Introduction and short history of focused ultrasound (HIFU)
Touring points in the HIFU story

• 1880 Pierre e Jacques Curie) The piezoelectric effect
• 1978 Fry F, Johnson L. Tumor irradiation with intense ultrasound. Ultrasound Med. Biol. 1975 Lele P: “Focused ultrasound technology meets the requirements of an ideal surgical tool. It has the demonstrated ability to destroy pre-selected targets located deep within tissue without any damage to the tissue in the path or surrounding the lesions.” Ultrasound in Surgery
The basic physics of the transducer

- 1880 Piezoelectric effect (Jacques & Pierre Curie) Crystal physics: Development by pressure of polar electricity in hemihedral crystals with inclided faces”, Curie et al, Academie des Sciences, 1880 “We have found a new method for the development of polar electricity, consisting in subjecting them to variations in pressure along their hemihedral axes”
The first complete system

- A NEW METHOD FOR THE GENERATION AND USE OF FOCUSED ULTRASOUND IN EXPERIMENTAL BIOLOGY
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The fundamental work of Flynn brothers

By 1957, single and multiple element were used to produce lesions in the pallidofugal and nigral complexes in the brains of patients with hyperkinetic and hypertonic disorders. Several cases of Parkinson’s were treated successfully with FUS, but the study was halted. Difficulties in imaging and targeting of sites in the brain. (Introduction of L-dopa)

Experiments conducted by William Fry and colleagues (1958) first demonstrating that US can induce reversible suppression of sensory-evoked activity, from experiments in which light-evoked cortical potentials were recorded from V1. US transmitted to the lateral geniculate nucleus (LGN).

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Touring points in the USgFUS story 2

• In the 80 Francis Fry and Naren Sanghvi at the Diasonics Inc. developed the first HIFU device for prostate treatment: the Sonablate ®. Then Sonablate 200 by Focus Surgery, Inc, now Sonacare, was launched in Europe in 1994 after receiving CE approval in 2001 (benign prostatic hyperplasia - BPH). Comprehensive studies demonstrated clinical efficacy for the destruction of prostatic tissue without blood loss or long term side effects. As of January 2010, a total of more than 9,000 treatments have been performed for benign prostate hyperplasia and over 7,000 prostate cancer treatments. Project of variable focusing transducer. Developed in 1989 in France with Inserm (French National Institute of Medical Research), Edouard Herriot Hospital in Lyon and EDAP TMS (Nasdaq : EDAP), Ablatherm HIFU was the first robotic prostate cancer HIFU device to receive CE marking in 2000. The first "Ablathermy" treatments on men were performed in 1993 and as of January, 2010, more than 21,000 treatments have been performed worldwide. In 1988 the first scientific team of Haifu (ChongQing) started his work with the exploration of "Biological effects of ultrasound on human embryos." The similarity between embryonic cells and tumor cells suggests the possible application of ultrasound to tumors, which kicks off the early research in this field. A long experimentation way (headed by Prof Wu) lead to the recent Total Body system, HAIFU Model JC. In the recent time, other Chinese companies are proposing US guided total body HIFU devices, like Sumo Corporation (Hifu Model 2001) and Beijing Yuande Biomedical Engineering (FEP-BY – 02) Very recently, a French Firm Theraclion proposed a sealed transducer system (EchoPulse) CE cleared for benign fibroadenomas and, maybe in future, other malignancies.
Toward the total body HAIFU

1988 preclinical

1992 preclinical

1994 preclinical

First 1996 clinical prototype

The clinical system HAIFU Model JC