

Central Nervous System Tumor

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TABLE 2. Histopathologic typing of central nervous system tumors:WHO classification

Tumors of neuroepithelial tissue

- Astrocytic tumors (astrocytoma, glioblastoma, pilocytic astrocytoma)
- Oligodendroglial tumors (oligodendroglioma, anaplastic oligodendroglioma)
- Ependymal tumors (ependymoma, anaplastic ependymoma)
- Mixed gliomas (oligoastrocytoma, others)
- Choroid plexus tumors
- Neuronal tumors (gangliocytoma, ganglioglioma, neuroepithelioma)
- Pineal tumors (pineocytoma, pineoblastoma)

Embryonal tumors

- Medulloepithelioma
- Neuroblastoma
- Ependymblastoma
- Primitive neuroectodermal tumors, medulloblastoma (posterior fossa, cerebellar),

Tumors of meningotheial cells

- Meningioma
- Malignant meningioma

Tumors of uncertain histogenesis

- Hemangioblastoma

Germ cell tumors

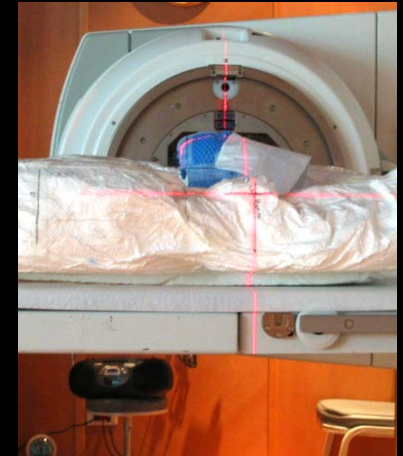
- Germinoma
- Embryonal carcinoma
- Endodermal sinus tumor
- Choriocarcinoma
- Teratoma
- Mixed germ cell tumors

Tumors of the sellar region

- Pituitary adenoma
- Craniopharyngioma

POSITIONING AND IMMOBILIZATION

- Head Immobilization System
- Craniospinal irradiation (CSI)
- Stereotactic radiosurgery (SRS)
- Stereotactic radiotherapy (SRT)



RADIATION THERAPY

- External-beam radiation therapy
- Stereotactic RadioSurgery SRS
Stereotactic RadioTherapy SRT
Target cannot exceed 3 cm
Distant from critical structures
(optic nerves and brainstem)



RADIATION THERAPY TECHNIQUES

- Pertinent Anatomic Landmarks
- Treatment Setup
- Treatment Volume in Brain Tumors

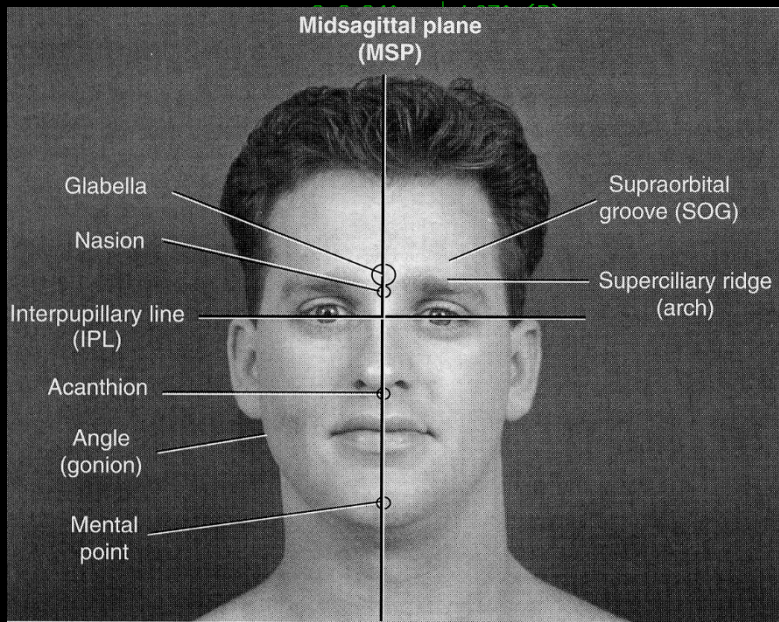
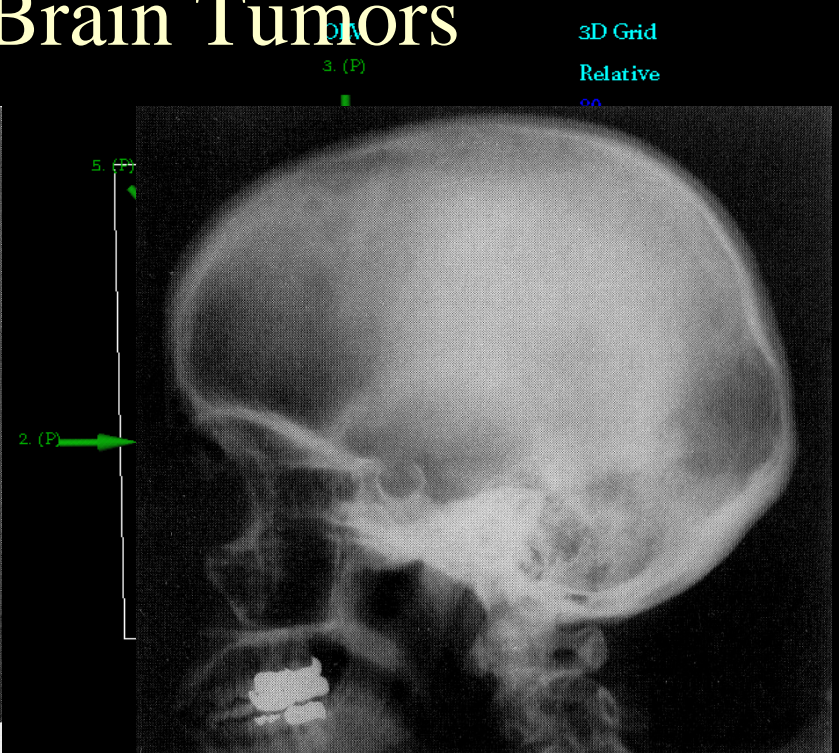


Fig. 11-62. Body planes and landmarks.



中樞神經系統腦瘤

兒童腦瘤

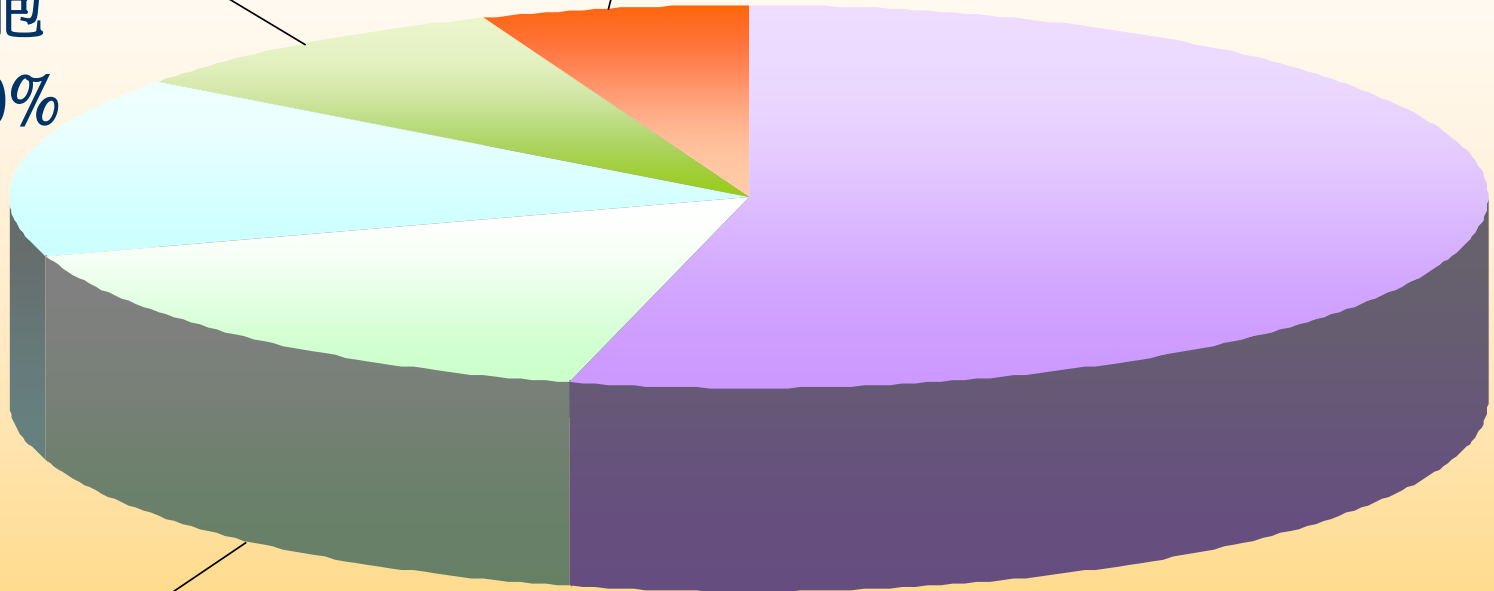
兒童腦瘤

- Pathology: 原發性瘤及轉移性瘤
- 原發性腫瘤-星狀細胞瘤、髓母細胞瘤 (medulloblastoma)、生殖細胞瘤、顱咽管瘤、及室管膜瘤

顱咽管瘤,
7.60%

室管膜瘤,
5.20%

生殖細胞
瘤, 13.40%



髓母細胞瘤,
14.20%

星狀細胞
瘤, 47.10%

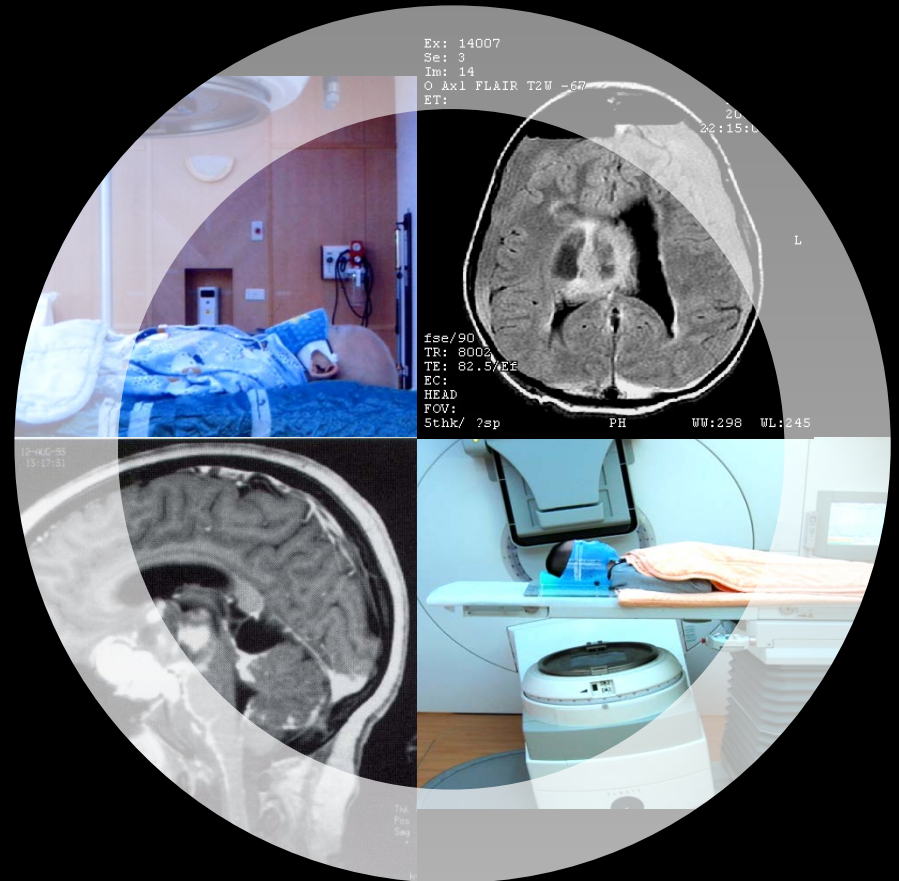
原發性腫瘤

TABLE 3. Relative incidence of common brain tumors in children

Supratentorial tumors	45-50%	Infratentorial tumors	50-55%
Astrocytoma	23%	Medulloblastoma	20%
Malignant gliomas (anaplastic astrocytoma,)	6 %	Astrocytoma	15%
Craniopharyngioma	6 %	Brainstem glioma	10%
Embryonal tumors (PNET and others)	4 %	Ependymoma	6%
Pineal region tumors/intracranial germcell tumors	4 %		
Ependymoma	3 %		
Oligodendroglioma	2 %		
Other (meningioma, ganglioma, choroidplexus tumors, others)	2 %		

Central Nervous System Tumor in Children

- Medulloblastoma
- Pilocytic astrocytoma
- Neuroblastoma
- Ependymoma



Medulloblastoma



Medulloblastoma

- 好發於小腦蚓部 (vermis)
- 小孩多，男性多於女性。10 y/o
- Cerebellar medulloblastoma with hydrocephalus
- CT&MRI有好的enhanced

Location

STAGE	DEFINITION
Tumor	
T ₁	Tumor <3 cm in diameter and limited to the midline position in the vermis, the roof of the fourth ventricle, and less frequently to the cerebellar hemispheres
T ₂	Tumor >3 cm in diameter, further invading one adjacent structure or partially filling the fourth ventricle
T _{3a}	Tumor invading two adjacent structures or completely filling the fourth ventricle with extension into the aqueduct of Sylvius, foramen of Magendie, or foramen of Luschka, thus producing marked internal hydrocephalus
T _{3b}	Tumor arising from the floor of the fourth ventricle or brain stem and filling the fourth ventricle
T ₄	Tumor further spreading through the aqueduct of Sylvius to involve the third ventricle or midbrain , or tumor extending to the upper cervical cord

Metastases	
M ₀	No evidence of gross subarachnoid or hematogenous metastasis
M ₁	Microscopic tumor cells found in CSF
M ₂	Gross nodule seedings demonstrated in the cerebellar or cerebral subarachnoid space or in the third or lateral ventricles
M ₃	Gross nodule seedings in the spinal subarachnoid space
M ₄	Extraneuroaxial metastasis

Medulloblastoma

- 腫瘤及其周圍的水腫造成顱內壓升高(IICP)：
 - 頭痛
 - 噁心、嘔吐(壓迫到嘔吐中樞)、視乳突水腫。
 - 意識模糊：記憶力降低，或呆滯、躁動等
- 運動失調或步態不穩
- 肢體無力或感覺障礙

症狀

Medulloblastoma

1. Aggressive surgery, without compromising neurologic function.

2. Radiotherapy :major reason for improvement in survival.(CSI:cranial spinal irradiation)

- 5000-6000 cGy to posterior fossa, and 3000-3600cGy to craniospinal axis.

3. Chemotherapy

治療

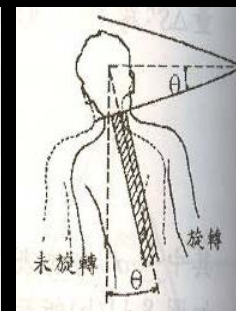
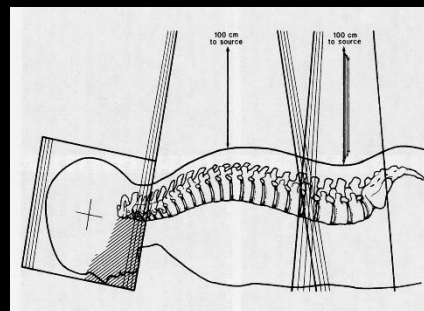
Surgery



小腦髓母細胞瘤手術示意

Craniospinal irradiation

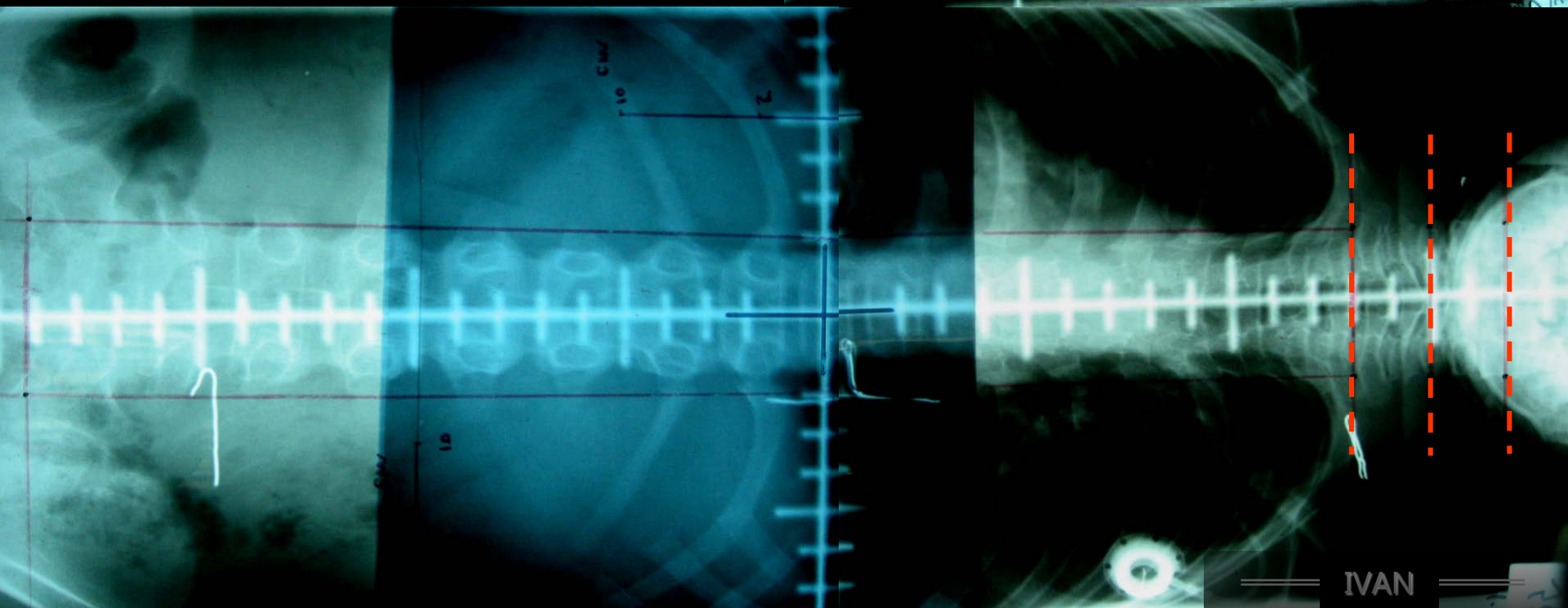
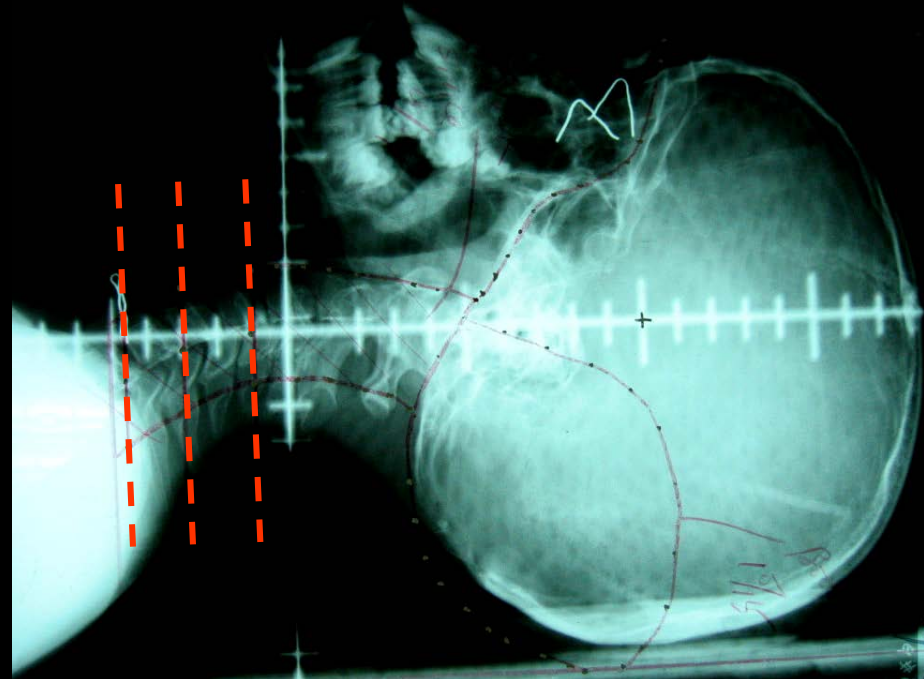
- 治療 medulloblastoma, neuroectodermal tumor, 需治療 entire CNS
- 方式：
 - 兩個頭部側面對照照野，加上脊髓後側照野
 - 轉 collimator：角度計算
 - moving junction：避免交界處 overdose

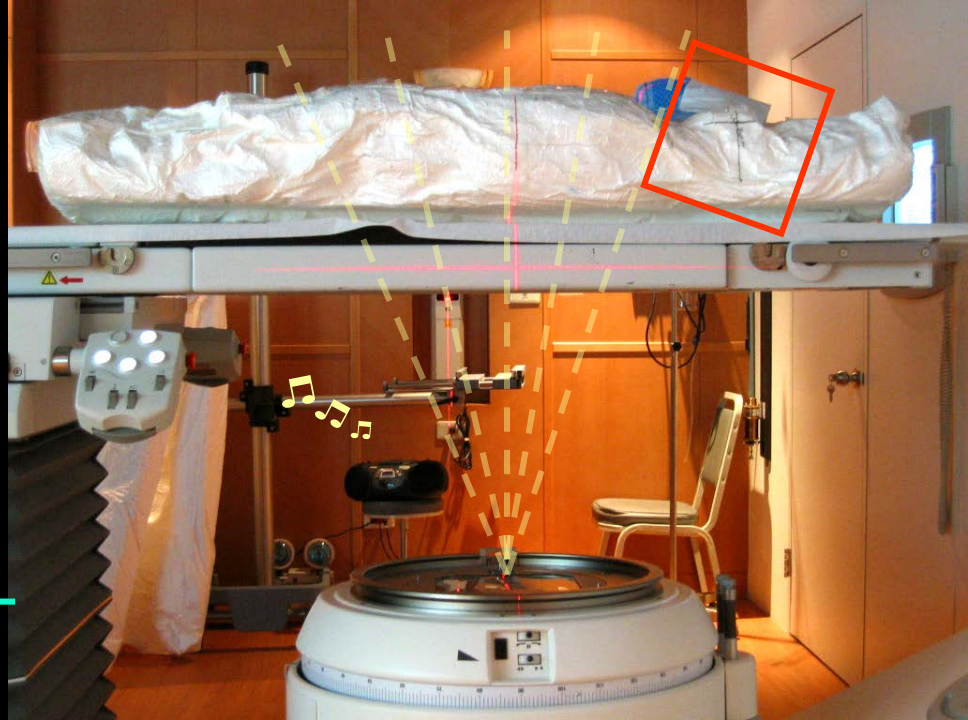
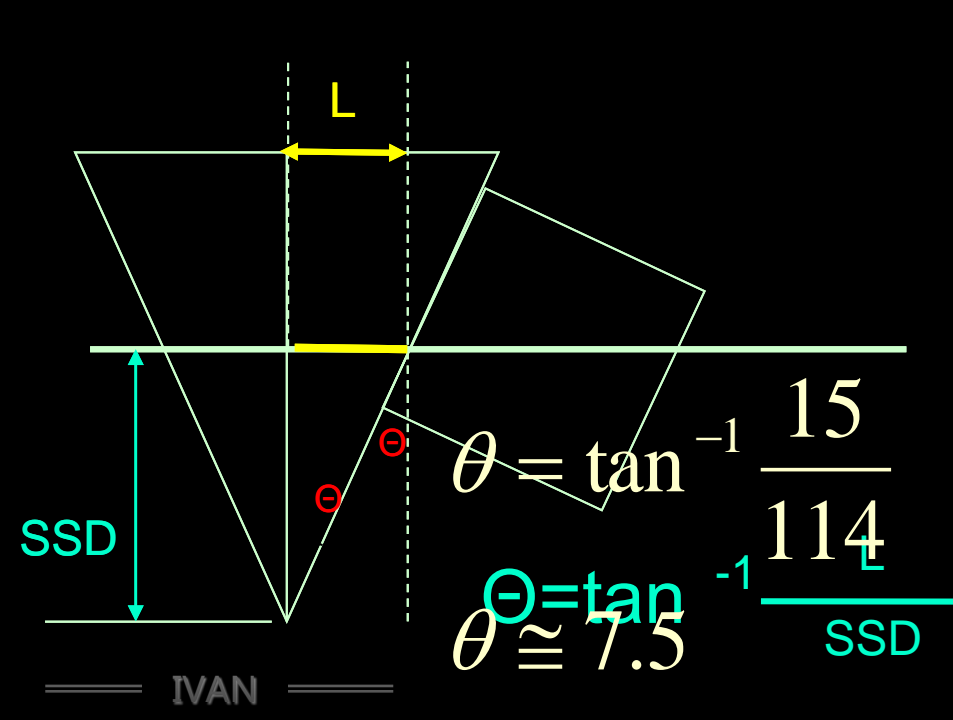
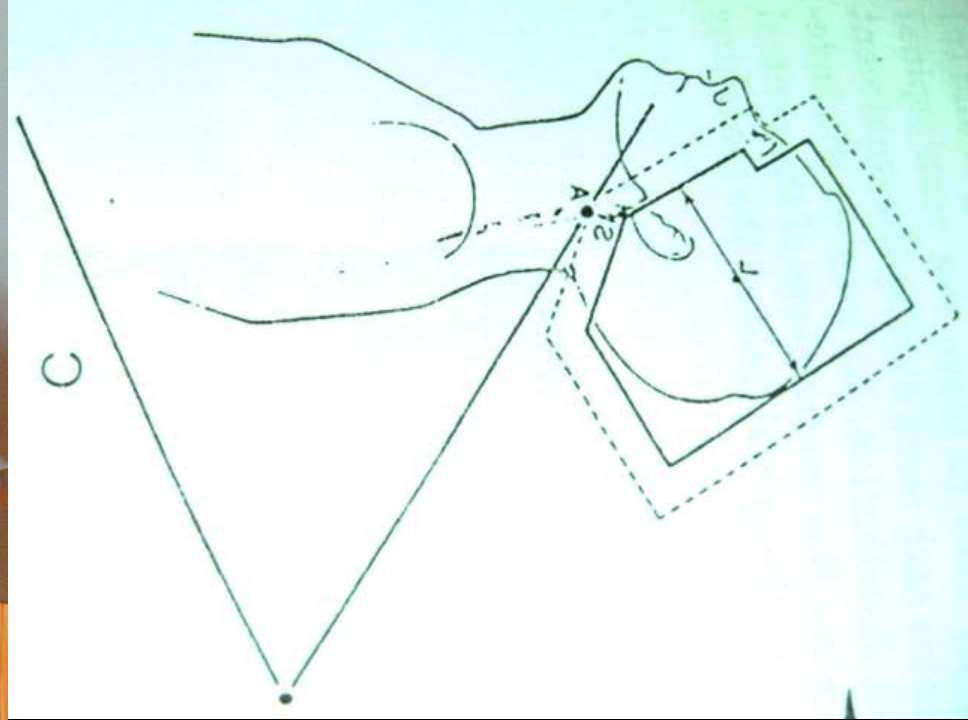


Radiotherapy

Moving junction

- 3個 junction
- 接點設4公分

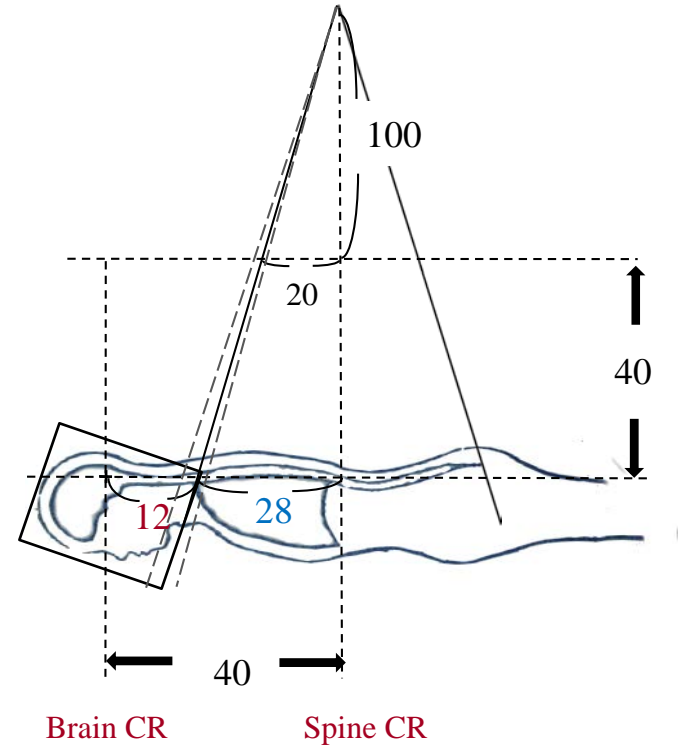




計算各組junction參數

- 依照以上的方式，繼續計算出各組junction的數值。

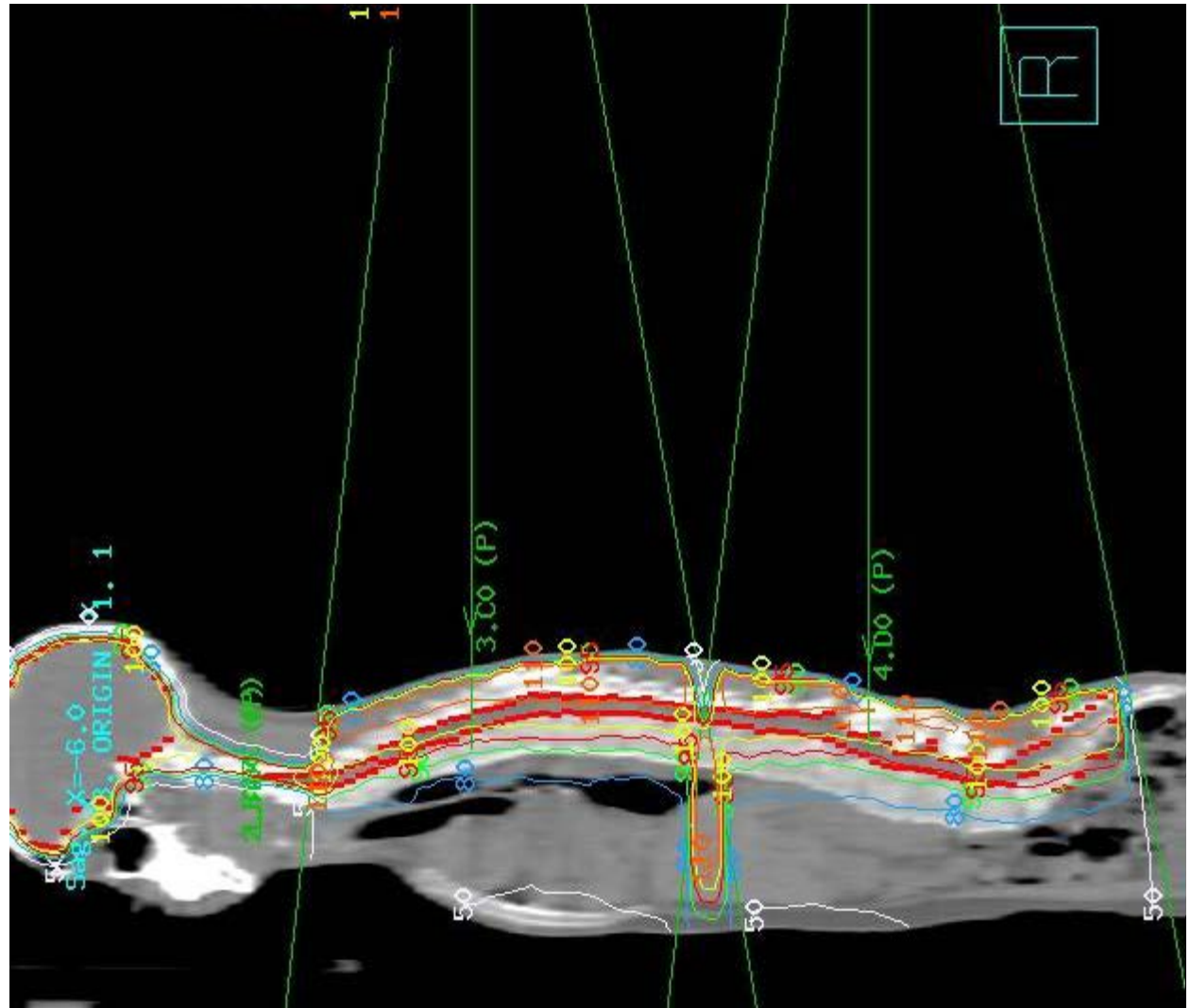
$$\theta = \tan^{-1} \frac{x}{SSD}$$



junction	Spine ; Y2	Brain ; Y1	Brain ; Coll.angle
A	28	12	11.3
B	26	14	10.52
C	30	10	12.1

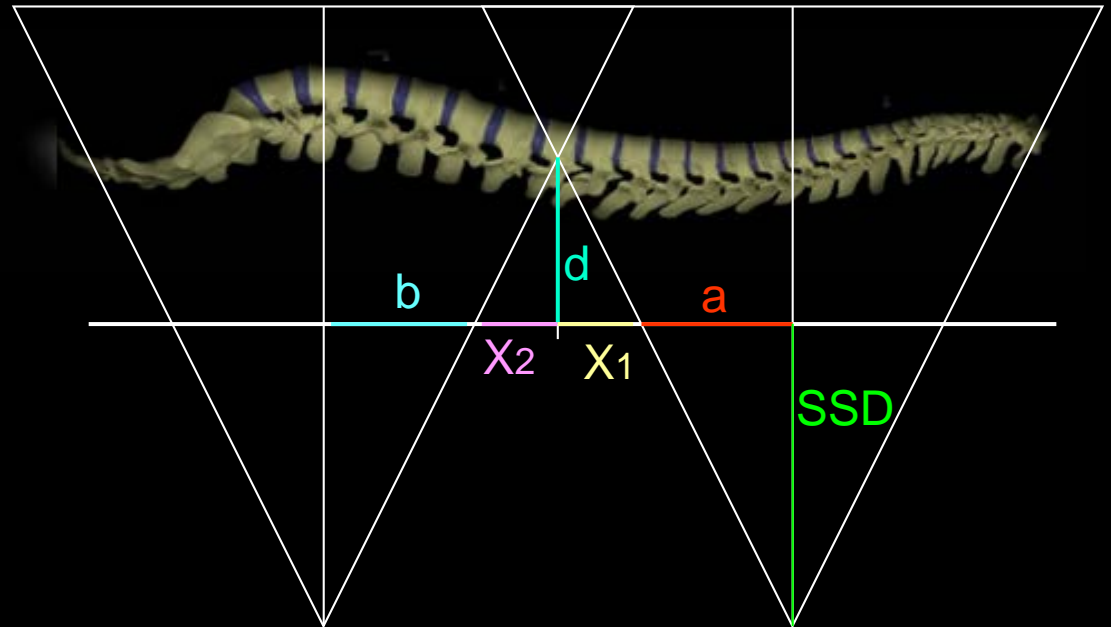
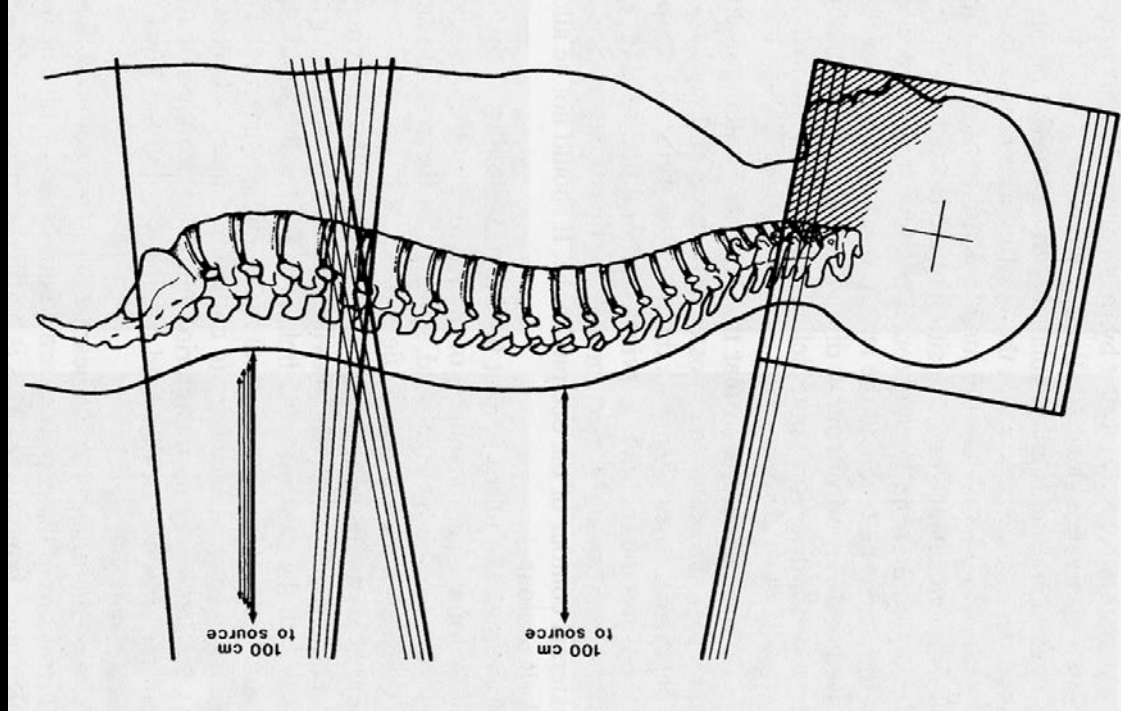
計算體表gap

Spine的部份可設計成兩個射束治療，但即使計算的十分完美，在接點處的下方劑量仍會過高。



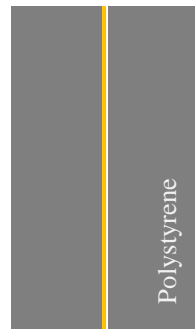
Gap

$$\begin{aligned} \text{Gap} &= X_1 + X_2 \\ &= \frac{(a + b)d}{SSD} \end{aligned}$$

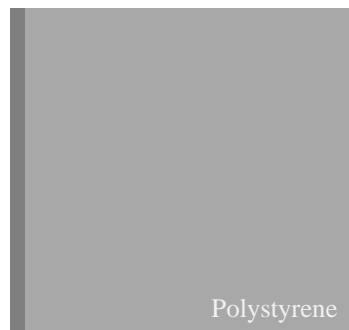


實驗一

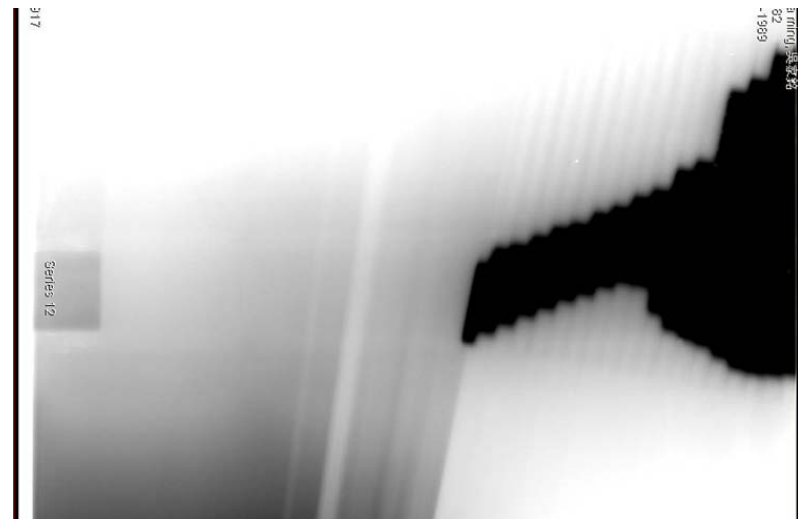
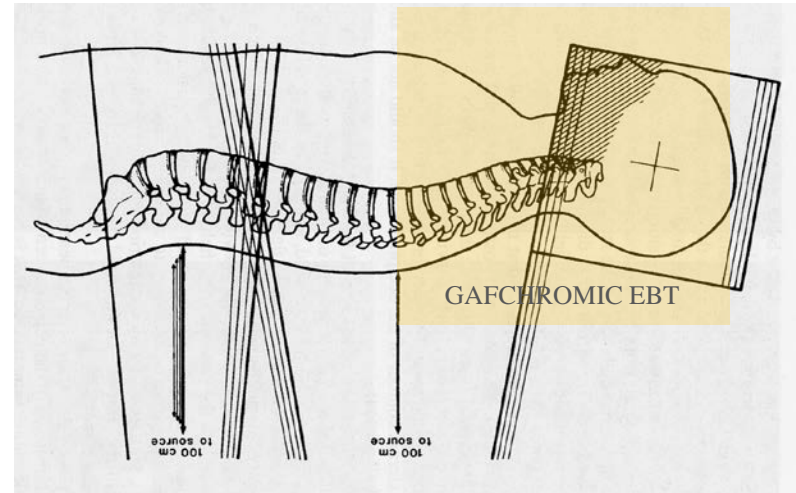
- ◆ GAFCHROMIC EBT
- ◆ Polystyrene



AP view



LAT view



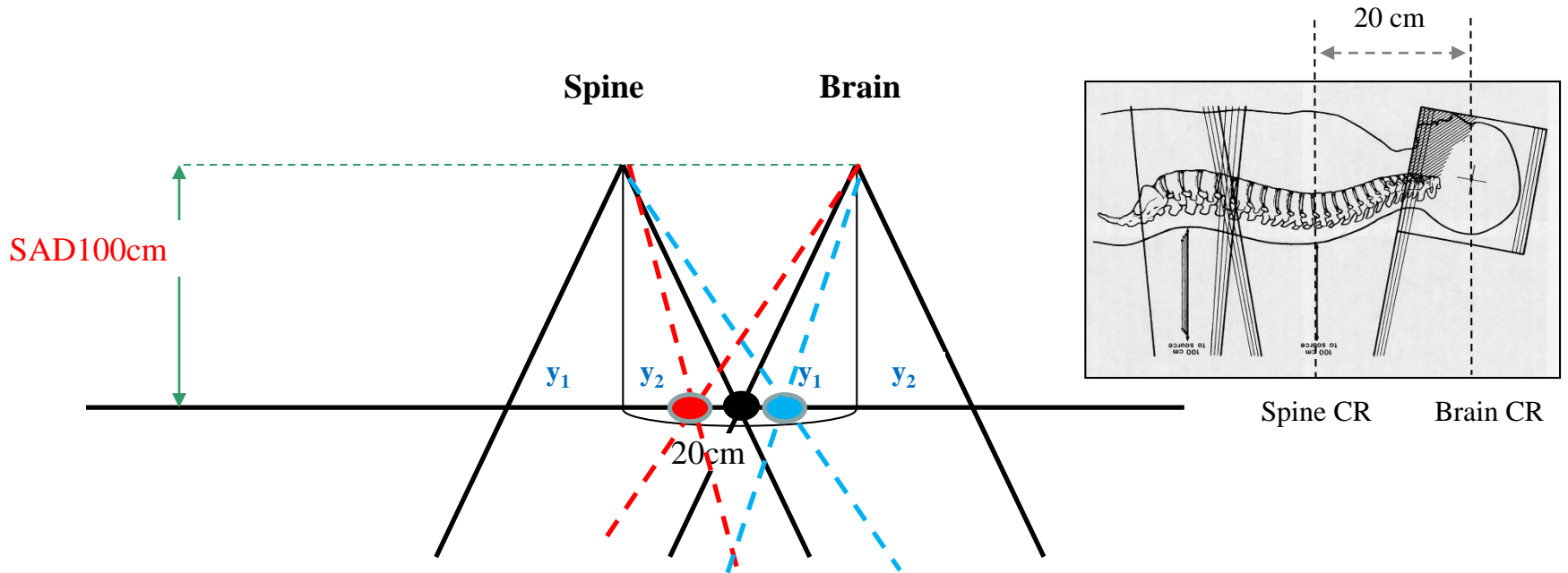
實驗二

- GAFCHROMIC EBT
 - 2 Field (Brain & Spine)
 - 3 Junction、2cm
 - 總劑量 < 800 cGy



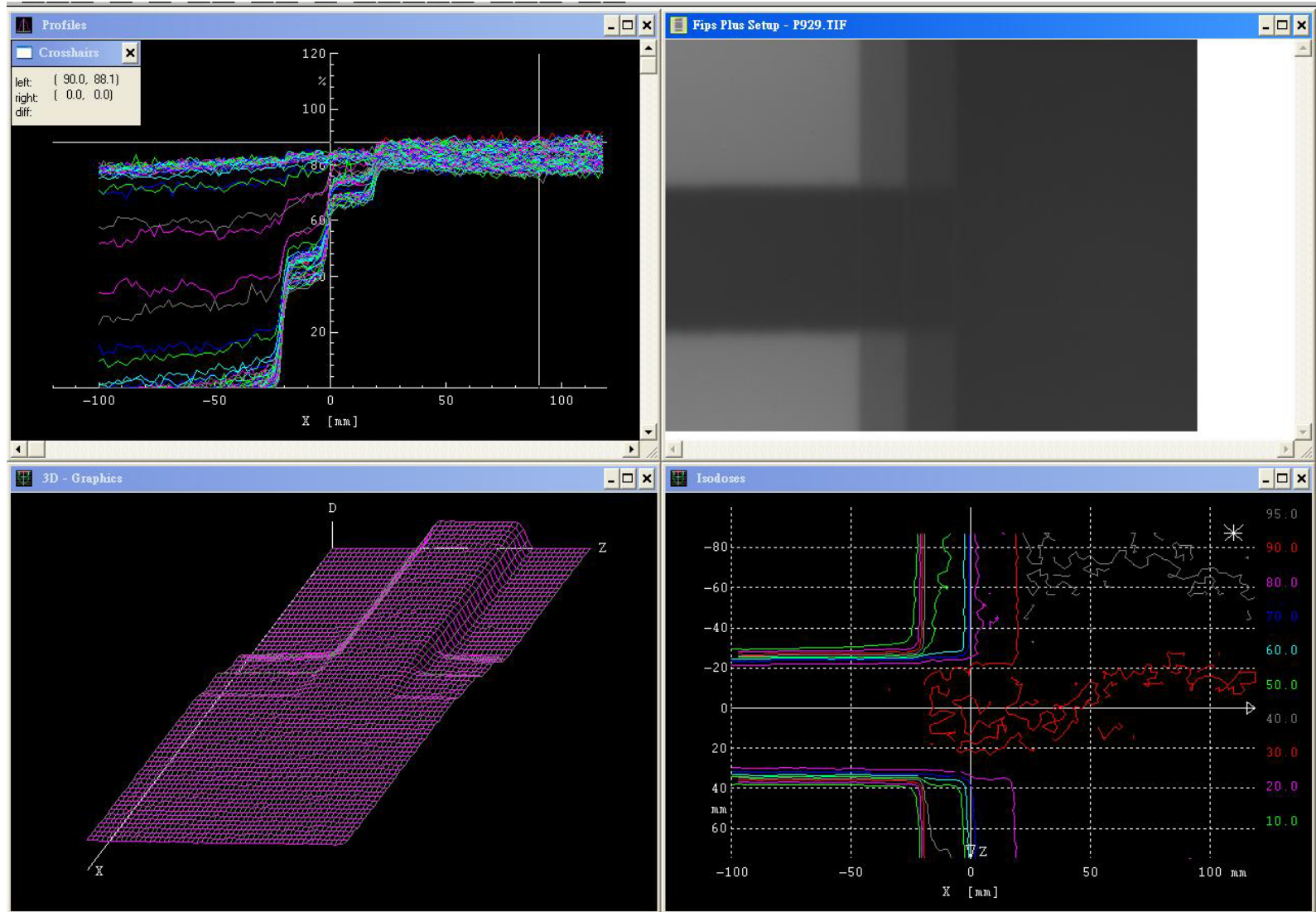
實驗二

3 Junction、2cm



次數 Field	①	②	③	①	②	③	①	②	③	①
Brain y ₁	10	8	12	10	8	12	10	8	12	10
Spine y ₂	10	12	8	10	12	8	10	12	8	10

實驗二



治療流程

診察室診療

模型室治療配件製作

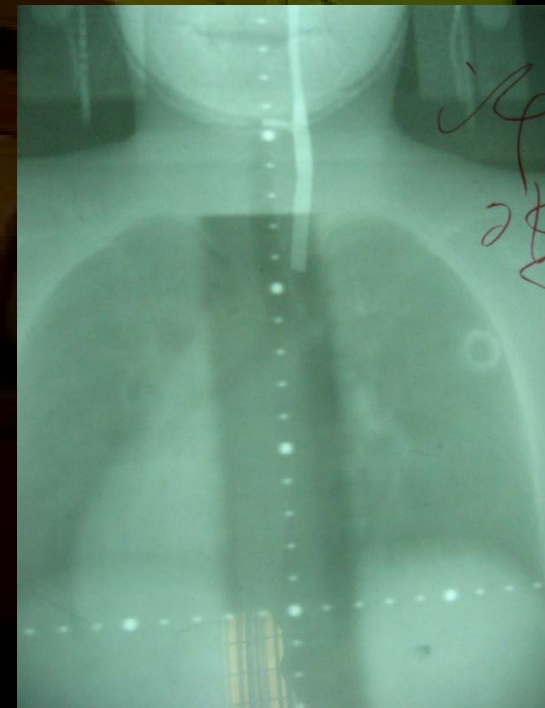
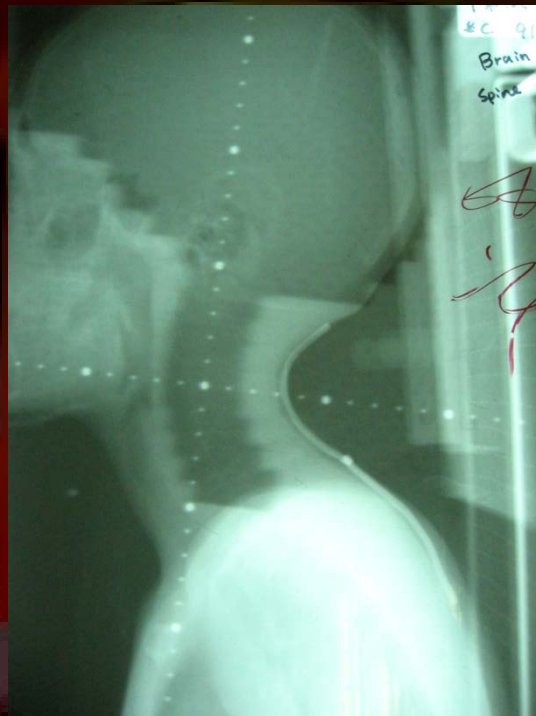
模擬攝影室定位

治療計畫與計量核算

治療室進行驗證攝影

放射治療

療程結束



驗證一

0.5 cm

(1)

MF: 0.72

0.5cm

(2)

SSD:130

Junction opint A:142

MF: 0.89

-0.2cm

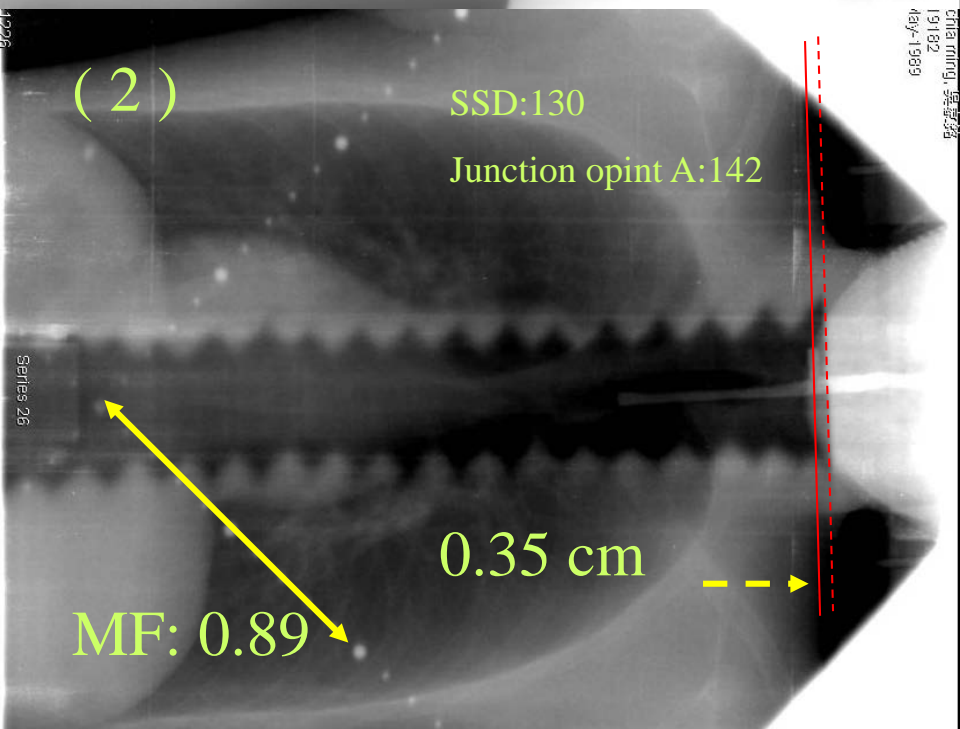
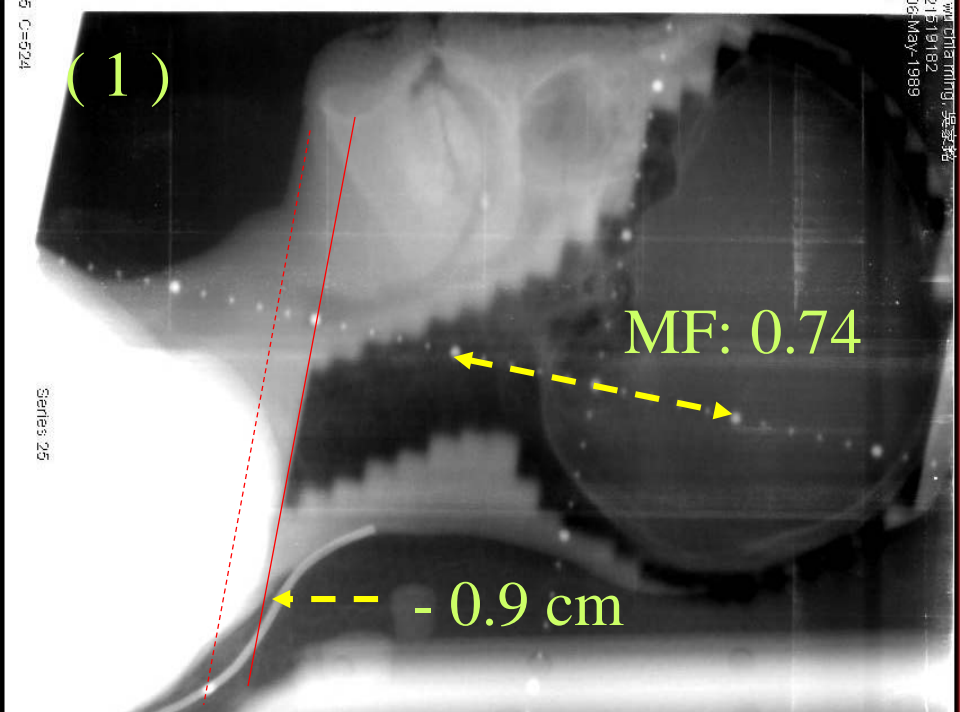
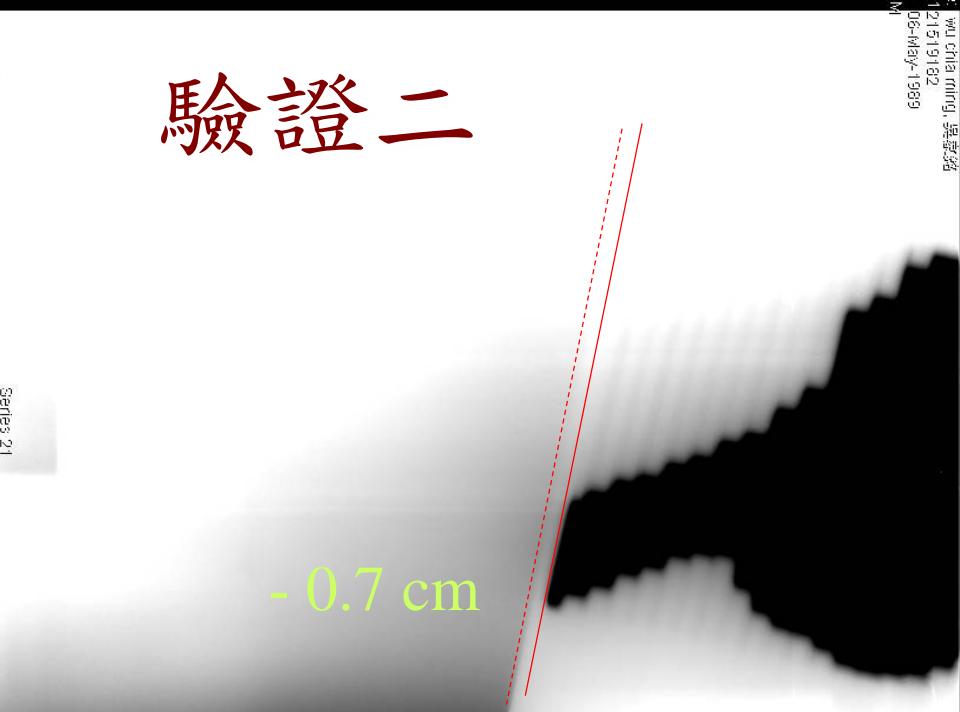
--- : Mark 的位置 Over mark 為正數
 ——— : Field 的位置 Under mark 為負數

(1) $0.5 / 0.72 = 0.69 \text{ cm}$

(2) $-0.2 \times 1.42 / 0.89 = -0.32 \text{ cm}$

$0.69 + (-0.32) = 0.37 \text{ cm}$

驗證二



- - - : Mark 的位置 Over mark 為正數
— — — : Field 的位置 Under mark 為負數

(1) $- 0.9 / 0.74 = - 1.2 \text{ cm}$

(2) $0.35 \times 1.42 / 0.89 = 0.6 \text{ cm}$

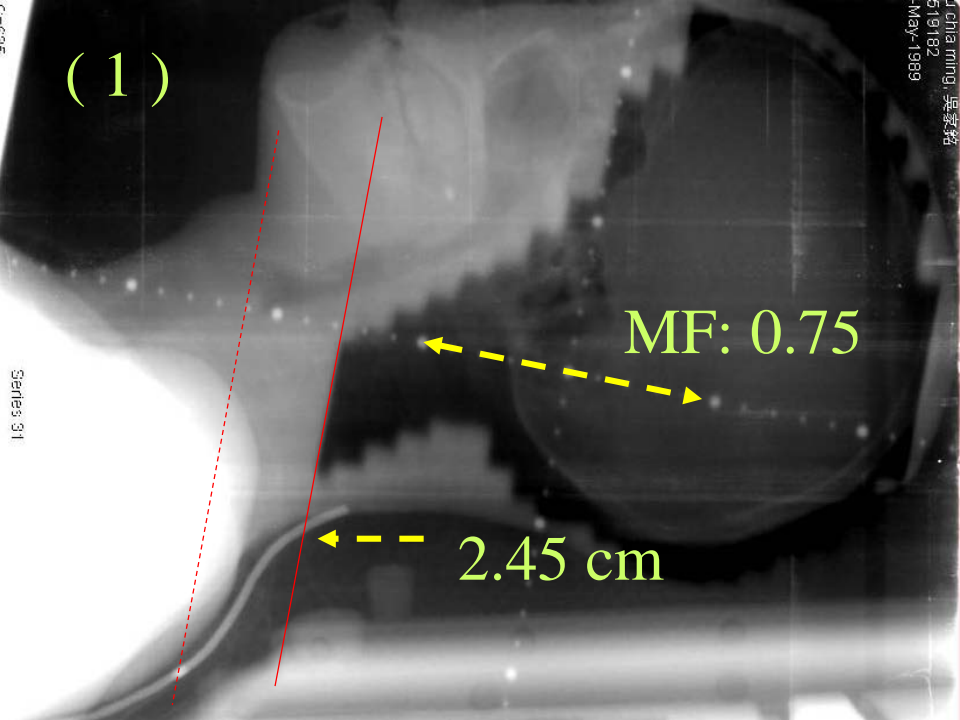
$- 1.2 + 0.6 = - 0.6 \text{ cm}$

==== IVAN ====

驗證三

0.1 cm

wu chiaoting, 吳家勳
519182
May-1989



(1)

MF: 0.75

2.45 cm

wu chiaoting, 吳家勳
519182
May-1989

(2)

SSD:130

Junction opint A:142

MF: 1.25

2.9 cm

wu chiaoting, 吳家勳
519182
May-1989

--- : Mark 的位置
— : Field 的位置

Over mark 為正數
Under mark 為負數

$$(1) 2.45 / 0.75 = - 3.2 \text{ cm}$$

$$(2) 2.9 \times 1.42 / 1.25 = 3.3 \text{ cm}$$

$$- 3.2 + 3.3 = 0.1 \text{ cm}$$

治療流程

診察室診療

模型室治療配件製作

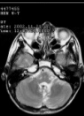
模擬攝影室定位

治療計畫與計量核算

治療室進行驗證攝影

放射治療

療程結束

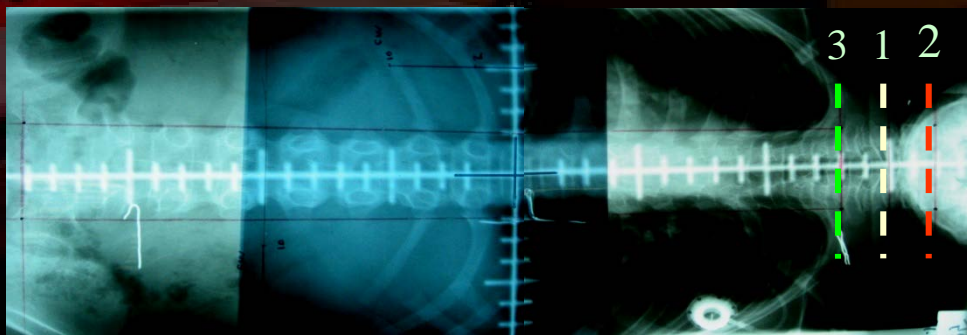


療程參數

			Head (Port A)				Head (Port B)				Spine (Port C)			
序			X1	X2	Y1	Y2	X1	X2	Y1	Y2	X1	X2	Y1	Y2
1	4	7	10	15	3	18	15	10	3	18	2	2	19	15
2	5	8	10	15	1	18	15	10	1	18	2	2	19	16.7
3	6	9	10	15	5	18	15	10	5	18	2	2	19	13.2

$$15 + \frac{2}{1.14} = 16.7 \text{ --- (2)}$$

$$15 - \frac{2}{1.14} = 13.2 \text{ --- (3)}$$



治療流程

診察室診療

模型室治療配件製作

模擬攝影室定位

治療計畫與計量核算

治療室進行驗證攝影

放射治療

療程結束(回診)

定期治療中檢查，請依規定
日至護理站報到接受醫師定
期治療檢查



結束治療



定期回院追蹤檢查



