CEPC Detector R&D Project

6.2 Interaction Region Mechanics

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| Document Responsible: |  |
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| Revision number: | 2 |
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Change history

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| **Revision** | **When** | **What changed and why** |
| 1 | 18/12/2019 | First draft |
| 2 | 6/5/2020 | Second draft |
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|  |  | < Add further lines to table as required > |

Readme first

1. Please do not delete or modify this section or its structure.
2. Only change text enclosed by (and including) angled brackets “< … >”.
3. Don’t change field directly, instead modify the document options, under File🡪 Properties (or similar)
   * Enter name of person that wrote the document in Document:Summary: Author
   * The project ID number, should follow the rules provided to you earlier. The number should be changed in Document:Custom: PBS.
   * The project name should be changed in Document:Summary: Subject.
4. In Section [*Project Objectives*](#ProjectObjectives) provide a brief description of the project goals, i.e. why and what is being produced, for PBS item . If this project includes identifiable sub-projects you can indicate them in the [*Sub-projects Description*](#SubprojectsDescription) Section, otherwise submit a separate document for each of them. The sub-project IDs are free for you to define.
5. Finally, remember to update the [*Change History*](#ChangeHistory).

Interaction Region Mechanics: Project Objectives

The proposed R&D topics shall address several critical mechanical issues around the complicated interaction region. It is aimed to machine a prototype Beryllium beampipe with a wall thickness of 0.35 um, which necessary to minimize the material budget between the interaction point and the first vertex detector layer. A reliable welding technique between the central between Beryllium beampipe and the Aluminum forward beampipe will be also be explored. It is also desirable to develop a feasible scheme to install all the detector and machine elements around the interaction region and achieve optimal performance with proper balance between the detector and machine. This installation scheme will also require R&D efforts to develop a reliable remote vacuum connection method and a stable supporting structure for the superconducting magnets.

: Sub-projects Description

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| **Project ID** | **Title** | **Description** |
| 6.2.1 | Beryllium beampipe prototype | Machining a short Beryllium beampipe with a wall thickness of 0.35 um and exploring reliable welding between Beryllium and Aluminum (with an industrial partner) |
| 6.2.2 | Installation scheme | To propose a feasible scheme to install the detector and machine components around the interaction region with required precision and reliability |
| 6.2.3 | Remote vacuum connection methods | To develop new methods for the remote vacuum connection and verify the candidate technologies with prototyping |
| 6.2.4 | Supporting structure of SC magnets | To design a stable and simple supporting structure for the superconducting magnet that can fit into the limited space close to the interaction region |

: CEPC Relationship

The proposed R&D topics on mechanics in the interaction region are aimed to address the most challenging machine detector interface issues of the CEPC project.

: Project Schedule

6.2.1

2020: Development of the technique for welding between Beryllium and Aluminum

2021: Prototyping a short Beryllium beampipe with a wall thickness of 0.35 um

6.2.2-6.2.4

2020 - 2021, Development of methods of remote vacuum connection and verification with prototyping

2020 – 2021 Design of the support system of SC magnets

2020 – 2022 Development of an installation scheme for the interaction region

: Funding Availability

There is very limited funding support for the moment. Bid for funding was already sent to NSFC.

It is possible to start with design effort but shall start prototyping for relevant items when funding becomes available.

: Leadership Arrangement

Haijing Wang (IHEP) and Quan Ji (IHEP) will jointly lead the R&D efforts and collaborate closely with industrial partners under the CEPC CIPC framework.

Interaction Region Mechanics: Manpower Resources

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| **Type** | **Average FTE Expected** |
| Faculty | 0.5 |
| Postdoc |  |
| Students |  |
| Engineers | 1.5 |