coherent synchrotron radiation for damping rings: assessment of theories & experimental proposal

> Frank Zimmermann IWLC2010, CICG, Geneva, 21 October 2010

Thanks to Karl Bane, Mitsuo Kikuchi, Kazuhito Ohmi, Katsunobu Oide, Yannis Papaphilippou, Demin Zhou

some references

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[2] S. Heifets and G. Stupakov, "Single-mode Coherent Synchrotron Radiation Instability," PRST-AB 6, 064401 (2003); <u>http://prst-</u> <u>ab.aps.org/pdf/PRSTAB/v6/i6/e064401</u>

[3] K.L.F. Bane, Y. Cai, G. Stupakov, "Comparison of Simulation Codes for Microwave Instability in Bunched Beams," Proc. IPAC'10, Kyoto Japan (2010) ;

http://epaper.kek.jp/IPAC10/papers/tupd078.pdf

[4] D. Zhou et al, "CSR in the SuperKEKB Damping Ring," IPAC'10 Kyoto (2010), <u>http://epaper.kek.jp/IPAC10/papers/tupeb018.pdf</u>

[5] F. Zimmermann, « Estimates of CSR Instability Thresholds for Various Storage Rings," CLIC Note to be published

Stupakov-Heifets formulae (2002)

$$\Lambda = \frac{N_b r_e \rho \sqrt{2\pi}}{C |\eta| \sigma_z \gamma \sigma_\delta^2}$$

Stupakov-Heifets parameter

conditions for instability:

$$\frac{\rho}{b} \leq \Lambda$$

no shielding by the beam pipe

$$\sigma_z \geq \frac{\rho}{2\Lambda^{3/2}}.$$

sufficiently long bunch (coasting beam approximation)

small horizontal beam size

$$\Lambda << \left(\frac{\rho^2}{\sigma_x \beta_x}\right)^{2/2}$$

negligible effect of velocity spread

not tuitilied!

$$\frac{N_b r_e}{\sqrt{2\pi}\gamma\sigma_z\sigma_\delta} << 1$$

continuous mode spectrum (2003):

3

$$C03 = \left(\frac{N_b r_e}{\sqrt{2\pi\gamma\sigma_z}}\right)^5 \left(\frac{2a}{\eta\rho}\right)^3 \frac{1}{\sigma_\delta^8} \frac{1}{\pi^{2/3}} \ge 1$$

Stupakov-Heifets formulae [1,2] **evaluated for several storage rings**

	SuperKEKB LER	SuperKEKB HER	SuperKEKB e+ DR	ATF DR
beam energy [GeV]	4	7	1.1	1.28
slip factor η	0.000274	0.000188	0.017	0.0019
rms mom. spread $\sigma_{\delta,rms}$ [%]	0.08	0.065	0.055	0.06
bunch population [109]	90	65	37.5	10
circumference <i>C</i> [m]	3016	3016	135	138.6
bending radius ρ [m]	73.3	104.5	2.65	5.73
vert. beam pipe radius b [cm]	4.7	2.5	1.6	1.2?
Stupakov-Heifets parameter Λ	1864	2905	67	339
ρ /b	1560	4180	166	478
σ_{z} [cm]	0.6	0.5	0.7	0.5
ρ/(2 Λ ^{3/2}) [cm]	0.05	0.03	0.24	0.05
$N_b r_0 / ((2\pi)^{1/2} \sigma_z \sigma_\delta \gamma)$	0.0027	0.0016	0.0051	0.0015
β_x at bend [m]	10?	10?	1.5	3?
ε _x [nm]	3.2	5.0	2100→41	~1.5
σ_x at bend [μ m]	179	224	248	67
$\rho^{4/3}/(\sigma_x\beta_x)^{2/3}$	20800	28800	710	2990
τ _x [ms]	37?	56?	11	17.2
C03	0.0128	0.0003	0.0033	0.0002
Q _s	-0.025	-0.025	-0.015	-0.0045
N _{b,thr}	1.0x10 ¹¹	1.9x10 ¹¹	4.5x10 ¹⁰	1.15×10^{10}
N _b /N _{b,thr}	0.89	0.35	0.83	0.86
$\Lambda b/\rho$	1.19	0.69	0.40	0.71

Bane-Cai-Stupakov result (2010)



Figure 2: For the CSR wake, threshold value of S_{csr} vs. shielding parameter, $\Pi = \rho^{1/2} \sigma_{z0} / h^{3/2}$. Symbols give results of the VFP solver (blue) and the LV code (red).

	SuperKEKB	SuperKEKB	SuperB	SuperB	CLIC	CDR
	LER	HER	LER	HER	2009	2010
beam energy [GeV]	4	7	4.18	6.7	2.	86
slip factor η	0.000274	0.000188	0.00042	0.0004	6.5x10 ⁻⁵	8x10 ⁻⁵
rms mom. spread $\sigma_{\delta,rms}$ [%]	0.08	0.065	0.066	0.062	0.11	0.13
bunch population [10 ⁹]	90	65	57.4	57.4	4	.1
circumference C [m]	3016	3016	1258	1258	493	421
bending radius ρ [m]	73.3	104.5	29.3	80.5	6.9	6.84
vert. beam pipe radius b [cm]	4.7	2.5	2.0	2.5	0.9	1.0
Stupakov-Heifets parameter Λ	1864	2905	1254	2557	915	387
ρ /b	1560	4180	1465	3220	767	684
σ_{z} [cm]	0.6	0.5	0.5	0.5	0.1	0.16
ρ/(2 Λ ^{3/2}) [cm]	0.05	0.03	0.03	0.03	0.01	0.04
$N_b r_0 / ((2\pi)^{1/2} \sigma_z \sigma_\delta \gamma)$	0.0027	0.0016	0.0024	0.0016	0.0007	0.0004
β_x at bend [m]	10?	10?	6?	2?	0.2	
ε _x [nm]	3.2	5.0	2.41	2.0	0.	09
σ_{x} at bend [μ m]	179	224	120	63		4
$\rho^{4/3}/(\sigma_x\beta_x)^{2/3}$	20800	28800	11230	137900	146600	144900
τ_x [ms]	37?	56?	44	29	1.62	1.88
C03	0.0128	0.0003	0.0042	0.0001	0.0052	0.0001
Q _s	-0.025	-0.025	-0.01	-0.01	-0.009	-0.0076
N _{b,thr}	1.0x10 ¹¹	1.9x10 ¹¹	5.5x10 ¹⁰	6.7x10 ¹⁰	5.7x10 ⁹	1.2x10 ¹⁰
N _b /N _{b,thr}	0.89	0.35	1.04	0.85	0.72	0.33
Λb/ρ	1.19	0.69	0.86	0.79	1.19	0.57

predictions from Stupakov-Heifets & Bane-Cai-Stupakov often similar, but not always!

- e.g., for SuperB LER $\rho/b < \Lambda$, and, yet, the Bane et al formula predicts instability.
- 2010 version of the CLIC DR more stable than the previous one
- both the shielding by the beam pipe and the finite bunch length will prevent any CSR microbunching instability in the KEKB Damping Ring; the instability is also unlikely to appear in the ATF for present operating conditions

Concern:

At the threshold the inequality "CO3≥1" of [2] is not fulfilled for any of the example storage rings considered so far!

This could mean that **only a single isolated mode should drive the CSR instability** in all these cases, and arguably that neither the formalism of [1] nor the one of [3] is applicable.

could one make CSR instability appear at ATF?

threshold strongly depends on the momentum spread through the parameter Λ

assumed scaling $\delta_{\rm rms} \sim E$, $V_{rf} \sim E$, $\sigma_z \sim E$, $\varepsilon_{x,y} \sim E^2$, $\tau \sim 1/E^3$

Beam & CSR-instability related parameters for the ATF DR at 2 different energies.

ATE damning ring	nominal	lower energy
hoom operate [CoV]	1 20	1.00
	1.20	1.00
slip factor η	0.	0019
rms momentum spread σ _{δ,rms} [%]	0.06	0.047
bunch population [10 ⁹]	10	10
circumference <i>C</i> [m]	1	38.6
bending radius ρ [m]	5	5.73
vert. beam pipe radius b [cm]	1	L.2?
Stupakov-Heifets parameter Λ	339	906
ρ/b		478
σ_{z} [cm]	0.5	0.39
ρ/(2 Λ ^{3/2}) [cm]	0.05	0.011
$N_b r_0 / (\sqrt{2\pi} \sigma_z \sigma_\delta \gamma)$	0.0015	0.0031
β_x at bend [m]		3?
ε _x [nm]	~1.5	0.9
σ_x at bend [μ m]	67	52
$\rho^{4/3}/(\sigma_x\beta_x)^{2/3}$	2990	3540
τ_x [ms]	17.2	36.1
C03	0.0017	0.0141
Q _s	-0.	.0045
N _{nb,thr}	1.15x10 ¹⁰	4.3x10 ⁹
$N_b/N_{nb,thr}$	0.86	2.32
Λb/ρ	0.71	1.90

ATF Damping Ring as test bed? Iowering ATF beam energy \rightarrow CSR instability

intensity/"threshold"



Note: Bane-Cai-Stupakov predict instability in a regime where it is excluded by Stupakov-Heifets Also note: ATF Damping Ring has initially operated at 0.96 GeV beam energy, in 1997

CSR stability for SuperKEKB Damping Ring designs

	SuperKEKB e+ DR	SuperKEKB e+ DR OLD DESIGN
beam energy [GeV]	1.1	1.0
slip factor η	0.017	0.00343
rms momentum spread $\sigma_{\delta,rms}$ [%]	0.055	0.054
bunch population [10 ⁹]	37.50	37.5
circumference <i>C</i> [m]	-21 1135	135.5
bending radius ρ [m]	2.650185	2.2
vert. beam pipe radius b [01]	roly app	1.4?
Stupakov-Heifets parameter Ar 1 SU	67	430
p/b 50 1	166	that 129
σ_{z} [cm]	0.7hoWS	0.51
ρ/(2 Λ ^{3/2}) [cm]	tion ⁰⁵⁴¹⁰	0.012
$N_b r_0 / ((2\pi)^{1/2} \sigma_z \sigma_\delta \gamma)$	OLL O.005/ B DI	0.078
β_x at bend [m]	orkisnu	<u>(SK- 1.5?</u>
ε _x [nm]	$U^{2100} \rightarrow 4he^{2100}$	2100→41
σ_x at bend [µm] 010	, have be	248?
$\rho^{4/3}/(\sigma_x\beta_x)^{2/3}$	C 710	553
τ_x [ms]	ble ¹¹	11
C03	t000.0033	7.68?!
Q _s	-0.015	-0.00788
N _{b.thr}	4.5x10 ¹⁰	1.1x10 ¹⁰
$N_b/N_{b.thr}$	0.83	3.27
$\Lambda b/\rho$	0.40	3.32

Instability threshold in the single-mode regime

For all other cases, CO3<1, and from [2] there is always an instability if (rewriting the condition " $|\mu| > \eta \omega_0 \delta_0$ " below Eq. (23) in Ref. [4]):



Condition "CO3b" evaluated for various storage rings

	SuperKEKB	SuperKEKB	SuperKEKB	ATF	ATF at	SuperB	SuperB	CLIC	DR
	LER	HER	DR		1 GeV	LER	HER	2009	2010
C03b	239	175	27	75	113	177	100	3851	540

If C03b <1 the beam could be stable in the single-mode model, which is not the case for any of the rings considered here.

This would imply that the HER and LER rings for SuperKEB and SuperB, the two CLIC DR examples, and the new SuperKEKB damping ring are CSR unstable, despite opposite predictions from [1] and [3].

"think the parallel plate shielded csr doesn't have discrete modes, unlike in a full torus. Nevertheless, it seems that the two geometries give similar results concerning the instability. I think I heard Agoh-san (who is at KEK) say that somehow the results of a closed torus compared to one with infinite circumference (but with finite rho—it doesn't really make sense physically) basically agree. (I've heard a similar thing from R. Warnock.) So from their point of view it doesn't seem to matter much whether there are discrete or continuous modes. How does this square with Sam and Gennady's paper? I don't know.

"

An answer from Karl Bane, 15 July 2010

the answer could be in the wake field



D. Zhou, K. Oide, G. Stupakov, et al, 2010



Figure 1: Total CSR impedances calculated by using Agoh and Yokoya's formulae (A&Y), Stupakov's code (GS), and Oide's code (KO).

Figure 2: Total wake potentials of CSR with 0.5 mm Gaussian bunch. The head of the bunch is to the left.

should we "close" the ring to find discrete modes?

benchmarking against other existing storage rings

	SLC DR	KEKB LER	KEKB HER
beam energy [GeV]	1.19	3.5	8.0
slip factor η	0.0147	0.00033	0.00034
rms mom. spread $\sigma_{\delta,rms}$ [%]	0.09	0.073	0.067
bunch population [10 ⁹]	40	65	47
circumference C [m]	35.28	3016	3016
bending radius ρ [m]	2.04	15.5	104
vert. beam pipe radius b [cm]	1	4.7	2.5
Stupakov-Heifets parameter Λ	90	389	952
ρ/b	204	330	4160
σ_{z} [cm]	0.65	0.5	0.5
ρ/(2 Λ ^{3/2}) [cm]	0.12	up giek	0.18
$N_b r_0 / ((2\pi)^{1/2} \sigma_z \sigma_\delta \gamma)$	0.0033	KEK9.0039 he	0.001
β_x at bend [m]	1.5 n	a nistab	15
ε _x [nm]	c D ^R a.	CSR 18	24
σ_x at bend [µm]	150 66	520	600
$\rho^{4/3}/(\sigma_x\beta_x)^{2/3}$	hoully .	983	11300
τ _x [ms]	3.7	90	45
C03	0.0001	1.5	4x10 ⁻⁶
Q _s	-0.012	-0.025	-0.021
N _{b.thr}	8.7x10 ¹⁰	7.0x10 ¹⁰	1.8x10 ¹¹
N _b /N _{b,thr}	0.46	0.92	0.26
$\Lambda b/ ho$	0.44	1.18	0.23
C03b	17	609	81

conclusions - 1

- 2002 formulae from Stupakov & Heifets perhaps not applicable in most cases, except old SuperKEKB DR and KEKB LER which should be unstable
- unlikely that IPAC10 result from Bane, Cai and Stupakov is applicable for cases with C03<1
- C03>1 not fulfilled for most machines → singlemode CSR regime: for SuperKEKB & SuperB HER & LER, both CLIC DR designs, ATF, KEKB HER, SLC DR, and new SuperKEKB DR) beam predicted to be unstable (C03b>>1)
- indeed SLC DR has been plagued by longitudinal instabilities

conclusions - 2

 only present KEKB LER & old SuperKEKB DR design operate in regime of [1,3]; present KEKB LER unstable from [1], but it should be close to CSR instability threshold from [3] - evidence for CSR adding to longitudinal impedance [D. Zhou]. safe findings: old SuperKEB DR design unstable, ATF DR unstable for beam energies < 1 GeV; for all other accelerators conflicting predictions. trusting [1] and [3]: new SuperKEKB DR, CLIC DR and ATF at 1.28 GeV stable with regard to CSR. CSR instability and various theories could be studied in ATF damping ring by lowering the ring energy from 1.28 GeV to 1.0 or 1.1 GeV

CSR study in ATF DR ?!



Email to Junji Urakawa, 17 July.

"I have proposed to use the ATF DR as test bed for CSR instability by lowering the beam energy to ~1.1 or 1.0 GeV. ... Do vouthink it is possible? ifts fo

Answer from Junji, 30 July 2010

Sorry for my late reply. I think this experimentary **KEKB** construction. Several days No. sked nel possibly of proposed experiment. I answered if we a make as chable s ATF2 program, COSR instability study with existing ATF-DR studies and some priority. Toda Vasked 202 research group from KEKB because nun ver

TF DR at 1.0GeV from 1997. I think we need a ration You know we started the tuning. It takes about three shifts hopefully. time for, I hope to be **ODE** Aryshev will prepare to detector system for micro wave measurement. Could you prepare the detail of experimental plan? Terunuma will ask you to present a talk about your proposal and will include about three shifts for this experiment until end of this year

Sorry for limited machine time because other important studies should be proceeded.

we need a detailed proposal for ATF CSR experiment



some contributors:

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First sketch of the ATF CSR experiment

single bunch with N≥10¹⁰;

no small transverse emittance because of IBS; no careful tuning; operation on linear coupling resonance to blow up the vertical emittance, so that the effect of IBS is not strong, and the emittances almost independent of bunch intensity

Region of CSR instability should be reached at **beam energies below** about 1 GeV. ATF already operated at lower energy, 0.96 GeV, in 1997.

To observe the CSR instability:

=> Direct detection of microwave radiation

⇒Extract bunches and measure energy spread with a wire scanner in the

extraction line by scanning over many bunches, and doing so for different bunch intensities.

We should perhaps hope to see a kink in the bunch length versus bunch intensity curve, and at the same time an increase in energy spread, plus the emission of microwaves, all happening at the same bunch intensity.

energy spread & bunch length on coupling resonance



Figure 1: Energy spread as function of current when the ring voltage $V_c = 300 \text{ kV}$, with the beam on (a) and off (b) the coupling resonance.



from K. Bane et al, "Impedance Analysis of Bunch Length Measurements at the ATF Damping Ring," SLAC=PUB-8846, May 2001

Figure 2: Bunch length (σ) and asymmetry parameter (ϵ) of the asymmetric Gaussian fit to the measured bunch distributions, as functions of current, for the beam on resonance (a,b) and off (c,d). $V_c = 250$ kV. The curves are fits to these results.



in 2006 CSR signal had been seen at ATF using Schottky barrier diode detector

CSR current dependence

Current dependence



from A. Aryshev et al, "KEK ATF Coherent Synchrotron Radiation Study," July 2006



ANKA CSR studies (Marit Klein)



Various optics with different α . From 10000-steps optics onward and synchrotron frequencies below 10 kHz coherent radiation is seen. Prediction according to Bane-Cai-Stupakov agrees in the order of magnitude; for short bunches 20% discrepancy in value.

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lelector radius 00 2,82 *10^*15 m 2,82 ± 10^*15 m 2,82 ± 03 + 3 × 5 ± 5 ± 5 ± 5 ± 5 ± 5 ± 5 ± 5 ± 5 ± 5	vert. beam pipe hight	b	32 mm	3,20E-002							
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gamma gamma Z544 2,54E+003 2,40E+004 1,85E+004 3,50E+003 8,20E+003 6,70E+003 8,20E+003 6,70E+003 2,50E+003 3,50E+003 3,40E+003 1,50E+004 3,50E+003 1,50E+004 3,50E+003 1,50E+004 3,50E+003 1,50E+004 3,50E+003 1,50E+004 3,50E+003 1,50E+004 3,50E+003 3,50E+003 3,50E+003 3,50E+003 3,50E+003 3,50E+003 3,50E+004 3,50E+004 3,50E+004 3,50E+004 3,50E+004 3,50E+004 3,50E+004 3,50E+003 3,50E+003 3,50E+003 3,50E+003 3,50E+003 3,50E+003 3,50E+003 3,50E+003 3,50E+004 3,50E+003 3,50E+004 3,50E+003 3,50E+003 3,50E+004 3,50E+003 3,50E+004 3,50E+003 </th <td>sqrt(2*pi)</td> <td></td> <td>2,51</td> <td>2,51E+000</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	sqrt(2*pi)		2,51	2,51E+000							
sync freq fs Hz 3,05E-004 2,40E+004 2,50E+003 8,20E+003 6,70E+003 5,50E+003 2,20E+003 6,70E+003 5,50E+003 5,20E+033 6,70E+003 5,70E+003 2,04E+033 3,17E+033 1,04E+034 3,04E+034 3,04E+034 <td>gamma</td> <td>gamma</td> <td>2544</td> <td>2,54E+003</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	gamma	gamma	2544	2,54E+003							
sync tune Qs 1,3E-003 2,48E-003 2,24E-003 3,5ZE-003 3,5ZE-003 3,5ZE-003 3,64E-003 2,48E-003 2,04E-003 2,04E-003 2,04E-003 2,04E-003 2,04E-003 1,3E-003 3,5ZE-003 3,5ZE-003 3,5ZE-003 3,5ZE-003 3,5ZE-003 1,3E-003 1,3E-004 9,0E+004 min current min current min current min wax Nmax 9,19E+009 5,29E+003 1,62E+003 3,7E+003 3,74E+004 2,41E+004 1,52E+004 1,52E	sync freq	fs	Hz		3,05E+004	2,40E+004	1,85E+004	9,50E+003	8,20E+003	6,70E+003	5,50E+003
silp factor / alpha eta Ref: 8,00E-003 8,00E-003 4,95E-003 2,94E-003 7,76E-004 5,78E-004 3,86E-004 2,60E-004 bunch length sigmaz0 mm 5,22E-003 4,11E-003 3,17E-033 1,63E-003 1,40E-003 1,15E-033 9,40E-004 min current imin 0,1 mA 1,00E-004 1,10E-003 1,15E-03 9,40E-004 min current imin 0,1 mA 1,00E-004 1,10E-003 1,15E-03 9,40E-004 min current imin 0,1 mA 1,00E-004 1,12E-003 3,14E-003 1,40E-004 2,41E-004 1,52E-004 9,52E-005 min max bunch length 2,30E+008 2,30E+008 2,30E+008 1,20E+003 3,78E+009 3,78E+008 3,50E+008 3,	sync tune	Qs			1,13E-002	8,89E-003	6,85E-003	3,52E-003	3,04E-003	2,48E-003	2,04E-003
bunch length sigmaz0 mm 5,22E-003 4,11E-003 3,17E-03 1,63E-003 1,40E-003 1,15E-003 9,40E-004 max current imin 0,1 mA 1,00E-004 <	slip factor / alpha	eta	Ref:	8,00E-003	8,00E-003	4,95E-003	2,94E-003	7,76E-004	5,78E-004	3,86E-004	2,60E-004
max current min current min current min mx bunch population min mx bunch popula	bunch length	sigmaz0	mm		5,22E-003	4,11E-003	3,17E-003	1,63E-003	1,40E-003	1,15E-003	9,40E-004
min om	max current	Imax	4mA	4,00E-003							
max bunch population min Nmax Nrin 9,19E+009 2,30E+003 5,20E+003 2,98E+003 3,44E+044 2,41E+004 1,52E+004 9,52E+008 2,19E+008 measured threshold Nthmeas 5,17E+010 6,84E+009 3,73E+003 3,44E+004 1,52E+004 3,50E+008 2,19E+008 re R sqrt(1pi)/(Cg sigd*2) S 5,17E+013 1,44E+002 2,34E+002 5,10E+002 3,76E+003 5,87E+003 1,97E+004 1,94E+004 Stupakov-Heifets-parameter Iambda (N=Nmax) 1,14E+002 2,34E+002 5,10E+002 3,73E+003 5,87E+003 1,97E+004 4,98E+002 4,08E+002	min current	Imin	0,1 mA	1,00E-004							
min measured threshold Nthmeas Nmin timeas 2,30E+008 1,20E+010 2,98E+003 6,84E+009 3,73E+009 3,73E+009 2,41E+04 7,91E+008 1,52E+004 5,54E+008 3,50E+008 3,50E+008 3,50E+008 2,98E+030 2,91E+008 Rs grid(pi)/(C g sigd^2) state	max bunch population	Nmax		9,19E+009							
measured threshold Nthmeas thmeas (Nthmeas 5,20E-003 (Nthmeas 2,98E-003 (N=Nthmeas 3,44E-004 (N=Nthmeas) 2,41E+004 (N=Nthmeas) 1,52E-004 (N=Nthmeas) 9,52E-005 (N=Nthmeas) stupakov-Heifets-parameter lambda (N=Nthmeas) 1,14E+002 (N=Nthmeas) 2,34E+002 5,10E+002 3,76E+003 5,87E+003 1,07E+004 1,92E+004 stupakov-Heifets-parameter lambda (N=Nthmeas) 1,44E+002 2,34E+002 5,10E+002 3,76E+003 5,87E+003 1,07E+004 4,68E+002 R/b Image Image 1,44E+002 2,42E+004 1,21E+003 6,18E+006 6,58E+004 1,03E+004 1,02E+004 1,02E+004 1,02E+004 1,02E+004 1,02E+004 1,02E+004	min	Nmin		2,30E+008							
Nthmeas 1,20E+010 6,84E+009 3,73E+009 7,91E+008 5,54E+008 3,50E+008 2,19E+008 Stupakov-Heifets-parameter Iambda (N=Nmax) (N=Nmin) 2,34E+002 2,34E+002 3,76E+003 5,87E+003 1,07E+004 4,86E+002 R/b (N=Nmin) 2,85E+000 1,74E+002 2,07E+003 3,23E+002 3,28E+002 4,86E+002 R/b 1,74E+002 2,07E+001 3,23E+002 3,28E+002 4,08E+002 4,08E+002 R/b 1,74E+002 2,07E+001 6,11E+002 3,23E+002 4,08E+002 4,08E+002 R/d 1,74E+002 2,07E+001 6,11E+002 3,23E+002 4,08E+002 4,08E+002 R/d 1,74E+002 2,72E+001 6,11E+002 3,02E+003 1,03E+006 2,51E+006 1,03E+004 3,75E+004 3,7	measured threshold	Ithmeas			5,20E-003	2,98E-003	1.62E-003	3.44E-004	2.41E-004	1.52E-004	9,52E-005
re R sqrt(1pi)/(C g sigd^2) 5,17E-013 5,17E-013 1,14E+002 2,34E+002 5,10E+002 3,76E+003 1,07E+004 1,94E+004 Stupakov-Heifets-parameter Iambda (N=Nmax) 1,14E+002 2,34E+002 5,10E+002 3,76E+003 5,87E+003 1,07E+004 4,86E+002 R/b (N=Ntimeas) 1,44E+002 1,74E+002 2,07E+002 3,23E+002 3,54E+002 4,08E+002 4,68E+002 R/(2*lambda^3/2) 1,44E+002 1,74E+002 2,07E+001 6,11E-002 3,05E+003 1,56E+003 6,35E+004 2,59E+004 Nb r0/sqrt(2pi) g sigz sigd (N=Nmax) 1,56E+003 1,92E+003 1,94E+003 1,94E+003 1,94E+004 1,79E+004 4,17E+004 3,37E+004 2,98E+004 1,90E+003 1,41E+003 1,00E+003 4,17E+004 3,37E+004 2,98E+004 2,98E+004 2,98E+004 2,98E+004 2,98E+004 2,98E+004 2,98E+004 2,98E+004 1,98E+004 1,70E+004 1,70E+004 1,77E+004 <td></td> <td>Nthmeas</td> <td></td> <td></td> <td>1,20E+010</td> <td>6,84E+009</td> <td>3,73E+009</td> <td>7,91E+008</td> <td>5,54E+008</td> <td>3,50E+008</td> <td>2,19E+008</td>		Nthmeas			1,20E+010	6,84E+009	3,73E+009	7,91E+008	5,54E+008	3,50E+008	2,19E+008
Stupakov-Heifets-parameter lambda (N=Nmax) (N=Nmin) 1,14E+002 2,85E+000 2,34E+002 5,10E+002 3,76E+003 5,87E+003 1,07E+004 1,94E+004 R/de (N=Nmin) 2,85E+000 1,27E+001 9,39E+001 1,47E+002 2,68E+002 4,86E+002 R/de 1,44E+002 1,48E+002 1,74E+002 3,23E+002 3,54E+002 4,68E+002 R/de 1,44E+002 2,29E+003 7,79E+004 1,21E+005 6,18E+006 2,51E+003 5,55E+003 1,55E+003 1,37E+004 2,55E+	re R sqrt(1pi)/(C q sigd^2)			5,17E-013		13	à.	1.0			
(N=Nmin) 2,85E+000 5,84E+000 1,27E+001 9,39E+001 1,47E+002 2,68E+002 4,66E+002 R/b I/4E+002 1,74E+002 2,07E+002 3,23E+002 3,54E+002 4,68E+002 4,63E+002 R/b I/4E+002 7,79E-004 2,24E-004 1,21E-005 6,18E-006 2,51E-006 1,03E-006 R/2"lambda^3/2) 2,29E-003 7,79E-001 1,97E-001 6,11E-002 3,05E-003 1,56E-003 3,37E-004 2,51E-005 1,03E-006 Nb r0/sqrt(2pi) g sigz sigd (N=Nmax) 1,54E-003 1,97E-003 1,97E-003 2,46E-003 4,17E-004 3,37E-004 2,97E-004 2,97E-004 Nb r0/sqrt(2pi) g sigz sigd (N=Nmax) 1,50E-003 1,90E-003 2,46E-003 4,71E-004 3,37E-004 2,98E-004 1,98E-004 1,97E-004 3,72E-004 3,72E-004 2,98E-004 1,98E-003 1,01E-033 3,46E-030 9,62E-039 3,81E-032 6,58E-004 1,98E-004 1,98E-004 1,98E-004 1,98E-004 1,98E-004 1,98E-004 1,98E-004 1,98E-004 <td>Stupakov-Heifets-parameter</td> <td>lambda</td> <td>(N=Nmax)</td> <td>11.070-0-0-010-0-000000-0-0</td> <td>1.14E+002</td> <td>2.34E+002</td> <td>5.10E+002</td> <td>3,76E+003</td> <td>5.87E+003</td> <td>1.07E+004</td> <td>1.94E+004</td>	Stupakov-Heifets-parameter	lambda	(N=Nmax)	11.070-0-0-010-0-000000-0-0	1.14E+002	2.34E+002	5.10E+002	3,76E+003	5.87E+003	1.07E+004	1.94E+004
R/b (N=Nthmeas) 1,48E+002 1,74E+002 2,07E+002 3,23E+002 3,54E+002 4,08E+002 4,63E+002 R/(2*lambda^3/2) 2,29E-003 7,79E-004 2,42E-004 1,21E-005 6,18E-003 6,35E-004 2,59E-004 1,03E-004 2,59E-004 1,56E-003 6,35E-004 2,59E-004 2,79E-004 4,79E-004 4,79E-004 4,77E-004 3,37E-004 2,79E-004 1,05E-003 1,40E-004 3,37E-004 2,79E-004 1,05E-003 1,40E-004 3,37E-004 2,79E-004 1,05E-003 1,40E-004 1,77E-004 3,37E-004 2,79E-004 1,05E-003 1,40E-004 1,70E-003 8,31E-003 9,02E-004 1,02E-004 1,0	600) e		(N=Nmin)		2.85E+000	5,84E+000	1,27E+001	9.39E+001	1,47E+002	2,68E+002	4.86E+002
R/b T/4E=002 7,79E=004 2,42E=004 1,21E=005 6,18E=006 2,51E=006 1,03E=006 R/(2*lambda^3/2) 5,79E=001 1,97E=001 6,11E=002 3,05E=003 1,56E=003 6,33F=004 2,59E=004 1,54E=003 1,21E=003 9,34E=004 4,79E=003 1,56E=003 6,33F=004 2,79E=004 Nb r0/sqrt(2pi) g sigz sigd (N=Nmax) 1,50E=003 1,90E=003 2,46E=003 4,79E=004 4,79E=003 5,58E=003 6,79E=001 8,31E=003 Nb r0/sqrt(2pi) g sigz sigd (N=Nmax) 1,50E=003 1,90E=003 2,46E=003 4,79E=004 4,79E=003 5,58E=003 6,79E=001 1,98E=004 1,40E=004 1,70E=004 2,98E=004 1,98E=004 1,47E=035 1,18E=035 1,18E=032 2,08E=033 3,81E=032 2,08E=033 3,81E=032 2,08E=034 4,42E=035 1,18E=035			(N=Nthmeas)		1.48E+002	1.74E+002	2.07E+002	3.23E+002	3.54E+002	4.08E+002	4.63E+002
R/(2*lambda^3/2) 2,29E-003 7,79E-004 2,42E-004 1,21E-005 6,18E-006 2,51E-006 1,03E-006 sigma20 5,79E-001 1,97E-001 6,11E-002 3,05E-003 1,56E-003 6,35E-004 2,59E-004 Nb r0/sqrt(2pi) g sigz sigd (N=Nmax) 1,50E-003 1,21E-003 3,17E-004 4,79E-004 4,79E-004 4,79E-004 4,79E-004 4,79E-004 3,37E-004 2,59E-003 Nb r0/sqrt(2pi) g sigz sigd (N=Nmax) 1,50E-003 1,90E-003 2,46E-003 4,79E-004 4,79E-004 1,70E-004 2,08E-003 8,31E-003 (N=Nmin) 3,74E-005 4,75E-005 6,16E-005 1,20E-004 1,40E-004 1,70E-004 2,08E-004 (N=Nmax) 1,00E+000 1,95E-003 1,41E-003 1,00E-003 4,12E-004 3,37E-004 2,59E-004 1,98E-004 (N=Nmin) 2,79E-004 1,98E-003 1,42E-003 3,46E-030 9,40E-037 3,46E-030 9,40E-037 1,47E-035 1,51E-027 (N=Nmin) 2,98E+000 1,26E+001 5,98E+001	R/b			1.74E+002							,
S,79E-001 1,97E-001 6,11E-002 3,05E-003 1,56E-003 4,17E-004 2,59E-004 Nb r0/sqrt(2pi) g sigz sigd (N=Nmax) 1,54E-003 4,11E-003 3,17E-004 4,17E-004 3,37E-004 2,79E-004 Nb r0/sqrt(2pi) g sigz sigd (N=Nmax) 1,50E-003 1,90E-003 2,46E-003 4,79E-004 4,17E-004 3,37E-004 2,79E-003 (N=Nmin) 3,74E-005 4,75E-005 6,16E-005 1,20E-004 1,40E-004 1,70E-004 2,08E-004 (Nb r0/sqrt(2pi) g sigz)^5 (N=Nmax) 2,79E-003 1,41E-003 1,00E-003 4,12E-004 3,37E-004 2,59E-004 1,98E-004 (Nb r0/sqrt(2pi) g sigz)^5 (N=Nmax) 2,86E-031 9,44E-031 3,46E-030 9,62E-029 2,06E-028 5,50E-028 1,51E-027 (Nb r0/sqrt(2pi) g sigz)^5 (N=Nmax) 2,99E-000 1,26E-001 5,98E-003 9,42E-034 1,46E-034 4,42E-035 1,51E-027 (Nb r0/sqrt(2pi) g sigz)^5 (N=Nmax) 2,99E-000 1,26E+001 5,98E+003 2,62E+029 2,06E-028 5,38E-036 </th <td>R/(2*lambda^3/2)</td> <td></td> <td></td> <td></td> <td>2,29E-003</td> <td>7,79E-004</td> <td>2,42E-004</td> <td>1,21E-005</td> <td>6,18E-006</td> <td>2,51E-006</td> <td>1,03E-006</td>	R/(2*lambda^3/2)				2,29E-003	7,79E-004	2,42E-004	1,21E-005	6,18E-006	2,51E-006	1,03E-006
sigma20 1,54E-003 1,21E-003 9,34E-004 4,17E-004 3,37E-004 2,79E-004 Nb r0/sqrt(2pi) g sigz sigd (N=Nmax) 1,50E-003 1,11E-003 3,17E-003 1,40E-003 1,40E-003 1,15E-003 8,31E-003 Nb r0/sqrt(2pi) g sigz sigd (N=Nmax) 3,74E-005 1,90E-003 2,46E-003 4,79E-003 5,58E-003 6,79E-003 8,31E-003 (N=Nmin) 3,74E-005 1,00E-003 1,00E-003 4,12E-004 3,37E-004 2,98E-004 1,92E-004					5,79E-001	1,97E-001	6,11E-002	3,05E-003	1,56E-003	6,35E-004	2,59E-004
sigma20 5.22E-003 4.11E-003 3.17E-003 1.63E-003 1.40E-003 1.15E-003 9.40E-004 Nb r0/sqrt(2pi) g sigz sigd (N=Nmax) 1.50E-003 1.90E-003 2.46E-003 4.79E-003 5.58E-003 6.79E-003 8.31E-003 (N=Nmin) 3.74E-005 4.75E-005 6.16E-005 1.20E-004 1.40E-004 1.70E-004 2.08E-004 (Nb r0/sqrt(2pi) g sigz)^5 (N=Nmax) 1.00E+000 1.95E-003 1.41E-003 3.46E-035 9.62E-029 2.06E-028 5.50E-028 1.50E-028 1.50E-028 1.50E-028 5.50E-028 1.51E-027 1.08E-004 1.98E-004					1,54E-003	1,21E-003	9,34E-004	4,79E-004	4,17E-004	3,37E-004	2,79E-004
Nb r0/sqrt(2pi) g sigz sigd (N=Nmax) 1,50E-003 1,90E-003 2,46E-003 4,79E-003 5,58E-003 6,79E-003 8,31E-003 (N=Nmin) 3,74E-005 4,75E-005 6,16E-005 1,20E-004 1,40E-004 1,70E-004 2,08E-004 (Nb r0/sqrt(2pi) g sigz)^5 (N=Nmax) 2,86E-031 9,44E-031 3,46E-030 9,62E-029 2,06E-028 5,58E-036 6,79E-003 1,98E-004 (Nb r0/sqrt(2pi) g sigz)^5 (N=Nmin) 2,86E-031 9,44E-031 3,46E-030 9,62E-039 3,38E-038 9,40E-037 2,01E-036 5,38E-036 1,47E-035 (N=Nmin) 2,79E-039 9,22E-039 3,38E-038 9,40E-037 2,01E-036 5,38E-036 1,47E-035 (2a/eta R)^3 1,06E-030 2,15E-031 3,81E-032 4,52E-034 1,64E-034 4,42E-035 1,15E-035 (2a/eta R)^3 (N=Nmax) 7,42E+005 1,03E-001 5,98E+001 3,26E+003 7,89E+003 2,65E+004 8,67E+004 '1/(sigd^8 p i^2/3) (N=Nmax) 7,42E+005 1,01E+011 1,76E+0101				sigmaz0	5,22E-003	4,11E-003	3,17E-003	1,63E-003	1,40E-003	1,15E-003	9,40E-004
(N=Nmin) 3,74E-005 4,75E-005 6,16E-005 1,20E-004 1,40E-004 1,70E-004 2,08E-004 (Nb r0/sqrt(2pi) g sig2)^5 (N=Nmax) 2,86E-031 9,44E-031 3,46E-030 9,62E-029 2,06E-028 5,50E-028 1,51E-027 (Nb r0/sqrt(2pi) g sig2)^5 (N=Nmax) 2,79E-039 9,22E-039 3,38E-038 9,62E-029 2,06E-028 5,50E-028 1,51E-027 (N=Nmin) 2,79E-039 9,22E-039 3,38E-036 1,64E-034 4,42E-035 1,72E-035 (2a/eta R)^3 1,06E-030 2,15E-031 3,81E-032 4,52E-034 1,64E-034 4,42E-035 1,15E-035 (2a/eta R)^3 2,98E+000 1,26E+001 5,98E+001 3,26E+003 7,89E+003 2,65E+004 8,67E+004 11/(sigd^8 pi^2/3) 8,72E+025 1,01E-011 1,76E-010 2,67E-007 1,38E-006 1,24E-005 1,11E-004 (N=Nmin) 7,25E-013 1,01E-011 1,76E-010 2,67E-007 1,38E-006 1,24E-005 1,11E-004 C03 (N=Nmin) 7,25E-013 <t< th=""><td>Nb r0/sqrt(2pi) g sigz sigd</td><td></td><td>(N=Nmax)</td><td></td><td>1,50E-003</td><td>1,90E-003</td><td>2,46E-003</td><td>4,79E-003</td><td>5,58E-003</td><td>6,79E-003</td><td>8,31E-003</td></t<>	Nb r0/sqrt(2pi) g sigz sigd		(N=Nmax)		1,50E-003	1,90E-003	2,46E-003	4,79E-003	5,58E-003	6,79E-003	8,31E-003
(N=Nthmeas) 1,00E+000 1,95E+003 1,41E+003 1,00E+003 4,12E+004 3,37E+004 2,59E+004 1,98E+004 (Nb r0/sqrt(2pi) g sig2)^5 (N=Nmax) 2,86E+031 9,44E+031 3,46E+030 9,62E+029 2,06E+028 5,50E+028 1,51E+027 (Nb r0/sqrt(2pi) g sig2)^5 (N=Nmax) 2,79E+039 9,22E+039 3,38E+038 9,40E+037 2,01E+036 5,38E+036 1,47E+035 (N=Nmin) 2,79E+039 9,22E+039 3,38E+038 9,40E+037 2,01E+036 5,38E+036 1,47E+035 (2a/eta R)^3 1,06E+030 2,15E+031 3,81E+032 4,52E+034 1,64E+033 4,42E+035 1,15E+035 (2a/eta R)^3 2,98E+000 1,26E+001 5,98E+001 3,26E+003 7,89E+003 2,65E+004 8,67E+004 '1/(sigd*8 pi^2/3) (N=Nmax) 7,42E+005 1,03E+003 1,81E+002 2,74E+001 1,42E+002 1,27E+003 1,14E+004 (N=Nmin) 7,25E+013 1,01E+011 1,76E+010 2,67E+007 1,38E+006 1,24E+005 1,11E+004 3,33E+01			(N=Nmin)		3,74E-005	4,75E-005	6,16E-005	1,20E-004	1,40E-004	1,70E-004	2,08E-004
(Nb r0/sqrt(2pi) g sigz)^5 (N=Nmax) 2,86E-031 9,44E-031 3,46E-030 9,62E-029 2,06E-028 5,50E-028 1,51E-027 (N=Nmin) 2,79E-039 9,22E-039 3,38E-038 9,40E-037 2,01E-036 5,38E-036 1,47E-035 (N=Nthmeas) 1,06E-030 2,15E-031 3,81E-032 4,52E-034 1,64E-034 4,42E-035 1,15E-035 (2a/eta R)^3 2,98E+000 1,26E+001 5,98E+001 3,26E+003 7,89E+003 2,65E+004 8,67E+004 '1/(sigd^8 pi^2/3) 8,72E+025 1,03E-003 1,81E-002 2,74E+001 1,42E+002 1,27E+003 1,14E+004 (N=Nmin) 7,25E-013 1,01E-011 1,76E-010 2,67E-007 1,38E-006 1,24E-005 1,11E-004 (N=Nmin) 7,25E-013 1,01E-011 1,76E-010 2,67E-007 1,38E-006 1,24E-005 1,11E-004 (N=Nmin) 7,25E-013 1,01E-011 1,76E-010 2,67E-007 1,38E-006 1,24E-005 1,11E-004 (N=Nmin) 7,25E-013 1,01E-011 1,76E-010<			(N=Nthmeas)	1,00E+000	1,95E-003	1,41E-003	1,00E-003	4,12E-004	3,37E-004	2,59E-004	1,98E-004
(N=Nmin) 2,79E-039 9,22E-039 3,38E-038 9,40E-037 2,01E-036 5,38E-036 1,47E-035 (2a/eta R)^3 (N=Nthmeas) 1,06E-030 2,15E-031 3,81E-032 4,52E-034 1,64E-034 4,42E-035 1,15E-035 (2a/eta R)^3 2,98E+000 1,26E+001 5,98E+001 3,26E+003 7,89E+003 2,65E+004 8,67E+004 1/(sigd^8 pi^2/3) (N=Nmax) 7,42E+005 1,03E-003 1,81E-002 2,74E+001 1,42E+002 1,27E+003 1,14E+040 (N=Nmin) 7,25E-013 1,01E-011 1,76E-010 2,67E-007 1,38E-006 1,24E-005 1,11E-004 (N=Nmin) 7,25E-013 1,01E-011 1,76E-010 2,67E-007 1,38E-006 1,24E-005 1,11E-004 (N=Nmin) 7,25E-013 1,01E-011 1,76E-010 2,67E-007 1,38E-006 1,24E-005 1,11E-004 (N=Nthmeas) 1 2,66E-004 1,99E-004 1,29E-004 1,02E-004 8,96E+012 7,32E+012 6,01E+012 sigz Asi get phil2 (ba32) 5,11E-004	(Nb r0/sqrt(2pi) g sigz)^5		(N=Nmax)	1.1	2,86E-031	9,44E-031	3,46E-030	9,62E-029	2,06E-028	5,50E-028	1,51E-027
(N=Nthmeas) 1,06E-030 2,98E+000 2,15E-031 1,26E+001 3,81E-032 5,98E+001 4,52E-034 3,26E+003 1,64E-034 7,89E+003 4,42E-035 2,65E+004 1,15E-035 8,67E+004 C03 (N=Nmax) (N=Nmin) 7,42E-005 1,26E+014 1,03E-003 1,01E-011 1,81E-002 1,76E-010 2,74E+001 1,42E+002 1,27E+003 1,11E-004 2pi Qs g sigd/re sigz 4/3 /R*1/3 3,33E+013 2,62E+013 2,02E+013 1,04E+013 8,96E+012 7,32E+012 6,01E+012 Desch 1/2 circle PA1/2 (AP3/2) Co3 3,33E+013 2,62E+013 2,02E+013 1,04E+013 8,96E+012 7,32E+012 6,01E+012 Sigz 4/3 /R*1/3 Co3 Co3 Co3 Co3 2,62E+001 7,02E+001 5,98E+001 5,98E+001 7,92E+002 1,14E+004 Display Co3 Co3 Co3 Co3 Co3 1,01E-011 1,76E-010 2,67E-007 1,38E-006 1,24E-005 1,11E-004 Display Co3 C			(N=Nmin)		2,79E-039	9,22E-039	3,38E-038	9,40E-037	2,01E-036	5,38E-036	1,47E-035
(2a/eta R)^3 2,98E+000 1,26E+001 5,98E+001 3,26E+003 7,89E+003 2,65E+004 8,67E+004 1/(sigd^8 pi^2/3) 8,72E+025 7,42E-005 1,03E-003 1,81E-002 2,74E+001 1,42E+002 1,27E+003 1,14E+004 1,27E+004 1,27E+003 1,14E+004 1,27E+004 1,27E+004 1,27E+004 1,27E+003 1,14E+004 1,27E+004 1,27E+004 1,27E+003 1,14E+004 1,27E+004 1,27E+004 1,27E+004 1,27E+004 1,27E+004 1,27E+004 1,27E+004 1,27E+014 6,01E+012 5,20E+013 2,02E+013 1,04E+013 8,96E+012 7,32E+012 6,01E+012 sigz*4/3 /R*1/3 5,11E+004 3,72E+001 5,72E+001 5,72E+001 5,72E+001 5,72E+001 5,72E+001 5,72E+001 <			(N=Nthmeas)		1,06E-030	2,15E-031	3,81E-032	4,52E-034	1,64E-034	4,42E-035	1,15E-035
*1/(sigd^8 pi^2/3) 8,72E+025 1,03E-003 1,81E-002 2,74E+001 1,42E+002 1,27E+003 1,14E+004 C03 (N=Nmax) 7,42E-005 1,03E-003 1,81E-002 2,74E+001 1,42E+002 1,27E+003 1,14E+004 (N=Nmin) 7,25E-013 1,01E-011 1,76E-010 2,67E-007 1,38E-006 1,24E-005 1,11E-004 (N=Nthmeas) 1 2,76E-004 2,36E-004 1,99E-004 1,29E-004 1,02E-004 8,71E-005 2pi Qs g sigd/re 3,33E+013 2,62E+013 2,02E+013 1,04E+013 8,96E+012 7,32E+012 6,01E+012 sigz^4/3 /R^1/3 5,11E-004 3,72E-004 2,63E+004 1,98E-004 8,84E+005 6,80E-005 5,20E-005 DE+0.12 cize 5,11E-004 3,72E-001 5,81E-004 5,84E-004 5,84E-004 5,84E-005 5,20E-005	(Za/eta R)^3				2,98E+000	1,26E+001	5,98E+001	3,26E+003	7,89E+003	2,65E+004	8,67E+004
C03 (N=Nmax) 7,42E-005 1,03E-003 1,81E-002 2,74E+001 1,42E+002 1,27E+003 1,14E+004 (N=Nmin) 7,25E-013 1,01E-011 1,76E-010 2,67E-007 1,38E-006 1,24E-005 1,11E-004 (N=Nthmeas) 1 2,76E-004 2,36E-004 1,99E-004 1,29E-004 1,13E-004 1,02E-004 8,71E-005 2pi Qs g sigd/re 3,33E+013 2,62E+013 2,02E+013 1,04E+013 8,96E+012 7,32E+012 6,01E+012 5,11E-004 3,72E-0014 2,63E-004 1,99E-004 5,20E-0015 5,20E-005 5,20E-005 5,20E-005 5,20E-005 0=4,012 cizz 5,01E-0014 5,63E-0014 5,70E-0015 5,72E-0015 5,26E-0015 5,20E-0015 5,20E-0015 <td>'1/(sigd^8 pi^2/3)</td> <td></td> <td></td> <td>8,72E+025</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	'1/(sigd^8 pi^2/3)			8,72E+025							
(N=Nmin) 7,25E-013 1,01E-011 1,76E-010 2,67E-007 1,38E-006 1,24E-005 1,11E-004 (N=Nthmeas) 1 2,76E-004 2,36E-004 1,99E-004 1,29E-004 1,13E-004 1,02E-004 8,71E-005 2pi Qs g sigd/re 3,33E+013 2,62E+013 2,02E+013 1,04E+013 8,96E+012 7,32E+012 6,01E+012 sigz A4/3 /R^1/3 5,11E-004 3,72E-001 2,63E-004 1,08E-004 8,84E-005 6,80E-005 5,20E-005 BE+0.12 7,52E-001 7,02E-001 5,72E-001 5,72E-001 5,72E-001 5,72E-001 5,72E-001 5,72E-001 5,72E-001 5,72E-001 5,72E-001 5,74E-001 5,74E-001 <t< th=""><td>C03</td><td></td><td>(N=Nmax)</td><td>350</td><td>7,42E-005</td><td>1,03E-003</td><td>1,81E-002</td><td>2,74E+001</td><td>1,42E+002</td><td>1,27E+003</td><td>1,14E+004</td></t<>	C03		(N=Nmax)	350	7,42E-005	1,03E-003	1,81E-002	2,74E+001	1,42E+002	1,27E+003	1,14E+004
(N=Nthmeas) 1 2,76E-004 2,36E-004 1,99E-004 1,22E-004 1,13E-004 1,02E-004 8,71E-005 2pi Qs g sigd/re 3,33E+013 2,62E+013 2,02E+013 1,04E+013 8,96E+012 7,32E+012 6,01E+012 sigz ^4/3 /R^1/3 5,11E-004 3,72E-004 2,63E+001 5,02E+0015 5,20E+0015			(N=Nmin)		7,25E-013	1.01E-011	1,76E-010	2.67E-007	1.38E-006	1,24E-005	1.11E-004
Zpi Qs g sigd/re 3,33E+013 2,62E+013 1,04E+013 8,96E+012 7,32E+012 6,01E+012 sigz^4/3 /R^1/3 5,11E-004 3,72E-004 2,63E-004 1,08E-004 8,84E-005 6,80E-005 5,20E-005 BE+0.12 cizz P011 5,57E-001 5,87E-001 5,87E-001 <td></td> <td></td> <td>(N=Nthmeas)</td> <td>1</td> <td>2,76E-004</td> <td>2,36E-004</td> <td>1,99E-004</td> <td>1,29E-004</td> <td>1,13E-004</td> <td>1,02E-004</td> <td>8,71E-005</td>			(N=Nthmeas)	1	2,76E-004	2,36E-004	1,99E-004	1,29E-004	1,13E-004	1,02E-004	8,71E-005
sigz ⁴ /3 /R ⁴	2pi Qs q sigd/re		- 1	het for	3,33E+013	2,62E+013	2,02E+013	1,04E+013	8,96E+012	7,32E+012	6,01E+012
7 50C 001 5 57C	sigz^4/3 /R^1/3				5.11E-004	3.72E-004	2.63E-004	1.08E-004	8,84E-005	6.80E-005	5,20E-005
7.30E*001 7.03E*001 0.37E*001 0.37E*001 0.37E*001 0.37E*001 0.37E*001 0.37E*001	0.5+0.12 sigz R^1/2 /b^3/2				7.58E-001	7.03E-001	6.57E-001	5.81E-001	5.69E-001	5.57E-001	5.46E-001
1,29E+010 6.85E+009 3.49E+009 6.52E+008 4.51E+008 2.77E+008 1.71E+008	Nb.thr				1,29E+010	6.85E+009	3,49E+009	6,52E+008	4.51E+008	2.77E+008	1.71E+008
Nthmeas 1.20E+010 6.84E+009 3.73E+009 7.91E+008 5.54E+008 3.50E+008 2.19E+008	1 / 1011 / 11 / 12 / 1			Nthmeas	1,20E+010	6.84E+009	3.73E+009	7.91E+008	5.54E+008	3.50E+008	2.19E+008

thank you for your attention!