S1240

Precision mass cartography of the island of inversion

TITAN mass measurement of ^{29,30}Al

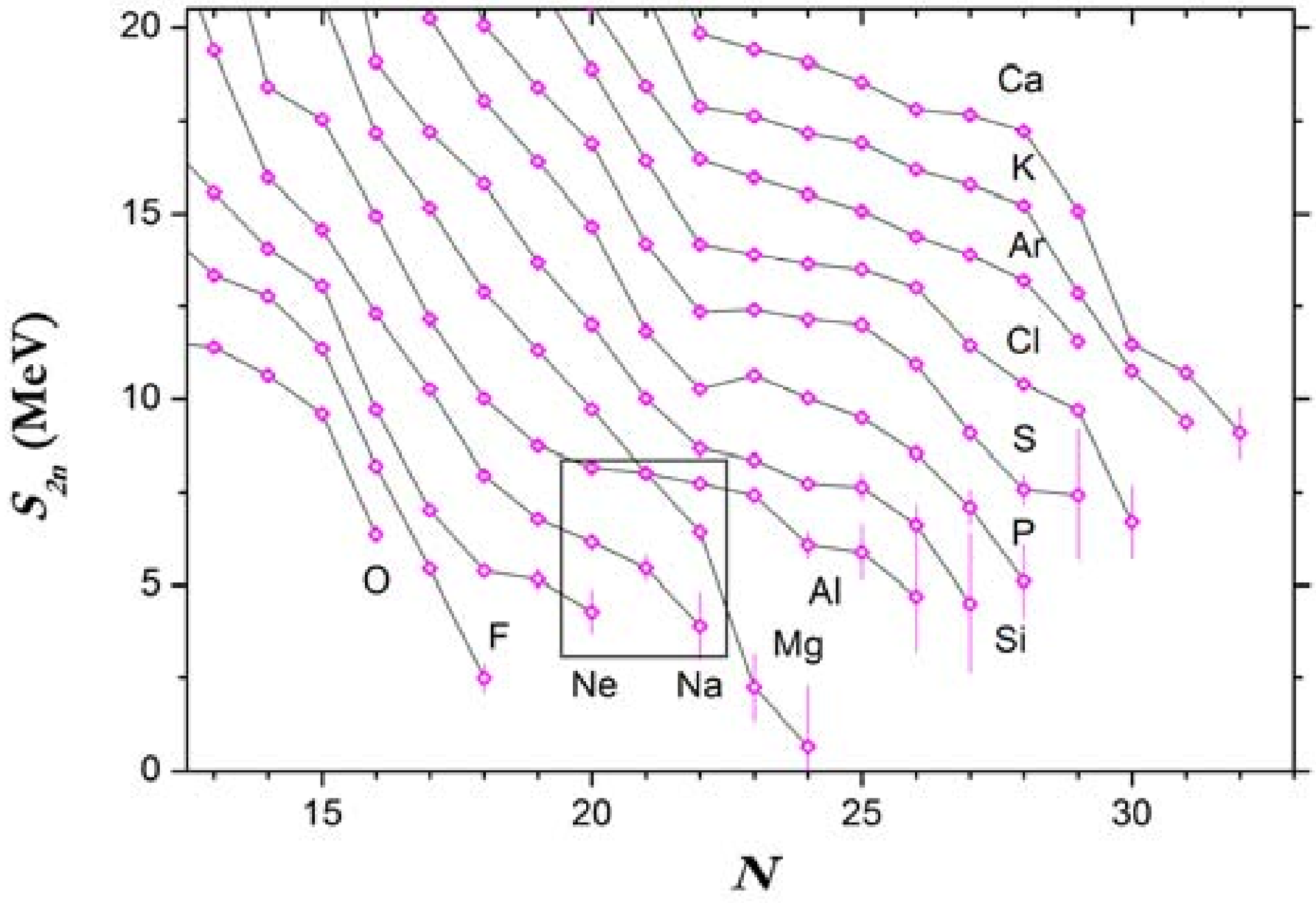
stephan ettenauer
for the TITAN collaboration

ISAC Science Forum, Sept. 8th, 2010

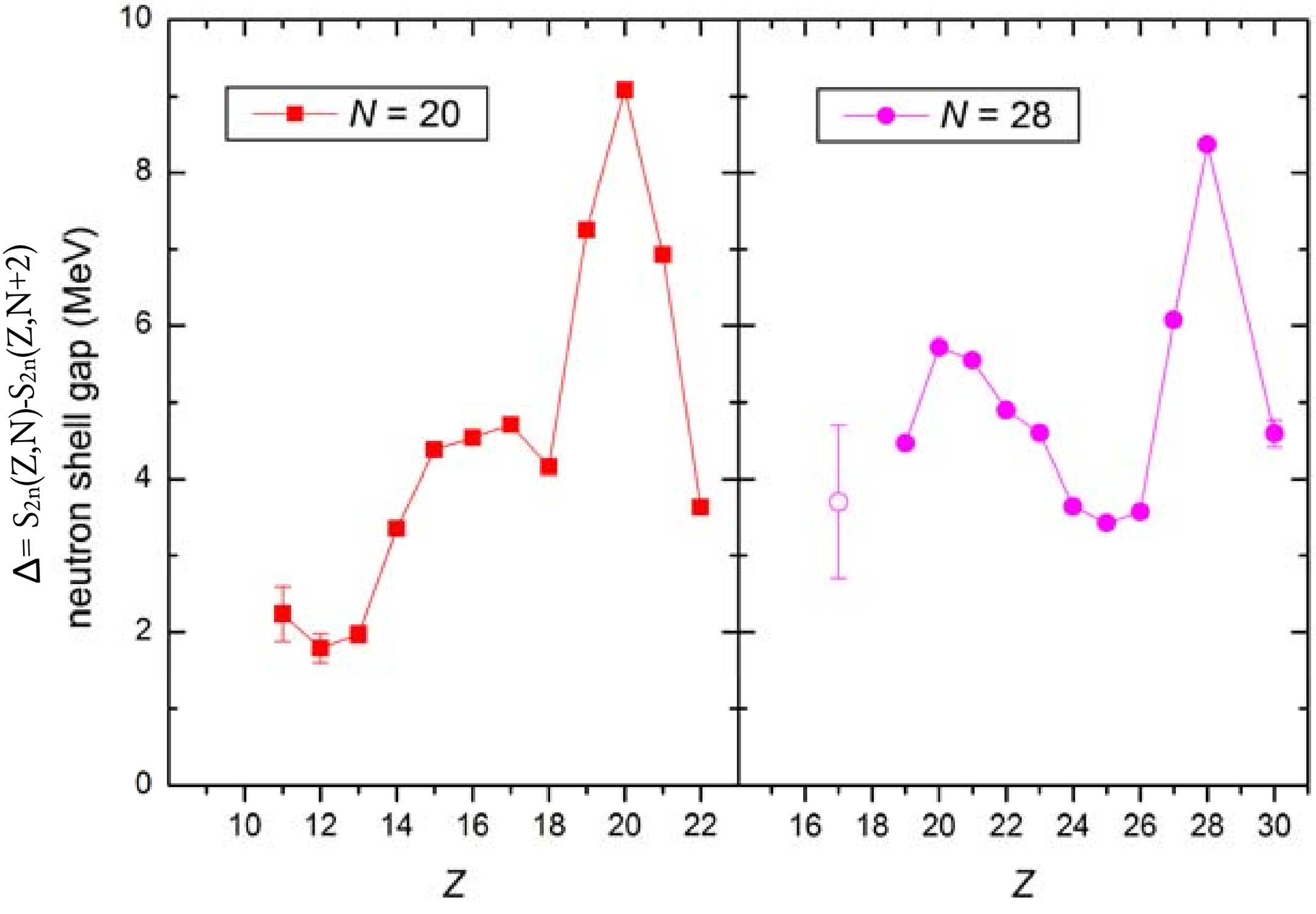
Motivation for S1240

view on the island of inversion through S_{2n}

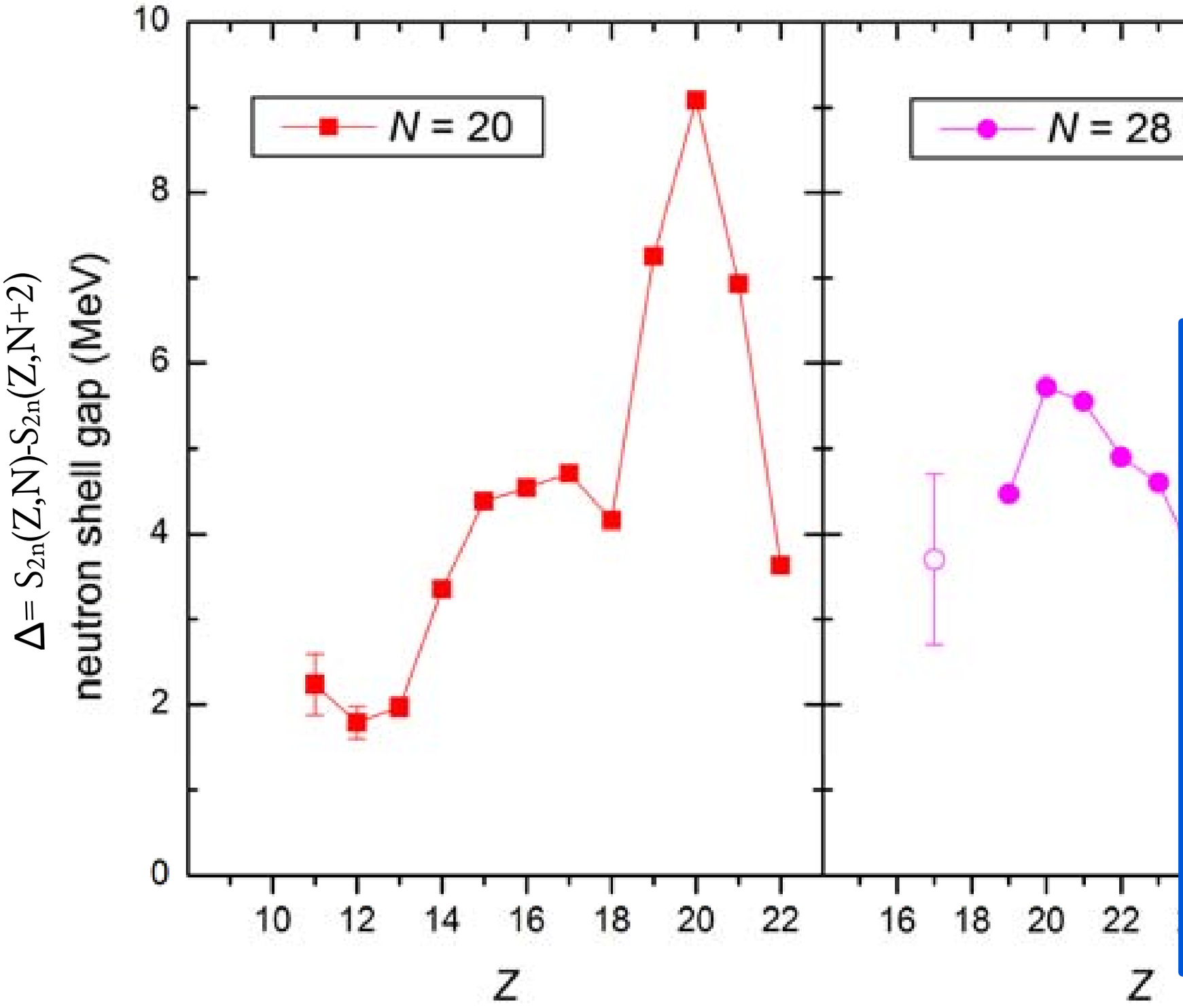
$$S_{2n} = m(Z, N-2) + 2m_n - m(Z, N)$$



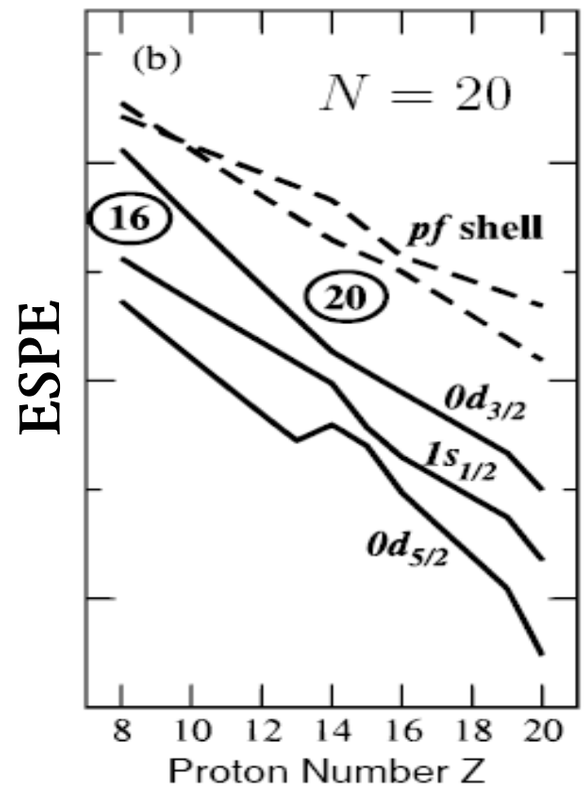
Motivation for S1240



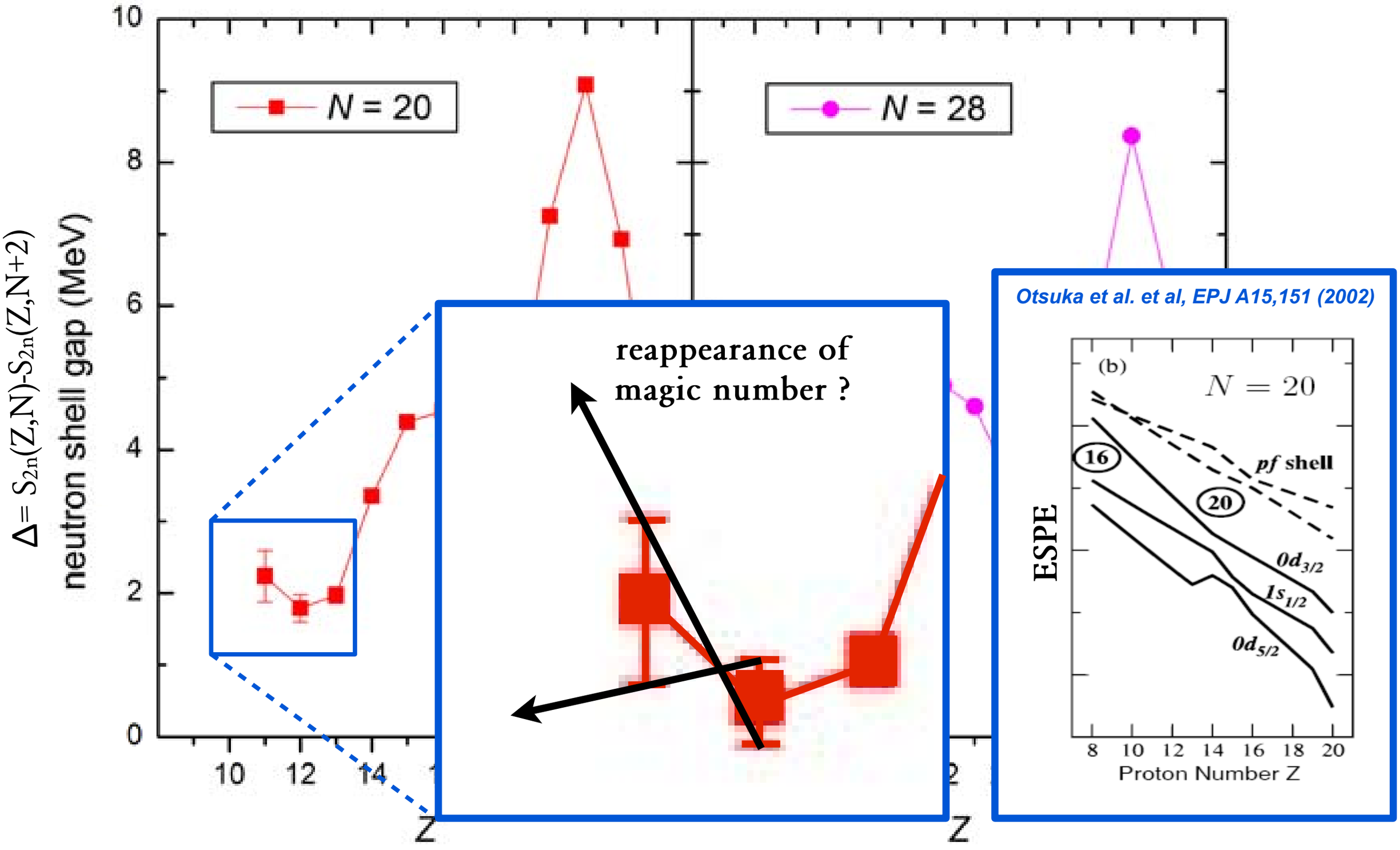
Motivation for S1240



Otsuka et al. et al, EPJ A15,151 (2002)



Motivation for S1240

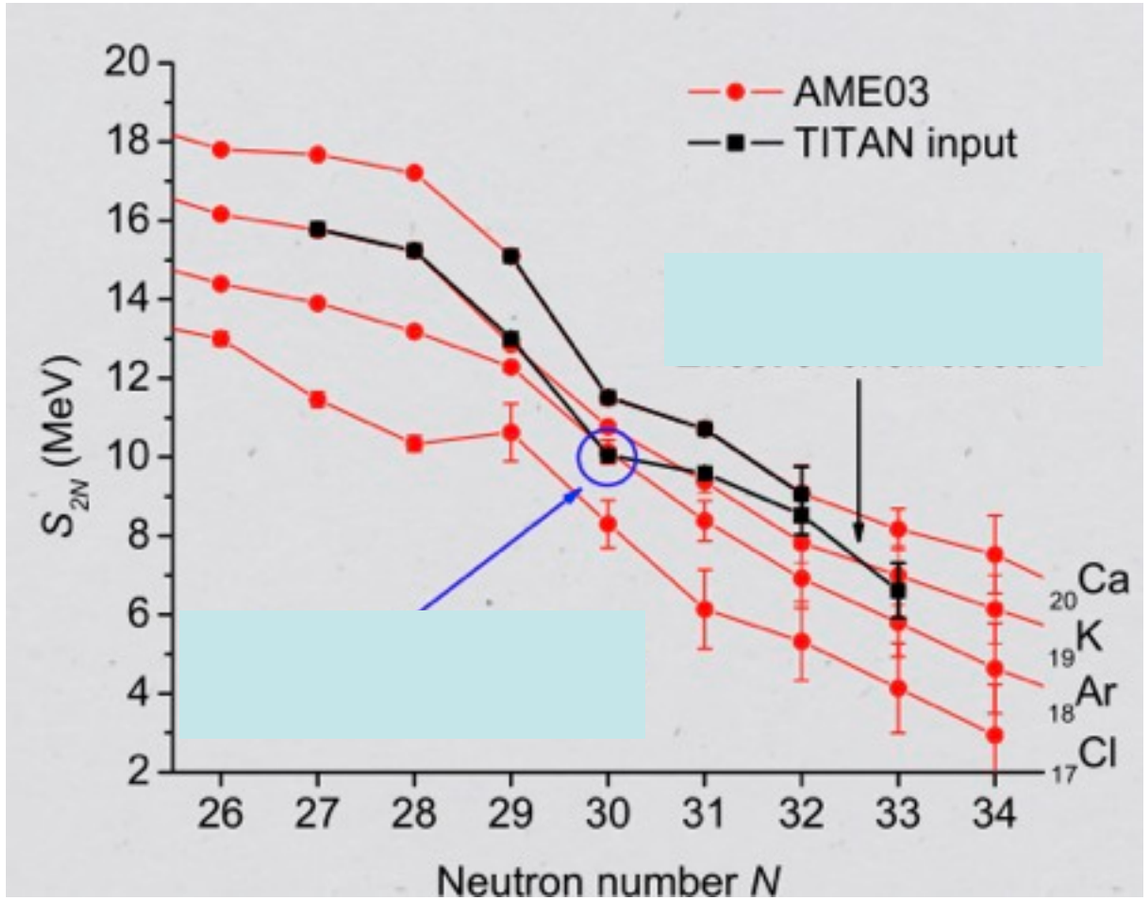


Motivation for S1240

S1240

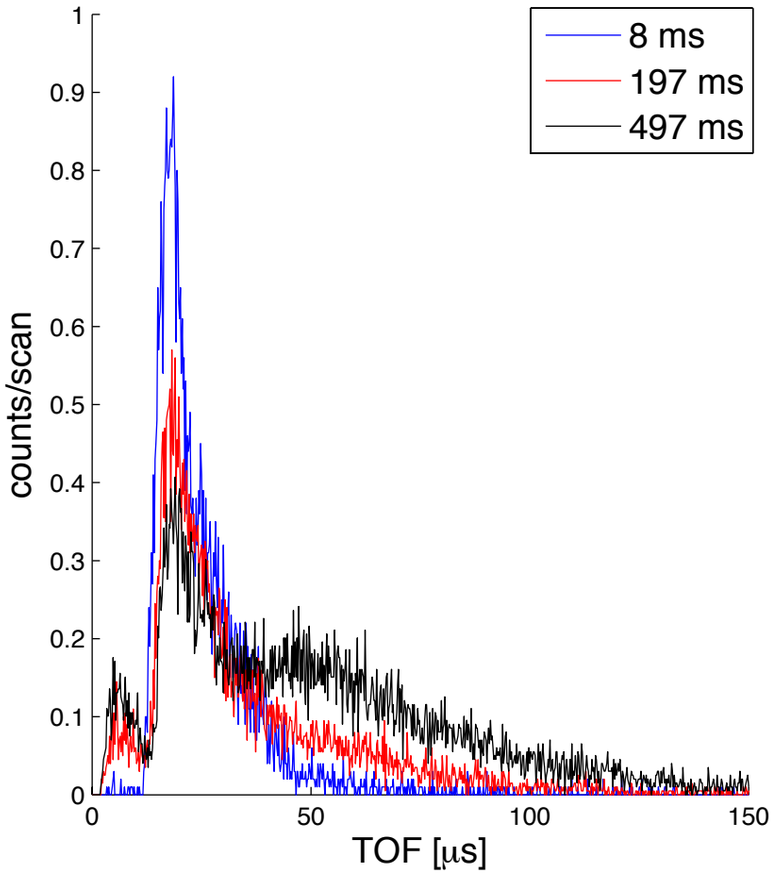
27Al	28Al	29Al	30Al	31Al	32Al	33Al	34Al	35Al
26Mg	27Mg	28Mg	29Mg	30Mg	31Mg	32Mg	33Mg	34Mg
25Na	26Na	27Na	28Na	29Na	30Na	31Na	32Na	33Na
24Ne	25Ne	26Ne	27Ne	28Ne	29Ne	30Ne	31Ne	32Ne
23F	24F	25F	26F	27F	28F	29F	30F	31F
22O	23O	24O	25O	26O	27O	28O		

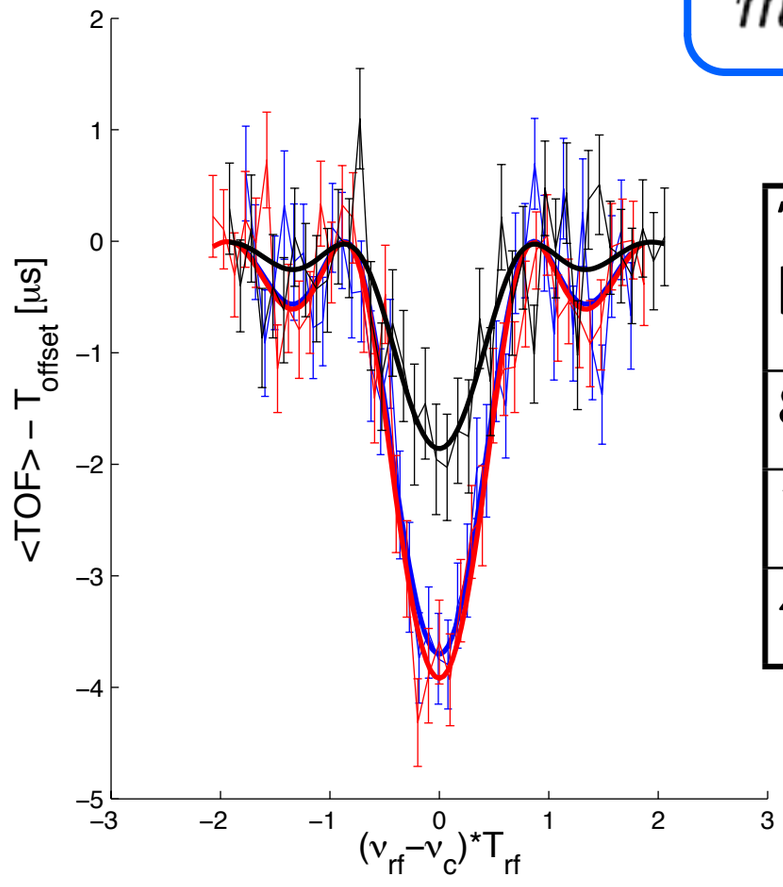
TITAN: Sept. '09:



MPET Vacuum for HCI

$^{39}K^{4+}$ @5.7·10^{-10} Torr



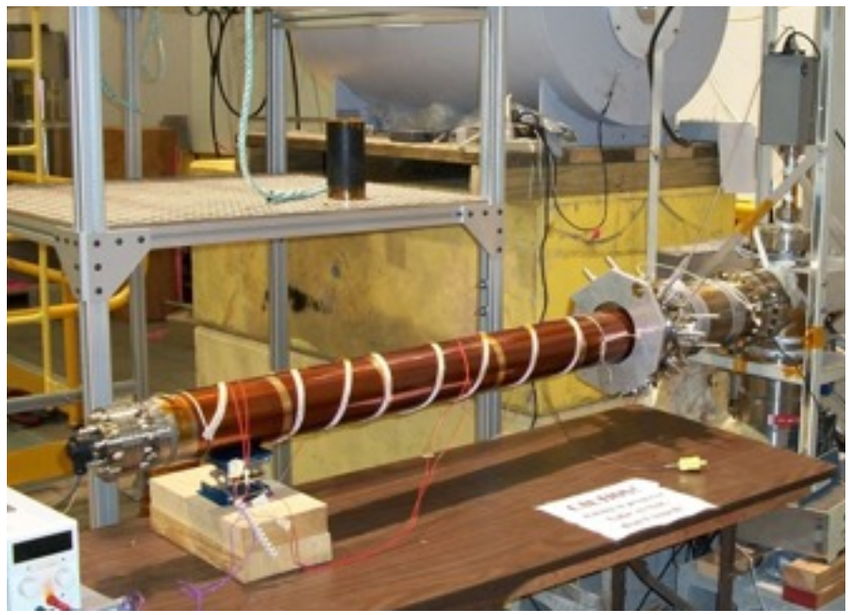


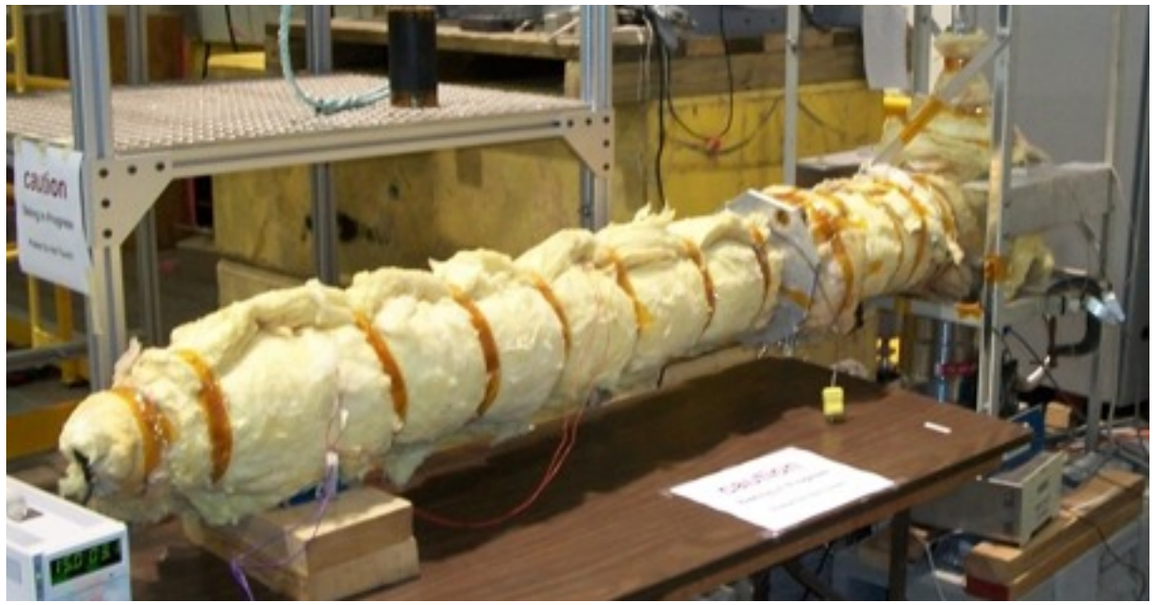
$$\frac{\delta m}{m} \approx \frac{m}{q \cdot B \cdot T_{RF} \cdot \sqrt{N_{ion}}}$$

T_{rf} [ms]	scans	Δν [Hz]	exp Δν [Hz]
8	100	2.607	
197	200	0.096	0.074
497	199*	0.094<	0.030

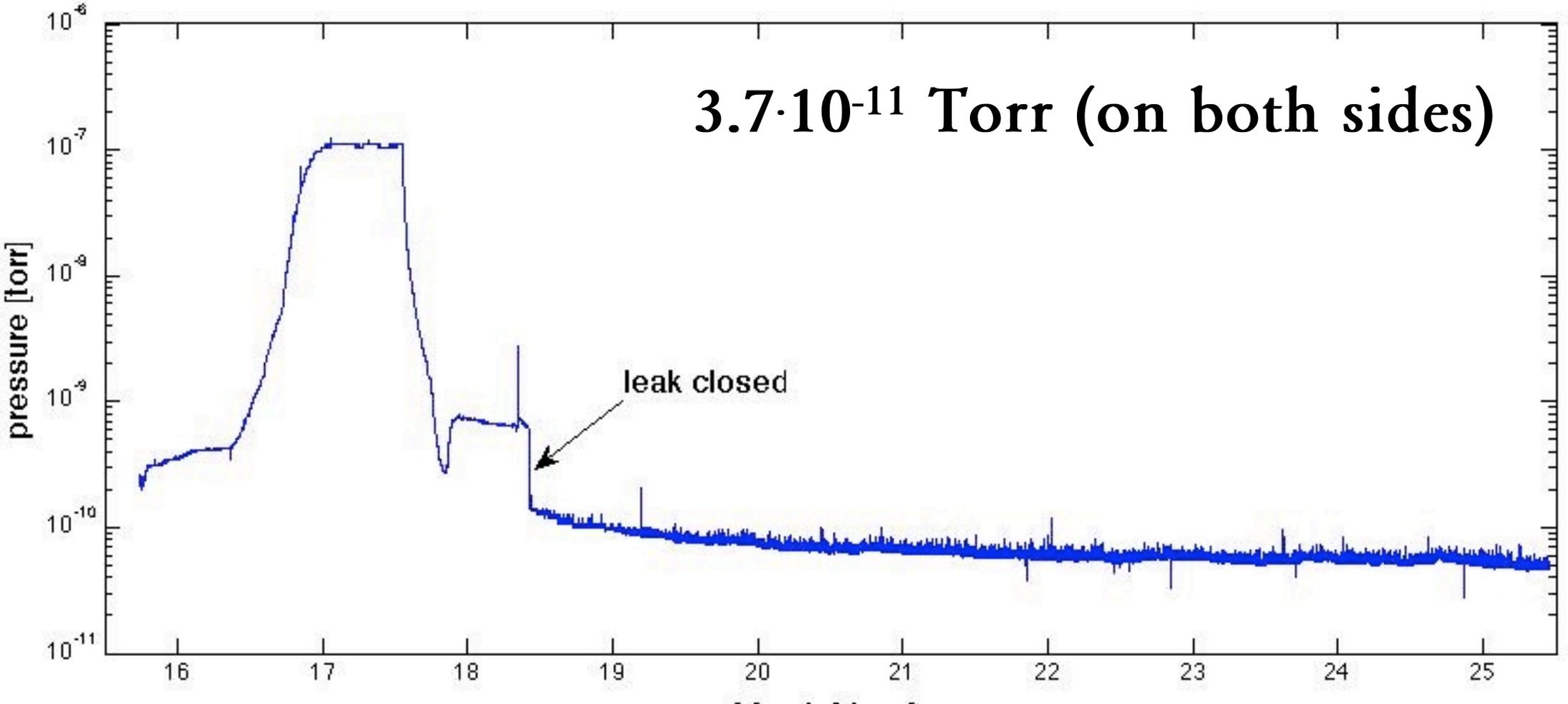
=> for futher HCI: better vacuum required

MPET baking

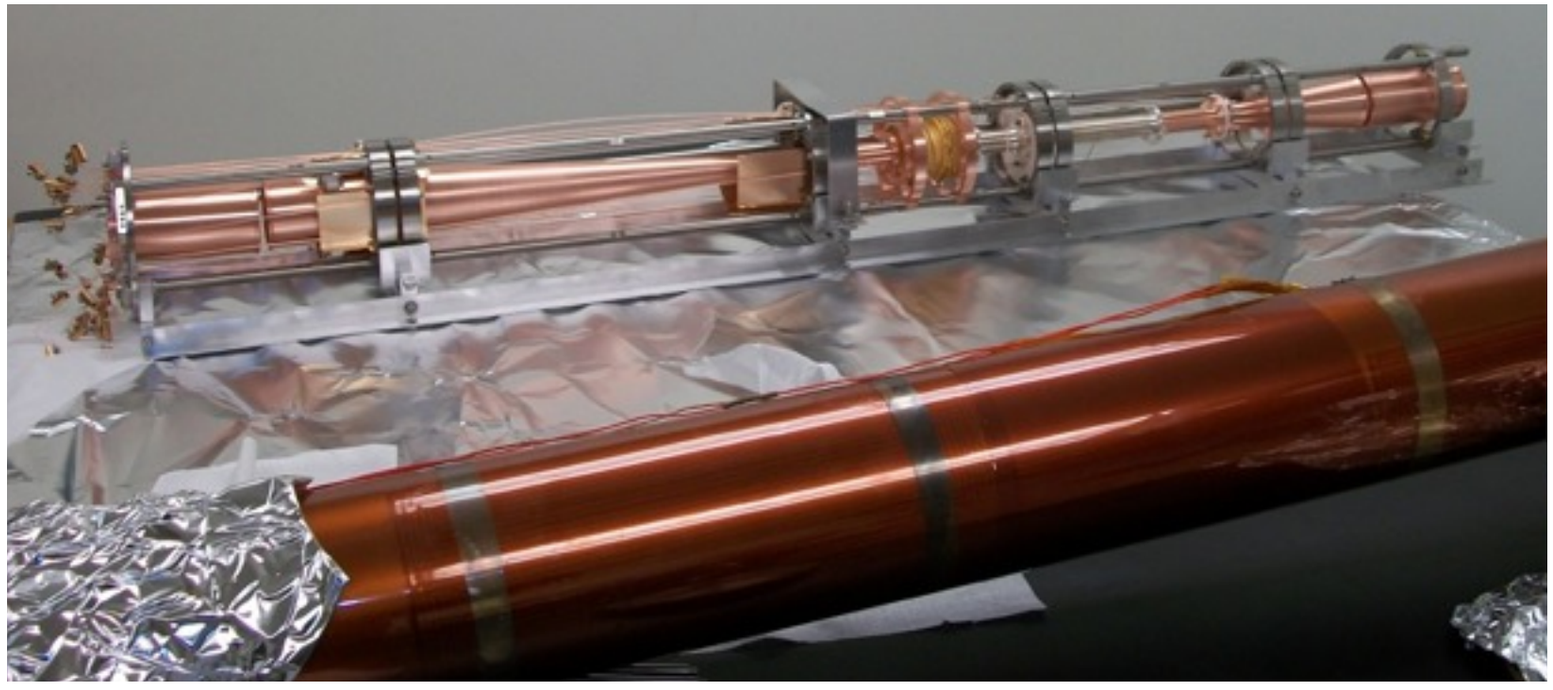


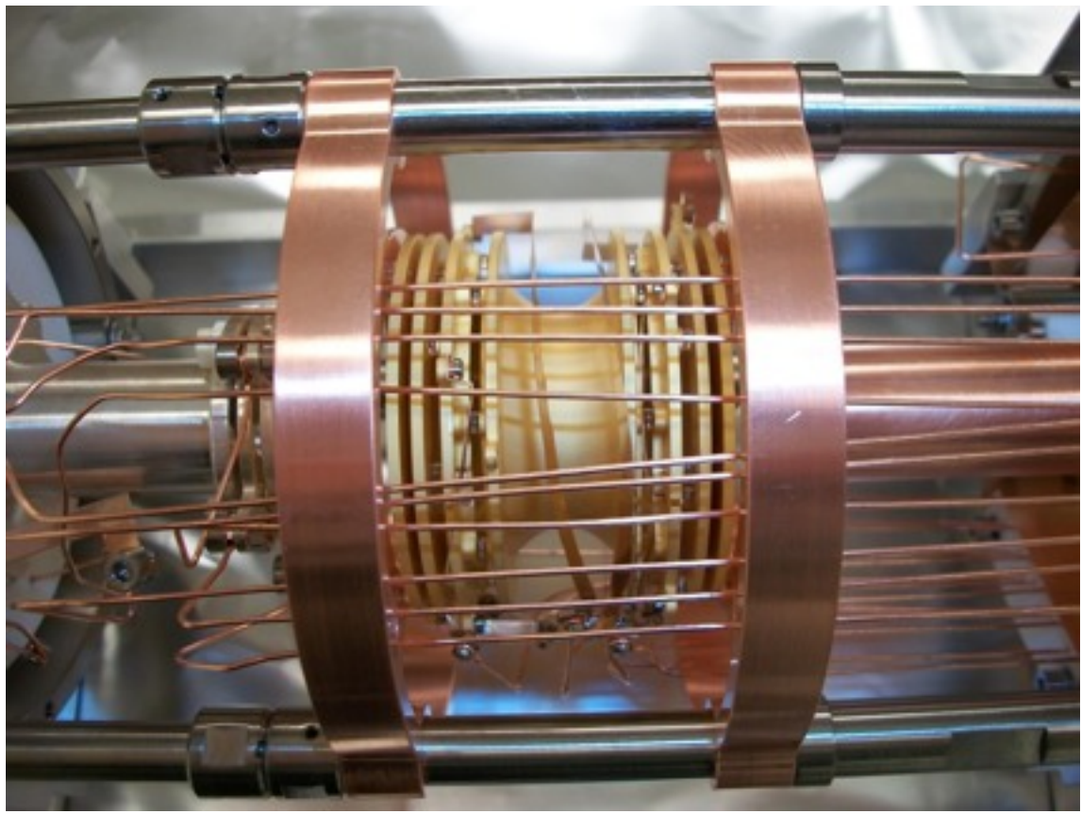


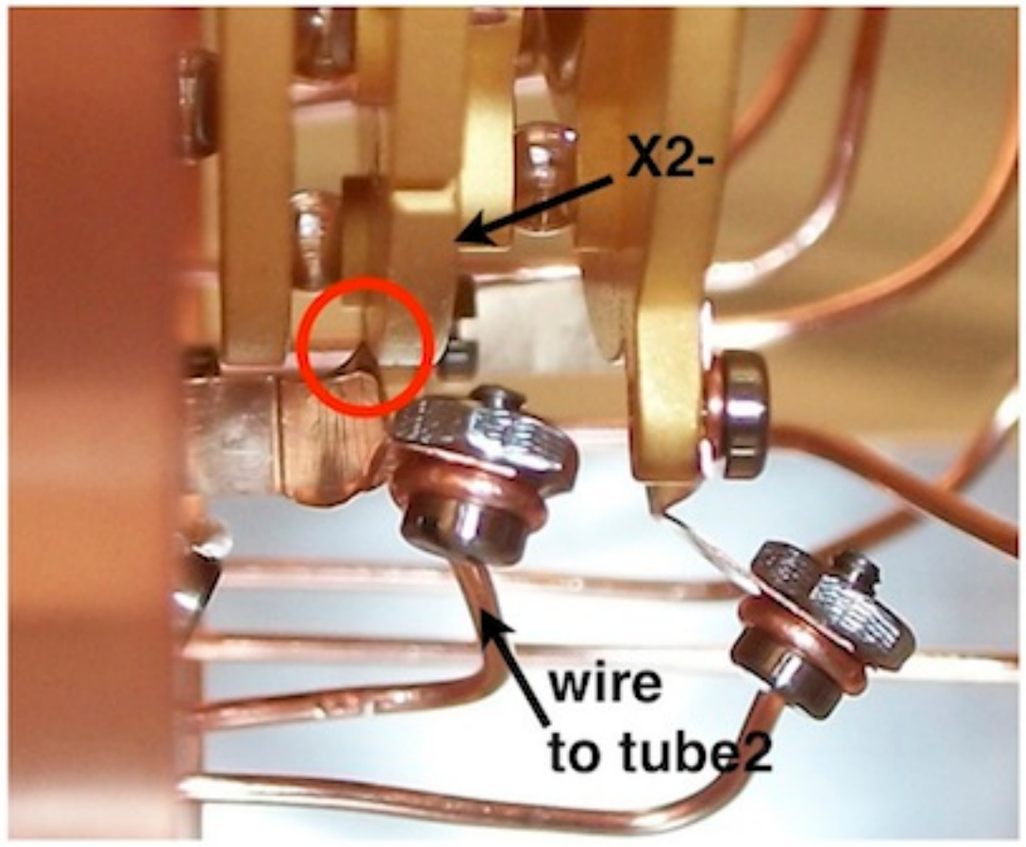
$3.7 \cdot 10^{-11}$ Torr (on both sides)



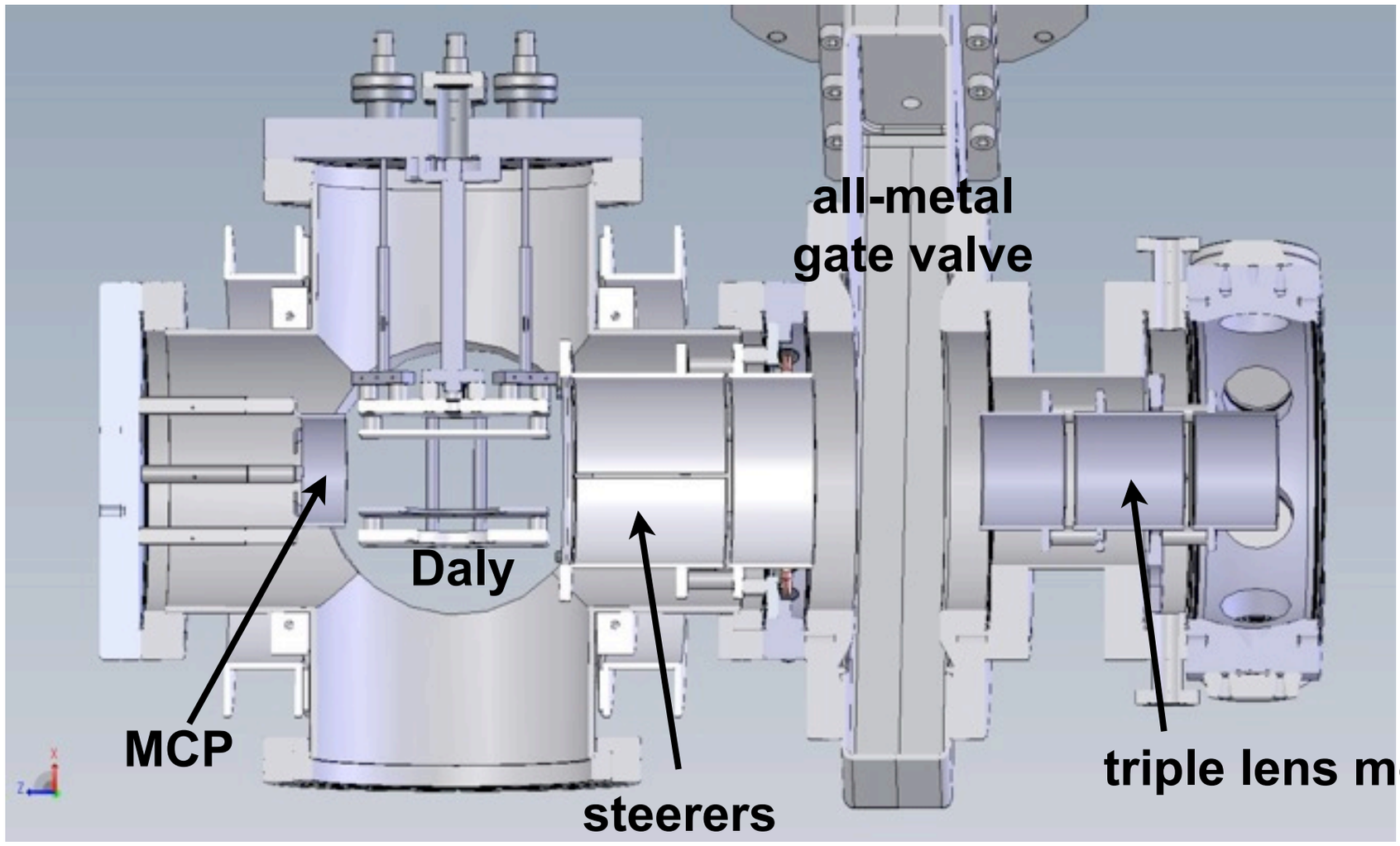
Shorts after baking

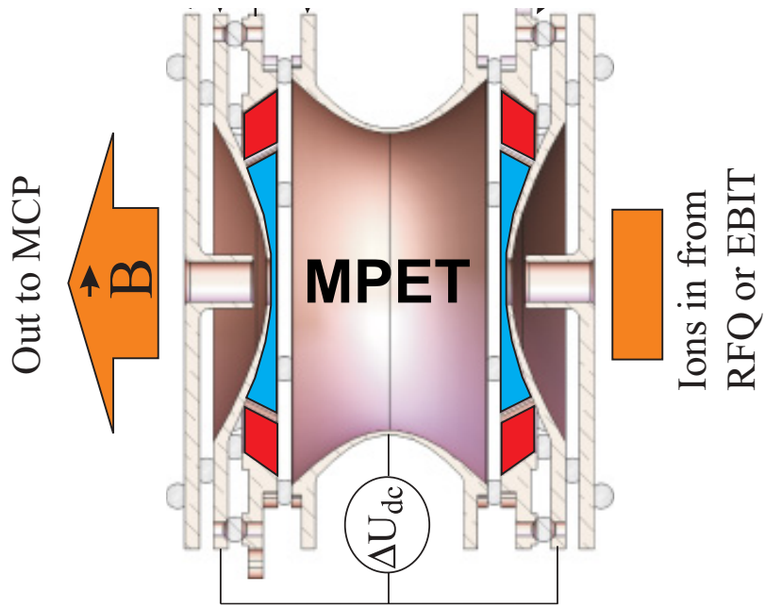






Vacuum System and Detector Upgrade





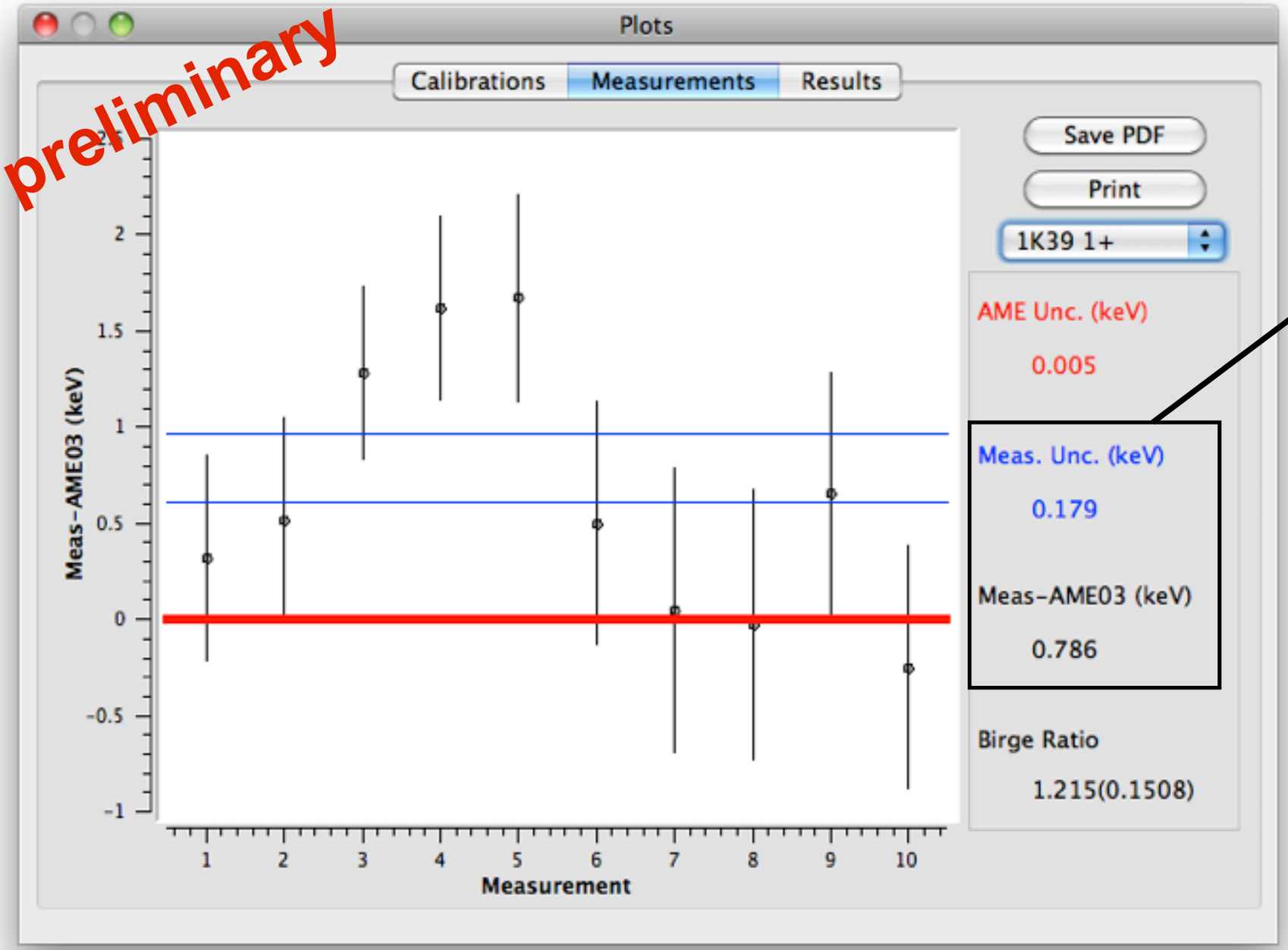
Advantages:

- 2 independent detection systems
- detector repair without venting MPET
- independent baking possible

Accuracy check

- before beamtime
- ^{39}K vs ^{23}Na
- literature: new FSU data

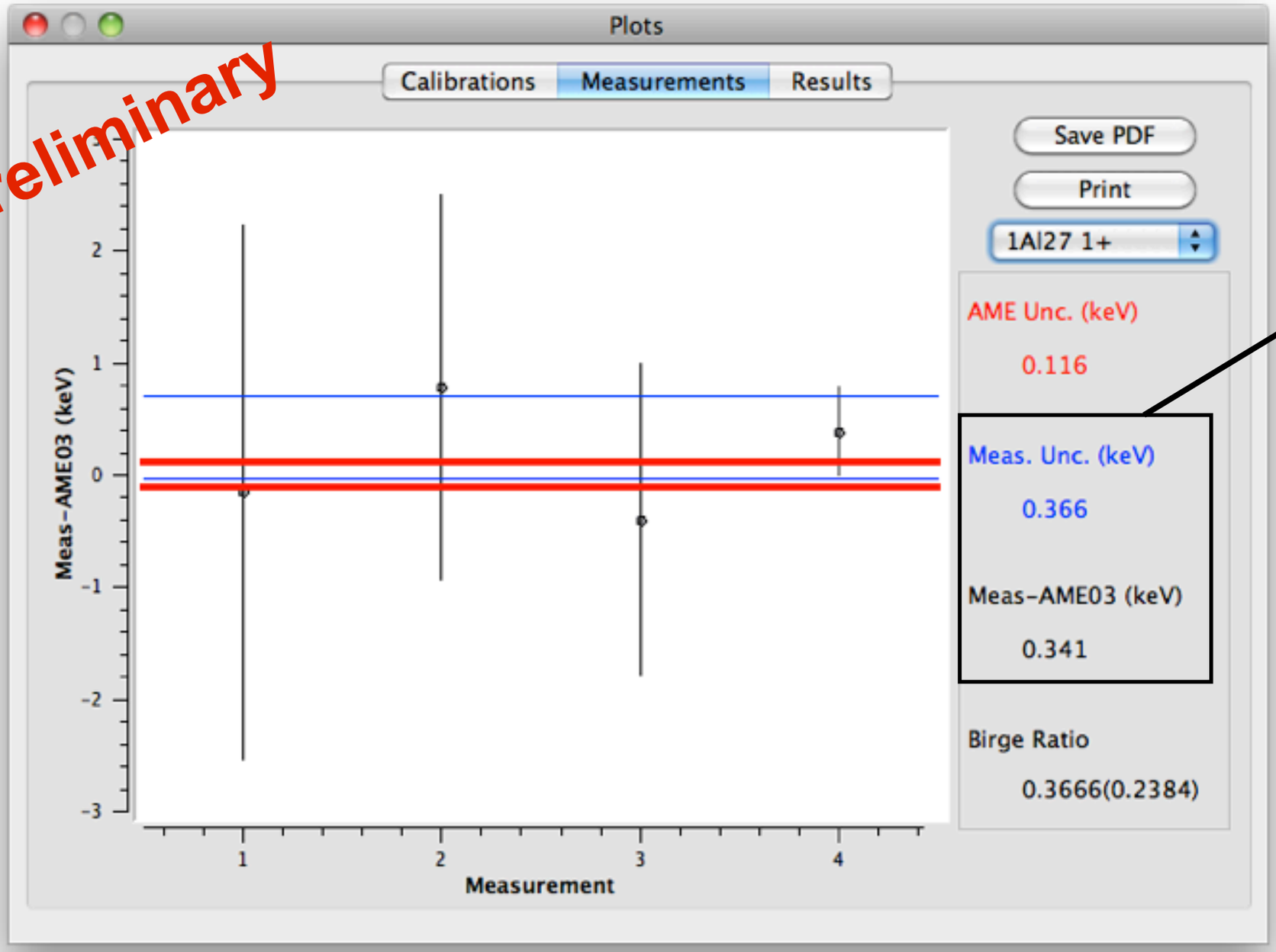
$$R = R_{meas}\left(1 + (\Delta R/R)_{mds}\Delta A\right)$$



mass dep. shift:
0.8(2) keV
over
ΔA=16

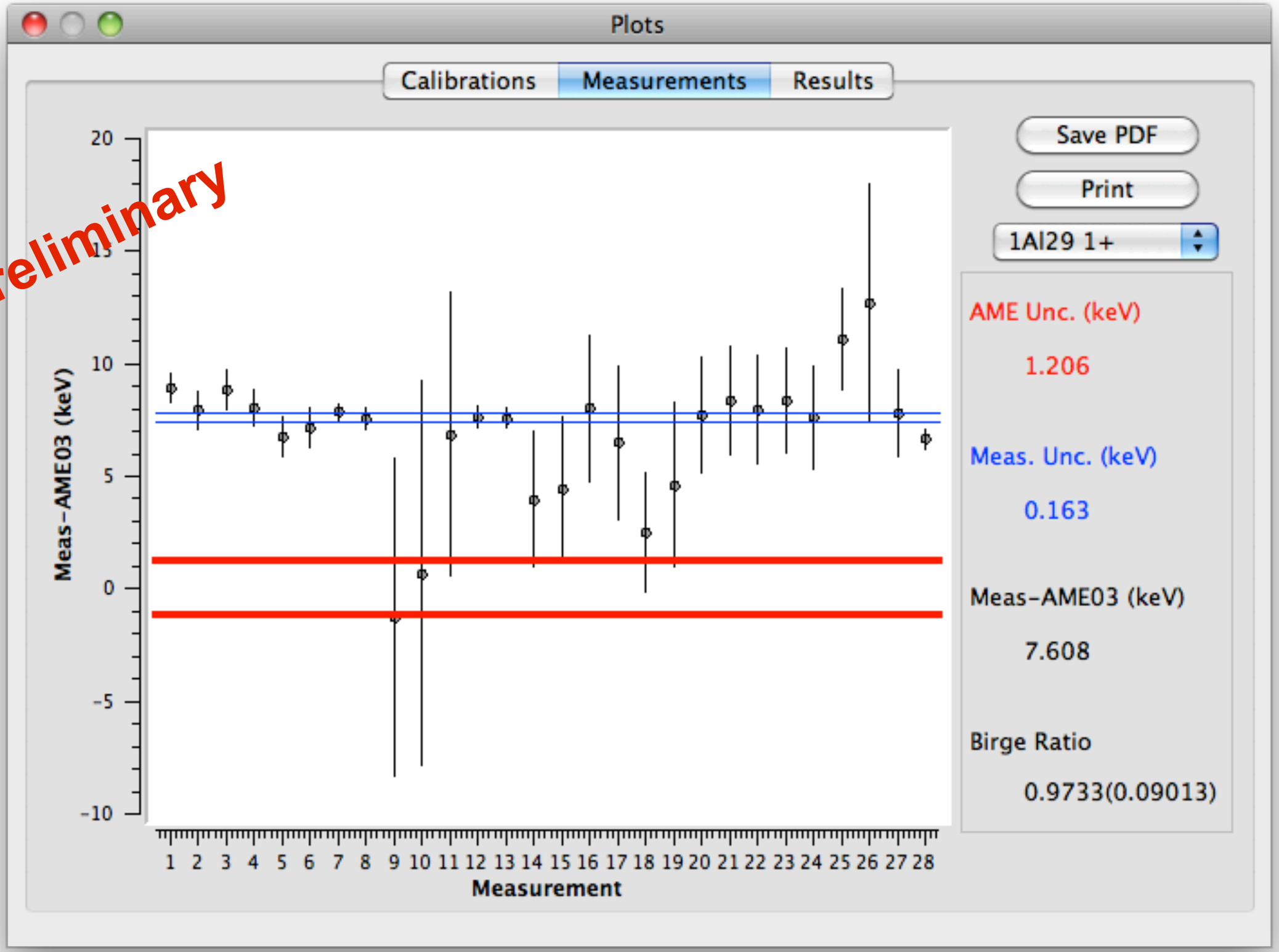
Accuracy check II:

- ^{27}Al from ISAC
- use ^{27}Al to optimize trapping parameters and scale from there for radioactives
- reference: ^{23}Na

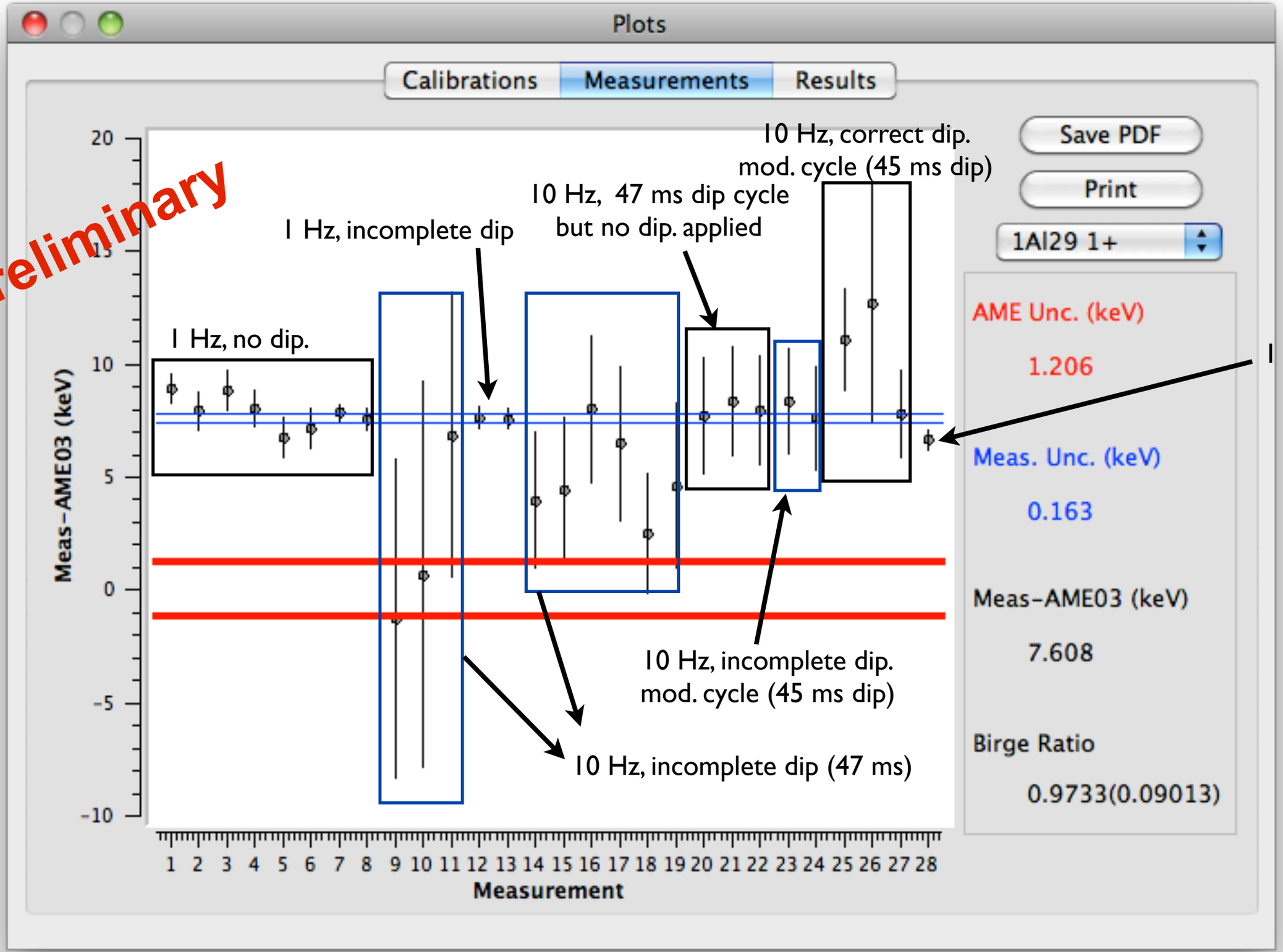


mass dep. shift:
0.3(4) keV
over
ΔA=4

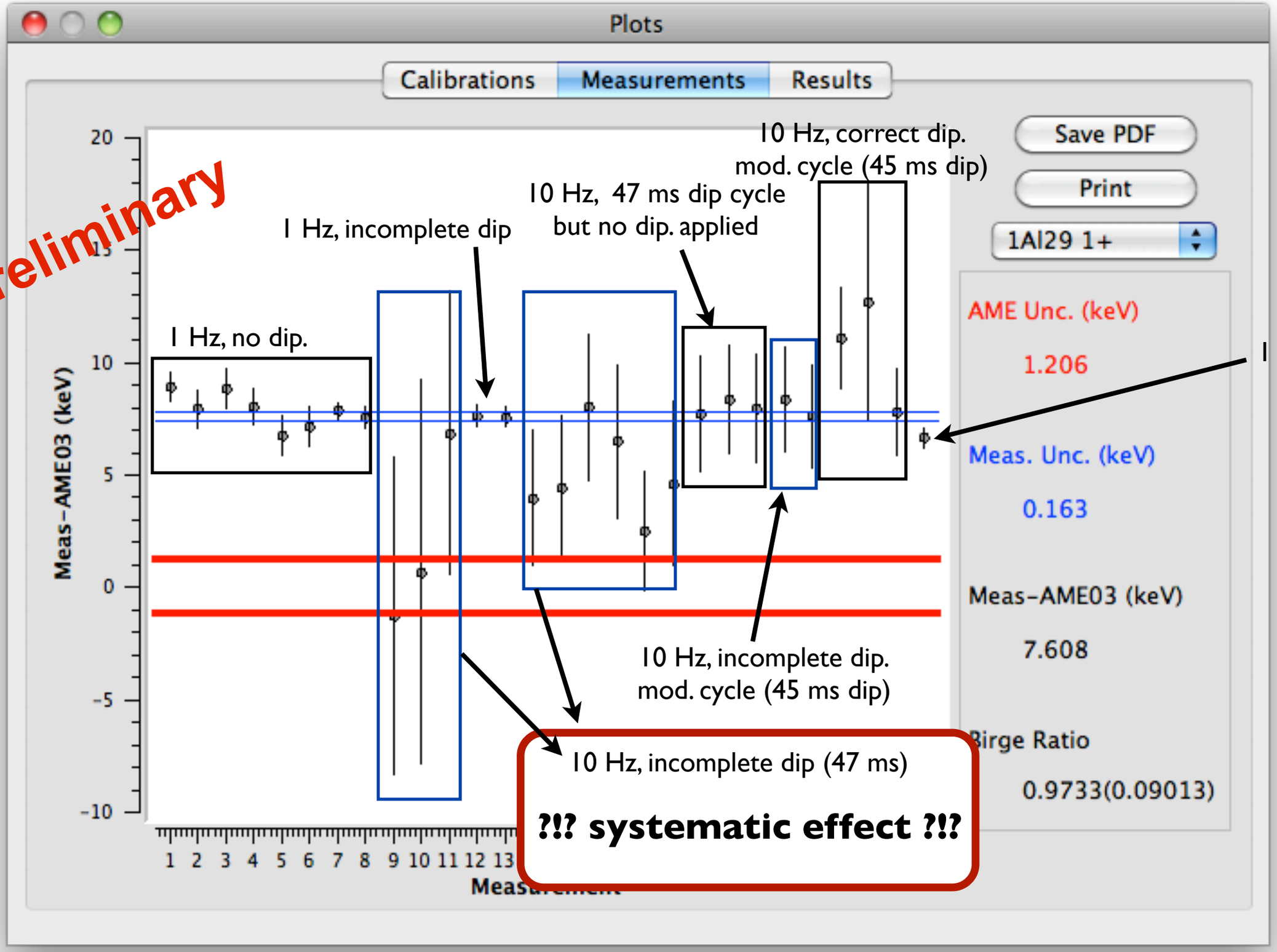
^{29}Al complete data:



^{29}Al complete data:

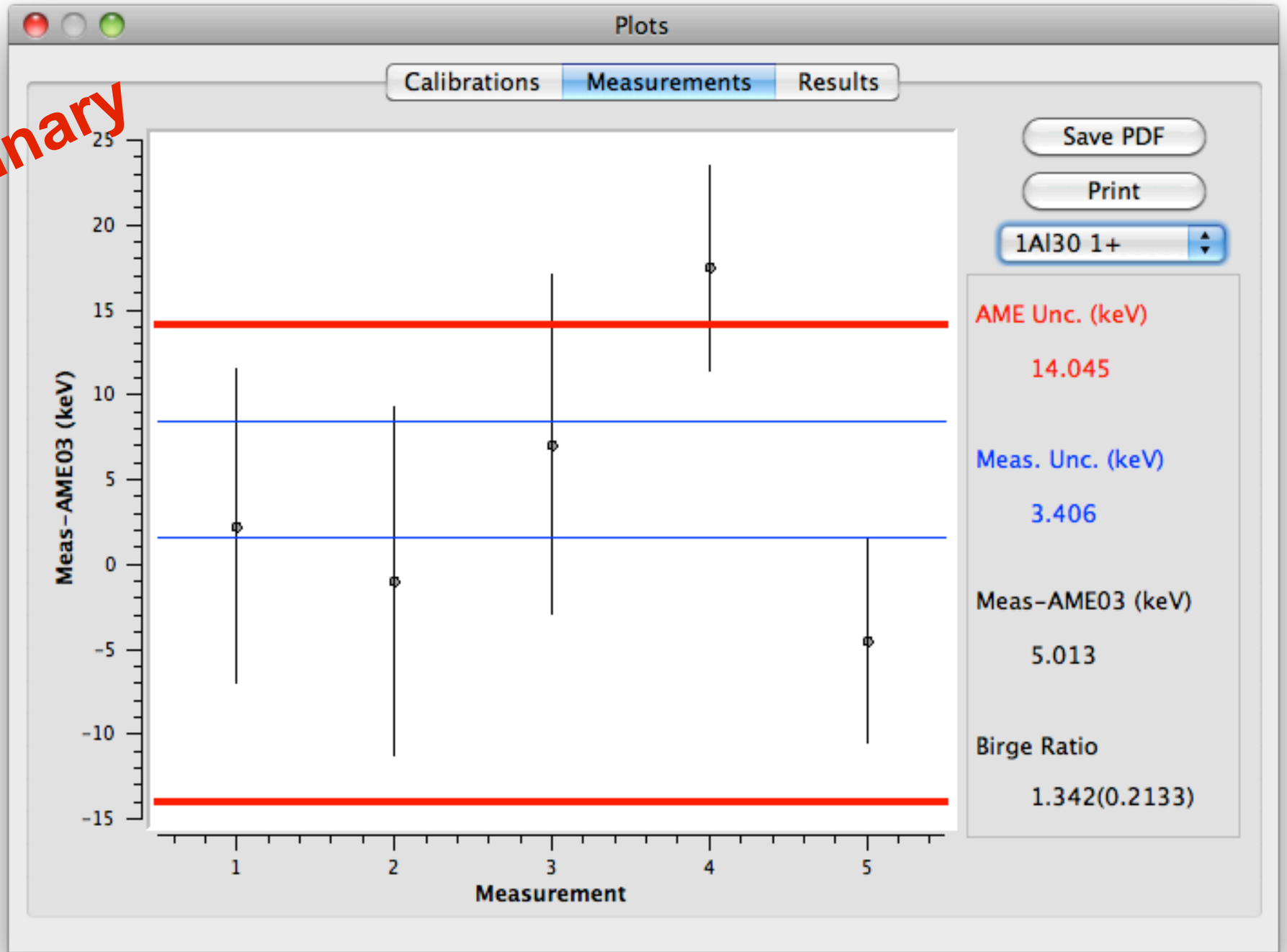


^{29}Al complete data:



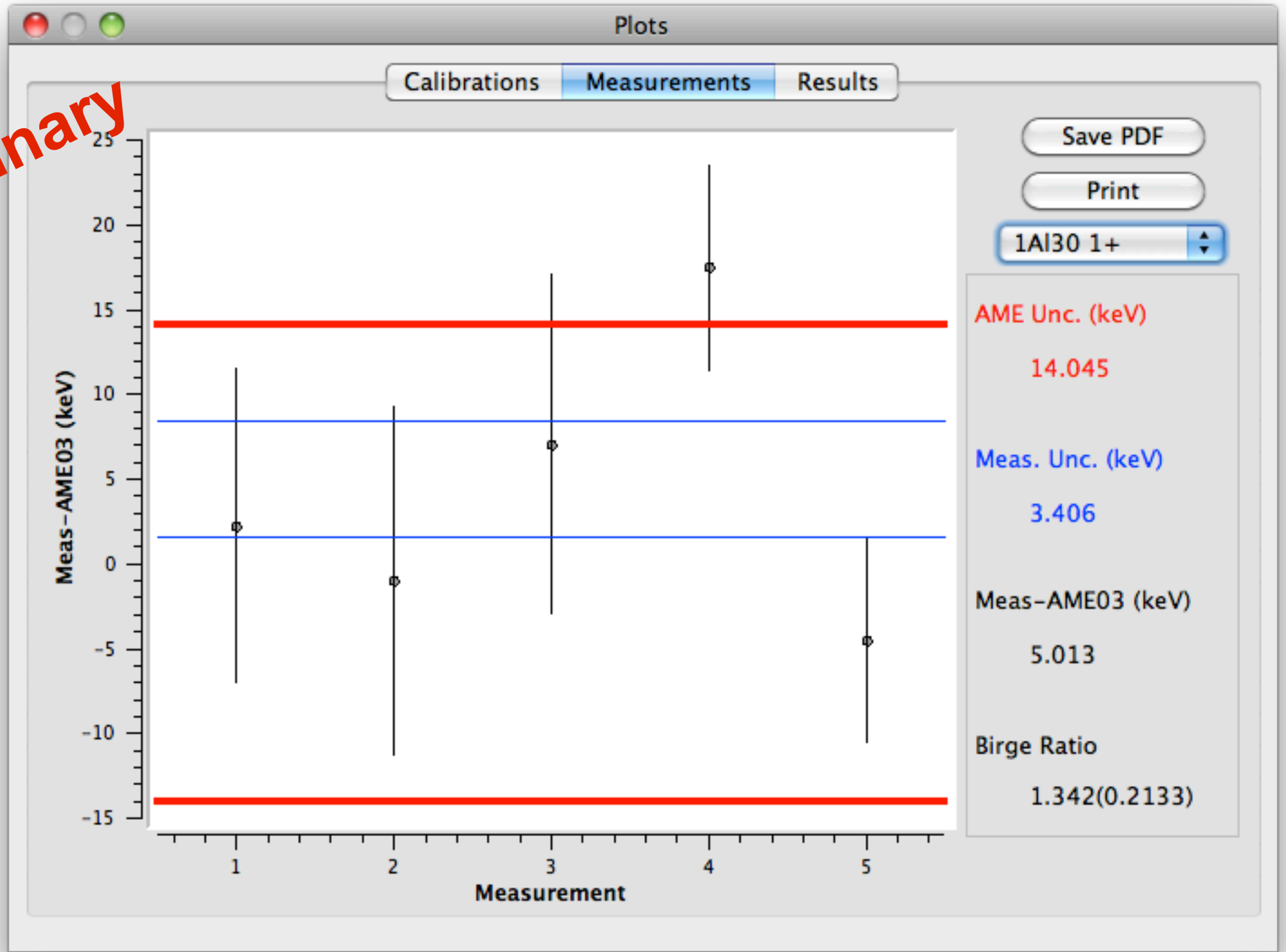
^{30}Al

preliminary



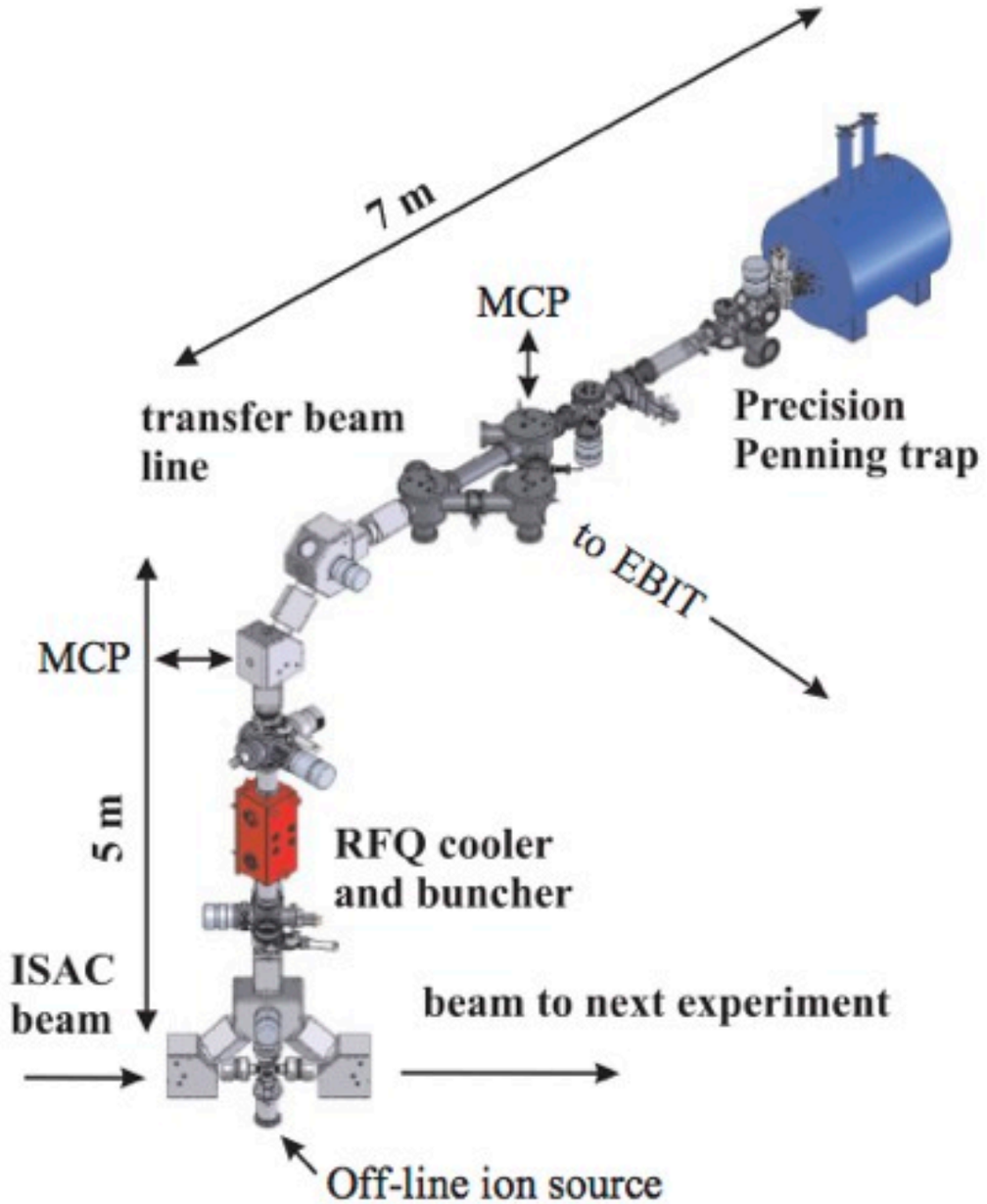
^{30}Al

- 30,000 ions/sec at the channeltron but hardly anything at MPET MCP (ca. 400 counts in 1/2h)

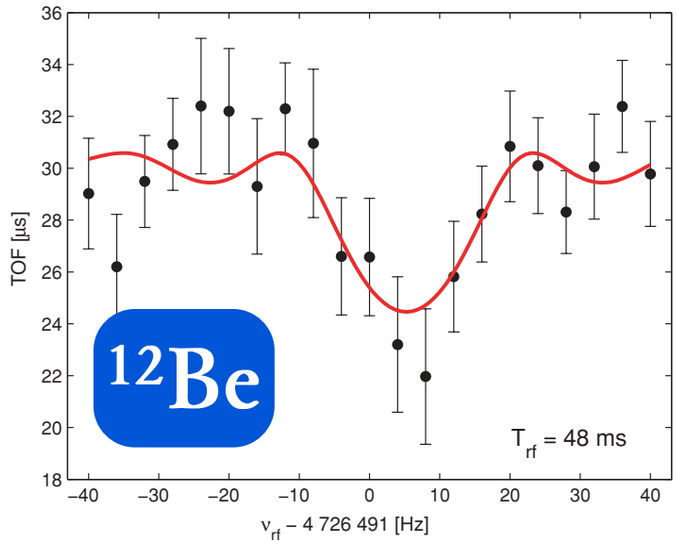


preliminary

Transfer Efficiency



normal condition:



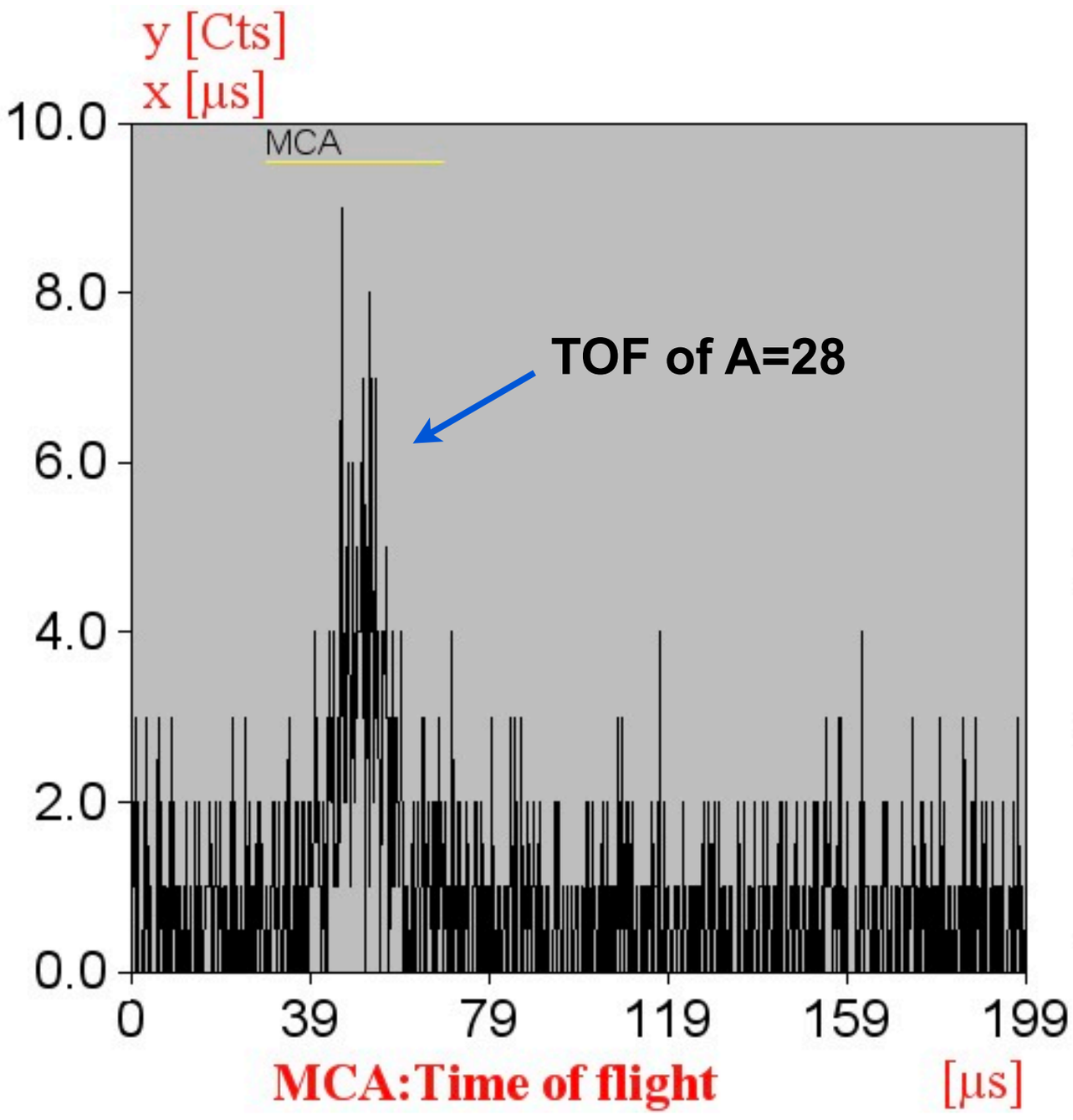
$T_{1/2}$ = 24 ms
~30-300 ions/s

<u>terrible transfer efficiency through RFQ:</u>

- 'chemistry' He ↔ Al?
- low pressure in gas bottle => more contamination in gas
- RF problem

- **needs further investigation & repair !!!**

^{28}Na



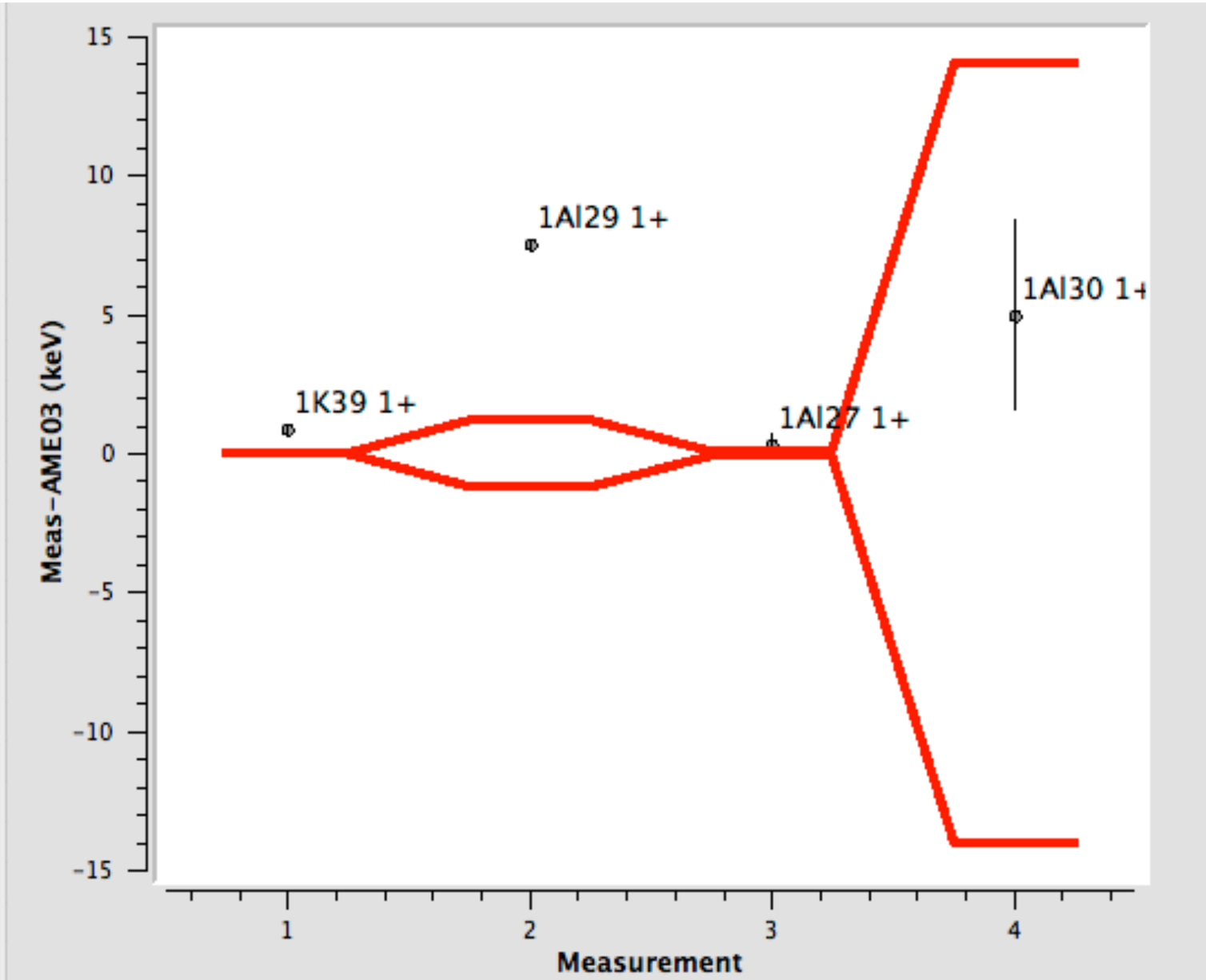
Info :
Ions : 382
MCA : [151, 351]
O. error 0.5 [μs]
Mean TOF 51.4 [μs]

Rec. time error:
8.814 [μs]

- 2,000 ions/sec at the channeltron
- 380 ions in 2 1/2 h
  => we were able to trap
- but no (real) reasonacne

Conclusion

- <u>after baking, repair & upgrade:</u> MPET online again
- but serious problems with RFQ transfer efficiency
- mass of ^{29,30}Al measured



TITAN collaboration

- The TITAN Group: Jens Dilling, Paul Delheij, Gerald Gwinner, Melvin Good, Alain Lapierre, David Lunney, Mathew Pearson, Ryan Ringle, Maxime Brodeur, Ernesto Mané, Vladimir Ryjkov, Martin C. Simon, Thomas Brunner, Usman Chowdhury, Benjamin Eberhart, Stephan Ettenauer, Aaron Gallant, Vanessa Simon, Mathew Smith

- TRIUMF Staff: Pierre Bricault, Ames Freidhelm, Jens Lassen, Marik Dombsky, Rolf Kietel, Don Dale, Hubert Hui, Kevin Langton, Mike McDonald, Raymond Dubé, Tim Stanford, Stuart Austin, Zlatko Bjelic, Daniel Rowbotham, Daryl Bishop

And the rest of the TITAN collaboration....

U. of Manitoba
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Max Plank Inst. of Heidelberg
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CNRS- CSNSM
U. of Windsor
Colorado School of Mines
TRIUMF
UBC