^{11}C-aided hadron therapy

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CERN

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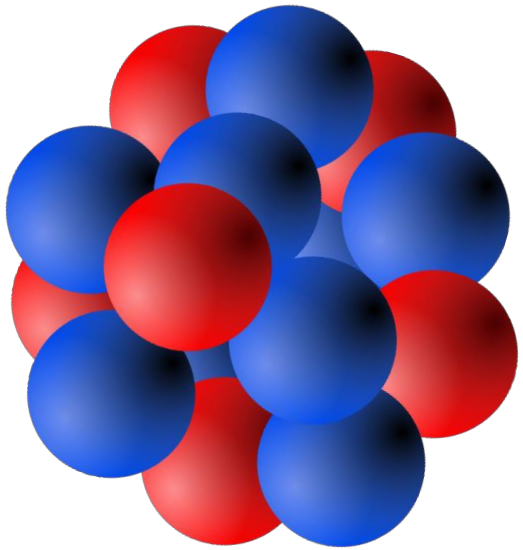
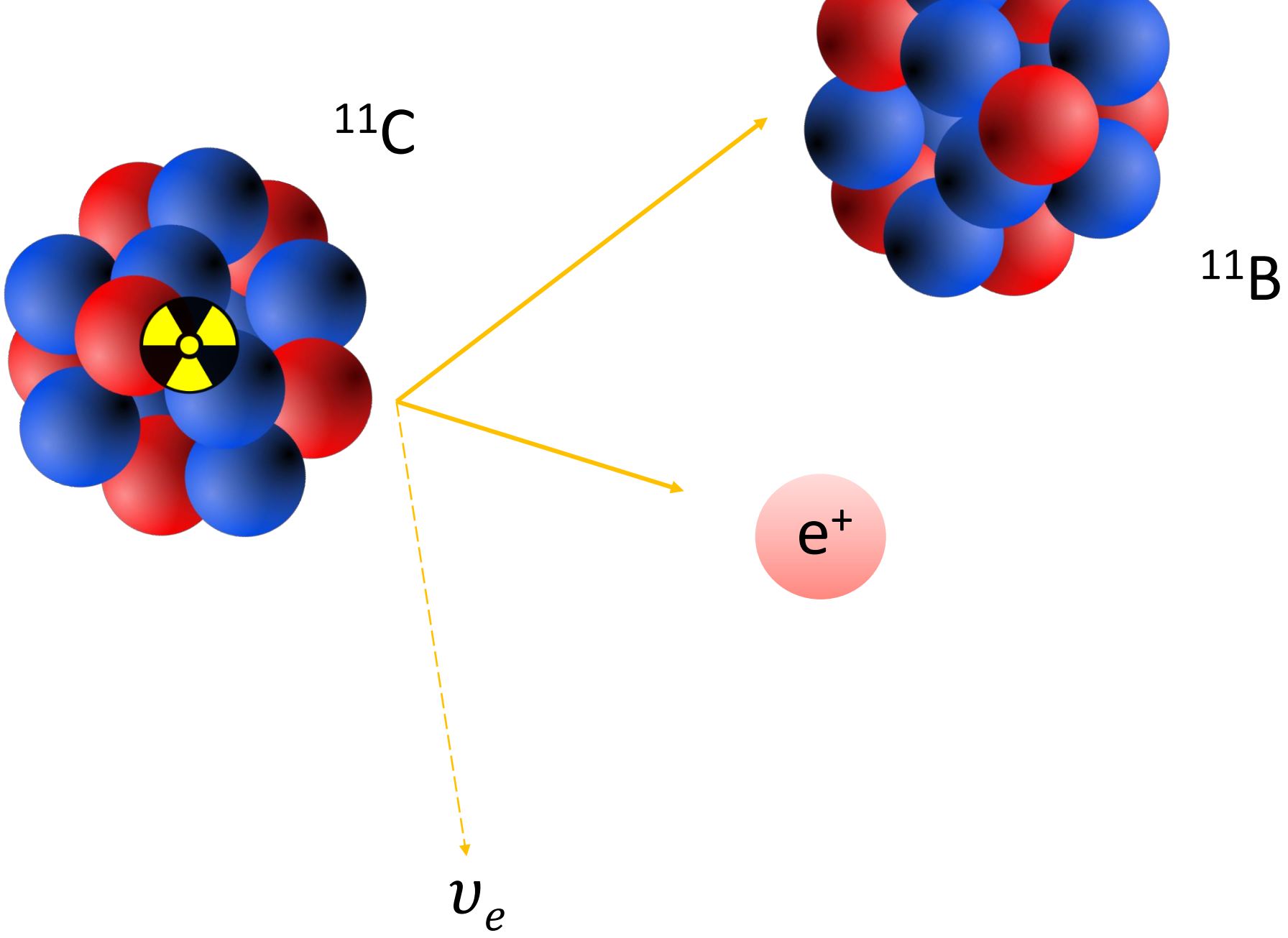
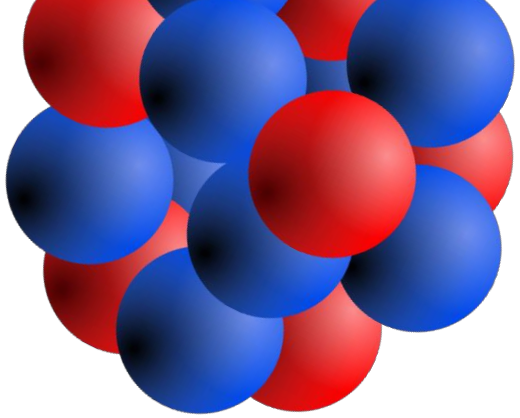
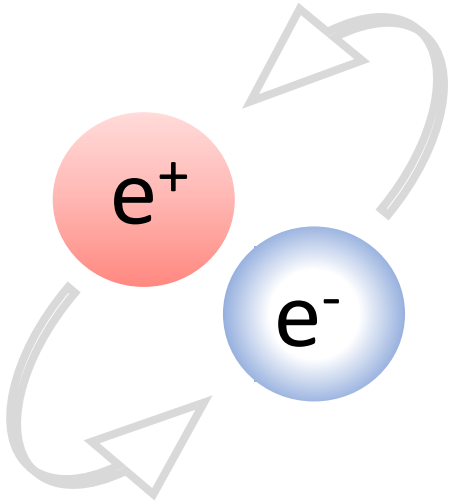
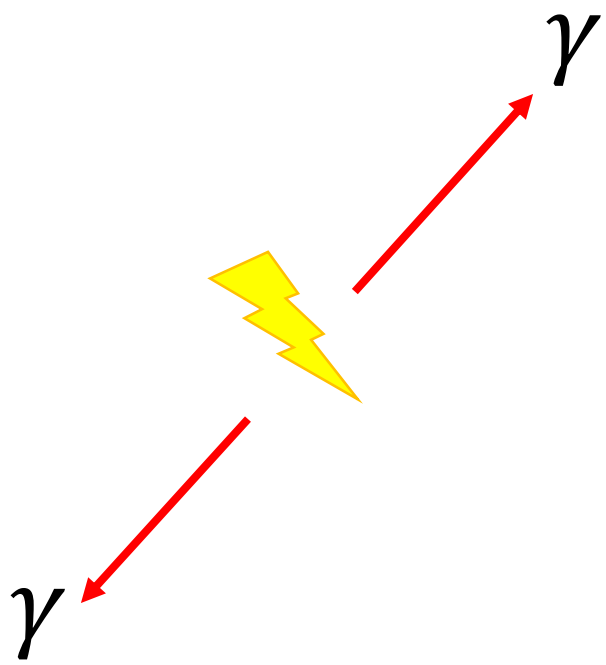
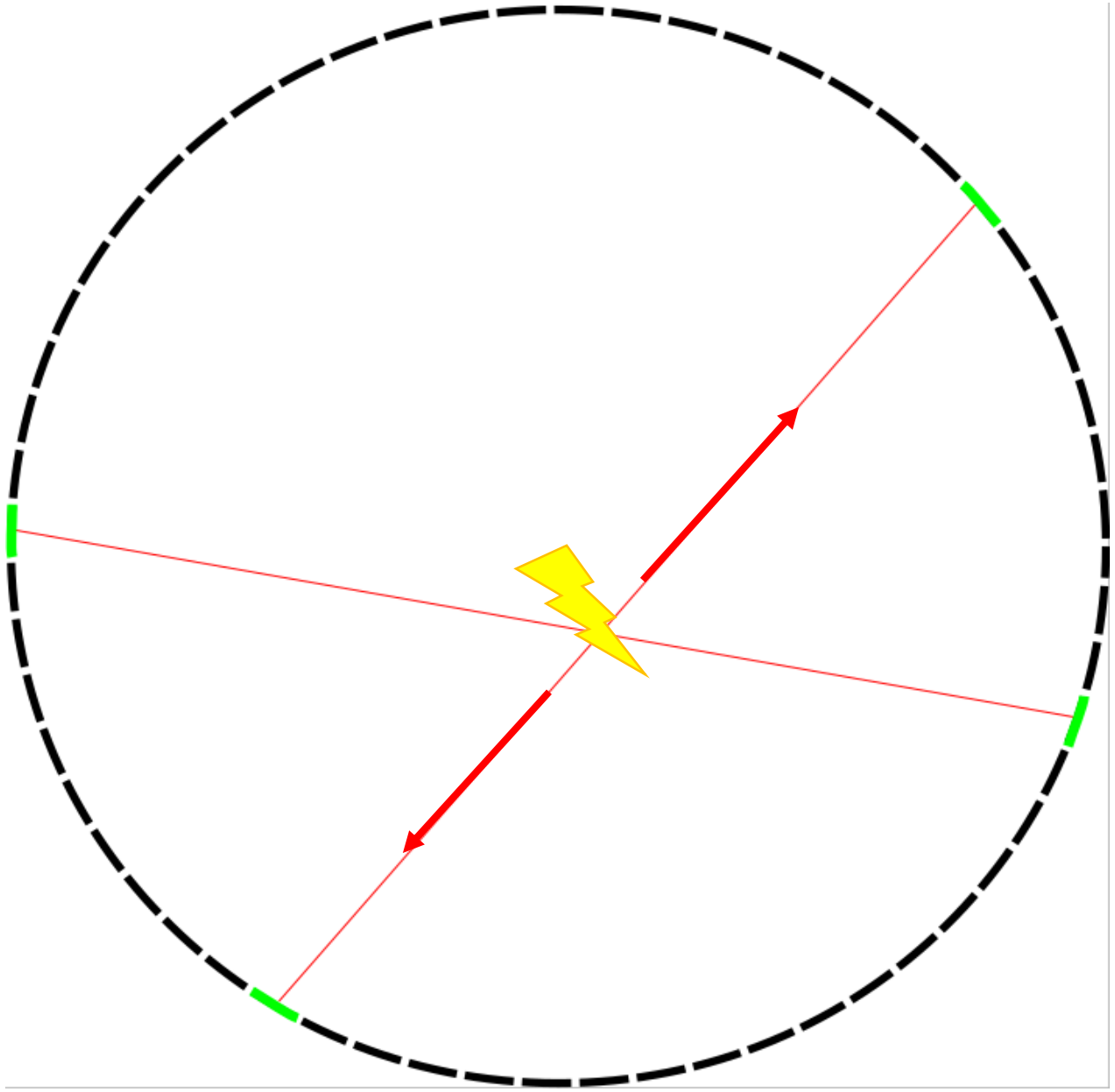


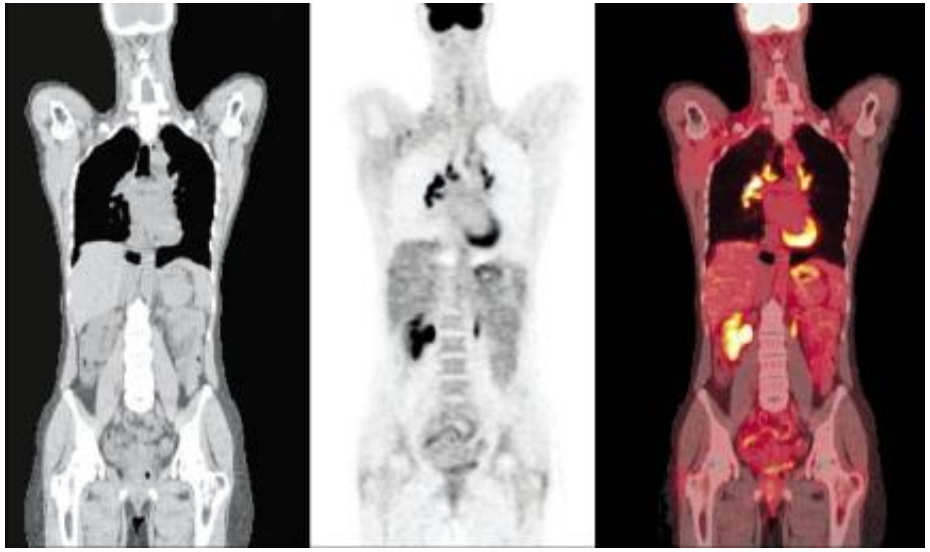

^{11}C
^{11}B
e^+
υ_e



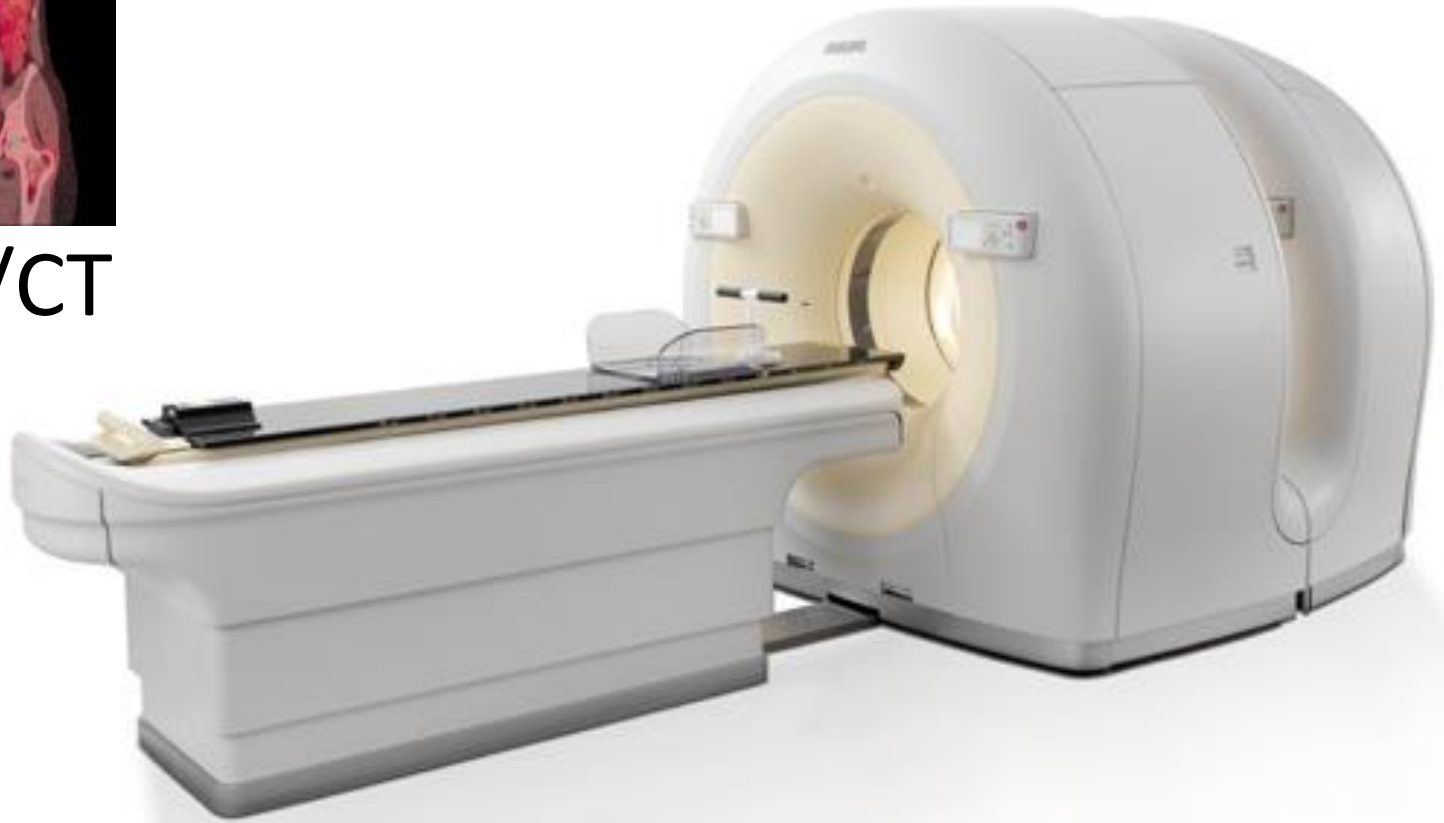

e+
e-

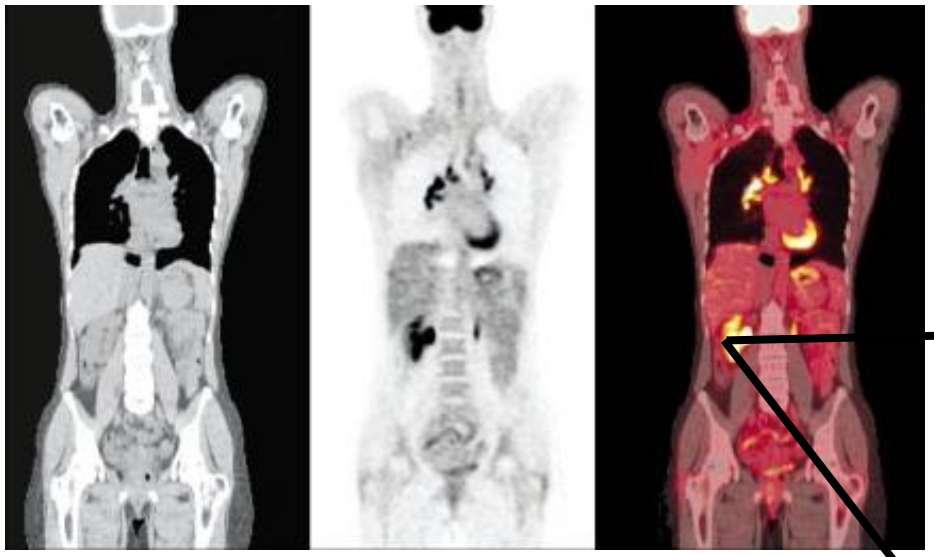

γ
γ

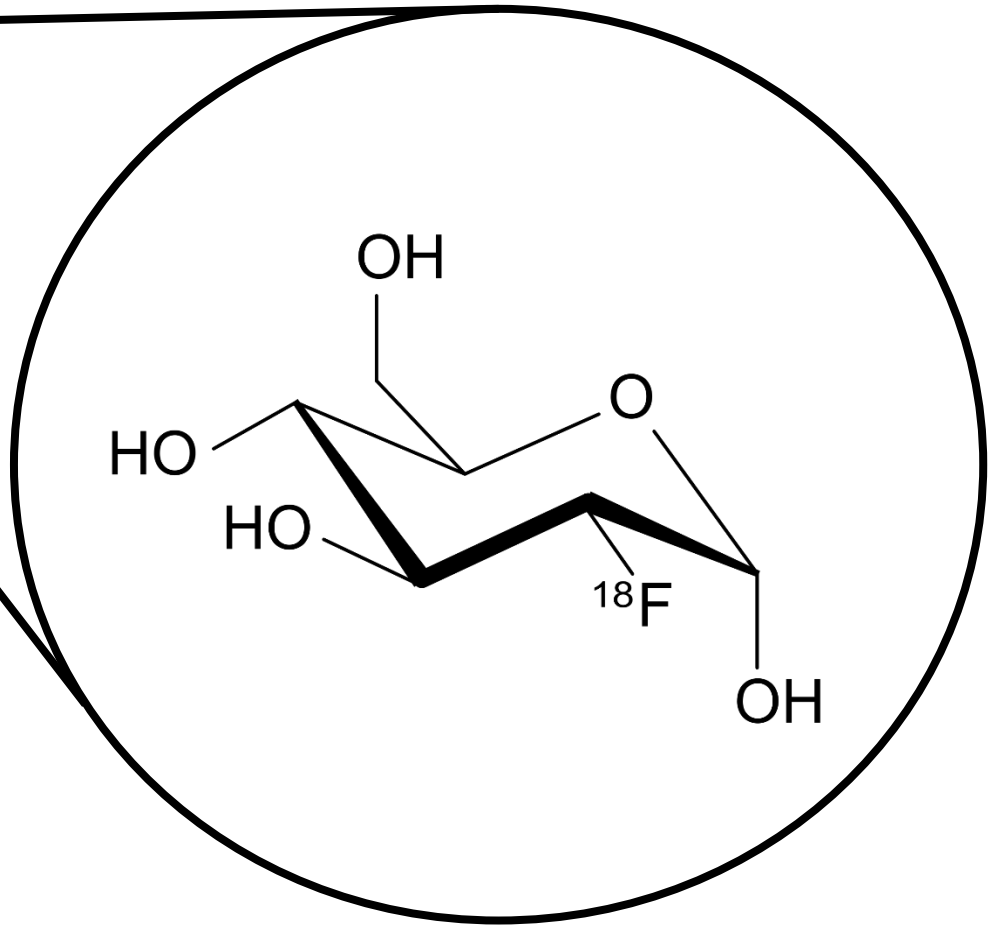


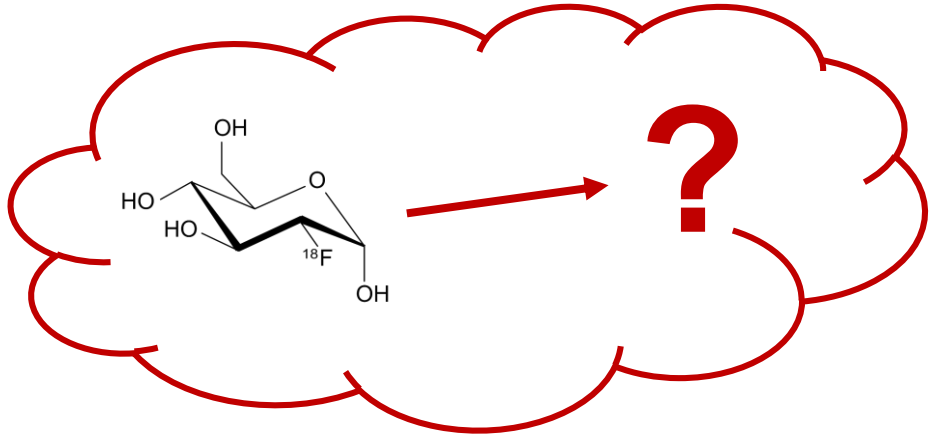


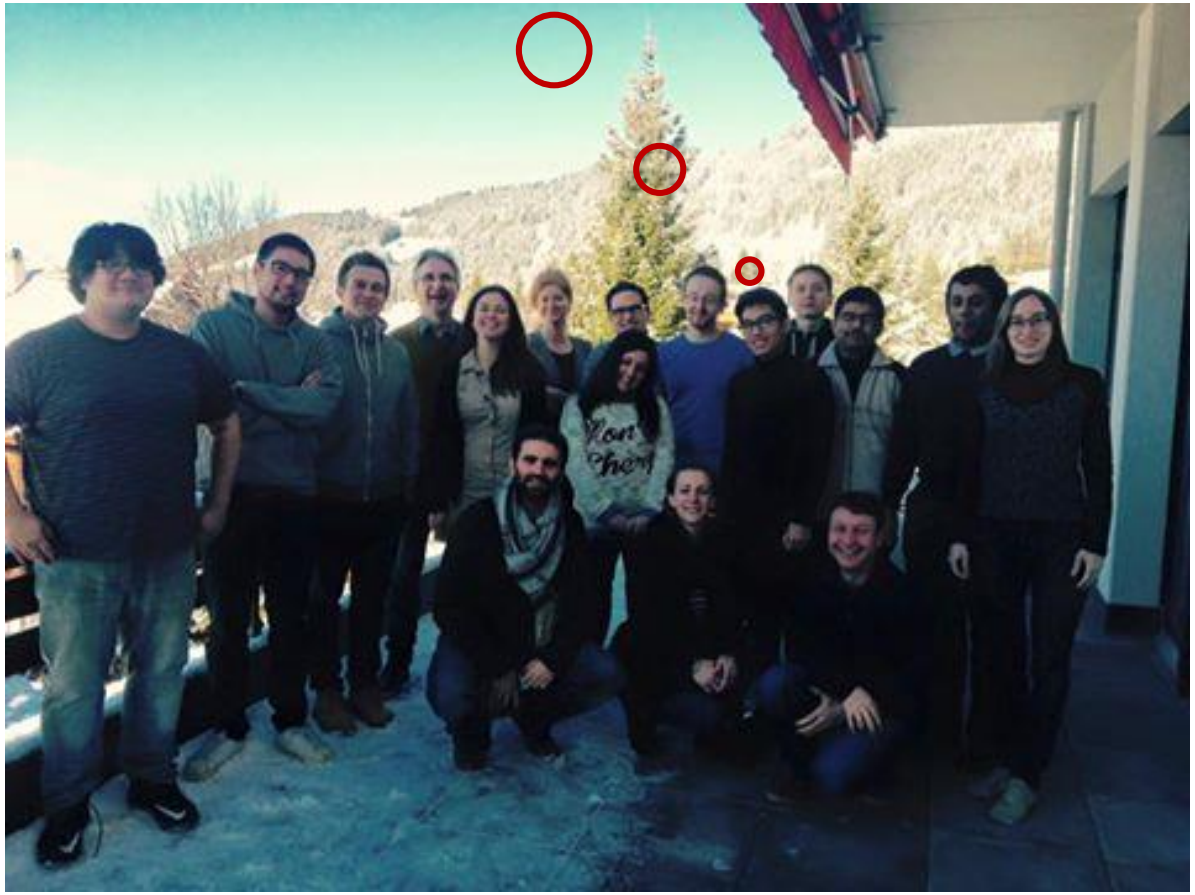
CT + PET = PET/CT

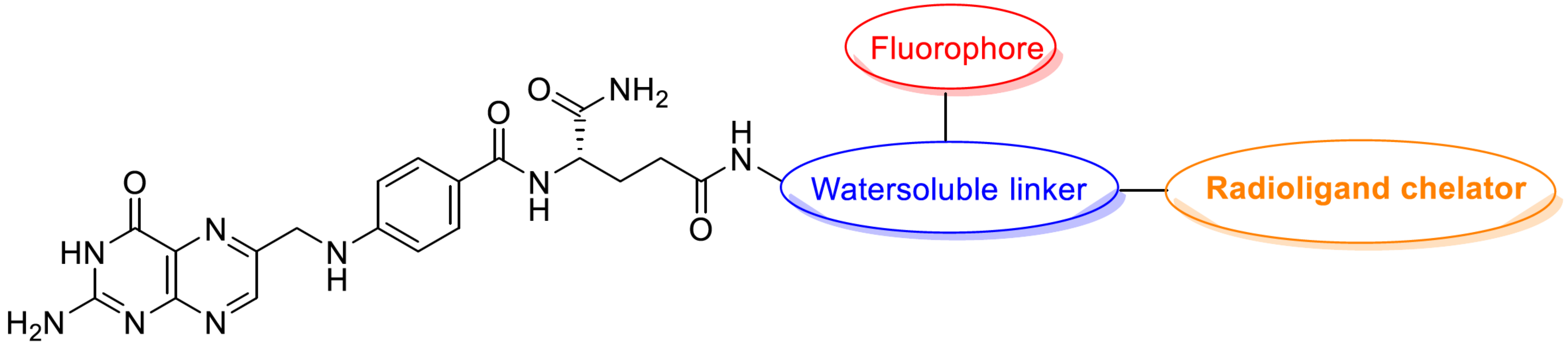




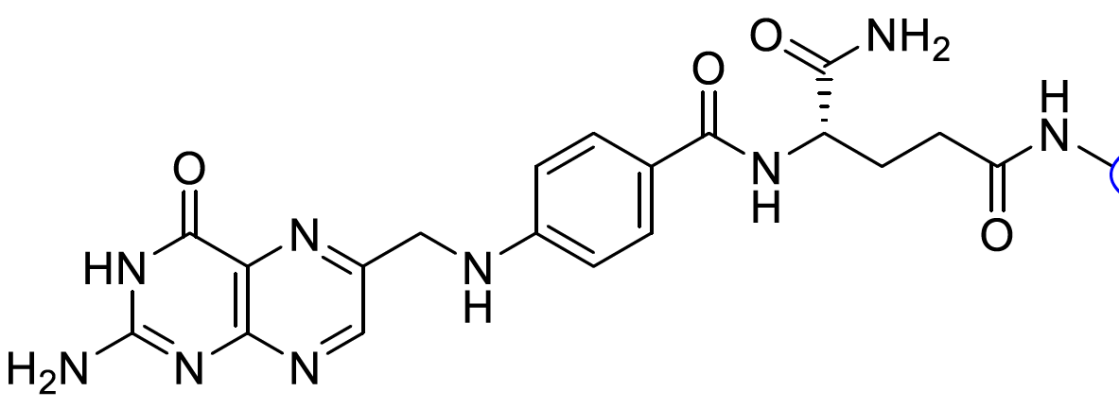

OH
O
HO
HO
18F
OH


OH
HO
HO
O
18F
OH
?





Fluorophore
Watersoluble linker
Radioligand chelator

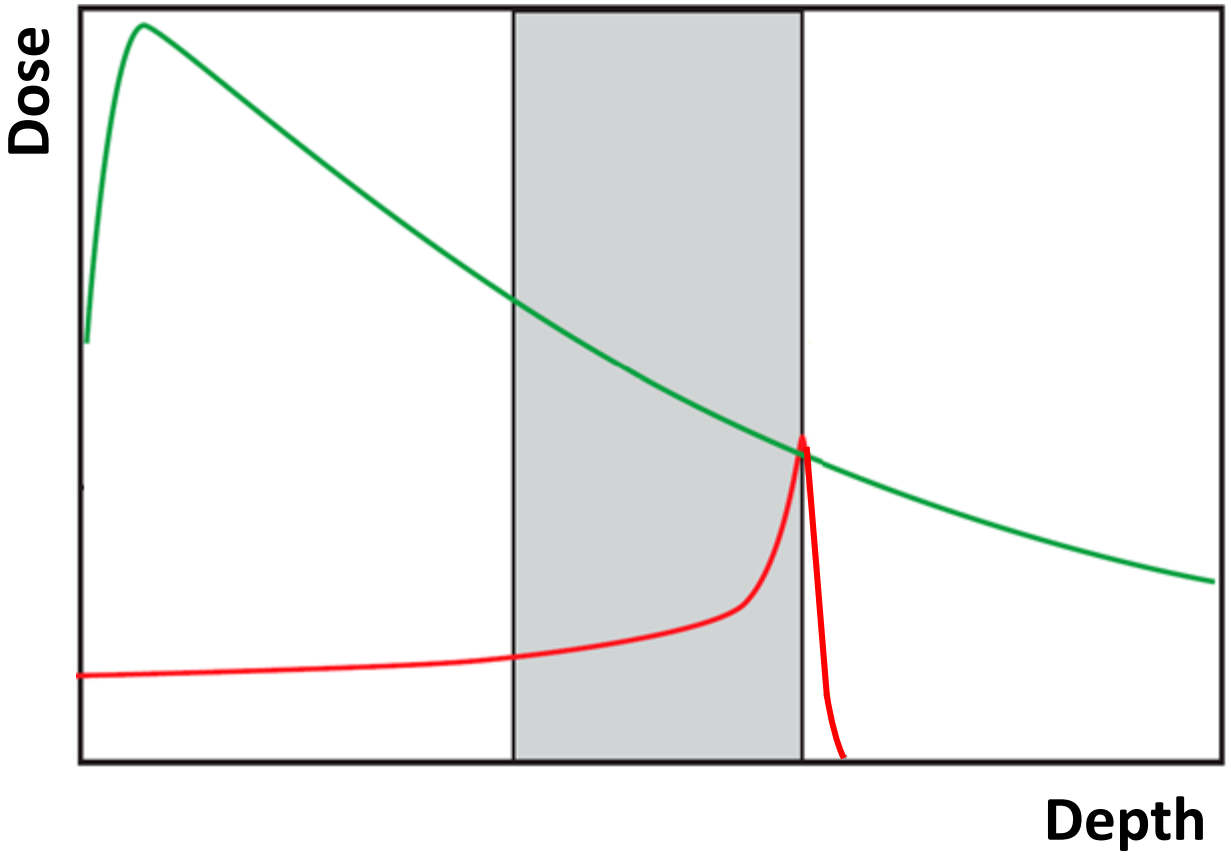


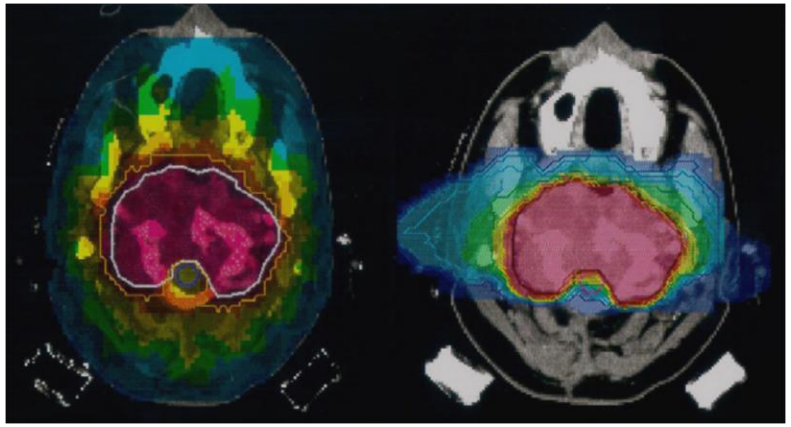
Fluorophore

Watersoluble linker

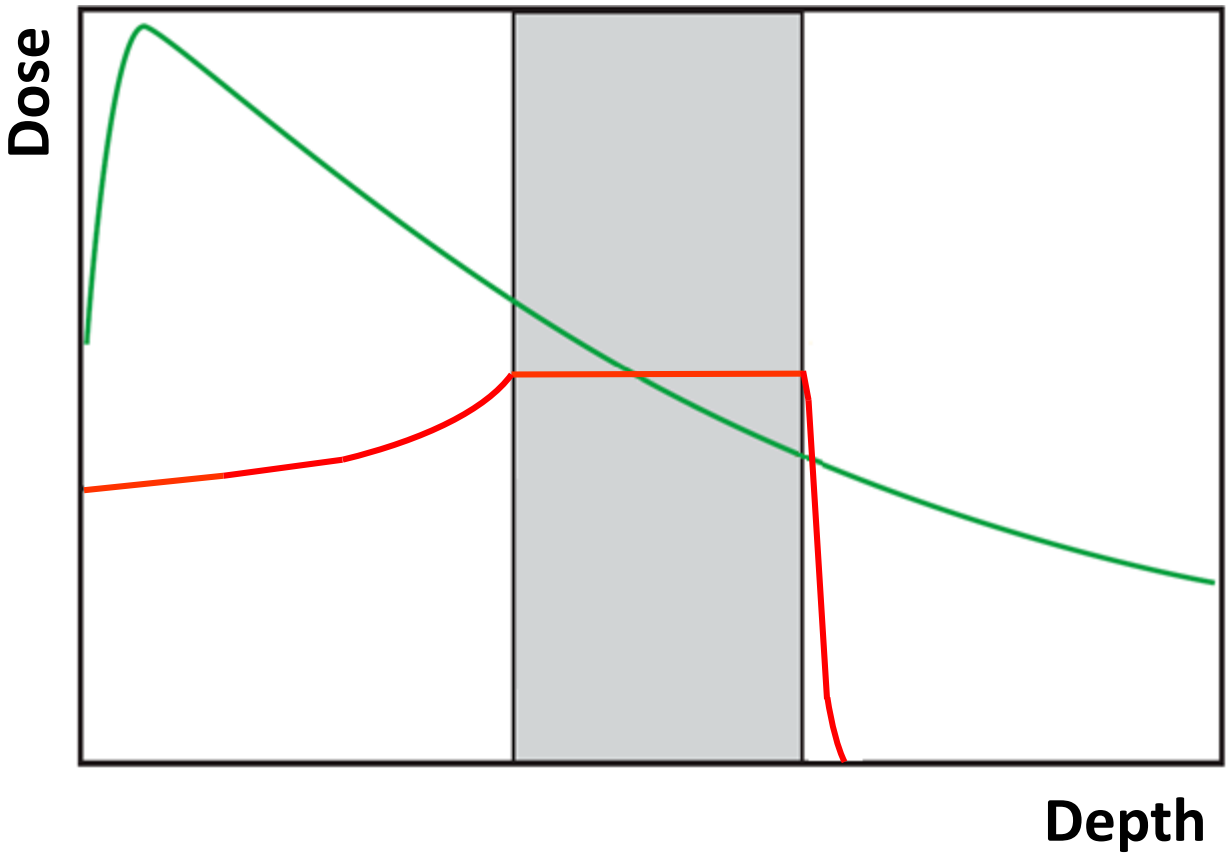
Radioligand chelator

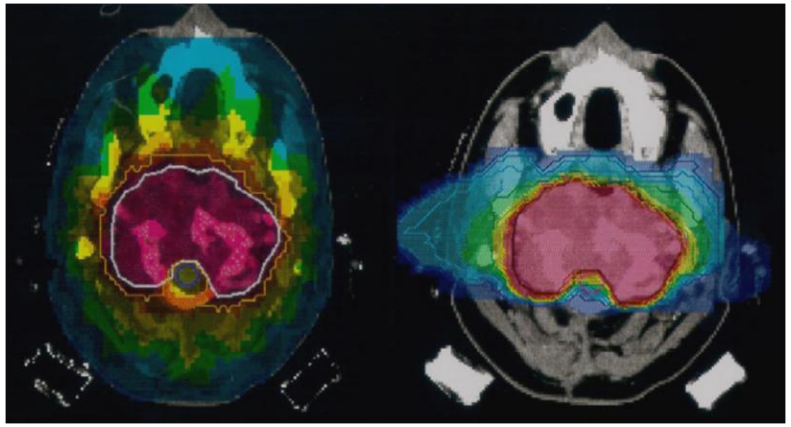
Tb 149	Tb 152	Tb 155	Tb 161
4.2 m / 4.1 h	4.2 m / 17.5 h	5.32 d	6.90 d
ε β+ α 3.99 γ 796; 165...	ε α 3.97 β+ 1.8 γ 352; 165...	ε γ 87; 105;... 180, 262	β- 0.5; 0.6... γ 26; 49; 75... e-
	ε β+ 2.8... γ 344; 586; 271...		
	ε; β+... γ 344; 411...		



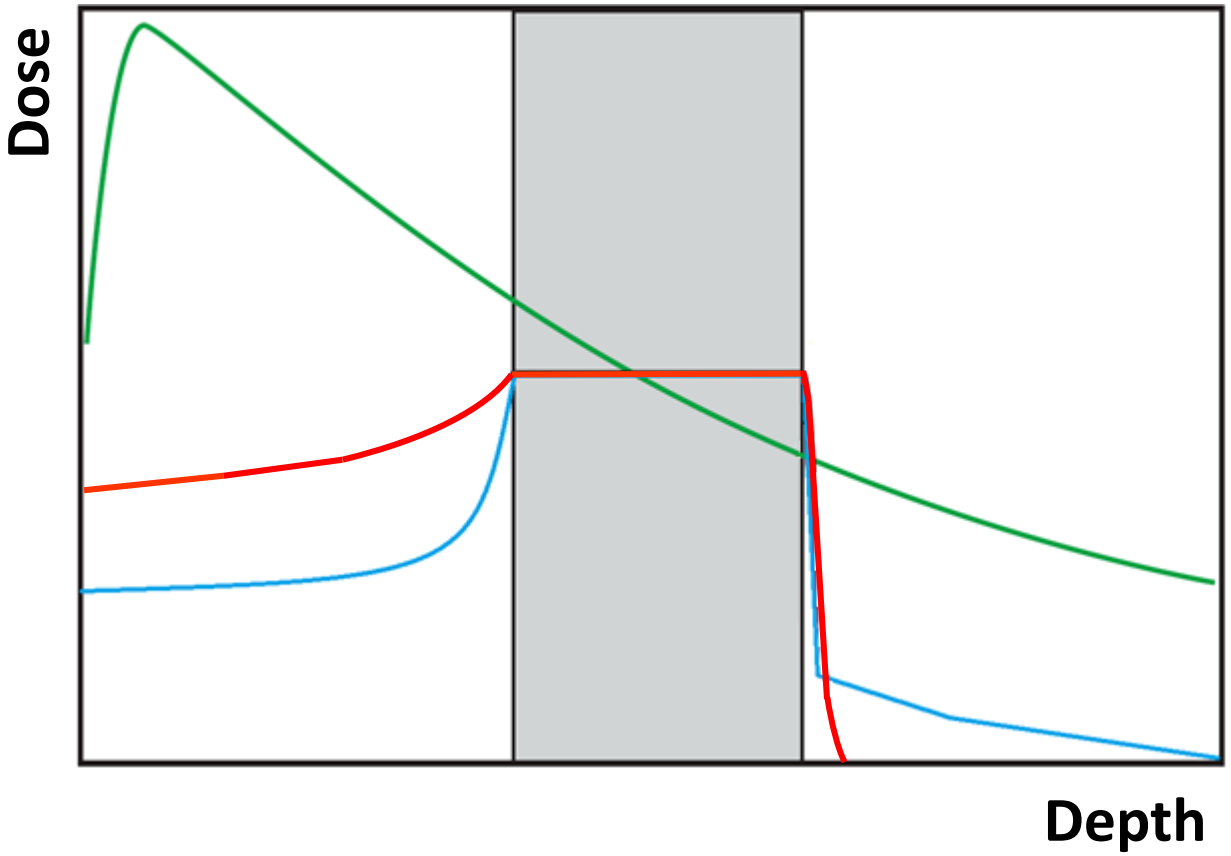


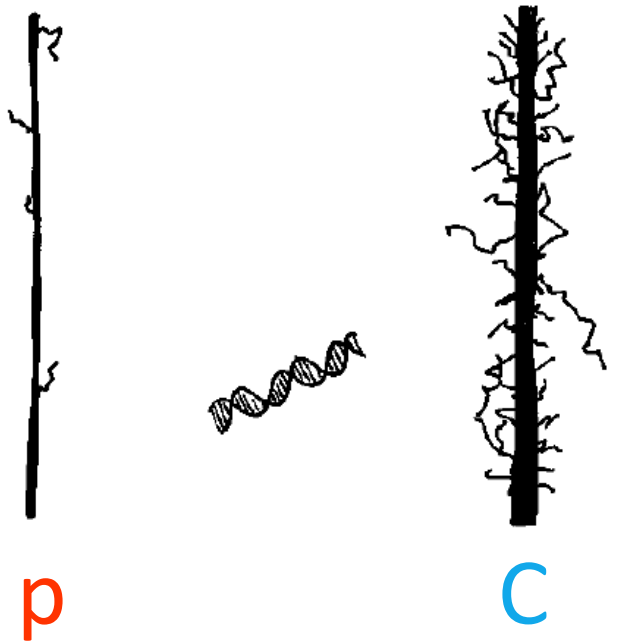
γ p





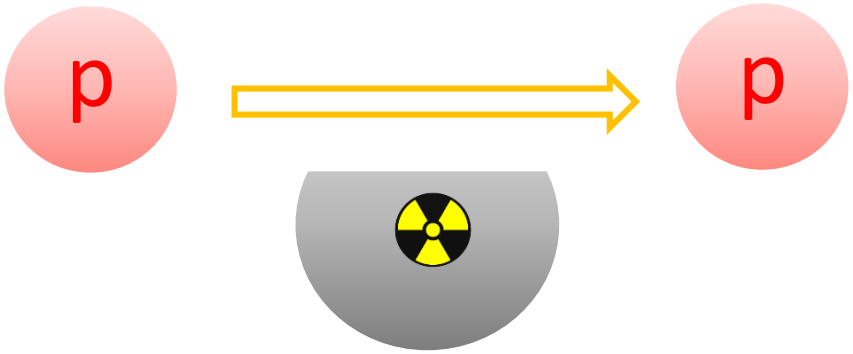
γ p

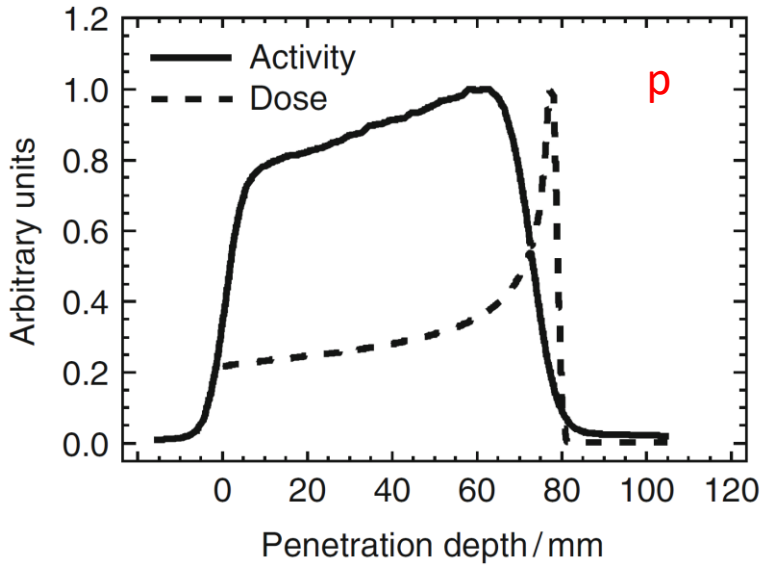

Dose
Depth

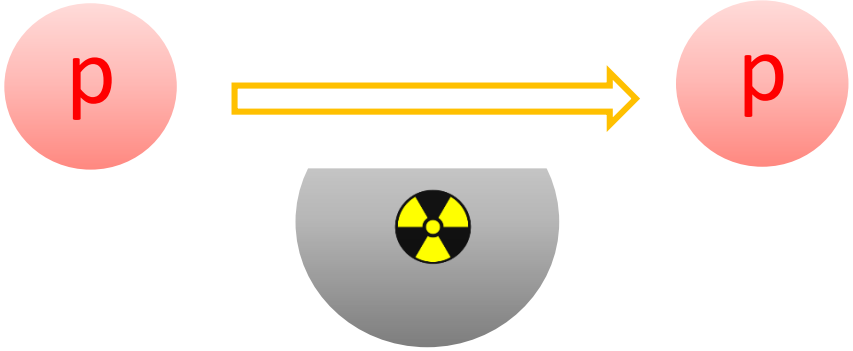

p
C

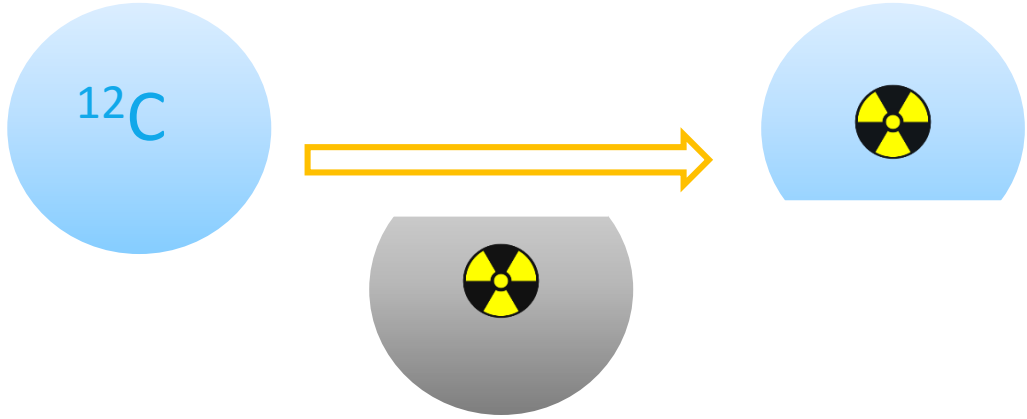
p

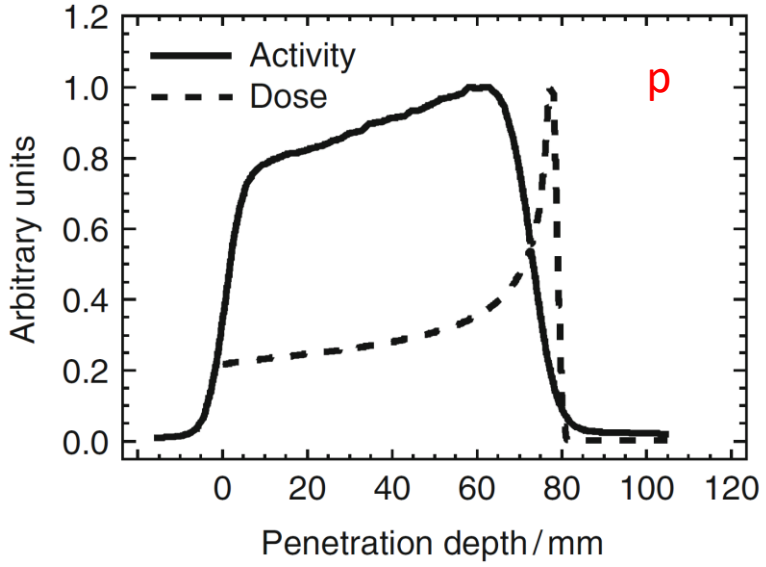
C

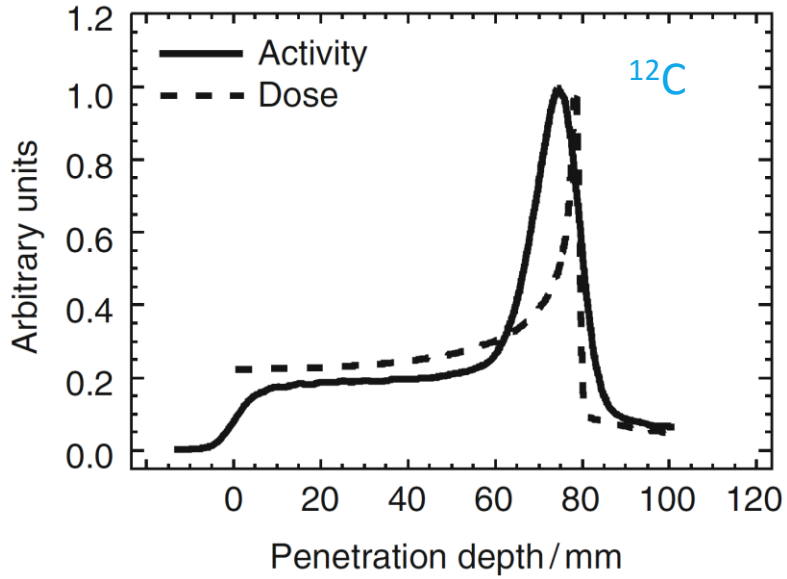

p
p

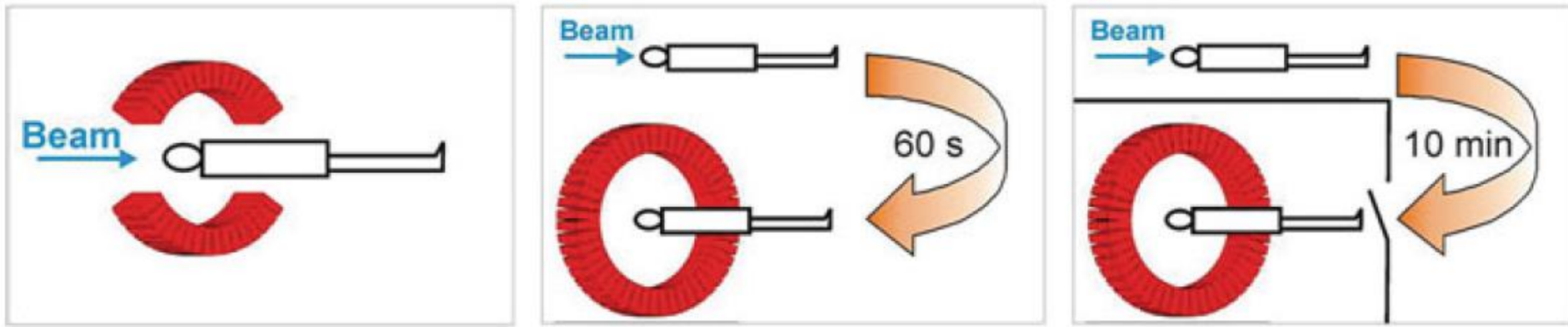

Activity
Dose
p
Arbitrary units
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
80
100
120
Penetration depth / mm

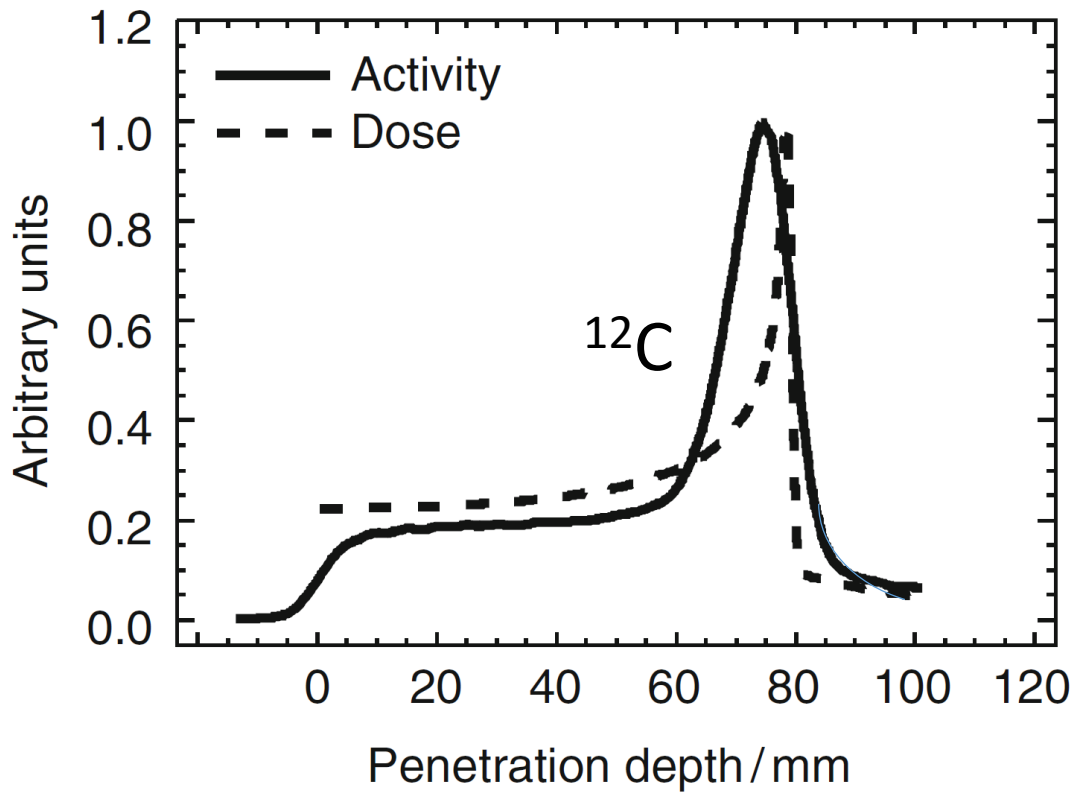

p
p

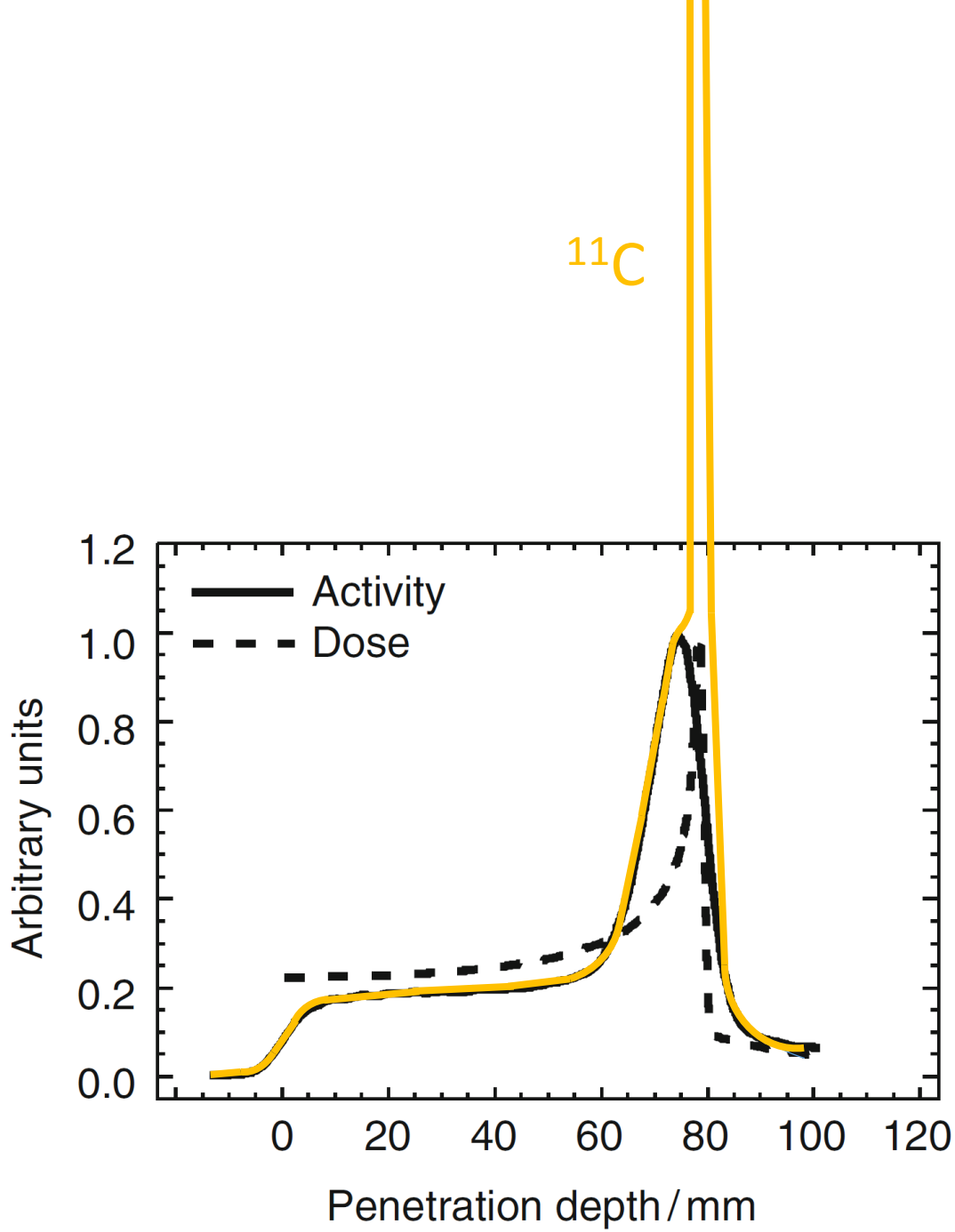

12C

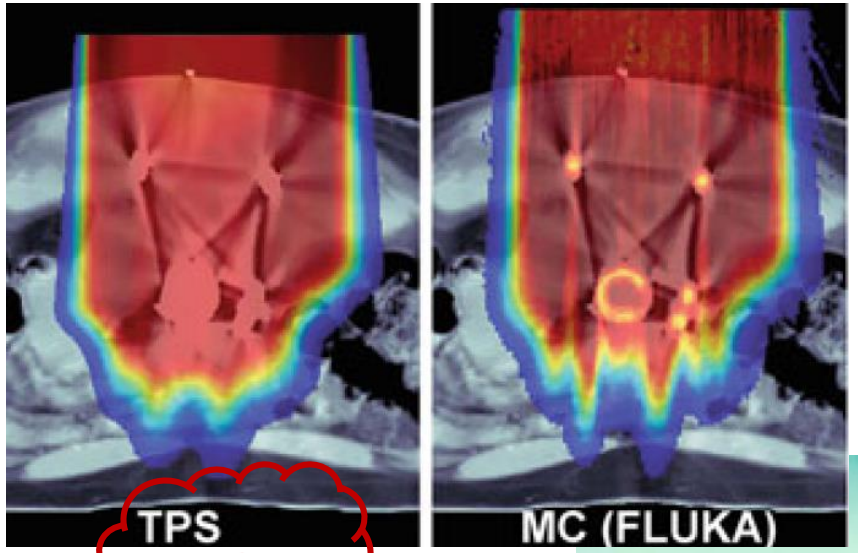

Activity
Dose
p
Arbitrary units
Penetration depth / mm
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0
20
40
60
80
100
120

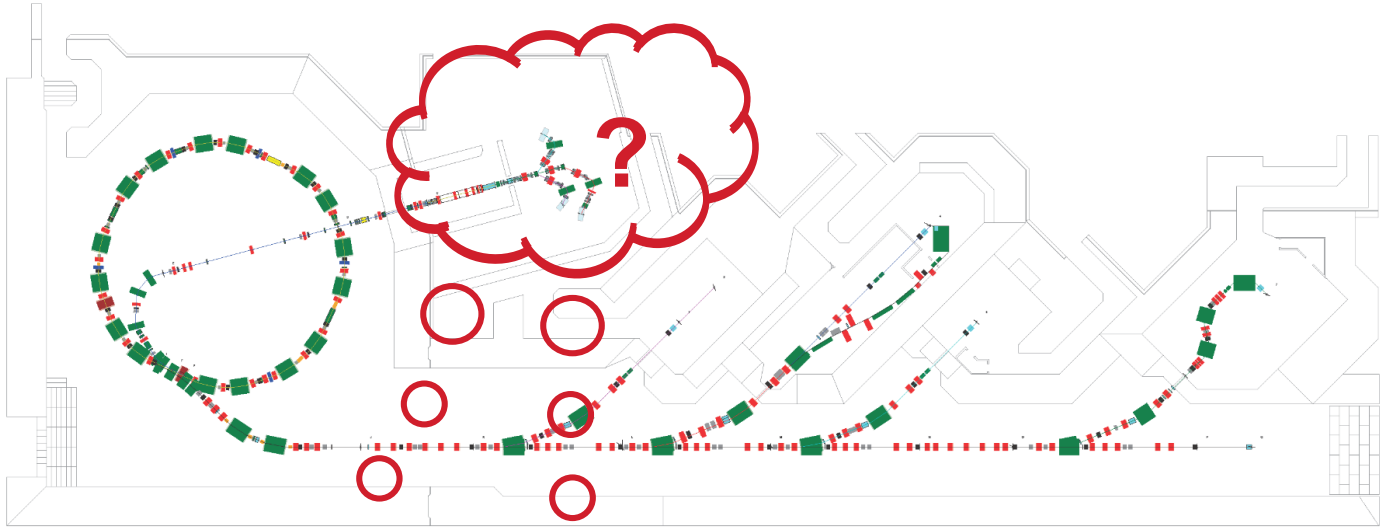

Activity
Dose
12C
Arbitrary units
Penetration depth / mm
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0
20
40
60
80
100
120

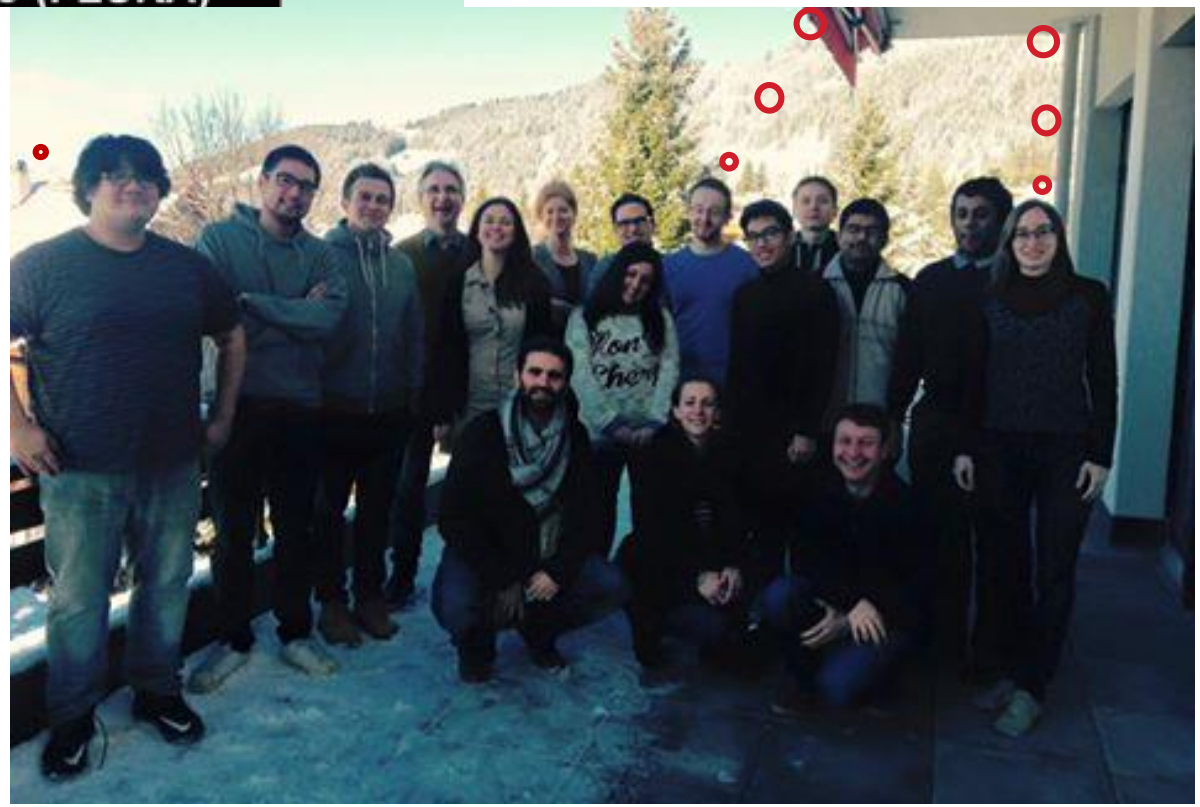

Beam
Beam
60 s
Beam
10 min

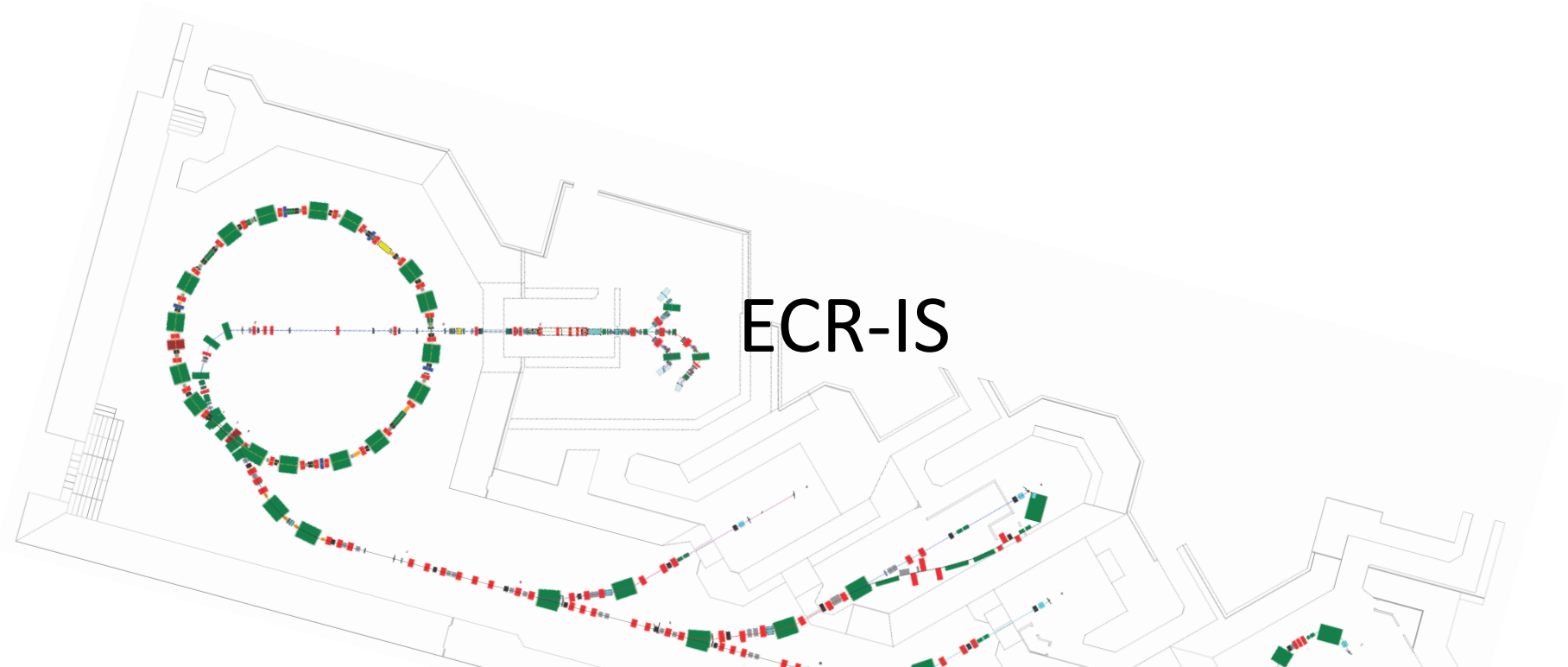

Activity
Dose
^{12}C
Arbitrary units
Penetration depth / mm
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0
20
40
60
80
100
120


^{11}C
Activity
Dose
Arbitrary units
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
80
100
120
Penetration depth / mm


TPS
MC (FLUKA)

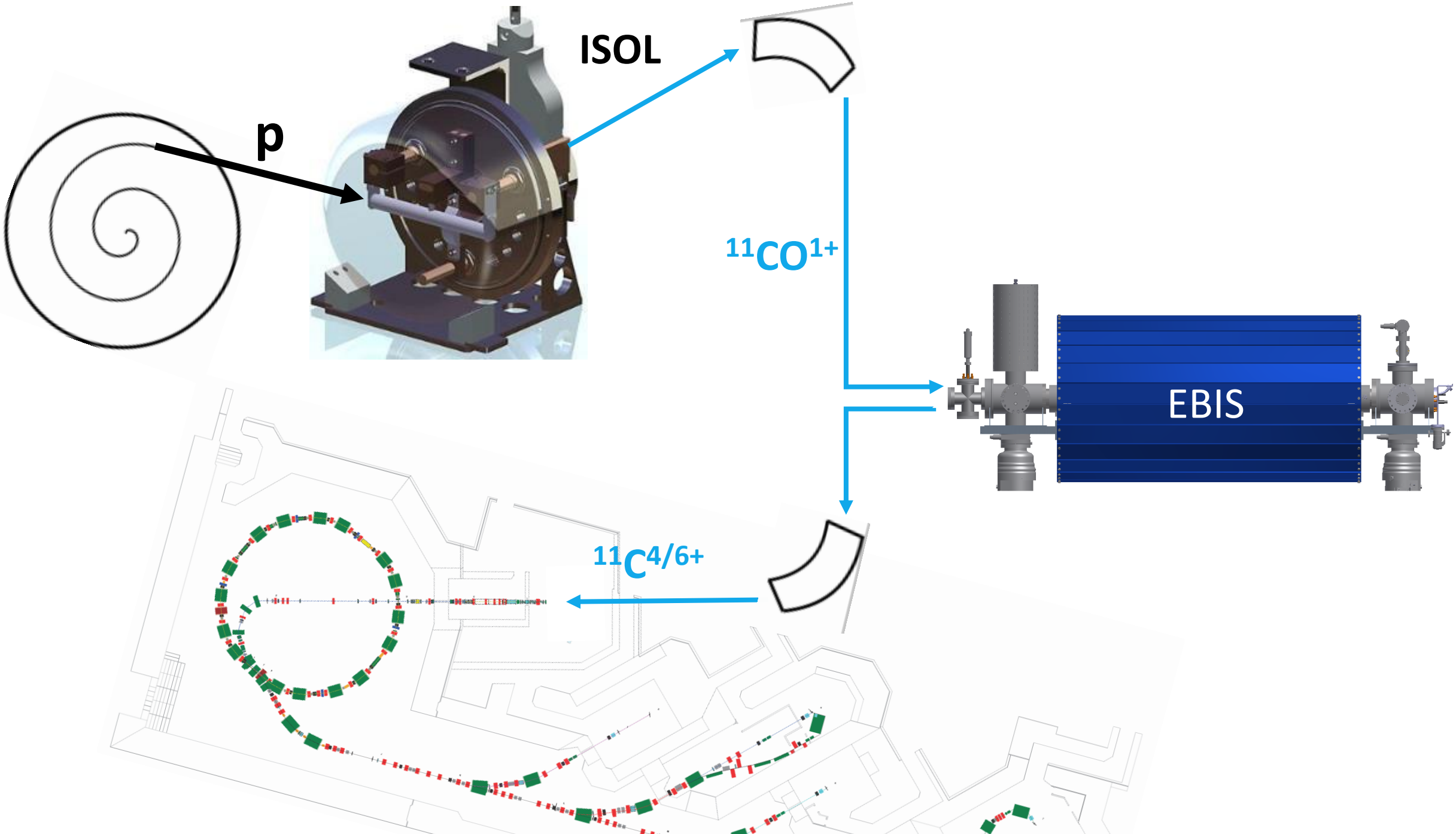


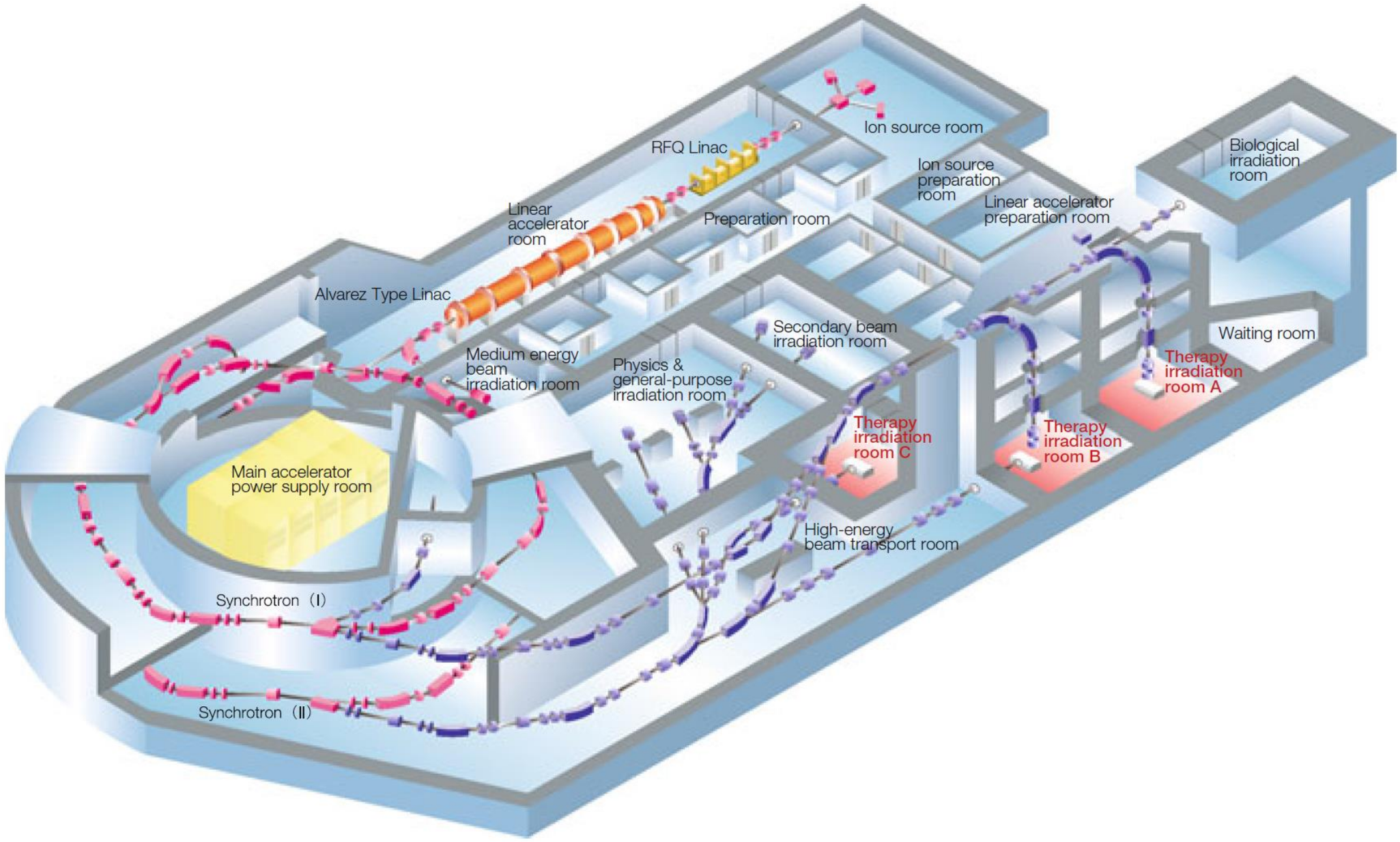


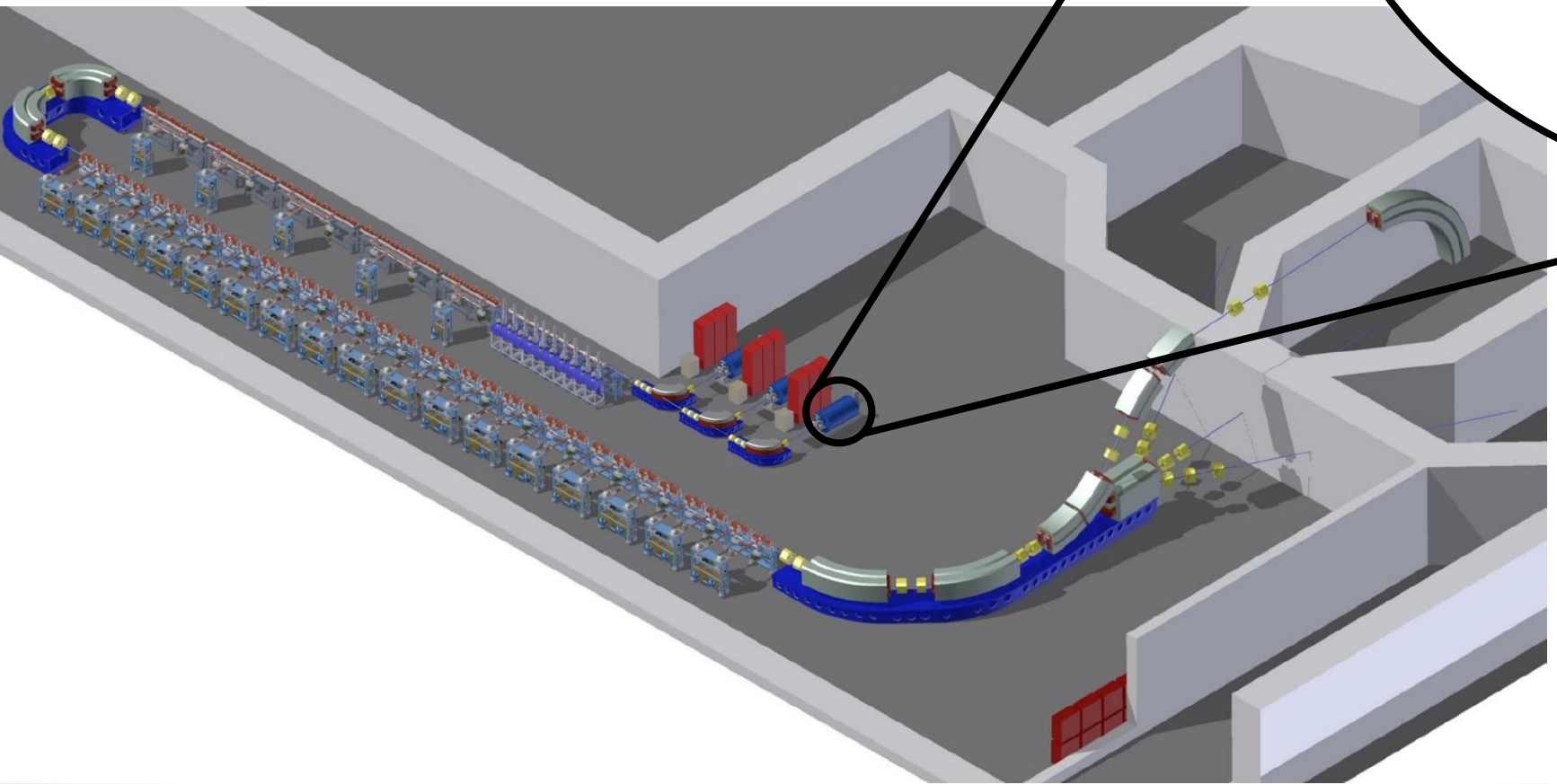


ECR-IS


ECR-IS


p
ISOL
$^{11}CO^{1+}$
EBIS
$^{11}C^{4/6+}$


Ion source room
RFQ Linac
Ion source preparation room
Biological irradiation room
Linear accelerator room
Preparation room
Linear accelerator preparation room
Alvarez Type Linac
Secondary beam irradiation room
Waiting room
Medium energy beam irradiation room
Physics & general-purpose irradiation room
Therapy irradiation room A
Therapy irradiation room C
Therapy irradiation room B
Main accelerator power supply room
High-energy beam transport room
Synchrotron (I)
Synchrotron (II)



Picture References

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