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Strategy and Scenarios for Deferrals in ALICE

Introduction

In document CERN-RRB-2002-042, presented to the RRB in April 2002, ALICE has identified a total shortfall of 6,887 kCHF which are needed to complete, commission, integrate and install the experiment ('Cost-to-Completion', CtC). Of this total amount, 2,848 kCHF are identified as CtC of the individual detector subsystems, 875 kCHF are needed for additional racks and the remainder (3,165 kCHF) consists of common costs.

The Collaboration has proposed to cover some 295 kCHF of the common costs by extending the membership fee of 5 kCHF per institute per year by one year into 2006.

After discussion at the April RRB, and in line with the practice in other LHC experiments, a part of the Cost-to-Completion are referred to as Commissioning and Integration (C&I) cost. The ALICE C&I costs have been submitted to and evaluated by the C&I Scrutiny Group. These C&I costs are part of the total Cost-to-Completion for ALICE, which remains at 6,887 kCHF.

Funding of the Cost-to-Completion

ALICE has proposed (CERN-RRB-2002-042) a sharing of the CtC, which is reproduced in Table 1 below. The Table indicates, per funding agency, the amount requested, the amount currently agreed, and, if applicable and without commitment, the amount of additional funds which in the future might become available.

Funding Agency	***Requested***	***Agreed***	***Possible +***
CERN (Si Pixel, Strip)	825	825	
CERN	525	525	
Czech Republic	52	10	+42
Denmark	103	103	
Finland	77	77	
France CEA	172	150	+22
France IN2P3	846	650	+196
Germany BMBF[3)]	679	679	
Germany GSI[3)]	389	389	
Hungary	32	32	
Italy	1,378	1,378	
Netherlands	147	147	
Norway	117	117	
Poland[1)]	53	0	53
Slovak Republic	51	30	+21
Sweden	199	199	
Switzerland[2)]	14	0	
United Kingdom[1)]	69	0	69
Armenia	11	11	
China NSFC[1)]	125	0	125
Croatia[1)]	17	0	17
India	276	165	+111
JINR[3)]	206	95	
Mexico	6	6	
Romania[1)]	23	0	23
Russia	394	24	
Ukraine	82	82	
United States	19	15	
Total	***6,887***	***5,709***	***679***

Table 1: Sharing of Cost to Completion (kCHF).

1) Contribution not yet known **2)** Switzerland left the Collaboration **3)** C&I (including racks) only

Discussions with Funding Agencies have been very encouraging, and ALICE acknowledges gratefully the generous help and tremendous efforts made by the FA's to address the funding shortfall. However, in particular as for some FA's the total amount of additional funding available still has some margin of uncertainty, CERN has asked ALICE to prepare a contingency plan for the case where up to 1.2 MCHF would be missing.

Strategy and deferral scenarios

General approach

Unlike for pp operation, the LHC is expected to reach rather quickly its design luminosity with heavy ion beams. Therefore ALICE is conceived as a single stage detector and has no later stage 'high luminosity' components which would be natural targets for possible deferral.

Given that ALICE went already through some cost optimisation process in preparation for the MoU (leading e.g. to significant reductions in the PHOS and ITS detectors) and during the CtC evaluation (reducing the preliminary CtC estimate presented to the RRB in October 2001 by 2 MCHF), and given the advanced state of production of most systems, the options concerning the various subdetectors turn out to be rather limited and/or very damaging to the physics capabilities. We therefore had to concentrate on items which are still in an early phase of production.

In this note 'deferrals' are referred to as a mechanism to redirect the funding to the completion costs of highest-priority and time-critical items from components that could eventually be added at a later stage. These actions, if necessary, would ensure timely construction and installation of the most vital components, albeit inevitably at the cost of initially strongly reduced physics performance.

Additional funding possibilities

Currently the secured additional funding reaches some 5.7 MCHF, leaving a shortfall of 1.2 MCHF. However, some funding agencies, which currently are not in a position to guarantee the full amount, have indicated the possibility that further funds might become available to cover their share as indicated in Table 1. In this case the shortfall could be reduced to well below 1 MCHF.

The ALICE CtC contains 200 kCHF for the T0 and FMD detectors, resulting from the withdrawal of all Greek institutes in early 2002. As instructed by the RRB, discussions are currently under way to see if part of the Athens group, which has expressed an interest to remain in ALICE, would be funded by Greece to continue participation in these forward detectors at the required level of 200 kCHF, reducing the shortfall correspondingly.

Contingency plans to address a potential shortfall of up to 1.2 MCHF

PHOS: up to **440 kCHF**

While the production of crystals for the electromagnetic calorimeter PHOS is well under way, the other components (electronics, readout, mechanics) are at an earlier stage. In addition, PHOS is comparatively easy to access and install and therefore could eventually be restored to its currently foreseen size.

Therefore ALICE considers deferring up to one of the five PHOS modules (up to 20% of the area). However, only about 440 kCHF (< 5% of the PHOS cost) of funds could be redirected to cover other CtC items. This reduction in acceptance would lead to a moderate deterioration of the main physics goal (measuring direct photons and neutral mesons), as it would reduce the statistical accuracy at high p_T in proportion to the area (i.e. by 20%) and would raise the threshold of low p_T mesons by some 50% (from 500 MeV to about 800 MeV for the eta meson).

DAQ: up to **1,100 kCHF**

ALICE currently already plans to deploy its Data Acquisition system (DAQ) in several stages with full capacity foreseen only for the 2nd heavy ion run, i.e. by end 2008. Reducing the DAQ capacity to about 60% of the original aim would reduce the cost by about 18%, i.e. 1.1 MSF. While some of the rare signals with low trigger rate (e.g. Ypsilon suppression) could be largely protected, others like the hadronic charm measurement would suffer a loss in statistics directly in proportion to the DAQ capacity and would most likely require longer running time, spread over several years.