Contents

List of Figures

List of Tables

Chapter 1

Introduction

This document sets out the organisation, cost estimate and time schedule of the ALICE Muon Chambers (MCH) Detector, Muon Identifier Detector (MID), the Fast Interaction Trigger Detector (FIT) Upgrade, the common read-out ASIC SAMPA and the common read-out (CRU) Projects as described in the TDR (CERN-LHCC-2013-019, April 15, 2014).

Within the ALICE upgrade program two common hardware developments are pursued. The SAMPA detector read-out ASIC will be used by the MCH and the Time Projection Chamber (TPC). The common read-out unit (CRU) is a hardware read-out platform used TPC, MCH, MID, Inner Tracking System (ITS), Zero Degree Calorimeter (ZDC) and Transition radiation detector (TRD).

Chapter 1 describes the MCH, chapter 2 the MID, chapter 3 the SAMPA ASIC, chapter 4 the CRU and chapter 5 the FIT. All chapters are organised in a similar manner where section 2 lists the participating institutes and shows the organisational chart for the management of the corresponding Upgrade Project. Section 3 provides explanations and justifications of cost estimates for the main cost items. The work breakdown structure (WBS) of the Upgrade projects is explained in detail in section 4, starting with an overview of all cost items and a responsibility chart for the allocation of funding. Then, for each level 1 cost item, details of the cost estimates are given in summary tables together with explanations of the underlying basis for estimates. Section 5 describes the resource loaded schedule and section 6 deals with the manpower requirements necessary for the execution of the corresponding upgrade projects. An evaluation of the most relevant project risks is given in section 7.

Chapter 2

Muon Chambers - MCH

2.1 Project Organisation

The MCH Project Leader (PL) heads the Muon Chamber Project. He/she is assisted by the MCH Deputy Project Leader (DPL) and the MCH Technical Coordinator (TC). The MCH PL, DPL and TC are all members of the ALICE Technical Board and thus can assure the coherence of this project within the ALICE experiment in general. Issues of a financial, managerial and organizational nature are discussed and decided by the MCH Institute Board. This board also endorses technical matters recommended by the MCH Technical Board (see below) and proposed by the MCH Project Leader or Deputy Project Leader. All Institutes participating in the MCH Upgrade Project, shown in Tab. 2.1, are represented by their Team Leader in the Institute Board. The Project Leader, Deputy Project Leader and Technical Coordinator are ex-officio members of the Institute Board.

As shown in Fig. 2.1, the MCH Upgrade Project is organised into xx Work Packages. The Work Package Coordinators are nominated by the Project Leader and endorsed by the MCH Institute Board. They are members of the MCH Coordination Board. The Project Leader, Deputy Project leader and Technical Coordinator are ex-officio members of the ITS Coordination Board. Other scientists with dedicated technical expertise are also nominated "ad personam" by the PL to be members of the MCH Coordination Board.

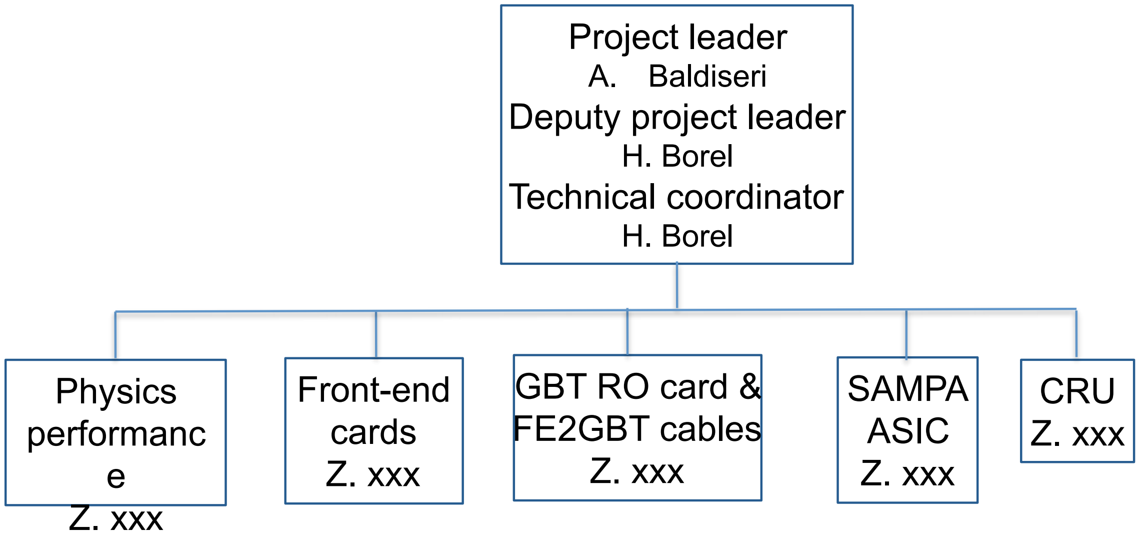

Figure 2.1: The MCH Coordination board.

Country	City	Institute
France	Eurodisney	Walt Disney
Austria	Nordpol	Christmas

Table 2.1: Institutes participating in the MCH Upgrade Project.

2.2 Budget Explanation and Justification

This chapter addresses important design choices and their possible impact on the project cost and schedule.

2.2.1 GBT Read-out card and existing infrastructure

In order to minimise the overall upgrade effort on development and cost the MCH upgrade design is designed to reuse the existing chamber design including the infrastructure such as data transmission via printed circuit boards and data cables, cooling, mechanics and power supply systems. These considerations have been taken into account for the front-end electronics data interface, power consumption and the the on-detector read-out architecture. As a result the front-end cards are designed to be compatible with the existing infrastructure. The MCH read-out architecture follows the ALICE common approach shared with a majority of upgraded detectors. The standardised front-end links use the versatile link and GBT components. This optical and electrical, redaction tolerant serial transmission link set is developed by the CERN Electronics Design Group and is targeted are and the off-detector read-out

2.2.2 Front-end cards & SAMPA

The presently used front-end ASIC is inappropriate for the upgrade operation conditions due to the increased interaction rate. The same situation applies for the ALICE TPC front-end electronics. In order to reduce the overall effort the MCH and TPC projects develop a common read-out ASIC, called SAMPA. The differences in specifications, such as the different signal polarity and dynamic range are taken into account by the implementation of programmable parameters in the ASIC. For the MCH application the SAMPA specifications on noise or data bandwidth provide a comfortable margin.

2.2.3 Common Read-out Unit

The MCH detector upgrade design has adopted the ALICE common read-out architecture, which standardised the front-end links with versatile link and GBT components and offers common read-out units (CRU) to multiplex the data and provide a connection to the ALICE standard link to the online systems (DDL3) and the standardised timing and trigger distribution link (TTS). This approach reduces the overall development by benefiting from centralised versatile link component developments and the development of the common read-out unit used by a large number of upgraded ALICE detectors.

2.3 Cost Chart

Table **??** shows the Work Breakdown Structure (WBS) chart for MCH Upgrade Project. The tasks of the WBS have been broken down in xx level 1 subgroups

Activity	Material Cost	Manpower Cost	Total Cost/item
1. Front-end cards	**x**	**x**	**xx**
1.1. Design & Prototyping	x	x	xx
1.1. Qualification	x	x	xx
1.2. Production	x	x	xx
1.2. Test	x	x	xx
1.2. Installation	x	x	xx
2. SAMPA ASIC	**x**	**x**	**xx**
3. GBT Read-out Cards	**x**	**x**	**xx**
3.1. Qualification	x	x	xx
3.2. Production	x	x	xx
3.2. Test	x	x	xx
3.2. Installation	x	x	xx

Table 2.2: Cost breakdown structure of the ALICE MCH upgrade, divided into material cost and cost for externally hired manpower.

Table 2.3: Exchange rates used in the cost estimates.

1 EUR	1.23 CHF
1 USD	0.9 CHF

referring to either main detector subcomponents or to the most essential parts and services foreseen to be installed in the MCH.

Cost estimates are provided for each level 2 task and are understood as to be CORE costs, including detector components and production costs, as well as industrial or outsourced manpower for production, but not costs for personnel and basic infrastructures of the participating institutes. In addition, costs for R&D are not included in the estimate. The aforementioned cost for outsourced manpower has been estimated with 100 kCHF per man year (220 working days). All estimates based on offers or quotes in foreign currency have been converted into Swiss francs using the exchange rates of February 2014 (cf. Table 3.3).

More detailed information on the cost estimate for the level 1 items are given in the following sections. The expected spending profile, based on the detailed cost estimates and the project planning, is shown in Fig. **??**. Figures **??** and **??** finally show the cost breakdown structure together with the expected funding contributions.

Year	2014	2015	2016	2017	2018	2019
Spending [kCHF]	xx	xx	xx	xx	xx	xx

Table 2.4: Expected spending profile for the ALICE MCH upgrade.

Activity	Country or Inst	Country or Inst	Country or Inst
1. Front-end cards	**x**	**x**	**xx**
1.1. Design & Prototyping	x	x	xx
1.1. Qualification	x	x	xx
1.2. Production	x	x	xx
1.2. Test	x	x	xx
1.2. Installation	x	x	xx
2. SAMPA ASIC	**x**	**x**	**xx**
3. GBT Read-out Cards	**x**	**x**	**xx**
3.1. Qualification	x	x	xx
3.2. Production	x	x	xx
3.2. Test	x	x	xx
3.2. Installation	x	x	xx

Table 2.5: Cost breakdown structure of the ALICE MCH upgrade, including expected funding from the different contributors.

	#FEC	**x% Spares**	**Total**
Station 1	xx	xx	xx
Station 2	xx	xx	xx
Station 3	xx	xx	xx
Station 4	xx	xx	xx
Station 5	xx	xx	xx
Total	xx	xx	xx

Table 2.6: Quantities of Front-end cards needed for the different detector parts.

	#ROC	x% Spares	Total
Station 1	xx	xx	xx
Station 2	xx	xx	xx
Station 3	xx	xx	xx
Station 4	xx	xx	xx
Station 5	xx	xx	xx
Total	xx	xx	xx

Table 2.7: Quantities of GBT read-out cards needed for the different detector parts.

	#SAMPA	x% Spares	Total
Station 1	xx	xx	xx
Station 2	xx	xx	xx
Station 3	xx	xx	xx
Station 4	xx	xx	xx
Station 5	xx	xx	xx
Total	xx	xx	xx

Table 2.8: Quantities of SAMPA ASICs needed for the different detector parts.

2.3.1 Front-end cards

2.3.2 GBT read-out cards

2.3.3 Front-end cables (FE2GBT)

The unit prices are based on an offer by xx. Cables are standard, acceptance criteria,..

2.3.4 SAMPA

Section **??** deals is in detail with the SAMPA project. The cost estimate for the SAMPA is based on 33000 SAMPA plus 10% spares for a total of 37000 ASICs. Table **??** gives an overview of the quantity of chips needed for the MCH stations. It is planned to build 10% spare ASICs. If a production yield of 70% is assumed, this results in a number of 53000 ASICs to be produced. The number of chips per wafer is approximately xx, which leads to a number of xx wafers. Section **??** shows the cost estimate for the SAMPA ASIC manufacturing, packaging and testing.

2.3.5 Common read-out unit

number of channel calculation

2.3.6 fiber installation

2.3.7 Power Distribution and Cooling

old stuff reused

2.3.8 Detector Control System

2.4 Schedule

Microsoft Project or similar.

2.5 Man Power

The estimated manpower available in the collaboration institutes, which is needed for the different activities, is shown in Fig. **??**. The numbers are divided into physicists (PH), mechanical engineers (ME) and technicians (MT), electronics engineers (EE) and technicians (ET) and others (OT). The manpower available from the different participating institutes is shown in Fig. **??**.

2.6 Risk Register

SAMPA otherwise technically no risk

SAMPA :
see section @.

Activity	Contact Person	PH	EE	ET	Ot
1. Front-end cards	**x**	**x**	**xx**	**xx**	**xx**
1.1. Design & Prototyping	x	x	x	x	x
1.1. Qualification	x	x	x	x	x
1.2. Production	x	x	x	x	x
1.2. Test	x	x	x	x	x
1.2. Installation	x	x	x	x	x
2. SAMPA ASIC	**x**	**x**	**xx**	**xx**	**xx**
3. GBT Read-out Cards	**x**	**x**	**xx**	**xx**	**xx**
3.1. Qualification	x	x	x	x	x
3.2. Production	x	x	x	x	x
3.2. Test	x	x	x	x	x
3.2. Installation	x	x	x	x	x
Total	**x**	**x**	**xx**	**xx**	**xx**

Table 2.9: Available man power per institute and year.

Funding risks:

General schedule risks

SAMPA, 17000 Front-end card production & test.

Chapter 3

Muon Identifier - MID

3.1 Project Organisation

The Muon TRigger (MTR) and the Muon CHambers (MCH, see section xx) are the two sub-detectors of the Muon Spectrometer. As such, their organization, described in section xx, has the same structure, with a common Muon Spectrometer PL and dedicated sub-PLs and Upgrade TCs. The Muon IDentifier (MID) Upgrade Project refers to the upgrade of the current MTR sub-detector system.

As shown in Fig. 3.1, the MID Upgrade Project is organized into two main Work Packages. The Work Package Coordinators are physicists and engineers with permanent or long-term positions chosen for their technical expertise. The institutes participating in the MID Upgrade Project are listed in Table 3.1.

Country	City	Institute
France	Clermont-Fd	LPC, IN2P3 and Blaise Pascal Univ.
France	Nantes	SUBATECH, IN2P3, Ecole des Mines and Univ.
Italy	Turin	INFN and Dipartimento di Fisica dell'Univ.
South Korea	Seoul	Konkuk Univ.

Table 3.1: Institutes participating in the MID Upgrade Project.

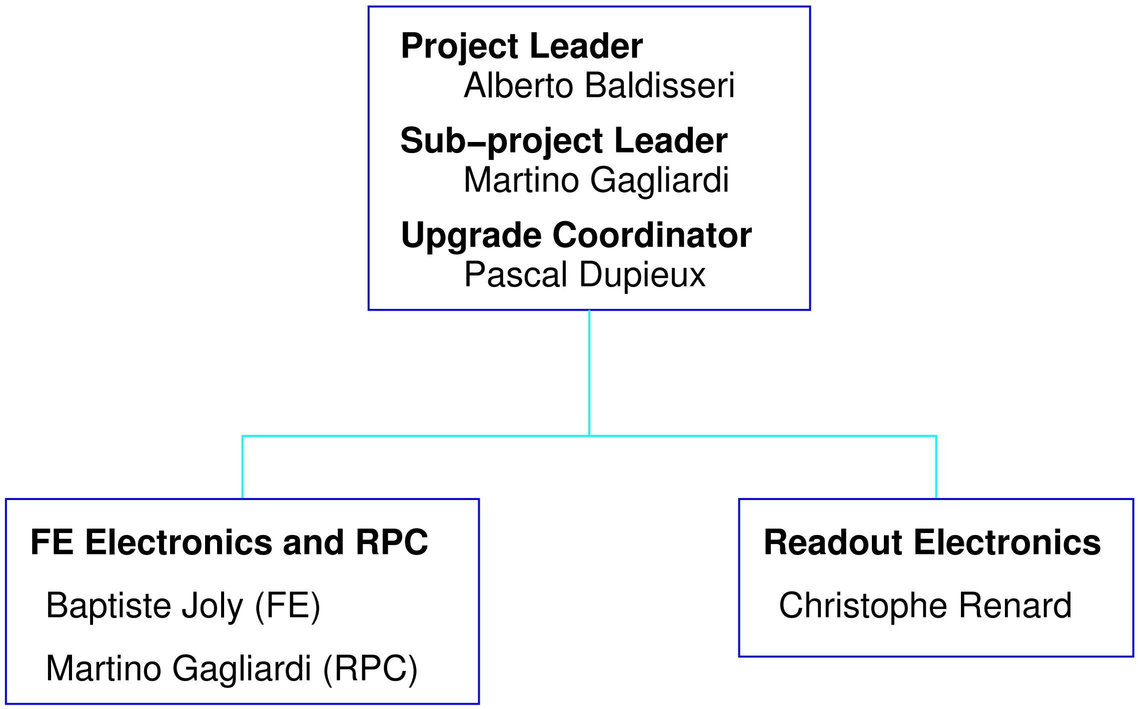

Figure 3.1: The MID Coordination board.

3.2 Budget Explanation and Justification

This chapter addresses important design choices and their impact on the project cost and schedule.

3.2.1 Front-End Electronics and RPC

The current Front-End (FE) electronics must be replaced in order to slow down the aging of the Resistive Plate Chamber (RPC) detectors in the future high luminosity operating conditions at LHC. For this purpose, an amplification stage is added in the new FE ASIC (called FEERIC), like it is already the case in ATLAS and CMS. In order to minimize the upgrade cost, the FE cards (2384 cards) for the MID are designed to be fully compatible with the current ones. Existing low voltage power supplies and cables, cables for signal transmission, FE threshold configuration system, DCS project, FE test system, cooling and mechanical supports can be re-used without any modifications. A R&D program was started in 2012. The second prototype generation of the FEERIC ASIC and of the FE card are produced. Their performance is presently being evaluated on test bench as well as on detector with cosmics. Current test results are very encouraging.

The cost of RPC spares and gas system upgrade is included in the upgrade cost. Indeed the most exposed RPCs will have accumulated a significant dose after LHC run-1 and run-2, and might need to be changed so spares must be prepared. The strip read-out planes might be damaged during the installation of the upgraded FE cards which also requires to have some available spares. The present gas mixture is flammable, inducing safety constraints. With the upgraded FE, the RPC will be fluxed with a non-flammable gas mixture, the same as the one used by ATLAS and CMS, thus reducing the operating constraints. However, since there is iso-butane in the mixture, a flammability control and security system must be added to the present gas system.

3.2.2 Read-out Electronics

The current read-out cards (250 cards) are not compatible with the future expected event rates, up to 100 kHz including a safety 2 factor, and corresponding data flow. The proposed MID read-out architecture follows the ALICE common approach shared with a majority of upgraded detectors using standardized front-end links and GBT components as well as the ALICE Common Read-out Unit (CRU). The choice of the architecture, with 234 interface (LOCAL) cards with the FE and 16 data concentrator (REGIONAL) cards, optimizes the number of optical links from the cavern towards the CRU in the counting room at the surface and the number of CRU (section 3.2.3). The same card is used as LOCAL and REGIONAL, with different firmwares and implemented components accounting for the different required functionalities, in order to reduce the costs and manpower for development. In order to further reduce the cost, the present format of the LOCAL cards is kept hence the large amount of signal cables coming from the FE and their connectors don't need to be changed. The existing VME crates are also kept for the upgraded LOCAL and REGIONAL cards mechanical support and powering which also saves a lot of money.

3.2.3 Common Read-out Unit

The MID Upgrade Project design has adopted the use of the ALICE Common Read-out Unit and related architecture. This approach reduces the overall development costs and gives a guaranty of reliability. The chosen architecture requires only one single CRU which has enough bandwidth for the whole MID.

3.3 Cost Chart

Table 3.2 shows the Work Breakdown Structure (WBS) chart for the MID Upgrade Project. The tasks of the WBS have been broken down in two level-1 subgroups referring to the most essential parts foreseen to be produced for the MID.

Cost estimates are provided down to each level-3 task and are understood as to be CORE costs, including components and production costs, as well as industrial or outsourced manpower for production, but not costs for personnel and basic infrastructures of the participating institutes. In addition, costs for R&D are not included in the estimate. The aforementioned cost for outsourced manpower has been estimated with 30 kCHF per man year (220 working days) corresponding to repetitive and non-specialized technical activities. All estimates based on offers or quotes in foreign currency have been converted into Swiss francs using the exchange rates of February 2014 (cf. Table 3.3). The installation costs will be fully covered by staff members of the participating institutes.

More detailed information on the cost estimates down to level-3 items are given in the following sections. The expected spending profile, based on the detailed cost estimates and the project planning, is shown in Table 3.4. An overall 5% contingency relative to requested funds is available. Table 3.5 finally shows the cost breakdown structure together with the expected funding contributions.

Activity	Material Cost	Manpower Cost	Total Cost/item
1. Front-End and RPC	**381444**	**60000**	
1.1. FE pre-serie	13920		232
1.2. FE production			
1.2.1. PCBs	26496		9.2
1.2.2. ASIC (FEERIC)	124000		31
1.2.3. Other components	84672		29.4
1.2.4. Cabling	14256	30000	4.95
1.3. Qualification	6100	30000	6100
1.4. RPC			
1.4.1. Spares	72000		1800
1.4.2. Gas system	40000		40000
2. Read-out electronics	**296528**		
2.1. Regional for run-2	36000		1500
2.2. Production (LOCAL)			
2.2.1. PCBs	27900		93
2.2.2. Components	176700		589
2.2.3. Cabling	18300		61
2.3. e-links	2500		10
2.4. Production (REGIONAL)			
2.4.1. PCBs	2232		93
2.4.2. GBTx	1440		60
2.4.3. VTRx	4800		200
2.4.4. Other components	14136		589
2.4.5. Cabling	1464		61
2.5. Optical fibers	6000		300
2.6. CRU	5056		316

Table 3.2: Cost breakdown structure of the MID Upgrade Project, divided into material cost and cost for externally hired manpower.

Table 3.3: Exchange rates used in the cost estimates *(could be common to all sections !)*.

1 EUR	1.23 CHF
1 USD	0.9 CHF

Year	2014	2015	2016	2017	Total
Spending	96	274	274	94	738
Requested funds	100	280	275	125	780
Contingency (%)	4%	2%	0%	25%	5%
Spending per source per level-1 item					
IN2P3 - Read-out	36	71	160	29	296
IN2P3 - FE + RPC	20	125	44	15	204
INFN - FE + RPC	40	68	60	40	208
Korea - FE + RPC		10	10	10	30

Table 3.4: Expected spending profile for the MID Upgrade Project, per level-1 item and per funding source (in kCHF).

Activity	France/IN2P3	Korea/Konkuk	Italy/INFN
1. Front-End and RPC	**204086**	**30000**	**207358**
1.1. FE pre-serie	13920		
1.2. FE production	184066		95358
1.3. Qualification	6100	30000	
1.4. RPC			112000
2. Read-out electronics	**296528**		
2.1. Regional for run-2	36000		
2.2. Production (LOCAL)	222900		
2.3. e-links	2500		
2.4. Production (REGIONAL)	24072		
2.5. Optical fibers	6000		
2.6. CRU	5056		

Table 3.5: Cost breakdown structure of the MID Upgrade Project, per source and per level-1 and level-2 items (in CHF).

	#FE Cards	x% Spares	Total
Station 1, pol+, 1 cm wide strips	120	25%	150
Station 1, pol+, 2 cm wide strips	528	18%	625
Station 1, pol+, 4 cm wide strips	168	22%	205
Station 1, pol-, 2 cm wide strips	224	20%	270
Station 1, pol-, 4 cm wide strips	152	23%	190
Station 2, pol+, 1 cm wide strips	120	25%	150
Station 2, pol+, 2 cm wide strips	528	18%	625
Station 2, pol+, 4 cm wide strips	168	22%	205
Station 2, pol-, 2 cm wide strips	224	20%	270
Station 2, pol-, 4 cm wide strips	152	23%	190
Total	2384	21%	2880

Table 3.6: Quantities of FE cards needed for the different detector parts.

3.3.1 Front-End Electronics and RPC

The estimated cost for the FE in Table 3.2 is based on preliminary offer of prices or extrapolation of the current electronics production cost. A pre-serie of 60 FE cards is presently being built and will be installed on one (out of 72) RPC in the ALICE cavern before the end of the LS1. The performance of this pre-serie will be followed up carefully during the first months of operation with beam-on in 2015, before launching the production.

The quantities of FE cards of different sizes are given in Table 3.6 as well as the number of required spares which is of the order of 20% from our past experience. The FE cards with 1 cm wide strips support two FEERIC ASICs (8 channels each) while all other FE cards support only one ASIC hence 2624 ASIC in total are required. 4000 ASICs will be produced in order to account for the production yield (usually better than 90%) and the selection of those complying with sharp quality specs. The CMOS 0.35 μm technology chosen for the ASIC is cheap leading to a very competitive production cost (see Table 3.2, the ASIC price includes packaging).

The price of the spare RPCs and gas system upgrade are obtained from offer of prices. It has been chosen to build spares for the ten more exposed to radiation RPCs, in each of the four MID detection planes (Table 3.7). The accumulated dose in some areas of these RPCs, including the exposition measured during the run-1

	#RPC spares	Ext. dim. (mm^2)
Station 1, RPC 3 and 7	8	2740 × 720
Station 1, RPC 4 and 6	8	2740 × 720
Station 1, RPC 5	4	2230 × 720
Station 2, RPC 3 and 7	8	2920 × 765
Station 2, RPC 4 and 6	8	2920 × 765
Station 2, RPC 5	4	2376 × 765
Total	40	

Table 3.7: Quantities of RPC spares needed for the different detector parts.

	#RO Cards	x% Spares	Total
Regional for run2	16	50%	24
LOCAL cards	234	28%	300
REGIONAL cards	16	50%	24
Total	266	31%	348

Table 3.8: Quantities of LOCAL and REGIONAL read-out cards needed for the different detector parts.

and estimates for the run-2, could be as high as few tens of mC/cm^2 which is of the order of the safe limit for operation achieved during our R&D on aging.

3.3.2 Read-out Electronics

The estimated cost in Table 3.2 is based on offer of prices or extrapolation of the current read-out electronics production cost. The quantities of LOCAL and REGIONAL read-out cards is given in Table 3.8 as well as the number of required spares. The cost evaluation accounts for 30% LOCAL card spares. From the experience that we have from the current project, such an amount of spares is needed considering the production yield for such complex cards. The REGIONAL cards being less numerous, a larger yield of spares has been considered. The total cost of the project includes the replacement of the REGIONAL cards for the run-2 which is a preliminary step towards the MID Upgrade Project.

3.3.3 Common Read-out Unit

The MID Upgrade Project makes use of a single CRU with 16 optical links to the REGIONAL cards. The maximum expected data flow is 300 MB/s which is more than one order of magnitude less than the available bandwidth of the chosen design.

3.4 Schedule

The schedule is described with some details in Fig. 3.2. The main phases are the following :

- 2014 - apr 2016 : Pre-series and validation
- sep 2015 - dec 2017 : FE production and qualification
- apr 2016 - jan 2018 : LOCAL and REGIONAL card production and qualification
- feb 2018 - sep 2018 : contingency
- sep 2018 - dec 2018 : installation
- 2019 : commissioning (with few months of contingency)

3.5 Man Power

The estimated manpower available in the collaboration institutes, which is needed for the different activities, is shown in Table 3.9. The numbers, corresponding to FTE integrated over the period 2013-2018, are divided into physicists (PH), electronics engineers (EE) and technicians (ET) and mechanical engineers (ME).

3.6 Risk Register

Risks associated to technological and design choices:
The technological choices which are made for the MID Upgrade Project are based on industrial standards (electronics cards and components, mostly) so there is technically no risks. Let's also stress that, at the location of both the FE and read-out

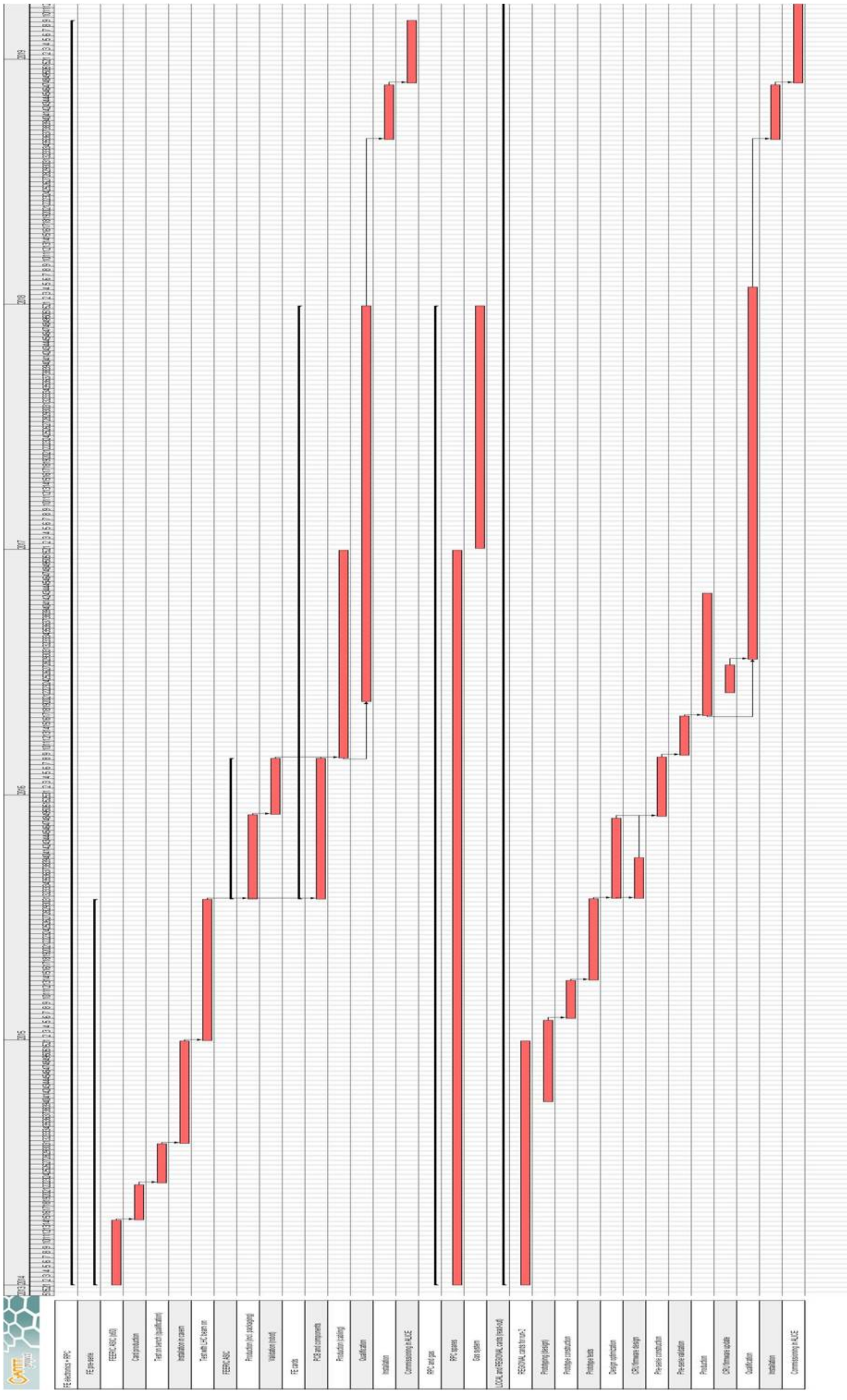

Figure 3.2: The MID Upgrade Project schedule

Activity	Contact Person	PH	EE	ET	ME
Upgrade Project coordination	P. Dupieux, IN2P3	1.8			
1. Front-End and RPC		**2.8**	**4.8**	**2.5**	**1.1**
FE (coordination, electronics)	B. Joly, IN2P3		2.0		
FE (ASIC)	S. Manen, IN2P3		1.4		
FE (electronics, qualification)	F. Jouve, IN2P3		1.4		
FE (performance)	A. B. Caméjo, IN2P3	0.4			
FE (qualification)	B. Kong, Korea	0.3			
FE (qualification)	Y. Baek, Korea	0.3			
FE (technical work)	LPC staff, IN2P3			2.5	0.5
RPC (coordination)	M. Gagliardi, INFN	0.6			
RPC (mechanics)	P. Mereu, INFN				0.6
RPC (validation)	A. Ferretti, INFN	0.6			
RPC (performance)	INFN students	0.6			
2. Read-out electronics		**0.6**	**4**	**2.5**	
RO (coordination)	G. Batigne, IN2P3	0.6			
RO (coordination, electronics)	C. Renard, IN2P3		2.4		
RO (online, qualification)	J.L. Béney, IN2P3		1.6		
RO (technical work)	Subatech staff, IN2P3			2.5	

Table 3.9: Available man power per institute for the MID Upgrade Project

electronics of the MID, the radiation level is quite low. Hence the risk associated to radiation effects on electronics is very limited even without radiation-hard components.

The new FE electronics will allow to operate the MID RPCs in the same mode as the ones of ATLAS and CMS. This is quite reassuring in the light of the success of their RPC performance during LHC run-1 but also in terms of sharing expertise or new R&D, on gas for example.

Finally, as already mentioned, the choice of the read-out architecture follows ALICE standards. The MID Upgrade Project could then benefit from the support of specialists.

Risks associated to man power:

The hard core of the man power for the MID Upgrade Project is based on physicists and engineers with permanent or long term positions which is a guaranty of a serious follow-up. Most of the experts who have built the Muon Trigger are involved in the

MID Upgrade Project. Their knowledge turned out to be crucial for the MID design and will certainly be essential during the construction phase. Let's also emphasize that most of the present experts of the Muon Trigger operation and software are also willing to help.

Funding risks:

A global ALICE upgrade budget has been requested to IN2P3 during the Scientific Council of January 2014. The repartition between sub-projects could still be fine-tuned depending on the global allocated budget which is not yet known. The funding risk of the MID Upgrade Project by IN2P3 is weak but however correlated with the risk of funding from other contributors to common upgrade items with IN2P3. The expected decision date is not yet known.

INFN has formally agreed on funding the project when it was presented to the INFN committee in May 2013. The exact amount of the MID funding will be defined at the moment the MoU is signed. The funding risk is considered to be low.

The Konkuk University provides man power for the FE validation. The contribution of Konkuk to the overall project is rather modest and as a consequence the associated risk is low.

General schedule risks

The R&D related to the FE electronics upgrade is well on tracks. There is a long available period of about three years for the production and qualification. It is foreseen to start the production in the second half of 2015 after the pre-serie validation with LHC beam on. A first prototype of the production test bench is already built. This bench allows to characterize four FE cards in parallel in few minutes, including the set-up time. Based on the experience for the current FE card production, the full time for the qualification should not exceed on full year. The installation time is evaluated to about six weeks for three people working in parallel.

The read-out card production is scheduled to be started in early 2016 after more than one year for prototyping. The production and validation time should not exceed two years considering the limited number of required cards.

The overall risk for being behind schedule is then very low.