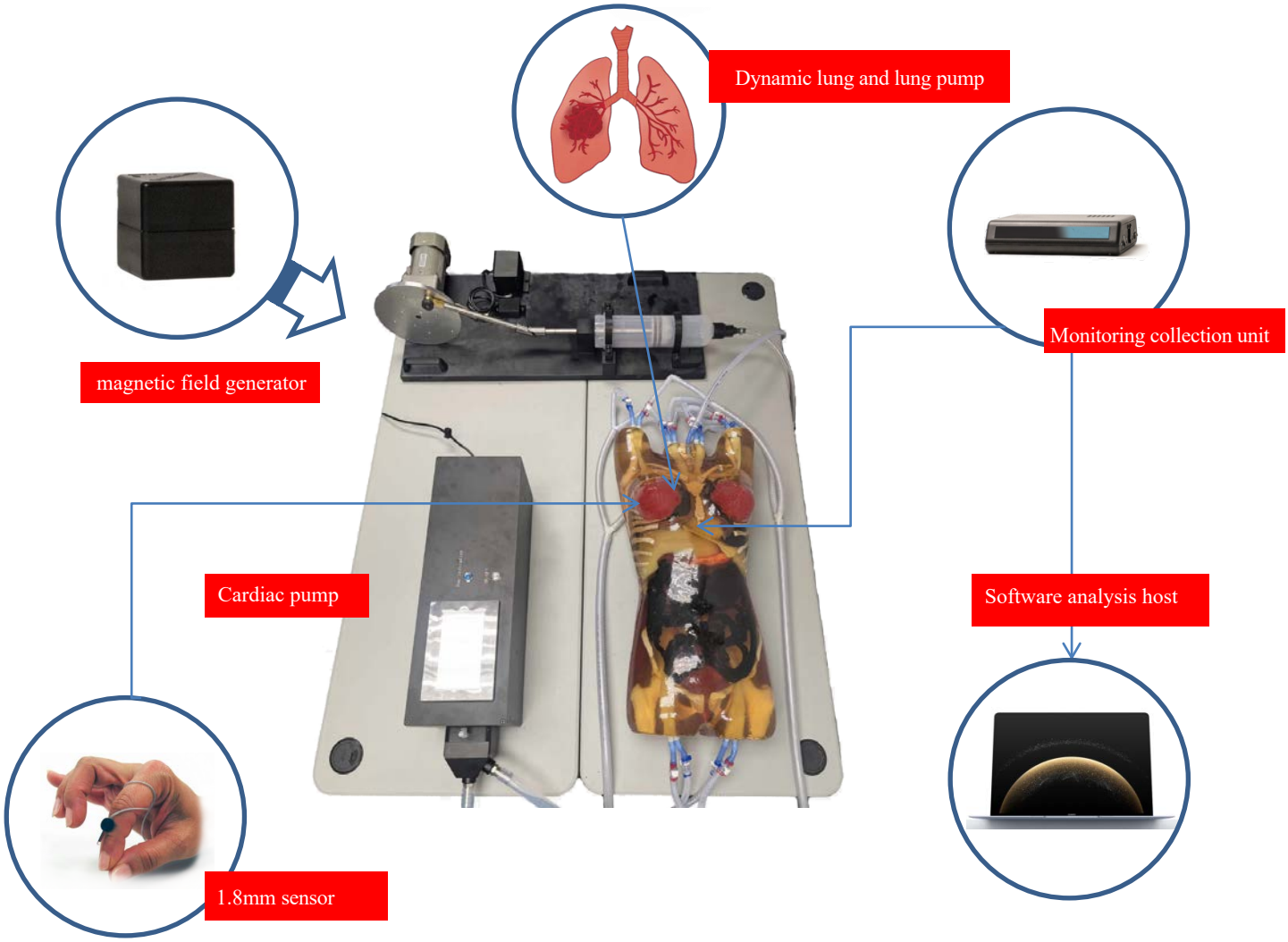
WEK RLFMA02 Moving Tumor Phantom Simulation and Localization System

1. Schematic Diagram of Structural Composition

(Adult female torso model, dynamic lung, freely controllable lung pump, tumor markers, host machine, alternating electromagnetic field generator, micro sensor)



2. Product Introduction

The **WEK-RLFMA02** activity tumor target simulation and positioning system features a full-body model of an adult female with major human organs. It is equipped with an inflatable dynamic lung and a multi-functional lung pump. Through the piston movement of the lung pump, the lung with the tumor lesion is subjected to regular breathing simulation, enabling variations in all dimensions during deep breathing, thus achieving the simulation of the moving tumor target. Each tumor internal clamp has a highly sensitive electromagnetic sensor. By monitoring the changes in the magnetic field units, the displacement of the tumor target can be accurately tracked. The system is also equipped with a dynamic heart pump, which realizes periodic ventricular wall pulsation through hydraulic drive.

This provides a tumor target area positioning and diagnosis scenario for the thoracic and abdominal tumors affected by respiratory movement and heart pulsation for a wide range of researchers, thereby offering scientific research references for improving the precise positioning of moving tumor targets.

3. Phantom Features

a) Compatible with X-ray and CT imaging.
b) Built-in complete human skeleton including spine, ribs, shoulder, clavicle, pelvis and partial femur (visible in X-ray images).
c) Major simulated organs: heart, lungs, diaphragm, breasts, liver, gallbladder, stomach, kidneys, spleen, pancreas, intestines, uterus and others.
d) Inflatable lungs driven by the lung pump to reproduce physiological periodic respiratory motion; adjustable respiratory frequency.
e) Equipped with cardiac pump to simulate periodic cardiac pulsation from ventricular-wall dilation; adjustable heart rate.
f) Independent control units for lung pump and cardiac pump, no mutual interference, supporting separate operation.

4. Tumor Lesions

a) Three lesions in the lung, each embedded with a displacement sensor at its center.
b) One lesion in the liver with built-in displacement sensor.

5. Localization System

a) Four miniature sensors support full six-degree-of-freedom motion tracking.
b) Light-weight sensor probe: weight <1 g, outer diameter only 1.8 mm, length approx. 17.3 mm.
c) Maximum sampling rate up to 240Hz, latency $\leq$3ms.
d) Alternating-field generator with footprint approx. 10 cm × 10 cm.
e) Localization root-mean-square (RMS) error: 0.38 mm along X, Y and Z axes.
f) Supporting software enables real-time data visualization, dynamic display of motion trajectories, sensor readings and system status.

6. Product Compliance

Design and manufacturing comply with safety standards including GB 4793.1-2007 for electrical and mechanical safety, as well as quality-management specifications GB/T 25000.51-2016 and ISO 9001.