

Commissioning of a photocathode and interaction laser system at RadiaBeam

Compact Inverse Compton Light Source

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This work was supported by DARPA project HR001120C0072

Laser system global overview





- C-band hybrid RF photoinjector for a compact 100 MeV-class source for inverse Compton scattering
- Photoinjector accelerates electrons up to 4.5MeV,
 <0.8mm.mrad transverse emittance, >200A peak current
- Two C-band linacs (5.712GHz)





Laser system in three parts:

The laser cleanroom, where the source of both UV and IR laser is installed.







Laser system in three parts:

The low vacuum transport at ~10⁻³mbar, only composed of 3" mirrors.







Laser system in three parts:

The bunker, where laser breadboard, imaging setup and diagnostics are installed.







IR and UV lasers

Single bunch operation







Laser simulations done with Zemax OpticStudio.

- Ability to create lenses ٠ corresponding to catalogues
- Compute beam size as a • function of the beam parameters and optics used
- Generate a cross-section ٠ view of the optical system



Sui	Comment	Radius	Thickness	Material	Coating	Clear Semi-Dia	Chip Zone	Mech Semi-Dia	Mixed	Mode results for	M2 = 1.18
) Stan	Iris	Infinity	50.000			2.500	0.000	2.500			
1 Stan		Infinity	624.160			2.500 U	0.000	2.500 U	Sur	Size	Waist
2 Stan		Infinity	2500.000			2.500 U	0.000	2.500 U	OBJ	2.49845E+00	2.498
3 Stan	Delay line	Infinity	488.700			2.500 U	0.000	2.500 U	1	2.49844E+00	2.49
4 Stan	Front div lens	100.000	3.000	F_SILICA		12.700 U	0.000	12.700 U	2	2.50031E+00	2.49
5 Stan	Beam expander length	33.700	248.749			3.242	0.000	12.700	510	2.54464E+00	2.49
6 Stan	Front conv lens	100.100	5.100	F_SILICA		25.400 U	0.000	25.400 U	5	2.53654E+00	1.72
7 Stan	End of table	279.100	100.000			22.860 U	0.000	25.400	6	8.10495F+00	2.75
8 Stan	Vacuum input	Infinity	846.100			10.635	0.000	10.635	7	8,05553E+00	3.63
Stan	1st mirror	Infinity	304.800			9.605	0.000	9.605	8	7.94911E+00	3.63
10 Stan	2nd mirror	Infinity	3390.900			9.234	0.000	9.234	9	7.04882E+00	3.63
11 Stan	3rd mirror	Infinity	317.500			5.108	0.000	5.108	10	6.72457E+00	3.63
12 Stan	4th mirror	Infinity	3556.000			4.722	0.000	4.722	11	3.12364E+00	3.63
13 Stan	Iris	Infinity	0.000			1.984	0.000	1.984	12	2.78798E+00	3.63
14 Stan	Iris to telescope	Infinity	500.000			1.984	0.000	1.984	13	1.08644E+00	3.63
15 Stan	Front div lens	100.000	3.000	F SILICA		2.564	0.000	2.564	14	1.08644E+00	3.63
16 Stan	Beam expander length	50.200	1119.235	-		2.542	0.000	2.564	15	1.59840E+00 1.58566E±00	0.2/
17 Stan	Front conv lens	100.100	5.100	F SILICA		22.000 U	0.000	22.000 U	17	1.06097E+01	9.76
18 Stan	Conv to injection	279.100	120.000	-		22.000 U	0.000	22.000	18	1.04702E+01	1.70
19 Stan	,	Infinity	0.000			11.972	0.000	11.972	19	7.73974E+00	1.70
20 Stan	Accelerator window	Infinity	118,560			11.972	0.000	11.972	20	7.73974E+00	1.70
21 Stan	Mirror	Infinity	221,250			7.679	0.000	7.679	21	5.04201E+00	1.70
2 Stan	Interaction region 20 µm	Infinity	221,250			0.333	0.000	0.333	22	1.86277E-02	1.70
3 Stan	Mirror	Infinity	118,560			8.344	0.000	8.344	23	5.02679E+00	1.70
24 Stan	Output window	Infinity	0.000			12 637	0.000	12 637	24	7.72452E+00	1.70
25 Stan	Diagnostics	Infinity	0.000			0.000 11	0.000	0.000	IMA	7.72452E+00	1.70

500 U	Sur	Size	Waist	Position
500 11	OBJ	2.49845E+00	2.49844E+00	-5.00000E+01
500 0	1	2.49844E+00	2.49844E+00	0.00000E+00
300 0	2	2.50031E+00	2.49844E+00	6.24160E+02
700 0	STO	2.54484E+00	2.49844E+00	3.12416E+03
700	4	2.56031E+00	3.36715E-02	-3.23094E+02
.400 U	5	2.53654E+00	1.72821E-02	1.13307E+02
400	6	8.10495E+00	2.75283E-02	-8.36256E+02
635	7	8.05553E+00	3.63162E-01	-7.55411E+03
.605	8	7.94911E+00	3.63162E-01	-7.45411E+03
234	9	7.04882E+00	3.63162E-01	-6.60801E+03
108	10	6.72457E+00	3.63162E-01	-6.30321E+03
722	11	3.12364E+00	3.63162E-01	-2.91231E+03
004	12	2.78798E+00	3.63162E-01	-2.59481E+03
.504	13	1.08644E+00	3.63162E-01	9.61190E+02
.984	14	1.08644E+00	3.63162E-01	9.61190E+02
.564	15	1.59840E+00	6.27959E-02	-3.75917E+02
.564	16	1.58566E+00	4.79802E-02	1.96564E+02
.000 U	17	1.06097E+01	9.76035E-03	-3.88131E+02
000	18	1.04702E+01	1.70023E-02	-4.60144E+02
972	19	7.73974E+00	1.70023E-02	-3.40144E+02
972	20	7.73974E+00	1.70023E-02	-3.40144E+02
679	21	5.04201E+00	1.70023E-02	-2.21584E+02
333	22	1.86277E-02	1.70023E-02	-3.34450E-01
244	23	5.02679E+00	1.70023E-02	2.20916E+02
.544	24	7.72452E+00	1.70023E-02	3.39476E+02
.b3/	IMA	7,72452E+00	1.70023E-02	3.39476E+02



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- Ability to create lenses ٠ corresponding to catalogues
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0	Stan	Iris	Infinity	50.000			2.500	0.000	2.500			
1	Stan		Infinity	624.160			2.500 U	0.000	2.500 U	Sur	Size	1
2	Stan		Infinity	2500.000			2.500 U	0.000	2.500 U	OBJ	2.49845E+00	
3	Stan	Delay line	Infinity	488.700			2.500 U	0.000	2.500 U	1	2.49844E+00	
4	Stan	Front div lens	100.000	3.000	F_SILICA		12.700 U	0.000	12.700 U	2 6 T O	2.50031E+00	
5	Stan	Beam expander length	33.700	248.749			3.242	0.000	12.700	310	2.54464E+00 2.56031E±00	
6	Stan	Front conv lens	100.100	5.100	F_SILICA		25.400 U	0.000	25.400 U	5	2.53654E+00	
7	Stan	End of table	279.100	100.000			22.860 U	0.000	25.400	6	8,10495E+00	
8	Stan	Vacuum input	Infinity	846.100			10.635	0.000	10.635	7	8.05553E+00	
9	Stan	1st mirror	Infinity	304.800			9.605	0.000	9.605	8	7.94911E+00	
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11	Stan	3rd mirror	Infinity	317.500			5.108	0.000	5.108	10	6.72457E+00	
12	Stan	4th mirror	Infinity	3556.000			4.722	0.000	4.722	11	3.12364E+00	
13	Stan	Iris	Infinity	0.000			1.984	0.000	1.984	12	2.78798E+00	
14	Stan	Iris to telescope	Infinity	500.000			1.984	0.000	1.984	13	1.08644E+00	
15	Stan	Front div lens	100.000	3.000	F_SILICA		2.564	0.000	2.564	14	1.08044E+00 1.50840E+00	
16	Stan	Beam expander length	50.200	1119.235			2.542	0.000	2.564	16	1.59540L+00	
17	Stan	Front conv lens	100.100	5.100	F_SILICA		22.000 U	0.000	22.000 U	17	1.06097F+01	
18	Stan	Conv to injection	279.100	120.000			22.000 U	0.000	22.000	18	1.04702E+01	
19	Stan		Infinity	0.000			11.972	0.000	11.972	19	7.73974E+00	
20	Stan	Accelerator window	Infinity	118.560			11.972	0.000	11.972	20	7.73974E+00	
21	Stan	Mirror	Infinity	221.250			7.679	0.000	7.679	21	5.04201E+00	
22	Stan	Interaction region 20 µm	Infinity	221.250			0.333	0.000	0.333	22	1.86277E-02	
23	Stan	Mirror	Infinity	118.560			8.344	0.000	8.344	23	5.02679E+00	
24	Stan	Output window	Infinity	0.000			12.637	0.000	12.637	24	7.72452E+00	
25	Stan	Diagnostics	Infinity				0.000 U	0.000	0.000	TWA	7.72452E+00	

= 1.1800:

2500 0 0BJ 2.49845E+00 2.49844E+00 -5.00000E+01 2500 0 2 2.9845E+00 2.49844E+00 -5.00000E+01 2500 2 2.50031E+00 2.49844E+00 6.24160E+02 2700 2 2.50031E+00 2.49844E+00 6.24160E+02 2700 2 2.50031E+00 2.49844E+00 6.24160E+02 2700 4 2.56031E+00 3.6715E-02 -3.23094E+02 5400 6 8.10495E+00 2.75283E-02 -8.36256E+02 6535 7 8.05553E+00 3.63162E-01 -7.55411E+03 9.605 8 7.94911E+00 3.63162E-01 -6.60801E+03 5.108 10 6.72457E+00 3.63162E-01 -2.91231E+03 7.108 11 3.12364E+00 3.63162E-01 -2.9481E+03 1.984 12 2.78798E+00 3.63162E-01 -2.91231E+03 1.984 13 1.08644E+00 3.63162E-01 -2.9481E+03 1.984 14 <th0.8646e+00< th=""></th0.8646e+00<>	2 5 0 0		Size	Waist	Position
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5 2.53654E+00 1.7287E+02 1.13307E+02 6 8.10495E+00 2.75283E+02 -8.36256E+02 0.635 7 8.05553E+00 3.63162E+01 -7.55411E+03 9.605 8 7.94911E+00 3.63162E+01 -7.55411E+03 9.234 9 7.04882E+00 3.63162E+01 -6.60801E+03 5.108 10 6.72457E+00 3.63162E+01 -2.91231E+03 4.722 11 3.12364E+00 3.63162E+01 -2.91231E+03 1.984 12 2.78798E+00 3.63162E+01 -2.91231E+03 1.984 13 1.08644E+00 3.63162E+01 9.61190E+02 2.564 16 1.59840E+00 6.27959E+02 -3.75917E+02 2.564 16 1.58566E+00 4.79802E+02 1.96564E+02 2.000 18 1.04702E+01 1.70023E+02 -3.40144E+02 1.972 19 7.73974E+00 1.70023E+02 -3.40144E+02 3.033 22 1.86277E+02 1.70023E+02 -3.40144E+02	5 400	4	2.56031E+00	3.30/15E-02	-3.23094E+02
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0.635 7 8.05553E+00 3.63162E-01 -7.55411E+03 9.605 8 7.94911E+00 3.63162E-01 -7.45411E+03 9.234 9 7.04882E+00 3.63162E-01 -6.60801E+03 5.108 10 6.72457E+00 3.63162E-01 -6.30321E+03 1.722 11 3.12364E+00 3.63162E-01 -2.91231E+03 1.984 13 1.08644E+00 3.63162E-01 -2.59481E+03 1.984 14 1.08644E+00 3.63162E-01 -2.59481E+03 1.984 14 1.08644E+00 3.63162E-01 -2.59481E+03 1.984 14 1.08644E+00 3.63162E-01 -9.61190E+02 2.564 15 1.59840E+00 6.27959E-02 -3.75917E+02 2.664 16 1.58566E+00 4.79802E-02 1.96564E+02 2.000 18 1.04702E+01 1.70023E-02 -3.40144E+02 1.972 19 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.700	5.400	6	8.10495E+00	2./5283E-02	-8.36256E+02
9.605 8 7.94911E+00 3.63162E-01 -7.45411E+03 9.234 9 7.04882E+00 3.63162E-01 -6.60801E+03 5.108 10 6.72457E+00 3.63162E-01 -6.30321E+03 4.722 11 3.12364E+00 3.63162E-01 -2.91231E+03 1.984 13 1.08644E+00 3.63162E-01 -2.59481E+03 1.984 13 1.08644E+00 3.63162E-01 9.61190E+02 2.564 14 1.08644E+00 3.63162E-01 9.61190E+02 2.564 15 1.59840E+00 6.27959E-02 -3.75917E+02 2.564 16 1.58566E+00 4.79802E-02 1.96564E+02 2.000 17 1.06097E+01 9.76035E-03 -3.88131E+02 2.000 18 1.04702E+01 1.70023E-02 -4.60144E+02 1.972 19 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.7002	0.635	7	8.05553E+00	3.63162E-01	-7.55411E+03
9.234 9 7.04882E+00 3.63162E-01 -6.60801E+03 5.108 10 6.72457E+00 3.63162E-01 -6.30321E+03 4.722 11 3.12364E+00 3.63162E-01 -2.91231E+03 1.984 12 2.78798E+00 3.63162E-01 -2.91231E+03 1.984 13 1.08644E+00 3.63162E-01 9.61190E+02 1.984 14 1.08644E+00 3.63162E-01 9.61190E+02 2.564 15 1.59840E+00 6.27959E-02 -3.75917E+02 2.564 16 1.5856E+00 4.79802E-02 1.96564E+02 2.000 17 1.06097E+01 9.76035E-03 -3.88131E+02 2.000 18 1.04702E+01 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 21 5.04201E+00 1.70023E-02 -3.40144E+02 0.333 22 1.86277E-02 1.70023E-02 -3.34450E-01 0.333 23 5.02679E+00 1.7002	9.605	8	7.94911E+00	3.63162E-01	-7.45411E+03
5.108 10 6.72457E+00 3.63162E-01 -6.30321E+03 4.722 11 3.12364E+00 3.63162E-01 -2.91231E+03 1.984 12 2.78798E+00 3.63162E-01 -2.91231E+03 1.984 13 1.08644E+00 3.63162E-01 -2.91231E+03 1.984 14 1.08644E+00 3.63162E-01 9.61190E+02 2.564 15 1.59840E+00 6.27959E-02 -3.75917E+02 2.564 16 1.88566E+00 4.79802E-02 1.96564E+02 2.000 17 1.06097E+01 9.76035E-03 -3.88131E+02 2.000 18 1.04702E+01 1.70023E-02 -3.40144E+02 1.972 19 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 7.679 21 5.04201E+00 1.70023E-02 -3.4450E-01 0.333 22 1.86277E-02 1.70023E-02 -3.34450E-01 0.333 23 5.02679E+00 1.70	9.234	9	7.04882E+00	3.63162E-01	-6.60801E+03
4.722 11 3.12364E+00 3.63162E-01 -2.91231E+03 1.984 12 2.78798E+00 3.63162E-01 -2.59481E+03 1.984 13 1.08644E+00 3.63162E-01 -2.59481E+03 1.984 13 1.08644E+00 3.63162E-01 9.61190E+02 2.564 14 1.8664E+00 6.27959E-02 -3.75917E+02 2.564 15 1.59840E+00 6.27959E-02 -3.75917E+02 2.664 16 1.58566E+00 4.79802E-02 1.96564E+02 2.000 17 1.06097E+01 9.76035E-03 -3.88131E+02 2.000 18 1.04702E+01 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 0.333 22 1.86277E-02 1.70023E-02 -3.4450E-01 0.333 23 5.02679E+00 1.700	5.108	10	6.72457E+00	3.63162E-01	-6.30321E+03
12 2.78798E+00 3.63162E-01 -2.59481E+03 1984 13 1.08644E+00 3.63162E-01 9.61190E+02 1984 14 1.08644E+00 3.63162E-01 9.61190E+02 2564 14 1.08644E+00 3.63162E-01 9.61190E+02 2564 15 1.59840E+00 6.27959E-02 1.96564E+02 2000 17 1.06097E+01 9.76035E-03 -3.88131E+02 2000 18 1.04702E+01 1.70023E-02 -3.40144E+02 1.972 19 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 21 5.04201E+00 1.70023E-02 -3.40144E+02 1.972 21 5.04201E+00 1.70023E-02 -3.40144E+02 0.333 22 1.86277E-02 1.70023E-02 -3.34450E-01 0.333 23 5.02679E+00 1.70023E-02 3.394	4 722	11	3.12364E+00	3.63162E-01	-2.91231E+03
13 1.08644E+00 3.63162E-01 9.61190E+02 1.984 14 1.08644E+00 3.63162E-01 9.61190E+02 2.564 15 1.59840E+00 6.27959E-02 -3.75917E+02 2.564 16 1.58566E+00 4.79802E-02 1.96564E+02 2.000 17 1.06097E+01 9.76035E-03 -3.88131E+02 2.000 18 1.04702E+01 1.70023E-02 -4.60144E+02 1.972 19 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 0.333 22 1.86277E-02 1.70023E-02 -3.40144E+02 0.333 23 5.02679E+00 1.70023E-02 -3.34450E-01 8.344 24 7.72452E+00 1.70023E-02 3.39476E+02 2.637 IMA 7.72452E+00 1.70023E-02 3.39476E+02	1.004	12	2.78798E+00	3.63162E-01	-2.59481E+03
1384 14 1.08644E+00 3.63162E-01 9.61190E+02 2.564 15 1.59840E+00 6.27959E-02 -3.75917E+02 2.564 16 1.58566E+00 4.79802E-02 1.96564E+02 2.000 17 1.06097E+01 9.76035E-03 -3.88131E+02 2.000 18 1.04702E+01 1.70023E-02 -3.40144E+02 1.972 19 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 7.679 21 5.04201E+00 1.70023E-02 -3.4458E+01 0.333 22 1.86277E-02 1.70023E-02 -3.34458E+01 8.344 24 7.72452E+00 1.70023E-02 3.39476E+02 2.637 IMA 7.72452E+00 1.70023E-02 3.39476E+02	1.904	13	1.08644E+00	3.63162E-01	9.61190E+02
2.564 15 1.59840E+00 6.27959E-02 -3.75917E+02 2.564 16 1.58566E+00 4.79802E-02 1.96564E+02 2.000 17 1.06097E+01 9.76035E-03 -3.88131E+02 2.000 18 1.04702E+01 1.70023E-02 -4.60144E+02 1.972 19 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 7.679 21 5.04201E+00 1.70023E-02 -3.4454E+02 0.333 22 1.86277E-02 1.70023E-02 -3.34450E-01 8.344 24 7.72452E+00 1.70023E-02 3.39476E+02 2.637 IMA 7.72452E+00 1.70023E-02 3.39476E+02	1.984	14	1.08644E+00	3.63162E-01	9.61190E+02
2.564 16 1.58566E+00 4.79802E-02 1.96564E+02 2.000 17 1.06097E+01 9.76035E-03 -3.88131E+02 2.000 18 1.04702E+01 1.70023E-02 -4.60144E+02 1.972 19 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 0.333 22 1.86277E-02 1.70023E-02 -3.34450E-01 0.333 22 1.86277E-02 1.70023E-02 -3.34450E-01 8.344 24 7.72452E+00 1.70023E-02 3.39476E+02 2.637 IMA 7.72452E+00 1.70023E-02 3.39476E+02	2.564	15	1,59840E+00	6.27959E-02	-3.75917E+02
2.000 U 17 1.06097E+01 9.76035E-03 -3.88131E+02 2.000 18 1.04702E+01 1.70023E-02 -4.60144E+02 1.972 19 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 7.679 21 5.04201E+00 1.70023E-02 -2.21584E+02 0.333 22 1.86277E-02 1.70023E-02 -3.34450E-01 8.344 23 5.02679E+00 1.70023E-02 2.20916E+02 2.637 IMA 7.72452E+00 1.70023E-02 3.39476E+02	2.564	16	1.58566E+00	4.79802E-02	1.96564E+02
2.000 18 1.04702E+01 1.70023E-02 -4.60144E+02 1.972 19 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 7.679 21 5.04201E+00 1.70023E-02 -2.21584E+02 0.333 22 1.86277E-02 1.70023E-02 -3.4450E-01 8.344 23 5.02679E+00 1.70023E-02 2.20916E+02 2.637 IMA 7.72452E+00 1.70023E-02 3.39476E+02	2.000	U 17	1.06097E+01	9.76035E-03	-3.88131E+02
1.972 19 7.73974E+00 1.70023E-02 -3.40144E+02 1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 7.679 21 5.04201E+00 1.70023E-02 -2.21584E+02 0.333 22 1.86277E-02 1.70023E-02 -3.34450E-01 8.344 23 5.02679E+00 1.70023E-02 2.0916E+02 2.637 IMA 7.72452E+00 1.70023E-02 3.39476E+02	2.000	18	1.04702E+01	1.70023E-02	-4.60144E+02
1.972 20 7.73974E+00 1.70023E-02 -3.40144E+02 7.679 21 5.04201E+00 1.70023E-02 -2.21584E+02 0.333 22 1.86277E-02 1.70023E-02 -3.34450E-01 8.344 23 5.02679E+00 1.70023E-02 3.39476E+02 2.637 IMA 7.72452E+00 1.70023E-02 3.39476E+02	1.972	19	7.73974E+00	1.70023E-02	-3.40144E+02
7.679 21 5.04201E+00 1.70023E-02 -2.21584E+02 0.333 22 1.86277E-02 1.70023E-02 -3.34450E-01 8.344 23 5.02679E+00 1.70023E-02 2.20916E+02 8.344 24 7.72452E+00 1.70023E-02 3.39476E+02 2.637 IMA 7.72452E+00 1.70023E-02 3.39476E+02	1.972	20	7.73974E+00	1.70023E-02	-3.40144E+02
22 1.86277E-02 1.70023E-02 -3.34450E-01 0.333 23 5.02679E+00 1.70023E-02 2.20916E+02 8.344 24 7.72452E+00 1.70023E-02 3.39476E+02 2.637 IMA 7.72452E+00 1.70023E-02 3.39476E+02	7 679	21	5.04201E+00	1.70023E-02	-2.21584E+02
23 5.02679E+00 1.70023E-02 2.20916E+02 8.344 24 7.72452E+00 1.70023E-02 3.39476E+02 2.637 IMA 7.72452E+00 1.70023E-02 3.39476E+02	0.222	22	1.86277E-02	1.70023E-02	-3.34450E-01
8.344 24 7.72452E+00 1.70023E-02 3.39476E+02 2.637 IMA 7.72452E+00 1.70023E-02 3.39476E+02	0.555	23	5.02679E+00	1.70023E-02	2.20916E+02
2.637 IMA 7.72452E+00 1.70023E-02 3.39476E+02	ö.344	24	7.72452E+00	1.70023E-02	3.39476E+02
	2.637	IMA	7.72452E+00	1.70023E-02	3.39476E+02



Position

-5.00000E+01

0.00000E+00

6.24160E+02

3.12416E+03

-3.23094E+02

1.13307E+02

-8.36256E+02

-7.55411E+03

-7.45411E+03

-6.60801E+03

-6.30321E+03

-2.91231E+03

-2.59481E+03

9.61190E+02

9.61190E+02

-3,75917E+02

1.96564E+02 -3.88131E+02

-4.60144E+02

-3.40144E+02

-3.40144E+02

-2.21584E+02

-3.34450E-01

2.20916E+02

3.39476E+02 3.39476E+02

Laser simulations done with <u>Zemax OpticStudio</u>.

- Ability to create lenses
 corresponding to catalogues
- Compute beam size as a function of the beam parameters and optics used
- Generate a cross-section
 view of the optical system



	Sui	Comment	Radius	Thickness	Material	Coating	Clear Semi-Dia	Chip Zone	Mech Semi-Dia	Mixed	Mode results fo	r M2 = 1.1800:
0	Stan	Iris	Infinity	50.000			2.500	0.000	2.500			
1	Stan		Infinity	624.160			2.500 U	0.000	2.500 U	Sur	Size	Waist
2	Stan		Infinity	2500.000			2.500 U	0.000	2.500 U	OBJ	2.49845E+00	2.49844E+0
3	Stan	Delay line	Infinity	488.700			2.500 U	0.000	2.500 U	1	2.49844E+00	2.49844E+0
4	Stan	Front div lens	100.000	3.000	F_SILICA		12.700 U	0.000	12.700 U	2	2.50031E+00	2.49844E+6
5	Stan	Beam expander length	33.700	248.749			3.242	0.000	12.700	510	2.54484E+00 2.56021E±00	2.49844E+0
6	Stan	Front conv lens	100.100	5.100	F_SILICA		25.400 U	0.000	25.400 U	4	2.50051E+00 2.53654E+00	1 72821E-0
7	Stan	End of table	279.100	100.000			22.860 U	0.000	25.400	6	8.10495E+00	2.75283E-0
8	Stan	Vacuum input	Infinity	846.100			10.635	0.000	10.635	7	8.05553E+00	3.63162E-0
9	Stan	1st mirror	Infinity	304.800			9.605	0.000	9.605	8	7.94911E+00	3.63162E-0
10	Stan	2nd mirror	Infinity	3390,900			9.234	0.000	9.234	9	7.04882E+00	3.63162E-0
11	Stan	3rd mirror	Infinity	317,500			5,108	0.000	5.108	10	6.72457E+00	3.63162E-0
12	Stan	4th mirror	Infinity	3556.000			4,722	0.000	4,722	11	3.12364E+00	3.63162E-0
13	Stan	Iris	Infinity	0.000			1.984	0.000	1.984	12	2.78798E+00	3.63162E-0
14	Stan	Iris to telescope	Infinity	500.000			1.984	0.000	1.984	13	1.08644E+00	3.63162E-0
15	Stan	Front div lens	100.000	3 000	E SILICA		2 564	0.000	2 564	14	1.08644E+00	3.63162E-0
16	Stan	Ream expander length	50,200	1119 235			2 542	0.000	2 564	15	1.59840E+00	6.2/959E-0
17	Stan	Front conv lens	100 100	5 100	E SILICA		22 000 11	0.000	22.000 11	10	1.06007E+00	4.79802E-0
18	Stan	Conv to injection	279 100	120,000			22,000 U	0.000	22,000	18	1 04702E±01	1 70033E-0
10	Stan	conv to injection	Infinity	0.000			11 972	0.000	11 972	19	7.73974E+00	1.70023E-0
20	Stan	Accelerator window	Infinity	118 560			11.972	0.000	11.972	20	7.73974E+00	1.70023E-0
20	Stan	Accelerator window	Infinity	221.250			7,670	0.000	7.670	21	5,04201E+00	1.70023E-0
21	Stan		Infinity	221.250			0.075	0.000	7.079	22	1.86277E-02	1.70023E-0
22	Stan	interaction region 20 µm	infinity	110 5 6 0			0.555	0.000	0.555	23	5.02679E+00	1.70023E-0
23	stan	Mirror	intinity	118.560			8.344	0.000	8.344	24	7.72452E+00	1.70023E-0
24	Stan	Output window	Infinity	0.000			12.637	0.000	12.637	IMA	7.72452E+00	1.70023E-0
25	Stan	Diagnostics	Infinity	-			0.000 U	0.000	0.000 U			



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- Ability to create lenses ٠ corresponding to catalogues
- Compute beam size as a • function of the beam parameters and optics used
- Generate a cross-section • view of the optical system



	Sui	Comment	Radius	Thickness	Material	Coating	Clear Semi-Dia	Chip Zone	Mech Semi-Dia	Mixed	Mode results for	M2
0	Stan	Iris	Infinity	50.000			2.500	0.000	2.500			
1	Stan		Infinity	624.160			2.500 U	0.000	2.500 U	Sur	Size	1
2	Stan		Infinity	2500.000			2.500 U	0.000	2.500 U	OBJ	2.49845E+00	
3	Stan	Delay line	Infinity	488.700			2.500 U	0.000	2.500 U	1	2.49844E+00	
4	Stan	Front div lens	100.000	3.000	F_SILICA		12.700 U	0.000	12.700 U	2	2.50031E+00	
5	Stan	Beam expander length	33.700	248.749			3.242	0.000	12.700	310	2.54464E+00 2.56021E±00	
6	Stan	Front conv lens	100.100	5.100	F_SILICA		25.400 U	0.000	25.400 U	5	2.53654E+00	
7	Stan	End of table	279.100	100.000			22.860 U	0.000	25.400	6	8.10495F+00	
8	Stan	Vacuum input	Infinity	846.100			10.635	0.000	10.635	7	8.05553E+00	
9	Stan	1st mirror	Infinity	304.800			9.605	0.000	9.605	8	7.94911E+00	
10	Stan	2nd mirror	Infinity	3390.900			9.234	0.000	9.234	9	7.04882E+00	
11	Stan	3rd mirror	Infinity	317.500			5.108	0.000	5.108	10	6.72457E+00	
12	Stan	4th mirror	Infinity	3556.000			4.722	0.000	4.722	11	3.12364E+00	
13	Stan	Iris	Infinity	0.000			1.984	0.000	1.984	12	2.78798E+00	
14	Stan	Iris to telescope	Infinity	500.000			1.984	0.000	1.984	13	1.08644E+00	
15	Stan	Front div lens	100.000	3.000	F_SILICA		2.564	0.000	2.564	14	1.08044E+00	
16	Stan	Beam expander length	50.200	1119.235			2.542	0.000	2.564	15	1.59840E+00 1.58566E+00	
17	Stan	Front conv lens	100.100	5.100	F SILICA		22.000 U	0.000	22.000 U	17	1.06097E+01	
18	Stan	Conv to injection	279.100	120.000	-		22.000 U	0.000	22.000	18	1.04702E+01	
19	Stan	,	Infinity	0.000			11.972	0.000	11.972	19	7.73974E+00	
20	Stan	Accelerator window	Infinity	118.560			11.972	0.000	11.972	20	7.73974E+00	
21	Stan	Mirror	Infinity	221.250			7.679	0.000	7.679	21	5.04201E+00	
22	Stan	Interaction region 20 um	Infinity	221,250			0.333	0.000	0.333	22	1.86277E-02	
23	Stan	Mirror	Infinity	118.560			8.344	0.000	8.344	23	5.02679E+00	
24	Stan	Output window	Infinity	0.000			12.637	0.000	12.637	24	7.72452E+00	
25	Stan	Diagnostics	Infinity	_			0.000 U	0.000	0.000 U	TWA	/./2452E+00	

= 1.1800:

2.500	U Sur	Size	Waist	Position
2.500	U OBJ	2.49845E+00	2.49844E+00	-5.00000E+01
2 500	<u> </u>	2.49844E+00	2.49844E+00	0.00000E+00
2 700	2	2.50031E+00	2.49844E+00	6.24160E+02
2.700	ST0	2.54484E+00	2.49844E+00	3.12416E+03
2.700	4	2.56031E+00	3.36715E-02	-3.23094E+02
5.400	0 5	2.53654E+00	1.72821E-02	1.13307E+02
5.400	6	8.10495E+00	2.75283E-02	-8.36256E+02
0.635	7	8.05553E+00	3.63162E-01	-7.55411E+03
9.605	8	7.94911E+00	3.63162E-01	-7.45411E+03
9.234	9	7.04882E+00	3.63162E-01	-6.60801E+03
5.108	10	6.72457E+00	3.63162E-01	-6.30321E+03
4.722	11	3.12364E+00	3.63162E-01	-2.91231E+03
1.984	12	2.78798E+00	3.63162E-01	-2.59481E+03
1 98/	13	1.08644E+00	3.63162E-01	9.61190E+02
2.564	14	1.08644E+00	3.63162E-01	9.61190E+02
2.564	15	1.59840E+00	6.27959E-02	-3.75917E+02
2.564	16	1.58566E+00	4.79802E-02	1.96564E+02
2.000	U 17	1.06097E+01	9.76035E-03	-3.88131E+02
2.000	18	1.04702E+01	1.70023E-02	-4.60144E+02
1.972	19	7.73974E+00	1.70023E-02	-3.40144E+02
1.972	20	7.73974E+00	1.70023E-02	-3.40144E+02
7.679	21	5.04201E+00	1.70023E-02	-2.21584E+02
0.333	22	1.86277E-02	1.70023E-02	-3.34450E-01
8.344	23	5.02679E+00	1.70023E-02	2.20916E+02
2 6 3 7	24	7.72452E+00	1.70023E-02	3.39476E+02
2.007	IMA	7.72452E+00	1.70023E-02	3.39476E+02



- From the FHG module to the photocathode, we are going through 14 mirrors, 4 lenses, 2 beam sampler and a total of ~10.5m of distance
- Most of the transport under vacuum
- Ability to measure UV energy, beam position









- From the split between IR and UV to the interaction point, we will be going through 18 mirrors, 4 lenses, 1 beam sampler and a total of ~15m of distance (UV + 4365.5 mm +/- 5 mm)
- Half of the transport is the vacuum transport





Laser cleanroom



Laser cleanroom ISO5, 5x4m:

- Temperature controlled environment
- Low dust presence and laminar flow
- 8'x4' Optical damped table
- Laser enclosure





Picosecond Yb:YAG amplifier:

- Up to 23mJ delivered at 1030nm
- Up to 100µJ delivered at 257nm
- Repetition rate adjustable from 1 to 120Hz
- < 2ps pulse width
- < 10µrad rms pointing stability
- Full synchronization capabilities





- UV beam expanding for transport
- UV motorized mirror for real time beam position correction
- IR beam expanding for transport
- IR long path travelled and delay stage to adjust the transport length





Laser transport



- Pneumatic valves
- Low vacuum
- Nitrogen purge







Bunker's setup

Photocathode breadboard (UV)



- Cover has been mounted
- Beam aligned
- UV beam injected in accelerator





RadiaBeam Technologies

Photocathode breadboard (UV)



- Injection polished aluminum mirror 45degree angle
- Only horizontal reflection angle adjustable



RadiaBeam Technologies

1st iris image (UV laser - bunker)



FHG output imaged







1mm iris imaged

Mask imaged





22nd – July – 2024

RadiaBeam Technologies

Interaction Point (IP) breadboard (IR)

RadiaBeam

- IP chamber in three parts
- Insertable mirrors
- Insertable and motorized alignment iris (30µm)







- Aluminum enclosure
- Acrylic top
- Flexible PVC curtains







- IR beam aligned through the IP chamber
- Beam profiler installed at the virtual interaction point and after the IP chamber
- Interaction point lenses mounted and aligned in respect with the initial beam
- ✤ Goal 40-48µm beam diameter (1/e²)
- Achieved 64.1µm vertically and 73.7µm horizontally









- Goal 40-48μm beam diameter (1/e²) or 10-12μm (σ)
- Achieved 64.1 μ m vertically and 73.7 μ m horizontally or σ = 17.26 μ m





Thank you



Infra-red beam



Ultra-violet beam (after FHG)

