Presentasjon av postere til PTCOG2017

Helge Pettersen, 2017-04-27

May 8-13, 2017

PTCOG56











Program

- 1. Educational session (I didn't bother)
- 2. Scientific meeting i Yokohama

Relevant presentations

A direct comparison of helium and proton computed tomography using TOPAS simulations and experimental data

GERMAN CANCER RESEARCH CENTER

P. Piersimoni¹, C.A. Collins Fekete^{1,2}, V. A. Bashkirov³, B. A. Faddegon⁴, R. P. Johnson⁵, C. Ordoñez⁶, J. Ramos Méndez⁴, R.W. Schulte³, L. Volz^{1,7}, J. Seco^{1,7}

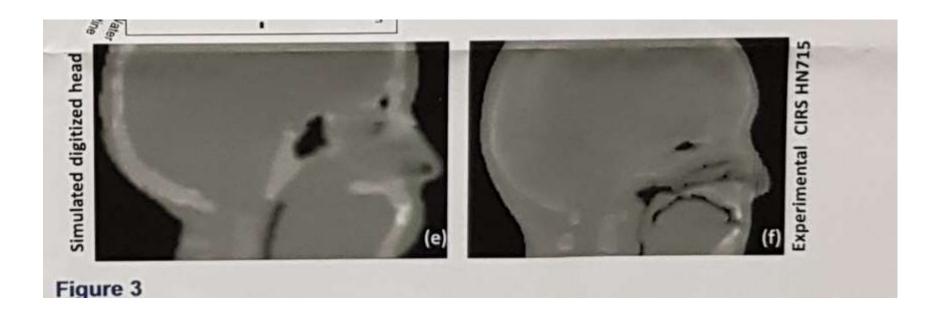
Research for a Life without Cancer

¹German Cancer Research Center (DKFZ), Medical Physics in Radiooncology, Heidelberg, Germany ²Université Lavalle, Quebec, QC, Canada

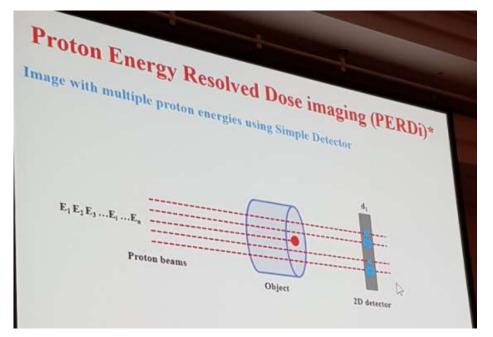


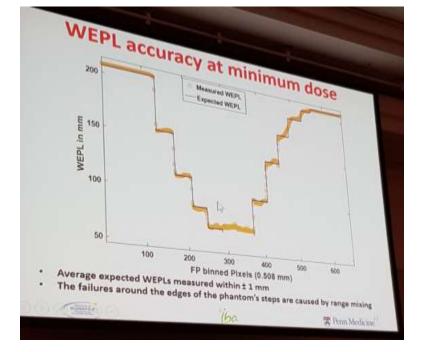
- ³Loma Linda University, Radiation Research, Loma Linda CA, USA
- ⁴University of California San Francisco, Radiation Oncology, San Francisco CA, USA
- ⁵University of California Santa Cruz, Institute for Particle Physics, Santa Cruz CA, USA
- ⁶Northern Illinois University, Center for Research Computing and Data, DeKalb IL, USA
- ⁷University of Heidelberg, Department of Physics and Astronomy, Heidelberg, Germany

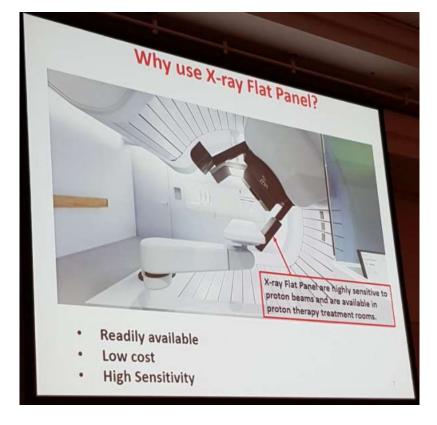
Abstract



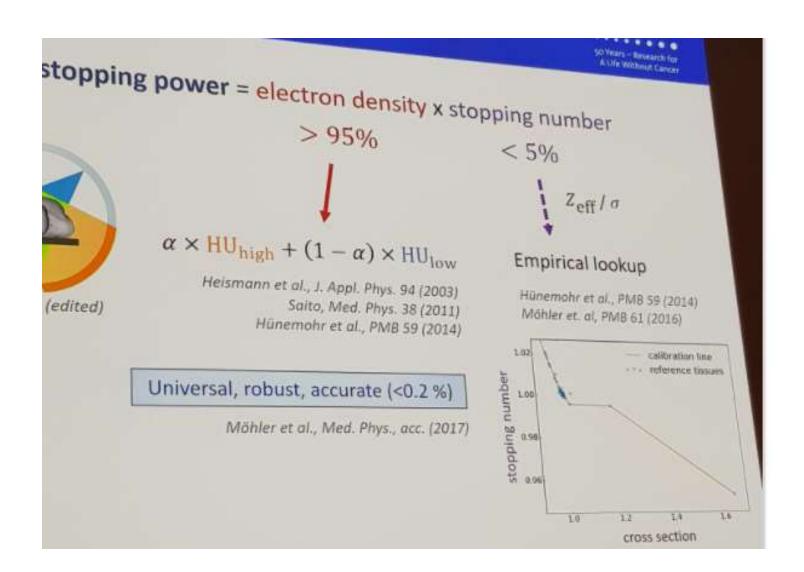
Simulated (left) and experimental (LLUMC scanner @ HIT) HeCT (right)







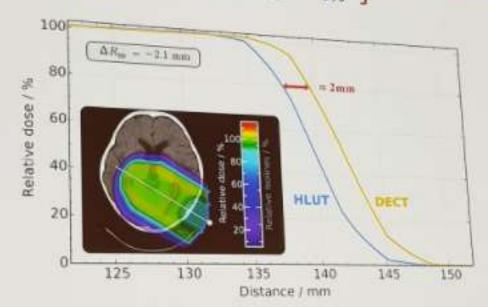
Stopping power from DECT



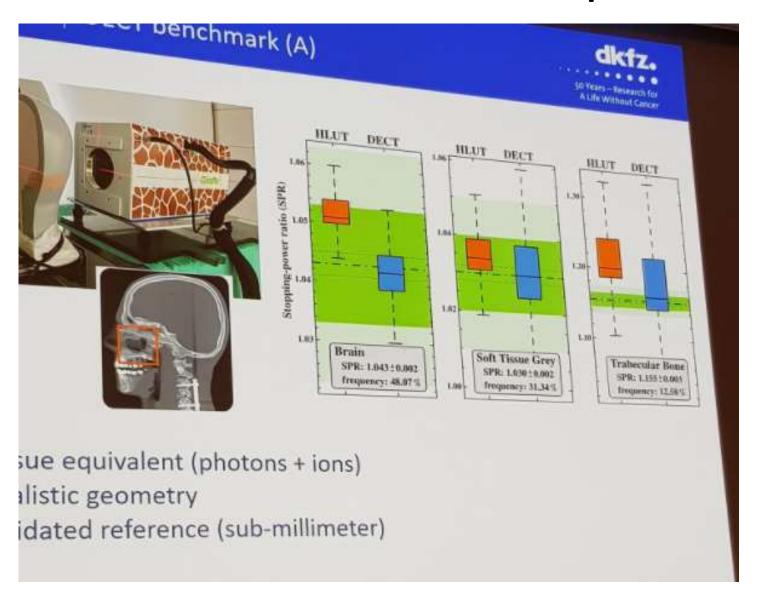


- Clinical database of currently 800 patients (1700 DECT scans) Wontphrt et al., (JRD8F 97 (2017)
- Range differences SECT DECT: 1.5 2.5%
- Compare to typical treatment margin ~ 3%

⇒ The effect is relevant!

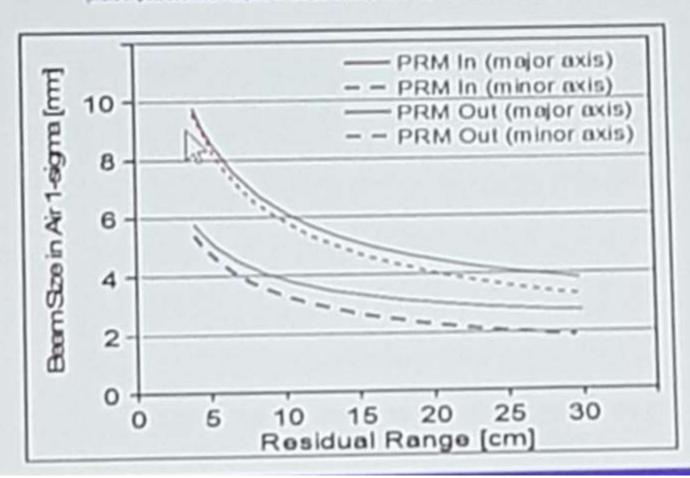


HLUT = Hounsfield lookup table



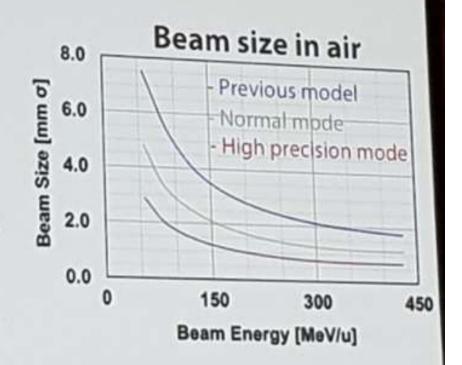
Removing the Profile Monitor (PRM) reduces the Spot Size by ~40%

(more impact at shallow depths where it's usually more important - Ex. H&N, brain)



Compact and yet keeping
scan speed 100mm/ms
& field size 24cmx24cm
(available up to 34cmx34cm)

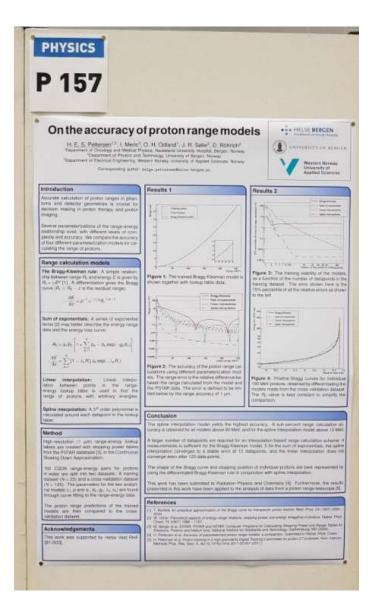
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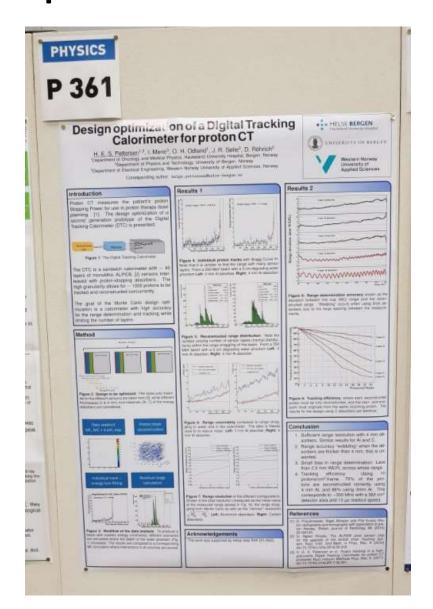




Leading Innovation >>>

I had two posters





IMPT imaging & reconstruciton workshop @ LLUMC in August

Dear Helge,

the summer is within sight and we wish to have our third annual Loma Linda imaging and IMRT/IMPT algorithm workshop 2017. i plan to arrive LLU thursday august 3, 2017 and depart on thursday august 10, 2017. this occurs right after the conclusion of the 2017 AAPM Annual Meeting (Denver, CO, July 30 - August 3, https://www.aapm.org/announcements/2017AMRFP.asp).

we are informing in separate mails our collaborators from Baylor, from NIU and a few others, hoping to create an as large as possible overlap that will enable us to work intensively together, exchange information, finalize and/or start or restart new things!

our previous (2015 and 2016) summer workshops at LLU were in an informal setting, not even a workshop webpage, a large round table room, etc. we hope to repeat this format.

we aim to have the workshop in session Monday through Wednesday 7, 8 and 9 of August. we will be most pleased if you could come during this (or part of this) period.

please let us know if you can come and give us details of your planned stay days. additional details can be obtained from reinhard.

best regards, reinhard and yair.

Irrelevant & interesting presentations

PROTONMBRT: an innovative therapeutic approach

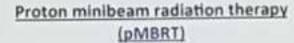
Our proposal: a novel approach in disruption with standard RT (Prezado et al 2013)

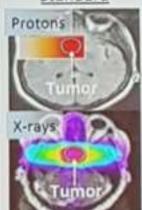
Minibeam radiation therapy (MBRT)

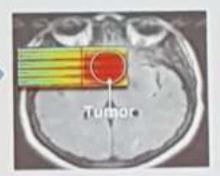


Different particle type, protons, and specific physics and biology

Standard







Homogeneous dose in the tumour

Spatial fractionation in normal tissue

Biological advantages of protons

Ion therapy is not THAT expensive

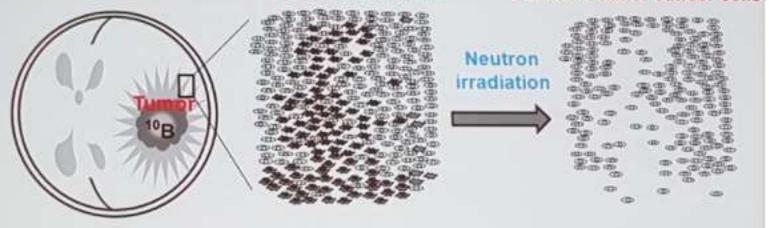
非小細胞肺がん・Stage Iの治療法	
Lung resection	1,469,230 Yen
+thoracoscopy	1,645,130 Yen
• SRT	927,920 Yen
Heavy particle	3,377,750 Yen
Adjuvant (UFT)	348,080 Yen
Adjuvant (CDDP+VNR)	341,430 Yen
Alectinib per month	794,940 Yen
Nivo/Pemb <u>per month</u>	1,609,898 Yen

BNCT was proposed in 1936 by the American physicist Prof. Gordon Locher. It was 4 years after the discovery of neutron by Prof. James Chadwick in 1932.

The following schema presents selective cancer cell kill at an invasion area where cancer cell and normal cell coexist under ideal condition with no accumulation of B-10 in normal cells.

Selective accumulation of ¹⁰B in cancer cells

Selective kill of cancer cells



TOKYO





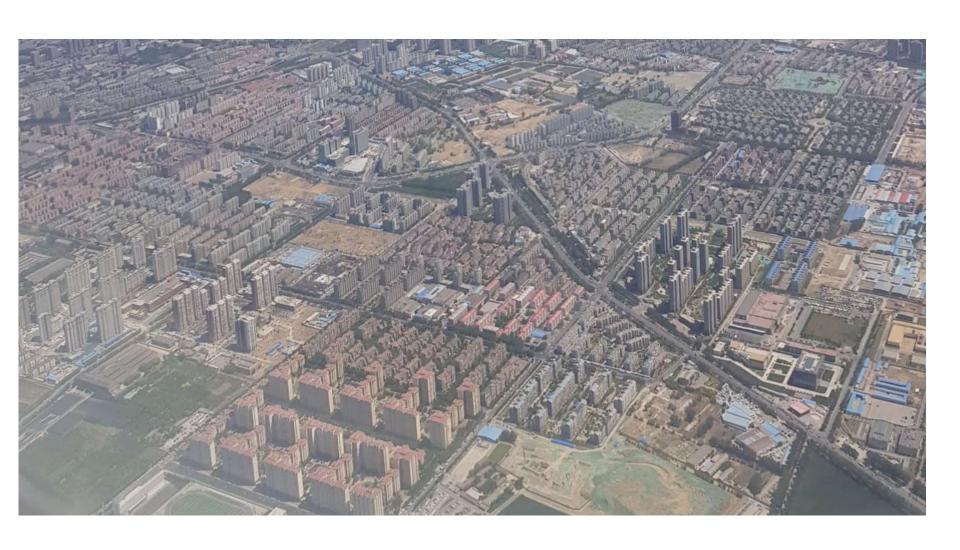
TOKYO







Beijing... CTRL-C CTRL-V architecture



Miscellanea

Status range calculation paper

Start New Submission

Click here to view your submissions with a final decision

My Submissions with Journal (1)

Accuracy of parameterized proton range models; a comparison

Current status: Reviewer Invited (0 (01/May/2017)

RPC_2017_252

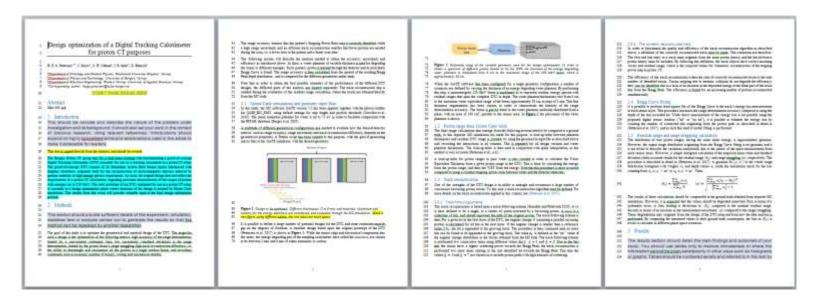
Associate Editor: Eric Shirley

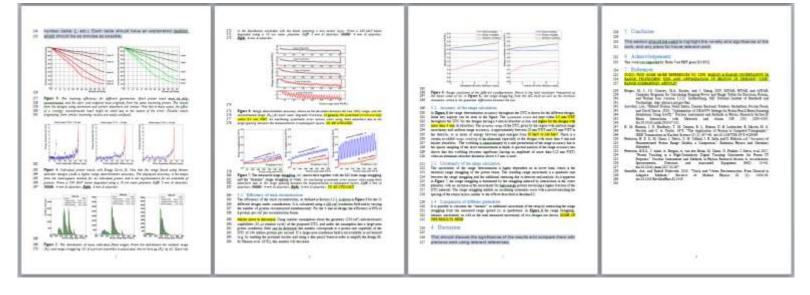
Article Type: Short Communication

Initial submission: 03/Apr/2017

T. S. Statement at Assessed Special Assessment and Assessment Special Company B.T. E. Hitsonicat of Associated Statement of the Print Statement No. 9, 201. To the channer of Degree Nove Descript the desgription to their Thomas or There of Nove. No. 9, 200. A comparison of future requires requirement of their sequence of their requirement of their sequence of their requirement of their sequence of their se 1.1. Special companies of 200 Me. The companie 2.5 Comparison of the shape of the Bragg cores The Bragg cores of single points another on easier shaped from a differentiation of the energy and another the state of the state of the state cores comparing page (4) price from and make points recording the cores of a single point. The followed parameters agent too in energy too cores of a single point. The followed parameters agent too in energy too cores of the page of the core force. Accuracy of parameterized proton range models; a companion H. E. S. Research, J. Steel, O. H. Ottor, J. S. Sand, D. Steart, Pagament of Change and placks Phase. Resident Eliza on Regist. Himse Department of Physics and Estimates. Change of English, Names Superiors of Estimated Engineering. Resident Physics Designation of Systems. Physics (1) After incomprise media, the mailing parameter furthe Suggi Demon modil, Eq. 141, an easily million related by others are Talle 1. The parameter from Each of the case of exponence made at Eq. 4-4 are an easy to coopers, the to the case; most accordinately. The State of the S The accounty of the points range demonstrate using different modes are provinted from a distribution of the models are distributed. Space 2 though two ranges coulding from the different models are distributed from the Tipe 1. Note, a sort procedure respond those for Better reperson or those straff the to progressing relate. Given the property of exponents were (Theo, 207) has been appropriate some extension model for magnetisations. For expose appropriate are the effect to other a stability \hat{x}_1 and \hat{x}_2 , represents the formula of the interpretation in the \hat{x}_1 to turn: Figure Legend's Paper. Figure 1. The second of the processings of inflations using different parameters about 10 feb. The major material field of the process of the contract and point in the PATAM Area The contract and point with a specific of the process of a second using point with a specific of the parameter of a second paper. But limited before the PATAM Area The contract of a second paper. 4 Dismissive and constation The uplice paragraphics model problem to tagget recommon in an approximation accommon ordered for all models above 10 MeV, and the tangular double above 10 MeV. $E_0 = \omega_0 E_0 \left[1 + \sum_i \left(|k_i - k_i| \exp(-g_0 \cdot E_0)\right)\right]$ Figure 2. The mining ratiols of the access on a function of the access of designant. 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The cross produce of the stamp to describe the respect function can be controlled for the company of the stamps of the stage The different productions a_1,b_1,b_2,b_3 is said c_1 and described in (Time, 1947), there are described by Time, 1947, there are described by the production on the models of terms on this conduction for the model of the conduction of the co In this early we compare the money from different parameter matter when appear in this context. Eight-rectations image-monign faither not context image the WEAD, strategy (Seppe et al., 2005), and the Self-Recommendation would not be described. The months are the contested to comparing their respective mone to the representation target, and the resulting Wagg current for militarial primare results. As application for the main is book in the regional actions on processing events one. If the Assistance of the regional region is necessarily and following the regional acquisition is the application. 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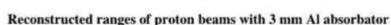
Status optimization paper

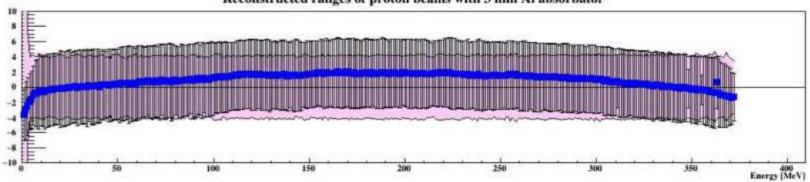




Systematic errors in March:

Features we don't understand

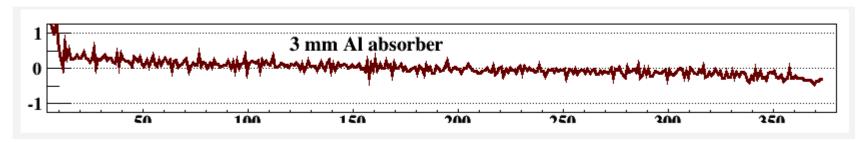




Why do we have these «nice» systematic errors in range determination?

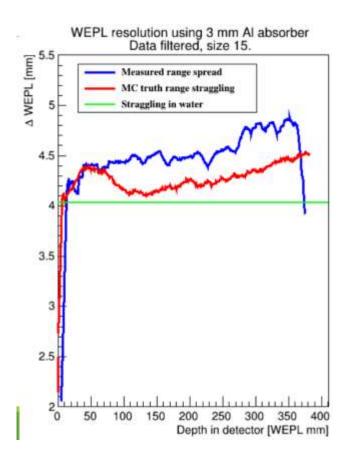
Looks like Bragg-Kleeman-type error of range-energy,
 but I can't think of any place I use the equation... (I use LUTs to calculate this)

Systematic errors in May:

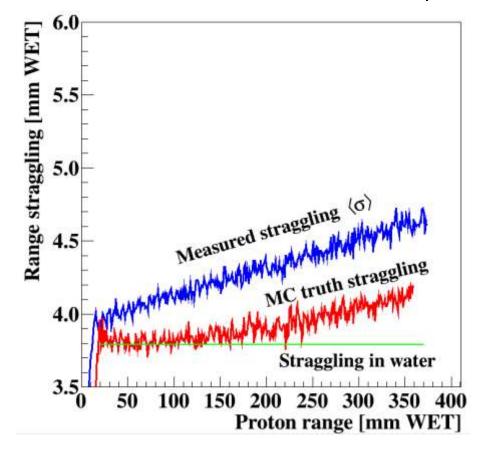


WET error [mm]

Stochastic errors in March:



Stochastic errors in May:



Status FFV article

Proton CT

Billes Bell Sema Peneses, Diese Röbrich

Andering for Implicationality og medicinish fisski Radioland Christophoropholic

Justiner for Pic. 8t or Telepology 1147

Innledning

Strileterapi er en behandling som go til om lag hab-parten av alle kreftparienter i Norge. Byloskus i Norge har tilbydd strikesaga i form av wageiste forme die distress tides Radiomhomitalet fild: Juralier Wideoer lietatron i 1953. Partitions vokadviskninger kniseer molekyler i pasiecies, som igjec kan trekke opp DNA-straturer i historilles. Out atclientage et à losfisykdommen, og begrense usmint bestikling av

De sure tilesen has det vært en dreining mot bruk av protone og tytegre inner inner strikenetspi. Idens om l bodis inne stationer fra 1646, og mange skapermientelle fjeldklaboratorier har biskapillet pariente sides des gang. Fuere sykshus-baserte protessante bis bygger i 1990 vad Lonna Linda utsufic Lox Angeles i California. I dag fisses 69 sentes på verbessbasis, og over 140 000 pasioner har fix air behanding and partner of tyago inter-Sverige groot protospeniere Skandineklinken i Opposite i 2013, og Dunsk Cause for Partikaltangs i Actus once på å behandle flesse parent med protone i 2018. I Norpe unebelde nå de fire intransponents on plan for a trigge partition temps.

Protonets dans mot avulsten

Som knermijosit volimeni met frome bremmidenson i en doperación filosofia il esobalista giston parette Subnequite boroker parience for vibin visible. Do vil man ogena et oreside i evalutes med hey does, og et sikatt Inninse-bad til dat Bisks venie.

Ex as utilistrapes inner perkinnings heale i k beegns hyorden man skal bereiks sydner. Tange og ledde petikler vil oppleve as gadvis nedtrenning i parieties, de petikless øvgir energi som innhere malakyter i bein, fert og studiel. In layer buright petibles hat, deto legge tid hat de pă inniestapporesse: Enegitape son loudenia unu inniestapporeside l uses vanora Frontie mol filimbe harighe. Effaites et m sharpi lun man să finne distrumentorus!

everene coulds end bay inciseingshird og dom an effekt som ble oppdaget i 1903 av W. H. Bragg. Området kalles for en Ævagy peak, og politisk tak ingen dose blir giti bak den (för tyngse inner som karboner, decimot, avgis der noe dose bak Bruge Peak graces M.s. fragmenteing at procisinions, bros flagrommes has length reliberable). Medicinate finitions og sikulte deseptanleggere på sykolus bestemmer da fizies bare den beste vindosien å bestelli e bu, mas også trillan enegi parikten må ka. Den cross fordeles til nursidielbespi knowne av Bragg peak. Man levere hav does til et argemoet soulde



Figur 1: To belonding plane con baptive on main i Guerra, our half kileted it bromiter. Bad flower story have daze, bilt forge vicer inverse daze. Vename: Economyconell circlisterapt med flamer. Legg mente cil stimolore-basisti i largane og lijerat: Heyre: Propoperagi: Proposition copper net eine coulten, of die his git minde door it. der meliggende State verm Pro G. M. Donarett val Managed Determination that a

Vevets sammensetning

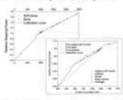
En protonstrike med en enegt på 130 MeV empper etw 13 cm fet, 12 cm muskel eller 7 cm ben. Da w det viktig å vite bys som ligger mellom strålenset og evaluated En lies followegaing has fire til stose mengder strälling till biskt ver, og en stralet som offenser terms. Skielett han korenne inn i participations ved purche epities, parietres has be gårt mel en buksemmelse siden doseplanen ble godicient, eller rychner han ha krymper siden ant Wike naturities bendelser, som tides endrer desenviset east one east fit present under forour-rapi, spiller he

For a lease beingse sayaging liver percentiles stopper i pasiecter, treuper statt et godt kart over potnest supplied i pariente. Protesta supplied subseque opra proposicional su elektronnethene og liggertreist av iminetagsprommislet i vevet, gjennen Bethe-likningen. Den er relativt endel å benegne anatyrisk, eses literer kjesselop til de to flätonen. Vesligvis

Deceme CT

Magneyeonnammonogod (MRI) saller retheso at their totale doses til frisk ver. En sayskrig personal many depresental (CT) make behandling lower product diagnostical Securiogalization for finnow. Despuippionthes et et manistegrep som bestik av finosiskinnik Proton CT skoopplen og Composuperdning, og signalet et lides om i bruke mille seven sammensening direkte risekt erbengig er einstellet til materiale (rentgerfromer law on energy pil medican 70 og 147 keV, og or limit under seeman for non-position into

For & beingse elaktrostettjetes healtes vaslige CTopptak: En CT-skunner kalibrerer til oppgaven ved å erfelde en 72 om euer erfonkrisk plaatsiskre ened uitbe muste, ale i feskjelige tethete og metrisle good letter elektropromether. Et allier obtain leakes the etfactors, on or or vening verkney for a knowledgeners. desperioral refers i de talice moduleta, liste supe lagaes haldewingstorre melion despringstraft og siskynnerhet. Dense haldewingskorren brikes sk for a bessens elektrossenbasikertet for det eskelts parietres, voes igles trubes for I benegor relicevishtes til pertense med en gitt energi-Deservers has side deans known an enter from og det vanlig å seta at den består av stagvisse onte linjer. Se Figuer I for et eksempel på en side olione. Resiltatet av et slik estapske er es total cuitibaties i protossidoviddes pil 5-3 %



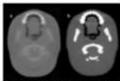
og despringsingt (Alburgfeld Chick). Pro Sologfine, B. and E. Fedrani, Phys Med Biol. 1868, 4578.

Den landige grad-spras til protosatskim gjer at man i beriet hat bestille vilatur het opptil britiske organer men hjerne og symmerre, men en slik-tarikkerher i protospikken idden kræver ekse værgivær. tive, at man also consists soon bestilles og avelaties. Fundt 85 millionar programmar. Fra deletire, 8, P et al., fir ritrig striketon nev met unknehm i bengningers. Der lagger begrenninger på brox tett oppel kritiska organe man kun behandle, og eker

med protoper on her eknisten niden 50-table. Ved & or flators town & stoppe belt loss man tilbérentres des riencompilles sondrafes til famomer. Silk arbenger den endelige unkbeheren i hergoing av relibertide but av eterptopplestinget vil callingen, som kan være mye bedre enn 2-3 %.

En company CT forgoes vad i bentile parients med or eligible colfboor viffethouse operandist, or ipregresende CNICG- detaktorer miller den varierende concurrence passement has platter embedates. Refligiele base gier bildeskommulojonen nägirt mitst. En protos CT, detaut, sul ta benyn til st potenhaner er buedo grunner europe send arboyninger (multiple Contamb scattering), og statt må måle trätteren til hvert månit proton håde for og ette pasient. Exegien til kriet enkelt proton må også mains, og flere deraktrens er formiller for denne positions: Ulike types pointillainese, samunankohlade oniversignizators og sporkegninkskrieners

Flare sources has knoatment person CT-prototypes Forst ut var se grappe ved Lonia Linda, som i dag har published gode regulation for six flex-deley planticienllator og Silicia litrip Descriptioners inning Se et eksempti på et rekommun todefaction / Figur 3. Totals for little postetyper blist



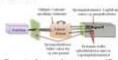
(secure) at proper CF og (kejne) at raceget CF. Franchiste for proon CT his resources and gap or MIX Dunt Shel St 1036 4370

Fernan CT

Proton CT i Bergen

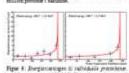
UB, Heyelolas på Vertander og Haskeland om å utvikle, kommune og varden dan nern CT-evenes bases of relocation for haveness fruits.

In light pliceliteiter our viet i Figur 8 stal en mager burig og effectiv desarlening og hums spot taxese w protecture senting. Durie statement. Du tile samebeitspetnens e tildat baset på sampling-princippet, bvor perikle brense midle fix TOPPFORIX, Bergen firekningerifiske net red bjelp er et absorbatormanetale mellom brent og 18elne. Vent, og amerier Sere doktor og securing. Den tile opprinnelig utvikler som en protoktorstipendiger de nette årete med mål om å protottpe på et elektromagnesisk kalendosser for å utvikle protottpen mot et klimak bjelpenddel. talls particle i from og elektrondurjer ved ALICE - Likevel - det er næren unning i si sår nytt medininsk Superments and CERN, og det appropriage spiket unstyrnår sitt endelige spik Fasterier ver à undersolie tox opertugalisateramente laux bruites (



Figur 4: Opposite As an prices CT mail

Analysis is softed gistants I knowledge processoring og modelje for protesses menjamening glesson sikult Bragg Curve modelitipening I Highr 5 vises energiameningen for to ulike process. Genome studie as bids supermemble data mild set KVI-CART i Groninger, Nederland og Mours Carlo-simularinger har 14 famout at percovering the recommissionly resourced some til forvettningene. En energingplesning på 4 % av rakkeriddes semt muligheten for å måte) million protoner i salozofet.



and forward more! [16] Mell: Bleet dissipant more till dyblin from protonic has might at restarting. In Brugg Curve-modal it graving artitized decreak furner.

Veien mot klinikken

I Begen foregie cå et nemafreidsprosjekt mellom. I den men frentid vil gruppen i Begen samafreide vembataylokus med mil om å urrilde et posten. postorypen av sporingskalorimeteset. Samarbeide med ALICE forecast, og desktorbekker fra ITSdetaktoren skal bidts til at den næte prototypen får

Videre lesning

Poladniovski, G. N. M. Alimon, and P. M. Ryana Trans Radiography and Tomography with application to Praton Therapy." The Behick Journal of Ratiology SE, no. 1053 (September 2015): 20110134 doi:10.1219/bjc.20150134

Petietes, H.E.S., J. Alme, A. Elegan, A. ras des Brink, M. Chaw, D. Feblikes I. Meric, et al. "Proner. Tracking it a High-Granularty Digital Ducking Calor/henry for Proces CT Purpasse." Nuclear Instruments and Methods in Pipeirs Research. Section A: Accidentum, Spectromers, Descripti and Associated Equipment 880C (2017): 51-61. doi:10.10581 pinus.2017.02.007

Study points

- I have 25 from PHYS391 + MNF990 + courses
- +2 from FFV
- +2 from international conference(s)
- +1-2 from popular science talk??

Fagseminar 08.11.2016 Rad avd, HUS og NRF lokallag

Tema: Bildediagnostikk for fremtiden

17.00 - 17.45	Protonterapi og protonforskning i Bergen. Utvikling av proton-CT	
	Ved Helge Pettersen, PhD stipendiat avd. for kreftbehandling og medisinsk fysikk	
	HUS	
47.45.40.00		