

## JEUMICO and TRILAMICO: Dimensions of successful Bavarian-Czech cooperation

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**Abstract.** In December 2017 the two projects JEUMICO (an acronym for Joint European Mirror Cooperation) and TRILAMICO (standing for Trilateral Mirror Collaboration) are ending. Different aspects of this Bavarian-Czech collaboration between Aschaffenburg University and the Czech Technical University in Prague are discussed. The multiple dimensions of this cooperation are scientific achievements, public relation measures, internationalization of education, financial aspects, inter-cultural communication, and also the actual political situation within Europe.

**Key words:** X-ray optics – international – cooperation

### 1. Introduction

The Bavarian-Czech Academic Agency BTHA, which is a German abbreviation for Bayerisch-Tschechische Hochschulagentur, is a department of the Bavarian Academic Center for Central, Eastern and Southeastern Europe (BAYHOST). BTHA coordinates the bilateral cooperation between Bavaria and the Czech Republic in the field of higher education and science. Thereby funding provided by BTHA includes grants for students visiting the partner country, as well as mobility grants for internships, research travels, or excursions. Moreover significant funding is supporting selected bilateral academic projects and conferences in Bavaria and in the Czech Republic. It is the goal of the Bavarian-Czech Academic Agency to support the academic collaboration in research and education and to contribute to an increased cooperation of the two neighbored countries in general (Hudec & Döhring, 2017).

Aschaffenburg University of Applied Sciences and the Czech Technical University in Prague successfully applied for grants on two joint projects. The JEUMICO project (an acronym for Joint European Mirror Cooperation) was financed via BTHA during 2016 and 2017, based on a joint initiative of the Bavarian State Ministry of Education, Science and Arts and the Ministry of Education, Youth and Sports of the Czech Republic (Hudec & Döhring, 2017).



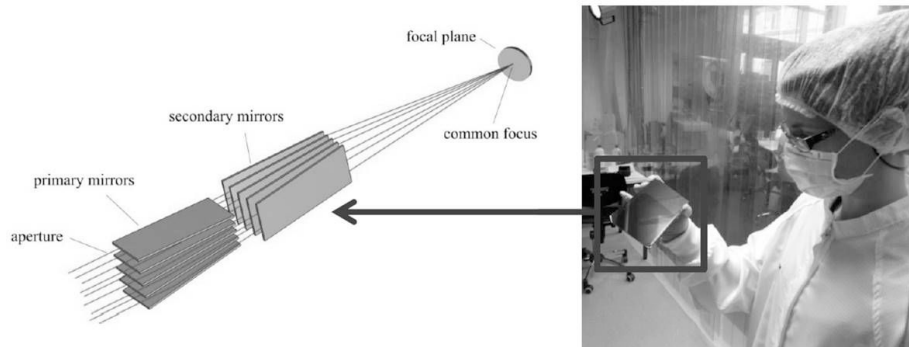
**Figure 1.** The logo of the projects JEUMICO and TRILAMICO.

The TRILAMICO project (standing for Trilateral Mirror Collaboration) was funded in 2017 by the Bavarian-Czech Academic Agency as part of a wider trilateral collaboration including the Institute Fresnel in Marseille (France). The logos of the two projects are shown in figure 1, depicting the international cooperation. As both projects have been recently finalized successfully, it is time now to resume and to discuss the different dimensions of such collaborations.

## 2. Technical content and scientific output

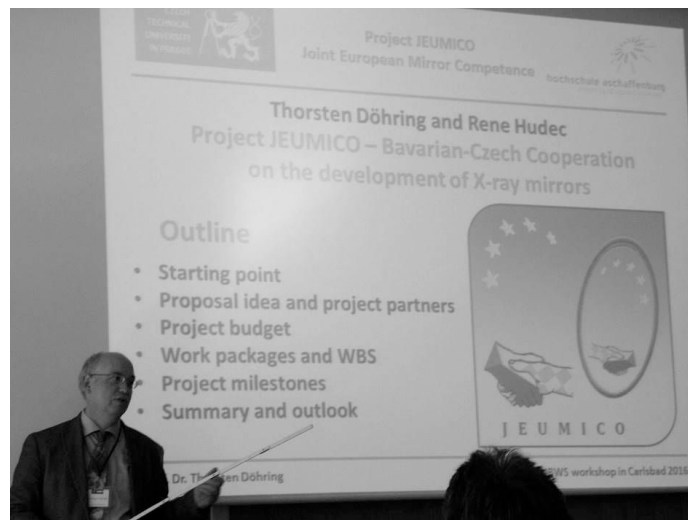
Within the bilateral projects JEUMICO and TRILAMICO emphasis is given to the development of innovative thin and very lightweight X-ray mirrors for satellites (Hudec & Döhning, 2017). The mirrors thickness is below 1 mm and they are coated by thin reflective layers (Döhning et al., 2017b). Hereby especially astrophysical applications are considered (Stehlíková et al., 2017). Other topics of cooperative work have been a market study on astronomical filters, the environmental testing of satellite sensors, and the commission of an UV-VIS micro-spectrometer.

Based on a bionic approach we had chosen a special Lobster Eye optics design in Schmidts arrangement, which uses dual reflections to increase the collecting area of astronomical X-ray telescopes (Stehlíkova et al., 2017). The individual mirrors of this wide-field telescope are made of flat silicon wafers coated with reflecting iridium (Ir) coatings, as this material is promising high reflectivity in the X-ray range of interest (3 keV to 10 keV). The new optics is designed as a hybrid between two types of reflective optics, of the Kirkpatrick-Baez design, which uses parabolic curved mirrors, and of the Lobster Eye design in Schmidts arrangement, using two sets of flat mirrors. Thereby this hybrid approach consists of two separated mirrors sets, turned for 90 degrees (Stehlíkova et al., 2017). Radio frequency (rf) magnetron sputtering technology is available at Aschaffenburg University of Applied Sciences for the mirror coating processes (Döhning



**Figure 2.** The optics design of a Lobster-Eye telescope.

et al., 2017a). Superpolished silicon wafers have been chosen as substrates for the X-ray mirrors of the Lobster Eye telescope. By applying an intermediate chromium adhesion layer a suitable mirror coating was achieved, resulting in a first mirror prototype (Döhring et al., 2017b). The telescope design and a mirror prototype are depicted in figure 2. The joint effort within the two projects resulted in more than ten papers and several conference contributions like talks and posters (see figure 3). Authorship of such publications is especially important for the involved young scientists in the early stages of their scientific careers.



**Figure 3.** JEUMICO presentation at a scientific conference.

### 3. Internationalization of education and science

One main aim of the BTHA funding programs is to enhance the bi-national cross-border cooperation between Bavaria and the Czech Republic. Within the two granted projects an exchange of scientific staff between the involved partner organizations took place. In this context research stays at Aschaffenburg University of four young Czech Ph.D. students have been organized in the framework of the bilateral projects (Hudec & Döhring, 2017). A visual impression of such visit is given in figure 4. Note that during their studies Czech PhD students have to stay one semester abroad to get international research experience. The financing of such mandatory research stays is often difficult for them, but within the bilateral BTHA projects the possibility to give grants for research stays helped a lot. In the other direction several German students participated at the POSTER conference in Prague, a conference especially dedicated to give young scientists first experience at international scientific conferences. On an institutional level Aschaffenburg University of Applied Sciences and the Czech Technical University in Prague officially signed an ERASMUS+ contract in 2016 to fund the cross-border exchange of students (Hudec & Döhring, 2017). Following the university goal of internationalization the bilateral cooperation got valuable support from the university management. On top management level a delegation of Czech university presidents visited Bavaria in October 2017, and a delegation of Bavarian university presidents visited Czech universities the same months. One can state that the collaboration in education and science between the two neighbored regions in Europe is on a promising way into the future.



**Figure 4.** Research stay of Czech PhD students in Bavaria.

#### 4. Aspects of project management

Both projects had to be managed with relatively small financial budgets. The granted funding was mainly dedicated to costs for traveling and accommodation of the involved team members. Thereby the regulations followed the principle of reciprocity: The Bavarian budget could be used for visit of Czech scientists in Bavaria and the Czech budget for visit of Bavarian scientists in the Czech Republic. However, also some hardware procurement was possible and a small salary for a PhD student could be paid to compensate his additional coordination effort. In general German Universities of Applied Sciences faces a lack of research funding and they usually have no permanent research staff. Nevertheless more and more research activities are done at German Universities of Applied Sciences. At Aschaffenburg University the granted bi-national funding allowed an interesting combination of research activities and internationalization. On the Czech side the granted funding co-sponsored IBWS workshops and AXRO conferences, both organized by the Czech partners. This gave more organizational flexibility and resulted in successful events. However, additional resources from other funding sources were needed on both sides to execute the joint projects successfully. The project management was also challenged by intercultural differences and there are some lessons learned. For Germans project planning is more important - which has pros and cons - whereas Czech people are more flexible here. There seem to be more bureaucracy in the Czech Republic for the submission of proposals than in Germany. Technically a joint field of work is needed for such cooperation, resulting in a common scientific goal. Thereby the complementary qualification respectively complementary technical equipment was beneficial for the project execution. The trilateral cooperation between Germany, the Czech Republic, and France was more difficult to organize. Direct meetings between French scientists and Czech scientists could not be financed by the granted bilateral budgets, which was a disadvantage in the intended three-party collaboration.

#### 5. Public Relation Management

Publicity is another dimension of such cooperative projects. One should not underestimate the importance of public relation measures. They help for the visibility and the acceptance of the presented project inside and outside the university. For stakeholders like funding agencies, university management, and ministries this is often the most important output of a project. Here press releases on the two bilateral projects have been placed at the home-pages of both institutions. An example is shown in figure 5. In addition the joint projects have been presented with posters and talks at scientific conferences which is a scientific output as well as a valuable project marketing event in parallel. Furthermore the project team was present at public events of the funding agency

BTHA and even some public articles have been initiated in local newspapers and in Internet news.

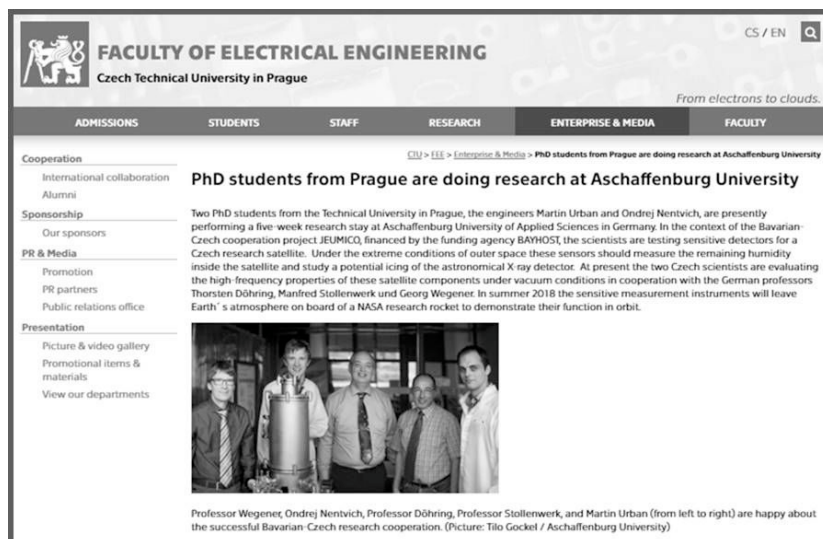


Figure 5. JEUMICO press release on the CVUT homepage.

## 6. Summary and outlook

In December 2017 the two bi-national projects JEUMICO and TRILAMICO will run out. The multiple dimensions of this successful Bavarian-Czech collaboration between Aschaffenburg University and the Czech Technical University in Prague have been discussed. Scientific cooperation and exchange in an international context - here between Bavaria and the Czech Republic - and also corresponding private contacts are important contributions for political stability and for joint economic development in both countries. Thereby one should not underestimate the positive effect of informal communication while socializing in the evening (see figure 6).

The two projects also paved the way for future cooperation. A proposal on another joint project (AMAFUSMI - Advanced materials for future space missions) have already been submitted to the funding agency BTHA. However, this call got a large interest from many other joint Czech-Bavarian proposal teams and the chances for funding are therefore quite small. Other options for joint proposals, especially for European funding programs like Horizon2020 are under consideration between the project partners. There is the strong intention on both sides to continue the established partnership also in the future.



**Figure 6.** Social dinner of the joint bi-national project team.

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