|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID: D\_RD\_9 | Title: Toward the final design of a TPC for the ILD detector | | | | | | | | | | | | | | | |
| Project Leader | **French Group** | | | | | | | | | **Japanese Group** | | | | | | |
| Name | | | **Title** | | **Lab/Organis.** | | | | **Name** | | **Title** | | | **Lab/Organis.** | |
| Serguei Ganjour | | | Dr | | IRFU/CEA | | | | Keisuke Fujii | | Dr. | | | IPNS/KEK | |
|  | | | | | | | | | | | | | | | | |
| **Spending on French Funds** | | | | | | | | | | | | | | | | |
| **Description** | | | **€/unit** | | | | | **Nb of units** | | | Total (€) | | Provided by:1 | | | |
| TYL WS (Strasbourg) | | |  | | | | |  | | |  | |  | | | |
| S. Ganjour, P. Colas / 3 days | | |  | | | | | 2 | | |  | |  | | | |
| Japan (KEK) S. Ganjour, P. Colas | | |  | | | | |  | | |  | |  | | | |
| / 14 days | | |  | | | | | 2 | | |  | |  | | | |
|  | | |  | | | | |  | | |  | |  | | | |
|  | | |  | | | | |  | | |  | |  | | | |
|  | | |  | | | | |  | | |  | |  | | | |
| Total | | |  | | | | |  | | |  | |  | | | |
| **Spending on KEK Fund** | | | | | | | | | | | | | | | | |
| **Description** | | | **k¥/Unit** | | | | **Nb of units** | | | | **Total (k¥)** | |  | | | |
| France (Saclay) K.Fujii / 6 days | | | 251 | | | | 1 | | | | 251 | |  | | | |
| France (Paris) K. Fujii / 1 day | | | 111 | | | | 1 | | | | 0 | | from HEP\_01 | | | |
|  | | |  | | | |  | | | |  | |  | | | |
|  | | |  | | | |  | | | |  | |  | | | |
|  | | |  | | | |  | | | |  | |  | | | |
|  | | |  | | | |  | | | |  | |  | | | |
|  | | |  | | | |  | | | |  | |  | | | |
| Total | | |  | | | |  | | | | 251 | |  | | | |
|  | | |  | | | |  | | | |  | |  | | | |
| **Additional spending on French funds** | | | | | | | | | **Additional spending on Japan funds** | | | | | | | |
| **Provided by:2** | | **Type** | | | **€** | | | | **Provided by:3** | | | | | **Type** | | **k¥** |
| IRFU/CEA | | Equipment | | | 12000 | | | | IPNS/KEK | | | | | Equipment | | 3000 |
|  | |  | | |  | | | |  | | | | |  | |  |
|  | |  | | |  | | | |  | | | | |  | |  |
| Total | |  | | | 12000 | | | | Total | | | | |  | | 3000 |

1 For example: IN2P3, Irfu;. 2 French Embassy, other CNRS or CEA programs, PICS, European grants… 3 JSPS, RIKEN, Universities,….;

|  |  |
| --- | --- |
| **Summary**  **of**  **2017-18 Activities** | With the JAHEP’s proposal to build the ILC in Japan as a Higgs factory operating at 250 GeV, followed by its endorsement by the ICFA, the year 2017 saw an important development of the ILC project. This revision is now seriously reviewed by the ILC advisory panel of the Japanese funding agency (MEXT). We are expecting some positive message from the Japanese government in time for the European strategy process. In parallel, the ILD group is starting massive Monte Carlo simulation to re-optimize the design of the International Large Detector (ILD), using a new improved software framework. The TPC, being the central tracker of the ILD, plays the central role and its realistic simulation requires inputs from hardware R&D studies. These inputs include beam tests results for the basic performance parameters such as single hit spatial resolution in r-phi and z directions, dE/dx resolution, the geometry of the field cage and the end-plane housing readout modules, and various services including cables and cooling that should be taken into account in the material budget of the ILD detector.  In the JFY2017, the Japanese team analyzed the test beam data taken at the end of 2016 with a new LP-module with a large aperture gating GEM and 2-layer GEM amplification. The test beam results demonstrated that the required spatial resolution of 100μm or better over the full drift length of 2.2m in a magnetic field of 3.5T would be achievable with the gating GEM. Both the Japanese team and the French team also studied dE/dx resolution for the GEM and the Micromegas modules, respectively, and demonstrated that better than 5% resolution for 5 GeV electrons. It has also been conf8rmed that the dE/dx performance would not be hampered by the gating GEM.  To understand the behavior of the gating GEM in various measurements described above, we have been doing simulation using Garfield++ with algorithmic improvements of the electron tracking code to accommodate rapid E-field variation. The improved simulation resulted in a very good agreement with measurements using Fe55 and laser beam. The French team tested the sample gating GEM provided by the Japanese team and confirmed the electron transmission in excess of 80%.  The distortions observed near the module boundaries have also been tackled. The French team is developing a new module with a Michromegas mesh at ground potential so as to mitigate the distortion near the module boundaries, while the Japanese team has been simulating electron and ion behavior in the GEM module to understand and mitigate the distortion near the module boundaries.  Most of the R&D items of D\_RD\_9 have been successfully addressed and completed. The detector integration, calibration strategy, positive ion gating, 2-phase CO2 cooling system, hit point distortions observed distortions near their boundaries, and readout electronics design turned out to have no show stoppers though they require further work to be ready for technology choice and design finalization..  K. Fujii visited France in July and in October to discuss the status and plan for the JFY2017 action items regarding the gating GEM studies, the distortions, gas gain measurements, etc. Both the French and the Japanese teams joined the LCWS 2017 in France to discuss the status and plan for the TYL program in the ILD context. S. Ganjour and P. Colas visited KEK for 10 days in November, 2017 and 5 days in February, 2018, which provided opportunities to summarize this TYL program and plan for the future collaboration. |
| **Workshop / satellite session at annual workshop**  **(if applicable)** | D\_RD\_9 workshop at Saclay, July 19, 2017 |
| **Common Articles**  **(if applicable)** |  |
| **Seconded / Jointly Supervised Students**  **(if applicable)** |  |