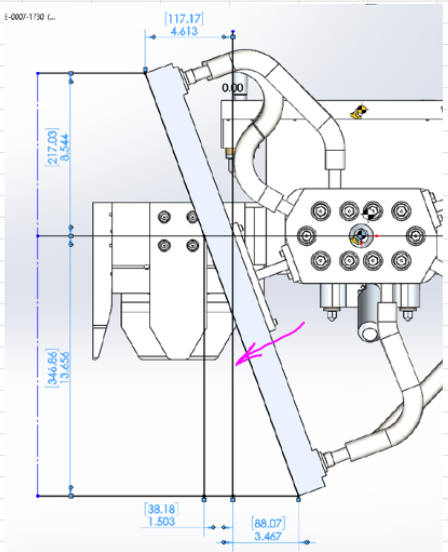
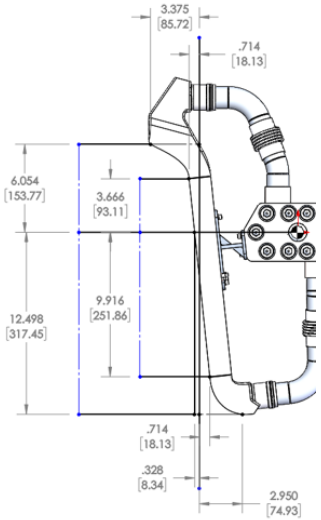
LISE++ *cute* ARIS Beam Dump utility

v.17.6
06/23/24

Adaptation of Marc's Excel sheets to the LISE Beam Dump dialog (Foster, Shane, Daniel, Oleg)

			616.5489																					
			591																					
	LongDist	616.5489	mm	longitudinal distance from SCD1 exit to beam dump along beam axis																				
		6	degree	angle of BD plane																				
	Bdangle	0.10472	rad	angle of BD plane																				
	Bdwidth	177.8	mm																					
	Bdcenter	115	mm																					
	Bdbottom	26.1	mm																					
	Bdtop	203.9	mm																					
											0	26.1												
											-173.46	26.1												
											-173.46	203.9												
											173.4098	203.9												
											173.4098	26.1												
											0	26.1												
	20-deg dump transverse	38.18	mm																					
	20-deg dump longitudinal	104.8987	mm																					
	6-deg dump transverse	8.34	mm																					
	6-deg dump longitudinal	79.3498	mm																					
	delta	25.54889	mm																					
	6-deg downstream straight longi	172.4598	mm																					
	6-deg upstream straight longi	172.5102	mm																					
	6-deg downstream straight plane	173.4098	mm	length along straight plane																				
	6-deg upstream straight plane	173.4604	mm	length along straight plane																				
											18.13155	-172.51	444.0387											
											-18.1263	172.4598	789.0087											

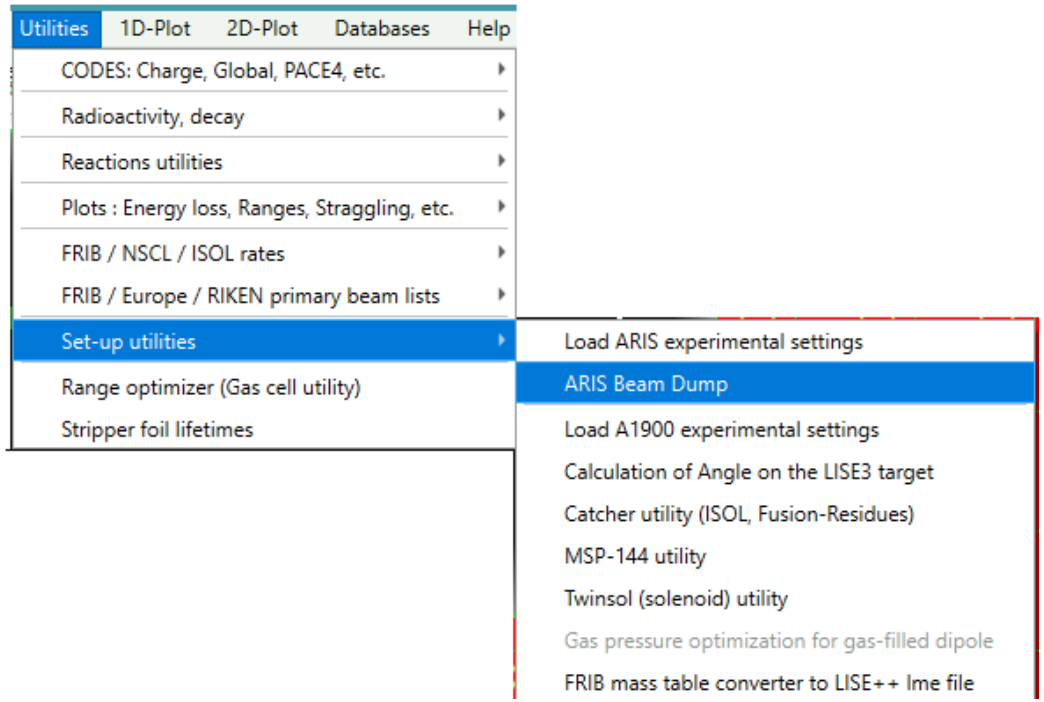


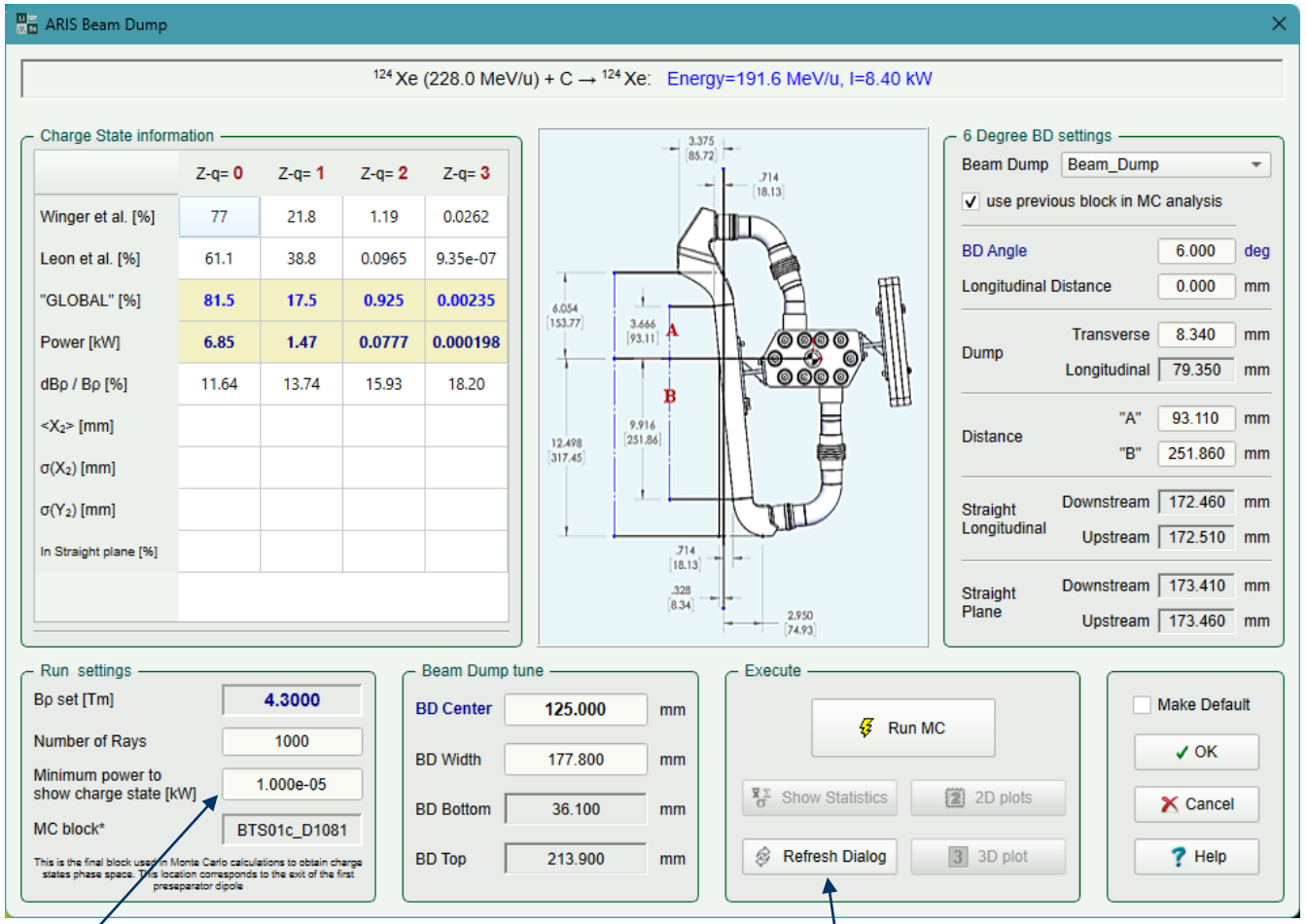


picture for top view: ..\..\21003\Replanning_2

Main | Beam on 6-deg plane | Beam projected on mid plane | Top View | Beam in plane normal to axis | Statistics | On BD | BD params | Data 54plus

ARIS Beam Dump Dialog



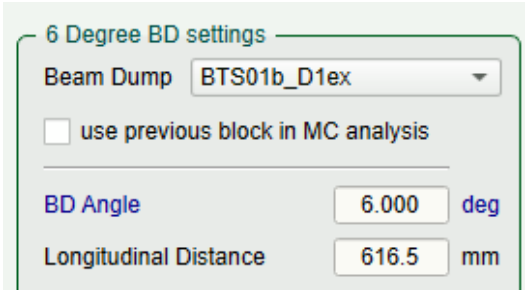


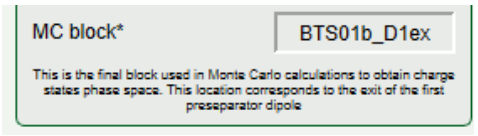
6 charge states are analyzed by the utility, only those above the threshold are shown in the dialogue

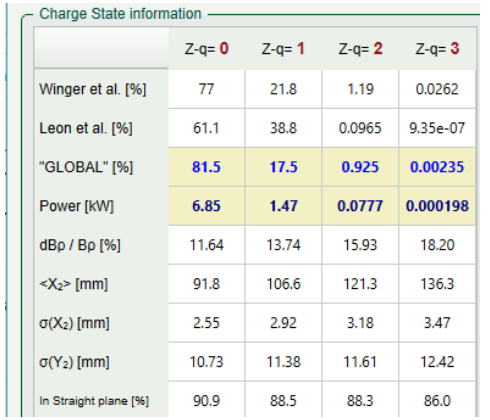
Refresh the dialog if you modify he main configuration (beam, target, optics, Brho)

Selection Block for MC

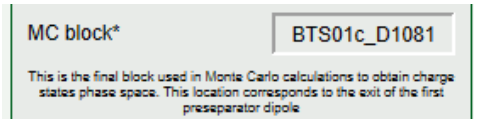
two different choices: answer one

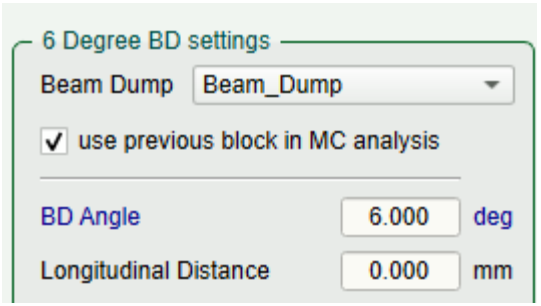


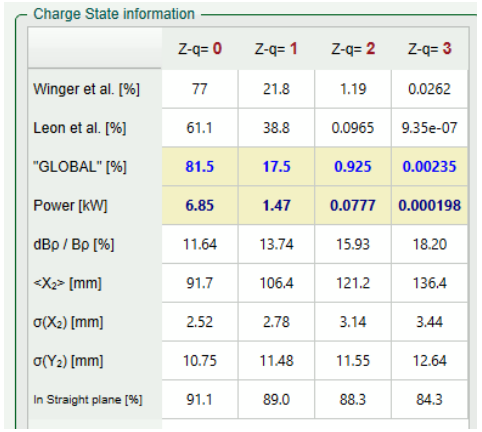




	Z-q= 0	Z-q= 1	Z-q= 2	Z-q= 3
Winger et al. [%]	77	21.8	1.19	0.0262
Leon et al. [%]	61.1	38.8	0.0965	9.35e-07
"GLOBAL" [%]	81.5	17.5	0.925	0.00235
Power [kW]	6.85	1.47	0.0777	0.000198
dBρ / Bρ [%]	11.64	13.74	15.93	18.20
<X_2> [mm]	91.8	106.6	121.3	136.3
σ(X_2) [mm]	2.55	2.92	3.18	3.47
σ(Y_2) [mm]	10.73	11.38	11.61	12.42
In Straight plane [%]	90.9	88.5	88.3	86.0







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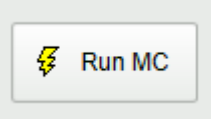
Power [kW]	6.85	1.47	0.0777	0.000198
dBρ / Bρ [%]	11.64	13.74	15.93	18.20
<X_2> [mm]	91.7	106.4	121.2	136.4
σ(X_2) [mm]	2.52	2.78	3.14	3.44
σ(Y_2) [mm]	10.75	11.48	11.55	12.64
In Straight plane [%]	91.1	89.0	88.3	84.3

MC calculates the transmission "AFTER" the selected block, so do not use the Beam Dump block directly.

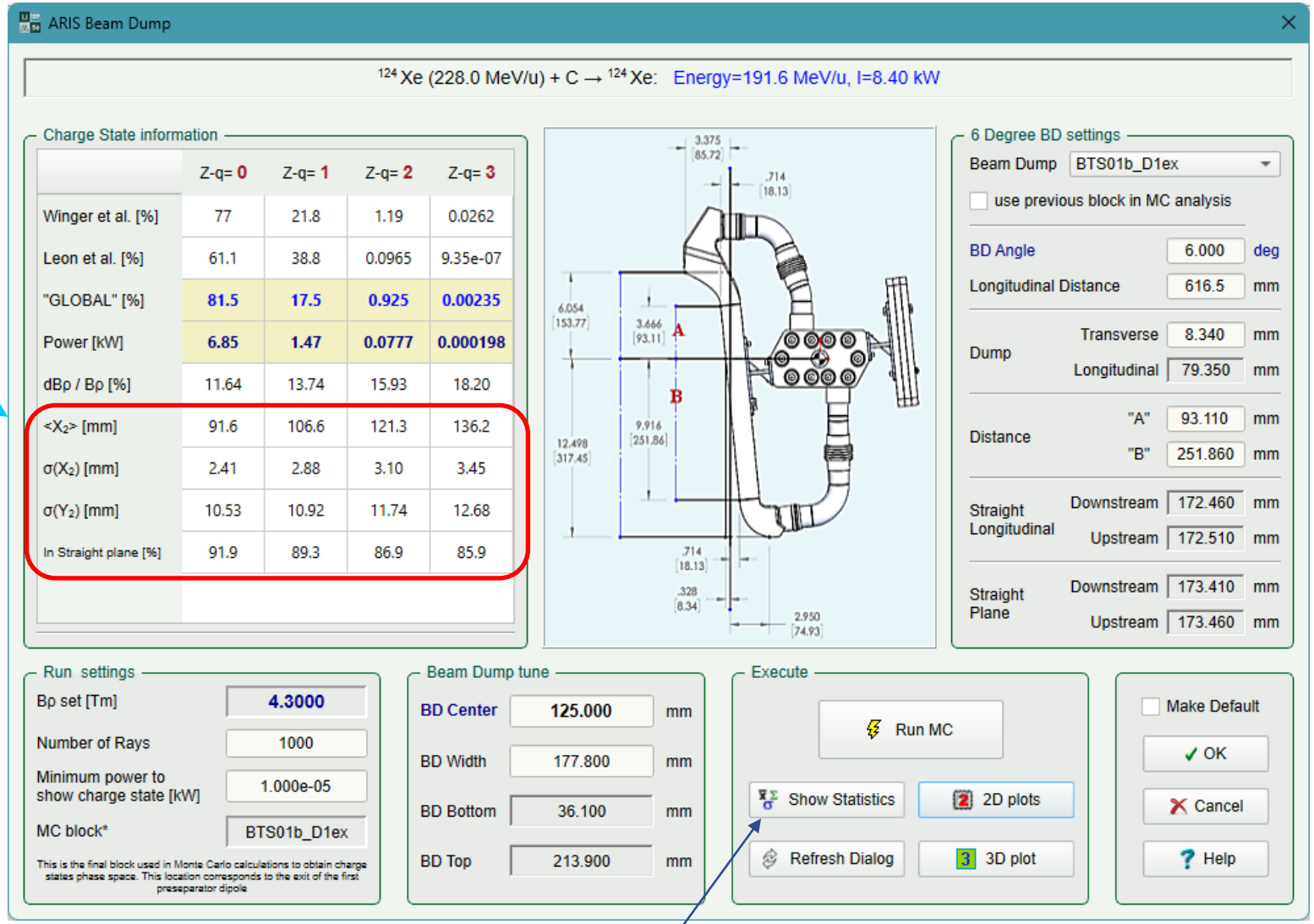
Run MC

It takes a couple seconds



Marc's Excel notations moved to C++

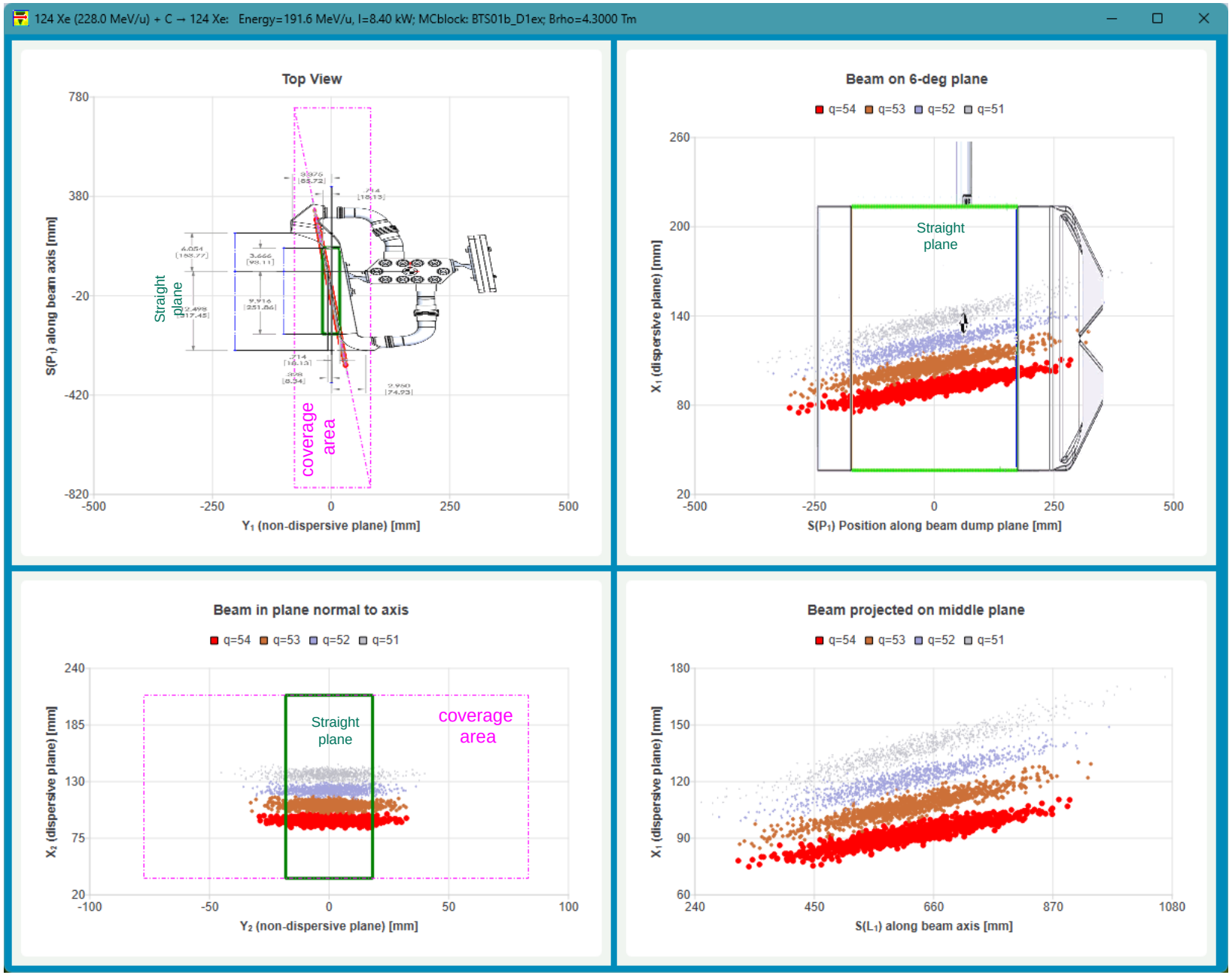
```
pointBD::pointBD(const pointMC& pMC)
{
  double angleRad = qDegreesToRadians(_BD.angle);

  double tanAr = qTan(angleRad);
  double tanXp = qTan(pMC.getXp()/1000.);
  double tanYp = qTan(pMC.getYp()/1000.);

  x0 = pMC.getX();
  a0 = pMC.getXp();

  l1 = (_BD.LongDist * tanAr - pMC.getY())/ ( tanYp + tanAr);
  p1 = (l1-_BD.LongDist)/qCos(angleRad);

  x1 =  pMC.getX() + l1 * tanXp;
  y1 =  pMC.getY() + l1 * tanYp;

  x2 =  pMC.getX() + _BD.LongDist * tanXp;
  y2 =  pMC.getY() + _BD.LongDist * tanYp;
}
```



Enabled (See the next slide)

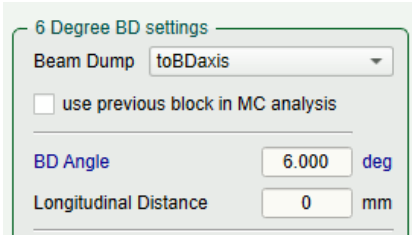
2D plots

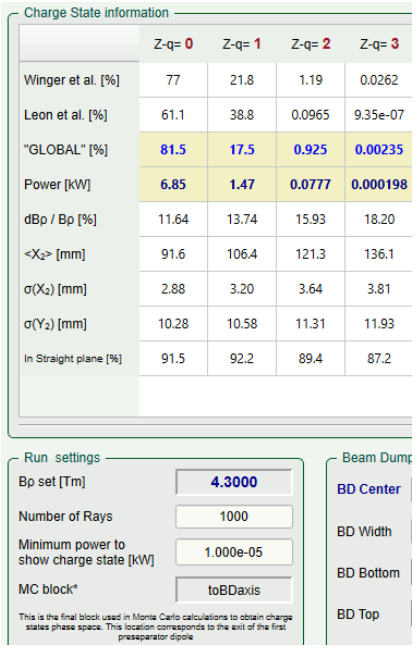
Segmented
LISE file

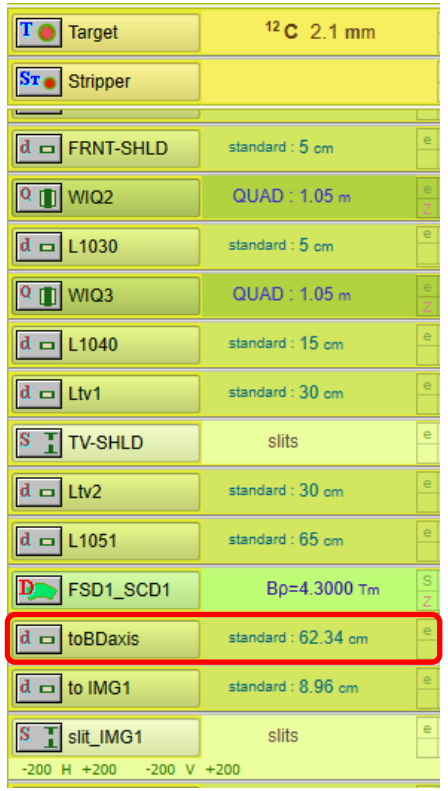


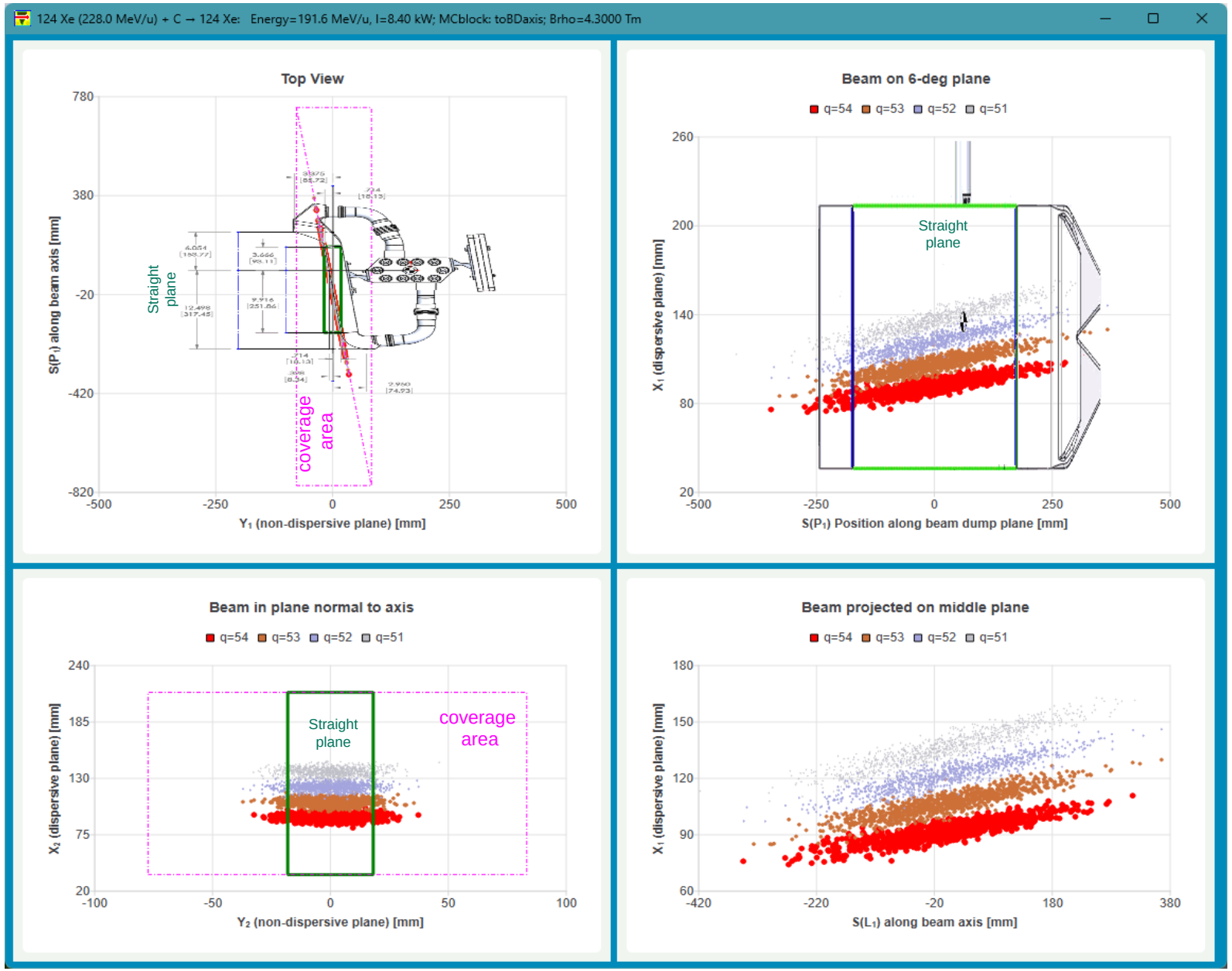
ARIS extended configuration

Extended
LISE file
5th order









MC results statistics

Segmented

Beam Dump MC statistics

Save As | Print | PrintView | Consolas

^{124}Xe (228.0 MeV/u) + C → ^{124}Xe: Energy=191.6 MeV/u, I=8.40 kW
MC block : **BTS01b_D1ex**; Bρ = **4.3000** Tm; MC high order = 5

q	54	53	52	51
Power [kW]	6.85e+00	1.47e+00	7.77e-02	1.98e-04
<A_0>	54.07	62.83	71.42	80.14
<L_1>	616.31	614.98	614.28	612.52
<P_1>	-0.19	-1.53	-2.23	-4.01
<X_0>	58.43	67.68	77.30	86.59
<X_1>	91.78	106.36	121.24	135.77
<X_2>	91.79	106.46	121.40	136.10
<Y_1>	0.02	0.16	0.23	0.42
<Y_2>	0.13	0.31	0.40	0.63
σ(A_0)	1.78	1.70	1.60	1.61
σ(L_1)	98.67	108.70	111.46	123.86
σ(P_1)	99.21	109.30	112.07	124.54
σ(X_0)	3.38	3.67	3.87	4.19
σ(X_1)	5.95	7.32	8.64	10.55
σ(X_2)	2.57	2.87	3.11	3.39
σ(Y_1)	10.37	11.42	11.71	13.02
σ(Y_2)	10.37	11.45	11.71	13.03

cov(X_0,A_0)	-4.89	-5.11	-5.08	-5.64
corr(X_0,A_0)	-0.81	-0.82	-0.82	-0.84
slope(X_0,A_0)	-0.43	-0.38	-0.34	-0.32
cov(P_1,X_1)	532.76	736.00	903.89	1245.21
corr(P_1,X_1)	0.90	0.92	0.93	0.95
slope(P_1,X_1)	0.05	0.06	0.07	0.08

L I S E ++ [C:\buffer_LAB_experiments\FRIB\e21049_124Xe\Beam_on_beam_dump\21049A_4.3Tm__PBtoBD.lpp]
03:23 06/24/2024

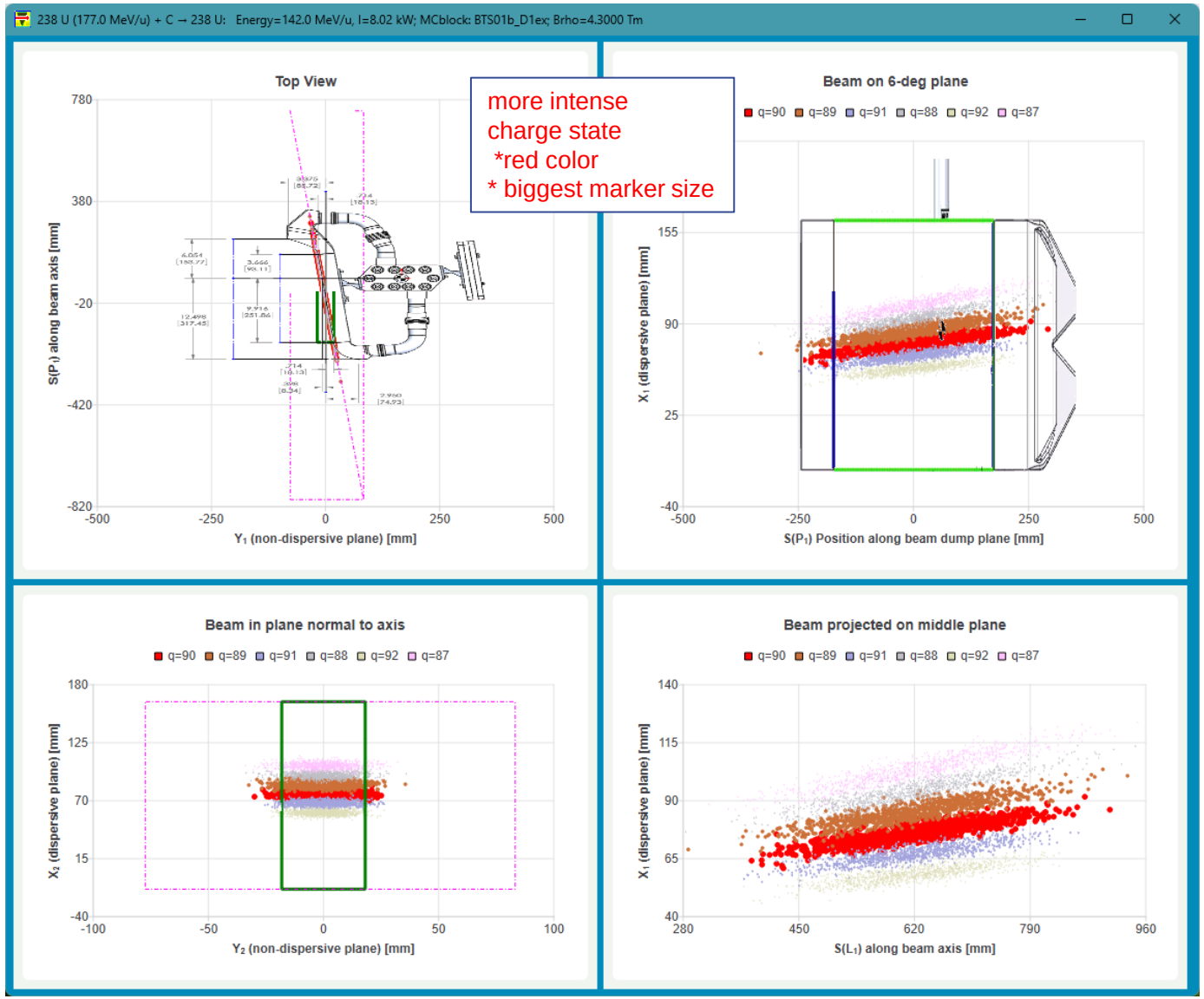
Extended

^{124}Xe (228.0 MeV/u) + C → ^{124}Xe: Energy=191.6 MeV/u, I=8.40 kW
MC block : **toBDaxis**; Bρ = **4.3000** Tm; MC high order = 5

q	54	53	52	51
Power [kW]	6.85e+00	1.47e+00	7.77e-02	1.98e-04
<A_0>	53.91	62.50	71.03	79.77
<L_1>	-2.82	0.31	3.28	-3.41
<P_1>	-2.84	0.31	3.30	-3.43
<X_0>	91.60	106.43	121.28	136.10
<X_1>	91.45	106.45	121.52	135.83
<X_2>	91.60	106.43	121.28	136.10
<Y_1>	0.30	-0.03	-0.35	0.36
<Y_2>	0.41	0.09	-0.19	0.53
σ(A_0)	1.84	1.76	1.71	1.68
σ(L_1)	97.68	100.68	107.84	113.44
σ(P_1)	98.22	101.23	108.44	114.07
σ(X_0)	2.88	3.20	3.64	3.81
σ(X_1)	5.92	7.11	8.39	9.78
σ(X_2)	2.88	3.20	3.64	3.81
σ(Y_1)	10.27	10.58	11.33	11.92
σ(Y_2)	10.28	10.58	11.31	11.93

L I S E ++ [C:\buffer_LAB_experiments\FRIB\e21049_124Xe\Beam_on_beam_dump\eC_124Xe_BeamDump_4.3Tm.lpp]

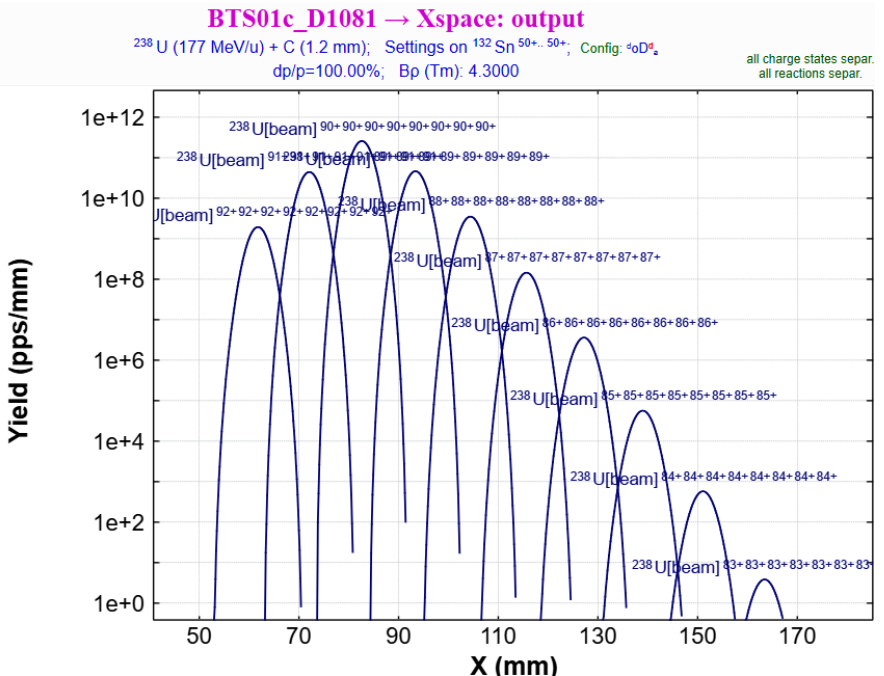
2D plots U-beam, 6 charge states



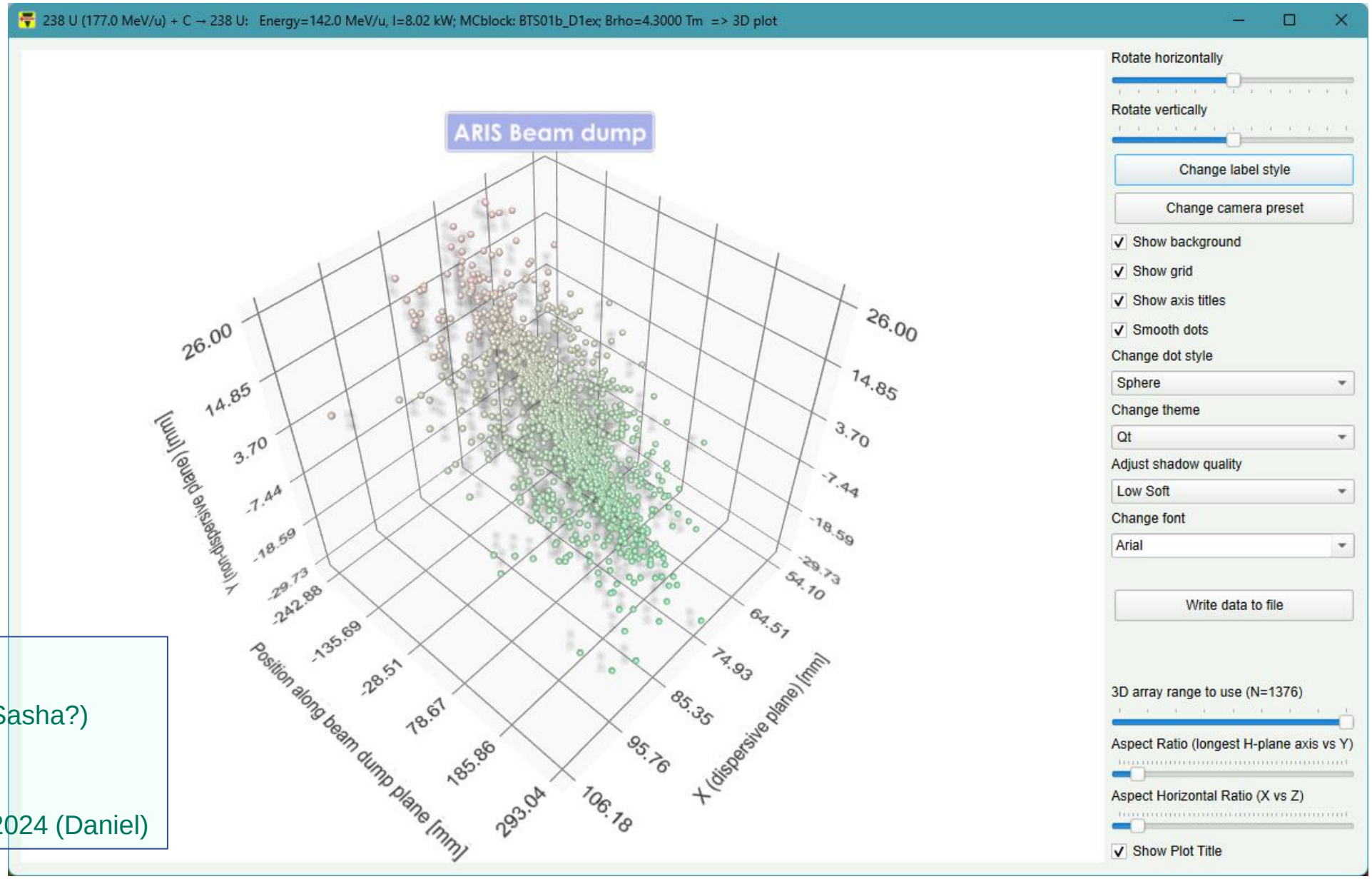
more intense
charge state
*red color
* biggest marker size

Charge State information

	Z-q= 0	Z-q= 1	Z-q= 2	Z-q= 3	Z-q= 4	Z-q= 5
Winger et al. [%]	0.00101	3.17	49.2	41.8	5.63	0.213
Leon et al. [%]	2.47	15.9	37.6	32.5	10.3	1.19
"GLOBAL" [%]	**0.537**	**12.4**	**72.8**	**13.2**	**1.01**	**0.0423**
Power [kW]	**0.0431**	**0.994**	**5.84**	**1.06**	**0.0812**	**0.00339**
dBρ / Bρ [%]	7.06	8.24	9.44	10.67	11.93	13.21
$<X_2>$ [mm]	58.0	66.9	75.8	85.0	93.7	102.8
$\sigma(X_2)$ [mm]	2.14	2.24	2.31	2.51	2.64	2.78
$\sigma(Y_2)$ [mm]	8.46	8.95	9.31	9.93	10.11	10.73
In Straight plane [%]	96.7	95.9	95.0	93.3	92.6	90.5



3D plot



Next steps

- 3D objects implementation (Sasha?)
- OpenGL (Sasha?)
- Beam Dump poster on DNP2024 (Daniel)

Keeping Beam Dump information in LISE files

Option file (*.lopt)

```
[BeamDump]
distTransverse=8.34
LongDist=616.5
distA=93.11
distB=251.86
Width=177.8
Center=75
angle=6
minPower=1e-05
Nrays=1000
blockName=BTS01b_D1ex
usePrevious=false
```

LISE file (*.lpp)

```
[finger]
 Diffuseness = 0.01
 Suppression = 1e+12
 BeamDumpBlock = BTS01b_D1ex
 BD_LongDistance = 616.5
 BD_usePrevious = 0
```