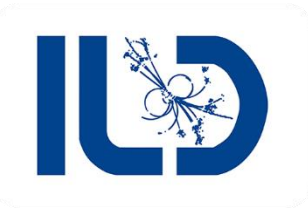


Costing for the IDR

Henri Videau
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CNRS/IN2P3 École polytechnique

IDR, the state of ILD or the elements for a comparison between small and large ILD models?



To this end a costing group exists capable of handling the problem except for the SET and beam tube and DAQ.

Part of the job has been done.
Some tables or even papers have been written

Henri Videau, Karsten Büsser as chairs

			Costing in €
Uwe Schneekloth, Christophe Berriaud	magnet (coil and yoke)	note written	
Valeri Saveliev	iron instrumentation	?	
Felix Sefkow,	AHCAL	?	
Imad Laktineh	SDHCal	?	
Henri Videau,	SiECal	tables	
Tohru Takeshita	ScECal	?	
Paul Colas, Ron Settles	TPC	?	
Auguste Besson	Vdet, SIT	note presented at the integration meeting	
Marcel Vos	FTD	?	
Yan Benhammou, Wolfgang Lohmann	Forward calorimetry	tables for LumiCal, BeamCal, LHCal	

Each sub-detector should use 3 minutes to convince us that something will come in time for the IDR

Even if after the 7th of March

Those who have done could spend 5 minutes to summarize their results, if they are present.



Detailed re-estimation of the magnet cost from formulas and CMS detailed expenditures (same source as DBD)

Large model

	TDR 2013 [MILCU]	TDR 2013 [M€ 2018]	Estimation [M€ 2018]
Magnet system	131	99	88
4.1 Coil		19,4	29,4
4.1.1 Conductor and winding operation	12,9	9,8	18,5
4.1.2 Internal cryogenics and suspension	1	0,8	3,7
4.1.3 Suspension system	0,56	0,4	0,3
4.1.4 Internal instrumentation		0,0	0,9
4.1.5 Tooling, assembling	10	7,6	5,4
4.1.6 Qualification and partial testing	1,1	0,8	0,6
4.2 Yoke and vacuum tank		70,3	48,4
4.2.1 Yoke steel incl. Works & vacuum tank	80,4	60,9	39,6
4.2.2 Support	1,7	1,3	1,2
4.2.3 Moving system	3,5	2,7	2,6
4.2.4 Assembly	6,7	5,1	4,8
4.2.5 Photogrammetry & survey	0,5	0,4	0,3
4.3 Ancillaries for coil		9,5	10,6
4.3.1 Cryogenics and vacuum	6,8	5,2	6,5
4.3.2 Electrical power circuits	1,7	1,3	0,9
4.3.3 Control and safety systems	0,35	0,3	0,6
4.3.4 Engineering (transport to cavern)	2,2	1,7	2,1
4.3.5 Integration in cavern	0,93	0,7	0,3
4.3.7 Field mapping	0,56	0,4	0,3

[M€ 2018]	Complete coil	Complete magnet
ILD TDR estimation	31	99
ILD estimation formulae	47	100
2018 cost estimation	50	88

For the complete magnet, ILD TDR and Green estimation are in a good agreement by mere chance! The Green's formula underestimated the iron cost as the ILD field shielding quality required is very high. ILD TDR estimation has removed the institute manpower that is at the same level as the iron extra cost. Our estimation without the manpower and margin is about 10% lower.

Both estimations are done without the manpower of the institutes (98-9.4 M€).



Magnet system



For the small model no time could be allocated by Christophe before a certain date for a real study.
Yoke estimate from the iron mass 12754t at the price elaborated for the large 3€/kg, (38262)
Not a dramatic change. *More important a choice on the acceptable stray field.*

Coil using a formula (à la Hervé) from the magnetic stored energy and the inner area: $S = L^2 \pi R$
But we had chosen for the large that the 3.5T field coil should be designed to go up to 4.
Should it for the small go to 4.5? What are the implications?

The cost should also be derived from the Japanese studies

Choices



Iron instrumentation



Valeri Saveliev for 6.5 MILCU in the DBD



Felix Sefkow 3' for 44.9 MILCU in the DBD

AHCAL



AHCAL cost update

- Revised the unit costs:
- SiPM stays at 1 € (CMS plans for 2-3 €, for 5% of our order size)
- The scintillator cost is confirmed at 0.02 € per tile (Danilov)
- The ASIC channel cost stays at 0.30 € (de La Taille)
- The PCB cost went down, simplification thanks to thinner BGA package for ASIC
- Naked HBU 140 €, assembled 223 €, or 1720 € / m²
- Anyway, should use same cost per / m² as for SDHCAL, or less, since AHCAL has 10x fewer channels and thus fewer PCB layers, and no extra complication
- There is no news on the other items
- The AHCAL cost estimate from the TDR is still valid
- No cost optimisation yet
- Possibilities for cost reduction at very moderate performance impact exist in granularity of rear layers and absorber plate thickness

Felix Sefkow, 24.2.2019 10:49

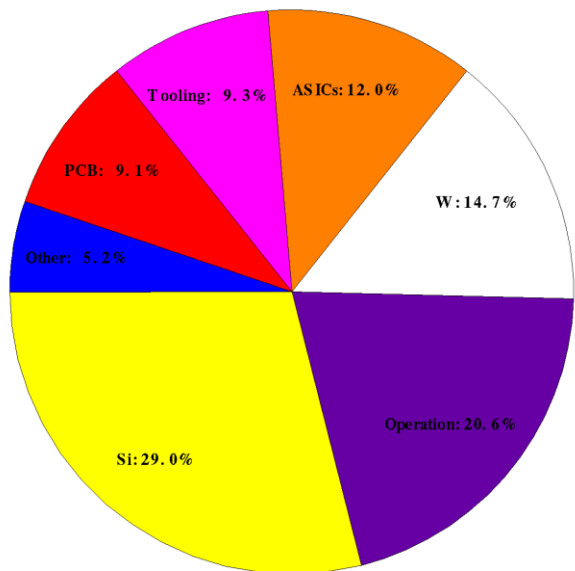
LMR



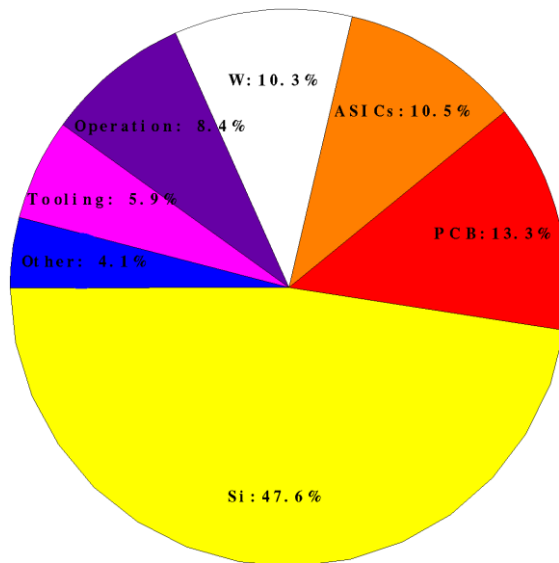
sDHCAL



Imad Laktineh 3' for 44.8 MILCU in the DBD



Small model, 26 layers, last
 About 90-95 M€
 6M€ of in house MY included
 Almost complete costing



DBD model
 About 150 MILCU
 No man power

Small model 90-96
 No man power
 To be revised

Large model
 110-118M€
 No manpower
 To be revised

Not at the end

Should I make it for a large model with 26 layers?
 It has to be checked by competent people and scrutinized by the Ecal group.



The Sc-ECal



Tohru Takeshita 3' for 74. + MILCU in the DBD

LMR



TPC



3' for Paul or Ron for a TPC at 35.9 MILCU



5' for Auguste but he presented already at the integration meeting and wrote a note!

Detector	Cost	Sensors	Mechanics	Eletronics	Services	Installation	Total
VXD	Material	1152	452	486	770	100	2960
	Manpower	100	500	400	250	200	1450
	TOTAL (kEUR)	1252	952	886	1020	300	4410
SIT	Material	3820	760	1275	1580	110	7545
	Manpower	200	500	800	300	200	2000
	TOTAL (kEUR)	4020	1260	2075	1880	310	9545

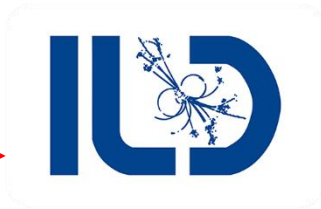
Table 6: VXD and SIT cost estimate summary

DBD without manpower in MILCU: Vertex 3.4
SIT + Forward 2.3
SET 21

LMR



FTD



3' for Marcel to tell us about FTD's embedded in Si tracking for DBD 2.3 MILCU



FCals estimated by FCal collaboration



BeamCal				LumiCal				LHCaI			
	number	price	total		number	price	total		number	price	total
Mechanics				Mechanics				Mechanics			
tungsten plates	140	3000	420000	tungsten plates	140	3000	420000	tungsten plates (totalW 5.6 t)	60	15000	900000
support frames	3	20000	60000	support frames	3	15000	45000	support frames	3	20000	60000
temperature stabilisation	2	15000	30000	temperature stabilisation	2	15000	30000	temperature stabilisation	2	15000	30000
sensor support structures	140	1000	140000	sensor support structures	140	1000	140000				
				Connectivity				Connectivity			
				fan out Kapton HV			45000	fan out Kapton HV			70000
				fan out Kapton, signal			45000	fan out Kapton signal			70000
GaAs sensors	900	1000	900000	Silicon sensors	800	2000	1600000	Silicon sensors	60	20000	1200000
				Laser positioning system							
				laser	2	10000	20000				
				sensors	20	1000	20000				
				mirrors and frames	20	1500	30000				
Front-end ASICs				Front-end ASICs				Front-end ASICs			
prototyping	50	1000	50000	prototyping	50	1000	50000	Kpix chips	150	1300	195000
chips	3500	30	105000	chips	3500	60	210000	probecard for tests	1	20000	20000
probecard for tests	1	20000	20000	probecard for tests	1	20000	20000				
front-end electronics				front-end electronics				front-end electronics			
PCB and assembly	350	70	24500	PCB and assembly	750	70	52500	PCB and assembly	350	70	24500
bonding			40000	bonding			50000	bonding			20000
components			30000	components			50000	components			10000
Power supplies				Power supplies				Power supplies			
HV	5	4000	20000	HV			50000	HV	5	4000	20000
LV	5	4000	20000	LV			50000	LV	5	4000	20000
cables, connectors and patch-panels			40000	cables and connectors, patch panels			70000	cables, connectors and patch panels			40000
Data acquisition				Data acquisition				Data acquisition			
Receiver cards	350	300	105000	Receiver cards	750	300	225000	Receiver cards	350	300	105000
crates	50	1000	50000	crates	50	1000	50000	crates	50	1000	50000
crate computer	50	1000	50000	crate computer	50	1000	50000	crate computer	50	1000	50000
racks	1	2000	2000	racks	1	2000	2000	racks	1	2000	2000
PCs	5	2000	10000	PCs	5	2000	10000	PCs	5	2000	10000
Tooling				Tooling				Tooling			
			30000				30000				30000
Sum			2146500	Sum			3364500	Sum			2926500
			2,15M€				3,36M€				2,93M€
Engineering Personpower				Engineering Personpower				Engineering Personpower			
			2 FTEyears				2 FTEyears				2 FTEyears

BeamCal 2.15M€
 LumiCal 3.36 M€
 LHCaI 2.93 M€
 Total 8.44M€
 6MY
 TDR 8.1 MILCU



Would there be a better place to spend the money saved on size?

The end for today

Start writing the IDR for costing by collecting the parts
then (if?) holding a cost dedicated meeting to understand and bless the results