

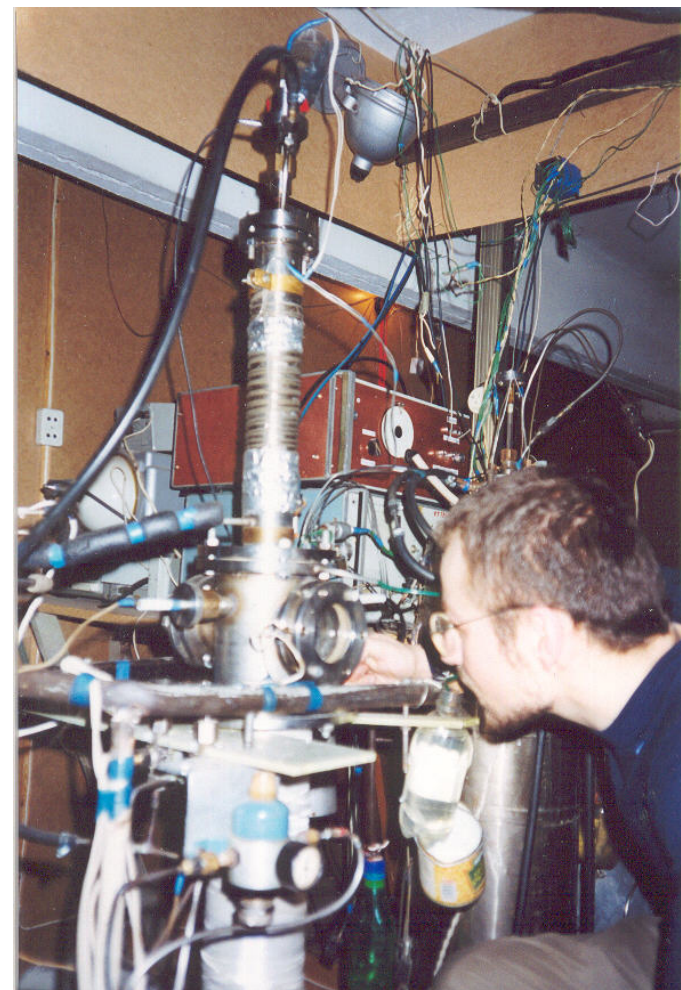
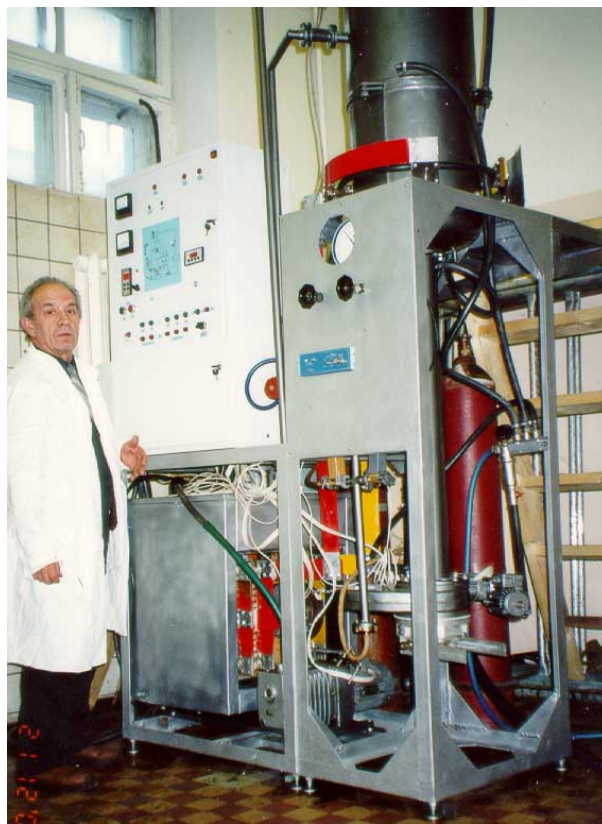
Technological Installations (project and creation) for Laser Targets Productions from Thermonuclear Target Laboratory of Lebedev Physical Institute for Other Scientific Centers

Yu.A. Merkuliev

Thermonuclear target laboratory (TTL) of Lebedev Physical Institute had taken part in preparing of several projects on laser fusion complex programs including the complete set of installations for target production, characterization, capsules DT-mixture filling, cryogenic layers formation and target delivery inside laser interaction chamber with in-flight metrology right before laser shot. Most of the projects were powerful single-shot lasers, only 1 (or 2) projects deal with repetition (high-repetition rate) driver performance. There were programs for which the technology was developed and transferred to the buyers together with the equipment for both: target production and target characterization. Thus our target specialists can evaluate the cost of development and production of separate lines of equipment for targets complex (especially those, which is unique and cannot be bought commercially). The costs by now are estimated under condition of fabrication in Russia. Of course, it is possible to recalculate the costs of equipment to be produced in Europe, but many ratios between the separate groups of equipment (capsules, characterization apparatus, cryotargets, tritium installations, etc) will remain similar to the Russian ones. Key tasks is:

1. Large capsule production and characterization, including new materials for capsules (BeD_2 or ND_3BD_3).
2. Foam layers and shells fabrication
3. Cryogenic layers formation and cryotargets delivery in interaction chamber
4. Tritium systems (DT-gas filling for high pressure and $\text{D} \leftrightarrow \text{T}$ exchange in capsule materials of ready targets).

Equipment for the scientific centers in other countries



The installations produced in LPI for other laboratories of different countries, 1992 - 2002.

LPI TTL

Thermonuclear Targets Laboratory

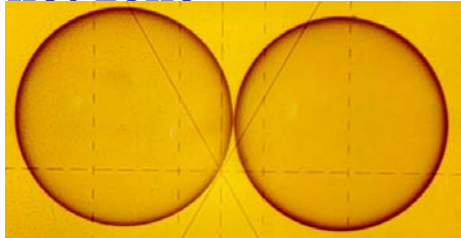
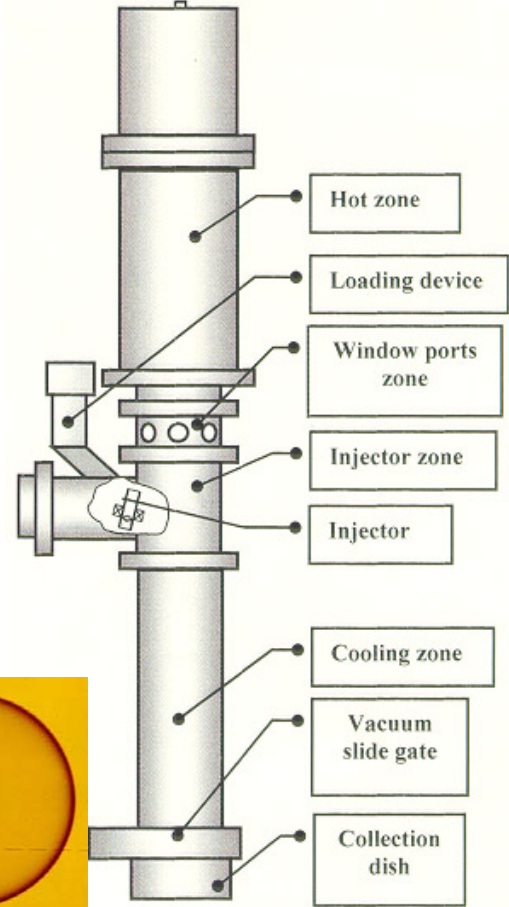
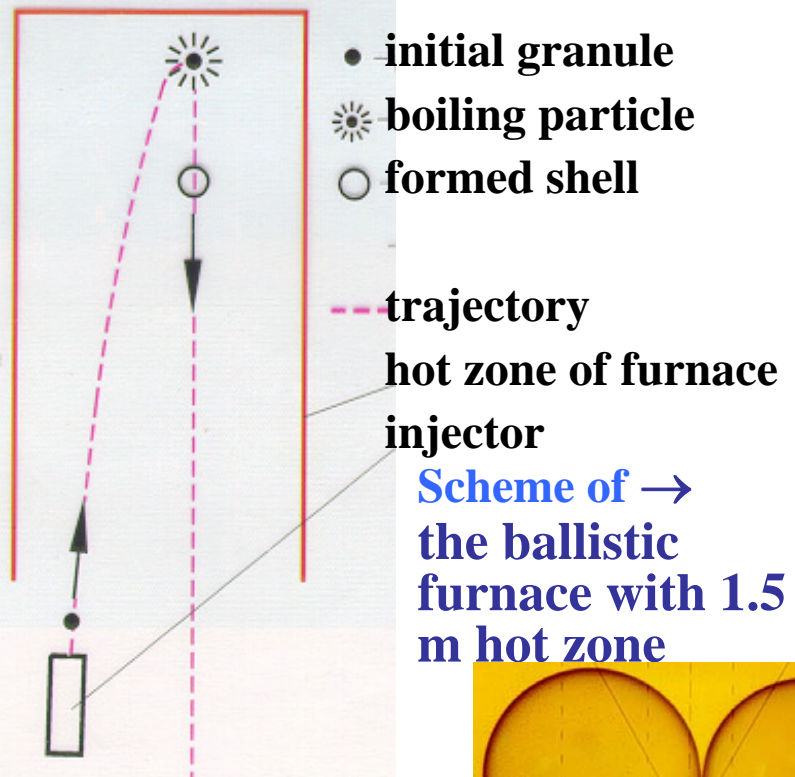
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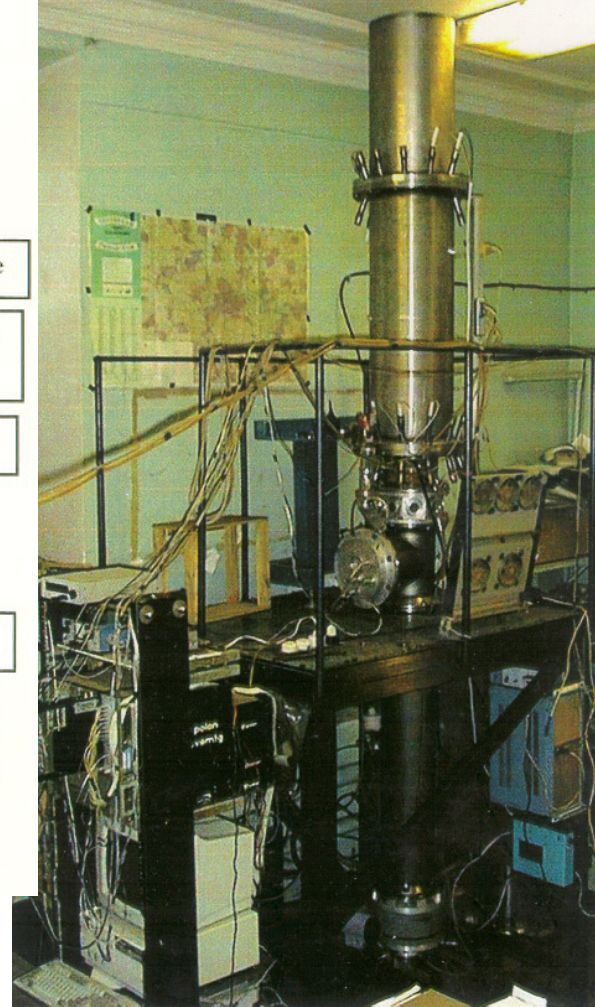


High temperature droplet generator for concentrate silicate solution.

Ballistic furnace for large (2 mm) polymer shells, created by LPI for LLNL (USA)



Polymer (1.85-1.9 mm) shells



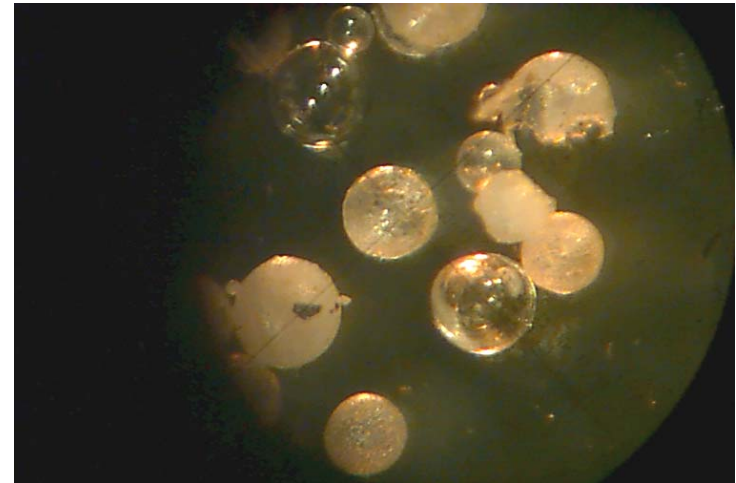
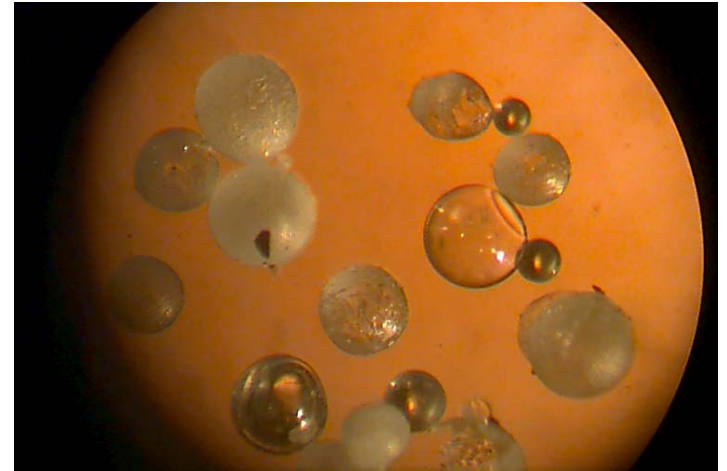
Photography, 1997.

Scheme of polymer particles movement in the ballistic furnace

Equipment for Russian scientific centers



← Automatic vacuum installation with 3 hot zones for formation of BeD_2 and LBeD_3 shells (up to $\text{Ø } 0.5 \text{ mm}$) with lock and vessel in which targets are transposed in vacuum to the laser chamber. TTL of LPI, 2002.



First shells from NH_3BH_3 , fabricated in TTL at 14.04.03.

LPI TTL

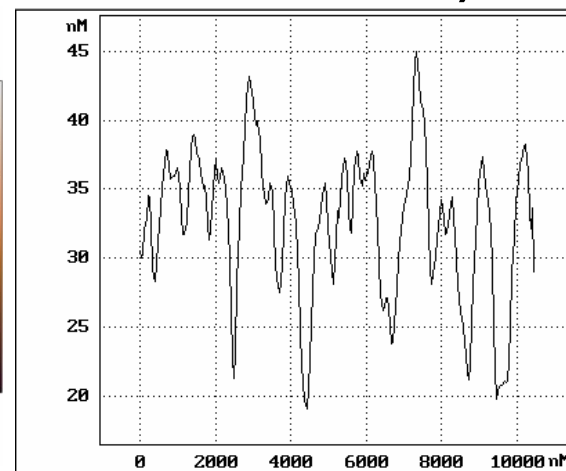
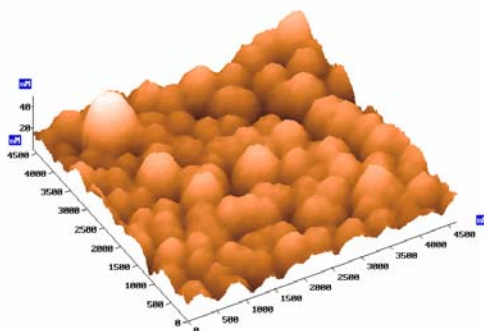
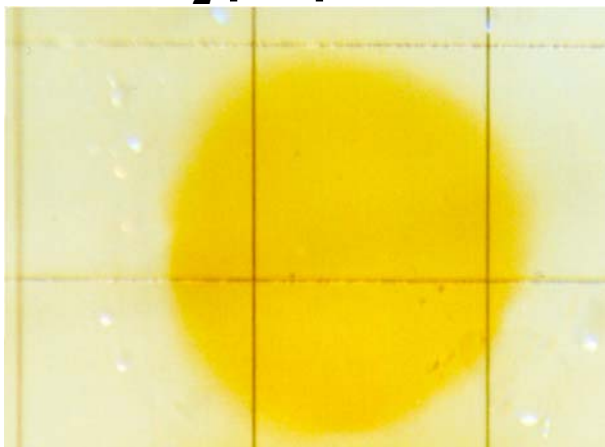
Thermonuclear Targets Laboratory

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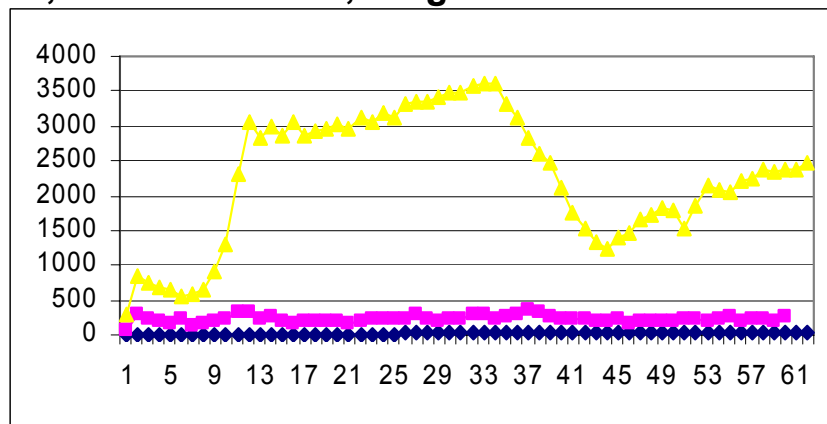
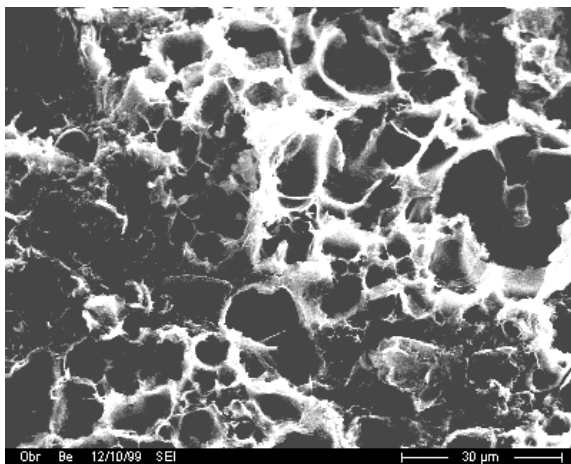
BD₂ properties for laser targets (Lebedev PI & Bochvar VNIINM)



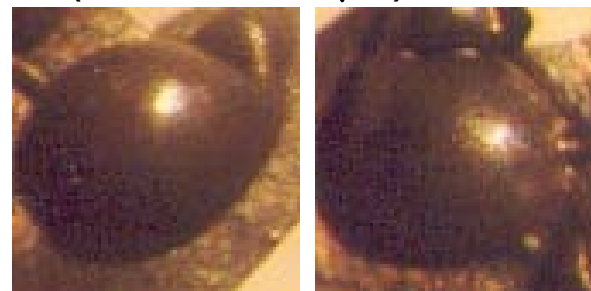
Optical transparency of beryllium hydride. 7 μm beryllium deuteride layer on 50 μm glass substrate lies on the glass with lines. Lines on glass can be observed very well through BeD layer. Yellow color indicates metal beryllium in BeD layer (possibility of cryogenic layer monitoring is vivid).

amorphous structure; smooth surface, roughness less than 10 nm

BeD₂ was transformed into Be foams → at fast heating. Scale 30 μm



Copper (yellow) concentration in BeD₂ layer (thickness - 12 μm). Maximum is about 6% mass.



← The bubbles from beryllium deuteride films

Conclusion

Lebedev Physical Institute with collaboration of Institutes having developed targets, technological installations, apparatus for target characterization, cryogenic systems and delivery equipment in interaction chamber are ready to take part in the works under HiPER project

Analysis of high repetition-rate injection and tracking techniques in LPI RAS falls into project.

It is necessary target production for experimental validation program on the existing facilities fulfilled in Thermonuclear Target Laboratory of LPI RAS with laser shot experiments at PALS, LULI, LIL, LUCH and Iskra-5 support in HiPER project.

We are ready to analyze the world experience of shells fabrication for HiPER condition and to estimate the cost of this part of “target factory”

Merkuliev Yu.A.

