EFDA WORKPROGRAMME 2010

Call for Participation

(Part of the EFDA WP, Diagnostic TG)

Diagnostics Topical Group

Deadline for Responses: 20th November 2009

Topical Group Chair: Tony Donne

Topical Group Vice-Chairs: Mark Beurskens and Andrea Murari

EFDA CSU contact person: Danilo Pacella

This Call for Participation aims to implement the EFDA Work Programme for 2010 on Diagnostic under Task Agreements as foreseen in the new EFDA Art. 5

Introduction

At its meeting in Prague on 12 March 2009, the EFDA Steering Committee approved elements of the EFDA 2010 Work Programme, including a set of tasks relating to the EFDA Topical Groups on Heating & Current Drive & Fuelling, MHD, Transport and Diagnostics. This Call covers the Diagnostics Topical Group related work implemented under Task Agreements on the basis of the provisions given in Art. 5 of the EFDA Agreement.

The activities to be implemented following this call for participation will be organised as follows:

Task Agreement WP10-DIA-01: Diagnostics for burning plasma - Measurements of confined alpha particles - Measurements of escaping alpha particles - Measurements of the fuel ion ratio - High resolution neutron spectroscopy
Task Agreement WP10-DIA-02: Diagnostics for protection of plasma facing components - Multi-colour pyroreflectometry and bicolour IR thermography - Fast algorithms for recognition of hot spots
Task Agreement WP10-DIA-03: Diagnostics for long pulse tokamak operation - Reflectometry for plasma position control - New types of magnetic field sensors
Task Agreement WP10-DIA-04: New concept diagnostics - Development of gas detectors for neutrons and soft X-ray - Feasibility study of polycapillary lenses for X-ray imaging
Task Agreement WP10-DIA-05: Data analysis validation, calibration and real time techniques - Development of new techniques for improved data acquisition and analysis - Feasibility studies for improved algorithms and diagnostics for real time feedback control

1. Diagnostics for burning plasma:

Task Agreement WP10-DIA-01:
Diagnostics for burning plasma

1.1 Introduction

Information on many key plasma parameters in ITER will be derived from diagnosing the fusion products. The development of a number of fusion product diagnostics (or measurements related to them) have been categorized as High Priority by either the ITER IO or by the ITPA, and several tasks in this category were launched in the EFDA WP 2008/2009 as part of a long term programme. These tasks include:

- A comparison of different diagnostic systems for fast ion measurements on a single fusion device, with the ultimate aim to find out whether the full fast particle distribution – in particular the fast alphas – can be diagnosed with the set of diagnostics that is presently foreseen for ITER;
- Feasibility studies to demonstrate the viability of proposed escaping alpha diagnostics and to assess the likely radiation hardness of these techniques. In case the result of a feasibility study for a particular system is considered positive, the realization of a prototype escaping alpha detector might be pursued;
- Demonstrations of the various techniques proposed for measuring the fuel ion ratio. In case of successful pilot measurements still much work needs to be devoted in the years to come to turn the systems into routine systems;
- Development of a high-resolution neutron spectrometer. ITER does require such a spectrometer for the measurements of the core ion temperature, the neutron flux and emissivity. The drawback of most of the proposed systems is that they do require a large diameter (~ □20 mm) direct coupling to achieve high enough a signal/noise ratio, which leads to activation of the diagnostic. After assessment which technique gives the best performance at the smallest collimator diameter, the diagnostic should be subsequently realized and tested.

The ultimate aim of this task is to bring the optimum diagnostics for confined alphas, fuel ion ratio and high resolution neutron spectroscopy to a level that is mature enough for the

respective domestic agencies to start the detailed engineering design and procurement of the systems from 2012 onwards.

1.2 Objectives

Measurement of confined alpha particles

Demonstrate, by measurements in present devices and – where not possible in experiments – by feasibility studies, that the ITER measurement requirements for confined alpha particles can be met over the full energy range. In order to do that, the various diagnostics should be reviewed first, on the basis of the present status and further developments should be indicated.

Measurement of escaping alpha particles

A limited number of techniques for diagnosing escaping alpha particles are being developed under EFDA (activation probes, scintillators). First results are promising but still much more work needs to be done to bring the techniques to a level where they are suited for implementation in ITER. Simulation studies of alpha-particle losses that have been started under WP08/09 need to be benchmarked with the simulations performed outside the EU.

Measurements of fuel ratio

Various techniques for measurements of the fuel ion ratio are being explored under WP08/09 as rather independent activities. Under the present task, it should be assessed which (combination of) techniques needs to be implemented on ITER to match the measurement requirements. The respective diagnostics need then to be further developed.

High resolution neutron spectroscopy

WP08/09 started the activity on which of the various high resolution neutron spectrometers gives the best performance at the smallest collimator diameter. This task should complete this work, giving an answer on which are the best spectrometers, with the relative pro and cons, providing a preliminary assessment for their implementation on present devices

1.3 Work Description and Breakdown

Work Breakdown

WP10-DIA-01-01

Measurement of confined alpha particles

- Simulation of the spatial and energy distribution of the confined alphas in the ITER scenario.
- Realisation of experiments, in present day machines, or in alternative of feasibility studies, to demonstrate the capabilities of the proposed techniques

WP10-DIA-01-02

Measurement of escaping alpha particles

- Benchmarking of the simulations of alpha-particle losses performed under WP08/09 with the simulations performed outside the EU, especially those done by the Japanese Party.
- Following the preliminary studies performed in WP08/09 on detection of escaping alpha particles, an accurate description of the future experiments, required to benchmark these techniques, will be provided, to be implemented in the next years
- Evaluation if at least one of these diagnostics can cope with the specific measurement conditions in ITER

WP10-DIA-01-03

Measurements of fuel ratio

- Evaluation of which (combination of) techniques can be used for ITER to match the measurement requirements
- Studies on the developments required for each diagnostics, to be carried out in the next years

WP10-DIA-01-04

High resolution neutron spectroscopy

- Comparison of all the proposed spectrometers
- Assessment for the implementation of the best candidates on a present device

JET related activities

No JET experiments are foreseen to be implemented under this Task. However, should JET carry experiments in this area, a close coordination with the JET Task Forces will be sought.

Resources

6 ppy under Baseline Support; 6 ppy under Priority Support related to task coordination, joint experimentation team; 300 KEuros for hardware under Priority Support

1.4 Scientific and Technical Reports

Progress reports

At the end of each calendar year, during the Topical Group annual meeting, the Task Coordinator shall present a report on activities under the Task Agreement to the EFDA Leader for his approval. These reports shall integrate the progress made by each Association on each activity, and they shall indicate the level of achievement of the objectives, the situation of the activities, the allocation of resources and recommendations for the next year when applicable. The EURATOM financial contribution will be made through the usual procedures for baseline support through the Contract of Association.

Report of achievements under Priority Support

Achievement of Priority Support deliverables will be reported separately to the EFDA Leader. A final report (and intermediate reports marking substantial progress in the achievement of deliverables, if the EFDA Leader so requests) shall be prepared by the Task Coordinator and submitted to the EFDA Leader. Each participating Association will have to report in one subsection on the degree to which the deliverables of their Task have been achieved, and shall include a breakdown of expenditure. The Task Coordinator will collect

the individual subsections into the final report for Priority Support activities addressing the milestones. The EURATOM financial contribution will be made after approval by the EFDA Leader of these reports.

Milestones and Deliverables

Milestones:

- Mid 2010 Activity Meetings: Collection and discussion of results obtained from the evaluation of theoretical work and experiments performed in 2009 and early 2010.
- End second trimester 2010 Annual meeting of the Topical Group: coordinated presentation of the results from the theoretical work and experimental campaigns in 2010.
- December 2010 Final report sent to EFDA-CSU.

Deliverables:

Measurement of confined alpha particles

- Report on the review of the techniques under consideration at the present for the measurements of the confined alphas and comparison of the different features.
- Report on the simulation of the spatial and energy distribution of the confined alphas in the ITER scenarios.
- Summary on the performed experiments, in present day machines, or in alternative of feasibility studies, to demonstrate the capabilities of the proposed techniques and/or detailed indications for future experiments

Measurement of escaping alpha particle

- Benchmarking of the simulations of alpha-particle losses performed under WP08/09 with the simulations performed outside the EU, especially those done by the Japanese Party.
- Following the preliminary studies performed in WP08/09 on detection of escaping alpha particles, an accurate description of the future experiments, required to benchmark these techniques, will be provided, to be implemented in the next years

- Evaluation if at least one of these diagnostics can cope with the specific measurement conditions in ITER

Measurements of fuel ratio

- Report on what is the optimum combination of diagnostic systems, to meet the ITER requirements
- Identification of the required improvements, both for the diagnostics and the algorithms, to be implemented in the next years

High resolution neutron spectroscopy

- Report on comparison of all the proposed spectrometers
- Definition of the prime candidate and proposal for its implementation on a present device
- Report on the preliminary engineering design of this candidate

2. Diagnostics for protection of plasma facing components:

Task Agreement WP10-DIA-02:
Diagnostics for protection of plasma facing components

2.1 Introduction

Infrared (IR) thermography has become a routine diagnostic in many devices to monitor the heat loads on the first wall for both physical studies and machine protection. The good results of the technique obtained so far motivate the use of IR cameras for control. Present day IR camera technologies are fully adequate for this purpose but versatile, efficient and reliable methods to automatically analyze the frames in real time for feedback purposes have to be developed. Moreover solutions to overcome the problems posed by thermography on metallic surfaces need to be consolidated. Particularly challenging are the problems induced by the reflected flux and the changing emissivity of Be with temperature. It should be noted that IR thermography is also a useful tool to observe the qualitative impact of lost alphas and fast ions on the first wall and is in this context important for machine protection for burning plasma devices as well.

2.2 Objectives

Multi-colour pyroreflectometry and bicolour thermography

A number of new very promising approaches have been recently proposed for thermography that deserve to be further studied and explored. These include amongst others multi-colour pyroreflectometry and bicolour IR thermography. Feasibility studies, laboratory tests and experiments can be proposed for a better evaluation of these techniques

Fast algorithm for recognition of hot spot

Fast algorithms have been developed under WP08/09 for recognition of hot spots in the IR and visible images. A comparison is now required and a further optimization to use these systems in a fully automated way as well.

2.3 Work Description and Breakdown

Work Breakdown

WP10-DIA-02-01

Multi-colour pyroreflectometry and bicolour thermography

Pyroreflectometry and bicolour IR thermography feasibility studies, laboratory tests and experiments.

WP10-DIA-02-02

Fast algorithm for recognition of hot spot

- Comparison between different techniques developed so far for recognition of hot spots in the IR and visible images
- Feasibility study of the integration of these techniques in a fully automated way

JET related activities

No JET experiments are foreseen to be implemented under this Task. However, should JET carry experiments in this area, a close coordination with the JET Task Forces will be sought.

Resources

10ppy under Baseline Support; 2 ppy under Priority Support related to task coordination, joint experimentation team; 125 KEuros for hardware under Priority Support

2.4 Scientific and Technical Reports

Progress reports

At the end of each calendar year, during the Topical Group annual meeting, the Task Coordinator shall present a report on activities under the Task Agreement to the EFDA Leader for his approval. These reports shall integrate the progress made by each Association on each activity, and they shall indicate the level of achievement of the objectives, the situation of the activities, the allocation of resources and recommendations for the next year

when applicable. The EURATOM financial contribution will be made through the usual procedures for baseline support through the Contract of Association.

Report of achievements under Priority Support

Achievement of Priority Support deliverables will be reported separately to the EFDA Leader. A final report (and intermediate reports marking substantial progress in the achievement of deliverables, if the EFDA Leader so requests) shall be prepared by the Task Coordinator and submitted to the EFDA Leader. Each participating Association will have to report in one subsection on the degree to which the deliverables of their Task have been achieved, and shall include a breakdown of expenditure. The Task Coordinator will collect the individual subsections into the final report for Priority Support activities addressing the milestones. The EURATOM financial contribution will be made after approval by the EFDA Leader of these reports.

Milestones and Deliverables

Milestones:

- Mid 2010 Activity Meetings: Collection and discussion of results obtained from the evaluation of theoretical work and experiments performed in 2009 and early 2010.
- End second trimester 2010 Annual meeting of the Topical Group: coordinated presentation of the results from the theoretical work and experimental campaigns in 2010.
- December 2010 Final report sent to EFDA-CSU.

Deliverables:

Multi-colour pyroreflectometry and bicolour thermography

- Feasibility studies of multi-colour pyroreflectometry and bicolour IR thermography
- conceptual designs of their implementation on a present fusion device

Fast algorithm for recognition of hot spot

- comparison between different techniques developed so far for recognition of hot spots in the IR and visible images

- report on the integrability of these techniques in a fully automated way

3. Diagnostics for long pulse tokamak operation:

Task Agreement WP10-DIA-03:
Diagnostics for long pulse tokamak operation

3.1 Introduction

It is not clear yet whether the set of magnetic diagnostics planned for ITER will be able to cope with the long pulses (because of effects of drift in the integrator and/or radiation-induced effects in the mineral insulated cables). A back up technique to measure the gap between the separatrix and the first wall – part of the European Diagnostics Procurement Package for ITER – is plasma position reflectometry. The development of this diagnostic for ITER is coordinated by F4E. A demonstration of the technique at ASDEX-UG in ongoing under WP08/09 but might need some further steps to bring the technique to the level of routine operation. Additional, new types of magnetic field sensors are being developed (magnetic strain gauges, Hall probes) that need to be tested on their performance and radiation insensitivity.

3.2 Objectives

Reflectometry for plasma position control

Under the assumption that the viability of plasma position reflectometry is demonstrated in WP08/09, further developments are needed to bring the system to a routine status such that it can be used in a fully automated feedback system for controlling the gaps between plasma and first wall. The investigation of strategies to switch during a discharge from the magnetic diagnostics to the reflectometry for plasma position control (hot swap) would also be particularly interesting for ITER

New Types of magnetic field sensors

New types of magnetic field sensors (magnetic strain gauges, Hall probe) have been recently proposed. They need to be further developed and tested, to assess whether they are suited for measuring the magnetic field in the future generation of fusion devices.

3.3 Work Description and Breakdown

Work Breakdown

WP10-DIA-03-01

Reflectometry for plasma position control

- Incorporation of the reflectometer in a fully automated feedback system of a tokamak
- Experiments in as wide as possible set of plasma scenarios to demonstrate the capability and reliability of plasma control.
- Test of the capability to switch from magnetic to reflectometric position control during a discharge

WP10-DIA-03-02

New Types of magnetic field sensors

- Developments of these sensors to a stage where they can actually be implemented in a present fusion device
- Comparison with standard magnetic sensors.

JET related activities

No JET experiments are foreseen to be implemented under this Task. However, should JET carry experiments in this area, a close coordination with the JET Task Forces will be sought.

Resources

2 ppy under Baseline Support; 1 ppy under Priority Support related to task coordination, joint experimentation team; 25 KEuros for hardware under Priority Support

3.4 Scientific and Technical Reports

Progress reports

At the end of each calendar year, during the Topical Group annual meeting, the Task Coordinator shall present a report on activities under the Task Agreement to the EFDA

Leader for his approval. These reports shall integrate the progress made by each Association on each activity, and they shall indicate the level of achievement of the objectives, the situation of the activities, the allocation of resources and recommendations for the next year when applicable. The EURATOM financial contribution will be made through the usual procedures for baseline support through the Contract of Association.

Report of achievements under Priority Support

Achievement of Priority Support deliverables will be reported separately to the EFDA Leader. A final report (and intermediate reports marking substantial progress in the achievement of deliverables, if the EFDA Leader so requests) shall be prepared by the Task Coordinator and submitted to the EFDA Leader. Each participating Association will have to report in one subsection on the degree to which the deliverables of their Task have been achieved, and shall include a breakdown of expenditure. The Task Coordinator will collect the individual subsections into the final report for Priority Support activities addressing the milestones. The EURATOM financial contribution will be made after approval by the EFDA Leader of these reports.

Milestones and Deliverables

Milestones:

- Mid 2010 Activity Meetings: Collection and discussion of results obtained from the evaluation of theoretical work and experiments performed in 2009 and early 2010.
- End second trimester 2010 Annual meeting of the Topical Group: coordinated presentation of the results from the theoretical work and experimental campaigns in 2010.
- December 2010 Final report sent to EFDA-CSU.

Deliverables:

Reflectometry for plasma position control

- Description of the integration of a reflectometer in a fully automated feedback system of a tokamak

- Experiments to demonstrate the capability and reliability of plasma control in a wide spectrum of plasma scenario
- Test of the capability to switch from magnetic to reflectometric position control during a discharge

New Types of magnetic field sensors

- Technical proposals of installation of these sensors in one of the present devices
- Comparisons with standard magnetic sensors.

4. New concept diagnostics:

Task Agreement WP10-DIA-04:
New concept diagnostics

4.1 Introduction

In general the diagnostic capability of present day tokamaks, even if impressive, is far from being fully satisfactory (very important weaknesses are measurements of turbulence, fast particles, MHD instabilities, X-ray imaging just to mention a few). The situation is expected to become even more critical in ITER and DEMO. It is therefore extremely important to support within EFDA the capability to innovate in this field. Indeed in recent years a series of proposals for new concept diagnostics, detectors and/or measurement techniques have been put forward. These new approaches deserve to be studied in laboratory, because they could be very promising. Since it is just a matter of proof of principle or feasibility studies at this stage, a very limited amount of resources is required, in particular for hardware, making these activities extremely valuable in term of benefit/cost ratio. Moreover these new diagnostics, for which a very preliminary work has been already done, concern several of the most crucial subjects mentioned in this program. Three activities have been selected as first step: a new dual gas detector able to detect selectively 2.5 and 14 MeV neutrons, laboratory feasibility studies of a soft-X ray polycapillary lens for tomography or imaging for fast MHD detection, detection of soft-X ray emissions at the plasma edge.

4.2 Objectives

Development of gas detectors for neutrons and soft X-ray

Development of a multi gem (gas electron multiplier) dual gas detector able to detect separately neutrons at 2.5 MeV and 14 MeV. Development of a multi gem gas detector for subsequent application of detection of soft-X ray emissions at the edge, and its characterization against neutron irradiation. The objective is the study of feasibility or preliminary laboratory tests, to check the capability and attractiveness of these new detectors.

Feasibility study of polycapillary lenses for X-ray imaging

Preliminary laboratory tests of the optical and dispersive properties of polycapillary lenses, in the soft-X ray range approximately 4-40 keV, at long distances. Feasibility study of these optical devices for tomography or imaging of fusion plasmas.

4.3 Work Description and Breakdown

Work Breakdown

WP10-DIA-04-01

Development of gas detectors for neutrons and soft X-ray

Feasibility or preliminary laboratory tests, to check the capability and attractiveness of gas detectors for neutrons and soft X-ray measurements.

WP10-DIA-04-02

Feasibility study of polycapillary lenses for X-ray imaging

Preliminary laboratory tests of the optical and dispersive properties of polycapillary lenses.

JET related activities

No JET experiments are foreseen to be implemented under this Task. However, should JET carry experiments in this area, a close coordination with the JET Task Forces will be sought.

Resources

4 ppy under Baseline Support; 1.5 ppy under Priority Support related to task coordination, joint experimentation team; 100 KEuros for hardware under Priority Support

4.4 Scientific and Technical Reports

Progress reports

At the end of each calendar year, during the Topical Group annual meeting, the Task Coordinator shall present a report on activities under the Task Agreement to the EFDA Leader for his approval. These reports shall integrate the progress made by each Association on each activity, and they shall indicate the level of achievement of the objectives, the situation of the activities, the allocation of resources and recommendations for the next year

when applicable. The EURATOM financial contribution will be made through the usual procedures for baseline support through the Contract of Association.

Report of achievements under Priority Support

Achievement of Priority Support deliverables will be reported separately to the EFDA Leader. A final report (and intermediate reports marking substantial progress in the achievement of deliverables, if the EFDA Leader so requests) shall be prepared by the Task Coordinator and submitted to the EFDA Leader. Each participating Association will have to report in one subsection on the degree to which the deliverables of their Task have been achieved, and shall include a breakdown of expenditure. The Task Coordinator will collect the individual subsections into the final report for Priority Support activities addressing the milestones. The EURATOM financial contribution will be made after approval by the EFDA Leader of these reports.

Milestones and Deliverables

Milestones:

- Mid 2010 Activity Meetings: Collection and discussion of results obtained from the evaluation of theoretical work and experiments performed in 2009 and early 2010.
- End second trimester 2010 Annual meeting of the Topical Group: coordinated presentation of the results from the theoretical work and experimental campaigns in 2010.
- December 2010 Final report sent to EFDA-CSU.

Deliverables:

- Feasibility studies and/or proof-of-principle demonstration of the proposed detectors or components
- Feasibility studies and/or proof-of-principle demonstrations of polycapillary lenses for tomography or imaging.

5. Data analysis validation, calibration and real time techniques:

Task Agreement WP10-DIA-05:
Data analysis validation, calibration and real time techniques

5.1 Introduction

Two expert working groups have been created under the auspices of the EFDA Topical Group Diagnostics: one concerning data analysis techniques and calibration and the other one on the feedback controls for real time applications. Calls for proposals are foreseen in WP2010-2011 to pursue the objectives identified after the start-up and review phase in 2009. They represent a tremendous potential of innovation, particularly if the very limited amount of resources required are taken into account. In particular we mention the techniques of intelligent and active data acquisition, data mining of huge archives, elaboration of new approaches for data analysis, development of algorithms for real time applications and so on. Also in this case the aforementioned techniques are not only relevant for the long term fusion programme, but surely crucial in the priority areas identified in this Work Programme, like the burning plasma diagnostics, fast MHD activity and in general event recognition, plasma operations, long pulses, disruption prediction, automatic generation of specific data bases and so on. In addition, advanced data validation and calibration techniques are required in a future environment in which conventionally used calibration methods are not frequently or possibly not at all possible. Advanced data analysis can help in the cross validation of diagnostic data, but new in-situ calibration techniques are required for ITER and beyond, but also to increase the data validity in current devices.

5.2 Objectives

Developments of new techniques for improved data acquisition and analysis

Proposals concerning improvements on active and intelligent data acquisition, data mining and analysis techniques will be considered. Proposals for new algorithms or schemes for data analysis and interpretation are encouraged as well. Only one or two tasks, out of the four

proposed, will be implemented, depending on the available budget. The others will be considered in the WP2011

Feasibility study for improved algorithms and new diagnostics for real time feedback control

Proposals concerning improvements on feedback techniques and algorithms for plasma real time control will be considered, together with feasibility studies for new diagnostics to be included in the feedback control systems. Only one or two tasks, out of the four proposed, will be implemented, depending on the available budget. The others will be considered in the WP2011

5.3 Work Description and Breakdown

Work Breakdown

WP10-DIA-05-01

Developments of new techniques for improved data acquisition and analysis

- Identify and resolve IDA capabilities for most urgent diagnostics (forward modelling instead of inversion techniques) and identify candidate solutions for error evaluation.
- Promote automatic methods for the creation of specific databases, recognition of events, data validation and development of data-driven theories for massive databases.
- Development of pilot virtual diagnostics to guide the design of new instruments with simulations in coordination with the ITM Task Force.
- Explore and demonstrate the potential of GPUs to process large amounts of data for real time applications.

WP10-DIA-05-02

Feasibility study for improved algorithms and new diagnostics for real time feedback control

- Feasibility study of a new diagnostics and software using SXR measurements for RT control (Zeff, boundary reconstruction…)

- Management of disruption: development of feedback control strategies when signs of disruptions are detected
- Application of model based profile control to long pulses scenarios with investigation about the use of quantised methodology in the ITER case.
- Management of exception and failures in a discharge: development of adaptative strategies (exception handling, reconfiguration) for better exploitation of long pulses

JET related activities

No JET experiments are foreseen to be implemented under this Task. However, should JET carry experiments in this area, a close coordination with the JET Task Forces will be sought.

Resources

3 ppy under Baseline Support; 1.5 ppy under Priority Support related to task coordination, joint experimentation team; 50 KEuros for hardware under Priority Support

5.4 Scientific and Technical Reports

Progress reports

At the end of each calendar year, during the Topical Group annual meeting, the Task Coordinator shall present a report on activities under the Task Agreement to the EFDA Leader for his approval. These reports shall integrate the progress made by each Association on each activity, and they shall indicate the level of achievement of the objectives, the situation of the activities, the allocation of resources and recommendations for the next year when applicable. The EURATOM financial contribution will be made through the usual procedures for baseline support through the Contract of Association.

Report of achievements under Priority Support

Achievement of Priority Support deliverables will be reported separately to the EFDA Leader. A final report (and intermediate reports marking substantial progress in the achievement of deliverables, if the EFDA Leader so requests) shall be prepared by the Task Coordinator and submitted to the EFDA Leader. Each participating Association will have to report in one subsection on the degree to which the deliverables of their Task have been

achieved, and shall include a breakdown of expenditure. The Task Coordinator will collect the individual subsections into the final report for Priority Support activities addressing the milestones. The EURATOM financial contribution will be made after approval by the EFDA Leader of these reports.

Milestones and Deliverables

Milestones:

- Mid 2010 Activity Meetings: Collection and discussion of results obtained from the evaluation of theoretical work and experiments performed in 2009 and early 2010.
- End second trimester 2010 Annual meeting of the Topical Group: coordinated presentation of the results from the theoretical work and experimental campaigns in 2010.
- December 2010 Final report sent to EFDA-CSU.

Deliverables:

Developments of new techniques for improved data acquisition and analysis

- Proposals concerning improvements on active and intelligent data acquisition, data mining and analysis techniques
- Proposals for new algorithms or schemes for data analysis and interpretation

Feasibility study for improved algorithms and new diagnostics for real time feedback control

- Report on improvements on feedback techniques and algorithms for plasma real time control Feasibility studies for new diagnostics to be included in the feedback control systems.