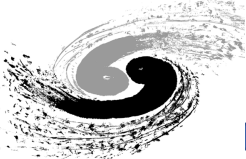# Working Plan towards MDI Part of Ref-TDR of CEPC Detector

Haoyu SHI

2024.2.6

MDI+LumiCal

- Interference region with Acc.(Discussion when needed)

- Beam Induced Backgrounds
  - Estimation(Simulation) of Impacts and Radiation Environment
  - Software Upgrade
  - Validation and optimization of the Codes

- LumiCal(Led by Suen/Lei, Meeting Tuesday Afternoon, 4pm, first time last week)
  - Detector Design of the LumiCal
    - Detector Technology/Electronics/Readout…
    - Software/Simulation
  - Interference with other detectors/acc components

- Optimization of Interaction Region/MDI
  - Shielding for the detectors/detector hall
  - Working together with accelerator colleagues
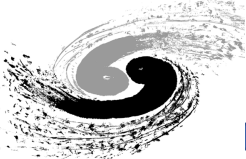
Beam Induced Backgrounds

- Estimation of Impacts and Radiation Environment(50MW)
  - Three Stage:
    - First Preliminary version: Using existing tool/geometry with beam pipe and inner vtx updated; Focusing on Higgs/Z; with a safety factor of 10 in all results – March
    - Upgrading of software/geometry: Before the end of June(together with CEPCSW plan)
    - Second Preliminary version: Using new tool/geometry; all 4 modes; with a safety factor of 10 in all results – Late July/Early August
    - Optimization of the IR layout/configuration…(need help from all sub-D)
    - Final Ref-TDR version: Using new tool/geometry; all 4 modes; with optimized safety factor -- Late October/Early November

- Offering BG samples for mixing/detector optimization: when needed, further discussion needed.

- Validation of the tool/simulation: Using BII/BIIU this year.
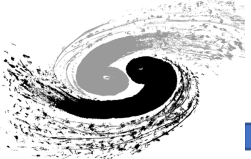
Beam Induced Backgrounds

- ## Current Status towards First Pre. Version:

| Background	Mode	Generation	Tracking	Noise Estimation	Rad. Da. Esti.	Rad. Env. Esti.
Synchrotron Radiation	Higgs	Partial Done	Patrial Done	To do	-	-
	Z	To do	To do	To do	-	-
Beamstrahlung/Pair Production	Higgs	Done	-	Done	Done	-
	Z	Doing	-	To do	To do	-
Beam-Thermal Photon	Higgs	Done	Done	Doing	Doing	-
	Z	Done	Done	Doing	Doing	-
Beam-Gas Bremsstrahlung	Higgs	Done	Done	Doing	Doing	-
	Z	Done	Done	Doing	Doing	-
Beam-Gas Coulomb	Higgs	Done	Done	Doing	Doing	-
	Z	Done	Done	Doing	Doing	-
Radiative Bhabha	Higgs	-	-	-	-	-
	Z	-	-	-	-	-
Touschek	Higgs	-	-	-	-	-
	Z	Doing	To do	To do	To do	-

LumiCal
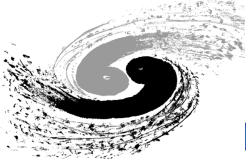
- Baseline detector schematic ready, remaining tasks
  - Requirement/Goal: 1e-4 precision measurement of integrated lumi; fast meet the requirement from acc.
  - Software Updating:
    - Standalone: Migrate from GEANT3 to GEANT4 with the necessary validations
    - Working together with CEPCSW team to implement the geometry/detector to CEPCSW
  - Simulate the updated beampipe with the electron and photon from Bhabha
  - Finalize the design of the tracker and the EM calorimeter, logically consistent
    - The silicon/diamond tracker and crystal detector of the LumiCal will closely following the central detector
  - Finalize the readout electronics/TDAQ
  - Simulation studies to be finished by September to October 2024
  - Test beam or cosmic ray studies to validate the simulation of the beam pipe interacting with electron/photon
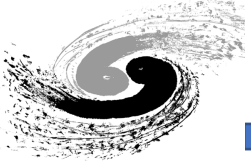
Optimization

- Mitigation methods for BIB: Collimators/Masks/Shielding

- Optimization for layout of the IR including the detectors(boundary req. if exists)

- Iteration based on simulation and discussion.
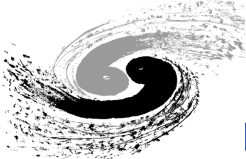
- One whole Chapter(same with CDR): Machine Detector Interface and Luminosity Detectors (Haoyu/Suen/Sha)
  - Introduction & Requirements
  - IR Layout(Haoyu/Sha/Quan/Haijing)
  - Key design/parameters(beampipe, final focusing, etc..)(Haoyu/Sha/….)
  - Detector/IR Backgrounds(Haoyu)
    - Introduction
    - Shielding Design/mitigation methods
    - Estimation
  - Luminosity Measurement System(Suen/Lei/Weiming)
  - Summary & Outlook
  - Ref. List

Backup
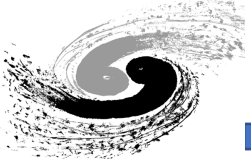
Beam Induced Backgrounds

- Current Tools:

Background	Generation	Tracking	Detector Simu.
Synchrotron Radiation	BDSim	BDSim/Geant4	Mokka
Beamstrahlung/Pair Production	Guinea-Pig++	SAD	
Beam-Thermal Photon	PyBTH[Ref]		
Beam-Gas Bremsstrahlung	PyBGB[Ref]		
Beam-Gas Coulomb	BGC in SAD		
Radiative Bhabha	BBBREM		