Where do we stay with the costing for ILD

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Really not much has been done at the ILD level
but we need first to let the two approaches converge more.
Working on items under strong evolution is waste of time

But the changes in the versions ILD1 or ILD2 imply some evolution of the cost

The optimisation, to be realistic, has to take the costs into account

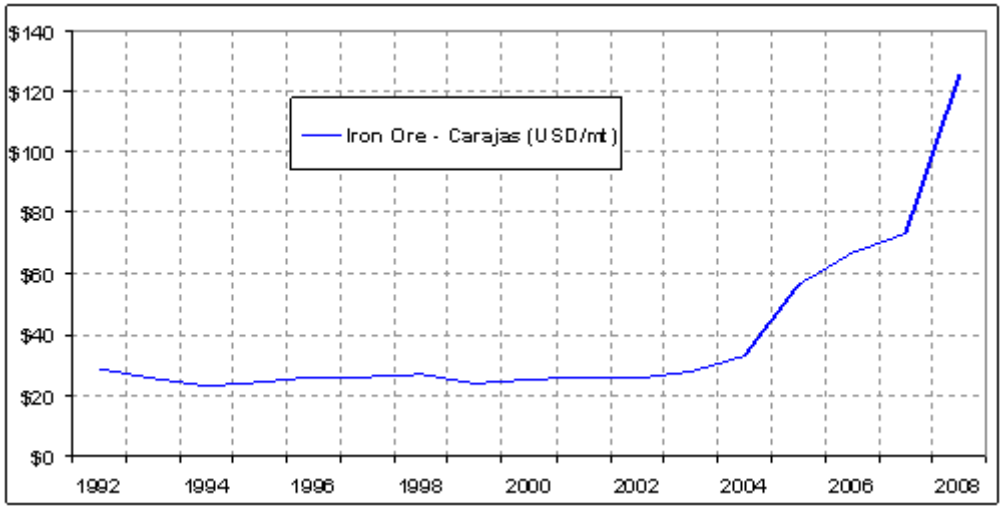
The evolution of the material costs in the coming 10 years
is not easy to anticipate

Here are some updates for ILD2.

Remembering that the driving costs are :
The magnet, coil and return yoke
The calorimeter, ECAL + HCAL

Evolution of the price for the iron ore.

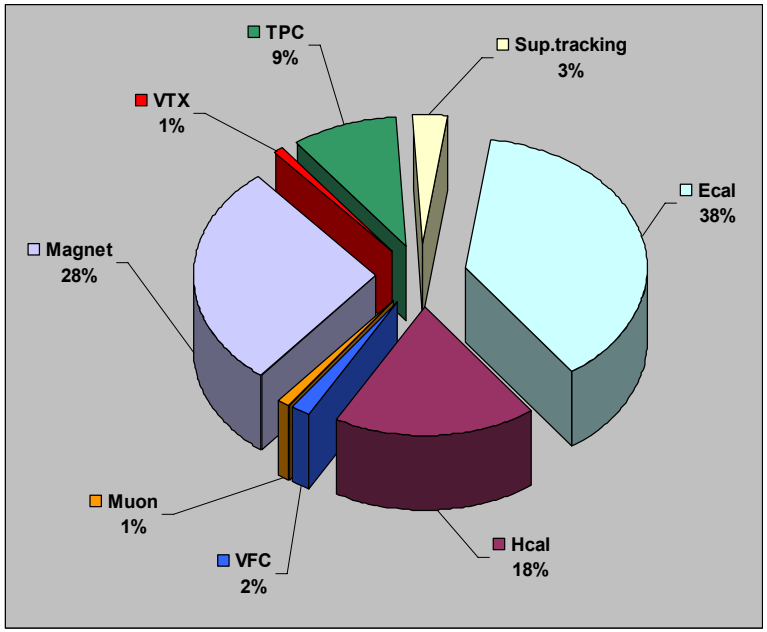
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008 (E)
Iron Ore Price (USD/mt)	25,01	26,06	25,45	27,7	32,76	56,18	66,85	73,2	125,17



But the cost of machining does not follow

The anticipated cost for the yoke iron was 3.6 €/Kg

LDC-V4 Cost estimation (nov 2006)

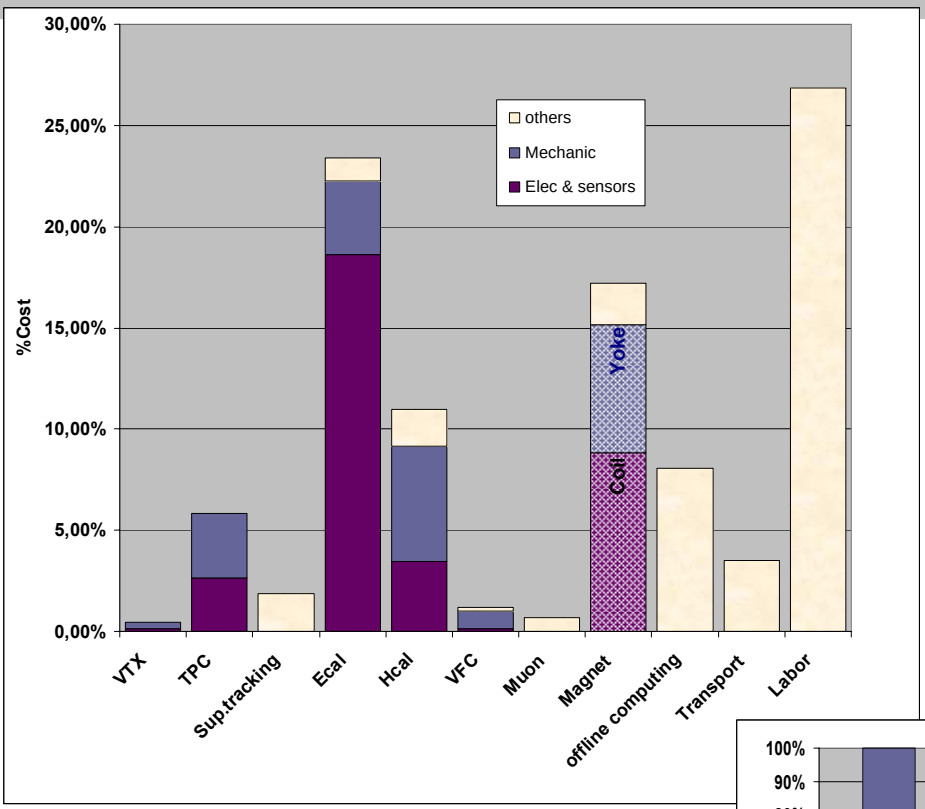


M&S	
VTX	1 700 000,00 €
TPC	21 661 500,00 €
Supp.tracking	6 900 000,00 €
Ecal	87 035 070,00 €
AnalogHcal	40 849 900,00 €
VFC	4 440 200,00 €
Muon	2 500 000,00 €
Magnet	64 000 000,00 €
total	229 086 670,00 €

Last version : ½ length of coil = 3.59 m and ½ length of detector =7 m :

Magnet	70 894 310,74 €

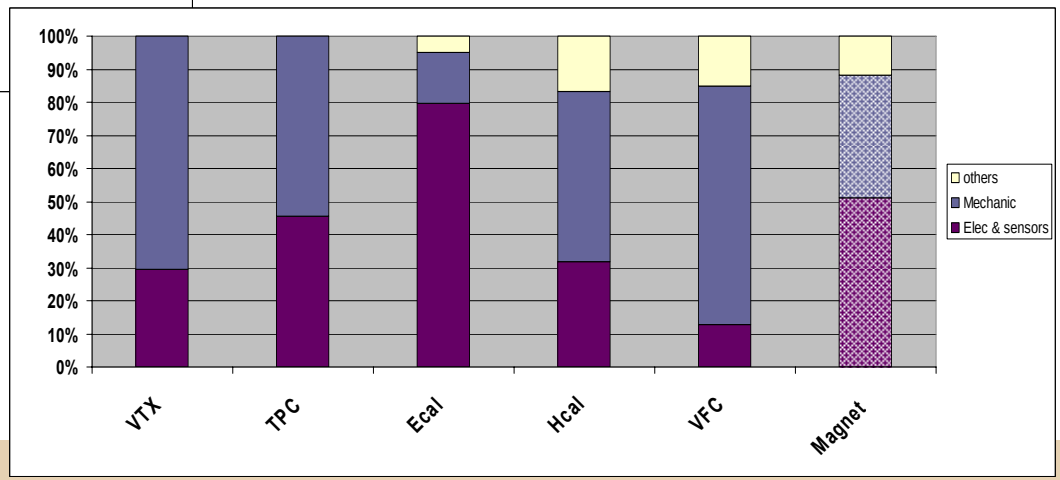
→ Increase of 10 % on magnet cost, then 3% on Total M&S



	Cost (€)	Cost (%)
VTX	1 700 000,00 €	0,5%
TPC	21 661 500,00 €	5,8%
Sup.tracking	6 900 000,00 €	1,9%
Ecal	87 035 070,00 €	23,4%
Hcal	40 849 900,00 €	11,0%
VFC	4 440 200,00 €	1,2%
Muon	2 500 000,00 €	0,7%
Magnet	64 000 000,00 €	17,2%
offline computing	30 000 000,00 €	8,1%
Transport	13 000 000,00 €	3,5%
Labor	100 000 000,00 €	26,9%
	372 086 670,00 €	

LDC V4

GLD, LDC and SiD were
Similar in total price ~500 M$



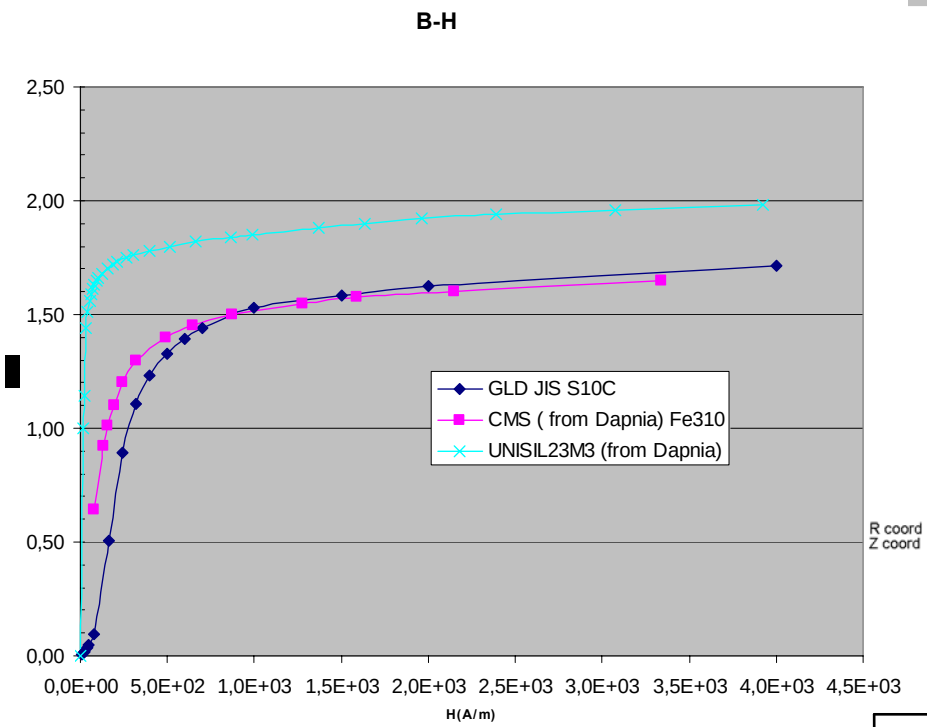
Where were the changes coming from?

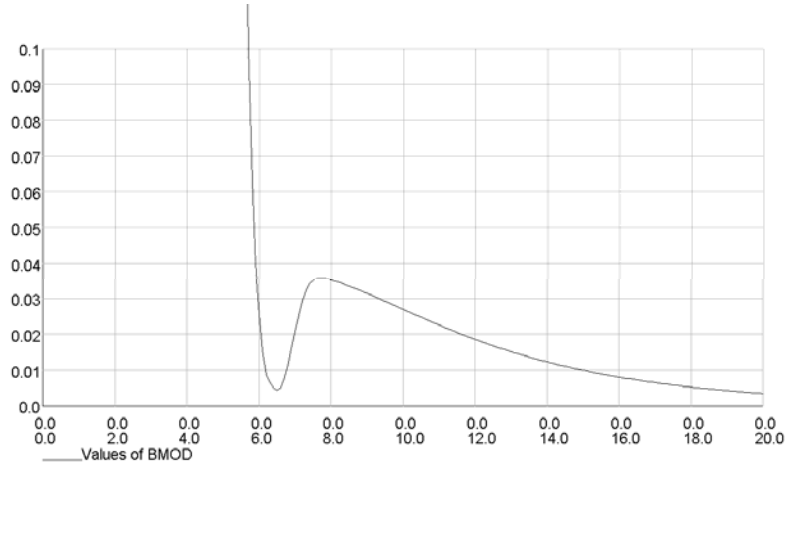
From the lengthening of the ECAL barrel for technical reasons,

from the lengthening of the coil related to the ECAL barrel
and to a shortening of the gap between coil cryostat and end cap
impact on TPC field quality,

from the lengthening of the yoke end caps (1m) due to stray field.

Stray field



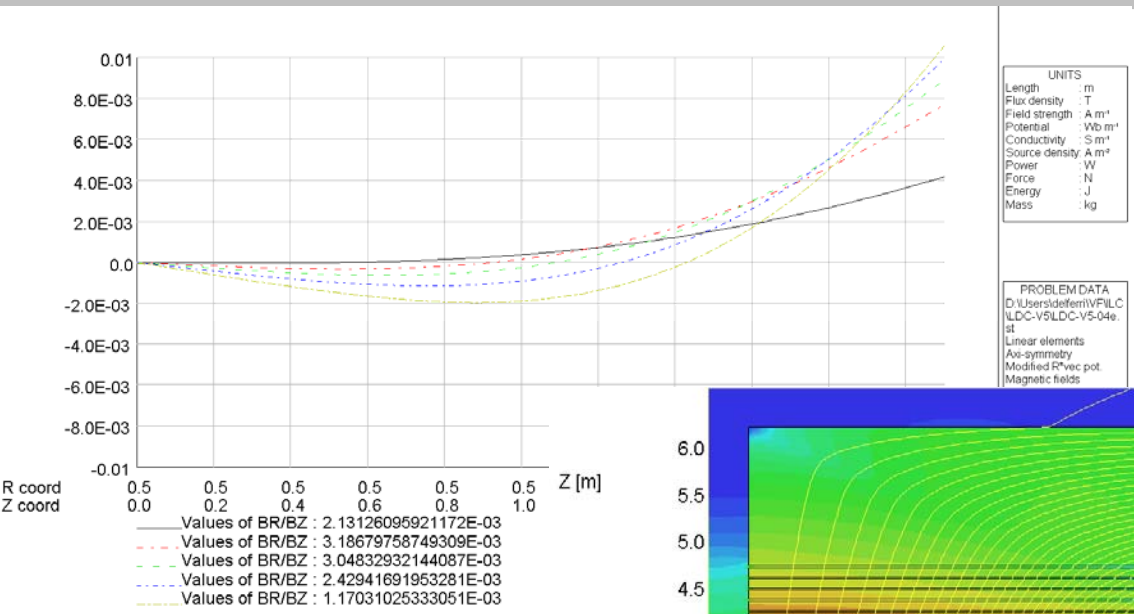


		B=4T		B=3.5T	
Rout Yoke (m)	Zout Yoke (m)	Stray field (G) at 7 m	Stray field (G) at 10m	Stray field (G) at 7 m	Stray field (G) at 10m
5.9	6	1200	400	**620**	**250**
7	7	150	90		
5.9	**7**	**360**	**270**		
7	6.3	1100	270		

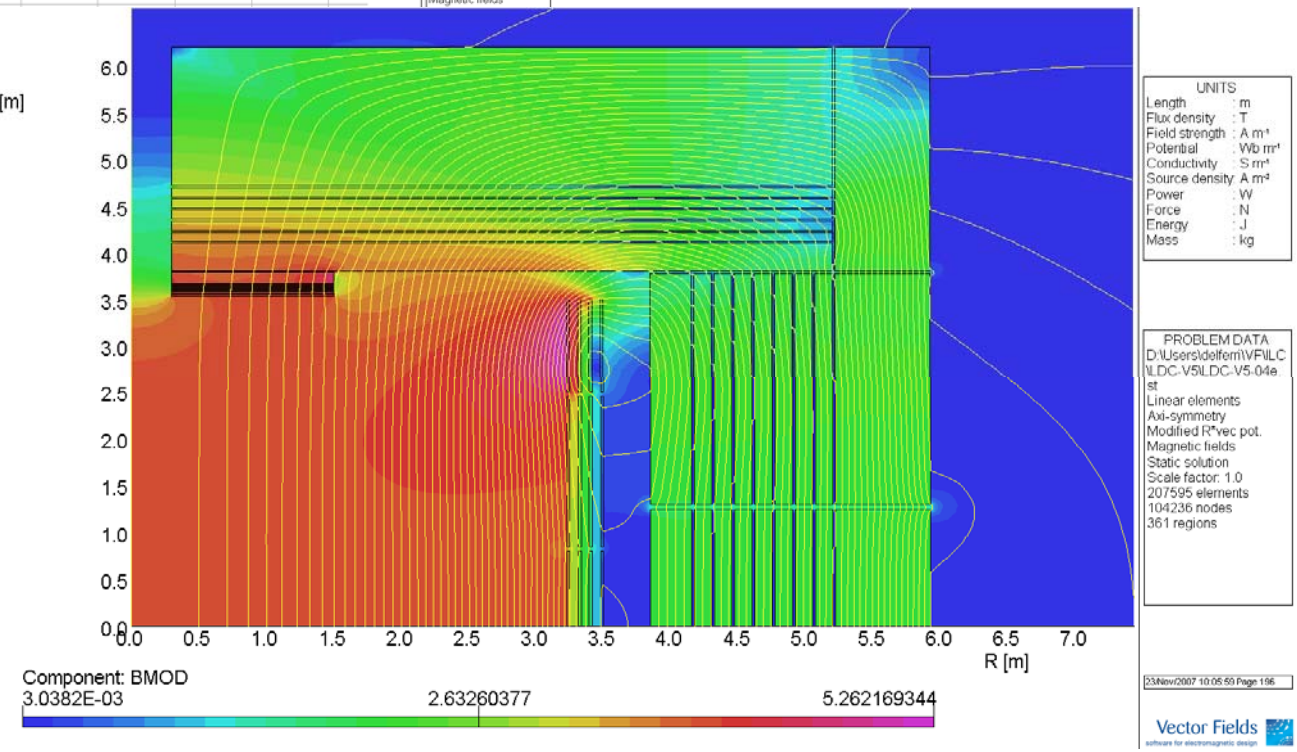
3OO adequate for equipments

O. Delferrière

TPC field, optimisation to be done



HCal endcap , magnetic plate = 200 mm



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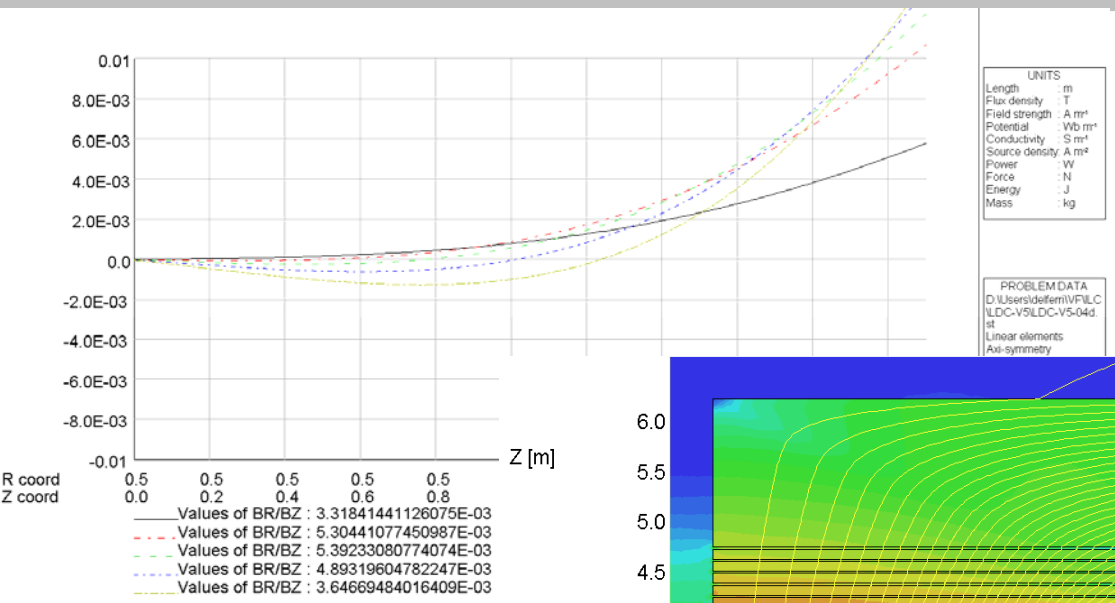
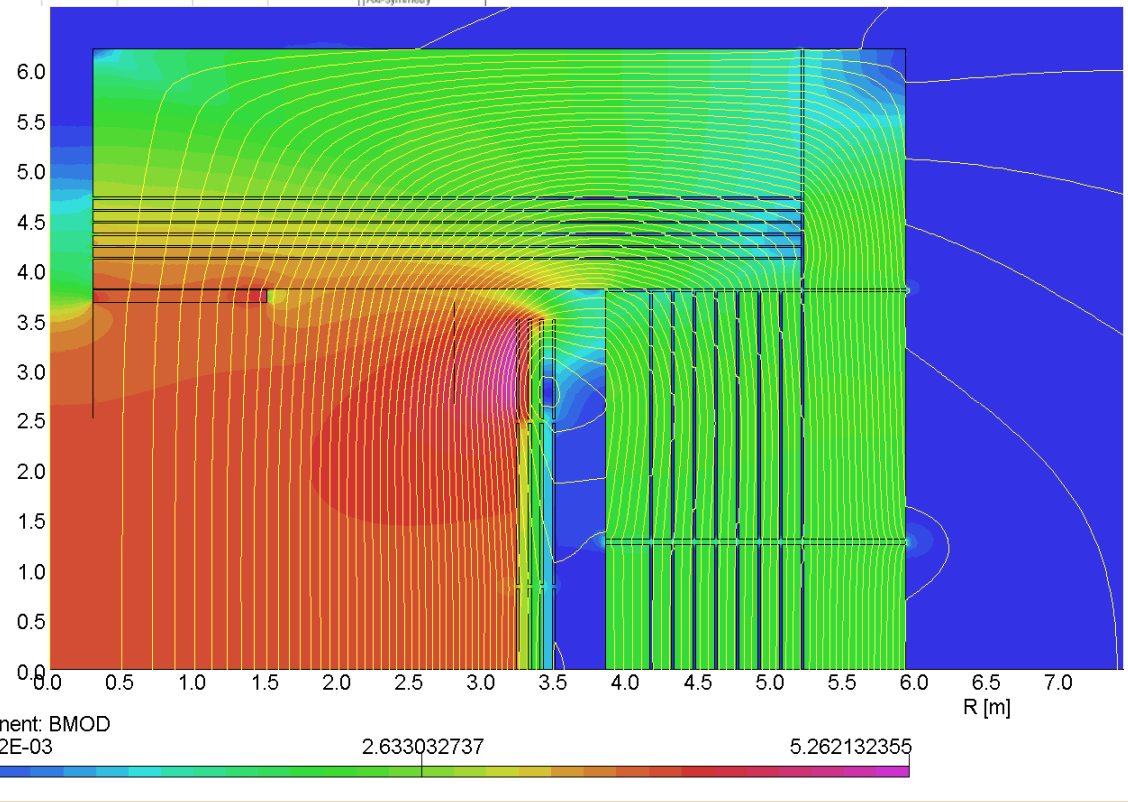


HCal endcap , magnetic plate = 100 mm



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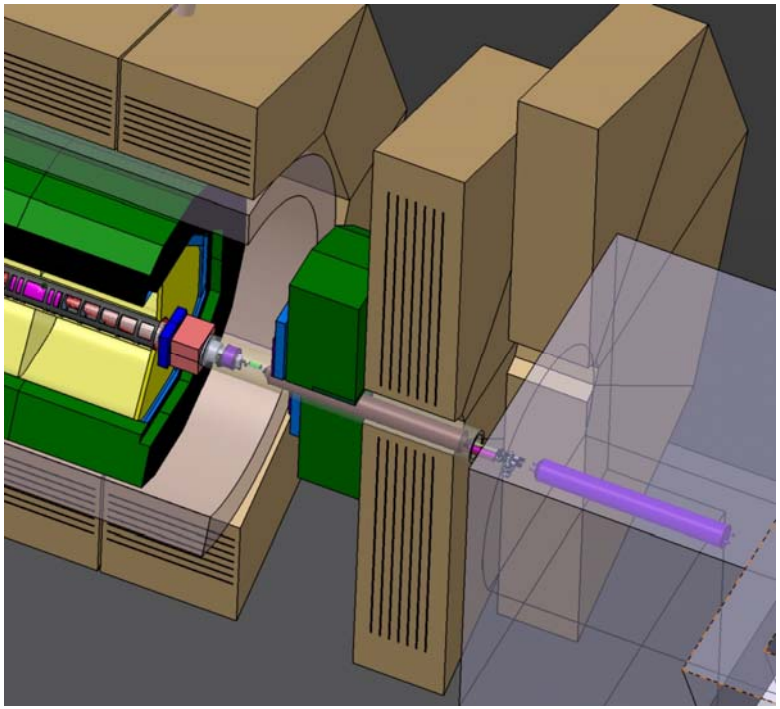
The impact of the stray field

LDC DOD version (12m) :

One endcap (Yoke + Calo)≈ 2000 t

LDC 14 m ≈ 2500 t



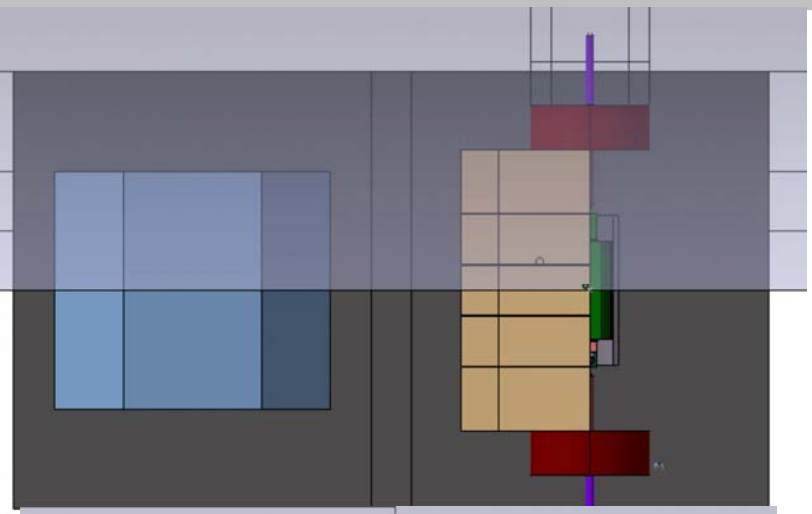
Endcap Yoke will have to be made of 2 rings

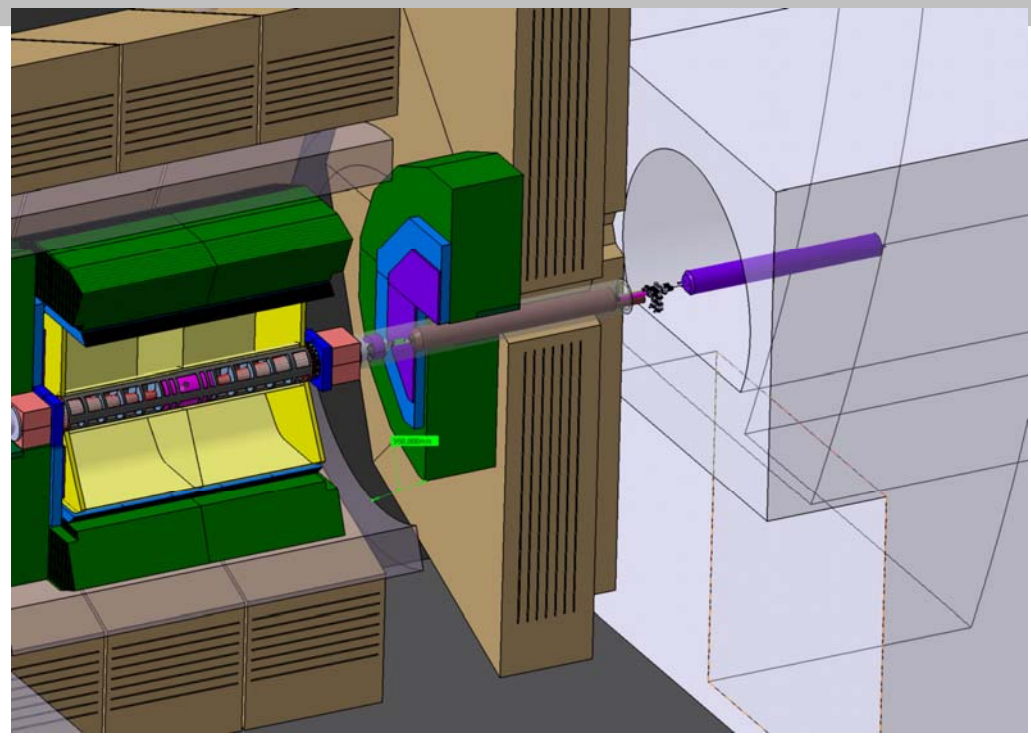
2nd Ring might be split in 2

Makes easier the opening on beam position

BUT because of clutter of the hall

the opening possibilities « on beam » will be limited





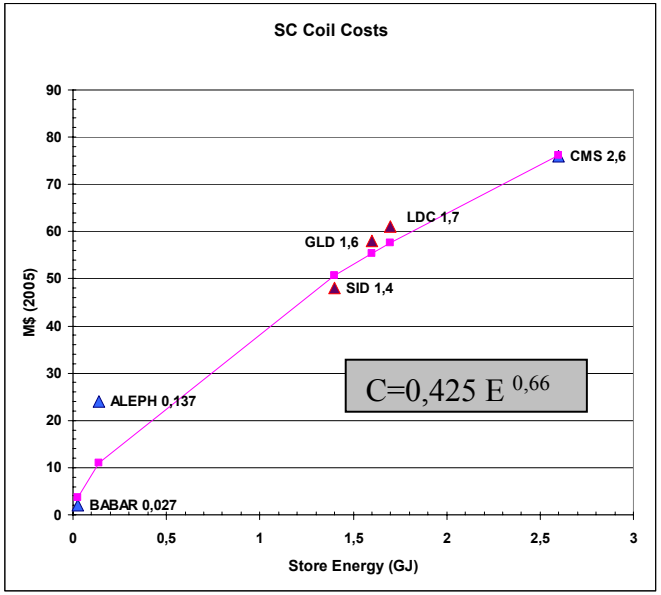
On Beam position, access to :

- All Forward detectors
- Endplates TPC
- Endcaps Calorimeters and Muons chambers
- Outer modules of calorimeters
- But the VDET !!!

Scaling laws

On the coil
on the magnet (yoke)
on the calorimeters
on LDC

- Coil Cost



The main parameters involved in the cost of the magnet are the
surface of the cryostat, S, and the stored energy, E, in the magnet. The formulas used for the calculations are the following:

- $S = 2\,\pi\,(1.1 \times R)\,L$ (1) Surface of the cryostat
- $V = \pi\,R^2\,L$ (2) Mean magnetized volume
- $E = V\,B^2 / 2\,\mu 0$ (3) Stored energy

Where:

- R is the mean radius of the solenoid
- L is the length of the solenoid
- B is the central induction in the solenoid
- $\mu 0 = 1.257$ 10-6 H/m

From the curve: $C=0{,}425\ E^{0{,}66}$ and with $tg(\alpha)=R/L$

$$C \propto Cst \times B^{1.32} R^{1.98} \ with\, Cst = 0.425\left(\pi / 2\mu 0 * tg(\alpha)\right)^{0.66}$$

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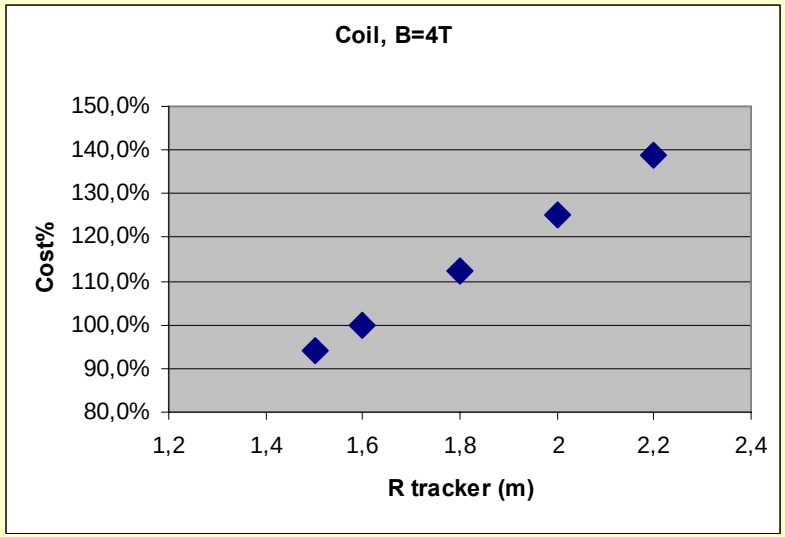
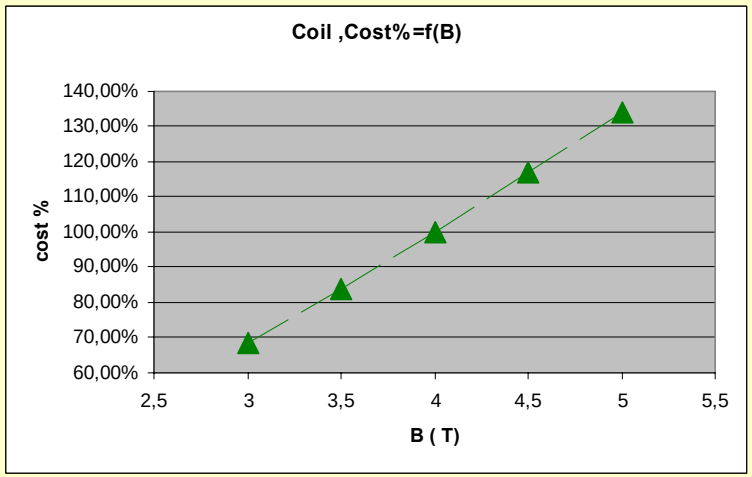


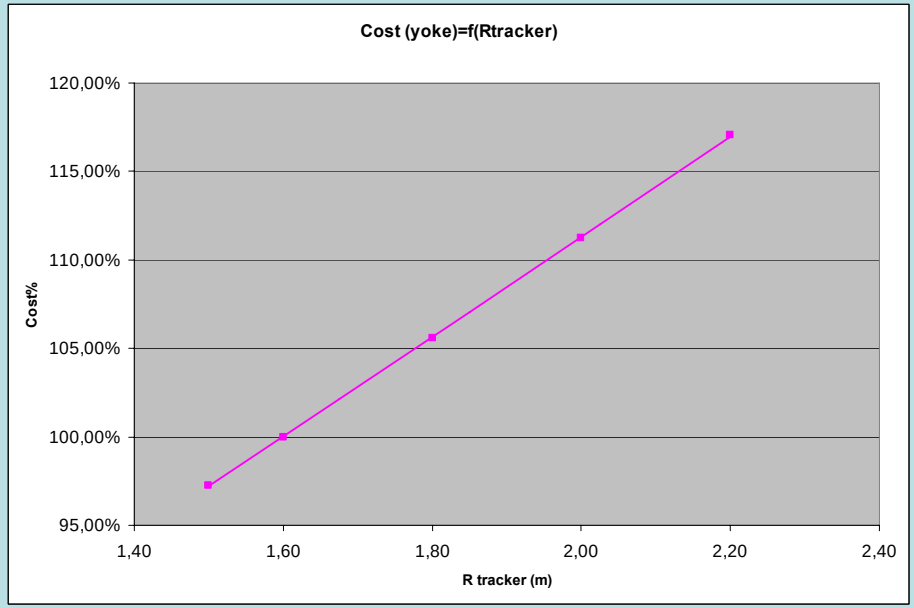


$$C \propto Cst \times B^{1.32} R^{1.98}$$

Coil cost is half of the total magnet price

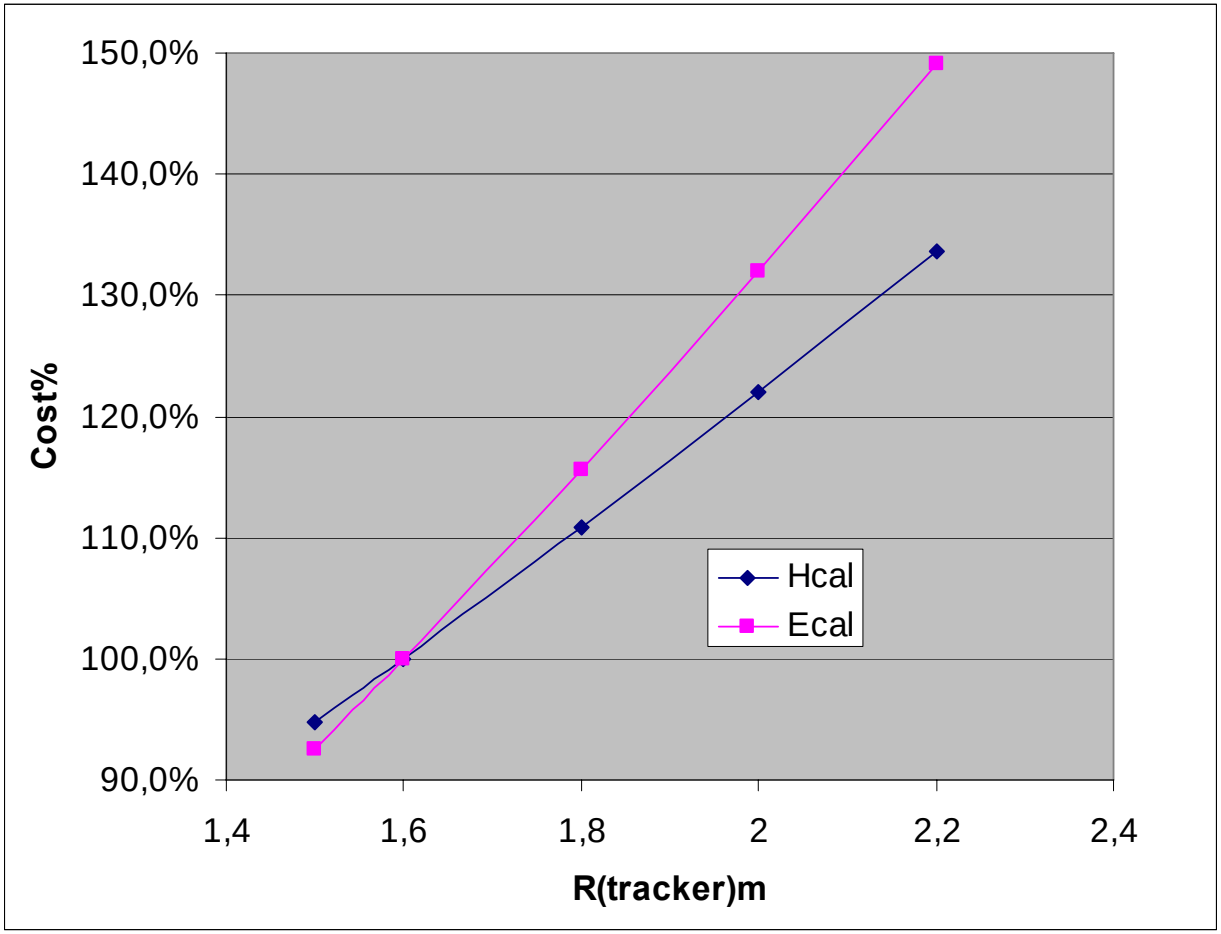
Yoke is 37% of total magnet price

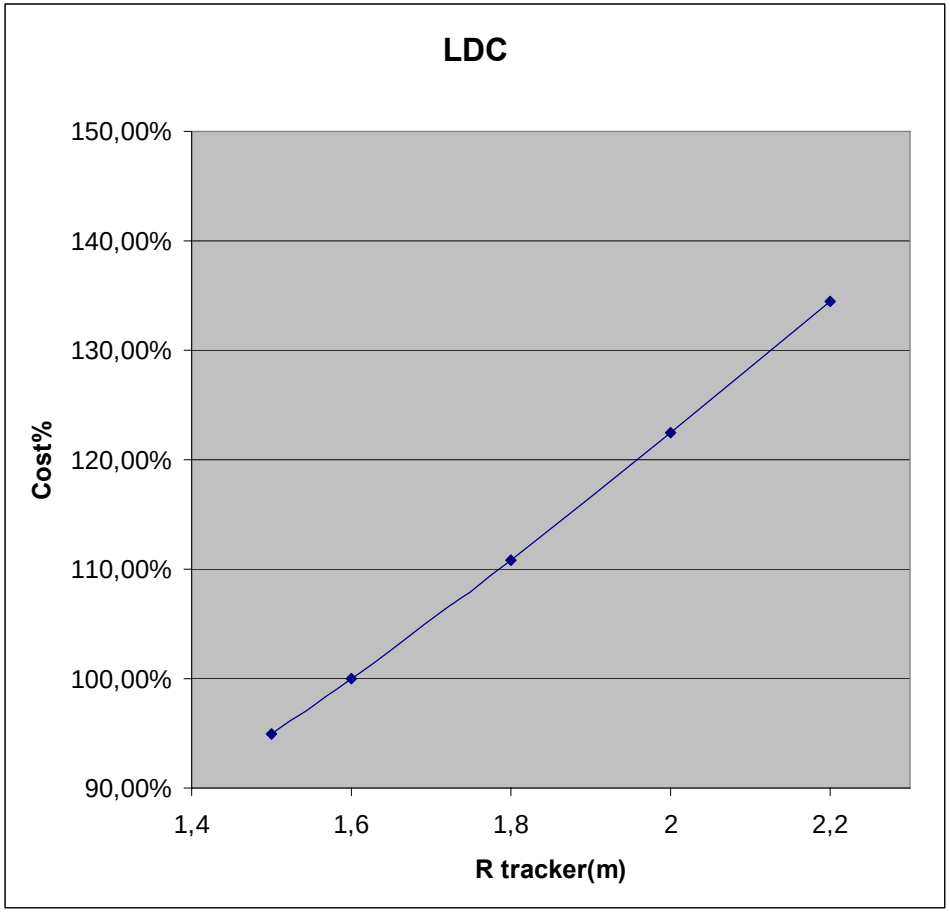
YOKE



Calorimeters

For a constant value of L





For given cost

- M&S,
- Transport (constant)
- Offline computing (constant)

But :

- Without manpower

As soon as the main parameters are settled

- a new evaluation has to be done in a cooperative way to get a more « accurate » value
- to evaluate the cost of the different options
- to make public the most important scaling laws with the parameters under optimisation

Is the exercize to be done for the LoI? YES!
Up to what point?