Vorabgrenzung Rigorosum

HAUPTFACH: Technologie der Strahlentherapie und der Nuklearmedizin
Version 1:
Fokus Beschleuniger, different types
Elektronenlinearbeschleuniger gründlich Krieger 7, 8
Why irradiation isocenter, Wirkung MLC, IMRT
Zyklotorns
   für die Radionukliderzeugung
   für die Protonentherapie, Krieger 9, Isochronzyklotrons
Synkrotrons (Therapie)
Generatorsysteme Mo-Tc
(Laufendes) radioaktives Gleichgewicht, Krieger 13
Natürliche Zerfallsreihen
Version 2:
Linearbeschleuniger: Komponente und Funktionen
Wanderwelle / Stehwelleprinzip skizzieren
Erfordernisse LINAC, warum baut man das so?
Notwendigkeit Isozentrum wegen gesunder Gewebe
Wirkung MLC für konformale vgl. zu IMRT
Abschätzung Dosisleistung 2Gy/min, 20 MeV e- 10cm, wie viel mittlerer Strom braucht man?
Strahlströme peak current, mean current, LINAC time structure
Warum braucht man Makropulse? (Wärme)
Radionuklide, was ist das meist benutzte? (Tc, Halbwertszeiten wissen)
Generatorsysteme Mo-Tc
Laufender radioaktiver Gleichgewicht
Isotopengenerator
Herstelleung von beta+ Strahler, was sind die Probleme (short-lived, cross section).
Wichtigste beta+ Strahler wissen und ihre Halbwertszeiten
Isochronzyklotron, warum mit negative Ionen (stripping)
Warum nicht Therapiezyklotron für Isotopenerzeugung (Energie, Strom)?
Aktivierungsgleichungen beta+ Erzeugung
Thick target yield Formalismus (aus AuK Vorlesung)

NEBENFACH: Biostatistik
Tabelle Alter, Geschlecht, Überleben, Dosis
Beispiel, wie auswerten um X zu schaffen
multivariate Cox-Modelle, logistische Regression, siehe Computerpraktikum Belege Python
Formeln nicht schreiben, aber Verständnis, Erläuterung
X-Test skizzieren
Ganz leichte Herleitung (mean of rectangular distribution, or CDF) könnte auch gefragt werden.

Andere Erfahrungen:
Einzelnen Komponenten des Linacs erklären
Stehwellenprinzip
Zyklotron zur Protonenbeschleunigung
Relativistische Massezunahme der Protonen bei ihrer Beschleunigung herleiten
Wenn Du die Grundlagen sicher drauf hast, länger erzählen von selbst, dass für die schweren Fragen weniger Zeit gibt.
Vorteilhaft, was an die Tafel zu zeichnen, wenn es die Frage anbietet, auch ohne Aufforderung.
Ausführlich antworten, im Zweifel mehr erzählen, man wird dann schon unterbrochen, wenn man genug gesagt hat.

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- Describe the main components of medical electron LINAC

Tafel zeichnen alle Komponente, Klystron, SF6, vacuum – cooling system, beam pipe, bending magnets, nozzle, patient table, EPI, cameras

- Why isocentric irradiation?

Spare normal tissue

- Describe how acceleration is performed

First introduction TE/TM waves, coupling, E field in beam pipe, which accelerates. Absorber wave dump or reflector.

- Travelling wave principle

Runzelröhre, disk loaded wave guide, 2a, 2b, c, d, neeed for v_phase<c
Velocity wave = velocity particle
Explain if d is constant or not (buncher section)
Phase phi=0, phi=pi/2, phi=pi

- Describe nozzle in e- mode and gamma mode

Wirkung first scatterer foil, secondary scatterer, for homogeneous, collimator
Flattening filter
Why secondary foils hollow or thick
Beam hardening flattening filter, etc.

- Bremsstrahlung is photon or gamma?

Photon, charged particle through electric field, not a nuclear level change

- What is flattening filter changing in the beam

Makes it homogeneous, reduces intensity, but also distorts energy spectrum, and thus dose profile in the patient as a function of the lateral separation from central beam axis
And it is contaminating beam, pair production, Compton, photo effect, photoneutron, skin dose

- Do all accelerators have flattening filter?

No, modern ones with MLC opening times, take into account non-homogeneous and adapt accordingly.
FFF=flattening filter free. No E-distortion, more intensity, less contamination

- Radionuclides, which is the most used one?

Tc, 6h, beta-, 140 keV

- Describe Mo-Tc generator system. How escapes TcO4, which one binds from solvent, which takes its place?

Describe benerator column, eluation solvent NaCl, AlMo04;2-, TcO4- escapes Al nuclear recoil, chem. lighter, binds to Na+, Cl- replaces its position.

- What are the most important beta+, typical half lives, what are problems for generation.

11C 13N 15O 18F (20 10 2 109 min). Short-lived, not time to transport. Generate in place, break Coloumb barrier, shoot charged particles several MeV.

- Why negative ion cyclotron? Which ion?

H- acceleration, due to strippinng extraction 25 um C foil, 100% effectivity, change of curvature radius (sign), easy

- Why not with therapy cyclotron?

Much more current is needed 25uA vs 300nA, 1kW vs 1W, less energy

- Why that current?

Need to create still the beta + emitter through nuclear reaction, production cross section, and also it is decaying.

NEBENFACH: Biostatistik

You have a table with non-small cell lung cancer patients, with volume, age, dose, tumor control (binary variable), time of death (if died, or censored if study finished), tumor control (yes/no)
- How to check if difference in mean volume between Group A (tumor controlled) with Group B (tumor not controlled)

two-sample t-test if normally distributed, Mann-Whitney rank sum test otherwise

- Is it logical that Volume is normally distributed?

Rather not, skewed due to zero.

- Describe Mann-Whitney rank sum test. For n>10 test variable how distributed.

Steps of Mann-Whitney test. For n high, test variable $T(R1)$ follows normal distribution. Why? Central limit theorem.

- Describe in words how $T=T(R1)$ is calculated.

Repeat many times and get R1, substract mean value of R1 and divide by standard deviation of R1, so that you obtain t variable. N high, cnetral limit, normally distributed.

- How to check if significant?

Critical value, or p-value = 2 * (1 - phi(t))

- For t-test, why t and not normal distributed?

Due to change of s with sigma. But for n>>10 it tends to normal distribution. That applied in MW rank.

- How to check if volume is affecting the survival time of patients.

With Cox model.

- Explain Cox model. How do censored data enter in it? What do you obtain, how?

Steps, likelihood definition. Product exponent delta_i censored data. Then maximize likelihood, numerically, obtain most likely beta parameters. Baseline Hazard not needed to know.

- How to test if beta parameter is non-zero.

Wald statistics, or likelihood quotient test.

- What is Hazard ratio. What means HR>1

exp(beta), ratio after increasing covariate by one. HR>1 means higher risk of dying due to that covariate.