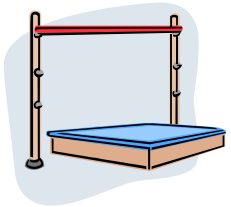
EUROnu Costing

Status Update

Outline

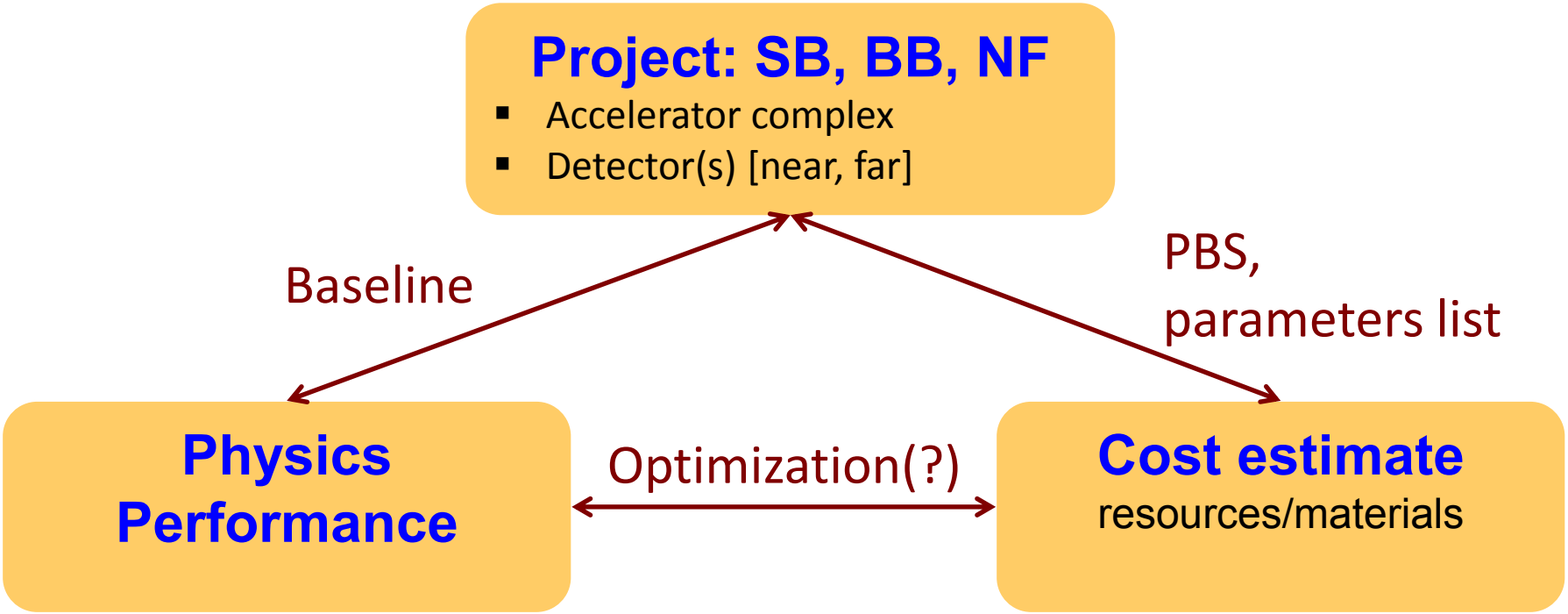
- General remarks - reminder
- Progress since last Annual Meeting – June 2010
- Next steps - timeline



Ilias Efthymiopoulos – CERN
P. Bonnal, J. De Junghe, B. Daudin
EUROnu costing panel

General remarks - reminder

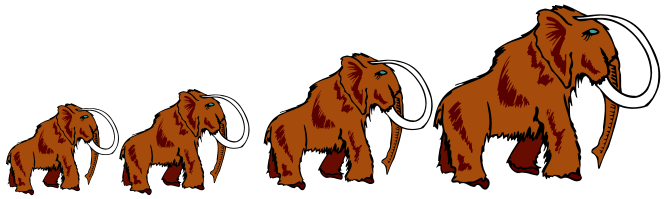
- The **cost estimate** of the proposed facilities is a deliverable of the EUROnu project



- Consistency throughout the document is the key issue!

General remarks - reminder

- Getting a complete costing for the facility would be rather challenging
  - Collective effort, needs engineers not only physicists!
- We should present an **objective** cost estimate, i.e. what we estimate with today's knowledge will be needed to build the facilities
  - do not hide complications or unknowns → **risk register**
  - demonstrate to possible funding agencies that a certain level of maturity in matters of costing is achieved
- Apply confidentiality to the cost figures until the costing exercise is completed
- Must establish a **budget control** to monitor the cost of the project if changes to the baseline are made
  - Any cost increase must be justified
  - Technical solutions should involve cost considerations



Progress since last Annual Meeting

- Presentation and discussion in the IDS-NF meeting @RAL – September'10
  - Costing section in IDS-NF IDR included; explain the adopted methodology leaving he numbers for the final document
  - Work on PBS for NF
- Work on the CERN costing tool to adopt it in our needs
  - Handling of options and parallel PBSs or sections of PBSs
  - Excel interface for massive data input
- Costing documents available
  - **Guidelines** for doing the costing – focused on NF, will be adopted to BB & SB
  - **Excel** template
  - **Assumption Data Sheet**

⇨Available (next week) in EUROnu WG1 web

EUROnu costing – **Documents**

International Design Study for the Neutrino Factory

Guidelines for Costing

P. Bonnal, I. Efthymiopoulos — v1. 0, November 8,2010

Abstract

The Intermediate Design Report (IDR) of the project of a Neutrino Factory is expected to be released in early 2010 together with a Cost Estimate; So the Reference Design Report (RDR) in a few years time. In order to present economical figures that are consistent throughout the projects, a common cost estimating approach is required. The present guidelines aim at proposing an approach, in line with generally agreed practices in matter of project economics, to be followed by all members of the IDS-NS initiative. These guidelines also give tricks for using efficiently CERN's Project Costing Tool to be use for estimating this project.

Cost estimating at a glance

Four approaches

There are four approaches for estimating the cost of a project:

- **Intuitive approaches**, i.e. rules-of-thumb, the less accurate!
- **Global approaches** (a.k.a. analogical or top-down)
- **Modular approaches** (a.k.a. parametric approaches)
- **Detailed approaches** (a.k.a. analytical or bottom-up) that are the most accurate.

The four approaches are listed according to their level of accuracy. When possible, detailed approaches are preferred.

Global and modular approaches

Several research have been conducted showing that the cost of a new facility/system/equipment can be derived from the actual cost a larger or smaller one in size following a function a.k.a. the **Chilton law**:

$$\left(\frac{\text{Cost}}{\text{Cost}_{ref}}\right)=\left(\frac{\text{Size}}{\text{Size}_{ref}}\right)^{\chi} \quad \text{i.e} \quad \text{Cost}=\text{Cost}_{ref}\times\left(\frac{\text{Size}}{\text{Size}_{ref}}\right)^{\chi}$$

According to the facility/system/equipment, the size can be a weight, a volume, a surface, a length...

Where χ is a coefficient comprised between 0.3 and 0.7.

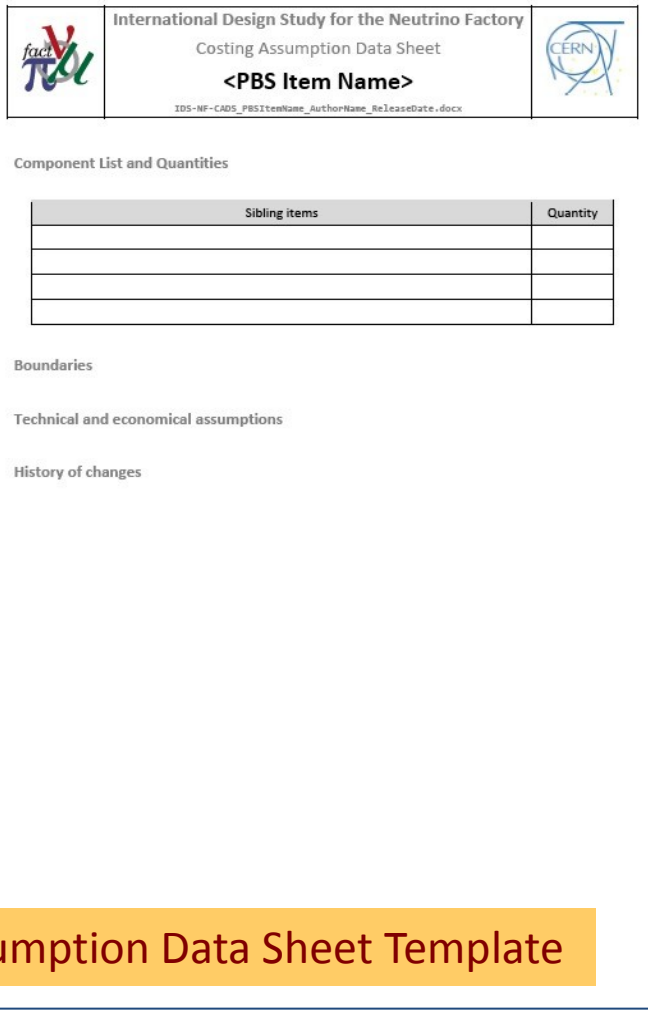
E.g. Cost of a cryogenics refrigerator[1]: $\text{Cost}_{[\text{MCHF}'1998]} = 2.2 \times \left(\text{Capacity}_{[\text{kW@4.5K}]}\right)^{0.6}$

Modular approaches suppose that the facility/system/equipment is described by means of sizing parameters, and the cost results from the aggregation of these parameters in a function:

$\text{Cost} = f(p_1, p_2, \cdots, p_n)$

...s the CLIC case." *EUROnu Costing Workshop*, CERN, 15-16 March 2010.

Guideline document



International Design Study for the Neutrino Factory

Costing Assumption Data Sheet

<PBS Item Name>

IDS-NF-CADS_PBSItemName_AuthorName_ReleaseDate.docx

Component List and Quantities

Sibling items	Quantity

Boundaries

Technical and economical assumptions

History of changes

Assumption Data Sheet Template

EUROnu costing – **Documents**

	LEVEL	CODE			LABEL						
		WU_ID		WU_TYPE	LABEL						
		WU_ID	RA_ID	RA_TYPE	LABEL	PV	UNIT	YEAR	LOCATION		
		WU_ID	DE_ID	DE_TYPE	LABEL	QTY	UNIT	YEAR		Responsible	
5	0	NF			**Neutrino Factory**						
6	1	NF.1a			**Proton driver - CERN**					Jurgen Posimski, ICL	Juergen Pozimski <j.pozimski@imperial.ac.uk>
7	2	NF.1.1			Ion source						
8	—	0001	—	I	**Industrialisation and Tendering**						
9	—	0001	1	MC	Material Costs	0.00	kCHF	2010	CH		
10	—	0001	2	LT	Manpower Technician	0.00	PersonYear	—	CH		
11	—	0001	3	LE	Manpower Engineer	0.00	PersonYear	—	CH		
12	—	0001	1	SP	Start of industrialisation	—	—	0			
13	—	0001	2	FP	Contract awarded	—	—	0			
14	—	0002	—	P	**Procurement (i.e. component manufacturing)**						
15	—	0002	1	MC	Fixed Costs (≠ quantity)	0.00	kCHF	2010	CH		
16	—	0002	2	MC	Proportional Costs (f(quantity))	0.00	kCHF	2010	CH		
17	—	0002	3	LT	Manpower Technician	0.00	PersonYear	—	CH		
18	—	0002	4	LE	Manpower Engineer	0.00	PersonYear	—	CH		
19	—	0002	1	SP	Start of procurement	—	—	0			
20	—	0002	2	FP	Last component delivered	1.00	U	0			
21	—	0003	—	P	**Reception (i.e. construction, installation and commissioing)**						
22	—	0003	1	MC	Fixed Costs (≠ quantity)	0.00	kCHF	2010	CH		
23	—	0003	2	MC	Proportional Costs (f(quantity))	0.00	kCHF	2010	CH		
24	—	0003	3	LT	Manpower Technician	0.00	PersonYear	—	CH		
25	—	0003	4	LE	Manpower Engineer	0.00	PersonYear	—	CH		
26	—	0003	1	SP	Start of consctruction/installation	—	—	0			
27	—	0003	2	FP	End of reception/commissioning	1.00	U	0			
28	2	NF.1.2			RFQ						

Excel Template

EUROnu costing – **Documents**

7	wbs	0	NF			Neutrino Factory					
8	wbs	1	NF.1a			Proton driver - CERN					
9	wbs	2	NF.1.1			Ion source					
10	wu	—	0001	—	I	Industrialisation and Tendering					
16	wu	—	0002	—	P	Procurement (i.e. component manufacturing)					
23	wu	—	0003	—	P	Reception (i.e. construction, installation and commissioing)					
24	ra	—	0003	1	MC	Fixed Costs (≠ quantity)	0.00	kCHF	2010	CH	
25	ra	—	0003	2	MC	Proportional Costs (f(quantity))	0.00	kCHF	2010	CH	
26	ra	—	0003	3	LT	Manpower Technician	0.00	PersonYear	—	CH	
27	ra	—	0003	4	LE	Manpower Engineer	0.00	PersonYear	—	CH	
28	de	—	0003	1	SP	Start of consctruction/installation	—	—	0		
29	de	—	0003	2	FP	End of reception/commissioning	1.00	U	0		

counter

WBS identifier

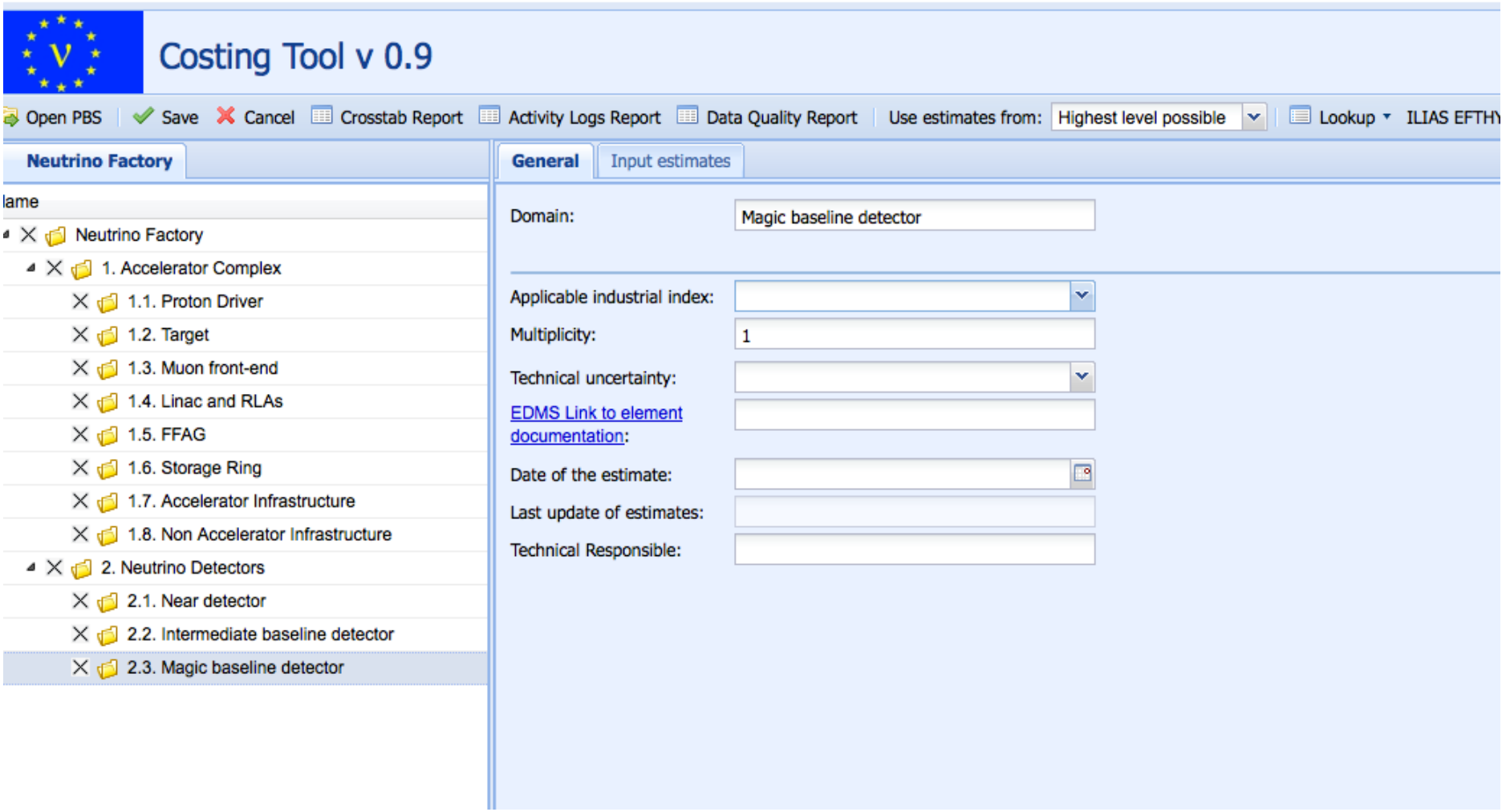
automatically calculated

line idendifier: each line has different content as defined in the gray filled table on top
- wbs :

Type:
- **MC** : material (fixed or proportional)
- **LT, LE** : labour (technician or engineer)
- **SP** : start of an activity
- **FP** : end of an activity. For the case of procurement defines the number (multiplicity) of components to be purchased or delivered. The proportional costs will be multiplied by that number!

Excel Template Help page

EUROnu costing – **Costing Tool**



EUROnu costing – **Methodology**

- Establish the **Project Breakdown Structure**
  - Describes the components of the baseline: sub-systems, sub-sub-systems etc.
  - Use excel template file → load it to the Costing Tool
  - Start with the baseline, leave options for later
- For each of them, identify activities to perform – **Work Breakdown Structure**
  - Include **Engineering activities**
    - EMC studies, radiation hardness of equipment, accelerator & detector physics optimization, safety/environment engineering, risk analysis, commissioning, ramping-up, etc.
    - Apply a global approach if not explicitly studied : +40% on material cost
  - Do not include **operation costs** or **dismantling costs**
- Try to evaluate costs associated to these activities, by all means
  - Follow the proposed **common rules**
- Identify the **Cost Focal Points**
  - those responsible at the syb-system level to collect the cost information and maintain it in the costing tool → members of the Costing Panel

EUROnu costing – **Methodology**

- At (sub-)system level
  - If **analytical approach** possible:
    - Detailed design + tendering + contracting / Manufacturing design + tooling procurement
    - Raw material + manufacturing costs / Quality control + logistic
    - Installation + pre-commissioning
  - If not possible: **global approach**.

- Create an **Assumption Data Sheet**
  - Sourcing of the data/figures:
    - Derived from previous projects
    - Derived from analytical tool such as DFM/A…
    - Quotes from manufacturers
  - Monetary figure + currency + date + location
    - E.g. 5 M US$ of 1997 ; Illinois USA
      300 k CHF of 2007 ; Geneva CH

- Economical/financial factors taken care within the costing tool:
  - location, FX, price escalation…

EUROnu costing – **Methodology**

- Options : justify options in the project based on
  - Expected improvements in technology
  - Performance improvement that justifies the study
  - Possible cost reduction

- Cost aggregation by blended sub-system cost estimates
  - And choice or options

- Risk register where no technical solution i available

$$S = P \times C$$

P \ C	.05	.1	.2	.4	.8
.9	.05	.09	.18	.36	.72
.7	.04	.07	.14	.28	.56
.5	.03	.05	.10	.20	.40
.3	.02	.03	.06	.12	.24
.1	.01	.01	.02	.04	.08

Accept Cancel Mitigate Transfer

EUROnu costing – **Next steps**

Costing panel

- reps from each WP as cost contact persons
- Include the **CFP** frm each sub-system
- EUROnu MB
- **Tasks:**
  - Trained to use the costing tool
  - Responsible for collecting information and cost update in the tool

Costing workshop

- Training
- Decide on costing strategy

June'10: EURONU annual meeting

- Costing session
- Review WBS

~~**Nov/Dec 2010**~~

March 2011 ????

2nd Costing workshop

- Complete WBS
- First global cost evaluation

March 2011

IDS/NF Interim Design Report

Dec 2011

Cost review workshop

- Review of cost estimates for each facility in view of the final report

CERN support

Project Office support: costing tool, consultancy, access to information and possibly experts

And then ……