

Qualification Requirements for PET Brain (PTBR)

All scanners for which a site is seeking ACRIN qualification must be a PET/CT scanner. PET ONLY scanners will no longer be accepted for qualification.

Phantom must be a water-filled cylinder injected with ^{18}F . $^{68}\text{Ga}/^{68}\text{Ge}$ solid cylinders are no longer acceptable

Uniform cylinder acquisition for trials involving PET/CT brain scans must be acquired and reconstructed on a FOV with a maximum diameter of 350 mm. A 1-bed position acquisition of a 10 minute duration is required for 3D acquisitions. 2D scanners are not permitted

Materials Required

The following must be submitted for each PET/CT or PET/MRI scanner to be used to scan EAF223 trial participants:

- 1) Completed PET Qualification Application Form (data entered in QUIC)
- 2) Completed PET Quantitative Brain Imaging Qualification Form (provided with qualification image data)
- 3) two (2) previous PET Brain test patient studies (i.e., FDG, amyloid or flortaucipir) acquired in the last 30 days (DICOM-formatted)
- 4) ^{18}F water-filled Uniform Phantom images (DICOM-formatted) acquired in the last 2-3 weeks
- 5) MR-based attenuation correction (AC) map *for PET/MRI scanners only*

Uniform Cylinder Phantom Requirements

The uniform cylinder can be any fillable, cylindrical phantom that does not have any internal structure. The phantom should have an internal diameter of at least 18 cm - 22 cm and be at least 20 cm long. On most systems, the ACR PET phantom can be used for the uniform phantom scan as long as the cold rods and cold spheres are removed and the 'flat' lid is used, instead of the lid with the cylinders attached. However, manufacturers typically supply all PET scanners, at the time of installation, with a uniform cylinder that is used for routine QA and calibrations

Inject a known amount of FDG, amyloid or flortaucipir into the phantom. The activity concentration at the time of phantom scanning should be $\pm 10\%$ of the average activity concentration in a standard ^{18}F -FDG/amyloid/flortaucipir patient at scan start. For example, assuming a 70 kg patient being scanned 60 minutes post-injection, if the standard radiotracer injection is 6 mCi (222 MBq) then the target concentration in the phantom is approximately 60 nCi/ml (2.2 kBq/mL). If the standard FDG injection is 10 mCi (370 MBq), the target concentration is approximately 100 nCi/ml (3.7 kBq/mL). If the phantom scan will begin promptly after filling, then for manufacturer standard uniform phantoms the corresponding injection targets are:

		Target Activity for Standard Phantoms (mCi)		
Standard Dose (mCi)	Target Concentration (uCi/ml)	GE 5640 ml Phantom	Siemens 6283 ml Phantom	Philips 9293 ml Phantom
2	0.020	0.11	0.12	0.18
4	0.039	0.22	0.25	0.36
6	0.059	0.33	0.37	0.55
8	0.078	0.44	0.49	0.73
10	0.098	0.55	0.61	0.91
12	0.117	0.66	0.74	1.09
14	0.137	0.77	0.86	1.27
16	0.157	0.88	0.98	1.45
18	0.176	0.99	1.11	1.64
20	0.196	1.10	1.23	1.82

If you are not using one of the 3 standard phantoms listed above, the target activity can be calculated using this formula:

$$\langle \text{Target Activity (mCi)} \rangle = \langle \text{Phantom Volume (ml)} \rangle * \langle \text{Target Concentration (uCi/ml)} \rangle / 1000$$

Uniform Cylinder Phantom Acquisition Requirements

Place the phantom on its side on the scanner table (not suspended in air). Some sheets may be used under the phantom to prevent the phantom from rolling and to assist in leveling. Align the phantom so that its long axis is parallel to the axis of the scanner. A bubble level should be used to ensure that the phantom is properly positioned in the horizontal plane. Adjust the table height so that the phantom is centered in the transaxial FOV. A maximum

The phantom should be scanned using your site's standard clinical protocol for PET Brain, in accordance with the manufacturer's recommendations. For the 'patient' weight enter the phantom's volume in liters, (i.e., 5.64 kg for a phantom with a volume of 5,640 ml). If the software requests a height, enter the internal length of the phantom in cm, e.g., 20 or 30 cm. The dose should be entered as the net dose obtained from the values recorded on the Application/Qualification Form.

PET Brain scans must be acquired and reconstructed on a FOV with a maximum diameter of 350 mm, acquired in a single (1) bed position.

A 1-bed position acquisition of 10 minute duration is required for 3D acquisitions. 2D scanners are not permitted.

The acquisition(s) should be reconstructed using your site's standard brain reconstruction parameters.

Note: The Uniform Cylinder images must have been acquired in the last 2-3 weeks.

Optional ROI Analysis – On a transverse slice of phantom acquisition, draw a 2D circular ROI that encompasses an area of ~200 cm² of the center of each slice. The same ROI can then be copied and applied across all slices of the phantom. The SUV of this region in each slice should read between 0.90 and 1.10 with less than 10% axial variation across the entire axial field. An optional SUV analysis spreadsheet is available upon request (rdigati@acr.org) but is not required.

Test Patient Requirements

Submit images of two unidentified patients consisting of three volumes or multi-slice files as follows:

- o Brain FOV transmission CT for PET/CT
- o Brain MR AC map for PET/MRI
- o Brain FOV emission (PET) with attenuation correction (AC)
- o Brain FOV emission (PET) without attenuation correction (NAC)

Note: The two PET Brain test patient images must have been acquired in the last 30 days.