

Preliminary Closeout Report

Roberto T. for the Review Committee

General Comments -1

- We have seen two days with many interesting presentation and a lot of material to digest
- The SAND INFN group is clearly a motivated and well-committed team and the review committee appreciate it
- There are clear progresses with respect to previous presentations at CSNs , nevertheless in many areas the project is still in an R&D phase, with important choices to be made (e.g. camera vs mask for GRAIN, STRAW vs DRIFT for Tracker)
- The new SAND Consortium – DOE agreement, with important mandates to Fermilab, is an excellent news (please send us a copy of the MoU)

General Comments -2

- In view of the forthcoming TDR it is important to quantify the target performance for the various SAND detectors, defined as the minimum performance needed to achieve the physics goals
- In several cases we have seen an evolution with respect of the latest CORE time profile, however we have not seen a coherent new picture: some costs are being updated, other costs seems not included in the present plan (e.g. some ECAL electronics)
 - This, together with the R&D aspects of some projects, makes hard to validate or update in a solid way the current financial plan



Piano attuale DUNE @ INFN

| INFN Core Cost Spending Profile | | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|-------------------------------------|--|------------|-------------|------------|-------------|------|------|------|--------|
| SAND | | | | | | | | | |
| MAGNET | Yoke | | | | | | | | |
| | Yoke disassembly, packaging, storage at LNF | | | | 300 | | | | 300 |
| | Yoke Integration/Installation | | | | | | | 200 | 200 |
| | Superconducting solenoid refurbishment | | | 100 | 540 | | | | 640 |
| | Transport to FNAL (includes EMC) | | | | | 1300 | | | 1300 |
| EMC | EMC test, disassembly, renovation | 340 | 149 | 300 | 565 | 750 | | | 2104 |
| GRAIN | LAr design, assembly, integration | | 40 | 315 | 680 | 1040 | 980 | | 3055 |
| | Spares, small components and transport to FNAL | | | | | | 200 | | 200 |
| STT | Design and Prototype | | | 65 | 150 | | | | 215 |
| | Contribution to the construction of STT | | | | | 1700 | 1700 | 1700 | 5100 |
| TRIGGER | Trigger design, realization | | | | | 200 | | | 200 |
| FD1 | | | | | | | | | |
| FD1 | SIPM | | 1583 | | | | | | 1583 |
| | electronics | | | | 312 | | | | 312 |
| | module (mass test of supercell) | | | | | | | 50 | 50 |
| FD2 | WLS bars from Glass-to-Power | | 33 | | 40 | 320 | | | 393 |
| | Dichroic filter | | | | 479 | 550 | | | 1029 |
| | Electronics | | | | | 216 | | | 216 |
| | Meccanica | | | | 80 | 40 | | | 120 |
| | Labor | | | | 38 | 114 | 76 | | 228 |
| | SIPMs | | 5 | | 1320 | 174 | | | 1499 |
| ND Integration (Contingency) | | | | | | | | | |
| | ND Integration (Contingency) | | | | | 2000 | 1500 | 700 | 4200 |
| | <i>Core Cost Total</i> | 340 | 1809 | 780 | 4504 | 8404 | 4456 | 2650 | 22943 |
| | Assegnato da CSN2 | 340 | 1809 | 128,5 | | | | | 2277,5 |
| | Assegnato da GE | | | 651,5 | | | | | 651,5 |
| | Assegnato da CSN1 su apparati 2024 (Core A) | | | | 960 | | | | |

Attualmente

- Totale CSN2+CSN1 3237,5 k€

- Totale Giunta 1892,5 k€

- Grand total 5190 k€

+ 1241 k€ gara SiPM 2024

General Comments -3

- We **recommend** to include running costs (e.g. MOF-B like) to the expenditure time profile, other things related to cables, cryogenics that are part of our (INFN) responsibilities, in other words known costs that we will have to include
 - It is important to see the full cost of the SAND project, non only the INFN part, to see if there are missing parts.
- We **recommend** to extend the plan beyond 2027 and provide more details on the cost evaluation
- We **recommend** to make evident the contingency in the GANTT-like planning
- We **recommend** to develop a resource loaded schedule with the required personpower included, including the Fermilab part.
- We **recommend** to associate young people to the more experts ones in responsibility roles (e.g. people retiring in cryo-related responsibilities, etc.)
- We are still worried about the strong prevalence of INFN in this project.

Magnet and ECAL comments

- We **recommend** to clarify the interplay between magnet dismounting, magnet tests and power supplies procurement.
- We **recommend** to clarify with Fermilab the requirements of the exceptional-vessel operational qualification procedure.
- We **recommend** to clarify the cost of the ECAL electronics and include it in the budget plan
 - LV and HV power supplies
 - Readout board (make the choice and include it)

Grain comments

- We **recommend** to clarify what are the crucial roles of GRAIN in SAND, developing one or two physics cases in the TDR, showing the benefits of including GRAIN readout information in the analysis
- We **recommend** to devise a procedure for the selection of the lens vs mask readout, including the impact of costs
 - Do we understand the GPU demands and can they be accommodated by DUNE computing ?
- We **recommend** to devise a realistic plan for ASIC production, including a program of realistic tests
- We **recommend** to devise an installation and commissioning plan if GRAIN is delayed
- We **recommend** to proceed with the procurement of the needed cryogenic LNL plant equipments, which are already well defined
 - The project of the facility is final and a substantial fraction of the plant will eventually be shipped to Fermilab

Tracker Comments

- The straw tubes option appears to have mostly historical motivations and it looks hard to be implemented without additional resources (human and money wise) outside INFN
 - If this option is pursued a solid and realistic construction plan has to be developed
- The multiwire drift chamber option looks promising. Presumably it naturally includes more room for contingency and should be cheaper. However a construction plan is presently missing
 - We **recommend** to develop such a plan, including proposed construction sites, before a final selection of the technology is done
 - It would be great to have non-INFN contribution to the construction, if this option is selected.
- We **recommend** to define the minimal changes to the present ASIC options (TIGER, VWM3) as soon as possible to avoid delays on the chip side.

Software and Computing Comments

- We **recommend** to take advantage of the excellent progress on the software (MC, reconstruction, analysis) to include a few benchmark channels in the TDR, with realistic simulation and reconstruction.
- We **recommend** to quantify the computing resources needed and the INFN share, with a proper time profile.
- Will INFN play a role in the computing model ? We **recommend** to clarify this point.
- We **recommend** also to clarify the role of WLCG in DUNE computing.

Project Management Comments

- We endorse the hiring of a project management engineer
 - We encourage you to get support from Fermilab for this, in order to help integration
- We repeat here the **reccomendation** to make evident floatings and contingency

Next Steps

- A Question&Answers Session in written form will take place in the next days
- The committee will write a short report (two-three pages maximum) for the giunta (INFN executive committee)
- Could be useful to have another review session after the completion of the TDR