α_s (s), 4 Loops

Chunks

In[21]:=
```
As50sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 50^2, 4];
As500sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 500^2, 4];
As1000sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 1000^2, 4];
```

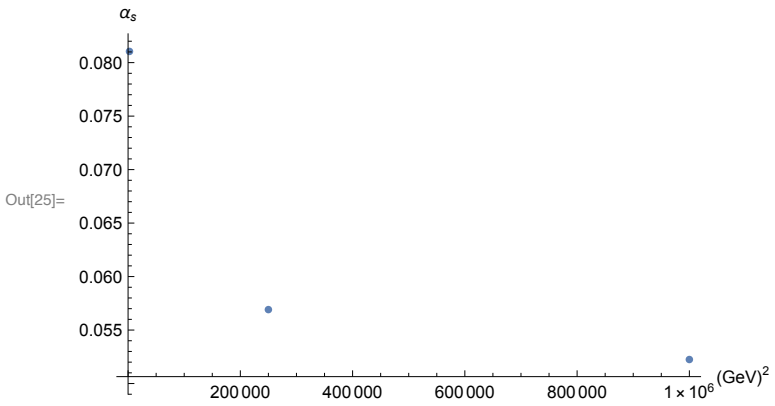
In[24]:=
```
Tablesq = TableForm[{{50^2, As50sq}, {500^2, As500sq}, {1000^2, As1000sq}},
  TableHeadings → {None, {"(GeV)^2", "α_s"}}]
```

Out[24]//TableForm=

$(\text{GeV})^2$	α_s
2500	0.08104744286206835422 0
250 000	0.05691185276344192554 1
1 000 000	0.05224585171459885091 4

```
A = ListPlot[%, AxesLabel → {"(GeV)^2", "α_s"}]
```

Out[25]=



In[26]:=
```
As100sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 100^2, 4];
As150sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 150^2, 4];
As200sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 200^2, 4];
As250sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 250^2, 4];
As300sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 300^2, 4];
As350sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 350^2, 4];
As400sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 400^2, 4];
As450sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 450^2, 4];
```

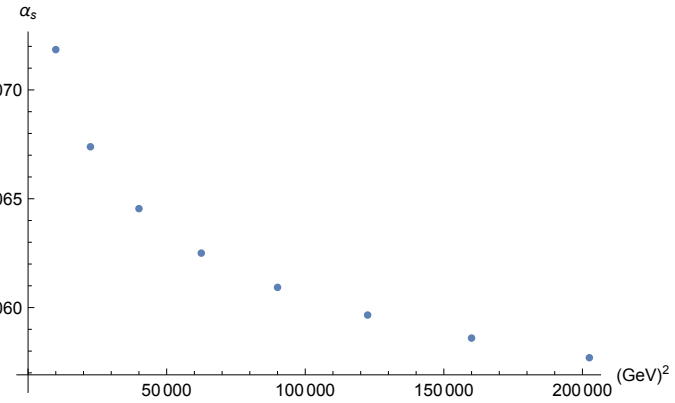
In[34]:=
```
Tablesq =
 TableForm[{{100^2, As100sq}, {150^2, As150sq}, {200^2, As200sq}, {250^2, As250sq},
   {300^2, As300sq}, {350^2, As350sq}, {400^2, As400sq}, {450^2, As450sq}},
  TableHeadings → {None, {"(GeV)^2", "α_s"}}]
```

Out[34]//TableForm=

$(\text{GeV})^2$	α_s
10 000	0.071851606589246904918
22 500	0.067387616701294621139
40 000	0.064545398679831175395
62 500	0.062502069417089455757
90 000	0.060926962639263847121
122 500	0.059656383325729758176
160 000	0.058598181747164769227
202 500	0.057695714440271760104

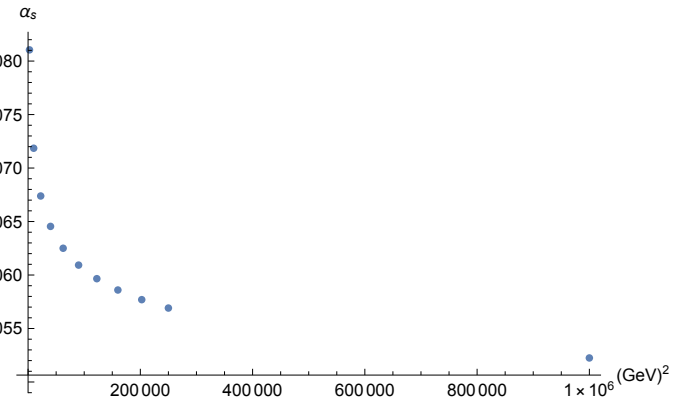
In[35]:=
```
B = ListPlot[%, AxesLabel → {"(GeV)^2", "α_s"}]
```

Out[35]=



In[20]:=
```
Show[A, B]
```

Out[20]=



In[36]:=
```
As550sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 550^2, 4];
As600sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 600^2, 4];
As650sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 650^2, 4];
As700sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 700^2, 4];
As750sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 750^2, 4];
As800sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 800^2, 4];
As850sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 850^2, 4];
As900sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 900^2, 4];
As950sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 950^2, 4];
```

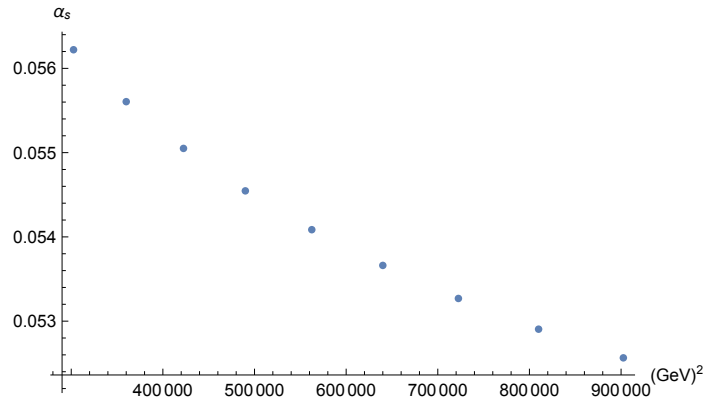
In[47]:=
```
Tablesq = TableForm[{{550^2, As550sq}, {600^2, As600sq}, {650^2, As650sq},
   {700^2, As700sq}, {750^2, As750sq}, {800^2, As800sq}, {850^2, As850sq},
   {900^2, As900sq}, {950^2, As950sq}}, TableHeadings → {None, {"(GeV)^2", "α_s"}}]
```

Out[47]//TableForm=

$(\text{GeV})^2$	α_s
302 500	0.056221034863166959406
360 000	0.055604966134750124812
422 500	0.055050134856295275995
490 000	0.054546298709304271396
562 500	0.054085521843304228367
640 000	0.053661539550037010488
722 500	0.053269325948238549657
810 000	0.052904791891815312328
902 500	0.052564568941381061881

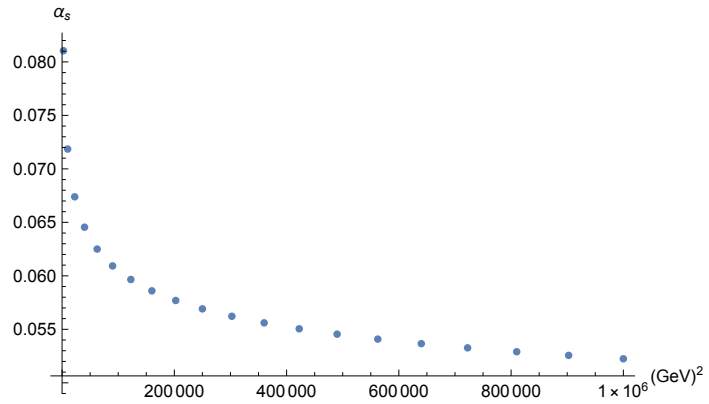
In[48]:=
```
F = ListPlot[%, AxesLabel → {"(GeV)^2", "α_s"}]
```

Out[48]=



In[50]:=
```
Show[A, B, F]
```

Out[50]=



In[53]:=
```
As60sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 60^2, 4];
As70sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 70^2, 4];
As80sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 80^2, 4];
As90sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 90^2, 4];
```

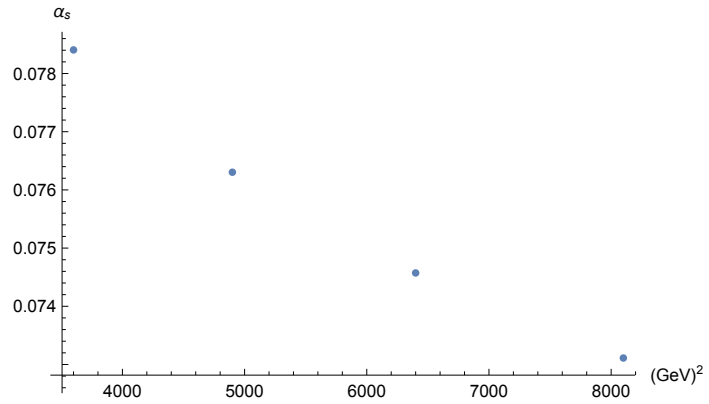
In[57]:=
```
Tablesq = TableForm[{{60^2, As60sq}, {70^2, As70sq}, {80^2, As80sq}, {90^2, As90sq}},
  TableHeadings → {None, {"(GeV)^2", "α_s"}}]
```

Out[57]//TableForm=

$(\text{GeV})^2$	α_s
3600	0.078405375366205428314
4900	0.076303717116715597241
6400	0.074573114316542665601
8100	0.073111154629109787553

In[58]:=
```
G = ListPlot[%, AxesLabel → {"(GeV)^2", "α_s"}]
```

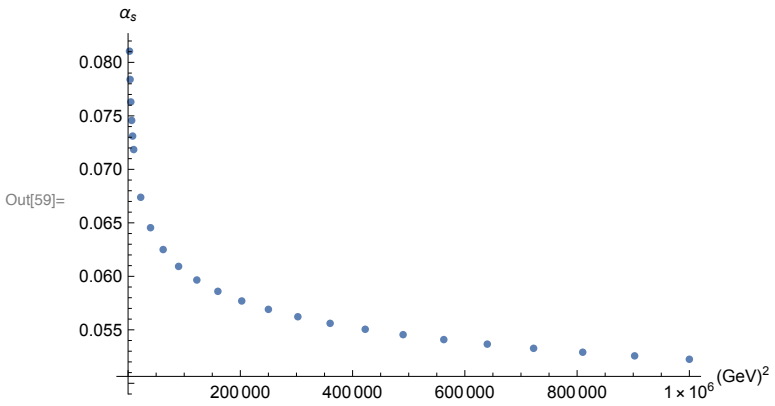
Out[58]=



Partial Plot

In[59]:=
```
Show[A, B, F, G]
```

Out[59]=



Chunk 100

In[60]:=
```
As110sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 110^2, 4];
As120sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 120^2, 4];
As130sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 130^2, 4];
As140sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 140^2, 4];
As160sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 160^2, 4];
As170sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 170^2, 4];
As180sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 180^2, 4];
As190sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 190^2, 4];
```

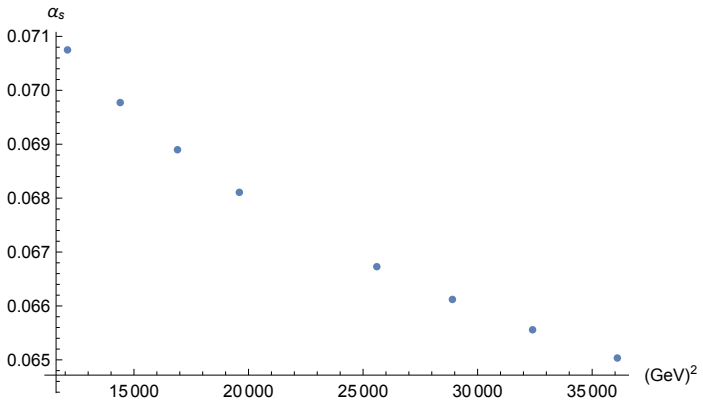
In[68]:=
```
Tablesq =
 TableForm[{{110^2, As110sq}, {120^2, As120sq}, {130^2, As130sq}, {140^2, As140sq},
   {160^2, As160sq}, {170^2, As170sq}, {180^2, As180sq}, {190^2, As190sq}},
  TableHeadings → {None, {"(GeV)^2", "α_s"}}]
```

Out[68]//TableForm=

$(\text{GeV})^2$	α_s
12 100	0.070749388383036940445
14 400	0.069772550569333984470
16 900	0.068897698925862461739
19 600	0.068107235029174489852
25 600	0.066728219678487325452
28 900	0.066120568731252369726
32 400	0.065557803987584704392
36 100	0.065034301634386674162

In[69]:=
```
A1 = ListPlot[%, AxesLabel → {"(GeV)^2", "α_s"}]
```

Out[69]=



Chunk 200

In[70]:=
```
As210sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 210^2, 4];
As220sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 220^2, 4];
As230sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 230^2, 4];
As240sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 240^2, 4];
As260sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 260^2, 4];
As270sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 270^2, 4];
As280sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 280^2, 4];
As290sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 290^2, 4];
```

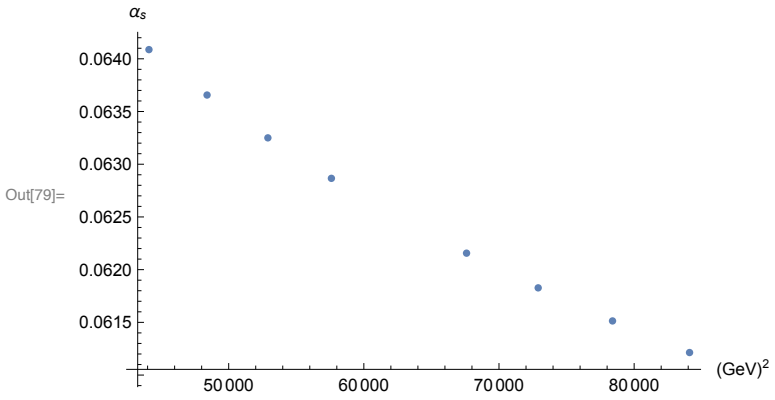
In[78]:=
```
Tablesq =
 TableForm[{{210^2, As210sq}, {220^2, As220sq}, {230^2, As230sq}, {240^2, As240sq},
   {260^2, As260sq}, {270^2, As270sq}, {280^2, As280sq}, {290^2, As290sq}},
  TableHeadings → {None, {"(GeV)^2", "α_s"}}]
```

Out[78]//TableForm=

$(\text{GeV})^2$	α_s
44 100	0.064087189521932243891
48 400	0.063656373106459043788
52 900	0.063250136393961376339
57 600	0.062866064324965214842
67 600	0.062156336107537810806
72 900	0.061827276309937617759
78 400	0.061513493598224224030
84 100	0.061213754097401342640

In[79]:=
```
A2 = ListPlot[%, AxesLabel → {"(GeV)^2", "α_s"}]
```

Out[79]=



Chunk 300

In[80]:=
```
As310sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 310^2, 4];
As320sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 320^2, 4];
As330sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 330^2, 4];
As340sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 340^2, 4];
As360sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 360^2, 4];
As370sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 370^2, 4];
As380sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 380^2, 4];
As390sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 390^2, 4];
```

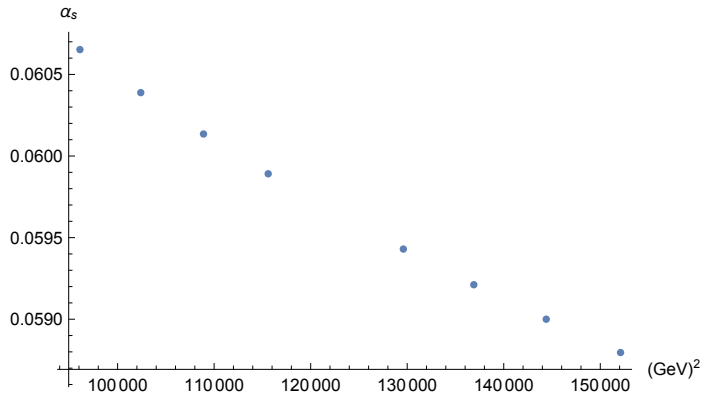
In[88]:=
```
Tablesq =
 TableForm[{{310^2, As310sq}, {320^2, As320sq}, {330^2, As330sq}, {340^2, As340sq},
   {360^2, As360sq}, {370^2, As370sq}, {380^2, As380sq}, {390^2, As390sq}},
  TableHeadings → {None, {"(GeV)^2", "α_s"}}]
```

Out[88]//TableForm=

$(\text{GeV})^2$	α_s
96 100	0.060652143088477628239
102 400	0.060388421999658314592
108 900	0.060135014955767075100
115 600	0.059891215080553203371
129 600	0.059429940216145267932
136 900	0.059211358799911389780
144 400	0.059000158599969752471
152 100	0.058795900402374475734

In[89]:=
```
A3 = ListPlot[%, AxesLabel → {"(GeV)^2", "α_s"}]
```

Out[89]=



Chunk 400

In[90]:=
```
As410sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 410^2, 4];
As420sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 420^2, 4];
As430sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 430^2, 4];
As440sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 440^2, 4];
As460sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 460^2, 4];
As470sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 470^2, 4];
As480sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 480^2, 4];
As490sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 490^2, 4];
```

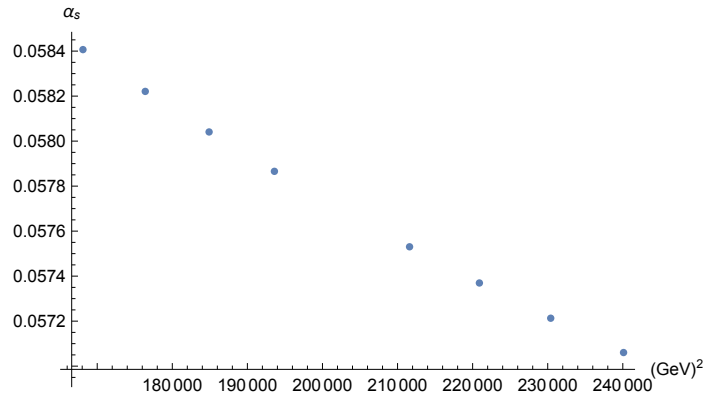
In[98]:=
```
Tablesq =
 TableForm[{{410^2, As410sq}, {420^2, As420sq}, {430^2, As430sq}, {440^2, As440sq},
   {460^2, As460sq}, {470^2, As470sq}, {480^2, As480sq}, {490^2, As490sq}},
  TableHeadings → {None, {"(GeV)^2", "α_s"}}]
```

Out[98]//TableForm=

(GeV)^2	α_s
168 100	0.058406633011998791438
176 400	0.058220913998135429581
184 900	0.058040710943952376694
193 600	0.057865733903804160227
211 600	0.057530403586227731609
220 900	0.057369570040011472818
230 400	0.057212998562673099505
240 100	0.057060488550937935285

In[99]:=
```
A4 = ListPlot[%, AxesLabel → {"(GeV)^2", "α_s"}]
```

Out[99]=



Chunk 500

In[100]:=
```
As510sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 510^2, 4];
As520sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 520^2, 4];
As530sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 530^2, 4];
As540sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 540^2, 4];
As560sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 560^2, 4];
As570sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 570^2, 4];
As580sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 580^2, 4];
As590sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 590^2, 4];
```

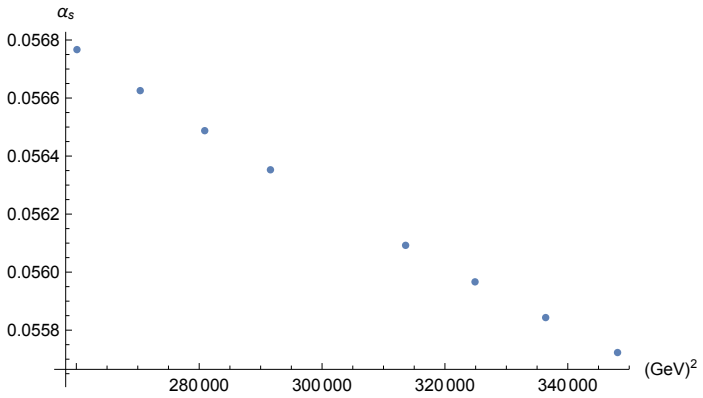
In[108]:=
```
Tablesq =
 TableForm[{{510^2, As510sq}, {520^2, As520sq}, {530^2, As530sq}, {540^2, As540sq},
   {560^2, As560sq}, {570^2, As570sq}, {580^2, As580sq}, {590^2, As590sq}},
  TableHeadings → {None, {"(GeV)^2", "α_s"}}]
```

Out[108]//TableForm=

$(\text{GeV})^2$	α_s
260 100	0.056766916181049859718
270 400	0.056625514984794638203
280 900	0.056487495637276966348
291 600	0.056352714055300979127
313 600	0.056092330717436679044
324 900	0.055966481695178615353
336 400	0.055843374738718490020
348 100	0.055722903150791890158

In[109]:=
```
A5 = ListPlot[%, AxesLabel → {"(GeV)^2", "α_s"}]
```

Out[109]=



Chunk 600

In[110]:=
```
As610sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 610^2, 4];
As620sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 620^2, 4];
As630sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 630^2, 4];
As640sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 640^2, 4];
As660sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 660^2, 4];
As670sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 670^2, 4];
As680sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 680^2, 4];
As690sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 690^2, 4];
```

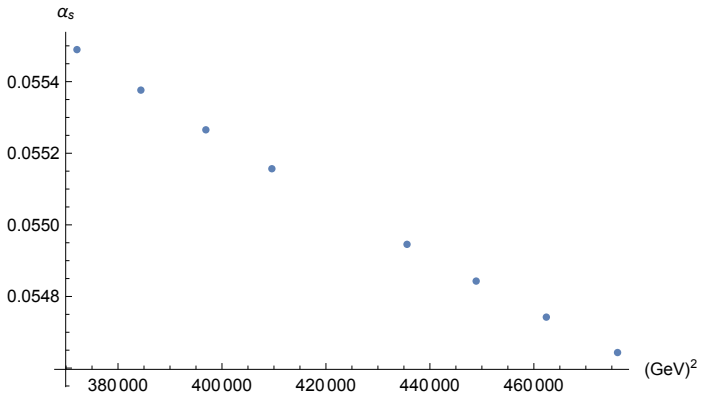
In[118]:=
```
Tablesq =
 TableForm[{{610^2, As610sq}, {620^2, As620sq}, {630^2, As630sq}, {640^2, As640sq},
   {660^2, As660sq}, {670^2, As670sq}, {680^2, As680sq}, {690^2, As690sq}},
  TableHeadings → {None, {"(GeV)^2", "α_s"}}]
```

Out[118]//TableForm=

$(\text{GeV})^2$	α_s
372 100	0.055489468375113863483
384 400	0.055376319654332663219
396 900	0.055265434502091777519
409 600	0.055156731873929174644
435 600	0.054945570395505045860
448 900	0.054842969048315465218
462 400	0.054742264752106250783
476 100	0.054643394612856791230

In[119]:=
```
A6 = ListPlot[%, AxesLabel → {"(GeV)^2", "α_s"}]
```

Out[119]=



Chunk 700

In[120]:=
```
As710sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 710^2, 4];
As720sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 720^2, 4];
As730sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 730^2, 4];
As740sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 740^2, 4];
As760sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 760^2, 4];
As770sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 770^2, 4];
As780sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 780^2, 4];
As790sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 790^2, 4];
```

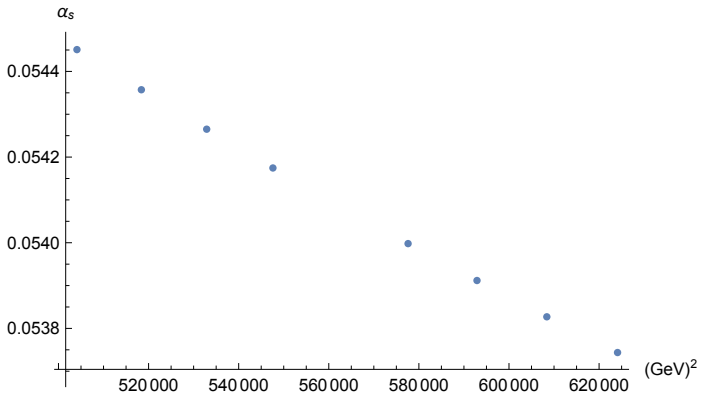
In[128]:=
```
Tablesq =
 TableForm[{{710^2, As710sq}, {720^2, As720sq}, {730^2, As730sq}, {740^2, As740sq},
   {760^2, As760sq}, {770^2, As770sq}, {780^2, As780sq}, {790^2, As790sq}},
  TableHeadings → {None, {"(GeV)^2", "α_s"}}]
```

Out[128]//TableForm=

$(\text{GeV})^2$	α_s
504 100	0.054450919911834203193
518 400	0.054357203714802931817
532 900	0.054265098081123838090
547 600	0.054174553298064412038
577 600	0.053997958260397700041
592 900	0.053911819042865392578
608 400	0.053827062526211801140
624 100	0.053743648787233187404

In[129]:=
```
A7 = ListPlot[%, AxesLabel → {"(GeV)^2", "α_s"}]
```

Out[129]=



Chunk 800

In[130]:=
```
As810sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 810^2, 4];
As820sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 820^2, 4];
As830sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 830^2, 4];
As840sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 840^2, 4];
As860sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 860^2, 4];
As870sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 870^2, 4];
As880sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 880^2, 4];
As890sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 890^2, 4];
```

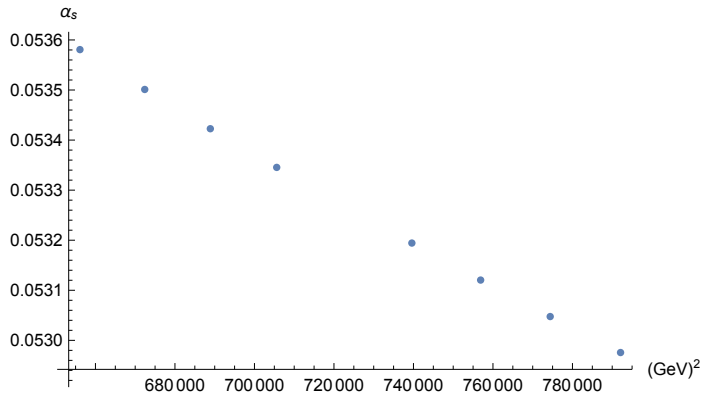
In[138]:=
```
Tablesq =
 TableForm[{{810^2, As810sq}, {820^2, As820sq}, {830^2, As830sq}, {840^2, As840sq},
   {860^2, As860sq}, {870^2, As870sq}, {880^2, As880sq}, {890^2, As890sq}},
  TableHeadings → {None, {"(GeV)^2", "α_s"}}]
```

Out[138]//TableForm=

$(\text{GeV})^2$	α_s
656 100	0.053580698098246867243
672 400	0.053501089192915336083
688 900	0.053422678995707558084
705 600	0.053345434996958318966
739 600	0.053194321799099320302
756 900	0.053120393637688653399
774 400	0.053047513634962049072
792 100	0.052975654992231128607

In[139]:=
```
A8 = ListPlot[%, AxesLabel → {"(GeV)^2", "α_s"}]
```

Out[139]=



Chunk 900

In[140]:=
```
As910sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 910^2, 4];
As920sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 920^2, 4];
As930sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 930^2, 4];
As940sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 940^2, 4];
As960sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 960^2, 4];
As970sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 970^2, 4];
As980sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 980^2, 4];
As990sq = AsRunDec[asMz /. NumDef, Mz /. NumDef, 990^2, 4];
```

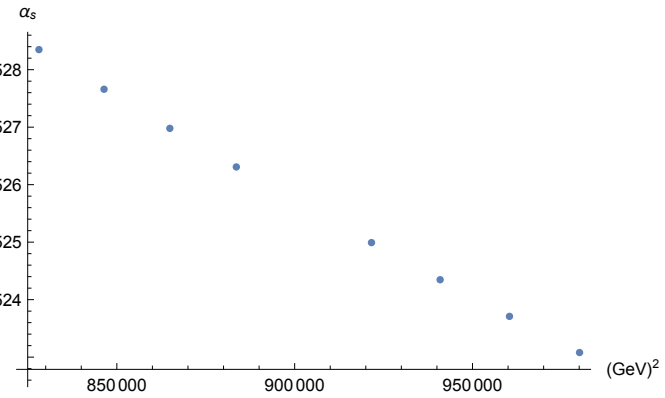
In[148]:=
```
Tablesq =
 TableForm[{{910^2, As910sq}, {920^2, As920sq}, {930^2, As930sq}, {940^2, As940sq},
   {960^2, As960sq}, {970^2, As970sq}, {980^2, As980sq}, {990^2, As990sq}},
  TableHeadings → {None, {"(GeV)^2", "α_s"}}]
```

Out[148]//TableForm=

$(\text{GeV})^2$	α_s
828 100	0.052834899450580376379
846 400	0.052765953676165005014
864 900	0.052697931425712483941
883 600	0.052630810366938817476
921 600	0.052499186329682455245
940 900	0.052434642418781293307
960 400	0.052370917770880756721
980 100	0.052307993594085351674

In[149]:=
```
A9 = ListPlot[%, AxesLabel → {"(GeV)^2", "α_s"}]
```

Out[149]=



Total Plot

In[150]:=
```
Show[A, B, F, G, A1, A2, A3, A4, A5, A6, A7, A8, A9]
```

Out[150]=