Local Considerations

Things to do before you bring the patient in

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Local Considerations

- **Transport**
- **Storage**
- **Generator Set Up**
- **Camera Set up**
- **Patient considerations**

Transport

- **Need to comply with the ADR Regulations 2009; Radioactive Material (Road Transport) Regs 2002**
- **Krypton generators are unusual - still radioactive on return to us.**
- **You need to ensure correct labels and packaging used for the return.**
- **Generators are often shared between hospitals, and correct documentation is needed for this transfer.**

Generator Transport category

- **On Dispatch –**
  - **Category Yellow II (Surface Dose rate ~400 μSv hr^{-1})**
  - **UN 2915**
  - **Dispatch Note**
  - **Break-proof seal**

Shared Generator needs to be repacked with new seal and with dispatch notes supplied

Spent Generator Return

- > 30 hours after use
- < 5 μSv hr^{-1} surface dose rate
- Excepted Package
- Yellow II labels inside
- Dispatch note
- UN 2910
- Break-proof seal

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EA Site Limits

- **Environment agency permit (or licence)**
- **Need an activity level for ^{81}Rb**
- **Production activity ~ 5 GBq @ 10 pm**
- **Half-life 4.6 hours , but may arrive at 3am!**
- **Latest interpretation by EA is to allow activity value at 9am to be the permitted activity**
- **Therefore site limit > 1 GBq @ 9 am is OK (just!)**

EA Site Limits

- **Excretion?**
- **Kr81m gas breathed out by patient**
- **However half life is 13secs**
- **Half-life < 30secs is currently exempt**
- **No need (currently) to notify**

Delivery Out of Hours

- **Handed over to ‘Responsible Person’ on site.**
- **Security staff / on-call radiographers**
- **Driver should hand over at a controlled area**
- **‘Responsible Person’ to sign site log book**
- **Driver to sign for spent generator**

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Secondary Shield

- **Generator is unique in being used in the camera room**
- **Without the secondary shield can get high camera background**
- **Surface dose rates –**
  - **Unshielded generator**

    300 μSv hr^{-1}
  - **Secondary shield**

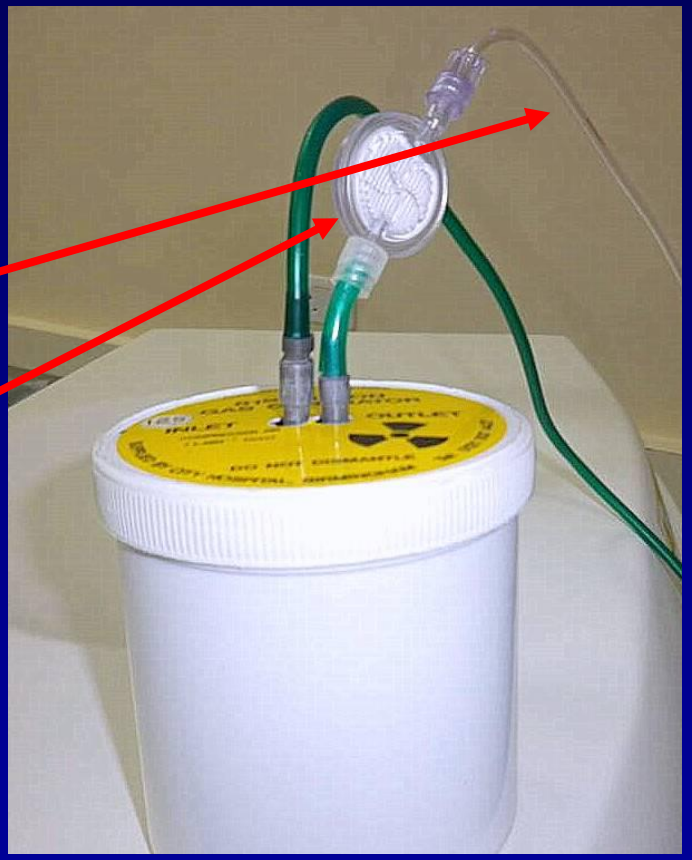
    2 μSv hr^{-1}

Elution Flow Rate

- **Pump supplies room air at 1 $l.min^{-1}$**
- **(Patients need 3 $l\ min^{-1}$)**
- **Supplies enough flow for the Kr81m gas elution.**

Elution Transit Time

- $^{81}Kr^{m}$ half life 13 secs.
- Need low transit time from generator to patient mask.
- thin-bore manometer line (2m) is essential.
- At 1 $l.min^{-1}$ flow rate, transit time < 0.1 s
- Note the in-line filter. This must not get wet or no flow!



Elution Bubble Test

- **Bubble test the generator output in beaker (or cup) of water**
- **If no flow, no Kr81m!**
- **Check connections**

- **Supplies enough flow for the Kr81m gas elution.**

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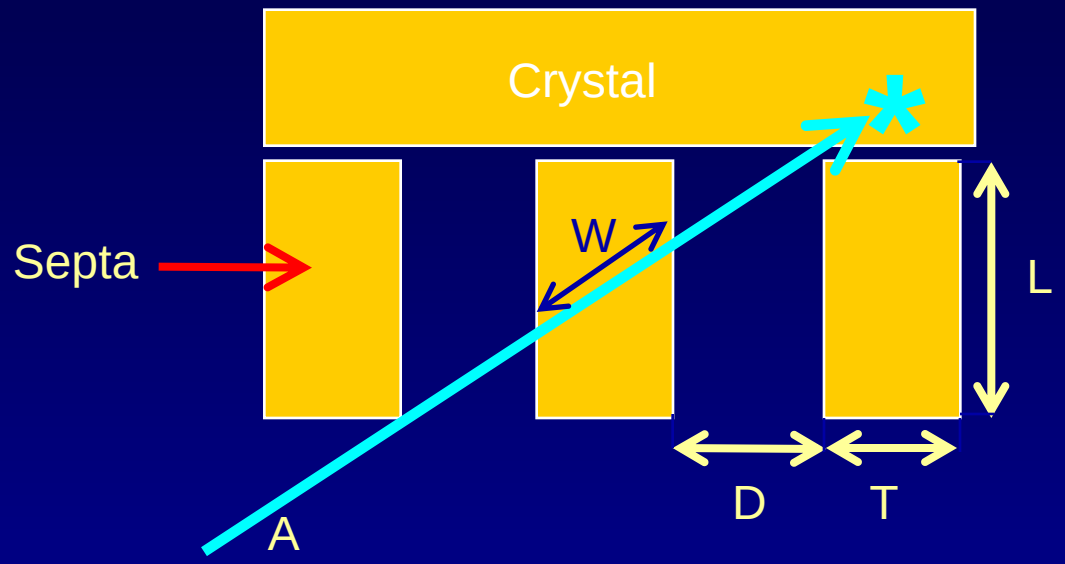
Gamma Camera Collimator

- **Resolution and Sensitivity**
- **Energy – main consideration**
- **General Purpose suitable @ 140 keV**
- **Check septal penetration @ 190 keV**
- **Two ways to check –**
  - **Calculation from collimator parameters**
  - **Image a Williams phantom**

Septal Penetration

***W* = longest path of incident gamma 'A'**

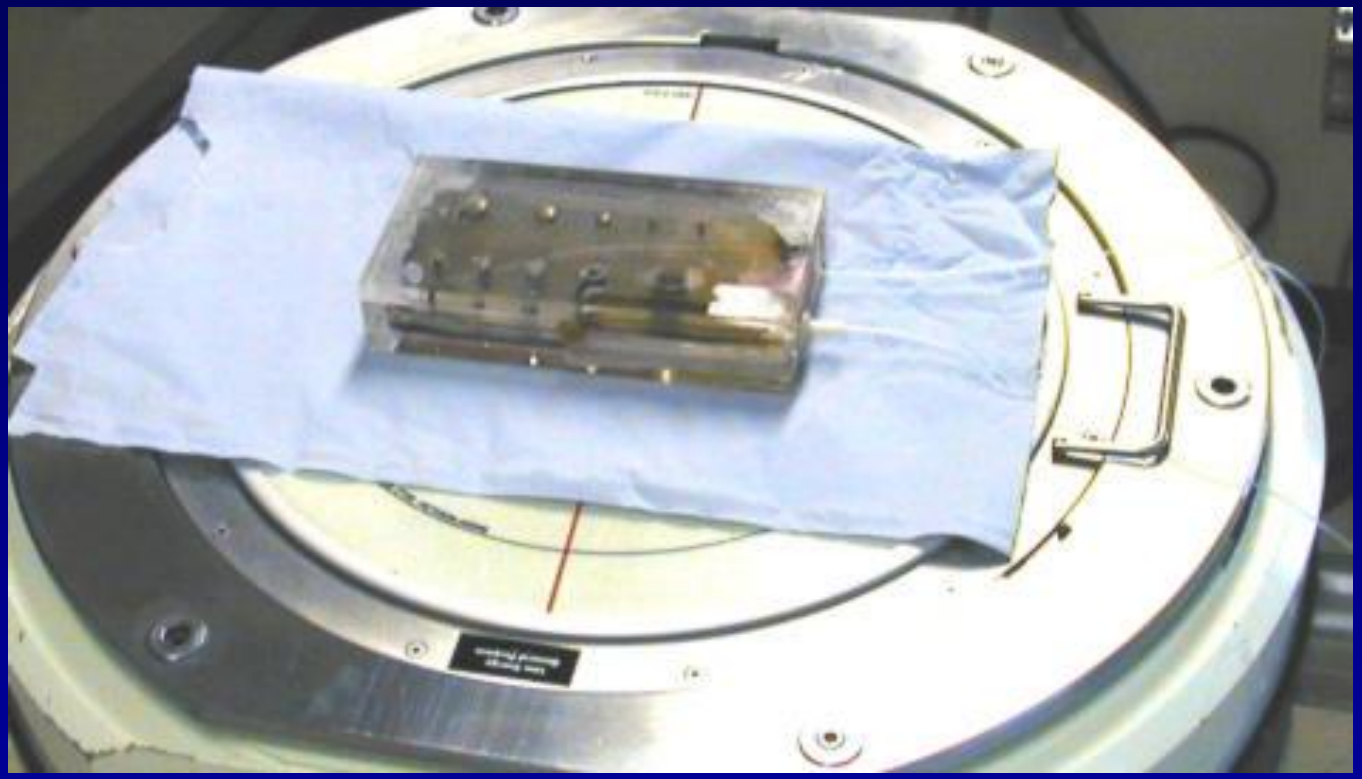
$$W = \frac{T\,L}{(2\,D + T)}$$



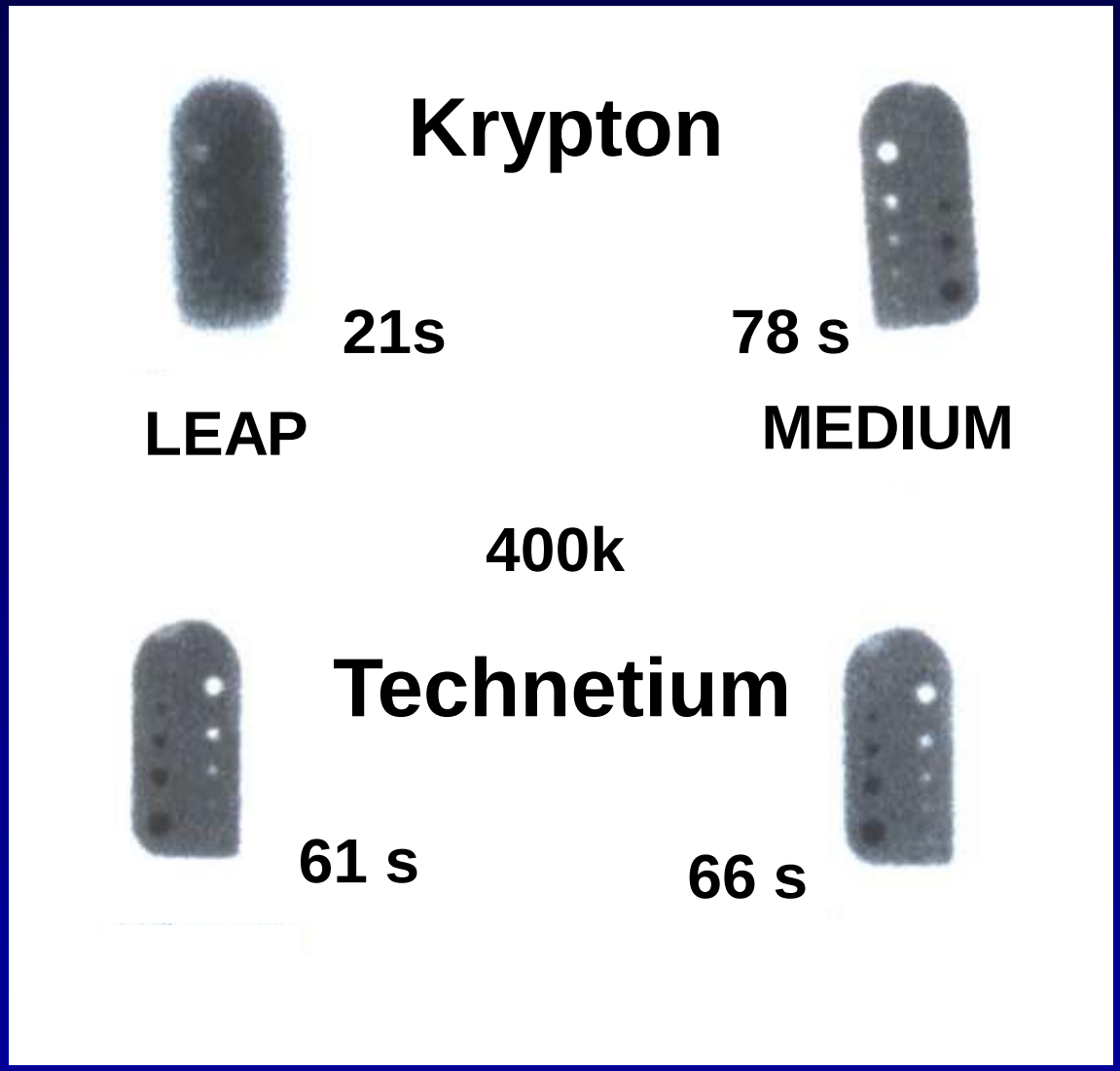
- **Septal Attenuation = $1 - e^{-\mu W}$**
- **For Kr81m, can be > 90%**

  (Tc99m normally >98%)

Septal Penetration – William's Phantom



Krypton / Technetium phantom



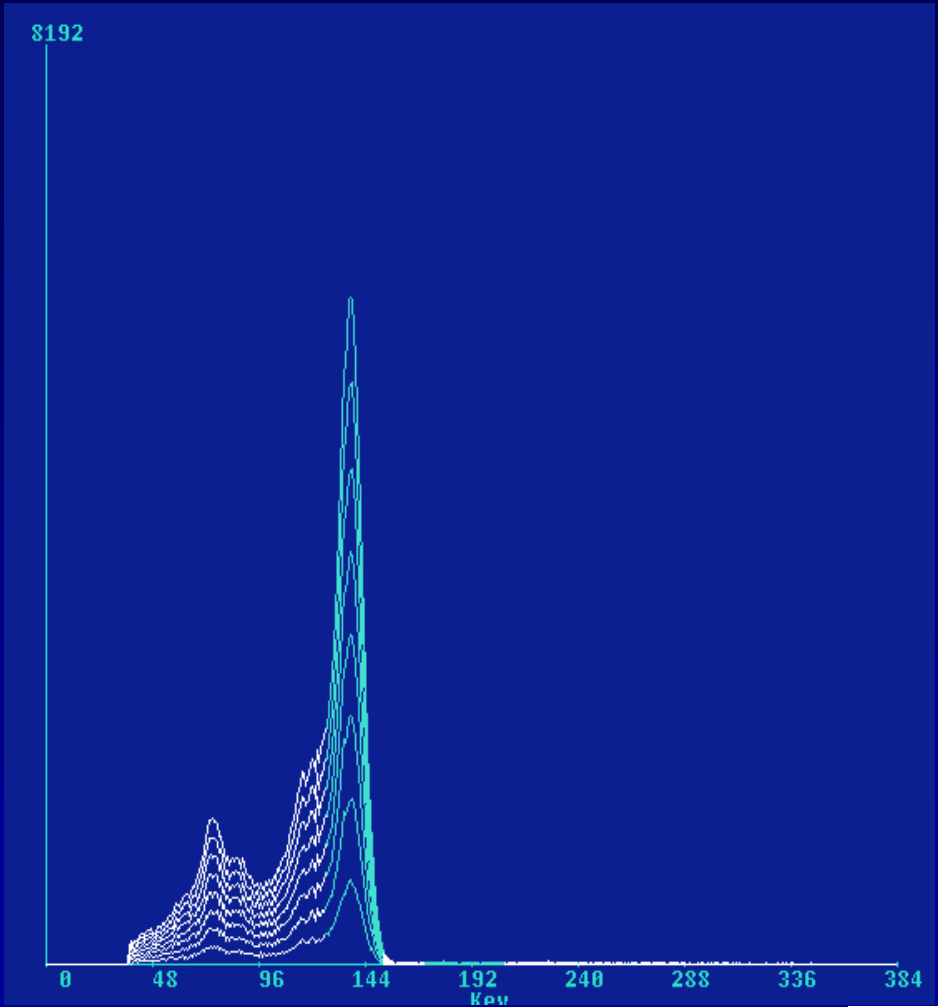
Dual isotope Gains?

- **140 keV Tc99m & 190 keV Kr81m**
- **Two for price of one?**
- **Saves time?**

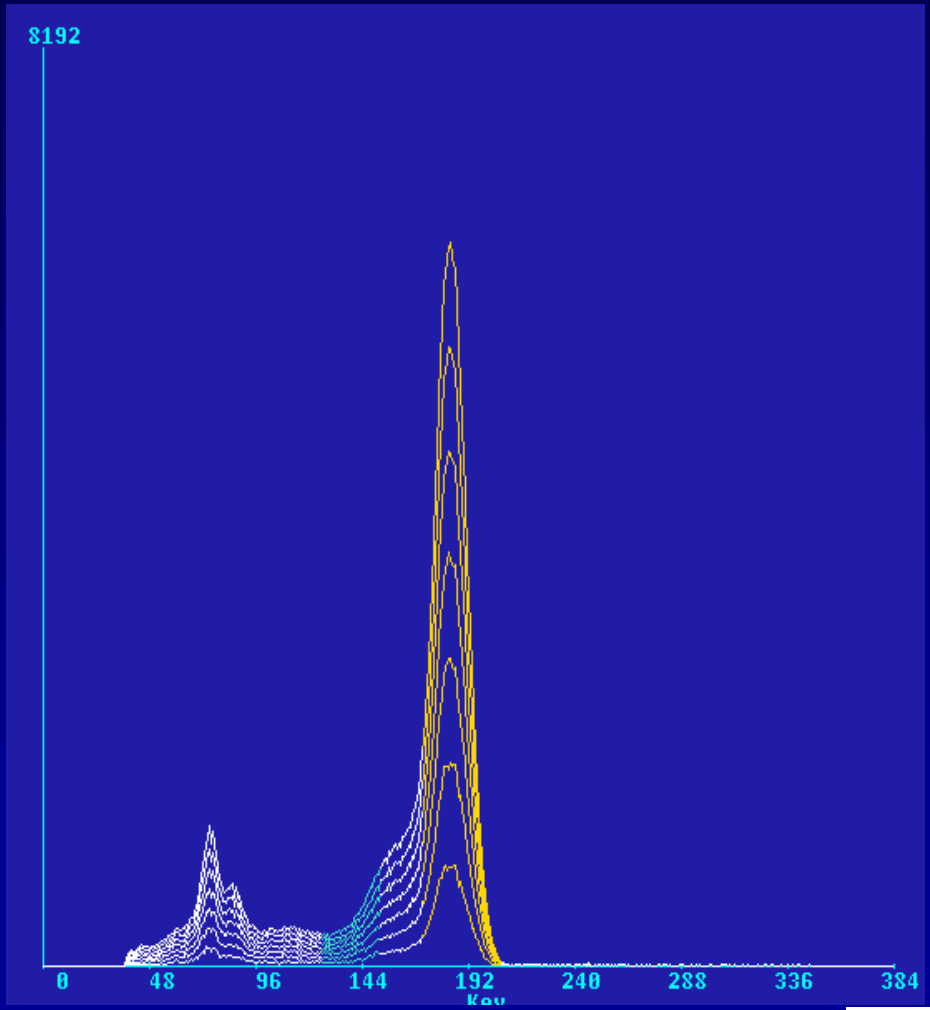
Dual isotope Problems

- **Compton scatter down from Kr81m into Tc99m window**
- **Variable Kr81m count rate through the day**
- **Want < 25% downscatter**
- **Early morning scans may be an issue**
- **Separate stop conditions for Kr81m into Tc99m not common**

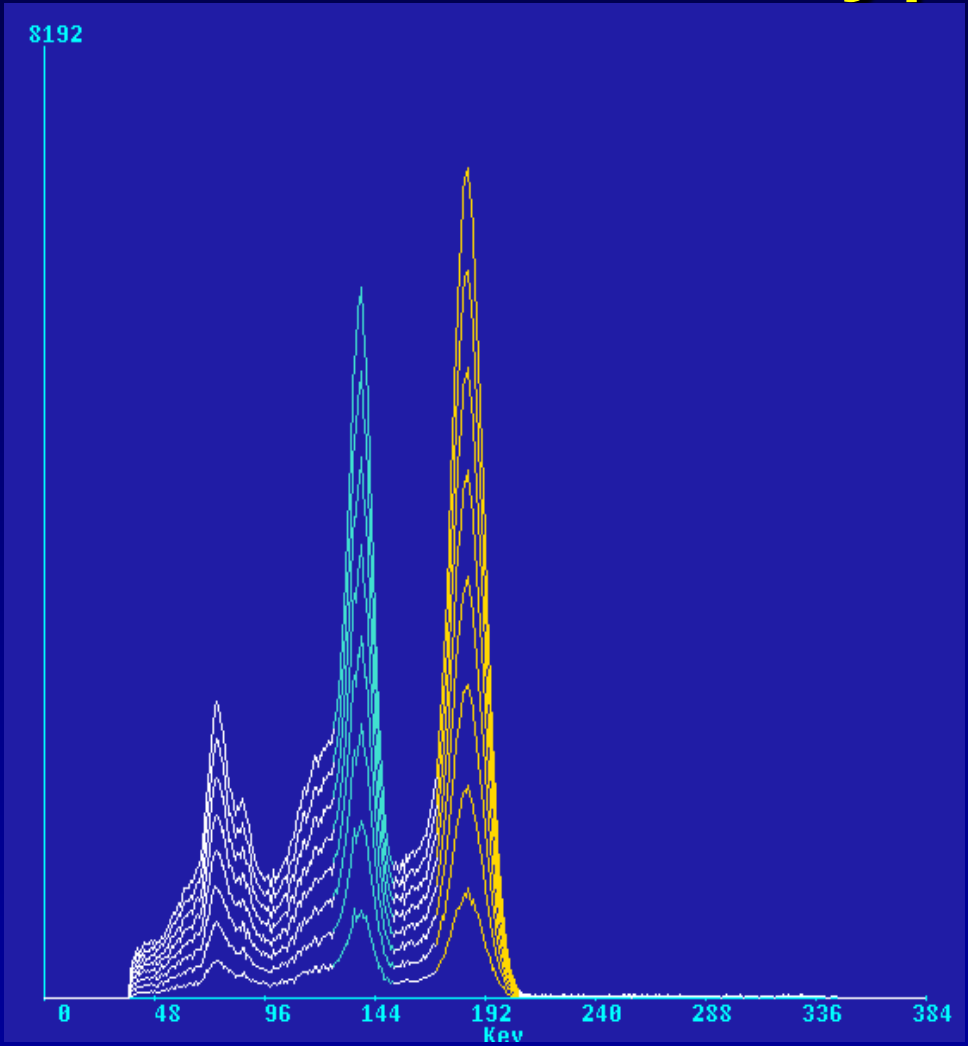
Technetium only



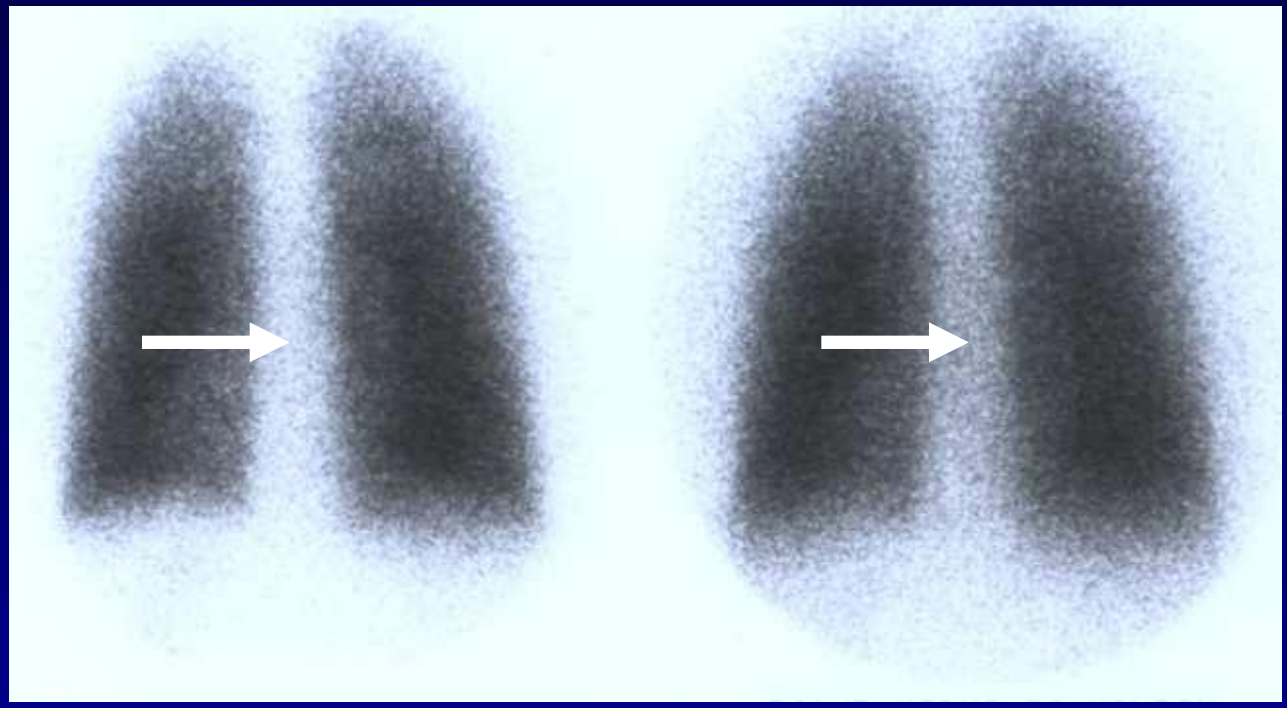
Krypton only



Technetium and Krypton



Compton scatter Effect



65s Tc99m image
400 K

65s Tc99m image + Kr81m
497 K

25% downscatter - Degrades contrast

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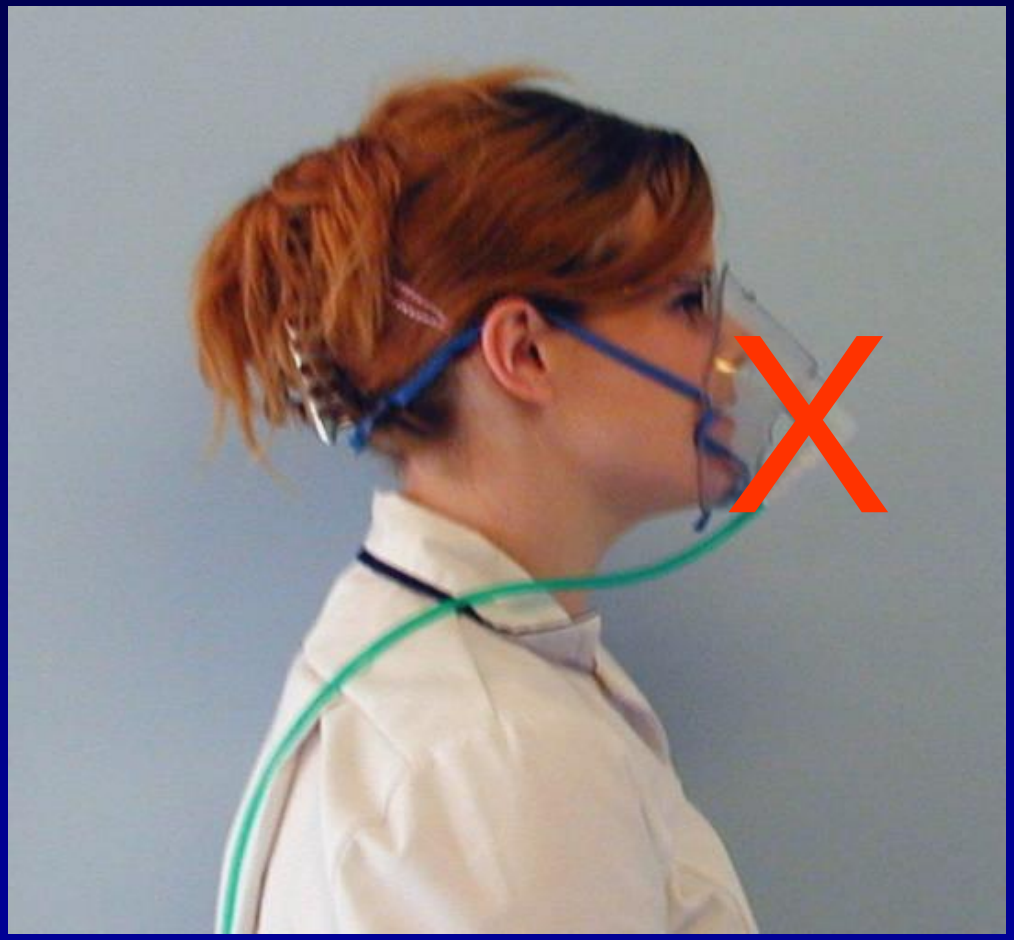
Wrong Mask system

- **Large bore tube**
- **No reservoir**
- **Leaks from side of mask**



Recommended Mask system

- **Thin bore tube**
- **Reservoir**
- **No leaks from side of mask**

Reservoir Breathing System

- **Doubles Count rate**
- **Reduces background**
- **No need for fans**