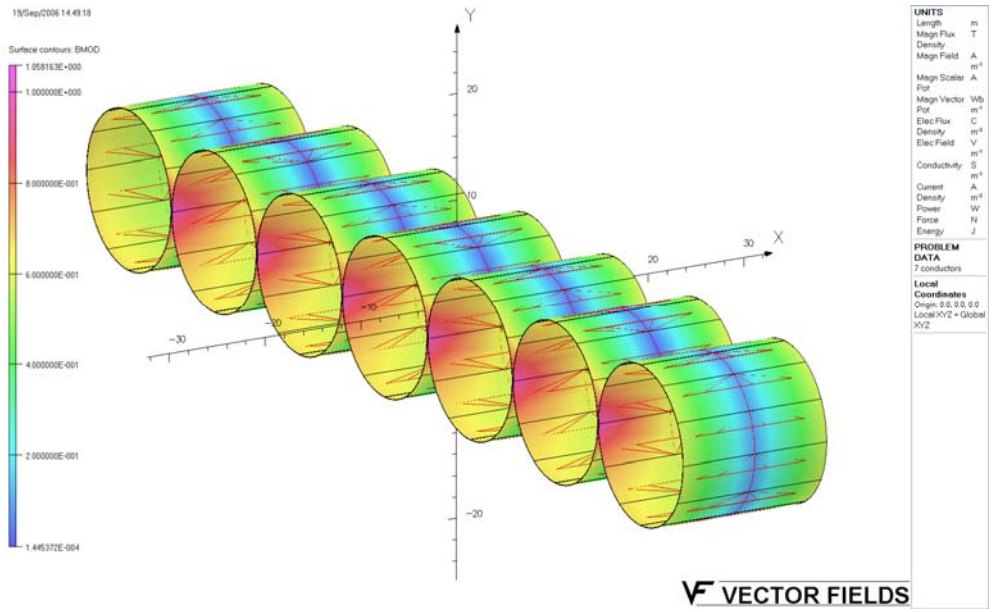
Big Magnet Designs

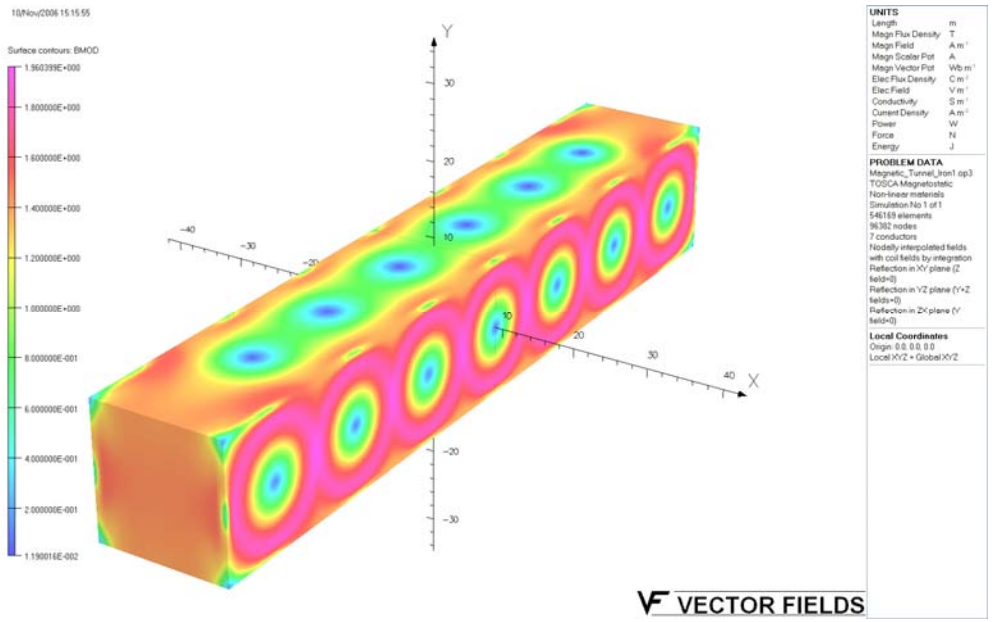
V.V. Kashikhin

Magnetic tunnel designs

Without iron



With iron

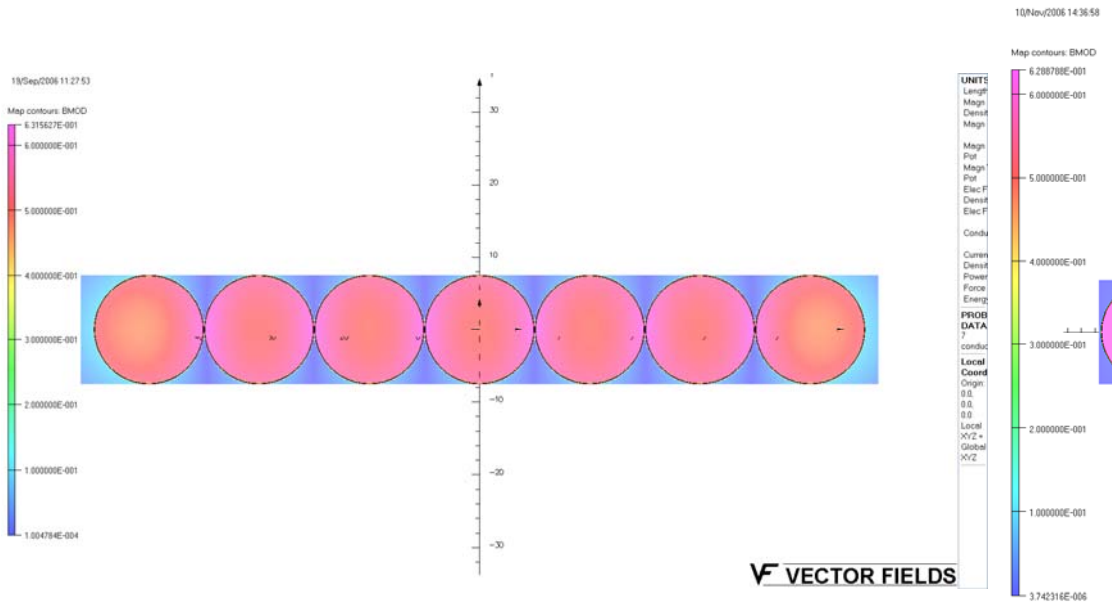


1 m iron wall thickness.

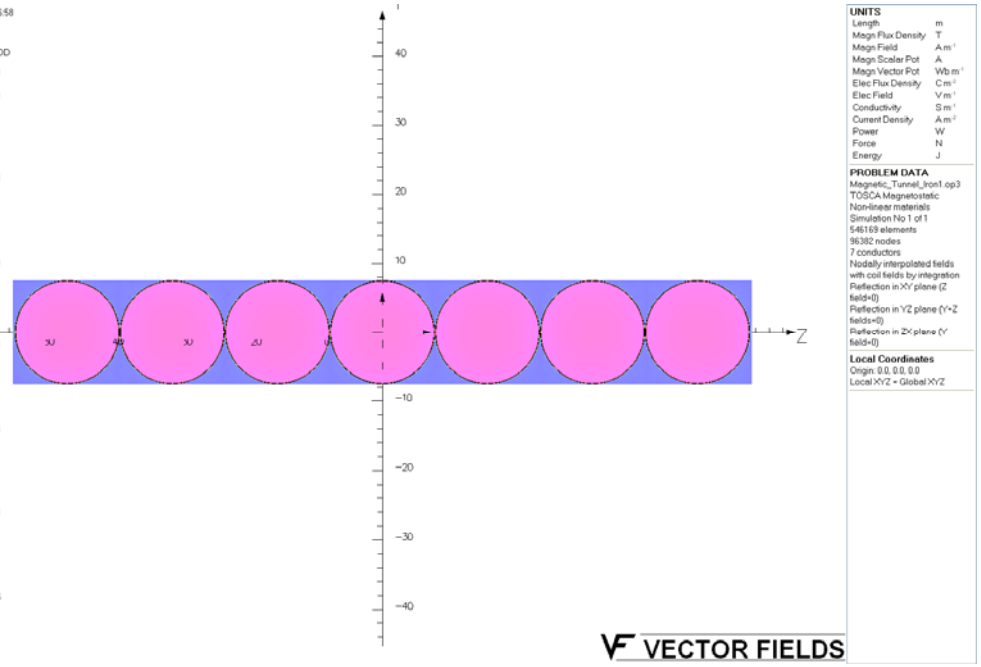
~2 T peak field in the iron.

|B| in YZ cross-section

Without iron



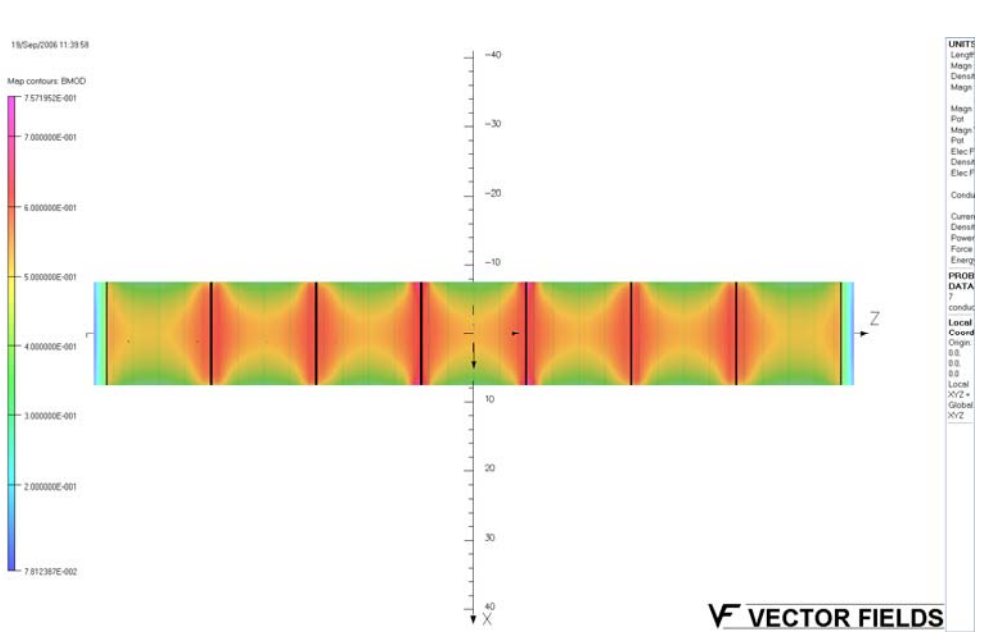
With iron



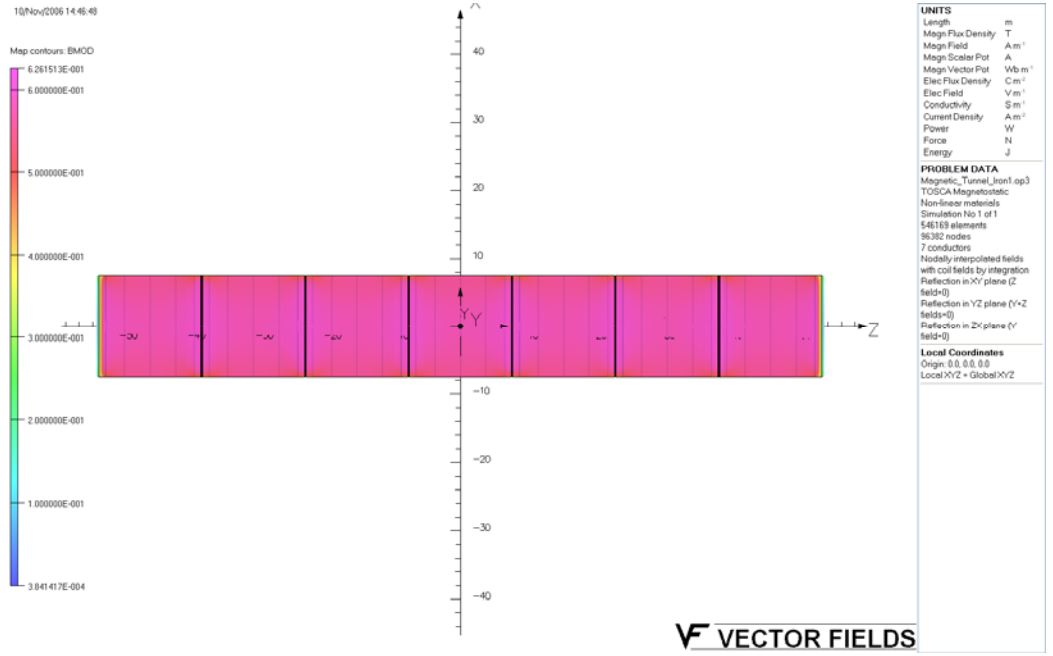
Noticeably better field uniformity with iron

|B| in XZ cross-section

Without iron



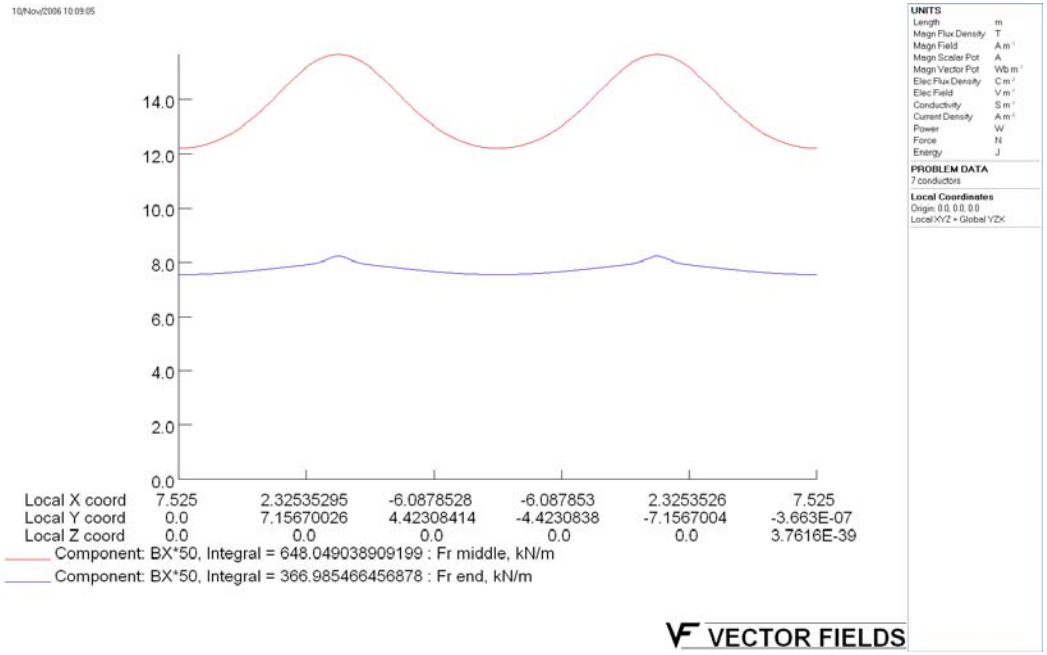
With iron



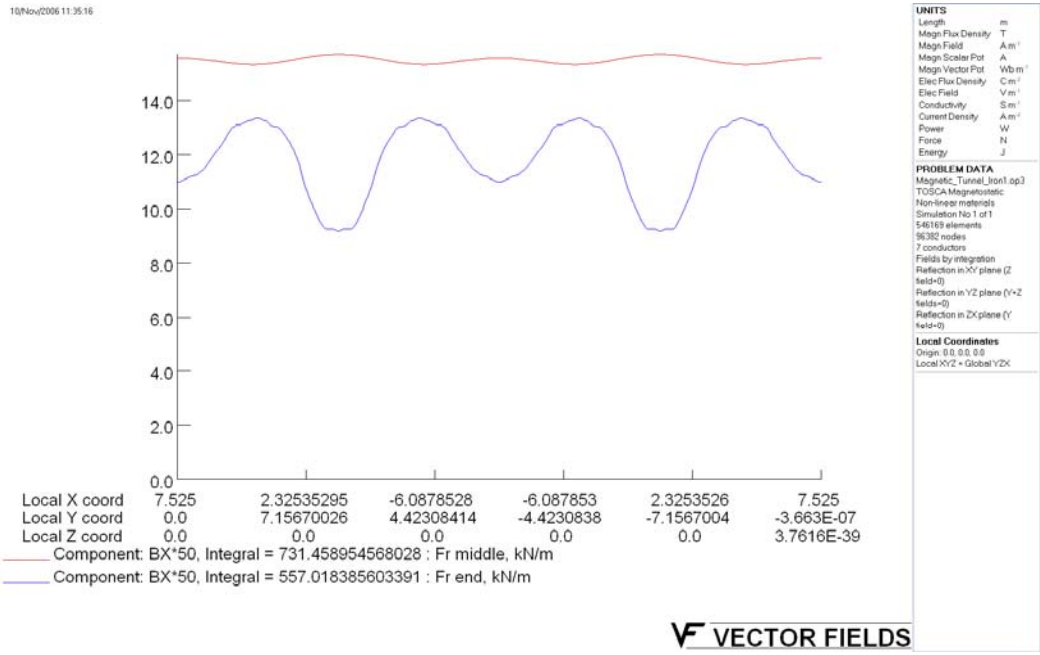
Much better field uniformity with iron

F_r in the middle/end turns

Without iron



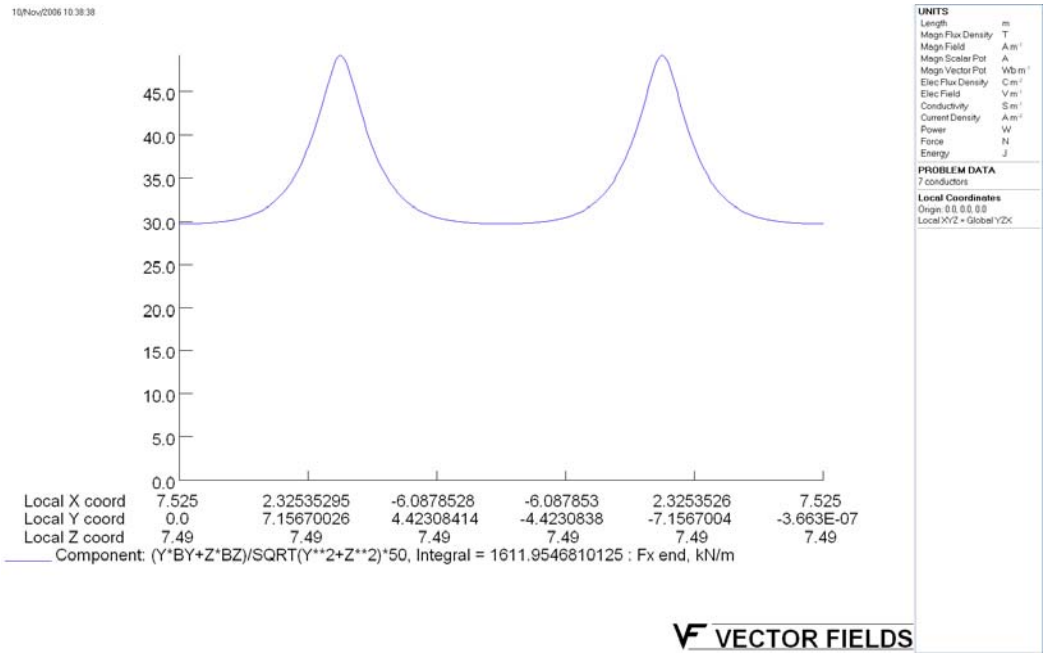
With iron



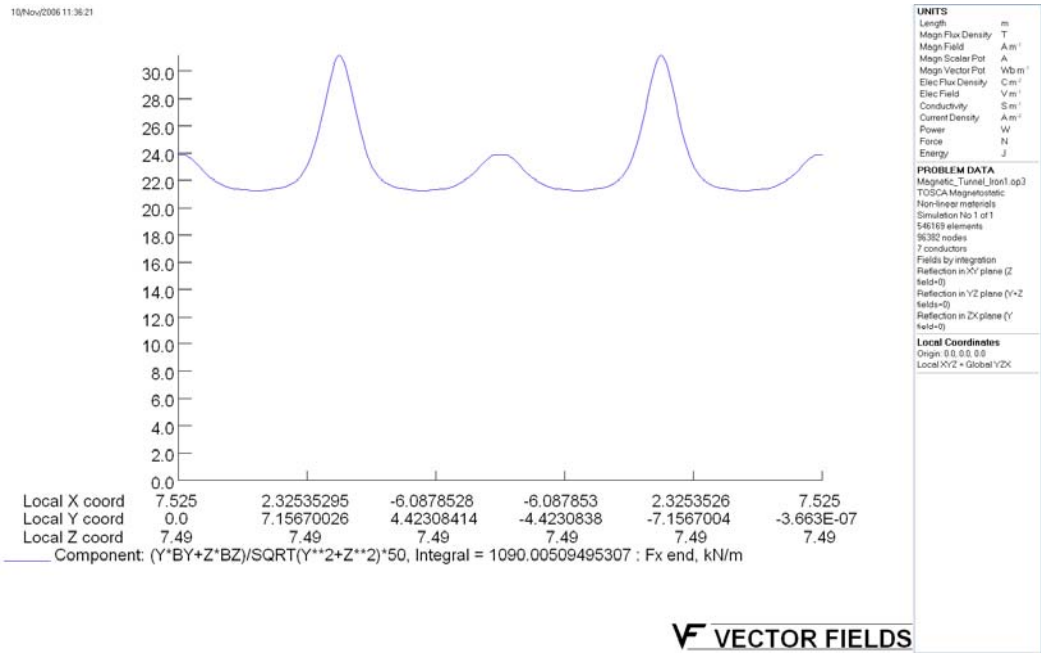
Similar force level in both cases

F_x in the end turn

Without iron



With iron



The largest force component => drives the mechanical design. ~60% lower force with iron.

Parameters

PARAMETER	UNIT	DESIGN	
		No iron	With iron
$I_{solenoid}$	MA	7.5	
N_{turns}/solenoid		150	
I_{turn}	kA	50	
$\|B\|_{average}$ in XZ	T	0.483	0.586
W_{total}	GJ	2.11	2.75
L_{total}	H	1.69	2.20
F_r maximum	kN/m	15.6	15.7
F_x maximum	kN/m	49.2	31.1