WG2 SRF: WP3 Crab Cavities

Down Selection Preparation Meeting

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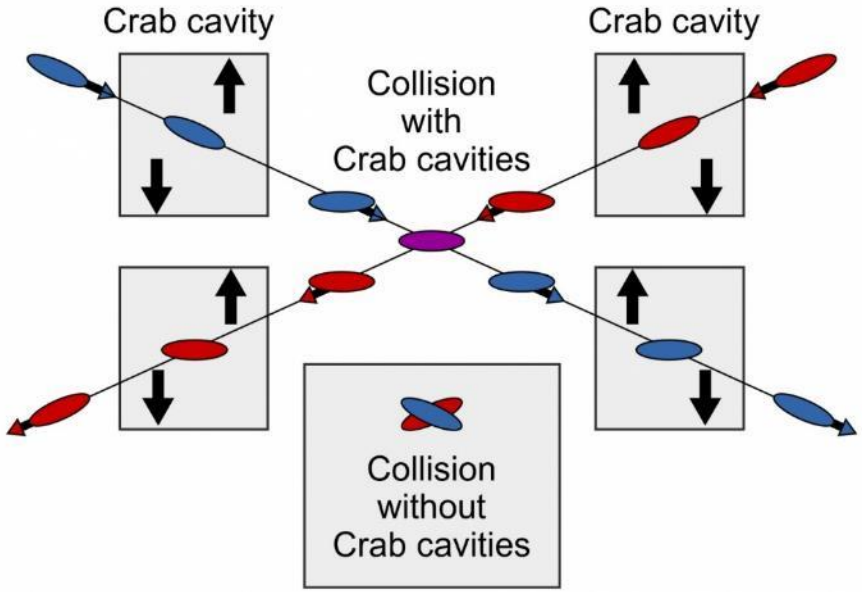
30th November 2022



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Agenda for WP3 Down Selection Preparation Meeting (GMT)

Friday 21st October 2022			
14:30	Introduction and Remit for the Discussion	Peter McIntosh	5 min
14:35	IDT Perspective for the CC Developments	Shin Michizono	5 min
14:40	Assessment of cavity parameters (review collated table)	Peter McIntosh	5 min
14:45	The down-selection process and criteria to be clarified	Open Discussion	50 min
15:35	Format for the review, i.e. duration, location, reviewers, expectation	Kirk Yamamoto/Peter McIntosh	15 min
15:50	Conclusion	Peter McIntosh	5 min
15:55	Meeting close		

Introduction and Remit for Discussion

- Assess and compare CC EM designs, finally optimised:
  - Cavity,
  - HOMs,
  - Couplers (input and HOM),
  - Multipacting,
  - Pressure stability and tuning,
  - Fabrication - Sheet/Ingot/Mixed, Nb material required,
  - Cryomodule integration compliance with specification,
  - Anything else – level of design detail - bare/dressed?
- **WP3 meeting to review and agree criteria in Nov/Dec (today).**

Identified from WP3 Design Review Meeting #3

Next Stage WP3 CC Preparations

- What alignment is needed with ILC IDT processes – timescales likely? **(Spring 2023?)**
- Context for a proposed down-selection review:
  - **Terms of reference to be developed/agreed.**
  - **Specialist membership – who defines/invites?**
  - **IDT output anticipated and when?**
- Additional Design Review #4 at end Jan 23 – review progress and provide any additional convergence required.
- Down selection review ideally before end Mar 23.

(From WP3 Design Review #3 discussions)

IDT Perspectives for the CC Developments (Shin)

Cavity Parameter Review (v16)

Parameter	Elliptical/Racetrack	RFD	DQW	DQW Notes	WOW	QMIR	Units	Nomenclature
Operating frequency	3.9	1.3	1.3		1.3	2.6	GHz	
SOM	5.07	None	N/A		NA	2.217	GHz	
1st Longitudinal HOM	3.32	2.396	2.00		1.765	3.46	GHz	
1st Transverse HOM	5.07	2.0885	2.21	Vertical	2.299	2.82	GHz	
E_p/E_t^*	3.55	3.76	270	Assume Et* = Vt/lambda/2	3.24			E_t - clarify eqtn (JD)
B_p/E_t^*	8.3	6.8	461	Assume Et* = Vt/lambda/2	5.75		mT/(MV/m)	
B_p/E_p	8.3	1.8	1.71	No ports	1.77		mT/(MV/m)	
G	164	129.54	102		130.9	130	Ω	
R/Q	47.6	440.4	211	Circuit	454.3 acc. def.	225	Ω	
R_tR_s	7830	5.70×10^4		What is assumption for Rs?	59446	13.5	Ω^2	Assumptions for Rs
V_t per cavity	0.5	1.35	0.93	Computed as total Vcc required for 125 GeV crabbing divided by number of cavities	1.60 max 1.48 nominal	0.92	MV	
E_p	23.05	44.2	29.0	Below 45 MV/m	45.0 max 41.6 nominal	40	MV/m	
B_p	53.9	79.6	49.5	Below 80 mT	79.8 max 73.8 nominal	75	mT	
Total V_t	2.5	8.1	1.86	This is a requirement, not a DQW parameter	8	3.7	MV	
Total No. of cavities	5	6	2		5	4		
Active Cavity Length	77		117		168	250	mm	
Flange-flange Cavity Length	177	310	TBD	Further Mech Eng needed	514	500	mm	
Number of cells	2	1	1		1	3		
Cavity Diameter	108.6	99.4	104		97.2	75	mm	
Minimum Aperture	25	25	25		25	25	mm	
FPC Q_L		1.5×10^7	1.00E+07	0.5 mm max offset, 50 Hz detuning, Vt = 1.48 MV per cavity for 500 GeV beam crabbing	3e6 with 0.5mm offset & 200Hz shift	1.00E+06		List assumptions used
Bandwidth		0.0867	130		200	2.6	kHz	
Cavity Input Power		31	0.3		0.85	1.5	kW	
Longitudinal Kick Factor k_x			TBD	TBD	2.71		V/pC	
Horizontal Kick Factor k_x			TBD	TBD	23.3 w/o 1.3GHz, 36.2 w/	45	V/pC/m	
Vertical Kick Factor k_y			TBD	TBD	15.6	< 0.05	V/pC/m	
Stored Energy W	0.11	0.0037	0.0032	Assume Q0 = 1e10	0.6 nominal	< 0.2	J	Assume E_t 1 MV/m
HOM impedance (Longitudinal)	29.1		TBD	HOM filter and damper design optimization ongoing	0.14	130	MΩ	
HOM impedance (Transverse)	22.8		TBD	HOM filter and damper design optimization ongoing	4.87 vertical 3.65 horizontal	150	MΩ/m	
First 3 multipole pararameters			TBD	TBD				
Nb material quantity (Kg)		20	1.79	Further Mech Eng needed. Only hollow cavity body and beam ports, no flanges.	50.2	100		
Nb material sheet/ingot		ingot and tubes	Ingot for main body: 100 mm x 120 mm x 130 mm. Sheets or ingot for ports.	Further Mech Eng needed	sheet	ingot, Ø100		

The down-selection process and criteria to clarify (Open)

Format for the review, i.e. duration, location, reviewers, expectation (Kirk/Peter)

- Review terms of reference to be approved.
- Reviewers to be identified and solicited (regional representation).
- Review date to be confirmed (before end-Mar23).
- Location to be agreed (in-person/remote).
- Review output to clarified.

MANY THANKS

Questions?

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