Design of the new BI.DHZ.DVT50 and BI.DHZ.DVT70[1]

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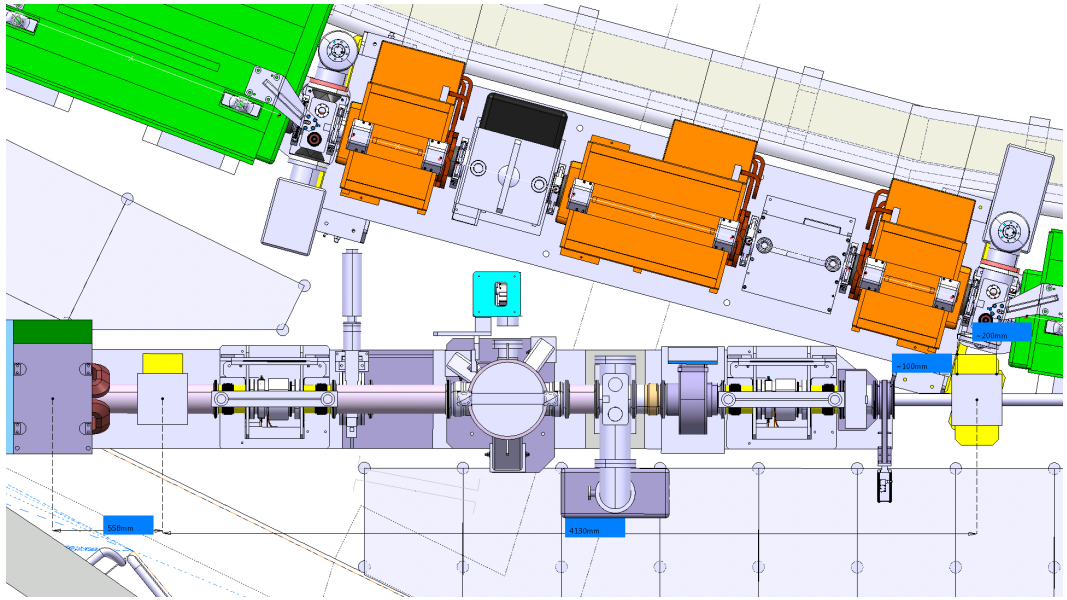
LIU-PSB Working Group Meeting, 16 May 2013

[1] Design report in work: EDMS 1277962

Motivation



[Courtesy Jean-Michel Lacroix]

New beam dynamics requirements

- new position of BI.DHZ.DVT.70: 2 m upstream
- Linac2 $\rightarrow$ Linac4
- 10 mm offset at injection point

Design requirements

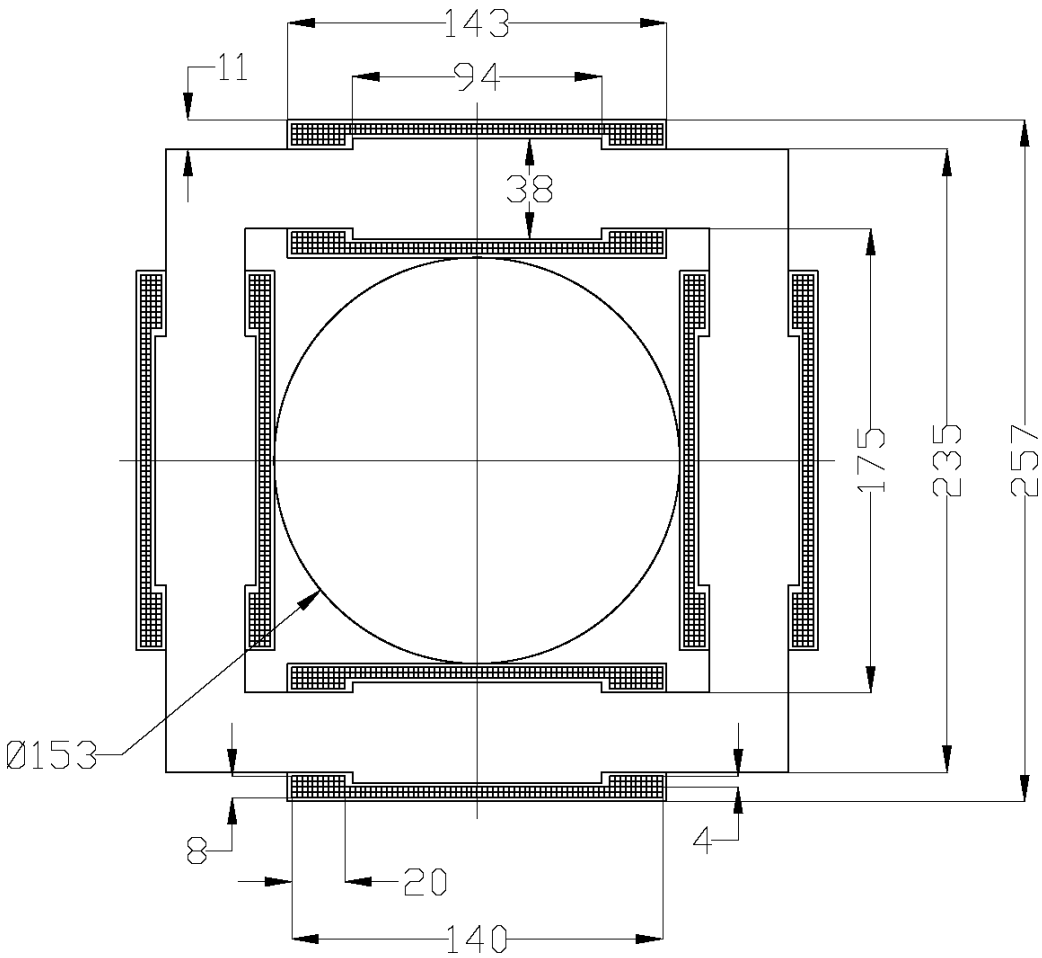
	Integrated flux density	**Aperture width × height**	**Good field region radius**
BI.DHZ.DVT50	130 Gm	150 mm × 150 mm	50 mm
BI.DHZ.DVT70	160 Gm	70 mm × 70 mm	25 mm
Merged	160 Gm	150 mm × 150 mm	50 mm


C. Carli, 31 October 2011


Norma Database, `http://norma-db.web.cern.ch`

Magnet design

Magnet layout



Dimensions

- overall length $\sim$ 255 mm
- overall weight $\sim$ 60 kg

Coil

- air-cooled

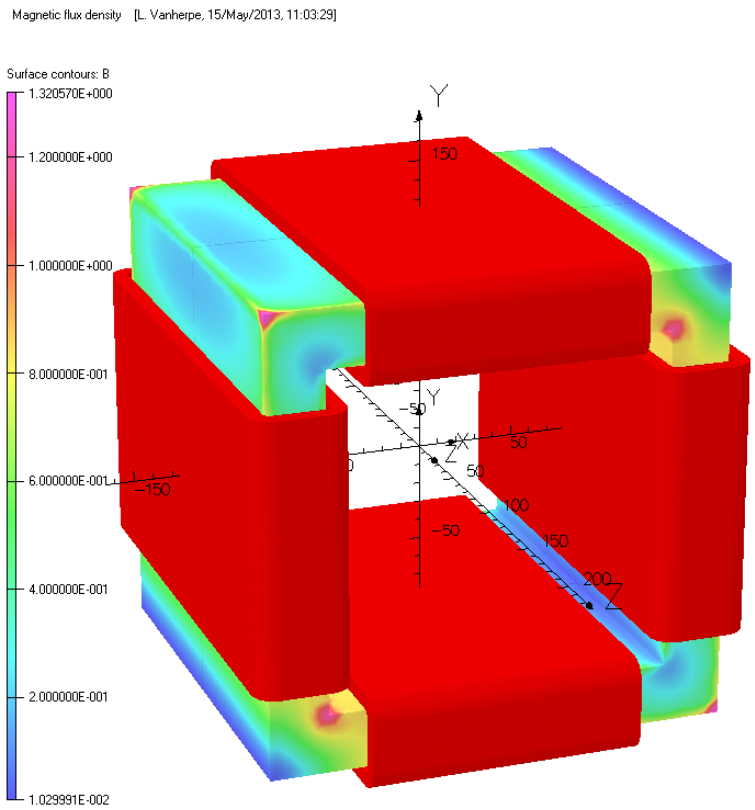
Magnet design

Electrical parameters for nominal operation (0.0182 Tm)

Parameter	**Value**	**Unit**	**Remark**
Nominal current I_{max}	35	A	
Rise time	4	ms	
Flat top time	2	ms	
Fall time	5	ms	
Total duty cycle	900	ms	
Nominal rms current I_{rms}	2.6	A	
Resistance @ 20°	1.5	Ω	Per plane
Inductance	40.2	mH	Per plane
Required voltage during rise	405	V	On magnet
Required voltage during fall	228	V	On magnet
Power dissipation	10.4	W	Per plane

Compatible with MidiDiscap power supply (S. Pittet)

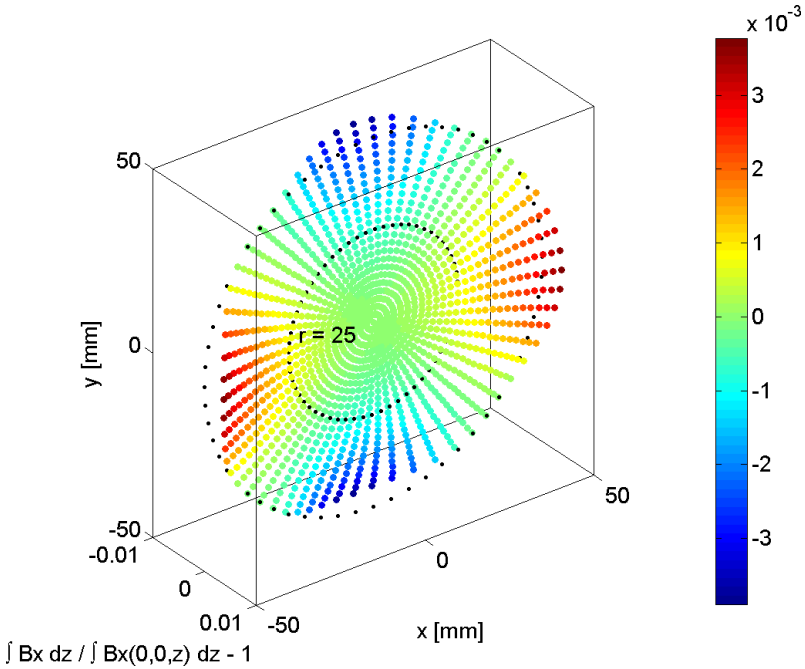
Magnetic field calculations



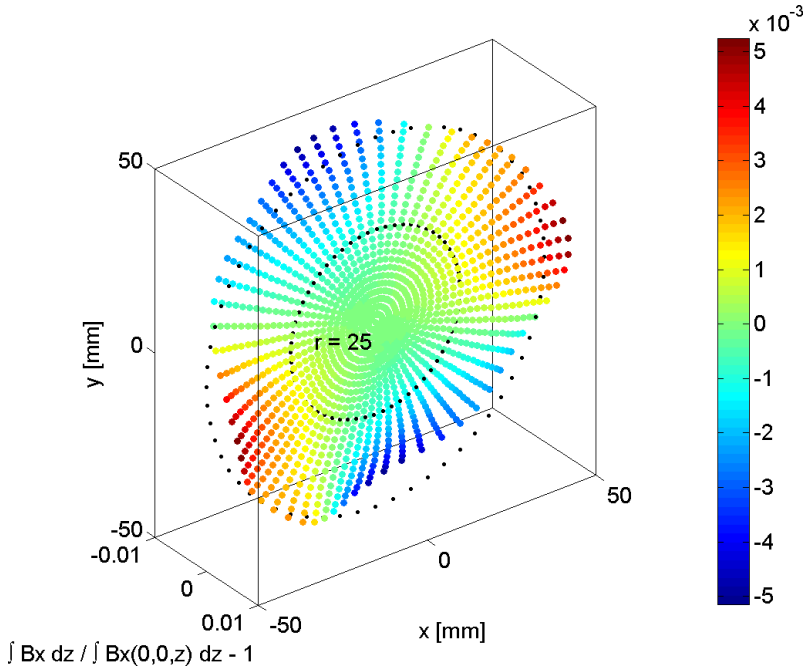
Parameter	**Value**	**Unit**
Integrated flux density per plane (margin...)	0.0182	Tm
Magnetic length	388.8	mm
Good field region radius	50	mm
Field homogeneity inside GFR	$\pm 5 \times 10^{-3}$	

Magnetic field calculations

Field homogeneity



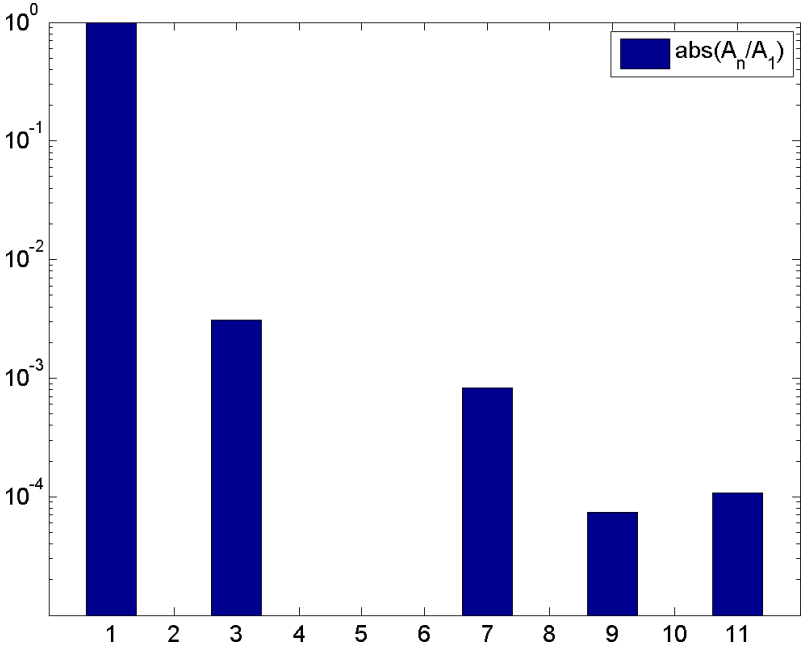
(a) Single plane excited



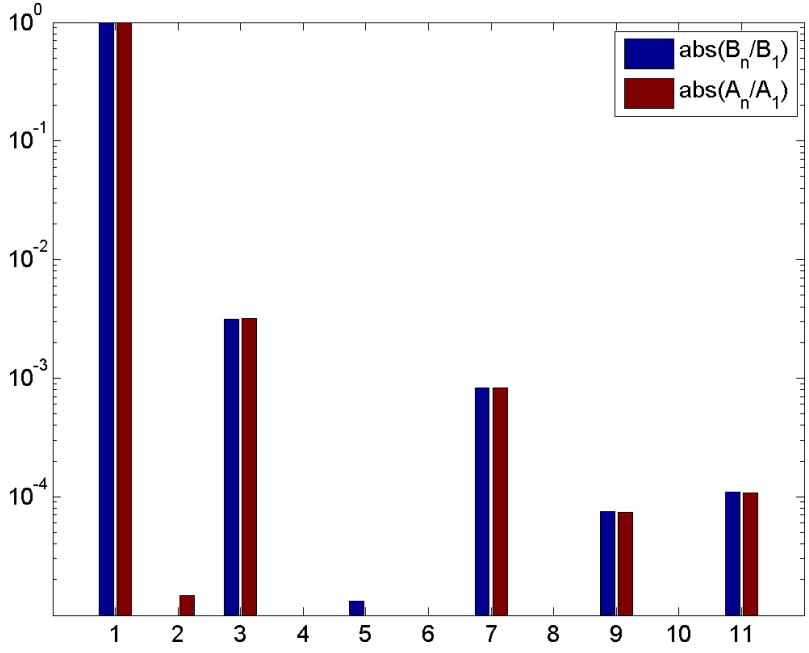
(b) Both planes excited

Magnetic field calculations

Harmonic analysis

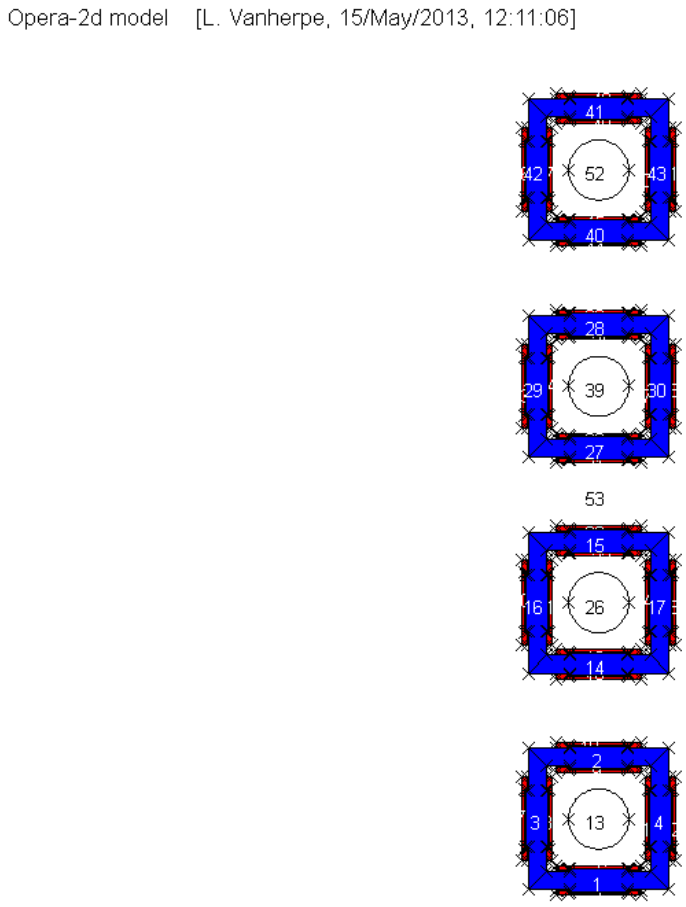


(c) Single plane excited



(d) Both planes excited

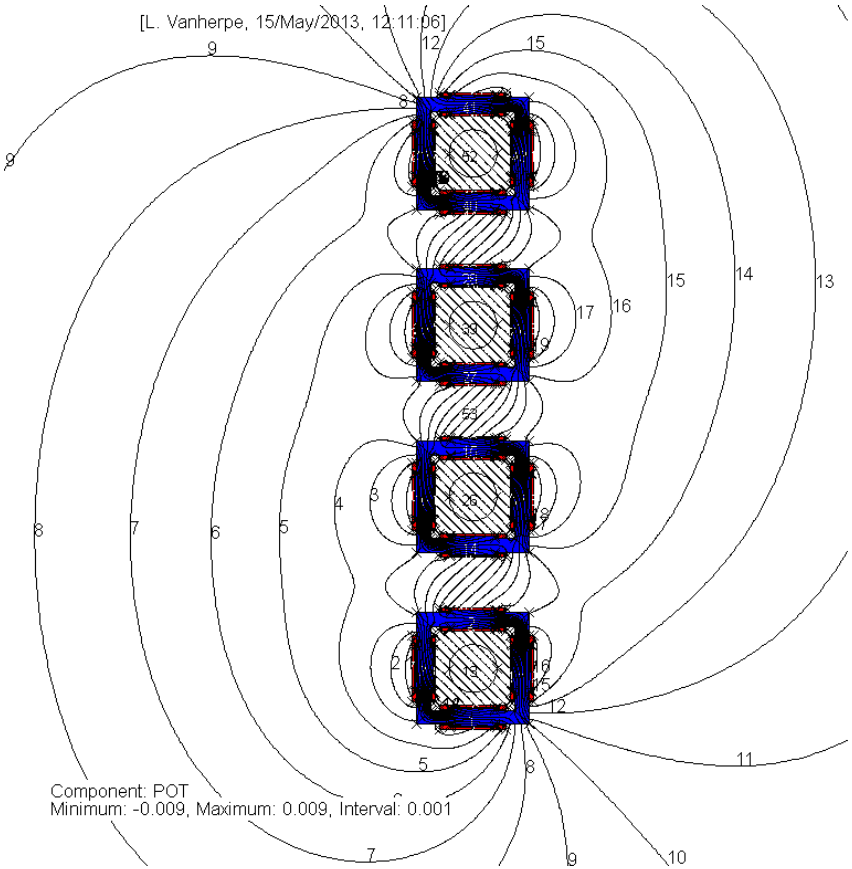
Stack of four magnets

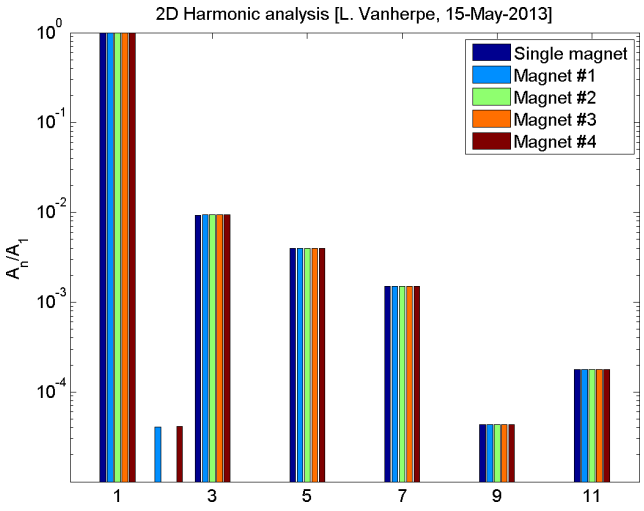


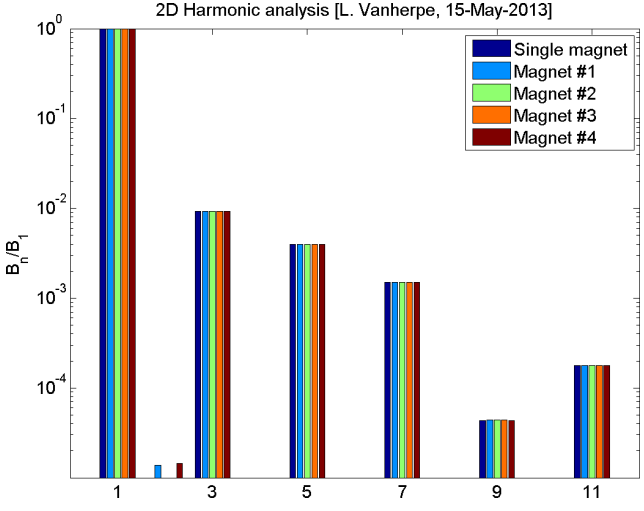
- Two-dimensional simulation results
- Assumption: distance between beam lines of 360 mm

Stack of four magnets

Both planes excited

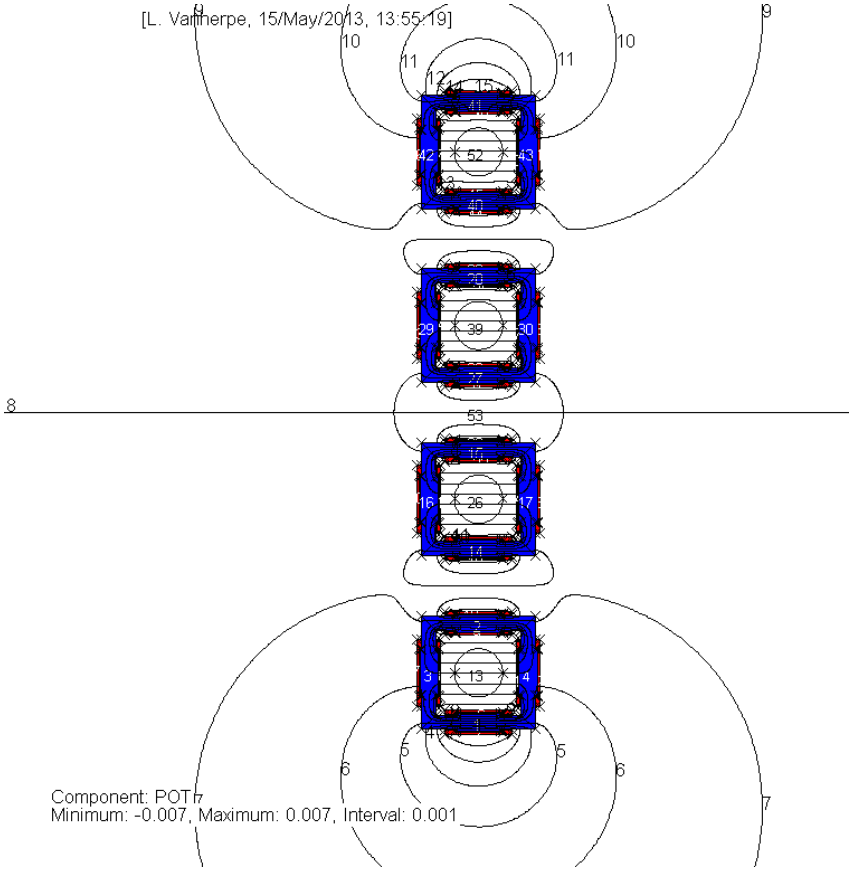


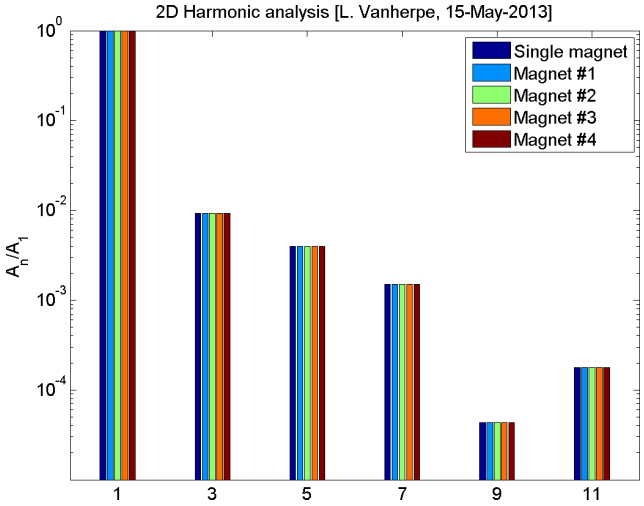




Stack of four magnets

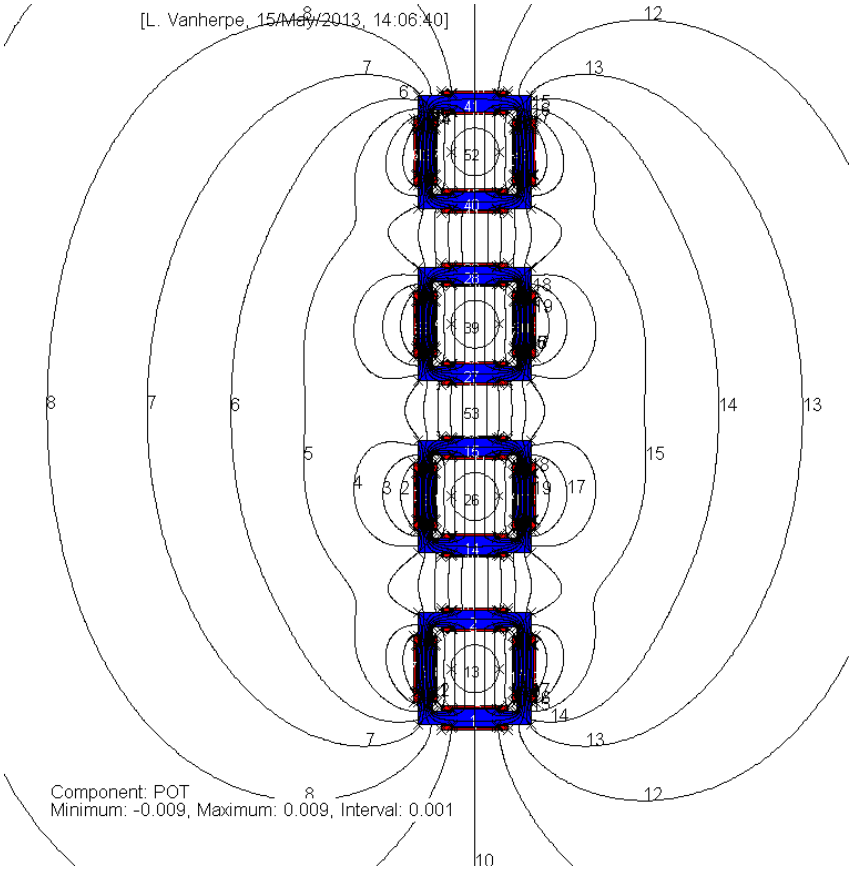
Vertical plane excited

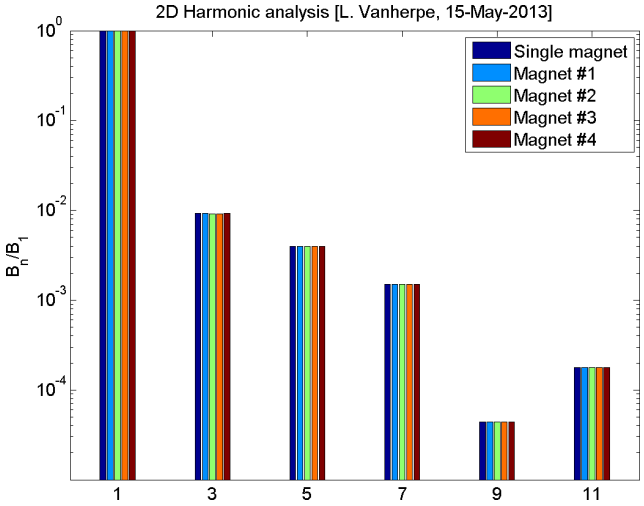




Stack of four magnets

Horizontal plane excited





Summary

- Magnetic design finished
  - Design report in work: EDMS 1277962
- Preliminary integration study performed (J.-M. Lacroix)

Action list

- Design report release
- Complete mechanical design $\leftrightarrow$ integration study
- ECR (A. Newborough)
- Technical specification
- Call for Tender and Procurement
- Delivery $\sim$ end of 2014