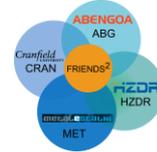




# FRIENDS<sup>2</sup>



## Minutes of Meeting Kick-off meeting

<b>Subject:</b>	FRIENDS2 Kick Off meeting	Nº	1
<b>Date:</b>	22-23/01/2015		
<b>Time:</b>	09:00		
<b>Venue:</b>	Seville-CPA		
<b>Meeting chairman:</b>	Ramón Escobar Galindo		

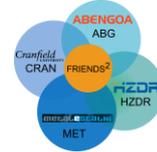
Previous Meeting		Future Meetings	
<b>No.</b>		<b>No.</b>	
<b>Date:</b>		<b>Date:</b>	
<b>Time:</b>		<b>Time:</b>	
<b>Venue:</b>		<b>Venue:</b>	

### Attendees Name

Ramón Escobar Galindo	REG
Manuel Gallas Torreira	MGT
Elena Guillén Rodríguez	EGR
Irene Heras Pérez	IHP
Gonzalo Rincón Llorente	GRLI
Mercedes Alcon Camas	MAC
Azucena Bello Fernández	ABF
Carlos Alcañiz García	CAG
Irma Mantilla	IM
Maria López Herraiz	MLH
Matthias Krause	MK
Robert Wenisch	RW
Erik Schumann	ES
Frank Lungwitz	FL
Ibon Azkona	IA
John Raymond Nicholls	JN
Jose Luis Endrino Armenteros	JLE



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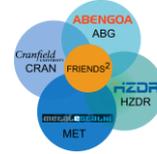


Topic	FRIENDS2 Kick off meeting
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<p><b>(22/01/15)</b></p> <ul style="list-style-type: none"><li><b>Agenda:</b><ul style="list-style-type: none"><li>9:00-9:15 - Welcome</li><li>9:15-10:15 - Presentation of each institution</li><li>10:15-10:45 - Project overview</li><li>10:45-11:00 - Coffee break</li><li>11:00-13:00 - Workpackages presentation</li><li>13:00-14:30 - Lunch</li><li>14:30-16:00 - Visit to Soland Laboratories</li><li>16:00-18:00 - Visit to solar plant</li></ul></li></ul> <p><b>1) Welcome:</b> After a short introduction by REG, MGT on behalf of Manuel Doblaré welcomed the participants of FRIENDS<sup>2</sup> to the kickoff meeting. He congratulated the partners of the consortium for the successful proposal with a very high score in such a competitive call.</p> <p><b>2) Presentation of each institution</b></p> <ul style="list-style-type: none"><li>- <b>Abengoa (MGT)</b> Abengoa search for new business models based on technology. Concession type structure/ Industrial production. AR is the starting point of the chain (300 patents and 300 people working on R&amp;D) Abengoa invested 420 M€ in R&amp;D (2013) including the demonstration plant in South Africa Abengoa research mission: being focus on the product, without forgetting the fundamental research, comprising people from different backgrounds and collaborations with research centers. In particular, looking for boundaries between research centers and the company. A main goal of Abengoa research is keeping the know-how in house providing a continuous learning to the company. Regarding the project, MGT pointed out that <u>a key subject in H2020 is materials</u>. Materials are crucial for a technologic company as Abengoa. The work that will be done in FRIENDS<sup>2</sup> is very important to Abengoa.</li></ul> <p><b>Q&amp;A</b></p> <p><u>JLE:</u> Are projects defined by the TRL scale in ABG? <u>MGT:</u> The activities in ABG are divided in horizons, in all parts of the company people work according to horizons. H1 generates cash. TRL1 and 2 would be Horizon 3. So we are working with TRL, because it is easy to translate the TRL to horizons. We also have the methodology of the stage gate. <u>MK:</u> does the 420 million investments include pilot plants? MGT explained the money invest for each stage: lab, pilot plant. Each pilot plant carries an investment of around 20M€. MGT talks about the experience in Eureka. 80 million to pilot projects.<li>- <b>HZDR (MK)</b> MK as the leader of the nanocomposite group described the different German research centres: Max Plank, Fraunhofer, Leibniz Association and Helmholtz association (15%) The industrial sector cover two third of the R&amp;D money in Germany. Mission of Helmholtz association: use-inspired basic research with strategic programs in</li></p>
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health, matter, energy.

HZDR main facilities include ELBE (different types of radiation: electrons, positrons, protons, neutrons, X. ray, infrared and gamma radiation) and the **Ion Beam Center** (three accelerators for analysis, ion implanters for material modification, **cluster tool** at channel 9 of Ion beam center, PVD chambers)

The nanocomposite group comprises 1 staff member, 3 PhD students and 2 technicians and performs research on nanocomposites (C-Ni, Si-SiO<sub>2</sub>, TCO)

- **Cranfield University (JN)**

Cranfield is the only post-graduate university in the UK (to some extent it is comparable to Fraunhofer institutes). Money from the industry support great part of the research.

Research areas: **coatings for extreme service**. Development of all classes of surface protection systems including tribology, aqueous corrosion, oxidation, hot corrosion, active materials functional materials, catenation compounds (self-lubrication of the coatings), ceramic coatings, optically active surfaces, coating self-reparation applications.

JN, as an expert in high temperature and corrosion resistance, showed an example of a commercial “pink coated” turbine as an example of a smart thermal barrier coating developed by his group for Rolls Royce. He also explained his own experience with in molten salts and its interaction with metals, remarking the importance of being able to scale the deposition technology.

CRAN, and in particular the Surface Engineering and Nanotechnology Institute (SENTi) has both coating manufacturing and testing capabilities. JN described the **combinatorial deposition** as a very useful strategy to obtain a complete set of stoichiometries in a single sample. Deposition techniques include plasma spraying and electroplating. The performance test capabilities of CRAN include a high temperature corrosion test laboratory.

**Q&A**

FL asked about the optical facilities at Cranfield. They include ellipsometry, optical characterization (UV-Vis-NIR and FTIR)

MK asked about the possibility of PVD deposition at Cranfield. JN replied that those capabilities are available as the group is a large manufacturing group and the merge will depend on the skills needed in the project.

JLE remarked that we should have clear the objectives and try to accomplish with the resources already available. He ended up indicating the University has been historically focused on the UK industry but in the last years with a new corporate plant it is expanding with more than 400 researchers working.

- **Metal Estalki (IA)**

IA explained that MET is a technological SME (16 people). The technology is based on arc deposition as they are the Spanish representative of the Swiss company Plattit. This technology is the most commonly used technology with the Spanish business for cutting tools. He briefly explained the main principles of the arc technique and described the different setups. They have a semi industrial reactor PL50 for R& D projects and other three **larger reactors including a PL1400 able to coat long tubes up two meters**. Other production facilities include vacuum technology for pretreatment (EU2000 cleaning unit), decoating processes, and a mass spectrometry for characterization of the species in the plasma. MET complies the ISO 9001, ISO 14001 certifications.

MET is specialized on ceramic, few microns thick, hard coatings to improve the lifetime of the tools (or implants). Standard coatings include TiN, TiCN, AlTiN using complicate architectures (multilayers, nanocomposites, etc). The main activity is on wear applications, but they are also involved in many other projects in collaboration with Spanish universities.



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(Renamill, Nanorein, Microtools, Intelimplant, Bacteriocoat). He ended up showing the results of a successful project (Solar orbiter project) where MET has been selected as the provider of the coatings for the thermal protection of the solar probe after many tests performed at ESTEC facilities in The Netherlands, due to the low temperature of the MET coatings compared to its competitor's.

### 3) Project overview

REG introduced the objectives, scope and expected impact of RISE call according to the Commission. FRIENDS<sup>2</sup> is not a typical H2020 research project and it is also different from an ITN. RISE seeks the **promotion of collaboration between academic and non-academic** partners based on secondments. He briefly explained how the secondments will be in Friends<sup>2</sup>, although a more detailed explanation will be given later.

REG described the project duration (4 years), participants, researchers involved (21, not including new people such as MAC or MLH), number of secondments (101).

In REG's opinion FRIENDS<sup>2</sup> proposal was a success mainly due to the amount of work, effort done and people involvement during the proposal writing. In particular REG thanked EGR, IHP and ABF for their work. REG enumerated the objective facts that provoke the excellent score (> 97/100) of the proposal. Among them he highlighted: i) the integral (aiming at three key elements of a solar plant) and multidisciplinary (from lab to the plant) approach of the project; ii) a clear definition of the consortium and the workpackages according to the skills of the partners; iii) a balanced distribution academia-industry of the secondments; iv) the internal support of the institutions and v) the fulfillment of all the evaluation criteria of the proposal.

Finally, REG is certain that FRIENDS<sup>2</sup> will be a success as, under its umbrella, we will work on already ongoing projects. He stressed the importance of dissemination and common operation procedures and to go beyond FRIENDS<sup>2</sup> establishing second level connections in order to start a European network on coatings for thermal applications.

#### Q&A

MK asked about the review meeting and REG explained that it was anticipated to month 14 after the proposal done by the officer.

JLE asked if the proposed template of documents (ppt, doc) was mandatory. REG said it is not, but it would make things easier with the commission, so he recommends its use. REG showed the logo of the project and asked for suggestions about it with no response.

### 4) Workpackage presentations

#### - WP1: New generation of optical coatings for thermosolar applications. (MK)

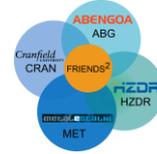
MK started his talk giving a general overview of this WP, including its main objectives. He mentioned the need for a **selection of potential coatings for scaling up**. Moreover, MK stressed out the importance of determining which deposition technology will be the most appropriate. He summarized the main properties a solar absorber coating must fulfill: i) high temperature stability (800°C), ii) good optical and mechanical properties, iii) long operation lifetime, and iv) oxidation resistance.

He noted that those are very demanding properties and we need to find an optimum. Then he summarized the different **deposition techniques available** for FRIENDS<sup>2</sup> project. He noticed during JN talk that not all the available techniques at Cranfield University were mentioned in the proposal, therefore we have underestimated the capabilities.

MK discussed which are in his opinion the current **list of candidates for solar absorbers**: C:TM nanocomposites, colored oxide nanocomposites, transparent conducting oxides (TCO) and AlTiN(O) based hard coatings.



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Then MK outlined some of facilities available at HZDR. Among the different deposition equipment, he started with Ion beam Assisted Deposition (IBAD) system, highlighting the advantages of this technique: i) precise and independent control of the deposition parameters, ii) control of morphology and size. Since 2014, there are new experimental features in the system such as the possibility of carrying out reactive deposition (with O<sub>2</sub>), which make the equipment even more flexible.

MK showed an example of a C:Ni nanocomposite deposited by this technique. They consider this material as a model system for IBAD. MK said that they are not only experimentalist. There are people working on simulation at HZDR, for instance working on 3D binary collision simulation (TRI3DYN), and these knowledge is also available for FRIENDS<sup>2</sup> project.

MK also mentioned Co:CoO nanocomposites as a very interesting material, because both components are stable over 900°C. He questioned if it would be feasible to obtain such a nanocomposite, and showed some preliminary X-Ray diffraction (XRD) results.

Another deposition technique available at HZDR is HiPIMS, which is slowly moving into industrial application. However, he doubts if advantages of this technique outweigh disadvantages. Due to the high power density it is possible to obtain very dense films, and there are some nice examples of C:Ti nanocomposites for tribological applications. However, deposition rates (~5 nm/min) are very low.

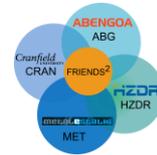
Finally, he talked about Magnetron Sputtering (MS) deposition. He emphasized the importance of the feedback loop for oxygen control available in the MS chamber. This opens up the possibility of checking if the deposition process is in the reactive or metallic modes. MK showed pure TiO<sub>2</sub> and tantalum doped TiO<sub>2</sub> films deposited by MS. One of the chamber is devoted to TCOs growth. However, there are 4 more systems available for MS deposition. In the last part of his talk, MK mentioned that he is expecting some feedback from simulations in order to optimize the deposition parameters.

## Q&A

REG suggested MK to **include in his presentation information about the facilities available in the different institutions**, as long as the role of each partner in the WP. As MK focused his presentation on solar absorber coatings, REG proposed Carlos to give his **input about reflective coatings**. According to MK, the best scenario would be to focus on few materials and to reduce the number of deposition techniques used. Moreover, it is very important to keep in mind the scaling process. Regarding this, JLEA remarked that it was clear in the proposal that Metal Estalki was going to be responsible for the scaling process and asked IA about his involvement in this matter. According to JLEA it is possible to coat long tubes (up to 4 meters) at Cranfield, using sol-gel processes. However, from his point of view it was clear in the proposal that PVD was the selected technique for scaling process. IA pointed out that Metal Estalki has only experience in cathodic arc deposition, not in magnetron sputtering. He asked for more information about the whole process, and also mentioned that the possibility of welding the tubes needs to be discussed. JN asked if the tubes have to be single tubes and ABF informed about the characteristics of the coating substrates for the different applications. Solar absorber tubes are 6 meters long for tower applications and 4 meters long for parabolic. JN remarked that moving from 4 to 6 meters long tubes is a big challenge. ABF said that it is not mandatory to work with 6 meters long, but to use shorter tubes means more welding processes. JLEA asked about previous experience in Platit for long tubes coating. REG said that there are already successful examples of coating long tubes by PVD. EGR mentioned that there are Plasma technology (PT) systems for this kind of deposition, as Dr. Ricky Fu, plasma technology engineer informed during his last visit. Once again, JLEA pointed out that it is very important to rely on IA feedback, because he has substantial experience on industrialization process, including for example cost management.



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Another important aspect to bear in mind is the deposition rate of the films. MK and FL informed that for TiO<sub>2</sub> films it is possible to obtain rates of 50 nm/min by MS.

## - **WP2: Protective coatings for heat storage components**

JLEA gave an overview of WP2. To lead this WP, Cranfield University needs the involvement and support from Abengoa. They need to understand the actual problem they are going to face. They do not have enough information about the magnitude of the problem. The development of protective coatings opens the possibility of i) using cheaper substrates, ii) rising working temperature and iii) increasing operating lifetimes. In his opinion PVD techniques can be used to develop proof of concept samples in the lab. However plasma spray is a much more appropriate technique for coating long surface area tanks. JN agrees at this point: **PVD can be used for alloys selection** but once the optimal composition is known, we should move to **plasma spray as the scale up technique**. According to him, we will never get good corrosion resistance by PVD techniques. MG asked about the target temperature of the coating. It is very important to clarify the target. Everyone agree that we are not working with the temperature proposed in the project (1050°C). However, JN pointed out that this temperature is not out of range when we think in terms of **accelerating tests**. We don't have 20 years to test the coatings, so we can accelerate the corrosion by increasing the temperature. JN also proposed to use combinatorial method for coating optimization. For finite element analysis (FEM) REG will contact simulation team at Abengoa. JLEA doubted if deliverables in month 3 and 12 are feasible or not.

### **Q&A**

REG pointed out the singularities if this WP. In contrast to previous one, in this WP we have to start from scratch, there is no previous work done. REG suggested to focus on combinatorial analysis instead of FEM. MG agrees on the clear differences between this WP and the previous one. For this reason, he thinks it is very important to **devote enough time to the state of the art** (SoA) study. JLEA proposed he and REG could discuss about this SoA at Cranfield during REG first secondment.

## **WP3: Advanced coating characterization**

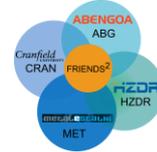
RW started the talk pointing out the difference between "in situ" and "environmental". According to him, "in situ" is defined as heating in vacuum and "environmental" when the sample is heated under a controlled atmosphere. RW mentioned that research institutions, HZDR and CA will provide training and teaching. He talked about the different characterization techniques available at HZDR (ellipsometry, photospectrometry, ion beam analysis, etc.). He paid special attention to the **description of the cluster tool**, explaining its different components including the environmental chamber. In situ Raman is already available, and it is under discussion to install a spectrophotometer. He showed some examples of Raman measurements carried out the previous week. He also showed ellipsometry data for TiO<sub>2</sub> films annealed at different temperatures. Those films are optically stable up to 800°C.

### **Q&A**

JLEA asked about the maximum temperature for in situ measurements. RW replied that it is possible to measure ellipsometry under environmental conditions up to 900°C. In the vacuum 1000°C can be reached. REG proposed to **develop a characterization protocol for each type of sample**. Every partner should inform about the **available characterization techniques in the different institutions**. MK reminded all the participants that procedure to obtain beam time has changed. A proposal is needed for every kind of sample. However,



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he said that maybe it is possible to fill a long term proposal. REG suggested Robert to send information about this matter.

## ***WP4: Evaluation tests of optimized and selected coatings***

EGR gave an overview of WP4. She started by recalling the main objective of this WP: testing and evaluating the durability of the coatings. It is the last technical WP, and it is closely related to the previous ones. Lead participant is Abengoa, and three clear stages can be defined: i) selection of coating for stability tests, ii) stability tests in the laboratory and iii) test in the field at Abengoa R&D platform. She stressed out the importance of this WP to obtain the holistic approach which is aimed with the project. It is necessary to define the durability goals for the different coatings. We are going to develop coatings for three very different applications, and the required properties will depend on those applications. For example, she stressed out that both mirrors and solar absorber coatings need to maintain good optical properties in the long term, but absorber coatings need to be stable at high temperatures meanwhile for mirrors it is very important to obtain good mechanical stability. In relation with JLEA previous talk, she highlighted again the importance of determining the target temperature for protective coatings. She showed the number of secondments for this WP, as long as the percentage of p-m per institution. An overview of the tasks was shown, including the participation of each institution in those tasks. After that, a more detailed description of the role of each participant was given, starting with Abengoa. The **main role of Abengoa will be to carry out stability tests in the laboratory and in the field.** EGR showed some pictures of the test bench developed by ABF at Solucar platform. Concerning **HZDR, its main role is to carry out measurements in the environmental chamber included in the cluster tool.** An important part will be the characterization of the optical constants at high temperature, simulating operation conditions. Finally, **Cranfield University will be critical for corrosion and temperature resistance tests.** EGR suggested involving Chris Samson also in the characterization of degradation in mirrors, taking into account the facilities available at this University for erosion and mechanical stability tests. Then she showed a Gannt diagram for this WP4, where the duration of the tasks and the deliverables were included. She also discussed the 4 deliverables associated to this WP. She mentioned several times during his talk the importance of the development of durability protocols for each type of coating, with the support of all the participants. She included in her presentation an example of a durability protocol for solar absorber coatings elaborated by ABF and IHP. She finished her talk with the following open question: **who is going to be involved in WP4?**

(23/01/15)

- **Agenda:**

- 09:00-11:00 - Dissemination and management session
- 11:00-12:00 - Discussion and closure
- 12:00-13:00 - AR Laboratories tour

- 1) **Dissemination and management session**

- ***WP5: Networking and dissemination***

JLE started his presentation saying that it will be difficult that transfer of knowledge (ToK)



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will not work within the consortium as the academic groups are already working with the industrial groups. We will succeed and secondments will be critical for the ToK. Regarding dissemination JLE suggests to take advantage of the different ways of advertising every institution already has (i.e. institutional magazines). There was already an article about the collaboration at HZDR newsletter. REG comments that **Abengoa's newsletter will include information about the kick off meeting.**

Workshops (WS) will be a key issue within the dissemination of the project. Workshops dates are flexible. In this regard, JLE introduced the **WS at Cranfield (Extreme Surface Engineering and Nanotechnology 23-25 June 2015)**. For FRIENDS<sup>2</sup> partners, it will be free of charge. REG comments that it would be a good idea to **combine WS with secondments and with project meetings.** Regarding seminars, JN will give a seminar in Abengoa this year (September) to show his work on CSP. JLE will prepare an excel file to include participations in conferences, papers regarding the project. The funding of the EU should be included in all contributions and papers related to the project.

**A project webpage should be created.** JLE comments the possibility of host it within CRAN servers but it will have a Cranfield domain. JN suggests the use of a .eu domain. REG will ask the officer about that. REG and JLE will look for quotations for external webpages. According to Irma, those costs can be included in the management. JN proposed the **creation of a LinkedIn group** and everyone agrees it is a good idea.

## - ***WP6: Administrative project management***

IM started her presentation with a **recommendation to all participants to read the Grant Agreement** (GA). She described the different parts of the agreement. Annex 1 is the most important part, as it includes the Description work, research, activities, milestones, etc. If there is any change on the GA, we have to do an amendment and notify it to the officer. Everyone should have a copy of the project.

The **Consortium agreement (CA) is not yet signed.** It is based on the DESCA model from the Commission EU and establishes the relationship between beneficiaries. It includes for example the dissemination rules, if we want to publish something we have to give notice, etc. All the information we talk about is confidential. In the CA the distribution of costs should also be included. Although the Consortium agreement is not mandatory in this project everyone agrees that DESCA model is an acceptable model. There is some discussion about the inclusion of background. ABG decided not to include anything because we have agreements with everyone. In principle we have to share background. During the discussion she clarified JN that it is about confidential background.

Distribution of funds: 2000 € for travel accommodation and institutional costs; 1800€ for consumables, conferences, networking activities and 700€ for overheads, financial management, logistic and legal advice. IM explained how unit costs are eligible. The online application only allows introducing the justification once a secondment is fulfilled. Commission says they are not going to check the bills. But it is possible to make an audit. Therefore, REG recommends **keeping all the receipts of the project.**

IA asked what would happen if we make less secondment than planned. In that case we would have to give the received money back. IM said that the commission will pay the complete 4500€ so it is up to the partners the distribution of the funds.

Finally IM suggested a redistribution of the budget to add to ABG some amount related to management and to MET regarding dissemination but after a discussion it was agreed to keep the budget as presented to the commission as the final amounts are not static but depend on the number of secondments the institutions will carry out.

IM talked about the general obligations of each beneficiary. In any publication a logo and a



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sentence regarding the project has to be included. We must keep the original project documents until 5 years after. It is necessary to check if the national law accept scanned documents or not.

## - **Organization of secondments**

REG summarized the **general rules of secondments**:

- Minimum duration of 1 month, maximum of 12 months
- Secondments should be intersectorial
- Secondments  $\neq$  person month
- Payments are linked to secondments
- Secondments can be split but without exceeding 12 months and within the duration of the project. **Note: the more you split the more you spend.**
- Stays shorter than one month are possible, but they must sum up at least one month in total and should be done by the same researcher, and involving the same sending and hosting organizations.
- The secondments can be exchanged by researchers if they have the same profile (ER or ESR)
- Secondments in parallel to different institutions are allowed.

REG recommends minimum one week stays. The definition of a week is not clear. This must be clarified by the officer. The **suggestion for students is to stay at least 3 weeks.** Administrative staff (i.e. IM) can also do secondments. There is flexibility to shift start dates and duration of secondments. REG prepared an **excel table with the secondments** prevision for 2015. It has to be updated by the partners. JN proposed to put the table in the cloud, so any modification can be seen for everyone. **A short report after each secondment should be done by the seconded staff and send to REG.**

IM comments about ASNT staff (MAC, ABF, CAG) as they do not belong yet to the AR structure they cannot. It has to be decided whether an amendment will be made to include ASNT as beneficiary or not. In that case the budget (and secondments) of AR will be redistributed without affecting the other partners. Once the ASNT staff joins ART they will have to wait 6 months before doing any secondment within FRIENDS<sup>2</sup>.





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## Plan of actions

Action	Person in charge	Date	Status
1. Upload Kick off presentations, project documents and Secondments table to Box	REG	12 <sup>th</sup> Feb 2015	Done
2. WP5.- Request quotation for web page	REG	12 <sup>th</sup> Feb 2015	Done
3. Read and accept MoM of the kick off meeting	All partners	27 <sup>th</sup> Feb 2015	Done
4. Revision of secondment table with prevision for 2015	REG, MK, JLE, IA	27 <sup>th</sup> Feb 2015	
5. Send information about beamtime allocation procedure at HZDR	RW	27 <sup>th</sup> Feb 2015	
6. All WPs.- Identification of staff involved on each WP	WP leaders (MK, JLE, EGR, IM)	27 <sup>th</sup> Feb 2015	
7. WP5.- Creation of LinkedIn group	JLE	27 <sup>th</sup> Feb 2015	Cancelled
8. WP1.- Summarize deposition techniques available at HZDR, CRAN, IA and AR	MK	March 2015	
9. WP1.- Preparation of D 1.1 State of the art (absorbers and mirrors)	MK	March 2015	
10. WP2.- WP1.- Preparation of D 2.1 State of the art (protective)	JLE	June 2015	Postponed until new ESR is recruited
11. WP3.- Summarize characterization techniques available at HZDR, CRAN, IA and AR	MK	March 2015	
12. WP5.- Creation of webpage	JLE	March 2015	
13. WP6.-Signature of consortium agreement	All partners	March 2015	

Next meeting: Teleconference of the Central Executive Board (March 2015)