

V0-Plus

1. The V0-plus Project Leader (PL) heads the V0-Plus Project. He is assisted by the V0-Plus Deputy Project Leader (DPL) and the V0-Plus Technical Coordinator (TC). The V0-Plus 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 V0-Plus Institute Board. This board also endorses technical matters recommended by the V0-Plus Technical Board (see below) and proposed by the V0-Plus Project Leader or Deputy Project Leader. All Institutes participating in the V0 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 V0 upgrade project is organized as a single work package (WP), having the PL acting as WP coordinator, endorsed by the V0-plus Institute Board, which itself acts as Coordination Board (CB). Other scientists with dedicated technical expertise are also nominated “ad personam” by the PL to be members of the V0-plus CB.

Country	City	Institute
Mexico	Mexico City	Instituto de Física, UNAM

Table 2.1: Institute participating in the V0 Upgrade Project (termed “V0-plus”).

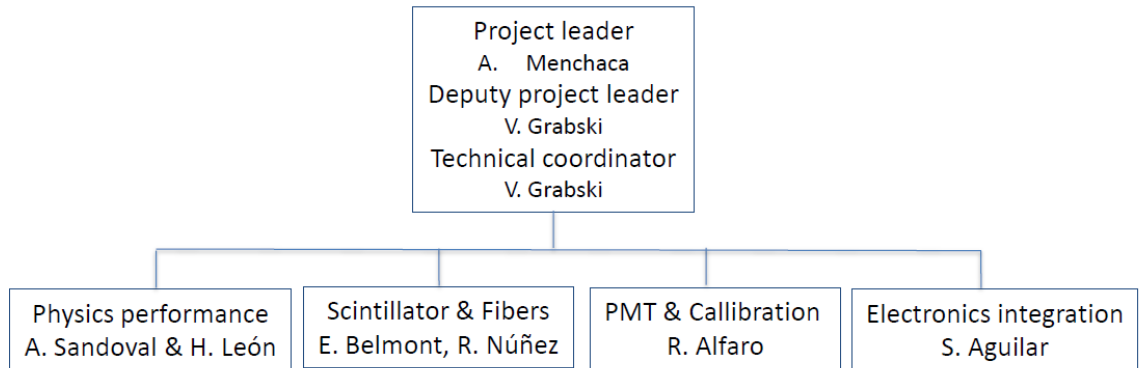


Figure 2.1: The V0-Plus Coordination board.

2. Explanation and justification of cost for main items.

As part of FIT, V0-Plus is expected to supply fast time signals to the first level trigger, as well as on-line multiplicity measurement and reaction plane determination. Based on a different technique, as compared to T0-plus (Cherenkov on quartz), a V0-plus based on plastic scintillation adds redundancy to FIT, what is considered as an strategic advantage.

Thus, V0-Plus should:

- a) Approach the level of 200 ps
- b) Maintain a large acceptance
- c) Use the same electronics modules as T0-plus
- d) Have a high efficiency for the Minimum Bias Trigger
- e) Eliminate or, at least, reduce to acceptable levels the PMT after-pulsing
- f) Reduce the PMT aging problems found in V0
- g) Keep the relative low-cost of V0.

Conditions (a-f) suggest the simple alternative of reducing FIT to a large coverage T0-plus system based on Multi Channel Plate (MCP) PMT's. Yet, this choice is incompatible with the as-low-as-possible-cost condition (g), reduces the multiplicity determination capability (better measured by dE/dx than by Cherenkov) and eliminates the redundancy advantage. Full FIT alternatives (i.e., including a V0-Plus) have been proposed to fulfill the condition list. A typical example is a V0-plus based on MCP's, optically coupled directly to the plastic scintillator disks to comply with conditions (a) and (e). Yet, when this coupling is done with the photosensors placed parallel to the beam, as in T0, the number of units required by condition (b) is not less than the large coverage T0-plus option, thus, making this option incompatible with condition (g). Placing the photosensors perpendicular to the beam could solve this problem, but implies a photon-trajectory length dispersion that condition (a) could no longer be fulfilled. In this case, the corresponding geometrical-efficiency dispersion would also prevent a multiplicity determination.

The V0-plus architecture considered here is based on the use of a clear-fiber (0.5-1.0 mm diameter) matrix optically coupled to a 2.5-3.0 cm thick plastic scintillator disk. The fibers would be optically coupled perpendicular to the disk surface (i.e. parallel to the beam), and distributed uniformly along the scintillator modules. Bundled together, the other fiber-ends are coupled to the photosensors. The use of thin scintillators fulfills condition (a). Condition (b) depends on disk diameter and available space, as in the current V0. The use of sufficiently long fibers (clear ones have sufficiently large attenuation lengths for it) should take care of condition (f), if this is a result of radiation damage. Conditions (c) and (d) depend on photonic response, and their ability to accurately deduce charge from timing information, what is required by multiplicity determination. Condition (e) could be met using MPC's, the most expensive phosensors in the market, hence affecting the fulfillment of condition (g). The use of Si-PMT's is also being considered, which would comfortably comply with condition (g), but would require a high photonic collection efficiency to fulfill condition (e). Thus, R&D is required.

3. Cost Chart

The previous argumentation helps define the overall, as well as the detailed; cost-ranges described in the rest this section. The main cost-items to be considered here are:

- i. R&D
- ii. Photo sensors

- iii. Clear fibers
- iv. Scintillator plastic
- v. Electronic modules
- vi. R&D

The following table (2.2) provides the estimated costs per item, breaking it among sub activities, when appropriate. Note that, except for clear fiber machining, no man power external to the institution is foreseen.

Activity	Material Cost	Manpower Cost	Total Cost/Item
1. R&D	50	0	50
1.1 Photo sensor selection	30	0	30
1.2 Scintillator plastic selection	3	0	3
1.3 clear fiber selection	7	0	7
1.4 fiber matrix density sel.	4	0	4
1.5 Charge measuring technique	6	0	6
2. Photo Sensors	200	0	200
3. Clear Fibers	25	0	25
3.1 Machinning	0	5	5
4. Scintillator disk	15	0	15
5. PMT electronics modules	190	0	190
6. Mechanical supports	0	25	25

Table 2.2: Cost breakdown structure of the ALICE V0 upgrade, divided into material cost and cost for externally hired manpower.

Activity	Institution/Country
1. R&D	CONACYT/Mexico
1.1 Photo sensor selection	CONACYT/Mexico
1.2 Scintillator plastic selection	CONACYT/Mexico
1.3 clear fiber selection	CONACYT/Mexico
1.4 fiber matrix density sel.	CONACYT/Mexico
1.5 Charge measuring technique	CONACYT/Mexico
2. Photo Sensors	CONACYT/Mexico
3. Clear Fibers	CONACYT/Mexico
3.1 Machinning	CONACYT/Mexico
4. Scintillator disk	CONACYT/Mexico
5. PMT electronics modules	CONACYT/Mexico
6. Mechanical supports	CONACYT/Mexico

Table 2.3: Cost of the ALICE V0 upgrade shall have only one fund contributor.

With a total budget of 510 USD, the V0-Plus construction project, as occurred with VOA, shall be executed by just one institution (Table 2.1), and funded by a sole institution (Table 2.3), according to the following spending profile (Table 2.4):

Year	2014	2015	2016	2017	2018	2019
Spending (USD)	50	100	360	0	0	0

Table 2.3: Expected spending profile for the ALICE V0 upgrade.

3 Work Breakdown Structure (WBS).

Activity	Contact Person	PH	EE	ET
1. R&D	1	5	1	2
1.1 Photo sensor selection	1	5	1	2
1.2 Scintillator plastic selection	1	5	1	2
1.3 clear fiber selection	1	5	1	2
1.4 fiber matrix density sel.	1	5	1	2
1.5 Charge measuring technique	1	5	1	2
2. Photo Sensors	1	5	1	2
3. Clear Fibers	1	5	1	2
3.1 Machinning	1	5	1	2
4. Scintillator disk	1	5	1	2
5. PMT electronics modules	1	5	1	2
6. Mechanical supports	1	5	1	2

Table 2.9: Available man power.