A_T Analysis Update (~final results)

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Outline

- 1 minirun removed for PREX-2 Pb dataset (redid analysis)
- New non-linearity systematic calculation
- Final polarization results
- Final CREX dilution factor (rate ratio)
- New beam correction systematic
- A_T results and summary

A_T Dataset

		Average (HWP IN/OUT)		regression [units ppb]				dithering [units ppb]			
Experiment	Target	Araw [ppb]	d(Araw) [ppb]	A	d(A)	abs(Araw - A)	Abeam corr	A	d(A)	abs(Araw - A)	Abeam corr
PREX-2(respi	Carbon-12	5267.8	740.8	5464.5	329.6	196.7	49.2	5493.9	330	226.1	56.5
	Pb208	-196.2	671.7	-0.9	127	195.3	48.8	-0.3	128.8	195.9	49
	Ca40	4439.2	1219	5276.3	288.3	837	209.3	5294.7	289.7	855.5	213.9
CREX(respin-	Carbon-12	7614.4	1040.3	8224.8	878.7	610.4	152.6	8166.8	879.5	552.4	138.1
	Pb208	2414.2	1741.4	2733.1	1608.4	319	79.7	2765.3	1610.1	351.1	87.8
	Ca40	8363.1	1198.5	8399.7	924.2	36.6	9.2	8405	925.6	41.9	10.5
	Ca48	7784.4	1074.7	7969.8	837.6	185.4	46.4	7916.9	839.2	132.5	33.1

- PREX-2(respin-2): from summer 2020 haplogs 4169 and 4155
- While investigating PREX-2 Aq, a bad minirun was found at very beginning of run 4117;

  --It was removed and then re-analyzed by Ryan (shown in blue); results are in haplog 4549

- New CREX results from Weibin posted in haplog 4524 following respin-2; no big changes
- Note that Abeam corrections in above table still use the original 0.25*(Araw-Acorr)

New non-linearity systematic calculation

- New correction separates the contributions from detector and BCM non-linearity
- The old calculation simply multiplied Acorr by 2.0 %

- Detector non-linearity uses 0.5 % x Araw

Det non linearity	
d(A) syst [ppb]	d(A) syst [%]
26	0.50%
1	0.50%
22	0.50%
38	0.50%
12	0.50%
42	0.50%
39	0.50%

AND

- BCM non-linearity uses 1.0 % x Aq

	New BCM Non Linearity Systematic			
	Target	Aq [ppb]	d(A) syst [ppb]	d(A) syst [%]
PREX-2	Carbon-12	-52.863	0.5	1.00%
	Pb208	140.602	1.4	1.00%
	Ca40	-104.763	1.0	1.00%
CREX	Carbon-12	50.09	0.5	1.00%
	Pb208	-1.61	0.0	1.00%
	Ca40	47.81	0.5	1.00%
	Ca48	27.35	0.3	1.00%
	Analysis done by Weibin: http://ace.phys.virginia.edu/HAPPEX/4544			

Beam Polarization for A_T

- Both PREX-2 and CREX A_T will use the Moller results
- PREX-2 uses the Apv publication numbers: 89.7 ± 0.80 %
- CREX uses the measurements taken just before A_T data collection: 86.9 ± 0.14 % (stat)
    - It uses the systematic error over the entire run with one additional contribution from dead-reckoning the Wein rotation angle when going vertical
        - Assuming a 3deg precision, cos(3deg) = 99.86 % -- which gives an extra 0.14 % uncertainty added in quadrature with the Apv systematic
        - Including this additional error, the overall systematic error for CREX A_T is 0.881 %pol
    - CREX numbers for A_T publication: 86.9 ± 0.78 %

Slide from Eric and Don

A_T RUNS POLARIZATION (0.881%)

Moller measurements performed on 2/8 relevant to A_T running.

Summaries for groups 3022 (HWP-OUT) and 3023 (HWP-IN) are shown in the table.

Note: Pol% units are polarization percentages and not relative percentages.

Group	Date	iHWP	Polarization Measured	Stat Error [Pol%]	Syst Error [Pol%]
3022	2020-02-08	OUT	-86.98	0.203	0.766
3023	2020-02-08	IN	+86.83	0.197	0.764

Error-Weighted Mean Polarization [Pol%]	Stat Error [Pol%]	Syst Error [Pol%]
86.897	0.141	0.7655

Slide from Eric and Don

CREX A_T RUNS SYSTEMATICS (0.881%)

Source	Value	$\delta P/P$ (%)
A_{zz}	0.75421	0.16
Foil Polarization	0.08005	0.57
Dead Time Correction	0.148%	0.148
Accidental Correction	0.205%	0.041
Charge Normalization	0.029%	0.009
Null Asymmetry (Cu Foil)	0.0%	0.220
PITA Variation	—	0.06
Spin Precession (dP/P)	—	0.04
High Current Extrapolation	—	0.5
Bleedthrough	—	0.26
Slit Dependence	—	0.1
3° Wien Rotation Error	—	0.14
	Total	**0.881**

We have zero motivation to believe that there was anything other than a zero null asymmetry on this day consistent will all other measurements during PREX-II and CREX. This will remain unchanged.

PITA Variation over these two days was smaller than average so we will leave the systematic as the experimental average.

Bleed through was higher than average this day at 0.13%. Since Hall-C polarization is opposite that of Hall-A the value must be doubled.

Uncertainty in the angle rotation considering that the Wein angle rotation is good to +/-3 degrees (1-cos(3deg)=0.14%)

Dilution factors and Target Impurity

- CREX dilution factor for Pb finalized and taken from Weibin's simulation (same as for the PREX-2 result)
- The issues that were addressed/fixed were related to implementing Chuck's new XS tables correctly (fairly minor) but the BIG issue was we learned that:
  --Due to the radiative effects in the Pb (in between the diamond), the 'effective' radiation length of the diamond is lowered by ~0.5 (haplog: 4532)
  --After realizing this, the calculated rate ratio from data widths as well as (FF/Q)^2 scaling calculations agree with simulated results at 10 % level!

	Target impurity R_C/R_Pb	uncert	uncert [%]	Reference
Pb208 @ 1GeV	0.0671	0.0057	8%	from weibin's simulation (consistent with f_c used in Apv analysis)
Pb208 @ 2.2GeV	0.6089	0.0609	10%	from weibin's simulations. Consistent with calcs from data widths and FF/Q scaling at 10% level
Ca40	0.0003	0.0000	1%	https://prex.jlab.org/DocDB/0003/000306/001/Assay-2019.pdf
non-Ca48/(Ca48+non-Ca48) (atomic fraction)	0.0907	0.0018	2%	Ammount of non Ca48 0.08311570795 https://logbooks.jlab.org/entry/3769028
	The purity for Ca40/48 is atomic fraction			https://prex.jlab.org/DocDB/0003/000306/001/Assay-2019.pdf
				https://logbooks.jlab.org/files/2016/03/3386944/Assay%20Ca-48%20900242.pdf

New Beam corrections systematic

- New beam systematic based on the error in Dit-Reg correction residual (not 1.25 x (Acorr – Araw) as before)
- Uses the error in pattern-level differences between dither-corrected and reg-corrected asymmetry

Currently using this column for the error

		Dit-corrected [ppb]		Reg-corrected [ppb]		Avg residuals [ppb]		pattern-wise (Dit - Reg)		Options for d(Abeam) syst		Previous d(Abeam)
		Acorr	d(Acorr)	Acorr	d(Acorr)	<dit>-<raw>	<dit>-<reg>	residual	d(residual)	uniform d(res	quad sum	) Abeam corr
PREX-2	Carbon-12	-5,494	330	-5,357	339	-226	-137	-291	16	30	291	56.5
	Pb208	0.26	129	-27	139	-196	27	174	24	30	176	49
	Ca40	-5,295	290	-5,138	318	-856	-157	-319	33	30	321	213.9
CREX	Carbon-12	-8,167	880	8,277	904	-553	110	-622	36	70	623	138.1
	Pb208	-2,765	1,610	2,741	1,647	-351	-24	603	69	70	607	87.8
	Ca40	-8,405	926	8,357	947	-42	-48	-197	50	70	203	10.5
	Ca48	-7,917	839	7,666	855	-133	-251	-506	50	70	508	33.1
						Analysis done by Robert: http://ace.phys.virginia.edu/HAPPEX/4552						

Note the ‘quad’ sum is quadrature sum of residual and its error

PREX-2 Systematic Errors

PREX-2 An Systematics:	Target	quantity	ppb	%		From March ppb	From March %
	C	pdA_nonlinDet	30.37	0.48	= dA_nonlin/P/<cos>	126.98	2.00
		pdA_nonlinBCM	0.61	0.01	= dA_nonlin/P/<cos>		
		pdA_beam	18.18	0.29	= dA_beam/P/<cos>	65.33	1.03
		pdP	-56.50	-0.89	= (A_corr/P/<cos>)*dP/P		
	D-Pb-D	pdA_nonlinDet	1.13	0.27	= dA_nonlin/P/<cos>	7.92	2.00
		pdA_nonlinBCM	1.62	0.03	= dA_nonlin/P/<cos>		
		pdA_beam	27.90	6.56	= dA_beam/P/<cos>	65.41	16.52
		pdA_carbon	25.54	6.00	= f_carbon*dA_carbon/P/<cos>		
		pdf_carbon	36.12	8.49	= (A_corr - A_carbon)*df_carbon/P/<cos>		
		pdP	3.80	0.89	= [(1+f_carbon)*A_corr/P/<cos> - f_carbon*A_carbon/P/<cos>]*dP/P		
	Ca40	pdA_nonlinDet	25.66	0.42	= dA_nonlin/P/<cos>	122.69	2.00
		pdA_nonlinBCM	1.21	0.02	= dA_nonlin/P/<cos>		
		pdA_beam	38.16	0.62	= dA_beam/P/<cos>	247.79	4.04
		pdP	-54.59	-0.89	= (A_corr/P)*dP/P/<cos>		

CREX Systematic Errors

CREX An Systematics:	Target	quantity	ppb	%		From March ppb	From March %
	C	pdA_nonlinDet	45.23	0.47	= dA_nonlin/P/<cos>	194.19	2.00
		pdA_nonlinBCM	0.58	0.01	= dA_nonlin/P/<cos>		
		pdA_beam	42.69	0.44	= dA_beam/P/<cos>	161.81	1.67
		pdP	-11.19	-0.12	= (A_corr/P)*dP/P/<cos>		
	D-Pb-D	pdA_nonlinDet	14.34	2.31	= dA_nonlin/P/<cos>	14.38	2.00
		pdA_nonlinBCM	0.02	0.00	= dA_nonlin/P/<cos>		
		pdA_beam	81.78	13.16	= dA_beam/P/<cos>	111.17	15.46
		pdA_carbon	636.03	102.32	= f_carbon*dA_carbon/P/<cos>		
		pdf_carbon	390.60	62.83	= (A_corr - A_carbon)*df_carbon/P/<cos>		
		pdP	0.72	0.12	= [(1+f_carbon)*A_corr/P/<cos> - f_carbon*A_carbon/P/<cos>]*dP/P		
	Ca40	pdA_nonlinDet	49.61	0.50	= dA_nonlin/P/<cos>	198.83	2.00
		pdA_nonlinBCM	0.55	0.01	= dA_nonlin/P/<cos>		
		pdA_beam	59.54	0.60	= dA_beam/P/<cos>	8.81	0.09
		pdP	-11.50	-0.12	= (A_corr/P)*dP/P/<cos>		
	Ca48	pdA_nonlin	46.18	0.49	= dA_nonlin/P/<cos>	187.09	2.00
		pdA_nonlinBCM	0.32	0.00	= dA_nonlin/P/<cos>		
		pdA_beam	59.79	0.64	= dA_beam/P/<cos>	36.46	0.39
		pdA_calcium	99.57	1.07	= f_ca40*dA_ca40/P/<cos>		
		pdf_calcium	1.04	0.01	= (A_phys - A_ca40)*df_ca40/P/<cos>		
		pdP	-10.77	-0.12	= [(1+f_ca40)*A_corr/P/<cos> - f_ca40*A_ca40/P/<cos>]*dP/P		

~Final A_T Results

- Systematic errors in tables are added in quadrature
- The new non-linearity systematics are smaller than before (except for CREX Pb)
- The new beam correction systematics are smaller than before (except for CREX Ca targets)
- What exactly to use for the beam systematic is perhaps the final detail to iron out before ~final → FINAL

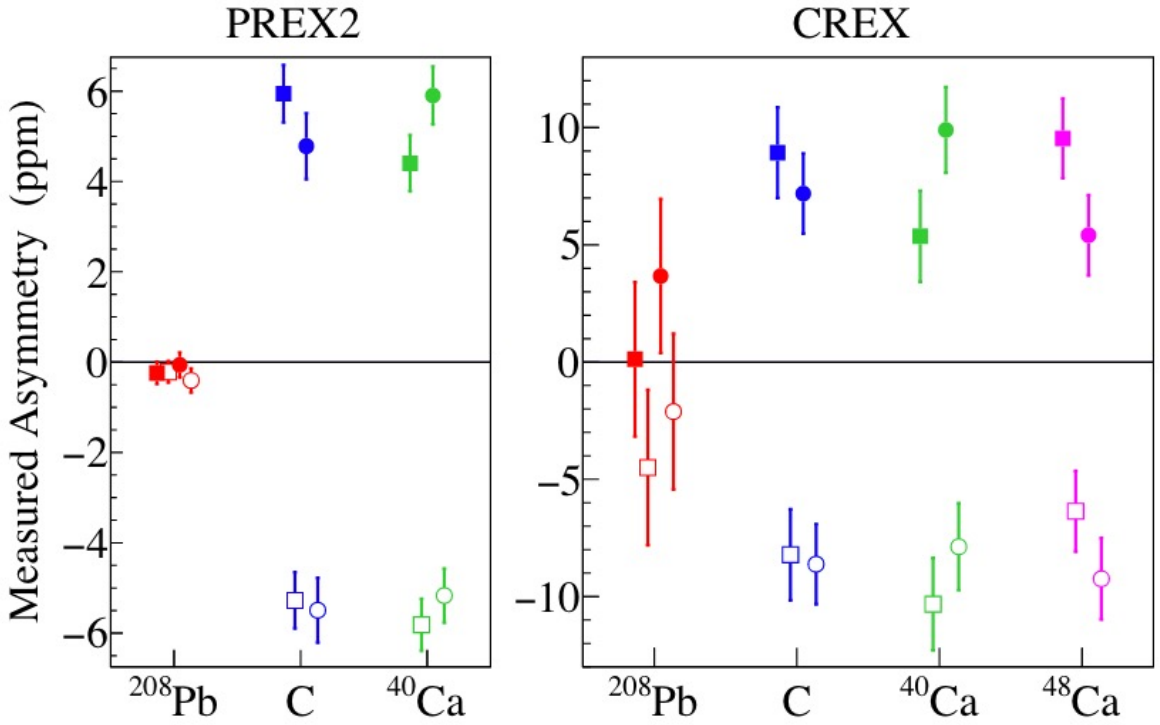
Current Results

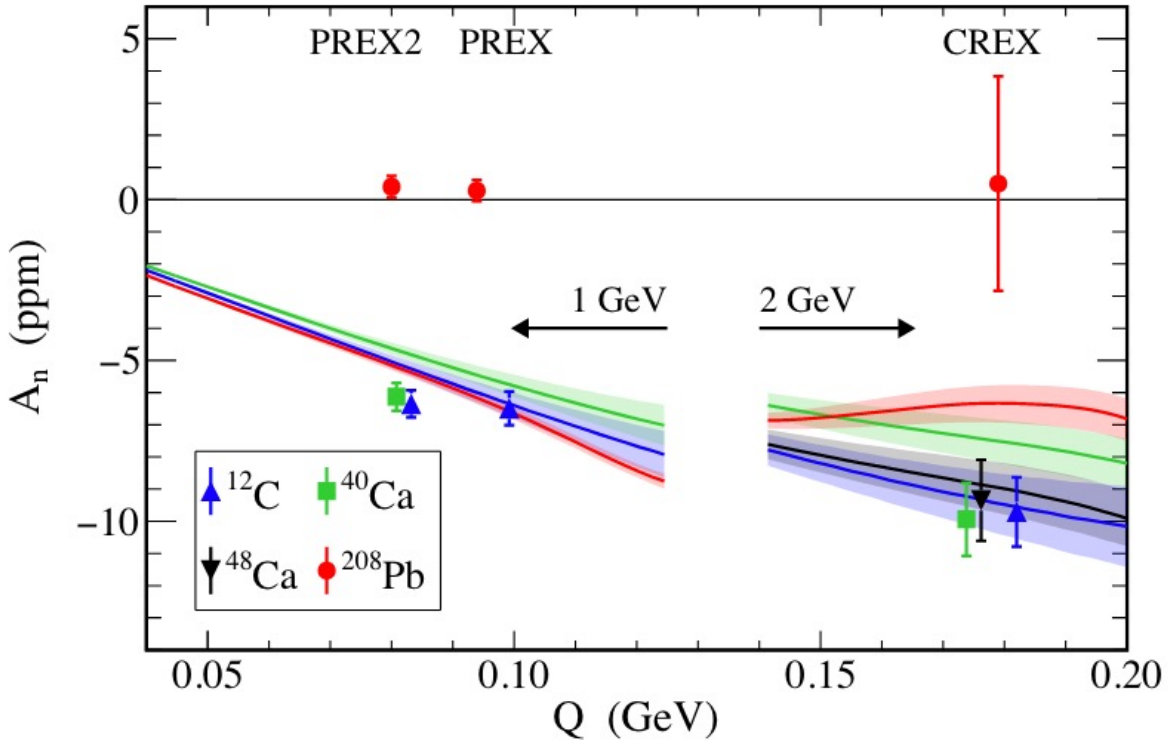
		A_T			
Experiment	Target	A [ppm]	d(A) stat [ppm]	d(A) syst [ppm]	syst/stat
PREX-2 (respin-2)	Carbon-12	-6.34	0.38	0.07	18%
	Pb208	0.43	0.16	0.05	33%
	Ca40	-6.12	0.33	0.07	21%
CREX (respin-2)	Carbon-12	-9.70	1.05	0.06	6%
	Pb208	0.62	3.14	0.75	24%
	Ca40	-9.97	1.10	0.08	7%
	Ca48	-9.34	1.09	0.13	11%

Results from March for comparison

A_T			
A [ppm]	d(A) stat [ppm]	d(A) syst [ppm]	syst/stat
-6.35	0.38	0.14	38%
0.40	0.16	0.08	50%
-6.13	0.34	0.28	83%
-9.71	1.05	0.25	24%
0.72	3.18	0.75	24%
-9.94	1.10	0.20	18%
-9.35	1.09	0.22	20%

Some plots (sorry not exactly up to date)





Slides from March 9, 2021

False Asymmetries

PREX-2:

Analysis from Ryan following respin-2; posted in haplog 4160 (July 2020); Final -- no changes for prex-2

	A_{raw}	dA_{raw}	A_{reg}	dA_{reg}	A_{dit}	dA_{dit}	Reg Diff	Dit Diff	$dFalse_{reg}$	$dFalse_{dit}$
C12	5267.752	740.798	5464.458	329.616	5493.883	330.014	191.706	226.131	49.177	56.532
Pb208	-201.844	666.141	22.688	125.958	24.461	127.647	224.532	226.305	56.133	57.576
Ca40	4439.244	1218.993	5276.284	288.271	5294.703	289.734	837.04	855.459	209.26	213.865

CREX:

Analysis from Weibin; posted in haplog 4144 (June 2020 – prompt output)

$A_{false} = 0.25 * \Delta A$

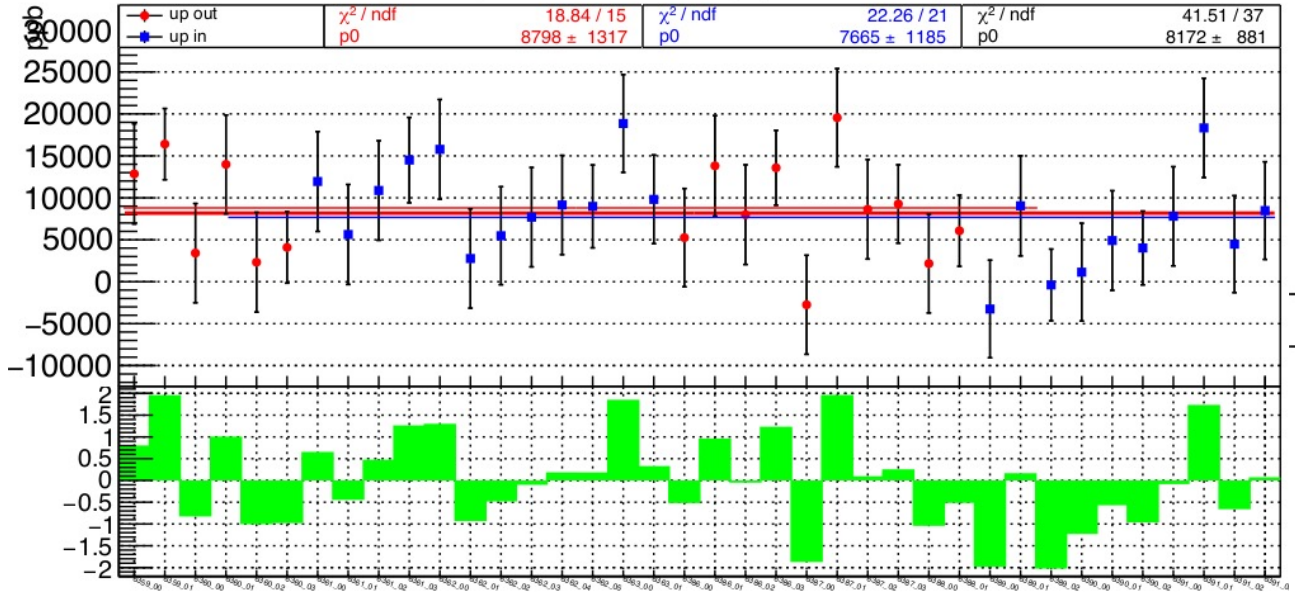
Target	Raw (ppb)	Regression (ppb)			Dithering (ppb)			
	A	A	$\lvert\Delta A\rvert$	A_{false}	A	$\lvert\Delta A\rvert$	A_{false}	Old
C	-7813 ± 1090	-8528 ± 920.6	715	178.75	-8430 ± 921.5	617	154.25	
Ca40	-8711 ± 1265	-8757 ± 975.2	46	11.5	-8700 ± 977	11	2.75	
Ca48	-7860 ± 1142	-8283 ± 889.5	423	105.75	-8220 ± 891.6	360	90	
Pb	-2955 ± 1882	-3253 ± 1737	298	74.5	-3317 ± 1739	352	88	

(Feb 2021 – respin1 output haplog 4464)

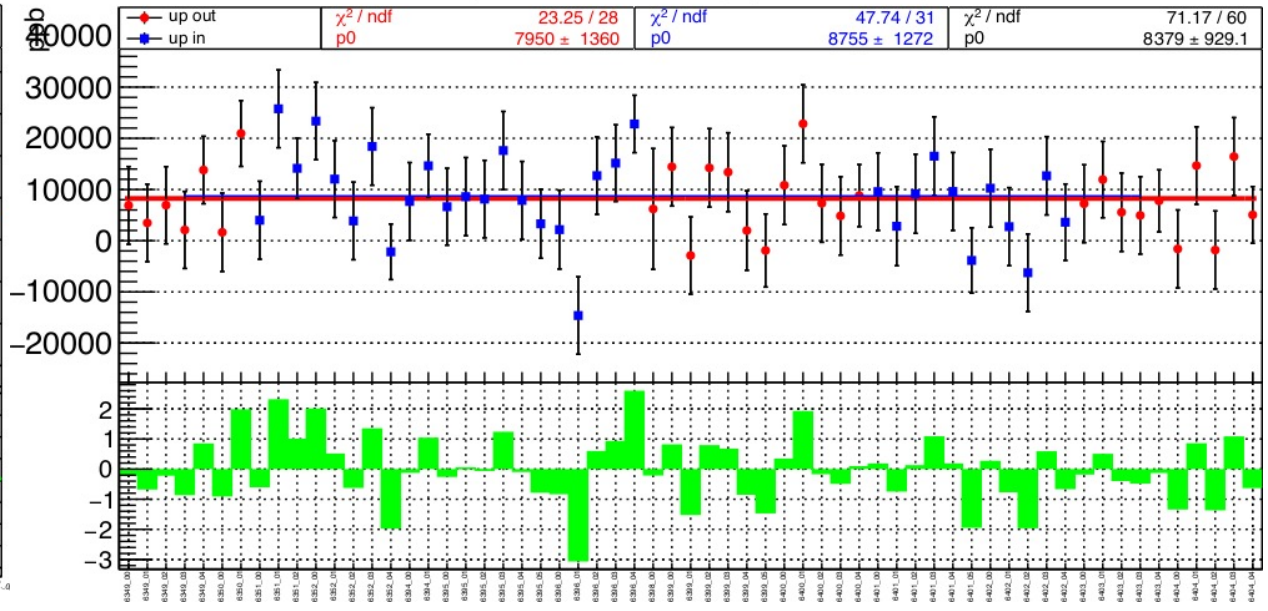
										$A_{false,\ dit}$	New
Carbon-12	-7628	1042	-8230	880.1	602	151	-8172	881.0	544	136	
Ca40	-8350	1203	-8372	927.7	22	5.73	-8379	929	29	7.25	
Ca48	-7802	1079	-7978	840.8	176	44.0	-7925	842	123	30.8	
Pb208	-2446	1763	-2770	1628	324	81.1	-2820	1630	374	93.5	

Respin1 CREX Asymmetries

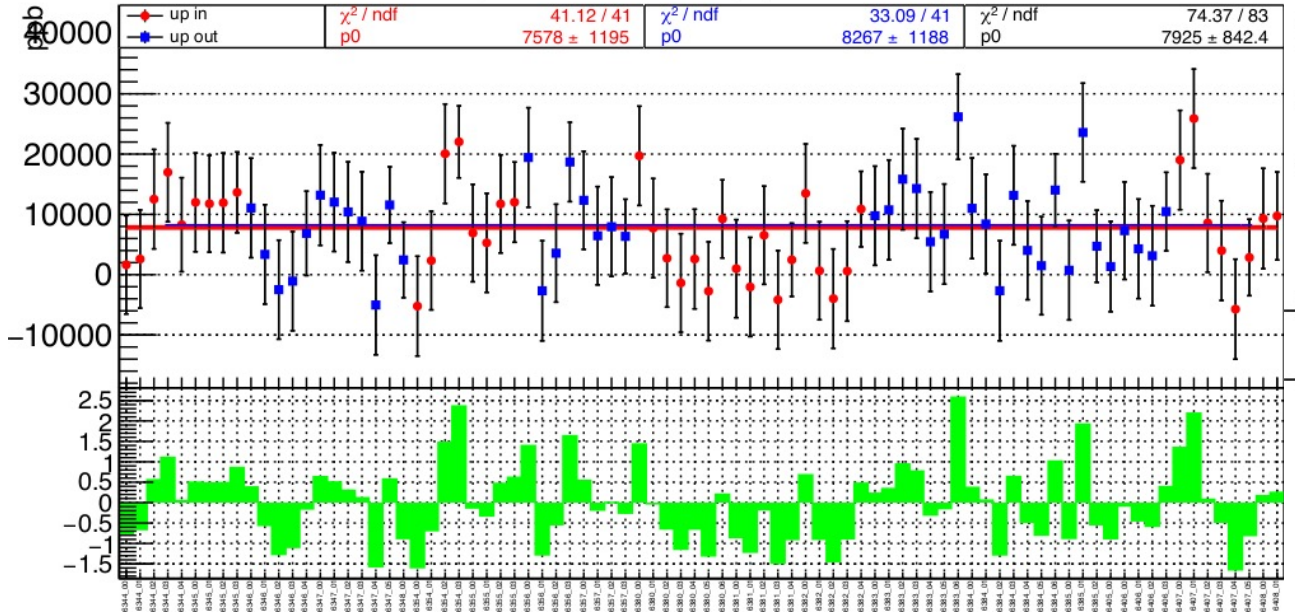
Carbon



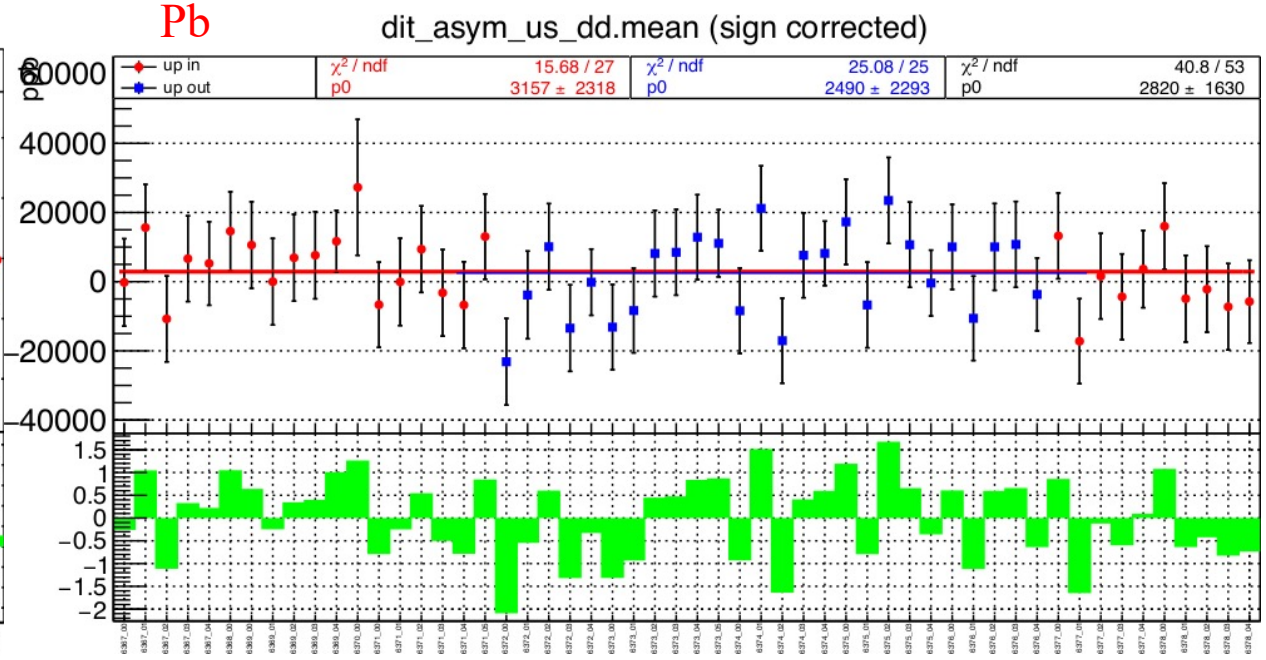
Ca-40



Ca-48



Pb



Changes in CREX results: Respin1 - Prompt (summer)

Target	Araw diff [ppb]	d(Araw diff) [ppb]	Araw diff [%]	d(Araw diff) [%]	Acorr diff [ppb]	d(Acorr diff) [ppb]	Acorr diff [%]	d(Acorr diff) [%]
Carbon-12	-185	320	-2.37	4.09	-258	270	-3.06	3.21
Pb208	-509	659	-17.24	22.3	-479	606	-14.5	18.4
Ca40	-361	392	-4.15	4.50	-321	302	-3.69	3.47
Ca48	-58.2	374	-0.74	4.76	-295	292	-3.59	3.55

- All raw and corrected asymmetry magnitudes decreased. Why?
  - Change in magnitudes are statistical (at 1σ level), but all same direction
  - Det. pedestals changed by approx. -2000 ch due to bcm ped re-calibration
    --resulting in a ~3 to 6% predicted decrease in measured asymm for all targets
  - Respin1 event cut changes give ~10^4 more events per run
- Shift in C and Ca targets consistent with predicted shift from pedestal change
- Shift in Pb results are 2x more than predicted, but within statistics
- Two back to back outlier Pb runs at the end deviate by -1.2 σ after accounting for changes due to pedestal shift. Cameron investigated this

Rate ratios and Asymmetry Correction

Pb data:

- Analysis uses the following formula for the carbon dilution correction:

From summer 2020: $A^{Pb}{}_{corr} = Adit^{meas}(1 + f_C) - f_C A_C$ where $f_C = \frac{\text{rate\_C}}{\text{rate\_Pb}}$

$f_C = \frac{\text{rate\_C}}{\text{rate\_Pb}} = 0.0765 \pm 0.0153$ (20%) for PREX-2 and 0.89 ± 0.178 (20%) for CREX (haplog 4129)

--these values came from averages of analyses using calculated rates (FF/Q2) and rates from real data widths

March 2021:

$f_C = \frac{\text{rate\_C}}{\text{rate\_Pb}} = 0.0671 \pm 0.0057$ (8%) for PREX-2 and 0.64 ± 0.0512 (8%) for CREX (haplog to come)

--these values come from simulation (Method 3 in table)

Experiment	Method 1 f_C	Method 2 f_C	Method 3 (Current) f_C	avg(Meth1 + 2) (summer) f_C
PREX-Pb	0.0834	0.0696	0.0671	0.0765
CREX-Pb (respin1)	0.959	0.667	0.64	0.81
CREX-Pb (prompt)	1.08	0.704	-	0.892

Method 1: from real data widths **Method 2:** sim result scaled using $scale = \left\{ \frac{width_{C,PREX}}{width_{C,CREX}} \times \frac{width_{Pb+D,CREX}}{width_{Pb+D,PREX}} \right\}^2$

Method 3: Simulated results using Chuck's xs tables with focal plane momentum cut

Rate ratios and Asymmetry Correction

Ca data:

$$A^{Ca48}{}_{corr} = Adit^{meas}(1 + f_{Ca40}) - f_{Ca40}A_{Ca40} \qquad \text{where } f_{Ca40} = \frac{\text{non\_Ca48}}{\text{Ca48}}$$

$f_{Ca40} = \frac{\text{non\_Ca48}}{\text{Ca48}} = 0.0907 \pm 0.0018$ for CREX (atomic fraction) obtained from isotopic analysis

Impurity in Ca-48 dominated by Ca-40

Dilution/purity correction Summary

$$A_{corr} = Adit^{meas}(1 + f_i) - f_i A_i$$

Column no longer used

Current Results
prex respin2 &
crex respin1

		corrected asymmetry (dithering)				purity correction			
		A_{corr} [ppb]	dA_{corr} stat [ppb]	dA_{beam} syst [ppb]	syst/stat %	A_{corr} [ppb]	dA_{corr} stat [ppb]	dA_{corr} syst [ppb]	Rate ratio (f_i)
PREX-2	Carbon-12	-5494	330	57	17%	-5494	330		March 2021
	Pb208	-24	128	57	44%	343	136	276	$f_C = 0.0671 \pm 0.0134$
	Ca40	-5295	290	214	74%	-5295	290		
CREX	Carbon-12	-8172	881	136	15%	-8172	881		
	Pb208	-2820	1630	94	6%	606	2673	686	$f_C = 0.64 \pm 0.0512$
	Ca40	-8379	929	7	0.8%	-8379	929		
	Ca48	-7925	842	31	4%	-7884	919	583	$f_{Ca40} = 0.0907 \pm 0.0018$

from summer 2020 (prex -- respin2 and crex – prompt output)

PREX-2	Carbon-12	-5494	330	57	17%	-5494	330		Summer 2020
	Pb208	-24	128	57	44%	394	140	276	$f_C = 0.0765 \pm 0.0153$
	Ca40	-5295	290	214	74%	-5295	290		
CREX	Carbon-12	-8430	922	154	17%	-8430	922		
	Pb208	-3299	1739	86	5%	1278	3394	938	$f_C = 0.892 \pm 0.1784$
	Ca40	-8700	977	3	0.3%	-8700	977		
	Ca48	-8220	892	90	10%	-8176	976	605	$f_{Ca40} = 0.0907 \pm 0.0018$

A_n calculation

$$A_n = \frac{A_{corr}}{P_b \langle \cos\phi \rangle}$$

Current Results

		A_{corr} [ppb]	$\langle \cos\phi \rangle$	A_n [ppm]
PREX-2	Carbon-12	-5494	0.967	-6.35
	Pb208	343	0.966	0.40
	Ca40	-5295	0.964	-6.13
CREX	Carbon-12	-8172	0.969	-9.71
	Pb208	606	0.969	0.72
	Ca40	-8379	0.970	-9.94
	Ca48	-7884	0.970	-9.35

Results from summer 2020

A_{corr} [ppb]	$\langle \cos\phi \rangle$	A_n [ppm]
-5494	1/0.966	-5.93
394	1/0.969	0.43
-5295	1/0.974	-5.76
-8430	1/0.963	-9.34
1278	1/0.963	1.42
-8700	1/0.964	-9.66
-8176	1/0.964	-9.07

Polarimetry								
	Compton		Moller		Average			
Exp.	Polarization	Uncert	Polarization	Uncert	Polarization	Assigned uncertainty	Calc uncert	Relative uncert
PREX-2	88.5533	0.447	89.5	0.3	89.50	1.79	0.30	0.02
CREX	86.874	0.101	86.9	0.2	86.89	1.74	0.09	0.02

Old Error Calculations

		Dilution/purity correction			A_n			
		A_{corr} [ppb]	dA_{corr} stat [ppb]	dA_{corr} syst [ppb]	A_n [ppm]	dA_n stat [ppm]	dA_n syst [ppm]	syst/stat
PREX-2	Carbon-12	-5494	330		-6.35	0.40	0.12	31%
	Pb208	343	141	276	0.40	0.16	0.28	172%
	Ca40	-5295	290		-6.13	0.36	0.24	67%
CREX	Carbon-12	-8172	881		-9.71	1.06	0.21	20%
	Pb208	606	2746	710	0.72	3.26	0.72	22%
	Ca40	-8379	929		-9.94	1.12	0.17	15%
	Ca48	-7884	923	583	-9.35	1.11	0.60	54%

$$dA_{corr}^{stat} = \sqrt{((1+f_{i,r}) \times dA_{corr})^2 + ((A_{corr} - A_i) \times df_{i,r})^2 + (f_{i,r} \times dA_i)^2}$$

$$dA_n^{stat} = |A_n| \text{ x } \sqrt{(dA_{corr}/A_{corr})^2 + (dP_b/P_b)^2}$$

$$dA_{corr}^{syst} = \sqrt{(0.05 \text{ x } A_{corr})^2 + (0.05 \text{ x } A_i)^2 + (f_{i,r} \text{ x } dAi)^2}$$

$$dA_n^{syst} = \sqrt{(0.02 \text{ x } A_{corr})^2 + (dA_{corr}^{syst})^2 + (dA_{beam}^{syst})^2}$$

non-linearity

New Error Calculations

		Dilution/purity correction			A_n			
		A_{corr} [ppb]	dA_{corr} stat [ppb]	dA_{corr} syst [ppb]	A_n [ppm]	dA_n stat [ppm]	dA_n syst [ppm]	syst/stat
PREX-2	Carbon-12	-5494	330		-6.35	0.38	0.14	38%
	Pb208	343	136		0.40	0.16	0.08	50%
	Ca40	-5295	290		-6.13	0.34	0.28	83%
CREX	Carbon-12	-8172	881		-9.71	1.05	0.25	24%
	Pb208	606	2673		0.72	3.18	0.75	24%
	Ca40	-8379	929		-9.94	1.10	0.20	18%
	Ca48	-7884	919		-9.35	1.09	0.22	20%

$$dA_{corr}^{stat} = (1+f_i) \times dA_{meas}$$

$$dA_n^{stat} = \frac{1}{P_b \langle \cos\phi \rangle} (1+f_i) \times dA_{corr}$$

$$dA_n^{syst} = \frac{1}{P_b \langle \cos\phi \rangle} \sqrt{((A_{corr} - A_i) \times df_i)^2 + (f_i \times dA_i)^2 + (A_{corr} \times 0.02)2 + (|A_{corr} - A_{raw}| \times 0.25)2 + (pdP)^2}$$

non-linearity

$$pdP = [(1+f_i) \times A_{corr} - f_i \times A_i] \times dP_b/P_b$$

Error in $\langle \cos\phi \rangle$ is negligible

Error due to different beam corrections not included

New results compared to summer

		Current Results				Results from summer 2020			
		A_n				A_n			
		A_n [ppm]	dA_n stat [ppm]	dA_n syst [ppm]	syst/stat	A_n [ppm]	dA_n stat [ppm]	dA_n syst [ppm]	syst/stat
PREX-2	Carbon-12	-6.35	0.38	0.14	38%	-5.93	0.38	0.12	33%
	Pb208	0.40	0.16	0.08	50%	0.43	0.15	0.28	186%
	Ca40	-6.13	0.34	0.28	83%	-5.76	0.34	0.24	71%
CREX	Carbon-12	-9.71	1.05	0.25	24%	-9.34	1.04	0.23	22%
	Pb208	0.72	3.18	0.75	24%	1.42	1.93	0.94	49%
	Ca40	-9.94	1.10	0.20	18%	-9.66	1.10	0.17	16%
	Ca48	-9.35	1.09	0.22	20%	-9.07	1.01	0.63	63%

- You can find the new results in the google spreadsheet. In the tab labelled ‘New Summary March 2021’

Summary

- Fixed a couple issues with spreadsheet from summer(nothing new since last presentation on 2/18):
  -- A_n calculation multiplied $\langle\cos\phi\rangle$ instead of divided by (caused ~5% increase in A_n)
  -- stat error propagation formula for dilution correction had incorrect term: $(dA_{meas} - dA_i) * df_{i,r}$ instead of $(A_{meas} - A_i) * df_{i,r}$
  [15% increase for prex-2 Pb and 3.5% increase for crex Pb; no changes for Ca]
  -- A_n stat error calc had mixed dither-corr *A's* (means) with dilution-corr *dA*'s…
- No changes in run selections. Prex-2 analyses were not redone—only carbon/pb rate ratio changed
- Re-examined and changed rate ratios:
  --new values obtained from simulation for both PREX-2 and CREX
  --Simulated $f_C{}'$s and those obtained from FF^2/Q^2 scaling are consistent, but both disagree with analysis using. real data widths
  --CREX Pb f_C rate ratio factor went from 0.890 to 0.64; old values from average using scaled rates and real data widths
- New respin1 CREX A_T dataset has been examined; shifts in data are understood; two Pb runs are still being scrutinized
  --Not sure what a future respin would entail… if we decide to change pedestals a little, then central values will 'jiggle'
- Re-analyzed $\langle\cos\phi\rangle$ due to optics calibration changes since summer: changes in $\langle\cos\phi\rangle$ were double/triple checked
  --summer analysis used s0-hole problem runs, new analysis does not; also the pointing angle was changed since summer
- Small changes in Q^2 also occurred since summer due to above optics changes and s0-hole issues
- Residual tasks still remaining:
  --Put final polarization numbers in for PREX-2 (consistent with Apv paper) as well as final numbers for CREX
  --Finalize dilution factor analysis (get error on simulated rate ratio for CREX--soon). But real widths disagree
  --Finalize CREX respin1 Pb data (today?). So far, no smoking-gun reason to exclude last two runs (discussion)