DETECTORS

777

Ultra Low-Background Shield

FEATURES

- 15 cm (6 in.) lead thickness
- Ultra low-background materials
- Versions for vertical or U-style™ cryostats
- Purge port for radon expulsion
- Graded tin-copper liner

DESCRIPTION

The Mirion 777 is an ultra low-background lead shield for germanium gamma-ray detectors. It features 50% greater lead thickness than that of typical lead shields and is constructed from materials carefully selected for low background. The 777 shield is available in three versions which complement Mirion ultra low-background cryostats. The 777 shield (pictured above) can accommodate either a vertical dipstick slimline cryostat or a U-style cryostat. The 777A shield accommodates vertical dipstick cryostats only such as the 7500SL with a remote detector chamber (Model RDC-6). The 777B shield accommodates only U-style cryostats. All versions of the 777 system are equipped with a swing-top door for sample chamber access and a door lift mechanism which allows the door to fit tightly against the shield body.

Background radiation from lead is dominated by ^{210}Pb because other elements are chemically separated fairly effectively in the refining process. ^{210}Pb decays with the emission of a 46.5 keV gamma ray. This gamma ray is generally absorbed by the tin-copper liner and may be below the energy range of the detector so it is of little concern. The ^{210}Bi daughter of ^{210}Pb, however, is of concern. It is an energetic beta emitter and bremsstrahlung from this beta gives rise to a continuum of background counts ranging up to 500 keV. For this reason, the 777 shield is constructed with layered bulk lead. The outer five inches is ordinary low-background lead while the innermost one inch is selected for ^{210}Pb content of about 20 Bq/kg. This thickness of lead will stop the bremsstrahlung from the outer lead volume.

The 777 has a graded liner to stop the lead K-shell x rays in the energy range of 75-85 keV. Liner materials are low background tin with a thickness of 1 mm (0.040 in.) and high purity copper with a thickness of 1.5 mm (0.060 in.).

The 777 is equipped with a gas port for the introduction of gas (bottled air or nitrogen) to flush the shield interior and reduce background from radon and radon daughters. Boil-off nitrogen from the LN$_2$ cryostat is a free source of gas but care must be taken to prevent liquid nitrogen from entering the shield and freezing the cryostat seals. An N$_2$ purge kit is available from Mirion for most cryostat types.

The 777A (see illustration) is supplied with a table which supports the shield above the LN$_2$ Dewar. This shield has an opening in the floor and a split annular back shield which surrounds the cryostat RDC neck. The 777B (see illustration) is attached to a steel plate which normally sits on the floor. The 777B has a side port which accommodates the horizontal arm of a U-style cryostat and a rectangular plug which is withdrawn vertically to provide access to the port. An optional cryostat stand (Model 777-5) is available to support the cryostat.

777 | ULTRA LOW-BACKGROUND SHIELD

SPECIFICATIONS

MATERIALS
- Outer Jacket: 9.5 mm (0.375 in.) thick low carbon steel
- Bulk Shield: 15 cm (6 in.) thick low background lead with the innermost 2.5 cm (1 in.) having ^{210}Pb content of less than 25 Bq/kg
- Graded Liner: 1 mm (0.040 in.) low background tin and 1.6 mm (0.062 in.) high purity, low-background copper

WEIGHT
- 1633 kg (3600 lb) installed; 1769 kg (3900 lb) shipping

MECHANICAL
- Door Hinge: oiled bronze bushings
- Door Lift: lever actuated cam

FINISH
- Light gray textured finish outside; clear polyurethane inside

OPTIONS
- 777-1: Solid floor plug for 777 unit (use with U-style cryostat)
- 777-2: Side plug for 777 unit (use with vertical cryostat)
- 777-3: Split backshield for 777 or 777A unit
- 777-4: Cryostat stand for 777 unit
- 777-5: Cryostat stand for 777B unit
- 777-6: N_2 gas purge kit for vertical cryostat
- 777-7: N_2 gas purge kit for U-style cryostat

MODELS
- 777: For vertical or U-style cryostat
- 777A: For vertical cryostat only
- 777B: For U-style cryostat only

777A MODEL

777 MODEL

777B MODEL

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