RELAZIONE DEL PROGRAMMA STM

Il Fruitore: Dalla Palma Mauro
Istituto di afferenza: Istituto Gas Ionizzati (IGI)
con qualifica: Ricercatore, livello: III

Descrizione dell'Istituzione ospitante
ITER Organization
Route de Vinon sur Verdon – 13115 St Paul Lez Durance – France
Dipartimento di afferenza: Control, Data Access & Communication Section
Information Technology (IT) Section
Heating & Current Drive Division
Diagnostics Division

Titolo del programma
Sviluppo tecnico e tecnologico per la fornitura dei Componenti della linea d'iniezione dell'esperimento MITICA

Introduzione descrittiva del progetto
Gli obiettivi perseguiti e le attività svolte durante la mobilità rientrano nel progetto e costruzione dei Componenti della linea di iniezione dell'esperimento MITICA (Megavolt ITer Injector and Concept Advance) che sarà costruito nell'Area del CNR di Padova e costituirà il prototipo degli iniettori per il riscaldamento del plasma del reattore sperimentale ITER.
L'avanzamento del progetto dei Componenti di MITICA ha raggiunto l'importante fase di finalizzazione e revisione sulla base dei requisiti già definiti e delle analisi di verifica svolte. Queste attività di progettazione e verifica sono state controllate dal candidato nella struttura della collaborazione internazionale con il gruppo di lavoro sugli iniettori di ITER e con altre Associazioni europee coinvolte nella fornitura dei Componenti per MITICA.
Le attività svolte durante la mobilità hanno richiesto forti interazioni ed incontri che hanno rafforzato la cooperazione scientifica dell'IGI con le Associazioni europee.

Obiettivi raggiunti
Gli obiettivi raggiunti durante il programma “Short term mobility” sono elencati di seguito.

1) condividere, con le Associazioni europee coinvolte nella costruzione di MITICA, la revisione del progetto dei Componenti della linea d’iniezione dell’esperimento MITICA;
2) finalizzare i requisiti e valutare le modifiche del progetto dei Componenti per MITICA verificando la compatibilità con i requisiti dei Componenti per ITER;
3) identificare le tecnologie critiche e pianificare attività di ricerca e sviluppo tecnologico propedeutiche ed urgenti per la costruzione dei Componenti per MITICA.

Attività svolte
Le attività svolte durante il programma “Short term mobility” sono elencate nell’allegato I.

Data
1 agosto 2011

Firma

Allegato I

Legenda delle Associazioni europee coinvolte nel progetto

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OX14 3DB
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Working hours: 08.15-16.30
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IGI Istituto Gas Ionizzati, CNR

IO ITER Organization
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Elenco dettagliato delle attività svolte

Date	#	Topic	Description	Action	Status	Closing date	Responsible	Data
17/05/2011	1	Integrated CAD model of the injector	The interfaces of the components can be evaluated with an integrated CAD model	An integrated CAD model of the MITICA components will be prepared by IGI	Close	14/06/2011	IGI	-
17/05/2011	2	Interface of the source tilting mechanism with actuators through the vessel	IGI is designing the source tilting mechanism.	The interface of the actuator through the vessel will be detailed considering the possibility to realise two small apertures instead of a single larger one	Open	-	IGI-IO	-
20/05/2011	3	Vessel instrumentation feedthroughs	The vessel instrumentation feedthroughs foreseen by the IO for the ITER HNBs will be compared with the ones of MITICA in order to group subsets of measurements and feedthroughs	The IO will share with IGI the available material about the vessel instrumentation feedthroughs (see IGI's technical note at action #36)	Close	20/05/2011	IO	-
20/05/2011	4	Gas flow inertial analyses for the Neutraliser feeding lines	Gas flow evaluations for the gas feeding to the Neutraliser during transient events related to the closure of the ex-vessel gas valve.	Analyses will be carried out by IGI with the support of KIT	Open	-	IGI-KIT	-
24/05/2011	5	Work plan for next activities related to BLCs	The work plan should be prepared for activity planning and resources allocation during next F4E contract (milestone M1 of F4E GRT-313, tasks 4.3-4.5)	The program for next activities is presented during the closure meeting of the F4E GRT-032. Other actions are detailed in the minutes	Close	24/05/2011	IGI-CCFE	-

				of the closure meeting				
21/05/2011	6	Integration of the Adjustable Bed with BLCs	A critical section has been identified with clashes between the bottom plate of the Adjustable Bed and the inspection lines of sight inside the Neutraliser beam channels	The minor clashes will be fixed during the next design activities	Open	-	IGI-CCFE	-
31/05/2011	7	Design of the Adjustable Bed for BLC position adjustment	The design of dowels will be analysed to verify adjustable bed fixing and adjustment. The replacement of bearings with bushes will allow cost saving of the system.	Technical details will be verified in order to simplify the design of the adjustable bed.	Open	-	CCFE	-
31/05/2011	8	Design of the Adjustable Bed for BLC position adjustment	The adjustable bed shall operate for adjusting the BLC position only during the first installation inside the vacuum vessel. The spare BLC will be machined at the positioning and locking pads in order to compensate the adjustments measured during the installation of the first BLC.	Technical details will be verified in order to simplify the design of the adjustable bed considering that adjustments will be carried out one time only at the first installation of the BLCs inside the vessel	Open	-	CCFE	-

31/05/2011	9	Cooling bellows for the interface between vessel and each BLC	The design of the bellows at the vessel has been fixed by the IO after optimization. Bellows are integrated with the vessel to allow retraction/extension after/before cutting/welding of the cooling headers	A finite element simulation of the cooling pipes including bellows will be carried out at IGI; this simulation could help to design the system limiting the axial expansion of bellows due to internal coolant pressure. The thickness of the cooling tubes will be verified considering also the cutting/welding section	Open	-	IGI-IO	-
31/05/2011	10	Integration of the ERID inside the vacuum vessel	A mismatch has been observed at the interface between the cooling pipes and the vacuum vessel	Further verifications have been carried out by IGI that has prepared and released the CAD model defining the interfaces for the MITICA injector	Close	14/06/2011	IGI	-
31/05/2011	11	Integration of the ERID inside the HNBs vessel	The clearance between the lateral vessel wall and the ERID cooling headers appears to be not large enough in order to carry out the lifting lowering operations and the positioning of the ERID	The position of the cooling headers and electrical breaks will be verified	Open	-	CCFE	-
31/05/2011	12	Integration of the ERID inside the vacuum vessel	A mismatch has been observed at the interface between the electrical bias plug and the vacuum vessel	Further verifications have been carried out by IGI that has prepared and released the CAD model defining the interfaces for the MITICA injector	Close	14/06/2011	IGI	-

31/05/2011	13	Electrical measurements on the ERID panels	The current of particles impinging on the ERID grounded panels could be measured	The pads at the vessel could be insulated in order to electrically insulate the ERID wrt the vessel, whereas the current at cooling headers could be measured using LEM, see MIT-TQU-011; after a preliminary investigation will be done, a meeting will be asked to the IO and F4E	Open	-	CCFE, F4E-IO	-
31/05/2011	14	Definition of the BLC alignment requirements	The document already distributed by the IO is the most updated one. A new document will be released probably in August 2011	The alignment requirements have been defined to be implemented in the BLC design. Element targets will be placed on significant locations of the BLC elements during the component assembly; these locations will be identified considering the nominal position of the particle beamlets. The positions of the element targets will be summarised by global targets that will be positioned on some locations in order to carry out the alignment of the entire BLC wrt the nominal position of the particle beam.	Close	31/05/2011	IO	email sent by Vincent Pilard on the 22nd December 2010

17/05/2011	15	Position of the Calorimeter along the beam line	The position of the Calorimeter is different in MITICA and ITER HNBs	The Calorimeter is positioned 150mm downstream in MITICA	Close	31/05/2011	IGI	-
31/05/2011	16	Integration of the Calorimeter inside vessel	A mismatch has been observed at the interface between the cooling pipes and the vacuum vessel	Further verifications have been carried out by IGI that has prepared and released the CAD model defining the interfaces for the MITICA injector	Close	14/06/2011	IGI	-
31/05/2011	17	Interface between Calorimeter actuator mechanism and cryo-pump	A clash has been observed at the interfaces between the actuator mechanism and the cryo-pump, and between the actuator mechanism and the vacuum vessel	The actuator mechanism requires degree of manipulation; it could be optimized to be self coupling during Calorimeter lifting/lowering. After the design details will be finalized, the system will be integrated inside the vacuum vessel	Open	-	CCFE, IGI	-
31/05/2011	18	Design of the Calorimeter actuator	The diameter of 50 mm requires high fluid pressure	Information will be asked to CCFE about the detailed design of the actuator	Open	-	IGI	-
31/05/2011	19	BLC lifting points	No structural welding is admitted at the lifting points, whereas high quality bolts can be used	The design of the lifting points will be detailed accordingly to standard and regulations	Open	-	CCFE, IGI	-
31/05/2011	20	Integration of the Neutraliser inside vessel	A mismatch has been observed at the interface between the cooling pipes and the vacuum vessel	Further verifications have been carried out by IGI that has prepared and released the CAD model defining the interfaces	Close	14/06/2011	IGI	-

				for the MITICA injector				
31/05/2011	21	Integration of the Neutraliser inside vessel	A mismatch has been observed at the interface between the gas feeding lines and the vacuum vessel	Further verifications have been carried out by IGI that has prepared and released the CAD model defining the interfaces for the MITICA injector	Close	14/06/2011	IGI	-
31/05/2011	22	Interface between Neutraliser cooling headers and cutting-welding tool	The compatibility of the interface requires to be verified considering the headers geometry	IGI will detail the geometry of the cooling headers and will share the data with the IO and F4E	Open	-	IGI	-
31/05/2011	23	Application of pressure equipment directive (PED) and French order ESP(N) to pressure equipments of ITER/MITICA	The application of PED to BLCs was discussed	IO (Vincent Pilard) will share some documents and information about the application of PED to BLCs	Close	20/07/2011	IO	emails sent by Vincent Pilard on the 19th and 20th July 2011
31/05/2011	24	Draining and drying procedure and parameters	The BLCs should be designed to be classified in category 0/1 accordingly to PED classification. The temperature limit of 110 °C was considered by the IO for water; gas pressure should be fixed (e.g. bar gas pressure corresponds to 100 litres volume)	IO will share a possible draining and drying procedure with parameters that are compatible with PED classification of the BLCs in category 0/1	Open	-	IO	-

31/05/2011	25	BLC cooling channels design considering draining and drying requirements	Cavities located along cooling channels appear to be closed for coolant filling and draining	Verifications of the cooling circuits design will be carried out considering also the draining and drying procedure and parameters fixed with action #24	Open	-	CCFE, IGI	-
31/05/2011	26	Requirements for ERID panel biasing	Info about the bias of ERID HV panels is requested	The IO confirms that the bias of the HV panels is changed from -20kV +/-5kV to 25kV+/-5kV	Close	31/05/2011	IO	email sent by Vincent Pilard on the 31st May 2011
31/05/2011	27	Requirements for ERID panel biasing	The bias of the HV panels is changed from -20kV +/-5kV to 25kV+/-5kV	The impact of the PD profile with 25kV+/-5kV will be evaluated and a discussion with the IO and F4E will be organized in case of major change required.	Open	-	CCFE	-
31/05/2011	28	Gas density profile along the beam line for BTR analyses	Data about the gas density profile along the beam line provided by the IO (Ron Hemsworth and Alexander Krylov, email on the 16th May 2011) and by KIT (Stefan Hamke and Xuely Luo, email on the 14th May 2011) were shared between IGI and CCFE (email sent by Mauro Dalla Palma on the 31st May 2011)	BTR analyses are planned at CCFE. The condition with highest power/power density could be identified considering that the MITICA BLCs shall be verified also with the thermal loads foreseen in the ITER HNBs; after the significant gas density profile has been identified, IGI and CCFE can discuss with the IO and F4E about possible implications on the	Open	-	CCFE	-

				present design of the BLCs.				
31/05/2011	29	Vacuum classification of NB components	The NB components could be composed by parts with different vacuum classes: VQC 1A for panels or cooling pipes because they form vacuum boundary, and VQC 1B for support structure	IO will clarify the vacuum classification for NB components	Close	07/07/2011	IO	email sent by Vincent Pilard on the 7th July 2011
01/06/2011	30	R&D for TC fixings and heterogeneous welding	Technological issues require some R&D activities and sharing of R&D results.	Common R&D activities are shared among IO, F4E, IGI, CCFE considering current contract tasks: IGI (Mauro Dalla Palma) sends to the IO the R&D activities carried out within the F4E GRT-032; IGI receives from the IO (Marc Urbani) the documents related to the R&D for the Duct Liner	Close	01/06/2011	IGI, F4E, IO	-

01/06/2011	31	Injector cooling parameters	The cooling parameters of the injector components should be verified	The design description and the analysis reports of the BLCs have been shared between IGI (Mauro Dalla Palma) and the IO (Joseph Graceffa and Dario Carloni). The reports have been also provided by F4E	Close	01/06/2011	IGI-IO	-
01/06/2011	32	Lay-shaft for locking of BLCs and Adjustable Bed	The design of the lay-shaft with reaction hole and guides has been proposed	The proposed design of the lay-shaft with reaction hole and guides needs to be further developed and detailed during the next design step	Open	-	IGI-CCFE	-
01/06/2011	33	Seismic analyses	Elastic analyses have been performed by CCFE setting in bonded contact	Data about the seismic analyses carried out for ERID and Calorimeter could be shared by CCFE, in particular for the type of element such as spring elements	Open	-	CCFE (MG)	-
01/06/2011	34	Lifting points	It has been assumed that the new design of the lifting points developed by CCFE has been approved by the IO (the geometry has been scaled from 13ton to 25ton based on ISO 1161)	The design validated by the IO will be distributed to be implemented in the BLCs	Open	-	CCFE-IO	-
01/06/2011	35	Thermal measurements on the Calorimeter STEs	The number of TCs on the Calorimeter STEs could be fixed	CCFE recommendations will be taken into account in the technical note describing signals and	Close	01/06/2011	IGI	-

				measurements (see action #36)				
01/06/2011	36	Diagnostics embedded in MITICA components	Information and data shared among CCFE, F4E, IO, IGI will be collected in an overall system description of the diagnostics embedded in MITICA components	The technical note IGI-MITICA-TN-71 will be shared	Open	-	IGI	-