Task 9.2

NORMAL CONDUCTING HIGH GRADIENT CAVITIES

CERN, 27-Mar-2009

Task 2 in DoW:

Task2. Normal Conducting High Gradient Cavities

- Investigate fundamental high-precision, high-power and HOM damping technical and scientific issues underlying the CLIC module
- Prepare hardware to test a CLIC module in the two-beam test stand of CTF_3

Task 2. Normal Conducting High Gradient Cavities

The energy and luminosity design parameters for CLIC are 3 TeV and $6*10^{34}$ cm^{-2} s^{-1} respectively, and CLIC stands here synonymous for any future multi-TeV linear collider. These parameters result in extremely demanding requirements for the accelerating structures in terms of the accelerating gradient (100 MV/m or higher), high-power (of the order of 100 MW), tight mechanical tolerance (microns to tens of microns) and strong higher-order mode damping (complex geometries). A further level of difficulty is encountered when the challenges must be addressed simultaneously as is the case in the CLIC module.

The CLIC Test Facility 3 (CTF_3) has been constructed to address the above issues to demonstrate feasibility of a multi-TeV linear collider based on CLIC technology. This project seeks to complement ongoing efforts, which are addressing the individual requirements, by concentrating primarily on questions of the integration, i.e. to simultaneously satisfy requirements of highest possible gradient, power handling, tight mechanical tolerances and heavy HOM damping. In addition this project will enhance the expansion of the CLIC study from its origins as a CERN project to a truly international collaboration. Existing collaborations with SLAC and KEK will be built upon and included in this project.

- **Sub-task 1:** Design, manufacture, and validate experimentally a Power Extraction and Transfer Structure (PETS) prototype to improve CTF_3.
- **Sub-task 2:** Explore influence of alignment errors on wake fields, elaborate and demonstrate appropriate High Order Mode (HOM) damping in the presence of alignment errors.
- **Sub-task 3:** Breakdown simulation: Develop and use atomistic simulations of atom migration enhanced by the electric field or by bombarding particles, understand what kind of roughening mechanisms lead to the onset of RF breakdown in high gradient accelerating structures.
- **Sub-task 4:** Design and build equipment to diagnose the electrons, ions and light emanating from the breakdown event both in the CTF_3 Two-Beam Test-Stand at CERN and inside a scanning electron microscope in UU to analyze the surface science relevant to RF-breakdown.
- **Sub-task 5:** Precise assembly: Develop a strategy of assembly for the CLIC accelerating and power extraction structures satisfying the few to 10 micrometer precision requirement of positioning both radial and longitudinal taking into account dynamical effects present during accelerator operation.

Deliverables & Milestones

Deliverable	Description/title	Nature	Delivery month
9.2.1	Simulation and experimental results with report on the theoretical and scientific aspects of the CLIC module	R	M48
9.2.2	Prototypes with descriptive report (technical, design and fabrication) of the hardware prepared for the test module.	P	M48

Milestone	Description/title	Nature	Delivery month	Comment
9.2.1	Modification of NCLinac computer codes and first round of simulations.	R	M24	
9.2.2	Design of NCLinac hardware for test module	R	M24	
9.2.3	Prototype components for CLIC module prepared	P	M36	

Budget

EuCARD - WP9 NCLinac-Task 9.2: NC High gradient cavities										
Beneficiary short name [a]	Average direct monthly salary * (€)	Rate for personnel indirect costs (%)	Rate for material and travel indirect costs (%)							
CIEMAT	3,500 €	109	0							
UMAN	5,800 €	60	60							
UH	4,600 €	60	60							
UU	4,920 €	60	60							
Beneficiary short name (all costs in €)	Person-Months	Personnel direct costs	Personnel indirect costs	Consumable and prototype direct costs	Travel direct costs	Material and travel indirect costs	Total direct costs	Toal indirect costs	Total costs (direct +indirect)	EC requested funding[1]
CIEMAT	32	112,000	122,080	130,000	15,000	0	257,000	122,080	379,080	114,000
UMAN	52	301,600	180,960		20,000	12,000	321,600	192,960	514,560	149,000
UH	112	515,200	309,120			0	515,200	309,120	824,320	249,000
UU	68	334,560	200,736	125,000		75,000	459,560	275,736	735,296	220,300
…		0	0			0	0	0	0	
…		0	0			0	0	0	0	
…		0	0			0	0	0	0	
…		0	0			0	0	0	0	
Totals:	**264**	**1,263,360**	**812,896**	**255,000**	**35,000**	**87,000**	**1,553,360**	**899,896**	**2,453,256**	**732,300**

People

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