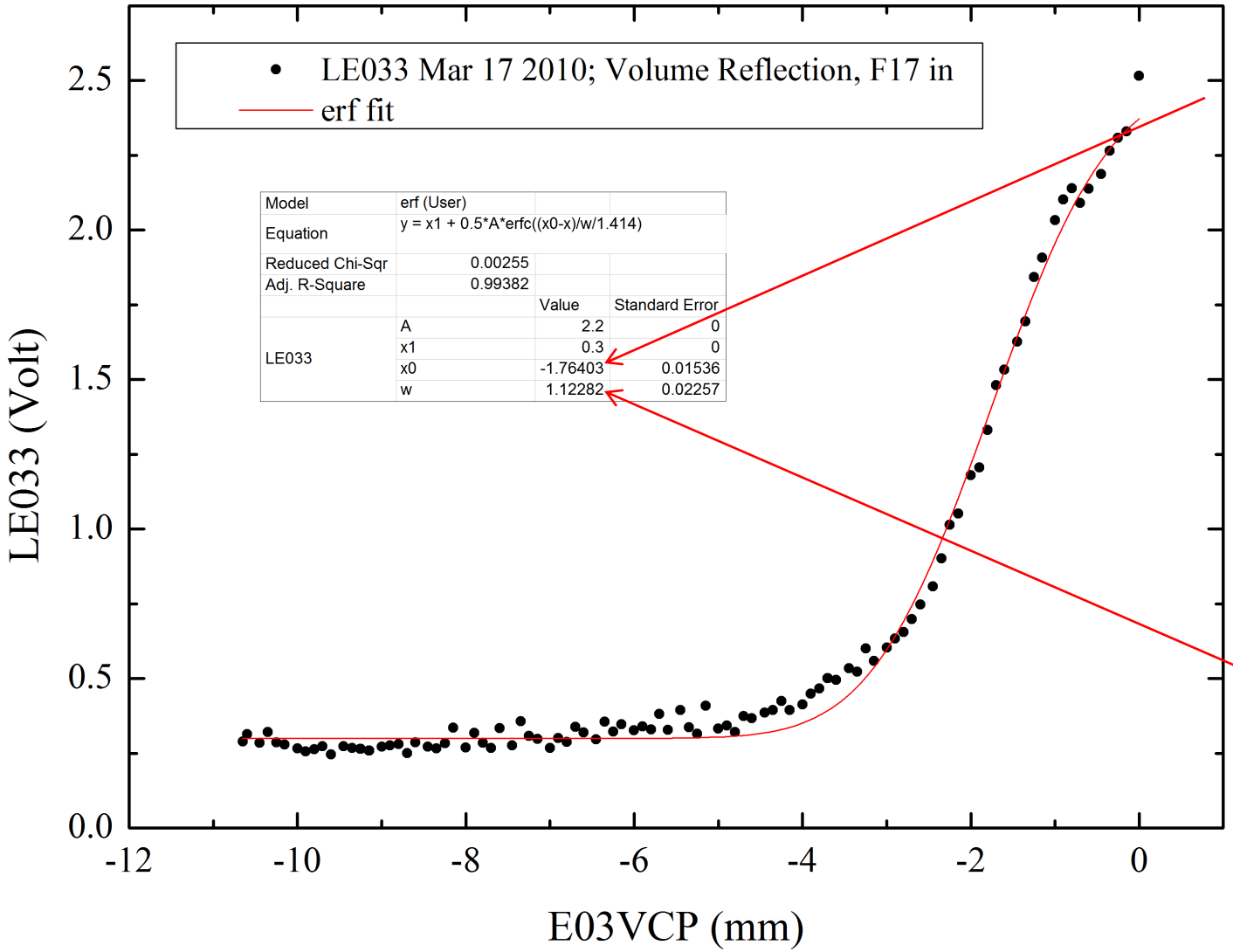
T980 Crystal Collimator Data: Hor CH and Vert VR and CH

Mar 17, 2010 Data Analysis

Vladimir Shiltsev

VR beam about where has to be (onlv if F17 is in)



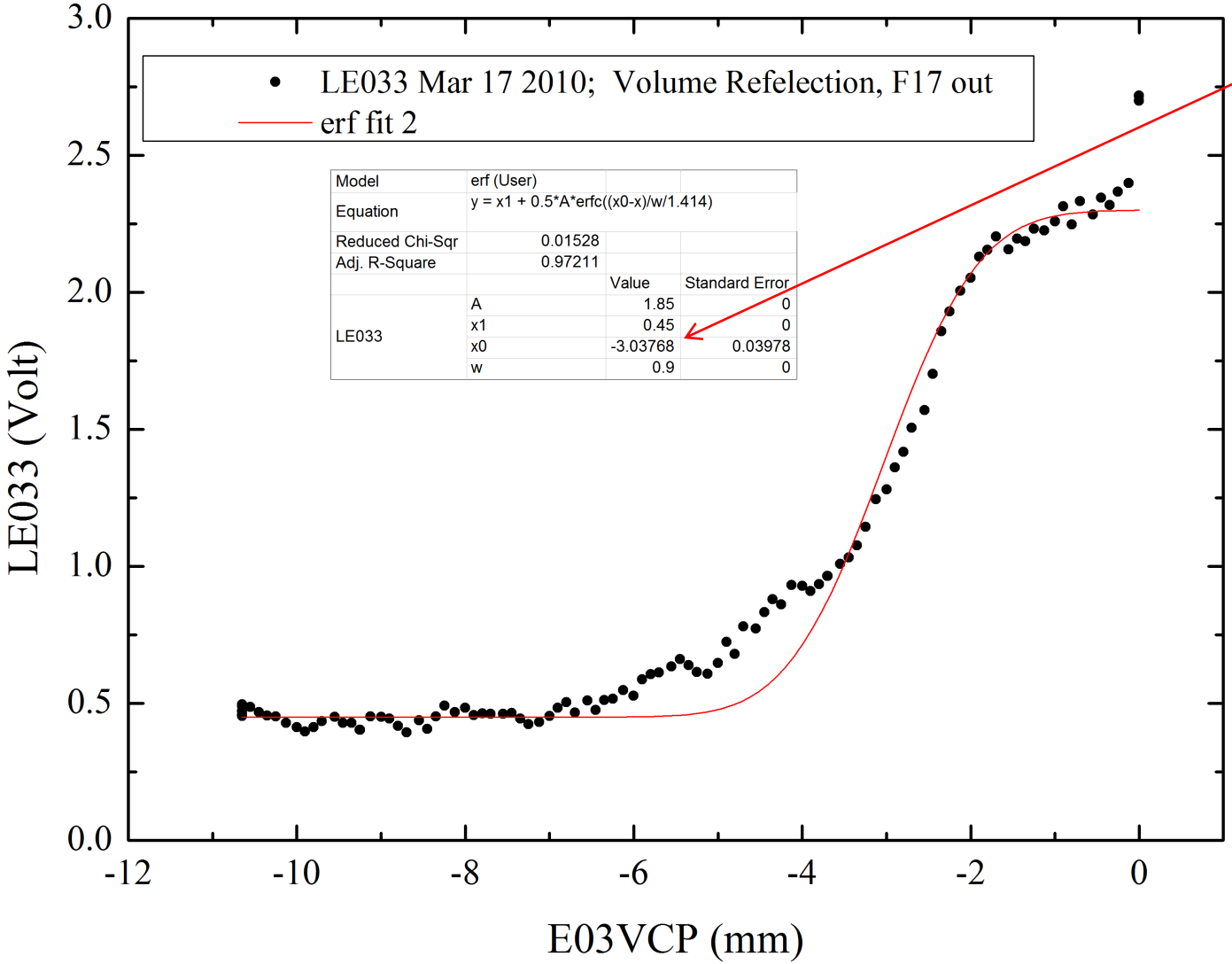
Model	erf (User)		
Equation	y = x1 + 0.5*A*erfc((x0-x)/w/1.414)		
Reduced Chi-Sqr	0.00255		
Adj. R-Square	0.99382		
		Value	Standard Error
LE033	A	2.2	0
	x1	0.3	0
	x0	-1.76403	0.01536
	w	1.12282	0.02257

Corresponds to θ=1.76mm/28m= 63 urad

it should be: from the SPS measurements 93 urad/ sqrt(980/400)=59 urad

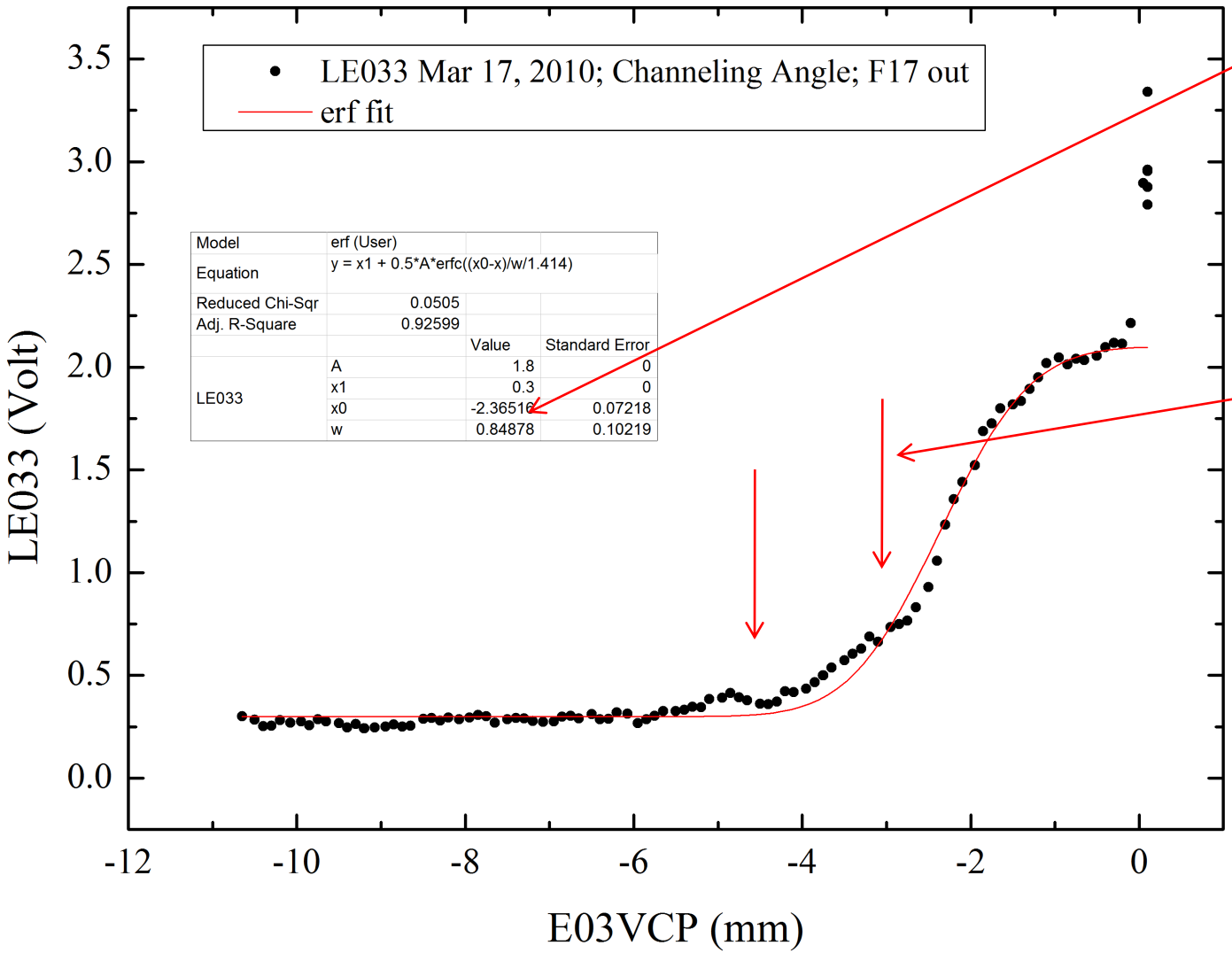
Width is ~39 urad that's *wider* than expected fr SPS: 18*sqrt(980/400) =29 urad (?)

VR angle but F17 is out – there is stuff all over the place



Corresponds to
θ=3.03mm/28m
=110 urad **- ???**

CH angle & F17 is out – there is stuff all over the place

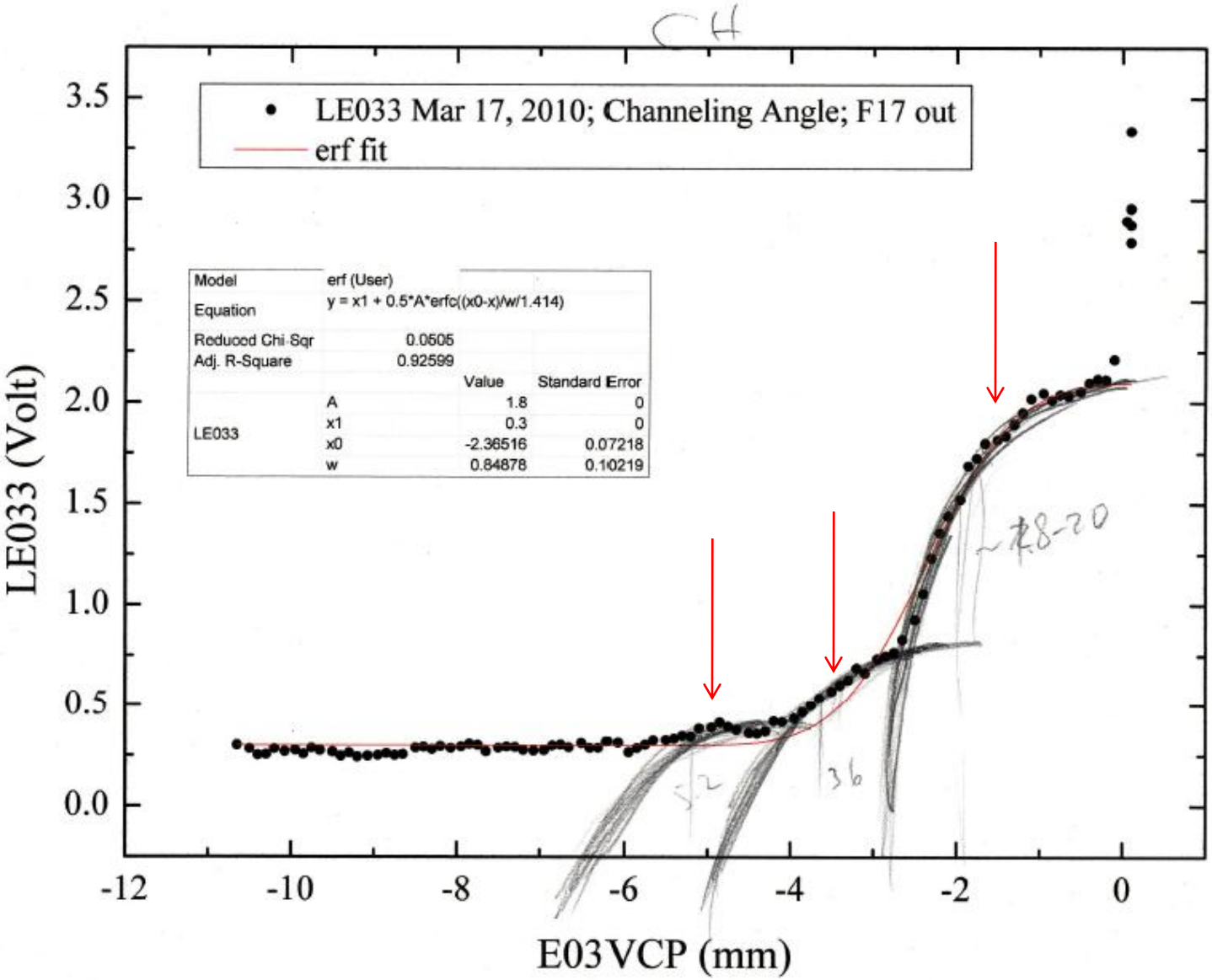


Model	erf (User)		
Equation	y = x1 + 0.5*A*erfc((x0-x)/w/1.414)		
Reduced Chi-Sqr	0.0505		
Adj. R-Square	0.92599		
		Value	Standard Error
LE033	A	1.8	0
	x1	0.3	0
	x0	-2.36516	0.07218
	w	0.84878	0.10219

Corresponds to
θ=2.37mm/28m
=85 urad **- ???**

Are these bumps meaningful?

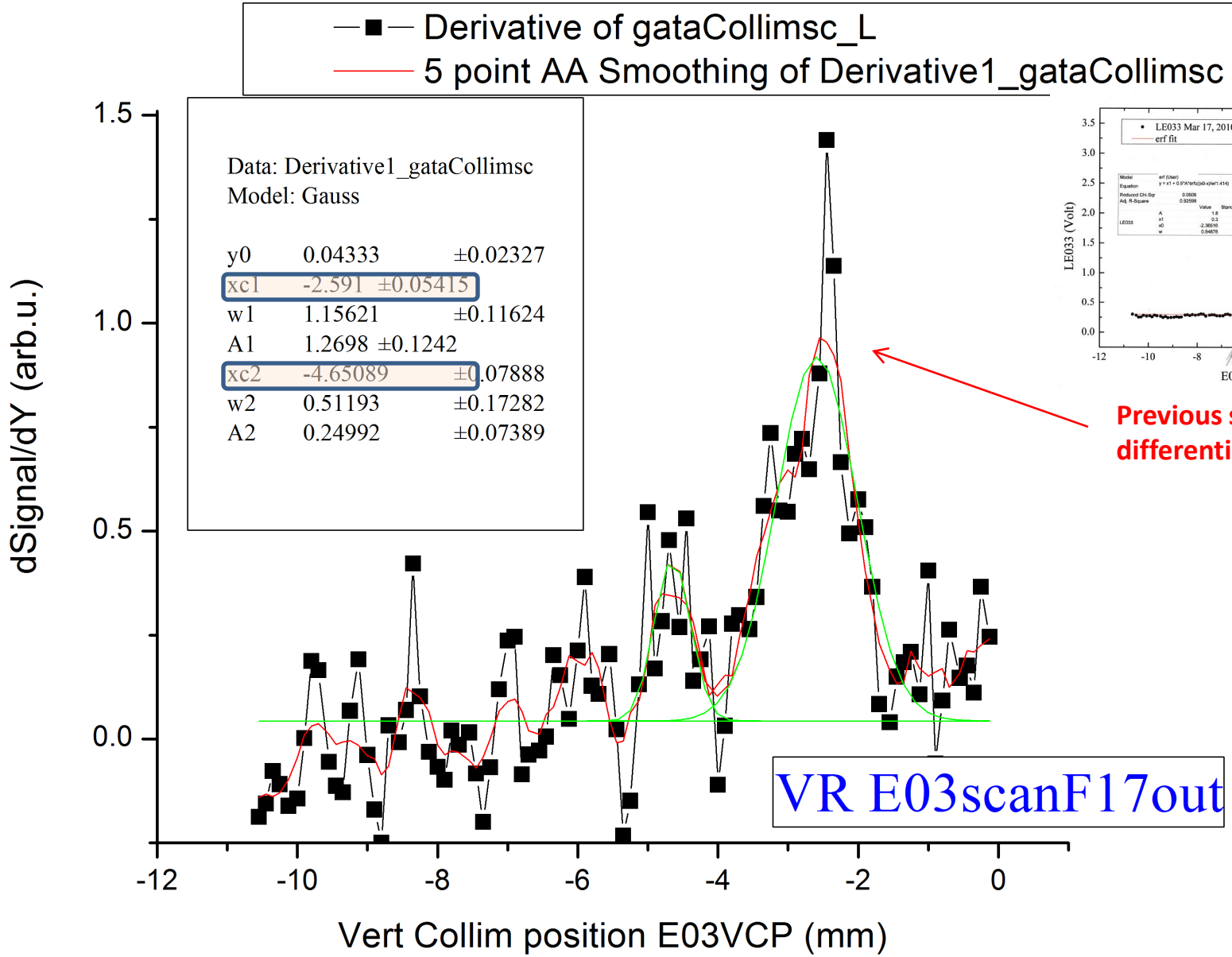
Do we see “bands”?

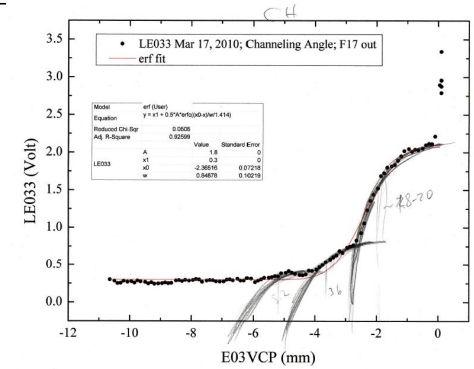


Same data as on Slide 4

… mb similar bands on slide 3 data -?

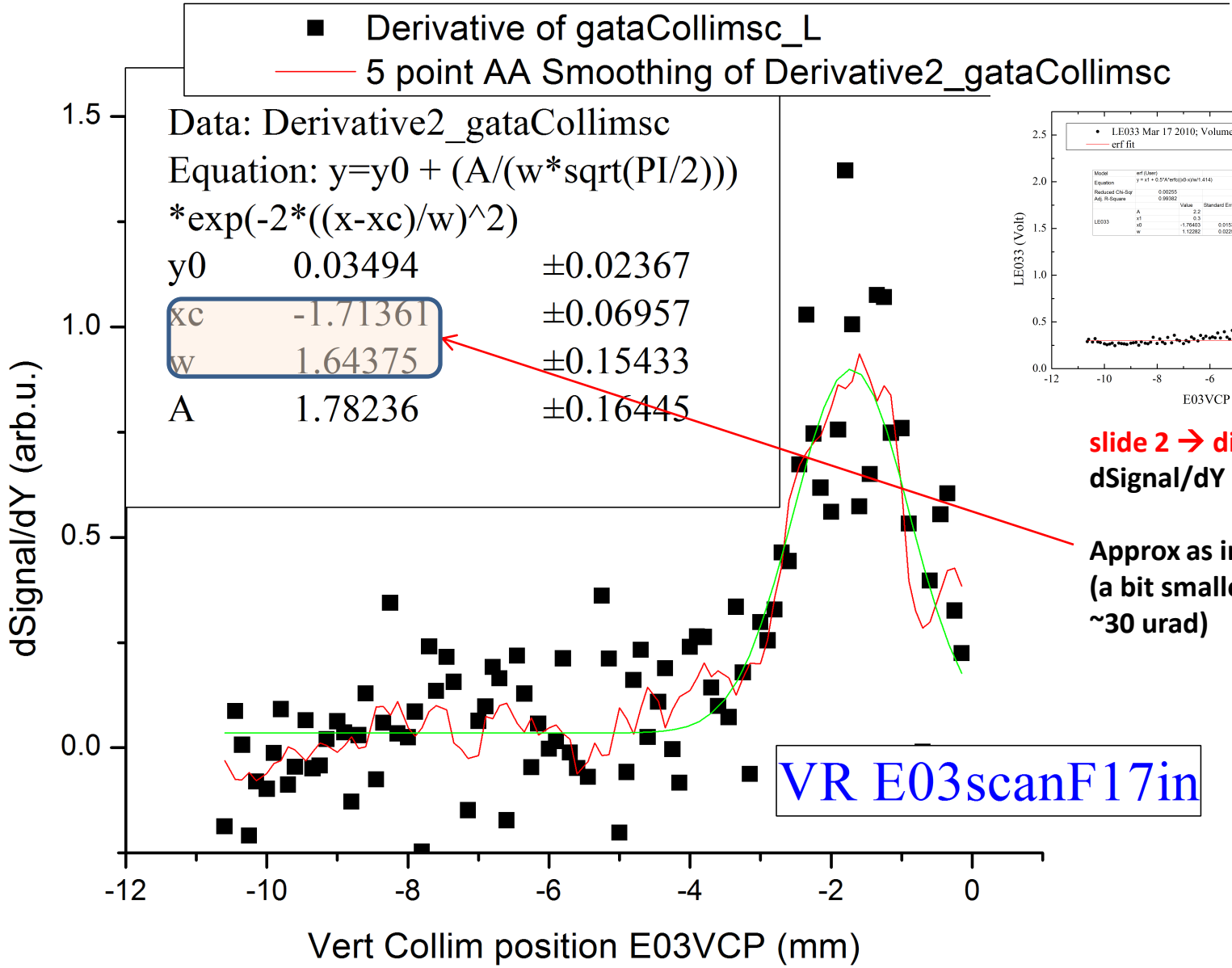
Differentiate and analyze

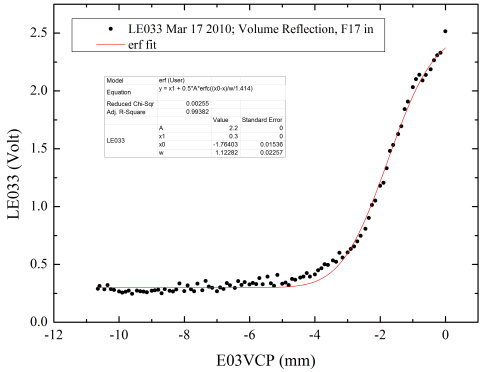




Previous slide → differentiate dSignal/dY

Same with F17 in:

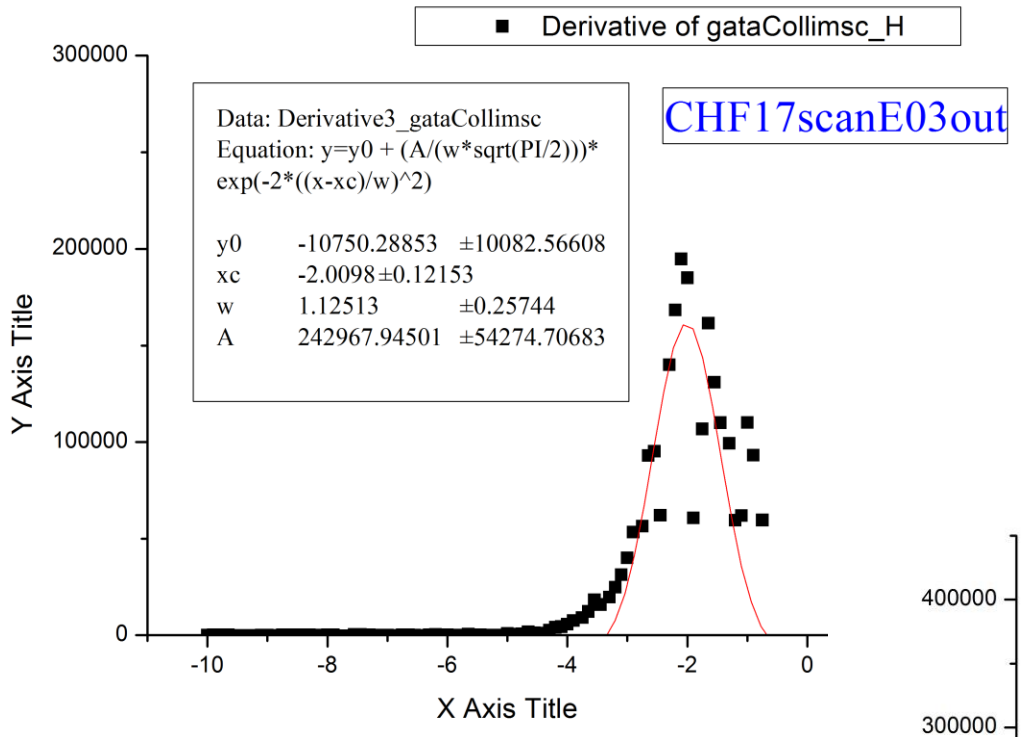


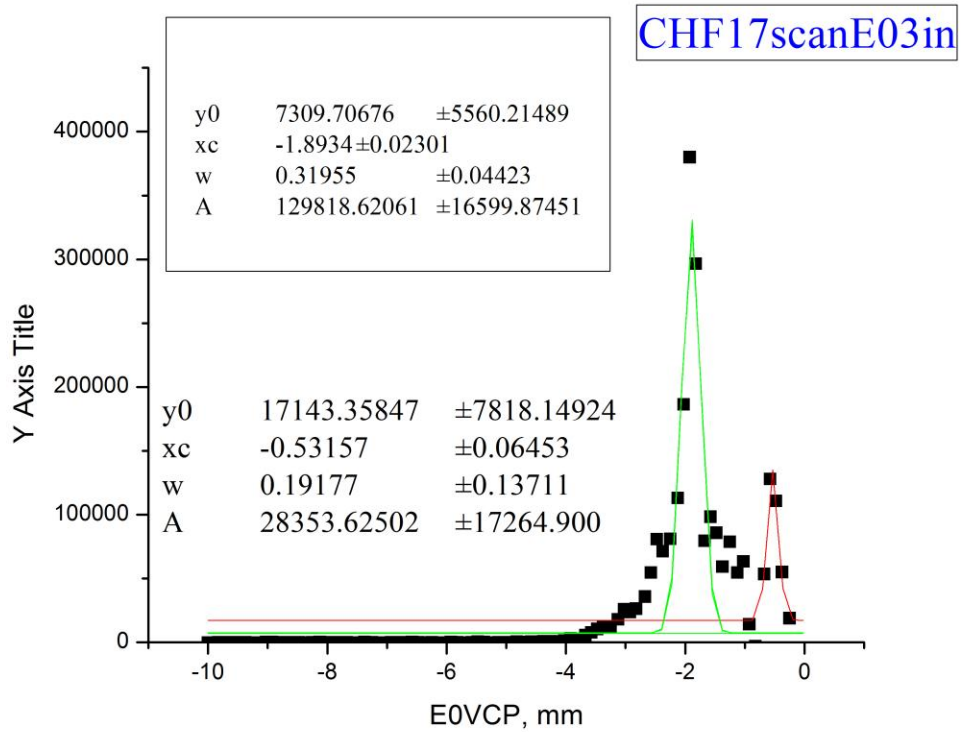


slide 2 → differentiate dSignal/dY

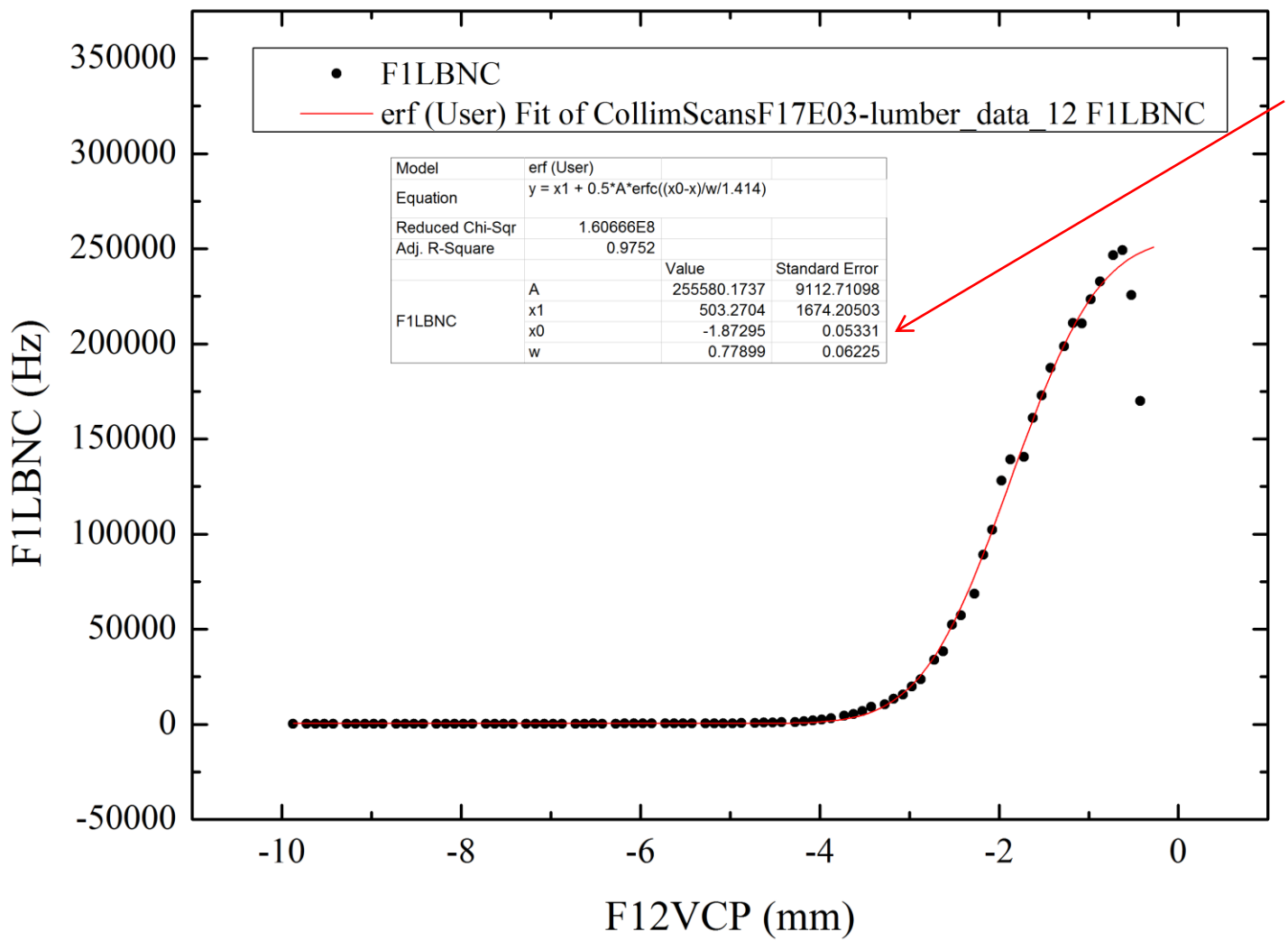
Approx as in "erf"-fit (a bit smaller wdth of ~30 urad)

Same for scans at CH angle:





CH beam scan at F17 (E03 is in)



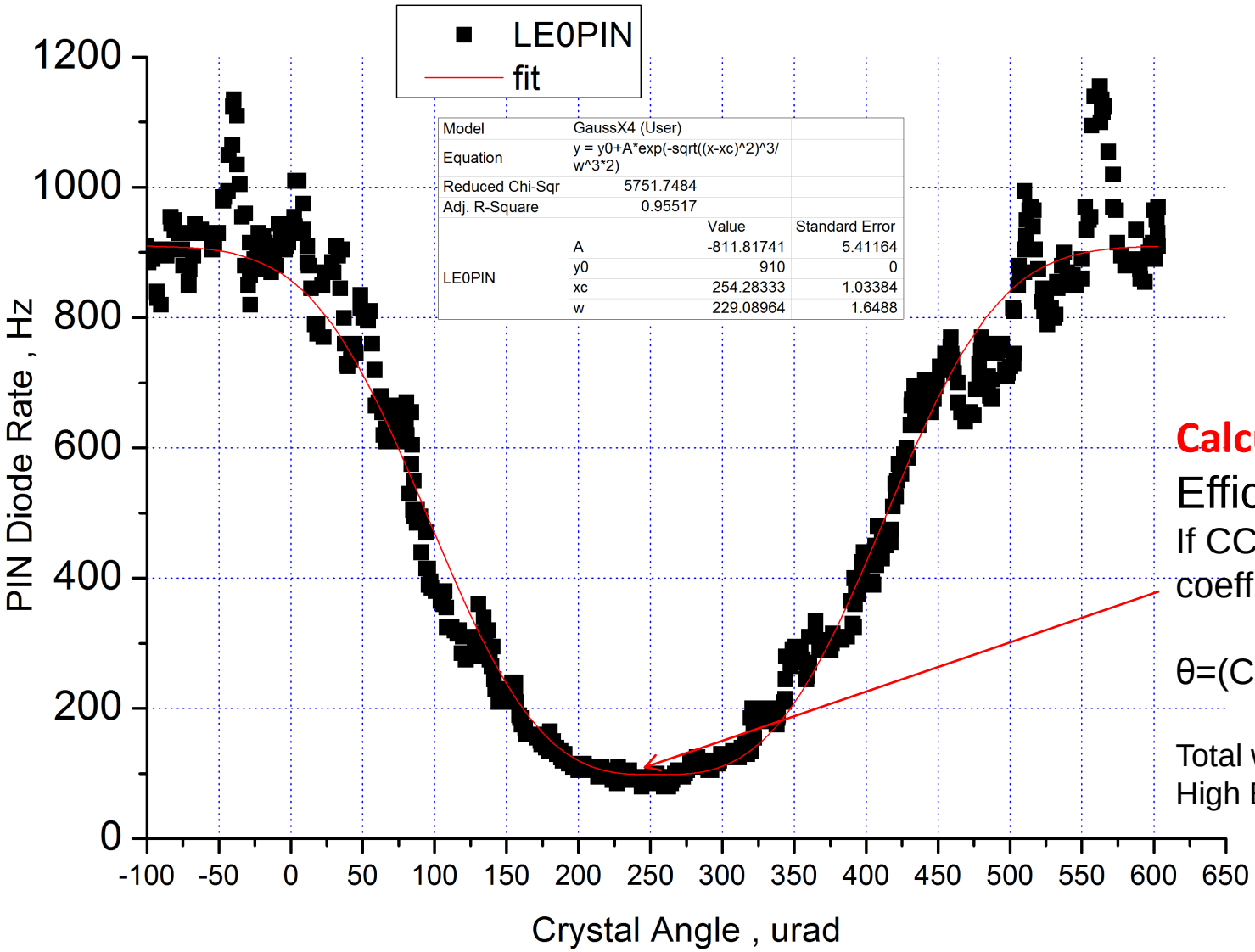
Corresponds to
θ=1.87mm/29m=65 urad

instead of 200 urad
Width is ~28 urad
that's *narrower?* than expected

Comments:

- Expected positions of particles kicked at the MS position:
  - VR Deflected beam at E03 dY[mm]=θ[urad]*0.028
  - CH Deflected beam at F17 dY[mm]=-θ[urad]*0.029
  - Circ'ng beam at E03(F17) δY[mm]=θ[urad]*0.079 (.054) if large
- If we close up the aperture (set F17 and E03 close to the beam), then VR beam occurs approx where it supposed to be… still wider than expected
- Seems that if we open up the aperture, "stuff" goes all over the place (due to diffusive or even CH/VR processes) and fills the aperture (not uniformly)
- Channeled beam is not where it supposed to be, much closer to the circulating beam → indication of vert aperture btw E03 and F17

MS Crystal Angle Scan: LE0PIN Loss rate



Model	GaussX4 (User)		
Equation	y = y0+A*exp(-sqrt((x-xc)^2)^3/w^3*2)		
Reduced Chi-Sqr	5751.7484		
Adj. R-Square	0.95517		
		Value	Standard Error
LE0PIN	A	-811.81741	5.41164
	y0	910	0
	xc	254.28333	1.03384
	w	229.08964	1.6488

Calculated

Efficiency=90%

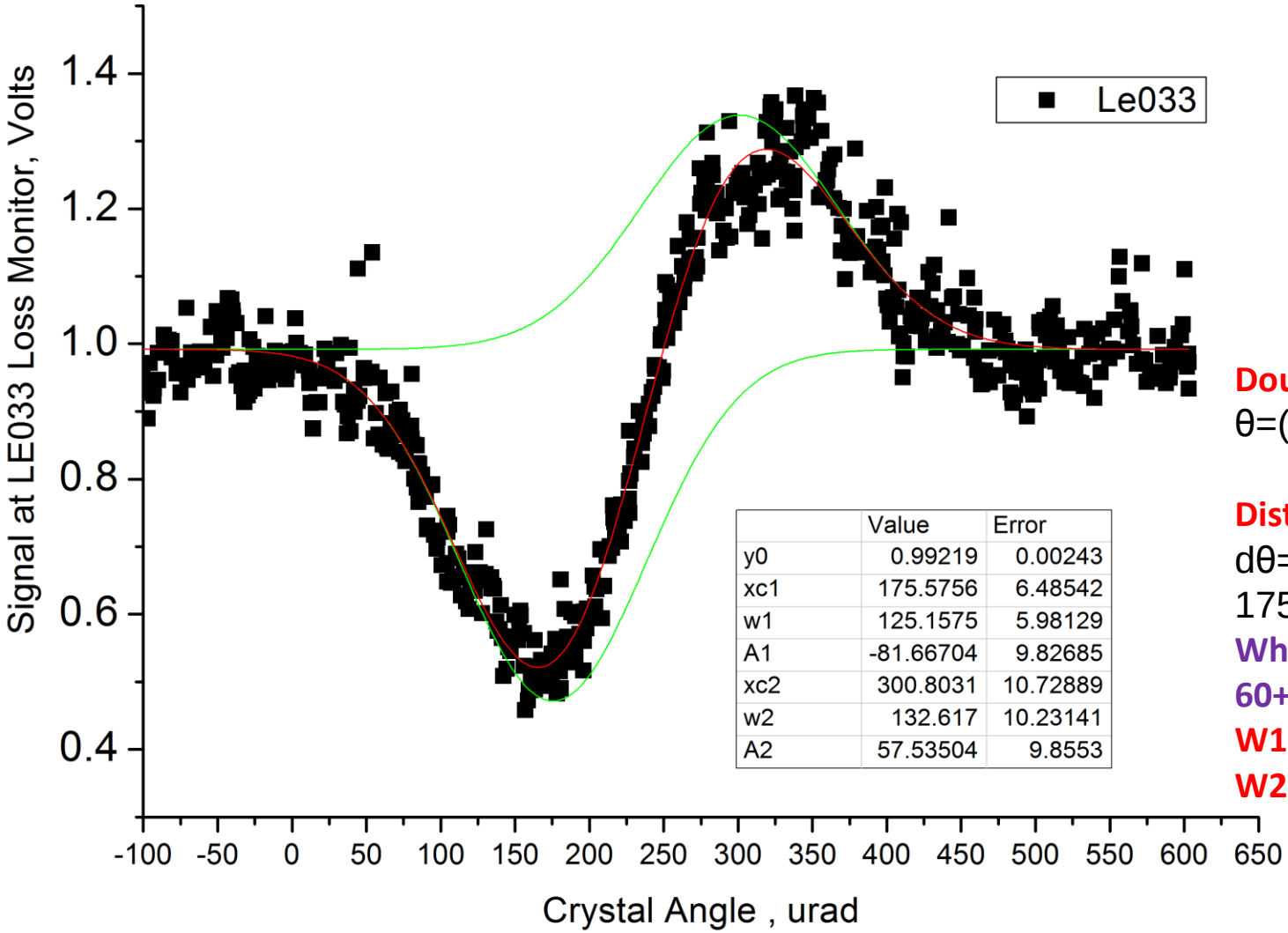
If CCVAD calibration coefficient is 1.24

θ=(CCVAD-500) ***1.24**

Total width ~550 urad

High Eff width ~100 urad

MS Crystal Angle Scan: LE033 Loss rate



	Value	Error
y0	0.99219	0.00243
xc1	175.5756	6.48542
w1	125.1575	5.98129
A1	-81.66704	9.82685
xc2	300.8031	10.72889
w2	132.617	10.23141
A2	57.53504	9.8553

Double Gaussian fit

θ=(CCVAD-500) ***1.24**

Distance btw peaks

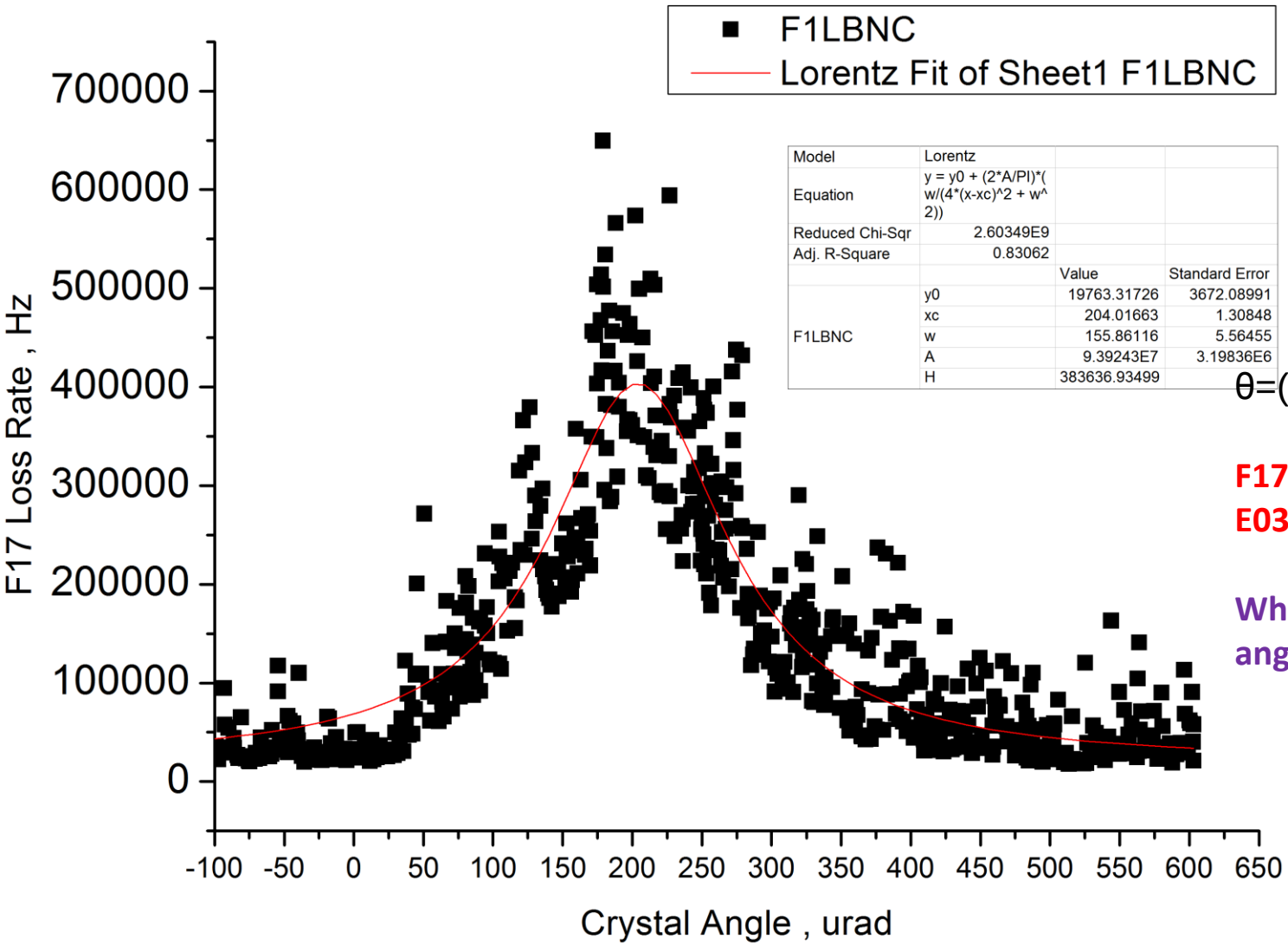
dθ=θ2-θ1=300-175=125 urad

While it has to be 60+200=260 urad

W1(2xsigma)=125 urad

W2(2xsigma)=132 urad

MS Crystal Angle Scan: F17 Loss rate



Model	Lorentz		
Equation	y = y0 + (2*A/PI)*(w/(4*(x-xc)^2 + w^2))		
Reduced Chi-Sqr	2.60349E9		
Adj. R-Square	0.83062		
		Value	Standard Error
F1LBNC	y0	19763.31726	3672.08991
	xc	204.01663	1.30848
	w	155.86116	5.56455
	A	9.39243E7	3.19836E6
	H	383636.93499	

θ=(CCVAD-500) ***1.24**

F17 max at 204 urad
E03 max at 175 urad

What is optimum CH angle?

The peaks are at:

Crystal	Bend Angle And rms angular spread (urad)	Measured E03h,v/F12V displacement and width (mm)	Expected E03h,v/F12V displacement and width (mm)	Measured equivalent dipl. Angle and rms (urad)
Oct 2008 O-BNL-02	410 rms 6	7.44±0.05 rms 0.31±0.07	9.92±0.2 rms 0.18±0.03	310±2 rms 13±3
Dec 2009 O-05-09	360 rms 6	4.18±0.05 rms 0.55±0.07	9.0±0.2 rms 0.18±0.03	174±2 rms 23±3
Mar 3, 2010 MS-08-09	CH 210 ?? rms 6??	CH 2.0±0.07 CH rms 0.73±0.07	CH 5.9±0.2 ?? CH rms 0.22±0.04	CH 70±2 CH rms 26±3
Mar 3, 2010 MS-08-09	VR 63	VR 3.1±0.04 VR rms 0.52±0.05	VR 1.92 VR rms ??	VR 39±0.5 VR rms 6.5±0.07
Mar 17, 2010 MS-08-09	VR 59	VR 1.76±0.02 VR rms 1.12±0.02	VR 1.65 VR rms ??	VR 63±0.6 VR rms 39±0.8
Mar 17, 2010 MS-08-09	CH 200 Width ~100	CH 1.87±0.06 CH rms 0.78±0.06	CH 5.7±0.4 ?? CH rms (wide)	CH 65±2 CH rms 28±3

Next studies:

1. Calibrate actual crystal angle (CCVAD coefficient=?)
2. See how shoulder at F17 collim scan moves vs F0 position in Lamberston
3. Slow(fine) scans with apertures open - Is there really interference?
4. E03 and F17 at several crystal angles – say AM→VR→CH→AM
5. Try single vertical collimator
6. Horizontal crystal mystery not resolved (deflection less than 360urad)
7. Try two-plane collimation