

Phojet Event Generator

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Event Generators Session

What is PHOJET?

- ✓ PHOJET: Two-component model
 - Contributions from soft and hard interactions.
 - For soft processes Dual Parton Model is used
 - For hard interactions perturbative QCD is applied
- ✓ Gives an almost complete picture of high-energy hadron collisions.
- ✓ Simulates hadron-hadron, photon-hadron and photon-photon collisions
- ✓ Provides an alternative to PYTHIA.
- ✓ Written in FORTRAN

F. W. Bopp, R. Engel, and J. Ranft, "Rapidity gaps and the PHOJET Monte Carlo," arXiv:hep-ph/9803437

Difference between PHOJET and PYTHIA

	PHOJET	PYTHIA
Collide	Hadron-hadron, Photon-hadron Photon-photon	ee^+ , pp, ppbar, ep
To describe the non-perturbative phenomena	Dual Parton Model	multiple parton-parton interactions
User setting	Less settings	More settings that can be adjusted in order to better reproduce the data
Language	FORTRAN	C++

Installation

->Source file is not publicly available. On request one can get it.
The package (phojet-1.12-35.tar.gz) will be provided

->Manual can be found here
<https://wiki.bnl.gov/eic/upload/Phoman5c-2.pdf>

-> In a terminal window,
cd path to the directory containing phojet-1.12-35.tar.gz

```
tar -xvfz phojet-1.12-35.tar.gz
```

```
cd main2
```

```
-> compile  
make
```

main1

```
phojet1.12-35.f pythia6115.f  
trapfpe.c, main1.f Makefile  
pp-14t-ine.inp lc-500-bl.inp  
lc-500-brems.inp ppb-2t-diff.inp  
lc-500-beam.inp README.TXT
```

main2

```
phojet1.12-35.f  
pythia6115.f  
trapfpe.c main2.f  
Makefile  
README.TXT
```

Now you are ready to run PHOJET

Program structure

```
// Initializes the random number generator prepares internal parton distribution functions  
CALL PHOINP(LINP,IREJ)
```

```
//Random seed  
CALL PHO_RNDIN(52,22,32,42)
```

```
//Phojet settings and particle data  
CALL PHO_SETPAR(1,2212,0,0)// side, PDG code, Similar to PDG code, required for photon  
CALL PHO_SETPAR(2,-2212,0,0)
```

```
//Initialize all aspects of the subsequent generation  
CALL PHO_EVENT(-1,P1,P2,SIGMAX,IREJ) (for int., 4 mom of Proj., 4 mom of Tar., Max val C S, flag)
```

```
//To generate the next event  
CALL PHO_EVENT(1,P1,P2,SIGCUR,IREJ)
```

```
Print events  
CALL PHO_PREVNT(0)  
CALL PHO_CHARA1
```

Main event and particle informations

Event information
Number of produced particles
Process code
and more

The main properties of each particles, by column:

- the index number of the particle
- status
- PDG particle identity code
- particle name
- the components of the momentum four-vector (px, py, pz, E), in units of GeV with $c = 1$

NR	STAT	NAME	X-MOMENTA	Y-MOMENTA	Z-MOMENTA	ENERGY	MASS	PT
1	2	p+	0.000	0.000	3500.000	3500.000	0.938	0.000
2	2	p~-	0.000	0.000	-3500.000	3500.000	0.938	0.000
3	25	hard scattering	0.001	0.007	7.315	-0.498	0.000	0.007
4	20	hard ini. part.	0.000	0.000	2.075	53.515	53.475	0.000
5	20	hard ini. part.	0.000	0.000	-25.789	53.515	46.891	0.000
6	21	hard fin. part.	4.890	5.441	-11.807	0.000	-13.890	7.315
7	21	hard fin. part.	-4.890	-5.441	-11.907	0.000	-13.974	7.315
8	2	(ud)_0	0.146	0.238	2335.488	2335.488	0.000	0.279
9	2	u	-0.227	-0.118	68.968	68.968	0.000	0.256
10	2	(ud)_0~	-0.324	0.449	-3020.527	3020.525	0.000	0.554

Main event and particle information

(Only final state particles)

Event No

Number of produced particles

Process code

The main properties of each particles, by column:

- the index number of the particle
- status (SC);
- PDG particle identity code (PID);
- charge
- the components of the momentum four-vector (px, py, pz, E), in units of GeV with $c = 1$

Event information

Evt No. Number of final particles Process code

1 95 7

Particle information

Sl. No	SC	PID	Charge	Px	Py	Pz	Energy
1	1	211	1	-0.094	-0.382	287.297	287.297
2	1	-211	-1	0.398	0.053	10.020	10.029
3	1	22	0	0.090	0.328	67.465	67.466
4	1	22	0	0.338	-0.151	96.846	96.847
5	1	211	1	0.234	-0.255	73.200	73.201
6	1	-211	-1	0.240	0.114	8.984	8.989
7	1	22	0	-0.217	0.047	30.656	30.657
8	1	22	0	-0.164	-0.007	11.889	11.890
9	1	22	0	0.012	0.082	4.775	4.776
10	1	22	0	-0.175	0.151	15.379	15.380

Hands on session

1. Download and install Phojet
2. Generate 100000 events
3. Read the output and draw the following distributions like P_x , P_y , P_z , P_T , eta, phi and multiplicity for charged particle.

Backup

PID codes

1	d	11	e^-	21	g	211	π^+	111	π^0	213	ρ^+	2112	n
2	u	12	ν_e	22	γ	311	K^0	221	η	313	K^{*0}	2212	p
3	s	13	μ^-	23	Z^0	321	K^+	331	η'	323	K^{*+}	3122	Λ^0
4	c	14	ν_μ	24	W^+	411	D^+	130	K_L^0	113	ρ^0	3112	Σ^-
5	b	15	τ^-	25	H^0	421	D^0	310	K_S^0	223	ω	3212	Σ^0
6	t	16	ν_τ			431	D_s^+			333	ϕ	3222	Σ^+

Where and why event generators are used?

