

X-ray irradiation using the X-RAD 225XL machine

Since June 2016, a new X-RAD 225XL cabinet X-ray machine has been in operation, designed specifically for controlled irradiation of cells and mice. The **Biological Irradiator X-RAD 225XL** is located at the X-ray Irradiation Facility of the Institute of Molecular Genetics in the CH building (rear entrance), in room 1.26 (control room) next to the existing Wolf T-200 orthovoltage X-ray machine. **Supervision** of the use of the instrument and its **programming** is provided by the **Super-user**:

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Alternatively, in his absence, the new radiation protection supervisor at the Institute of Molecular Genetics, Mgr. Vadym Sulimenko, Ph.D. (Department 26-Biology of the Cytoskeleton), tel. 296 442 640

The X-RAD 225XL X-ray machine can be used **independently**, at the time **booked** in the **Calpendo** reservation system (<https://booking.img.cas.cz/#facilityinfopages>), only by **trained personnel - Users**. The procedure for use is described in detail in the updated (attached) document dated 16.1.2023 **Operating Instructions** (and in the User's Manual, stored on the table in the room with the X-RAD instrument, and also on the intranet of the IMG).

Rules and Pricelist

- Before using the X-ray machine for actual irradiation of biological material, the built-in X-ray tube must be **preheated/conditioned (warm-up/conditioning)**, unless it has been used as an X-ray source within the **previous 8 hours!** The computer software embedded in the X-ray machine automatically records the time that has elapsed since the last emission of X-rays produced by the X-ray tube. If more than 8 hours have elapsed, the "**Warm-up required**" message will appear on the built-in touch screen of the instrument and X-ray irradiation cannot be performed until the warm-up of the X-ray lamp has been completed. The **time required to preheat the X-ray tube is 20 minutes** if it has not been in use for **8-96 hours**, or **60 minutes** if more than **96 hours have elapsed** since it was last used for X-ray emission! Therefore, the manufacturer of the X-RAD 225XL X-ray irradiator recommends that a warm-up be performed at least once a week, regardless of the frequency of use of the machine.
- The following **operating parameters are permanently preset** on the X-RAD 225XL: standard X-ray tube **voltage and current 225 kV/13.3 mA**; **filters 1.0 mm Al (F6)** for "soft" and **0.5 mm Cu (F5)** for "hard" X-rays (i.e., identical to the Wolf T-200).
- The possible fixed distances of the metal shelf for placing the irradiated objects from the focal point of the X-ray lamp (**Source-Specimen Distance, SSD**) are 20, 30, 40, 50, 60 and 70 cm, but it is recommended to **use only** the "short" **SSD distance of 30 cm** (especially for surface irradiation of cultured cells) and the "long" **SSD distance of 50 cm** (especially for deep irradiation of mice with hard X-rays).
- A **series of irradiation programs** (currently #21-40) are defined for these parameters in the built-in operator PC (TouchRAD Panel with Touch screen Interface) - see Inventory pasted below the Touch screen. The **standard irradiation programs** are defined exclusively in **Time Mode**, i.e. the number of seconds of the X-ray lamp in the on state needed to achieve a total dose of **1, 2, 3, 5 or 10 Gy** at standard operating parameters of the X-ray lamp and using F6 or F5 filters and SSD irradiation distances of 30 cm or 50 cm, respectively.

- For **non-standard**, experimental irradiation, it is necessary for the Super-user to define the appropriate non-standard irradiation programs (currently # **41-50**) according to the Users requirements - see Inventory.
- Detailed statistical analysis of more than 1,300 records in the X-ray software, capturing the frequency and duration of the actual X-ray irradiations of biological material (495 times in total) and the preheating of the X-ray tube (95 times in total), in periods 1.4.-31.5.2019, 1.6.-31.7.2019 and 1.8.-30.9.2019 **clearly demonstrated that it was necessary to perform** (on average) **exactly 2 minutes of pre-warming** (warm-up) of the X-ray tube **to perform 1 minute of irradiation**. This time of operation of the X-ray tube, necessary to perform the actual X-ray irradiation, is therefore (newly) **included in the attached Pricelist**.
- X-ray irradiation of brought biological material - cell cultures, mice, or other (by agreement with the Super-user) **is a paid service**. Fees are the same for **separate use** of the X-RAD 225XL irradiator **during and outside working hours**. When X-ray irradiation is performed **with an operator (Super-user)**, the **fee increases to 4 times** - see the attached **Price List effective from 1.10.2022**:

User:		IMG	Other – acad.	Other – non-acad.
CZK/second of irradiation	Separate use	2,00	4,00	8,00
	With operator (Super-)	8,00	16,00	32,00

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