GE Healthcare

DST PET-CT NEMA Test Procedures

Applicable to: Software Labeled 07MWXXXX36.4 or Later

5159176-100
Revision 7

IMPORTANT PRECAUTIONS

LANGUAGE

ПРЕДУПРЕЖДЕНИЕ (BG)	Това упътване за работа е налично само на английски език. • Ако доставчикът на услугата на клиента изиска друг език, задължение на клиента е да осигури превод. • Не използвайте оборудването, преди да сте се консултирали и разбрали упътването за работа. • Неспазването на това предупреждение може да доведе до нараняване на доставчика на услугата, оператора или пациента в резултат на токов удар, механична или друга опасност.
警告 (ZH-CN)	本维修手册仅提供英文版本。 • 如果客户的维修服务人员需要非英文版本，则客户需自行提供翻译服务。 • 未详细阅读和完全理解本维修手册之前，不得进行维修。 • 忽略本警告可能对维修服务人员、操作人员或患者造成电击、机械伤害或其他形式的伤害。
警告 (ZH-HK)	本服務手冊僅提供英文版本。 • 倘若客戶的服務供應商需要英文以外之服務手冊，客戶有責任提供翻譯服務。 • 除非已參閱本服務手冊及明白其內容，否則切勿嘗試維修設備。 • 不遵從本警告或會令服務供應商、網絡供應商或病人受到觸電、機械性或其他的危險。
警告 (ZH-TW)	本維修手冊僅有英文版。 • 若客戶的維修廠商需要英文版以外的語言，應由客戶自行提供翻譯服務。 • 請勿試圖維修本設備，除非 您已查閱並瞭解本維修手冊。 • 若未留意本警告，可能導致維修廠商、操作員或病患因觸電、機械或其他危險而受傷。
UPOZORENJE (HR)	Ovaj servisni priru?nik dostupan je na engleskom jeziku. • Ako davatelj usluge klijenta treba neki drugi jezik, klijent je dužan osigurati prijevod. • Ne pokušavajte servisirati opremu ako niste u potpunosti pro?itali i razumjeli ovaj servisni priru?nik. • Zanemarite li ovo upozorenje, može do?i do ozljede davatelja usluge, operatera ili pacijenta uslijed strujnog udara, mehani?kih ili drugih rizika.
VÝSTRAHA (CS)	Tento provozní návod existuje pouze v anglickém jazyce. • V případě, že externí služba zákazníkům potřebuje návod v jiném jazyce, je zajištění překladu do odpovídajícího jazyka úkolem zákazníka. • Nesnažte se o údržbu tohoto zařízení, aniž byste si přečetli tento provozní návod a pochopili jeho obsah. • V případě nedodržování této výstrahy může dojít k poranění pracovníka prodejního servisu, obslužného personálu nebo pacientů vlivem elektrického proudu, respektive vlivem mechanických či jiných rizik.

ADVARSEL (DA)	Denne servicemanual findes kun på engelsk. • Hvis en kundes tekniker har brug for et andet sprog end engelsk, er det kundens ansvar at sørge for oversættelse. • Forsøg ikke at servicere udstyret uden at læse og forstå denne servicemanual. • Manglende overholdelse af denne advarsel kan medføre skade på grund af elektrisk stød, mekanisk eller anden fare for teknikeren, operatøren eller patienten.
WAARSCHUWING (NL)	Deze onderhoudshandleiding is enkel in het Engels verkrijgbaar. • Als het onderhoudspersoneel een andere taal vereist, dan is de klant verantwoordelijk voor de vertaling ervan. • Probeer de apparatuur niet te onderhouden alvorens deze onderhoudshandleiding werd geraadpleegd en begrepen is. • Indien deze waarschuwing niet wordt opgevolgd, zou het onderhoudspersoneel, de operator of een patiënt gewond kunnen raken als gevolg van een elektrische schok, mechanische of andere gevaren.
WARNING (EN)	This service manual is available in English only. • If a customer's service provider requires a language other than english, it is the customer's responsibility to provide translation services. • Do not attempt to service the equipment unless this service manual has been consulted and is understood. • Failure to heed this warning may result in injury to the service provider, operator or patient from electric shock, mechanical or other hazards.
HOIATUS (ET)	See teenindusjuhend on saadaval ainult inglise keeles • Kui klienditeeninduse osutaja nõuab juhendit inglise keelest erinevas keeles, vastutab klient tõlketeenuse osutamise eest. • Ärge üritage seadmeid teenindada enne eelnevalt käesoleva teenindusjuhendiga tutvumist ja sellest aru saamist. • Käesoleva hoiatuse eiramine võib põhjustada teenuseosutaja, operaatori või patsiendi vigastamist elektrilöögi, mehaanilise või muu ohu tagajärjel.
VAROITUS (FI)	Tämä huolto-ohje on saatavilla vain englanniksi. • Jos asiakkaan huoltohenkilöstö vaatii muuta kuin englanninkielistä materiaalia, tarvittavan käännöksen hankkiminen on asiakkaan vastuulla. • Älä yritä korjata laitteistoa ennen kuin olet varmasti lukenut ja ymmärtänyt tämän huolto-ohjeen. • Mikäli tätä varoitusta ei noudateta, seurauksena voi olla huoltohenkilöstön, laitteiston käyttäjän tai potilaan vahingoittuminen sähköiskun, mekaanisen vian tai muun vaaratilanteen vuoksi.

ATTENTION (FR)	Ce manuel d'installation et de maintenance est disponible uniquement en anglais. • Si le technicien d'un client a besoin de ce manuel dans une langue autre que l'anglais, il incombe au client de le faire traduire. • Ne pas tenter d'intervenir sur les équipements tant que ce manuel d'installation et de maintenance n'a pas été consulté et compris. • Le non-respect de cet avertissement peut entraîner chez le technicien, l'opérateur ou le patient des blessures dues à des dangers électriques, mécaniques ou autres.
WARNUNG (DE)	Diese Serviceanleitung existiert nur in englischer Sprache. • Falls ein fremder Kundendienst eine andere Sprache benötigt, ist es Aufgabe des Kunden für eine entsprechende Übersetzung zu sorgen. • Versuchen Sie nicht diese Anlage zu warten, ohne diese Serviceanleitung gelesen und verstanden zu haben. • Wird diese Warnung nicht beachtet, so kann es zu Verletzungen des Kundendiensttechnikers, des Bedieners oder des Patienten durch Stromschläge, mechanische oder sonstige Gefahren kommen.
ΠΡΟΕΙΔΟΠΟΙΗΣΗ (EL)	Το παρόν εγχειρίδιο σέρβις διατίθεται μόνο στα αγγλικά. • Εάν ο τεχνικός σέρβις ενός πελάτη απαιτεί το παρόν εγχειρίδιο σε γλώσσα εκτός των αγγλικών, αποτελεί ευθύνη του πελάτη να παρέχει τις υπηρεσίες μετάφρασης. • Μην επιχειρήσετε την εκτέλεση εργασιών σέρβις στον εξοπλισμό αν δεν έχετε συμβουλευτεί και κατανοήσει το παρόν εγχειρίδιο σέρβις. • Αν δεν προσέξετε την προειδοποίηση αυτή, ενδέχεται να προκληθεί τραυματισμός στον τεχνικό σέρβις, στο χειριστή ή στον ασθενή από ηλεκτροπληξία, μηχανικούς ή άλλους κινδύνους.
FIGYELMEZTETÉS (HU)	Ezen karbantartási kézikönyv kizárólag angol nyelven érhető el. • Ha a vevő szolgáltatója angoltól eltérő nyelvre tart igényt, akkor a vevő felelőssége a fordítás elkészíttetése. • Ne próbálja elkezdeni használni a berendezést, amíg a karbantartási kézikönyvben leírtakat nem értelmezték. • Ezen figyelmeztetés figyelmen kívül hagyása a szolgáltató, működtető vagy a beteg áramütés, mechanikai vagy egyéb veszélyhelyzet miatti sérülését eredményezheti.
AÐVÖRUN (IS)	Þessi þjónustuhandbók er aðeins fáanleg á ensku. • Ef að þjónustuveitandi viðskiptamanns þarfnast annas tungumáls en ensku, er það skylda viðskiptamanns að skaffa tungumálaþjónustu. • Reynið ekki að afgreiða tækið nema að þessi þjónustuhandbók hefur verið skoðuð og skilin. • Brot á sinna þessari aðvörun getur leitt til meiðsla á þjónustuveitanda, stjórnanda eða sjúklings frá raflosti, vélrænu eða öðrum áhættum.

AVVERTENZA (IT)	Il presente manuale di manutenzione è disponibile soltanto in lingua inglese. • Se un addetto alla manutenzione richiede il manuale in una lingua diversa, il cliente è tenuto a provvedere direttamente alla traduzione. • Procedere alla manutenzione dell'apparecchiatura solo dopo aver consultato il presente manuale ed averne compreso il contenuto. • Il mancato rispetto della presente avvertenza potrebbe causare lesioni all'addetto alla manutenzione, all'operatore o ai pazienti provocate da scosse elettriche, urti meccanici o altri rischi.
警告 (JA)	このサービスマニュアルには英語版しかありません。 • サービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。 • このサービスマニュアルを熟読し理解せずに、装置のサービスを行わないでください。 • この警告に従わない場合、サービスを担当される方、操作員あるいは患者さんが、感電や機械的又はその他の危険により負傷する可能性があります。
경고 (KO)	본 서비스 매뉴얼은 영어로만 이용하실 수 있습니다 . • 고객의 서비스 제공자가 영어 이외의 언어를 요구할 경우 , 번역 서비스를 제공하는 것은 고객의 책임입니다 . • 본 서비스 매뉴얼을 참조하여 숙지하지 않은 이상 해당 장비를 수리하려고 시도하지 마십시오 . • 본 경고 사항에 유의하지 않으면 전기 쇼크 , 기계적 위험 , 또는 기타 위험으로 인해 서비스 제공자 , 사용자 또는 환자에게 부상을 입힐 수 있습니다 .
BRDINJUMS (LV)	Šī apkopes rokasgrāmata ir pieejama tikai angļu valodā. • Ja klienta apkopes sniedzējam nepieciešama informācija citā valodā, klienta pienākums ir nodrošināt tulkojumu. • Neveiciet aprīkojuma apkopi bez apkopes rokasgrāmatas izlasīšanas un saprašanas. • Šī brīdinājuma neievērošanas rezultātā var rasties elektriskās strāvas trieciena, mehānisku vai citu faktoru izraisītu traumu risks apkopes sniedzējam, operatoram vai pacientam.
ĮSPĖJIMAS (LT)	Šis eksploatavimo vadovas yra tik anglų kalba. • Jei kliento paslaugų tiekėjas reikalauja vadovo kita kalba – ne anglų, suteikti vertimo paslaugas privalo klientas. • Nemėginkite atlikti įrangos techninės priežiūros, jei neperskaitėte ar nesupratote šio eksploatavimo vadovo. • Jei nepaisysite šio įspėjimo, galimi paslaugų tiekėjo, operatoriaus ar paciento sužalojimai dėl elektros šoko, mechaninių ar kitų pavojų.
ADVARSEL (NO)	Denne servicehåndboken finnes bare på engelsk. • Hvis kundens serviceleverandør har bruk for et annet språk, er det kundens ansvar å sørge for oversettelse. • Ikke forsøk å reparere utstyret uten at denne servicehåndboken er lest og forstått. • Manglende hensyn til denne advarselen kan føre til at serviceleverandøren, operatøren eller pasienten skades på grunn av elektrisk støt, mekaniske eller andre farer.

OSTRZEŻENIE (PL)	Niniejszy podręcznik serwisowy dostępny jest jedynie w języku angielskim. • Jeśli serwisant klienta wymaga języka innego niż angielski, zapewnienie usługi tłumaczenia jest obowiązkiem klienta. • Nie próbować serwisować urządzenia bez zapoznania się z niniejszym podręcznikiem serwisowym i zrozumienia go. • Niezastosowanie się do tego ostrzeżenia może doprowadzić do obrażeń serwisanta, operatora lub pacjenta w wyniku porażenia prądem elektrycznym, zagrożenia mechanicznego bądź innego.
ATENÇÃO (PT-BR	Este manual de assistência técnica encontra-se disponível unicamente em inglês. • Se outro serviço de assistência técnica solicitar a tradução deste manual, caberá ao cliente fornecer os serviços de tradução. • Não tente reparar o equipamento sem ter consultado e compreendido este manual de assistência técnica. • A não observância deste aviso pode ocasionar ferimentos no técnico, operador ou paciente decorrentes de choques elétricos, mecânicos ou outros.
ATENÇÃO (PT-PT)	Este manual de assistência técnica só se encontra disponível em inglês. • Se qualquer outro serviço de assistência técnica solicitar este manual noutro idioma, é da responsabilidade do cliente fornecer os serviços de tradução. • Não tente reparar o equipamento sem ter consultado e compreendido este manual de assistência técnica. • O não cumprimento deste aviso pode colocar em perigo a segurança do técnico, do operador ou do paciente devido a choques eléctricos, mecânicos ou outros.
ATENȚIE (RO)	Acest manual de service este disponibil doar în limba engleză. • Dacă un furnizor de servicii pentru clienți necesită o altă limbă decât cea engleză, este de datoria clientului să furnizeze o traducere. • Nu încercați să reparați echipamentul decât ulterior consultării şi înțelegerii acestui manual de service. • Ignorarea acestui avertisment ar putea duce la rănirea depanatorului, operatorului sau pacientului în urma pericolelor de electrocutare, mecanice sau de altă natură.
ОСТОРОЖНО! (RU)	Данное руководство по техническому обслуживанию представлено только на английском языке. • Если сервисному персоналу клиента необходимо руководство не на английском, а на каком-то другом языке, клиенту следует самостоятельно обеспечить перевод. • Перед техническим обслуживанием оборудования обязательно обратитесь к данному руководству и поймите изложенные в нем сведения. • Несоблюдение требований данного предупреждения может привести к тому, что специалист по техобслуживанию, оператор или пациент получит удар электрическим током, механическую травму или другое повреждение.

UPOZORENJE (SR)	Ovo servisno uputstvo je dostupno samo na engleskom jeziku. • Ako klijentov serviser zahteva neki drugi jezik, klijent je du?an da obezbedi prevodila?ke usluge. • Ne poku?avajte da opravite ure?aj ako niste pro?itali i razumeli ovo servisno uputstvo. • Zanemarivanje ovog upozorenja mo?e dovesti do povre?ivanja servisera, rukovaoca ili pacijenta usled strujnog udara ili mehani?kih i drugih opasnosti.
UPOZORNENIE (SK)	Tento návod na obsluhu je k dispozícii len v angličtine. • Ak zákazníkov poskytovateľ služieb vyžaduje iný jazyk ako angličtinu, poskytnutie prekladateľských služieb je zodpovednos″ou zákazníka. • Nepokúšajte sa o obsluhu zariadenia, kým si neprečítate návod na obluhu a neporozumiete mu. • Zanedbanie tohto upozornenia môže spôsobi″ zranenie poskytovateľa služieb, obsluhujúcej osoby alebo pacienta elektrickým prúdom, mechanické alebo iné ohrozenie.
ATENCION (ES)	Este manual de servicio sólo existe en inglés. • Si el encargado de mantenimiento de un cliente necesita un idioma que no sea el inglés, el cliente deberá encargarse de la traducción del manual. • No se deberá dar servicio técnico al equipo, sin haber consultado y comprendido este manual de servicio. • La no observancia del presente aviso puede dar lugar a que el proveedor de servicios, el operador o el paciente sufran lesiones provocadas por causas eléctricas, mecánicas o de otra naturaleza.
VARNING (SV)	Den här servicehandboken finns bara tillgänglig på engelska. . • Om en kunds servicetekniker har behov av ett annat språk än engelska, ansvarar kunden för att tillhandahålla översättningstjänster. • Försök inte utföra service på utrustningen om du inte har läst och förstår den här servicehandboken. • Om du inte tar hänsyn till den här varningen kan det resultera i skador på serviceteknikern, operatören eller patienten till följd av elektriska stötar, mekaniska faror eller andra faror.
DIKKAT (TR)	Bu servis kılavuzunun sadece ingilizcesi mevcuttur. • Eğer müşteri teknisyeni bu kılavuzu ingilizce dışında bir başka lisandan talep ederse, bunu tercüme ettirmek müşteriye düşer. • Servis kılavuzunu okuyup anlamadan ekipmanlara müdahale etmeyiniz. • Bu uyarıya uyulmaması, elektrik, mekanik veya diğer tehlikelerden dolayı teknisyen, operatör veya hastanın yaralanmasına yol açabilir.

DAMAGE IN TRANSPORTATION

You should closely examine all packages at time of delivery. If damage is apparent, have the notation “Damage in Shipment” written on all copies of the freight or express bill before delivery is accepted or “signed for” by a General Electric representative or a hospital receiving agent. Whether noted or concealed, you MUST report damage to the carrier immediately upon discovery and within 14 days after receipt, and you must hold the contents and containers for inspection by the carrier. A transportation company will not pay a claim for damage if you do not request an inspection within this 14-day period.

To file a report:

- Call 1-800-548-3366 and use option 8.
- Fill out a report on http://egems.med.ge.com/edq/home.jsp
- Contact your local service coordinator for more information on this process.

Rev. June 13, 2006

CERTIFIED ELECTRICAL CONTRACTOR STATEMENT

All electrical installations that are preliminary to positioning of the equipment at the site prepared for the equipment shall be performed by licensed electrical contractors. In addition, electrical feeds into the Power Distribution Unit shall be performed by licensed electrical contractors. Other connections between pieces of electrical equipment, calibrations and testing shall be performed by qualified GE Healthcare personnel. The products involved (and the accompanying electrical installations) are highly sophisticated, and special engineering competence is required. In performing all electrical work on these products, GE will use its own specially trained field engineers. All of GE’s electrical work on these products will comply with the requirements of the applicable electrical codes.

The purchaser of GE equipment shall only utilize qualified personnel (i.e., GE’s field engineers, personnel of third-party service companies with equivalent training, or licensed electricians) to perform electrical servicing on the equipment.

IMPORTANT...X-RAY PROTECTION

X-ray equipment, if not properly used, may cause injury. Accordingly, the instructions herein contained should be thoroughly read and understood by everyone who will use the equipment before you attempt to place this equipment in operation. The General Electric Company, GE Healthcare Group, will be glad to assist and cooperate in placing this equipment in use.

Although this apparatus incorporates a high degree of protection against x-radiation other than the useful beam, no practical design of equipment can provide complete protection. Nor can any practical design compel the operator to take adequate precautions to prevent the possibility of any persons carelessly exposing themselves or others to radiation.

It is important that anyone having anything to do with x-radiation be properly trained and fully acquainted with the recommendations of the National Council on Radiation Protection and Measurements as published in NCRP Reports available from NCRP Publications, 7910 Woodmont Avenue, Room 1016, Bethesda, Maryland 20814, and of the International Commission on Radiation Protection, and take adequate steps to protect against injury.

The equipment is sold with the understanding that the General Electric Company, GE Healthcare Group, its agents, and representatives have no responsibility for injury or damage which may result from improper use of the equipment.

Various protective materials and devices are available. It is urged that you use such materials and devices.

IMPORTANT...RADIOACTIVE MATERIAL HANDLING

Only employees formally trained in radioactive materials handling and this equipment are authorized by the GE Healthcare Radiation Safety Officer to use radioactive materials to service this equipment.

GE Healthcare Services is required to notify the applicable U.S. state agency PRIOR to any source service event involving pin source handling. See NUC/PET Radioactive material guides for specific instruction or contact your EHS Specialist.

A radiation survey must be performed when a pin source has been removed and replaced. See Radiation Survey Form Instructions or contact your EHS Specialist.

Rev 2 (July 21, 2005)

LITHIUM BATTERY CAUTIONARY STATEMENTS

CAUTION
Risk of Explosion

Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

ATTENTION
Danger d'Explosion

Il y a danger d'explosion s'il y a replacement incorrect de la batterie. Remplacer uniquement avec une batterie du même type ou d'un type recommandé par le constructeur. Mettre au rébut les batteries usagées conformément aux instructions du fabricant.

OMISSIONS & ERRORS

Customers: please contact the GE Healthcare Sales or Service representatives.

GE personnel: please use the GE Healthcare iTrak/PQR Process to report all omissions, errors, and defects in this publication.

Revision History

Revision	Date	Reason for change
1	11/09/05	Initial release
2	4/17/06	Removed the word "None:" from the bottom "Acquisition, Time, Disk Space column" entries in Table 1-2 and 1-3; Added a "Well Counter" row to Table 1-6; Updated page 44, step 21 from "activity value (in kBq)" to "activity concentration (in kBq/cc)" to resolve SPR, FCTge19296
3	9/6/06	**Limited Release for Review purposed only:** Changed procedure steps on pg 34; Replaced Table 1-5; Added Section 1-7: Performance Specifications; made changes according to review markups of hardcopy pages; made final changes to Section 1.7 per 24 August email from Jay Williams
4	9/6/06	Final release - approved by Marketing and Systems Engineering
5	3/29/07	Changed the Y coordinates on page 14 to from positive to negative; Added a step (10) to page 34 instructions; Changed the Table 1-6 3D Recon Method to "Reprojection" (page 44); Updated the Performance Specifications in Section 1-7
6	8/28/07	Updated the manual to current manual formatting standards. Added Count Rate Accuracy Correction Fit (CRACFIT) section. Title Page: Subheading changed per J. Williams. 1-2.1: Step 2 changed per J. Williams. 1-2.2 and 1-2.3: Redundant verbiage removed. 1-3.2: Step 1 and verbiage in Figure 1.6 and 1.7 changed per J. Williams. Redundant verbiage also removed from procedure. 1-3.3: Step 1 amended per J. Williams. 1-5-1.3: Notes added to procedure per J. Williams. 1-5-2: Step 1 amended per J. Williams.
7	8/26/09	Updated the Language statement (added ZH-HK, ZH-TW, HR). Changed the acquisistion time in Tables 1-2 and 1-3 per V. Tran. 1-5-1.1: Updated step 2 and Figure 1-23 per FCTge48122. 1-7.2: Updated step 5 for alternate 2D/3D restore window per V. Tran.

Table of Contents

Chapter 1 NEMA NU2-2001 Test Procedures for DST

Section 1-1: Test Overview

NOTICE **All performance testing presumes that the system is well tuned and has current corrections. The well counter and normalization corrections should be less than 2 weeks old. The gain calibration should be updated on the day of test. Any abnormalities observed during tuning or DQA, should be corrected before testing.**

Follow the procedures in this chapter to test Discovery ST PET-CT Systems.

All Discovery ST software releases contain the NEMA NU2-2001 processing tools. All performance measurements are evaluated per NEMA Standards Publication, NU2-2001, *Performance Measurements of Positron Emission Tomographs*. Where applicable, the calculations have been updated to the NEMA NU2-2007 methods to account for the natural radioactivity in Lutetium bearing detectors.

Table 1-1, Table 1-2 and Table 1-3 summarize the requirements for each test and provide a recommended time line for executing the series.

Table 1-1: (Day 1) Spatial Resolution, Sensitivity, Image Quality, and Corrections Tests

Chapter Section and Test Title	Phantom, Isotope, Activity	Acquisition, Time, Disk Space	Analysis Process
Section 1-2 – : Spatial Resolution Test on page -17	Capillary Tubes, Support for tubes .1 cc F-18, with concentration > 200 MBq/cc (5 mCi/cc)	Via diagnostic acquisition 2 hours 1256 Mb	Recon 256x256 images. Use Investigator to compute result based on images.
Section 1-3 – : Sensitivity Test on page -25	NEMA 2001 Sensitivity Phantom, support for aluminum tubes 10 MBq (0.4 mCi) F-18	Via diagnostic acquisition 1 hour 628 Mb	No recon. Use Investigator to compute result from raw data at each radial position.
Section 1-4 – : Image Quality, Attenuation Accuracy & Scatter Correction Test on page -32	NEMA 2001 Image Quality Phantom, NEMA 2001 Scatter Fraction Phantom 370 MBq (10 mCi) F-18	Via patient acquisition 20 minutes per replication (3 replications recommended) 63 Mb per replication	Recon images. Requires recent, good quality norm and well counter.

A typical activity order consists of 20MBq (0.5 mCi) in a 5cc syringe for the Sensitivity tests, and 1GBq (30 mCi) in a 5cc syringe for the Spatial Resolution and Image Quality tests.

Table 1-2: (Night 1) 2D Scatter Fraction, Count Losses, and Randoms Test

Chapter Section and Test Title	Phantom, Isotope, Activity	Acquisition, Time, Disk Space	Analysis Process
Section 1-5 – : Scatter Fraction, Count Losses, and Randoms Test on page -43	NEMA 2001 Scatter Fraction Phantom 2590 MBq (70 mCi) F-18	2D:via diagnostic acquisition 18 hours 231 Mb	No recon. Use Investigator to compute result from raw data.
Section 1-6 – : Accuracy: Correction for Count Losses and Randoms on page -48	None: Uses data from Scatter Fraction, Count Losses, and Randoms Test	Uses data from Scatter Fraction, Count Losses, and Randoms Test	Recon 128x128 images. Use investigator to compute result based on images. Must have peak NECR activity value from Scatter Fraction, Count Losses, and Randoms Analysis.

Table 1-3: (Night 2) 3D Scatter Fraction, Count Losses, and Randoms Test

Chapter Section and Test Title	Phantom, Isotope, Activity	Acquisition, Time, Disk Space	Analysis Process
Section 1-5 – : Scatter Fraction, Count Losses, and Randoms Test on page -43	NEMA 2001 Scatter Fraction Phantom 900 MBq (25 mCi) F-18	3D: via diagnostic acquisition 19 hours 1100 Mb	No recon. Use Investigator to compute result from raw data.
Section 1-6 – : Accuracy: Correction for Count Losses and Randoms on page -48	None: Uses data from Scatter Fraction, Count Losses, and Randoms Test	Uses data from Scatter Fraction, Count Losses, and Randoms Test	Recon 128x128 images. Use investigator to compute result based on images. Must have peak NECR activity value from Scatter Fraction, Count Losses, and Randoms Analysis.

NOTICE **If you plan to save multiple NEMA reports as postscript files, create a destination directory to store the files. After you click SAVE POSTSCRIPT FILE, go to the `user/g/ctuser` directory to retrieve the `service.ps` file, rename it and copy it to the destination directory you created, BEFORE you save the next file. Each time you save a new postscript file, it overwrites the existing file in `user/g/ctuser`.**

Section 1-2: Spatial Resolution Test

The spatial resolution of a system represents its ability to distinguish between two points after image reconstruction.

1-2.1 Prepare the Hematocrit Capillary Tubes

NOTICE **You may add a small amount of concentrated dye to the activity, to enhance visibility of the drops you will make and draw during this procedure.**

1.) Use a micro pipette in good condition, or a new syringe, to place samples of F-18 with >200 MBq/cc (5 mCi/cc) activity concentration on a slide. Refer to Figure 1-1 for additional guidance.

Note: For best results, tap the tip of the syringe against the slide in about 10 different places, then choose three samples of equal size to use.

2.) Place the end of a hematocrit capillary tube onto one of the drops. The capillary action draws the drop into the tube.

NOTICE **The prepared point sources must be less than 1mm in axial length. If the source is longer than 1mm, the measured axial resolution will increase proportionately.**

3.) Verify the drop fills less than 1mm of the hematocrit tube. If the fill length exceeds 1mm, discard the tube and try again.

4.) Press each end of the tube into Critoseal clay to seal it. Be sure to seal the end of the tube with activity first.

5.) Repeat the process to make three sources.

Figure 1-1: Example of Hematocrit Tubes, Pipette, and Critoseal used in Generating Point Sources

1-2.2 Position the Source and Acquire the 2D Data

NOTICE **For data processing to execute correctly, position all three point sources in the specified locations. For best results, use the NEMA 94 source holder to maintain the exact point source locations and use hematocrit capillary tubes to hold the source.**

1.) Insert the three F-18 point sources into the NEMA 94 source holder at the locations listed below, referring to Figure 1-2 for additional guidance, if necessary:

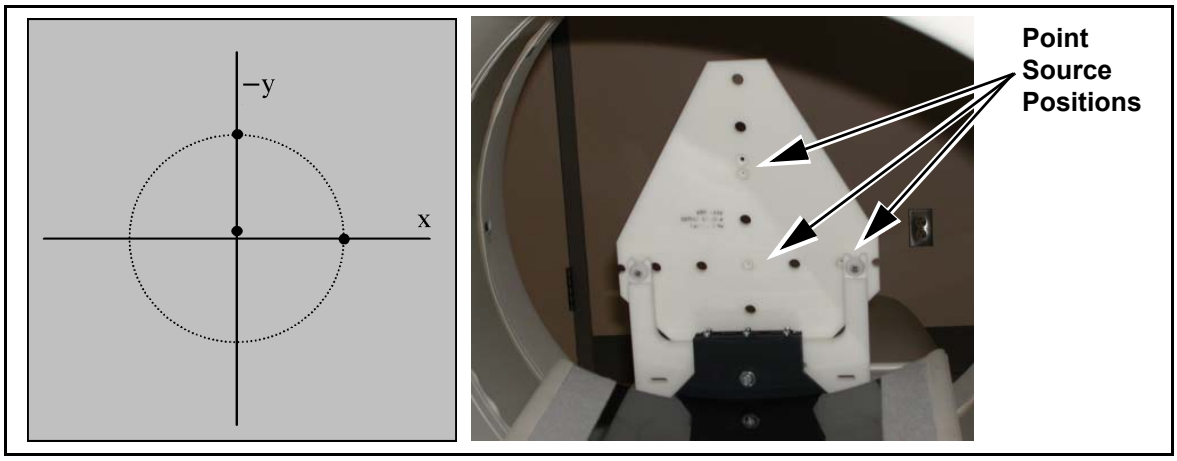
a.) x = 0 cm and y = -1 cm

b.) x = 0 cm and y = -10 cm

c.) x = 10 cm (viewed from the table side of the gantry) and y = 0 cm

NOTICE **Orient the capillary tubes so all three active points enter the gantry at the same time, ahead of the source holder.**

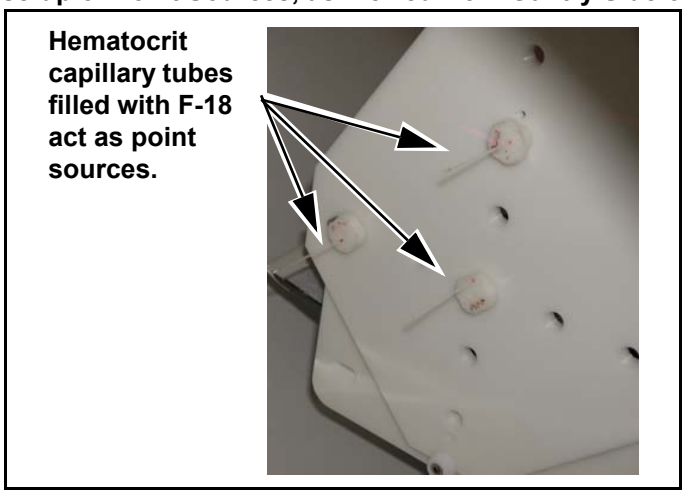
Figure 1-2: Point Source Positions, as Viewed from the Table Side of the Gantry



2.) Press the **ALIGNMENT LIGHT** button and move the cradle into the CT scan FOV until the lasers at the CT image plane illuminate the active spot of all three point sources simultaneously.

3.) Press the **INTERNAL LANDMARK** button.

Figure 1-3: Close-up of Point Sources, as Viewed from Gantry Side of Table



4.) Click the SERVICE button to open the Common Service Desktop. If necessary, click the PET option button to display the PET Common Service Desktop.

5.) Click the DIAGNOSTICS icon on the Common Service Desktop to open the corresponding folder.

6.) Click DIAGNOSTIC ACQUISITION to open the Diagnostic Acquisition panel.

7.) Scroll through the DIAGNOSTIC SCAN SELECTION protocol list and click the `NU2-2001_2D_Resolution` scan protocol to highlight it.

8.) Click ACCEPT SETUP to begin the scan sequence.

9.) When the **START** button flashes, press it to initiate the acquisition sequence.

Note: The acquisition consists of two bed positions, each lasting 20 minutes, for a total acquisition time of 40 minutes.

NOTICE **After about 20 minutes, the MOVE TO SCAN button will flash.**

10.) When the **MOVE TO SCAN** button flashes, press it to move the cradle to the next bed position and continue the data acquisition.

11.) Proceed to Section 1-2.3.

1-2.3 Position the Source and Acquire the 3D Data

This procedure assumes that you have just completed the 2D acquisition sequence.

1.) Use the same landmark setting from Section 1-2.2.

2.) If necessary, perform the following steps:

   a.) Click the SERVICE button to display the Common Service Desktop.

   b.) Click the PET option button to display the PET Common Service Desktop.

   c.) Click the CDS DIAGNOSTICS button to open the corresponding folder.

   d.) Click `Diagnostic Acquistion` to open the Diagnostic Acquisition panel.

3.) Scroll through the DIAGNOSTIC SCAN SELECTION protocol list and click on highlight the `NU2-2001_3D_Resolution` scan protocol to highlight it.

4.) Click ACCEPT SETUP to begin the scan sequence.

5.) When the **START** button flashes, press it to initiate the acquisition sequence.

Note: The acquisition consists of two bed positions, each lasting 20 minutes, for a total acquisition time of 40 minutes.

NOTICE **After about 20 minutes, the MOVE TO SCAN button will flash.**

6.) Press the **MOVE TO SCAN** button when it flashes to move the cradle to the next bed position and continue the data acquisition.

7.) When the acquisition finishes, click OPTIONS to display the submenu.

8.) Click or drag to QUIT SCREEN to exit the acquisition screen.

1-2.4 Analysis Procedure

1-2-4.1 Analyze the 2D Data Set

1.) Click the PET button.
2.) Click SCREENS to display the submenu.
3.) Click or drag to RECON to open the Reconstruction panel.
4.) Click NEXT RECON to open the Scan Data Selection panel.
5.) Click the `Diagnostic Acquistion` exam, to display the series list.
6.) Click the `NU2-2001 2D Resolution` series for reconstruction, to highlight it.
7.) Click OK.
8.) Select the following 2D reconstruction options:
   - Recon Method: `Backproject`
   - Matrix Size: `256 x 256`
   - FOV Diameter: `25.0 cm`
   - Center L: `5.0 cm`
   - Center P: `-5.0`
   - Transaxial Filter: `Ramp`
   - Filter Cutoff: `Minimum available for ramp filter` (see note below)
   - Deadtime: `No`

Note: The `minimum available ramp filter` is constrained to the Nyquist limit for each crystal geometry. Iterative reconstruction with a smaller filter width can be applied to the raw data. The reconstructed images will show smaller FWHM, but the result is not useful for comparison between systems.

9.) Click SUBMIT TO BOTTOM.
10.) When reconstruction completes, click UTILITIES to display the submenu.
11.) Click or drag to INVESTIGATOR to open the PET Diagnostic Analysis panel.
12.) Follow the steps below to select the 2D image set for processing:
   a.) Click `Diagnostic Acquisition` in the patient list to highlight it and click EXAMS.
   b.) Click `NU2-2001 2D Resolution` in the exam list to highlight it and click IMAGESETS.
   c.) Click the first image in the list to highlight it and click SHOW IMAGE.

13.) Perform the following steps on the Show Image screen:

a.) Click `NU2-2001` to display the submenu.

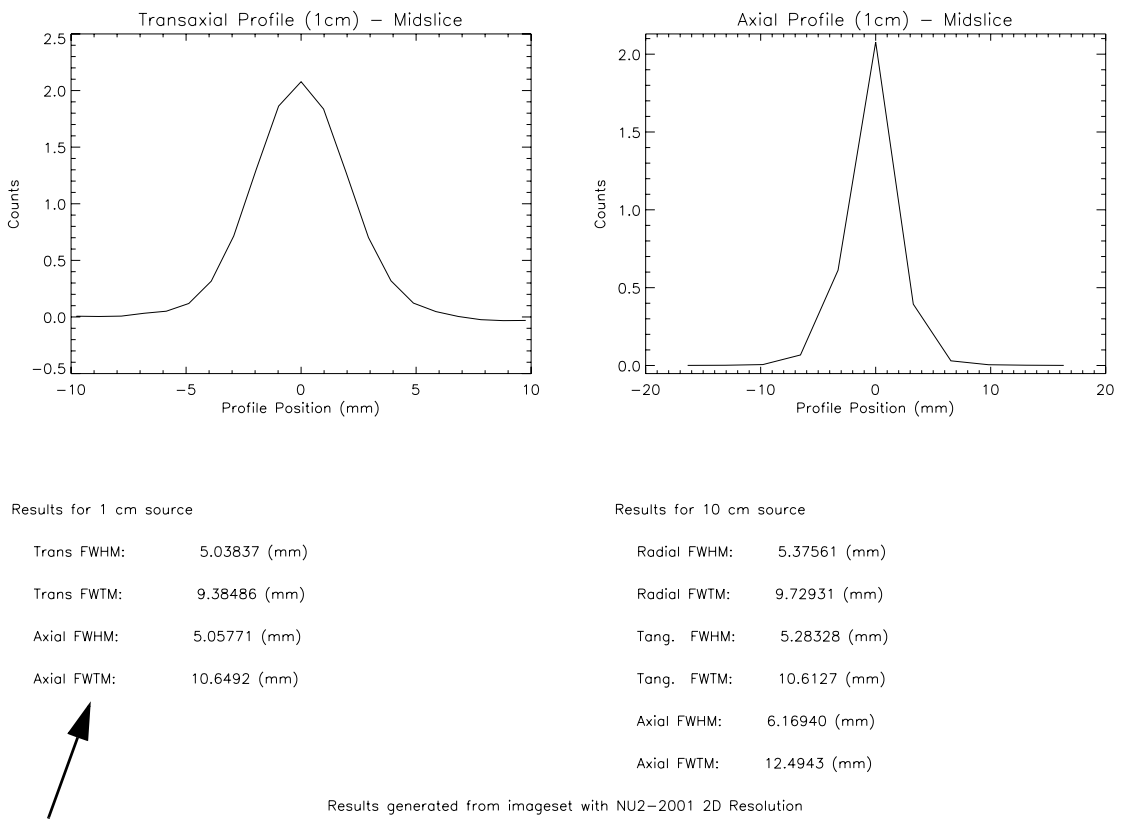
b.) Click or drag to SPATIAL RESOLUTION to open the Analysis Parameters Shell.

14.) Click ACTION to display the submenu.

15.) Click or drag to EXECUTE ANALYSIS. Do NOT modify the parameters.

Note: The screen should update and show a results screen similar to the one in Figure 1-4.

Figure 1-4: Example of a Resolution Report - Typical Results for DSTE 2D



FWTM values are shown per NEMA standard. FWTM is expected to be about twice FWHM, but variation is too large to compare to specification.

16.) Perform the following steps to save or print the results:

a.) Click FILE in the toolbar on the Sensitivity Report screen.

b.) Click or drag to PRINT HARD COPY to send a copy of the screen to the designated local printer.

c.) Click or drag to SAVE POSTSCRIPT FILE to place a copy of the screen in directory `user/g/ctuser`. The file name is `service.ps`.

17.) Click FILE in the Analysis Shell toolbar to display the submenu.

18.) Click or drag to DONE to close the Analysis Shell panel.

19.) Click FILE in the Show Image toolbar to display the submenu.

20.) Click or drag to DONE to close the Show Image panel.

1-2-4.2 Analyze the 3D Data Set

1.) If necessary, click the PET icon to display the desktop.
2.) Click SCREENS to display the submenu.
3.) Click or drag to RECON to open the Reconstruction panel.
4.) Click NEXT RECON to open the Scan Data Selection panel.
5.) Click the `Diagnostic Acquistion` exam to display the series list.
6.) Click the `NU2-2001 3D Resolution` series to highlight it for reconstruction.
7.) Click OK.
8.) Select the following 3D reconstruction options:
   - Recon Method: `FORE-FBP`
   - Matrix Size: `256 x 256`
   - FOV Diameter: `25.0 cm`
   - Center L: `5.0 cm`
   - Center P: `-5.0`
   - Transaxial Filter: `Ramp`
   - Filter Cutoff: `Minimum available for ramp filter` (see note below)
   - Deadtime: `No`

Note: The `minimum available ramp filter` is constrained to the Nyquist limit for each crystal geometry. Iterative reconstruction with a smaller filter width can be applied to the raw data. The reconstructed images will show smaller FWHM, but the result is not useful for comparison between systems.

9.) Click SUBMIT TO BOTTOM.
10.) When reconstruction completes, click UTILITIES to display the submenu.
11.) Click or drag to INVESTIGATOR to open the PET Diagnostic Analysis panel.
12.) Select the 3D image set for processing:
   a.) Click `Diagnostic Acquisition` to highlight it in the patient list and click EXAMS.
   b.) Click `NU2-2001 3D Resolution` to highlight it in the exam list and click IMAGESETS.
   c.) Click the first image in the list to highlight it and click SHOW IMAGE.
13.) Perform the following steps on the Show Image screen:
   a.) Click `NU2-2001` to display the submenu.
   b.) Click or drag to SPATIAL RESOLUTION to open the Analysis Parameters Shell.
14.) Click ACTION to display the submenu.
15.) Click or drag to EXECUTE ANALYSIS. Do NOT modify the parameters.

Note: The screen should update and show a results screen similar to the one in Figure 1-4.

16.) Perform the following steps to save or print the results:

   a.) Click FILE in the toolbar of the Sensitivity Report screen.

   b.) Click or drag to PRINT HARD COPY to send a copy of the screen to the designated local printer.

   c.) Click or drag to SAVE POSTSCRIPT FILE to place a copy of the screen in directory `user/g/ctuser`. The file name is **`service.ps`**.

17.) Click FILE in the Analysis Shell toolbar to display the submenu.

18.) Click or drag to DONE to close the Analysis Shell panel.

19.) Click FILE in the Show Image toolbar to display the submenu.

20.) Click or drag to DONE to close the Show Image panel.

Section 1-3: Sensitivity Test

The sensitivity test measures the number of counts (coincidence detection events) per second that the DST scanner makes for every unit of activity in the field of view. The test is run with activity levels so low that the count losses are negligible. Sensitivity measurements are then made with differing amounts of attenuating material, with the results extrapolated to give the scanner sensitivity with no attenuating material.

The randoms are subtracted from prompts to obtain "trues only" sensitivity results. This is required to obtain valid results on lutetium bearing detectors, and it improves the consistency of results for all detectors.

NOTICE **The amount of activity should be less than 10MBq, to produce no more than 5% Randoms, but sufficient to produce measurable results. You may prepare the line source with higher activity, then wait until the activity decays to acceptable levels.**

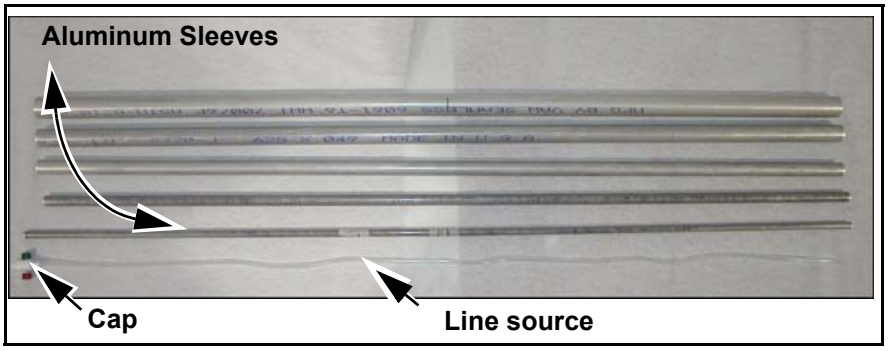
1-3.1 Prepare the Source

1.) Draw 10 MBq (0.3 mCi) of F-18 into a syringe.
2.) Empty the syringe into a clean container and fill the container with water to 6 cc.
3.) Use a new 10 cc syringe to draw the diluted activity from the container.
4.) Measure the syringe activity in a dose calibrator.

NOTICE **The reported sensitivity is directly proportional to the dose calibrator readout. Be sure that the instrument calibration has been recently verified and the isotope is set to F-18.**

5.) Record the syringe activity measurement and time of measurement in a lab book.
6.) Inject the syringe into a line until the central 70 cm of the line contains activity, being sure to observe the following guidelines:
   - Fill ONLY the central 70 cm of the line source with F-18 from the 10 cc syringe.
   - Cap or seal the ends of the line. (One end of the line source must be able to fit through the smallest diameter aluminum sleeve. You may use Critoseal to seal one end of the line if the smallest cap is too big to fit into the sleeve.)

Figure 1-5: Line Source and Aluminum Sleeves

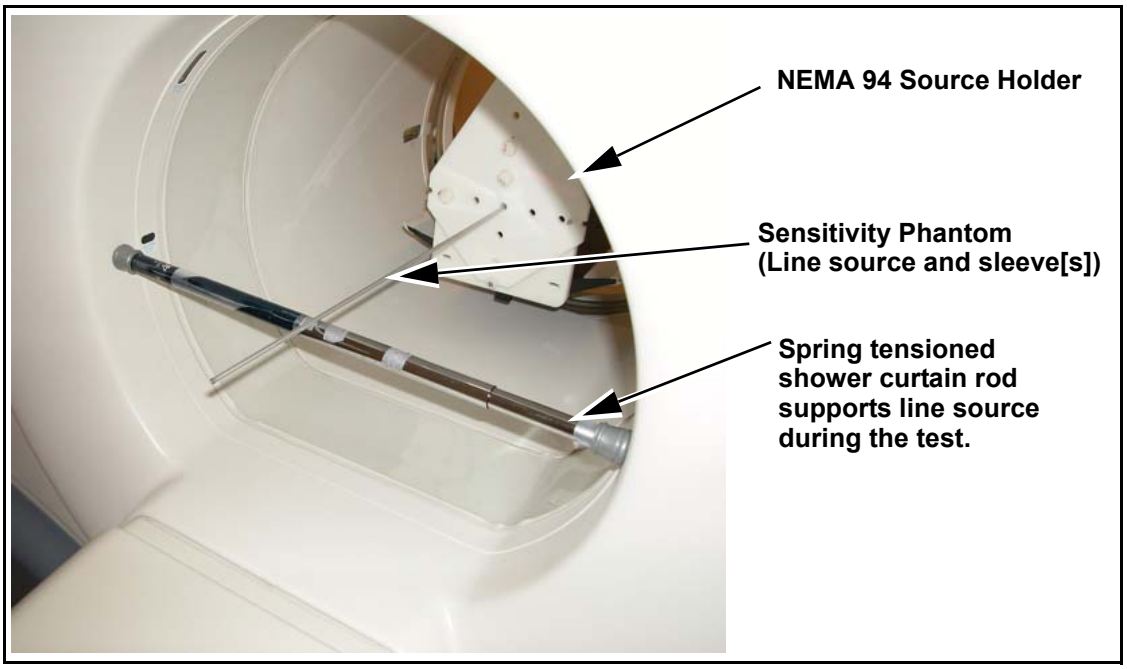


7.) Return the syringe to the dose calibrator and record both pre-and post-injection times and activity in the lab book. You will need all four values later.
8.) Thread the line source through the smallest diameter aluminum sleeve.
9.) Proceed to Section 1-3.2.

1-3.2 Position the Source Line and Acquire the 2D and 3D Data

1.) Employ a support system to hold up the sensitivity phantom on the gantry side to prevent drip. Examples of systems you can use to support the aluminum sleeves and line source during the sensitivity test include constructing a sling from tape or installing a spring tensioned shower curtain rod just inside the gantry rear cover bore opening, as pictured below. Refer to Figure 1-6 and Figure 1-7 for more information.

Figure 1-6: Employ Line Source Support System (Example: Spring Tensioned Rod)

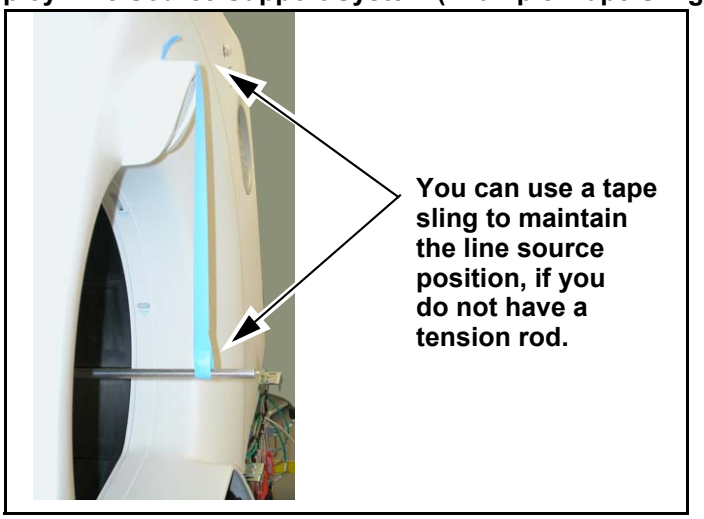


2.) Measure and mark the center of the smallest diameter aluminum sleeve with a permanent marker. The sleeve should be about 700 mm long. Refer to Figure 1-8.

3.) Attach the phantom positioning device to the end of the table and fasten the NEMA 94 source holder to the phantom positioning device. Refer to Figure 1-8.

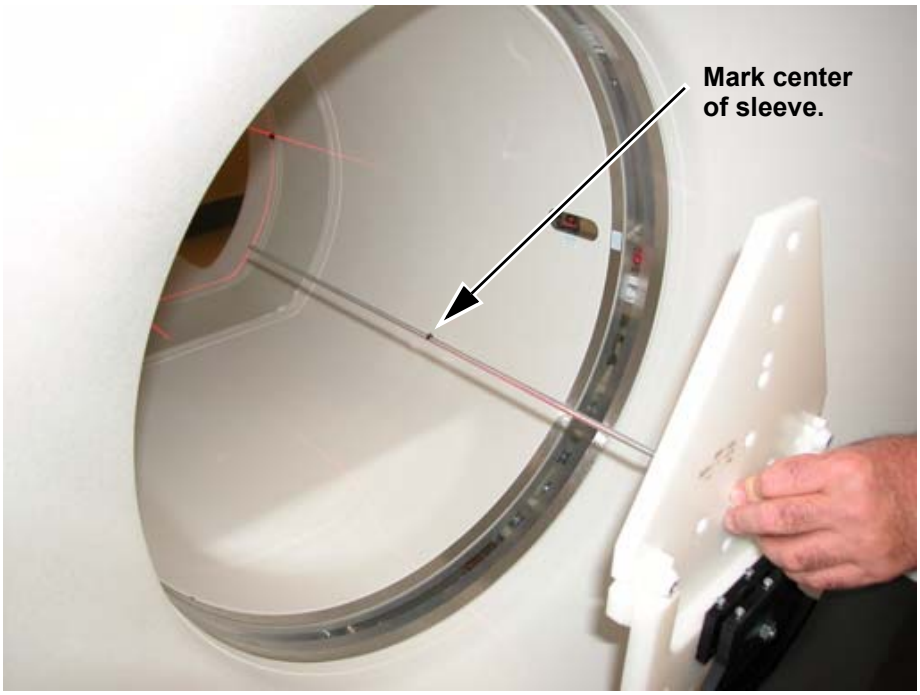
4.) Insert the aluminum sleeve through the NEMA 94 Source Holder and secure it into place as shown in Figure 1-6 or Figure 1-7. If you do not have a spring tensioned rod, use tape or some other support system to steady the source.

Figure 1-7: Employ Line Source Support System (Example: Tape Sling)



5.) Move the Table base to the CT position.
6.) Press the CT **ALIGNMENT LIGHT** button to turn on the lasers, and use the Sagittal and Coronal lasers to align the sleeve to isocenter and perpendicular to the scan plane.
7.) Align the axial laser line to the mark on the center of the aluminum sleeve. The line source should appear in the center of all the resulting PET images.
8.) Press the **INTERNAL LANDMARK** button to zero the gantry display.
9.) Move the cradle 75 mm into the bore of the scanner.
10.) Press the **INTERNAL LANDMARK** button a second time to reset the landmark.
11.) Move the Table base to the PET position.

Figure 1-8: Position the Line Source in the FOV



Source holder and aluminum sleeve secured.
Mark on sleeve aligned to isocenter, perpendicular to scan plane.

12.) Click the SERVICE button to open the Common Service Desktop. If necessary, click the PET option button to display the PET Common Service Desktop.
13.) Click the DIAGNOSTICS button to open the corresponding folder.
14.) Click DIAGNOSTIC ACQUISITION to open the Diagnostic Acquisition panel.
15.) Scroll through the DIAGNOSTIC SCAN SELECTION protocol list, and click the `NU2-2001_2D_Sens_R0` scan protocol to highlight it.
16.) Click ACCEPT SETUP to prescribe a sequence of five 2D scans.
17.) When the **START** button flashes, press it to initiate first scan.

NOTICE **You must add the remaining sleeves and scan them, one at a time, until all five sleeves surround the line source, for data processing to execute correctly.**

18.) Upon completion of the first scan, slide the next larger sized sleeve OVER the existing aluminum sleeve and line source. Refer to Figure 1-9 for additional guidance.

Figure 1-9: Add the Next Larger Diameter Aluminum Sleeve between Scans

19.) Verify the assembly is STILL centered in the FOV and perpendicular to the scan plan, then press the **START** button.

Note: When using a tension rod to support the source, adding new sleeves will shift the source upward by the thickness of each new sleeve; however, this distance will not effect the test results.

20.) Upon completion of each subsequent scan, slide the next larger aluminum sleeve over the existing sleeves, verify the assembly is still aligned to isocenter and perpendicular to the scan plan, then press the flashing **START** button.

Note: Make sure you do not dislodge the line source while sliding the next sleeve into place.

21.) Remove the four outermost sleeves from the sensitivity phantom.

22.) Move the line source and smallest sleeve to the x=10 cm, y=0 cm position on the source holder.

23.) Return to the Diagnostic Acquisition utility, and select `NU2-2001_2D_Sens_R10` from the protocol list.

24.) Repeat Step 16 through Step 21 to acquire another 2D data set.

25.) Remove the four outermost sleeves from the sensitivity phantom.

NOTICE **Wait until the activity decays to 3D levels (less than 5MBq) before you proceed to the next step.**

26.) Move the smallest aluminum sleeve and line source back to the X=0, y=0 position in the source holder.

27.) If you move the table out of the bore to reposition the line source, do the following:

a.) Move the table base to the CT position.

b.) Center the line source to the scan FOV, perpendicular to the scan plane.

c.) Press the **LANDMARK** button to reset the landmark to zero

d.) Move the cradle 75mm into the bore of the scanner.

e.) Press the **LANDMARK** button to reset the landmark to zero.

f.) Move the table base to the PET position.

28.) Display the Diagnostic Acquisition screen:

a.) Click the SERVICE button to open the Common Service Desktop.

b.) If necessary, click the PET option button to access the PET Common Service Desktop.

c.) Click the CDS DIAGNOSTICS icon to open the corresponding folder.

d.) Click DIAGNOSTIC ACQUISITION to open the Diagnostic Acquisition panel.

29.) Scroll through the DIAGNOSTIC SCAN SELECTION protocol list, and click the `NU2-2001_3D_Sens_R0` scan protocol to highlight it.

30.) Click ACCEPT SETUP to prescribe a sequence of five 3D scans.

31.) Press the **START** button when it flashes to initiate first scan.

32.) Upon completion of the first 3D scan, slide the next larger sized sleeve OVER the existing aluminum sleeve and line source, WITHOUT dislodging the line source.

Note: The collimator returns to the field of view at the end of each acquisition, and then moves back out of the field of view at the beginning of the next acquisition. The **START** button will NOT light up until the collimator leaves the field of view.

33.) Verify that the assembly is still centered in the FOV and perpendicular to the scan plan, then press the **START** button.

34.) Upon completion of each subsequent scan, perform the following steps:

a.) Slide the next larger aluminum sleeve over the existing sleeves, referring to Figure 1-9 for additional guidance, if necessary.

Note: Each additional aluminum sleeve increases the attenuation.

b.) Verify that the assembly is still aligned to isocenter and perpendicular to the scan plane.

c.) Press the flashing **START** button.

d.) Repeat until you complete the five scans of this 3D series.

35.) Remove the four outermost sleeves from the sensitivity phantom.

36.) Move the line source and smallest sleeve to the x=10 cm, y=0 cm position in the source holder.

37.) Return to the Diagnostic Acquisition utility, and select `NU2-2001_3D_Sens_R10` from the protocol list.

38.) Repeat Step 30 through Step 34 to acquire another 3D data set.

39.) Click OPTIONS to display the submenu.

40.) Click or drag to QUIT SCREEN to exit the PET acquisition screen.

41.) Remove the sensitivity phantom from the FOV.

1-3.3 Analyze the 2D and 3D Data

1.) Perform the following steps to edit the tracer information for the first scan of each series acquired in Section 1-3.2:

   a.) Click the SERVICE icon to open the Common Service Desktop.
   b.) If necessary, click the PET radio button to display the PET Common Service Desktop.
   c.) Click UTILITIES to open the folder.
   d.) If necessary, click MORE to display the submenu.
   e.) Click EDIT TRACER INFO.
   f.) Select the first scan in a series and enter both the pre- and post-injection activity times.
   g.) Update the date and time of pre-injection with the date and time you filled the line source.
   h.) Repeat this process for the first scan of each series acquired in Section 1-3.2.

2.) Follow the steps below to select the sensitivity data for processing:

   a.) If necessary, click the PET icon to display the desktop.
   b.) Click UTILITIES to display the submenu.
   c.) Click or drag to INVESTIGATOR to open the PET Diagnostic Analysis panel.
   d.) Highlight `Diagnostic Acquisition` in the patient list and click the EXAMS button.
   e.) Highlight `NU2-2001 2D Sens R0` in the exam list and click the SCANS button.
   f.) Click/Highlight the first 2D scan in time.
   g.) Click on the FRAMES button.
   h.) Click the first frame in the list to highlight it.
   i.) Click SHOW SINO to open the ShowSino screen.

NOTICE **The Analysis function will not display a Sensitivity Report screen until the designated image has valid tracer information.**

3.) Click `NU2-2001` to display the submenu.
4.) Click or drag to SENSITIVITY to open the Analysis Parameter Shell window.
5.) Click ACTION to display the submenu.
6.) Click or drag to EXECUTE ANALYSIS. Processing will take a few minutes. The screen will update to display a Sensitivity Report screen similar to the one in Figure 1-10.

7.) Perform the following steps to save or print the results:

   a.) Click FILE in the toolbar of the Sensitivity Report screen.

   b.) Click or drag to PRINT HARD COPY to send a copy of the screen to the designated local printer.

   c.) Click or drag to SAVE POSTSCRIPT FILE to place a copy of the screen in directory `user/g/ctuser`. The file name is **`service.ps`**.

8.) Click FILE in the Analysis Shell toolbar to display the submenu.

9.) Click or drag to DONE to close the Analysis Shell panel.

10.) Click FILE in the Show Sino toolbar to display the submenu.

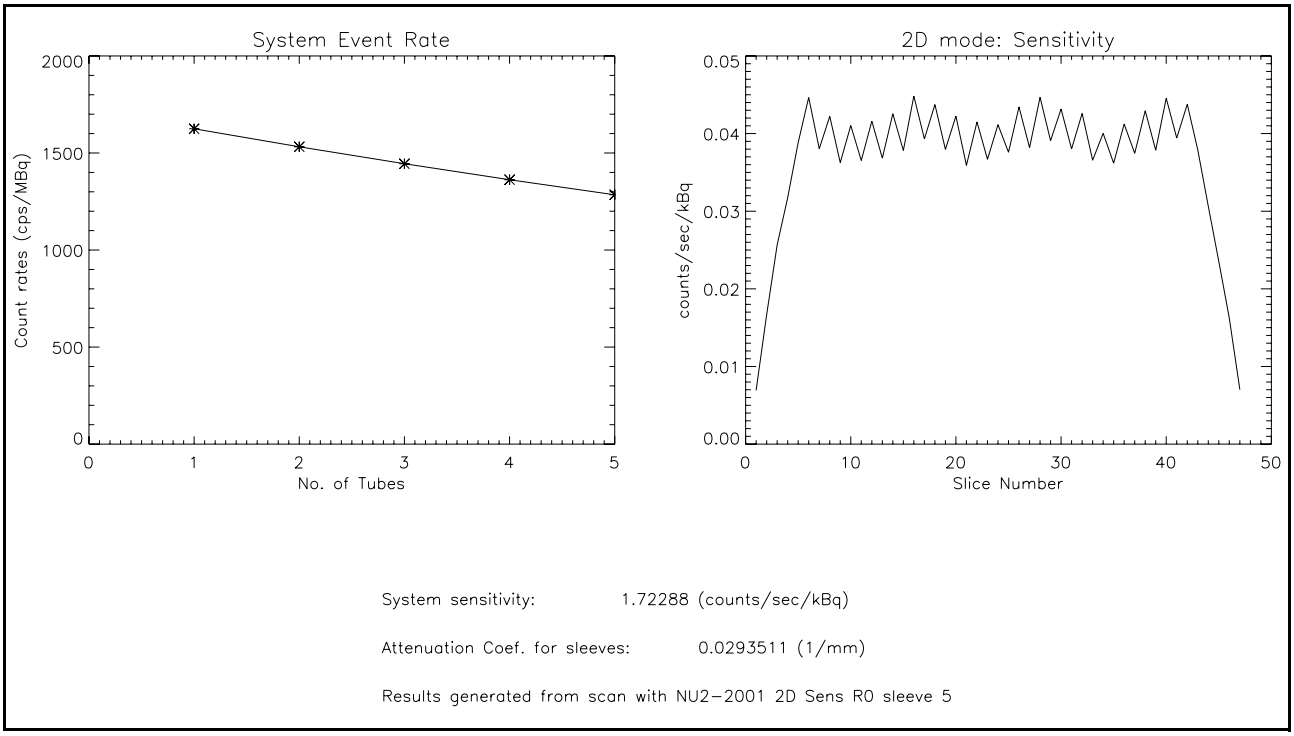
11.) Click or drag to DONE to close the Show Sino panel.

12.) Return to the Exams level of the Investigator navigation screen.

13.) Repeat Step 2 through Step 11 to process the remaining sensitivity data for:

- *Nu2001 2D Sens R10*
- *Nu2001 3D Sens R0*
- *Nu2001 3D Sens R10*

Figure 1-10: Example of a Sensitivity Report Screen



Section 1-4: Image Quality, Attenuation Accuracy & Scatter Correction Test

The image quality test simulates a PET-CT whole body clinical use case. Refer to Figure 1-11. The test phantom presents different sized hot and cold spheres in a volume of non-uniform attenuation. Additional activity is placed outside the scan FOV, to represent scatter radiation. Image quality is reported in terms of image contrast and signal--noise ratios for the hot and cold spheres.

1-4.1 Prepare the Source

Figure 1-11: Example of an Image Quality Phantom

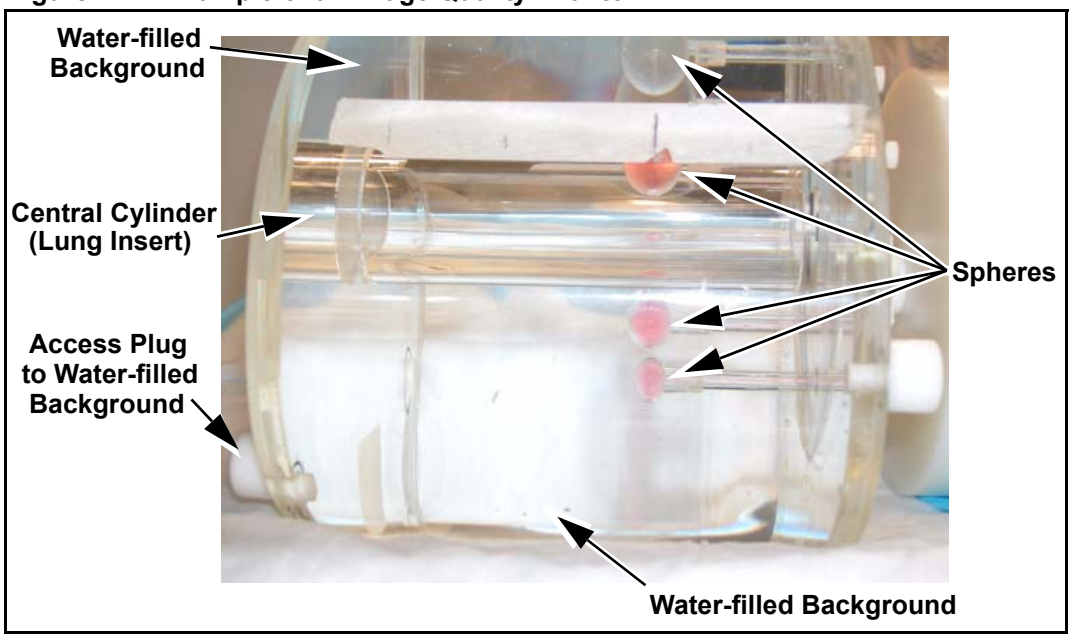


Figure 1-12: Example of a NEMA Scatter Phantom

Most phantoms break down into three or four sections (phantom design varies with manufacturer).

1-4-1.1 Calculate the Activity

This test uses an Image Quality phantom and a line source. Follow the procedures in this section to calculate the activity levels you need to fill the phantom and the line source. The NEMA NU2 standard recommends multiple measurements to minimize variation in observations. A practical way to obtain multiple samples is to fill the phantoms with 150% of the activities in Table 1-4, and collect independent scans before and after the target activity time.

NOTICE **The filling method described will deliver a 4:1 concentration ratio between the hot spheres and the background volume. This method does not require the calculation of specific volumes to determine activity concentrations.**

You may use alternate methods to calculate concentrations for known phantom volumes. The alternate method allows you to prepare a separate volume of solution concentrate for the hot spheres.

Note: Typical background volume equals the volume of the phantom MINUS the volumes of the lung insert and sphere assembly. A typical background volume measures 9830 cc. Sphere volume is approximately 20 cc. Refer to Figure 1-11 and Table 1-4.

1.) Determine the amount of time you will require to fill and position the phantom. 45 minutes represents a typical time-frame. Calculate higher activities at the time of fill so they can decay to the correct activities by the time of the scan.

2.) Use the estimated fill time to determine the amount of activity you must inject in order to attain the 21 kBq/cc (0.6 uCi/cc) and 5.3 kBq/cc (0.15 uCi/cc) activity levels at scan time.

3.) Measure out about 80 cm of plastic tubing to use as the scatter fraction line source.

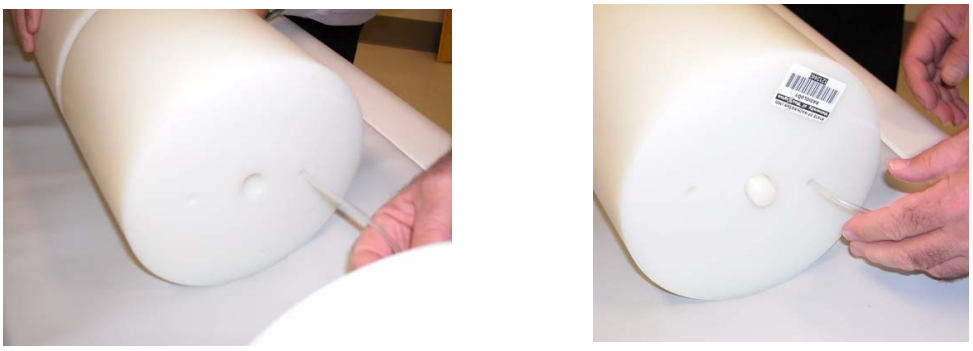
4.) Determine the volume of the central 70 cm of tubing. A typical value is 5 cc.

5.) Prepare a volume of solution to fill the central 70 cm of the scatter fraction source, aiming for an activity of 120 MBq (3 mCi) at scan time.

Table 1-4: Source Activities at the time of Scan

Phantom Volume	Typical Volume	Activity	Activity Concentration
Background	9830 cc	52MBq (1.5 mCi)	5.3 kBq/cc (0.15 uCi/cc)
Hot spheres	~20 cc	N.A.	21kBq/cc (0.6 uCi/cc)
Line	5 cc	120 MBq (3 mCi)	N.A.

Figure 1-13: Thread the Line Source Tubing through the NEMA Phantom



Line source tubing threaded through each segment when assembling NEMA Scatter Phantom. Activity then injected into central 70 cm.

1-4-1.2 Fill the Line Source

Note: Use the values from Table 1-4 during this procedure.

1.) Draw an amount of F-18 activity equal to the calculated injection activity into a syringe.

2.) Complete the following steps, referring to Table 1-4 and Figure 1-14 for additional guidance:

   a.) Flush the contents of the syringe into a container.

   b.) (optional) Add dye, such as food coloring.

   c.) Add water to the container until the total volume equals the solution volume in Table 1-4.

Figure 1-14: Prepare the Line Source Activity

3.) Use a new syringe to draw the activity from the container.

4.) Fill the central 70 cm of the scatter fraction line source from the syringe.You may thread the tubing through the NEMA scatter fraction phantom BEFORE you fill the central 70 cm with activity. Refer to Figure 1-13 for more information.

5.) Plug both ends of the tube.

1-4-1.3 Fill the Image Quality Phantom Volumes

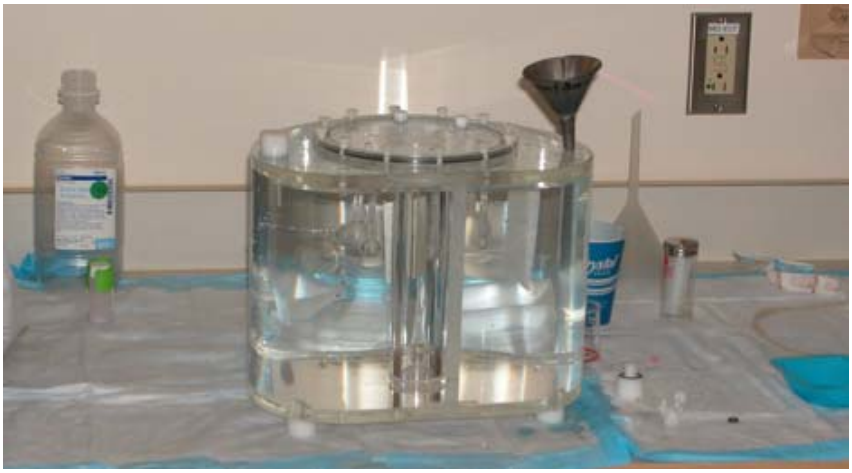
1.) Fill the Image Quality phantom lung insert with lung simulating material with an average density of 0.3 g/cc. Refer to Figure 1-11 for more information (Note that our pictures show an empty insert).

2.) Draw some de-ionized (DI) water into a new syringe. Fill the two largest spheres in the image quality phantom with water. If necessary, you may dye the water, for visual contrast. Refer to Figure 1-15 for further guidance.

Figure 1-15: Fill the Largest Spheres with Plain Water

3.) Fill the background volume of the Image Quality phantom to one quarter (25%) with de-ionized water. Refer to Figure 1-16 for additional guidance.

Figure 1-16: Partially Fill the Phantom Background Volume



4.) Follow the steps below to add the activity to the background volume:

   a.) Draw the calculated amount of F-18 Background activity into a syringe.
   b.) Measure the syringe activity with the dose calibrator.
   c.) Record the activity and time of measurement in the lab book.
   d.) Flush the contents of the syringe into the large volume (background) portion of the image quality phantom.

5.) Thoroughly mix the Image Quality phantom contents.

6.) Use a long needle (or narrow syringe) to reach the background volume and fill the new syringe with the concentrated activity from the background volume.

7.) Fill each of the four smallest spheres with the concentrated solution from the syringe. Be sure that you pull the needle slowly out of the sphere as you fill it, to prevent the formation of air bubbles in the spheres. Refer to Figure 1-17 for additional guidance.

NOTICE **Good results depend upon the presence of valid activity concentrations in the hot spheres. When you fill the spheres, flush the solution in and out of the syringe a few times to assure that each fill consists of a full concentration.**

8.) Empty any remaining solution in the syringe back into the background volume.

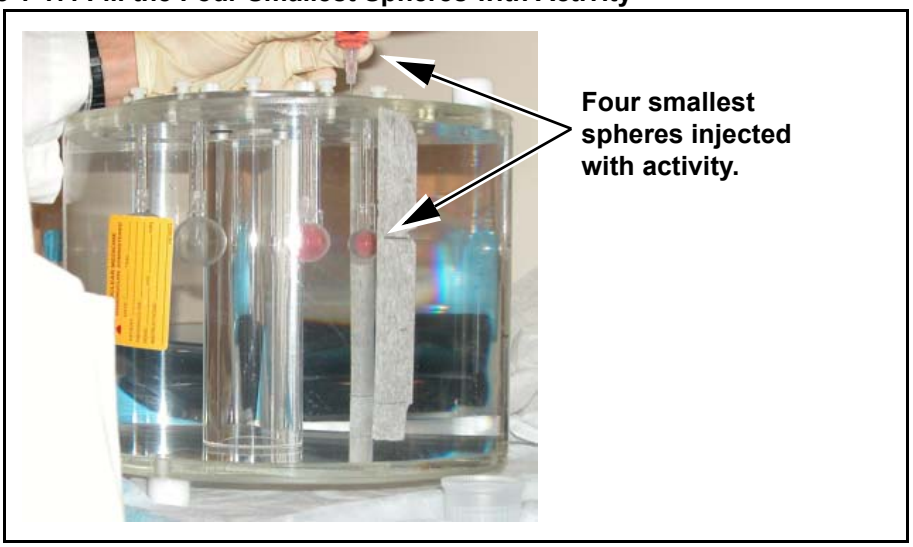
9.) Fill the background volume with DI water until almost completely full.

10.) Mix well.

11.) Top off the Image Quality phantom with DI water and attempt to eliminate all air bubbles.

12.) Fasten all the fill plugs into place.

Figure 1-17: Fill the Four Smallest Spheres with Activity

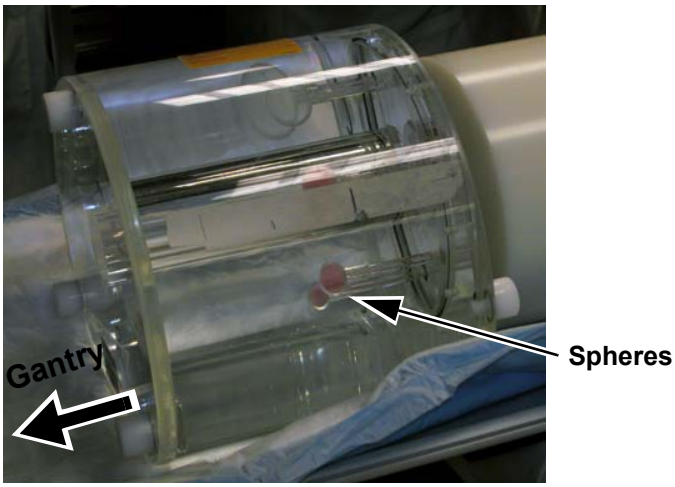


1-4.2 Position the Source and Acquire the Data

Follow the procedure in this section to position the phantoms and acquire the data. Select a Whole Body protocol that prescribes a CTAC scan, followed by an 8 minute and 20 second 2D PET scan, and a 7 minute and 19 second 3D PET scan.

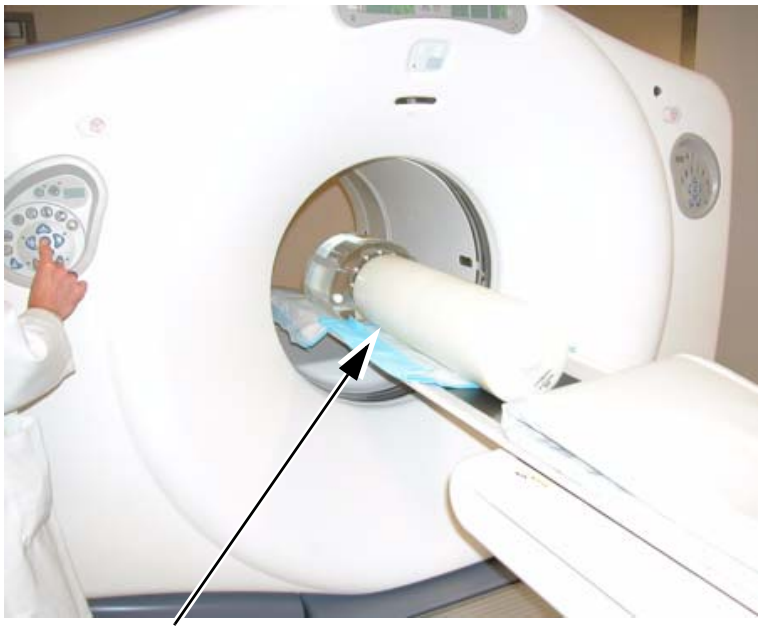
1.) Position the Image Quality phantom on the cradle and orient it so that the spheres enter the gantry bore last. Refer to Figure 1-18 for more information.

Figure 1-18: Image Quality Phantom Orientation



2.) Place the scatter fraction phantom (with line source) just behind the Image Quality phantom, as shown in Figure 1-19.

Figure 1-19: Center the Image Quality Phantom in the Scan FOV



NEMA Scatter Fraction phantom placed behind IQ phantom.

3.) Move the table base to the CT position.

4.) Center the phantoms in the sagittal and coronal planes, performing the following steps:

   a.) Align the axial landmark line on the center of the spheres.

   b.) Press the **INTERNAL LANDMARK** button to zero the gantry display.

5.) Click the EXAM RX button to open the PET-CT acquisition screen.

6.) Click NEW PATIENT and enter the following information into the fields listed below:

   - Patient ID: **`NEMA IQ`**
   - Patient Name: **`NEMA IQ`**
   - Enter the Tracer activity and measurement time for the syringe you injected into the background volume.

7.) Select a Whole Body study (`PTCT_ET_2D` protocol)

8.) Acquire the scout image.

9.) Use the Graphic Rx function to center the scan range over the hot and cold spheres.

10.) Change the `No. of Images` parameter in the CT series to **`47`** (equal to one PET bed).

11.) Acquire the CTAC series.

12.) Prescribe and acquire a 2D PET scan of 8 minutes and 20 seconds by performing the following steps:

   - Type this information in the SCAN DESCRIPTION field: **`2D 8:20 IQ NEMA`**
   - Open the Prospective Recon screen, and click the CLEAR button.
   - Click ACCEPT SETUP to initiate the scan sequence.

13.) Change the acquisition mode from 2D to 3D in the PET Acquisition GUI.

14.) Prescribe and acquire a 3D PET scan of 7 minutes and 19 seconds, by performing the following steps:

   - Type this information in the SCAN DESCRIPTION field: **`3D 7:19 IQ NEMA`**
   - Click ACCEPT SETUP to initiate the scan sequence.

15.) Upon the completion of the 3D acquisition, click OPTIONS to display the submenu.

16.) Click or drag to QUIT SCREEN to exit the acquisition function.

17.) Click the EXAM RX button to return to the PET-CT screen.

18.) Click END EXAM.

19.) Click COMPLETE.

1-4.3 Analyze the Data

1-4-3.1 Reconstruct the Image Data

1.) Click the PET button to display the desktop.
2.) Click SCREENS to display the submenu.
3.) Click or drag to RECON to open the Extended Recon panel.
4.) Click NEXT RECON to open the Scan Data Selection panel.
5.) Click the `Diagnostic Acquisition` patient to display its series list.
6.) Click the 2D `NU2-2001 IQ Transmission` data set for reconstruction.
7.) Click OK to accept the current selection and close the Scan Data Selection panel.
8.) Perform the following steps, referring to Table 1-5 for additional guidance, if necessary:
    a.) Set the 2D Reconstruction options to the values listed in the table below.
    b.) Leave all unspecified parameters at the default values.

Table 1-5: Reconstruction Parameters

RECON Parameter	2D	3D
Image Size	256 x 256	256 x 256
Recon Method	OS-EM	Iterative
Attenuation Type	CTAC	CTAC
Recon FOV	40 cm	40 cm
Iterations	4	4
z-filter	none	none
subsets	default	default

9.) Click SUBMIT TO BOTTOM.
10.) Repeat Step 4 through Step 7 to reconstruct the 3D data set.
11.) Perform the following steps, referring to Table 1-5 for further guidance, if necessary:
    a.) Set the 3D Reconstruction options to the values listed in the table.
    b.) Leave all unspecified parameters at the default values.
12.) Click SUBMIT TO BOTTOM.
13.) Click OPTIONS to display the submenu.
14.) Click or drag to QUIT SCREEN to exit the reconstruction function.

1-4.4 Determine the Actual Sphere/Background Contrast

The instructions for filling the phantoms will result in the 4:1 concentration ratio between the background volume and hot spheres.

Note: If you used alternative methods to fill the volumes, calculate the exact ratio of concentrations.

1-4.5 Analyze the Image Quality Data

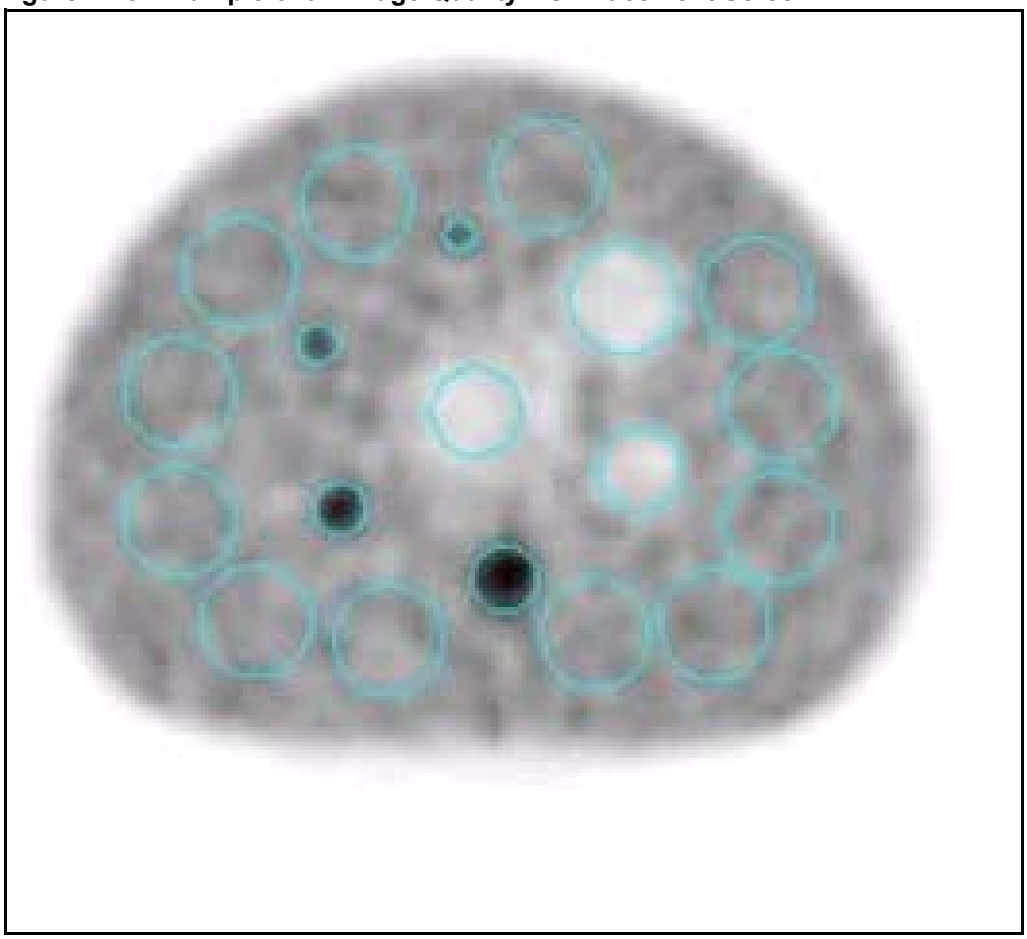
1.) Select an image set to process:
   a.) If necessary, click the PET button to display the desktop.
   b.) Click UTILITIES to display the submenu.
   c.) Click or drag to INVESTIGATOR to open the PET Diagnostic Analysis panel.
   d.) Click `NEMA IQ` in the patient list to highlight it, then click EXAM.
   e.) Click the most recently acquired scan to highlight it, and click IMAGESETS.
   f.) Click on one of the two imagesets generated during reconstruction to highlight it.
   g.) Click the IMAGES button.
   h.) Click the first image in the list to select it.
   i.) Click SHOW IMAGE to open the Show Image panel.
2.) Click `NU2-2001` to display the submenu.
3.) Click or drag to IMAGE QUALITY to open the Analysis Parameter Shell window.
4.) Click ACTION to display the submenu.
5.) Click or drag to EDIT VALUE.
6.) Highlight the `Contrast Ratio` field and enter the hot sphere to background contrast from Section 1-4.4.
7.) Click ACTION to display the submenu.
8.) Click or drag to EXECUTE ANALYSIS.
9.) Navigate through the image volume to find the slice in which the smallest sphere is most visible. Navigate using the following mouse commands:
   - Click the left mouse button to page backward.
   - Click the right mouse button to page forward.
   - Click the center mouse button to select the currently displayed image.

10.) Follow the on-screen instructions to deposit ROIs on the selected phantom image. The software prompts for 6 sphere ROIs, 1 lung ROI, and 12 background ROIs. Use the following mouse commands and refer to Figure 1-20 for additional guidance:

- Click the left mouse button to deposit the ROI over the current cursor location.
- Click the right mouse button to delete the previously deposited ROI.

After you deposit the final ROI, the analysis shell software will prompt you to simultaneously press the middle and left mouse buttons to analyze the ROIs.

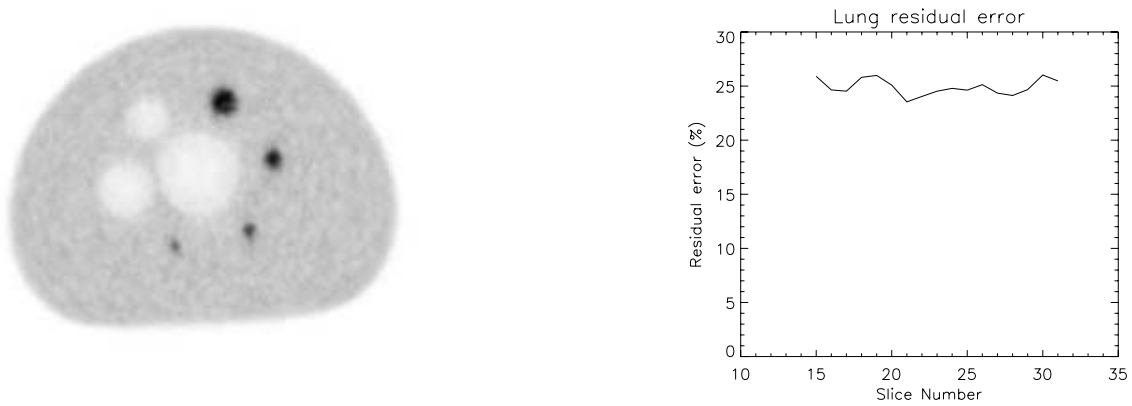
Figure 1-20: Example of an Image Quality ROI Placement Screen



11.) Analyze the ROIs by following the analysis shell software prompt and simultaneously pressing the middle and left mouse buttons.

Note: Upon completion of the analysis, a screen similar to that in Figure 1-21 will appear.

Figure 1-21: Example of an Image Quality Report



Sphere diameter (cm):	1.0	1.3	1.7	2.2	2.8	3.7
Hot Sphere Contrast (%):	29.6	37.9	54.9	70.7		
Cold Sphere Contrast (%):					56.4	62.8
Background Variability (%):	4.7	3.8	2.9	2.4	2.1	1.6
Average residual lung error (%):	24.9					

Results generated from imageset with 3D 8 min

NOTICE **Substantial variation may occur in this contrast measurement due to sphere filling, slice alignment, ROI placement, and image statistics. The NEMA NU2-2001 standard recommends multiple measurements to minimize variation in observations.**

12.) Perform the following steps to save or print the results:

a.) Click FILE in the toolbar of the Sensitivity Report screen.

b.) Click or drag to PRINT HARD COPY to send a copy of the screen to the designated local printer.

c.) Click or drag to SAVE POSTSCRIPT FILE to place a copy of the screen in the `user/g/ctuser` directory, with the file name `service.ps`.

13.) Click FILE in the Analysis Shell toolbar to display the submenu.

14.) Click or drag to DONE to close the Analysis Shell panel.

15.) Click FILE in the Show Sino toolbar to display the submenu.

16.) Click or drag to DONE to close the Show Sino panel.

17.) Return to the Exams level of the Investigator navigation screen.

18.) Return to Step 1 and repeat the procedure to analyze the 3D imageset.

Section 1-5: Scatter Fraction, Count Losses, and Randoms Test

The count losses and randoms portion of this test measures the count rate performance of the **DST PET-CT** across a range of radioactivity levels. The scatter fraction portion of this test measures the sensitivity of the **DST** scanner to coincidence events caused by scatter. The scatter fraction measurement takes place when activity levels are so low that system dead-time and randoms are negligible.

1-5.1 Acquisition Procedure

Note: The measurement of 2D peak NECR requires a high amount of activity in a relatively small volume. In the absence of a large amount of activity, acquire a 3D study to assess the count rate performance of the scanner.

1-5-1.1 Position the Phantom

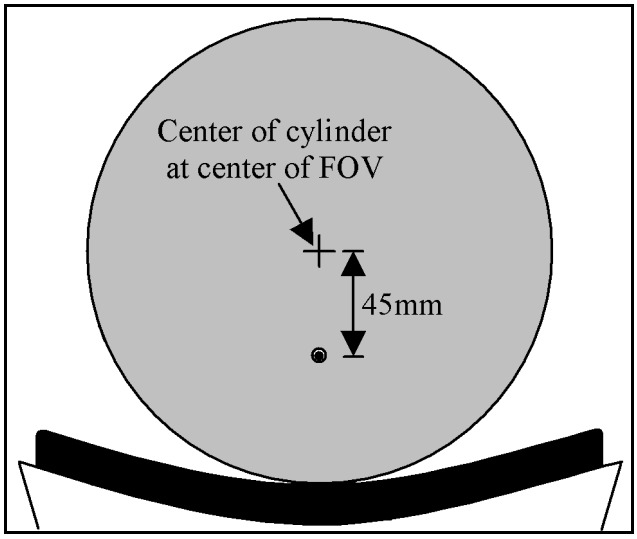
1.) Assemble the solid phantom segments as shown in Figure 1-22.

Figure 1-22: Example of a NEMA Scatter Phantom

Most phantoms break down into 3 or 4 sections (phantom design varies with manufacturer).

2.) Place the phantom on the patient table with the foam pad in place and the hole for the line source nearest the surface of the cradle, as shown in the illustration. Refer to Figure 1-23 for guidance.

Figure 1-23: Line Source Orientation



1-5-1.2 Prepare the Source

1.) Use a piece of tubing at least 70 cm long for the line source.
2.) Measure and record the volume of the line source tubing.
3.) Perform ONE of the following:
   - If you plan to use a 3D acquisition, draw 900 MBq (24 mCi) of F-18 into a syringe.
   - If you plan to use a 2D protocol, draw 2600 MBq (70 mCi) of F-18 into a syringe.
4.) Flush the contents of the syringe into an empty container.
5.) Fill the container to the volume recorded in Step 2, PLUS *0.5cc*, to ensure that the center 70 cm of the line is completely filled.
6.) Use a new syringe to draw activity from the container.
7.) Measure the syringe activity in a dose calibrator and record the activity and time of measurement in the lab book.
8.) Practice inserting the line source into the phantom, making sure that it slides easily into place to minimize operator exposure. Refer to Figure 1-24 for more information.
9.) Carefully fill the central 70 cm of the line with activity either before or after you insert it into the phantom. Use the guideline in the note below to determine when to fill the line.

Note: You may fill the line first, only IF it slides easily into place. Otherwise, insert the empty line into the phantom and then fill it with activity.

Figure 1-24: Thread the Line Source Tubing through the NEMA Phantom

Line source tubing threaded through each segment when assembling NEMA Scatter Phantom. Activity then injected into central 70 cm.

10.) Return the syringe to the dose calibrator and record the remaining activity and time of measurement in the lab book.

NOTICE **The precision of activity and time determination will directly influence the reported activity concentrations. The finite sampling periods also limit the reported concentration to the closest sample point.**

11.) Enter the following values into the tracer information data fields:
   - Pre - activity and time
   - Post - activity and time

1-5-1.3 Acquire the Data

1.) If necessary, move the table base to the CT position.
2.) Enable the alignment lights and center the phantom in the FOV.
3.) Press the **INTERNAL LANDMARK** button to zero the gantry display.
4.) Move the cradle 75 mm into the bore of the scanner.
5.) Press the **INTERNAL LANDMARK** button again to set the landmark and zero the gantry display.
6.) Click the service icon to open the Common Service Desktop.
7.) If necessary, click the radio button to display the PET Common Service Desktop.
8.) Click the DIAGNOSTICS button to open the corresponding folder.
9.) Click DIAGNOSTIC ACQUISITION to open the Diagnostic Acquisition panel.
10.) Scroll through the DIAGNOSTIC SCAN SELECTION protocol list and click on the **2D** `NU2-2001 2D SF and Cnt Rates` -or- **3D** `NU2-2001 3D SF and Cnt Rates` scan protocol to highlight your selection.
11.) Click ACCEPT SETUP to start the scan initialization sequence.
12.) Press the flashing **START** button to initiate the scan. The acquisition lasts about 18 hours. The long acquisition time obtains fine samples through the time of peak NECR and final samples after randoms become insignificant. After acquisition, the **START** button will flash.

Note: Leave the source in the phantom. Press the **START** button immediately when it flashes.

13.) Press the flashing **START** button to initiate Scan Number 2 of 2.

Note: BG0 systems do not require a second scan.

1-5.2 Analysis Procedure

1.) Follow the steps below to edit the tracer information for the scatter fraction/count rates acquisition:
   a.) Click the SERVICE button to open the Common Service Desktop.
   b.) If necessary, click the PET option button to display the PET Common Service Desktop.
   c.) Click UTILITIES to open the folder.
   d.) If necessary, click MORE to display the submenu.
   e.) Click EDIT TRACER INFO.
   f.) Select the data acquired in the scatter fraction and count rates test and update the injection field with the phantom activity recorded in Section 1-5-1.2, Step 11, and the time of measurement.
2.) Click UTILITIES to display the submenu.
3.) Click or drag to INVESTIGATOR to open the PET Diagnostic Analysis panel.
4.) Select the 2D or 3D image set for processing:
   a.) Click `Diagnostic Acquisition` in the patient list, then click EXAMS.
   b.) Click `NU2-2001_3D_SfandCntRates` -or- `NU2-2001_2D_SfandCntRates` in the exam list to highlight it and click SCANS.
   c.) Click/highlight a `NU2-2001_3D_SfandCntRates` -or- `NU2-2001_2D_SfandCntRates` scan and click FRAMES.
   d.) Click the first frame in time to highlight it, then click SHOW SINO.

5.) Perform the following steps on the Show Sino screen:

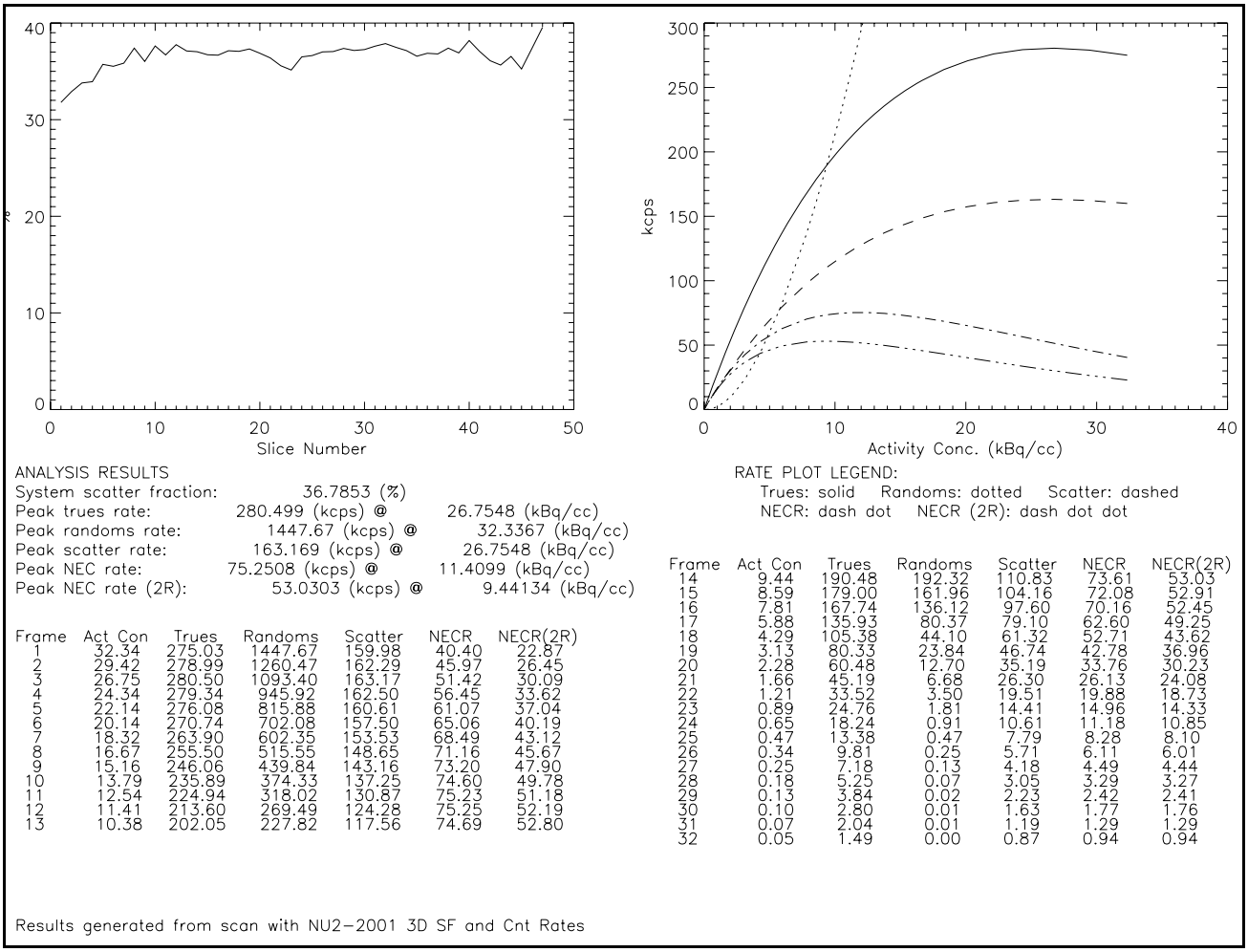
   a.) Click `NU2-2001` to display the submenu.

   b.) Click or drag to SCAT. FRAC. & COUNT RATES to open the Analysis Parameters Shell.

6.) Click ACTION to display the submenu.

7.) Click or drag to EXECUTE ANALYSIS. Do NOT modify the parameters. If you chose the 3D set, the display will update to show a results screen similar to the one shown in Figure 1-25.

Figure 1-25: Example of a 3D Scatter Fraction and Count Rate Results



Frame	Act Con	Trues	Randoms	Scatter	NECR	NECR(2R)
1	32.34	275.03	1447.67	159.98	40.40	22.87
2	29.42	278.99	1260.47	162.29	45.97	26.45
3	26.75	280.50	1093.40	163.17	51.42	30.09
4	24.34	279.34	945.92	162.50	56.45	33.62
5	22.14	276.08	815.88	160.61	61.07	37.04
6	20.14	270.74	702.08	157.50	65.06	40.19
7	18.32	263.90	602.35	153.53	68.49	43.12
8	16.67	255.50	515.55	148.65	71.16	45.67
9	15.16	246.06	439.84	143.16	73.20	47.90
10	13.79	235.89	374.33	137.25	74.60	49.78
11	12.54	224.94	318.02	130.87	75.23	51.18
12	11.41	213.60	269.49	124.28	75.25	52.19
13	10.38	202.05	227.82	117.56	74.69	52.80
14	9.44	190.48	192.32	110.83	73.61	53.03
15	8.59	179.00	161.96	104.16	72.08	52.91
16	7.81	167.74	136.12	97.60	70.16	52.45
17	5.88	135.93	80.37	79.10	62.60	49.25
18	4.29	105.38	44.10	61.32	52.71	43.62
19	3.13	80.33	23.84	46.74	42.78	36.96
20	2.28	60.48	12.70	35.19	33.76	30.23
21	1.66	45.19	6.68	26.30	26.13	24.08
22	1.21	33.52	3.50	19.51	19.88	18.73
23	0.89	24.76	1.81	14.41	14.96	14.33
24	0.65	18.24	0.91	10.61	11.18	10.85
25	0.47	13.38	0.47	7.79	8.28	8.10
26	0.34	9.81	0.25	5.71	6.11	6.01
27	0.25	7.18	0.13	4.18	4.49	4.44
28	0.18	5.25	0.07	3.05	3.29	3.27
29	0.13	3.84	0.02	2.23	2.42	2.41
30	0.10	2.80	0.01	1.63	1.77	1.76
31	0.07	2.04	0.01	1.19	1.29	1.29
32	0.05	1.49	0.00	0.87	0.94	0.94

8.) To save or print the results:

   a.) Click FILE in the toolbar of the Sensitivity Report screen.

   b.) Click or drag to PRINT HARD COPY to send a copy of the screen to the designated local printer.

   c.) Click or drag to SAVE POSTSCRIPT FILE to place a copy of the screen in the directory `user/g/ctuser` with the filename **`service.ps`**.

9.) Click FILE in the Analysis Shell toolbar to display the submenu.

10.) Click or drag to DONE to close the Analysis Shell panel.

11.) Click FILE in the Show Sino toolbar to display the submenu.

12.) Click or drag to DONE to close the Show Sino panel.

13.) Click FILE in the *P*ET Diagnostic Analysis toolbar to display the submenu.

14.) Click or drag to QUIT to close the PET Diagnostic Analysis screen (Investigator.)

Section 1-6: Accuracy: Correction for Count Losses and Randoms

Measuring the accuracy of count losses and randoms corrections consists of comparing the trues rate calculated using count losses and randoms corrections with the trues rate extrapolated from measurements with negligible count losses and randoms. This test uses the data acquired in Section 1-5.

1-6.1 Analysis Procedure

1.) Click the PET icon to display the desktop.
2.) Click SCREENS to display the submenu.
3.) Click or drag to RECON to open the Extended Recon panel.
4.) Click NEXT RECON to open the Scan Data Selection panel.
5.) Click the `Diagnostic Acquisition` patient to highlight it and display its series list.
6.) Click the **2D** or **3D** `NU2-2001 XD SF` and `Cnt Rates` data set to highlight it for reconstruction.
7.) Click OK to accept the current selection and close the Scan Data Selection panel
8.) If you acquired 2D data during Section 1-5, use the 2D values listed in the table. If you acquired 3D data during Section 1-5, use the 3D values. Leave all the remaining recon parameters at the default values. Refer to Table 1-6 for more information.

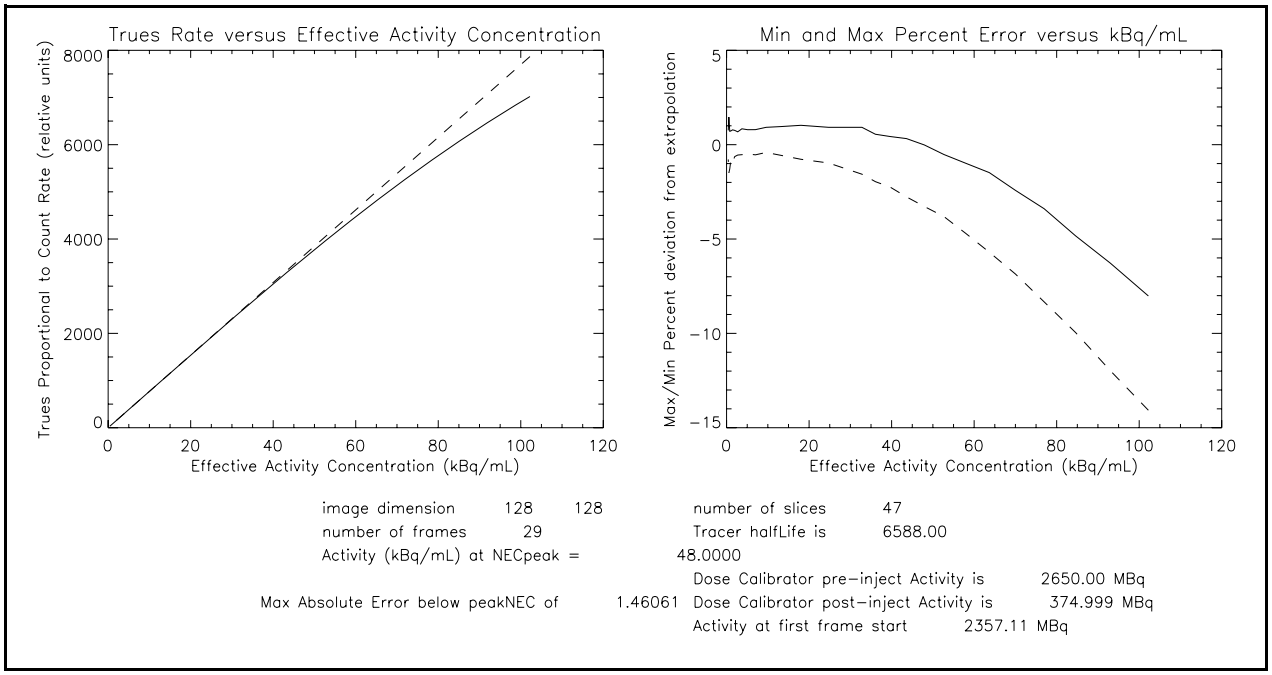
Table 1-6: 2D and 3D Reconstruction Parameters

Recon Parameter	2D	3D
Recon Method	Backproject	Reprojection
FOV Diameter	18.0 cm	18.0 cm
Decay	No	No
Attenuation	None	None
Well Counter	Sensitivity Only	Sensitivity Only

9.) Click SUBMIT TO BOTTOM.
10.) When reconstruction completes, follow the steps below to open the Investigator:
    a.) Click UTILITIES to display the submenu.
    b.) Click or drag to INVESTIGATOR to open the PET Diagnostic Analysis panel.
11.) Click on `Diagnostic Acquisition` to highlight it in the patient list, then click the EXAM button.
12.) Click on `NU2-2001 XD SF` and `Cnt Rates` to highlight them in the exam list and click the IMAGESETS button.
13.) Click on one of the two imagesets generated during reconstruction to highlight it.

14.) Click IMAGES.
15.) Click the first image in the list to highlight it.
16.) Click SHOW IMAGE to access the Show Image panel.
17.) Click NU2-2001 to display the submenu.
18.) Click COUNT RATE CORRECTION.
19.) Edit peak NECR activity, by performing the following steps:
    a.) Click ACTION to display the submenu.
    b.) Click EDIT VALUES.
20.) Click the `peakNecActivity` field to highlight it.
21.) Type the peak NECR1 activity concentration (in kBq/cc), obtained from the Section 1-5.2 analysis.
22.) Click ACTION to display the submenu.
23.) Click EXECUTE ANALYSIS to display a results screen similar to that shown in Figure 1-26.

Figure 1-26: **Sample Count Loss Correction Accuracy Report**



24.) To save or print the results:

a.) Click FILE in the toolbar of the Sensitivity Report screen.

b.) Click or drag to PRINT HARD COPY to send a copy of the screen to the designated local printer.

c.) Click or drag to SAVE POSTSCRIPT FILE to place a copy of the screen in directory user/g/ctuser. The file name is service.ps.

25.) Click FILE in the Analysis Shell toolbar to display the submenu.

26.) Click or drag to DONE to close the Analysis Shell panel.

27.) Click FILE in the Show Image toolbar to display the submenu.

28.) Click or drag to DONE to close the Show Image panel.

29.) Click FILE in the PET Diagnostic Analysis toolbar to display the submenu.

30.) Click or drag to QUIT to close the PET Diagnostic Analysis screen (Investigator).

Section 1-7: Count Rate Accuracy Correction Fit (CRACFIT)

1-7.1 Overview

The CRACFIT tool computes site-specific deadtime parameters to achieve improved count rate correction accuracy. Follow this procedure to compute new deadtime parameters and upload them into the deadtime config file and the decay series. Rerun this procedure for 2D and/or 3D data sets, as necessary.

1-7.2 CRACFIT Procedure

1.) Make a copy of the decay series by following the steps below:

a.) Click the IMAGE WORKS button.

b.) Select the appropriate diagnostic exam and decay series to copy/anonymize.

c.) Click the UTILITIES menu, then click on CREATE ANONYMOUS PATIENT BY SERIES from the submenu.

d.) Click OK at the next prompt.

e.) Look for the copy of the anonymized decay series. Use the anonymized copy to compute and update new parameters; do NOT use the original copy. The anonymized copy will be uploaded with new parameters and used for subsequent count rate accuracy analysis.

2.) Open and Run the Count Rate Accuracy Correction (CRAC) Utilities by performing the following steps:

a.) Open the Common Service Desktop.

b.) On the Common Service Desktop, check the PET option button in the upper left corner of the screen.

c.) Use the SORT window on the Common Service Desktop to select the 901 raw data series of the anonymized decay series; do NOT use IMAGE WORKS to select the series.

Note: A decay data set usually consists of two series (901 and 902). Select the 901 series, which includes about 31-36 frames.

d.) On the Common Service Desktop click CALIBRATION, then click on COUNT RATE ACCURACY CORRECTION.

e.) Click CRA CORRECTION.

f.) Click the RUN CRAC button in the Count Rate Accuracy Correction window. Upon completion, a confirmation dialog box will appear.

Note: If the program does not run, confirm that you selected the RAW decay series using the Sort window.

WARNING **Display plots are for engineering use ONLY. If you checked the DISPLAY PLOTS box, there will be four (4) graphical plots upon completion. In this case, to continue you must close these plots using the File menu (not just minimize them). After closing them, a confirmation dialog box will appear.**

g.) Click YES to update the config file.

3.) Update deadtime parameters in the anonymized decay series by following the steps below:

   a.) Confirm that you selected the 901 series in the anonymized decay series on the Common Service Desktop.

   b.) Click the UPDATE PARAMS button in the Count Rate Accuracy Correction window.

   c.) Click YES to update the RAW data with the new parameters.

4.) Repeat Section 1-6 on page 48 (*Accuracy: Correction for Countloss and Randoms*) using images reconstructed from the anonymized decay series that has just been updated with new site-specific deadtime parameters.

5.) If the new deadtime parameters do not improve count loss correction accuracy, follow the steps below to restore the old deadtime parameters and contact GECARES for assistance:

   a.) Open the Common Service Desktop.

   b.) Click CALIBRATION, then click COUNT RATE ACCURACY CORRECTION.

   c.) Click on the `Restore Default Config` file.

   d.) If a window opens with two checkbox options for 2D and 3D:

      1.) To restore 3D deadtime parameters, check only the 3D checkbox. To restore 2D deadtime parameters only, check only the 2D checkbox. Checking both 2D and 3D checkboxes will restore both 2D and 3D deadtime parameters.

      2.) Click the RESTORE button to start restoring deadtime parameters.

      3.) Close the window by clicking the either the CANCEL button or the Cross-Button at top right hand corner. Close the cracRestore terminal window if open.

   If prompted to restore the original `compute.cfg` file:

      1.) Type: **y**

      2.) Close the terminal window.

6.) Perform the following steps to reset the system so that the new deadtime parameters can take effect:

   a.) Click the pink SHUTDOWN button.

   b.) Click RESET.

Section 1-8: Performance Specifications

When fully installed, a new system should meet the performance specifications listed in Table 1-7 through Table 1-11, provided, it has been tuned (per Service Methods CD) and carefully tested, as described in this document. The tests in this manual expect a well aligned system with full covers. Be sure to power the system on for at least 24 hours to stabilize it to the environment. Carefully follow the procedures in this document to prepare the source, acquire data, and analyze the results as it describes.

Table 1-7: Spatial Resolution (Upper Limit)

Scan Type	Units	System Type			Measured	P/F
2D mode		**DST**	**DSTE**	**RX**	**2/D**	
Transaxial @ 1cm	mm FWHM	6.8	5.5	5.3		
Transaxial @ 10 cm[1]	mm FWHM	7.5	6.2	5.8		
Axial @ 1 cm	mm FWHM	5.3	5.3	5.3		
Axial @ 10 cm	mm FWHM	6.5	6.5	6.5		
3D mode	**Units**	**DST**	**DSTE**	**RX**	**3D**	**P/F**
Transaxial @ 1cm	mm FWHM	6.8	5.5	5.3		
Transaxial @ 10 cm	mm FWHM	7.4	6.2	5.7		
Axial @ 1 cm	mm FWHM	6.2	6.2	6.2		
Axial @ 10 cm	mm FWHM	6.5	6.5	6.5		

[1] Transaxial Resolution at 10 cm is evaluated as the average of the radial and tangential measurements, calculated based on a source image in a single slice

Table 1-8: Sensitivity (Lower Limit)

Scan Type	Units	System Type			Measured	P/F
2D mode		**DST**	**DSTE**	**RX**	**2D**	
Average 0, 10 cm	cps/kBq	1.8	1.8	1.5		
3D mode	**Units**	**DST**	**DSTE**	**RX**	**3D**	**P/F**
Average 0, 10 cm	cps/kBq	8.4	7.7	7.2		

Table 1-9: Scatter Fraction (Upper Limit)

Scan Type	Units	System Type			Measured	P/F
2D mode		**DST**	**DSTE**	**RX**	**2D**	
At low activity	%	21	21	19		
3D mode	**Units**	**DST**	**DSTE**	**RX**	**3D**	**P/F**
At low activity	%	48	39	39		

Table 1-10: NECR Countrate (Lower Limit)

Scan Type	Units	System Type			Measured	P/F
2D mode		**DST**	**DSTE**	**RX**	**2D**	
NECR peak	kcps	86	86	135		
Expected Conc.[2]	kBq/ml	49	49	100	**N/A**	
3D mode	**Units**	**DST**	**DSTE**	**RX**	**3D**	**P/F**
NECR peak	kcps	59	68	99		
Expected Conc.	kBq/ml	12	12	25	**N/A**	

[2] Measured concentration at peak NECR depends on activity meter calibration and frame sampling time. More than 20% variation in the reported concentration is expected. This value is not a performance specification.

Table 1-11: Correction Accuracy[3] (Upper Limit)

Scan Type	Units	System Type			Measured	P/F
2D mode		**DST**	**DSTE**	**RX**	**2D**	
Max error below peak NECR	%	3.3	3.3	3.3		
3D mode	**Units**	**DST**	**DSTE**	**RX**	**3D**	**P/F**
Max error below peak NECR	%	3.3	3.3	3.3		

[3] To attain this performance, the system may require site-specific characterization. Please contact your service representative for additional information.

Additional values are reported on test reports per NU2 standard. These values are for information only and not compared to a performance specification.

GE Medical Systems, a General Electric Company, going to market as GE Healthcare.
3000 N. Grandview Boulevard
Waukesha, Wisconsin 53188
USA

www.gehealthcare.com