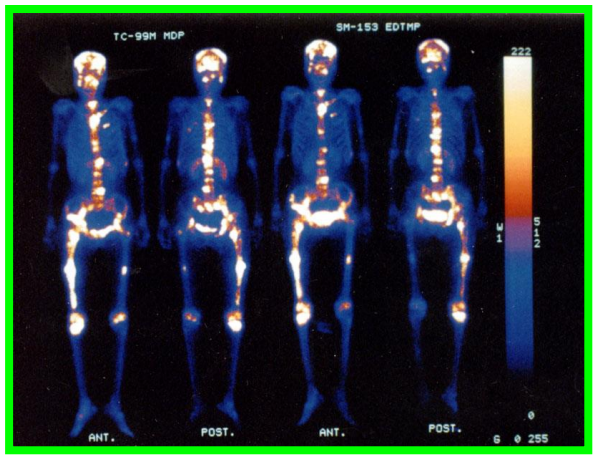
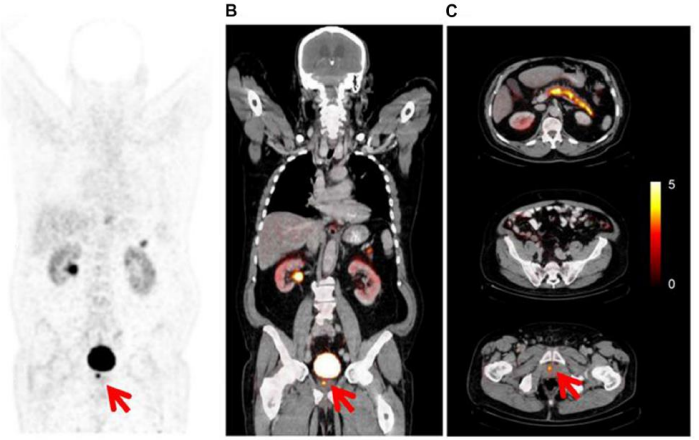
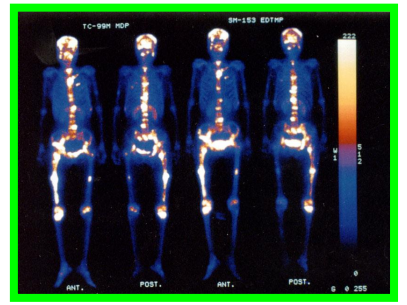
การผลิตสารเภสัชรังสีด้วยเทคโนโลยีนิวเคลียร์



โมพีพัณณ์ แดงประเสริฐ
ผู้จัดการศูนย์ไอโซโทปรังสี



Radiotherapy is a cancer treatment that uses high doses of radiation to kill cancer cells and reduce tumor size.

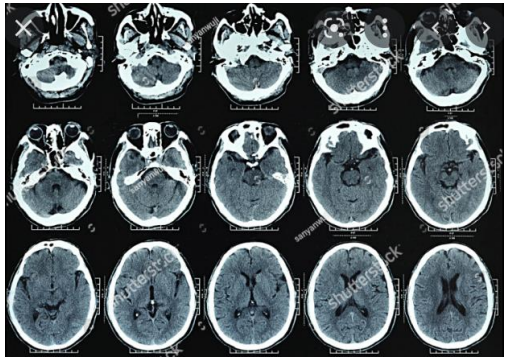


Target organ

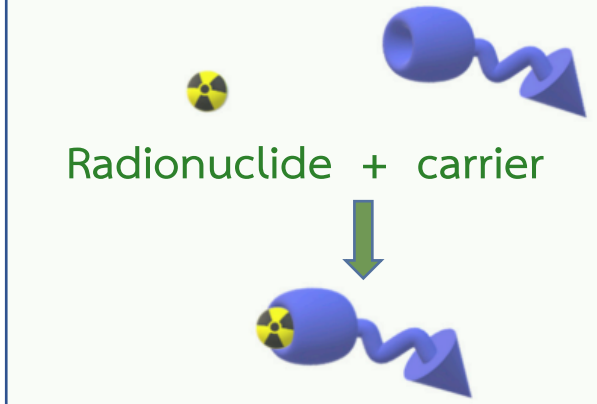
A low dose radiation is used to generate images of the inside of the body.

Radiotherapy

Diagnostic radiology



Nuclear Medicine



- Diagnosis
- Treatment

Radiopharmaceuticals

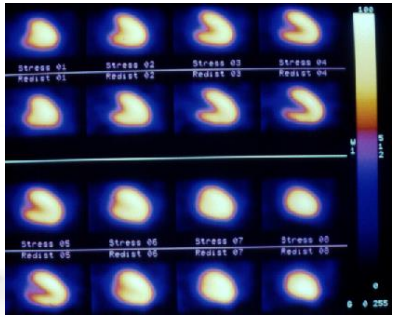
Cancer treatment

β^- or α-emitters

Radiopharmaceuticals at target sites

γ–emitters

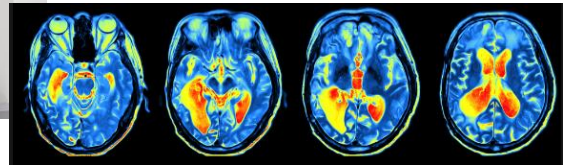
SPECT/CT scanner



Diagnosis

β^+–emitters

PET/CT scanner

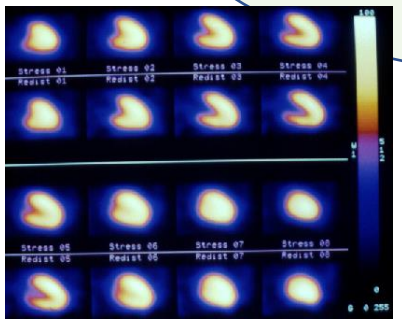


Radionuclides

Diagnosis

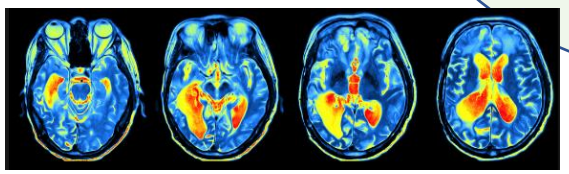
γ-emitters (SPECT radionuclides)

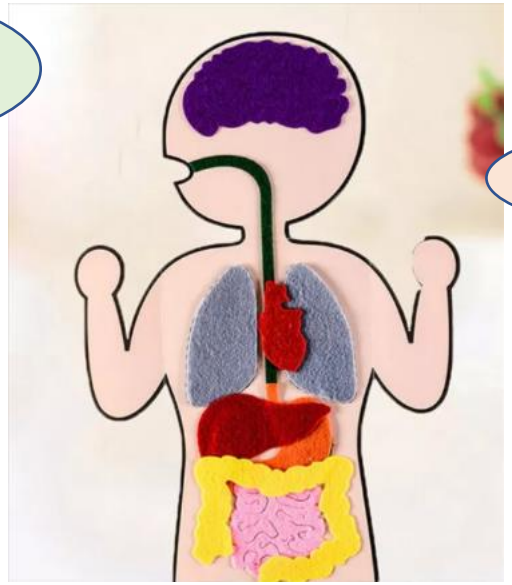
Tc-99m, Tl-201,Ga-67, In-111



β⁺ emitters (PET radionuclides)

F-18, C-11, Cu-64, Zr-89, Ga-68





Treatment

β⁻ emitters

I-131, Lu-177, Sm-153, Y-90

α-emitters

Ra-223, Ac-225

Radioisotope production

Nuclear research reactor

I-131, Lu-177, Sm-153,

Tc-99m, Ho-166, Re-186

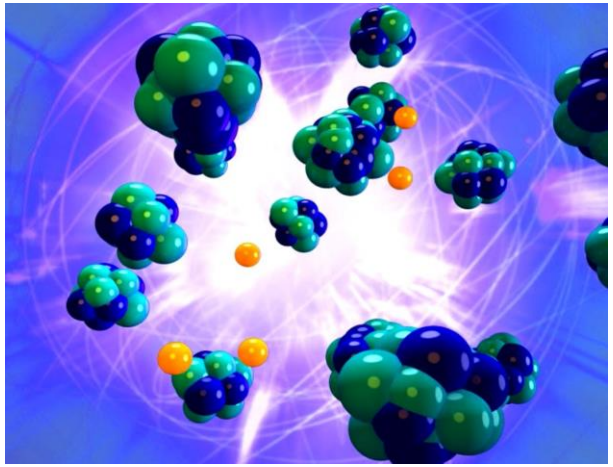
$$^{98}Mo(n,\gamma)^{99}Mo \xrightarrow[67\ h]{\beta} {}^{99m}Tc$$

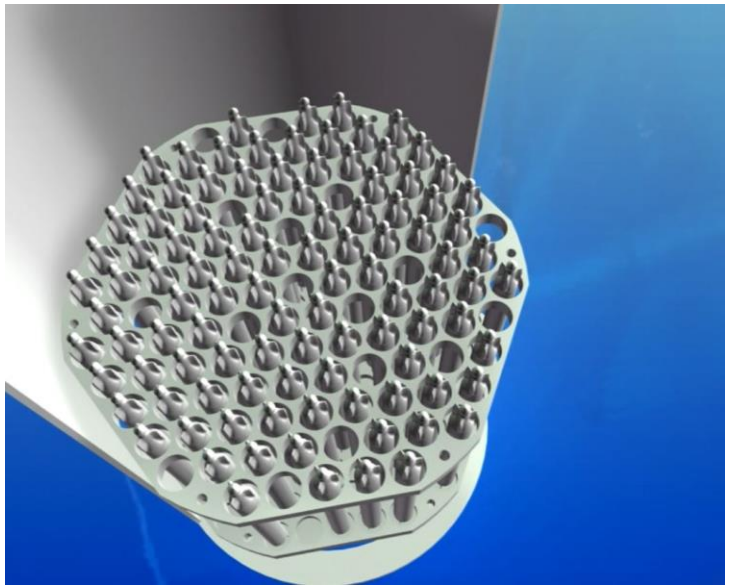
$$^{130}Te(n,\gamma)^{131}Te \xrightarrow[25\ min]{\beta} {}^{131}I$$

$$^{152}Sm(n,\gamma)^{153}Sm$$

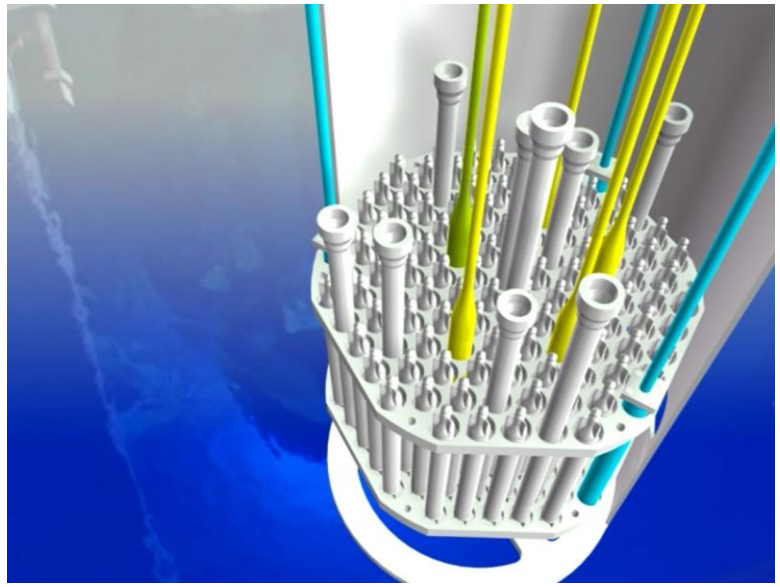
Nuclear research reactor

Chain reaction





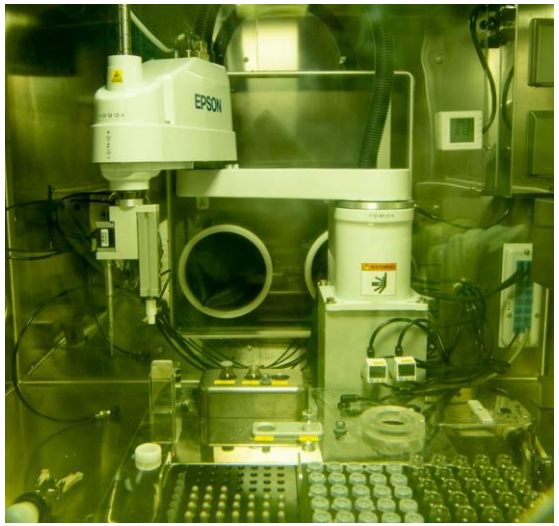
แท่งเชื้อเพลิง

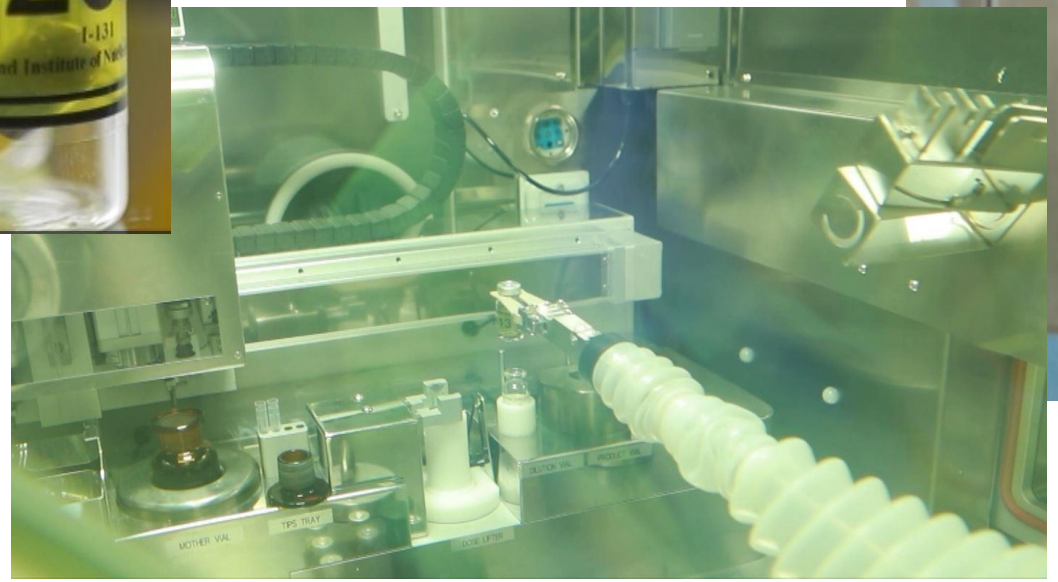


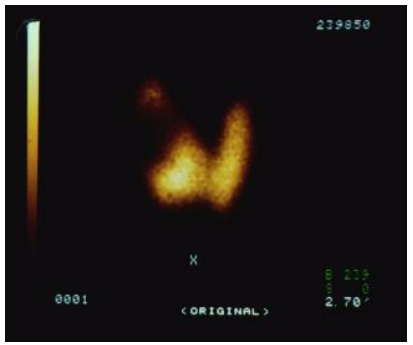
ท่ออาบรังสีนิวตรอน

$$A(t) = \sigma\phi N(1-e^{-0.693t/T1/2})$$

A = activity produced
N = number of atom of the nuclide activated
σ = neutron capture cross section (barn = 10^{-24} cm^2)
ϕ = neutron flux of the reactor (n/cm^2-sec)
t = time of irradiation
$T_{1/2}$ = half-life of radioisotope produced







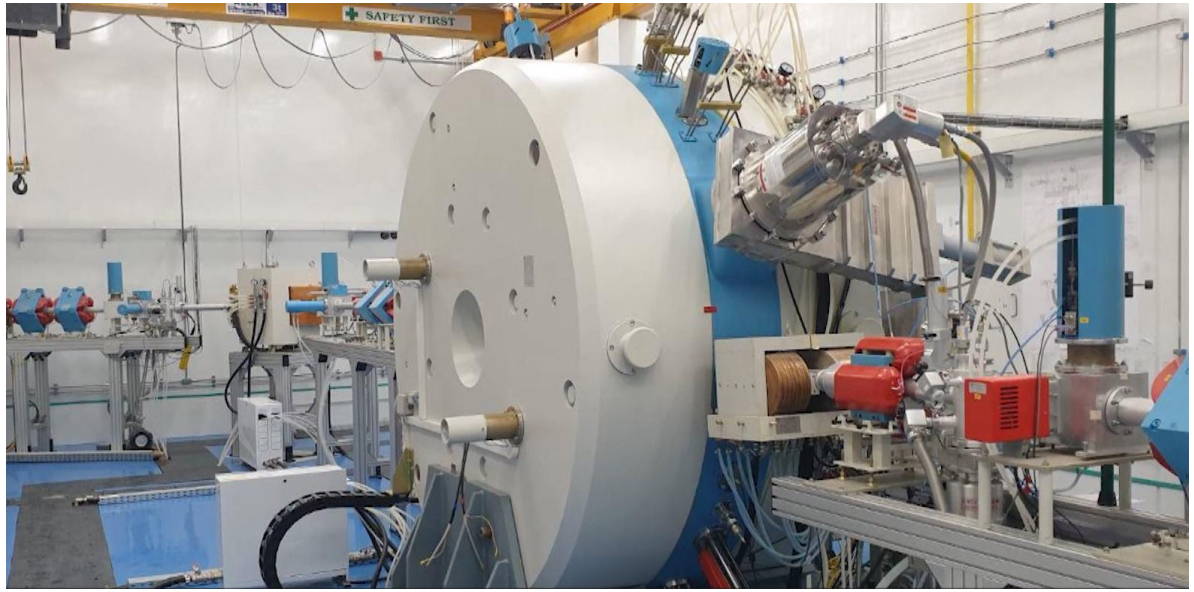
I-131 capsule

Radioisotope production

Cyclotron

Tl-201, Ga-67, In-111, F-18,

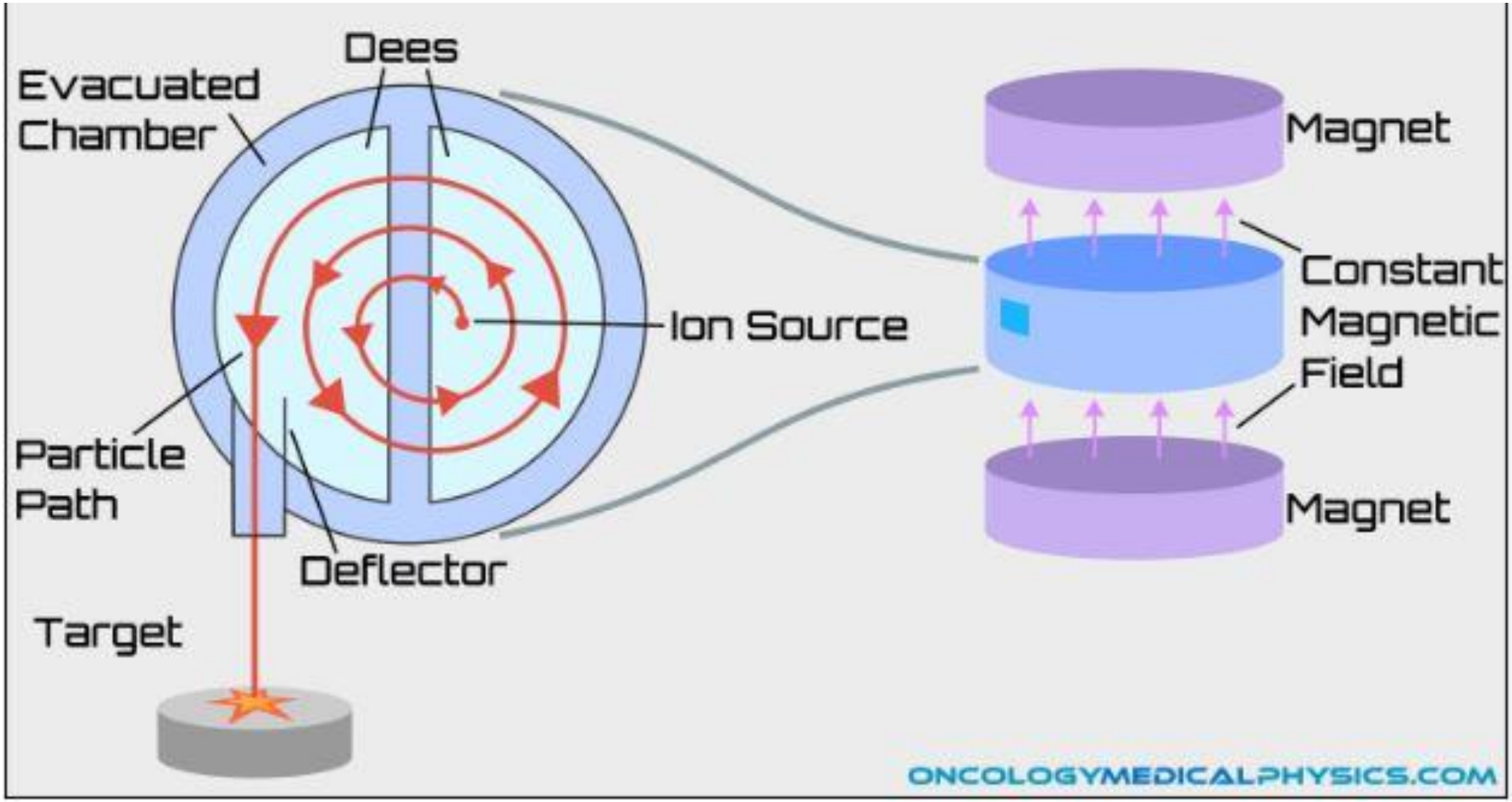
C-11, Cu-64, Zr-89, Ga-68



In-111 $^{112}Cd(p,2n)^{111}In$

Tl-201 $^{203}Tl(p,3n)^{201}Pb \longrightarrow {}^{201}Tl$

F-18 $^{18}O(p,n)^{18}F$


Dees
Evacuated Chamber
Magnet
Constant Magnetic Field
Ion Source
Particle Path
Deflector
Target
Magnet
ONCOLOGYMEDICALPHYSICS.COM

$$-\frac{dn}{dt} = R = nI(1-e^{-\lambda t})\int_{E_s}^{E_0}\frac{\sigma(E)}{dE/dx}dE$$

R = the number of nuclei formed per second
n = the target thickness in nuclei per cm2
t = time of irradiation
σ = reaction cross section (cm^2)
I = the incident particle flux per second (beam current)
E = the energy of the incident particles
$T_{1/2}$ = half-life of radioisotope produced

Radiopharmaceuticals for diagnosis

SPECT radiophamaceuticals	
^{99m}Tc-MDP	bone
^{99m}Tc-MIBI	heart
^{99m}Tc-MAG3	kidney
^{99m}Tc-ECD	brain
^{99m}Tc-MAA	lung
^{201}TlCl	heart
^{67}Ga citrate	inflammation

PET radiopharmaceuticals	
^{18}F-FDG	tumors
^{18}F-FDOPA	Parkinson's
^{18}F-FMISO	Tumor hypoxia
^{18}F-FES	Breast cancer
^{11}C-PIB	Alzheimer's
^{68}Ga-DOTATATE	Neuroendocrine tumor
^{68}Ga-PSMA	Prostate cancer

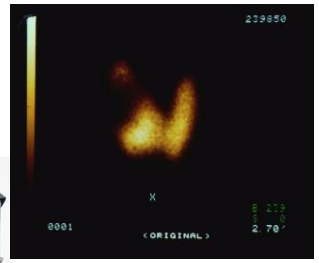
Radiopharmaceuticals for therapy

^{131}I-NaI	Thyroid cancer
^{131}I-MIBG	neuroblastoma
^{153}Sm-EDTMP	Bone pain palliation
$^{223}RaCl_2$	Bone metastasis
^{90}Y-colloid	Knee arthritis
^{225}Ac-PSMA	Prostate cancer
^{177}Lu-PSMA	Prostate cancer
^{177}Lu-DOTATATE	Neuroendocrine tumor

> 75,000 cases/year

> 12,000 cases/year

> 20,000 cases/year



งานที่ สทน.
ให้บริการในปัจจุบัน

Ready-to-use RPs	Application
$Na^{131}I$ capsule for therapy	Hyperthyroidism and Thyroid Cancer
$Na^{131}I$ capsule for diagnosis	Hyperthyroidism and Thyroid Cancer
^{131}I-MIBG for therapy	Neuroblastoma
^{131}I-MIBG for diagnosis	Neuroblastoma
^{68}Ga-PSMA	Diagnosis of prostate cancer
^{68}Ga-DOTATATE	Diagnosis of neuroendocrine tumor
^{177}Lu-DOTATATE	Treatment of neuroendocrine tumor
^{177}Lu-PSMA	Treatment of prostate cancer
^{153}Sm-EDTMP	Bone pain palliation

Thank you
for your attention!!