MDI Status Report

Hongbo Zhu

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Machine Parameters -- Shown Last Time

CEPC Parameters update 20171229

	tt	*Higgs*	*W*	*Z*
Number of IPs	2			
Energy (GeV)	175	120	80	45.5
Circumference (km)	100			
SR loss/turn (GeV)	7.82	1.73	0.34	0.036
Half crossing angle (mrad)	16.5			
Piwinski angle	0.85	2.58	4.29	10.16
N_e/bunch (10^{10})	25	15	5.4	4.0
Bunch number (bunch separation)	32 (10.4us)	242 (1.4us)	3390 (ns)	9524 (35ns)
Beam current (mA)	3.84	17.4	88.0	183.1
SR power /beam (MW)	30	30	30	6.54
Bending radius (km)	10.6			
Momentum compaction (10^{-5})	1.11			
β_{IP} x/y (m)	1.2/0.0037	0.36/0.002	0.36/0.001	0.2/0.001
Emittance x/y (nm)	2.57/0.0078	1.21/0.0035	0.54/0.0016	0.17/0.0029
Transverse σ_{IP} (um)	55.6/0.17	20.9/0.083	13.9/0.04	5.9/0.054
ξ_x/ξ_y/IP	0.074/0.098	0.031/0.119	0.0148/0.062	0.011/0.062
V_{RF} (GV)	9.12	2.17	0.47	0.1
f_{RF} (MHz) (harmonic)	650 (217500)			
Nature bunch length σ_z (mm)	2.54	2.72	2.98	2.38
Bunch length σ_z (mm)	2.87	3.26	3.62	3.63
HOM power/cavity (kw)	0.53 (5cell)	0.54 (2cell)	0.47(2cell)	0.72(2cell)
Energy spread (%)	0.14	0.1	0.066	0.038
Energy acceptance requirement (%)	1.51	1.52		
Energy acceptance by RF (%)	2.65	2.06	1.47	1.7
Photon number due to beamstrahlung	0.18	0.29	0.16	0.28
Lifetime due to beamstrahlung (hour)	1.0	1.0		
Lifetime (hour)		0.33 (20 min)		
F (hour glass)	0.9	0.93	0.89	0.97
L_{max}/IP (10^{34}cm^{-2}s^{-1})	0.35	2.5	8.47	10.9

Updated Machine Parameters (NOT FINAL)

	Higgs	*W*	*Z*
Number of IPs		2	
Energy (GeV)	120	80	45.5
Circumference (km)		100	
SR loss/turn (GeV)	1.73	0.34	0.036
Half crossing angle (mrad)		16.5	
Piwinski angle	2.58	4.29	16.4
N_e/bunch (10^{10})	15	5.4	4.0
Bunch number (bunch spacing)	242 (0.68us)	3390 (98ns)	8332 (40ns)
Beam current (mA)	17.4	88.0	160
SR power /beam (MW)	30	30	5.73
Bending radius (km)		10.6	
Momentum compaction (10^{-5})		1.11	
β_{IP} x/y (m)	0.36/0.0015	0.36/0.0015	0.2/0.0015
Emittance x/y (nm)	1.21/0.0031	0.54/0.0016	0.17/0.004
Transverse σ_{IP} (um)	20.9/0.068	13.9/0.049	5.9/0.078
ξ_x/ξ_y/IP	0.031/0.109	0.0148/0.076	0.0043/0.04
V_{RF} (GV)	2.17	0.47	0.054
f_{RF} (MHz) (harmonic)		650 (216816)	
Nature bunch length σ_z (mm)	2.72	2.98	3.67
Bunch length σ_z (mm)	3.26	3.62	6.0
HOM power/cavity (kw)	0.54 (2cell)	0.47(2cell)	0.49(2cell)
Energy spread (%)	0.1	0.066	0.038
Energy acceptance requirement (%)	1.52		
Energy acceptance by RF (%)	2.06	1.47	0.76
Photon number due to beamstrahlung	0.29	0.16	0.28
Lifetime due to beamstrahlung (hour)	1.0		
Lifetime (hour)	0.67 (40 min)	2	4
F (hour glass)	0.89	0.94	0.99
L_{max}/IP ($10^{34}cm^{-2}s^{-1}$)	2.93	7.31	4.1

Workable dynamic aperture, but with littler margin to cope with magnet errors

Internal review 3 Feb followed by another review 10 Feb to make a final decision

Background Estimation

- Decided not to carry out background estimation with the latest machine parameters and lattice design → potential risk to re-run everything
  - Beamstrahlung/pair production
  - Synchrotron radiation
  - Off-energy particles (beam lost particles)
- Hit density, TID and NIEL calculation based on the ATLAS method; collimator system, mask tips to be re-optimized
- **Time Scale**： two weeks to have all results (CPU resource limited though) if sticking with the current machine parameters; longer time if machine parameters have to be updated again!

CDR Writing

- Added more texts on the final focusing magnets

- Re-wrote most of the background sections: better structured + improved description of the methodologies (generators + simulation + calculation)
  - *Waiting for the final results, to add interpretation*
  - *Not yet committed to GitLab repository, 10 pages in total (not including the LumiCal)*

- Received a new draft on the LumiCal (thanks to Suen et. al.); sent back comments to adjust part of the sections
  - *To commit the texts to GitLab when having the revised version ~ 7-8 pages*
  - *Detailed document (supporting note or paper) under preparation*