

NEUTRON THERAPY FACILITIES: STATUS

STATUS	REACTOR	D-T	CYCLOTRON	LINAC	TOTAL
Operational	1	1 (?)	5	1	6-7
Terminated	1	7	23	1	33
Unknown	0	1	2	0	41

(Update: Jan. 2011 by FM Wagner)



FAST NEUTRON THERAPY FACILITIES (8)

LOCATION	COUNTRY	SOURCE REACTION	SAD (cm)	BEAM DIRECTION	COLLIMATOR TYPE	FIRST	Oct. 2010 PATIENTS (March 2006)
Munich FRM I+II						1985/2007	
Garching (2)	Germany	Reactor	620	Horizontal	Multileaf	2006	
Essen [■]	Germany	d(14.3) + Be	125	Isocentric	Inserts	1978	763
Orleans [■]	France	p(34) + Be	169	Vertical	Inserts	1981	2103
Detroit MI [■]	USA	d(48.5) + Be	183	Isocentric cyclotron	Multirod	1990	2100
Seattle WA (2) [■]	USA	p(50.5) + Be	150	Isocentric Horizontal	Multileaf Inserts	1984	2489
Seoul [○]	South Korea	p(50.5) + Be	150	Isocentric	Variable jaws	1986	310
Batavia IL [•]	USA	p(66) + Be	190	Horizontal	Inserts	1976	3309
Somerset West [■]	South Africa	p(66) + Be	150	Isocentric	Variable jaws + Multiblade trimmer	1988	1396
Tomsk	Russia	p+Be					1200
Snezhinsk [°]	Russia	d-T		hor.	Inserts	1999	990

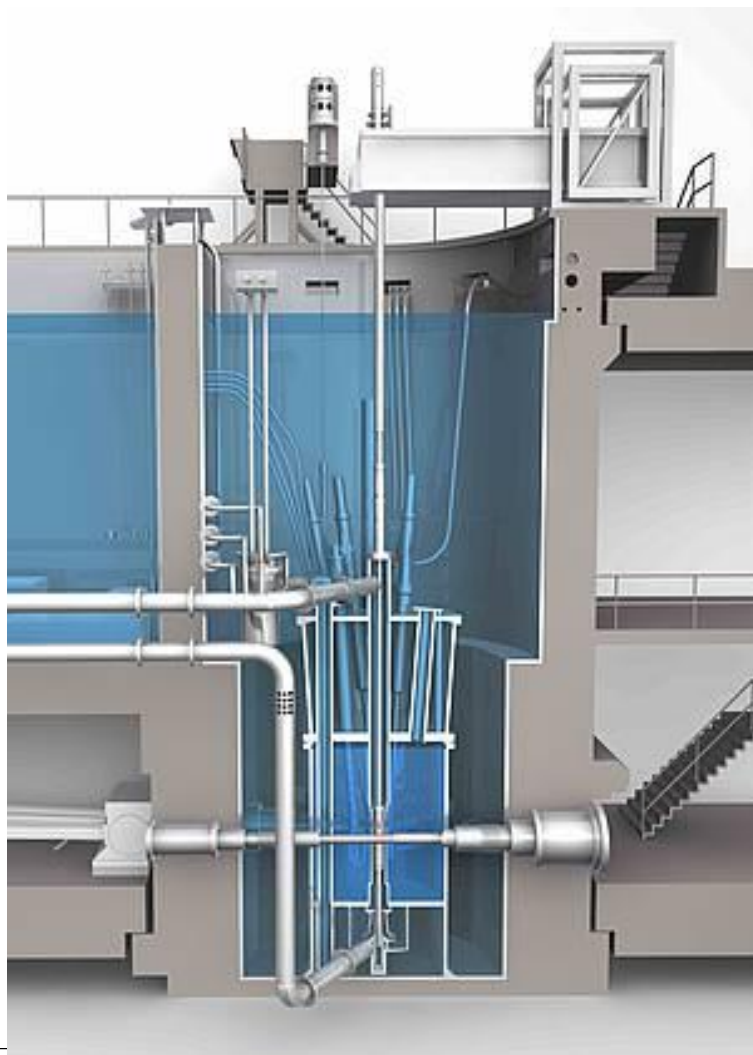


Forschungsneutronenquelle Heinz Maier-Leibnitz (FRM II) Technische Universität München, Garching

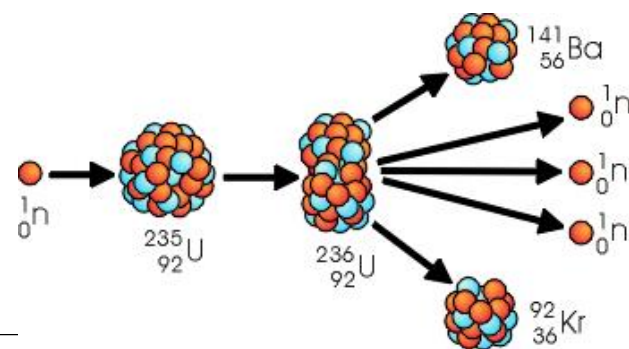
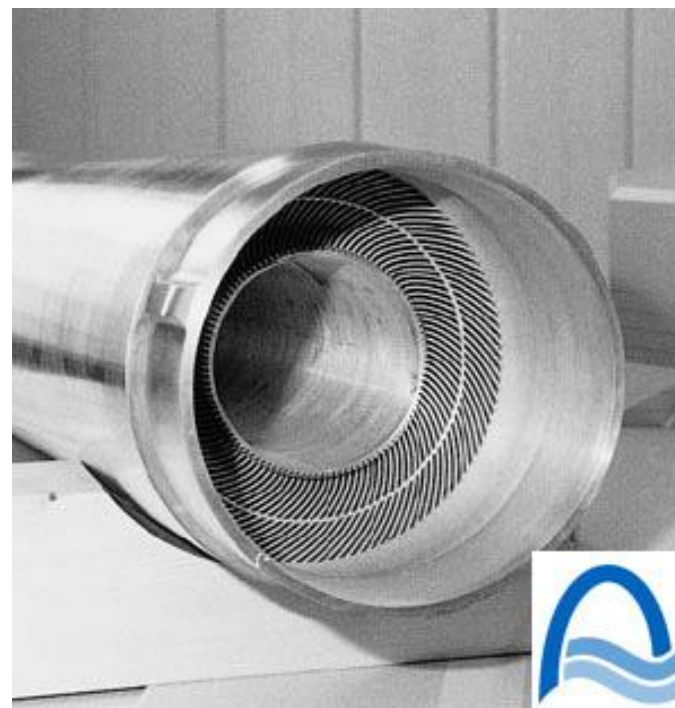




Reaktorbecken

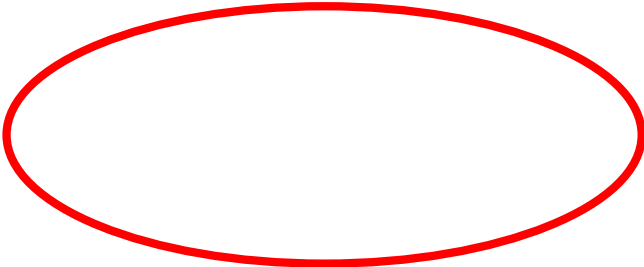
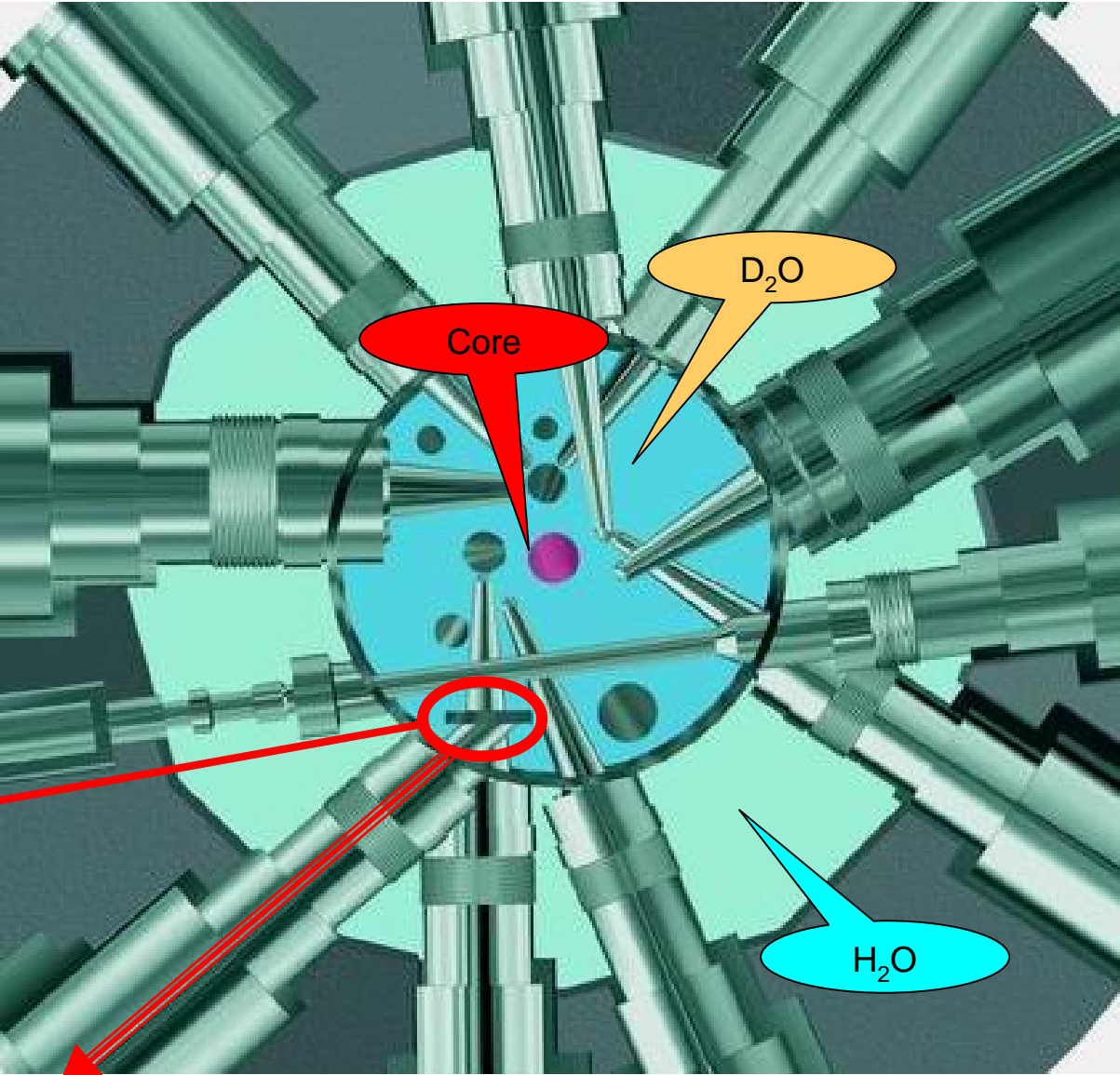


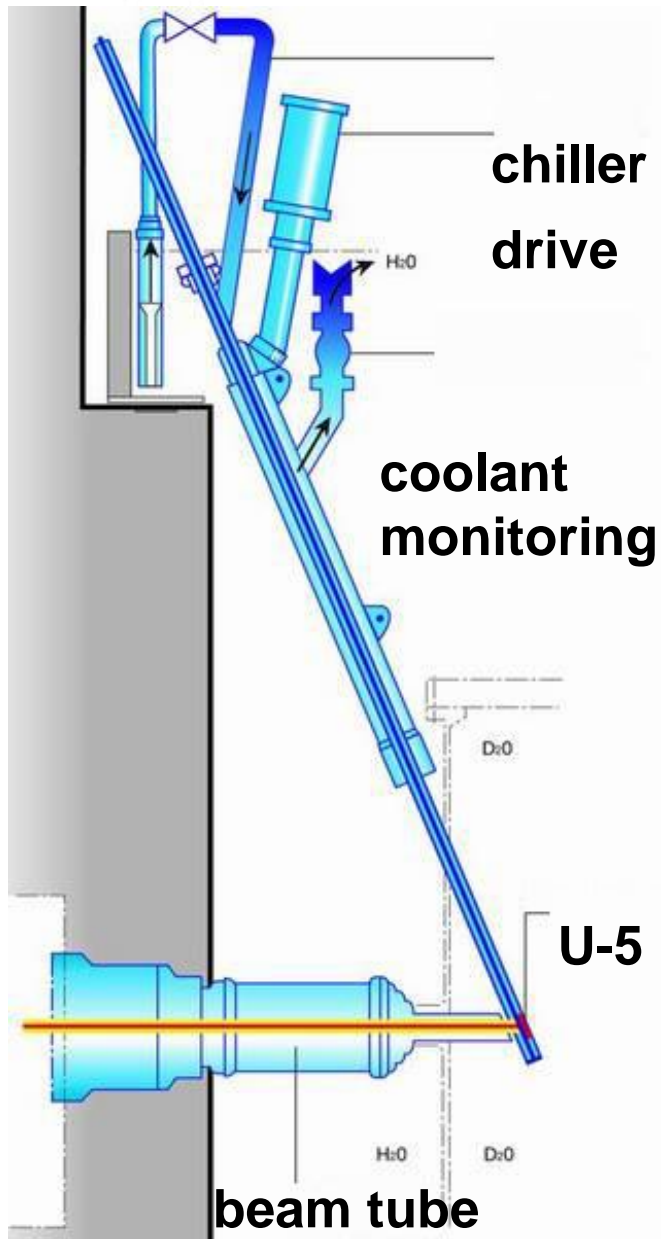
Brennelement





Reactorpool

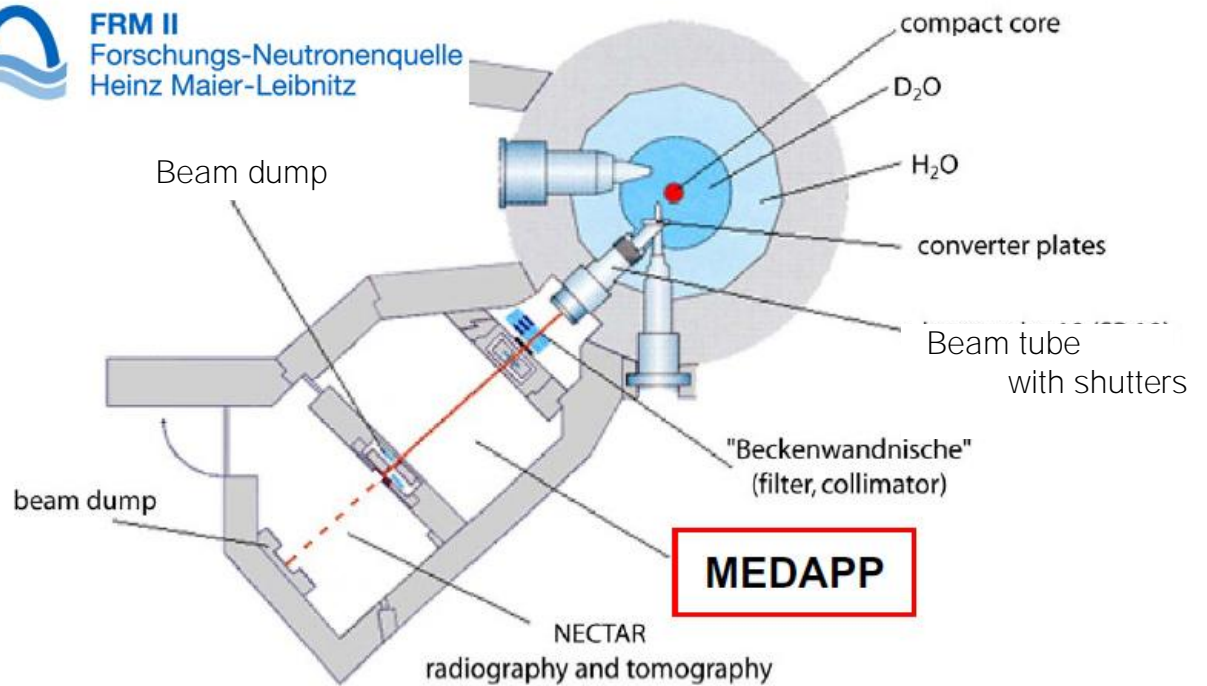




Thermal-to-Fast Neutron Converter



FRM II
Forschungs-Neutronenquelle
Heinz Maier-Leibnitz





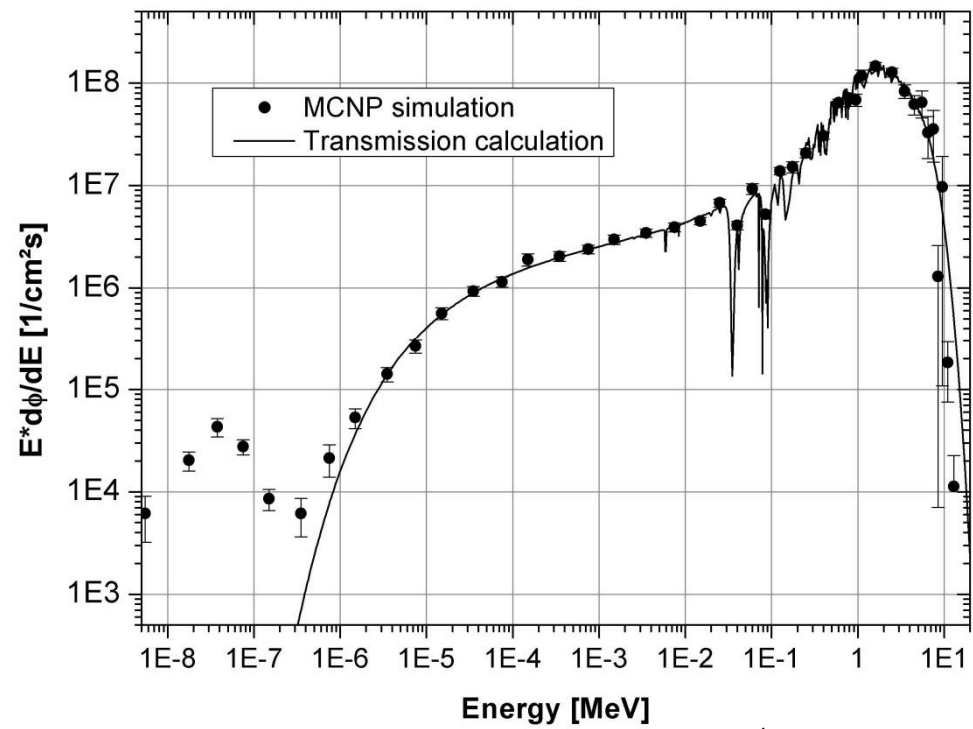
Bestrahlungsraum, Kollimator



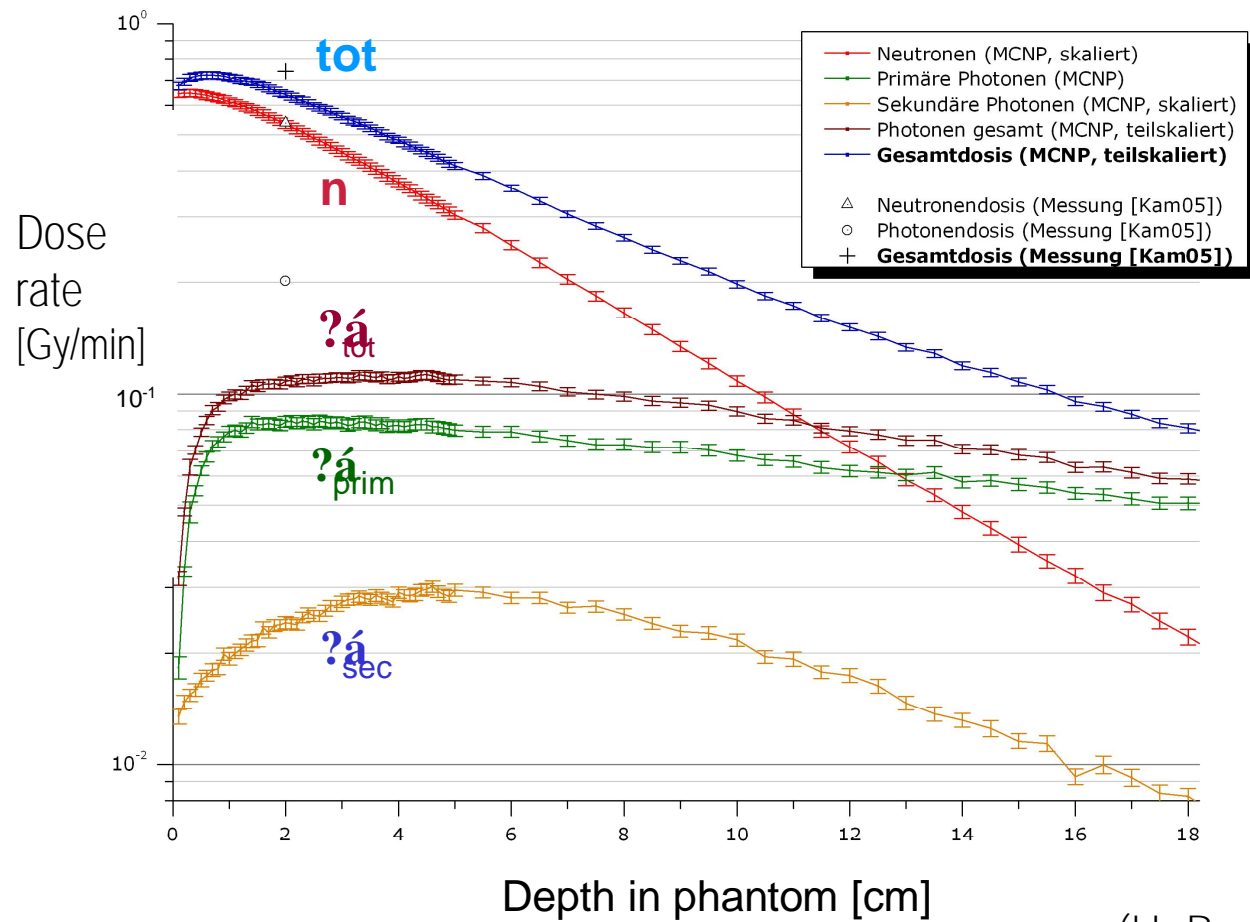








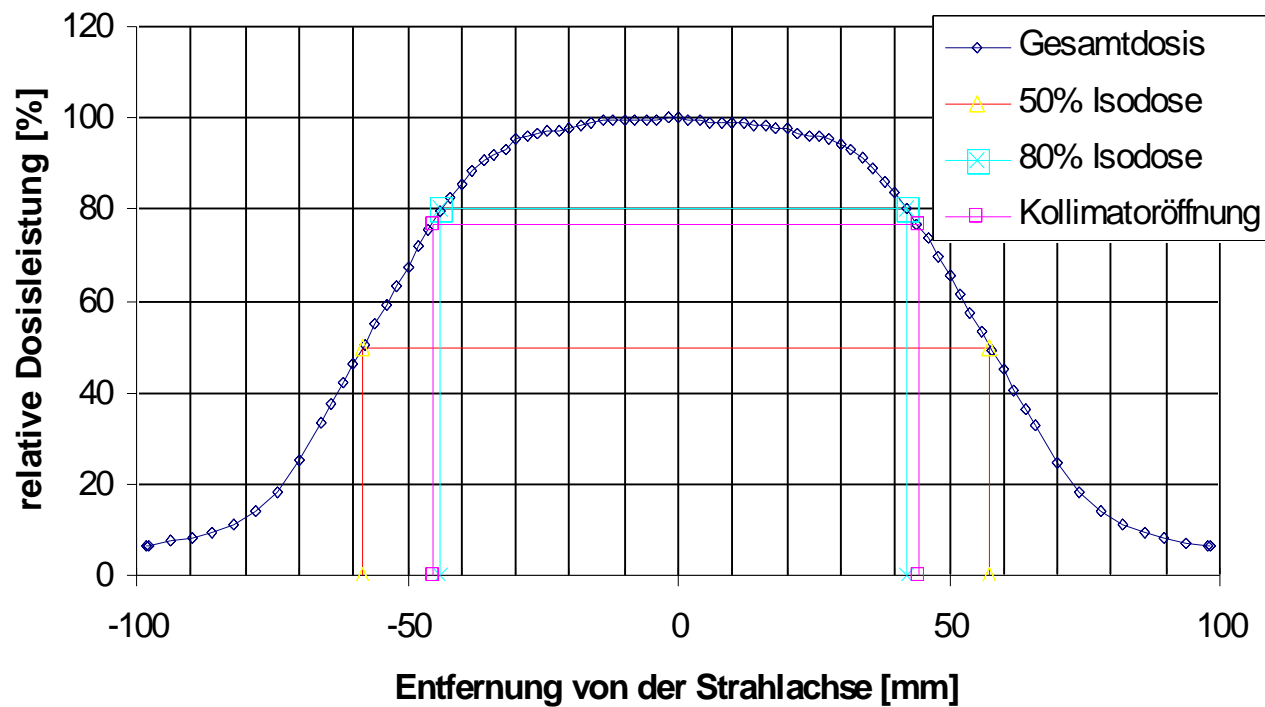
(H. Breikreutz)



(H. Breitzkreutz)



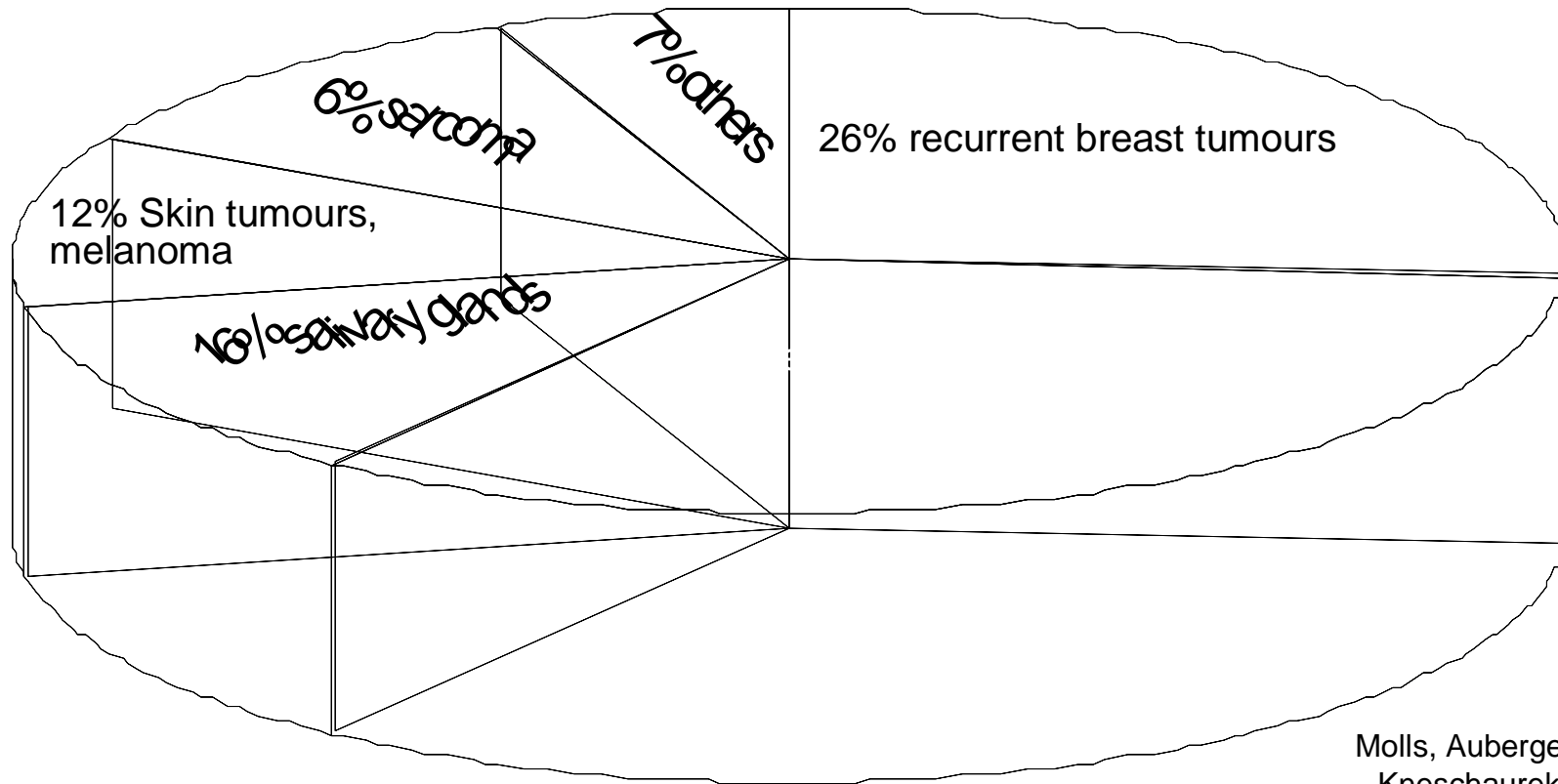
9 x 9 cm²-Feld in 5 cm Wassertiefe horizontal gemessen



Severin Kampfer



Indikationen zur Bestrahlung mit Spaltneutronen



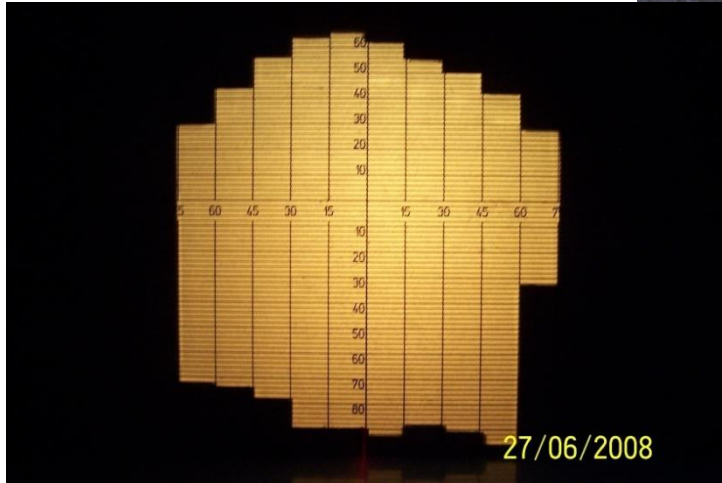
Molls, Auberger,
Kneschaurek

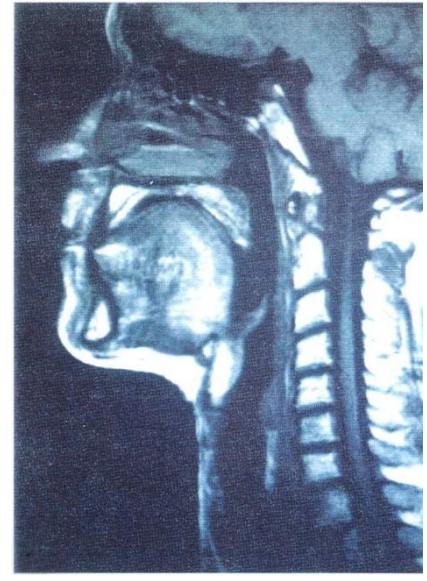
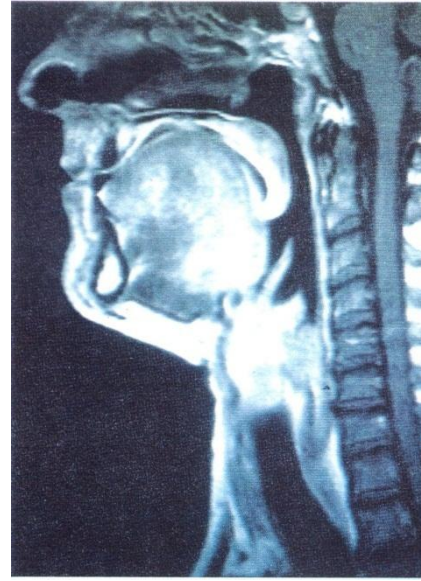
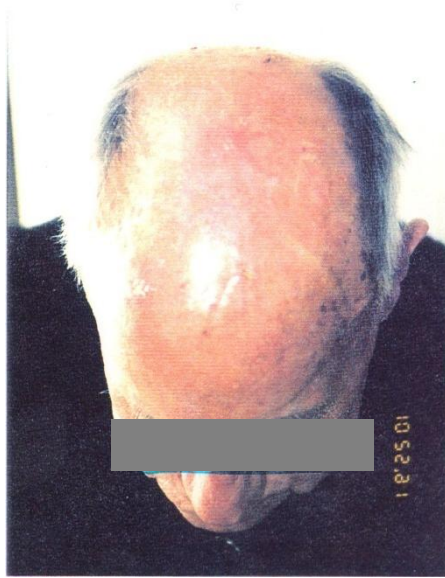






Brustwand-Metastasen eines Mamma-Ca: Verlauf





FAST NEUTRON THERAPY

Reflections - I

- ▶ ± 27 000 patients treated to date (estimated)
- ▶ Efficacy for several tumor types has been well established in randomized and other clinical trials
- ▶ But, many facilities were closed because of poor clinical results
 - side effects due to poor physical beam characteristics
 - poor penetration (low energy)
 - few had gantries
 - few had flexible beam shaping
 - unethical to treat patients if x-ray beams had similar characteristics
 - better treatments in photon arms of trials?
- ▶ Neutrons got a poor reputation, which has never been regained
- ▶ Viewed as outdated modality (~ radium)
- ▶ The advantages of neutrons are seriously underestimated

