























$$\tilde{V}_{ijk} = g_i(t) g_j^*(t) b_{ijk}(t) V_{ij}(v_k(t), v_k(t)) + \text{noise term}$$



















10

11

12 13 14 15







$$T_a^* = \frac{(1 + g_{im})}{\eta_f} e^{\tau_{atm}} T_a$$









$$I_b = \frac{c^2}{2kT^2} I_v$$



$$T_a^* = \frac{\eta_0 A}{2k} S_v = \frac{1}{j} S_v$$

↓

—
—

24
—
no A

Indice + Indice + Indice + Indice









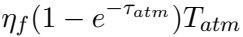














1-17-2020





$$T_{sys} = \frac{1 + g_{irm}}{\eta_f} e^{\tau_{atm}} T_{noise}$$













$$\sigma = \frac{1}{\eta_g \eta_p} \frac{\sqrt{2k}}{\eta_a A} \frac{T_{sys}}{\sqrt{\delta v \delta t}}$$

$$\sigma = \frac{1}{\eta_g \eta_p} \frac{2k}{\eta_a A} \frac{T_{sys}}{\sqrt{n(n-1)} \delta v \delta t}$$



100



1

0

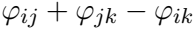
—

2

$$W_{ij} = \frac{1}{\sigma_{ij}^2}$$

$V_j = \omega_j$



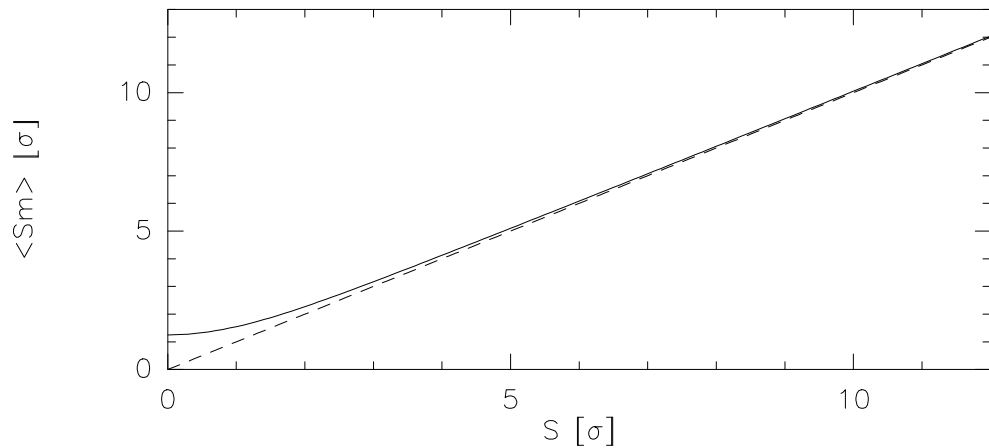
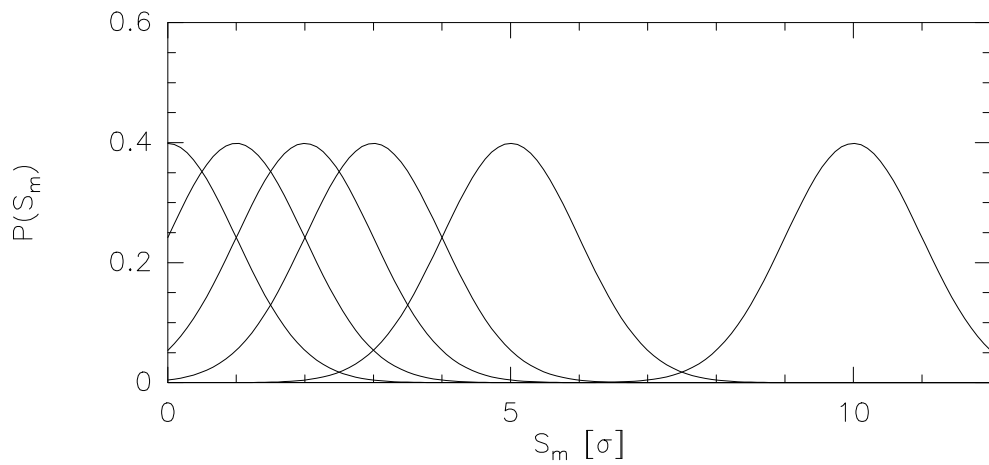
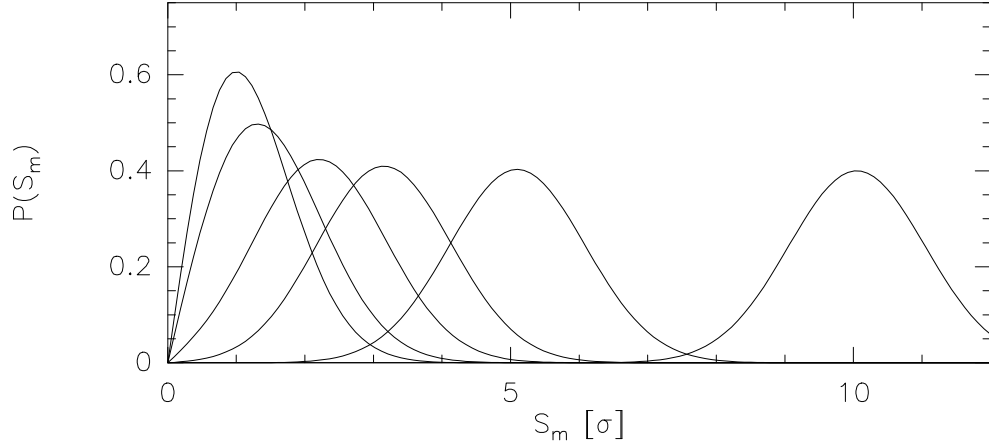


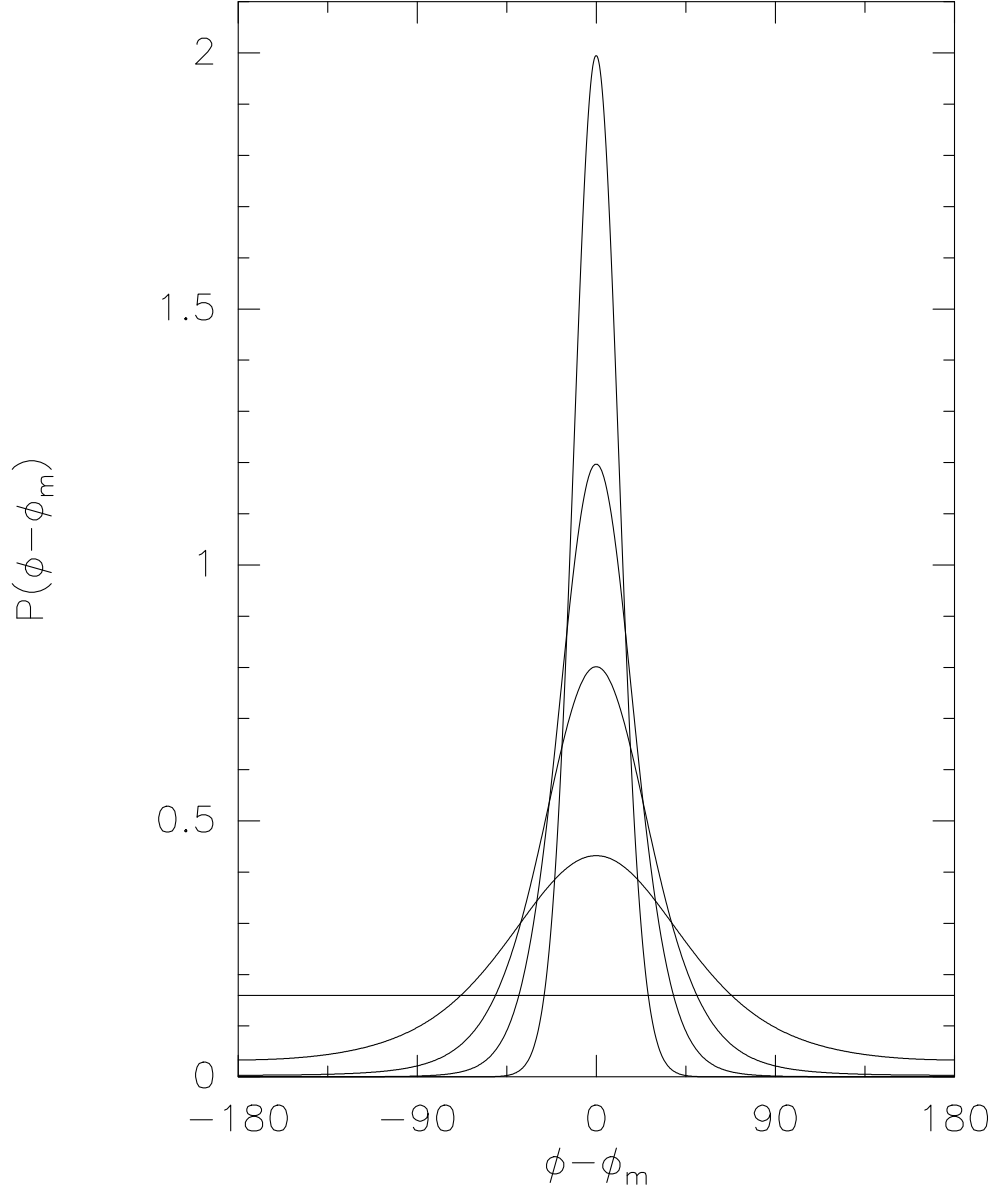
$$\begin{array}{c} \sim \qquad \qquad \sim \\ a_{ij} a_{kl} \end{array}$$

$$\begin{array}{c} \sim \qquad \qquad \sim \\ a_{ik} a_{jl} \end{array}$$

Qzj Qkl

Qzk Qji

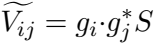


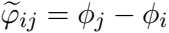


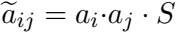


9020

Geometrische Optik



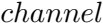






(spelled out, spelled in)

(c) 1997, 2000, 2003, 2006, 2009, 2012, 2015, 2018, 2021, 2024





Spectral windows: isotopologue REST: 89.200 GHz (LSR: 89.189, RF: 89.189) IF1: 6891 MHz USB

3C8

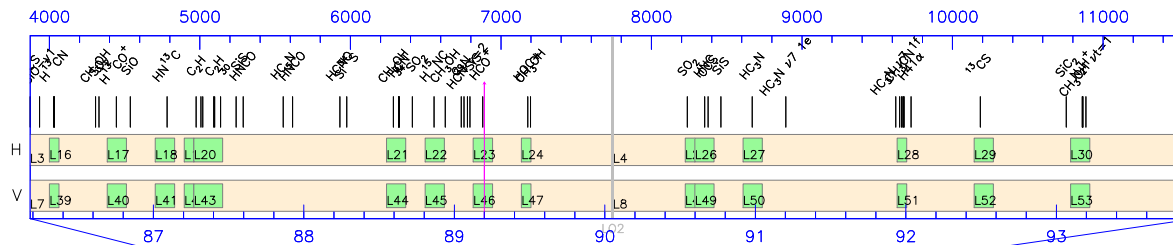
df = 2000.0 kHz

LO: 82.299 GHz

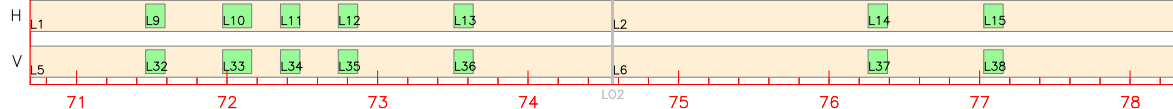
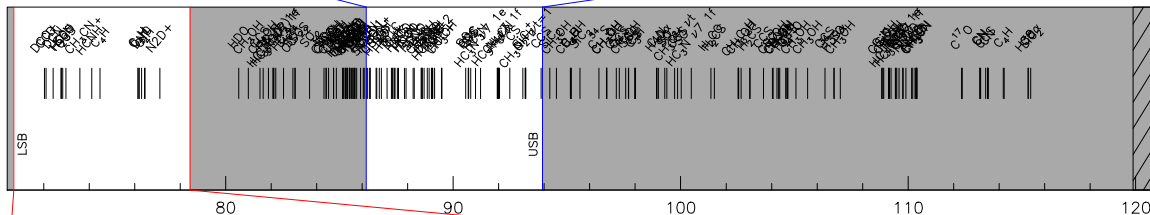
df = 62.5 kHz

Intermediate Frequency IF1 (MHz)

86/128 flexible chunks used



Band 1



Rest Frequency (GHz)

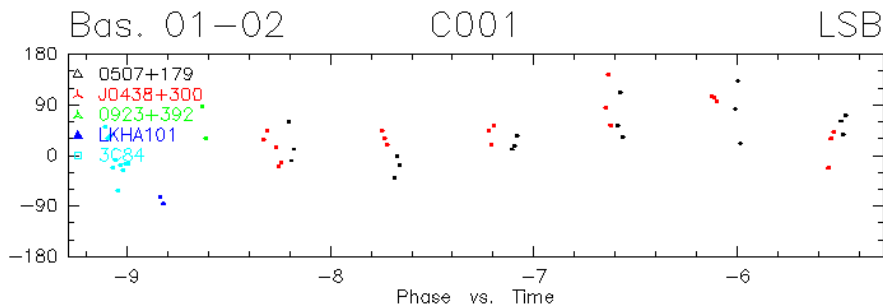
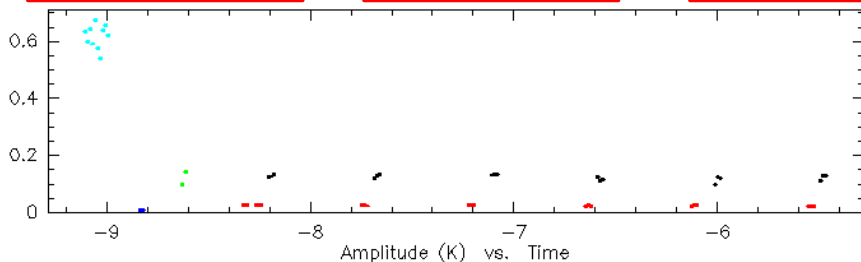
4

RF: Uncal.
Am: Abs.
Ph: Abs.

CLIC - 06-NOV-2019 13:30:29 - pietu@pietu.iram.fr ED3W12N11W20E16E68W09 7ant-Special
017IC001 isotopologue 89.200GHz B1 Q0() Q0()
(17 6322 P CORR)-(373 6602 P CORR) 19-APR-2018 14:53-18:31

Scan Avg.
HORIZONTAL pol.

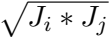
1 Bas. 01-02 2 C001 3 LSB





100%

15









Erw

—

Ordn





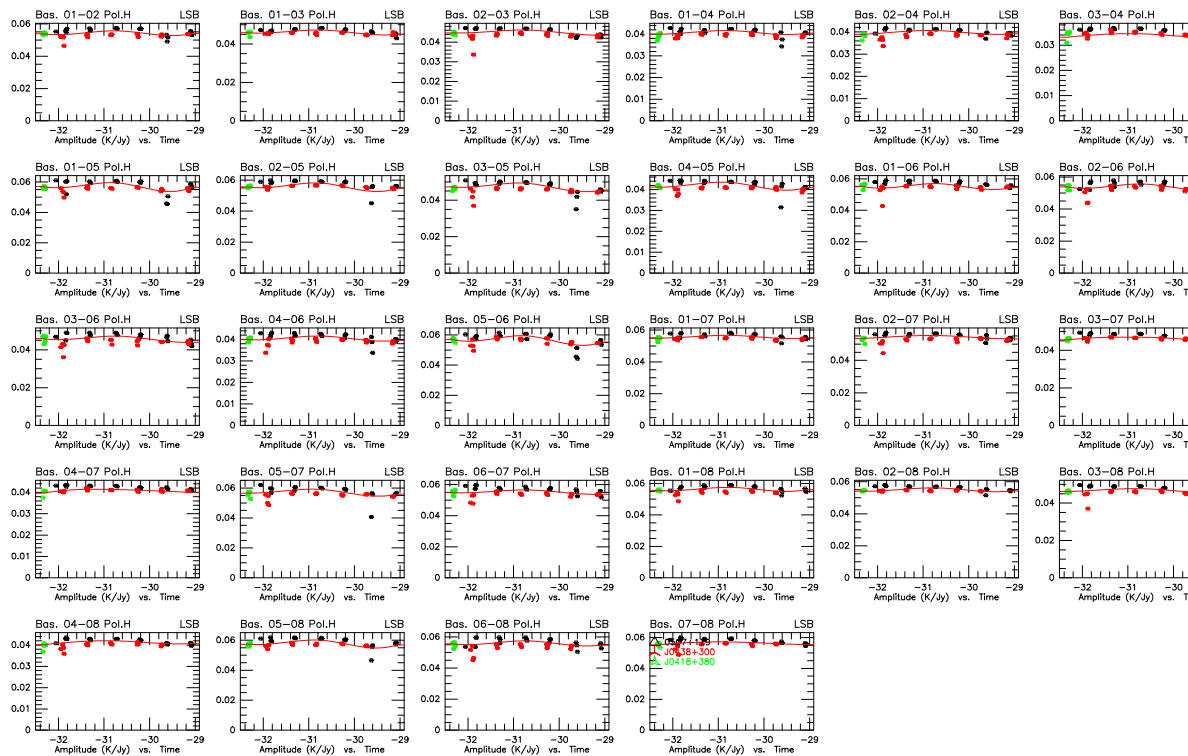


Q. 10. $\frac{1}{x^2} = x^{-2}$

RF: Uncal.
Am: Scaled
Ph: Abs.

CLIC - 07-NOV-2017 14:06:59 - pietu@pietu.iram.fr
D17IC001 isotopologue 89.200GHz B1 Q0() Q0()
(21 4716 P CORR)-(352 4985 P CORR) 18-APR-2018 15:39-18:55

Scan
HORIZONTAL



RF: Uncal.

CLIC - 07-NOV-2017 14:02:27 - pietu@pietu.iam.fr

E03W12N11N29W20E16N20W09 9C-E10

Scan

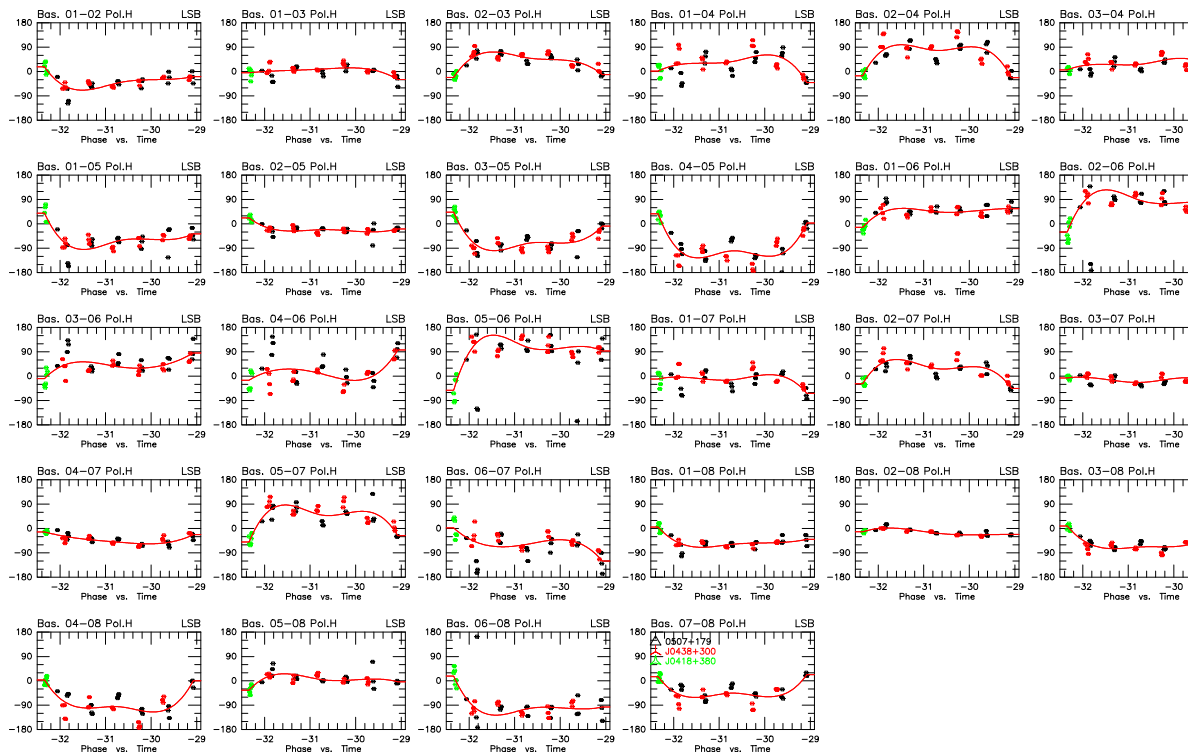
Am: Abs.

D17IC001 isotopologue 89.200GHz B1 Q0() Q0()

HORIZONTAL

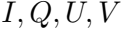
Ph: Abs.

(21 4716 P CORR)-(352 4985 P CORR) 18-APR-2018 15:39-18:55



$$A_j = a_j(1 + b \cos(2x) + c \sin(2x))$$





P

=

$$\frac{\sqrt{v_0^2 + v^2}}{I}$$



2024-11-11









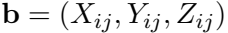


$$(T_{hot} + T_{rec}) \times \frac{P_{sky}}{P_{hot}} - T_{rec} = \eta_f \times Airmass \times T_{zenith} + (1 - \eta_f) \times T_{ground}$$

τ_g

$=$

$\frac{b.s}{c}$



$B = (b_{ij})_{i,j=1}^n$



2020-2021

2π

λ

b.s

$$\frac{2\pi}{\lambda_k} (X_{ij} \cos h \cos \delta - Y_{ij} \sin h \cos \delta + Z_{ij} \sin \delta)$$

GOVERNMENT

2024



30-sep-2019-holo-r1

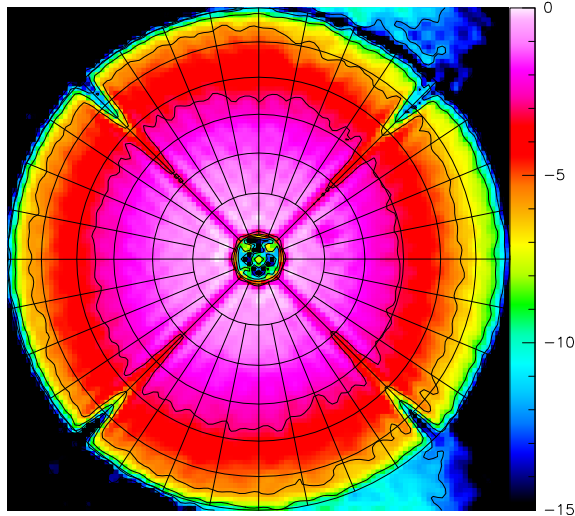
RF: Fr.(B) CLIC - 19-NOV-2019 10:01:36 - pietu@pietu.iram.fr - Ant 10 - N05N13W12W09E10E04W05N02N09
 Am: Rel.(B) 3C454.3 9D scans 6011 to 6085 30-SEP-2019 23:23UT El: 56.00
 Ph: Rel.(B)

rms Pha.

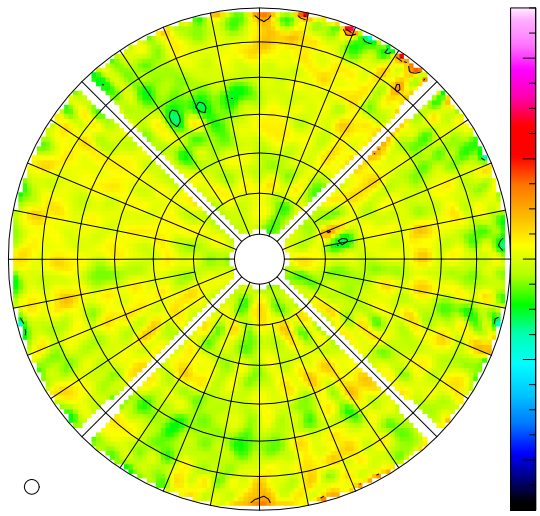
01-09 4.82
 02-09 3.75
 03-09 14.35
 04-09 13.36
 05-09 10.87
 06-09 10.26
 07-09 11.02
 08-09 8.17

Edge taper = 19.05x 16.49 dB - offset X= -0.39 Y= -0.13 m
 Focus offsets (X,Y,Z) = -0.71 -1.40 0.12 mm; Astigmatism = 20.4 μm (52.0deg.)
 Phase rms (unweighted)= 0.101 (weighted)= 0.097 radians
 Surface rms (unweighted)= 33.63 - (weighted)= 31.09 μm
 η_A (82.000 GHz) = 0.737; η_A (230.0 GHz) = 0.692; η_A (345.0 GHz) = 0.632
 S/T(82.000 GHz)= 21.179 Jy/K; S/T(230GHz)= 22.573 Jy/K; S/T(345 GHz)= 24.720 Jy/K
 $\eta_I=0.744$ $-\eta_S=0.862$ $-\eta_P$ (82.000 GHz)=0.991 $-\eta_P$ (230 GHz)=0.930 $-\eta_P$ (345 GHz)=0.849
 Rms/ring: 27.6 29.3 26.5 33.4 31.0 37.8

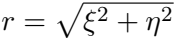
Amplitude (back view)
 -15.000 to 0.000 by 3.000



Normal errors (back view)
 -500.000 to 500.000 by 100.000









01234567













$$\delta z \left(1 - \frac{1 - \frac{r^2}{4f^2}}{\sqrt{\frac{r^2}{f^2} + \left(1 - \frac{r^2}{4f^2}\right)^2}} \right)$$



$$\delta x \frac{\xi}{f} \left(1 - \frac{1}{\sqrt{\frac{r^2}{f^2} + \left(1 - \frac{r^2}{4f^2} \right)^2}} \right)$$



$$\delta y \frac{\eta}{f} \left(1 - \frac{1}{\sqrt{\frac{r^2}{f^2} + \left(1 - \frac{r^2}{4f^2} \right)^2}} \right)$$



$$a + \frac{\xi^2 - \eta^2}{2f^2}$$



$$a \times \frac{257}{2f^2}$$





















$$\psi_a = \frac{\arctan(a_x, a_y)}{2}$$







$$|\int_A A(\xi, \eta) \exp(i\phi(\xi, \eta)) d\xi d\eta|^2$$

$$\pi r^2 \int_A A(\xi, \eta)^2 d\xi d\eta$$



$$|\int_A A(\xi, \eta) d\xi d\eta|^2$$

$$\pi r^2 \int_A A(\xi, \eta)^2 d\xi d\eta$$

$$J = \frac{2k}{\eta_A \pi r^2}$$

$$\delta p = \delta \phi \times \frac{\lambda}{4\pi} \times \sqrt{1 + \frac{r^2}{4f^2}}$$







bs



$$\frac{1}{c}(X_{ij}\cos h\cos\delta-Y_{ij}\sin h\cos\delta+Z_{ij}\sin\delta)$$

Free
Free



Free
AI





$$F_{topo} = F_{rest} \left(1 + \delta - \varepsilon \right)$$



$$F_{IF} = \pm \left(F_{rest} \left(1 + \delta - \frac{v}{c} \right) - F_{D1} \right)$$

$$F_{IO1} = F_{rest} \left(1 + \delta - \frac{v}{c} \right) \mp F_{IF}^{rest}$$



THE UNIVERSITY OF CHICAGO

Wrestling * Wrestling + Wrestling



$$dI_{pop} = dI_{rest} + d - v$$









FO

reel















Av



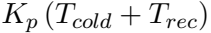
Kp Av





10

0010





$\ln \left(\frac{1}{1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \frac{1}{16} - \frac{1}{32} + \frac{1}{64} - \frac{1}{128} + \frac{1}{256} - \frac{1}{512} + \frac{1}{1024} - \frac{1}{2048} + \frac{1}{4096} - \frac{1}{8192} + \frac{1}{16384} - \frac{1}{32768} + \frac{1}{65536} - \frac{1}{131072} + \frac{1}{262144} - \frac{1}{524288} + \frac{1}{1048576} - \frac{1}{2097152} + \frac{1}{4194304} - \frac{1}{8388608} + \frac{1}{16777216} - \frac{1}{33554432} + \frac{1}{67108864} - \frac{1}{134217728} + \frac{1}{268435456} - \frac{1}{536870912} + \frac{1}{1073741824} - \frac{1}{2147483648} + \frac{1}{4294967296} - \frac{1}{8589934592} + \frac{1}{17179869184} - \frac{1}{34359738368} + \frac{1}{68719476736} - \frac{1}{137438953472} + \frac{1}{274877906944} - \frac{1}{549755813888} + \frac{1}{1099511627776} - \frac{1}{2199023255552} + \frac{1}{4398046511104} - \frac{1}{8796093022208} + \frac{1}{17592186044416} - \frac{1}{35184372088832} + \frac{1}{70368744177664} - \frac{1}{140737488355328} + \frac{1}{281474976710656} - \frac{1}{562949953421312} + \frac{1}{1125899906842624} - \frac{1}{2251799813685248} + \frac{1}{4503599627370496} - \frac{1}{9007199254740992} + \frac{1}{18014398509481984} - \frac{1}{36028797018963968} + \frac{1}{72057594037927936} - \frac{1}{144115188075855872} + \frac{1}{288230376151711744} - \frac{1}{576460752303423488} + \frac{1}{1152921504606846976} - \frac{1}{2305843009213693952} + \frac{1}{4611686018427387904} - \frac{1}{9223372036854775808} + \frac{1}{18446744073709551616} - \frac{1}{36893488147419103232} + \frac{1}{73786976294838206464} - \frac{1}{147573952589676412928} + \frac{1}{295147905179352825856} - \frac{1}{590295810358705651712} + \frac{1}{1180591620717411303424} - \frac{1}{2361183241434822606848} + \frac{1}{4722366482869645213696} - \frac{1}{9444732965739290427392} + \frac{1}{18889465931478580854784} - \frac{1}{37778931862957161709568} + \frac{1}{75557863725914323419136} - \frac{1}{151115727451828646838272} + \frac{1}{302231454903657293676544} - \frac{1}{604462909807314587353088} + \frac{1}{1208925819614629174706176} - 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\frac{1}{1482$



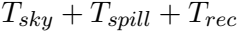
Reciprocal











$$T_{rec} = \frac{P_{cold} T_{hot} - P_{hot} T_{cold}}{P_{hot} - P_{cold}}$$

$$T_{sky} = (T_{hot} + T_{rec}) \frac{P_{sky}}{P_{hot}} - T_{rec} - T_{spill}$$



$$T_{\text{err}} = \frac{T_{\text{sky}}}{\eta_f}$$

Тотта

снэ, а







$$T_{emi} = \frac{T_{atm_{emi,s}} + g_{im} T_{atm_{emi,i}}}{1 + g_{im}}$$





$$T_{sys,s} = \frac{e^{\tau_s} (T_{hot} - T_{sky} - T_{spill}) (1 + G_{im})}{\eta_f} \frac{P_{sky}}{P_{hot} - P_{sky}}$$

$$T_{sys,i} = \frac{e^{\tau_i} (T_{hot} - T_{sky} - T_{spill}) \left(1 + \frac{1}{g_{im}}\right)}{\eta_f} \frac{P_{sky}}{P_{hot} - P_{sky}}$$

$$T_{sky} + T_{spill} = (1 - \eta_f) \left(\frac{T_{atm, s} + g_{im} T_{atm, i}}{1 + g_{im}} \right) + \eta_f T_{ground}$$





$$T_{ijk} = \frac{C_{ijk}}{\sqrt{C_{ik}C_{jk}}} \sqrt{T_{sys}(i)T_{sys}(j)}$$















$$T_{triple} = \frac{1 - \left(\frac{\nu_1}{\nu_2}\right)^2}{1 - \left(\frac{\nu_2}{\nu_3}\right)^2} \left(T_2 - T_3 \left(\frac{\nu_2}{\nu_3}\right)^2\right) - \left(T_1 - T_2 \left(\frac{\nu_1}{\nu_2}\right)^2\right)$$

