1st-order Cost Estimates of LHeC Detector

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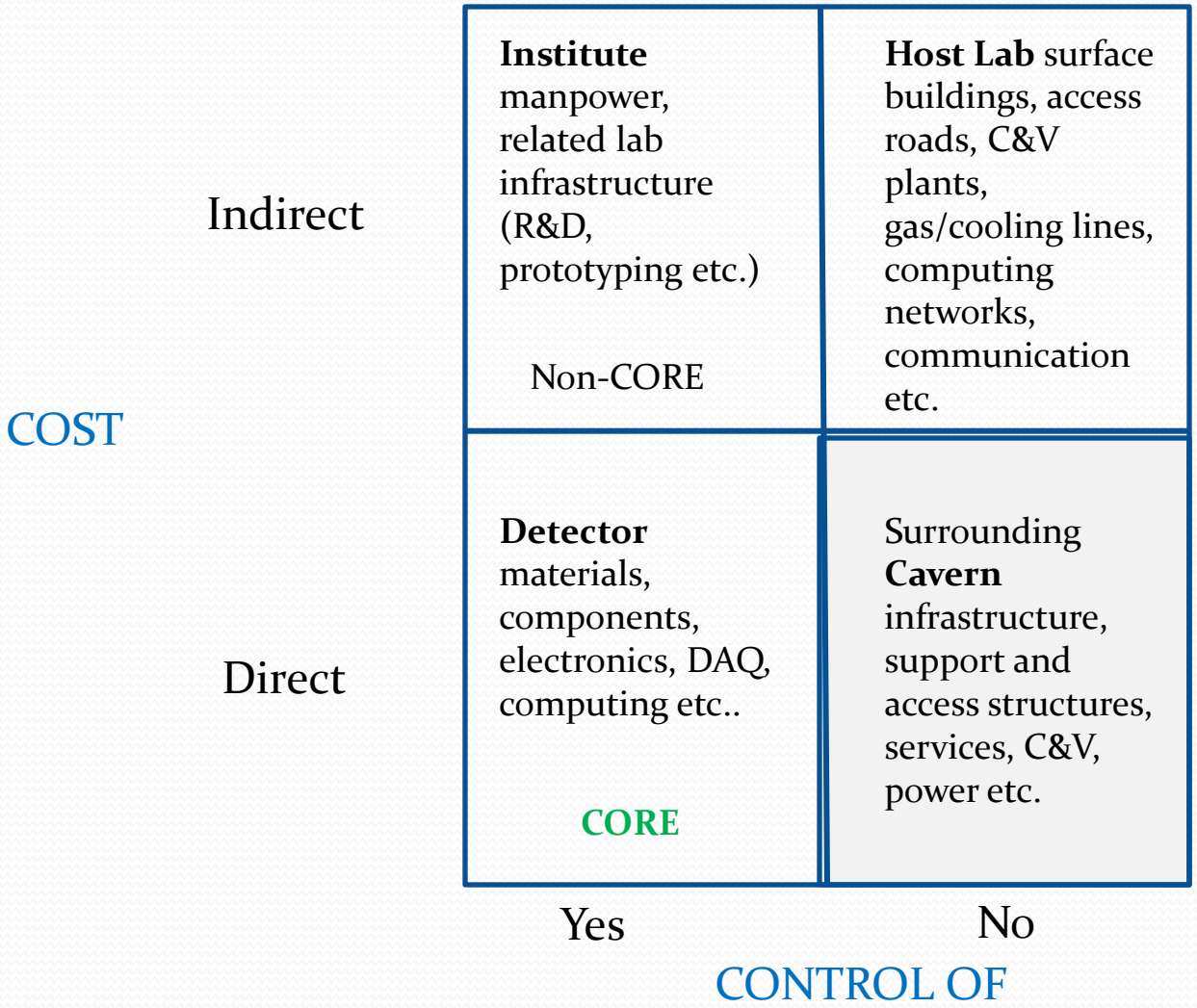
Which Costs to Include?



Basis of the Cost Estimates

- The LHeC detector cost estimates are based on the so-called **CORE** methodology used in the LHC Experiments
- The point of reference used here is ATLAS (CORE: 475 MCHF, final cost 540 MCHF)
- CORE items include: materials, 0-scale prototyping, direct production costs, assembly & integration paid to firms… - ie. costs that Project Mgmt should be able to control
- CORE does not include: institute manpower, institute infrastructure, R&D, spares (in general), currency fluctuations, VAT, Host Lab responsibilities (not always well defined)

Basic Assumptions Used

- ATLAS CORE-numbers scale linearly (downwards)
  - Total sub-system CORE = 3-4 x Sensor costs
  - Sensor costs unchanged since ATLAS construction …
    - … but cost updates reflected in error margins
    - … and that granularity/#channels scale with ATLAS
      - for example: SCT strips were 25 CHF/cm2, today ~ 50% less
  - TDAQ ~ 20% of the (total) detector costs
  - Magnet (solenoid) costs follow "A. Herve's equation"
  - Infrastructure ~ 10% of the detector+magnet cost
    - Note: Infrastructure costs depend much on the overlap with Host Lab responsibilities (not always clearly defined)

LHeC CORE (MCHF, 2011 prices)

Sub-system		R(inn) cm	R(out) cm	A (m2)	Length (m)	V (m3)	W (tn)	Power (kW)	Unit cost	Cost (M) (sensor)	Error (M)	Scaling-f	Total cost	Total error
Tracker														
	CST			16.2					0.25	4.1		3	12	6
	CPT			2.8					0.5	1.4		10	14	7
	CFT			3.6					0.25	0.9		3	3	1
	CBT			3.6					0.25	0.9		3	3	1
	FST			6.6					0.25	1.7		3	5	2
	BST			4.0					0.25	1.0		3	3	2
	Total			36.8						**9.9**	**5.0**		**40**	**20**
Calorimeter														
LAr	EMC				6.6	11	128		0.03	3.8	0.38	4	15.3	1.53
LAr	FEC1/2				0.8	0.3	6		0.03	0.2	0.02	4	0.7	0.07
LAr	BEC1/2				0.8	0.3	3		0.03	0.1	0.01	4	0.4	0.04
Tile	FHC1/2/3				5.3	4	32		0.002	0.1	0.03	3	0.2	0.10
Tile	FHC/4/HAC/BHC/4				9.5	121	921		0.002	1.8	0.9	3	5.5	2.76
Tile	BHC1/2/3				5.3	3	21		0.002	0.0	0.0	3	0.1	0.06
	Total				10.1	140	1111			**6.1**	**1.4**		**22**	**5**
Muons			450	1187	14				0.001	1.2	0.1	4	**4.7**	**0.5**
Sub-total 1													**67**	**25**
TDAQ									20%				**13**	**1**
Solenoid													11	3
Cryogenics								2	1.4				3	1
SC Quadrupole													1	0.5
Calorimeter cryostat														
Sub-total 2													**95**	**31**
Infrastructure									10%				9	5
Total													**104**	**36**

Summary

- LHeC 1st-order cost estimates based on ATLAS-CORE numbers, with an error bar reflecting current costs
  - 104 +/- 36 MCHF
- It is assumed ATLAS-numbers scale downwards
- Solenoid costs follow the "A. Herve-equation"
  - … which is also consistent with the experimental observation that magnet system ~ 25% of the total (CORE) cost