PXIE LEBT RGA STUDY

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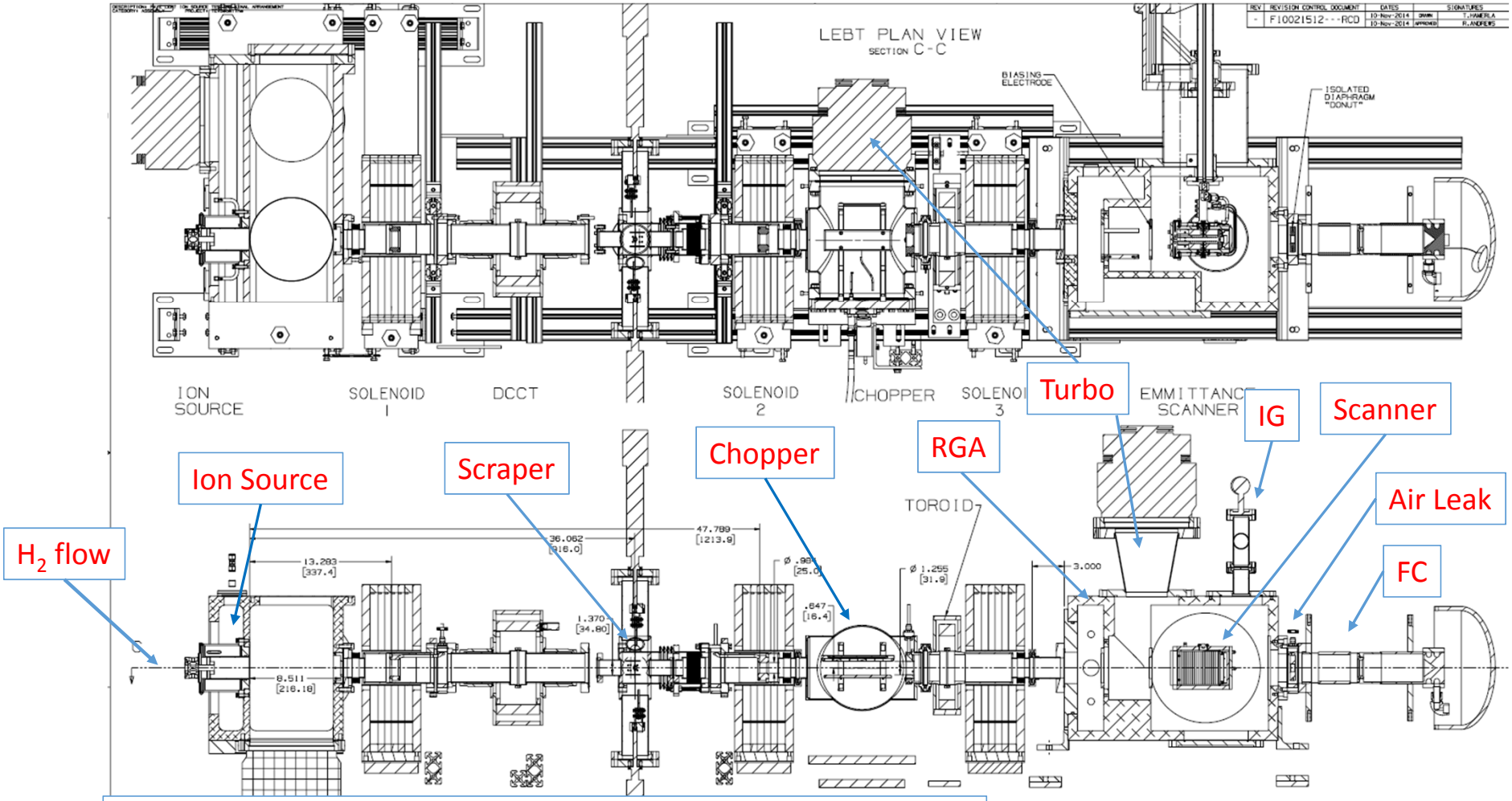
April 14, 2015

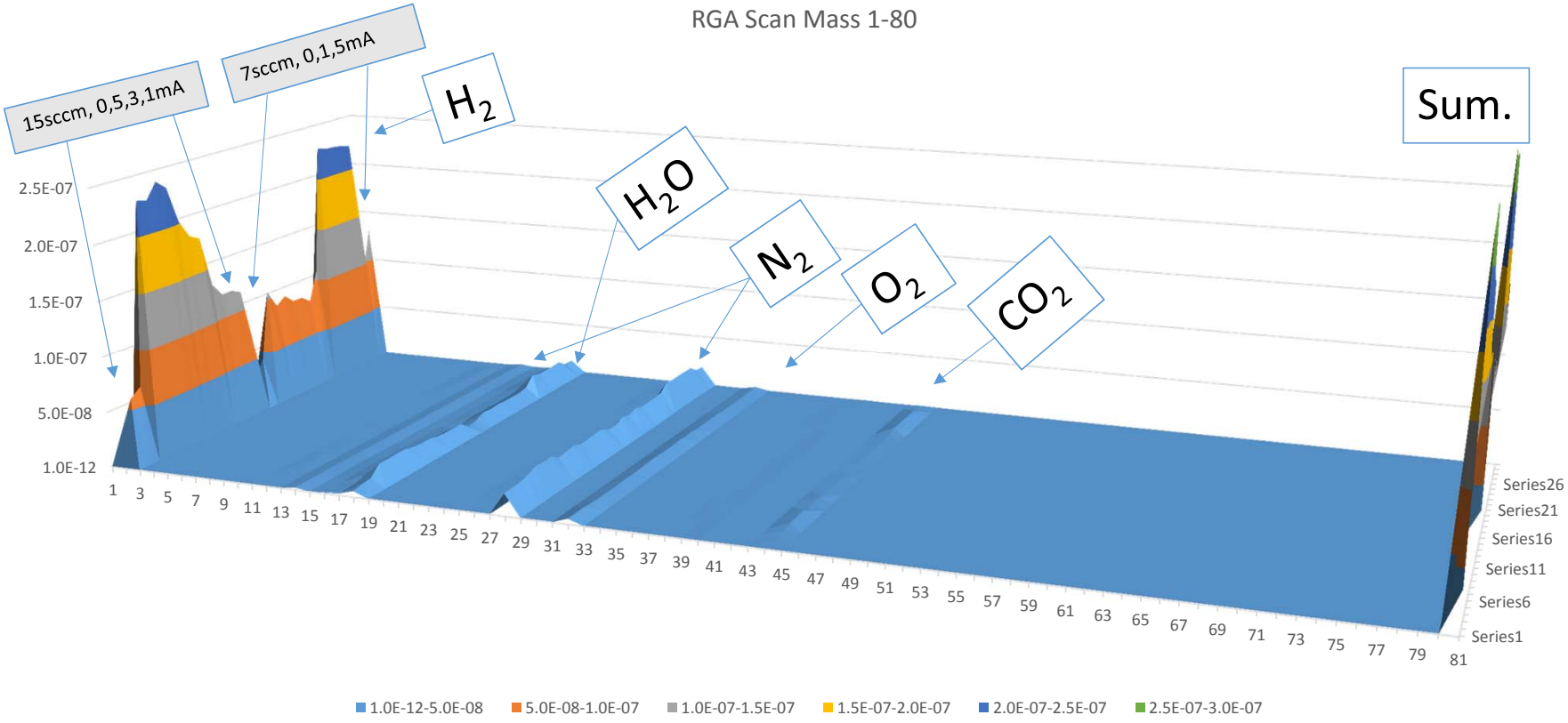
Outline

1. Setup
2. Residual Gases in operation scenarios:
   a) Baseline:
      - no hydrogen introduced
      - hydrogen on, plasma on, HV off(no beam)
   b) 15sccm of Hydrogen
      - Beam current 5mA, 3mA, 1mA
      - Beam size varies for each beam current using solenoid 3
   c) 7sccm of Hydrogen
      - 1mA; 5mA
      - Alison Scanner at various positions
      - Chopper on
      - Scraper on
3. Summary

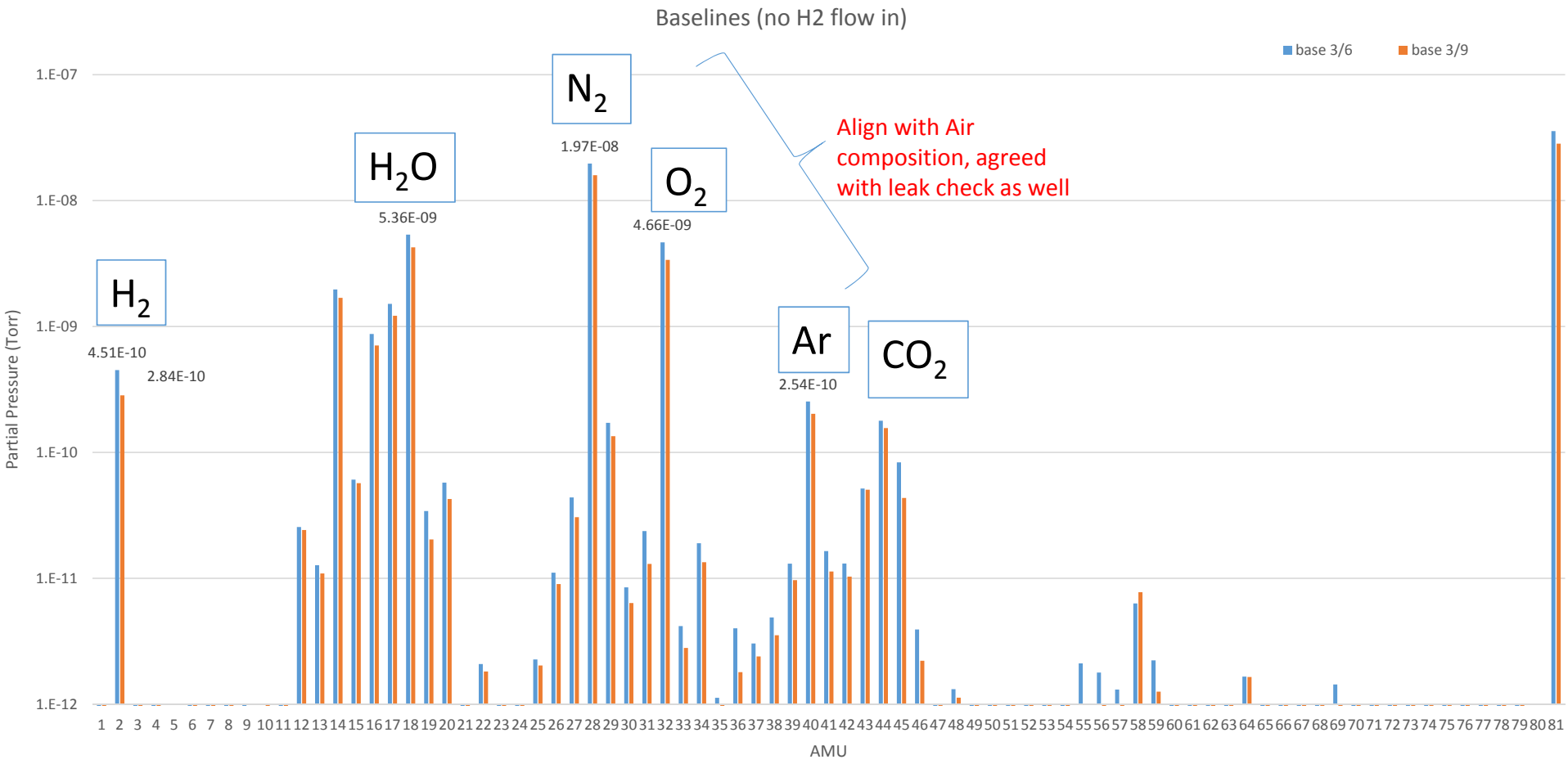


SETUP: RGA, IG all degased

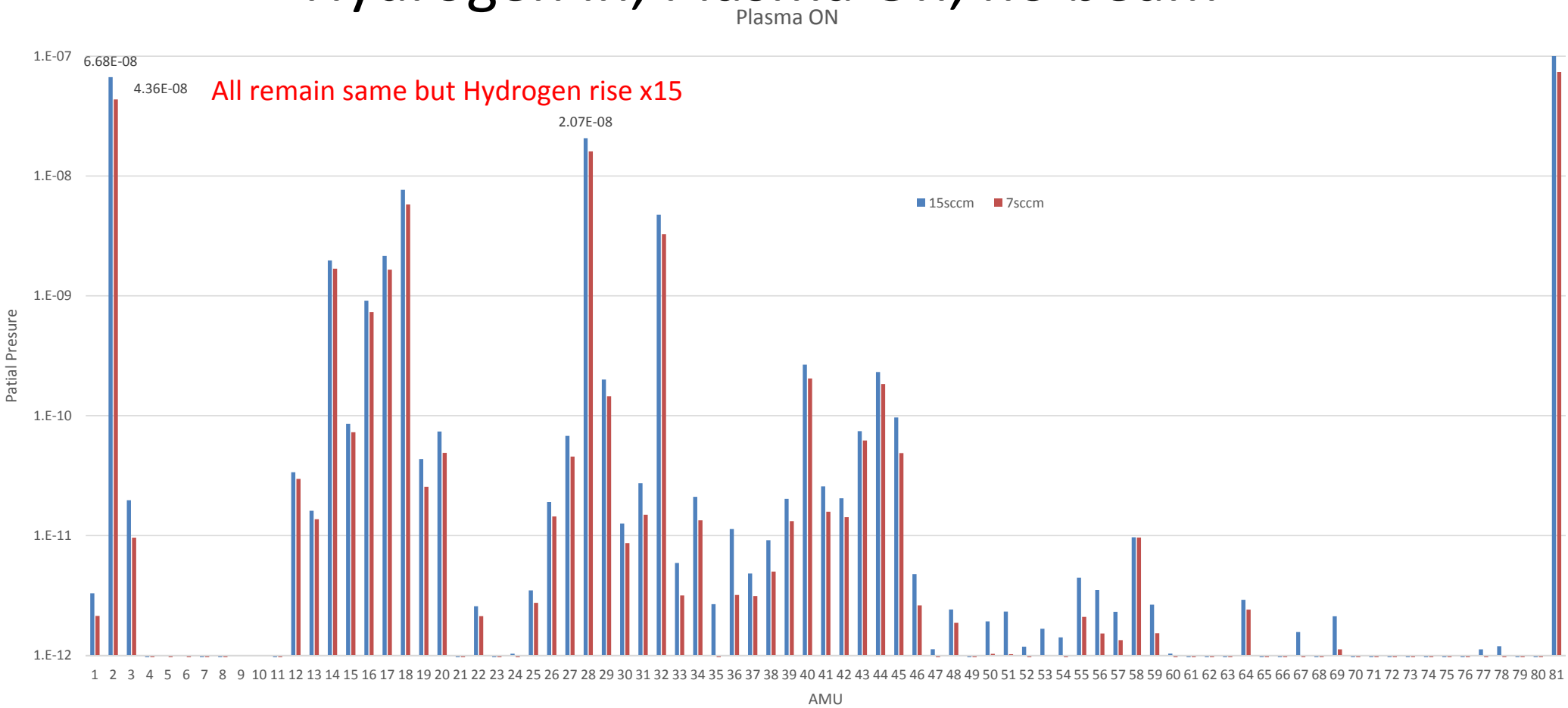
RGA SCANS (overall)



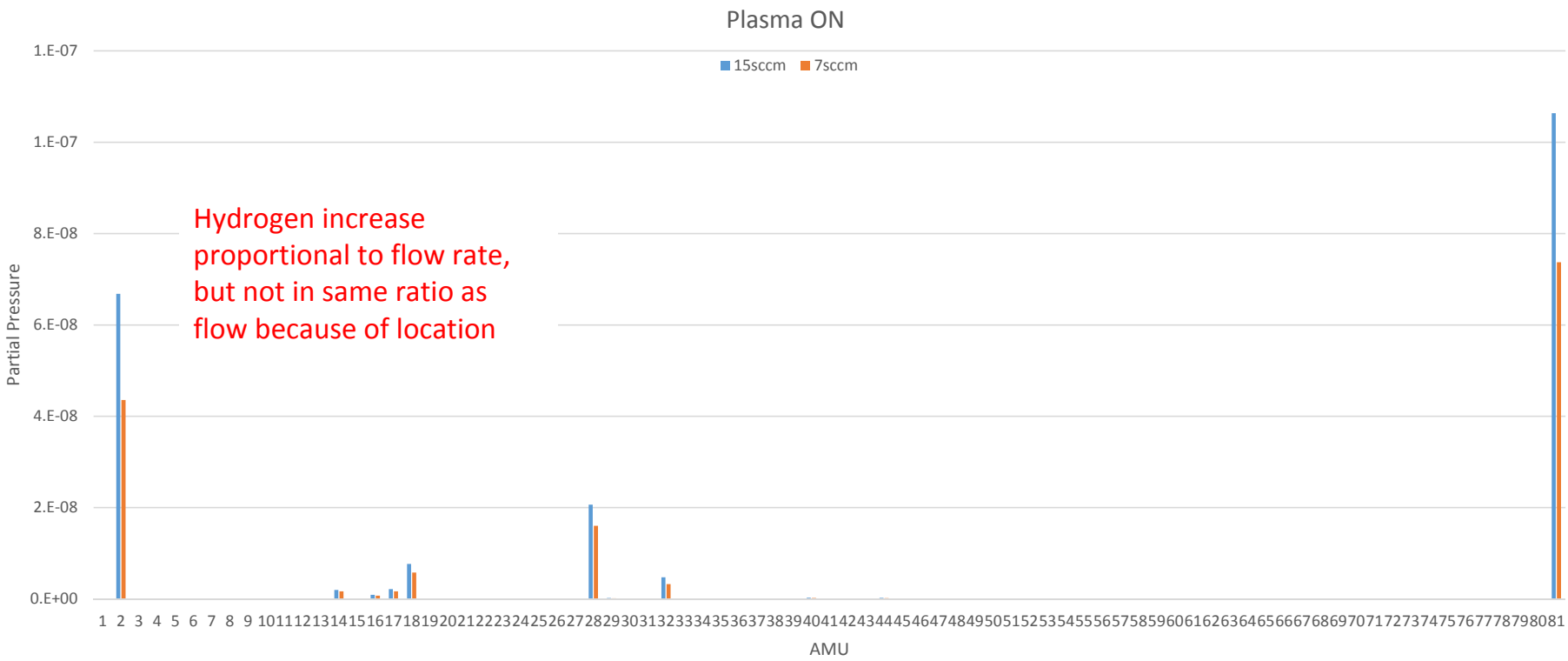
Baseline Scans: NO Hydrogen flow



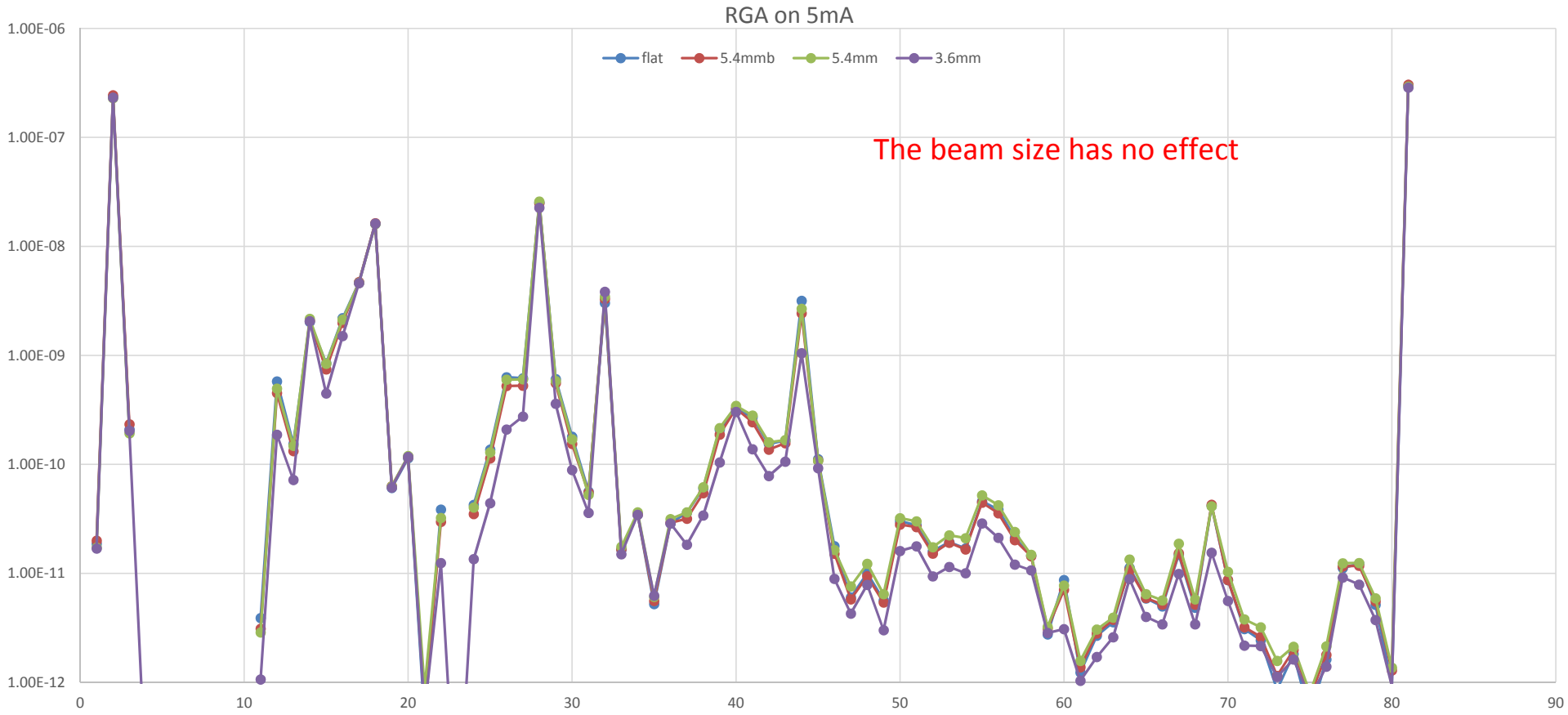
Hydrogen in, Plasma On, no beam



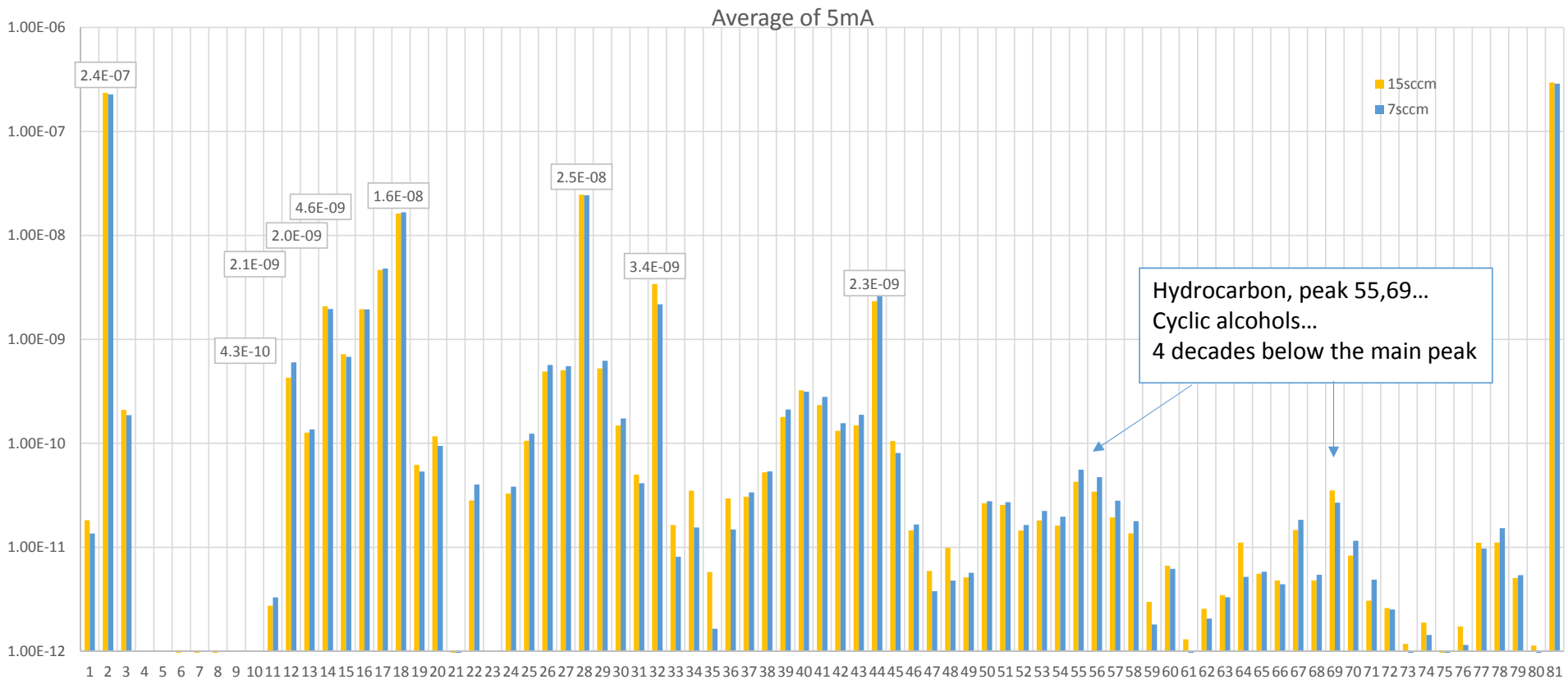
Plasma On


Plasma ON
15sccm
7sccm
1.E-07
1.E-07
8.E-08
6.E-08
4.E-08
2.E-08
0.E+00
Partial Pressure
Hydrogen increase proportional to flow rate, but not in same ratio as flow because of location
1 2 3 4 5 6 7 8 9 10111213141516171819202122232425262728293031323334353637383940414243444546474849505152535455565758596061626364656667686970717273747576777879808 1
AMU

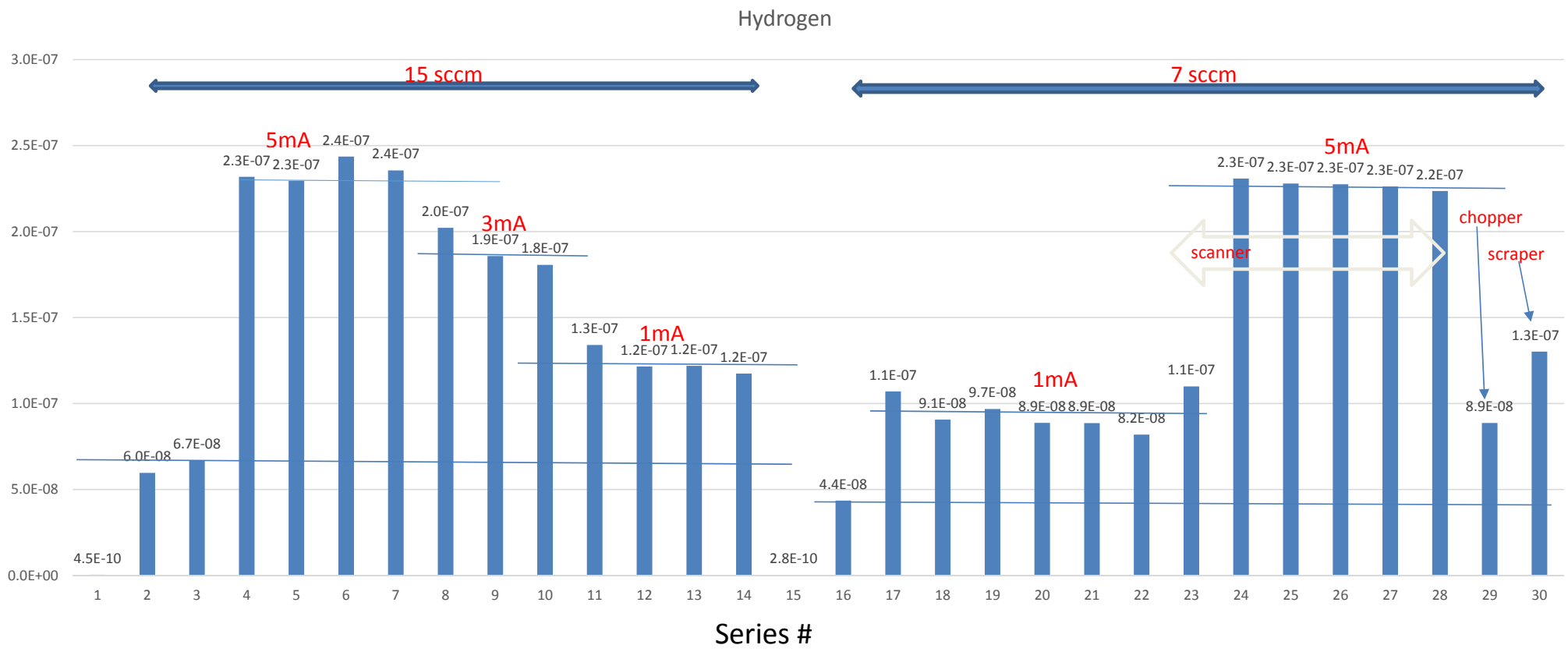
15sccm,5mA Beam Sizes



Residual Gases of Average 5mA Beam

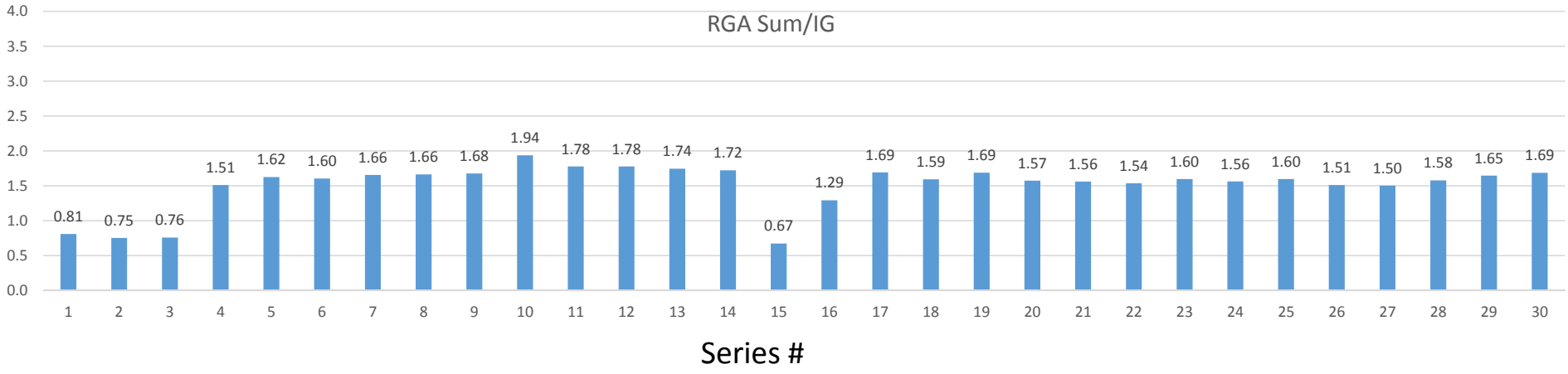


Hydrogen Production by Beam



Calibration with Ion Gauge

- 1st reason is that Ion Gauge measures pressure more reliable than RGA does, designed for relative strength. So it is necessary to be calibrated with IG, in order to determine partial pressure.
- 2nd reason is that the RGA is located in upstream chamber where the pressure will be different from the main chamber (IG located).



Hydrogen Production by Beam

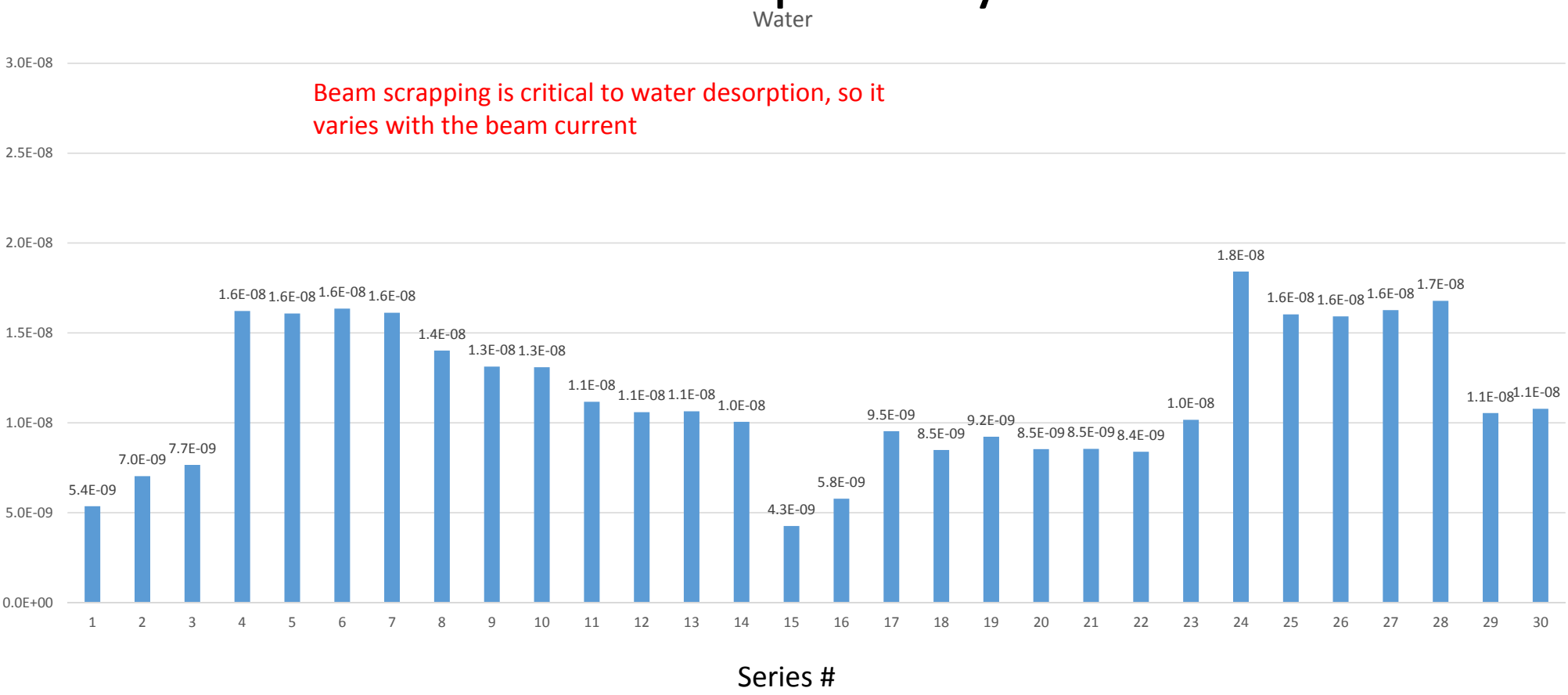
flow rate	current	Plasma base	P	dp = p-base	cal.# dp/mA	adj. * dp/mA
15sccm	5mA	6.68E-08	2.35E-07	1.68E-07	2.1E-08	4.60E-08
	3mA	6.68E-08	1.90E-07	1.23E-07	2.3E-08	5.05E-08
	1mA	6.68E-08	1.24E-07	5.69E-08	3.2E-08	7.05E-08
7sccm	1mA	4.36E-08	9.48E-08	5.13E-08	3.2E-08	6.94E-08
	5mA	4.36E-08	2.27E-07	1.84E-07	2.3E-08	5.04E-08
					Torr/mA	5.7E-08
H- current	# of H2	Q @25C				
mA		Torr.l/s		H2 Pumping Speed(l/s)		900
1	3.12E+15	9.64E-05			Torr.l/s.mA	5.2E-05

Hydrogen outgassing rate is 46% less than theory value, beside measuring errors, may indicate diffusion into bulk material.

Cal. dp/mA is calibrated by Ion Gauge

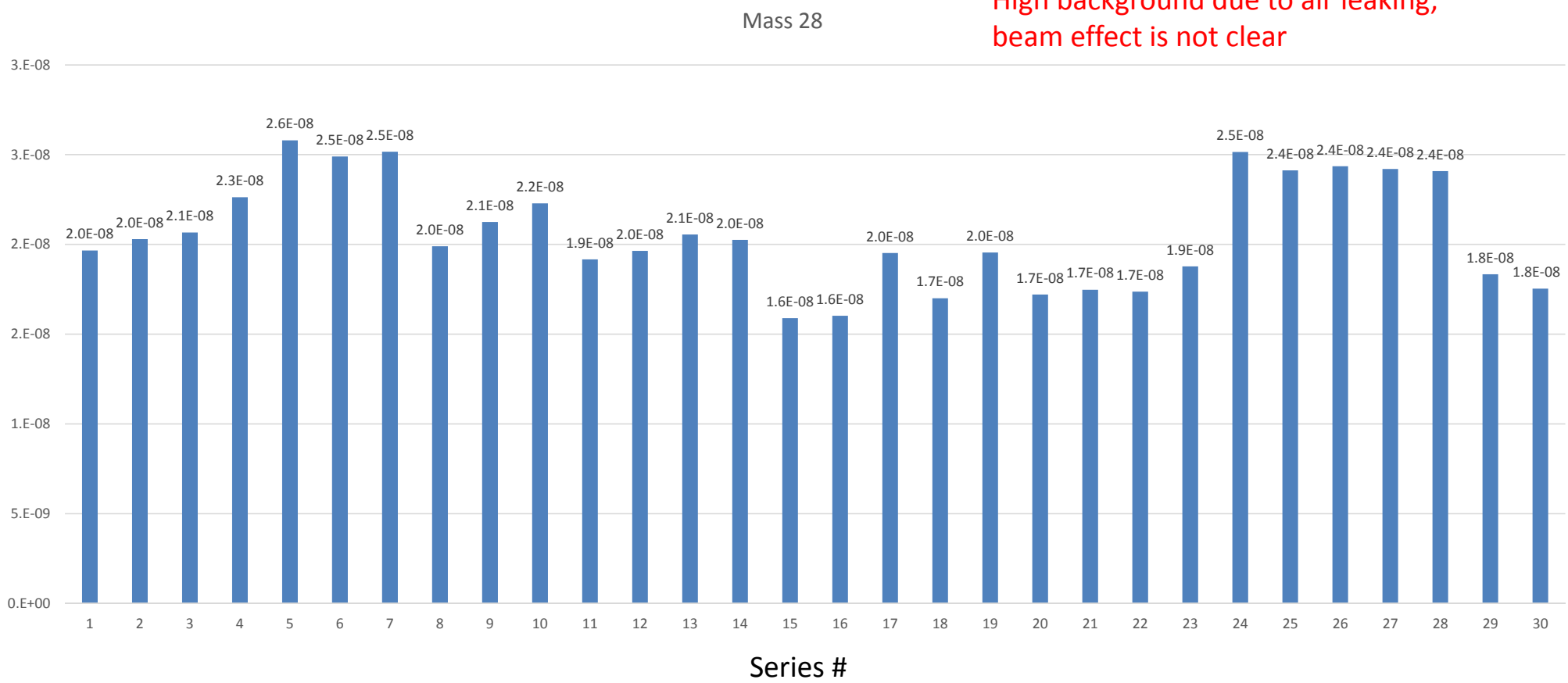
* Adj. dp/mA is adjusted by Hydrogen ionization sensitivity

Water Desorption by Beam

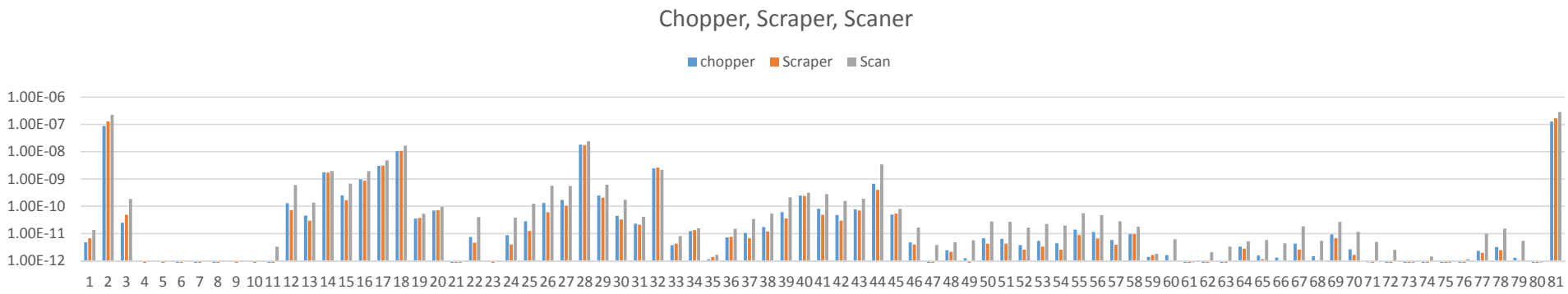


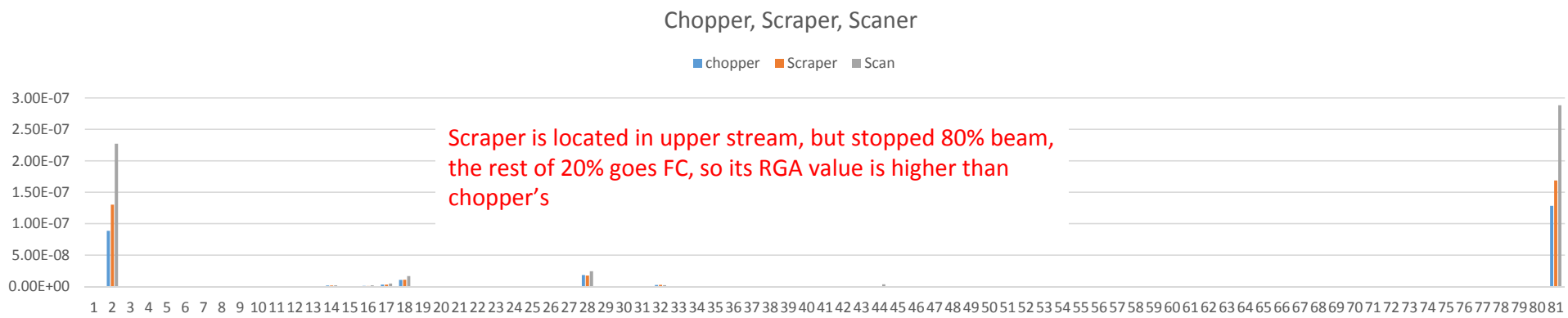
Nitrogen Desorption by Beam

High background due to air leaking, beam effect is not clear

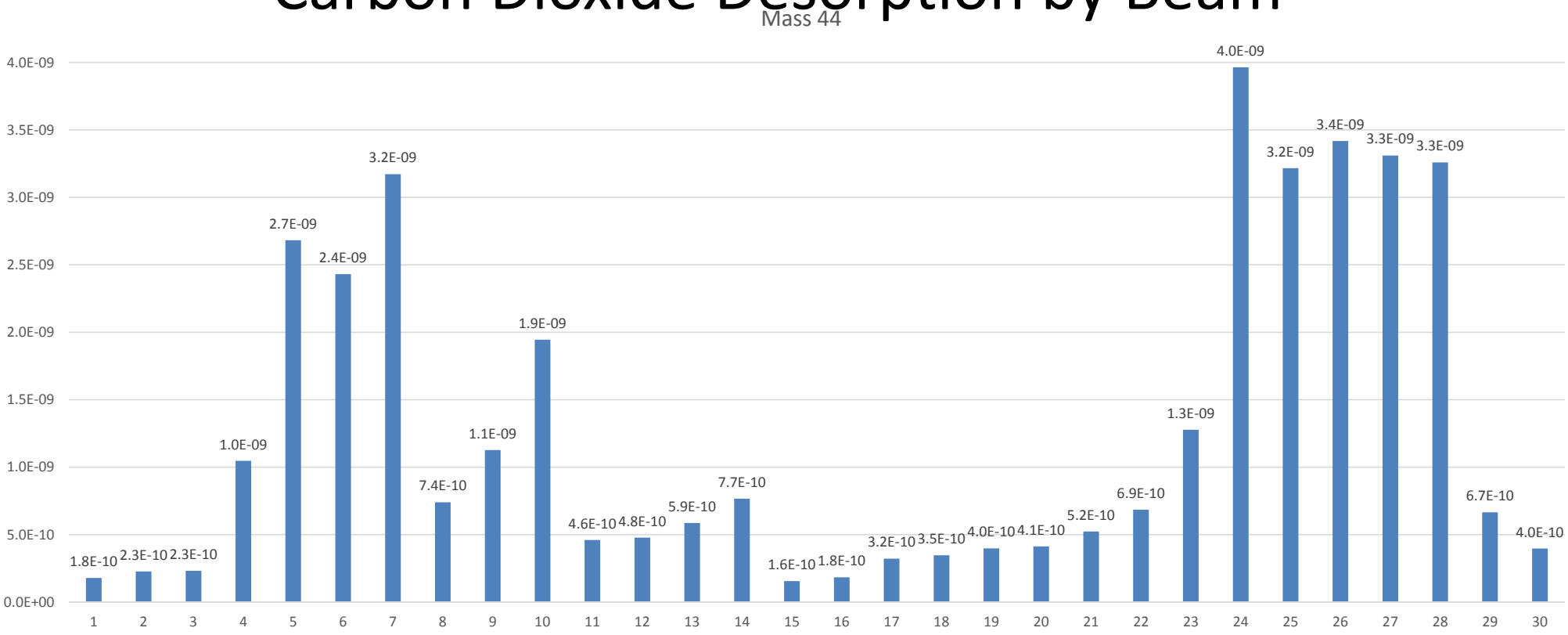


Effects of chopper, scraper, scanner





Summary

- Hydrogen dominates the vacuum space
- Hydrogen production
  - Hydrogen production is significant, (5.2E-5 Torr.l/s)
  - Is proportion to beam current
  - Beam size has no effect
  - 46% less than its theory value, may indicate diffusion into bulk material
- Hydrocarbons
  - Exists, but
  - Low enough, E-4, relative to Main Gas (H_2)
- Effects of scanner, chopper, and scraper are similar, variation due to locations

Carbon Dioxide Desorption by Beam