出國報告(出國類別：其他)

赴布拉格參加第 55 屆國際粒子治療合作組織 (Particle Therapy Co-Operative Group) 年度會議

服務機關：行政院原子能委員會

姓名職稱：侯政宇 薦任六職等技士

派赴國家：捷克

出國期間：105 年 5 月 24 日至 5 月 30 日

報告日期：105 年 7 月 25 日

摘要

國際粒子治療合作組織(Particle Therapy Co-Operative Group，PTCOG)為研究質子或醫用高能粒子放射治療系統之國際組織，主要會員國為加拿大、中國大陸、法國、德國、義大利、日本、俄國、南非、韓國、瑞典、瑞士、英國、美國、捷克等，並由相關粒子放射治療中心專家學者所組成，此外我國「林口長庚質子治療中心」亦於今年成為該組織會員。該組織主要工作除定期統計並更新全球粒子放射治療技術及設施之資訊外，每年皆由會員國舉辦國際年度會議，討論內容包括臨床醫學、保健物理、劑量評估、輻射生物效應、輻射醫療曝露品質保證計畫、迴旋加速器設計等方面的議題；舉辦期間，主辦國家會開放該國粒子治療中心提供與會人員參觀，以深入了解該國粒子治療系統使用之技術架構。

本次奉派前往捷克參加「第 55 屆國際粒子治療合作組織(Particle Therapy Co-Operative Group)」年度會議，會議於捷克首都布拉格的國際會議中心舉行，邀請國際專家學者就粒子治療相關成果進行專題講演及分享；期間與會人員並前往布拉格質子治療中心實地參訪，在美觀與實用兼具的設施裡，考察其輻射安全防護與監控、診療室配置以及目前針對不同癌症的治療成效。藉由參與此次會議，除可瞭解國際上執行高強度粒子治療設施之現況及管制作為，並提昇本會管制人員對於高強度粒子治療設施之專業知識，同時對本會精進粒子治療設施輻射安全與醫療曝露品保管制亦有所助益。

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一、出國目的

質子治療 (proton therapy)係使用帶有高能量的質子，攻擊癌症病灶，達到縮小進而消滅病灶之效。相較於傳統的放射治療，質子治療可以精準地攻擊深層病灶，並且縮減對正常組織傷害，為癌症治療的新方向。由於質子治療在癌症治療上越發成熟，台灣各醫學中心也陸續規劃質子治療中心，以期能投入臨床應用。本會已於 104 年 9 月 3 日核發林口長庚醫院高強度輻射設施第一～四間質子治療室使用許可證，該設施為國內首座質子治療設施，並於 104 年 11 月 10 日正式提供醫療服務，同時帶動台灣成為繼日本、韓國及中國大陸後，亞洲第四個有質子射束放射治療的國家，目前更是亞洲地區最大的質子中心。

本次奉派參加粒子放射治療合作組織 (Particle Therapy Co-Operative Group, PTCOG) 第 55 屆年會，希冀瞭解全球有關高強度治療設備的最新發展趨勢、粒子治療臨床上的應用進展、國際間各家廠商設備儀器發展，期間參訪布拉格質子治療中心，更可了解目前歐洲質子治療最新技術與運作現況，可供國內陸續成立之質子治療設施輻射防護管制參考，同時本會亦檢視現行對高強度粒子治療設施審查程序及後續管制之規範，進而保障就醫病患之健康及安全，以期建構更完善安全的輻射醫療空間。

二、出國行程

日期	地點	工作內容
105.05.24	台北、 捷克首都布拉格 (Czech Republic，Prague)	路程 (台北->阿姆斯特丹->布拉格)
105.05.25	捷克首都布拉格 (Czech Republic，Prague)	參訪布拉格質子治療中心 (Prague Proton Therapy Center)
105.05.26-28	捷克首都布拉格 (Czech Republic，Prague)	參加第 55 屆 PTCOG 年會 (Particle Therapy Co-Operative Group)
105.05.29-30	捷克首都布拉格、 (Czech Republic，Prague) 台北	路程 (布拉格->阿姆斯特丹->台北)

貳、出席第 55 屆國際粒子治療合作組織(Particle Therapy Co-Operative Group)年度會議

粒子治療合作組織(PTCOG)為研究質子與醫用高能粒子治療系統的國際組織，成員包含來自英國、美國、德國、法國、日本、韓國與中國大陸等國家的放射治療領域專家。除了統計全球粒子放射治療技術與設備外，每年定期舉行年度會議，討論臨床醫學、保健物理、劑量評估、輻射生物效應與輻射醫療品保計畫等議題。年會期間主辦國將開放該國高強度粒子治療設施，供與會成員參觀並了解其設施規劃、醫療應用以及輻射安全管理與規範。第 55 屆年會在捷克首都布拉格舉辦，並以質子治療(Proton Therapy)為今年主題，同時開放參觀布拉格質子治療中心，內容將詳述於後文。

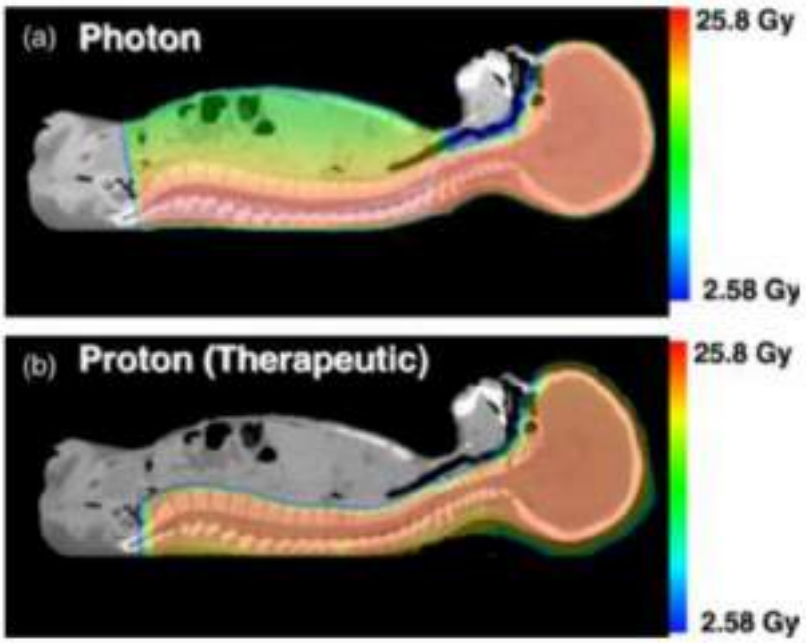
一、 質子治療發展及原理

1895 年，侖琴(Roentgen)首先發現 X-ray 的存在；1898 年，居禮(Curie)夫婦發現放射性元素「鐳」(radium)。其後歷經 30 個年頭，直至 1928 年首座治療 X 光機的問世，才成功利用於治療頭頸癌患者，同時開啟了放療治療領域的大門。綜觀整個癌症治療策略史，放射治療一直扮演著舉足輕重的角色，其原因在於屬非侵入性的放射治療技術不僅能給予外科手術無法觸及的病灶有效的破壞，同時更提供患者除了接受手術之外的選擇，大大降低心理上的不安及壓力；亦可搭配其他例如化學治療的複合式療程，提高惡性腫瘤的治癒率。

關於高強度粒子治療的發展，早在西元 1946 年於放射學期刊提出運用質子放射治療的觀念。1954 年在加州大學柏克萊分校首度用質子射束治療腦下垂體腫瘤並獲得成功。目前國際上總計約有 57 處質子治療設施，其中接受治療的病患約有 105,000 位(如附件一)。自歷年的統計數據觀察，國際間對於高強度粒子治療抱有很高的期待，為深入研究其物理及輻射生物特性，因此成立了質子治療共同合作組織(Proton Therapy Co-Operation Group, PTCOG)積極規劃各項研究及聯

合討論。此外，美國醫學物理師協會(American Association of Physicist in Medicine, AAPM)亦成立專責研究質子治療的劑量驗證作業負責研擬相關作業。

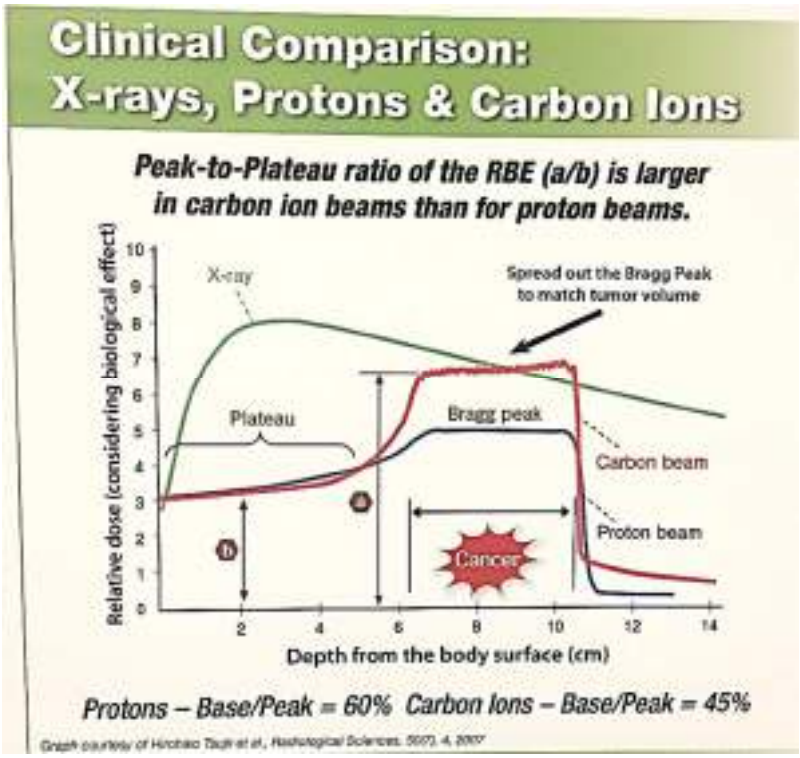
放射治療的基本原理乃是運用游離輻射以阻斷破壞細胞內去氧核醣核酸(deoxy-ribonucleic acid, DNA)與蛋白質等物質，誘發細胞壞死(necrosis)與凋亡(apoptosis)，進而達到殺死癌細胞或抑制其成長為目的，達成治療效果。但往往傳統光子治療產生之 X-ray 在穿過人體後，隨射線進入組織深度的增加，相對能量也成指數形式衰減，在尚未破壞腫瘤癌細胞前，將能量釋放至其行進路徑所及的組織就已經影響許多其他正常組織。而且當腫瘤位置越深層，不僅能量衰減而減低毒殺病灶的效果外，對於正常組織的傷害也會擴大。因此在對於深層癌症組織，如肝癌(liver cancer)、肺癌(lung cancer)與大腸癌(colorectal cancer))的治療效果有限。然而，高強度粒子治療所需的質子與重粒子以迴旋加速器(Cyclotron)或同步加速器(Synchrotron)在磁場中進行附加能量與速度，經由能量選擇系統與射束傳導系統將適當能量的粒子導入治療室中，經過噴嘴(Nozzle)打入病灶。質子與重粒子這類帶有能量的正電粒子在行進過程中不易釋放能量，而是在粒子將要停止時才一次釋放，這種現象稱作布拉格尖峰(Bragg Peak)。由於此特性，可以調整質子所帶的能量與速度，搭配筆尖射束掃描(pencil beam scanning)等技術，使得質子聚焦於癌症組織上進行能量釋放，藉此專一地破壞癌症病灶，所以可強化腫瘤的局部控制，並且於治療期間輔以即時影像校正治療位置，針對病灶聚焦治療。由於質子行經正常組織時，僅少部分能量釋放，故可以減低正常組織的損傷(如圖一)，達到較佳的治療與預後效果，同時也降低治療所可能產生的副作用，提高患者的生活品質。



圖一、傳統光子治療(上)與質子治療(下)於患者體內劑量分布比較，質子治療顯示正常組織接受較低劑量。

目前歐美國家粒子治療應用最多的是用於治療攝護腺癌、頭頸腫瘤；而亞洲則多使用於不適合開刀的肝癌、早期肺癌、頭頸癌等，據日本國家癌症中心的治療經驗顯示，運用質子治療於肝腫瘤平均 4.5 公分且不適合手術的患者，追蹤 2 年的局部控制率可達 96%，3 年存活率則為 62%。粒子治療使該類的病患，有機會獲得不遜於手術治療的成果。質子治療可針對腫瘤進行精密小範圍的治療，應用範圍已逐漸擴大到食道癌、口咽癌、腦下垂體瘤、腦動靜脈畸形、子宮腫瘤、骨盆腔腫瘤、脈絡膜黑色素瘤等全身不同部位的腫瘤。

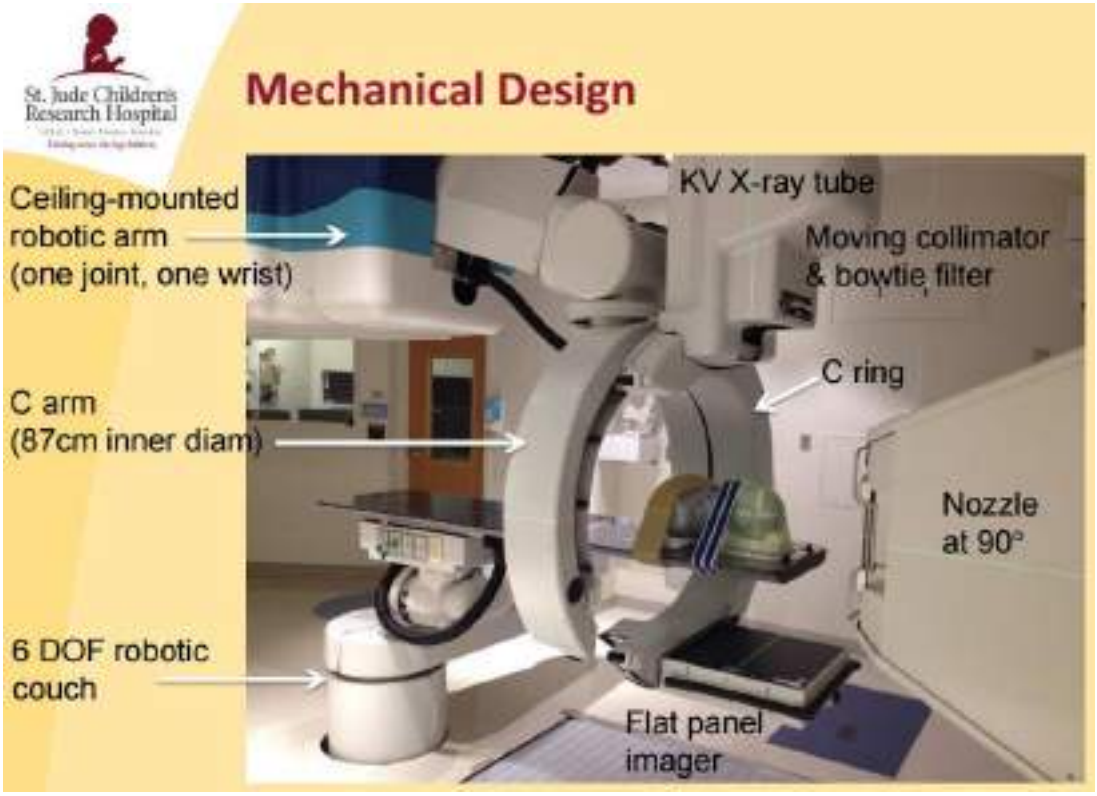
高強度粒子治療仍屬於蓬勃發展中的新興治療方法，就臨床成果探討若以高強度重粒子(如 ^{12}C)取代質子，可以增加布拉格尖峰的涵蓋區間內的能量強度(如圖二)，降低細胞毒性，且輻射生物效應表現較佳，能更有效毒殺病灶。



圖二、X-ray、質子與重粒子(C-12)於粒子治療的比較

另為了加強對病灶的定位與觀察，於機頭噴嘴(Nozzle)加裝影像導引攝影儀增加治療前病灶定位與解析能力。此外，若搭配 4D 治療計畫系統，可以校正病人在治療過程中呼吸等移動造成的位置偏移，而更能聚焦於病灶，增加治療效果(質子治療設備如圖三、即時影像導引攝影如圖四、圖五)。本次會議對於療效評估與管理方面也提出相關的說明與論證，惟仍需要更多研究數據，提供實用與安全的治療方案。

圖三、質子治療設備



圖四、搭配 C-Arm 斷層攝影(CBCT)的質子治療設備

圖五、4D 影像即時校正治療位置誤差

二、 專題演講

專題演講由國際相關醫療院所及研究單位專家學者分享其經驗及成果。內容包含高強度粒子治療的臨床研究、高強度射束的輻射生物效應、治療輔助配備研究與發展、劑量計算及治療計畫設計規劃及品質保證作業等內容。因許多專題演講同時舉行，以下僅就粒子治療臨床研究及輔助設備的研發等專題內容摘述如下：

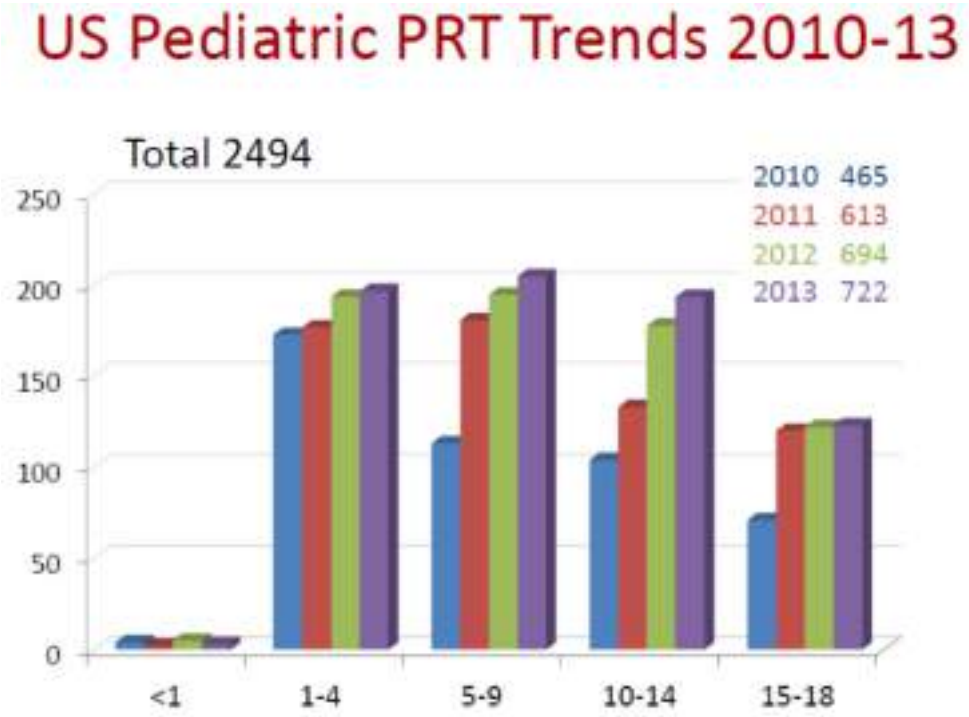
圖六、會議廳外同時進行大型的廠商展示博覽會。

(一) 高強度粒子治療的臨床研究

臨床研究案例分享包含有：小兒癌症、攝護腺癌、頭頸癌、肝膽腸胃癌、乳癌、肺癌及中央神經系統腫瘤等。由於質子治療能有效的聚焦病灶，並且降低正常組織的傷害，相較傳統放射治療療效較差的癌症，也能使用質子治療增加治療效果，案例治療及研究成果顯著。

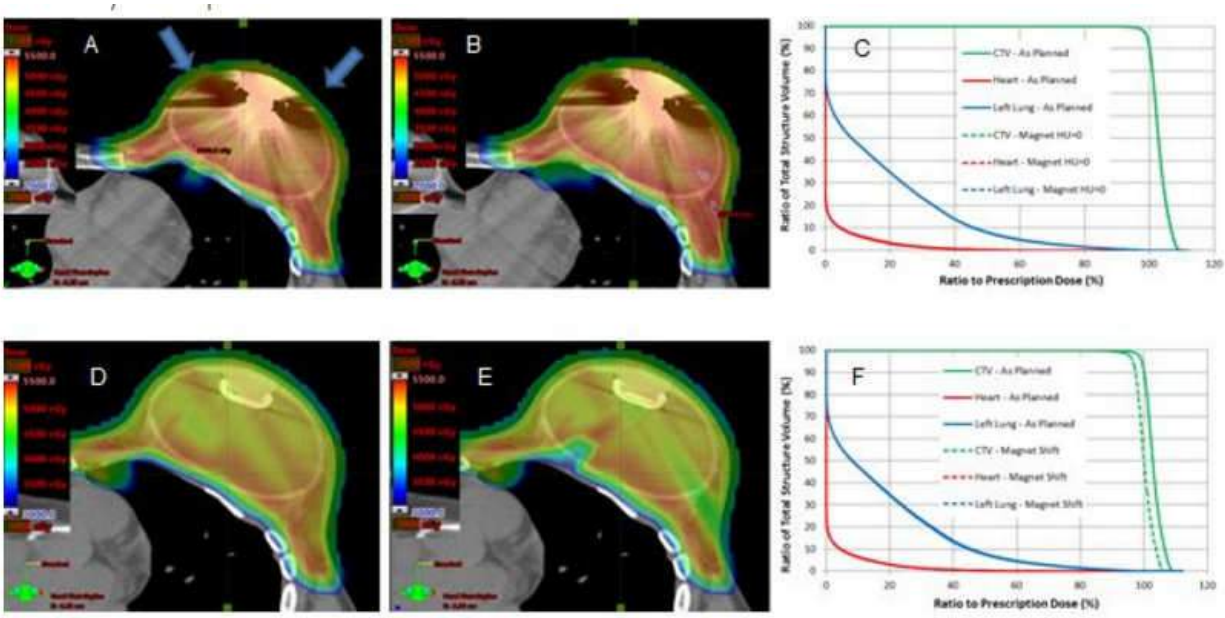
1. **小兒癌症**：好發於中央神經系統，使用化學藥物治療的療效有限，而傳統放射治療可能造成正常腦或神經組織損傷，影響病人後續成長發展。因此質子治療的物理特性及臨床優勢便成為小兒癌症治療的新趨勢(如圖七)。此次大會中，來自瑞士、德國與美國的研究團隊發表質子治療應用於該類癌症的治療成果。研究成果顯示，質子治療對於病人造成毒性

影響較低，並且能有效的達到抑制腫瘤生長，甚至使腫瘤萎縮，也有較佳的預後，是目前對小兒癌症較佳的治療手段。



圖七、2010-2013 美國接受質子治療的小兒腫瘤統計，顯示為逐漸增加。

2. **頭頸癌**：據瑞士、捷克、美國、義大利與中國大陸的團隊發表研究成果，使用質子治療後，病人不管在總體存活率(overall survival)、無疾病進展存活率(disease-free survival)、治療造成的組織毒性以及病人的健康狀態上都較傳統放療來的好，顯示出質子治療應用於頭頸癌的可行性。
3. **乳癌**：質子治療顯示出較高的存活率與較佳的預後，並且維持病人的生活品質。圖為美國研究團隊針對兩名乳癌患者，在質子治療(下排)與傳統治療(上排)的差異，顯現出質子治療對於輪廓曲線較大的惡性腫瘤，能給予平均的劑量分布，較不會產生治療位置有劑量過低或者過高(熱區)的狀況(如圖八、圖九)，降低皮膚表面潰爛等副作用，維持患者較佳的生活品質。



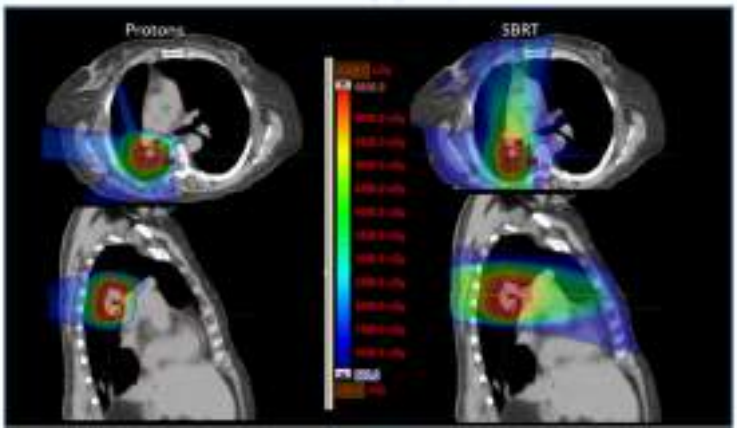
圖八、質子治療應用於乳癌治療

圖九、傳統放療(上)與質子治療(下)對於乳癌療效對比

4. **攝護腺癌：**日本名古屋質子治療中心研究針對攝護腺癌使用低分次質子治療(Hypofractionated Proton Therapy)技術及傳統質子治療技術產生泌尿系統毒性程度的比較，研究結果指出對於使用低分次質子治療(約60Gy/20 次)的患者產生泌尿系統生物毒性的結果低於傳統質子治療(74Gy/37 次)，換句話說，於臨床治療上，可參考此研究結果對攝護腺患者評估使用低分次及低總劑量的質子治療，在不影響整體預後的前提下

亦可合理抑低病人所接受的輻射劑量，降低患者治療次數，減少因治療住院或往返的辛勞，提昇生活品質。

5. **肺癌：**美國於 2015 年統計約有 225,000 名肺癌患者，期間約有 20%進行傳統放射線治療，另有 42%接受立體定位放射治療手術(SBRT)。佛羅里達大學 Romaine Charles Nichols, M.D.針對非小細胞肺癌接受 SBRT 及低分次質子治療(Hypofractionated Proton Therapy)輔以呼吸調控放療技術進行比較。結果證明低分次影像導引質子放射治療在腫瘤治癒率、組織毒性及預後上均表現優良(如圖十)，期望於更多樣本統計下，使更多患者受惠。



圖十、質子治療(左)與立體定位放射治療手術(右)的劑量分佈圖

針對其他多種癌症，包含腸胃道等深層癌症、生殖泌尿道癌症、中央神經系統癌症以及其他軟組織癌症等，質子治療較傳統放射治療不管在療效、預後以及組織毒性上都達到較佳的治療效果，且能維持病人的生活品質，替癌症治療提供了更有力的治療方式。

(二) 治療輔助配備研究與發展

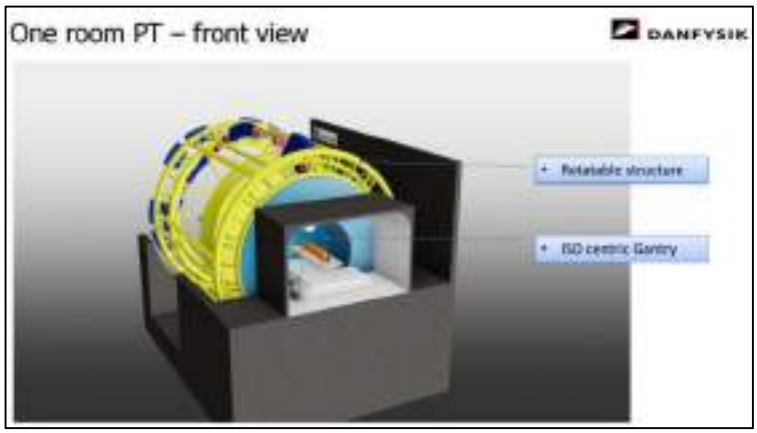
高強度粒子放射治療除了臨床應用的療效顯著外，相關的輔助治療硬體設備亦同步蓬勃發展，本次會議以即時影像校正設備及新型粒子治療室設計規劃發展尤其亮眼，茲摘述如下：

1. **搭載機械手臂型 C-Arm 攝影儀之影像導引質子放射治療：**相較於傳統型的影像擷取裝置大多安裝於出束噴嘴(Nozzle)旁，不僅限制了取像的角度

(180~200 度)，也可能造成成像上的干擾；機械手臂型的 C-Arm 斷層攝影儀與噴嘴處分離安裝，可控制取得患者 360 度斷層影像，同時減少影像的干擾(如圖十一)。惟機械手臂的大小、重建影像的時間及低對比影像清晰度等是當前需要持續精進改善的方向。

圖十一、搭載 C-Arm 影像擷取裝置空間位置

2. **單間粒子治療室設計概念：**由加速器設備廠商 Danfysik 提出單間治療室的概念，原則在於將治療設施最小化，可利用醫院現有的空間進行改裝升級，以求降低空間和成本的需求。搭載同步加速器(synchrotron)取代一般使用迴旋加速器的設計並取消射束降能器的安裝；取消射束傳導及射束能量選擇的過程中同時降低了射束活化現象，提昇整體治療設施的輻射安全(如圖十二)。



圖十二、配備同步加速器之單間粒子治療室概念圖

三、 參訪布拉格質子治療中心

捷克的質子治療中心坐落於首都布拉格，於 2012 年開始營運。此中心配備有四個質子治療室，並配有電腦斷層(computational tomography, CT)、核磁共振(magnetic resonance imaging, MRI)以及正子斷層(positron emission tomography/computational tomography, PET/CT)等先進的影像設備，可供臨床治療與研究使用，預計每年能服務超過 2200 名病患。此質子中心和捷克當地的大學合作，進行人員培訓與臨床研究。目前主要的研究與治療項目包含了兒童癌症、腦癌、頭頸癌、肺癌、腸胃道癌症、前列腺癌以及淋巴癌。以下以實際照片敘述重點設施。

圖十三、捷克的質子治療中心外觀是個現代感的玻璃帷幕建築。

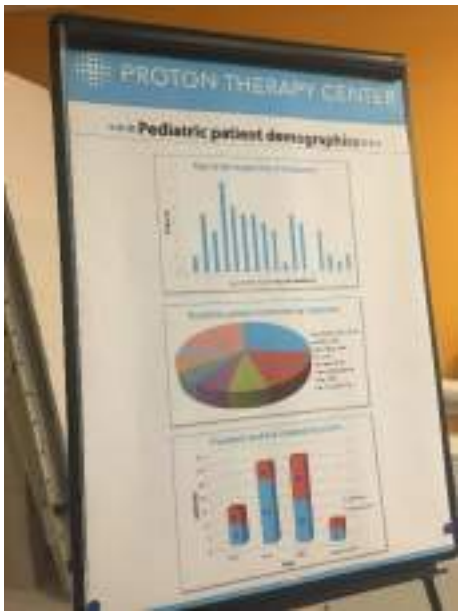
質子治療中心外觀以大片落地窗所構築，與城堡城市著稱的布拉格呈現強烈對比。第一眼不免有點冰冷的印象，然而內部家具擺飾卻以多種顏色配合呈現，加上採光佳的優點，反給人一種眼睛為之一亮的感覺(如圖十三)。


圖十四、工作人員認真的講解正子攝影電腦斷層掃描作業流程(左)及迴旋加速器射束傳導系統簡介(右)。

布拉格質子治療中心配置 5 間質子治療室，其中包括 1 間專門服務眼部腫瘤患者的固定型質子治療室。此外該中心也配置診斷型設備供醫事放射師取得模擬定位用斷層影像，並經由放射線專科醫師診斷病灶、簽訂醫囑，同時配合醫學物理師規劃設計治療計畫。診斷型設備包含模擬定位用電腦斷層掃描儀(CT)、磁振造影機(MRI)及正子攝影電腦斷層掃描機(PET/CT)。

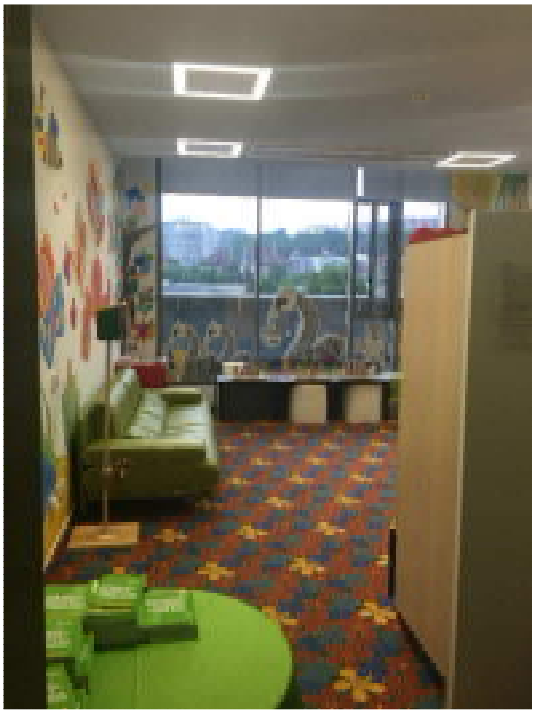

圖十五、設施工作人員介紹質子治療機操作及頭頸癌患者治療流程。


圖十六、控制室監控治療計畫相關參數同時配合視聽監視器即時確認病人治療狀況

圖十七、兒童癌症治療是該中心的重點項目。

布拉格質子治療中心專科醫師介紹小兒癌症治療現況(如圖十七)。該中心於 2013 開始為罹患癌症的孩童提供質子治療服務，統計至 2015 年的治療兒童數呈現逐漸成長。圖例中說明目前接受質子治療的孩童年齡主要集中在 2～10 歲，其中以髓母細胞瘤、室管膜母細胞瘤及中樞神經系統外腫瘤為主要病症。質子放射治療技術主要是將射束直接照射病灶所在部位以殺死腫瘤，或照射於整個全腦部及脊髓以殺死可能蔓延於腦脊髓液中的癌細胞。年紀太小的孩童若接受放射線治療，比較容易出現對正常腦組織及成長的傷害。但由於質子射束獨特的物理特性已改善了接受傳統放射治療的後遺症，因此該中心表示未來將持續致力於小兒癌症的臨床治療與相關研究。



圖十八、兒童等候室撥放著輕快的音樂並提供質子治療設備特製玩具。

布拉格質子治療中心使用繽紛的色彩及親切的卡通圖案裝飾等候室及麻醉室等(如圖十八、圖十九)，並且搭配特製的質子設施玩具向病童進行說明，用以安撫病童的不安情緒，同時播放時而輕快、時而輕柔的背景音樂，營造出使患者放鬆的氛圍。

圖十九、為病童所打造專屬的治療前麻醉室及等候室。

參、心得與建議

1. 質子治療為新一代的放射治療技術，藉由大會中來自國際間各專家學者的研究成果分享，深刻學習到高強度粒子治療技術的逐年演進以及在臨床使用上針對各種癌症治療的突破，同時證明了高強度粒子治療技術在臨床應用上的更趨成熟。依據 PTCOG 於 2015 年的統計，國際上已有 57 處質子治療中心提供醫療服務、33 處質子治療中心建造中(包含台灣大學附設醫院及高雄長庚紀念醫院)及 17 處質子治療設施尚在規劃階段。台灣目前只有林口長庚紀念醫院質子治療中心於 104 年 9 月 3 日取得本會核發之使用許可證並正式提供醫療服務。另高雄長庚紀念醫院亦取得本會核發該質子治療中心安裝許可，正積極建造中。台灣大學附設癌醫中心醫院則尚處於向本會申請設施安裝許可的審查階段，其餘 4 家醫學中心(台北榮民總醫院、中國醫藥大學附設醫院、臺北醫學大學附設醫院、彰化基督教醫院)亦積極籌備中。為因應世界高強度粒子治療趨勢，本會已建立「粒子放射治療設施輻射安全評估報告撰寫導則」、「醫用質子治療設施運轉訓練與運轉操作實務訓練課程」，同時蒐集國際間醫療曝露品保作業先進國家的作法擬訂相關的品保項目及容許誤差值。本會將持續參考國際間高強度粒子設施之管制規範，強化現行審查程序並作為未來擬定相關法規之參考，提早為萌芽期的質子治療領域建立起明確且實用的規範與準則，以期協助各醫療單位建立安全的質子治療環境，保障工作人員與病人的輻射安全。
2. 國際間各高強度粒子治療設施於臨床治療與專題研究過程中已個別建立資料庫用以蒐集臨床治療相關資料及研究成果，藉此提供數據分析以增進病患治療時的安全性與療效。然而，這些資料庫內患者資訊大多以西方人為主，考量到東方人與其在體質上的不同，治療效果與可承受的輻射劑量等可能會有所差異，故可建議台灣各高強度粒子設施若有需要，可就其研究資料及治療成果作參考及對照，另針對相關治療計畫數據與輻射安全規劃等則建議參考

日本、韓國與中國大陸等亞洲區資料庫，再對台灣族群做適當規劃及調整。

3. 持續發展的高強度粒子治療硬體設施需要仰賴各專業醫療從業人員提供謹慎精確的操作、設備品質的維護、輻射安全的管制及治療計畫的最佳化，方可造就優質的醫療服務並落實病人的輻射安全。許多國家的放射醫療領域有完善的專業人員配置，專科醫師、醫事放射師及護理師都有其相對應的法律定位，藉由國家考試取得法定醫事人員資格，唯獨醫學物理師制度則依各國家相關團體辦理認證，仍非屬國家法定醫事技術人員。我國醫學物理師現況亦與大多數國家相同，其相關資格門檻及考試認證則由民間團體「中華民國醫學物理學會」專責訂定。但由本次會議專題演講的講者大多數是由醫學物理師及臨床專科醫師擔任來思考，其醫學物理師於現行放射治療領域所扮演角色的重要性其實不難想像。醫學物理師執行放射診療設備的品質保證及其他醫學物理專業研究，同時配合許多相關單位致力於醫療曝露品質的提升，實為放射診療領域不可或缺的一環。衛生福利部於 101 年 11 月 23 日修正頒布之「特定醫療技術檢查檢驗醫療儀器施行或使用管理辦法」第二條附表(如附件二)，內容已針對設置高強度粒子治療設備之醫療機構明確規範人員配置標準，除放射腫瘤科專科醫師、醫事放射師及輻射防護師以外，包括單機型質子治療機須配置專任之醫學物理專業人員三人以上、多間質子治療室則每新增一間治療室依規定須多配置醫學物理專業人員一人；重粒子治療機構則須配置專任之醫學物理專業人員五人以上。由此可見國內衛生主管機關對於醫學物理師於設備品質保證作業、治療計畫規劃設計及醫學物理專業研究的地位越趨認同，建議衛生主管機關應盡速著手研議醫學物理師相關法規，明確規範醫學物理師具備的資格、執業內容、醫事人員專業證照的取得、醫療機構應配置的醫學物理師人力等事宜，以提升國人輻射醫療品質。

4. 本會自民國 94 年起依「游離輻射防護法」推動輻射醫療曝露品質保證制度，同年 7 月 1 日起，依據「輻射醫療曝露品質保證標準」，針對放射治療相關的

設備，訂定輻射曝露品質保證作業程序與規範。然而由於高強度粒子治療設備於全球尚未全面普及，國際間亦未有相關法規明訂其品質保證作業項目及其規範。目前國外醫療機構的作法是由原廠及醫療院所依據該質子設備的特性自行訂定該中心的輻射醫療曝露品質保證項目及容許值來確保其安全性。此外由本次會議僅有少數品質保證作業相關專題演講的情形顯示：現行國際間高強度粒子治療設備發展皆位處於各大廠相互競逐的跑道上，是否能在發展初期拔得頭籌遂成為優先考量。因此各家廠商對於新式高強度粒子治療技術的研究、臨床治療成果的呈現及相關放射治療輔助配備的研發投入大量的人力物力自然成為之間的默契，導致設備品質保證作業的研擬相對成長緩慢。儘管如此，高強度粒子治療設備的品質保證實屬重要，設備的保養維護應訂定明確之規範，並由合格之品質保證人員執行，以確保病人的醫療輻射安全。故本會已於 104 年建立「醫用質子放射治療設施品保作業研究計畫」，該計畫主要參考國際輻射單位與度量委員會(ICRU)59 號及 78 號報告之建議，並擬訂相關的品保項目及容許誤差值。本會將持續蒐集國際文獻及全球高強度治療設施所建議之品質保證作業項目及規範，並建議每年派員出國參訪相關會議，以持續瞭解國際間高強度粒子治療趨勢，以期未來於高強度粒子設施管制作業上能與國際間順利接軌，並邀請國內外具備高強度粒子治療設施輻射安全及醫療曝露品保實作或管制經驗之學者專家至本會進行演講及經驗交流，指導本會同仁在法規制訂時，應考量精準與務實，以兼顧輻射安全與臨床落實的可行性。有助於本會對於國內陸續增設之高強度粒子治療設施申請案審查，強化管制人員專業知識，研議制定適合國內之粒子治療醫療曝露品保相關規範。

5. 捷克是個中歐古國，自一般建築到醫療機構都展現出特別的風格，即便是質子治療中心此類與生命拔河的場所，除了先進的醫療設備外，隨處可見的休憩空間，妝點的典雅舒適，為冰冷的醫療單位帶來安定與寧靜感。置身該處

都能感受到心靈的平靜，對於病患與其家屬更能達到安撫與慰藉的效果。此外經由本次會議瞭解到國際間對於小兒癌症患者的治療照護越趨重視，由開放參訪的布拉格質子治療中心便可相互印證。充滿童趣的卡通裝飾搭配多色塊的繽紛背景呈現、輕快溫暖的自然音樂流倘，以舒緩放射治療孩童的不安及緊張情緒，連帶陪伴的家屬亦可感受到醫療環境的溫度，同時給予家人更多的關懷及鼓勵，這是一種正能量的循環。然而在台灣醫療設施卻相當少見。或許這樣以「人」為本的設計思維，才是在治療過程中患者最需要、最深切感受到的，相當值得本國各相關醫療機構在規劃上參考應用。

肆、附錄

附件一、全球高強度粒子治療設施統計表

附件二、「特定醫療技術檢查檢驗醫療儀器施行或使用管理辦法」第二條附表之醫用粒子治療設備摘述

附件三、第 55 屆國際粒子治療合作組織年度會議導覽

附件四、布拉格質子治療中心簡介

附件一、全球高強度粒子治療設施統計，資料由 PTCOG 網站提供。

Location			Particle	First (last) patient, y	Patient total, no.	Date of total, y
Country	City	Institution				
Belgium	Louvain-la-Neuve	-	p	1991 (1993)	21	1993
Canada	Vancouver	TRIUMF, Canada's national laboratory for particle and nuclear physics	π	1979 (1994)	367	1994
Canada	Vancouver	TRIUMF, Canada's national laboratory for particle and nuclear physics	p	1995	182	Dec 2014
Czech Republic	Prague	Proton Therapy Centre	p	2012	357	Dec 2014
China	Zibo	Wanjie Proton Therapy Center	p	2004	1078	Dec 2014
China	Lanzhou	Institute of Modern Physics, Chinese Academy of Sciences	C ion	2006	213	Dec 2014
China	Shanghai	Shanghai Proton and Heavy Ion Center	C ion	2014	22	Dec 2014
China	Shanghai	Shanghai Proton and Heavy Ion Center	p	2014	13	Dec 2014
England	Clatterbridge	-	p	1989	2626	Dec 2014
France	Nice	Centre Antoine-Lacassagne	p	1991	5205	Dec 2014
France	Orsay	Center of Prótontherapy of Orsay	p	1991	7004	Dec 2014
Germany	Darmstadt	GSI Helmholtz Centre for Heavy Ion Research	C ion	1997 (2009)	440	2009
Germany	Berlin	Hahn Meitner Institut	p	1998	2525	Dec 2014
Germany	Munich	Rinecker Proton Therapy Center	p	2009	2307	Dec 2014
Germany	Heidelberg	Heidelberg Ion-Beam Therapy Center	C ion	2009	1723	Dec 2014
Germany	Heidelberg	Heidelberg Ion-Beam Therapy Center	p	2009	824	Dec 2014
Germany	Essen	West German Proton Therapy Centre Essen	p	2013	139	Dec 2014
Italy	Catania	Istituto Nazionale di Fisica Nuclear (Laboratori Nazionali del Sud)	p	2002	350	Dec 2014
Italy	Pavia	National Centre of Oncological Hadrontherapy	p	2011	111	Dec 2014
Italy	Pavia	National Centre of Oncological Hadrontherapy	C ion	2012	318	Dec 2014
Japan	Chiba	Heavy Ion Medical Accelerator in Chiba	p	1979 (2002)	145	2002
Japan	Tsukuba	Proton Medical Research Center, 1	p	1983 (2000)	700	2000
Japan	Chiba	Heavy Ion Medical Accelerator in Chiba	C ion	1994	8841	Dec 2014
Japan	Kashiwa	National Cancer Center	p	1998	1560	Dec 2014
Japan	Hyogo	Hyogo Ion Beam Medical Center	p	2001	4652	Dec 2014
Japan	Hyogo	Hyogo Ion Beam Medical Center	C ion	2002	2148	Dec 2014
Japan	Tsuruga	Wakasa Wan Energy Research Center	p	2002 (2009)	62	2009
Japan	Tsukuba	Proton Medical Research Center, 2	p	2001	3416	Dec 2014
Japan	Shizuoka	Shizuoka Cancer Center	p	2003	1757	Dec 2014
Japan	Koriyama City	Southern TOHOKU Proton Therapy Center	p	2008	2797	Dec 2014
Japan	Gunma	Gunma University Heavy Ion Medical Center	C ion	2010	1486	Dec 2014
Japan	Ibusuki	Medipolis Proton Therapy and Research Center	p	2011	1317	Dec 2014
Japan	Fukui City	Fukui Prefectural Hospital Proton Therapy Center	p	2011	428	Dec 2013
Japan	Nagoya	Nagoya Proton Therapy Center	p	2013	627	Dec 2014
Japan	Tosu	SAGA HIMAT – Heavy Ion Cancer Treatment Center	C ion	2013	547	Dec 2014
Japan	Nagano	Aizawa Hospital Proton Therapy Center	p	2014	1	Oct 2014
Poland	Krakow	Institute of Nuclear Physics PAN	p	2011	85	Dec 14
Russia	Dubna	Joint Institute for Nuclear Research, 1	p	1967 (1996)	124	1996
Russia	Moscow	Institute for Theoretical and Experimental Physics	p	1969	4368	Dec 2014
Russia	St. Petersburg	Petersburg Nuclear Physics Institute	p	1975	1386	Dec 2012
Russia	Dubna	Joint Institute for Nuclear Research, 2	p	1999	1069	Dec 2014
South Africa	Cape Town	iThemba LABS	p	1993	524	Dec 2014
South Korea	Seoul	National Centers of Competence in Research	p	2007	1496	Dec 2014
Sweden	Uppsala	Swedberg Lab, 1	p	1957 (1976)	73	1976
Sweden	Uppsala	Swedberg Lab, 2	p	1989	1431	Dec 2014
Switzerland	Villigen	Swiss Institute for Nuclear Research/Paul Scherrer Institute, Piotron	π	1980 (1993)	503	1993

Location			Particle	First (last) patient, y	Patient total, no.	Date of total, y
Country	City	Institution				
Switzerland	Villigen	Swiss Institute for Nuclear Research/Paul Scherrer Institute, OPTIS1 gantry	p	1984 (2010)	5458	2010
Switzerland	Villigen	Paul Scherrer Institute, Center for Proton Therapy, including the OPTIS2 gantry	p	1996	1906	Dec 2014
USA	Berkeley, CA	Lawrence Berkeley National Laboratory (184 inch cyclotron)	p	1954 (1957)	30	1957
USA	Berkeley, CA		He	1957 (1992)	2054	1992
USA	Los Alamos, NM	Los Alamos Meson Physics Facility	π^-	1974 (1982)	230	1982
USA	Berkeley, CA		ions	1975 (1992)	433	1992
USA	Boston, MA	Harvard Cyclotron Laboratory	p	1961 (2002)	9116	2002
USA	Loma Linda, CA	Loma Linda University Medical Center	p	1990	18362	Dec 2014
USA	Bloomington, IN	Midwest Proton Radiotherapy Institute, 1	p	1993 (1999)	34	1999
USA	San Francisco, CA	University of California, San Francisco - Cracker Nuclear Laboratory	p	1994	1729	Dec 2014
USA	Boston, MA	Massachusetts General Hospital Francis H. Burr Proton Therapy Center	p	2001	8107	Sep 14
USA	Bloomington, IN	Indiana University Health Proton Therapy Center	p	2004 (2014)	2200	2014
USA	Houston, TX	MD Anderson Cancer Center	p	2006	5838	Dec 2014
USA	Jacksonville, FL	University of Florida Health Proton Therapy Center	p	2006	5376	Dec 2014
USA	Oklahoma City, OK	ProCure Proton Therapy Center	p	2009	1690	Dec 2014
USA	Philadelphia, PA	Penn Medicine's Roberts Proton Therapy Center	p	2010	2522	Dec 2014
USA	Warrenville, IL	Chicago Proton Center	p	2010	1782	Dec 2014
USA	Hampton, VA	Hampton University Proton Therapy Institute	p	2010	1200	Dec 2014
USA	New Jersey/ Metro New York	ProCure Proton Therapy Center	p	2012	1168	Dec 2014
USA	Seattle, WA	Seattle Cancer Care Alliance ProCure Proton Therapy Center	p	2013	420	Dec 2014
USA	St. Louis, MO	S. Lee Kling Proton Therapy Center	p	2013	149	Dec 2014
USA	Knoxville, TN	Provision Center for Proton Therapy	p	2014	100	Aug 2014
USA	San Diego, CA	Scripps Proton Therapy Center	p	2014	220	Dec 2014
USA	Shreveport, LA	Willis-Knighton Cancer Center	p	2014	28	Dec 2014
		Total of all facilities (in and out of operation):				
		He	2054	1957-1992		
		Pions	1100	1974-1994		
		C-ions	15736	1994-present		
		Other ions	433	1975-1992		
		Protons	118195	1954-present		
		Grand Total	137179			

Abbreviations: P, protons, C ion, carbon ions; π^-, pion.

[a]Data collected by the Particle Therapy Cooperative Group.

附件二、「特定醫療技術檢查檢驗醫療儀器施行或使用管理辦法」第二條附表之醫用粒子治療設備摘述

項目名稱	十四、醫用粒子治療設備
醫療機構條件	一、應符合具有危險性醫療儀器審查評估辦法第四條第一項之附表第一項目之設置機構條件第一點及第二點之規定。 二、設置質子治療設備之醫療機構應置下列人員： （一）單機型質子機： 1、專任之放射腫瘤科專科醫師五人以上，其中至少二人之專科醫師年資應滿五年。 2、專任之醫學物理專業人員三人以上。 3、專任之醫事放射師三人以上。 （二）多治療室質子機： 除以上(一)1、2、3之條件外，每增加一間治療室應需增加放射腫瘤科專科醫師二人、醫學物理專業人員一人及醫事放射師二人。 三、設置重粒子治療設備之醫療機構應置下列人員： （一）專任之放射腫瘤科專科醫師九人以上，其中至少四人之專科醫師年資應滿五年。 （二）專任之醫學物理專業人員五人以上。 （三）每間醫用粒子治療室，應有專任之醫事放射師三人以上。 四、專任之輻射防護師一人以上。
操作人員資格	操作人員應備具下列各點資格之一： 一、放射腫瘤科專科醫師：專科醫師年資三年以上，且該醫師須在國內或國外具有操作相同機組之運轉訓練三個月以上經驗，並取得證明文件。 二、醫事放射師：醫事放射師年資三年以上資格，且具有高能遠距放射治療設備操作一年以上臨床經驗，並提出證明。
適應症	依中央主管機關核發醫療器材許可證核定之適應症範圍。
相關事項	一、醫事放射師應配合放射腫瘤科專科醫師核定之治療計畫行之，不得單獨操作。 二、粒子治療參數之設定，得由醫事放射師依據放射腫瘤科專科醫師核定之電腦模擬放射治療計畫予以設定。 三、醫療機構應接受中央主管機關所設醫用粒子治療設備監督會之督導，建置及運作醫用粒子治療設備；並依中央主管機關之規定，收受符合醫用粒子治療適應症之病人、收費及對治療後病人之追蹤管理。 四、醫療機構未依上開規定執行，中央主管機關得要求限期改善，屆期未改善者，暫停營運至改善為止。

附件三、第 55 屆國際粒子治療合作組織年度會議導覽

PTCOG 55

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what evidence is necessary
for a clinical standard**

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Content

Welcome Letter from PTCOG55 Host

Dear Colleagues,

On behalf of the Proton Therapy Center Czech, welcome to Prague and the 55th Annual Conference PTCOG 55. For most of us an annual conference is already a highly significant event. However, we would like to add several other incentives for visiting Prague in 2016.

Primarily, particle therapy is getting stronger around the world with the number of proton centres and patients undergoing treatment growing. This simultaneously increases the clinical experience and public awareness. We are convinced that PTCOG 55 will provide many new, predominantly technical and clinical results that will become a turning point in this field and will further accelerate development and acceptance of particle therapy in radiation oncology. To participate in this will be both a great experience and opportunity.

Today, data sharing is possible with anyone, anywhere in the world. However, personal contact, networking, and discussion with industry partners can inspire further ideas and projects. We are looking forward to fruitful discussion about the presented results and the future of further advances in our field and co-operation.

Particle therapy is an exceptionally complex field based on the knowledge and efforts of many generations of scientists, predominantly doctors and physicists. From this point of view, Prague is the most suitable place for such a meeting. The prestige Charles University was founded in 1348 by Charles IV, the emperor of the Holy Roman Empire, and many important figures in the history of physics and medicine worked in Prague – for example, physicists Tycho de Brahe and Albert Einstein, and Jan Evangelista Purkyně in the field of medicine.

Prague was established 1,000 years ago and for the majority of its history has been a centre of European education and culture. We are proud of this legacy and it will be an honour to continue this tradition with your visit. In addition, the city is simply beautiful...

It is our pleasure to have you here. We wish all of you a nice stay as well as productive conference time.

Iva Tatounová
Director PTC

Welcome Letter from PTCOG Chair

I would like to add my welcome to PTCOG 55 in Prague! It is also my pleasure to acknowledge the fine and diligent work done by the local team to prepare a great venue for our annual meeting. As the new Chairman of PTCOG I've had the opportunity to reflect on the value and impact that PTCOG has on the field of Particle Therapy. We enjoy an exponential growth of facilities and ideas. There are also multiple organizations that have been formed to enable enhanced interactions in this field. Regions previously 'on-the-fence' have joined the community with examples in the UK and the Netherlands. Technology improvements are now rapid as are increases in treatment sites being investigated.

Yet with all of this, there are challenges to the growth of the field. The concept of cost-benefit analyses and comparisons with advanced photon therapy are factors in the adoption of particle therapy. These factors cannot be ignored. PTCOG is a wonderful venue for exchange of ideas and presentation of accomplishments; however we must recognize the context of the greater radiotherapy community. Questions like how particle therapy compares with other modalities and whether comparisons that are being made are in fact appropriate. Should we, for example, compare old scattered beam data with IMRT? Furthermore, the body of scientific data is used in a variety of ways. One way is to determine what insurance coverage will be available for a given treatment site. How is such data chosen?

One message I would like to convey, is for those of you intending to attend PTCOG 55 and present, it might be a consideration for you to share how you view the role of particle therapy in the larger context. What studies are being done and what results are favorable and/or unfavorable. How is particle therapy data used or misused? PTCOG is an appropriate place to identify weaknesses as well as strengths and I invite you to submit abstracts that will include these aspects of the work we do. We should continue to find ways in which PTCOG can help identify avenues of growth and improvement.

PTCOG is evolving with the field. The educational session attendance continues to grow as the subject matter is refined and updated. All are welcome to participate. This is the first year that the scientific program subcommittee will have been in operation enabling continuity from meeting to meeting going forward. The Particles journal continues to flourish. With the encouragement of Eugen Hug, prior chair, we now have several Clinical Subcommittees. This year we will begin to formalize their charges. The Thoracic subcommittee has written a paper detailing consensus standards. Multidisciplinary input is welcome on all these subcommittees. Perhaps you have ideas you'd like to see expanded upon, but cannot be done within the context of the normal PTCOG Scientific Sessions? Please let the members of the Executive Committee know and suggest a group. Finally I would like to acknowledge the importance of our vendor contributions. Remember, that it is the goal of our vendors to provide tools for our field and they are tied to our success. We will be working towards ways to expand the synergies with our vendors in the coming months and encourage your ideas to help.

I am truly honored to be the new Chairman of PTCOG and I look forward to hearing from you and meeting with you in beautiful Prague!

Jay Flanz
PTCOG Chair

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Programme at a Glance

Scientific Meeting

Thursday, 26 May

- 08:30–09:00 **Welcome**
- 09:00–09:30 **Keynote Lecture 1**
- 09:30–10:30 **Clinics** *Pediatrics*
- Coffee Break
- 11:00–12:00 **Physics** *IGPT and Treatment Planning*
- 12:00–13:00 **Clinics** *Head and Neck*
- Lunch Break
- **IBA Lunch Symposium**
- 14:15–15:45 **Physics** *Acceptance, Commissioning, Dose Calculations and Optimisation*
- 15:45–16:45 **Biology** *RBE*
- Coffee Break
- 17:15–18:15 **Clinics** *GU*

Friday, 27 May

- 07:30–08:30 **General Assembly**
- 08:30–09:00 **Keynote Lecture 2**
- 09:00–10:00 **Physics** *Adaptive Theapapy and Beam Delivery*
- Coffee Break
- 10:30–11:00 **Clinics** *Breast*
- 11:00–11:30 **Clinics** *GI*
- 11:30–12:30 **Physics** *4D Imaging and Treatments*
- Lunch Break
- **Varian Lunch Symposium**
- 13:45–15:30 **Clinics** *CNS/Base of Skull/Eye + Sarcoma / Lymphoma*
- Coffee Break
- 16:00–17:20 **Panel Disucssion** *Particle Therapy: What Evidence is Necessary for a Clinical Standard*
- 17:20–18:30 **Poster Sessions**

Saturday, 28 May

- 08:30–09:00 **Keynote Lecture 3**
- 09:00–10:00 **Biology** *Varia*
- Coffee Break
- 10:30–12:00 **Physics** *Dosimetry and Quality Assurance*
- 12:00–13:00 **Clinics** *Lung*
- 13:00–13:30 **Closing**

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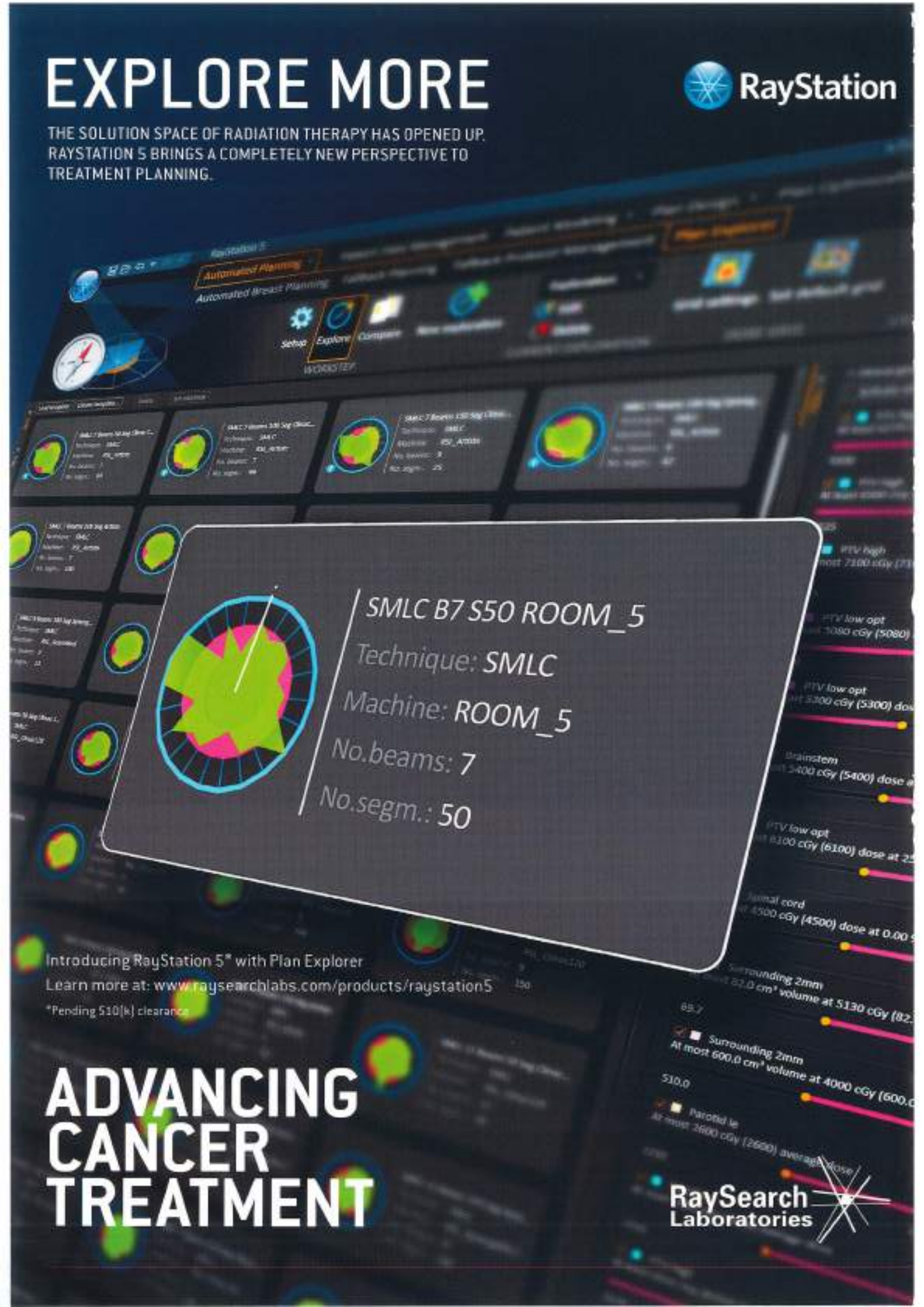

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Keynote Lectures

Let us draw your attention to this years keynote lectures. Each morning a special talk on one of our main themes has been scheduled, do not miss them!

Keynote Lecture 1 – Clinical Pediatrics

Anita Mahajan (USA)
Thursday, 26 May 2016, 09:00–09:30, Congress Hall

Keynote Lecture 2 – Physics

Katia Parodi (Germany)
Friday, 27 May 2016, 08:30–09:00, Congress Hall

Keynote Lecture 3 – Biology

Michael Story (USA)
Saturday, 28 May 2016, 08:30–09:00, Congress Hall

Industry Lunch Symposia

You are cordially invited to attend the Industry Satellite Symposia held on Thursday, 26 May and Friday, 27 May during the lunch breaks (lunch boxes offered onsite).

IBA Lunch Symposium

Thursday, 26 May, 13:15–14:15, Congress Hall

Advanced PBS Quality Assurance: Towards More QA Efficiency and Accuracy
Simon Marcelis *(Product Manager, IBA Dosimetry)*

Treatment of Moving Targets with PBS – Experience of PTC Czech
Vladimir Vondracek *(Chief Medical Physicist, PTC Czech)*

Building the Future of Proton Therapy
Sofie Gillis *(Clinical Solution Director, IBA), Damien Prieels (Research Director, IBA)*

Varian Lunch Symposium

Friday, 27 May, 12:45–13:45, Congress Hall

"Advancements in Adaptive Proton Therapy"

The Evolution of Varian's Proton Therapy Program
Jan Timmer *(Director of Marketing, Varian Particle Therapy)*

Clinical Experience and Recent Advancements in Adaptive Proton Therapy
Lei Dong *(Director and Chief of Medical Physics, Scripps Proton Therapy Center, USA)*

The Future of Adaptive Proton Therapy: Clinical knowledge through data integration
Ian R. Crocker *(Vice Chair of Radiation Oncology, Emory University School of Medicine, USA)*

Scientific Programme

This year a record number of abstracts has been received for the 55th PTCOG Annual Conference. The scientific Sub-Committee worked hard together with the members of the Local Organizing Committee to compile the final programme from more than 510 accepted abstracts. In the end there will be more than 30 Educational Lectures, over 80 Scientific Presentations and 3 Keynote Lectures delivered during the whole conference period.

Oral Presentations

Oral presentations are always accompanied by PowerPoint presentations. The speakers are entirely responsible for the presentation content (order, graphics etc...). All presentations and questions must be delivered in English, as English is the official language of the conference. Time reserved for scientific presentation is:

- **8 minutes** oral presentation + 2 minutes discussion

Presentation Format

All presentations should meet commonly compatible format, preferably using **PowerPoint version 2010 or higher in 16:9** aspect ratio.
Supported file types:

- **Presentation:** PPT, PPA, PPTA, PPTX, PDF
- **Video:** AVI, MPG, MKV, MOV, MP4, WMV
- **Audio:** WMA, MP3, WAV
- **Pictures:** JPG, GIF, BMP, TIF

When saving the final presentation to a USB stick, all video files if having any and all links to these multimedia files must be saved on the device with the presentation.

Depositing the File

Presentations must be handed over to the personnel in the **SPEAKERS´ PREVIEW ROOM**, either with a CD or a USB stick, as far in advance as possible and **TWO hours BEFORE the start of entire session, where the presentation is to be displayed, AT THE LATEST**. The presentation for an early morning session should be handed over the evening before.

SPEAKERS' PREVIEW ROOM will be **located on the 2nd floor of the Congress Centre** in the meeting **room 2.1** and will be **available in the following times**:

- **Sunday** **May 22, 16:00–18:00**
- **Monday** **May 23, 07:30–17:30**
- **Tuesday** **May 24, 08:00–17:30**
- **Wednesday** **May 25, 08:00–17:30**
- **Thursday** **May 26, 08:00–18:45**
- **Friday** **May 27, 07:00–19:15**
- **Saturday** **May 28, 08:00–12:00**

In the Lecture Room

All presentations will be sent directly to the lecture room through the internal computer network. Please, we kindly ask all authors NOT to come at the last minute with their own computer into the lecture room. All presentations must be downloaded in the SPEAKERS´PREVIEW ROOM beforehand.

Detailed Programme

Thursday, 26 May 2016

Welcome Words — Congress Hall

08:30–09:00 **Jay Flanz (USA), Jiri Kubes (Czech Republic), Vladimir Vondracek (Czech Republic)**

Keynote Lecture 1 — Congress Hall

09:00–09:30 **Chairs: Jiri Kubes (Czech Republic), Vladimir Vondracek (Czech Republic)**

09:00 **K 01** **Clinical Pediatrics**
Anita Mahajan (USA)

Clinics – Pediatrics — Congress Hall

09:30–10:30 **Chairs: Eugen Hug (USA), Claire Alapetite (France)**

09:30 **O 01** **Clinical Outcome of Pencil Beam Scanning Proton Therapy for Pediatric Craniopharyngioma Patients Treated at Paul Scherrer Institute**
Alessia Pica (Switzerland)

09:40 **O 02** **Planning Approach for Whole Lung Radiation Therapy Using IMPT**
Nicolas Depauw (USA)

09:50 **O 03** **Proton Beam Therapy in Childhood – Early Results of The Prospective Registry at West German Proton Therapy Center Essen (WPE)**
Dirk Geismar (Germany)

10:00 **O 04** **Proton Therapy Modality and Use of Combination Photons in Pediatric Patients: an Analysis of The Pediatric Proton Consortium Registry (PPCR)**
Stephanie Perkins (USA)

10:10 **O 05** **Proton Beam Therapy for Children: Current Practice in Europe**
Claire Alapetite (France)

10:20 **O 06** **Pencil Beam Scanning Proton Therapy for Treatment of The Retroperitoneum after Nephrectomy for Wilms Tumor: a Dosimetric Comparison Study**
Jennifer Vogel (USA)

Physics – IGPT and Treatment Planning — Congress Hall

11:00–12:00 **Chairs: Joost Verburg (USA), Vladimir Vondracek (Czech Republic)**

11:00 **O 07** **Estimation of the Ionization Potential Map from Dual-Energy CT and Proton CT**
Gloria Vilches-Freixas (France)

11:10 **O 08** **A Robotic C-arm CBCT System for Image-Guided Proton Therapy: Design, Performance, and Clinical Use**
Chiaho Hua (USA)

11:20 **O 09** A Clinical Prompt Gamma-Ray Spectroscopy System for Proton Range Verification
Joost Verburg (USA)

11:30 **O 10** Estimation of Normal Tissue Complication Probability Parameters for Temporal Lobe after Carbon Ion Therapy for Skull Base Tumors
Mai Fukahori (Japan)

11:40 **O 11** Spot Scanning Proton Radiosurgery: Is Patient Specific Hardware Needed?
Petra Trnkova (USA)

11:50 **O 12** Robust Identification of Individual Re-Irradiation Head and Neck Cancer Patients That Will Benefit From IMPT, a ROCOCO in Silico Trial
Sean Walsh (Netherlands)

Clinics – Head and Neck — Congress Hall

12:00–13:00 Chairs: Maria Bonora (Italy), Alex Lin (USA)

12:00 **O 13** Evaluation of Plan Robustness to Setup and Range Uncertainties for Head and Neck Patients Treated with Pencil Beam Scanning Protons
Tony Lomax (Switzerland)

12:10 **O 14** Pencil Beam Scanning (PBS) in Extensive Head and Neck Chemoradiotherapy – Dosimetry, Acute Toxicity and Short Term Results
Jiri Kubes (Czech Republic)

12:20 **O 15** Improving Local Control for Unresectable/Incompletely Resected Sinonasal Cancer with Hyperfractionated Proton Therapy and Concurrent Chemotherapy
Roi Dagan (USA)

12:30 **O 16** Adenoid Cystic Carcinoma of the Head and Neck Treated with Carbon Ion Radiotherapy at CNAO: Preliminary Results
Maria Bonora (Italy)

12:40 **O 17** Reirradiation of Recurrent and Second Primary Head and Neck Cancer With Proton Therapy
Mark McDonald (USA)

12:50 **O 18** Phase I/II Trials Evaluating Carbon Ion Radiotherapy with or without Concurrent Chemotherapy for Salvaging Treatment of Locally Recurrent Nasopharyngeal Carcinoma
Jiyi Hu (China)

Physics – Acceptance, Commissioning, Dose Calculations And Optimisation — Congress Hall

14:15–15:45 Chairs: Jonathan Farr (USA), Matej Navratil (Czech Republic)

14:15 **O 19** Polyenergetic Measurements using a Video-scintillator Detector for Scanned Particle Beams
John Eley (USA)

14:25 **O 20** Concrete activation at the Danish Center for Particle Therapy
Lars Hjorth Praestegaard (Denmark)

14:35 O 21 **Competitive Procurement of Proton Beam Therapy Systems: Evaluation of Technical and Clinical Capability for Delivery of a National Service**
Richard Amos (United Kingdom)

14:45 O 22 **A Novel Means of Deriving The Low-Dose Halo for Clinical PBS Beam Models**
Chris Ainsley (USA)

14:55 O 23 **Development and Clinical Commissioning of a Scanning System with Robotic CBCT Image Guidance Optimized for Pediatric Proton Therapy**
Jonathan Farr (USA)

15:05 O 24 **Halo Model for Small Fields With Apertures In PBS**
Benjamin Clasie (USA)

15:15 O 25 **Impact of Density Heterogeneities on The Degradation of Clinical C-12 Bragg peaks**
Riccardo Dal Bello (Germany)

15:25 O 26 **Rapid and Accurate Dose Computation and Optimization For IMPT**
Alan Sullivan (USA)

Biology – RBE — Congress Hall

15:45–16:45 Chairs: Rebecca Grün (Germany), Jan Schuemann (USA)

15:45 O 27 **Accounting for The Variable RBE in Prostate Proton Radiotherapy**
Jakob Oden (Sweden)

15:55 O 28 **Does the RBE Depend on LET?**
Armin Luhr (Germany)

16:05 O 29 **In-vitro Survival of H460 and H1437 Cells as a Function of Dose and LET in Proton, Helium and Carbon Beams**
Uwe Titt (USA)

16:15 O 30 **A MCNP6 Dosimetry and RBE Model of the University of Washington Clinical Neutron Therapy System**
Gregory Moffitt (USA)

16:25 O 31 **Systematics of Relative Biological Effectiveness Measurements along the Proton Spread out Bragg Peak and Validation of the Local Effect Model**
Rebecca Grün (Germany)

Clinics – GU — Congress Hall

17:15–18:15 Chairs: Tadashi Kamada (Japan), Romaine Nichols (USA)

17:15 O 32 **Impact of Biochemical Control on Overall Survival in Patients with High-risk Prostate Cancer after Carbon-ion Radiotherapy Combined with Hormonal Therapy**
Hiroshi Tsuji (Japan)

17:25 O 33 **Comparison of Acute Toxicity Between Hypofractionated and Conventionally Fractionated Proton Therapy for Prostate Cancer**
Yukiko Hattori (Japan)

17:35 O 34 **Interim Analysis of a Phase II Trial of Hypofractionated Proton Therapy in Men with Localized Prostate Cancer**
Usama Mahmood (USA)

17:45 O 35 Stereotactic Proton Radiotherapy In The Treatment Of Early Prostate Cancer – Dosimetry, Acute Toxicity and Short Term Results
Jiri Kubes (Czech Republic)

17:55 O 36 Changes in Sexual Function and Serum Testosterone Level After Proton Therapy in Patients with Low- or Intermediate-Risk Prostate Cancer
Yukiko Hattori (Japan)

18:05 O 37 Changes in Serum Testosterone 60 months after Proton Therapy for Localized Prostate Cancer
Romaine Nichols (USA)

Friday, 27 May 2016

General Assembly — Congress Hall

07:30–08:30 Chairs: Jay Flanz (USA), Martin Jermann (Germany)

Keynote Lecture 2 — Congress Hall

08:30–09:00 Chairs: Jiri Kubes (Czech Republic), Vladimir Vondracek (Czech Republic)

08:30 K 02 Physics
Katia Parodi (Germany)

Physics – Adaptive Therapy and Beam Delivery — Congress Hall

09:00–10:00 Chairs: Ditte Sloth Møller (Denmark), Jay Flanz (USA)

09:00 O 38 Proton Therapy for Non-Small Cell Lung Cancer (NSCLC) Requires Patient Specific Adaptive Strategies
Ditte Sloth Møller (Denmark)

09:10 O 39 Evaluation of CBCT Based Automatic Plan Adaptation for Intensity Modulated Proton Therapy of Head and Neck Cancer
Christopher Kurz (Germany)

09:20 O 40 Results of the Development of a Pencil Beam Scanning Delivery System Using Direct Beam Architecture
James Cooley (USA)

09:30 O 41 Optimizing the MedAustron Proton Gantry Beam Delivery: Providing Nozzle Design Recommendations Based on Gate/Geant4 Monte Carlo Simulation
Hermann Fuchs (Austria)

09:40 O 42 Technical Implementation and Validation of Volumetric Rescanning for Pencil Beam Scanning
Oxana Actis (Switzerland)

09:50 O 43 Compact Rotatable Particle Therapy Synchrotron Accelerator System for Helium Ions and Protons
Lars Kruse (Denmark)

Clinics – Breast — Congress Hall

10:30–11:00 **Chairs: Shannon MacDonald (USA), Kei Shibuya (Japan)**

10:30 O 44 **Initial Clinical Experience of Intensity Modulated Proton Therapy in Patients with Breast Expanders with Metallic Ports**
Robert Mutter (USA)

10:40 O 45 **Impact of Physiological Breathing Motion for Proton Radiotherapy for Breast Cancer**
Alexandru Dasu (Sweden)

10:50 O 46 **Hypofractionated Whole Breast Proton Beam Radiotherapy with Intensity Modulated Pencil Beam Scanning**
Marcio Fagundes (USA)

Clinics – GI — Congress Hall

11:00–11:30 **Chairs: Shannon MacDonald (USA), Kei Shibuya (Japan)**

11:00 O 47 **Short-Course Carbon Ion Radiation Therapy for Solitary Hepatocellular Carcinoma: a Multi-Institutional Analysis in Japanese Four Institutions**
Kei Shibuya (Japan)

11:10 O 48 **Proton Therapy Posterior Beam Approach With Pencil Beam Scanning For Esophageal Cancer: Clinical Outcome, Dosimetry, and Feasibility**
Jing Zeng (USA)

11:20 O 49 **Proton Therapy for Pancreatic Cancer: Clinical Experience with 2 Year Follow Up**
Barbara Bachtiary (Germany)

Physics – 4D Imaging and Treatments — Congress Hall

11:30–12:30 **Chairs: Chris Beltran (USA), Christian Graeff (Germany)**

11:30 O 50 **Laboratory and Beam Tests of a Compton Telescope for Treatment Monitoring**
Enrique Munoz Albaladejo (Spain)

11:40 O 51 **Digitally Subtracted Proton Range Probe as a Tool For Image Guided Particle Therapy**
Abdelkhalek Hammi (Switzerland)

11:50 O 52 **4D Optimization for Proton Pencil Beam Scanning – Sensitivity to Motion Parameters**
Kinga Bernatowicz (Switzerland)

12:00 O 53 **Abdominal Compression Effectively Reduces the Interplay Effect and Enables Pencil Beam Scanning Proton Therapy (PBSPT) of Liver Tumors**
Liyong Lin (USA)

12:10 O 54 **4D-Optimization to Counter Inter- and Intrafractional Motion in Scanned Ion Beam Lung Cancer Therapy**
Christian Graeff (Germany)

12:20 O 55 **State-Of-The-Art Treatment of Moving Targets with Scanned Proton Beams – Outcome of a Survey Among Eleven Proton Therapy Centers**
Antje Knopf (Netherlands)

Clinics – CNS/Base of Skull/Eye + Sarcoma/Lymphoma
Congress Hall

13:45–15:30 **Chairs: Helen Shih (USA), Damien Weber (Switzerland)**

13:45 O 56 **Incidence of Radiation Injury Was Determined for a Cohort of 279 Patients with CNS Tumors Treated with Proton Beam Therapy**
Semi Harrabi (Germany)

13:55 O 57 **Dry Eye Syndrome After Proton Therapy of Temporal Superior Uveal Melanomas**
Juliette Thariat (France)

14:05 O 58 **Long-Term Visual Acuity Preservation after Proton Therapy for Peri- and Parapapillary Melanoma Patients Treated at The Paul Scherrer Institute**
Alessia Pica (Switzerland)

14:15 O 59 **Visual Outcomes of Parapapillary Uveal Melanomas Following Proton Beam Therapy**
Juliette Thariat (France)

14:25 O 60 **Radiation Induced Brain Change (RIBC) after Carbon-Ion Radiotherapy for Skull Base Chordoma and Chondrosarcoma: Incidence and Preliminary Dosimetric Evaluation**
Elisa Ciurlia (Italy)

14:35 O 61 **Radiation Tolerance of The Optic Pathway after Fractionated Proton Radiation Therapy**
Helen Shih (USA)

14:45 O 62 **Treatment Outcomes of Particle Therapy Using Protons or Carbon Ions for Sarcomas of The Pelvis**
Yusuke Demizu (Japan)

14:55 O 63 **Proton Therapy Patterns-Of-Care and Early Outcomes for Hodgkin Lymphoma: Results from The Proton Collaborative Group Registry**
Brad Hoppe (USA)

15:05 O 64 **Phase I Trial of Pre-Operative Intensity Modulated Proton Radiation (IMPT) With Simultaneous Boost to High Risk Margin for Retroperitoneal Sarcomas**
Thomas DeLaney (USA)

Panel Discussion – Particle Therapy: What is Necessary for a Clinical Standard
Congress Hall

16:00–17:20 **Chair: Joe Chang (USA)**

Panellists: Joe Chang (USA), Katia Parodi (Germany), Tadashi Kamada (Japan), Anita Mahajan (USA), Ramesh Rengan (USA), Michael Story (USA)

Poster Sessions
Poster Area 1, 2, 3

17:20–18:30

Saturday, 28 May 2016

Keynote Lecture 3 — Congress Hall

08:30–09:00 **Chairs: Jiri Kubes (Czech Republic), Vladimir Vondracek (Czech Republic)**

08:30 K 03 **Biology**
Michael Story (USA)

Biology – Varia — Congress Hall

09:00–10:00 **Chairs: Marie Davidkova (Czech Republic), Marcelo Vazquez (USA)**

09:00 O 65 **Circulating Tumor Cells Kinetic Monitoring in Prostate Cancer Patients Under Carbon Ion Therapy**
Ping Li (China)

09:10 O 66 **Intrinsic Radiosensitivity of Prostate Cancer Patients as Determined by The Lymphocyte Micronucleus Assay and 53BP1 Foci Formation**
Marcelo Vazquez (USA)

09:20 O 67 **Microdosimetric Approach to The Modelling of Oxygen Effect for The Inclusion in Treatment Planning for Charged Particle Therapy**
Cécile Bopp (Japan)

09:30 O 68 **Proton Irradiation Induces Biphasic Double-Strand Break Generation And Repair in Glioma Stem Cells Through Reactive Oxygen Species**
Marcus Fager (USA)

09:40 O 69 **FDGal-PET Guided Functional Treatment Planning for Liver SBRT Using Scanning Proton Beams**
Joergen BB Petersen (Denmark)

09:50 O 70 **The Effect of Uneven Fractionation Using High LET Carbon-Ion Beams for Tumor Metastatic Abilities**
Yoshitaka Matsumoto (Japan)

Physics – Dosimetry and Quality Assurance — Congress Hall

10:30–12:00 **Chair: Benjamin Clasie (USA), Håkan Nystrom (Sweden)**

10:30 O 71 **A Gas Scintillator Detector for 2D Dose Profile Monitoring in Pencil Beam Scanning and Pulsed Beam Proton Therapy Treatments**
Steven Vigdor (USA)

10:40 O 72 **Range Verification Under Clinical Conditions Based on The Prompt Gamma Timing Method**
Johannes Petzoldt (Germany)

10:50 O 73 **Range Verification With Ionoacoustics: Simulations and Measurements at a Clinical Proton Synchro-Cyclotron**
Sebastian Lehrack (Germany)

11:00 O 74 **Evaluation of The Water-Equivalence of Plastic Materials in Carbon-Ion Radiotherapy**
Ana Lourenco (United Kingdom)

11:10 O 75 Assessment of Nuclear Interactions of Helium Beams Using a Pixelized Semiconductor Detector
Maria Martisikova (Germany)

11:20 O 76 Investigation of Gantry Angle Dependency of PBS Delivery Using Machine Logs
Benjamin Clasie (USA)

11:30 O 77 Imaging and Characterization of Primary and Secondary Radiation in Ion Beam Radiotherapy with Hybrid Semiconductor Pixel Detectors Timepix
Carlos Granja (Czech Republic)

11:40 O 78 Water-Based 3D Optical Dose Imaging for Particle Therapy Verification
Oksana Kavatsyuk (Netherlands)

11:50 O 79 Proton CT Uncertainties Estimated With Measurement-Validated Monte Carlo Simulations
Pierluigi Piersimoni (USA)

Clinics – Lung — Congress Hall

12:00–13:00 Chair: Brad Hoppe (USA)

12:00 O 80 A Bayesian Randomization Trial of Intensity-Modulated Radiation Therapy vs. Passively Scattered Proton Therapy for Locally Advanced Non-Small Cell Lung Carcinoma
Zhongxing Liao (USA)

12:10 O 81 Outcomes of Patients with Stage II-III Non-Small-Cell Lung Cancer Treated with Proton Therapy: the Proton Collaborative Group Prospective Registry Trial
Shahed Badiyan (USA)

12:20 O 82 Final Report of Long-Term Outcome of Phase II Study of High-Dose Proton Therapy with Concurrent Chemotherapy for Stage III NSCLC
Joe Chang (USA)

12:30 O 83 Final Report With Long-Term Outcome of Phase I/II Prospective Study of Dose Escalated/Accelerated Proton Therapy for Early Stage NSCLC
Joe Chang (USA)

12:40 O 84 Image-Guided Hypofractionated Proton Therapy in The Management of Centrally Located Relapsed and Early Stage Medically Inoperable NSCLC
Brad Hoppe (USA)

12:50 O 85 Dosimetric Analysis ON Rib Fracture After Carbon Ion Radiotherapy for Peripheral Stage I Lung Cancer
Daijiro Kobayashi (Japan)

Conference Closing — Congress Hall

13:00–13:30 Jay Flanz (USA), Jiri Kubes (Czech Republic), Vladimir Vondracek (Czech Republic)

Subcommittee Meetings

Wednesday 25 May, 2016

PTCOG Skull base/ Para spinal (proposed) Subcommittee
Club C, 09:00–10:30

PTCOG Optic Subcommittee
Club B, 09:00–11:00

PTCOG H&N (proposed) Subcommittee
Club D, 09:30–10:30

PTCOG GU (proposed) Subcommittee
Club B, 11:00–12:00

PTCOG GI (proposed) Subcommittee
Club B, 12:00–13:00

PTCOG Educational Subcommittee
Club B, 13:00–15:00

PTCOG Thoracic Subcommittee
Club C, 13:30–14:30

PTCOG Publication Subcommittee
Club A, 14:00–15:00

PTCOG Pediatric Subcommittee
Club B, 14:00–15:00

PTCOG Breast (proposed) Subcommittee
Club A, 15:00–16:00

PTCOG Particle Therapy Treatment Efficiencies (proposed) Subcommittee
Club C, 15:00–16:00

PTCOG CNS (proposed) Subcommittee
Club D, 15:00–16:00

PTCOG Indications eligible for hadron-therapy (proposed) Subcommittee
Club B, 15:00–16:00

PTCOG Steering Committee
Club A, 16:00–18:00

Thursday 26 May, 2016

PTCOG Scientific Committee
Club A, 07:30–08:30

Friday 27 May, 2016

PTCOG General Assembly
Congress hall, 07:30–08:30

GATE/GEANT Meeting
Club B, 14:00–15:30

Social Events

PROTON THERAPY CENTER

Wednesday, 25 May 2016
18:00–21:00
Proton Therapy Center

Site Visit of the Proton Therapy Center & Welcome Reception

Bus transfers:

At 17:30 departure from the Prague Congress Centre (in front of the Entrance nr. 10, signposted) to the PTC.

From 20:00 transfers back to the Prague Congress Center.

Address of the Proton Therapy Center:

www.ptc.cz
Budínova 2437/1a, Prague 8

1 ticket is included in the registration fee.

Thursday, 26 May 2016
19:30
Prague Castle, Spanish Hall

55 PTCOG Annual Conference Gala Dinner

Dress code: Black tie

Bus transfers:

At 19:00 departure from the Prague Congress Centre (in front of the Entrance nr. 10, signposted) to the Prague Castle.

Transfers are provided from the Prague Castle back to the Prague Congress Centre after the dinner.

Please note the number of participants is limited, check the availability at the registration desk.

For individual arrivals use entrance from Hradčanské náměstí (Matýášova brána).

Social Events Overview

	Wednesday, 25 May	Thursday, 26 May	Friday, 27 May
10:30			10:30–12:30 **Round Table meeting the PRESS Past, Present and Future of PT** **PCC** *Club E*
11:00			
11:30			
12:00			
12:30			
17:30			
18:00	18:00–21:00 **Site Visit of the Proton Therapy Center and Welcome Reception** *Proton Therapy Center*		
18:30			
19:00			
19:30		19:30 **PTCOG 55 Gala Dinner** *Spanish Hall of Prague Castle*	
20:00			
20:30			
21:00			

Posters

More than 340 abstracts were accepted for poster presentations. They will all be displayed within the whole conference period in **three Poster Areas located on the 2nd floor of the Prague Congress Centre**.

Poster Sessions

Special time only for poster viewing has been scheduled within the programme. All authors are requested to be present by their posters within the poster presentation time to address delegates' interests. There is one poster session divided into four parts according its main theme on **Friday, 27 May, 17:20–18:30**.

Poster Session 1 – Biology	**Poster Area 1 (Congress Hall Foyer)**	**P 001–P 017**
Poster Session 2 – Clinics	**Poster Area 1 (Congress Hall Foyer)**	**P 018–P 097**
Poster Session 3 – Physics I	**Poster Area 2 (North Hall)**	**P 098–P 224**
Poster Session 4 – Physics II	**Poster Area 3 (Terrace 1)**	**P 225–P 347**

Poster mounting & removing

Poster area will be **open for mounting as of May 25, 2016, 14:00**. All posters should be set up during Thursday, May 26 at the latest. Posters will remain displayed within the whole conference period. Each poster board was given a specific number. Authors are kindly asked to make sure to mount their poster on the poster board with the number corresponding to the number assigned to their poster presentation (e.g. P 01, P 02 etc...). Posters must be removed by their authors at the end of the conference.

List of Posters by Scientific Topics

POSTERS	TOPIC	POSTER SESSION	POSTER AREA
P 001–P 008	Relative Biological Effectivness	Poster Session – Biology	Poster Area 1
P 009	Biology – Varia	Poster Session – Biology	Poster Area 1
P 010–P 014	Models	Poster Session – Biology	Poster Area 1
P 015	Biological treatment planning	Poster Session – Biology	Poster Area 1
P 016–P 017	Biological optimization	Poster Session – Biology	Poster Area 1
P 018–P 042	CNS/Base of Skull/Eye Sarcoma/Lymphoma	Poster Session – Clinics	Poster Area 1
P 043–P 047	Pediatrics	Poster Session – Clinics	Poster Area 1
P 048–P 056	Breast	Poster Session – Clinics	Poster Area 1
P 057–P 063	Gastro Intestinal (GI)	Poster Session – Clinics	Poster Area 1
P 064–P 078	Genitourinary (GU)	Poster Session – Clinics	Poster Area 1
P 079–P 080	Sarcoma/Lymphoma	Poster Session – Clinics	Poster Area 1
P 081–P 084	Clinics – Head and Neck	Poster Session – Clinics	Poster Area 1
P 085–P 090	Unexpected outcomes	Poster Session – Clinics	Poster Area 1
P 091–P 097	Clinics – Lung	Poster Session – Clinics	Poster Area 1
P 098–P 125	Beam delivery and nozzle design	Poster Session – Physics	Poster Area 2
P 126–P 154	Accepting and commissioning new facilities	Poster Session – Physics I	Poster Area 2
P 155–P 187	Absolute and relative dosimetry	Poster Session – Physics I	Poster Area 2
P 188–P 224	Quality assurance	Poster Session – Physics I	Poster Area 2
P 225–P 272	Treatment planning	Poster Session – Physics II	Poster Area 3
P 273–P 303	Dose calculation and optimization	Poster Session – Physics II	Poster Area 3
P 304–P 332	Image guidance and IGPT	Poster Session – Physics II	Poster Area 3
P 333–P 337	Monitoring and modeling motion	Poster Session – Physics II	Poster Area 3
P 338–P 344	4D treatment and delivery	Poster Session – Physics II	Poster Area 3
P 345–P 347	Adaptive therapy	Poster Session – Physics II	Poster Area 3

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List of Posters by Poster Sessions

Poster Session – Biology

27 May 2016, 17:20–18:30, Poster Area 1 (Congress Hall Foyer)

P 001 **Preclinical Trials of the "Prometeus" Scanning Pencil Proton Beam**
Aleksei Solovev (Russia)

P 002 **Radiobiological Effectiveness and Its Role in Modelling Secondary Cancer Risk for Proton Therapy**
Abdossalam Madkhali (United Kingdom)

P 003 **Measurements of the Relative Biological Effectiveness of 200 MeV/u Carbon Ions in ITEP**
Nikolay Markov (Russia)

P 004 **Analysis of Treatment Related Toxicities in Patients with Hematologic Malignancies Treated with Proton Craniospinal Irradiation**
Dragan Mirkovic (USA)

P 005 **Geant4 Physics Model Comparison for the Calculation of the local Dose Enhancement in Gold Nanoparticle Enhanced Proton Therapy**
Marios Sotiropoulos (United Kingdom)

P 006 **An Approach to Modelling the Relative Biological Effectiveness from the Energy Deposition Clustering at a Nanometer Scale**
David Boersma (Sweden)

P 007 **Proliferation Impairment of Chondrosarcoma Cells Irradiated with Carbon Ions**
Francois Chevalier (France)

P 008 **Biological Comparison of Double Scattering and Pencil Beam Scanning Modes in Proton Therapy**
Anna Michaelidesova (Czech Republic)

P 009 **Trends in Cardiac Biomarkers Following Adjuvant Proton Therapy for Breast Cancer**
Babita Jyoti (USA)

P 010 **The Risk of Xerostomia in Oropharyngeal Cancer Patients Following Radiotherapy – A Model-Based Comparison of Photon and Proton Therapy**
Grete May Engeseth (Norway)

P 011 **Comparison of Differences in Prediction TCP/NTCP Between Constant and Variable RBE in Proton Therapy**
Pavol Matula (Slovak Republic)

P 012 **Nanox: A Model for Predicting Ion RBE in Ion Beam Therapy**
Micaela Cunha (France)

P 013 **The Local Brain Irradiation Insult in Mice Induced Progressive Brain Damage Related to Microvessel Density**
Nobuhiko Takai (Japan)

P 014 **Biological Effectiveness Calculations for an Eye Melanoma Proton Beam: a Modeling Approach**
Mario Pietro Carante (Italy)

P 015 **The Effect of Fractionated Irradiation of Mice Heads with Gamma Rays And Protons on Their Peripheral Blood Parameters and Behaviour**
Dorota Borowicz (Russia)

P 016 **Mitophagy and Apoptosis: a Model Depicting the Responses to Mitochondrial Damage Induced by carbon Ion Radiation in Tumor Cells**
Xiaodong Jin (China)

P 017 **The Biological Effect of X-ray and Carbon Ion Beam On Different MGMT Status Glioma Cells Treated by TMZ and O6-BG**
Jian Chen (China)

Poster Session – Clinics

27 May 2016, 17:20–18:30, Poster Area 1 (Congress Hall Foyer)

P 018 **Outcomes after Proton Beam Therapy for Large Choroidal Melanomas in 492 Patients**
Juliette Thariat (France)

P 019 **Dosimetric Advantages of Proton Therapy Compared to Conventional Radiotherapy With Photons in Young Patients and Adults with Low Grade Glioma**
Semi Harrabi (Germany)

P 020 **Mechanisms of Phosphenes in Patients Undergoing Proton Therapy for Eye Tumors**
Juliette Thariat (France)

P 021 **Cataract Prediction in Ocular Tumor Patients Treated with Proton Therapy**
Juliette Thariat (France)

P 022 **Gantry Based Proton Stereotactic Radiosurgery System Using the Combined Wobbling and Layer-Stacking Techniques**
Tungho Wu (Taiwan)

P 023 **Advanced Malignant Melanoma of the Conjunctiva Can Be Successfully Treated with a Dedicated Proton Therapy Technique**
Wolfgang Sauerwein (Germany)

P 024 **Practice Patterns Analysis of Ocular Proton Therapy Centers: the International OPTIC Survey**
Jan Hrbacek (Switzerland)

P 025 **Low Grade Glioma Irradiation Comparing VMAT, Tomotherapy and IMPT in a Multicentric in Silico ROCOCO Clinical Trial**
Danielle Eekers (Netherlands)

P 026 **Hippocampal Sparing During Whole Brain Irradiation Using Intensity Modulated Proton Therapy**
Joshua Stoker (USA)

P 027 **Some Effects that Could Influence Planning Treatment Results for Uveal Melanoma**
Irina Kancheli (Russia)

P 028 **Dosimetric Advantages of Intensity-Modulated Proton Therapy over Photon Stereotactic Radiosurgery in Treatment of Small Intracranial Lesions**
Yick-wing Ho (China)

P 029 **Temporal Evolution and Dosimetric Determinants of Visual Acuity After Proton Beam Therapy of Uveal Melanoma**
Kavita Mishra (USA)

P 030 **A Better Plan? How to Select Patients with Brain Lesions for Proton Therapy**
Silke Engelholm (Sweden)

P 031 **Results of Particle Radiation Therapy for Chordoma of the Skull Base: the Italian National Center for Hadrontherapy (CNAO) Experience**
Viviana Vitolo (Italy)

P 032 **Proton Radiation Therapy for Patients with Pituitary Adenoma is Safe and Effective**
Semi Harrabi (Germany)

P 033 **Proton Radiotherapy at the Skandion Clinic. The Clinical Experience so far**
Petra Witt Nystrom (Sweden)

P 034 **MRI Based 3D Validation of the EyePlan Eye Model**
Fabian Hennings (Switzerland)

P 035 **Proton Beam Therapy of Juxtapapillary Uveal Melanoma: Partial Papilla Sparing and Its Effects on Eye Preservation**
Johannes Gollrad (Germany)

P 036 **MRI Based Automatic Radiotherapy Target Segmentation Using Gaussian Mixed Model (GMM) and Apparent Diffusion Coefficient Maps (ADC)**
Wieslaw Bal (Poland)

P 037 **Clinical Use of Proton Medical Complex "Prometheus"**
Igor Gulidov (Russia)

P 038 **A Novel Vertebral Body Sparing Craniospinal Irradiation (VBS-CSI) Planning Technique Using Proton Pencil Beam Scanning (PBS)**
Peyman Kabolizadeh (USA)

P 039 **(68)Ga-DOTATATE PET/CT Imaging May Improve Target Delineation for Meningiomas of the Skull Base. Initial Experiments With Automatic Segmentation**
Malgorzata Stapor-Fudzinska (Poland)

P 040 **Particle on Particle boost – Neutron Radiotherapy Followed by Proton Boost for Advanced Salivary Gland Malignancies Involving the Skull Base**
Upendra Parvathaneni (USA)

P 041 **Patient Reported Symptoms and Health Related Quality of Life Due to Scanned Proton Therapy – Report from a Pilot Study**
Ulrica Langegård (Sweden)

P 042 **Impact of MRI Technology for Ocular Tumor Proton Beam Treatment Planning**
Kavita Mishra (USA)

P 043 **Proton Beam Therapy for Pediatric Patients with Skull Base Chordoma**
Masashi Mizumoto (Japan)

P 044 **Cranial Chordoma (CH) in a Child Managed with 2 Courses of Proton Therapy (PT): Case-Report, and Review of Literature**
Jean-Louis Habrand (France)

P 045 **Cost Effectiveness and Economic Impact for the Italian National Health System of Proton and Photon Radiotherapy Treatment in Pediatric Cancer**
Monia Vadrucci (Italy)

P 046 **Can Children Receive Radiation Therapy Without Anesthesia? Virtual Reality, Game, and Body Motion Sensors**
Huan Giap (USA)

P 047 **Poster withdrawn**

P 048 **Sparing Potential of Respiratory Gating for the Treatment of Internal Mammary Nodes in Proton Radiotherapy for Breast Cancer**
Alexandru Dasu (Sweden)

P 049 **Carbon-Ion Radiotherapy for Stage I Breast Cancer**
Kumiko Karasawa (Japan)

P 050 **Secondary Cancer Risk Comparison from Chest Wall and Regional Nodal Irradiation with Different Radiotherapy Techniques**
Jin Sung Kim (South-Korea)

P 051 **Dosimetric Comparison of Volumetric Modulated Arc Therapy and Proton Pencil Beam Scanning Technique under Deep Inspiration Breath Hold**
Huan-chang Liu (Taiwan)

P 052 **Intact Breast Treatment Using Intensity Modulated Proton Therapy**
Nicolas Depauw (USA)

P 053 **Biological Dose Delivered in Proton Treatment of Left-Sided Breast Cancer**
Marcus Fager (USA)

P 054 **Cardiac Sparing Effect of Proton Beam Therapy Using Accelerated Partial Breast Irradiation for Left-Sided Early-Stage Breast Cancer**
Sanford Katz (USA)

P 055 **Intensity Modulated Proton Therapy for Accelerated Partial Breast Irradiation: Initial Scripps Experience**
Huan Giap (USA)

P 056 **Intensity Modulated Proton Therapy For Re-irradiation of Recurrent Cancer in the Breast and Chest Wall: Initial Scripps Experience**
Huan Giap (USA)

P 057 **Evaluation of Deformable Image Registration of the Liver Using MIM Maestro and Velocity AI**
Nobuyoshi Fukumitsu (Japan)

P 058 **Proton Beam Therapy for Hepatocellular Carcinoma with Portal Vein Tumor Thrombu**
Hiroyuki Ogino (Japan)

P 059 **Limited Toxicity after Proton Beam Therapy for Esophageal Cancer: Outcomes from the Proton Collaborative Group**
Michael Chuong (USA)

P 060 **Esophagus Cancer with Proton Radiotherapy: Dosimetric Comparison of IMRT vs. Proton**
Miao Zhang (USA)

P 061 **Intensity Modulated Proton Therapy for Retreatment of Colorectal and Anal Cancer**
Huan Giap (USA)

P 062 **Postoperative Proton Therapy for Pancreatic Cancer Patients Enrolled on the Proton Collaborative Group (PCG) Registry**
Romaine Nichols (USA)

P 063 **Initial Results of Carbon Ion Radiotherapy for Locally Advanced Cholangiocarcinoma**
Takanori Abe (Japan)

P 064 **The Predictive Role of ADC Values in Prostate Cancer Patients Treated with Carbon-Ion Radiotherapy: Initial Clinical Experience at SPHIC**
Wei-Xiang Qi (China)

P 065 **Multiple Courses of Proton Beam Therapy for Patients with Hepatocellular Carcinoma**
Yoshiko Oshiro (Japan)

P 066 **The Impact of Duration of Androgen Deprivation Therapy on Sexual Function for Prostate Cancer Patients Receiving Carbon Ion Radiation Therapy**
Nobuteru Kubo (Japan)

P 067 **Efficacy and Toxicity of Proton Therapy for Prostate Cancer Patients with Unilateral Hip Prosthesis**
Romaine Nichols (USA)

P 068 **Efficacy of Three Variants of Hypofractionated Proton Boost at Patients with Intermediate and High Progression Risk Prostate Cancer**
Irina Kancheli (Russia)

P 069 **Carbon-Ion Radiotherapy for Prostate Cancer with Bladder Invasion**
Tatsuji Mizukami (Japan)

P 070 **Proton Beam Therapy in Prostate Cancer – First Experiences at West German Proton Therapy Center Essen (WPE)**
Dirk Geismar (Germany)

P 071 **Clinical and Dosimetric Aspects of Prostate Cancer Patients Treated with Pencil Beam Scanning (PBS) Proton Therapy Utilizing Hydrogel Rectal Spacer**
Marcio Fagundes (USA)

P 072 **Target Adherence Utilizing Bony Anatomy or Fiducial Marker Alignment for Proton Treatment of Prostate Cancer Stabilized with a Rectal Balloon**
Kuan Ling Chen (USA)

P 073 **Indian Proton Therapy set up: A Global Perspective**
John Chandy (India)

P 074 **Acute Toxicity Report of Post-Prostatectomy Proton Therapy for Prostate Cancer Patients Undergoing Adjuvant or Salvage Radiotherapy**
Curtiland Deville (USA)

P 075 **Pencil Beam Scanning Proton Therapy for Patients with Gynecologic Cancer**
Alisha Maity (USA)

P 076 **Active Bone Marrow Sparing with FLT-PET/CT in PBS Proton Therapy for Gynecologic Cancer**
Maura Kirk (USA)

P 077 **Comparison of Hydrogel Spacer and Rectal Immobilization on Intra-Fraction Motion Efficiency Using Image Guidance Prostate Proton Therapy**
Hazel Ramirez (USA)

P 078 **Early Experience with Hydrogel Rectal Spacer with Proton Therapy at Scripps: Stability Assessment with Weekly MRI**
Huan Giap (USA)

P 079 **Short Time Evaluation of Particle Radiotherapy for 2 Cases of Bulky Thymic Malignancies**
Jian Chen (China)

P 080 **Pencil Beam Scanning Proton Therapy for Lymphoma Patients with Mediastinal Involvement: Prague's Single Institution Experience**
Katerina Dedeckova (Czech Republic)

P 081 **Dosimetric Benefits of Intensity-Modulated Proton Therapy as Compared with Helical Tomotherapy in the Treatment of Nasopharyngeal Carcinoma**
Wai Wang Lam (China)

P 082 **Intensity Modulated Proton Therapy for Retreatment of CNS and H&N Tumors**
Huan Giap (USA)

P 083 **Early Clinical Experience with Intensity Modulated Proton beam Radiotherapy in the Management of Oropharyngeal cancers at the University of Washington**
Upendra Parvathaneni (USA)

P 084 **Head and Neck Proton Beam Radiation: Feasibility and Outcomes of Our Initial Patients**
John Han-Chih Chang (USA)

P 085 **The Proton Collaborative Group's Research Portfolio: An Update from the PTCOG 2015 Presentation**
Minesh Mehta (USA)

P 086 **Analysis on Research Related with Proton**
Qiuning Zhang (China)

P 087 **Long-term Outcome of Carbon Ion Radiotherapy in 60 Patients with Different Tumor**
Qiuning Zhang (China)

P 088 **Impact of Adding Proton Therapy to an Existing Conventional Radiation Center on New Patient Start Volume**
James Metz (USA)

P 089 **Trends in Proton Therapy in the USA, 2012–2014: A study from the National Association for Proton Therapy (NAPT)**
William Hartsell (USA)

P 090 **Pencil Beam Scanning Proton Therapy For Extracranial Chordomas and Chondrosarcomas: Long-Term Clinical Outcomes at the Paul Scherrer Institute**
Ralf Schneider (Switzerland)

P 091 **Predicted Reduction in Major Cardiac Events in Patients with Thymic Malignancies Treated with Proton Therapy Versus Intensity Modulated Radiation Therapy**
Jennifer Vogel (USA)

P 092 **Consensus Statement of Proton Therapy Inearly Stage and Locally Advanced Non–Small Cell Lung Cancer: On behalf of PTCOG Thoracic Subcommittee**
Joe Chang (USA)

P 093 **Intensity Modulated Proton Therapy for Early Stage Lung Cancer: Initial Scripps Experience**
Garrett Green (USA)

P 094 **Intensity Modulated Proton Therapy For Locally Advanced Lung Cancer: Initial Scripps Experience**
Garrett Green (USA)

P 095 **Intensity Modulated Proton Therapy for Lung Cancer: Initial Scripps Experience**
Huan Giap (USA)

P 096 **Toxicity and Clinical Outcome of Uniform Scanning Proton Therapy for Lung Cancer**
Yuanshui Zheng (USA)

P 097 **Intensity Modulated Proton Therapy for Re-treatment of Thoracic Malignancy: Initial Scripps Experience**
Huan Giap (USA)

Poster Session – Physics

27 May 2016, 17:20–18:30, Poster Area 2 (North hall)

P 098 **A Compact Hadron Driver for the Next Generation of Cancer Therapies Using Continuous Energy Sweep Scanning**
Ken Takayama (Japan)

P 099 **Planar Isocentric System Instead of Gantry**
Mark Kats (Russia)

P 100 **The 3D-printed Passive Beam Modifier Design for Carbon Ion Beam Radiobiological Studies**
Aleksei Solovev (Russia)

P 101 **Sensitivity Behavior of a Secondary Emission Monitor used for Dose Control in Carbon-Ion Radiotherapy**
Manabu Mizota (Japan)

P 102 **A Development of a Ripple Filter for Proton Line Scanning**
Nagaaki Kamiguchi (Japan)

P 103 **Proton Minibeam Radiation Therapy: A New Therapeutic Approach**
Catherine Nauraye (France)

P 104 **Development of Ripple Filters for Particle Beam Therapy that are Easier to Manufacture**
Taisuke Takayanagi (Japan)

P 105 **A Compact Proton Therapy Facility Concept for Pulsed Beams from High Power Laser Accelerators**
Umar Masood (Germany)

P 106 **Machine Parameter Selection and Treatment Time Prediction for a Synchrotron-Based Quasi-Discrete PBS Therapy Facility**
Gabriele Kragl (Austria)

P 107 **Monte Carlo Proton Beam Modeling for the Medaustron Fixed Beam Lines**
Alessio Elia (Austria)

P 108 **Optimization of Lateral Penumbra in Pencil Beam Scanning Treatments**
James Cooley (USA)

P 109 **Evaluation of Penumbra Improvement by Using Multi-Leaf Collimators in Proton Beam Scanning**
Yusuke Sakamoto (Japan)

P 110 **Novel Irradiation Concepts Enabled by a Use of Superconducting Magnets in Gantries**
Alexander Gerbershagen (Switzerland)

P 111 **A Cost-Effective Double-Scattering Device for Radiobiological Experiments at OncoRay**
Stephan Helmbrecht (Germany)

P 112 **Possibility to Produce C5+ IONS**
Atsushi Kitagawa (Japan)

P 113 **Development Status of Line Scanning in Sumitomo Proton Therapy System**
Toshiki Tachikawa (Japan)

P 114 **Integration of Range Shifter in Immobilization for Proton Therapy: 3D Printed Materials Characterization**
Steven Michiels (Belgium)

P 115 **ROGER: A Working Package for Beam Dynamics**
Valeria Rizzoglio (Switzerland)

P 116 **Feasibility Study of IMPT-like Delivery with Continuous Line Scanning of Protons**
Serena Psoroulas (Switzerland)

P 117 **Uncertainty Quantification Analysis for OPTIS2**
Valeria Rizzoglio (Switzerland)

P 118 **Modulation Power of Porous Materials and Usage as Ripple Filter in Particle Therapy**
Uli Weber (Germany)

P 119 **Design, Optimisation and Monte Carlo Simulation of a 3D Range-Modulator for Scanned Particle Therapy**
Yuri Simeonov (Germany)

P 120 **Particularities in Clinical Deployment of Range Shifters in Pencil Beam Scanning Proton Therapy**
Stefan Both (USA)

P 121 **Commissioning of the Full Energy Scanning with Carbon-Ion Beams Ranging from 55.6 to 430 MeV/u in NIRS-HIMAC**
Yousuke Hara (Japan)

P 122 **Commissioning of Moving Target Irradiation with a Scanned Carbon-Ion Beams in NIRS-HIMAC**
Yousuke Hara (Japan)

P 123 **The Impact of Dose Escalation in Proton Beam Therapy for Patients with Inoperable Pancreatic Cancer**
Takashi Ogino (Japan)

P 124 **Proton Beam Transport and Optimization Using the TOPAS Monte Carlo Code**
Eric Abel (USA)

P 125 **Imrovement of Layer Swiching Time for Proton Therapy**
Yoshinobu Murakami (Japan)

P 126 **Carbon-Ion Radiotherapy Facility Project of Yamagata University**
Takeo Iwai (Japan)

P 127 **Monte Carlo Study of Concrete Activation in a Synchrotron Based Proton Treatment Room**
Chi Wai Cheung (China)

P 128 **Clinical Commissioning of the University Proton Therapy Dresden**
Daniela Kunath (Germany)

P 129 **Gantry Based Proton Stereotactic Radiosurgery System Using the Combined Wobbling and Layer-Stacking Techniques**
Tungho Wu (Taiwan)

P 130 **Comparison of 4DCT Acquiring by Amplitude-Based Anzai Laser Gating Respiratory System and by Phase-Based Varian Real-Time Position Management (RPM) System**
Yin-Chun Lin (Taiwan)

P 131 **Recent Developments and New Perspectives for research at OncoRay's Experimental Beamline**
Stephan Helmbrecht (Germany)

P 132 **Present Status of the New PSI Gantry 3: Installation, Integration And Commissioning**
Alexander Koschik (Switzerland)

P 133 **Commissioning of New Carbon-Ion Radiotherapy Facility i-ROCK**
Shinichi Minohara (Japan)

P 134 **Evaluation of the Radiation Protection Barriers at the Danish Centre for Particle Therapy**
Anne Holm (Denmark)

P 135 **Validity of Generic Concrete Shielding Parameters for Different Concrete Recipes and Room Geometries**
Lars Hjorth Praestegaard (Denmark)

P 136 **Malthus Ramp-Up – A Framework Model for Proton Therapy Demand Scenarios in the NHS**
Thomas Mee (United Kingdom)

P 137 **Range Modulation of a Proton Wobbling Nozzle Using the Layer-Stacking Technique**
Chung-Chi Lee (Taiwan)

P 138 **Accuracy Map of a Robotic Patient Positioning System Equipped with an Integrated Optical Tracking System**
Alexander Ableitinger (Austria)

P 139 **Monte Carlo Simulation of Proton Spot Scanning Gantry at Seattle Cancer Care Alliance Proton Therapy Center (SCCA-PTC)**
Jatinder Saini (USA)

P 140 **The Christie Proton Therapy Research Facility**
Karen Kirkby (United Kingdom)

P 141 **An Overview of Program in Radiation Science and Proton Therapy Center at National Taiwan University Cancer Center**
Chun-Wei Wang (Taiwan)

P 142 **Configuration of the Nonlinear Universal Proton Optimizer (NUPO) in the Eclipse Treatment Planning System**
Natalia Adamek (Poland)

P 143 **Radiation Resurvey Results for Varian ProBeam Multi-Room Proton Therapy System**
Chun-Wei Wang (Taiwan)

P 144 **Commissioning of Spot Scanning Proton Therapy System. This is the End, is It?**
Liliana Stolarczyk (Poland)

P 145 **Selection of CT Scanning Parameters for Proton Radiotherapy Treatment Planning**
Anna Kozera (Poland)

P 146 **Line Scanning Proton Beam at Samsung Medical Center**
Kwangzoo Chung (South Korea)

P 147 **Commissioning of the Scanning Irradiation System at KCC**
Naoya Saotome (Japan)

P 148 **Ion Rapid Cycling Medical Synchrotron (iRCMS): Status and Future Plans**
Manny Subramanian (USA)

P 149 **Commissioning of Rotating Gantry and Scanning System at NIRS-HIMAC**
Takuji Furukawa (Japan)

P 150 **Development and Validation of a Geant4-based Monte Carlo Platform for Simulation of Proton Pencil Beams: Initial Results**
Richard Amos (United Kingdom)

P 151 **The Dire Straits of Acceptance Tests in a Proton Therapy Centre**
Tomasz Kajdrowicz (Poland)

P 152 **Commissioning of ELTR the New Ocular Proton Radiotherapy Facility at the IFJ PAN**
Tomasz Horwacik (Poland)

P 153 **Impact of the High Magnetic Field and RF Power in a Superconducting Cyclotron to a Nearby MR Facility**
Lionel Bouchet, Ph.D (USA)

P 154 **Characteristics of Proton In-Air Profiles Formed by MLC Alone and MLC + BK for a Wobbling Nozzle**
Chung-Yi Tseng (Taiwan)

P 155 **An Investigation on Treatment Couch Density Dose Pullback Threshold and the Effects on Proton PBS Delivery**
Kuan Ling Chen (USA)

P 156 **A Calibration Study of CT Mass Density Table for a new CBCT System on Proton Therapy**
Sanford Katz (USA)

P 157 **Out-of-Field Doses Around Active Scanning Proton Beam of theCzech Proton Therapy Centre**
Marie Davidkova (Czech Republic)

P 158 **Performance Evaluation of BioZorb Markers in Proton Therapy for Partial Breast Irradiation**
Miao Zhang (USA)

P 159 **Defining Small Field in Proton Beam?**
Indra Das (USA)

P 160 **Progress in Development of In-Vivo Dosimeter Specialized for Heavy-Ion Particle Therapy**
Hiroaki Matsubara (Japan)

P 161 **Modelling of Spread out Bragg Peaks Measured in Deformable Radiochromic 3D Dosimeters**
Ellen Marie Høye (Denmark)

P 162 **Novel Method to Quantify Physical Dose Enhancement Due to Gold Nanoparticles in Proton Therapy**
Ana Lourenco (United Kingdom)

P 163 **Feasibility of a Plastic Scintillator and Commercial Camera System for Routine Quality Assurance in Proton Therapy**
Mansour Almurayshid (United Kingdom)

P 164 **Development of Lung Phantom to Evaluate Range Uncertainties by Bone and Lung**
Haksoo Kim (South Korea)

P 165 **A New Look on Recombination Losses in Ionization Cambers Exposed to Ion Beams**
Jeppe Brage Christensen (Denmark)

P 166 **Dosimetry Audit of IBA Proteus 235 Proton Pencil Beam Scanning System in Proton Therapy Center Czech in Prague (PTC)**
Vladimir Dufek (Czech Republic)

P 167 **Implementation of Patched Fields in Gantry 2 at PSI**
Anna Fredh (Switzerland)

P 168 **Influence of Metallic Implants on LET Spectra of Charged Particles During Proton Irradiation**
Cristina Oancea (Romania)

P 169 **A Spectrometry and Dosimetry Study of Stray Neutron Radiation Field in Scanning Proton Therapy**
Vladimir Mares (Germany)

P 170 **A Comparison of Proton PBS and Photon VMAT Treatments with Film Dosimetry in a Dynamic Anthropomorphic Lung Phantom**
Rosalind Perrin (Switzerland)

P 171 **Experimental Characterization of Proton Pencil Beam Spot Profiles Including the Low-Dose Envelope Measurement**
Dawid Krzempek (Poland)

P 172 **Small-Field Dosimetry for Stereotactic Proton Therapy**
Jan Schuemann (USA)

P 173 **Fluorescent Nuclear Track Detector (FNTD) as a Tool for a More Accurate Cellular Dosimetery of Ion Beam Radiotherapy**
Shirin Rahmanian (Germany)

P 174 **Assessment of Microscopic Ion Beam Field Variation Using Fluorescence Nuclear Track Detectors**
Alexander Neuholz (Germany)

P 175 **Proton LET Measurement Using Nuclear Emulsion and TED at the National Cancer Center**
Vaclav Stepan (Czech Republic)

P 176 **Modelling Volume Recombination in Scanned Particle Beams**
Hugo Palmans (Austria)

P 177 **Thermal Modulation Mitigates Quenching Effect of a 3-D PRESAGE Dosimeter for Charged Particles**
Cheng-Shie Wuu (USA)

P 178 **Measurement of Stochastic Energy Loss in Clinical Ion Beams**
Jeannette Jansen (Germany)

P 179 **Current Status and Challenges of Volumetric Scintillation Dosimetry for Proton Therapy**
Sam Beddar (USA)

P 180 **Proton Therapy Reduces Normal Tissue Dose Compared to IMRT in Extended Field Pelvic Radiotherapy for Gynecologic Malignancies**
Maura Kirk (USA)

P 181 **Out-field Activation Dose Rate Measurements Immediately after Proton Pencil Beam Irradiation**
Liang-Hsin Chen (Taiwan)

P 182 **Implementation of Micro Collimators for Small Animal Study Using EBT Film and Monte Carlo Simulation**
Sam Ju Cho (South Korea)

P 183 **Evaluation of Relative Dose Differences Between Reusable PRESAGE Gel and Water for Small Animal Irradiator**
So Hyun Ahn (South Korea)

P 184 **Application of the MatriXX PT Detector for Verification of Patient Dosimetry in the Active Pencil Beam Scanning**
Malgorzata Liszka (Poland)

P 185 **Feasibility Test of Reusable 2D CR Dosimetry for Proton Therapy**
Steven Michiels (Belgium)

P 186 **An Evaluation and Quantification of Secondary Neutron Radiation Due to Double Scatter and Pencil Beam Scanning Proton Therapy**
Adam Glick (USA)

P 187 **Diode Array Dosimetry for Proton Dose Measurement**
Juliane Daartz (USA)

P 188 **Implementation of Dosimetry Equipment and Phantoms in Light Ion Beam Therapy Facility: the MedAustron Experience**
Loïc Grevillot (Austria)

P 189 **Implementation of Range Measurement Equipment in Light Ion Beam Therapy Facility: the MedAustron Experience**
Jhonnatan Osorio (Austria)

P 190 **IROC Houston's Anthropomorphic Proton Phantoms: Cautionary Tales from Past Irradiation Errors**
Paige Taylor (USA)

P 191 **Efficient QA Procedures for Proton Beam Characteristics and Collinearity**
Stefan Menkel (Germany)

P 192 **Pencil Beam Proton Radiography Using a Multilayer Ionization Chamber**
Sylvain Deffet (Belgium)

P 193 **A Single-Device Daily QA Program for a Spot-Scanning Proton Treatment Facility**
Daniel Mundy (USA)

P 194 **Design and Evolution of the Control System for Ocular Proton Beam Therapy at UCSF**
Inder Daftari (USA)

P 195 **A New Software Solution for Patient-Specific Plan QA in Active Pencil Beam Scanning with Proton and Carbon Ion Beams**
Antonio Carlino (Austria)

P 196 **Detector System for Fast PBS QA**
Chih-hsun Lin (Taiwan)

P 197 **Use of a Multi-Layer Faraday Collector as a Convenient Transferable Standard for Proton Range and Beam Energy**
John Gordon (USA)

P 198 **Treatment Plan Verification in PTC Prague**
Vladimir Vondracek (Czech Republic)

P 199 **First Beam Characterization of the TOP-IMPLART Proton Linear Accelerator for Cancer Radiotherapy**
Monia Vadrucci (Italy)

P 200 **Daily QA for Scanning Proton Nozzles Using a Novel Strip Detector**
Hsiao-Chieh Huang (Taiwan)

P 201 **QA team Activities of Japan Carbon-ion Radiation Oncology Study Group**
Hideyuki Mizuno (Japan)

P 202 **In-Vivo Beam Range Verification for Pencil Beam Scanning Based on Layer Energy Resolved Dose Measurement**
Hsiao-Ming Lu (USA)

P 203 **Evaluation of Scanned Beam Accuracy Using a Verification Tool of 2D Fluence Distribution**
Ryohei Tansho (Japan)

P 204 **A Simulator System for the Verification of Pencil Beam Scanning Dose Delivery Control Systems**
John Gordon (USA)

P 205 **Implementation of a Dose-Filtering Approach in RayStation for Analytical Estimation of Positron-Emitter and Prompt-Gamma Distributions**
Marco Pinto (Germany)

P 206 **Log File Analysis as a Potential Tool to Replace Patient Specific QA Measurements**
Erik Almhagen (Sweden)

P 207 **Short-Lived Positron Emitters in Beam-On PET Imaging During Proton Therapy**
Tom Buitenhuis (Netherlands)

P 208 **An Empirical Interpolation Method to Accurately Predict Modulation Width in IBA Passive Scattering Proton Therapy: A Monte Carlo Study**
Wook-Geun Shin (South Korea)

P 209 **Performance of a Treatment Quality Assurance System Based on Prompt Gamma Measurement in Ocular Proton Therapy**
Adela Carnicer (France)

P 210 **Phantom for Routine End-To-End Isocentricity Testing of spot-Scanned Proton Gantry Systems**
Erik Tryggestad (USA)

P 211 **A Simplified daily QA System with the Ancillary of Treatment Log Files for Proton Pencil Beam Scanning**
Chincheng Chen (USA)

P 212 **Efficient Patient-Specific QA for Spot-Scanned Proton Therapy Using Nozzle-Integrated Detectors and Fast Monte Carlo Dose Calculations**
Jedediah Johnson (USA)

P 213 **Experience on a Fast, Reliable and Inexpensive Daily QA Phantom for Pencil Beam Scanning Proton Therapy System**
Carlo Algranati (Italy)

P 214 **A Quasi-3D Algorithm for Count Starved Compton Camera Imaging**
Dennis Mackin (USA)

P 215 **Verification of Homemade TPS Using Radiochromic Films**
Konstantin Shipulin (Russia)

P 216 **Development and Validation of an Independent Dose Calculation Model for MU Verification in an All-PBS-Based Proton Facility**
Lei Dong (USA)

P 217 **The PSI Water Column Phantom for Patient-Specific Treatment Plan Verification**
Zema Chowdhuri (Switzerland)

P 218 **Daily Treatment Dose Verification with a Radio-Chromic Film for Proton Therapy Using Pencil Beam Scanning Technique**
Soonki Min (South Korea)

P 219 **From SuperNEMO to Proton Therapy: Adapting the SuperNEMO Optical Module For Proton Energy QA**
Simon Jolly (United Kingdom)

P 220 **Investigation of the Flat-Panel XRD 0822 as a Daily QA Device in Ion Beam Therapy**
Benjamin Ackermann (Germany)

P 221 **Highly Efficient Synchronized High-Speed Scintillation Camera System for Measuring Proton Range, SOBP and Dose Distributions in a 2D-Plane**
S. Murty Goddu (USA)

P 222 **Toward Proton Therapy Efficiency**
Niek Schreuder (USA)

P 223 **Proton Dose Delivery Tracking System Using Eclipse Scripting API**
Reynald Vanderstraeten (USA)

P 224 **Feasibility of a User-Resettable Radiochromic Polymer Gel Dosimeter for-High-Resolution 3D Dosimetry and QA in Particle Therapy**
Marek Maryanski, Ph.D. (USA)

Poster Session – Physics II

27 May 2016, 17:20–18:30, Poster Area 3 (Terrace I)

P 225 **Lung Phantom Study: Dose Evaluation Using CT Mass Density Versus Relative Stopping Power Ratio for Proton Pencil Beam Scanning System**
Sanford Katz (USA)

P 226 **Treatment Planning Study Comparing Proton Plans with Photon Plans Including Scattered Beams, Scanned Beams, and Intensity Modulated Beams for Meningioma**
Mayisha Nakib (USA)

P 227 **Proton Pencil Beam Scanning for Left-Side Breast Cancer: An Approach Based on NTCP-Guided Optimisation**
Francesco Tommasino (Italy)

P 228 **A Geometric Knowledge-Based Algorithm to Predict Patient-Specific Benefits of Proton Therapy**
David Hall (USA)

P 229 **An Adapter System for Supine CSI Treatments**
Marc Bussiere (USA)

P 230 **Treatment Planning with an Adaptive Dose Grid**
Matthias Prall (Germany)

P 231 **Modeling of Body Tissues for Monte Carlo Simulation of Radiotherapy Planned with Conventional x-ray CT**
Nobuyuki Kanematsu (Japan)

P 232 **Comparison of IMPT and IMRT Treatment Plans for 24 Consecutive Non-Small Cell Lung Cancer Patients**
Lone Hoffmann (Denmark)

P 233 **Investigation of a New Proton Spot Scanning Computed Tomography System**
Yusuf Karakaya (France)

P 234 **Smaller Spot Size Improves Organ at Risk Protection in Robustly-Optimized Intensity-Modulated Proton Therapy for Lung Cancer**
Wei Liu (USA)

P 235 **Comparison of Different Approaches to Robust Treatment Planning in Proton Therapy for Skull Base Cancer**
Joanna GORA (Austria)

P 236 **A 3D-Printed Eye Phantom for Proton Therapy**
Cornelia Hoehr (Canada)

P 237 **Fast and Efficient Cranio-Spinal Irradiation (CSI) Treatment Planning with Robust Optimization (RO)**
Jatinder Saini (USA)

P 238 **Comparison of CTV-based Robust Optimization and PTV-Based Conventional Optimization for Head and Neck Cancer**
Tony Wong (USA)

P 239 **GPU Accelerated Optimization of Multiple Slices Scanning Paths in Particle Cancer Therapy**
Alex Wu (China)

P 240 **Estimation of the Distal Safety Margin for Proton Therapy of Uveal Melanoma in Respect to Tissue Composition and Patient Positioning**
Jens Heufelder (Germany)

P 241 **Influence of Dose Uncertainty with Fractionation Effect on Tumor Control Probability in Carbon-Ion Therapy**
Makoto Sakama (Japan)

P 242 **A Robust Calculation of Proton Stopping Power Ratio Using Dual Energy CT**
Vicki Taasti (Denmark)

P 243 **Proton Energy and Scattering Radiographs to Improve Proton Treatment Planning: A Monte-Carlo Study**
Aleksandra K. Biegun (Netherlands)

P 244 **Enhance Manipulability for Patient Positioning Systems During the Pre-Positioning Phase Using Physical Human-Robot Interaction Approach**
julien Baumeyer (France)

P 245 **Spine SBRT Using Photon and Proton Therapy: A Dosimetric Comparison**
Wolfgang Tome (USA)

P 246 **A treatment Planning Comparison of SBRT of Liver Cancer With Either Photon or Proton Beams**
Gracinda Mondlane (Sweden)

P 247 **CT Characterization and Validation for Distributed Proton Treatment Planning in Eight Swedish Radiotherapy Clinics**
Christina Vallhagen Dahlgren (Sweden)

P 248 **A Beam Angle Optimisation Tool for Proton Therapy Planning**
Adam Aitkenhead (United Kingdom)

P 249 **Spot Characteristics in IMPT Treatment Planning**
Aafke Kraan (Switzerland)

P 250 **Different Margin Concepts for Paediatric Ependymoma Patients – Analysis of Plan Robustness for Pencil Beam Scanned Proton Therapy**
Barbara Knäusl (Austria)

P 251 **Clinical Implementation of Dual-Energy CT for Proton Treatment Planning to Reduce CT-related Range Uncertainties**
Patrick Wohlfahrt (Germany)

P 252 **Robust Range Prediction for Arbitrary Tissue Mixtures Based on Dual-Energy CT**
Christian Mohler (Germany)

P 253 **Internal Mammary Chain Dose Deposition TPS-MonteCarlo Comparison for Proton Breast Treatments**
Frank Van den Heuvel (United Kingdom)

P 254 **Estimation of Organ-Specific Radiation-Induced Secondary Cancer Risks Following Proton and Carbon Ion Irradiation Using a Particle Therapy Specific Model**
Camilla Stokkevag (Norway)

P 255 **The Evaluation of Plan Robustness for Proton Spot Scanning Irradiation**
Yuka Matsuzaki (Japan)

P 256 **Dosimetric Variations of Spot Scanned Proton Therapy of the Prostate Due to choice of Rectal Immobilization**
Thomas Whitaker (USA)

P 257 **The Robustness of Proton Therapy Towards Inter-Fractional Motion in Pelvic Irradiation from Different Beam Angles**
Andreas Gravgaard Andersen (Denmark)

P 258 **Are Proton Gantries Needed? An Analysis of 4332 Patient Proton Gantry Treatments and a Dosimetric Study with Pencil Beam Scanning**
Susu Yan (USA)

P 259 **Craniospinal Irradiation Using PBS Without Feathering Lines**
Michal Andrlik (Czech Republic)

P 260 **An Initial Comparison Study of Motion Interplay Effects between IMPT and SFUD in Liver Real-time-image Gated, Spot-scanning Proton Beam Therapy**
Taeko Matsuura (Japan)

P 261 **Cross Section Measurements for Improvement of TPS for Ion Beam Therapy**
Lembit Sihver (Austria)

P 262 **Evaluation of Robustness of Target Coverage: Transition from the PTV Concept to Multi-Scenario CTV Evaluation**
Erik Korevaar (Netherlands)

P 263 **Dosimetric Comparison of Intensity-Modulated Proton Therapy (IMPT) and Volumetric-Modulated Arc Therapy (VMAT) Treatment Plans for Ewing Sarcoma of the pelvis**
Richard Amos (United Kingdom)

P 264 **Clinical Feasibility of an Arms-Down Position for IMPT Chest Wall Irradiation**
Estelle Batin (USA)

P 265 **Implementation of an Analytical Lateral Dose Prediction in a Proton Therapy Treatment Planning System**
Valentina Elettra Bellinzona (Germany)

P 266 **Validation of a Proton Dose Calculation Engine for the Open-Source Treatment Planning Software Matrad**
Hans-Peter Wieser (Germany)

P 267 **A Fundus Imaging Tool for Eclipse Ocular Treatment Planning**
Tomasz Kajdrowicz (Poland)

P 268 **Innovative Computer Science for Proton Treatment Planning**
Thomas Madden (USA)

P 269 **Biological Modelling to Identify Proton Therapy Candidates in Focal Boosting of Prostate Tumours**
Jesper Pedersen (Denmark)

P 270 **An Independent Investigation of the Robustness of Proton Therapy Towards Inter-Fractional Pelvic Organ Motion Using Repeat Online Volumetric Imaging**
Kia Busch (Denmark)

P 271 **Comparison of Volumetric Healthy Tissue Sparing Between Photon and Proton Based Radiotherapy Plans for Four Anatomical Disease Sites**
Wei Liu (USA)

P 272 **Post-Prostatectomy Pencil Beam Scanning Proton Therapy (PBS) and Intensity-Modulated Radiation Therapy (IMRT) Comparative Robustness Analysis**
Curtiland Deville (USA)

P 273 **A Monte-Carlo Stady on the Effect of Respiratory Motion on Prescribed Dose onto Dynamic Tumor at Proton Therapy**
Tavassoli Hanieh (Iran)

P 274 **Clinical Implementation of a Proton Therapy Dose Verification System based on GPU Accelerated Monte Carlo Calculations**
Chris Beltran (USA)

P 275 **Commissioning of a Proton Spot Scanning Monte Carlo based and GPU Accelerated Calculation System for Clinical Use**
Chris Beltran (USA)

P 276 **Evaluation of a Monte Carlo-based QA Tool for Carbon-ion Therapy at Gunma University**
Ken Yusa (Japan)

P 277 **Dosimetric Validation of Small Field Apertures in PBS**
Nicolas Depauw (USA)

P 278 **Benchmarking Nuclear Models in Gate/Geant4 Using Innovative Transverse Dose Profile Measurements at Four Energies in a Proton Pencil Beam**
Antonio Carlino (Austria)

P 279 **Commissioning of a Proton Spot Scanning Monte Carlo based and GPU Accelerated Calculation System for Clinical Use**
Chris Beltran (USA)

P 280 **Comparison of Geant4 Multiple Coulomb Scattering of 160 MeV Protons with Experiment**
Anastasia Makarova (Germany)

P 281 **Validation of Nuclear Models in Geant4 Using the Dose Distribution of a 177 MeV Proton Pencil Beam**
Anastasia Makarova (Germany)

P 282 **Commissioning of the Eclipse Proton for Proton Therapy System with a Patient Specific Aperture Placed Downstream of a Range Compensator**
Yuya Sugama (Japan)

P 283 **A Novel Post-Processing Algorithm for the Minimum Monitor Unit Constraint in PBS**
Benjamin Clasie (USA)

P 284 **Experimental Validation and Calculation Benchmark for a Commercial Proton Monte Carlo PBS Treatment Planning System with and without Range Shifter**
Liyong Lin (USA)

P 285 **OpenCL-Based Cross-Platform Monte Carlo Simulation Package for Carbon Ion Therapy**
Nan Qin (USA)

P 286 **Evaluation of GPU-Based Fast Monte Carlo Code against FLUKA for Carbon Ion Therapy: Dose Deposition, Microdosimetry and Biological Response Analysis**
Reza Taleei (USA)

P 287 **A Clinically Viable and Comprehensive Robust IMPT Optimization Approach Based on Monte Carlo**
Chris Beltran (USA)

P 288 **Bayesian Approach for Monte Carlo Based Treatment Planning Optimization in Ion Beam Therapy**
Federico Dalmasso (Italy)

P 289 **Evaluation of Transient Dose Delivered by Quasi-Discrete Proton Pencil Beam Scanning**
Gabriele Kragl (Austria)

P 290 **Irradiation Time Optimization During Treatment Planning Process in Pencil Beam Scanning**
Isabel Huth (Germany)

P 291 **Comparisons Between Monte-Carlo FLUKA Predictions and Experimental Measurements for Helium Ions at the Heidelberg Ion Therapy Center**
Thomas Tessonnier (Germany)

P 292 **Development of a Spot-Scanning Proton Therapy Beam Model for Monte-Carlo Verification of Clinical Treatment Plans**
Adam Aitkenhead (United Kingdom)

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Sponsor Company Profiles

Booth D	Diamond Sponsor
Exhibitor Name	**IBA**
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IBA (Ion Beam Applications S.A.) is the worldwide technology leader in the field of proton therapy, the most advanced form of radiation therapy available today. IBA's proton therapy solutions are flexible and adaptable, allowing customers to choose from universal full-scale proton therapy centers as well as compact, single-room systems.

Booth P	Platinum Sponsor
Exhibitor Name	**Varian Medical Systems**
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Varian is the world's leading manufacturer of medical devices and software for treating cancer and other medical conditions with radiation. The company provides comprehensive solutions for radiotherapy, radiosurgery, proton therapy and brachytherapy. The company supplies informatics software for managing comprehensive cancer clinics, radiotherapy centers and medical oncology practices.

Booth G1	Gold Sponsor
Exhibitor Name	**RaySearch Laboratories**
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RaySearch is a world leader in the field of advanced software for radiation therapy. Our solutions are used in over 2,500 clinics in more than 65 countries. RaySearch's vision is to improve chances of survival and quality of life for cancer patients by providing innovative software to clinics for more effective radiation therapy of cancer.

Booth G2	Gold Sponsor
Exhibitor Name	**Mevion Medical Systems**
Contact Person	Scott Soehl, VP of Sales Operations
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Website	www.mevion.com

The MEVION S250i with HYPERSCAN technology overcomes existing pencil beam scanning limitations through its unique rapid energy layer switching. The result is a robust volumetric IMPT treatment delivered at hyper-speed with ultra-sharp lateral penumbra and invariant beam characteristics. **HYPERSCAN has not been cleared by the USFDA for clinical use.**

Booth S1	Silver Sponsor
Exhibitor Name	**Hitachi, Ltd.**
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Hitachi, Ltd., delivers innovations that answer society's challenges with our talented team and proven experience in global markets. The company's consolidated revenues for fiscal 2014 (ended March 31, 2015) totaled $88.7 billion. Hitachi is focusing more than ever on Healthcare, a key component to our Social Innovation Business.

Booth S2	Silver Sponsor and Partner of the Gala Dinner
Exhibitor Name	**XK Medical Investment (Beijing) Ltd.,Co.**
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Website	www.xkmed.com

Established in 2009, XKmed is a professional investment and management organization engaged in medical services. So far, XKmed has managed to bring in new cancer treatment technologies, especially the proton and heavy ion projects to treat cancer, and has worked to provide heavy ion treatment center management.

Booth B1	Bronze Sponsor
Exhibitor Name	**ZAO PROTOM**
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Website	www.protom.ru

ZAO "PROTOM" was founded in 2001 to commercialize PROMETHEUS – proton therapy system with next-generation synchrotron and gantry-less immobilization, designed by Professor Vladimir Balakin.

ZAO "PROTOM" has installed two PROMETHEUS system in Russia (treatment began January 2016) and has installed two synchrotrons in USA for McLaren (Flint, Michigan) and Masachussets General Hospital.

Booth B2	Bronze Sponsor
Exhibitor Name	**Siemens Healthcare GmbH**
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Website	www.healthcare.siemens.com

Siemens Healthcare is one of the world's largest suppliers of technology to the healthcare industry and a leader in medical imaging, laboratory diagnostics and healthcare IT. All supported by a comprehensive portfolio of clinical consulting, training, and services available across the globe and tailored to customers' needs.

Booth B3	Bronze Sponsor
Exhibitor Name	**Pyramid Technical Consultants, Inc.**
Contact Person	John Gordon
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Website	www.ptcusa.com

Founded in 1985, Pyramid has the expertise, and experience to deliver system-ready technology including electronics, software, magnetic optics, and electromechanical assemblies. Pyramid frequently takes a major role in the development of new systems, working closely with the client to structure innovative and effective solutions for particle therapy, industrial control, and scientific instrumentation.

Booth B4	Bronze Sponsor
Exhibitor Name	**humediQ GmbH**
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Email	annette.barth@humediq.com
Website	www.humediq.com

humediQ develops high-quality medical devices and implements the newest state of the art technology.
As radiotherapy treatment becomes more complex, identifying the right setup for each patient's treatment in a busy clinic can be challenging. It has to be done quickly and accurately to ensure the right patient is in the right location with the right technology setup.
At humediQ we are committed to giving the best possible technological support that can help you enhance treatment quality and avoid mistakes caused by stress and hectic pace in the daily routine.

Booth B5	Bronze Sponsor
Exhibitor Name	**Nanovi**
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Website	www.nanovi.com

Nanovi introduces BioXmark®, a liquid fiducial marker with minimal dose perturbation in proton therapy and visibility on x-ray, CT, CBCT, fluoroscopy, MRI and ultrasonography. BioXmark® creates limited artefacts in CT and MRI and has no sharp edges, which tend to cause migration of conventional metal based markers. Ideal for IGPT.

Booth R	Ruby partner of the Gala Dinner
Exhibitor Name	**ProTom International**
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Email	ssledge@protominternational.com
Website	www.protominternational.com

ProTom manufactures the Radiance 330 Proton Therapy System. Our mission is to increase the availability and affordability of a new generation of advanced, affordable and adaptable technology that makes this cutting-edge cancer treatment economically viable for more hospitals and physicians, giving patients access to proton beam therapy close to home.

Exhibitor Company Profiles

Booth Nr. 1	
Exhibitor Name	**Vertual Ltd**
Contact Person	Prof. Andy Beavis
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Website	www.vertual.co.uk

VERT is a proven radiation therapy training tool that provides a safe environment to train students, therapists, residents, dosimetrists and physicists. VERT uses authentic pendant controls and offers sophisticated 3D visualizations of treatment plans including anatomy, images, beams and dose. Vertual Ltd. can help transform your training and educational programs.

Booth Nr. 2	
Exhibitor Name	**Klarity Medical Products**
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Website	www.klaritymedical.com

Klarity Medical Products is a global leader in designing and manufacturing the highest quality thermoplastics and positioning devices. Our commitment to improving the standards of patient care is exemplified by development of Klarity Accucushions, a comfortable support pillow offering improved accuracy, and dry-heat ovens, a water-free option for mask making.

Booth Nr. 3	
Exhibitor Name	**Liverage Biomedical INC.**
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Email	charles@liverage.com.tw
Website	www.lbi.com.tw, www.liveragebiomedical.com.tw

Liverage Biomedical INC. beased in Hsichu Biomedical Science Park Taiwn and ISO 13485 certified. We are focusing the Opto Biomedical equipments, Opto Physic System, Opto Chemistry System, Bio Light System, Endoscope Compund Light Source System, Proton/ Photon Kinfe Detecting QA System. X-Ray Detecting System.

Booth Nr. 4	
Exhibitor Name	**PTW**
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Website	www.ptw.de

Founded in 1922, PTW ranks as the world's oldest and largest manufacturer of high-end dosimetry and quality control equipment in clinical radiation medicine. Focused on quality and patient safety since its beginnings, the family-owned German company also operates an accredited calibration laboratory traceable to PTB and IAEA standards.

Booth Nr. 5	
Exhibitor Name	**OCEM Power Electronics**
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For more than 70 years, OCEM Power Electronics has designed, manufactured and installed power systems for premier research laboratories around the world. Its customized power systems are enabling advances in the fields of plasma physics, particle physics and medical research, and driving advanced industries such as transportation and food processing.

Booth Nr. 6	
Exhibitor Name	**VOA Associates**
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Email	jjessen@voa.com
Website	www.voa.com

As the leading architectural design firm for proton therapy, VOA is experienced in responding to the unique demands and special requirements involved in the design of proton therapy centers. Known for our innovative design, VOA continues to stay at the forefront of the latest technological advances in proton therapy.

Booth Nr. 7	
Exhibitor Name	**medPhoton GmbH**
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Website	www.medphoton.at

medPhoton develops modern high-end technologies for the application in radiotherapy. Our main goal is to provide highest quality for highest safety and simultaneously making radiotherapy treatments comfortable for the patient. Besides the patients wellbeing we assure optimal occupancy rates of radio therapy treatment facilities due to modest workflows.

Booth Nr. 8	
Exhibitor Name	**Gold Anchor**
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Email	Samuel.Naslund@FineNeedleMarker.com
Website	www.fineneedlemarker.com

Gold Anchor is a **great fiducial marker**:

- Minimally invasive, with industry leading thin needles
- Instant stability, enabling CT/MR same day as implantation
- Great visibility, also on MRI
- Low dose perturbation, **ideal for proton therapy**

Booth Nr. 9	
Exhibitor Name	**Philips**
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Website	www.usa.philips.com/healthcare

At Philips, we look beyond technology to the experiences of patients, providers and caregivers across the health continuum. We unlock insights leading to innovative solutions that help deliver better care at lower costs. It's a unique perspective empowering us all to create a healthier future.

Booth Nr. 10	Emerald partner of the Gala Dinner
Exhibitor Name	**Elekta**
Contact Person	Roberto Pellegrini
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Website	www.elekta.com

Elekta Software creates an efficient clinical environment in which all activities related to patient care – from diagnosis and treatment to follow-up – are streamlined, giving clinicians more time to focus on patients. Elekta's open systems and vendor-neutral connectivity ensure cross-platform flexibility to integrate the most advanced and useful tools.

Booth Nr. 11	
Exhibitor Name	**LEONI CIA Cable Systems S.A.S.**
Contact Person	Claude Burlot
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Website	www.leoni-healthcare.com/en/applications/patient-positioning/

The Leoni Orion patient positioning system has key advantages in optimized safety for both patients and radiotherapy staff, while also designed to improve the throughput of patients. Additionally, it makes automated positioning adjustments possible in 6 degrees of freedom, to optimize the tumor's location.

Booth Nr. 12	
Exhibitor Name	**Sumitomo Heavy Industries, Ltd.**
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Website	www.shi.co.jp/english/products/index.html

Sumitomo Heavy Industries, Ltd. has been a manufacturer of proton therapy system since 1990s. Our proton therapy system features a reliable 230MeV cyclotron, a vertical arrangement with a short-length compact gantry, and a multi-purpose nozzle for wobbling and an advanced line scanning with optional MLC.

Booth Nr. 13	
Exhibitor Name	**Augmenix**
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Email	egardner@augmenix.com
Website	www.spaceoar.com

A leader in the development of hydrogel-based medical solutions, Augmenix is pioneering innovative products designed to improve outcomes in radiotherapy. The SpaceOAR® System, is an absorbable hydrogel prostate-rectum spacer that enables rectum-sparing prostate radiotherapy. Clinically proven to significantly reduce radiation exposure to the rectum reducing rectal radiation injury.

Booth Nr. 14	
Exhibitor Name	**LAP GmbH Laser Applikationen**
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Website	www.lap-laser.com

The characteristic features of LAP laser systems are sophisticated technology, quality and design for more than 30 years. This level of excellence has made us the global market leader for patient alignment in radiotherapy. Patient marking takes place during CT simulation and is required for reproducible treatment positioning.

Booth Nr. 15	
Exhibitor Name	**Vision RT**
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Vision RT was founded in 2001 with a mission to develop pioneering technology for surface guided radiation therapy, with the goal of enabling patient comfort and enhancing treatment efficiency. As the company has grown, it has been privileged to collaborate with some of the world's leading cancer centres and equipment vendors.

Booth Nr. 16	
Exhibitor Name	**Orfit Industries**
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Website	www.orfit.com

Orfit is a world leader in supplying High Precision Immobilization Systems for Head, Neck and Shoulders using a Frameless Mask System. Products include Open Face Masks for SRS, MammoRx Breast Boards, Systems for SBRT, Prone Breast, Extremities, Pelvis/Abdomen and Proton Therapy. Orfit also offers MR Compatible and Paediatric Systems.

Booth Nr. 17	
Exhibitor Name	**Anzai Medical Co., Ltd.**
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Established in 1976 Anzai Medical celebrates 40th anniversary this year. We're in the business of making great medical equipment with originality and careful attention to detail. The Respiratory Gating System is one of our products which is advanced, reliable and well proved. More than 1,700 units are installed and run worldwide.

Booth Nr. 18	
Exhibitor Name	**Best Particle Therapy**
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Website	www.teambest.com

Best Particle Therapy aims to provide advanced accelerator technologies with proton and carbon ions through their ion Rapid Cycling Medical Synchroton (iRCMS), a synchrotron of unique racetrack lattice design, created in collaboration with the Brookhaven National Laboratory. The iRCMS will require less shielding allowing it to be placed in a standard room. This innovative technology produces extremely small beam emittances allowing for beam delivery with unprecedented precision, reducing the risk of dose to healthy tissue. Best Particle Therapy is proud to be a member of the TeamBest group of companies.

Booth Nr. 19	
Exhibitor Name	**Mitsubishi Electric Corporation**
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Email	Nakamura.Daisuke@ce.MitsubishiElectric.co.jp
Website	www.mitsubishielectric.com/bu/particlebeam

Mitsubishi Electric is a leading supplier of particle therapy systems in Japan, and provides a full line of proton, carbon and proton-plus-carbon solutions. Mitsubishi Electric is currently working on expanding its successful particle therapy business into global markets.

Booth Nr. 20	
Exhibitor Name	**Cosylab**
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Email	info@cosylab.com
Website	www.cosylab.com

Cosylab integrates control systems for PT and research particle accelerators, either complete, or in part. Project directors, group leaders and engineers on such projects often face tight deadlines and certification challenges. They engage Cosylab to achieve better performance, while reducing commissioning time, manpower and cost.

Booth Nr. 21	
Exhibitor Name	**SAES Getters**
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Website	www.saesgroup.com

SAES Group

For several decades, the SAES Group has been the leading supplier of Non-Evaporative Getter (NEG) pumps used in a variety of accelerators, industrial and research applications. These pumps are extremely compact, and feature large pumping speed with no vibrations nor magnetic fields, and pump in total absence of power.

SAES can now even offer the capability to design and manufacture vacuum chambers, components and integrated vacuum systems for accelerators, research and industrial devices.

Booth Nr. 22+24	
Exhibitor Name	**Delivering Particle Therapy / CampbellReith**
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Website	www.campbellreith.com

CampbellReith is an independent practice of consulting engineers providing structural, civil, geotechnical, environmental and traffic and transportation services to a wide variety of clients. **Our teams are committed to providing innovative and cost effective solutions** across a broad range of sectors, including particle therapy, radiopharmaceutical, research and acute healthcare.

Booth Nr. 22+24	
Exhibitor Name	**Delivering Particle Therapy / Harley Haddow**
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Harley Haddow is an award winning multidiscipline engineering design practice specialising in delivering a wide range of complex projects within the healthcare and science/research sectors. We provide industry leading mechanical, electrical, public health (MEP), energy and sustainability services ensuring a focus on best engineering practices and cost effective, innovative solutions.

Booth Nr. 22+24	
Exhibitor Name	**Delivering Particle Therapy / Bouygues**
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Bouygues's core business designs, builds and operates buildings that improve the quality of people's living and working environment: public and private buildings, transport infrastructures and energy and communications networks. A leader in sustainable construction its 50,100 employees have a long term commitment to helping their customers shape a better life.

Booth Nr. 22+24	
Exhibitor Name	**Delivering Particle Therapy / Scott Tallon Walker Architects**
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Scott Tallon Walker Architects

Scott Tallon Walker, an award winning practice, takes pride in creating healthcare environments that deliver design quality, and best practice solutions using the most modern technology.

Our work follows established evidence based design principles to improve health outcomes. Our specialist knowledge incudes Radiopharmaceutical, Nuclear Medicine & Proton Beam Therapy design.

Booth Nr. 22+24	
Exhibitor Name	**Delivering Particle Therapy / WSP CCRD**
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WSP CCRD, is a leading engineering and consulting firm with a network of 34000 technical specialists in over 50 countries. We have been delivering complex solutions to the healthcare sector for more than 30 years and are committed to healthcare engineering that creates environments where wellness and healing are promoted.

Booth Nr. 23	
Exhibitor Name	**Veritas Medical Solutions**
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Email	bill.luecke@veritas-medicalsolutions.com patty.kendall@veritas-medicalsolutions.com
Website	www.veritas-medicalsolutions.com

Veritas Medical Solutions

Veritas manufactures pre-engineered radiation shielding systems for fast and efficient modular construction of proton centers ranging from large multi-room facilities to smaller single treatment rooms.

VeriShield proton shielding systems feature documented attenuation effectiveness, and VPAC shielding packs dramatically reduce construction time and provide unmatched neutron attenuation and guaranteed shielding performance.

Booth Nr. 25	
Exhibitor Name	**icotec ag**
Contact Person	Roger Stadler
Telephone	+41 71 757 00 00
Email	info@icotec.ch
Website	www.icotec.ch

icotec, a Swiss company, designs and manufactures non-metallic spinal implants made from carbon fibre reinforced PEEK (Carbon/PEEK). Carbon/PEEK breaks barriers in radiotherapy: it enables artifact-free CT/MRI images for accurate delineation of critical structures and accelerated dose planning. During radiotherapy, Carbon PEEK is radio-transparent, enables homogenous doses and avoids shielding and scattering.

Booth Nr. 27	
Exhibitor Name	**C-RAD AB**
Contact Person	Ling Zhang
Telephone	+4618666938
Email	ling.zhang@c-rad.com
Website	www.c-rad.com

C-RAD develops innovative solutions for use in advanced radiation therapy. The C-RAD group offers products and solutions for patient positioning, tumor localization and radiation treatment systems.

C-RAD's Catalyst PT Solution support integration in end-to-end multi-vendor PT workflow, from the computed tomography room to the treatment room.

Booth Nr. 28	
Exhibitor Name	**MedCom GmbH**
Contact Person	Tobias Braun
Telephone	+49-6151-95147-0
Email	info@medcom-online.de
Website	www.medcom-online.de

MedCom offers innovative, advanced imaging-based products with emphasis on cancer treatment, interventional & surgical navigation and specialized telemedicine solutions (trauma, military-special forces, rural areas, satellite). We deliver high-tech OEM products to a large number of worldwide acting manufacturers of integrated clinical solutions as well as to high-end clinics in the research-sector.

Booth Nr. 29	
Exhibitor Name	**Qfix**
Contact Person	Damon Kirk
Telephone	+1 610-268-0585
Email	Damon.Kirk@Qfix.com
Website	www.qfix.com

Qfix is a global leader specializing in patient positioning and immobilization devices. We are dedicated to helping radiation therapy professionals provide superior patient care with the world's finest devices to enhance patient outcomes. Qfix offers complete, innovative solutions for MR, kV and MV imaging and treatment.

	Ruby partner of the Gala Dinner
Company name	**GE Healthcare**
Website	www.ge.com

GE Healthcare provides medical technologies and services to help solve the challenges facing healthcare providers around the world. From medical imaging, software, patient monitoring and diagnostics, to biopharmaceutical manufacturing technologies, GE Healthcare solutions are designed to help healthcare professionals deliver better, more efficient and more effective outcomes for more patients.

GE Healthcare is betting big on digital; not just connecting hospital departments and physicians more effectively, but utilizing the masses of data from its equipment and the collaboration between hardware and software – "digital industrial" – to help clinicians make better care decisions. Sensors, software and smart data analytics are converging to enhance GE Healthcare's offerings not just in diagnostics, but also pathology, gene sequencing and even hospital asset tracking.

Tabletops

Booth T1	
Exhibitor Name	**DE.TEC.TOR. DEVICES AND TECHNOLOGIES TORINO srl**
Contact Person	Vanessa La Rosa
Telephone	+39 011 2257357 +39 3429563619
Email	larosa@detector-med.cpom
Website	www.detector-med.com

DE.TEC.TOR. designs, customizes and manufactures high precision particle detectors for on-line beam monitoring and daily quality assurance in particle therapy facilities. Constantly focused on innovation, it collaborates with research centres and clinical facilities for the development and commercialization of novel technology and devices, according to its certified Quality Management System ISO 9001:2008 and ISO 13485:2012.

Booth T2	
Exhibitor Name	**PTCOG 56 – Chiba & Yokohama, Japan**
Contact Person	Shogo Iwashita
Telephone	+81-3-5520-8821
Email	ptcog56@procomu.jp
Website	www.procomu.jp/ptcog56/

56th Annual Conference of the Particle Therapy Co-Operative Group (PTCOG 56) will be held in Chiba and Yokohama, Japan from Monday, May 8 to Saturday, May 13, 2017.

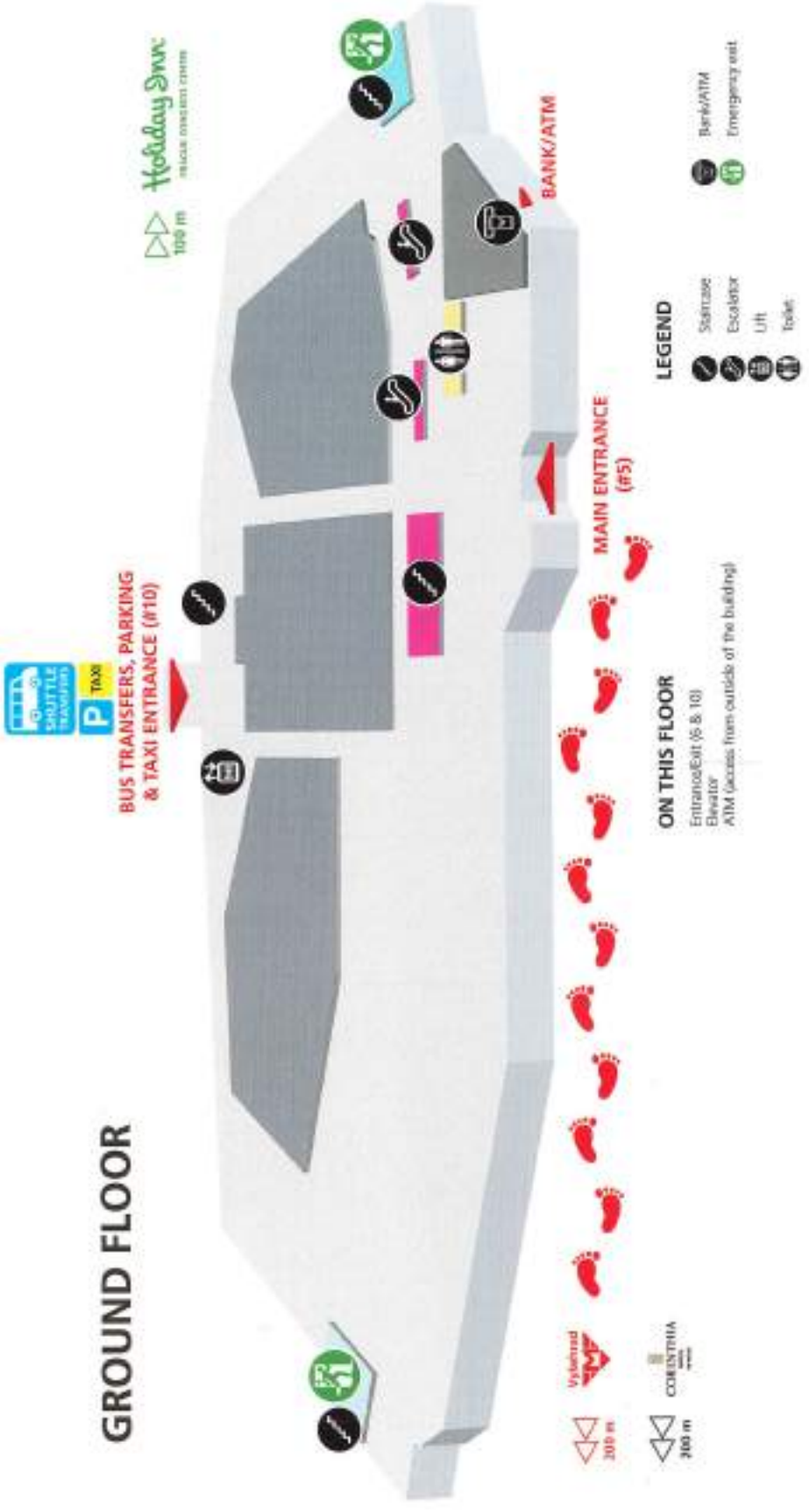
- Educational Workshop: Monday, May 8 – Wednesday, May 10, 2017
  Makuhari Messe International Exhibition Hall.
- Scientific Meeting: Thursday, May 11 – Saturday, May 13, 2017
  Pacifico Yokohama.
- Exhibition will be held on May 11 – May 13 in Yokohama.

It will be our pleasure to welcome you to Japan at PTCOG 56 in May, 2017.

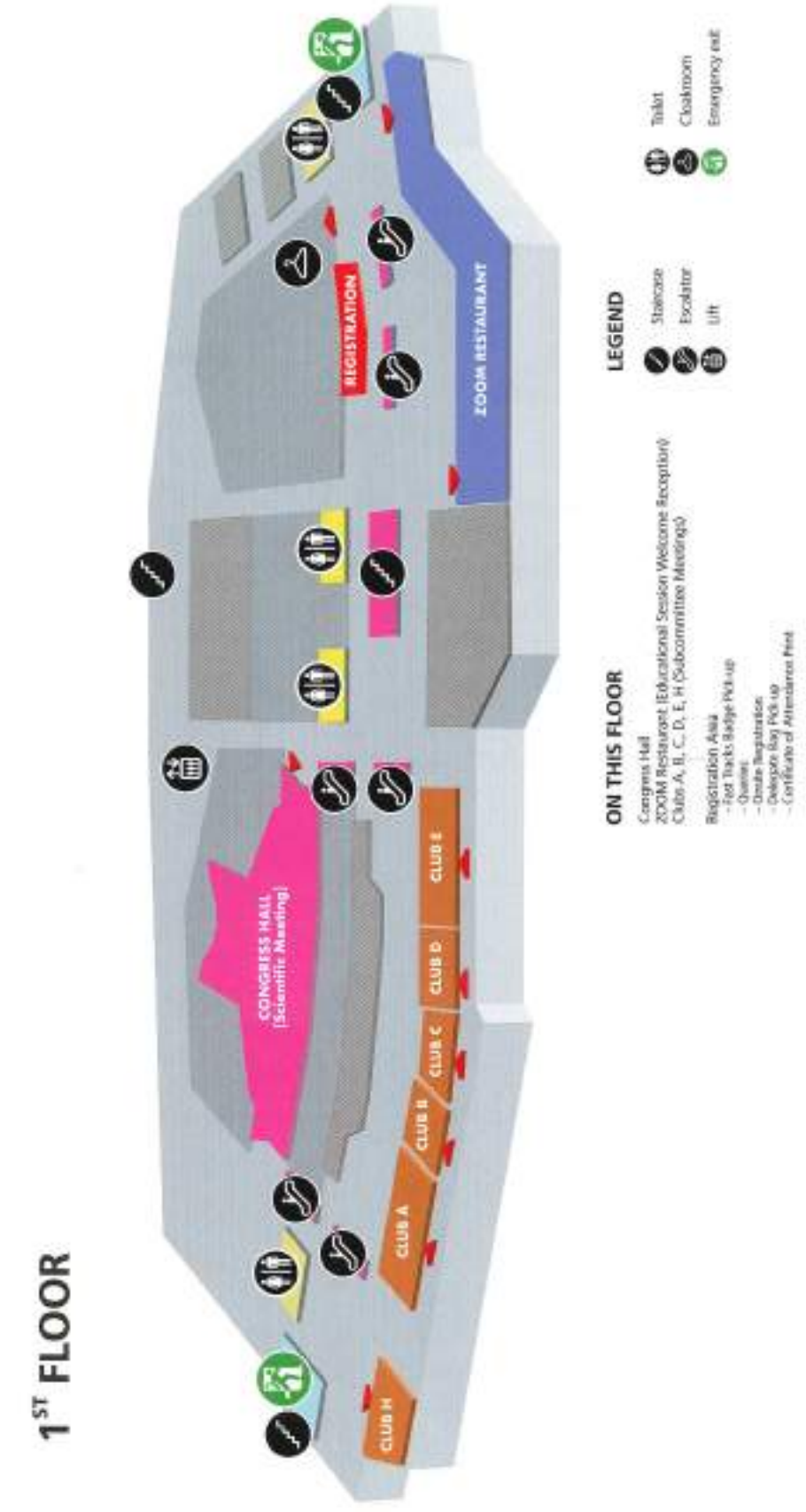
Booth T3	
Exhibitor Name	**International Journal of Particle Therapy**
Contact Person	Judy Tran
Telephone	+1 (352) 265-0680 ext. 87819
Email	tranju@shands.ufl.edu editors@theijpt.org
Website	www.theijpt.org

The International Journal of Particle Therapy (IJPT) is the official journal of PTCOG. IJPT publishes quarterly and is an open-access journal that does not charge for article submission or processing. Our mission is to provide a venue for disseminating information on clinical, physical, and biological research in particle therapy.

Venue Floorplan



Venue Floorplan



Venue Floorplan

PTCOG55 General Information

Registration

Registration area is located on the 1st floor of the Prague Congress Centre.

Opening Hours:

Sunday	22 May	16:00–18:00
Monday	23 May	07:30–17:30
Tuesday	24 May	08:00–17:30
Wednesday	25 May	08:00–17:30
Thursday	26 May	08:00–18:45
Friday	27 May	07:00–18:30
Saturday	28 May	08:00–14:15

Registration hotline: +420 727 803 219

Exhibition

Exhibition area is located on the second floor on the foyer of the Congress Hall.

Opening Hours:

Thursday	26 May	08:00–18:00
Friday	27 May	08:00–18:30
Saturday	28 May	08:00–14:00

Mobile Application

PTCOG55 mobile application is available for download for Android (4.2+) and iOS (7+) platforms. Look for app named PTCOG55.

The application includes complete program information as well as all delegate information (floorplans, social programme, general information about venue, Prague and Czech Republic) sponsors and exhibitors.

Internet at the Venue

There is free Wi-Fi internet connection available in the venue (Forum Hall foyer , Forum Hall, Congress Hall foyer, Congress Hall) network SSID: PTCOG55.

Cloakroom

A cloakroom is located on the 1st floor next to the registration area. The service is provided free of charge to all registered participants.

Conference Language

The conference language is English. No simultaneous translation is provided.

附件四、布拉格質子治療中心簡介

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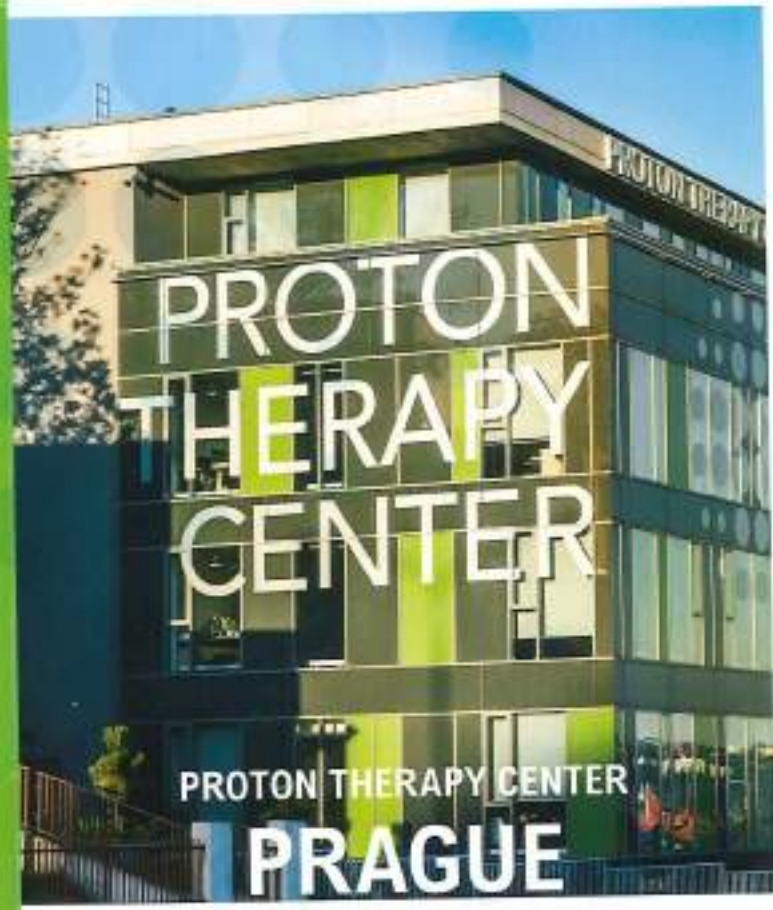
WELCOME



www.iba-protontherapy.com

Part of the iba family

Proton Therapy Center Czech is a state of the art Proton treatment center. In December 2015, the center celebrated its 3rd anniversary of patient treatment. On your visit there will be 8 stops

① Entrance and Waiting Hall

The styling of the hall is designed to reduce patient stress and prepare the patient for treatment. Check out: the aquarium, the coffee corner, the artworks and the patient record system.

② Consulting and Examination Rooms

In these rooms patients get advice and are able to follow concomitant chemotherapy treatment.

③ Gantry Room 4

This room has a dedicated nozzle for PBS treatment, usually used for breast and lung treatment. It is equipped with spirometry unit Dyn'R, used for monitoring of chest movement. GTR3 is an identical room, usually used for children treatment, equipped with anesthesia units.

④ Set up room and Anesthesia

The body of the patient must be in an exact and reproducible position before every session (fraction).This requires various immobilization devices made from suitable materials. The use of high quality suitable materials is justified by the need to prevent distorting the posterior radiation field, and also to minimize the occurrence of secondary radiation.

⑤ Fixed Beam Treatment Room

One of the treatment rooms is equipped with a fixed beam (appropriately known as the 'Fixed Beam Treatment Room'). In this room the nozzle is fixed in a single position and is immovable. Tumors of brain and prostate cancer are the most frequent indications treated here.

⑥ Mean Control Room, Cyclotron

The proton center uses a Proteus 235 cyclotron, a cyclic high frequency accelerator, which accelerates protons up to an extremely high speed - thereby producing a beam of high energy. A proton beam of a particular energy and intensity is then safely transported to the body of the patient through a 'Beam Transport System', and this beam is modulated via individual nozzles within the treatment room before being directed at the target tumor.

⑦ PET/CT, CT and MRI Presentation

This is one of the most precise and sensitive ways of imaging in contemporary nuclear medicine for both primary staging of oncological tumors, and for examinations following treatment (as well as for regular check-ups). The center is equipped with a Discovery PET/CT 600 by GE Healthcare.

⑧ Children's Room

This room and the graphics throughout the center show the center's attention to detail and making patients feel comfortable. Professor Proton is a friend for the smallest patients undergoing proton therapy. The center also has a dedicated physician in charge of the children treatment program.