

# Updates

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WP6 Meeting

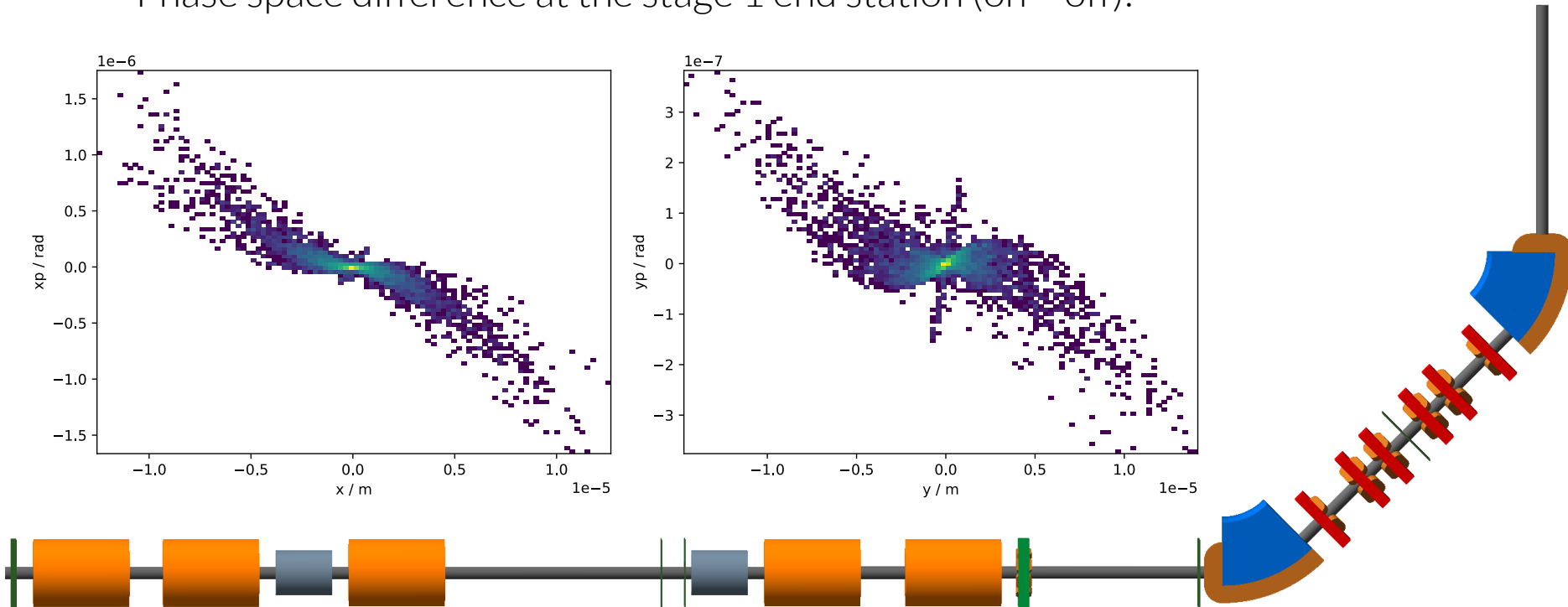
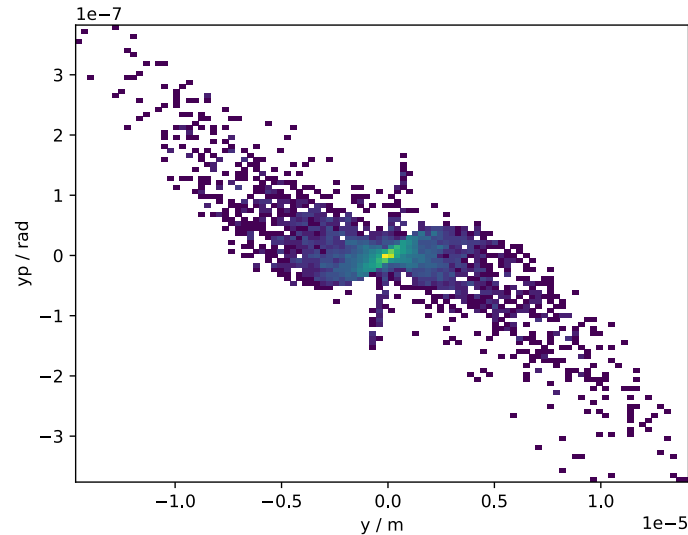
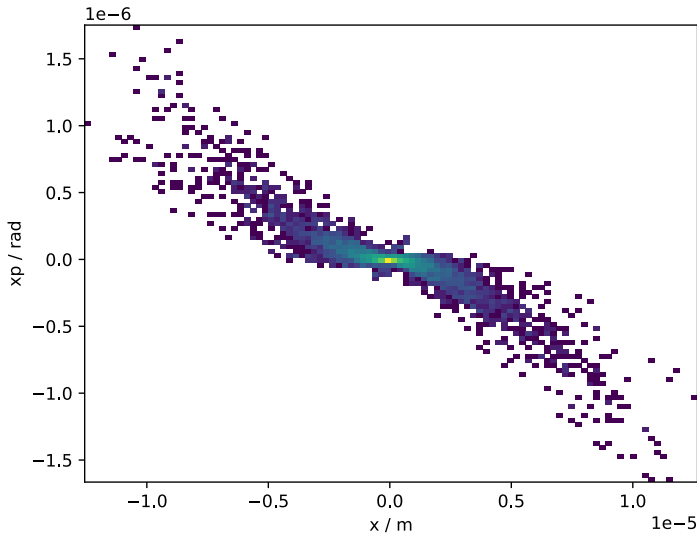
22<sup>nd</sup> November 2022



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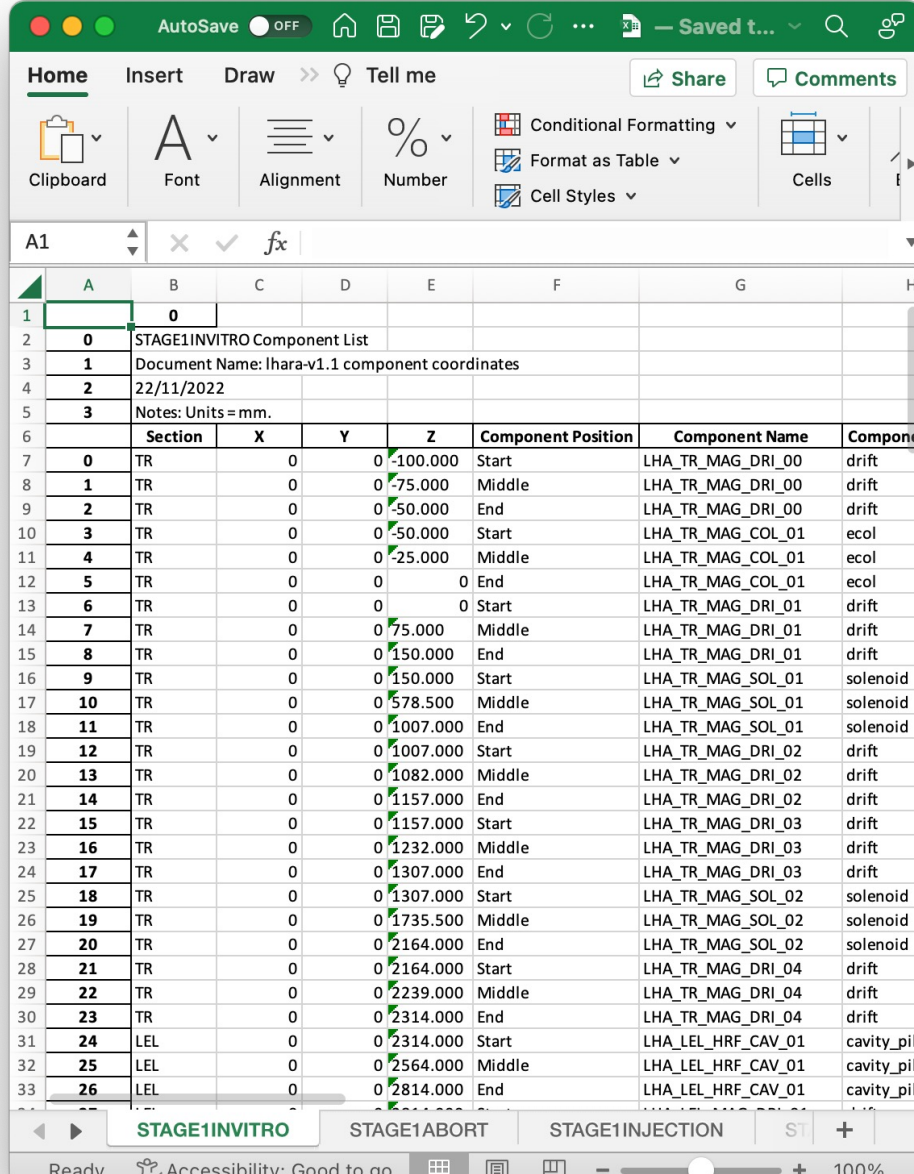


- Updated model with JP GL strengths & coll. pos. corrections
  - Stage 2 Gabor Lens strengths to be updated when JP confirms.
    - Non-parallel beam after GL2 – flexibility needed (wall, cavity, ...)
- Added S2 coll. 0.2m downstream of S1 coll. Open aperture.
- 1<sup>st</sup> Octupole removed:
  - No discernible impact on bunch uniformity
  - Phase space difference at the stage 1 end station (on – off):



# Device Naming

- Device name update near complete
  - Still to update FFA ring
  - GPT model comments still to do
    - 1:1 output with BDSIM
- Questions / issues ([scheme](#)):
  - Should drifts be in the component in scheme?
  - Which technical area do drifts come under?
  - Collimator technical area?
  - Dump technical area?
  - Target room domain to include capture section?
  - RF cavities are high power RF?
  - Switching dipole – separate component type?
  - Septum magnet – separate component type?
  - Domains (next slide)



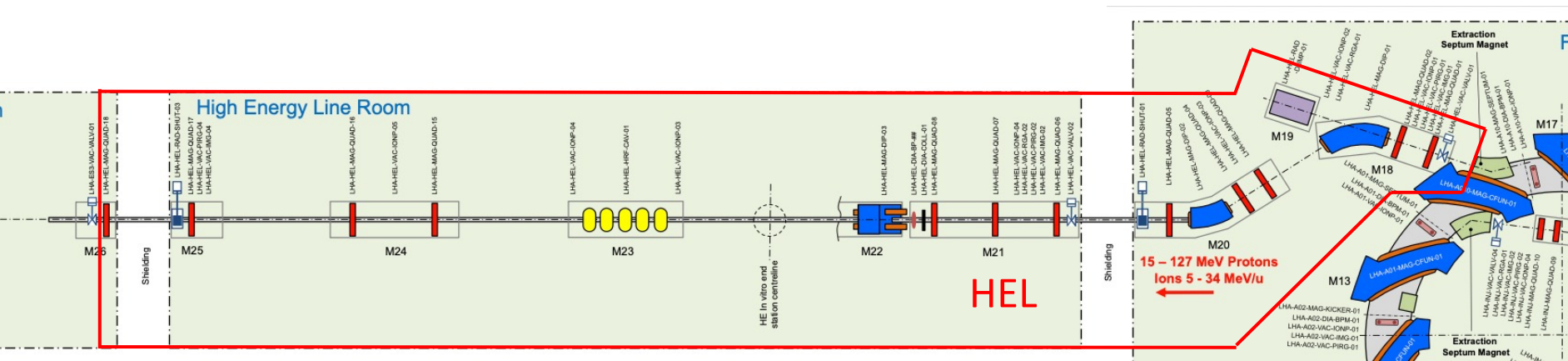
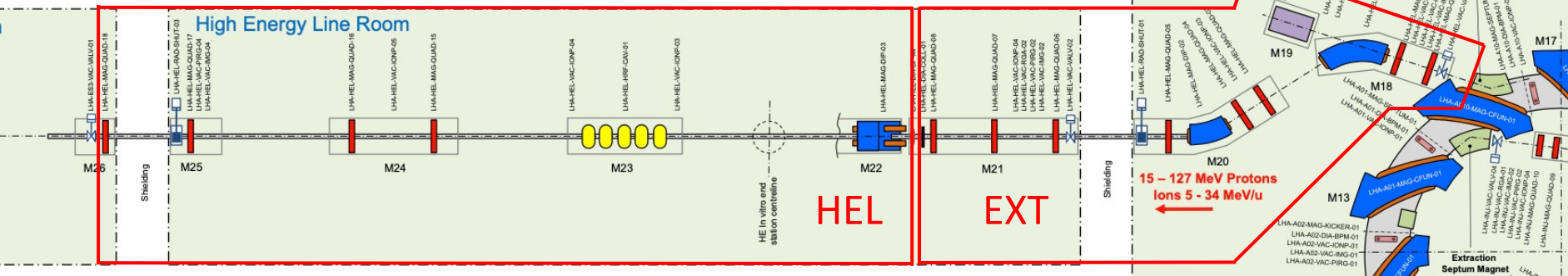
	Section	X	Y	Z	Component Position	Component Name	Component	
1	0							
2	0	STAGE1INVTRO Component List						
3	1	Document Name: lhara-v1.1 component coordinates						
4	2	22/11/2022						
5	3	Notes: Units = mm.						
7	0	TR	0	0	-100.000	Start	LHA_TR_MAG_DRI_00	drift
8	1	TR	0	0	-75.000	Middle	LHA_TR_MAG_DRI_00	drift
9	2	TR	0	0	-50.000	End	LHA_TR_MAG_DRI_00	drift
10	3	TR	0	0	-50.000	Start	LHA_TR_MAG_COL_01	ecol
11	4	TR	0	0	-25.000	Middle	LHA_TR_MAG_COL_01	ecol
12	5	TR	0	0	0	End	LHA_TR_MAG_COL_01	ecol
13	6	TR	0	0	0	Start	LHA_TR_MAG_DRI_01	drift
14	7	TR	0	0	75.000	Middle	LHA_TR_MAG_DRI_01	drift
15	8	TR	0	0	150.000	End	LHA_TR_MAG_DRI_01	drift
16	9	TR	0	0	150.000	Start	LHA_TR_MAG_SOL_01	solenoid
17	10	TR	0	0	578.500	Middle	LHA_TR_MAG_SOL_01	solenoid
18	11	TR	0	0	1007.000	End	LHA_TR_MAG_SOL_01	solenoid
19	12	TR	0	0	1007.000	Start	LHA_TR_MAG_DRI_02	drift
20	13	TR	0	0	1082.000	Middle	LHA_TR_MAG_DRI_02	drift
21	14	TR	0	0	1157.000	End	LHA_TR_MAG_DRI_02	drift
22	15	TR	0	0	1157.000	Start	LHA_TR_MAG_DRI_03	drift
23	16	TR	0	0	1232.000	Middle	LHA_TR_MAG_DRI_03	drift
24	17	TR	0	0	1307.000	End	LHA_TR_MAG_DRI_03	drift
25	18	TR	0	0	1307.000	Start	LHA_TR_MAG_SOL_02	solenoid
26	19	TR	0	0	1735.500	Middle	LHA_TR_MAG_SOL_02	solenoid
27	20	TR	0	0	2164.000	End	LHA_TR_MAG_SOL_02	solenoid
28	21	TR	0	0	2164.000	Start	LHA_TR_MAG_DRI_04	drift
29	22	TR	0	0	2239.000	Middle	LHA_TR_MAG_DRI_04	drift
30	23	TR	0	0	2314.000	End	LHA_TR_MAG_DRI_04	drift
31	24	LEL	0	0	2314.000	Start	LHA_LEL_HRF_CAV_01	cavity_pill
32	25	LEL	0	0	2564.000	Middle	LHA_LEL_HRF_CAV_01	cavity_pill
33	26	LEL	0	0	2814.000	End	LHA_LEL_HRF_CAV_01	cavity_pill

- Current beam line domains:

- TR: Target Room
- LEL: Low Energy Line
- ES1: Low Energy In Vitro End Station
- INJ: Injection line from LEL to FFA
- Axx: FFA Cell
- ES2: High Energy In Vitro End Station
- ES3: High Energy In Vivo End Station

- Proposed domains to be added:

- Option 1:
  - EXT: Extraction line from FFA to HEL
  - HEL: High Energy Line
- Option 2:
  - HEL: High Energy Line
- Option 3:?



- New component strength survey
- Updated component naming
- Strengths & units
- Lengths, cumulative length
- Stage 1 injection line contains Gabor Lens strengths for injection

AutoSave OFF | LhARAMagnetSurvey-v1.2 — Saved to my Mac

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B3 | Document Name: lhara-v1.2 EM Component Strengths

	A	B	C	D	E	F	G	H	I	J	K
2	0	STAGE1INVTRO Component List									
3	1	Document Name: lhara-v1.2 EM Component Strengths									
4	2	22/11/2022									
5	3	Notes: Length units = mm.									
6		Section	Cumulative Length	Component Name	Component Type	Length	Strength Parameter(s)	Strength Value(s)	Unit(s)	Tilt	Comments
7	0	TR	0.050	LHA_TR_MAG_DRI_00	drift	0.050					
8	1	TR	0.000	LHA_TR_MAG_COL_01	ecol	0.050					
9	2	TR	0.150	LHA_TR_MAG_DRI_01	drift	0.150					
10	3	TR	1.007	LHA_TR_MAG_SOL_01	solenoid	0.857	ks	2.560600	m^-1		
11	4	TR	1.157	LHA_TR_MAG_DRI_02	drift	0.150					
12	5	TR	1.307	LHA_TR_MAG_DRI_03	drift	0.150					
13	6	TR	2.164	LHA_TR_MAG_SOL_02	solenoid	0.857	ks	0.938149	m^-1		
14	7	TR	2.314	LHA_TR_MAG_DRI_04	drift	0.150					
15	8	LEL	2.814	LHA_LEL_HRF_CAV_01	cavity_pillbox	0.500	efield	0.000000	v		
16	9	LEL	2.964	LHA_LEL_MAG_DRI_01	drift	0.150					
17	10	LEL	3.821	LHA_LEL_MAG_SOL_01	solenoid	0.857	ks	1.448605	m^-1		
18	11	LEL	3.971	LHA_LEL_MAG_DRI_02	drift	0.150					
19	12	LEL	5.746	LHA_LEL_MAG_DRI_03	drift	1.775					
20	13	LEL	5.756	LHA_LEL_MAG_COL_01	ecol	0.010					
21	14	LEL	5.821	LHA_LEL_MAG_DRI_04	drift	0.065					
22	15	LEL	5.956	LHA_LEL_MAG_DRI_05	drift	0.135					
23	16	LEL	5.966	LHA_LEL_MAG_COL_02	ecol	0.010					
24	17	LEL	6.021	LHA_LEL_MAG_DRI_06	drift	0.055					
25	18	LEL	6.521	LHA_LEL_HRF_CAV_02	cavity_pillbox	0.500	efield	0.000000	v		
26	19	LEL	6.671	LHA_LEL_MAG_DRI_07	drift	0.150					
27	20	LEL	7.528	LHA_LEL_MAG_SOL_02	solenoid	0.857	ks	1.296400	m^-1		
28	21	LEL	7.678	LHA_LEL_MAG_DRI_08	drift	0.150					
29	22	LEL	7.778	LHA_LEL_MAG_DRI_09	drift	0.100					
30	23	LEL	7.928	LHA_LEL_MAG_DRI_10	drift	0.150					
31	24	LEL	8.785	LHA_LEL_MAG_SOL_03	solenoid	0.857	ks	1.128030	m^-1		
32	25	LEL	8.935	LHA_LEL_MAG_DRI_11	drift	0.150					
33	26	LEL	9.035	LHA_LEL_MAG_OCT_01	octupole	0.100	k3	0.000000	m^-4		
34	27	LEL	9.335	LHA_LEL_MAG_DRI_12	drift	0.300					
35	28	LEL	10.035	LHA_LEL_MAG_DIP_01_dr	drift	0.700					
36	29	LEL	10.535	LHA_LEL_MAG_DRI_13	drift	0.500					
37	30	LEL	10.555	LHA_LEL_MAG_COL_03	ecol	0.020					
38	31	LEL	10.755	LHA_LEL_MAG_DRI_14	drift	0.200					
39	32	LEL	11.555	LHA_LEL_MAG_DIP_02	sbend	0.800	angle	-0.785398	rad	-1.570796	
40	33	LEL	11.755	LHA_LEL_MAG_DRI_15	drift	0.200					
41	34	LEL	11.855	LHA_LEL_MAG_QUAD_01	quadrupole	0.100	k1	-22.544001	m^-2	-1.570796	
42	35	LEL	12.255	LHA_LEL_MAG_DRI_16	drift	0.400					
43	36	LEL	12.355	LHA_LEL_MAG_QUAD_02	quadrupole	0.100	k1	31.376801	m^-2	-1.570796	
44	37	LEL	12.355	LHA_LEL_MAG_DRI_17	drift	0.200					

Ready | Accessibility: Good to go | 100%

- GPTSolve – ongoing.
  - Aim reminder: optimise first & second Gabor Lens strengths to mitigate space charge induced emittance growth.
- Establishing limits (solenoid strengths, electron density).
  - 1.4T solenoid field limit – origin of value?
- Variable GL1 and GL2 strengths causes unavoidable GPT small time step error.
- Manually iterate GL2, vary GL1
- Struggling to achieve parallel beam with GL1 solenoid field  $< 1.46\text{T}$ .



- Done:
  - Models updated with Octupole, collimator & Gabor Lens strength corrections
    - Awaiting S2 Gabor lens strengths
  - Magnet strength survey
- Ongoing:
  - Update model components to match naming convention (mostly done)
    - Follow on from today's discussion
  - **AP:** GPT optimisation of capture section – gdfsolve
    - Establishing limits
    - Unavoidable GPT time step errors – optimisation limitation
    - Continuing (not super quick).
- Todo:
  - Identify locations for non-beam transport systems + add to model