

```

Moff35[r_, R_] := (1 + (r / R)^2)^(-3.5)

FindRoot[Moff35[r, 1.] == 0.5, {r, .5}] (* find HWHM *)

{r → 0.467989}

Moff35[r_, R_] := (1 + (0.467989 r / R)^2)^(-3.5)
(* R is now HWHM*)

NIntegrate[r Moff35[r, 1], {r, 0, Infinity}]

0.913185

Moff35[r_, R_] := ((1 + (0.467989 r / R)^2)^(-3.5) / (0.9131848657721058` R^2)
(* so Int[r Moff35[r,R]=1 *)

Moff35D[d_, D_] := Moff35[d / 2, D / 2] / 4
(* d and D now aperture diameter and FWHM, and Int[d Moff35[d,D]=1 *)

NIntegrate[d Moff35D[d, 1], {d, 0, Infinity}]

1.

FindRoot[NIntegrate[r Moff35[r, 1.], {r, 0, reff}] == 0.5, {reff, 2}]
(* so reff is half-light (or effective) radius *)

NIntegrate::nlim: r = reff is not a valid limit of integration. >>

{reff → 1.20783}

(* so reff = 1.2 x HWHM *)

Dsee[λ_] := 0.75 * (λ / 500)^(-0.2)
(* CTIO median seeing*)

RMSSpotSK[λ_] = Switch[λ, 370, 75, 400, 61, 450, 45, 500, 30,
550, 24, 600, 22, 650, 21, 700, 22, 750, 24, 800, 26, 850, 28, 900, 30, 950, 31, 1000, 33]

Switch[λ,
370, 75,
400, 61,
450, 45,
500, 30,
550, 24,
600, 22,
650, 21,
700, 22,
750, 24,
800, 26,
850, 28,
900, 30,
950, 31,
1000, 33]

DoptSK[λ_] := Sqrt[0.5^2 + (1.666 * RMSSpotSK[λ] / 57)^2]
(* FWHM in arcsec, includes 0.5" for surface and alignment errors *)

Dgal = 0.8
(* nominal ELG FWHM , ~ 1.2 x SK's reff val at i=23.5*)

0.8

D1[λ_] := Sqrt[Dgal^2 + Dsee[λ]^2 + DoptSK[λ]^2]

AppLoss1[λ_] := NIntegrate[d Moff35D[d, D1[λ]], {d, 0, 1.8}]

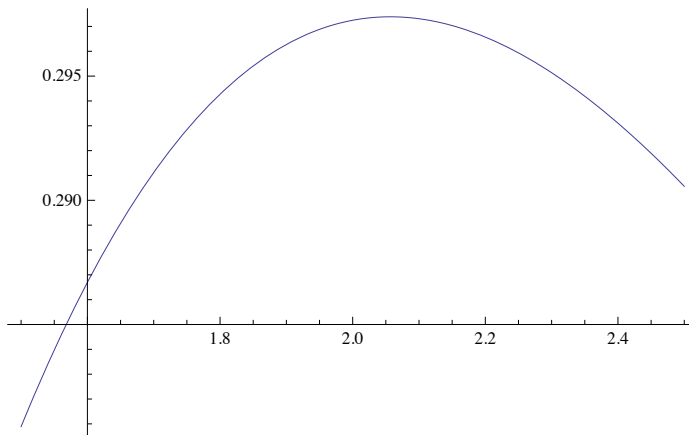
NIntegrate[
d Moff35D[d, {D1[370], D1[400], D1[450], D1[500], D1[550], D1[600], D1[650], D1[700],
D1[750], D1[800], D1[850], D1[900], D1[950], D1[1000]}], {d, 0, 1.8}]
{0.233282, 0.29719, 0.393333, 0.499942, 0.543896, 0.559834, 0.56894,
0.565152, 0.554166, 0.542293, 0.52969, 0.516506, 0.5104, 0.496524}

```

```

SN1[λ_, dfib_] :=
  NIntegrate[d Moff35D[d, D1[λ]], {d, 0, dfib}] / dfib (* S/N ratio, assumes sky-limited *)
P1850 = Plot[SN1[850, dfib], {dfib, 1.5, 2.5}]

```



```

RMSSpot6[λ_] = Switch[λ, 370, 36, 400, 34, 450, 31, 500, 27,
550, 24, 600, 21, 650, 19, 700, 18, 750, 17, 800, 17, 850, 18, 900, 19, 950, 20, 1000, 22]

```

```

Switch[λ,
  370, 36,
  400, 34,
  450, 31,
  500, 27,
  550, 24,
  600, 21,
  650, 19,
  700, 18,
  750, 17,
  800, 17,
  850, 18,
  900, 19,
  950, 20,
  1000, 22]

```

```

Dopt6[λ_] := Sqrt[0.5^2 + (1.666 * RMSSpot6[λ] / 57)^2]
(* FWHM in arcsec, includes 0.5" for surface and alignment errors *)

```

```

D6[λ_] := Sqrt[Dgal^2 + Dsee[λ]^2 + Dopt6[λ]^2]

```

```

NIntegrate[d Moff35D[d, D6[850]], {d, 0, 1.8}]

```

```

0.596418

```

```

NIntegrate[d Moff35D[d, D1[850]], {d, 0, 1.8}]

```

```

0.52969

```

```

NIntegrate[
  d Moff35D[d, {D6[370], D6[400], D6[450], D6[500], D6[550], D6[600], D6[650], D6[700],
    D6[750], D6[800], D6[850], D6[900], D6[950], D6[1000]}], {d, 0, 1.8}]

```

```

{0.449451, 0.465429, 0.489745, 0.520628, 0.543896, 0.566091, 0.581044,
  0.589534, 0.597659, 0.599985, 0.596418, 0.592404, 0.587982, 0.576577}

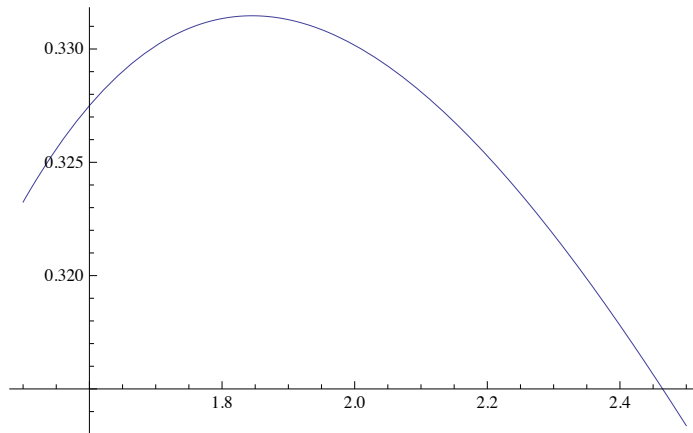
```

```

SN6[λ_, dfib_] :=
  NIntegrate[d Moff35D[d, D6[λ]], {d, 0, dfib}] / dfib (* S/N ratio, assumes sky-limited *)

```

```
P6850 = Plot[SN6[850, dfib], {dfib, 1.5, 2.5}]
```



```
(SN6[850, 1.8] / SN1[850, 1.8]) ^ 2
```

```
1.26782
```

```
D60[λ_] := Sqrt[Dsee[λ] ^ 2 + Dopt6[λ] ^ 2]
```

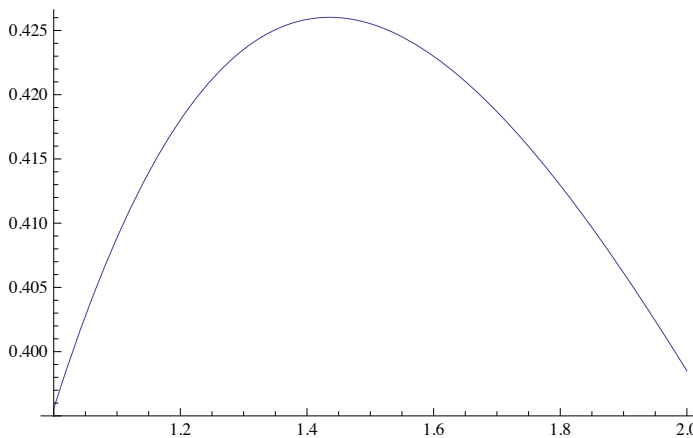
```
NIntegrate[
  dMoff35D[d, {D60[370], D60[400], D60[450], D60[500], D60[550], D60[600], D60[650],
    D60[700], D60[750], D60[800], D60[850], D60[900], D60[950], D60[1000]}], {d, 0, 1.8}]
```

```
{0.533214, 0.555457, 0.589678, 0.633706, 0.667209, 0.69934, 0.721028,
  0.73334, 0.745113, 0.748479, 0.743316, 0.737501, 0.73109, 0.714549}
```

```
SN60[λ_, dfib_] :=
```

```
NIntegrate[dMoff35D[d, D60[λ]], {d, 0, dfib}] / dfib (* S/N ratio, assumes sky-limited *)
```

```
P6850 = Plot[SN60[850, dfib], {dfib, 1.0, 2}]
```

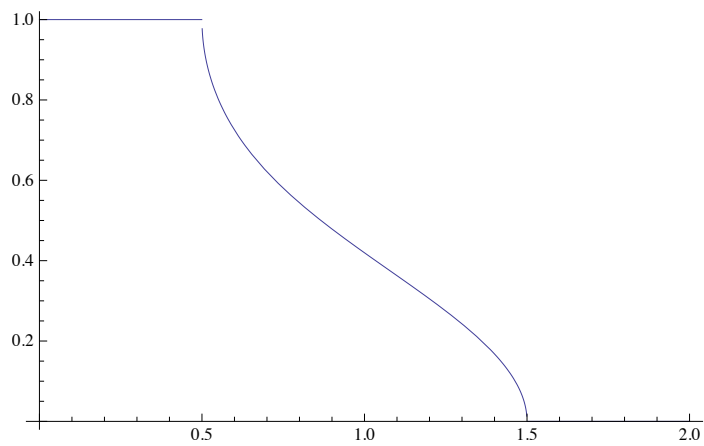


```
0.75 × 1.15 ^ 0.6
```

```
0.8156051654192582`
```

```
Frac[r1_, r2_, del_] := Re[ArcCos[Max[-1, Min[1, (r1^2 + del^2 - r2^2) / (2 r1 del)]]] / Pi]
```

```
Plot[Frac[0.5, 1, del], {del, 0.00001, 2}]
```



```
Frac[1, 1, 1]
```

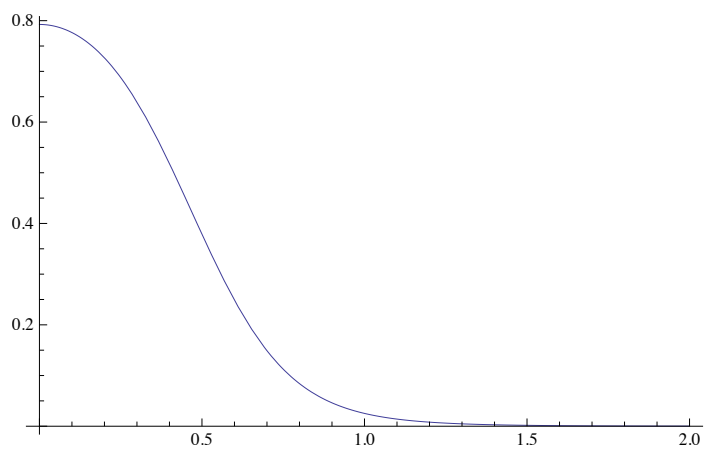
$$\frac{1}{3}$$

```
AppLossd[dfwhm_, dapp_, del_] :=  
  NIntegrate[d Frac[d / 2, dapp / 2, del] Moff35D[d, dfwhm], {d, 0, Infinity}]
```

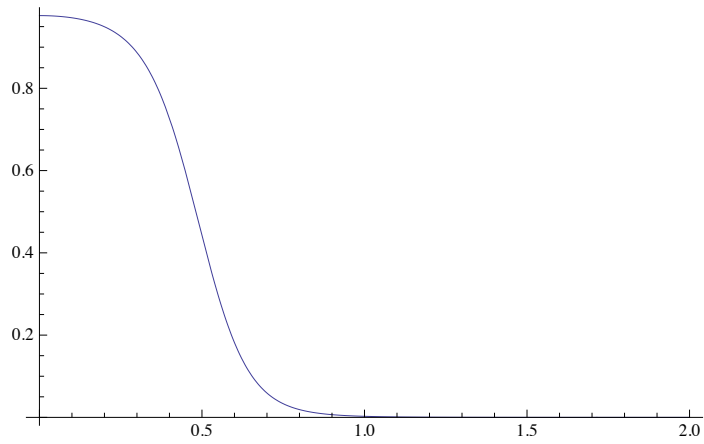
```
AppLossd[1, 1, 0.00001]
```

```
0.390493
```

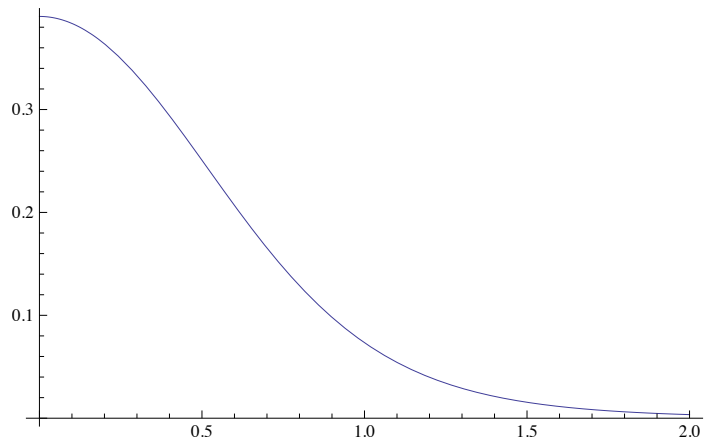
```
Plot[AppLossd[0.5, 1, del], {del, 0.00001, 2}]
```



```
Plot[AppLossd[0.25, 1, del], {del, 0.00001, 2}]
```



```
Plot[AppLossd[1, 1, del], {del, 0.00001, 2}]
```



```

RMSSpot7[λ_] = Switch[λ,
  350, 25.8,
  370, 24.7,
  400, 23.0,
  450, 19.9,
  500, 15.7,
  550, 13.3,
  600, 13.4,
  650, 13.4,
  700, 13.7,
  750, 14.1,
  800, 14.4,
  850, 15.3,
  900, 15.9,
  950, 16.6,
  1000, 17.3,
  1050, 18.1]

Switch[λ,
  350, 25.8,
  370, 24.7,
  400, 23.,
  450, 19.9,
  500, 15.7,
  550, 13.3,
  600, 13.4,
  650, 13.4,
  700, 13.7,
  750, 14.1,
  800, 14.4,
  850, 15.3,
  900, 15.9,
  950, 16.6,
  1000, 17.3,
  1050, 18.1]

Dopt7[λ_] := Sqrt[0.5^2 + (1.666 * RMSSpot7[λ] / 57)^2]
(* FWHM in arcsec, includes 0.5" for surface and alignment errors *)

D7[λ_] := Sqrt[Dgal^2 + Dsee[λ]^2 + Dopt7[λ]^2]

DR3540[AM_] := Switch[AM,
  1.0, 0.,
  1.05, .17,
  1.15, .31,
  1.25, .40,
  1.35, .52,
  1.45, .57,
  1.55, .64,
  1.65, .70,
  1.75, .77,
  1.85, .83,
  2.05, .96]

AppLossd0[dfwhm_, dapp_] := NIntegrate[d Moff35D[d, dfwhm], {d, 0, dapp}]

AppLossd0[D7[350], 1.8]

0.51594

ApplossDR[λ_, AM_] := AppLossd[D7[λ], 1.8, DR3540[AM]]

ApplossDR[350, 1.05]

0.506411

```

**ApplossDR[350, 1.15]**

0.484726

**ApplossDR[350, 1.25]**

0.464735

**ApplossDR[350, 1.35]**

**0.43168350676817074`**

**ApplossDR[350, 1.45]**

0.416072

**ApplossDR[350, 1.55]**

0.392742

**0.43168350676817074` / 0.5159403660045578`**

0.836693

**0.41607237456899737` / 0.5159403660045578`**

0.806435