COST Action 724
Developing the Scientific Basis for Monitoring, Modelling and Predicting Space Weather

Document CA724/WG1/CFC090404

Working Group 1
Monitoring and Predicting Solar Activity for Space Weather

CALL FOR COLLABORATION

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1. COST Action 724

1.1. Introduction to COST

COST is the acronym of "**CO**operation in the field of **S**cience and **T**echnology", a program aimed at the coordination of European activities in science and technology funded by EU through the European Science Foundation (ESF).

A set of Technical Committees (TC) is devoted to managing the approved "Actions" in the different fields such as e.g. Meteorology, Telecommunications, etc.

All the aspects relevant to an approved Action are decided by a Management Committee (MC), whose members are two national representatives for each participating countries, coordinated by a Chairman and a Vice-Chairman elected by the MC members during the opening meeting, which formally defines the start of the Action.

MC meetings are expected to be scheduled on an yearly basis.

Fundings are limited to activities related to coordination, i.e., Management Committee meetings, expert meetings, travels, and publications.

No research activity is directly funded by the COST program and it is the responsibility of participants contributing to the COST Actions to find their own funding sources by submitting relevant projects to the national and international funding organizations.

COST Actions can endorse research projects by stating the scientific excellence and international relevance. This can play a key role when COST Action participants submit a joint program as a consortium.

Detailed information about the ESF/COST Program is available at http://cost.cordis.lu .

1.2. Objectives of COST Action 724

COST Action 724 (CA 724) is aimed at Space Weather in the framework of Meteorology and is headed as "**Developing the scientific basis for monitoring, modelling and predicting Space Weather**".

Objectives and organizational structure of CA 724 are detailed in the Memorandum of Understanding (MoU) document, available at the dedicated web site http://cost724.obs.ujf-grenoble.fr or at the ESF/COST page http://cost.cordis.lu/src/action_detail.cfm?action=724 .

The general aims of the CA 724 are:
- To coordinate European research into modelling and prediction of Space Weather;
- To promote where necessary the deployment of new instrumentation to satisfy data requirements, and the development of new models;
- To educate potential users of Space Weather data;
- To gather feedback from users which may be used to improve services;
- To create a forum for exchanging "best practice" among users and providers of Space Weather services;
- To set standards on data exchange.

The main objectives are the development of the scientific basis of Space Weather applications in the European framework, and the exploration of methods for providing a comprehensive range of services to a variety of users, based on modelling and monitoring of the Sun-Earth system.

The general deliverables are scientific and technical reports and the development of web services as well as the formulation of specific recommendations to the national and European Ministries about Space Weather activities and services in Europe.

1.3. Operational structure of COST Action 724

The main goals of CA 724 are to be achieved through the collaborative work of 4 Working Groups, each devoted to a specific task in the framework of solar-terrestrial relations as follows:

– **WG 1 - Monitoring and predicting solar activity for Space Weather**.
  - To research the use of solar observations (eg. extreme ultraviolet images, X-ray observations, radio emissions) and models (eg. magneto-hydrodynamic models of flux tubes) for predicting energetic particle events;
  - To research the use of solar observations and models (as above) for predicting coronal mass ejections;
  - To research the modelling and prediction of solar extreme ultraviolet radiation (EUV) which affects atmospheric density and hence drag on satellites at low Earth orbit altitudes.
  - To liaise with COST Action 271 (http://www.cost271.rl.ac.uk/) where monitoring and modelling of solar activity is relevant to ionospheric radio propagation;
  - Liaise with WG4 to ensure relevant data and models are incorporated in a European Space Weather Network.

– **WG 2 - The radiation environment of the Earth.**
  - To develop a quantitative model of the interaction of solar energetic particle events with the Earth's magnetosphere;
  - To develop a quantitative model of the development of trapped radiation in the Earth's magnetosphere during geomagnetic storms;
  - To develop a quantitative model of the variation of galactic cosmic radiation in response to solar activity;
  - To study how electronic technology in satellites, launchers and aircraft is affected by the Earth's radiation environment;
  - To study how humans are affected by solar and cosmic radiation in different activities (eg. astronauts, aircrew, air passengers, on the ground).
  - To set up and maintain a database of recorded effects on electronic technology and human health;
  - Liaise with WG4 to ensure relevant data and models are incorporated in a European Space Weather Network.

– **WG 3 – Interaction of solar wind disturbances with the Earth.**
  - To develop a quantitative model of the propagation of observed coronal mass ejections (CME) through the interplanetary medium to predict their arrival at Earth;
  - To develop a quantitative model to predict geomagnetic storms and ionospheric current systems from observations of the solar wind made by ACE;
  - To liaise with COST Action 271 where modelling of the ionospheric response to geomagnetic storms is relevant to ionospheric radio propagation;
  - To develop the capability to model electric fields induced in the ground by geomagnetic storms;

- To set up and maintain a database of recorded effects of geomagnetic storms on technological systems;
- Liaise with WG4 to ensure relevant data and models are incorporated in a European Space Weather Network.

– **WG 4 – Space Weather observations and services.**
- Coordinate a network of European websites relevant to data, models, prediction and public outreach;
- Develop methods and standards for data exchange to enable coupling of different space weather models (eg. using Spacegrid) and to disseminate relevant information to users;
- Liaise with COST Action 271 to let COST 271 benefit from space weather model development and to incorporate COST 271 output where it will be of benefit to other space weather services;
- Maintain databases of users and statistics about the service.

1.4. Status of Cost Action 724

The Opening Meeting of CA 724 was held in Bruxelles on November 24th, 2003.

The Action will last for 4 years, i.e. until November 24th, 2007.

The first six months are dedicated to the organization of WGs, whose structure, work packages and deliverables, persons responsible of WPs and relevant timelines will be discussed and approved in the Management Committee Meeting scheduled on April 24th-25th in Nice (France).

During the Opening Meeting, the national representatives in the MC elected the following persons for the different roles in CA 724:

Chairman		J. Lilensten	France	jean.lilensten@obs.ujf-grenoble.fr
Vice-Chairwoman		A. Belehaki	Greece	belehaki@space.noa.gr
WG 1	Leader	M. Messerotti	Italy	messerotti@ts.astro.it
	Co-Leader	W. Schmutz	Switzerland	w.schmutz@pmodwrc.ch
WG 2	Leader	R. Vainio	Finland	rami.vainio@helsinki.fi
	Co-Leader	D. Heynderickx	Belgium	d.heynderickx@oma.be
WG 3	Leader	J. Watermann	Denmark	jfw@dmi.dk
	Co-Leader	S. Poedts	Belgium	stefaan.poedts@wis.kuleuven.ac.be
WG 4	Leader	F. Jansen	Germany	jansen@physik.uni-greifswald.de
	Co-Leader	M. Candidi	Italy	candidi@ifsi.rm.cnr.it

The ESF/COST Officials responsible of CA 724 are:

ESF/COST Officials	S. Joffre	sylvain.joffre@fmi.fi
	P. Nejedlik	pnejedlik@cost.esf.org

Participating Countries: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Norway, Poland, Slovakia, Spain, Sweden, Switzerland, United Kingdom.

Forthcoming Countries: Israel, Portugal, Turkey.

Non-EU Countries: Armenia, Russia, Ukraine.

Associate Organizations: ESF/COST Action 271, ESA, E-STAR.

2. Working Group 1

As listed in Section 1.3, the specific aims of WG 1 are respectively:

- To research the use of solar observations (eg. extreme ultraviolet images, X-ray observations, radio emissions) and models (eg. magneto-hydrodynamic models of flux tubes) for predicting energetic particle events;
- To research the use of solar observations and models (as above) for predicting coronal mass ejections;
- To research the modelling and prediction of solar extreme ultraviolet radiation (EUV) which affects atmospheric density and hence drag on satellites at low Earth orbit altitudes.
- To liaise with COST Action 271 where monitoring and modelling of solar activity is relevant to ionospheric radio propagation;
- Liaise with WG4 to ensure relevant data and models are incorporated in a European Space Weather Network.

The above specific aims can be achieved through the following actions:

a. To establish the current level of expertise in Europe.

b. To identify existing data providers.

c. To coordinate the development of relevant models.

d. To identify potential users.

e. To liaise with COST Action 271.

f. To liaise with WG 4.

The operating domain of WG 1 is schematized in Figure 1, where solar drivers of geoeffective phenomena are indicated as well as concurrent solar phenomena.

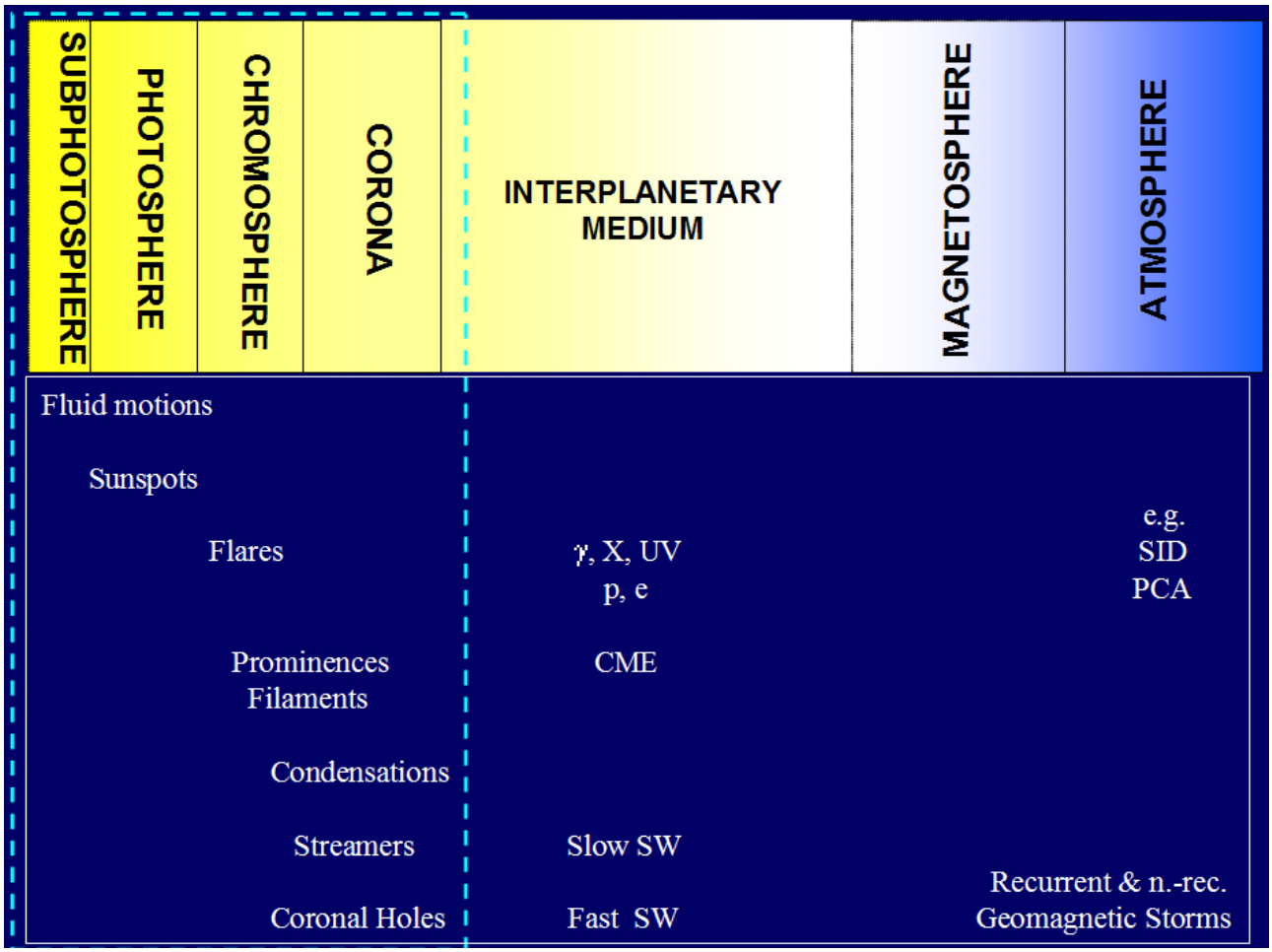

Figure 1 Operational domain of WG 1 (dashed box) with respect to the Solar-Terrestrial environment.

3. WG 1 Work Packages

The work of WG 1 is divided into Work Packages (WP) according to specific aims. A possible scheme is (see Figure 2):

- WP 11000 WG 1 Coordination Activities.
- WP 12000 Solar EM Radiation Analysis.
- WP 13000 Solar Particle Emission Analysis.
- WP 14000 Coronal Mass Ejection Analysis.
- WP 15000 Liason with COST Action 271.
- WP 16000 Liason with WG 4.

Each WP is coordinated by a Leader who is responsible for the organization and coordination of the work and the preparation of deliverables according to the agreed schedule.

The WP Leaders will be appointed in the next MC Meeting (Nice, 24-25 April, 2004).

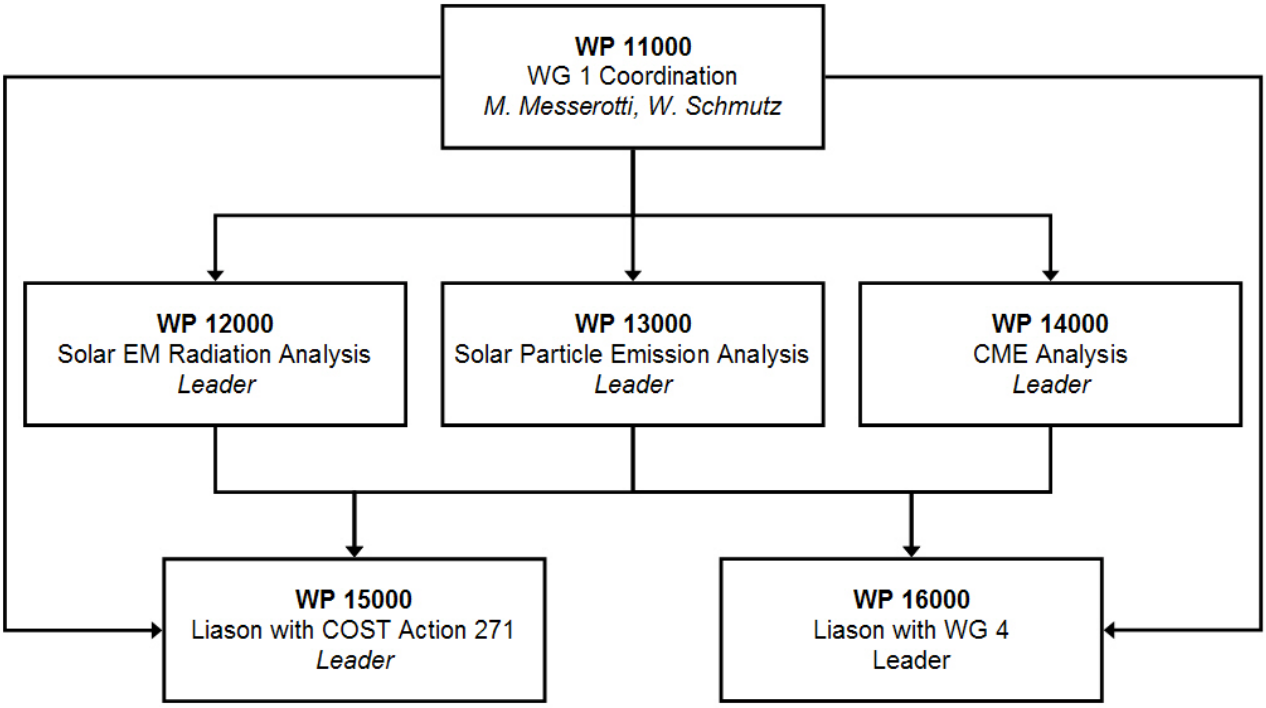

Figure 2 Scheme of WG 1 Work Packages.

4. WG 1 Work Package Deliverables

The Leades of WPs are responsible for the identification of specific goals in the framework of the project, which must anyway comply with the milestones indicated in the project document as follows:

a. Catalogue of data sources.

b. Catalogue of event models.

c. Review of scientific understanding.

d. Identification, implementation and evaluation of schemes for predicting geoeffective solar events.

With regard to Item a., an extended work has been carried out in the framework of EGSO (European Grid of Solar Observations; http://www.egso.org), which represents a useful and effective resource to be considered.

With regards to Item b., we refer to the paper by Lathuillère et al. (Annales Geophysicae, **20**, 1081, 2002) as a useful starting point, as an overview of scientific models available for Space Weather developments.

With regard to Item c., we suggest the use of Concept Maps to organize the knowledge in a series of graphical schemes which clearly point out the associations among the various aspects of solar activity in the framework of Space Weather. An example is presented in Figure 4, which depicts the possible interrelationships among solar drivers.

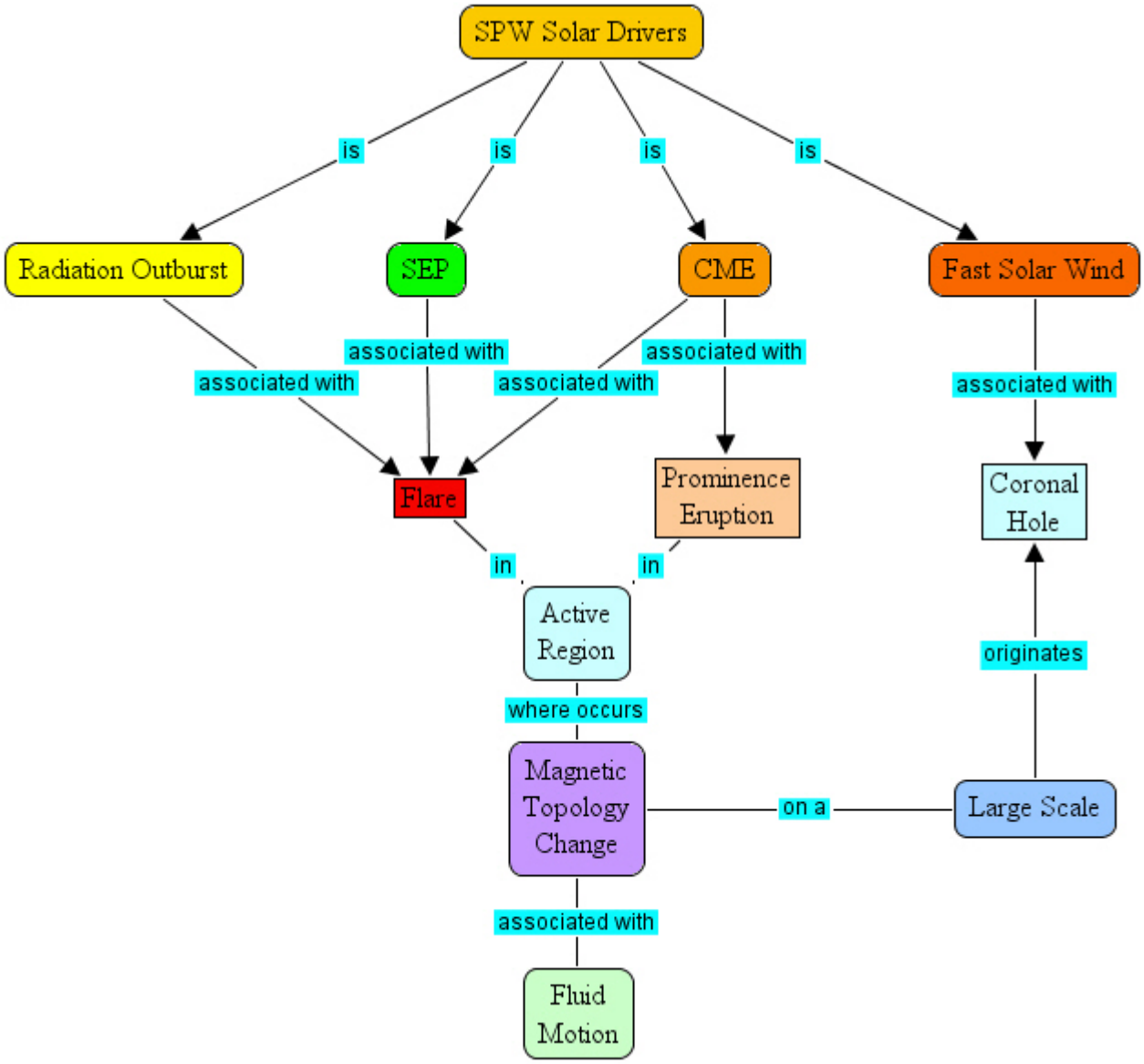

Figure 3 Concept Map of the Space Weather Solar Drivers.

5. WG 1 Tentative Timeline

The tentative timeline of WG 1 activities is graphed in Figure 4, where the milestones suggested in the original CA 724 proposal are listed and associated with the related WPs.

When a specific activity is supposed to continue for the refinement of the associated milestone, its timeline is hatched.

The tentative timeline as well as the milestones and deliverables are subject to modifications according to the indications of the WP Leaders and participants and are subject to the final approval of the Management Committee at the MC Meeting in Nice.

Upon the final approval by the MC, the WG organization in WPs, the WP Leaders, the WP deliverables and milestones, and the WG timeline will become fully operational.

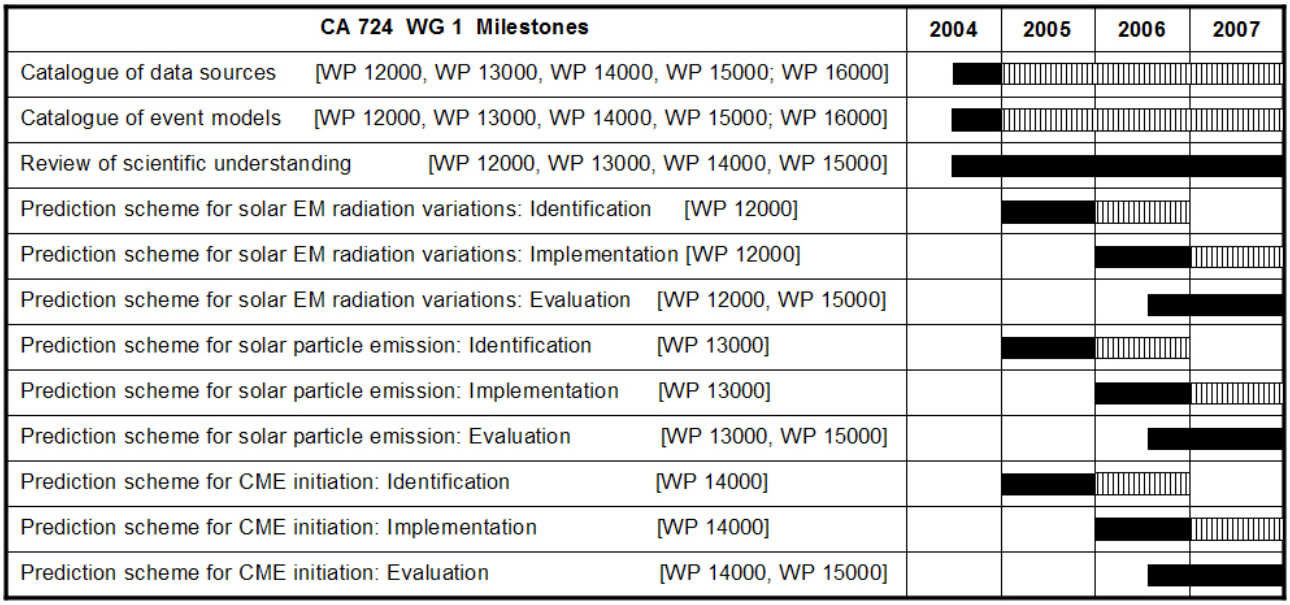

Figure 4 Tentative timeline and suggested milestones of WG 1.

6. Template for Expression of Commitment

Any potential participants interested in the activities of WG 1 are kindly asked to **email** (messerotti@ts.astro.it) a letter stating their Expression of Commitment, where the scientific contribution must be briefly detailed according to the template sketched in the following.

Expression of Commitment

Title of contribution	*Solar Flare Precursors*
Proposer(s)	*M. Messerotti and W. Schmutz*
General objectives relevant to CA 724 MoU	*Solar Activity Modelling*
Specific goals of MoU scientific programme	*Goal(s) of Working Group 1*
Specific WG Work Package(s)	WG 1 WP xxxx
Description of the project	*Analysis and interpretation multi-band solar data*
Deliverables	*Observation Data Base, Publications*
Timetable	*1 year (data analysis) + 1 year (interpretation)*
Required manpower	*2 post-docs*
Resources availability	*Ground- and space-based data*
Expected collaborations	*SOHO, TRACE, E-STAR, ESA*
Previous experience in the field	*National and International Projects*

7. WG 1 Contacts

Leader

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