

EBRT Plan Review – Eclipse/ARIA

Grace Gwe-Ya Kim, PhD, DABR
Radiation Medicine & Applied Sciences



AAPM Spring Clinical Meeting Apr. 8, 2018

2/25

Target Audience

Medical physicists who

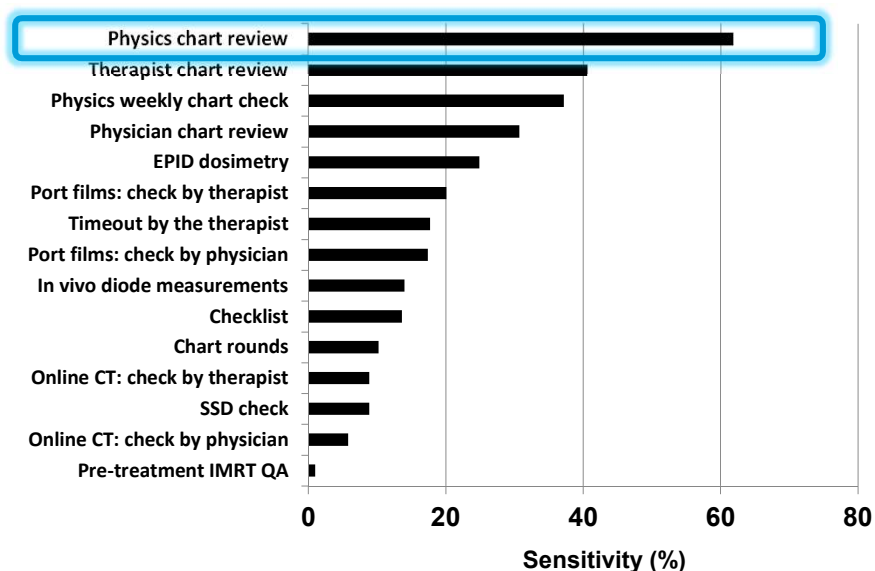
- Use Eclipse/Aria
- Use manual plan/chart review without 3rd party automatic plan check software
- Interested in quality management

Physics plan and chart review

The review of a specific patient's radiotherapy treatment plan and patient chart by a qualified medical physicist (QMP) [as defined by AAPM Professional Policy 1] or, where appropriate, their designee, to help ensure safe, high-quality treatment.

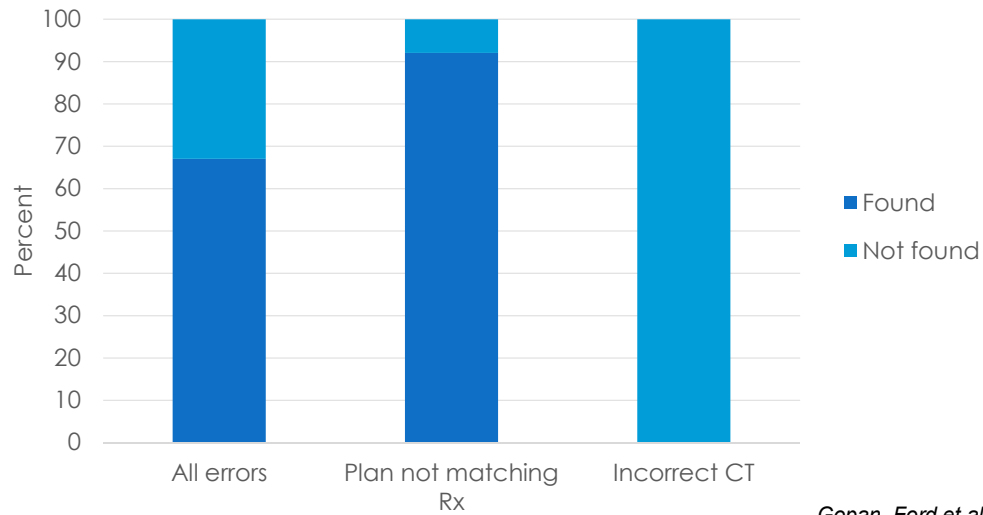
Literature indications

- Clark et al (2010): analyze 2,506 incident reports and half of the report originated in the tx preparation process.
- Novak et al (2016): most frequent (33%) near-miss incidents originated from tx planning process.
- RO-ILS Q4 report (2016): tx planning was the most commonly identified process step where events occurred. (from 2,681 incidents aggregate sum)
- Ezzell et al. (2018): 2/3 common errors types originated prior to initial physics plan check & chart review.



Ford et al. *Int J Radiat Oncol Biol Phys*, 84(3), e263-9 (2012)

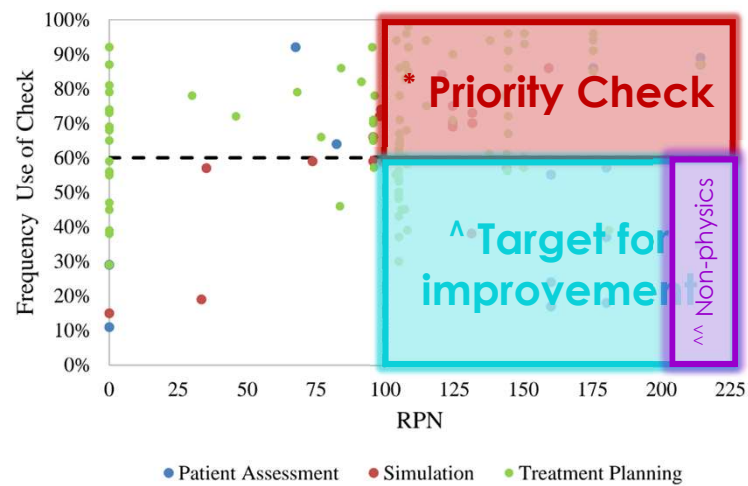
Results: Mock Plan Error Checks



Gopan, Ford et al. 2017

Slide Courtesy of Eric Ford

TG-275



Physics plan and chart review

- 1 Technical parameters (e.g. data transfer integrity)
- 2 Accuracy of calculations
- 3 Image guidance requests and their consistency
- 4 Plan quality
- 5 Proper consideration of tech related clinical factors

TEST CASE - Review consult

Encounter Type: 3/25/2018 PHYSICS - Second Check

Encounter Items:

- Review consult
- Review MD orders
- Review intent (signature, dose, img, laterality)
- Review aim note
- Review imaging in Eclipse
- Review contours in Eclipse
- Review fields in Eclipse
- Review doses/optimization in Eclipse
- Review/sign plan document (QA passed?)
- Review/prepare plan in RT Chart
- Daily Tx Chart (non-breast) (optional)
- Daily Tx Chart (breast) (optional)
- Create Imaging Order (MD author/supervisor)
- Complete Second Check Task
- Create Therapy Second Check Task
- AlignRT Export (optional)

Encounter 3/25/2018 (PHYSICS - Second Check) > Review consult

The summary below is limited to documents that are of type 'Consult - Outbound' (change)

11/30/2017 - Consult - Outbound - Outbound Consult... 10/5/2017 - Consult - Outbound - Outbound Consult... 8/8/2017 - Consult - Outbound - Outbound Consult...

Authorized By: _____ Supervised By: _____ Approved By: _____

Document: _____ Date of: _____ Template: _____

Status: _____ Completed: ☒ Hide Details

CONSULTING PHYSICIAN: _____

PATIENT: _____

MEDICAL RECORD NUMBER: _____

DATE OF SERVICE: _____

DATE OF BIRTH: _____

REQUESTING PHYSICIAN: _____

REASON: (Patient is a 54 year old Female with metastatic lung cancer to the brain s/p brain SRS here to review imaging

- ☐ Special considerations for radiotherapy *
- ☐ Previous radiotherapy treatments *
- ☐ Physician's plan of radiotherapy *
- ☐ Diagnosis definition including imaging and outside records, Pathology report ^^

View... Amend... Print... Fax...

Review MD Intent

- ☐ Final Plan & Rx approval*
- ☐ Site and laterality*
- ☐ Total dose, fractionation*
- ☐ Fractionation regimen*
- ☐ Energy, modality, technique, bolus, additional shielding*

Target coverage and target planning objectives*
ex. 100% cover at least 98% PTV

Sparing of OARs and OAR planning objectives*
ex. Brainstem max point dose < 31Gy
Follow the department CNS protocol

Imaging technique*

Imaging regimen*

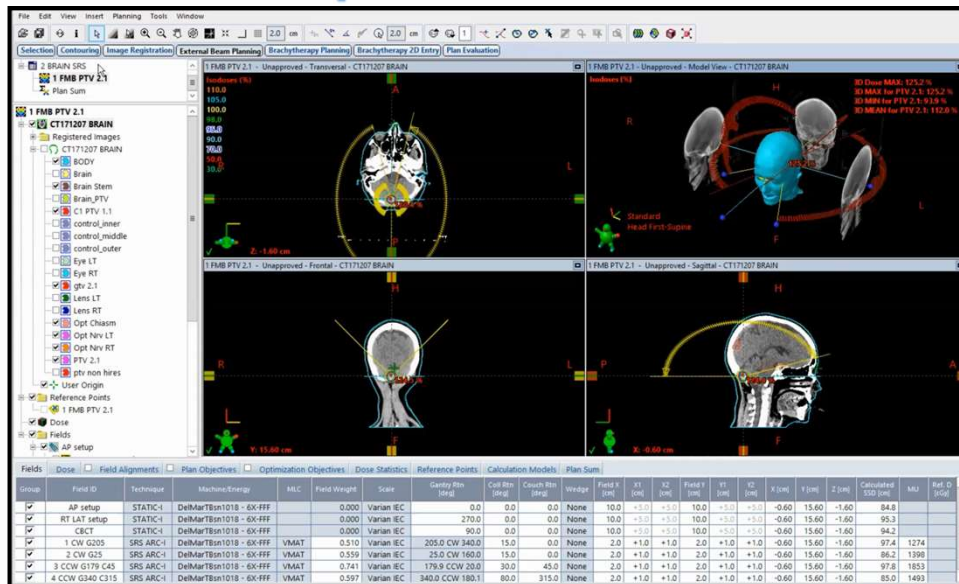
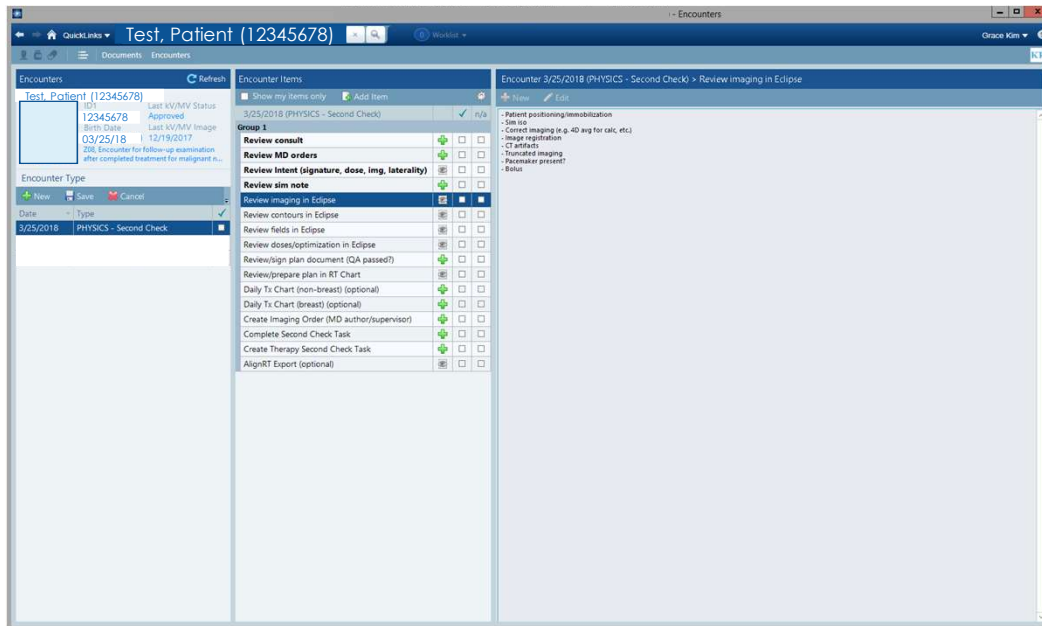
Matching instructions*

Bolus*

Gating technique*

Review sim form

- ☐ Patient set up, positioning and immobilization*
 - ☐ Appropriate for site and/or per clinical standard procedures
 - ☐ Written or photographic documentation of patient positioning, immobilization and ancillary devices, including setup note
- ☐ Image quality and usability: Scan range, Use of contrast
- ☐ Motion management (MD directive, breath-hold parameters, gating parameters)*
- ☐ Registration/Fusion of image sets (CT, PET, MRI, etc.)*
- ☐ Patient Orientation – CT information matches patient setup
- ☐ Transfer and selection of image set in treatment planning system*



- ☐ Target(s)*
- ☐ Organs-at-Risk*
- ☐ PTV and OAR Margin*
- ☐ Body/External contour*
- ☐ Density overrides applied as needed
- ☐ Consideration of Supporting Structures
- ☐ Isocenter: placement and consistency btw patient marking and setup instructions*

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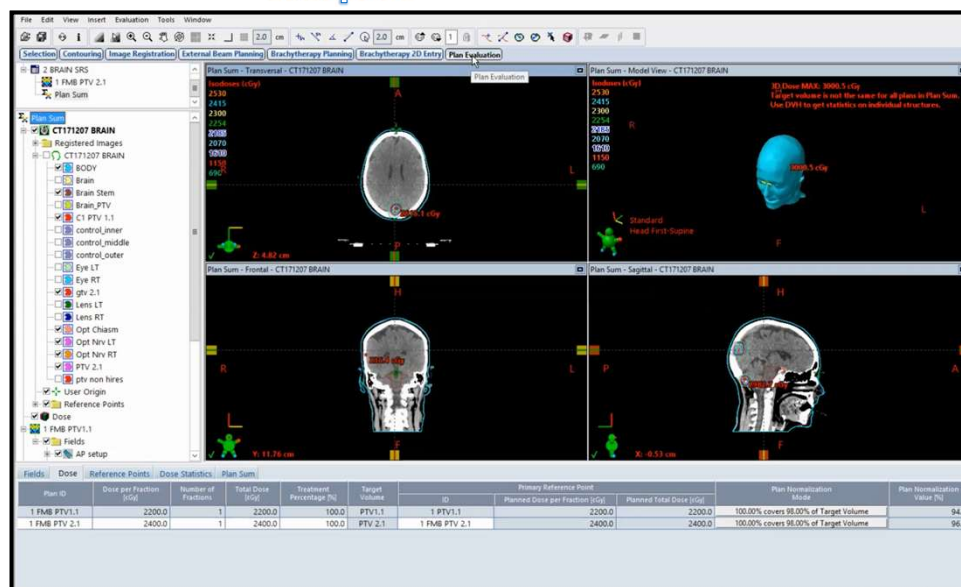
TEST CASE - Eclipse



Plan Quality

- ☐ Target coverage*
- ☐ Sparing of OARs*
- ☐ Plan confirms to clinical trial (if applicable)*
- ☐ Structures used during optimization*
- ☐ Physician designed apertures*
- ☐ Dose distribution*
- ☐ Hot spots*
- ☐ Ref. Points and plan normalization
- ☐ Calc. algorithm and calc. grid size

TEST CASE - Eclipse



Plan Quality

- ☐ Prior radiation accounted for in plan*
- ☐ Plan Sum
- Checks for a re-plan, adaptive plan or verification plan**
- ☐ Old/New CT registration*
- ☐ Isocenter placement
- ☐ Deformed or New contours*
- ☐ DVH comparison*
- ☐ Target Coverage*
- ☐ Sparing of OARs*

- ☐ Site and laterality*
- ☐ Total dose, fractionation*
- ☐ Fractionation regimen*
- ☐ Energy, modality, technique, bolus*
- ☐ Beam arrangement, beam deliverability*
- ☐ MU, energy, dose rate, field delivery times*
- ☐ Field size and aperture, bolus utilization, beam modifiers (wedges, blocks, trays etc)*
- ☐ Treatment plan warnings/errors
- ☐ Field ID or name
- ☐ Course and Plan ID
- ☐ Tolerance table
- ☐ Potential for collision
- ☐ Setup shifts use standard SOP*
- ☐ Setup for image-guidance*
- ☐ Setup ancillary systems*

File

Edit

View

Parameters

Tools

Window

Planning View

Prescribe Treatment

Plan Parameters

Planning Preparation

Plan Scheduling

Appointment Scheduling

RT Summary

Editing Log

2 FMB BRAIN

1 FMB PTV 2.1

Dose

AP setup

AP setup-DRR (Live)

RT LAT setup

RT LAT setup-DRR (Live)

CBCT

CBCT-DRR (Live)

1 CW G205

1 CW G205-DRR (Live)

2 CW G25

2 CW G25-DRR (Live)

3 CW G179 C45

4 CCW G340 C315

4 CCW G340 C-DRR

MR180128

FMB PTV 2.1 : R0

Volume Folder

1 CW G205-DRR (Live)

1 CW G205

Graculic

gr 2.1

PTV 2.1

Course

Plan

Machine

Primary Reference Point

Planned Dose per Fraction (cGy)

Fractions

Planned Total Dose (cGy)

Field Graphics

Treatment Unit

Secondary Reference Points

IMU Dose Scaling

2 FMB BRAIN - Unknown

1 FMB PTV 2.1

DeMarTSun1018

1 FMB PTV 2.1

2400.0

1

2400.0

☒

☒

☒

Validate for Treatment

Field

Add Reference Point

Field Order/Type

1/Setup

2/Setup

3/Setup

4/Target

5/Target

6/Target

7/Target

Field ID

AP setup

RT LAT Setup

CBCT

1 CW G205

2 CW G25

3 CW G179 C45

4 CCW G340 C315

Field Name

STATIC

STATIC

STATIC

SRS ARC

SRS ARC

SRS ARC

SRS ARC

Technique

Varian EC

Varian EC

Varian EC

Varian EC

Varian EC

Varian EC

Varian EC

Varian EC

Scale

6X-FFF

6X-FFF

6X-FFF

6X-FFF

6X-FFF

6X-FFF

6X-FFF

6X-FFF

Energy

Dose Rate [MU/min]

1400

1400

1400

1400

1400

1400

1400

1400

IMU

1274

1398

1853

1493

Dose to 1 FMB PTV 2.1 : 2400.0 cGy

508.2

557.6

738.9

595.4

Time [min]

4.35

4.99

6.62

5.38

Tot Treat

SRS/SRT Copla.

SRS/SRT Copla.

TB SRS/SRT No.

TB SRS/SRT No.

Calculated SSD [cm]

84.8

95.3

94.2

97.4

86.2

97.8

85.0

Planned SSD [cm]

84.8

95.3

94.2

97.4

86.2

97.8

85.0

Gantry Rot [deg]

0.0

270.0

90.0

205.0

25.0

179.9

348.0

Drop Angle [deg]

340.0

100.0

20.0

100.0

180.1

Gantry Direction

CW

CW

CW

CW

CW

CW

CW

CW

Coll Rot [deg]

0.0

0.0

0.0

15.0

15.0

30.0

80.0

Field X [cm]

10.0

10.0

10.0

2.0

2.0

2.0

2.0

X1 [cm]

+1.0

+1.0

+1.0

+1.0

+1.0

+1.0

+1.0

X2 [cm]

+1.0

+1.0

+1.0

+1.0

+1.0

+1.0

+1.0

Field Y [cm]

10.0

10.0

10.0

2.0

2.0

2.0

2.0

Y1 [cm]

+1.0

+1.0

+1.0

+1.0

+1.0

+1.0

+1.0

Y2 [cm]

+1.0

+1.0

+1.0

+1.0

+1.0

+1.0

+1.0

MLC

NONE

NONE

NONE

VMAAT

VMAAT

VMAAT

VMAAT

Dynamic Wedge

InterfaceMount

AccessoryMount

CompensationMount

ElectronAperture

Wedge

Couch Y1 [cm]

+10.20

+10.20

+10.20

+10.20

+10.20

+10.20

+10.20

Couch Ling [cm]

+42.54

+42.54

+42.54

+42.54

+42.54

+42.54

+42.54

Couch Lat [cm]

+1.03

+1.03

+1.03

+1.03

+1.03

+1.03

+1.03

Couch Rot [deg]

0.0

0.0

0.0

0.0

45.0

315.0

Imager Rot [cm]

+30.0

+30.0

+30.0

+30.0

+30.0

+30.0

+30.0

Imager Ling [cm]

+30.0

+30.0

+30.0

+30.0

+30.0

+30.0

+30.0

Imager Lat [cm]

+30.0

+30.0

+30.0

+30.0

+30.0

+30.0

+30.0

1 CW G205-DRR - 12/17/2017 6:46 PM

TEST CASE - Tx. preparations

19/25

Prescribe Treatment | Plan Parameters | Treatment Preparation | Plan Scheduling | Appointment Scheduling | RT Summary

Treatment Setup

Course: 2 FMB BRAIN - Active Planning & Treatment Approved Plans (1)

1 FMB PTV 2.1

Treatment Approved

Technique: SRS Arc
Machine: DeltaT18018
Scale: Varian IEC

Field	Energy	Dose Rate [MU/min]	MU	Gantry / So...	Coll Rtn	Field X [cm]	Field Y [cm]	Vrt	Couch [cm] [°]	Rtn	Vrt	Imager [cm]	Lat
AP setup	6K-FFF	1400		0.0	0.0	10.0	10.0	10.20	+42.54 1.03	0.0	50.0		
RT LAT setup	6K-FFF	1400		270.0	0.0	10.0	10.0	10.20	+42.54 1.03	0.0	50.0		
CBCT	6K-FFF	1400		90.0	0.0	10.0	10.0	10.20	+42.54 1.03	0.0	50.0		
1 CW G205	6K-FFF	1400	1274	205.0-340.0 CW	15.0	2.0	2.0	10.20	+42.54 1.03	0.0	50.0		
2 CW G25	6K-FFF	1400	1398	25.0-160.0 CW	15.0	2.0	2.0	10.20	+42.54 1.03	0.0	50.0		
3 CCW G179 C45	6K-FFF	1400	1853	179.9-20.0 CCW	30.0	2.0	2.0	10.20	+42.54 1.03	45.0	50.0		
4 CCW G340 C315	6K-FFF	1400	1493	340.0-180.1 C...	80.0	2.0	2.0	10.20	+42.54 1.03	315.0	50.0		

Field Parameters

Plan ID: 1 FMB PTV 2.1

Treatment: Machine: DeltaT18018 Tol. Table: Time: min Orientation: HFS

Calculated SSD: cm Planned SSD: cm Use Gated: ☐

Couch: Couch Vrt: 10.20 cm Delta Vrt: cm Imager Vrt: 50.0 cm
Couch Lng: +42.54 cm Delta Lng: cm Imager Lng: cm
Couch Lat: 1.03 cm Delta Lat: cm Imager Lat: cm
Couch Rtn: cm

Setup Notes / Photos

Field: AP setup

AP setup / AP setup-DRR - 12/7/2017 6:46 PM - 0°

Beam's Eye View

Field(s): 1 CW G205, 4 C...

FMB Board, Table Pad, KneeFix
S2 & cast couch, FMB mask, Tong
SHIFT 0.6 RT, 16.6 POST, 1.6 INF
1 MM MARGIN
CV 10.8, AP 84.8, RT 96.3, LT 94.2

TEST CASE - Plan scheduling

20/25

Prescribe Treatment | Plan Parameters | Treatment Preparation | Plan Scheduling | Appointment Scheduling | RT Summary

Plan Scheduling

Go to Reference Points

Course: 2 FMB BRAIN - Active Planning & Treatment Approved

Plan (Delay) Fraction Pattern Approval Planned Dose Per Fraction [cGy] Progress

1 FMB PTV 2.1 not defined Schedule Unapprove... 2400.0

Validation and Approval

Validation Findings

1 FMB PTV 2.1
Plan is 'Treatment Approved'.

Scheduling Overview

Patient Activities: December 2017 - Future
Timeline Displayed: December 2017 - Future

Scheduled Fractions

1 FMB PTV 2.1

AP setup

RT LAT setup

CBCT

1 CW G205

2 CW G25

3 CCW G179 C45

4 CCW G340 C315

Fraction (active) Fraction (completed) Fraction (inactive) Fraction (manual) Fraction (partial - open) Fraction (partial)

Fraction with imaging Multiple fractions Fraction with imaging MV CBCT Image (acquired) Image (active) Image (inactive) Image (manual) Image (partial) Image (partial)

Ref Point: 1 PTV1.1 Planned Dose... 2200.0 cGy Delivered Dose to date 0.0 cGy

Delivered Total Underdose / Overdose

2 FMB BRAIN

TEST CASE - Plan scheduling

21/25

The screenshot displays the 'Plan Scheduling' window. The top navigation bar includes tabs for 'Prescribe Treatment', 'Plan Parameters', 'Treatment Preparation', 'Plan Scheduling', 'Appointment Scheduling', and 'RT Summary'. The 'Plan Scheduling' tab is active, showing a 'Plan' section with '1 FMB PTV 2.1' and a 'Fraction Pattern' of 'not defined'. The 'Scheduling Overview' section shows a timeline for 'Patient Activities' from December 2017 to the future, with a 'Timeline Displayed' of 'December 2017 - Future'. A list of fractions is shown on the left, including 'CBCT', 'AP setup', 'RT LAT setup', 'CBCT', '1 CW G205', '2 CW G25', '3 CW G179 C45', and '4 CW G340 C315'. A pop-up window on the right lists courses: '0 Not Trexd - Completed', '0 QA - Completed', '0 RapidPlan_Test - Completed', '1 FMB Brain - Active', and '2 FMB BRAIN - Active'. The '2 FMB BRAIN - Active' course is highlighted with a 'Set course state to Completed' button.

TEST CASE - Plan scheduling

22/25

The screenshot displays the 'Reference Points' window. The top navigation bar is the same as the previous slide. The 'Reference Points' tab is active, showing a 'Validation Findings' section with '1 FMB PTV 2.1' and 'Plan is 'Treatment Approved''. The 'Reference Points' section includes a table with columns for 'Plan', 'Planned Dose per Fraction [cGy]', and 'Number of Fractions'. The table shows '1 FMB PTV 2.1' with a planned dose of 2400.0 and 1 fraction. Below the table, a 'Sum of visible Plans' section shows a total of 2400.0. An 'Approved Dose Summary [cGy]' section shows a delivered dose of 2400.0, with remaining planned dose and dose corrections all at 0.0. A 'Dose to be Recorded (this Course)' section shows a total of 2400.0. A 'Dose Limits [cGy]' section shows a total dose limit of 2400.0, with daily and session limits also at 2400.0. A 'Breakpoints [cGy]' section shows a breakpoint dose of 2400.0.

Summary

- Physics plan/chart review should be based on risk analysis
- Each clinic should develop standardized policies and procedures
- Practices should work to incorporate physics reviews as early in the workflow
- Tools such as checklists and standardization should be used to enhance the performance of physics plan and chart review.
- Consider automated tools (67% check items are possible full automation + maybe automation)