

Hadron Therapy Control System

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With the help of Primož Lavrič & Boštjan Mulej





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COSYLAB

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About Cosylab

Three areas of Cosylab

- Big Science
- Radiation Therapy
 - Hadron Therapy Control Systems
- Medical Devices

300+ people, 9 locations worldwide

- 200+ highly skilled developers and engineers
- 25+ PhD holders from STEM fields





About us

- Luka Šepetavc, Senior Systems Engineer & Project Manager
- Kristijan Kuhar, Senior Architect
 & Senior Developer



What is Hadron Therapy, What is a Control System?

Hadron Therapy

• Particle therapy: proton, carbon ion

Control System

- Software which controls devices in a desired way
- Provides user interface to the operator

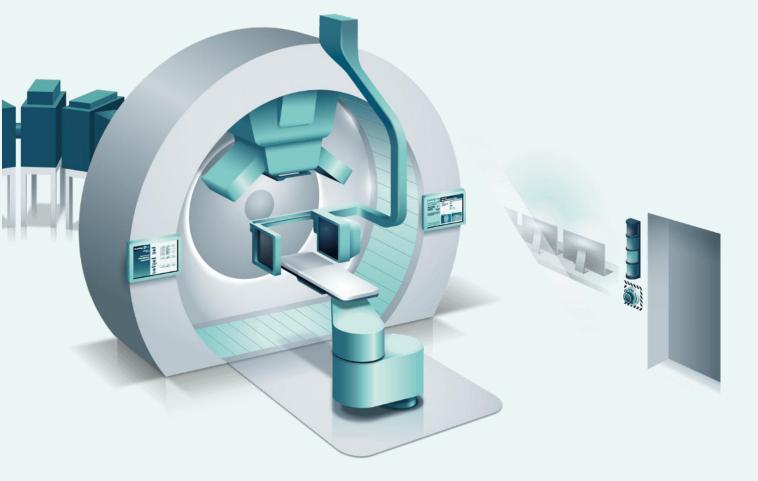
• What is special about Hadron Therapy Control System?

- Software must control tens or hundreds of devices
- Real-time (ns, μs, ms) and non-real-time requirements
- Optimize on patient throughput
- Must be safe

• What about other radiation therapy systems?

- RT electrons and photons
- BNCT (Boron Neutron Capture Therapy)





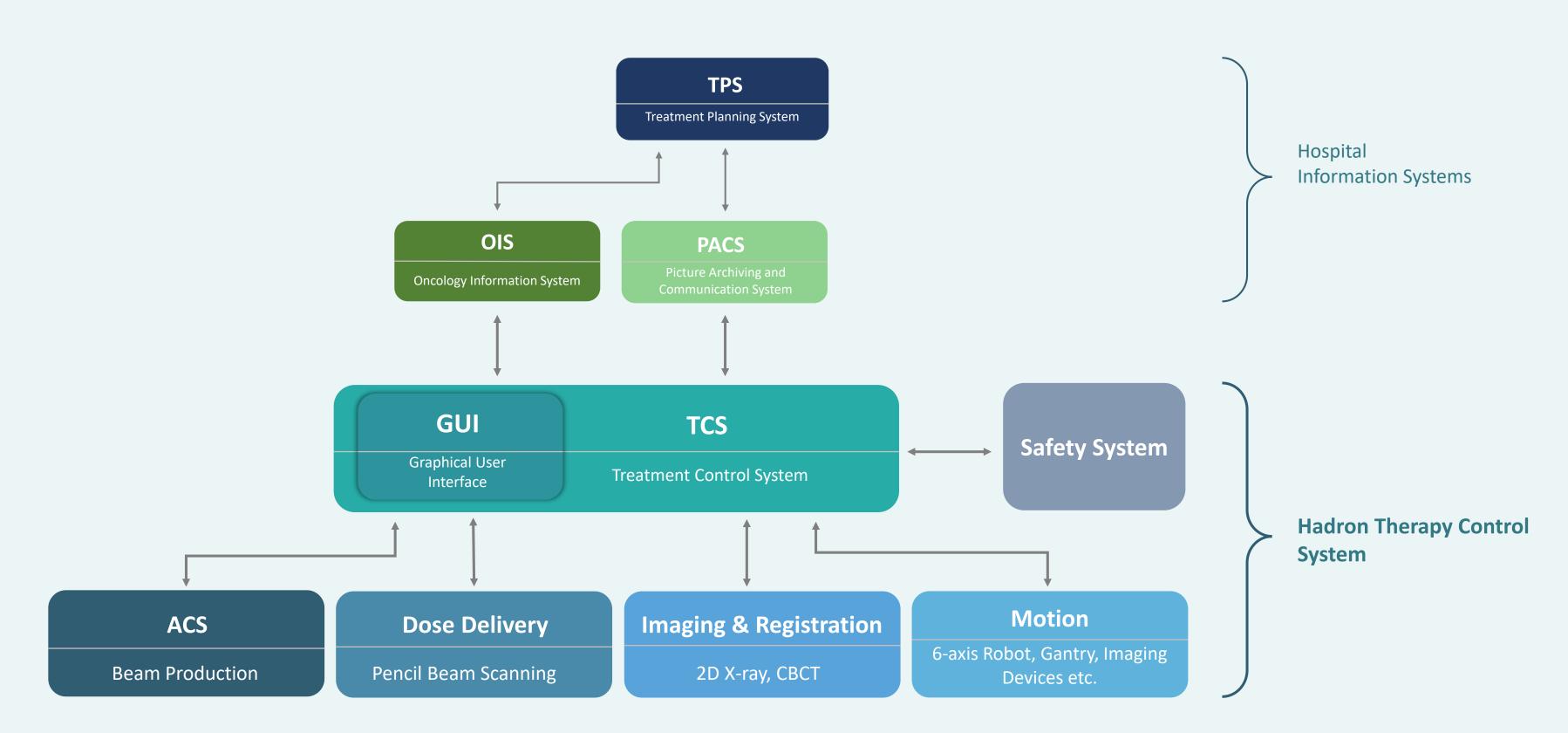


Architecture of a Hadron Therapy Control System



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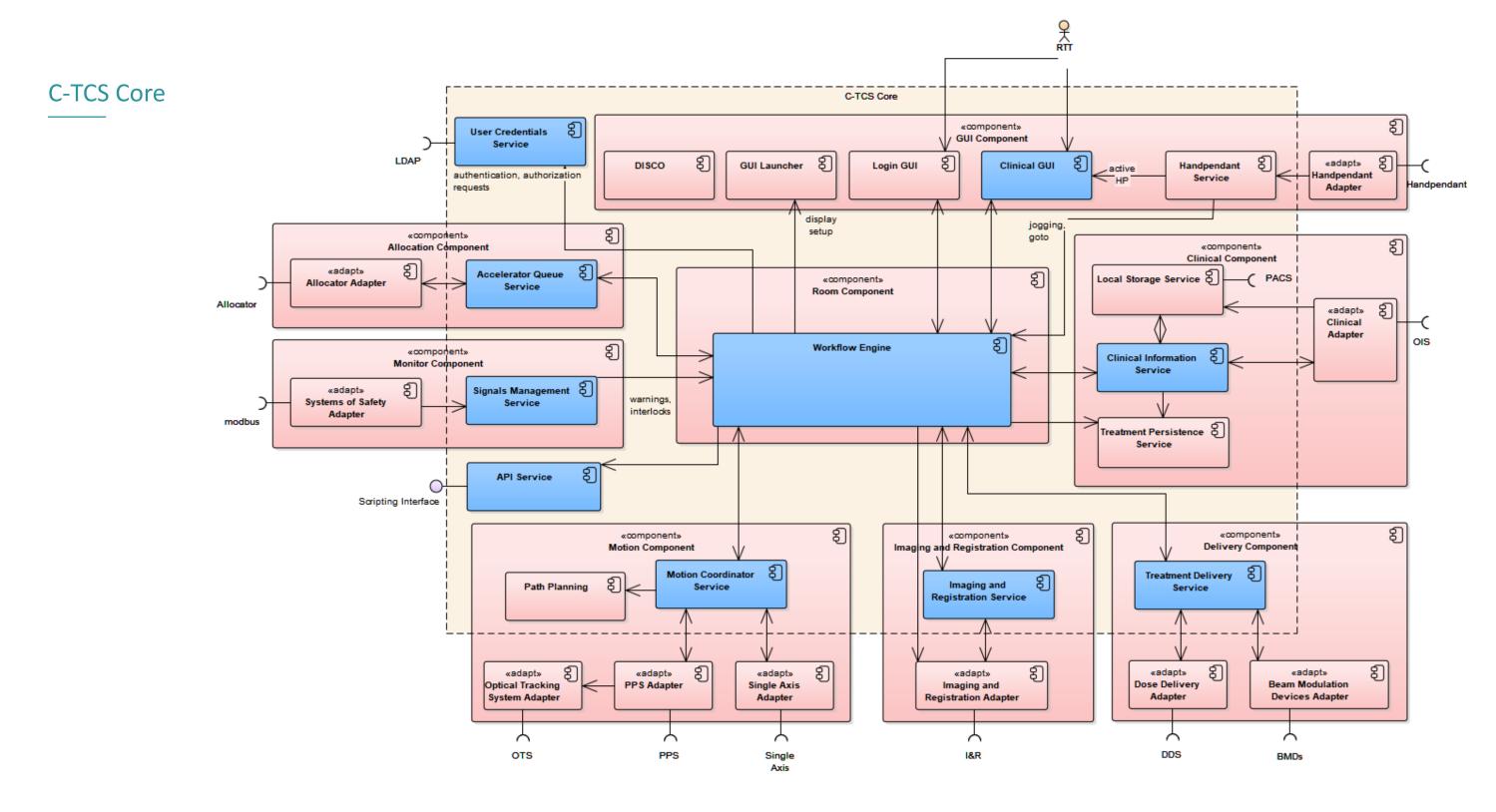
Breakdown of Hadron Therapy Control System





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Detailed Architecture 1/4

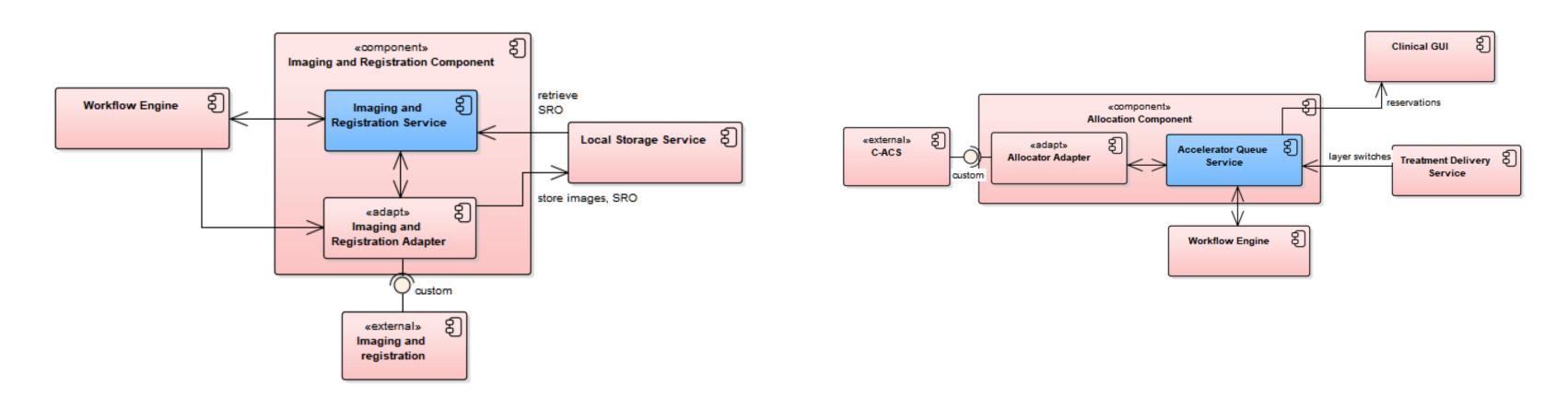




Detailed Architecture 2/4

Imaging and registration Component

Allocation Component

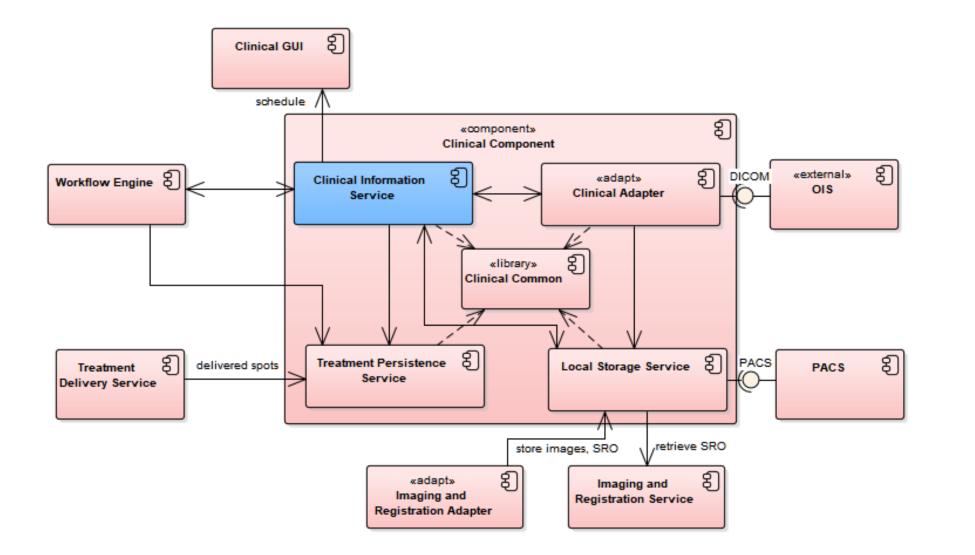




Detailed Architecture 3/4

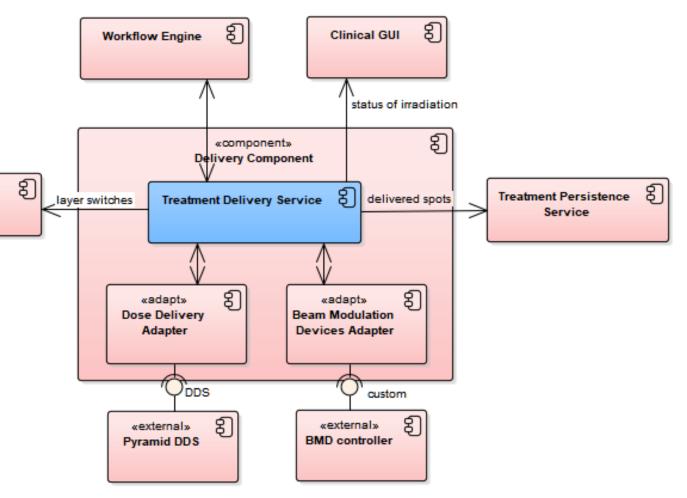
Clinical Component

Delivery Component



Accelerator Queue Service

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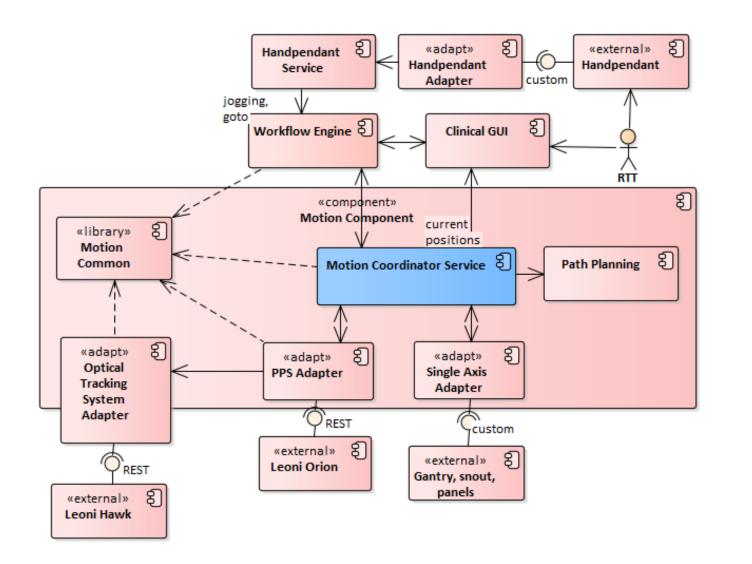


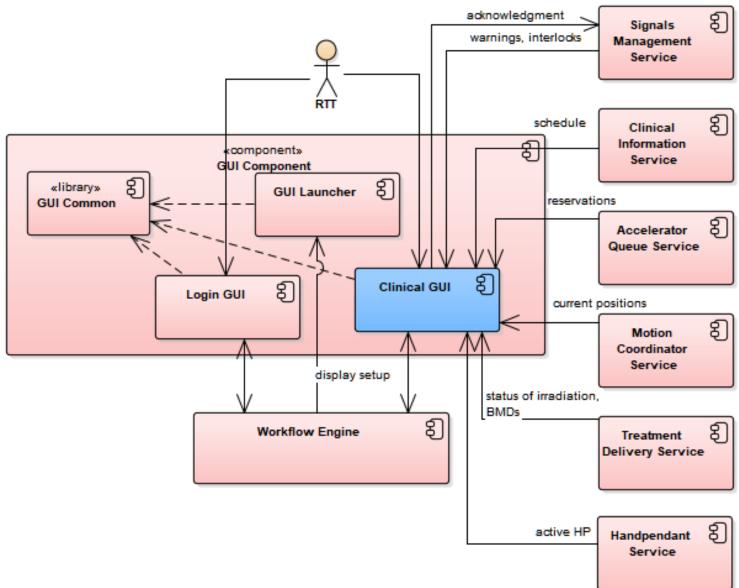


Detailed Architecture 4/4

Motion Component

GUI Component





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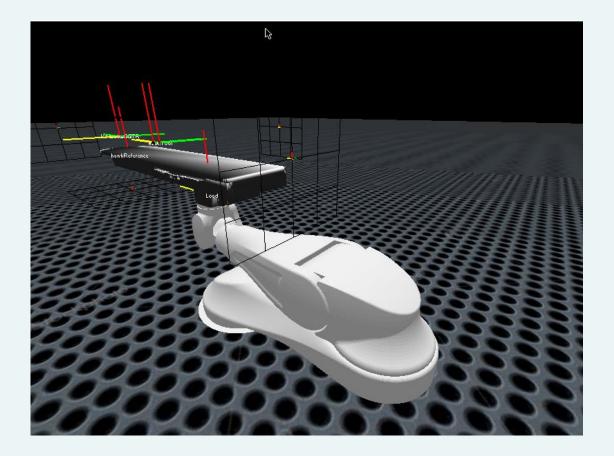


Usage of Simulators

- Speed up development and testing
 - Automated testing
 - Test edge cases and issues that occur rarely
 - Replace missing hardware with simulators
 - Save time on the real system

Types of simulators

- Programmatic
- With user interface
- - Formal testing of medical devices



ŝ	VAA	General		Progress report					
Ke la la Ke	8IS	Set port: 6302		Name	Value				
-	EVS	Disable simulate	or	irradiationState	Irradiating				
-	IR1HBL-CDDS	Status	-	deliveryld	139091703057600_B0				
1	IR2HBL-CDDS	DeliveryEnable	d	totalNumSpots	6243				
		Delivery ID	-	layerindex	1				
*	IR2VBL-CDDS	13909170305760	0_B0	numLayers	9				
*	IR3HBL-CDDS			spotIndex	454				
*	IR4G-CDDS	Configuration ID	03 []	numSpotsInLayer	667				
* *	Rotator	Select configuration		spotCompleted	False				
				timeInstructionsReceived_utc	2022-06-27T07:38:41.839625				
				timeProcessingSuccessful_utc					
				timeDeliveryStarted_utc	2022-06-27107:39:09.652262				
		Treatment plan Spot delay [ms] 0 Deactivate		Interlocks					
				Mon2lynintendedBeam_LongInt					
		key switch	Finist	Mon2UnintendedBeam_ShortInt					
		Logging							
		INFO ActivateKeySwi INFO Startlinadiation		Activated key switch. arted irradiation.					



Validation of simulators

7.	VAA	General		Virtual ac	celerators				12	31
7:	BIS	Set port: 5555	÷	Identifier		State		Operational		Disable VAcc
- R	EVS	Disable si	mulator	T1-15-00	D-ACC	Allocated		True	~	Select VAcc state:
-	IR1HBL-CDDS	Overall alloca	tion status	T1-15-10	D-ACC	Pending		True		Deallocated ¥
	IR2HBL-CDDS	Alloca	ated	H2-15-00	0-ACC	Deallocat	ed	True		Change state
		Currently activ	a allocation	H2-15-10	0-ACC	Deallocat	ed	True		
	IR2VBL-CDDS	dummy-uuic		T2-15-00	D-ACC	Deallocat	ed	True		
	IR3HBL-CDDS	<u> </u>		T2-15-10	D-ACC	Deallocat	ed	True		
:	IR4G-CDDS	Currently allo T1-15-00		T3-15-00	D-ACC	Deallocat	ed	True		
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		Allocation red	quests		l			1		1/
		UUID	Username	User type	VAcc identifier	Interrupti	bl Operation mode	Expiration time	MTSSIot	Add request
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		dummy- uuid-87654	dummyUse	Primary	T1-15-100	False	SERVICE	0	0	Open run file
		3211		Primary	ACC	Faise	SERVICE	^o	v.	Remove request
		Allocation rec	quest histo	ry						
		UUID	Username	User t	ype V/	cc identifier	Interruptible	Operation	Expiration	MTSSlot
		dummy- uuid-8765432	dummyU	ver Prima		-15-100-	False	SERVICE	0	0



Clinical Workflow Demonstration

Live demo of the Treatment Control System

Presented by Kristijan Kuhar

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Technologies Used

- Good object-oriented design is crucial
 - Readability, testability, scalability and maintainability.
- Higher level programming languages on higher tiers (C#, Java, Scala)
 - High performance is not necessary
 - Faster to develop and less bug prone development
- Lower lever programming languages on lower tiers (C, VHDL)
 - Real-time control, quick response times
- Good logging system is very important
 - Essential during testing
 - Often it is not feasible to block the execution with a debugger
 - Diagnostics when running in production

• Execution data collection for workflow optimization (future)



```
imaging in IMAGING position when imagingReady
```

when {

```
case s @ State(ss: WithBeam, _, None)
 if params.conditions.get(Cond.imagingReady) && ss.plan.planState.getCurrentlyAllowedImagingTypes.isEmpty() =>
   desc
        val planState = ImmutablePlanState.builder().from(ss.plan.planState)
          .currentlyAllowedImagingTypes(
           if (ss.plan.planData.getInitialImagingTypes.isEmpty()) { // ternary if
             params.config.getImagingTypes
             ss.plan.planData.getInitialImagingTypes
        newSubstate(s, ss.copyBeam(ss.plan.copy(planState = planState), ss.beamState))
case s @ State(ss: WithBeam, _, None)
 if params.conditions.get(Cond.imagingReady) && !ss.plan.planState.getCurrentlyAllowedImagingTypes.isEmpty()
   desc
        val planState = ImmutablePlanState.builder()
          .from(ss.plan.planState)
          .currentlyAllowedImagingTypes(Collections.emptyList())
        newSubstate(s, ss.copyBeam(ss.plan.copy(planState = planState), ss.beamState))
```

COSYLAB

Development Lifecycle

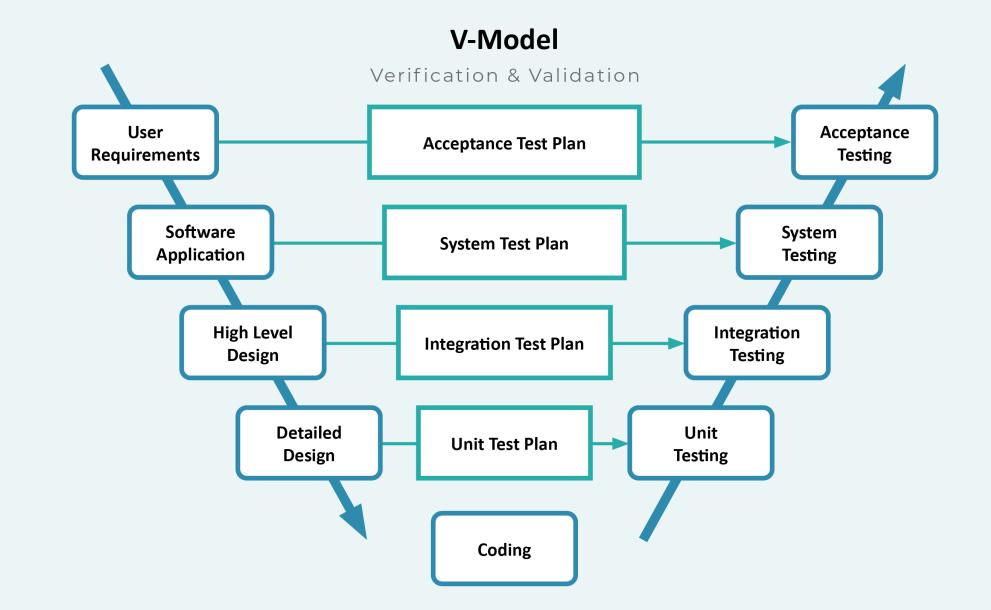
• Software for the most complex medical device in the world

Carefully follow development processes

- Requirements
- Architecture & Design
- Implementation & Integration
- Verification & Validation
- Risk Management
- Usability

Regulatory & standards

• EU, USA, China, Japan...







Team & Time to Develop

• Big Teams

- Product development: 10-40 people
- Integration: 5-10 people

Different Roles Involved

- Systems Engineer
- Architect
- Developer
- Tester
- Project Manager

• Multi-Year Projects

- Product development: ~4 years
- Integration: 1-2 years















Thank you! Q & A



APPENDIX: Treatment Control System Demonstration

 Screenshots taken from Cosylab's TreatmentOne Treatment Control System, demonstrating clinical workflow of a proton therapy session.







TR-1 5 jan, 18:10:31

English ↓ no user logged in



Log in

USERNAME

PASSWORD

MODE







Log in



TR-1 5 jan, 18:10:31

English 🗸 no user logged in



Log in



PASSWORD

.........

MODE











Validating user



TR-1: Treatment 5 jan, 18:10:31

English ∽ john.doe C→





Jame 13 Oct id: 9465

example

Mich 22 Nov id: 5067



Char

3 Jan 19 id: 3058





SCHEDULED SESSIONS

es Johnson 1976 — male 502669	Today, 11:30 TREATMENT
nael Williams / 1962 — male /735284	Today, 11:45
rles Miller 988 — male 835273	Today, 12:30



TR-1: Treatment 5 jan, 18:10:31

English 🗸 john.doe €+







tenti.

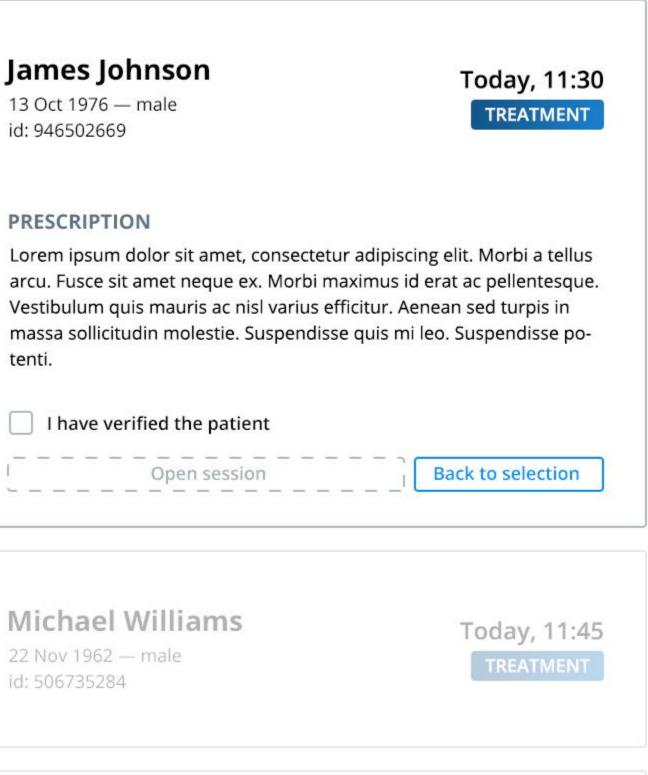




Charles Miller



SCHEDULED SESSIONS



Today, 12:30



TR-1: Treatment 5 jan, 18:10:31

English 🗸 john.doe €+







tenti.

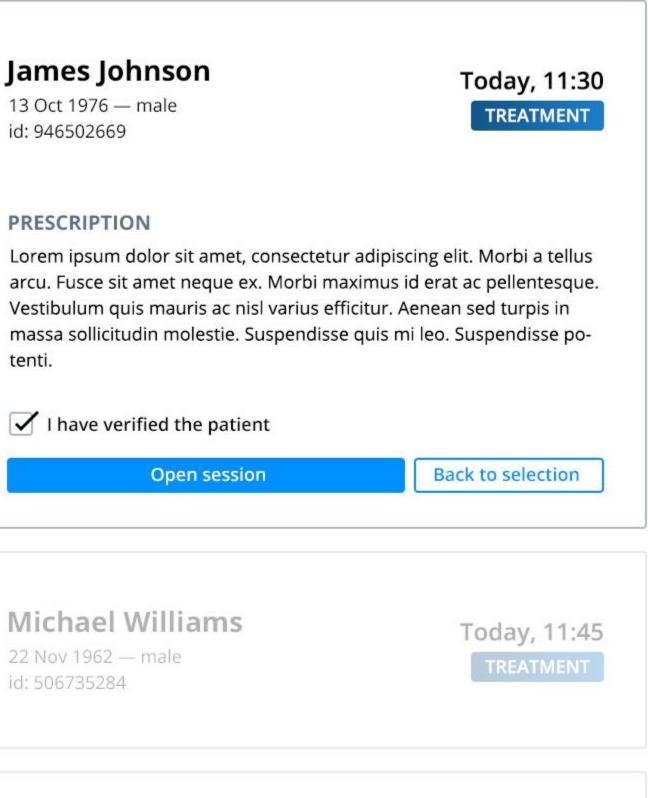






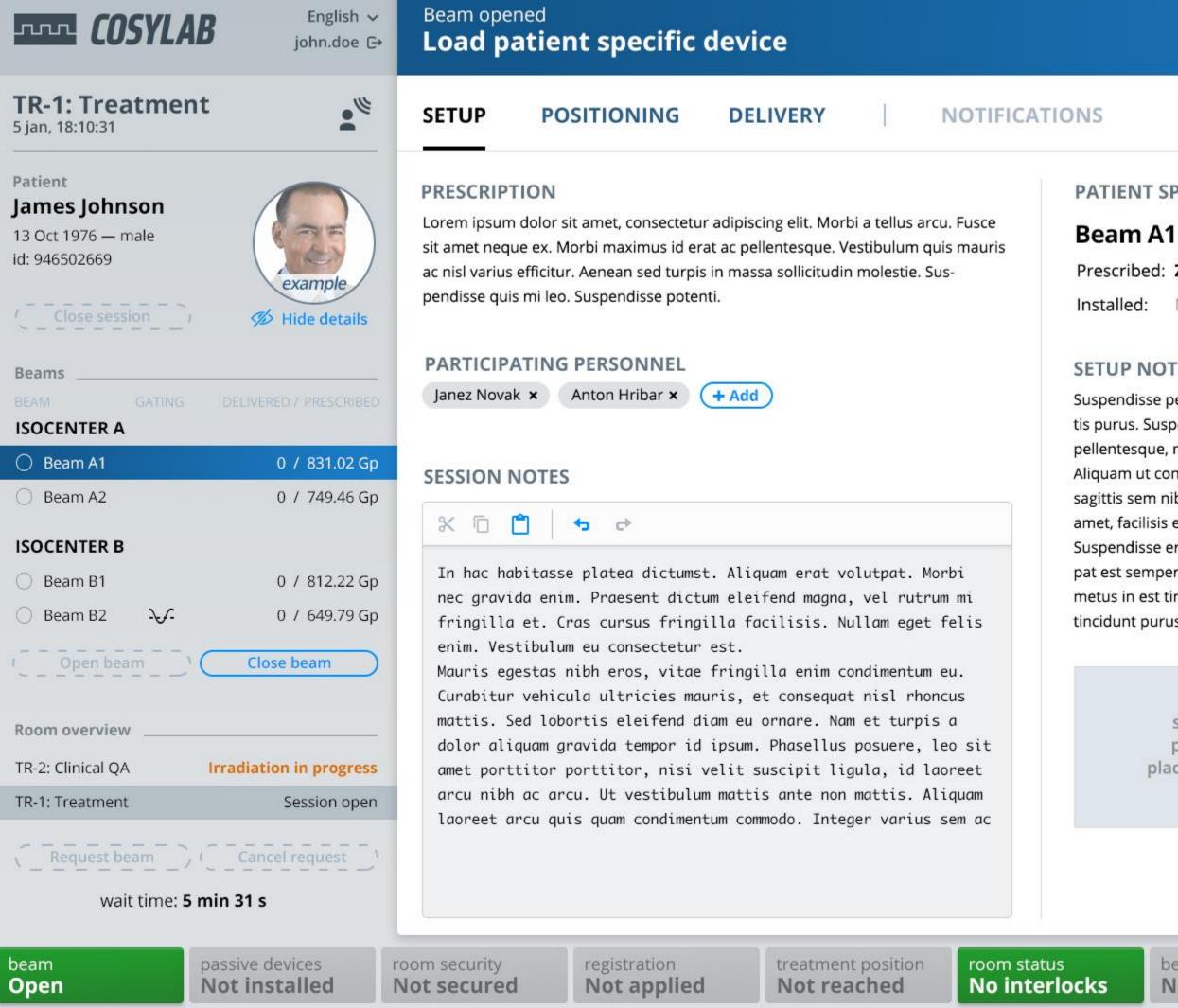


SCHEDULED SESSIONS



Charles Miller

Today, 12:30







PATIENT SPECIFIC DEVICES

Prescribed: ZX32986 (Device name)

Installed: None

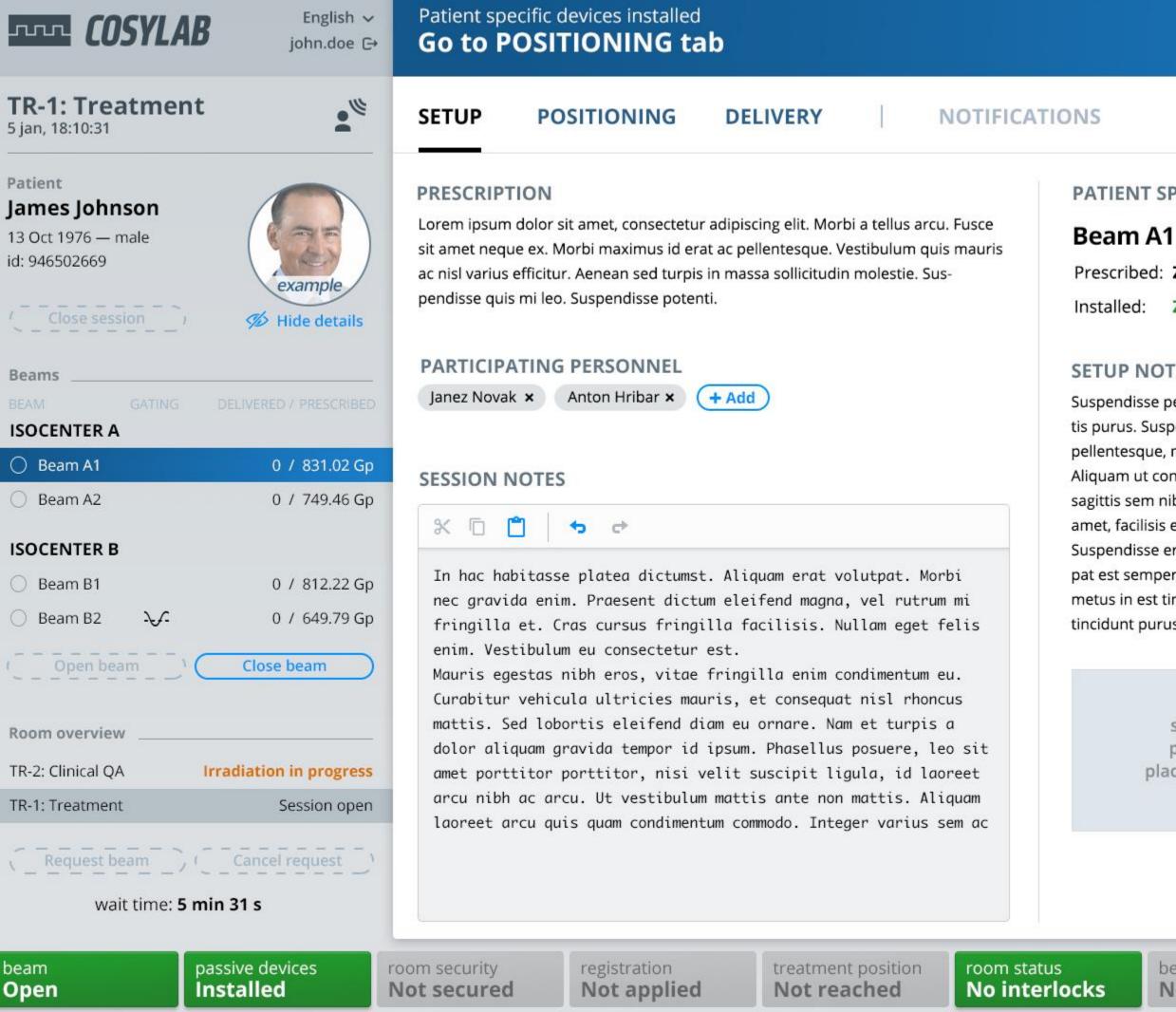
SETUP NOTES

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setup	setup	setup		
photo	photo	photo		
placeholder	placeholder	placeholder		

beam queue Not in queue beam availability Not available irradiation Not started







PATIENT SPECIFIC DEVICES

Prescribed: ZX32986 (Device name)

ZX32986 CORRECT

SETUP NOTES

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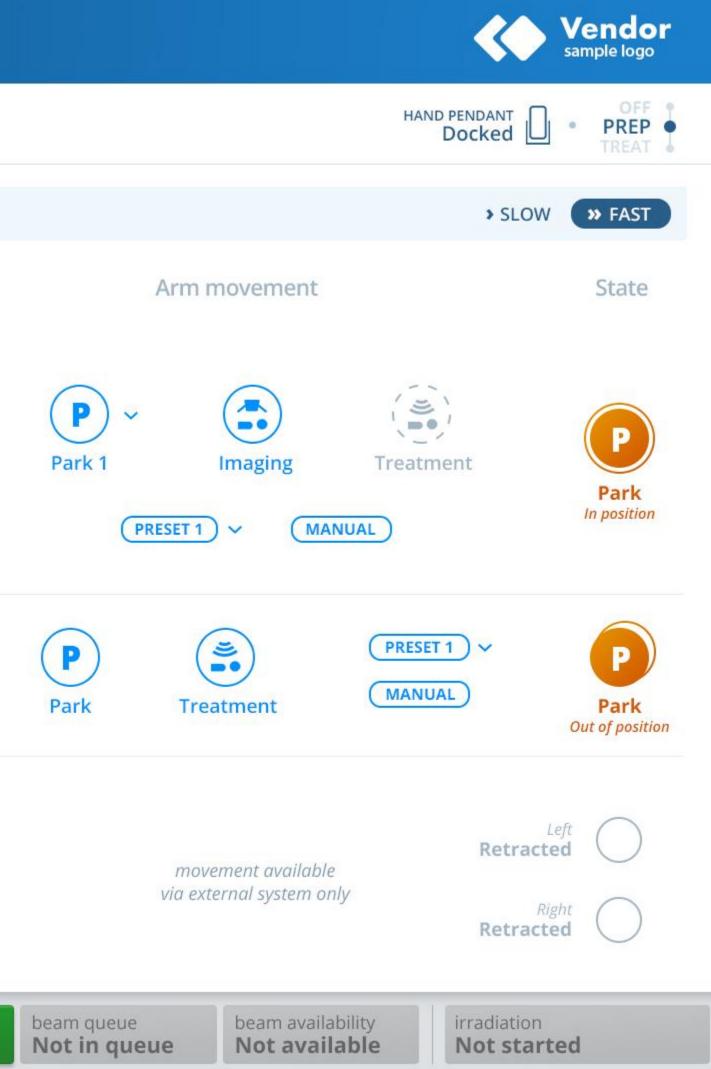
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photo	photo	photo
placeholder	placeholder	placeholder

beam	qu	ieue	3	
Not	in	qu	eu	e

beam availability Not available irradiation Not started

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Patient James Johnson 13 Oct 1976 — male		Registrati	ion result not ava	ilable				
id: 946502669	example	Instrument	t		Position			
Close session	🥬 Hide details	Patient	PCS ~	ACTUAL	DELTA	DESTINATION		
Beams		position	x>	+0.2 cm		+0.2 cm		
BEAM GATING	DELIVERED / PRESCRIBED		y 🐂	-100.0 cm		-100.0 cm		
ISOCENTER A		Capture	z 📫	+90.5 cm		+90.5 cm		
O Beam A1	0 / 831.02 Gp	alignment	θ 🛶	0.0 °		0.0 °		
O Beam A2	0 / 749.46 Gp	Override	- ψ - Φ	0.0 °		0.0 °		
ISOCENITED B		position	- ω Έ	0.0 °		0.0 °		
ISOCENTER B	0 / 012 22 Co	-						
O Beam B1	0 / 812.22 Gp	Gantry		ACTUAL	DELTA	DESTINATION		
O Beam B2 →	0 / 649.79 Gp		у 🔨	90.0 °	- 2°	88.0 °		
Open beam	Close beam							
Room overview								
TR-2: Clinical QA	Irradiation in progress	Panels		ACTUAL		DESTINATION		
TR-1: Treatment	Session open		Left panel	retracted				
			Left source	retracted				
Request beam	Cancel request		Right panel	retracted				
wait time: 5 n	nin 31 s		Right source	retracted				
	bassive devices nstalled	room security Not secured	registration Not appli		treatment position Not reached	room status No interlocks		



		Imaging position is armed Use hand pendant to start motion					
TR-1: Treatment 5 jan, 18:10:31	SETUR	POS	ITIONING	DELI	VERY	NOTIFICATIO	NS
Patient James Johnson 13 Oct 1976 — male id: 946502669	Regi Instru	stration res ment	ult not ava	ailable	Position		
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Room overview TR-2: Clinical QA Irradiation in TR-1: Treatment Sess (sion open	vement ABLED	Left panel Left source Right panel Right source	ACTUAL retracted retracted retracted retracted		DESTINATION	
beam passive device Open Installed	room secur Not secu		registration Not appli		treatment positior Not reached	room status No interlo	cks

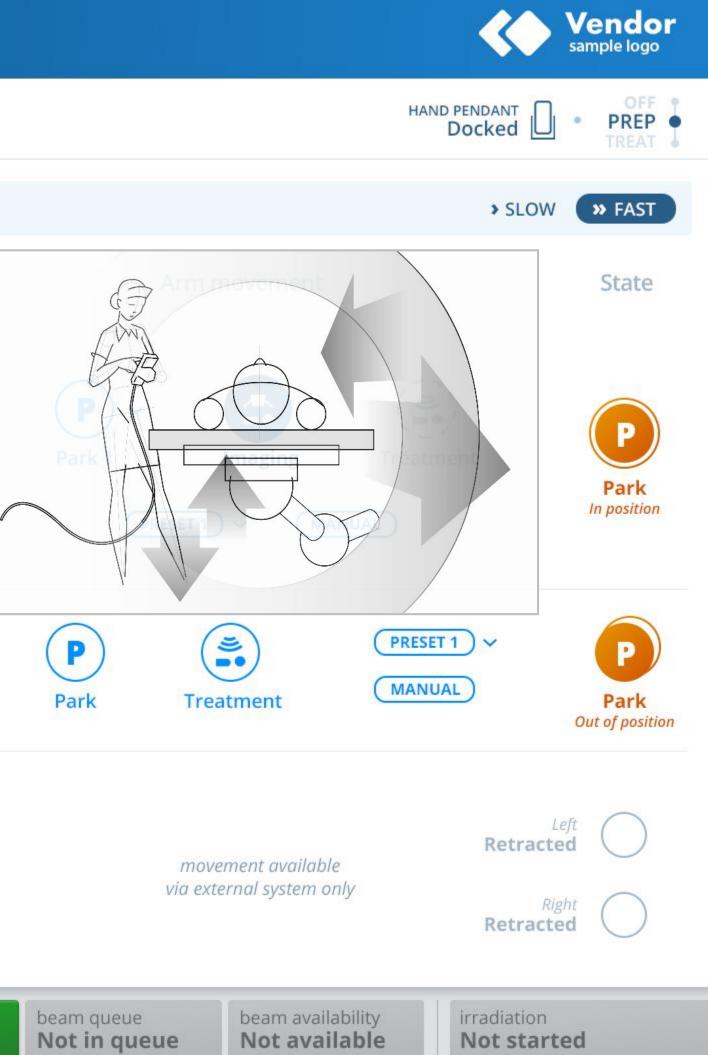
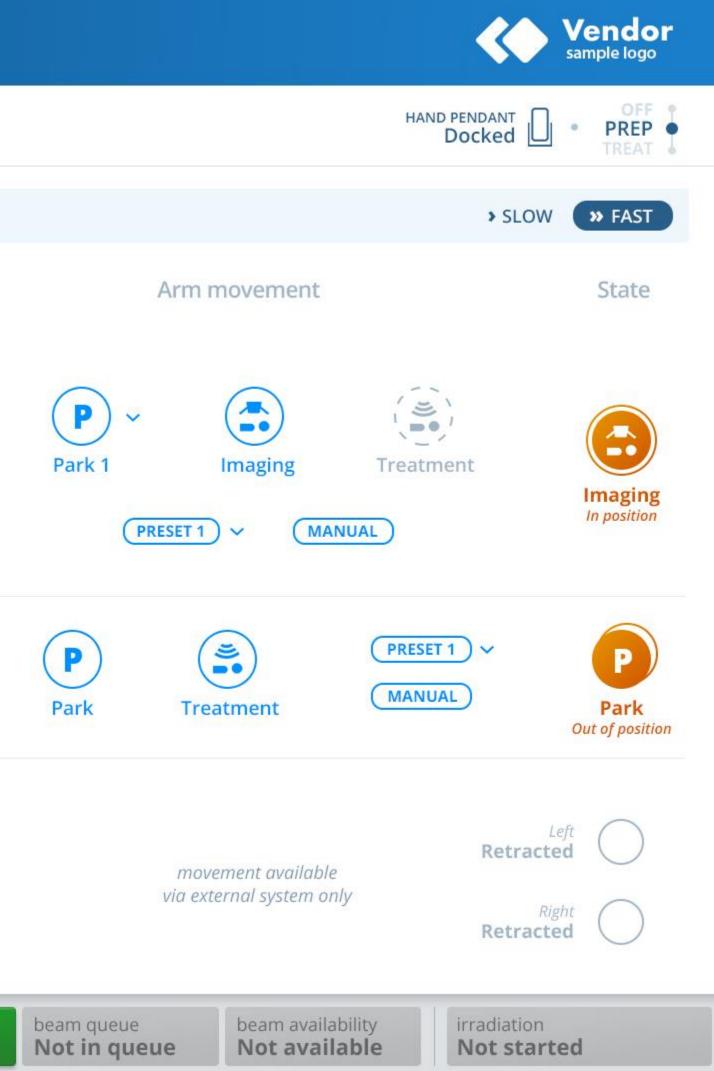
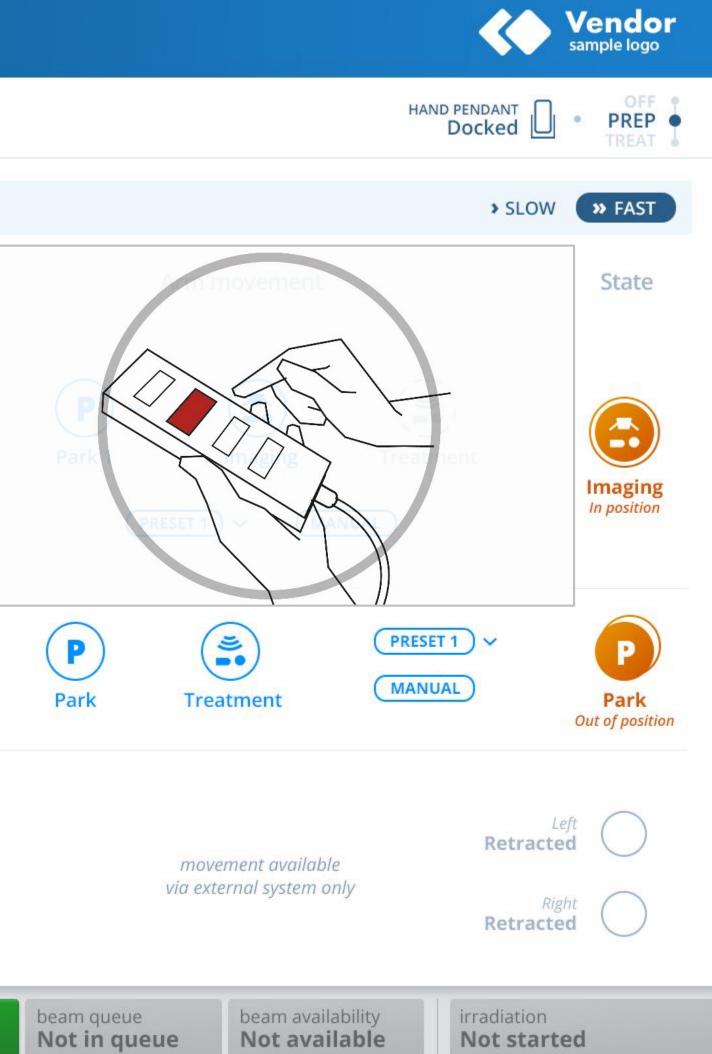


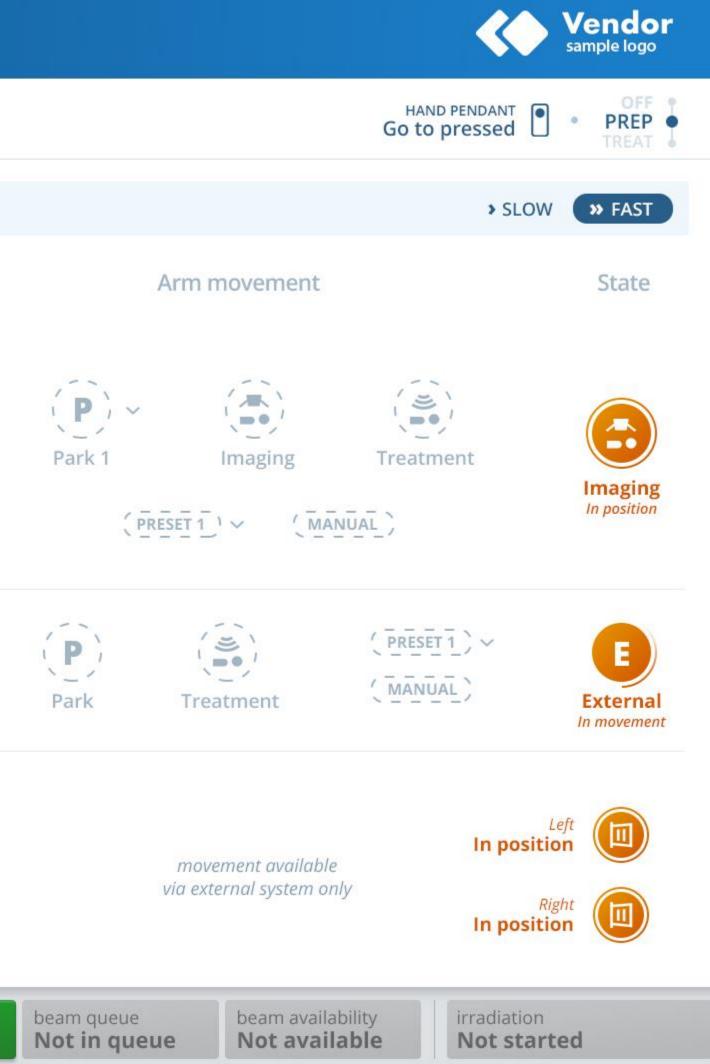
		Table is in imaging position Secure the room					
TR-1: Treatment 5 jan, 18:10:31		SETUP	POSITIONING	DELI	VERY	NOTIFICATIONS	
Patient							
James Johnson 13 Oct 1976 — male		Registratio	on result not avai	ilable			
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	details	Patient	PCS ~	ACTUAL	DELTA	DESTINATION	
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BEAM GATING DELIVERED / P	RESCRIBED	ENABLED	у	-93.2 cm		-93.2 cm	
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Close beam							
Room overview				A		OFCINIZION	
TR-2: Clinical QA Irradiation in	progress	Panels	l oft papel	ACTUAL		DESTINATION	
TR-1: Treatment Sess	sion open	movement ENABLED	Left panel	retracted			
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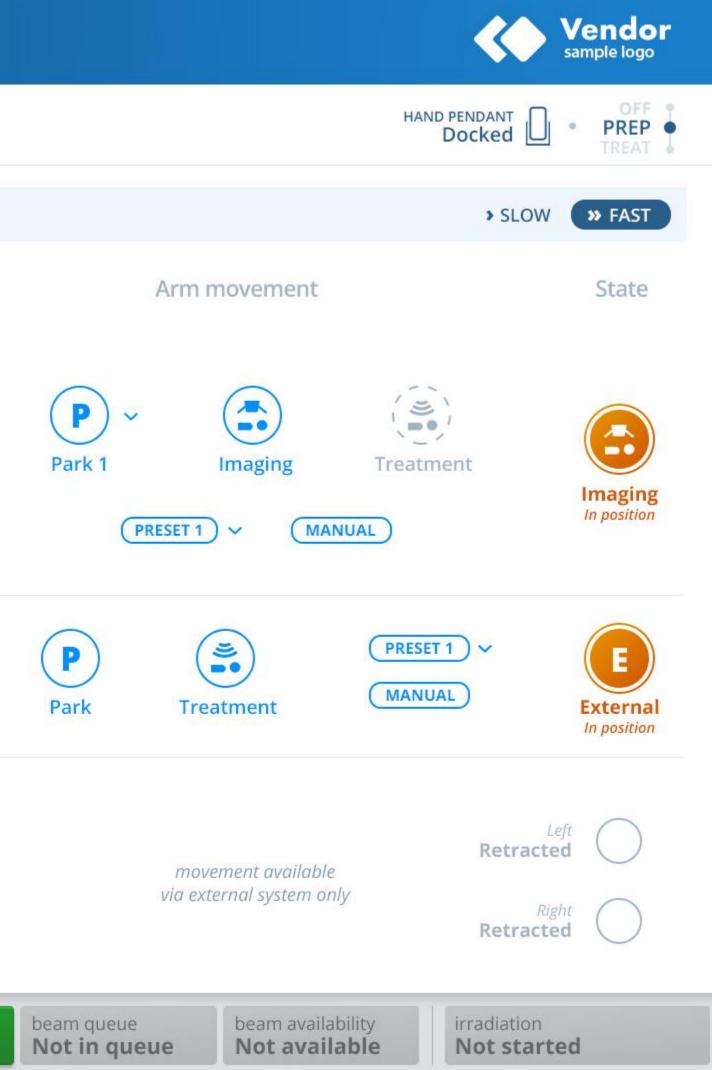
nnn COSYLA	B English ∽ john.doe G•	Table is in imaging position Start imaging					
TR-1: Treatme 5 jan, 18:10:31	nt 🙎	SETUP	POSITIONING	DEL	IVERY	NOTIFICATIONS	
Patient James Johnson 13 Oct 1976 — male		Registrati	on result not ava	ilable			
id: 946502669	example	Instrument			Position		
Close session	Hide details	Patient	PCS V	ACTUAL	DELTA	DESTINATION	
Beams		position	×>	+5.7 cm		+5.7 cm	
BEAM GATING	DELIVERED / PRESCRIBED	enabled enabled	y 🐂	-93.2 cm		-93.2 cm	
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ISOCENTER B			- ω Ο,	0.0 °		0.0 °	
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Open beam	Close beam						
Room overview				A (****) 1.6.1		DECTINIATION	
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Kequest beam	Cancel request		Right panel Right source	retracted			
wait time:	5 min 31 s		Right Source	retracted			
beam Open	passive devices Installed	room security Room secured	registration Not appli	ed	treatment position Not reached	room status No interlocks	



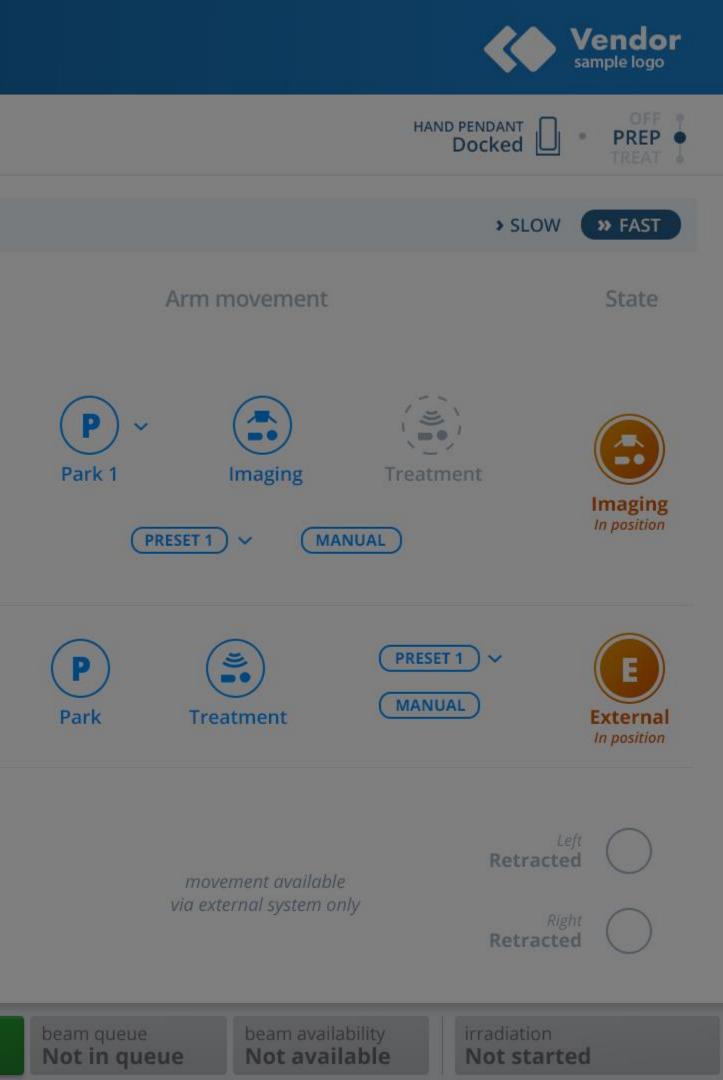
nnn COSYLA	B English ∽ john.doe G•	Table is in ima Imaging ii	ging position n progress			
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Patient						
James Johnson 13 Oct 1976 — male id: 946502669			n result not ava	ilable		
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	(100-11) - 2000-1400-14	position	ωČ	0.0 °		0.0 °
ISOCENTER B						
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(Open beam	Close beam	ENABLED	y /	50.0		00.0
Room overview						
TR-2: Clinical QA	Irradiation in progress	Panels		ACTUAL		DESTINATION
2004 074 98		enabled movement	Left panel	full fan		
TR-1: Treatment	Session open	ENABLED	Left source	extended		
Request beam	Cancel request		Right panel	full fan		
wait time:	5 min 31 s		Right source	extended		
beam Open	passive devices Installed	room security Room secured	registration Not applie	ed	treatment position Not reached	room status No interlocks



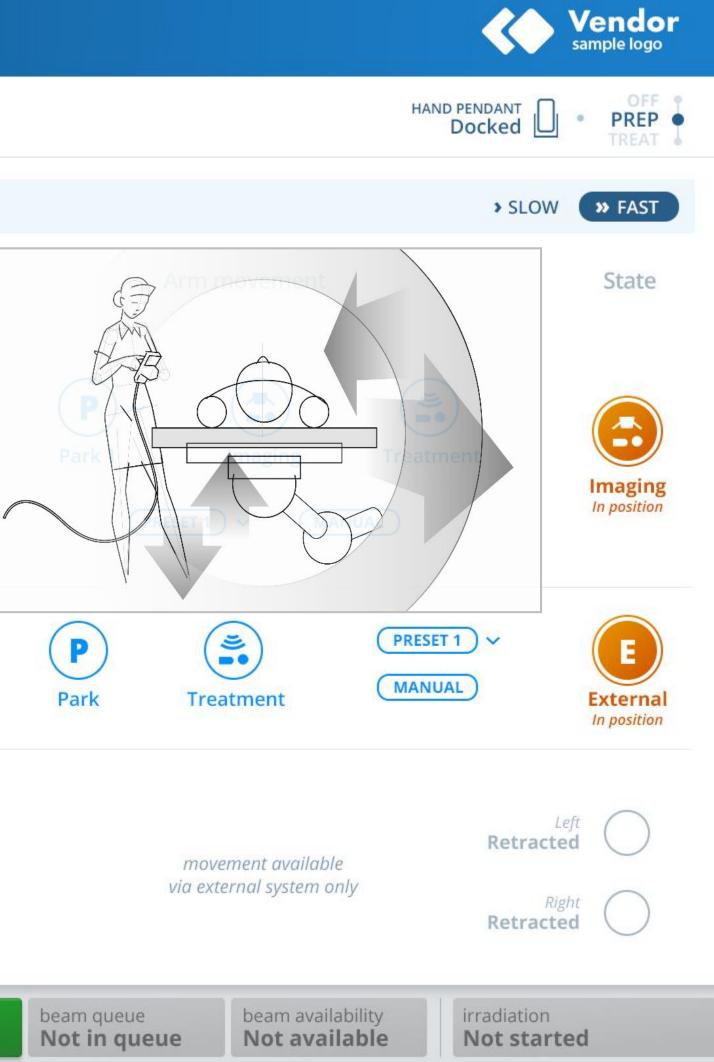
nnn COSYLA	B English ∽ john.doe G•	Imaging completed Registration in progress						
TR-1: Treatmer 5 jan, 18:10:31	nt 🙎	SETUP	POSITIONING	DELI	VERY	NOTIFICATIONS		
Patient James Johnson 13 Oct 1976 — male		Registratio	on result not ava	ilable				
id: 946502669	example	Instrument			Position			
Close session	Hide details	Patient	PCS V	ACTUAL	DELTA	DESTINATION		
Beams		position	× >	+5.7 cm		+5.7 cm		
BEAM GATING	DELIVERED / PRESCRIBED	ENABLED	у	-93.2 cm		-93.2 cm		
ISOCENTER A		Capture	z 📫 -	+125.8 cm		+125.8 cm		
O Beam A1	0 / 831.02 Gp	alignment	θ	5.0 °		5.0 °		
O Beam A2	0 / 749.46 Gp	Override	- ψ - Φ	0.0 °		0.0 °		
ISOCENTER B		position	- ω ζ	0.0 °		0.0 °		
O Beam B1	0 / 812.22 Gp	Gantry						
◯ Beam B2 🏒	0 / 649.79 Gp	Gantry	-	ACTUAL	DELTA	DESTINATION		
		ENABLED	у 🔨	80.0 °		80.0 °		
Open beam	Close beam							
Room overview								
TR-2: Clinical QA	Irradiation in progress	Panels		ACTUAL		DESTINATION		
TR-1: Treatment	Session open	enabled movement	Left panel	retracted				
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Request beam	Cancel request		Right panel	retracted				
wait time: 5	5 min 31 s		Right source	retracted				
beam Open	passive devices Installed	room security Room secured	registration Not applie		treatment position Not reached	room status No interlocks		



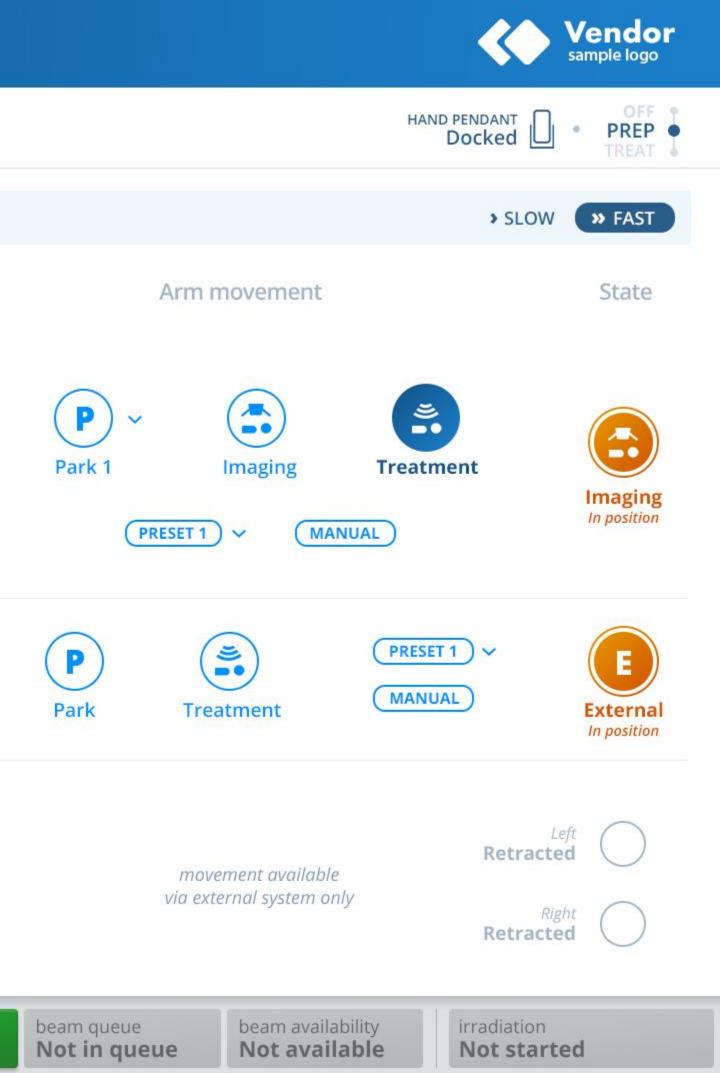
In COSYLAB English ~ john.doe G			ress		
TR-1: Treatment	Registrat	tion result	EL	IVERY	NOTIFICATIONS
Patient James Johnson	Registration	has finished.			
13 Oct 1976 — male	x	+0.2 cm			
id: 946502669	У	-1.0 cm		Position	
Close session / White details	Z	+0.5 cm			
(Close session)	θ	0.2 °	_	DELTA	
Beams	ψ	0.0 °			+5.7 cm
	ω	0.5 °	' m		-93.2 cm
ISOCENTER A			im		+125.8 cm
O Beam A1 0 / 831.02 Gp	Accept	Discard	° د ۲ ۵		5.0 °
O Beam A2 0 / 749.46 Gp	position I	ω `C.	0.0 °		0.0 ° 0.0 °
ISOCENTER B		ω Ο.	0.0		0.0
O Beam B1 0 / 812.22 Gp	Gantry				
◯ Beam B2 → 0 / 649.79 Gp		~	ACTUAL		
	ENABLED	y 🤨	80.0 °		80.0 °
Close beam					
De anti-automiante					
Room overview	Panels		ACTUAL		DESTINATION
TR-2: Clinical QA Irradiation in progress	movement	Left panel	retracted		
TR-1: Treatment Session open	ENABLED	Left source	retracted		
Request beam Cancel request		Right panel	retracted		
wait time: 5 min 31 s		Right source	retracted		
wait time. 5 min 51 S					
beam passive devices Open Installed	room security Room secured	registration Not applie	ed	treatment pos Not reache	



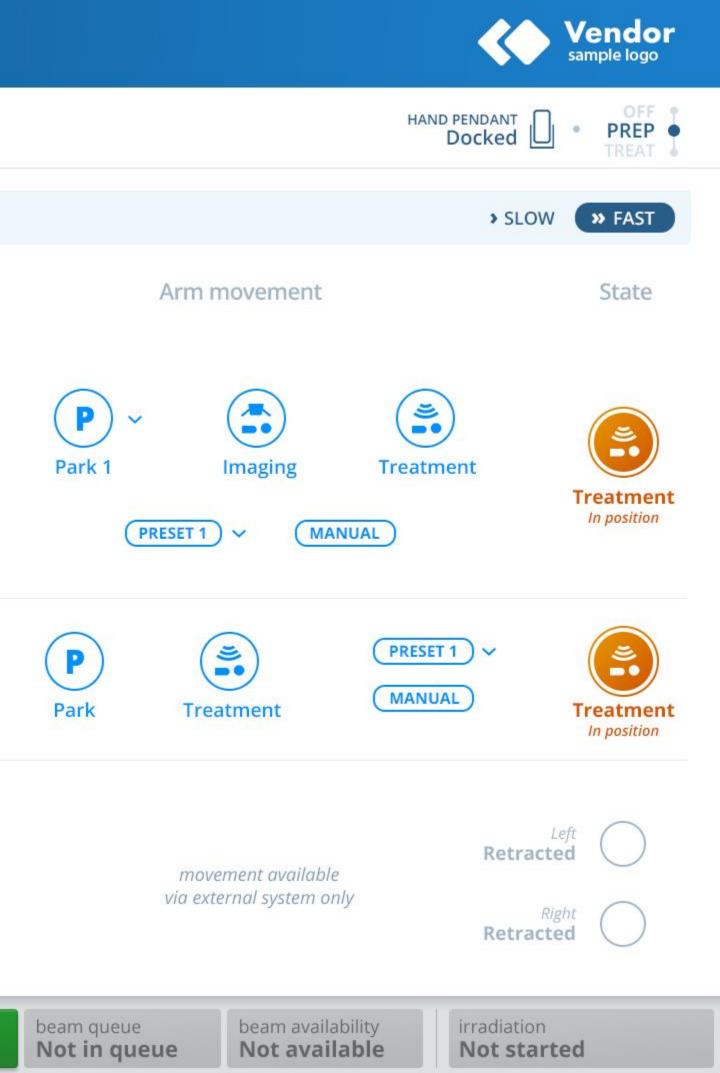
In COSYLAB English ~ john.doe G		completed	ment p	osition		
TR-1: Treatment 5 jan, 18:10:31	SETUP	POSITIONING	DEL	IVERY	NOTIFICATIO	NS
Patient James Johnson 13 Oct 1976 — male id: 946502669		ation result acce	epted		[
ld. 946502669	Instrument			Position		
(Close session)	Patient position	PCS V	ACTUAL		DESTINATION	
Beams	18 57	×>	+5.7 cm		+5.7 cm	
BEAM GATING DELIVERED / PRESCRIBED		y T	-93.2 cm		-93.2 cm	
ISOCENTER A REGISTRATION ACCEPTED	Capture	ι θ 🛶	125.8 cm+125.0 °		+125.8 cm 5.0 °	
O Beam A1 0 / 831.02 Gp		- ψ	0.0 °		0.0 °	1
O Beam A2 0 / 749.46 Gp	position	_ ω `C	0.0 °		0.0 °	, v
ISOCENTER B		0.				
O Beam B1 0 / 812.22 Gp	Gantry		ACTUAL	DELTA	DECTINATION	
○ Beam B2 -√- 0 / 649.79 Gp		v <	ACTUAL 80.0 °		DESTINATION 80.0 °	
Close beam	ENABLED	y L	80.0		80.0	
Room overview						
TR-2: Clinical QA Irradiation in progress		Loft papel	ACTUAL retracted		DESTINATION	
TR-1: Treatment Session open	enabled	Left panel	retracted			
Request beam Cancel request		Right panel Right source	retracted			
wait time: 5 min 31 s		Agresource	reducted			
beam passive devices Open Installed	room security Room secured	registration Applied		treatment position Not reached	room status No interlo	ocks



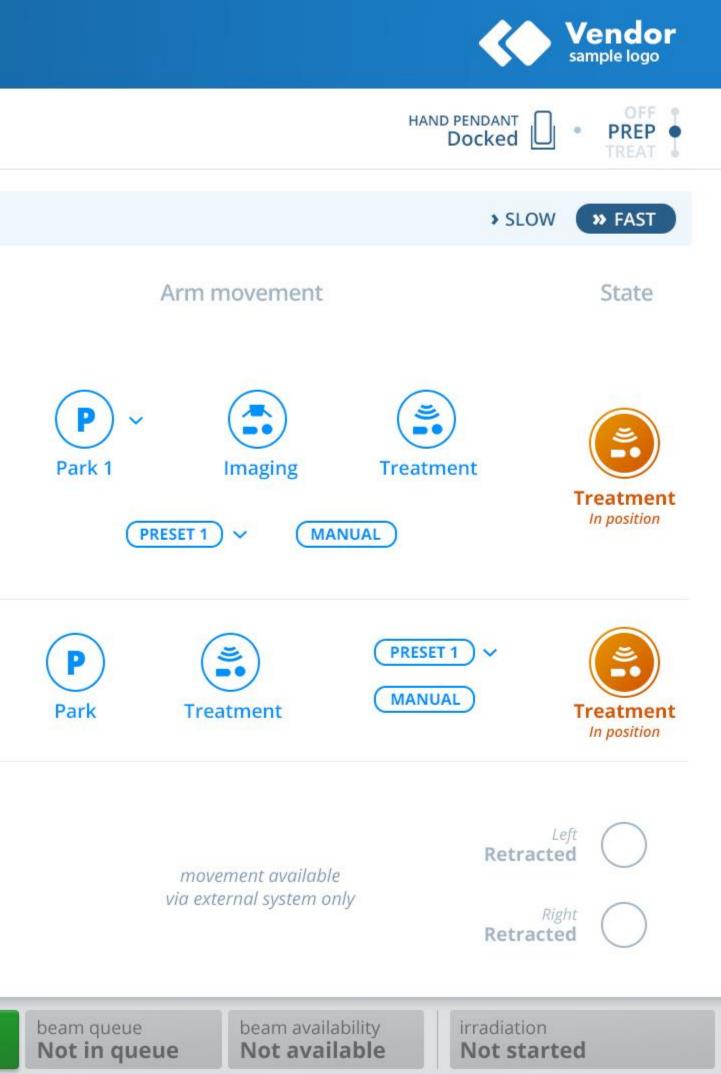
In COSYLAB English john.doe (ition is armed pendant t	o start	motion	
TR-1: Treatment 5 jan, 18:10:31	SETUP P	OSITIONING	DEL	IVERY	NOTIFICATIONS
Patient James Johnson 13 Oct 1976 — male	S Registra	tion result acce	epted		
id: 946502669	Instrument			Position	
(Close session) Mide details	Patient	PCS ~	ACTUAL	REFERENCE	IN TOLERANCE
Beams	position	X>	+5.7 cm		S - 3.5 cm
BEAM GATING DELIVERED / PRESCRIBE		y T	-93.2 cm ⊦125.8 cm		 2.0 cm - 4.3 cm
ISOCENTER A REGISTRATION ACCEPTED	Capture	z — -	5.0 °		 ✓ - 4.3 cm ✓ - 0.8 °
O Beam A1 0 / 831.02 G	1	ψ	0.0 °		★ + 0.7 °
O Beam A2 0 / 749.46 G	position	ω Έ.	0.0 °	0.5 °	😵 + 0.5 °
 ○ Beam B1 ○ A 12.22 G ○ Beam B2 ○ C ○ C<th>Gantry</th><th></th><th>ACTUAL</th><th>DELTA</th><th>DESTINATION</th>	Gantry		ACTUAL	DELTA	DESTINATION
○ Beam B2 -√- 0 / 649.79 G	enabled	у 🏹	80.0 °		80.0 °
(Open beam) Close beam					
Room overview	Danala		ACTUAL		DESTINATION
TR-2: Clinical QA Irradiation in progres		Left panel	retracted		DESTINATION
TR-1: Treatment Session oper		Left source	retracted		
Request beam Cancel request	N/	Right panel	retracted		
wait time: 5 min 31 s		Right source	retracted		
beam passive devices Open Installed	room security Room secured	registration Applied		treatment position Not reached	room status No interlocks



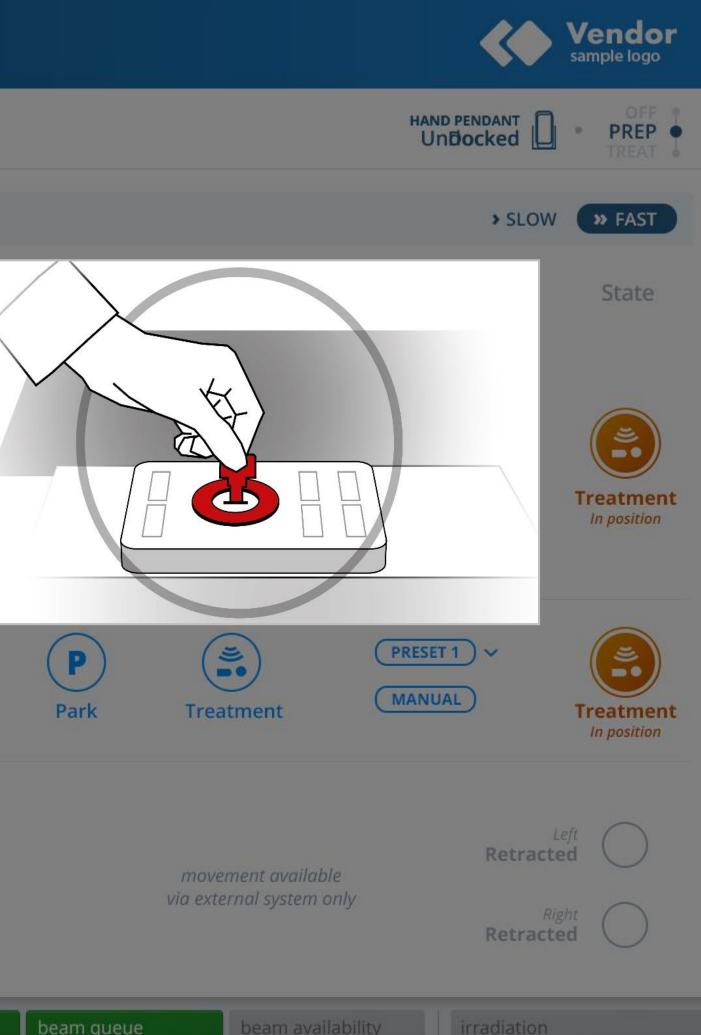
nnn COSYLA	B English ∽ john.doe G•		ntry are in treatme position	nent posit	ion	
TR-1: Treatmen 5 jan, 18:10:31	nt 🙎	SETUP	POSITIONING	DEL	IVERY	NOTIFICATIONS
Patient						
James Johnson 13 Oct 1976 — male id: 946502669		Regist	ration result acce	epted	Position	
	example	Instrument			POSICION	
Close session	96 Hide details	Patient	PCS ~	ACTUAL	REFERENCE	IN TOLERANCE
Beams		position	×>	+3.0 cm	+2.2 cm	- 0.8 cm
BEAM GATING	DELIVERED / PRESCRIBED	ENABLED	у	-95.2 cm	-95.2 cm	~
ISOCENTER A R	EGISTRATION ACCEPTED 💮	(z 📫 -	+121.5 cm	+121.5 cm	~
O Beam A1	0 / 831.02 Gp	Capture l alignment	ι θ 🛶	4.8 °	4.2 °	- 0.6 °
O Beam A2	0 / 749.46 Gp	Override	ψ	0.7 °	0.7 °	~
		position	ω`ζ	0.5 °	0.5 °	~
ISOCENTER B						
O Beam B1	0 / 812.22 Gp	Gantry		ACTUAL	REFERENCE	IN TOLERANCE
🔘 Beam B2 🛛 😽	0 / 649.79 Gp		v K.	66.0 °		1
(Open beam)	Close beam	ENABLED	y /'	00.0		•
Room overview						
TR-2: Clinical QA	Irradiation in progress	Panels		ACTUAL		DESTINATION
		enabled	Left panel	retracted		
TR-1: Treatment	Session open	ENABLED	Left source	retracted		
Request beam	(Cancel request)		Right panel	retracted		
wait time: 5	min 31 s		Right source	retracted		
beam Open	passive devices Installed	room security Room secured	registration Applied		treatment position Not reached	room status No interlocks



nnn COSYLAB		ind gantry Iest bea	are in treatn a m	nent positi	ion	
TR-1: Treatment 5 jan, 18:10:31	SETUP	POS	SITIONING	DEL	IVERY	NOTIFICATIONS
Patient James Johnson 13 Oct 1976 — male id: 946502669			n result acce	epted		
10. 940302009	example	ment			Position	
Close session Ø	Hide details Patie		PCS ~	ACTUAL	REFERENCE	IN TOLERANCE
Beams	posit	ion	× →	+3.0 cm	+2.2 cm	🗸 - 0.8 cm
		ement BLED	у 🍋	-95.2 cm	-95.2 cm	~
		1	z 🐴 -	+121.5 cm	+121.5 cm	~
	Car	oture l	θ 🛶	4.8 °	4.2 °	✓ -0.6°
		erride	ψ	0.7 °	0.7 °	~
U beam A2		sition I	ω ີ	0.5 °	0.5 °	~
ISOCENTER B					'	
	0 / 812.22 Gp Gant	ry		ACTUAL	REFERENCE	IN TOLERANCE
◯ Beam B2 -√-	0 / 649.79 Gp	ement BLED	v 🗲	66.0 °	66.0 °	~
(Open beam Close	se beam					
Room overview						
TR-2: Clinical QA Irradiatio	on in progress Pane	ls		ACTUAL		DESTINATION
2002 221 ÷ 200 200 0	e mov	ement	Left panel	retracted		
TR-1: Treatment	Session open 🛛 💙 ENA	BLED	Left source	retracted		
Request beam	el request		Right panel	retracted		
wait time: 5 min 31 s			Right source	retracted		
beam passive de Open Installe			registration Applied		treatment position Overridden	room status No interlocks



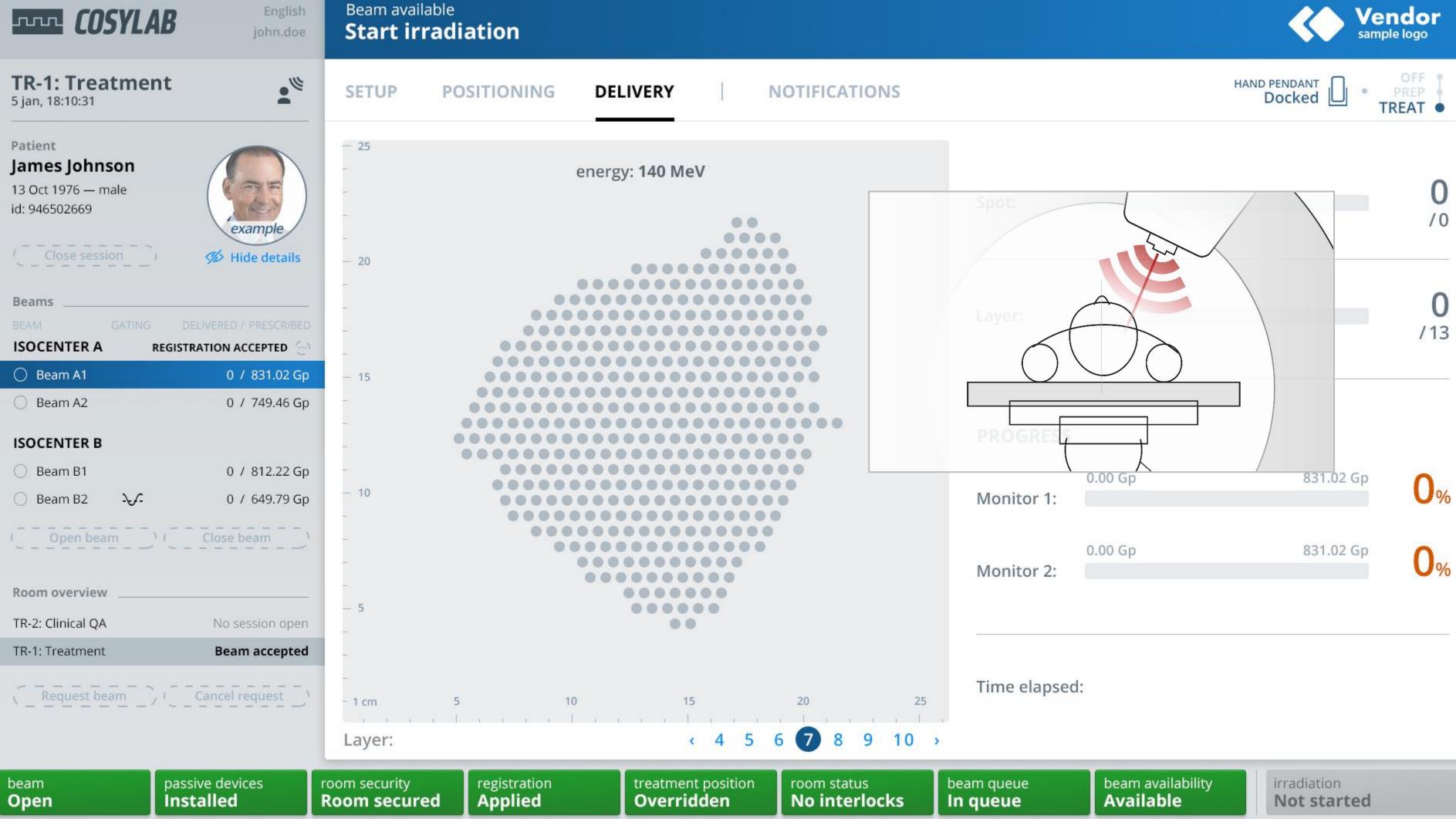
nnn COSYLA	B English ~ john.doe G			nent positio	n		
TR-1: Treatmer 5 jan, 18:10:31	nt 🙎	SETUP P	OSITIONING	DELIV	ERY	NOTIFICATI	ONS
Patient James Johnson 13 Oct 1976 — male id: 946502669		Registrat	ion result acc	epted	Position		
Beams GATING	example Hide details DELIVERED / PRESCRIBED REGISTRATION ACCEPTED	/	PCS ✓ x → y ^K z ↑	ACTUAL +3.0 cm -95.2 cm +121.5 cm	REFERENCE +2.2 cm -95.2 cm +121.5 cm	IN TOLERANCE	
O Beam A1	0 / 831.02 Gp	Capture	θ 🛶	4.8 °	4.2 °	🗸 - 0.6 °	
O Beam A2	0 / 749.46 Gp	Override	ψ	0.7 ° 0.5 °	l 0.7 °	✓ ✓	
ISOCENTER B							
O Beam B1	0 / 812.22 Gp	Gantry		ACTUAL	REFERENCE	IN TOLERANCE	
O Beam B2 →	0 / 649.79 Gp	enabled	у 🗲	66.0 °	66.0 °	· 🗸	
(Open beam)	Close beam						
Room overview		Bear	n ready				
TR-2: Clinical QA	No session open		ly for Room TR-1			DESTINATION	
TR-1: Treatment	Beam ready		by turning swite treat.	ted ted			
Auto-rejecto Reject			e <mark>ct beam</mark> -rejected in 27 s.	ted			
beam Open	passive devices Installed	room security Room secured	registration Applied		reatment position Overridden	n room statu: No inter	



In queue

Not available

Not started

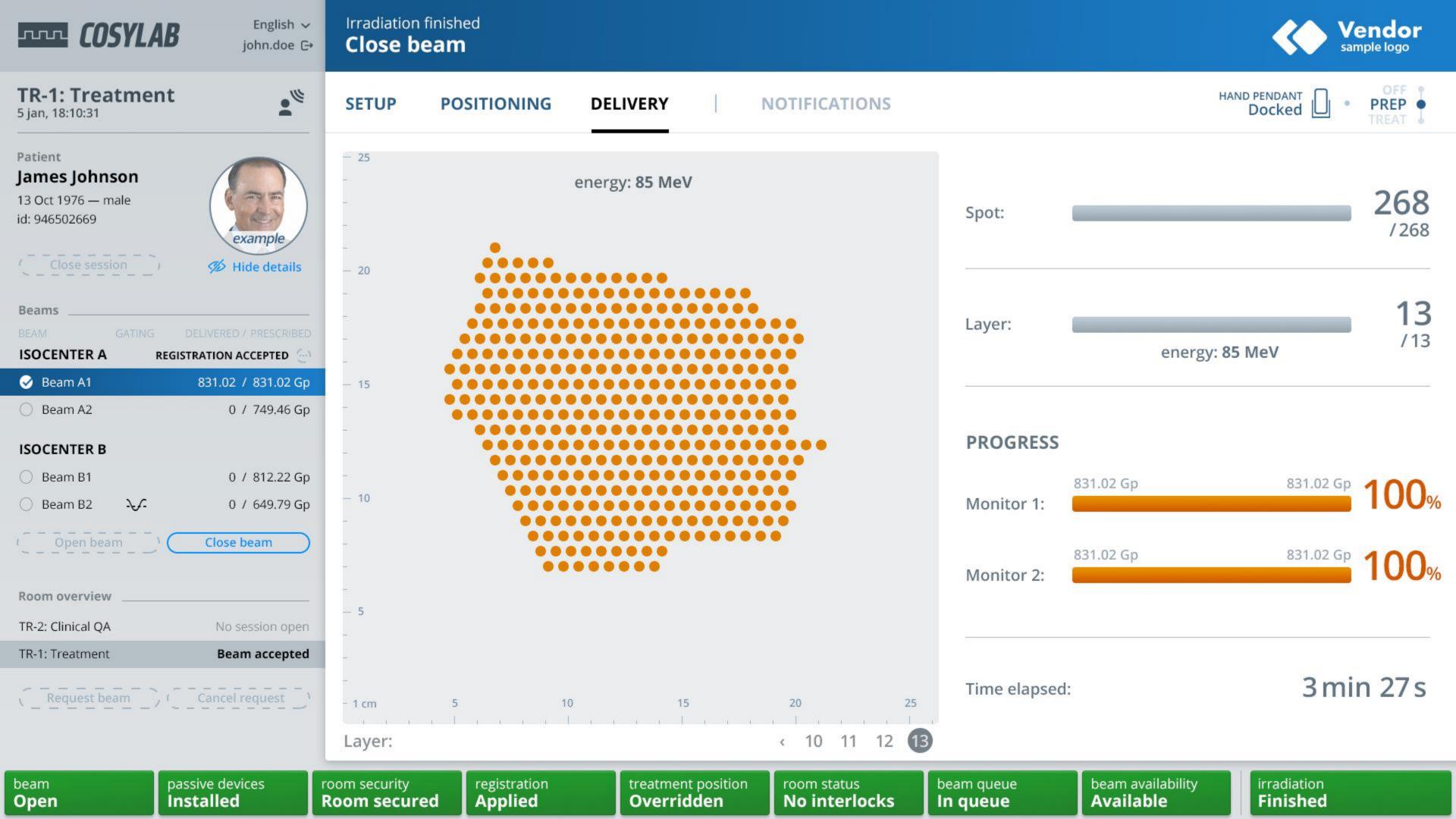






In COSYLAB English john.doe	Irradiation in pro Monitor irr	ogress adiation prog	gress		
TR-1: Treatment 5 jan, 18:10:31	SETUP PC	SITIONING	DELIVERY	1	NOTIFICATIONS
Patient James Johnson 13 Oct 1976 — male id: 946502669	- 25 - - -	ene	ergy: 140 MeV		
Close session Hide details Beams BEAM GATING DELIVERED / PRESCRIBED ISOCENTER A REGISTRATION ACCEPTED	-				
Beam A1 465.40 / 831.02 Gp	- 15	•••••			
O Beam A2 0 / 749.46 Gp	-				
ISOCENTER B	-				
O Beam B1 0 / 812.22 Gp	10				
○ Beam B2 ↓ 0 / 649.79 Gp	-				•
(Open beam) (Close beam)	-				
Room overview					
TR-2: Clinical QA No session open	- 5		•••		
TR-1: Treatment Beam accepted	-				
Request beam Cancel request	- 1 cm 5	10	15		20 25
	Layer:		<	4 5	6 7 8 9 10
beam passive devices Open Installed	room security Room secured	registration Applied	treatment Override		room status No interlocks







TR-1: Treatment

5 jan, 18:10:31

James Johnson

13 Oct 1976 — male

Patient

English 🗸 john.doe ⊖ Beam selected **Open beam or close session**

Session summary

Please verify that all the data is entered correctly.

id: 946502669		Anton Hribar X	+ Add		SESSION DU	IRATION	
Close session Beams BEAM GATING ISOCENTER A Beam A1 Beam A2 ISOCENTER B	REGIS In hac habi nec gravida fringilla e enim. Vesti	DTES tasse platea dictums a enim. Praesent dict et. Cras cursus fring bulum eu consectetur	+ Add t. Aliquam erat volutpat um eleifend magna, vel ru illa facilisis. Nullam eg est. fringilla enim condimen	utrum mi get felis	17 min 9 s BEAMS BEAM ISOCENTER A O Beam A1 D Beam A2 ISOCENTER B	8.31	1.02 / 8 0 / 7
 Beam B1 Beam B2 Geam B2 Open beam Room overview	mattis. Sed dolor aliqu amet portti arcu nibh a	l lobortis eleifend d nam gravida tempor id tor porttitor, nisi nc arcu. Ut vestibulu	uris, et consequat nisl iam eu ornare. Nam et tu ipsum. Phasellus posuer velit suscipit ligula, i m mattis ante non mattis tum commodo. Integer var	rpis a e, leo sit d laoreet . Aliquam	 Beam B1 Beam B2 	Υ	0/8
TR-1: Treatment							
Request beam	.C		Close session		Cancel		
wait time: 5	5 min 31 s						
beam Not open	passive devices Not installed	room security Not secured	registration Not applied	treatment pos Not reache		tatus terlocks	b



	/ICES
	vice name)
DELIVERED	etus non mi dignissim, a gravida lectus commodo. In tempor venena- r dolor vitae enim pretium, in porttitor dolor ultrices. Pellentesque
831.02 Gp	erdiet ultrices, metus libero dapibus enim, ut laoreet est urna id erat. sellus varius, turpis eu finibus hendrerit, velit diam lacinia lectus, vel
749.46 Gp	orbi nec quam augue. Pellentesque quam nulla, porta at porttitor sit
	icies at mi vel, semper ornare magna. Sed laoreet diam sem, id volut-
812.22 Gp	naximus leo vel elit aliquet mattis vestibulum nec lacus. Donec ut tie eu et enim. Maecenas eu lectus ac est tristique vehicula. Vivamus a
649.79 Gp	acilisis augue, et porta metus. Duis at suscipit risus, elementum pre-

setup photo placeholder

setup photo placeholder

Not in queue

beam availability Not available

Not started



English ∽ john.doe G→ Beam selected **Open beam or close session**

TR-1: Treatment

5 jan, 18:10:31

Patient James Johnson

13 Oct 1976 — male id: 946502669

Close session
Beams
ISOCENTER A REG
🎯 Beam A1
O Beam A2
ISOCENTER B
O Beam B1
◯ Beam B2 →
Open beam
Room overview
TR-2: Clinical QA
TR-1: Treatment



wait time: 5 min 31 s

beam Not open

passive devices Not installed

room security
Not secured

registration Not applied

treatment positio

Reporting to oncology information system. Please wait.

room status No interlocks

Session summary

Please verify that all the data is entered correctly.

Janez Novak × Anton Hribar ×

SESSION NOTES

* 🗋 🖕 🕈

In hac habitasse platea dictumst. Aliquam erat volutpat. Morbi nec gravida enim. Praesent dictum eleifend magna, vel rutrum mi fringilla et. Cras cursus fringilla facilisis. Nullam eget felis enim. Vestibulum eu consectetur est. Mauris egestas nibh eros, vitae fringilla enim condimentum eu. Curabitur vehicula ultricies mauris, et consequat nisl rhoncus mattis. Sed lobortis eleifend diam eu ornare. Nam et turpis a dolor aliquam gravida tempor id ipsum. Phasellus posuere, leo sit amet porttitor porttitor, nisi velit suscipit ligula, id laoreet arcu nibh ac arcu. Ut vestibulum mattis ante non mattis. Aliquam laoreet arcu quis quam condimentum commodo. Integer varius sem ac

SESSION DU	RATION			
17 min 9s				
BEAMS				
BEAM	GATING			1
ISOCENTER A				
📀 🛛 Beam A1	8.31	.02	1	8
O Beam A2		0	1	7
ISOCENTER B				
O Beam B1		0	1	8
O Beam B2	\mathcal{M}	0	1	6



	/ICES
	vice name)
DELIVERED	etus non mi dignissim, a gravida lectus commodo. In tempor vener r dolor vitae enim pretium, in porttitor dolor ultrices. Pellentesque
02 / 831.02 Gp	erdiet ultrices, metus libero dapibus enim, ut laoreet est urna id era sellus varius, turpis eu finibus hendrerit, velit diam lacinia lectus, vel
0 / 749.46 Gp	orbi nec quam augue. Pellentesque quam nulla, porta at porttitor si
	icies at mi vel, semper ornare magna. Sed laoreet diam sem, id volu
0 / 812.22 Gp	naximus leo vel elit aliquet mattis vestibulum nec lacus. Donec ut
0 / 649.79 Gp	tie eu et enim. Maecenas eu lectus ac est tristique vehicula. Vivamu acilisis augue, et porta metus. Duis at suscipit risus, elementum pre

setup photo placeholder setup photo placeholder

beam queue Not in queue beam availability Not available

irradiation Not started