

Braidwood
“Source Calibration System.”

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Version 1.0.0.2

1. Requirements

2. Suggested Design of “Source Calibration System.” List of Parts

3. Suggested Operation of “Source Calibration System.”

1. Requirements

1. 1. “Source Calibration System” must have as little volume as possible.
- 1.2. Volume of liquid scintillator oil to remain constant.
 - 1.2.1 We must make sure that by removing the “Source Calibration System” from the Acrylic Sphere after calibration, no oil is left on “Source Calibration System”.
 - 1.2.2. We might consider keeping inside the sphere a “replacement volume”, that is we keep a box (bag, balloon, etc) which volume is identical to the calibration source volume. During data taking we have the box inside; during calibration we remove the box and introduce the source.
- 1.3. Volume of liquid scintillator oil must be known with high precision (0.3% error)
 - 1.3.1. Measure the oil introduced inside the sphere by using two flow meters (or 3?)
 - 1.3.2. Introduce a known amount of scintillator.
 - 1.3.3. Combination of both
1. 4. “Source Calibration System” must not obstruct light (transparent)
 1. 3. 1. That is all / most parts of the calibration should be transparent / acrylic.
 1. 3. 2. If possible “Source Calibration System” parts should have same diffraction index as: the acrylic sphere? as the liquid scintillator? ...as?
1. 5. Movements of “Source Calibration System” should not disturb liquid (no turbulence, waves)
1. 6. After the calibration, “Source Calibration System” must be completely removed from liquid scintillator sphere.
1. 7. Remote control
1. 8. “Zero-ing” capabilities.
1. 9. Source should be moved to all (almost all) points inside the scintillator sphere.

2. Suggested Design of “Source Calibration System.” List of Parts

2. 1. List of the parts of the “Source Calibration System”, which will be attached

PERMANENTLY INSIDE the liquid scintillator sphere. Drawing 8 and 9

2.1.1. Bottom rollers made of acrylic; permanently attached inside, to the bottom of the liquid scintillator sphere

2.1.2. Four transparent / clear nylon cords (cables?), connecting the two (EM4 and EM5) electric motors, mounted to the bottom of the top veto’s, and bottom ROLLERS

2. 2. List of the parts of the “Source Calibration System”, which will be kept

PERMANENTLY OUTSIDE of the liquid scintillator sphere.

2.2.1. Parts which provide horizontal movement for transferring the source from “rest” position to “Top Position.” (drawing 2,3,4)

2.2.2. Two (EM4 and EM5) electric motors, mounted to the bottom of the top veto’s, providing vertical (up and down) travel of “The 4 nylon cords. & source platform” system

2.2.3. “Zero-ing” device: laser (light) next to (incorporated into) the PMT’s (every PMT’s? some PMT’s?)

2.3. List of the parts of the “Source Calibration System”, which will be placed

TEMPORARELY INSIDE the liquid scintillator sphere, (only during calibration).

2.3.1. Support and Rotating Platform, made of Acrylic, held in place by the 4 nylon cords (between EM4, EM5 and bottom rollers).

2.3.2. “Telescopic (Retractable) Platform System” made of acrylic (?) hollow elements, such as the total weight of the telescopic arm plus source should be same as the weight of the displaced liquid scintillator. It is mounted on the Rotating Platform. (drawing 7)

2.3.3. Source Unit: source itself and “zero-ing” sensor.

2.3.4. . Anti-sagging string.

2.4. **STORING & HANDLING**. Source will be stored outside the Acrylic Sphere, inside the VETO volume ? (outside the VETO volume?)

2.4.1. “Support Platform” for holding the storing and handling source device

2.4.2. Lead Source Holders

2.4.3. Rails, mounted outside the Steel & Acrylic Sphere, but inside “Veto.” For removing, adding, changing sources. The rails connect the source holder system, source transfer system to “Support and Rotating Platform.” (drawings 5, 5a)

2.4.3. On the “Support and Rotating Platform.”, electric motors (EM3, EM7, EM8, EM9,EM10) mechanisms to move, remove, place sources form holder onto to Telescopic Platforms (drawing 6, 7);

3. Suggested Operation of “Source Calibration System.”

3.1. Default positions:

3.1.1. Default position: source in Lead / Brass holder; shutter closed; resting on “Base platform” (see drawing 2, general view, or drawing 4, detailed view)

3.1.2. Default position: “Support and Rotating Platform,” including all telescopic platform, outside the Scintillator Sphere, above the “neck.”

3.2. Place source on “Support and Rotating Platform.”

3.2.1. Move the source from the REST position to TOP position (drawing 2.) During this operation source is locked on the BASE platform and shutter is closed

3.2.2. Push the source on the “Support and Rotating Platform System.” The source is still locked on BASE platform

3.2.3. Open the shutter. The shutter is part of BASE platform.

3.2.4. Engage EM3 and lock the source on “Rotating Platform.” For a brief moment, the source is locked both on BASE platform and ROTATING platform.(drawing 4 and 5a)

3.2.5.. Disengage EM2 and unlock source from BASE platform

3.2.6. Bring BASE platform to default / REST position.

3.3. Calibration / moving source around

3.3.1. Up and down: the “Support and Rotating Platform System.” with Telescopic Platforms go up and down driven by EM4 and EM5

3.3.2. X-Y movements accomplished by rotating the “Rotating Platform” and by extending the “Telescopic Platforms System”

3.3.2.1 Rotation by EM6. Rotating Platform rotates on Support Platform (Lazy Susan principle) Drawing 6

3.3.2.2. Linear movement by telescopic Platform, EM7, EM8, EM9, EM10, Drawing 7.

3.3.2.3. Anti-sagging string controlled by EM 11

3.3.2.4 Because of the viscous nature of the scintillating oil, “zero-ing” or checking the position of the source should be done several times during the calibration

3.4. Removing source from Scintillator volume

3.4.1 Retract “Telescopic Platforms”

3.4.2. Bring up “Rotating and Support Platforms” (including the “Telescopic Platforms” attached to it.)

3.4.3. We must make sure that by removing the “Source Calibration System” from the Acrylic Sphere after calibration, no oil is left on “Source Calibration System”.

3.4.3.1. Lift up slowly, so all oil drips

3.4.3.2. Apply some vibrations (?), so the oil drops

3.4.3.3. Make sure that all surfaces of parts in contact with the oil are smooth, non-sticky

3.4.4. Transfer the source from Rotating Platform to BASE platform, by engage and disengage EM2 and EM3

3.4.5. Bring source to default / REST position

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