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## the stage





### **MESA**











**P2** 





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## the early days



#### MESA

beam energy: 200 MeV

max. beam current 150  $\mu$ A (EB mode)

### experimental setup

ZEUS-like solenoid  $\rightarrow B_{max}$  = 1.8 T





### questions

resolve elastic?  $\triangle E$  (208Pb) = 2.7 MeV

0.5% measurement?







**Chuck Horowitz** 

 $\Delta \theta = 4^{\circ}$  : expected rate = 9.75 GHz,  $A_{PV} = 0.68$  ppm, P = 85%, Q  $\approx$  86 MeV

1440h →  $\delta R_n/R_n = 0.50\%$  (<sup>208</sup>Pb @ 200 MeV)

## ray trace simulation









 $\Delta \theta = 4^{\circ}$  : expected rate = 8.25 GHz,  $A_{PV} = 0.66$  ppm, P = 85%, Q  $\approx$  86 MeV

1440h →  $\delta R_n/R_n = 0.52\%$  (<sup>208</sup>Pb @ 155 MeV)







 $\Delta \theta = 4^{\circ}$  : expected rate = 0.87 GHz,  $A_{PV} = 2.14$  ppm, P = 85%, Q  $\approx$  143 MeV

1440h →  $\delta R_n/R_n = 0.38\%$  (<sup>48</sup>Ca @ 200 MeV)

# what is the need?

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- Is there a need for a systematic study over "many" nuclei? PREX, CREX, SREX, ZREX, ...
- Is there a need for more than one
   Q-square point?
   Radius and diffuseness ... the whole form factor?

Jorge Piekarewicz (concluding remarks, MITP 2015)



P.-G. Reinhard et al., Phys. Rev. C 88 (2013) 034325

	<sup>208</sup> Pb @ MREX	<sup>48</sup> Ca @ MREX	PREX-II	CREX
E <sub>beam</sub>	155 MeV / 105 MeV	155 MeV / 105 MeV	≈ 1 GeV	2.2 GeV
Q	86 MeV / 58 MeV 0.44 fm <sup>-1</sup> / 0.29 fm <sup>-1</sup>	143 MeV / 75 MeV 0.73 fm <sup>-1</sup> / 0.38 fm <sup>-1</sup>	86 MeV 0.44 fm <sup>-1</sup>	154 MeV 0.78 fm <sup>-1</sup>
δ <b>Α<sub>ΡV</sub>/Α<sub>ΡV</sub></b>	<b>1.3</b> %	1.3%	3.6%	<b>2.4</b> %
δ <b>R<sub>n</sub>/R<sub>n</sub></b>	0.52%	0.38%	1.0%	0.5%

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what is the need?			MREX		
	Iow	1 0.8 0.6 ⊡ <sup>©</sup> 0.4 0.2 0 0	$\Delta F_{w} \times 10$ 208Pb D 0.4 0.4 0.8 1.48Ca -208Pb -20	-min UGold EX - - - - - - - - - - - - - - - - - -	
\	<sup>208</sup> Pb @ MREX	PG. Rein <sup>48</sup> Ca @ MREX	nhard et al Phvs. Rev. C 88 ( <b>PREX-II</b>	2013) 034325 CREX	
E <sub>beam</sub>	155 MeV / 105 MeV	155 MeV / 105 MeV	≈ 1 GeV	2.2 GeV	
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δ <b>Α<sub>ΡV</sub>/Α<sub>ΡV</sub></b>	1.3%	1.3%	3.6%	2.4%	
δ <b>R<sub>n</sub>/R<sub>n</sub></b>	0.52%	0.38%	1.0%	0.5%	
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## remaining questions





MREX @ Q = 86 MeV (= PREX-value) assumption:  $F_w$  = const., extract radius from one Q-point measurement

**benefit:** more precise R<sub>n</sub> determination precise calibration combined with CREX

MREX @ Q = 58 MeV check assumption: measure  $F_w$  at two Q-points, **benefit:** precise  $R_n$  det. at 2<sup>nd</sup> Q-point but NO ab-initio theory MREX @ Q = 143 MeV (= CREX-value) benefit: ?

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MREX @ Q = 75 MeV
check assumption:
measure F<sub>w</sub> at two Q-points
benefit: precise R<sub>n</sub> det. at 2<sup>nd</sup> Q-point
theory 15/15
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