LUXE GEANT4 Simulation Update

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G4 MC Signal brems-laser gpc

https://confluence.desy.de/display/LS/Signal+MC

/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/brem-laser/phase0/gpc 221G

PTarmigan_v0.8.1
JETI40
gamma-laser 16.5 GeV

MC	intensity param. xi	laser waist w0 (um)	# MC h5 (BX)	Processed (BX)	Location	Notes
b0gpc_0.5_g4{0-9}	0.5	47.3	10	10	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/brem-laser/phase0/gpc/0.5	glaser feead3f1; MC: b0gpc_0.5_{0000-0009}
b0gpc_0.7_g4{0-9}	0.7	33.8	10	10	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/brem-laser/phase0/gpc/0.7	glaser feead3f1; MC: b0gpc_0.7_{0000-0009}
b0gpc_1.0_g4{0-9}	1.0	23.7	10	10	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/brem-laser/phase0/gpc/1.0	glaser feead3f1; MC: b0gpc_1.0_{0000-0009}
b0gpc_1.2_g4{0-9}	1.2	19.7	10	10	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/brem-laser/phase0/gpc/1.2	glaser feead3f1; MC: b0gpc_1.2_{0000-0009}
b0gpc_1.5_g4{0-9}	1.5	15.8	10	10	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/brem-laser/phase0/gpc/1.5	glaser feead3f1; MC: b0gpc_1.5_{0000-0009}
b0gpc_2.0_g4{0-9}	2.0	11.8	10	10	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/brem-laser/phase0/gpc/2.0	glaser feead3f1; MC: b0gpc_2.0_{0000-0009}
b0gpc_3.0_g4{0-9}	3.0	7.88	10	10	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/brem-laser/phase0/gpc/3.0	glaser feead3f1; MC: b0gpc_3.0_{0000-0009}
b0gpc_4.0_g4{0-9}	4.0	5.91	10	10	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/brem-laser/phase0/gpc/4.0	glaser feead3f1; MC: b0gpc_4.0_{0000-0009}
b0gpc_5.0_g4{0-9}	5.0	4.73	10	10	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/brem-laser/phase0/gpc/5.0	glaser feead3f1; MC: b0gpc_5.0_{0000-0009}
b0gpc_7.0_g4{0-9}	7.0	3.38	10	10	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/brem-laser/phase0/gpc/7.0	glaser feead3f1; MC: b0gpc_7.0_{0000-0009}

MC Signal brems-laser gpc

General physics case, phase 0

Located at brem-laser/phase0/gpc

waist w_0 w_0 (micron)	max photon energy (GeV)	ξ ξ	χ_e χ_e	N primaries	BXs	ident	Comments	Updated
237	16.5	0.1	0.0192	1e6	10			
118	16.5	0.2	0.0383	1e6	10			
78.8	16.5	0.3	0.0575	1e6	10			
47.3	16.5	0.5	0.0958	1e6	10	b0gpc_0.5_{0000-0009}	under 0.5/	2021/10/27
33.8	16.5	0.7	0.134	1e6	10	b0gpc_0.7_{0000-0009}	under 0.7/	2021/10/27
23.7	16.5	1.0	0.192	1e6	10	b0gpc_1.0_{0000-0009}	under 1.0/	2021/10/24
19.7	16.5	1.2	0.230	1e6	10	b0gpc_1.2_{0000-0009}	under 1.2/	2021/10/27
15.8	16.5	1.5	0.287	1e6	10	bogpc_1.5_{0000-0009}	under 1.5/	2021/10/27
11.8	16.5	2.0	0.383	1e6	10	b0gpc_2.0_{0000-0009}	under 2.0/	2021/10/24
7.88	16.5	3.0	0.575	1e6	10	b0gpc_3.0_{0000-0009}	under 3.0/	2021/10/24
5.91	16.5	4.0	0.766	1e6	10	b0gpc_4.0_{0000-0009}	under 4.0/	2021/10/27
4.73	16.5	5.0	0.958	1e6	10	b0gpc_5.0_{0000-0009}	under 5.0/	2021/10/24
3.38	16.5	7.0	1.34	1e6	10	b0gpc_7.0_{0000-0009}	under 7.0/	2021/10/24

PTarmigan_V0.8.1
JETI40 (Phase 0, circularly polarized laser)
e_laser 16.5 GeV

Can be removed, as included e.g. in e0gpc_3_g4_22_01

MC	intensity param. xi	laser waist w0 (um)	# MC out (BX)	Processed (BX)	Location	Notes
e0gpc_0.5_g4{0-9}	0.5	47.3	10	10	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/e0gpc_0.5	IP magnet 0.95T, MC: e0gpc_0.5{0-9}
e0gpc_1.0_g4{0-9}	1.0	23.7	10	10	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/e0gpc_1.0	IP magnet 0.95T, MC: e0gpc_1.0{0-9}
e0gpc_3.0_g4{0-9}	3.0	7.88	10	10	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/e0gpc_3.0	IP magnet 0.95T, MC: e0gpc_3.0{0-9}
e0ppw_3.0_g4{0-4}	3.0	7.88	4	4	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/ppw/	IP magnet 0.95T, G4 hics: beedd92a; MC: Generating positrons with physical weights
e0ppw_7.0_g4{0-4}	7.0	3.38	4	4	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/ppw/	IP magnet 0.95T, G4 hics: beedd92a; MC: Generating positrons with physical weights
e0gpc_0.15_g4{0000-0999}	0.15	158	1000	718	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/e0gpc_0.15	IP magnet 0.95T, MC: e0gpc_0.15{0000-0999}
e0gpc_0.2_g4{0000-0999}	0.2	118	1000	214	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/e0gpc_0.2	IP magnet 0.95T, MC: e0gpc_0.2{0000-0999}
e0gpc_0.15_g4_22_01	0.15	158	1010	1010	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/0.15	HICS e67ace8b. MC 16.5 GeV, e0gpc_0.15_{0000-0999}
e0gpc_0.3_g4_22_01	0.3	78.8	1010	1010	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/0.3	HICS e67ace8b. MC 16.5 GeV, e0gpc_0.3_{0000-0999}
e0gpc_0.5_g4_22_01	0.5	47.3	1000	1000	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/0.5	HICS e67ace8b. MC 16.5 GeV , e0gpc_0.5_{0000-0999}
e0gpc_0.7_g4_22_01	0.7	33.8	1000	1000	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/0.7	HICS e67ace8b. MC 16.5 GeV, e0gpc_0.7_{0000-0999}
e0gpc_1.0_g4_22_01	1.0	23.7	1000	1000	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/1.0	HICS e67ace8b. MC 16.5 GeV, e0gpc_1.0_{0000-0999}
e0gpc_1.5_g4_22_01	1.5	15.8	110	110	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/1.5	HICS e67ace8b. MC 16.5 GeV, e0gpc_1.5_{0000-0099}
e0gpc_2.0_g4_22_01	2.0	11.8	110	110	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/2.0	HICS e67ace8b. MC 16.5 GeV, e0gpc_2.0_{0000-0099}
e0gpc_3.0_g4_22_01	3.0	7.88	110	110	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/3.0	HICS e67ace8b. MC 16.5 GeV, e0gpc_3.0_{0000-0099}
e0gpc_4.0_g4_22_01	4.0	5.91	110	110	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/4.0	HICS e67ace8b. MC 16.5 GeV, e0gpc_4.0_{0000-0099}
e0gpc_5.0_g4_22_01	5.0	4.73	110	110	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/5.0	HICS e67ace8b. MC 16.5 GeV, e0gpc_5.0_{0000-0099}
e0gpc_7.0_g4_22_01	7.0	3.38	100	100	/nfs/dust/luxe/group/MCProduction/Signal /g4/ptarmigan-v0.8.1/e-laser/phase0/gpc/7.0	HICS e67ace8b. MC 16.5 GeV, e0gpc_7.0_{0000-0099}

G4 MC Signal brems-laser lp (linear polarization)

/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/lp 21G

PTarmigan_V0.8.1
JETI40 (Phase 0, linarly polarized laser)
e_laser 16.5 GeV

MC	intensity param. xi	laser waist w0 (um)	# MC out (BX)	Processed (BX)	Location	Notes
e0lp_5_g4_0	5.0	6.69	1	1	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/lp/e0lp_5_0_0_particles_g4.root	IP magnet 0.95T; MC: e0lp_5_0
e0lp_7_g4_0	7.0	4.78	1	1	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/lp/e0lp_7_0_0_particles_g4.root	IP magnet 0.95T; MC: e0lp_7_0
e0lp_10_g4_0	10.0	3.35	1	1	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/lp/e0lp_10_0_0_particles_g4.root	IP magnet 0.95T; MC: e0lp_10_0
e0lp_5x20_g4_0	5.0	20	1	1	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/lp/e0lp_5x20_0_0_particles_g4.root	hics: beedd92a; MC: e0lp_5x20_0
e0lp_7x20_g4_0	7.0	20	1	1	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/lp/e0lp_7x20_0_0_particles_g4.root	hics: beedd92a; MC: e0lp_7x20_0
e0lp_10x20_g4_0	10.0	20	1	1	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/lp/e0lp_10x20_0_0_particles_g4.root	hics: beedd92a; MC: e0lp_10x20_0
e0lp_5x40_g4_0	5.0	40	1	1	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/lp/e0lp_5x40_0_0_particles_g4.root	hics: beedd92a; MC: e0lp_5x40_0
e0lp_7x40_g4_0	7.0	40	1	1	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/lp/e0lp_7x40_0_0_particles_g4.root	hics: beedd92a; MC: e0lp_7x40_0
e0lp_10x40_g4_0	10.0	40	1	1	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/lp/e0lp_10x40_0_0_particles_g4.root	hics: beedd92a; MC: e0lp_10x40_0

```
21G     /nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/lp
2.2T    /nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/gpc
9.7G    /nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/ppw
2.2T    /nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase0/
```

G4 MC Signal e-laser gpc phase 1

PTarmigan_V0.8.1
Phase I
e_laser 16.5 GeV

MC	intensity param. xi	# MC out (BX)	Processed (BX)	Location	Notes
b1gpc_10.0_g4{0-9}	10	10	10	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase1/gpc/	G4 hics: beedd92a; MC: b1gpc_10.0_{0-9}
e1gpc_7.0_g4{0-4}	7.0	1	5	/nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase1/gpca/7.0	G4 hics: 406b86e9

```
Attaching file /nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase1/gpca/7.0/e1gpc_70_0003_particles_ak.root as _file0...
(TFile *) 0x10a6960
root [1] RunInfo->Show(1)
======> EVENT:1
 parameter       = MCFile
 value           = /nfs/dust/luxe/user/kropfann/7.0/03/e1gpc_7.0_0003_particles.h5
```

```
139G    /nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase1/gpca
29G     /nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase1/gpc
168G    /nfs/dust/luxe/group/MCProduction/Signal/g4/ptarmigan-v0.8.1/e-laser/phase1/
```

MC NPOD

/nfs/dust/luxe/group/MCProduction/Signal/**ptarmigan-v0.11**/elaser/phase1/npod

g0058	350 / 4 = 87.5	CP	3.41	10.0	5	1e8	2022/08/04	Photoproduction for NPOD. Reduced photon weight, no pair creation, laser duration increased to 120 fs.

/nfs/dust/luxe/group/MCProduction/Signal/g4/**ptarmigan-v0.11**/elaser/phase1/npod 925G

Background e-laser

1	3.0T	/nfs/dust/luxe/group/MCProduction/Background/elaser/31082021_7671ee4c
2	3.9T	/nfs/dust/luxe/group/MCProduction/Background/elaser/10102021_7671ee4c_fast
3	279G	/nfs/dust/luxe/group/MCProduction/Background/elaser/03112021_b7acaa6e
4	977G	/nfs/dust/luxe/group/MCProduction/Background/elaser/10022022_e67ace8b
5	2.6T	/nfs/dust/luxe/group/MCProduction/Background/elaser/22112022_33ace143_ecal
6	33G	~~/nfs/dust/luxe/group/MCProduction/Background/elaser/fluka_3076aff1~~
	11T	/nfs/dust/luxe/group/MCProduction/Background/elaser/

Electron-laser 16.5 GeV

	Simulation	ID	# particles	Processed (BX)	Location	Notes
1	Background for electron-laser setup	tdr_el_01	3.2e9	2.13	/nfs/dust/luxe/group/MCProduction/Background /elaser/31082021_7671ee4c /list_root_7671ee4c.txt	Setup corresponds to commit 7671ee4c305 (hics branch) elaer_tdr_v0.1
2	Background for electron-laser setup	tdr_el_f_01	1.12e10	7.45	/nfs/dust/luxe/group/MCProduction/Background /elaser/10102021_7671ee4c_fast	Setup corresponds to commit 7671ee4c305 (hics branch) elaer_tdr_v0.1 with the option to stop tracking particles which hit beam dumps or shielding.
3	Background for electron-laser setup	tdr_el_n_01	2.09e8	0.14	/nfs/dust/luxe/group/MCProduction/Background /elaser/03112021_b7acaa6e/ob	Setup corresponds to commit b7acaa6e (hics branch) with additional neutron absorber attached to the electron beam dump. It is made of borated polyethylene concrete.
4	Background for electron-laser setup	tdr_el_n_02	7.12e8	0.47	/nfs/dust/luxe/group/MCProduction/Background /elaser/10022022_e67ace8b	Setup corresponds to commit e67ace8b (hics branch) with additional neutron absorber attached to the electron beam dump. It is made of borated polyethylene concrete. Shielding material is changed to iron and additional infrastructrure components were implemented.

/nfs/dust/luxe/group/MCProduction/Background/elaser/22112022_33ace143_ecal

ECAL simulation, the version supports timing cut for tracks, but it was not applied probably, so it must be just a regular background.

Background γ-laser

252G /nfs/dust/luxe/group/MCProduction/Background/gammalaser/01122021_053bf4b7

Gamma-laser 16.5 GeV

Simulation	ID	# particles	Processed (BX)	Location	Notes
Background for gamma-laser setup	tdr_gl_01	1.91e9	1.27	/nfs/dust/luxe/group/MCProduction /Background/gammalaser/18102021_55ae8938	Setup corresponds to commit 55ae8938 (glaser branch). Bremsstrahlung target is 600um thick.
Background for gamma-laser setup	tdr_gl_t35um	1.89e9	1.26	/nfs/dust/luxe/group/MCProduction /Background/gammalaser/01122021_053bf4b7	glaser commit 053bf4b7. Bremsstrahlung target is 35um thick.

5.1T /nfs/dust/luxe/group/MCProduction/Background/gammalaser/10012021_850fd10d_fast_sim

The beam pipe section which joins interaction chamber with vacuum chamber in gamma laser setup was modified. It got rectangular cross section as large as magnet allows. The aim is to reduce the background of electron and positron pairs produced in collisions of bremsstrahlung photons with the beam pipe.

278G /nfs/dust/luxe/group/MCProduction/Background/gammalaser/09102020_lxb18e

Can be removed

Gamma-laser 16.5 GeV

https://confluence.desy.de/pages/viewpage.action?pageId=228762986

Simulation	ID	# particles	Processed (BX)	Location	Notes
Background for gamma-laser setup	bp0	7.53305e9	5.022	/nfs/dust/luxe/group/MCProduction /Background/gammalaser/09102020_lxb18e /Merged/Files	Setup corresponds to commit b18e55ec (master branch) The oldest simulation for the CDR, it is in the table for the CDR archive

452G /nfs/dust/luxe/group/MCProduction/Background/gammalaser/11062021_shielding

Can be removed

Study of the background in case the shielding is concrete, before it was Al-Fe-Al.

396G /nfs/dust/luxe/group/MCProduction/Background/gammalaser/08052022_6f606449

Cleaning magnet length is increased to 1 m and the outer radius of the collimator set to 45 mm, close to a possible maximum without overlap.

6.5T /nfs/dust/luxe/group/MCProduction/Background/gammalaser