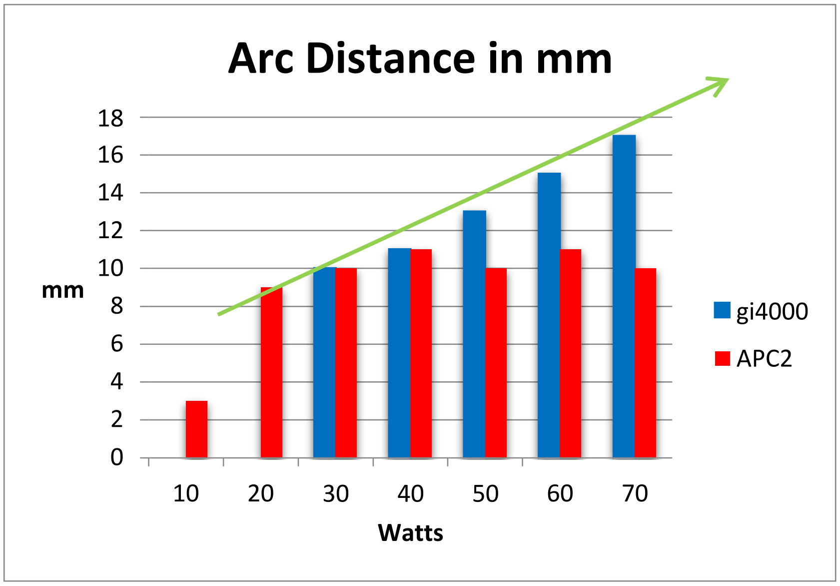
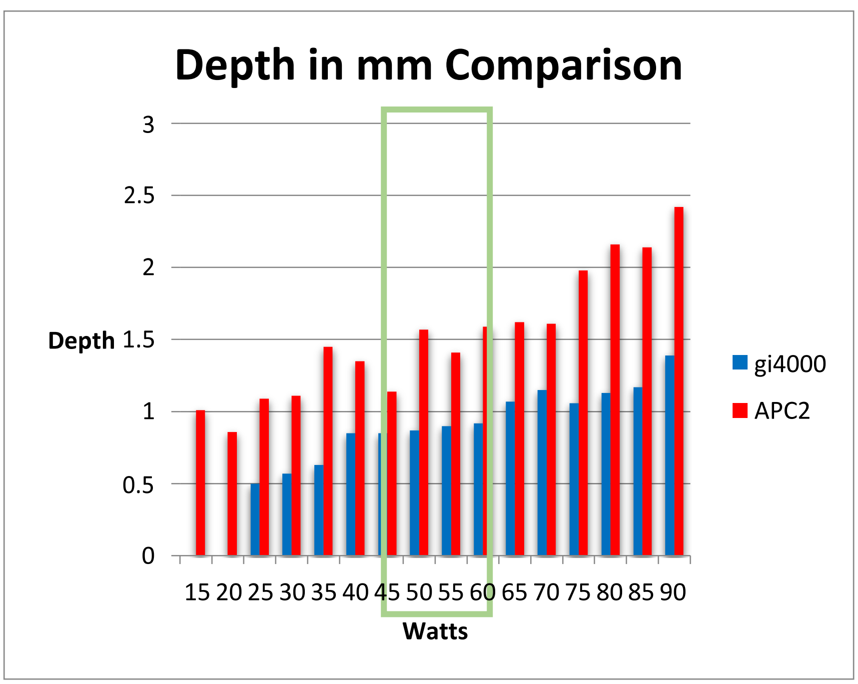
Education Special: The ArC Smart™ linear beam

Fig 1 **ArC Smart™ linear beam increases in length in a linear relationship with power increase.**



In this data set the beam length is maximized by the study protocol for both beams. In actual clinical applications, both beams will vary among patients with their variety of impedance characteristics. However, note that the 'red' amplified beam is rather 'all or nothing'. A power increase does not provide a beam length increase. The blue ArC Smart™ linear beam will increase in length with the increase in power regardless of the actual length of the beam in the clinical setting.

Fig 2 **ArC Smart™ linear beam depth of injury: compared to an amplified argon beam (one second activation)**



This data set demonstrates that overall at comparable power settings and one second of activation, the depth of tissue injury is less with the ArC Smart™ linear beam than with an amplified beam. Note that with two to five watt incremental increases the depth of injury change is minimal as the ArC Smart™ linear beam length increases (see above). The green box highlights the FDA cleared default setting range on the US Endoscopy *gi4000* which produces reliable beam ignition in most patients. See US Endoscopy August White paper (5) for study protocol and data.

The technology of argon coagulation (ArC, APC or ABC) involves inert argon gas flowing through a hollow, flexible catheter over an electrode which is activated (ionized) by a voltage output from a specially equipped electrosurgery generator. The method is monopolar with the electrosurgical circuit being completed via a remotely placed dispersive (grounding) pad. Argon's ionization into conductive plasma is known to be a threshold phenomenon. When a sufficiently high voltage is applied between the probe's electrode and the tissue, ionization occurs.(1) The distance of the probe from the tissue and the impedance of the total monopolar circuit play a role. Once ionized, the gas plasma is able to conduct high frequency energy over a gap to the tissue where it creates the desired thermal therapy. As long as there is a sufficient cloud of argon present, the flow rate of the argon gas has no effect on either the length of the beam or the tissue result.(2) This non-contact treatment method has proven exceptionally useful in the gut and lung for a multitude of indications.(3)

A common problem for argon coagulation therapies in flexible endoscopy has been the difficulty of maintaining an argon plasma beam of sufficient length to provide the desired 'non-contact' characteristic of the method. The advantages of maintaining a non-contact application include speed in treating large or diffuse lesions, a more homogeneous tissue coagulation zone with a reduced likelihood of submucosal or serosal injury, and less tissue sticking to the argon probe with its associated chance of promoting re-bleeding. While the exact mechanism of perforation during ArC remains unproven, it is thought to be related to touching the tissue with the active argon probe. Anecdotal reports favor the belief that most gut perforations while using ArC occur in the thinner walled right colon and cecum. A suggested mechanism is that deeper thermal injury from touching the tissue allows argon gas to flow into the submucosa producing pneumatosis and even extra-intestinal gas.(4)

US Endoscopy has produced an argon beam (the ArC Smart™ linear beam) with characteristics making it ideal for flexible endoscopy. The beam ignites reliably under actual clinical conditions within a range of default power settings. Once ignition has taken place, if the beam is not of sufficient length for the physician to straightforwardly complete the desired therapy without touching the tissue, (or if ignition is delayed) the power setting can be increased in two to five watt increments. The beam will lengthen in a linear relationship to the power increase. Overall, the beam is not as aggressive as commonly marketed amplified beams, and the increase in power has only a minimal effect on depth of tissue injury. As with all argon beam types, time of application is an important variable in injury depth.

1. K Grund, G Farin. Clinical application of argon plasma coagulation in flexible endoscopy. In Practice of Therapeutic Endoscopy, Second Edition. Tytgat, Classen, Waye, Nakazawa eds. WBS. 2000
2. C van Swol, R van Vliet, M Tatthijs, R Verdaasdonk. Tissue effects of argon gas flow during electrosurgery. In Proc. SPIE Vol. 3249;68-71 1998
3. ASGE Technology Status Evaluation Report: Electrosurgical Generators, ASGE Technology Committee, Sarah A. Rodriquez, Committee Chair. 2013 Gastrointest Endosc 78(2) 197-208
4. J Robotis, P Sechopoulos, Th Rokkas. Argon plasma coagulation: Clinical applications in gastroenterology. Annals of Gastroenterology 2003, 16(2):131-137
5. Argon coagulation tissue effects using pre-clinical data comparing the US Endoscopy gi4000 and the Erbe VIO300D/APC2 electrosurgery generators. White Paper. US Endoscopy. August 2012.