



MadGraph5_aMC on GPUs

Vectorizing Phase Space Sampling

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MadGraph5_aMC Phase Space Sampling

- Andrea discovered that `xbin` within `sample_get_x` (file: `dsample.f`) is very often called with the same arguments, e.g. 0 or 1
- I've tried to cache the value of the `xbin(0)` and `xbin(1)`; each time `xbin` is called, if the argument is 0 or 1, check whether this was previously computed, and if yes, fetch the value from the cache.

Before

```
1317 c write(*,*) 'getting variable ',ipole,j,minvar(j,ipole)
1318 c xbin_min = xbin(xmin,minvar(j,ipole))
1319 c xbin_max = xbin(xmax,minvar(j,ipole))
...
1320 c if (xbin_min .gt. xbin_max-1) then
1321 c   write(*,'(a,4e15.4)') 'Bad limits',xbin_min,xbin_max,
1322 c   &      xmin,xmax
1323 c   xbin_max=xbin_min+1d-10
1324 c   xbin_max = xbin(xmax,minvar(j,ipole))
1325 c   xbin_min = min(xbin(xmin,minvar(j,ipole)), xbin_max)
1326 c endif
```

After

```
...
if (xmax.ne.1 .or. .not.is_xbin1_set(j, ipole)) then
  xbin_max = xbin(xmax,minvar(j,ipole))
  if(xmax.eq.1) then
    xbin1_array(j, ipole) = xbin_max
    is_xbin0_set(j, ipole) = .true.
  endif
else
  xbin_max = xbin1_array(j, ipole)
endif

if (xmin.ne.0 .or. .not.is_xbin1_set(j, ipole)) then
  xbin_min = xbin(xmin,minvar(j,ipole))
  if (xbin_min .gt. xbin_max-1) then
    xbin_min = min(xbin_min, xbin_max)
  endif
endif

if(xmin.eq.0) then
  xbin0_array(j, ipole) = xbin_min
  is_xbin0_set(j, ipole) = .true.
endif
else
  xbin_max = xbin0_array(j, ipole)
endif
```

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- Cross sections for $g g > t \bar{t} g$, $g g > t \bar{t} g g$, and $g g > t \bar{t} g g g$ are all stable after the change.
- Where to push these changes to? I also want to see quantitative performance improvements, but perf needs an executable. Stand alone?

Before

```
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1321 c   write(*,'(a,4e15.4)') 'Bad limits',xbin_min,xbin_max,
1322 c   &      xmin,xmax
1323 c   xbin_max=xbin_min+1d-10
1324 c   xbin_max = xbin(xmax,minvar(j,ipole))
1325 c   xbin_min = min(xbin(xmin,minvar(j,ipole)), xbin_max)
1326 c endif
```

After

```
...
if (xmax.ne.1 .or. .not.is_xbin1_set(j, ipole)) then
  xbin_max = xbin(xmax,minvar(j,ipole))
  if(xmax.eq.1) then
    xbin1_array(j, ipole) = xbin_max
    is_xbin0_set(j, ipole) = .true.
  endif
else
  xbin_max = xbin1_array(j, ipole)
endif

if (xmin.ne.0 .or. .not.is_xbin1_set(j, ipole)) then
  xbin_min = xbin(xmin,minvar(j,ipole))
  if (xbin_min .gt. xbin_max-1) then
    xbin_min = min(xbin_min, xbin_max)
  endif
endif

if(xmin.eq.0) then
  xbin0_array(j, ipole) = xbin_min
  is_xbin0_set(j, ipole) = .true.
endif
else
  xbin_max = xbin0_array(j, ipole)
endif
```