ANNUAL

Advances and Innovations in Endoscopic Oncology and Multidisciplinary Gastrointestinal Cancer Care

Precision Power: Advanced GI Cancer Treatment with Precision Radiotherapy

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Disclosures

- I do not have any relevant financial relationships.

This presentation and/or comments will provide a balanced, non-promotional, and evidence-based approach to all diagnostic, therapeutic and/or research related content

Cultural Linguistic Competency (CLC) & Implicit Bias (IB)

STATE LAW:

The California legislature has passed Assembly Bill (AB) 1195, which states that as of July 1, 2006, all Category 1 CME activities that relate to patient care must include a cultural diversity/linguistics component. It has also passed AB 241, which states that as of January 1, 2022, all continuing education courses for a physician and surgeon **must** contain curriculum that includes specified instruction in the understanding of implicit bias in medical treatment.

The cultural and linguistic competency (CLC) and implicit bias (IB) definitions reiterate how patients' diverse backgrounds may impact their access to care.

EXEMPTION:

Business and Professions Code 2190.1 exempts activities which are dedicated solely to research or other issues that do not contain a direct patient care component.

The following CLC & IB components will be addressed in this presentation:

- Will review how RT advances are independent of race, gender, and sexual orientation.
- Will address possible barriers in communication.

ASTRO Annual Meeting

Sep 27 to Oct 1, 2025
San Francisco


SOUP KITCHEN
CHAPMAN
"I hope it's alphabet soup... it's good for the vowels."

RT for GI tumors: Key Approaches and Innovations

- 1. Image-Guided Radiation Therapy (IGRT)
- 2. Intensity-Modulated Radiation Therapy (IMRT)
- 3. Stereotactic Body Radiation Therapy (SBRT)
- 4. Adaptive Radiation Therapy (ART)
- 5. Proton Beam Therapy (PBT)
- 6. Biologically Targeted and Molecular-Guided Radiation
- 7. Theranostics and Radiopharmaceuticals
- 8. Artificial Intelligence (AI) and Big Data Integration

Image-Guided Radiation Therapy (IGRT)

- Uses advanced imaging techniques (e.g., cone-beam CT, MRI) to enhance tumor localization and track changes during treatment.
- Precision Advantage: Ensures accurate delivery to GI tumors despite organ motion (e.g., bowel peristalsis, respiratory motion).
- Applications: Pancreatic cancer, rectal cancer, and esophageal cancer benefit from improved targeting and reduced treatment margins.

Intensity-Modulated Radiation Therapy (IMRT)

- Includes commercial terms including “VMAT” and “Rapid Arc”
- Inversely planned
- Beamlets used to modulate beam intensity
- Improves dose conformality
- May increase integral dose
- Becoming SOC for complex GI cases to reduce GI toxicity

Stereotactic Body Radiation Therapy (SBRT)

- Overview: Delivers high-dose radiation in a few fractions with sub-millimeter accuracy.
- Precision Advantage: Enables ablative doses to tumors while minimizing exposure to healthy tissues.
- Applications: Common in treating unresectable pancreatic cancer, liver metastases, and oligometastatic disease.

Adaptive Radiation Therapy (ART)

- Overview: Adjusts treatment plans in real-time or between sessions based on anatomical and biological changes.
- Precision Advantage: Adapts to tumor shrinkage, organ movement, and patient weight changes.
- Applications: Particularly useful for GI cancers where organ motion and tumor regression are common.

Proton Beam Therapy (PBT)

- Overview: Uses protons rather than photons to deliver radiation with a sharp dose fall-off (Bragg peak).
- Precision Advantage: Reduces dose to surrounding organs, lowering toxicity.
- Applications: Ideal for treating GI tumors near critical structures, such as esophageal cancer and liver tumors.

Biologically Targeted and Molecular-Guided Radiation

- Overview: Integrates genomic and molecular profiling to guide radiation dose and volume.
- Precision Advantage: Allows for individualized treatment plans based on tumor biology and radiosensitivity.
- Applications: Trials are exploring radiosensitizers, biomarkers for response prediction, and personalized treatment intensification.

Theranostics and Radiopharmaceuticals

- Overview: Combines diagnostic imaging with targeted radiotherapy using radiopharmaceuticals.
- Precision Advantage: Offers systemic radiation delivery tailored to molecular targets.
- Applications: Lutetium-177 and Yttrium-90 are being used for liver metastases and neuroendocrine tumors.

Artificial Intelligence (AI) and Big Data Integration

- Overview: Uses machine learning to optimize treatment planning and predict patient outcomes.
- Precision Advantage: Improves efficiency in contouring, adaptive planning, and toxicity prediction.
- Applications: AI is being integrated into GI radiation oncology for patient selection and personalized treatment pathways.

MR linear accelerator technology (MRL)

The following slides are courtesy of Michael Chuong, MD at Miami Baptist Cancer Institute. MCI was an early adopter of MR linear accelerator tech

We do NOT have an MR linear accelerator at Mayo Clinic

Slide courtesy of Michael Chuong, MD

Causes of death

VOLUME 27 · NUMBER 11 · APRIL 10 2009

JOURNAL OF CLINICAL ONCOLOGY ORIGINAL REPORT

DPC4 Gene Status of the Primary Carcinoma Correlates With Patterns of Failure in Patients With Pancreatic Cancer

Christine A. Iacobuzio-Donahue, Baojin Fu, Shinichi Yachida, Mingde Luo, Hisashi Abe, Clark M. Henderson, Felip Vilardell, Zheng Wang, Jesse W. Keller, Priya Banerjee, Joseph M. Herman, John L. Cameron, Charles J. Yeo, Marc K. Halushka, James R. Eshleman, Marian Raben, Alison P. Klein, Ralph H. Hruban, Manuel Hidalgo, and Daniel Laheru

From the Departments of Pathology, Surgery, and Oncology, The Sol Goldman Pancreatic Cancer Research Center, Johns Hopkins Medical Institutions, Baltimore MD; and the Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, and Department of Surgery and the Jefferson Pancreas, Biliary and Related Cancer Center, Thomas Jefferson University, Philadelphia PA.

Submitted April 24, 2008; accepted November 24, 2008; published online ahead of print at www.jco.org on March 9, 2009.

Supported by grants No. CA62924 and CA106610 from the National Institutes

A B S T R A C T

Purpose
Contrary to the extensive data accumulated regarding pancreatic carcinogenesis, the clinical and molecular features characteristic of advanced stage (stage III and IV) disease are unknown. A comprehensive study of pancreatic cancers from patients who have succumbed to their disease has the potential to greatly expand our understanding of the most lethal stage of this disease and identify novel areas for intervention.

Materials and Methods
Rapid autopsies were performed on 76 patients with documented pancreatic cancer. The histologic features of end stage disease were determined and correlated to the stage at initial diagnosis, patterns of failure (locally destructive *v* metastatic disease) and the status of the *KRAS2*, *TP53*, and *DPC4* genes.

Results
At autopsy, 30% of patients died with locally destructive pancreatic cancer, and 70% died with

Rapid autopsy study 2003-2007

Stage: I/II: 29%, III: 24%, IV: 47%

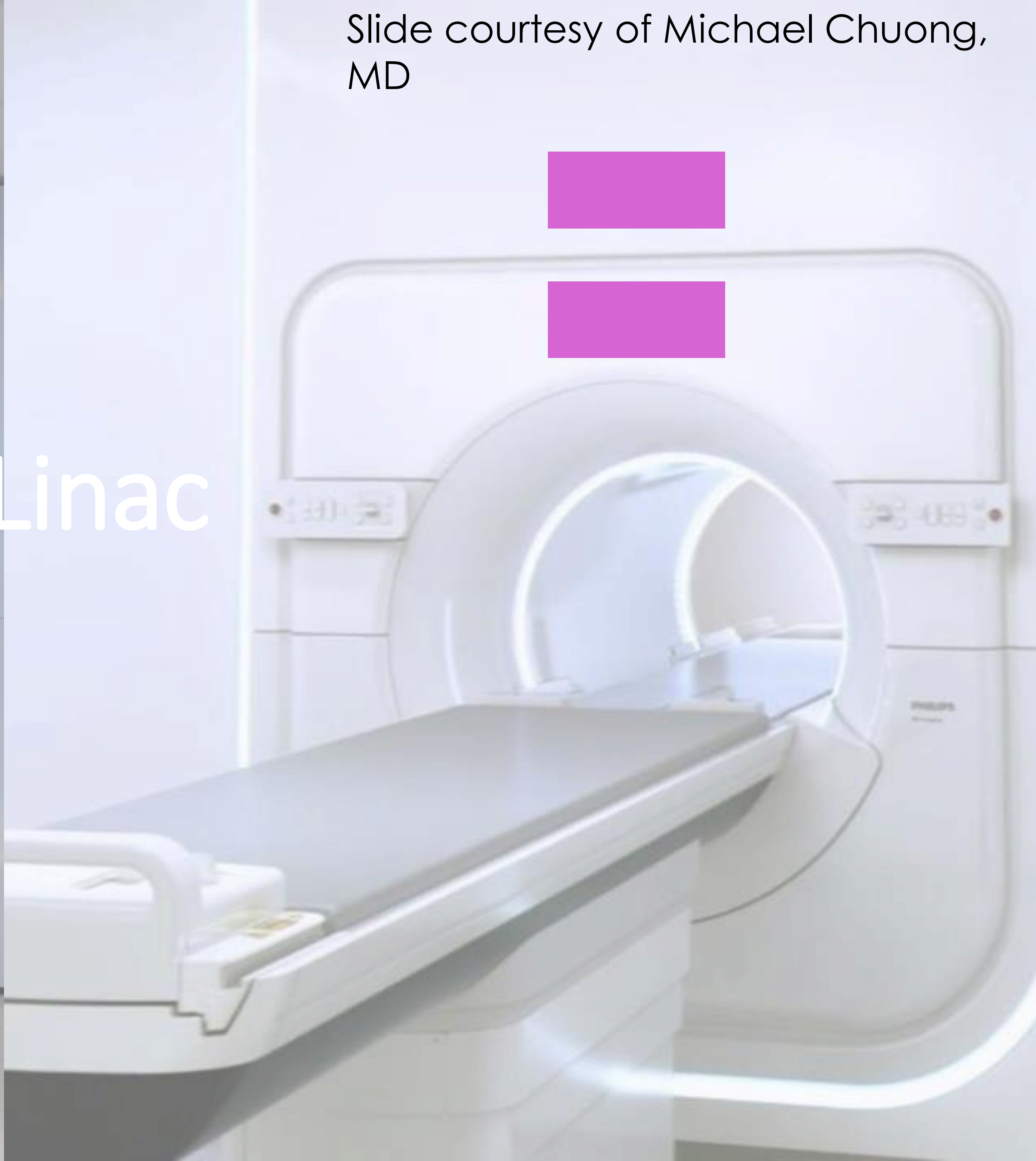
Metastatic disease at autopsy: 88%

"30% died from locally destructive pancreatic cancer"

"contrary to common belief, not all patients die of widespread metastatic disease"

Slide courtesy of Michael Chuong, MD

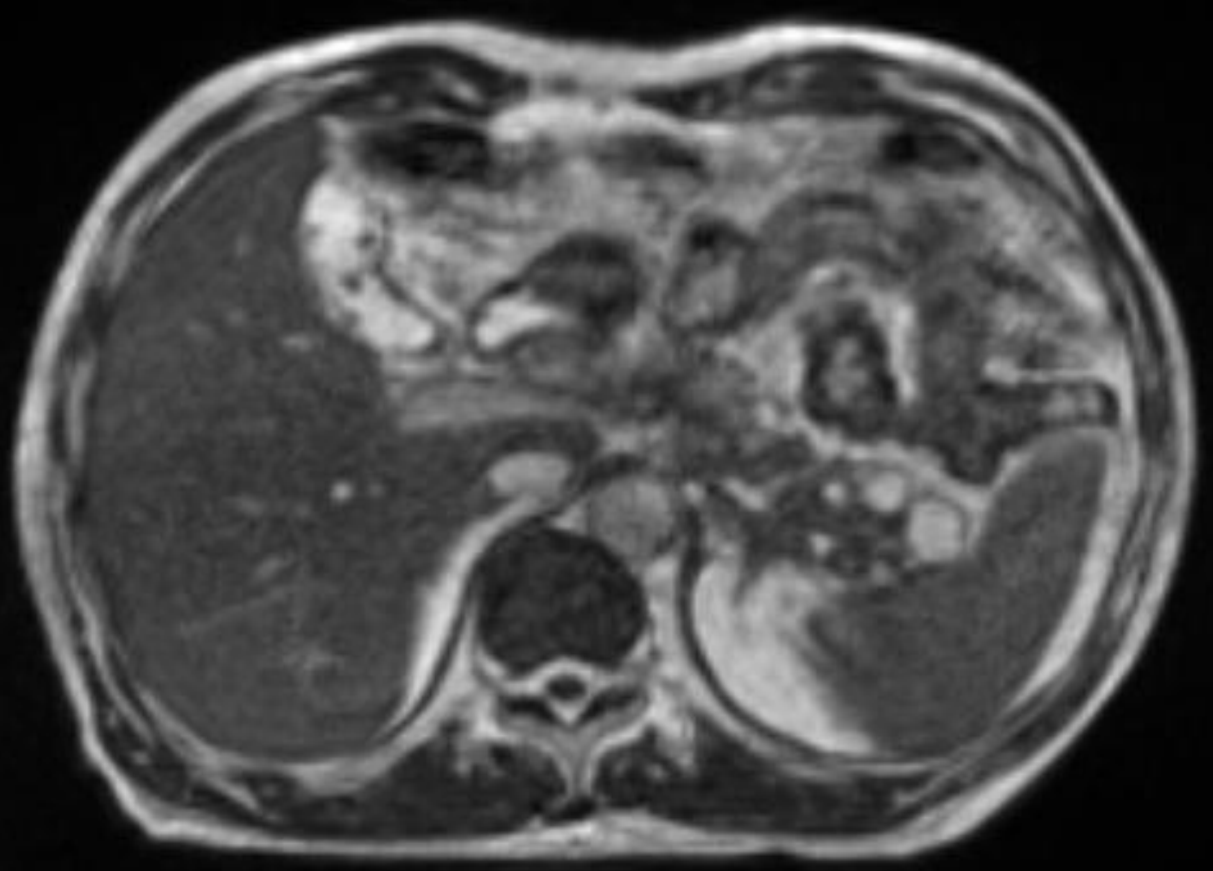
MR-Linac



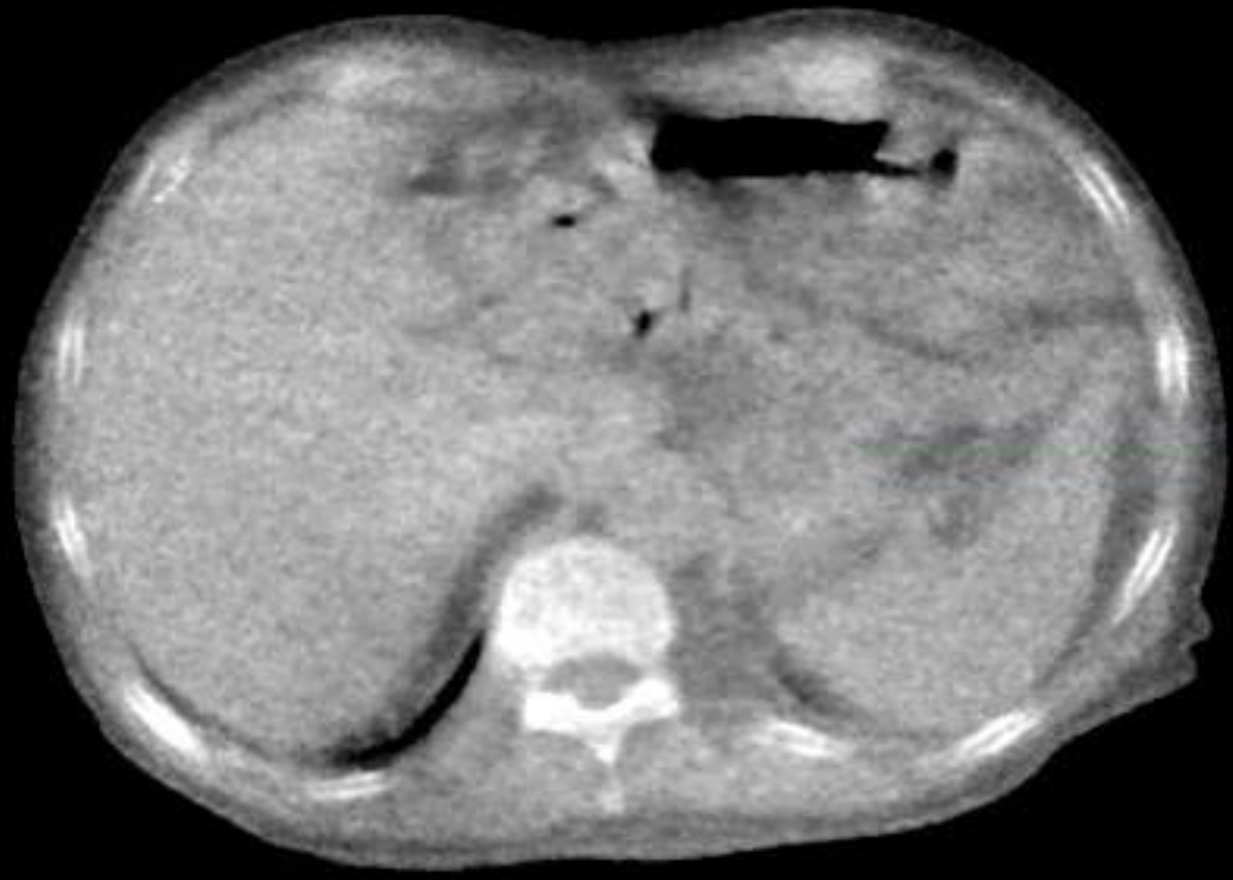
Slide courtesy of Michael Chuong, MD

Superior soft tissue contrast of MRI

0.35T MRL

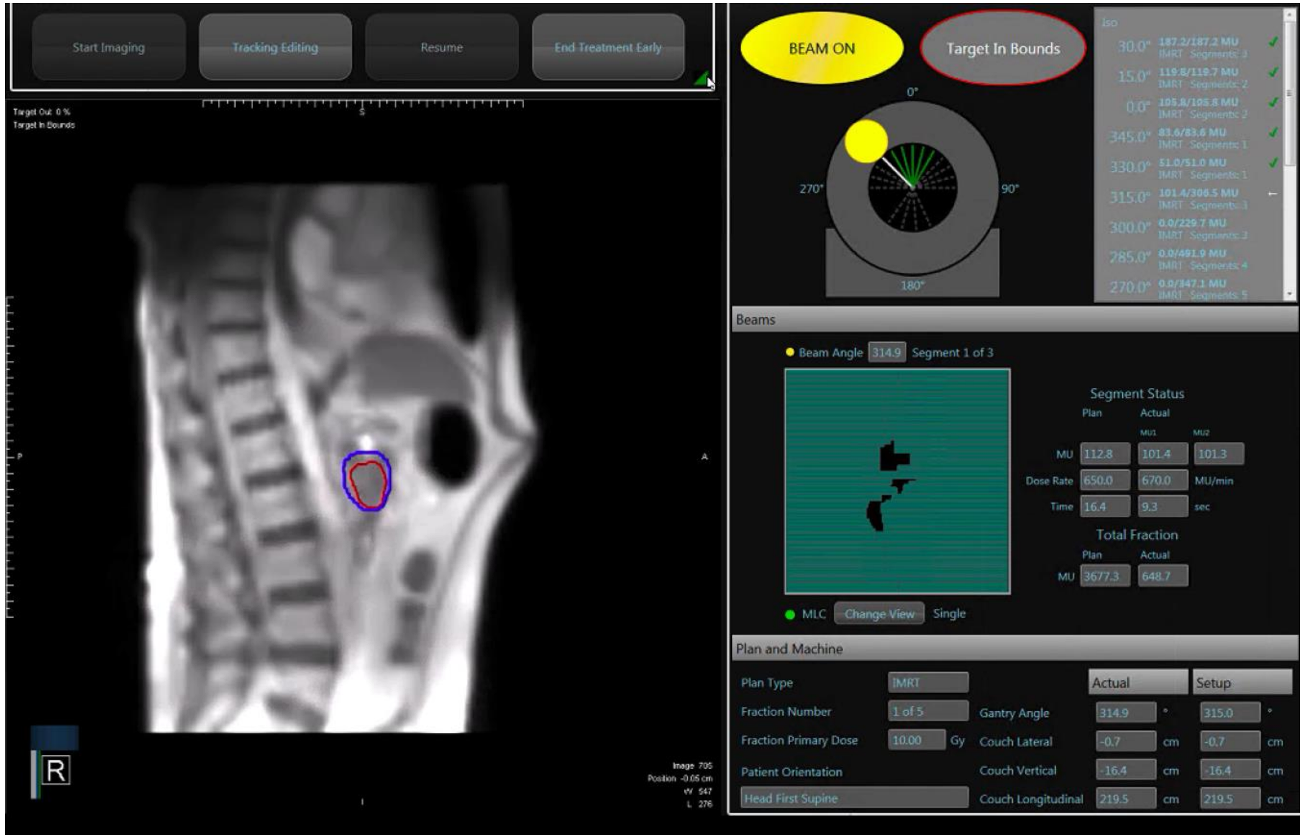


MVCT



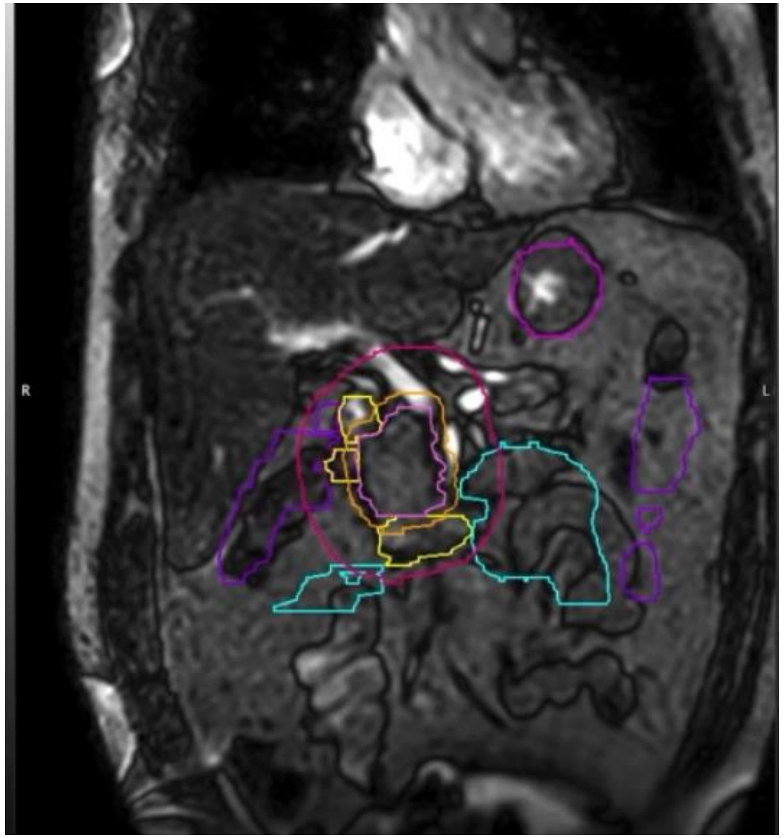
Slide courtesy of Michael Chuong, MD

0.35T MR Linac

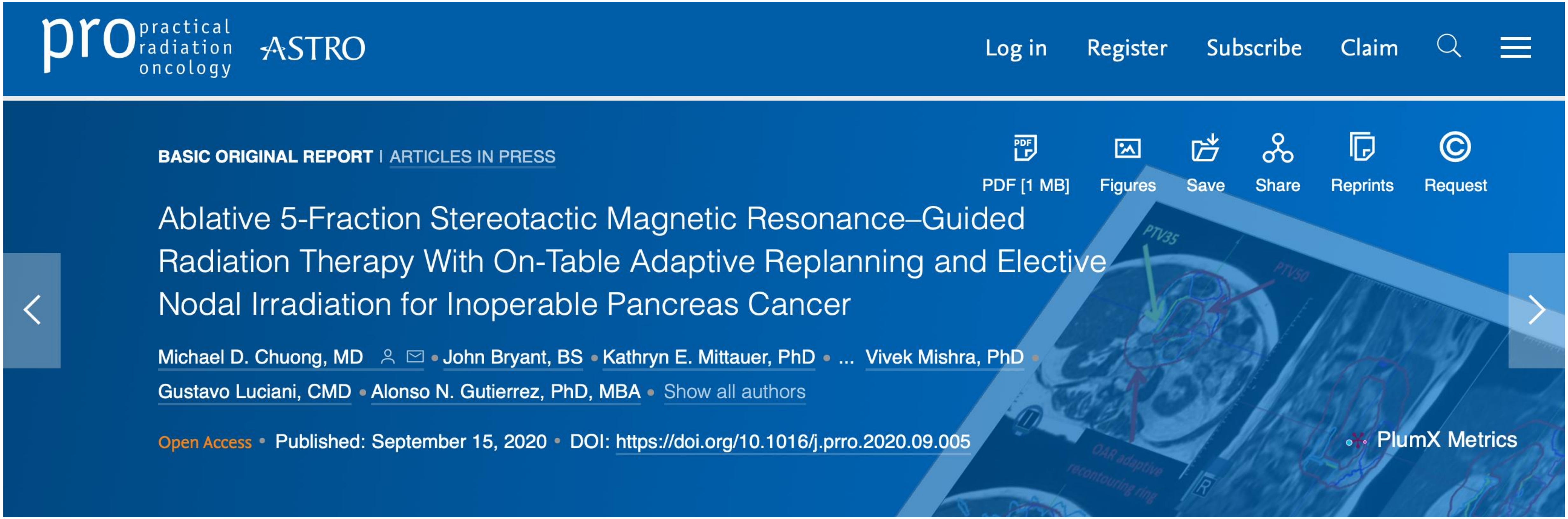


1.5T MR Linac

Courtesy of William Hall, MD



First 5-fraction MR-Linac outcomes (MCI)



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BASIC ORIGINAL REPORT | ARTICLES IN PRESS

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Ablative 5-Fraction Stereotactic Magnetic Resonance–Guided Radiation Therapy With On-Table Adaptive Replanning and Elective Nodal Irradiation for Inoperable Pancreas Cancer

Michael D. Chuong, MD • John Bryant, BS • Kathryn E. Mittauer, PhD • ... Vivek Mishra, PhD • Gustavo Luciani, CMD • Alonso N. Gutierrez, PhD, MBA • Show all authors

Open Access • Published: September 15, 2020 • DOI: https://doi.org/10.1016/j.prro.2020.09.005

PlumX Metrics

Daily treatment
No prophylactic PPI

Acute/late grade 3+ toxicity: 2.9%
1-yr LC: 88%, 1-yr OS: 59%

Favorable LC and OS

Radiotherapy and Oncology
Available online 20 December 2023, 110064
In Press, Journal Pre-proof   What's this?

Original Article

Stereotactic MR-guided on-table adaptive radiation therapy (SMART) for borderline resectable and locally advanced pancreatic cancer: a multi-center, open-label phase 2 study

Michael D. Chuong [a], Percy Lee [b], Daniel A. Low [c], Joshua Kim [d], Kathryn E. Mittauer [a], Michael F Bassetti [e], Carri K. Glide-Hurst [e], Ann C. Raldow [f], Yingli Yang [f], Lorraine Portelance [g], Kyle R. Padgett [g], Bassem Zaki [h], Rongxiao Zhang [h], Hyun Kim [i], Lauren E. Henke [i], Alex T. Price [i], Joseph D. Mancias [j], Christopher L. Williams [j], John Ng [k], Ryan Pennell [k], M. Raphael Pfeffer [l], Daphne Levin [l], Adam C. Mueller [m], Karen E. Mooney [m], Patrick Kelly [n], Amish P. Shah [n], Luca Boldrini [o], Lorenzo Placidi [o], Martin Fuss [p], Parag Jitendra Parikh [d]

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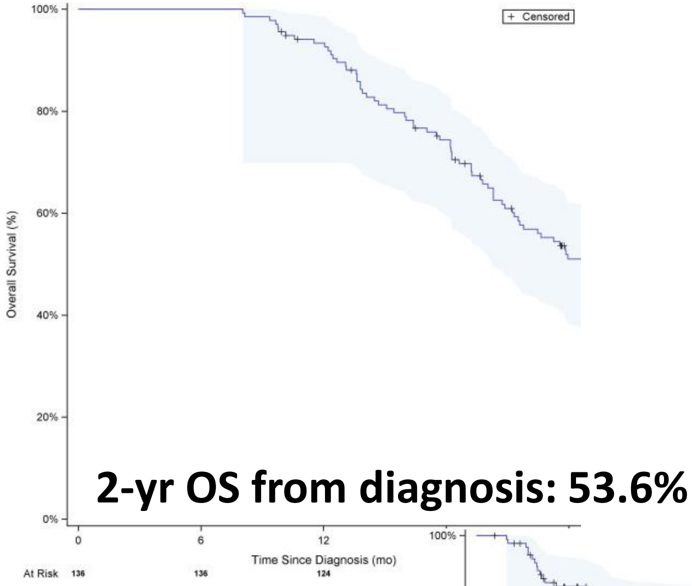
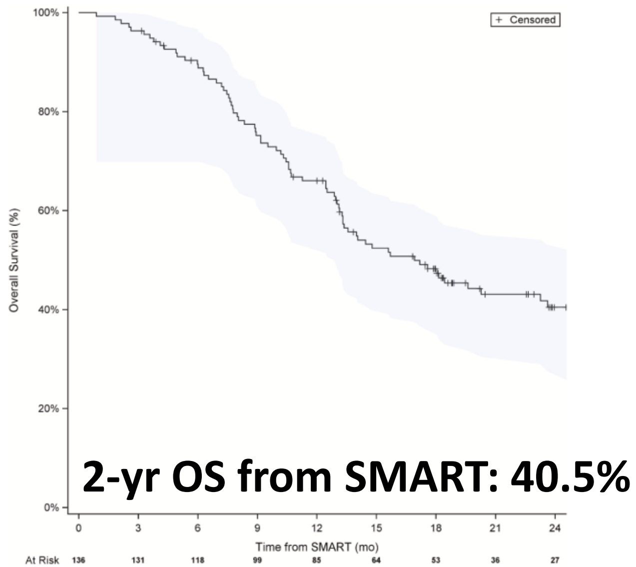
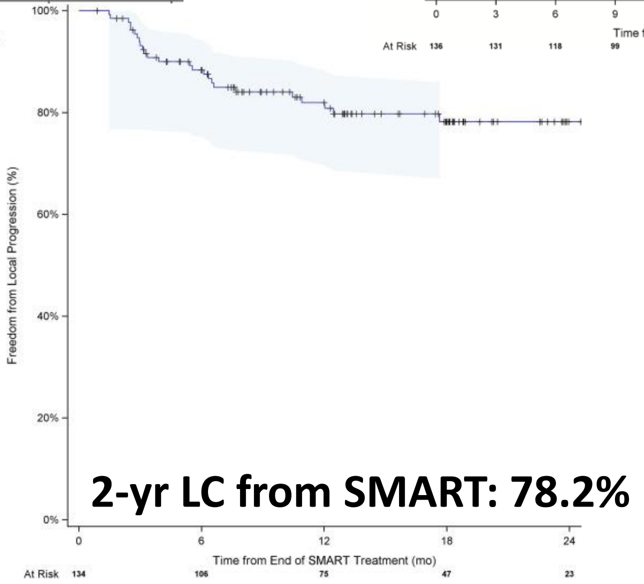
[e] University of Wisconsin—Madison, Department of Human Oncology, Madison, WI
[f] Department of Radiation Oncology, UCLA David Geffen School of Medicine, Los Angeles,







Proton Beam Therapy – Whole Pelvic RT

Indications for Proton Therapy

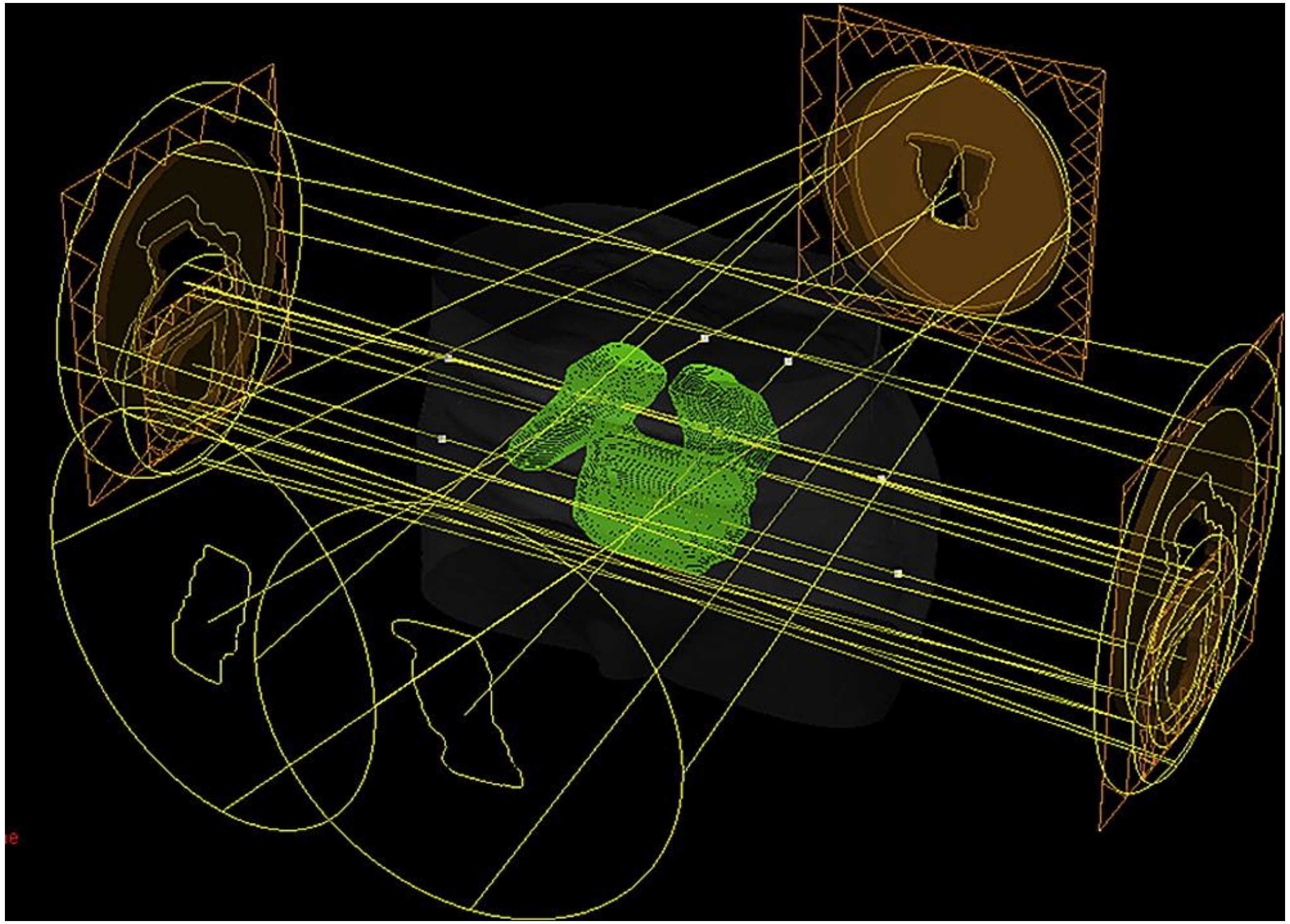
"Classic"

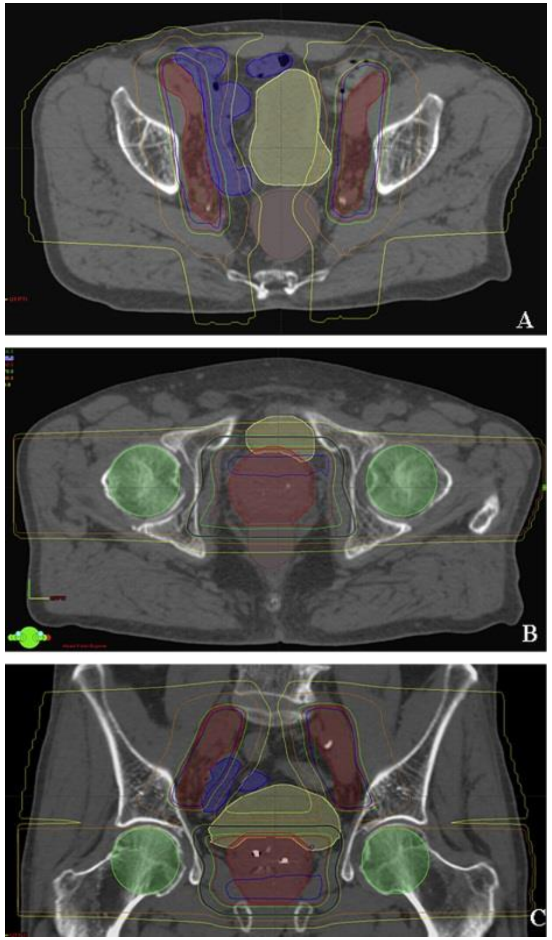
- Pediatric tumors
- Brain tumors
- Base of skull tumors
- Spinal tumors
- Paraspinal tumors
- Prostate cancers
- Uveal melanomas
- Intracranial radiosurgery

"Emerging"

- Lung
- Esophagus
- Breast
- Head and neck (PNS, NPC, OP)
- Whole pelvic RT
  - Examples: Rectal & Anal Canal
- Large sarcomas
- Liver
- Mediastinal tumors
  - Example: Lymphoma & Thymoma

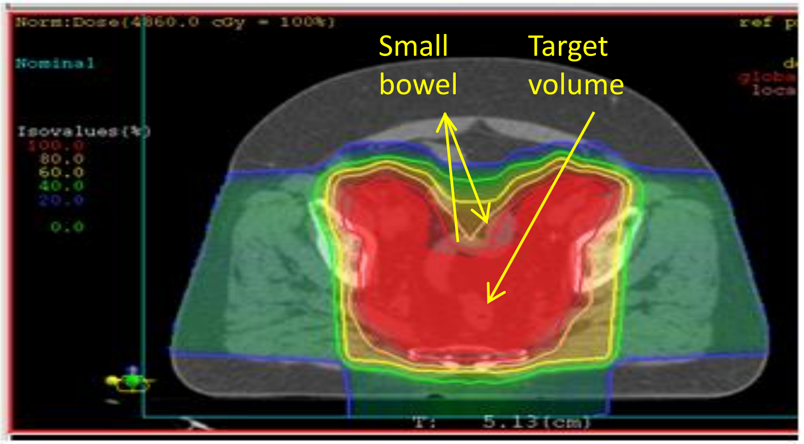
Whole Pelvis RT using Double Scatter Protons

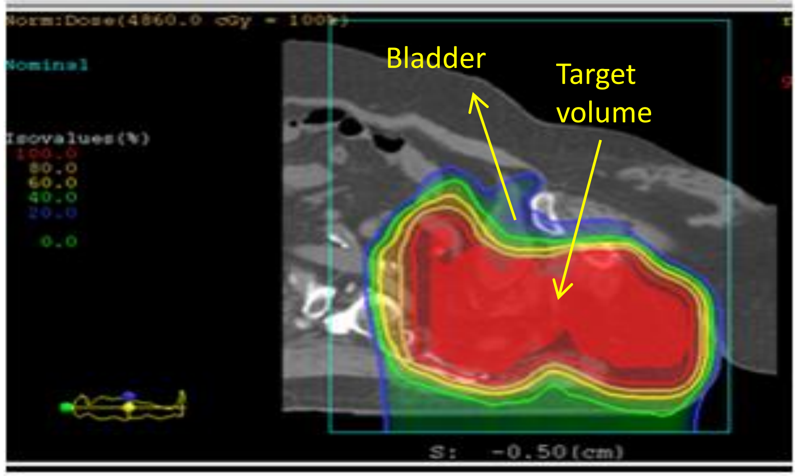




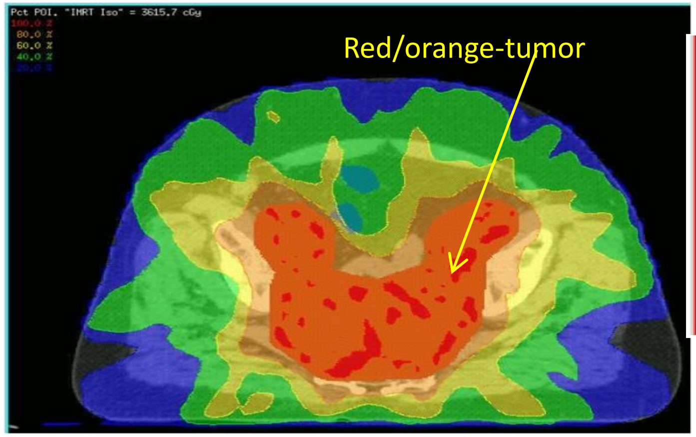
Whole Pelvis RT using Uniform Scanning Protons

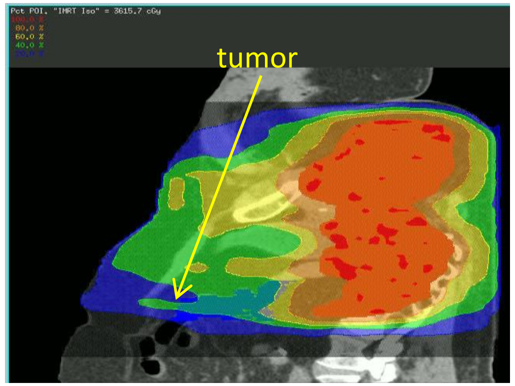
Proton treatment plan



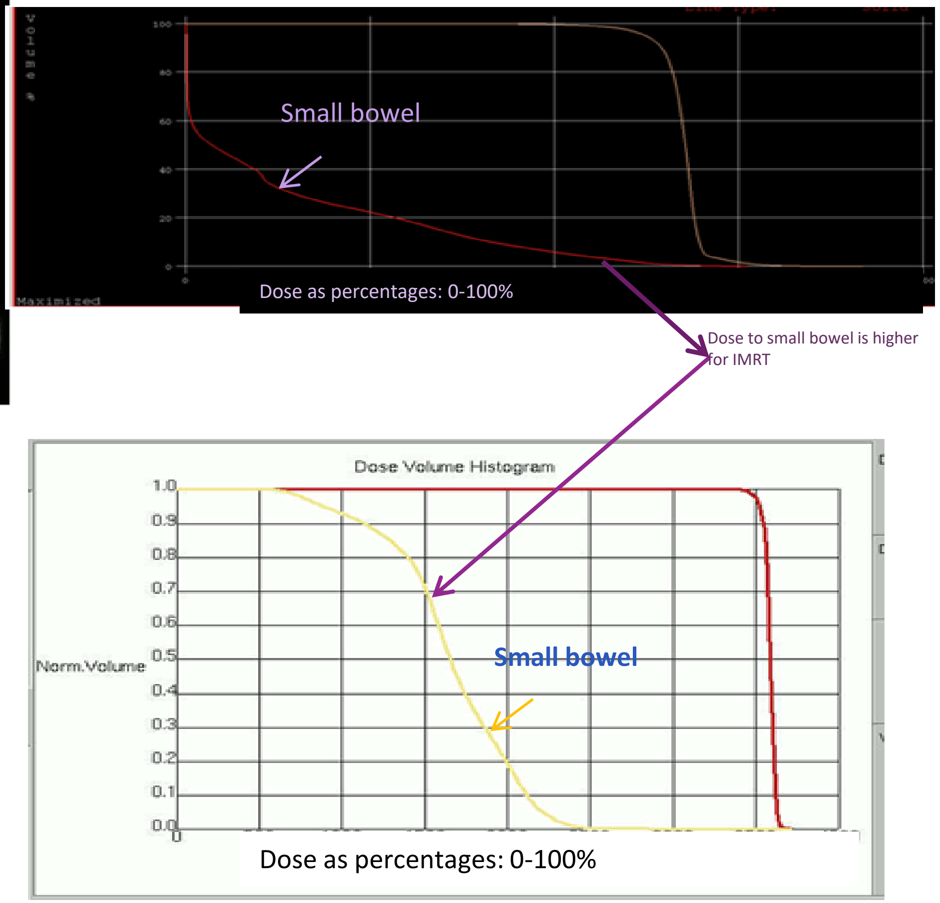


IMRT

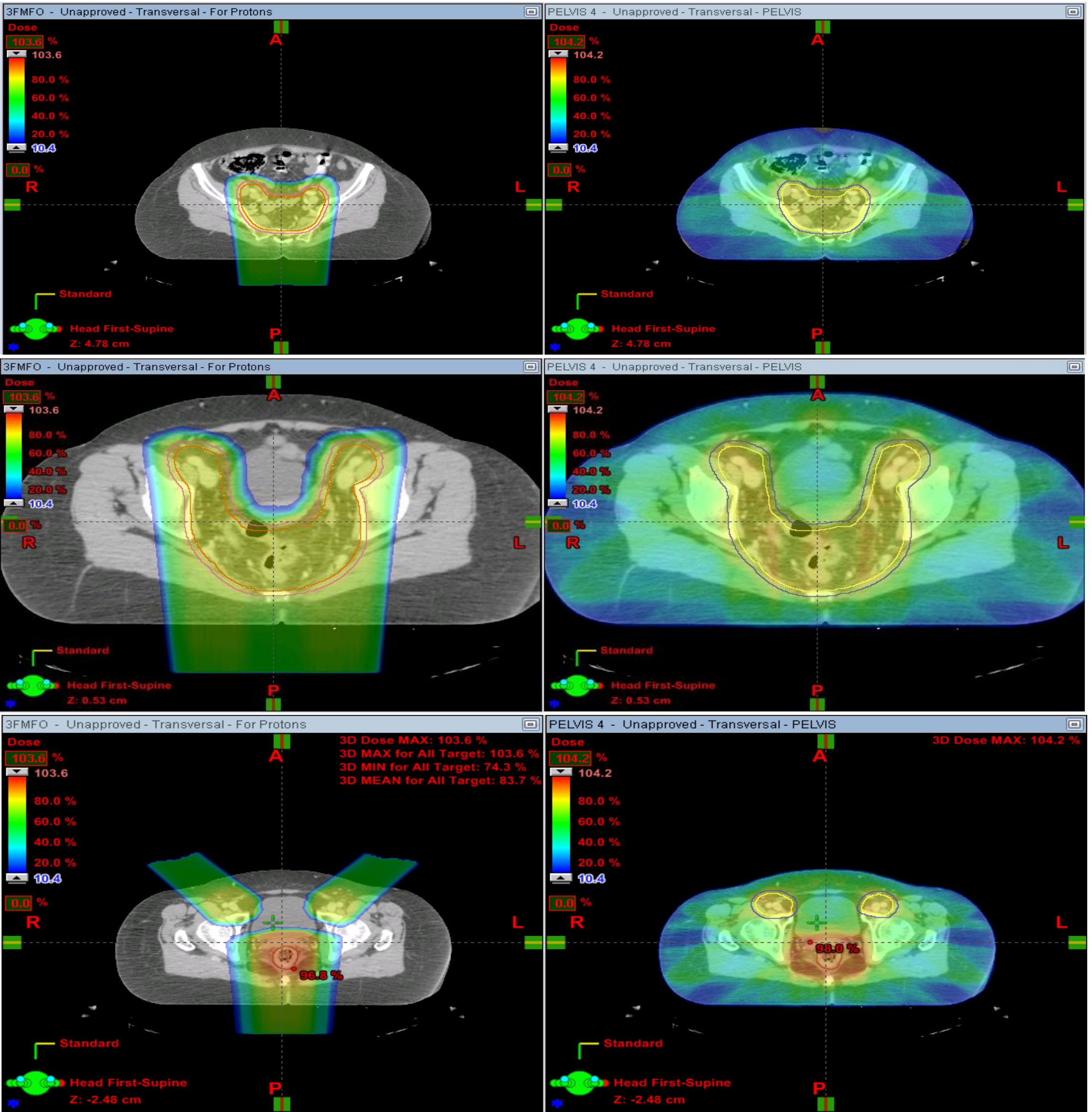


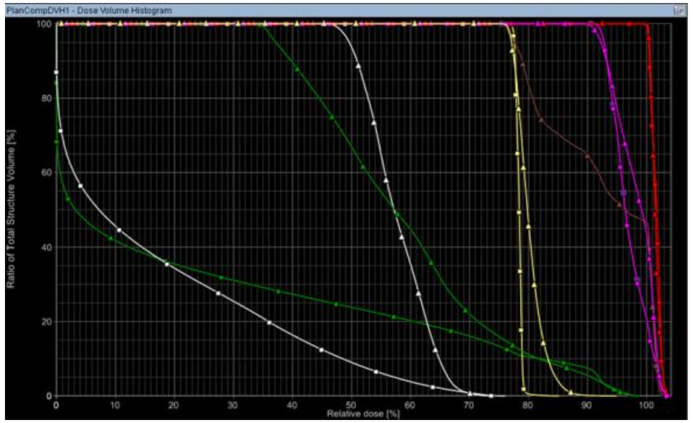


Dose volume histograms

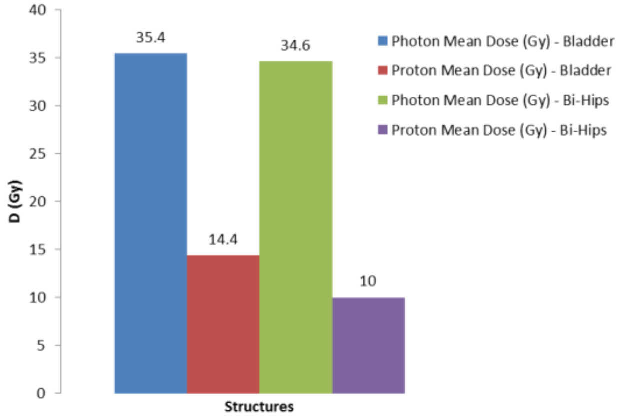


Whole Pelvis RT using Pencil Beam Scanning Protons





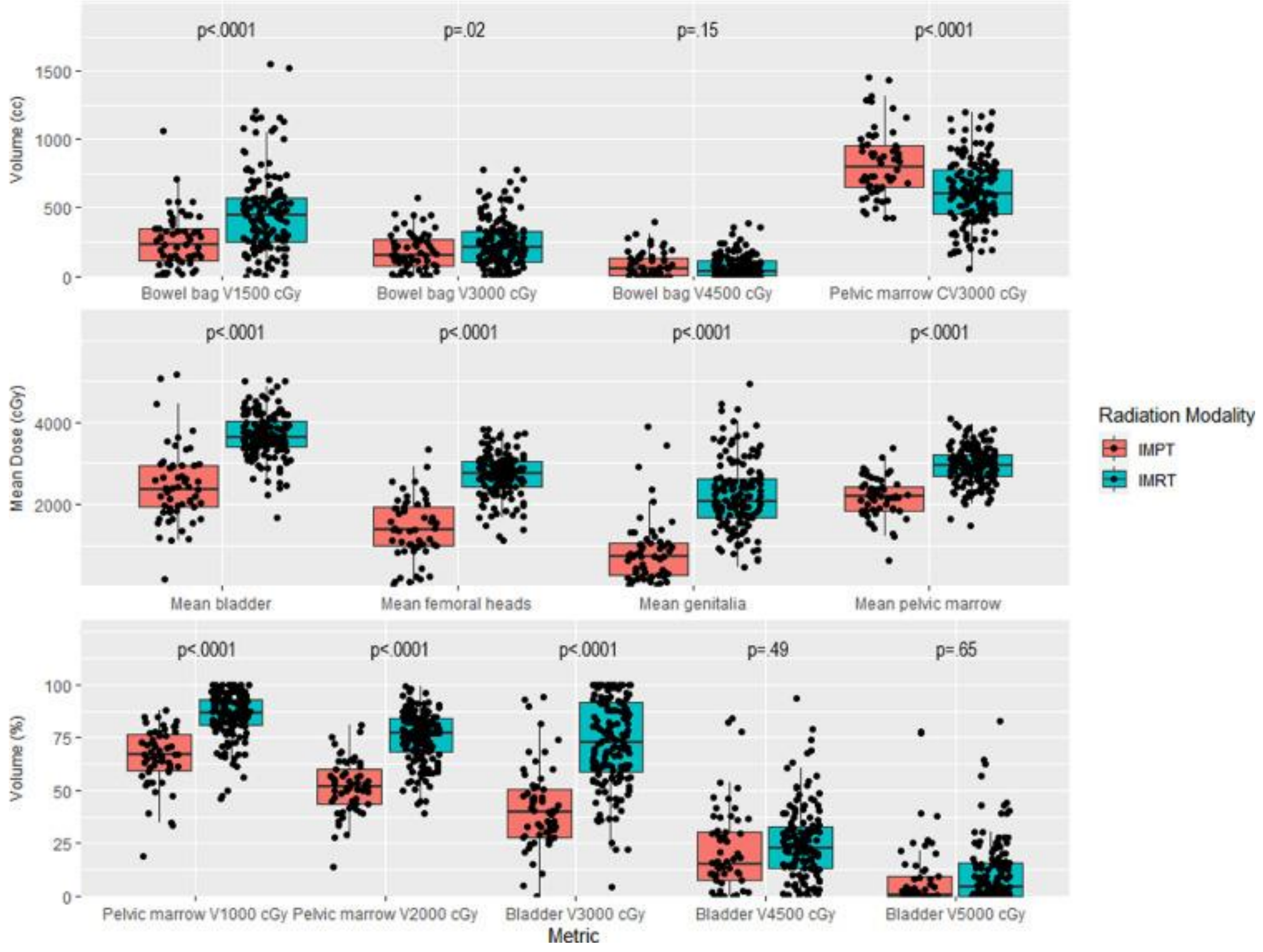
Legend: IDL : White -- BI- Hips; Green -- Bladder; Yellow – CTV 45; Magenta – CTV 54; Red -- GTV 60



Whole Pelvis RT – The Proton Evolution

- Fewer treatment fields
  - 6 fields → 3/4 fields → 2/3 fields
  - 60 min → 40 min → 25 min
- Improved sparing of non-target tissues
  - Bladder
  - Rectum
  - Bone marrow
- More practical & feasible

Initial data does NOT support reduced acute toxicity with protons vs. IMRT for anal canal cancer, however



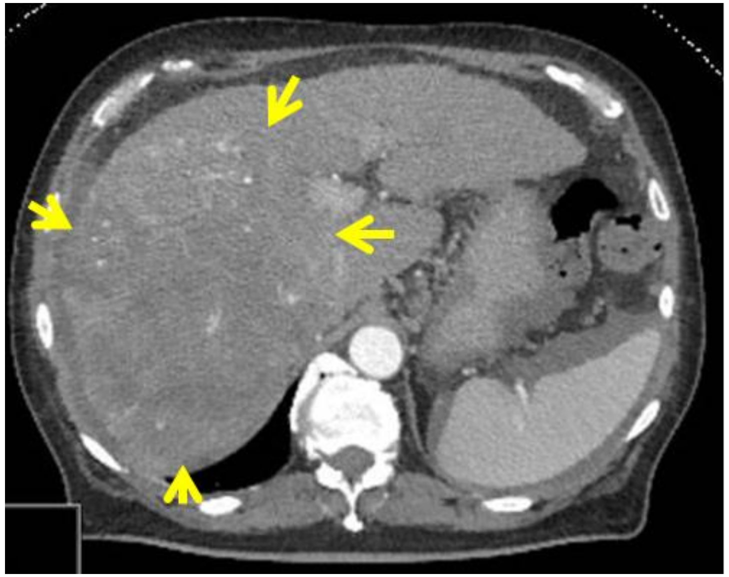
	IMPT, No. (%)	IMRT, No. (%)	*P* value
Hospitalized during radiation therapy	23 (40)	49 (33)	.34
Febrile neutropenia	16 (28)	22 (15)	.03
Median treatment time, d	41	42	.33
Grade 2 or greater acute toxicity			
GI or GU	39 (67)	91 (61)	.38
GI	38 (65)	88 (59)	.37
GU	4 (7)	14 (9)	.58
Skin	50 (86)	117 (78)	.19
Pain	31 (53)	80 (53)	.99
Hematologic	40 (69)	87 (69)	.99
Overall	57 (98)	141 (95)	.34
Grade 3 or greater acute toxicity			
GI or GU	14 (24)	31 (21)	.59
GI	13 (22)	30 (20)	.70
GU	1 (2)	1 (1)	.50
Skin	12 (21)	43 (29)	.24
Pain	7 (12)	20 (13)	.81
Hematologic	32 (55)	59 (47)	.29
Overall	39 (67)	92 (68)	.96

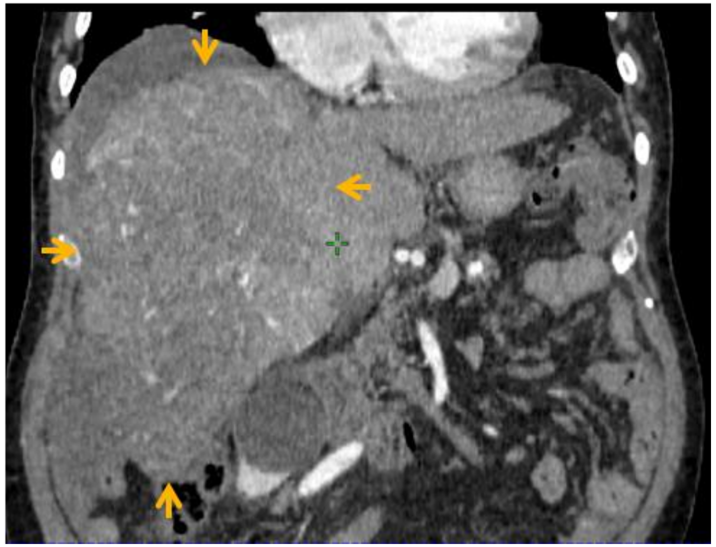
Protons for Liver Tumors

- Significantly reduced dose to non-target liver
- Less RILD with excellent OS
  - Sanford NN, Hong TS IJROBP 2019
- Supported in payer guidelines

Case: Large HCC

- CT: cirrhosis, 20 cm HCC, right branch portal vein tumor thrombus



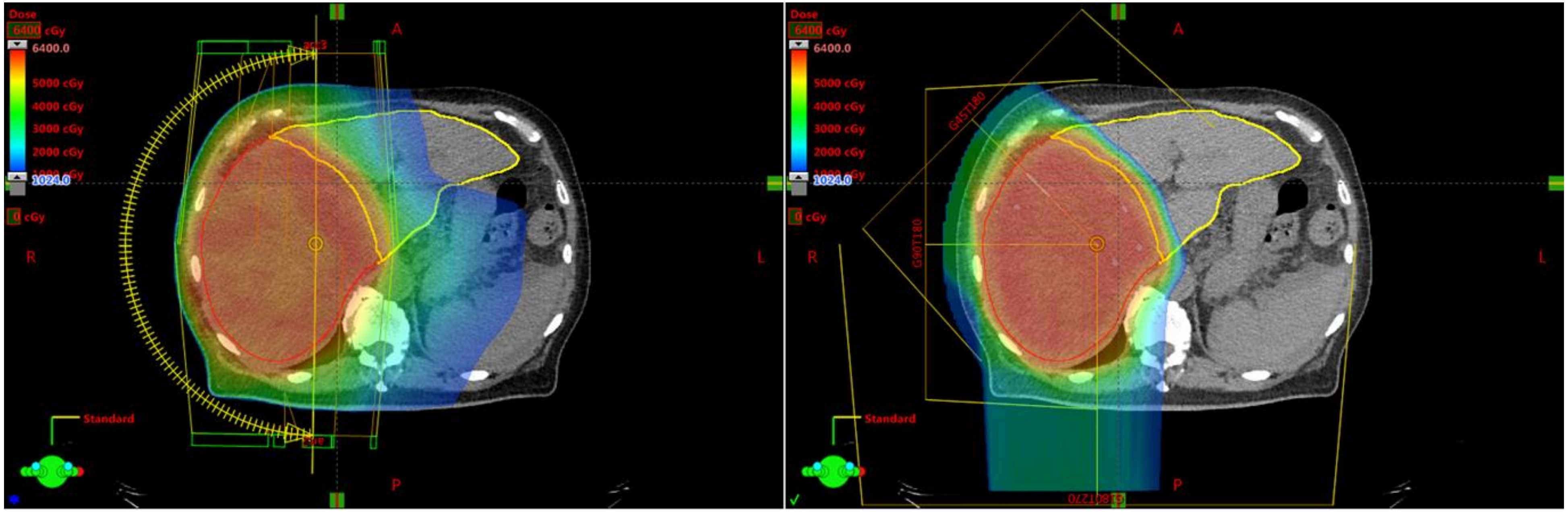


- Plan: PBT 58.5 Gy/15 fx

Courtesy of C. Hallemeier, MD

Case: Large HCC

- Fiducials, breath hold
- GTV: 2721 cc
- Protons: significant liver sparing

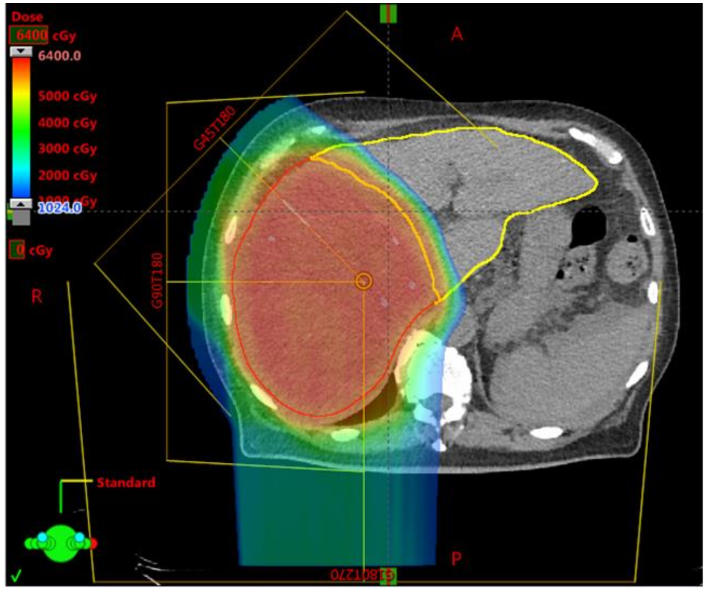


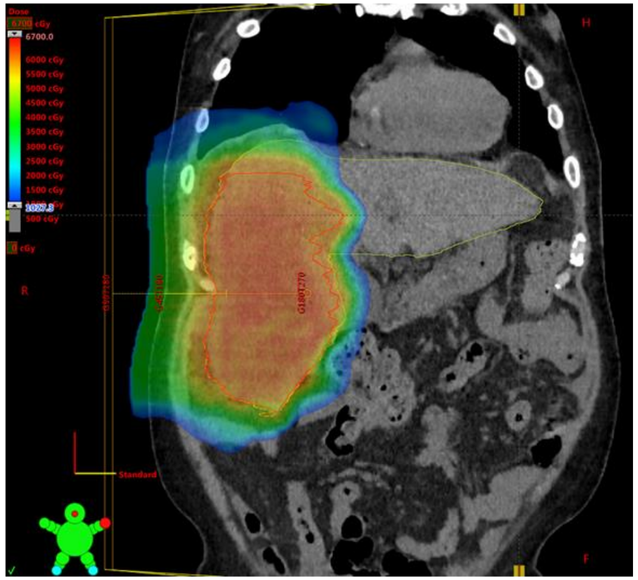
Photon IMRT PBS Proton

Courtesy of C. Hallemeier, MD

Case: Large HCC

- G180T270: 86 energy layers, 38,199 spots
- G90T180: 71 energy layers, 44,114 spots
- G45T180: 73 energy layers, 48,880 spots

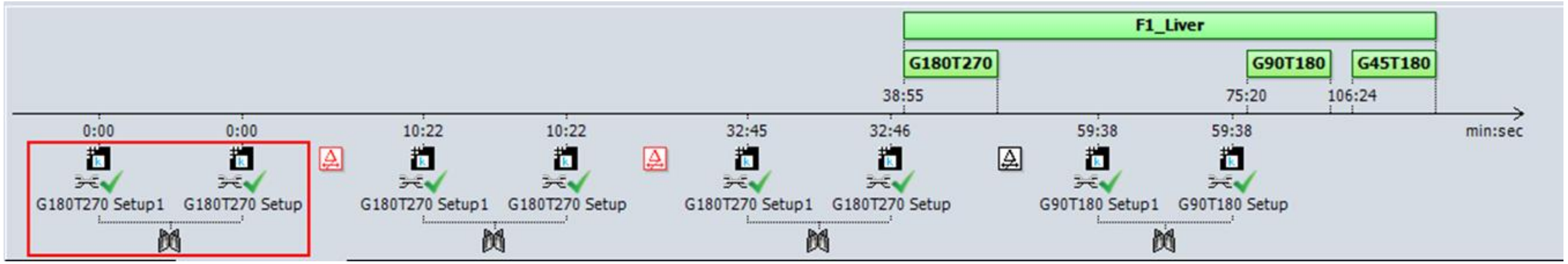




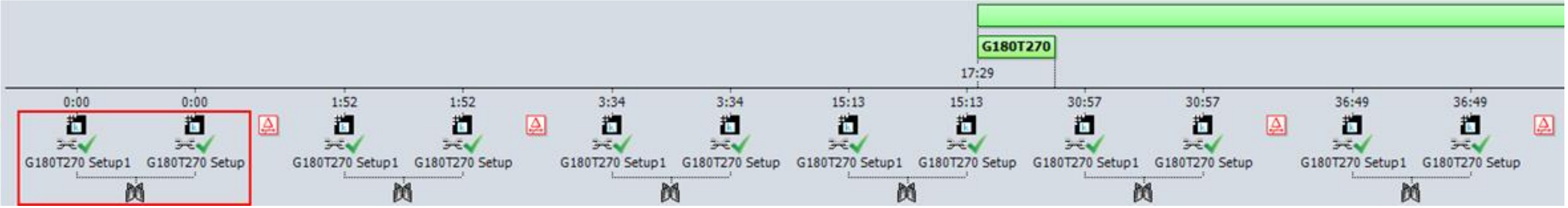
Courtesy of C. Hallemeier, MD

Case: Large HCC

- Fx 1, 10:30 am → 120 minutes

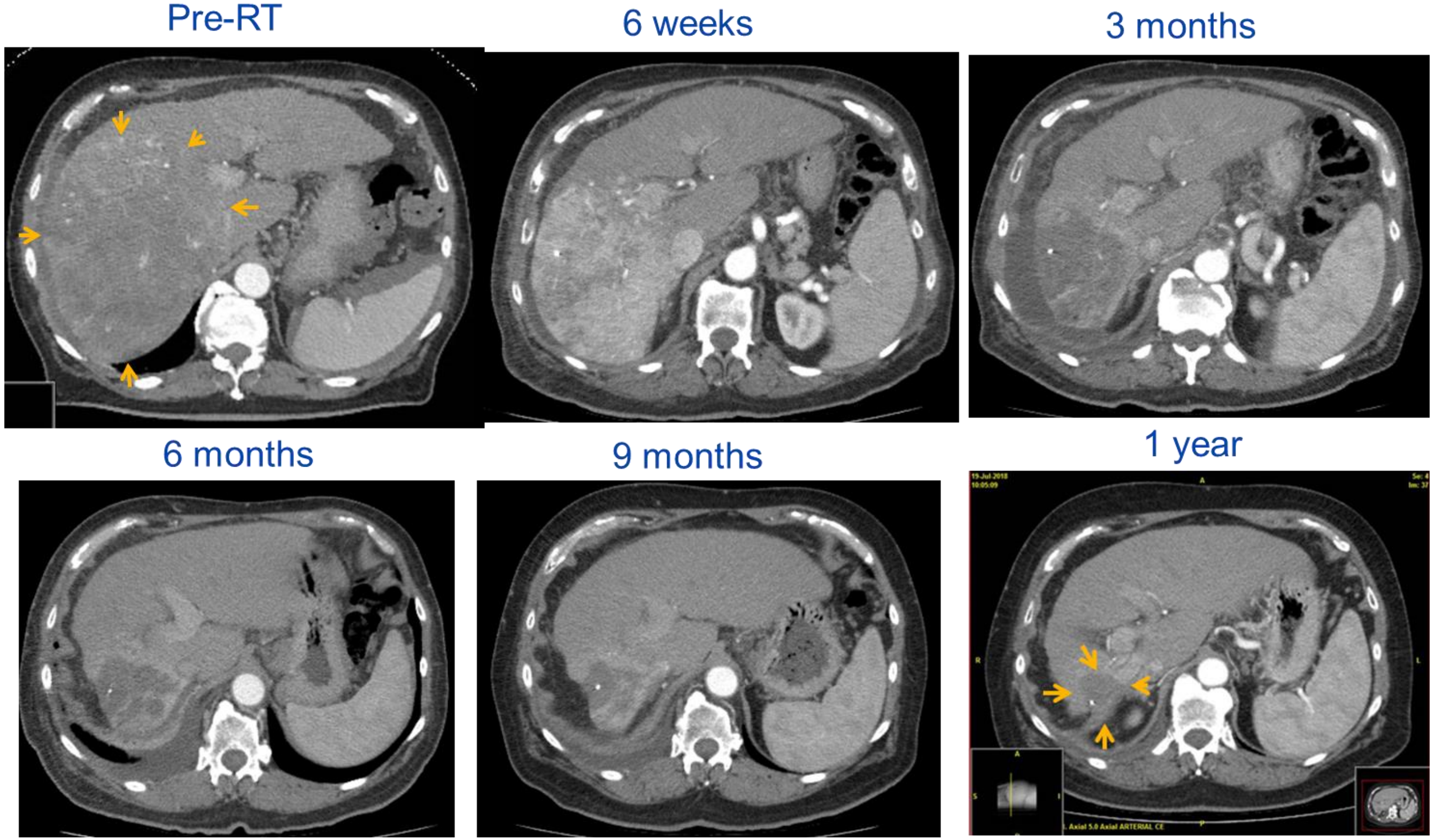


- Fx 2, 10:00 pm → 90 minutes



Courtesy of C. Hallemeier, MD

Case: Large HCC



Courtesy of C. Hallemeier, MD

Future Directions

- Personalized Dose Escalation: Using biomarkers and imaging to identify patients who benefit from higher radiation doses.
- Combination Therapies: Integrating radiation with immunotherapy (e.g., checkpoint inhibitors) for improved efficacy.
- Liquid Biopsies: Monitoring circulating tumor DNA (ctDNA) to guide adaptive therapy and detect minimal residual disease.

Thank you!