

## **Between fusion and cosmology – the future of the Tritium Laboratory Karlsruhe (TLK)**

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The TLK was commissioned with tritium in 1994. Since then it has continuously improved its infrastructure and expanded its experimental activities. With a fully closed tritium loop and the licence to handle 40 g of tritium the TLK is an almost unique facility. More than 10 glove box systems with a total volume of about 125 m<sup>3</sup> are operated to house experiments and infrastructure facilities on an area of nearly 1000 m<sup>2</sup>. Today TLK has 22 g tritium on site and is strongly involved in R&D tasks for both, fusion and cosmology.

The original mission of TLK was the development of tritium technologies for the fuel cycle of fusion reactors. As a result of the past R&D work TLK has now many similarities with the proposed ITER Tritium Plant. As far as the EU procurement package for the ITER Tritium Plant is concerned, extensive research activities related to the Water Detritiation System and the Isotope Separation System have been carried out. The experimental results allow defining the basic numbers for the design. TLK will continue the work in this field with high priority.

Because of its complete tritium infrastructure and its long lasting experience in tritium processing the TLK was chosen to be host of the Karlsruhe Tritium Neutrino experiment KATRIN. KATRIN will allow a model-independent measurement of the neutrino mass scale with an expected sensitivity of 0.2 eV/c<sup>2</sup> (90% CL) and so will help to clarify the role of neutrinos in the early universe. KATRIN requires a strong windowless gaseous source of almost pure molecular tritium (95%) and a throughput of 40 g tritium per day stabilized on 0.1% level. Development, setup and operation of the KATRIN source and its corresponding closed tritium loops will be one of the TLK key activities within the next decade.

A further key activity in the future will be the development of advanced analytical methods. With its high number of different analytical tools and the possibility to perform a large variety of tritium experiments TLK has a unique feature in the world. Since tritium analytics is the common denominator for every kind of tritium processing, results in this field do have a great impact on the design of tritium plants for fusion reactors. One example for important ongoing analytical work at TLK is the development of a Laser Raman system which is capable to detect the various gaseous hydrogen isotopologues at a level of 1 mbar in a few seconds.

This paper will discuss the perspectives of TLK R&D between fusion and cosmology.