Experimental environment

VUV Beamline, Swiss Light Source

This document covers the gas phase photoionization endstations at the VUV beamline.

Ionizing radiation

Bending magnet VUV radiation is monochromatized by a grazing incidence monochromator and focused into a differentially pumped gas filter. Three gratings are available: 1200, 600 (both laminar) and 150 mm^{-1} (blazed).

The available flux is 10^{11}–10^{12} s^{-1} at a resolving power of 1 : 2500–10000 in the 5–20 eV energy range. The horizontal exit slit (100 µ – 1 mm) is located at the focus in the gas filter. Depending on the photon energy, a MgF_2 window (5–10 eV), 10 mbar of Ne (11–21 eV) or a Ne/Ar/Kr mixture (7–14 eV) is used to suppress higher harmonic radiation. The endstation is, thus, past the focus, with the ionization region being some 50 cm downstream, and due to the divergence of the beam (4 x 8 mrad), the maximum interaction volume is rather large.

Light is also available up to 150 eV with some restraints.

Endstations

Two coincidence apparatuses are available, an imaging photoelectron photoion coincidence experiment (*i*PEPICO, RSI **80** 034101, 2009) and a double imaging photoelectron photoion coincidence experiment (i^2PEPICO, *to be published*). In the former, photoelectrons are velocity map imaged onto a 40 mm Roentdek delay line detector and photoions are mass analyzed by TOF, in the latter, both photoelectrons and photoions are imaged in a symmetric setup.

Extraction fields of 20–120 V cm^{-1} are available in the *i*PEPICO setup, while the theoretical high limit is ≈ 500 V cm^{-1} in the i^2PEPICO setup. Space focusing ensures comparably good ion mass resolution in *i*PEPICO, while the small fields enable us to resolve threshold electrons with a better than 1 meV resolution (electron up to 1.2 eV are imaged onto the detector with less than ideal optical properties) as well as to measure unimolecular dissociation rate constants of the photoions in the 10^3–10^7 s^{-1} range. The i^2PEPICO setup enables kinetic energy release measurements by ion imaging, or, can be altered, by introducing a second acceleration field, to space focus photoions at the detector.

Vacuum and sources

The compact, differentially pumped gas filer (NIMA **610** 597–603, 2009) enables pressures up to 40 mbar in the experimental chamber. Still, photoionization experiments are typically carried out at 10^{-6} mbar. The experimental chamber is pumped by a 500 l s^{-1} turbomolecular and a 1500 l s^{-1} cryogenic pump. In addition to a room temperature effusive source, a continuous molecular beam source is also available, with optional pulsing and/or pyrolysis. The source chamber is connected to the ionization chamber either through a 5 mm hole or through a skimmer and is pumped by a 1500 l s^{-1} turbomolecular and a 5000 l s^{-1} cryopump.

http://www.psi.ch/sls/vuv/

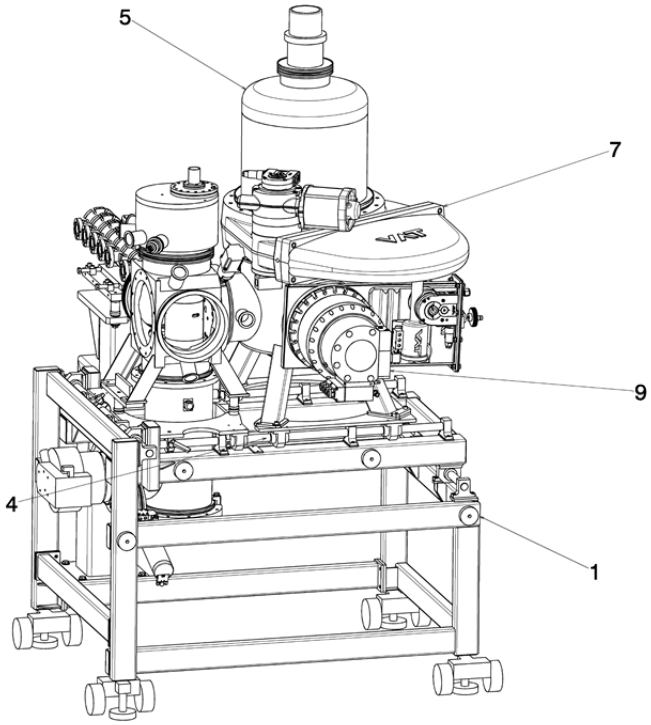


Figure 1. Overview of the *i*PEPICO endstation.

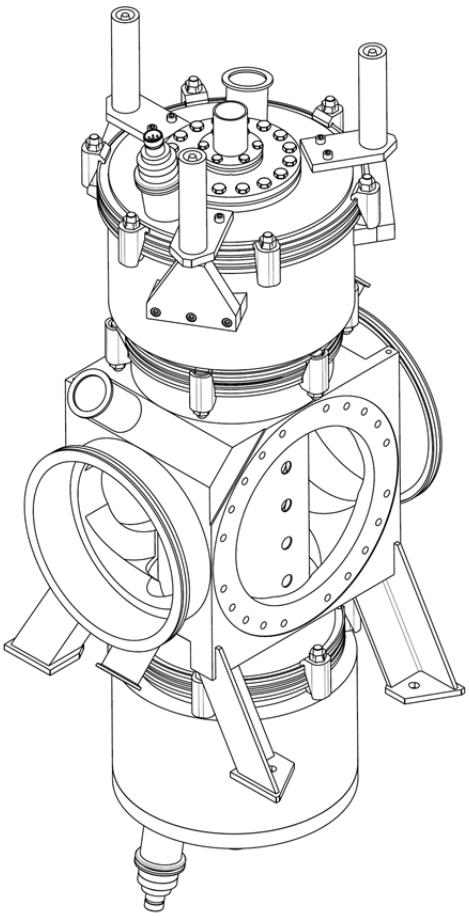


Figure 2. The symmetric i^2PEPICO setup.

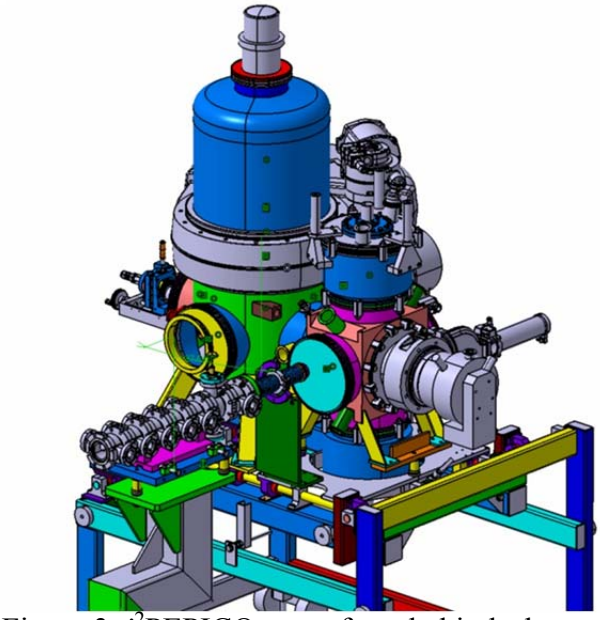


Figure 3. i^2PEPICO setup from behind, shown with the gas filter.

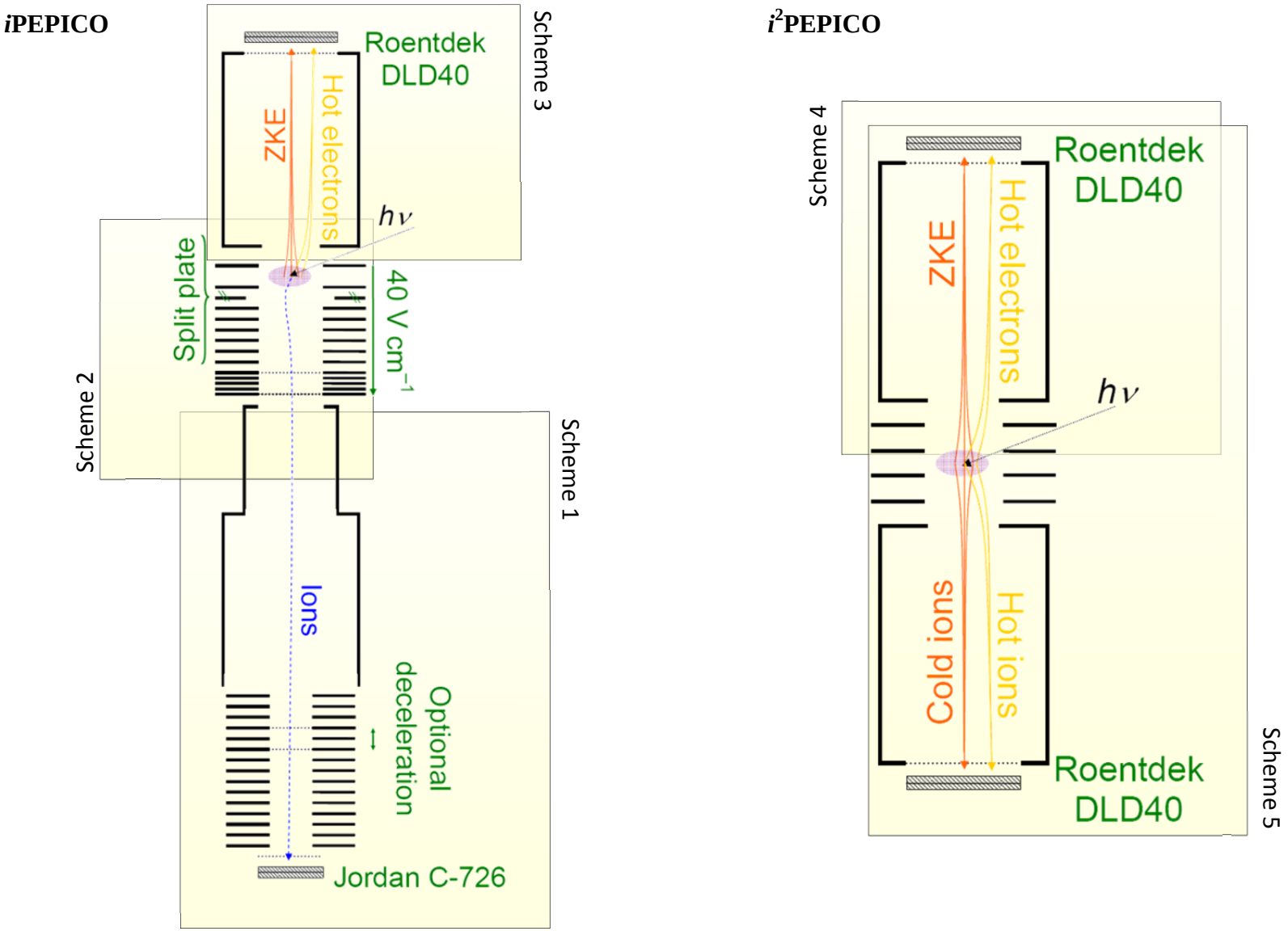
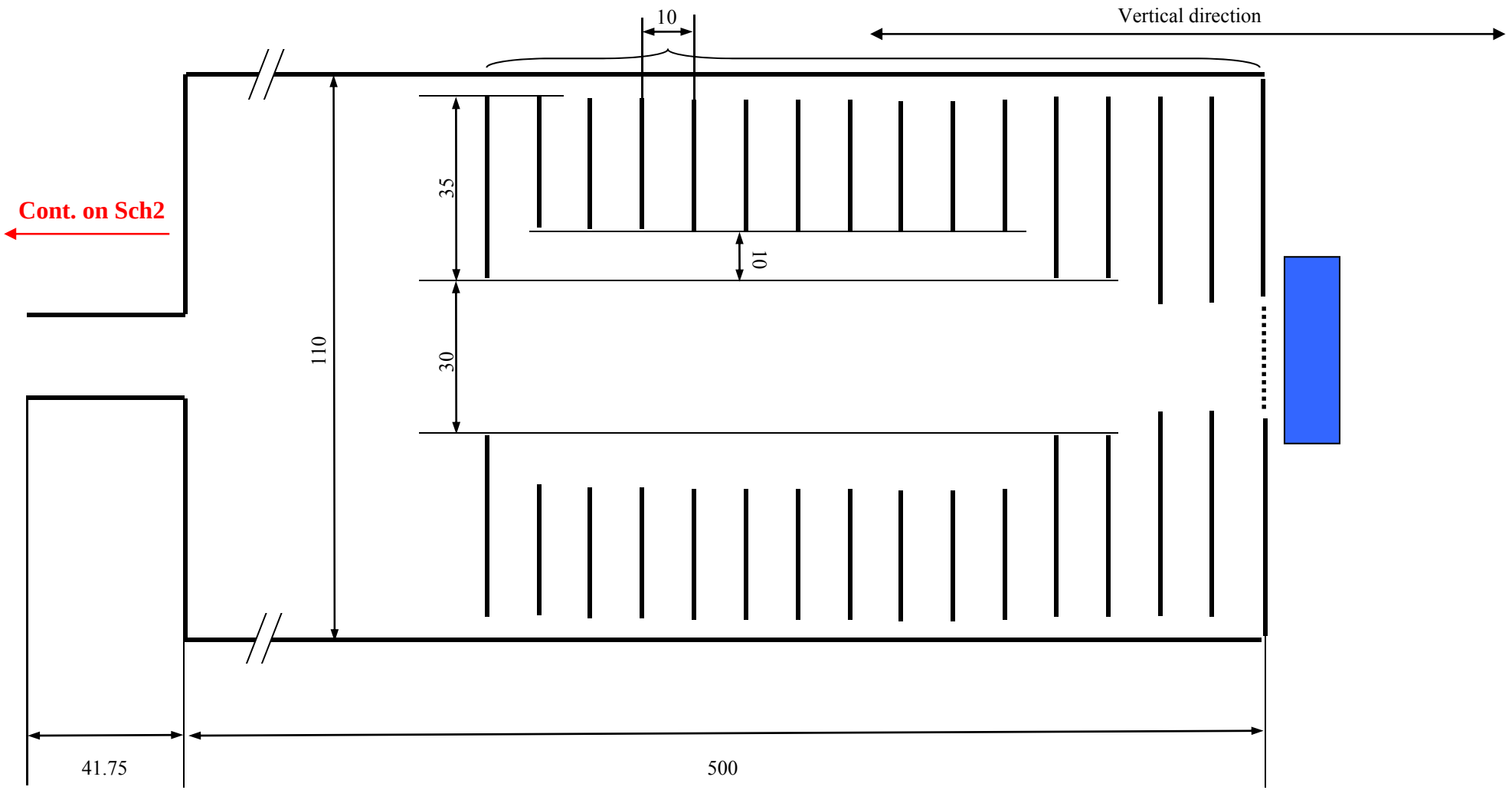
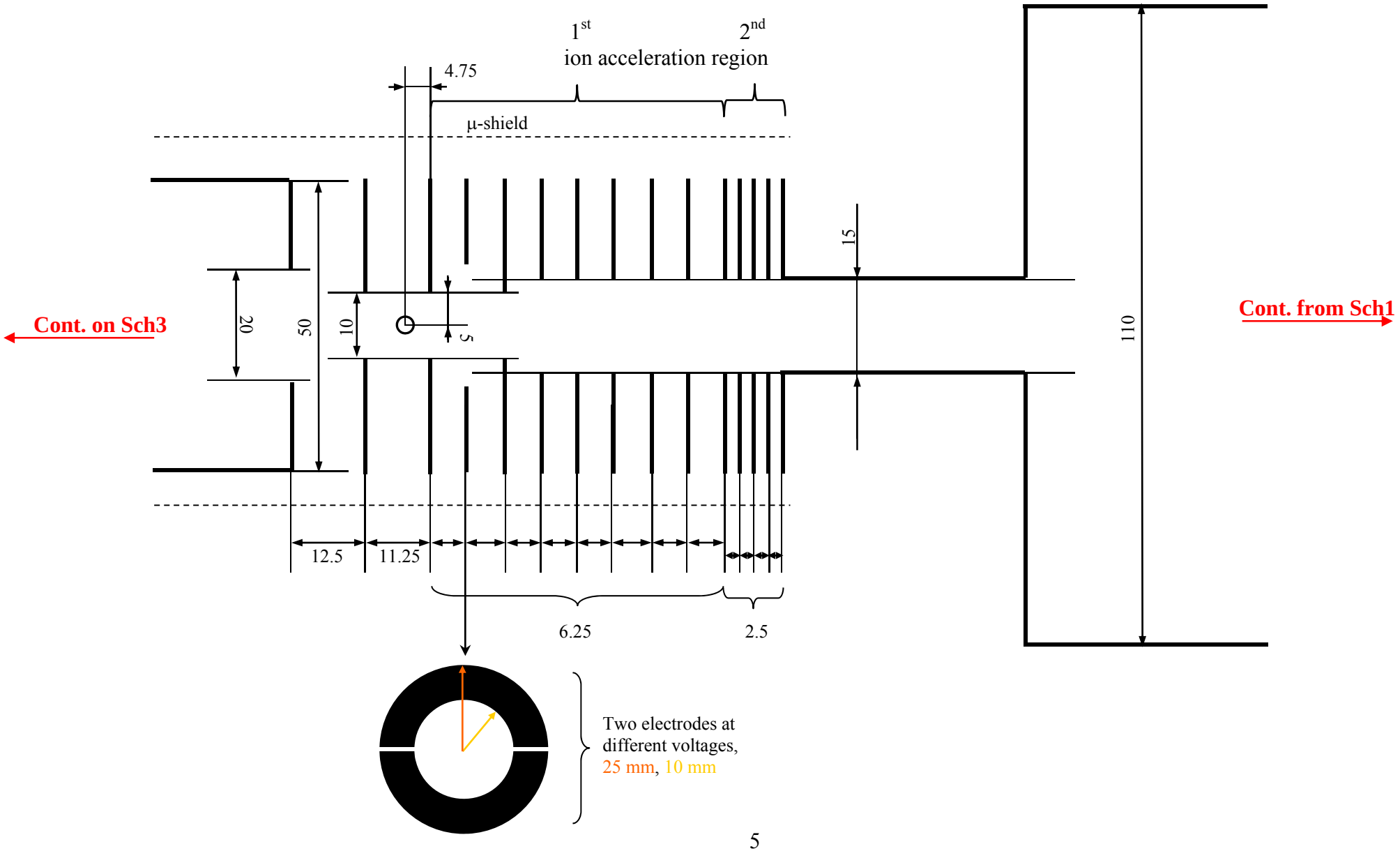


Figure 4. Legend to the instrument schemes 1–5 for the *i*PEPICO and i^2PEPICO setups.

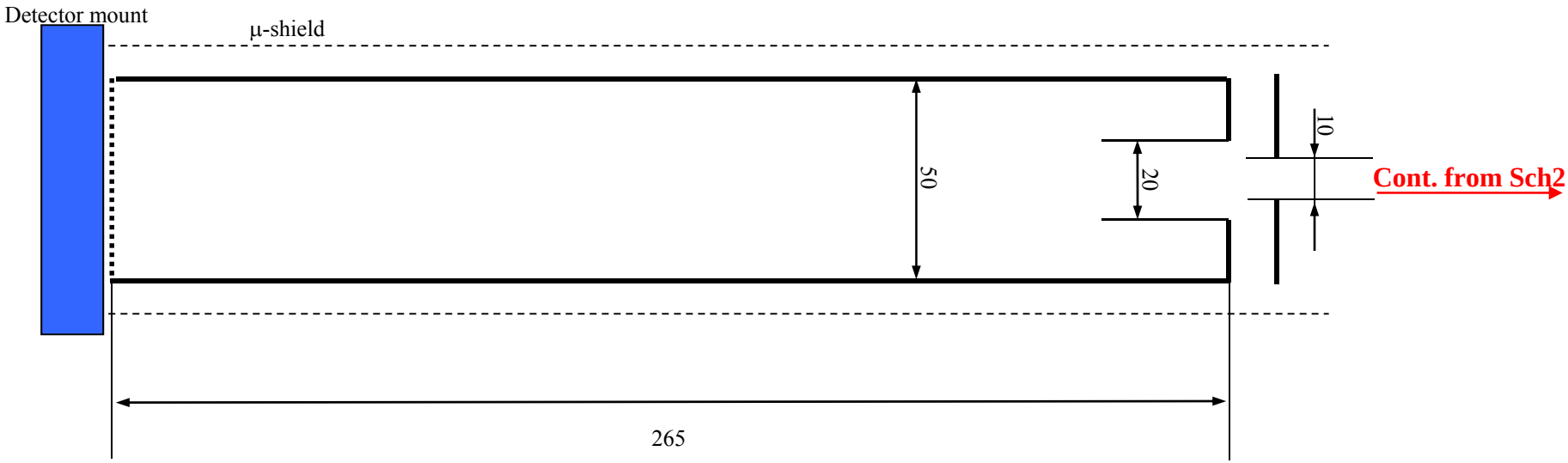
Scheme 1 – Ion Time-of-Flight Tube, *i*PEPICO (the current setup is of constant diameter and with an optional deceleration field)



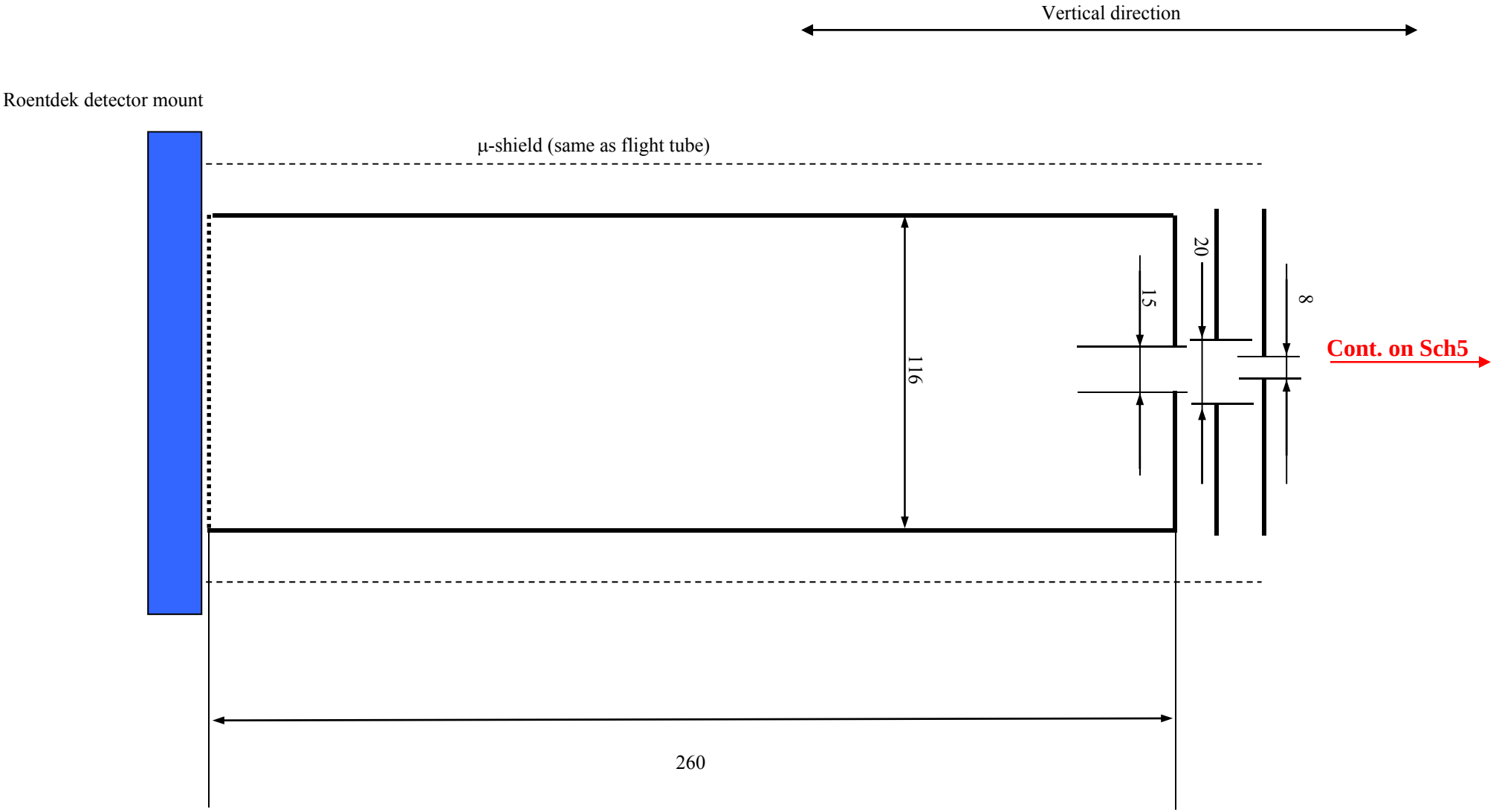
Scheme 2 – Electron & Ion Optics, *i*PEPICO



Scheme 3 – Electron Flight Tube, *i*PEPICO



Scheme 4 – i^2PEPICO top



Scheme 5 – i^2PEPICO overview