

加速器的QA

基于TG142号报告的更新

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京津冀鲁地区放射物理专业组第十四次学术会议资料
本资料唯一合法下载地址: www.csmp.org.cn

AAPM TG-40 Report

TABLE II. QA of medical accelerators.

Frequency	Procedure	Tolerance ^a
Daily	Dosimetry	
	X-ray output constancy	3%
	Electron output constancy ^b	3%
	Mechanical	
	Localizing lasers	2 mm
	Distance indicator (ODI)	2 mm
	Safety	
	Door interlock	Functional
Monthly	Audiovisual monitor	Functional
	Dosimetry	
	x-ray output constancy ^c	2%
	Electron output constancy ^c	2%
	Backup monitor constancy	2%
	x-ray central axis dosimetry parameter (PDD, TAR) constancy	2%
	Electron central axis dosimetry parameter constancy (PDD)	2 mm @ therapeutic depth
	x-ray beam flatness constancy	2%
	Electron beam flatness constancy	3%
	x-ray and electron symmetry	3%
	Safety Interlocks	
	Emergency off switches	Functional
	Wedge, electron cone interlocks	Functional
	Mechanical Checks	
	Light/radiation field coincidence	2 mm or 1% on a side ^d
	Gantry/collimator angle indicators	1 deg
	Wedge position	2 mm (or 2% change in transmission factor)
	Tray position	2 mm
	Applicator position	2 mm
	Field size indicators	2 mm
	Cross-hair centering	2 mm diameter
	Treatment couch position indicators	2 mm/1 deg
	Latching of wedges, blocking tray	Functional
	Jaw symmetry ^e	2 mm

协和医院放疗科-日检

Trilogy 直线加速器日检及操作记录

一、机械精度检查

内容	Gantry Rotation Readout	Collimator Rotation Readout	Collimator Rotational Isocenter	Optical Distance Indicator	Field Size
标准	$< \pm 0.5^\circ$	$< \pm 0.5^\circ$	$< 2\text{mm}$	$< \pm 1\text{mm}$	$< 2\text{mm}$
结果					

二、激光灯检查

内容	Left Wall	Right Wall	Ceiling	Sagittal
标准	$< 2\text{mm}$	$< 2\text{mm}$	$< 2\text{mm}$	$< 2\text{mm}$
结果				

三、设备状态

内容	MLC	气泵	内循环水			SF6 Pressure	气压
			水温	水压	水位		
标准	Pass	Pass	40°C	65-85 psi	H/M/L	30-34 psi	40-50 psi
结果							

四、安全检查

限光筒防碰撞功能	Portal Vision 防碰撞功能	OBI 防碰撞功能	控制台 键盘钥匙	控制台键盘及 BEAM ON/OFF
防护门 连锁	中子门防挤压功能	出束警示灯及蜂鸣器	监视对讲 广播系统	

五、剂量检查 标准值:100 偏差 $<2\%$

能量	6E	9E	12E	16E	20E	18X	6X
读数							

六、OBI 日检

日检项目	1、KVS 金属表面与加速器中心处距离	2、PCB 板中心与 OBI 数字标尺中心偏差	3、PCB 板中心到横于 20CM 标记点的距离	4、铅门开为 10CM×10CM 时 实际大小
标准	85.2CM $\pm$ 2MM	$\pm$ 1MM	10CM $\pm$ 1MM	10CM $\pm$ 2.5MM
结果				

开机时间 _____ 操作 _____

故障记录 1、 _____
 2、 _____
 3、 _____
 4、 _____
 5、 _____

日期: _____ 年 _____ 月 _____ 日 晨检操作: _____

协和医院放疗科-月检

机械检查

日期: 年 月 日

一. 机械

1. Gantry Angle Indicators

	0°	90°	270°	180°
标准	<1°	<1°	<1°	<1°
数字指示				

2. Collimator Angle Indicators

	0°	90°	270°
标准	<1°	<1°	<1°
机械指示			
数字指示			

3. Optical Distance Indicator (ODI)

SSD (cm)	100	95	105
标准	<2mm	<2mm	<2mm

4. Field Size Indicators

射野(cm)	10×10	20×20	30×(0,15)	30×(15,0)	(15,0)×30	(0,15)×30
标准	<2mm	<2mm	<2mm	<2mm	<2mm	<2mm

5. Couch Position Indicators

	角度			垂直	侧向	纵向
	0°	90°	270°			
标准	<1°	<1°	<1°	<2mm	<2mm	<2mm

6. Crosshair Stability with Collimator Rotation

Gantry Angle	0°	90°	270°
标准	<1mm	<2mm	<2mm

7. Laser Alignment with Isocenter

	Sagittal	Left	Right	Back	Ceiling	Sag vs. Couch	Coplanar
标准	<2mm	<2mm	<2mm	<2mm	<2mm	<2mm	<2mm

剂量检查

日期: 年 月 日

一. 剂量刻度

能量	d, cm	PDD	Readings(nC)	Output, Variation%	Average Reading	Expected Reading*	Output, Accuracy%	Output, cGy/MU	Pass/Fail
4E									
6E									
9E									
12E									
16E									
20E									
6X									
15X									

二. 平坦度, 对称性

能量	4E	6E	9E	12E	16E	20E	6X	15X
对称	标准							
平坦	标准							

三. 射线野与灯光野的一致性

能量	6X			15X		
Gantry Angle	0°	90°	270°	0°	90°	270°
标准	<2mm	<2mm	<2mm	<2mm	<2mm	<2mm
射野中心						
射野边缘						

协和医院放疗科-年检

一、机械

1. 标尺灯 (ODI)

	90cm	95cm	100cm	105cm	110cm
标准	<2mm	<2mm	<2mm	<2mm	<2mm

2. 射野灯照度 Light Field Illuminance :

(>40 Lux)

二、射线

		标准	4E	6E	9E	12E	16E	20E	6X	15X
剂量	稳定性	<1%								
	偏差	<2%								
	MU1 偏差	1%								
	MU2 偏差	1%								
	控制柜读数	2%								
	剂量率 (cGy/MU)	1%								
能量	Ratio (R_1/R_2)	<1%								
	偏差	参考值								
	压	测量值								

三、安全



• GRT

• IMRT

• IGRT

• DGRT

•

• www.csmp.org.cn

表一-加速器日检

TABLE I. Daily.

Procedure	Machine-type tolerance		
	Non-IMRT	IMRT	SRS/SBRT
Dosimetry			
X-ray output constancy (all energies)			
Electron output constancy (weekly, except for machines with unique e-monitoring requiring daily)		3%	
Mechanical			
Laser localization	2 mm	1.5 mm	1 mm
Distance indicator (ODI) @ iso	2 mm	2 mm	2 mm
Collimator size indicator	2 mm	2 mm	1 mm
Safety			
Door interlock (beam off)		Functional	
Door closing safety		Functional	
Audiovisual monitor(s)		Functional	
Stereotactic interlocks (lockout)	NA	NA	Functional
Radiation area monitor (if used)		Functional	
Beam on indicator		Functional	

加速器日检表更新及变化

1. 机器分类

Non-IMRT、IMRT、SRT\SBRT

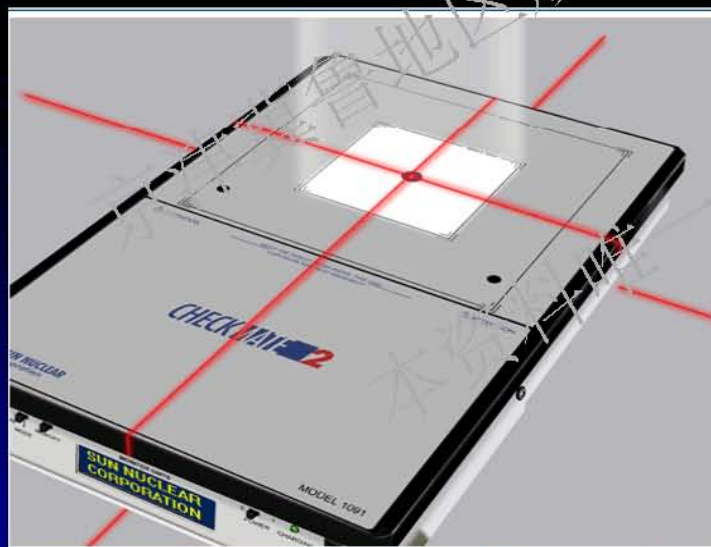
2. Tolerance 值的改变

激光灯精度 (2mm、1.5mm、1mm)



加速器日检表更新及变化

3. 使用方便、易操作的设备（如：Sun Nuclear: Checkmate）代替电离室和二维水箱检查绝对剂量的一致性。



加速器日检表更新及变化

4. 日检操作人员的变化

物理师 → 治疗师

经过QMP的培训和考核！

表二-加速器月检

Procedure	Non-IMRT	IMRT	SRS/SBRT
Dosimetry			
X-ray output constancy			
Electron output constancy		2%	
Backup monitor chamber constancy			
Typical dose rate ^a output constancy	NA	2% (@ IMRT dose rate)	2% (@ stereo dose rate, MU)
Photon beam profile constancy		1%	
Electron beam profile constancy		1%	
Electron beam energy constancy		2%/2 mm	
Mechanical			
Light/radiation field coincidence ^b		2 mm or 1% on a side	
Light/radiation field coincidence ^b (asymmetric)		1 mm or 1% on a side	
Distance check device for lasers compared with front pointer		1 mm	
Gantry/collimator angle indicators (@ cardinal angles) (digital only)		1.0°	
Accessory trays (i.e., port film graticle tray)		2 mm	
Jaw position indicators (symmetric) ^c		2 mm	
Jaw position indicators (asymmetric) ^d		1 mm	
Cross-hair centering (walkout)		1 mm	
Treatment couch position indicators	2 mm/1°	2 mm/1°	1 mm/0.5°
Wedge placement accuracy		2 mm	
Compensator placement accuracy		1 mm	
Latching of wedges, blocking tray ^e		Functional	
Localizing lasers	±2 mm	±1 mm	<±1 mm
Safety			
Laser guard-interlock test		Functional	
Respiratory gating			
Beam output constancy		2%	
Phase, amplitude beam control		Functional	
In-room respiratory monitoring system		Functional	
Gating interlock		Functional	

加速器月检表更新及变化

1. 机器分类

2. Tolerance 值的改变

(a) 平坦度 X:2% E:3%

对称性 X&E:3%

平坦度&对称性 X&E 1%

(b) 十字线中心精度 2mm 1mm

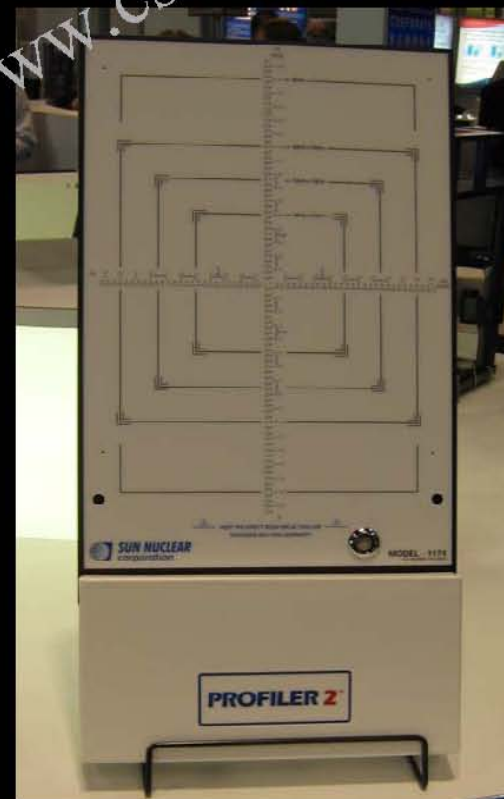
(c) 治疗床精度 (SRT) 2mm/1° 1mm/0.5°

3. 更新内容:

非对称铅门的光野射野一致性 1mm或一边的1%

加速器月检表更新及变化

4. 月检QMP牵头，物理师分组，分机器参加。
5. 使用方便、易操作的设备（如：Sun Nuclear: Profiler）代替三维水箱检查平坦度及对称性。



表三-加速器年检

Procedure	Machine-type tolerance		
	Non-IMRT	IMRT	SRS/SBRT
Dosimetry			
X-ray flatness change from baseline		±1%	
X-ray symmetry change from baseline		±1%	
Electron flatness change from baseline		1%	
Electron symmetry change from baseline		±1%	
SRS arc rotation mode (range: 0.5–10 MU/deg)	NA	NA	Monitor unit set vs delivered: 1.0 MU or 2% (whichever is greater) Gantry arc set vs delivered: 1.0° or 2% (whichever is greater)
X-ray/electron output calibration (TG-51)		±1% (absolute)	
Spot check of field size dependent output factors for x-ray (two or more FSs)		2% for field size <4×4 cm ² , 1% ≥4×4 cm ²	
Output factors for electron applicators (spot check of one applicator/energy)		±2% from baseline	
X-ray beam quality (PDD ₁₀ or TMR ₁₀ ²⁰)		±1% from baseline	
Electron beam quality (R ₉₀)		±1 mm	
Physical wedge transmission factor constancy		±2%	
X-ray monitor unit linearity (output constancy)	±2% ≥5 MU	±5% (2–4 MU), ±2% ≥5 MU	±5% (2–4 MU), ±2% ≥5 MU
Electron monitor unit linearity (output constancy)		±2% ≥5 MU	
X-ray output constancy vs dose rate		±2% from baseline	
X-ray output constancy vs gantry angle		±1% from baseline	
Electron output constancy vs gantry angle		±1% from baseline	
Electron and x-ray off-axis factor constancy vs gantry angle		±1% from baseline	
Are mode (expected MU, degrees)		±1% from baseline	
TBI/TSET mode		Functional	
PDD or TMR and OAF constancy		1% (TBI) or 1 mm PDD shift (TSET) from baseline	
TBI/TSET output calibration		2% from baseline	
TBI/TSET accessories		2% from baseline	
Mechanical			
Collimator rotation isocenter		±1 mm from baseline	
Gantry rotation isocenter		±1 mm from baseline	
Couch rotation isocenter		±1 mm from baseline	

加速器年检表更新及变化

1. 机器分类

2. Tolerance 值的改变

(a) Collimator、Gantry、Couch Rotation
Isocenter 2mm diameter $\pm 1\text{mm}$

(b) X线输出因子 2% $2\% < 4 \times 4, 1\% > 4 \times 4$

(c) X射线质 2% $\pm 1\%$

电子线质 (R50) 2% $\pm 1\text{mm}$

(d) 绝对剂量校准 2% $\pm 1\%$

加速器年检表更新及变化

3. 更新内容

- | | |
|----------------|-----------------|
| (a) 平坦度&对称性 | 1% |
| (b) MU线性 2-4MU | $\pm 5\%$ |
| (c) TBI 输出剂量率 | $\pm 2\%$ |
| (d) 治疗床的俯仰角 | 1° |
| (e) ARC 计划与实际 | 1° & 1MU |

加速器年检表更新及变化

4. 年检QMP牵头，物理师、剂量师、工程师及治疗师分组、分机器、分时间参加。
5. 测量设备：二维水箱、指型电离室、剂量仪、三维水箱等等。



表四-楔形板的QA

TABLE IV. Dynamic/universal/virtual wedges.

Dynamic-including EDW (Varian), virtual (Siemens), universal (Elekta) wedge quality assurance				
Frequency	Procedure	Tolerance		
		Dynamic	Universal	Virtual
Daily	Morning check-out run for one angle		Functional	
Monthly	Wedge factor for all energies	C.A. axis 45° or 60° WF (within 2%) ^a	C.A. axis 45° or 60° WF (within 2%) ^a	5% from unity, otherwise 2%
Annual	Check of wedge angle for 60°, full field and spot check for intermediate angle, field size	Check of off-center ratios @ 80% field width @ 10 cm to be within 2%		

我科现状

北京协和医院放疗科 Trilogy 加速器

楔形因子检测-18MV

角度	射野大小 (cm)	深度 (cm)	理论值	实测值	偏差 ($<2\%$)
EDW10	20*20	3.2	0.917		
EDW15	20*20	3.2	0.873		
EDW20	20*20	3.2	0.840		
EDW25	20*20	3.2	0.802		
EDW30	20*20	3.2	0.767		
EDW45	20*20	3.2	0.654		
EDW60	20*20	3.2	0.524		
W15	20*20	3.2	0.781		
W30	20*20	3.2	0.640		
W45	20*20	3.2	0.524		
W60	10*20	3.2	0.423		

北京协和医院放疗科 Trilogy 加速器

楔形因子检测-6MV

角度	射野大小 (cm)	深度 (cm)	理论值	实测值	偏差 ($<2\%$)
EDW10	20*20	1.5	0.896		
EDW15	20*20	1.5	0.841		
EDW20	20*20	1.5	0.791		
EDW25	20*20	1.5	0.748		
EDW30	20*20	1.5	0.704		
EDW45	20*20	1.5	0.572		
EDW60	20*20	1.5	0.438		
W15	20*20	1.5	0.736		
W30	20*20	1.5	0.569		
W45	20*20	1.5	0.50		
W60	10*20	1.5	0.388		

楔形板更新及变化

- 更新内容

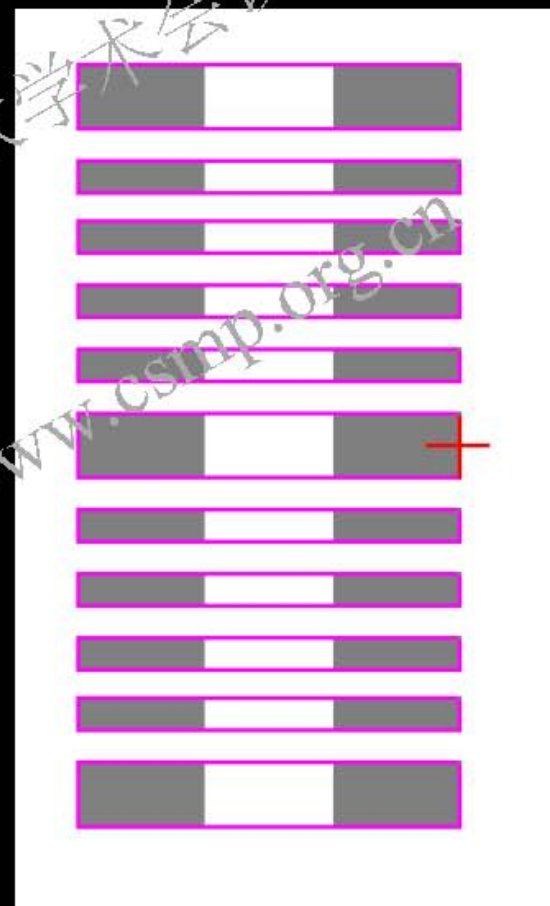
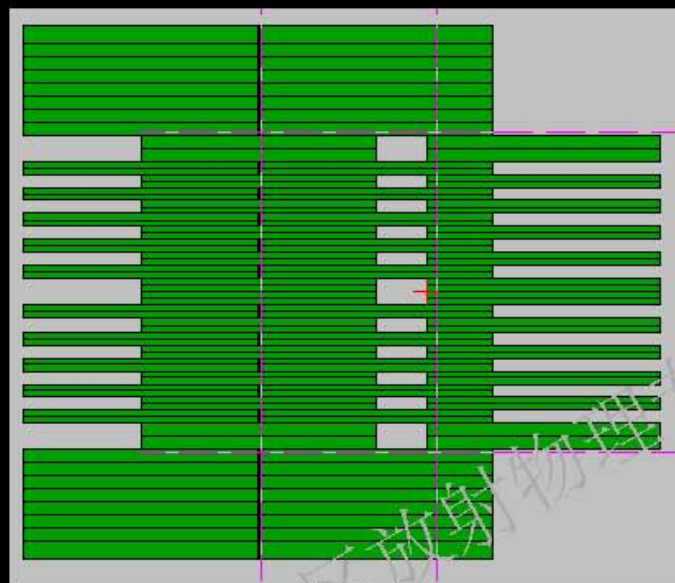
增加离轴方向的检测！



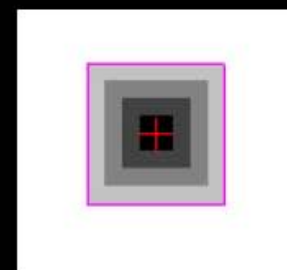
表五-MLC的QA

Procedure	Tolerance
	Weekly (IMRT machines)
Qualitative test (i.e., matched segments, aka "picket fence")	Visual inspection for discernable deviations such as an increase in interleaf transmission
	Monthly
Setting vs radiation field for two patterns (non-IMRT)	2 mm
Backup diaphragm settings (Elekta only)	2 mm
Travel speed (IMRT)	Loss of leaf speed >0.5 cm/s
Leaf position accuracy (IMRT)	1 mm for leaf positions of an IMRT field for four cardinal gantry angles. (<i>Picket fence</i> test may be used, test depends on clinical planning-segment size)
	Annually
MLC transmission (average of leaf and interleaf transmission), all energies	$\pm 0.5\%$ from baseline
Leaf position repeatability	± 1.0 mm
MLC spoke shot	≤ 1.0 mm radius
Coincidence of light field and x-ray field (all energies)	± 2.0 mm
Segmental IMRT (step and shoot) test	<0.35 cm max. error RMS, 95% of error counts <0.35 cm
Moving window IMRT (four cardinal gantry angles)	<0.35 cm max. error RMS, 95% of error counts <0.35 cm

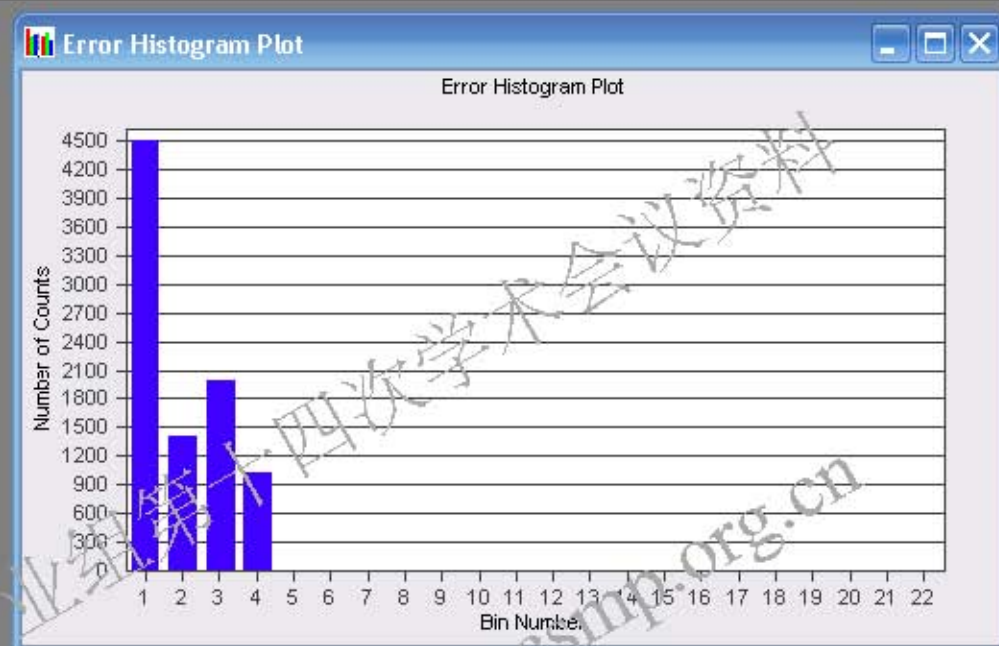
我科现状



Picket fence

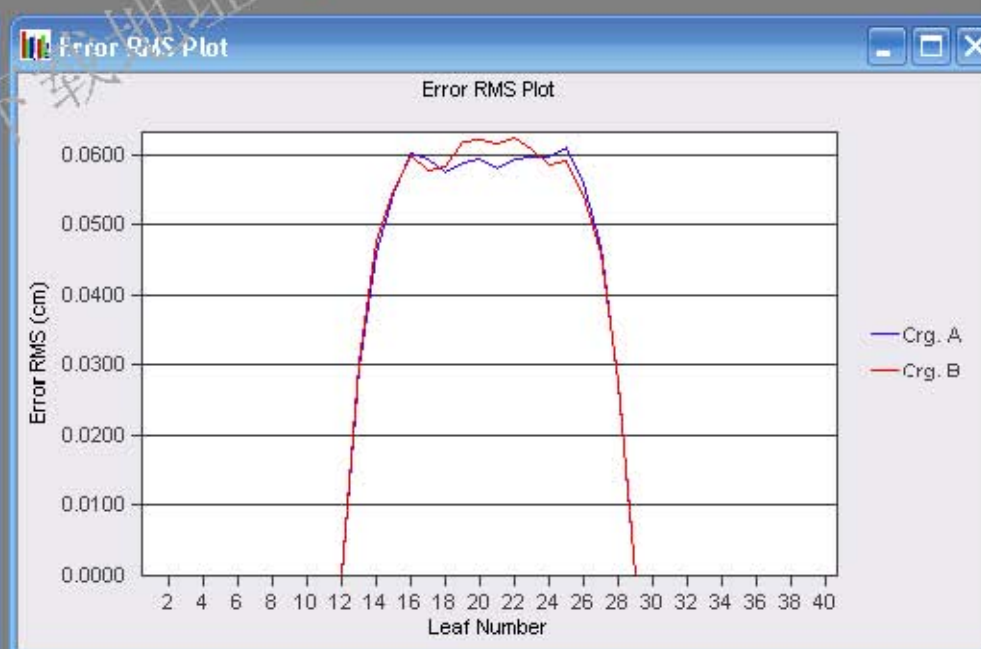


Leaf No.	Crg. A.	Crg. B
Average	0.053	0.054
Maximum	0.061	0.063
13	0.030	0.030
14	0.046	0.048
15	0.054	0.055
16	0.060	0.060
17	0.059	0.058
18	0.058	0.058
19	0.059	0.062
20	0.059	0.062
21	0.058	0.062
22	0.059	0.063
23	0.060	0.061
24	0.060	0.059
25	0.061	0.059
26	0.056	0.054
27	0.047	0.046
28	0.027	0.028



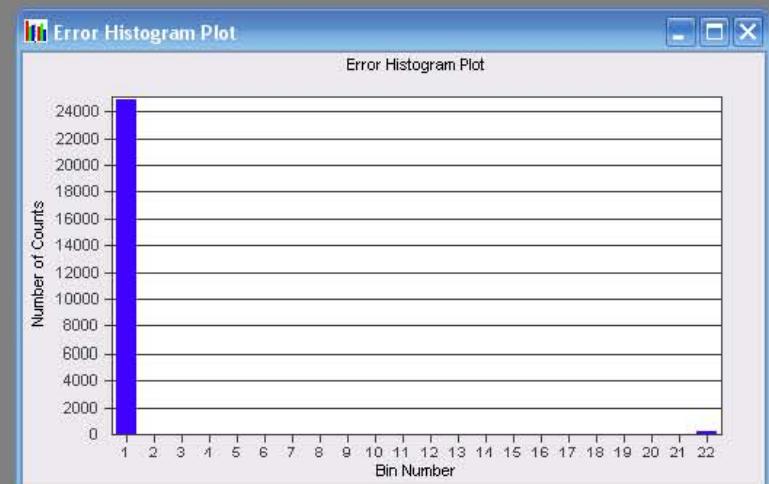
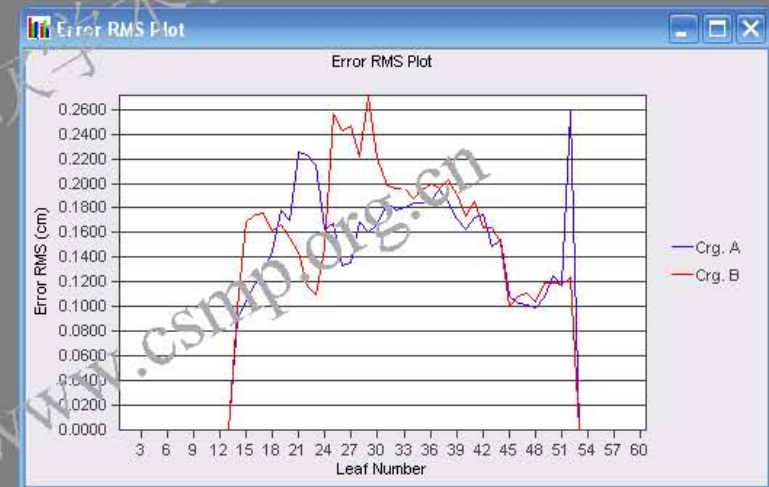
Moving window IMRT

Bin No.	Error (cm.)	# of Counts	Percent	Percent Sum
1	0.000 - < 0.005	4504	50.45	50.45
2	0.005 - < 0.050	1399	15.67	66.12
3	0.050 - < 0.100	1987	22.26	88.37
4	0.100 - < 0.150	1029	11.53	99.90
5	0.150 - < 0.200	9	0.10	100.00
6	0.200 - < 0.250	0	0.00	100.00
7	0.250 - < 0.300	0	0.00	100.00
8	0.300 - < 0.350	0	0.00	100.00
9	0.350 - < 0.400	0	0.00	100.00
10	0.400 - < 0.450	0	0.00	100.00
11	0.450 - < 0.500	0	0.00	100.00
12	0.500 - < 0.550	0	0.00	100.00
13	0.550 - < 0.600	0	0.00	100.00
14	0.600 - < 0.650	0	0.00	100.00
15	0.650 - < 0.700	0	0.00	100.00
16	0.700 - < 0.750	0	0.00	100.00
17	0.750 - < 0.800	0	0.00	100.00
18	0.800 - < 0.850	0	0.00	100.00
19	0.850 - < 0.900	0	0.00	100.00
20	0.900 - < 0.950	0	0.00	100.00
21	0.950 - < 1.000	0	0.00	100.00
22	1 and above	0	0.00	100.00



Error Histogram Data				
Bin No.	Error (cm.)	# of Counts	Percent	Percent Sum
1	0.000 - < 0.005	24887	97.57	97.57
2	0.005 - < 0.050	8	0.03	97.60
3	0.050 - < 0.100	22	0.09	97.69
4	0.100 - < 0.150	22	0.09	97.78
5	0.150 - < 0.200	31	0.12	97.90
6	0.200 - < 0.250	30	0.12	98.02
7	0.250 - < 0.300	36	0.14	98.16
8	0.300 - < 0.350	32	0.13	98.28
9	0.350 - < 0.400	29	0.11	98.40
10	0.400 - < 0.450	29	0.11	98.51
11	0.450 - < 0.500	22	0.09	98.60
12	0.500 - < 0.550	29	0.11	98.71
13	0.550 - < 0.600	19	0.07	98.78
14	0.600 - < 0.650	25	0.10	98.88
15	0.650 - < 0.700	21	0.08	98.96
16	0.700 - < 0.750	13	0.05	99.02
17	0.750 - < 0.800	14	0.05	99.07
18	0.800 - < 0.850	11	0.04	99.11
19	0.850 - < 0.900	12	0.05	99.16
20	0.900 - < 0.950	21	0.08	99.24
21	0.950 - < 1.000	16	0.06	99.31
22	1 and above	177	0.69	100.00

Error RMS Data		
Leaf No.	Crg. A.	Crg. B.
25	0.167	0.256
26	0.133	0.243
27	0.135	0.246
28	0.168	0.222
29	0.159	0.270
30	0.166	0.220
31	0.183	0.199
32	0.178	0.196
33	0.179	0.194
34	0.184	0.186
35	0.184	0.155
36	0.185	0.199
37	0.194	0.156
38	0.184	0.203
39	0.170	0.190
40	0.152	0.173
41	0.171	0.184
42	0.174	0.163
43	0.147	0.163
44	0.154	0.151
45	0.108	0.099
46	0.103	0.108
47	0.101	0.111
48	0.098	0.103
49	0.107	0.119
50	0.124	0.119
51	0.116	0.117
52	0.258	0.123



Segmental IMRT

Summary

Beam's Eye
View

Leaf Viewer

Gap Viewer

Fluence Maps

Leaf Histogram
AnalysisGap Histogram
Analysis

Selection Criteria

Selected Motors (nm = non-moving leaf)

Leaf Number	Bank A		Bank B	
	S	Result	S	Result
21	☐	nm	☐	nm
22	☐	nm	☐	nm
23	☒	Pass	☒	Pass
24	☒	Pass	☒	Pass
25	☒	Pass	☒	Pass
26	☒	Pass	☒	Pass
27	☒	Warn	☒	Fail
28	☒	Pass	☒	Pass
29	☒	Warn	☒	Warn
30	☒	Pass	☒	Pass
31	☒	Pass	☒	Pass

Bank A

Select All

Exclude Failed

Exclude Warned

Clear All

Bank B

Select All

Exclude Failed

Exclude Warned

Clear All

Individual Statistics

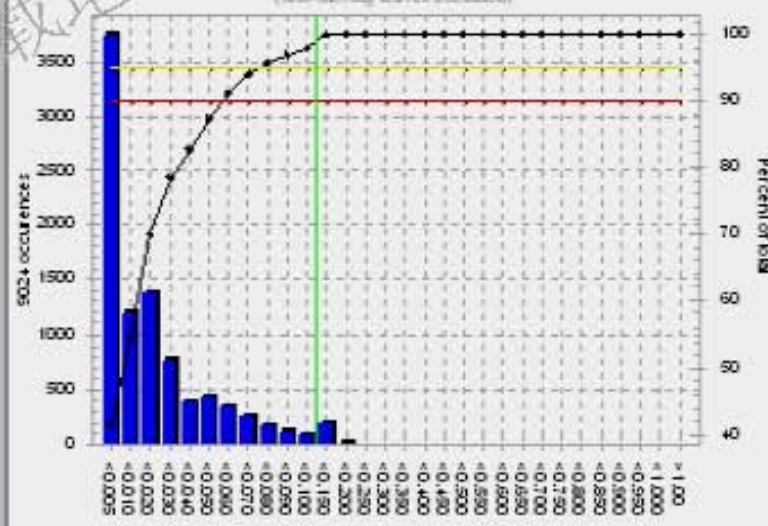
	Bank A	Bank B
Selected Motors:	16	16
Failed Motors:	1	2
Warning * Failed Motors:	5	
Failure * Failed Motors:	10	

Aggregate Statistics

Target Deviation (cm):	0.100
Total Observations:	9024
Failed Observations:	193
Failed Observations Percentage:	2.1 %
Warning Level:	5.0 %
Failure Level:	10.0 %

Leaf Position Histogram Data

Deviation Range (cm)	#	%	Running %
0 to 0.004	3742	41.5	41.5
0.005 to 0.009	1185	13.1	54.6
0.010 to 0.019	1373	15.2	69.8
0.020 to 0.029	770	8.5	78.3
0.030 to 0.039	384	4.3	82.6
0.040 to 0.049	426	4.7	87.3
0.050 to 0.059	340	3.8	91.1
0.060 to 0.069	253	2.8	93.9
0.070 to 0.079	166	1.8	95.7
0.080 to 0.089	112	1.2	97.0
0.090 to 0.099	80	0.9	97.9
0.100 to 0.149	190	2.1	100.0
0.150 to 0.199	3	0.0	100.0
0.200 to 0.249	0	0.0	100.0

Leaf positions, deviations from expected values - Distribution graph
(non-moving leaves excluded)

Print Screen

Export DynaLog to MLC rev. 6 file

Close

MLC更新及变化

- 更新内容

(a) MLC 穿透因子 $\pm 0.5\%$

京津冀鲁地区放射物理专业组第十四次学术会议资料

本资料唯一合法下载地址: www.csmp.org.cn

表六-Imaging的QA

Daily^a

Planar kV and MV (EPID) imaging

Collision interlocks	Functional	Functional
Positioning/repositioning	≤ 2 mm	≤ 1 mm
Imaging and treatment coordinate coincidence (single gantry angle)	≤ 2 mm	≤ 1 mm

Cone-beam CT (kV and MV)

Collision interlocks	Functional	Functional
Imaging and treatment coordinate coincidence	≤ 2 mm	≤ 1 mm
Positioning/repositioning	≤ 1 mm	≤ 1 mm

Monthly

Planar MV imaging (EPID)

Imaging and treatment coordinate coincidence (four cardinal angles)	≤ 2 mm	≤ 1 mm
Scaling ^b	≤ 2 mm	≤ 2 mm
Spatial resolution	Baseline ^c	Baseline
Contrast	Baseline	Baseline
Uniformity and noise	Baseline	Baseline

Planar kV imaging^d

Imaging and treatment coordinate coincidence (four cardinal angles)	≤ 2 mm	≤ 1 mm
Scaling	≤ 2 mm	≤ 1 mm
Spatial resolution	Baseline	Baseline
Contrast	Baseline	Baseline
Uniformity and noise	Baseline	Baseline

Cone-beam CT (kV and MV)

Geometric distortion	≤ 2 mm	≤ 1 mm
----------------------	-------------	-------------

我科现状

- 安全性和功能性的QA (1次/天)
 1. OBI系统相关的安全因素
 2. 患者信息传输的完整性(网络)
- 几何精度的QA (1次/月)
 1. OBI等中心精度QA
 2. 2D2D自动配准及治疗床移动精度的QA
 3. 放大倍数的QA
 4. KVD垂直运动时影像板中心点精度的QA
 5. 机架旋转时OBI等中心精度的QA

我科现状

- 图像质量的QA (1次/月)

- A. X线平片图像QA

- 1. 密度分辨率QA
 - 2. 空间分辨率QA

- B. CBCT图像质量QA

- 1. CT值线性的QA
 - 2. 密度分辨率的QA
 - 3. 空间分辨率的QA
 - 4. CT值的均一性的QA
 - 5. 图像重建精度的QA
 - 6. 扫描层厚的QA

京津冀鲁地区放射物理专业委员会第四次会议资料
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我科现状

OBI日常安全和功能质量保证

OBI安全质量保证表格

日期: _____

操作者: _____

检测内容	检测结果
呼吸预热	
门挂锁	
指示灯	监视器
	X线及水敏指示灯
	OBI操作台指示灯
声音警告	
手动锁	手动锁
碰撞挂锁	机械臂 KVS KVD
	声音警告
	机械臂急停
	直接加速器碰撞检测
	机械臂急停 KVS KVD
	声音警告
	机械臂急停
功能连续	直接加速器碰撞检测
	记录

OBI等中心和床位位置改变的质量保证 附检

日期: _____

操作者: _____

1. OBI等中心精确度

将射线野上光轴和激光灯靶线放在等中心。将病人并在定位野中设计验证计划。在控制台上将射线野位置定位计划。采集图像。每幅图像上比较十字中心的位置并测量每个方向的偏差。在左右方向上重复进行千伏摄影。

2. 2D2D 比对和床位改变精确度

在两张图像上进行等中心的质量保证的验证。采用2D2D 比对。在已知位置上沿射线野排列的相性方格标记偏离等中心的位置。记录改变的数据。应用改变的数据并移动床的位置。记录床现在的位置。在右野室内，手动床使偏离中心的标记对准射线野和激光灯放在等中心位置。看床最终位置。|A-B| 和 |C-D| 在各方误差是2mm。

	Expected (Left(A))	Shift (B)	A-B	New Couch position(C)	Final Couch position(D)	C-D	Tol.
vert							≤2mm
Lng							≤2mm
lat							≤2mm

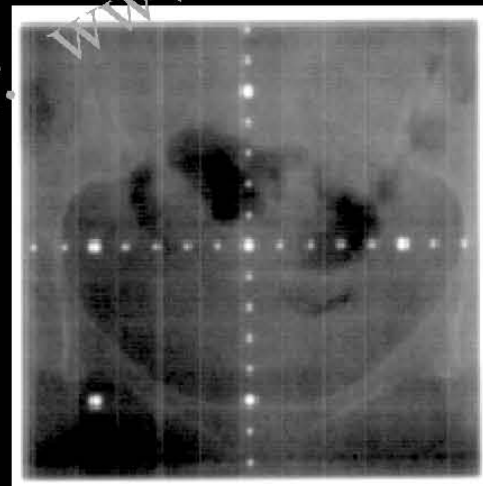
Imaging更新及变化

- Imaging Dose(年检)
(KV-KV、EPID、CBCT)



100kV

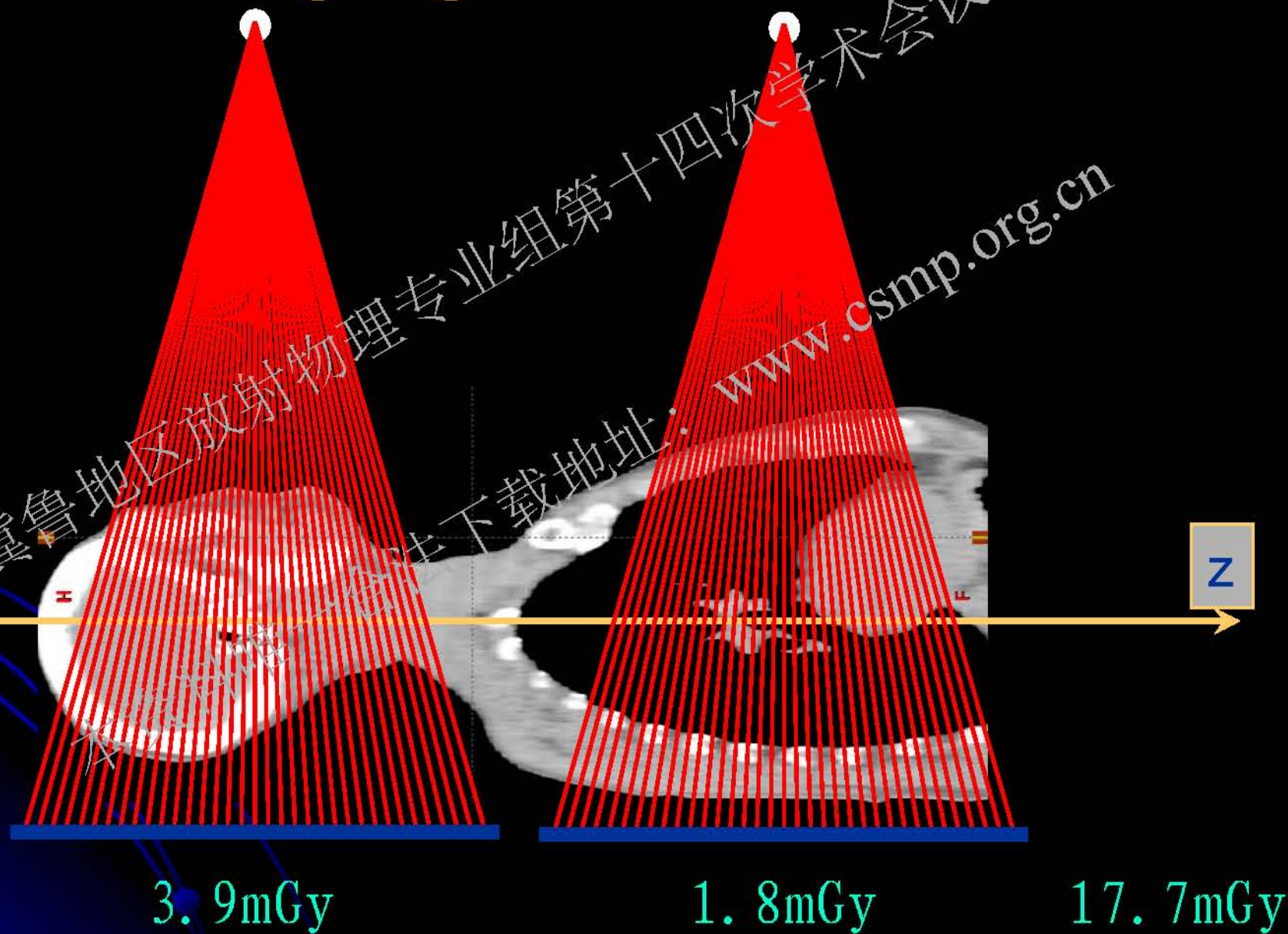
0.0003cGy



6MV 3MU

3cGy

Imaging更新及变化



1.QA 团队的形成

治疗师



工程师



物理师



QMP

治疗师



治疗师



物理师



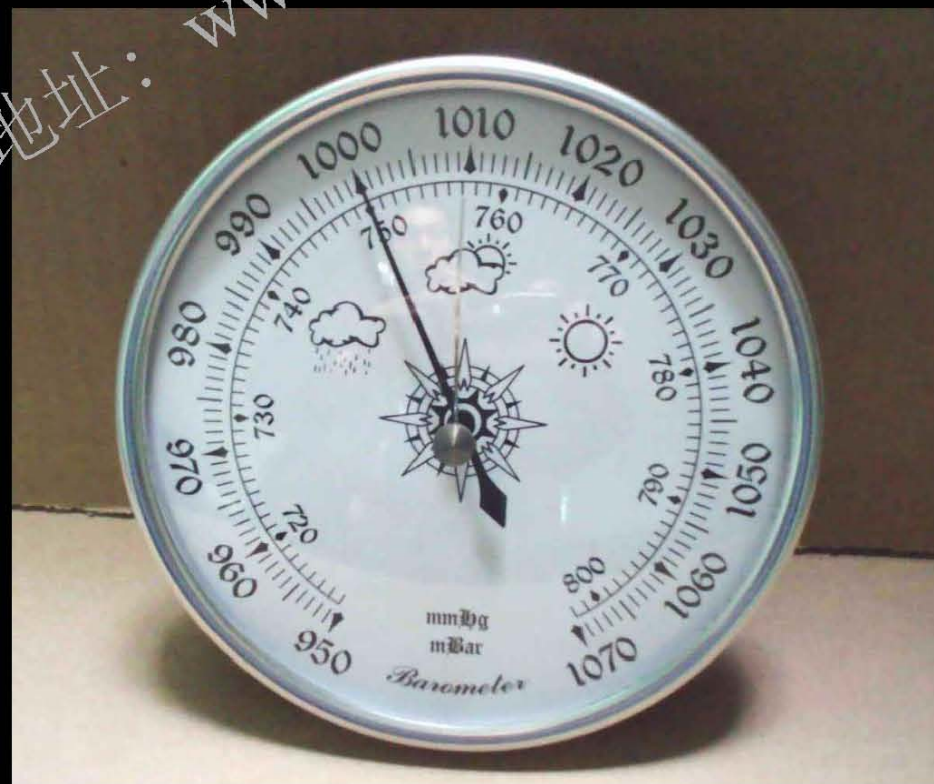
治疗师



2.QA工具的QA



QA工具的QA



QA工具的QA

学术会议资料



3. 阐明QA检测方法

Trilogy 直线加速器日检及操作记录

一、机械精度检查

内容	Gantry Rotation Readout	Collimator Rotation Readout	Collimator Rotational Isocenter	Optical Distance Indicator	Field Size
标准	$< \pm 0.5^\circ$	$< \pm 0.5^\circ$	$< 2\text{mm}$	$< \pm 1\text{mm}$	$< 2\text{mm}$
结果					

二、激光灯检查

内容	Left Wall	Right Wall	Ceiling	Sagittal
标准	$< 2\text{mm}$	$< 2\text{mm}$	$< 2\text{mm}$	$< 2\text{mm}$
结果				

三、设备状态

内容	MLC	气泵	内循环水			SF6 Pressure	气压
			水温	水压	水位		
标准	Pass	Pass	40°C	65-85 psi	H/M/L	30-34 psi	40-50 psi
结果							

四、安全检查

限光筒防碰撞功能	Portal Vision 防碰撞功能	OBI 防碰撞功能	控制台 键盘钥匙	控制台键盘及 BEAM ON/OFF
防护门 连锁	中子门防 挤压功能	出束警示灯及 蜂鸣器	监视对讲 广播系统	

五、剂量检查 标准值:100 偏差 $<2\%$

能量	6E	9E	12E	16E	20E	18X	6X
读数							

六、OBI 日检

日检项目	1. KVS 金属表面与加速器等中心处距离	2. PCB 板中心与 OBI 数字标尺中心偏差	3. PCB 板中心到板子 20CM 标记点的距离	4. 铅门开为 10CM×10CM 时 实际大小
标准	85.2CM $\pm$ 2MM	$\pm$ 1MM	10CM $\pm$ 1MM	10CM $\pm$ 2.5MM
结果				

开机时间 _____ 操作 _____

故障记录 1. _____
 2. _____
 3. _____
 4. _____
 5. _____

日期: _____ 年 _____ 月 _____ 日 晨检操作: _____

阐明QA检测方法

▪ M3. Laser Alignment

- a. Attach the front pointer and check that all lasers converge on the pointer tip.
- b. Check the coincidence of the two pairs of lateral lasers (left-right verticals and left-right horizontals) over 30 cm to both lateral sides of the isocenter.
- c. Check the cross plane ceiling laser coincidence with lateral vertical lasers over 30 cm radius of the iso.
- d. The sagittal lasers (ceiling and foot) should agree with the cross hair with the gantry at 0 and collimator at 0 over a range of 30 cm in-out and vertical from the iso.

▪ M4. Optical Distance Indicator

Use the front pointer to establish a flat surface at 100 SSD (isocenter) on the solid centerboard of the patient table. Check the ODI reading to be 100. From this surface add a 20 cm thick block and the ODI should read 80. Lower the surface so that the front pointer reads 100 on top of the block. Remove the block and the ODI should read 120. Tolerance is 2mm at 80 and 100 SSD and 5 mm at 120 SSD.

4. 年检报告的电子文档

肿瘤放疗物理

北京协和医院 (PUMCH)

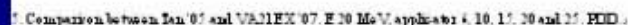
放射治疗科 (Department of Radiation Oncology)

质量控制规程

日检

测试内容	公差
直线加速器	
剂量学	
D1 Photon Beam Output Factors	2%
D2 Electron Beam Output Factors	2%
机械精度	
M1 Laser localization	± 1 mm
M2 Distance indicator (OD100)	± 1 mm
M3 Collimator alignment	± 1 mm
M4 Gantry/collimator angle indicators	1.0 deg
M5 Collimator rotation	± 1 mm
安全	
S1 Door interlock	Functional
S2 Door closing safety	Functional
S3 Neutron Door (if used)	Functional
S4 Neutron Door closing safety (if used)	Functional
S5 Audible signal monitor	Functional
S6 Radiation alarm monitor (if used)	Functional
S7 Beam on indicator	Functional
S8 Console Keyboard	Functional
S9 MLC Indicator	Functional
S10 Air Pump (if used)	Functional
S11 Inner Loop Water	Functional
S12 ign	Functional
kV and MV (XRD) imaging	
I1 Collision interlocks	Functional
I2 Positioning/repositioning	≤ 2 mm
I3 Imaging & Treatment coordinate concordance (four gantry angle)	≤ 2 mm
Cone-beam CT (kV)	
I4 Collision interlocks	Functional
I5 Imaging & treatment coordinate concordance	≤ 2 mm
I6 Positioning/repositioning	≤ 2 mm
蒙特卡罗机	
机械精度	
M6 Laser localization	± 1 mm
M7 Distance indicator (OD100)	± 1 mm
M8 Blade/cut indicator	± 1 mm
M9 Gantry/collimator angle indicators	1.0 deg
M10 Collimator rotation	± 1 mm
安全	
S13 Door interlock	Functional

目錄



5.个体化的QA

- 人力
- 物力
- 时间
- 机器
- 治疗方式
- 患者数量
-

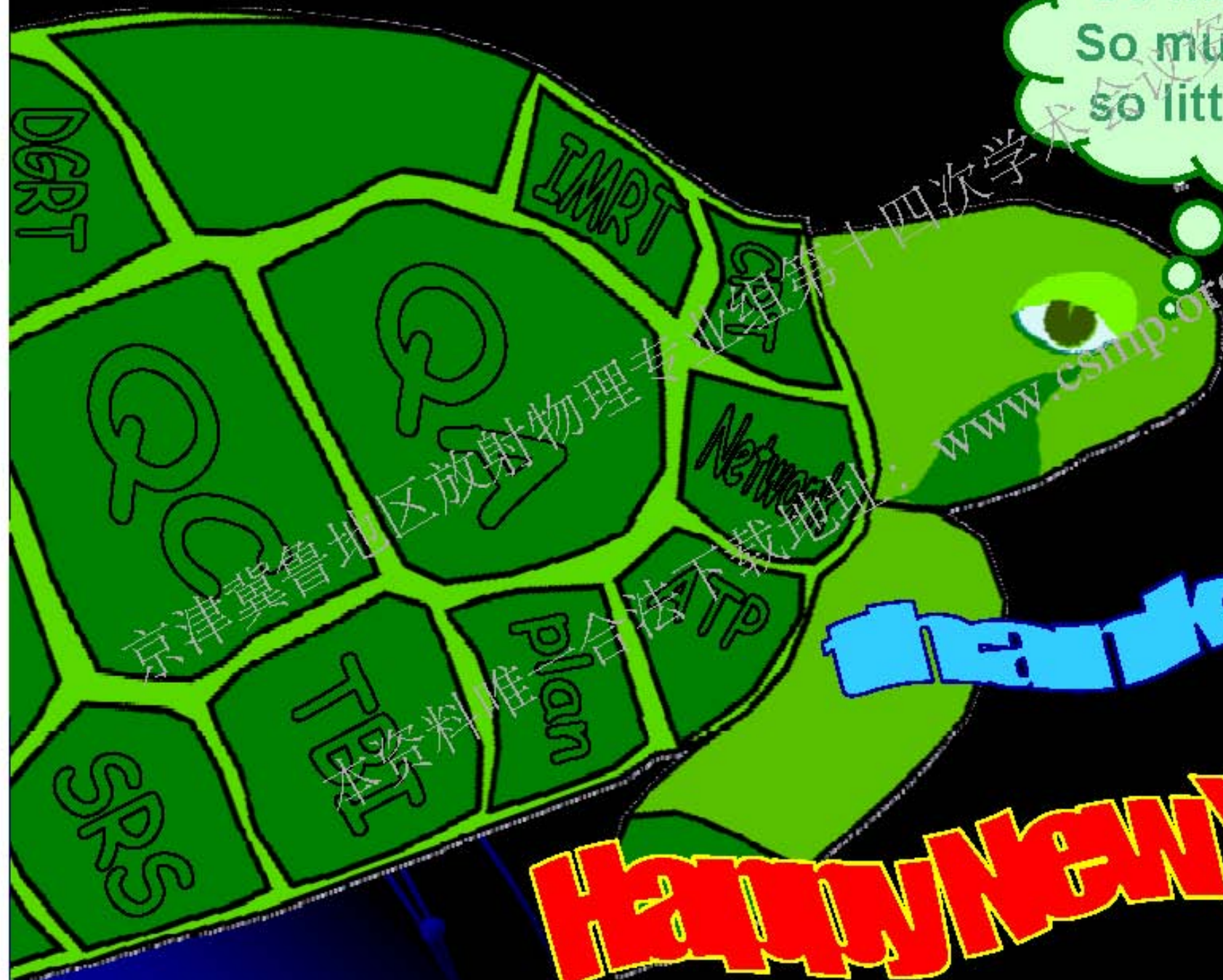
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So much work,
So much fun,
so little time.

Happy New Year

Happy New Year



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