BeAGLE simulations at lower energies

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Motivation

- ➤The previous BeAGLE simulations I ran used an electron beam with an 18 GeV/c momentum on an ion beam with a 110 (GeV/c)/A momentum. The events were generated with a minimum Q² of 0.5 GeV²/c².
- I want to test if BeAGLE can simulate events at lower energies. I tested the following settings:
 - 1. Electron momentum = 10 GeV/c; ¹⁹⁷Au momentum = 100 GeV/c/A; $Q^2 > 10$ GeV²/c²
 - 2. Electron momentum = 1 GeV/c; ¹⁹⁷Au momentum = 10 GeV/c/A; $Q^2 > 10$ GeV²/c²
 - 3. Electron momentum = 5 GeV/c; ¹⁹⁷Au momentum = 0 GeV/c/A; $Q^2 > 1$ GeV²/c²

*+1. PROJPAR	+2	.+3	+4	+5+	6+	ELECTRON
TARPAR	197.0	79.0	3			
TAUFOR	10.0	25.0	1.0			
FERMI	2	0.62				
* random nu	mber					
FSEED	13	-1	3	3		
* output fi	le with the	name of for	rt.xx (xx	=21-99)		
OUTPUT	92					
* energy of	interaction					
*						
*	momentum o	f beam1 mc	omentum o	f beam2		
*+1.	+2	.+3	+4	+5+	6+	· 7
MOMENTUM	10.0	100.0				
* dec	ay of pi0 2	/0 decay/r	not decay	red		
PARDECAY	2					
* tre	atment of di	ffractive e	events			
*DIFFRACT	-3	0	0	0		
* lepton ta	gger to samp	le events w	vith cert	ain kinematics	s cuts	
*	yMin	уМах	Q2Min	Q2Max theta	a_Min thet	:a_Max
L-TAG	1e-9	1.00	10.0	20000.0	0.0	6.29

*+1 PROJPAR	+2	.+3	.+4	+5+.	6+.	7 ELECTRON
TARPAR	197.0	79.0	3	¹⁹⁷ Au beam		
TAUFOR	10.0	25.0	1.0			
FERMI	2	0.62				
* random numł	ber					
FSEED	13	-1	3	3		
* output file	e with the	name of for	rt.xx (xx	=21-99)		
OUTPUT	92					
* energy of i	interaction					
*						
*	momentum o	f beam1 mo	omentum c	f beam2		
*+1	+ 2	.+3	.+4	+5+.	6+.	7
MOMENTUM	10.0	100.0				
* decay	/ of pi0 2	/0 decay/ı	not decay	ed		
PARDECAY	2					
* treat	tment of di	ffractive e	events			
*DIFFRACT	-3	0	0	0		
* lepton tagg	ger to samp	le events w	with cert	ain kinematics	cuts	
*	yMin	yMax	Q2Min	Q2Max theta	_Min theta	_Max
L-TAG	1e-9	1.00	10.0	20000.0	0.0	6.29

*						
*+1.	+2	.+3	+4.	+5+	6	+7
PROJPAR						ELECTRON
TARPAR	197.0	79.0	3			
TAUFOR	10.0	25.0	1.0			
FERMI	2	0.62				
* random num	nber					
FSEED	13	-1	3	3		
<pre>* output fil</pre>	Le with the	name of for	t.xx (x	x=21-99)		
OUTPUT	92					
* energy of	interaction					
*						
*	momentum o	f beam1 mor	nentum d	of beam2		
*+1			4.	+ 5 +		+7
MOMENTUM	10.0	100.0	Bea	am momenta		
* deca	ay of pi0 2	/0 decay/no	ot decay	/ed		
PARDECAY	2		-			
* trea	atment of di	ffractive e	vents			
*DIFFRACT	-3	0	0	0		
* lepton tag	ger to samp	le events w	ith cert	tain kinematic	s cuts	
*	yMin	yMax (Q2Min	Q2Max thet	a Min thet	a Max
L-TAG	1e-9	1.00	10.0	20000.0	0.0	6.29

*							
*+1.	+2	+3	.+4.	+5	+6	+7	
PROJPAR						ELEC	ron
TARPAR	197.0	79.0	3				
TAUFOR	10.0	25.0	1.0				
FERMI	2	0.62					
* random nu	mber						
FSEED	13	-1	3	3			
* output fi	le with the r	name of fo	rt.xx (x	x=21-99)			
OUTPUT	92						
* energy of	interaction						
*							
*	momentum of	f beam1 m	omentum (of beam2			
*+1.	+2	+3	.+4.	+ 5	+6	+7	
MOMENTUM	10.0	100.0					
* dec	ay of pi0 2/	/0 decay/	not decay	/ed			
PARDECAY	2	-	-		. n		
* tre	atment of di	fractive of	events	Minimum Ç			
*DIFFRACT	-3	0	0	0			
* lepton ta	gger to samp]	Le events i	with cer [.]	tain kinemati	cs cuts		
*	yMin	уМах	Q2Min	Q2Max the	ta_Min the	ta_Max	
L-TAG	1e-9	1.00	10.0	20000.0	0.0	6.29	



```
...+....1....+....2....+....3....+....4....+....5....+....6....+....7...
                                                                     ELECTRON
PROJPAR
TARPAR
                                     3
              197.0
                         79.0
TAUFOR
              10.0
                         25.0
                                    1.0
FERMI
               2
                         0.62
 random number
FSEED
                13
                          -1
                                     3
                                               3
 output file with the name of fort.xx (xx=21-99)
OUTPUT
                92
 energy of interaction
            momentum of beam1||momentum of beam2
<sup>•</sup>...+....1....+....2....+....3....+....4....+....5....+....6....+....7...
MOMENTUM
               1.0
                          10.0
       decay of pi0 2/0 decay/not decayed
PARDECAY
                  2
       treatment of diffractive events
*DIFFRACT
           -3
                            0
                                      0
                                                0
 lepton tagger to sample events with certain kinematics cuts
               yMin yMax
                                 Q2Min Q2Max theta_Min theta_Max
-TAG
                         1.00 10.0 <u>20000.0</u>
                                                                  6.29
                                                         0.0
               1e-9
```

```
...+....1....+.....2....+.....3....+....4....+....5....+....6....+....7...
                                                                         ELECTRON
PROJPAR
              197.0
                           79.0
                                       3
TARPAR
TAUFOR
                           25.0
                                      1.0
               10.0
FERMI
                2
                           0.62
 random number
FSEED
                 13
                            -1
                                       3
                                                  3
 output file with the name of fort.xx (xx=21-99)
OUTPUT
                 92
 energy of interaction
             momentum of beam1||momentum of beam2
              <u>+ 2 + 3 + 4</u> · · · · 4 · · · + · · · 5 · · · · + · · · 6 · · · · + · · · 7 · · ·
 ...+...1...
MOMENTUM
                1.0
                           10.0
        decay of pi0 2/0 decay/not decayed
PARDECAY
                   2
        treatment of diffractive events
*DIFFRACT
                  -3
                              0
                                        0
                                                   0
 lepton tagger to sample events with certain kinematics cuts
                yMin
                                   Q2Min
                                             Q2Max theta_Min theta_Max
                          yMax
 -TAG
                           1.00
                                     10.0
                                              20000.0
                                                                      6.29
                1e-9
                                                            0.0
```

Setting 2: Generated Q² distribution



7/1/2025

 Q^2 [GeV²/c²]

*							
*+1.	+2	+3	+4	+5.	+6	+7	
PROJPAR						ELEC	TRON
TARPAR	197.0	79.0	3				
TAUFOR	10.0	25.0	1.0				
FERMI	2	0.62					
* random nu	mber						
FSEED	13	-1	3	3			
* output fi	le with the n	ame of fo	ort.xx (x)	(=21-99)			
OUTPUT	92						
* energy of	interaction						
*							
*	momentum of	beam1 ı	nomentum d	of beam2			
*+1.	+2	+3	+4.	+5.	+6	+7	
MOMENTUM	5.0	0.0					
* dec	ay of pi0 2/	0 decay	/not decay	/ed			
PARDECAY	2						
* tre	atment of dif	fractive	events				
*DIFFRACT	-3	0	0	0			
* lepton ta	gger to sampl	.e events	with cert	ain kinem	atics cuts	S	
*	yMin	уМах	Q2Min	Q2Max	theta_Min	theta_Max	
L-TAG	1e-9	1.00	1.0	20000.0	0.0	6.29	

*						
*+1	+ 2	+3	+4		+6	+ 7
PROJPAR						ELECTRO
TARPAR	197.0	79.0	3			
TAUFOR	10.0	25.0	1.0			
FERMI	2	0.62				
* random num	ber					
FSEED	13	-1	3	3		
* output file	e with the r	name of fo	ort.xx (xx=21-99)		
OUTPUT	92					
* energy of :	interaction					
*						
*	momentum of	= beam1 ı	nomentum	of beam2		
*+1	+ 2	+ 3	+4			+ 7
MOMENTUM	5.0	0.0				
* decay	y ot p10 2/	o decay	/not dec	ayed		
PARDECAY	2					
* trea	tment of dif	fractive	events			
*DIFFRACT	-3	0	e	0		
* lepton tagg	ger to samp]	le events	with ce	rtain kine	matics cut	5
*	yMin	уМах	Q2Min	Q2Max	theta_Min	theta_Max
L-TAG	1e-9	1.00	1.0	20000.0	0.0	6.29

Setting 3 : Generated Q² distribution



Summary

- BeAGLE can generate events down to lower COM energies without any generation errors.
- >What energies do we want to use?