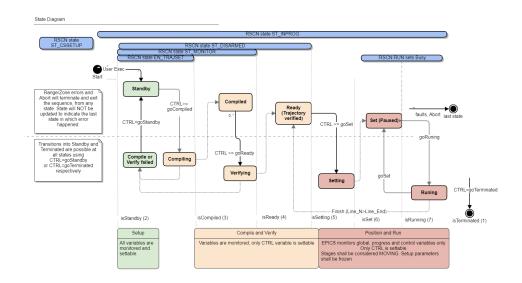# Rascan 2.0 system design

RaterScan sequence

EPICS interface

Interface/RaScan Scratchpad.WIP.xlsm

Interface

CS assignments:

CS No	CS Name and description	Fast Rascan axis Ax1	Slow Rascan axis Ax2	Locked Rascan axis Ax3	Forward kinematics	Inverse kinematics	Comments
4	X-Y	virtual X (replicating X)	virtual Y (replicating Y)	none	Ax1 = X Ax2 = Y	X = Ax1 Y = Ax2	
5	XZ-Y: X Z angled plane scan	Xp_VRT	Yp_VRT	Zp_VRT	Ax1 = X Cos() - Z Sin () Ax2 = Y Ax3 = X Sin() + Z Cos ()	X = Ax1 Cos() + Ax3 Sin() Y = Ax2 Z = -Ax1 Sin() + Ax3 Cos()	= cs_XZ_ThU in degrees

| 6 | TX-Y Theta-X: T_MTR geared with X_MTR | Tx_VRT | virtual Y (replicating Y) | none | Ax1 = Theta Ax2 = Y | X = Ax1 / GearRatio Y = Ax2 Theta = Ax1 | GearRatio = CS_TX_GRU |

Raster scan trajectory definitions

Calculating overall time and distances

Overall_Line_Time = 4*seg_SubN + tLine + 2*(t_ISkip + t_OSkip) + t_ESkip

Overall_Scan_Time = Overall_Line_Time * (seg_End - 0)

AX1_Travel_Range = ax1_Span + 2*ax1_OSkip

ax2_Step : ax2_StepU = 2*(ax2_ISkip + ax2_OSkip) + ax2_ESkip

ax2_Travel_Range = ax2_StepU*(seg_End - 0) + 2*ax2_OSkip

Interface Control

Signal	DeviceKey	EPICS Type	Default Value	Description	Flags	Unit
a1_HLM	P2002	float		Fly axis accel. desired limit	gsu	EGU/s2
a1_In	P2057	float		Fly axis inner-skip accel.	g	EGU/s2
a1_Out	P2004	float		Fly axis outer-skip accel.	g	EGU/s2
a2_HLM	none	float	0	Inc. axis accel. high limit	e	EGU/s
a2_Max	P2056	float		Inc. axis trajectory max accel.	g	EGU/s2
a2_Out	P2062	float		Inc. axis trajectory accel. Out	g	EGU/s2
cs_Active	P2090	float		Active CS number on pmac	gsu	
cs_AngleXY	P2017	float		X-Y scan angle	gsu	deg
cs_AngleXZ	P2009	float		X-Z scan angle	gsu	deg
cs_GearTX	P2010	float		Tomo-X scan gear ratio	gsu	deg/mm
cs_Status	P2091	float		Active CS status (CSSTRS)	db	
d1_Centre	P2013	float		Fly axis scan starting position	gsu	EGU
d1_In	P2052	float		Fly axis inner-skip distance	g	EGU
d1_In_HLM	none	float		Fly axis inner-skip high limit	e	EGU
d1_Ind_HLM	P2050	float		Fly axis total indent HLM	g	EGU
d1_IndL	P2079	float		Fly axis indent from Left	g	EGU
d1_IndL_Req	P2018	float		Fly axis Left indent request	gsu	EGU
d1_IndR	P2080	float		Fly axis indent from Right	g	EGU
d1_IndR_Req	P2019	float		Fly axis Right indent request	gsu	EGU
d1_IndSt	P2016	float		Device indentation live switch	gs	
d1_Out	P2045	float		Fly axis outer-skip band	g	EGU
d1_OutHDM	none	float		Fly axis outer distance desired lim	e	EGU
d1_Span	P2001	float		Fly axis span (span)	gsu	EGU
d2_Edge	P2065	float		Inc. axis Edge-skip distance	g	EGU
d2_In	P2053	float		Inc. axis inner-skip distance	g	EGU
d2_Out	P2054	float		Inc. axis skip distance	g	EGU

d2_Span	P2048	float		Inc. axis scan span (span)	g	EGU
d2_Start	P2014	float		Inc. axis scan start position	gsu	EGU
d2_Step	P2006	float		Inc. axis line separation	gsu	EGU
d2_TolRatio	none	float		Inc. axis tolerance ratio	e	
dev_CMD	P2000	float		Scan control word	s	
dev_Error	P2055	mbbi		SkipScan fault code	db	
dev_SLVD	P2011	float		Solved flag set by midlayer		
dev_State	P2040	mbbi		Scan state word	db	
sys_Warns	none	waveform		system warnings		
sys_Errors	none	waveform		system errors		
er_Solution	21		21	Solver didn't converge	d	
j1_HLM	P2020	float		Fly axis jerk desired limit	gsu	EGU/s2
j2_HLM	P2021	float		Inc. axis jerk desired limit	gsu	EGU/s2
line_Dir	P2049	float		Current line direction	g	
line_End	P2012	float		Scan line End count	gsu	
line_N	P2041	float		Scan line pointer	gsu	
line_SubEnd	P2060	float		Number of subsegments	g	
line_SubN	P2063	float		subsegment counter	g	
en_Always	x			Enabled at all times	n	
en_AutoSync	x			Enables map forced sync	n	
en_CSSetup	x			Enables CS setup	n	
en_Disarmed	x			stage is disarmed, not scanning	n	
en_Global	x			Enables Global var setting	n	
en_InProg	x			In motion program	n	
en_Monitor	x			Enables polling specific params	n	
en_Never	x			Never enables	n	
en_TrajSet	x			Enables setting specific params	n	
t_Edge	P2064	float		Edge-skip move time	g	s
t_Line	P2039	float		Total line move time	g	s
t_Scan	P2038	float		Total scan move time	g	s
t_In	P2044	float		inner-skip move time	g	s
t_In_LLM	P2005	float		Fly axis inner-skip time LLM	gsu	s
t_Mid	P2042	float		Scanline middle segnment time	g	s
t_Out	P2043	float		outer-skip move time	g	s
t_OvrHd	P2081	float		Calculated overhead time per line	g	s
v1_Diff	P2008	float		Fly axis scan velocity delta	g	EGU/s
v1_Out	P2007	float		Fly axis line exit velocity	g	EGU/s
v1_Scan	P2061	float		Fly axis line scan velocity	gsu	EGU/s
v1_ScanHLM	none	float		HLM Fly axis line scan velocity	e	EGU/s
v1_ScanLLM	none	float		LLM Fly axis line scan velocity	e	EGU/s
v2_In	P2047	float		Inc. axis line exit velocity	g	EGU/s
v2_Out	P2046	float		Inc. axis line entry velocity	g	EGU/s

Trajectory compilation validation faults

If the trajectory validation fails, Rascan returns fault codes via its EPICS interface. User needs to go back to Standby, change the parameters and retry compiling by hitting Ready.

Here is the list of possible trajectory validation faults.

Fault	Condition		Expressions	Comments
`ax1AISkip`	`ax1AISkip > ax1AccMaxU`		`ax1AISkip=ax1VAddU /tISkip`	Ax1 in-skip acceleration is too high. Consider reducing Ax1mid velocity
`ax1VMid`	`ax1VMid < 0.001`		`ax1VMid=ax1VOutU+ax1V AddU`	Overall line velocity is less than 0.001 EGU/s.
`ax1ISkip`	`ax1Span<2*ax1ISkip`			In-skip distance for Ax1 is too big for span. Consider reducing ax2Step and/or reducing Ax1 mid velocity
`tOSkip`	`tOSkip > tLineMax`			Out-skip move time exceeds the limit. Consider reducing ax1VOutU or increasing ax1AccMax
tMax	Any time value > 4.096 s			Check all time values. If tESkip > 4.095s then consider reducing t_OSkipMinU to less than 4.096s