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Contribution of the project in the development of assets for applied research to ensure collaboration with research driven SMEs in photonics domain

Even the best ideas for research as well as the best know-how and knowledges, especially for collaboration with industry, is rarely giving the positive results, if there is/are no a solid instrumentation basis, giving a possibility to realize those ideas or knowledges. Therefore one of the prime importance tasks for Fotonika was to build up such hardware. And doing it keeping in eyesight the possible collaboration partners, still trying to keep a balanced mind on double-use of all hardware, as for scientific value, as for collaborative value. Next will follow the ten such success stories, what existence is solely thank to Fotonika-LV.

Implants and BSI

Stoppers to overstep – the boron gaseous forms are extremely poisonous and demands frequent servicing, the mass selector magnet is drastically large, and ungridded accelerator must work to extremely large voltages.

We had some experience with high vaporizing elements thus we provided some experiments with crystalline boron ionization, what gave a more details how plasma chamber must be made. The design plans was elaborated, and found an intriguing idea how to suppress the boron freeze-on the inner walls of plasma cell.

Probable solutions: magnetic accelerator and RF QMC masselector

Such mini sized apparatus may have a market future so it is meaning to put efforts in it, and we have formulated what we need for to first demonstration apparatus producing, thus the idea's fate belongs to fund-raising projects writing success.

Vacuum coating and VU2

Good design vacuum coating apparatus with 70cm chamber, capable for work with filament sources and e-beam gun. Apparatus had demolished vacuum pumping system so it staid unused. We provided an efforts to make a good equipped place where to exploit this machine and thanks to Fotonika-LV bought the all necessary parts to retrofit vacuum to turbo-pumps.

Near future we may have a first switch on and be capable for potential partner - Lithuanian laser producer Ekspla, having a constant need for collaboration at optic coatings.

For the better control of process accuracy Fotonika-LV made a chance to procure a novel thickness meter, what instead of detecting quartz frequency shift detects a phase shift, thus gathering a more accuracy, reliability and quartz life-span.

Ekspla had gave a willing as soon we be ready to demonstrate our skills, to draw their vision to possible collaboration. The coater upgrade with radio-frequency unit is expected in future, thus giving a chance to coat thick insulator to insulator layers.

Other important task for this sputtering machine is technical support for local R&D SMEs, what has an ideas about optics hi-tech devices if it are so innovative that not selectable at catalogs. Our apparatus destiny will be to give a try to such small-series coatings for demonstration level new devices.

Cleanroom

As the thumbnail law, as smaller detailing must be controlled at coating process, as cleaner of dust the room must be obtained.

Target is optically transparent multilayer coatings => very clean

After analysis of needed and financially viable cleaning factors, was made a proper projecting and procurement jobs to convert a 25m² part of basement floor to high class clean-room. Building works was provided from other funds, thus all was happening very slow. Cleanroom will give a boost to whole Baltic region as with high accuracy optical coatings as with general clean-room place borrowing, for example, in aim of Space exploration micro-satellites composing needs.

Multipurpose crystal growing

In collaboration with certain industrial partners Fotonika-LV made a trials to grow the different special sorts of special semiconductor and other kind of crystals.

The Chochralsky vacuum growing was realized on loaned apparatus (LU-CFI), what gave a near to satisfactory results but not completely. Here the problem was caused by apparatus construction thus we was buying the materials for making our own crystal growing apparatus, equipped with induction heater.

The heater and stand metal was sponsored by Fotonika-LV, thus the good basis for future commercialization is set.

GRIBA as test stand

In general Gothenburg-Riga Ion Beam Apparatus refers to fundamental science infrastructure,

however it has a well application for commercial use too.

Just it allows to produce the different substances different excitation methods accelerated ion beam, and provide a preliminary mass analysis of that ion flux. Therefore in such cases as with BSI boron ion beam, this is a cheapest and most handsome way to check the beam purity and other parameters.

Astronomical mirrors

Before the Crimea war we had established a good contacts with their astronomical observatory optics workshop, what was able for high accuracy spherical mirror sliffing, metalization and retrofiting. Today them are unavailable for political reasons so the astronomy institute (LU-AI) and geodesy institute (LU-GGI) new projects have to be stopped, more, their existing techniques stays few years before coatings are damaged and must be re-coated.

Thus thanks to Fotonika-LV funds we succeed to buy the metal parts of 1.35m large vacuum chamber, collected to it some decommissioned vacuum pumps and power sources thus having well designed filament type of vacuum metalization complex. In the collaboration with small commercial partner, HEE, we got agreed that they shall deliver costless to us the mirror polishing stand if we give them access to mirror polishing on this machine.

The third needed machine for full spherical mirror manufacturing cycle is rough encarving machine. Most of Russia optical factories for that are using slightly re-built universal grinding machine for steel, thus we used Fotonika-LV capacities and bought that machine. The necessary modifications yet staid to later, to after-project schedule.

For sliffing form support, as well as for vacuum vessel customizing for science experiments we missed large diameter turning bench. We succeed to buy such for max 82 cm at bankruptcy sell-out. Bench is at relatively good condition.

Thus the heavy weight techniques was taking too much place for LU-AGI time covers

Baldone roofs

Baldone observatory a year ago came a heavy spring hurricane and damaged a small telescope`s roof. The rainwater begun to cause rust on the both 70 cm small telescopes (1.25m large telescope is still alive).

Therefore Fotonika made a daring effort buying a barrel of epoxy resin and glass-textile and number of volunteer helpers made a capital repairing to glass-plast cupole. If we would glued yachts from epoxy instead of cupole, we would succed to produce 6.5 seaships :)

The first winter shown that expensive instrument beyond is saved and water leaks are stopped. One of those minor telescopes is used for Solar science however another is reserved for coming future projects with SMEs.

Calcium 3-d printer

Australia and RTU experiments aimed to grow human bones to accurate order, leaded by 3-D scan or CAD drawing of missing fragment at traumatology cases. It is known how to organize bone material chemically, to be capable for grow-in the natural bone and become inhabited by living cells.

The stopper to introduce such revolutionary technique in the traumatology was difficulties to heat falling nanodroplets of calcites (hydroxylapatite) enough to melt and be well controllable.

Our previous experiments with RF-ICP plasma bubble at near-atmospheric pressure shown that ICP plasma generally fails to melt the mineral. Thanks to Fotonika secondment schemes we got a chance to hands-on learn at Belorussian Heat and Mass Transfer Institute that our fail was due to wrong frequency choice.

Simply, as frequency increases, as less plasma is unbalanced, so the electronic temperature falls near to ionic temperature, or other words plasma becomes hotter with a frequency. Therefore we must try with microwave plasma torch. The torch construction we are able to replicate, thus the last thing be needed is few microwave specific components, what are already ordered by another project and are on the way. If we shall succeed with melting, that critical breakthrough will be thanks to Fotonika-LV as the powerful booster of as science as commercial collaboration.