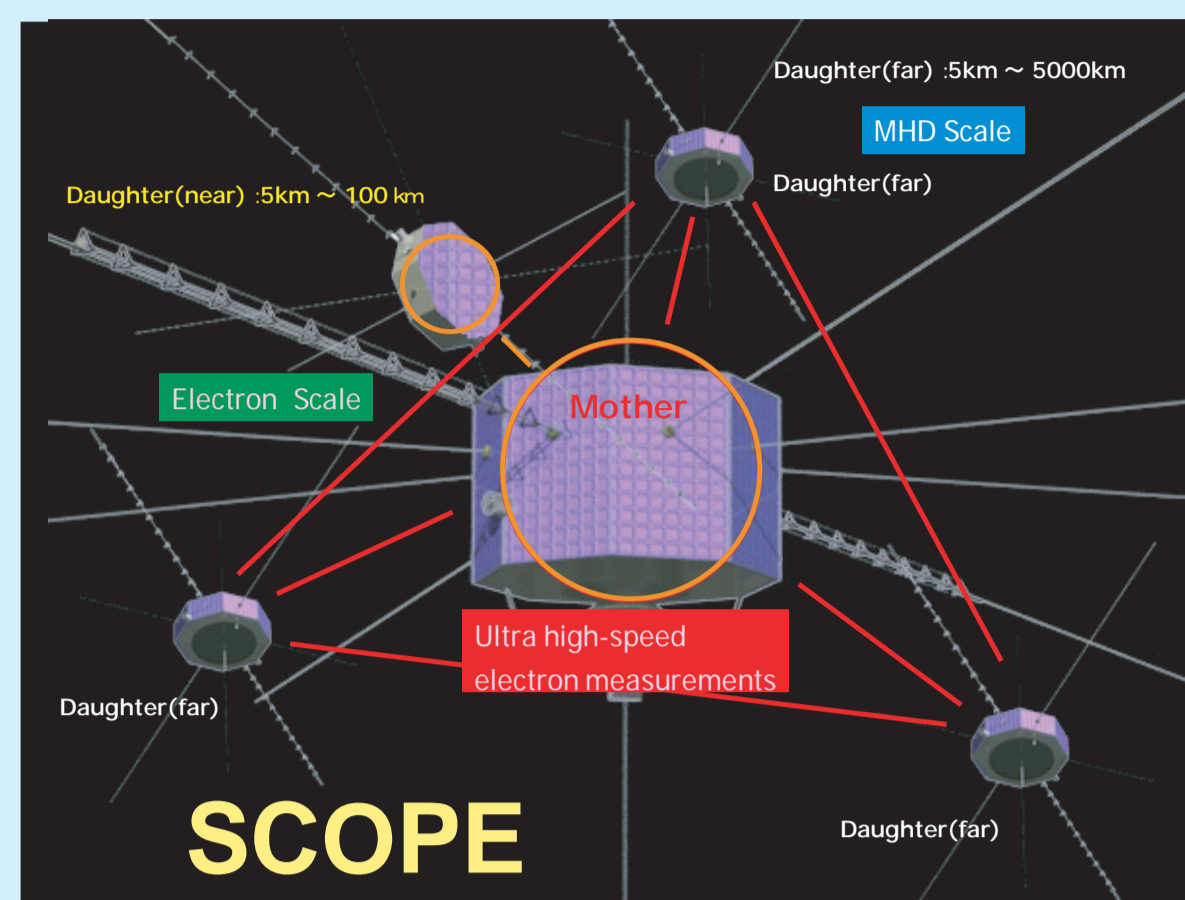


次期磁気圏観測衛星検討WG SCOPE計画

- プラズマ粒子観測器 -

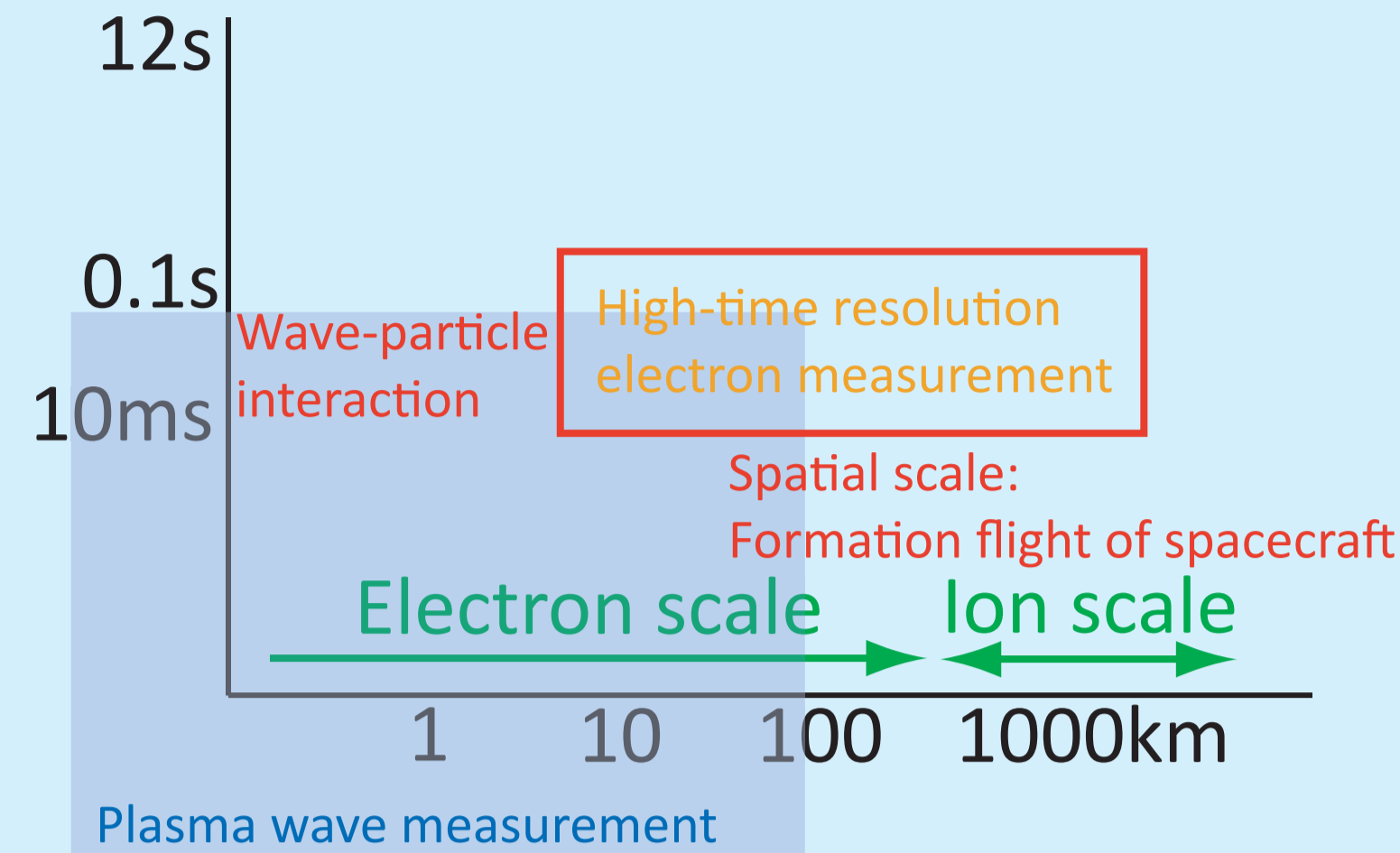
浅村和史、斎藤義文、横田勝一郎、笠原慧、高島健(ISAS/JAXA)
SCOPE粒子観測機器チーム



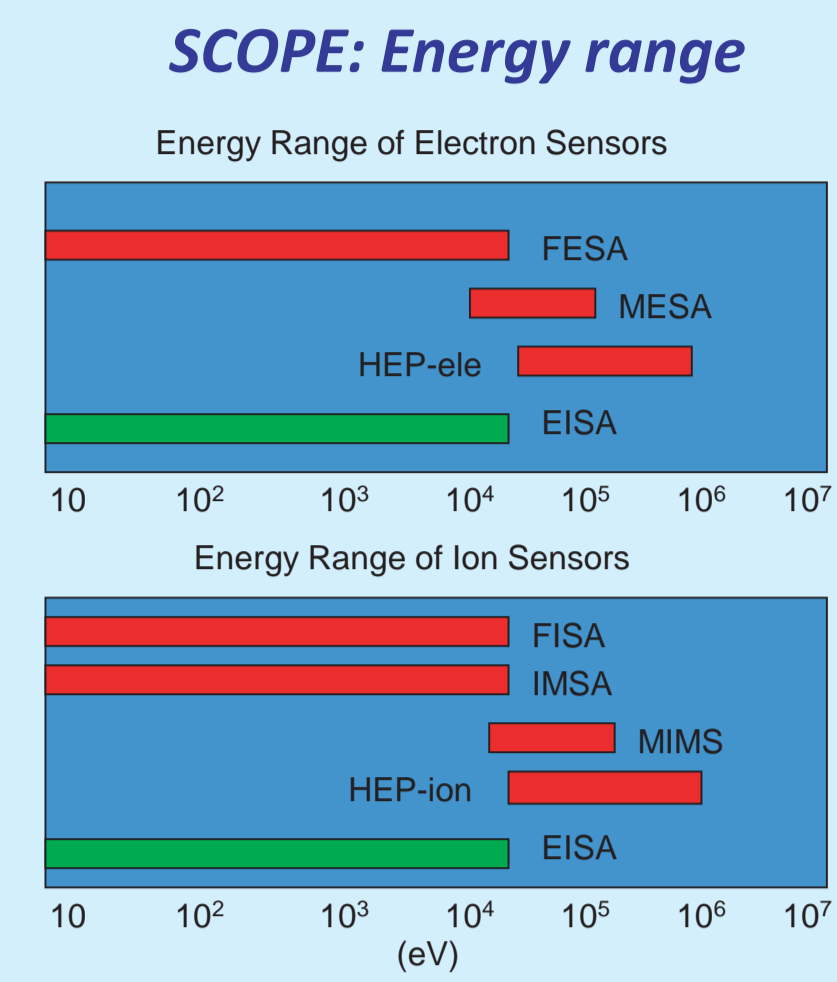
Spacecraft formation of SCOPE

Science Instruments		Mother	Daughter (near:1)	Daughter (far:3)
Plasma /Particle	electron	FESA (10eV-40keV High Time Resolution) MESA (20eV-100keV) HEP-elo (30eV-700keV)	N.A.	EISA (10eV-20keV/q) electron & ion measurement
	ion	FISA (5eV/q-40keV/q High Time Resolution) IMSA (5eV/q-20keV/q Mass) MIMS (10eV/q-200keV/q Mass) HEP-Ion (30keV-10MeV)	N.A.	N.A.
	Particle & Field	DWPC (Digital Wave-Particle Correlator)	N.A.	N.A.
Field	Magnetic Field	MGF (DC - Low Freq. Mag. < 120Hz) OFAWFC-B (f < 20kHz)	MGF (DC - Low Freq. Mag. < 64Hz)	OFAWFC-B
	Electric Field	EFD (DC-64Hz) OFAWFC-E (f < 100kHz) HFR (f < 10MHz)	N.A.	EFD (DC-64Hz) WFC-E (f < 100kHz) N.A.

Instruments onboard SCOPE



Available spatial / time scales provided by SCOPE measurement

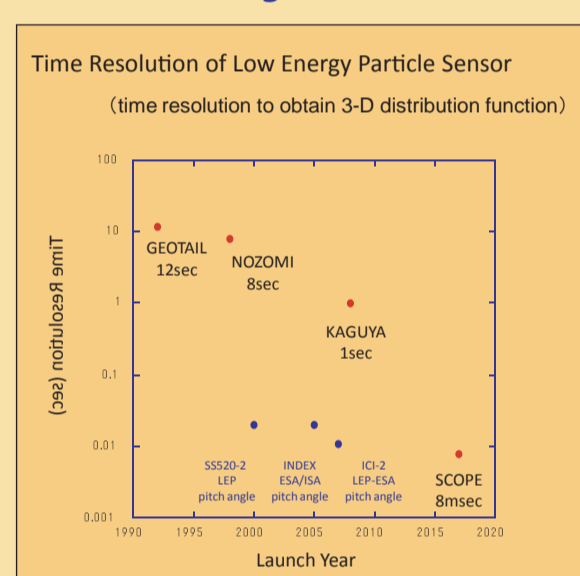


Particle measurements should cover energies from eV to MeV

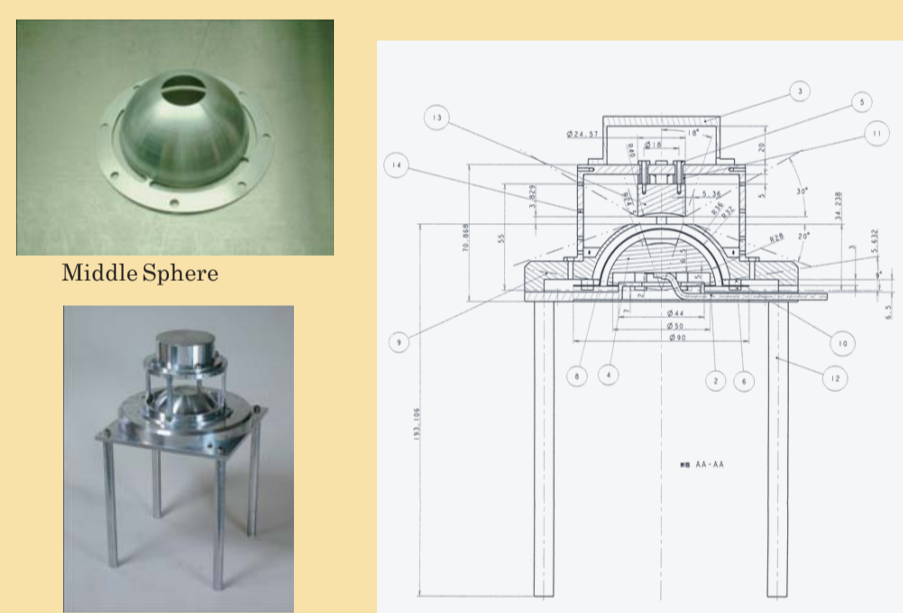
Electron instruments with very high-time resolution

<Analyzer>

For SCOPE, high-time resolution (8ms) is necessary, 1000 times larger than GEOTAIL



Improvement of the time resolution

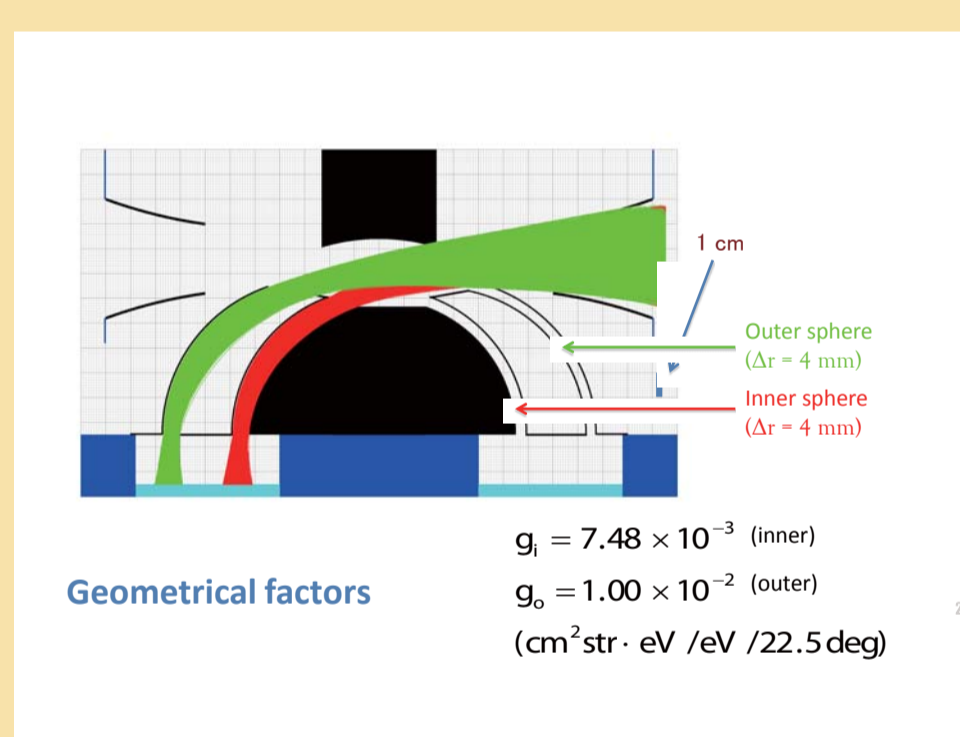


Test model of FESA (sectional view, middle shell, outside appearance)

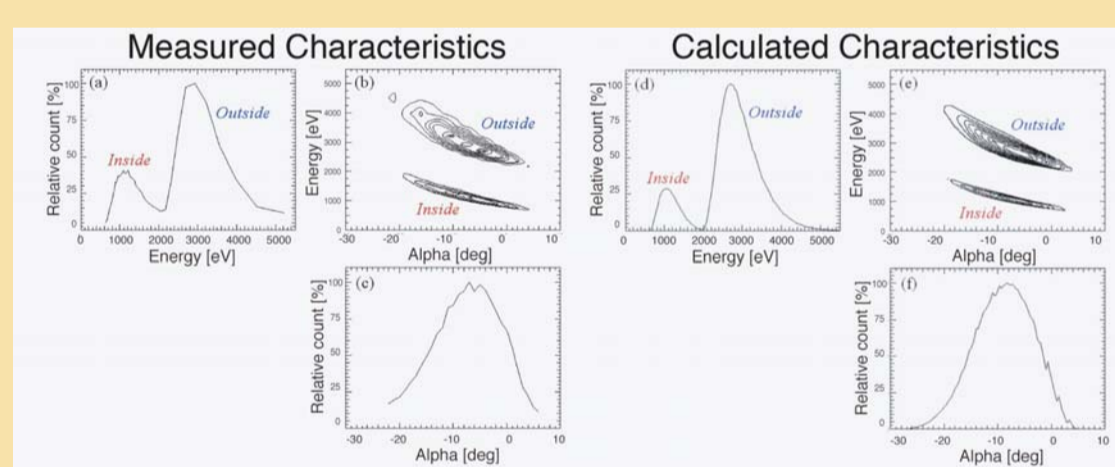
FESA specifications

- 8 FESA sensors on SCOPE mother satellite
- Time Resolution: 8msec / 3D electron distribution function
- Energy Step: 32 energy steps
- Energy Range: 10eV - 30keV
- Energy Resolution: ~12%
- HVPS Stepping Speed: 1msec / STEP
- Angular Resolution: 8 (polar) X 16 (azimuth) ((22.5deg. X 22.5deg.))
- Sensitivity: Similar count rate/sample with GEOTAIL LEP-EAe

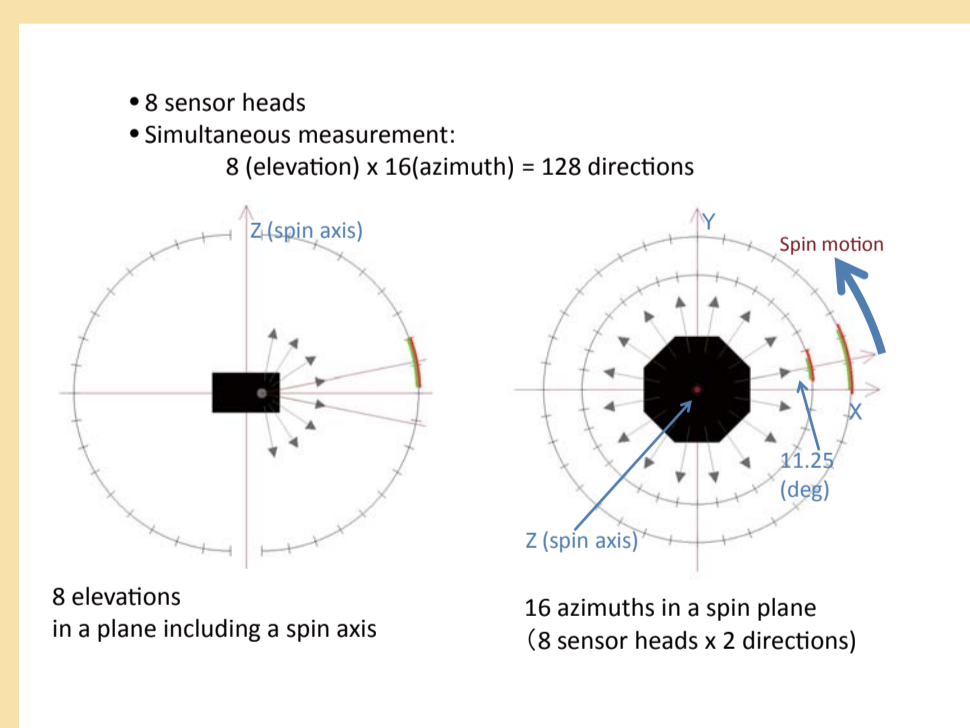
Requirements for FESA



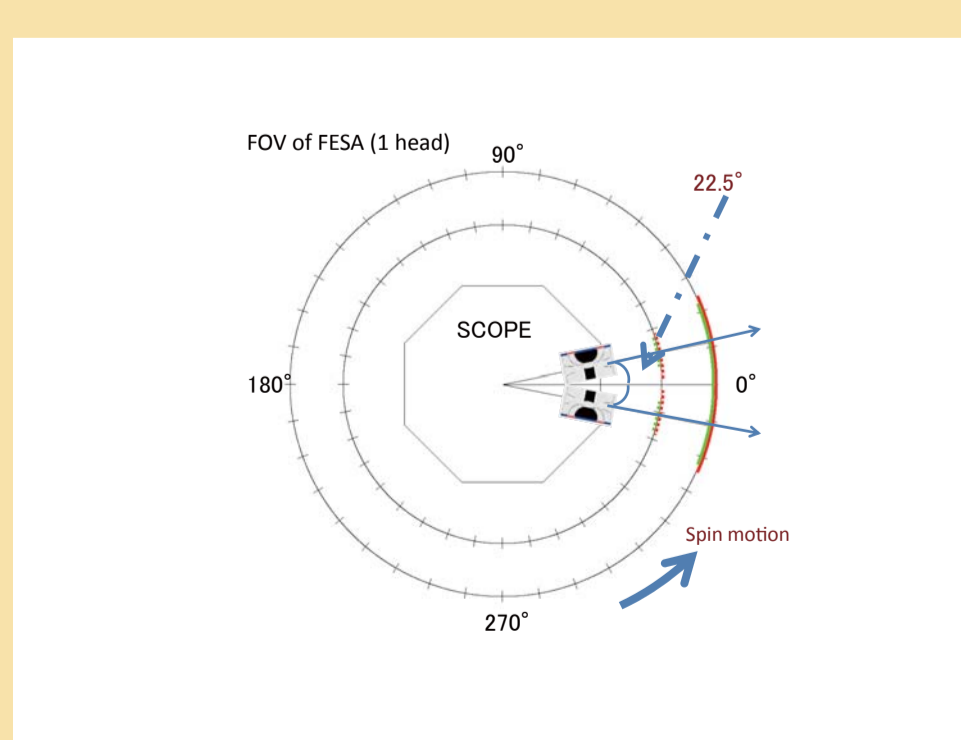
Triple shells to detect different energies simultaneously



Experimental results which agree well with those numerically calculated

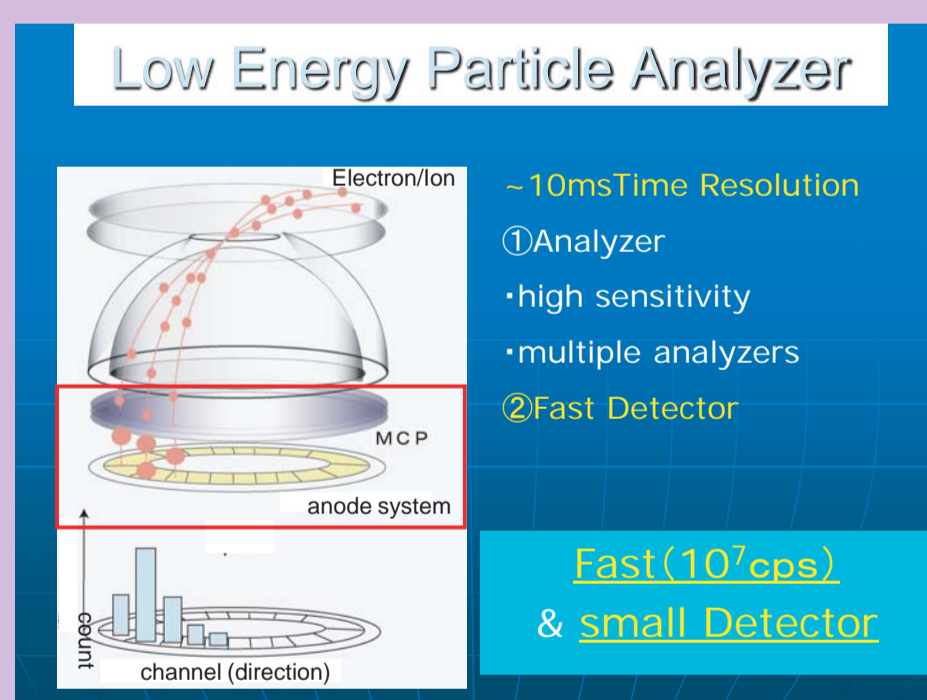


In order to get 8ms time resolution, 8 identical instruments will be onboard simultaneously

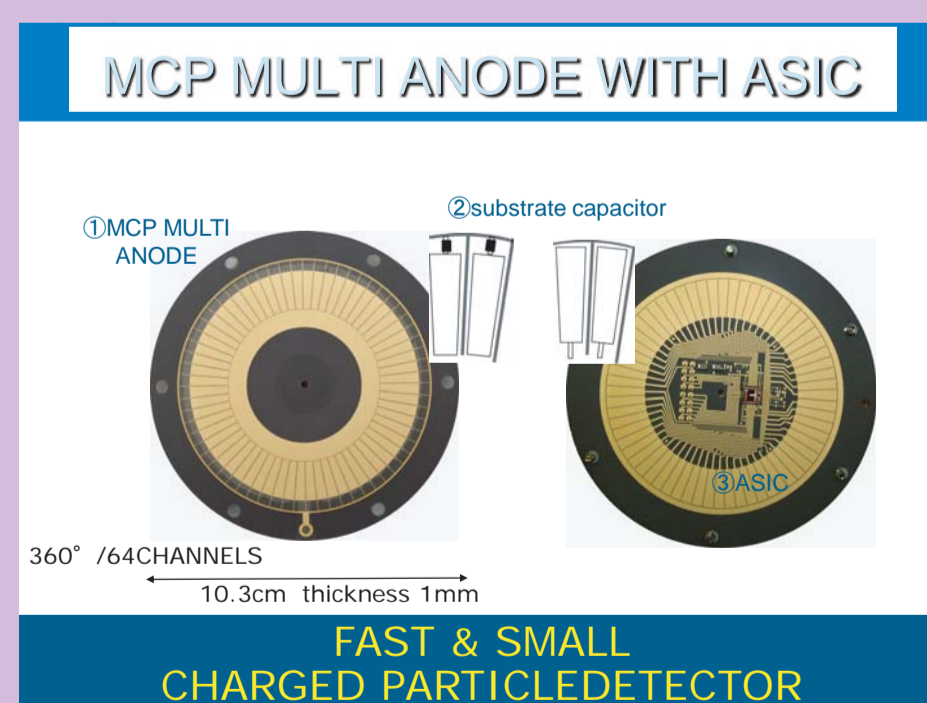


Two sensor heads are stacked, forming one instrument

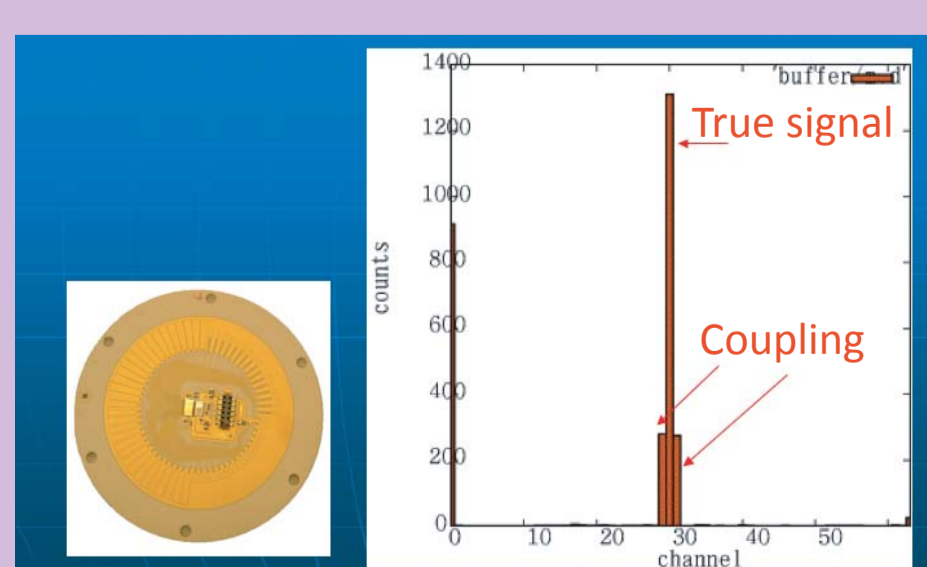
<Detector system>



Detector with small, high-speed, and low-power system is necessary

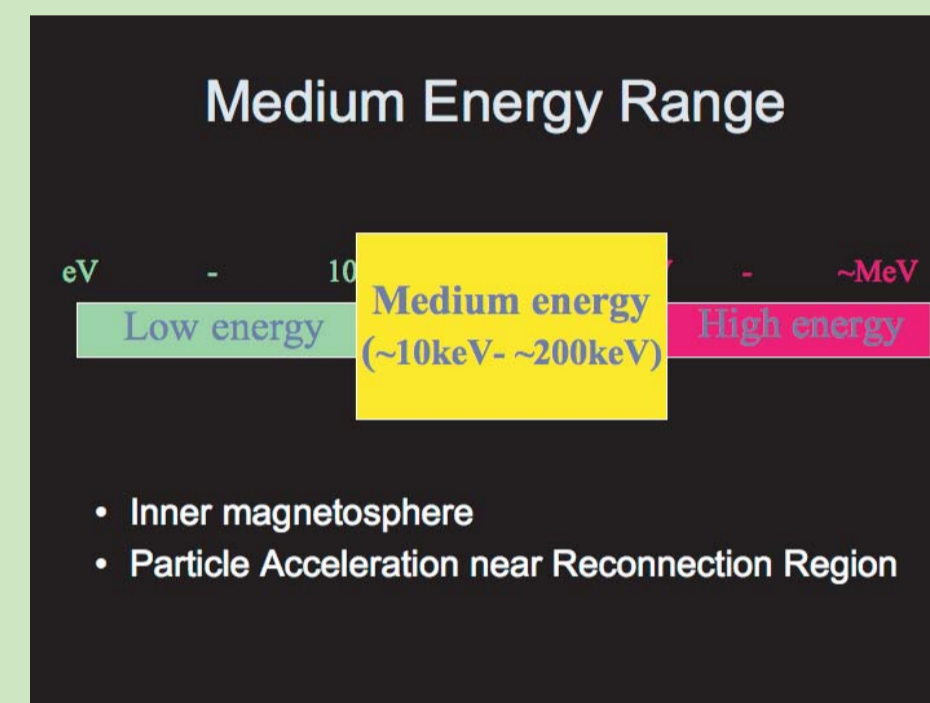


Multi-anode system with a preamplifier array implemented in ASIC

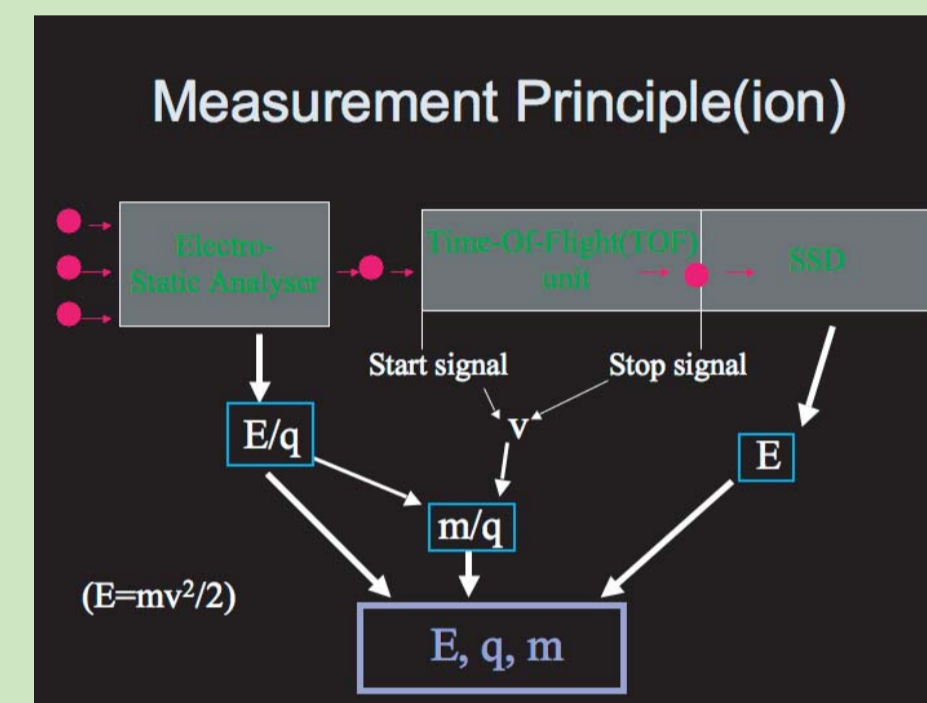


Results of testing with ion beams
Beam is irradiated onto one specific anode

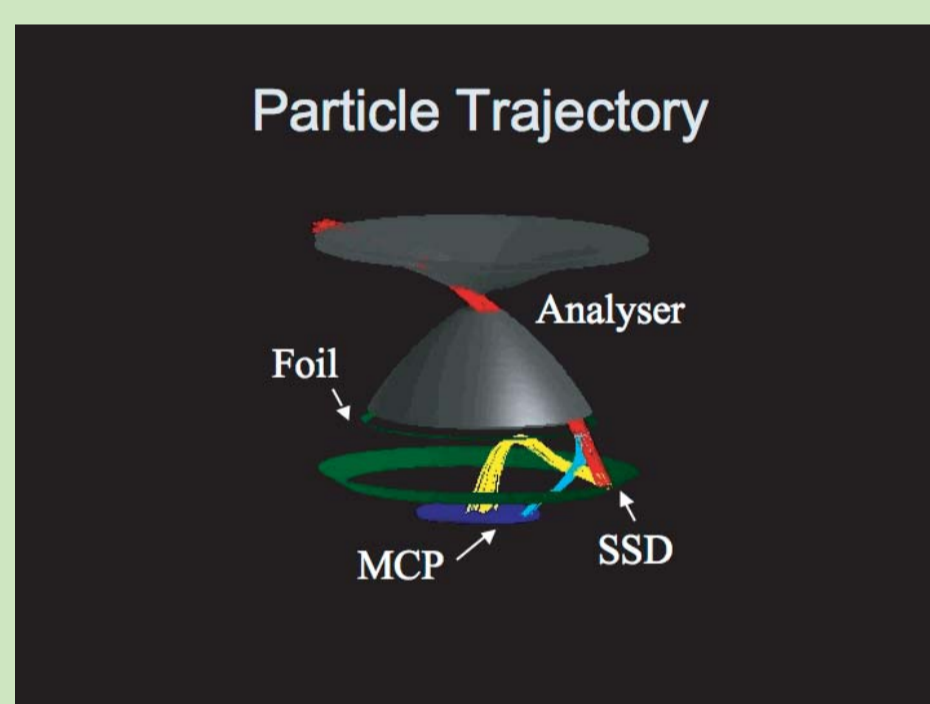
Medium-energy ion sensor



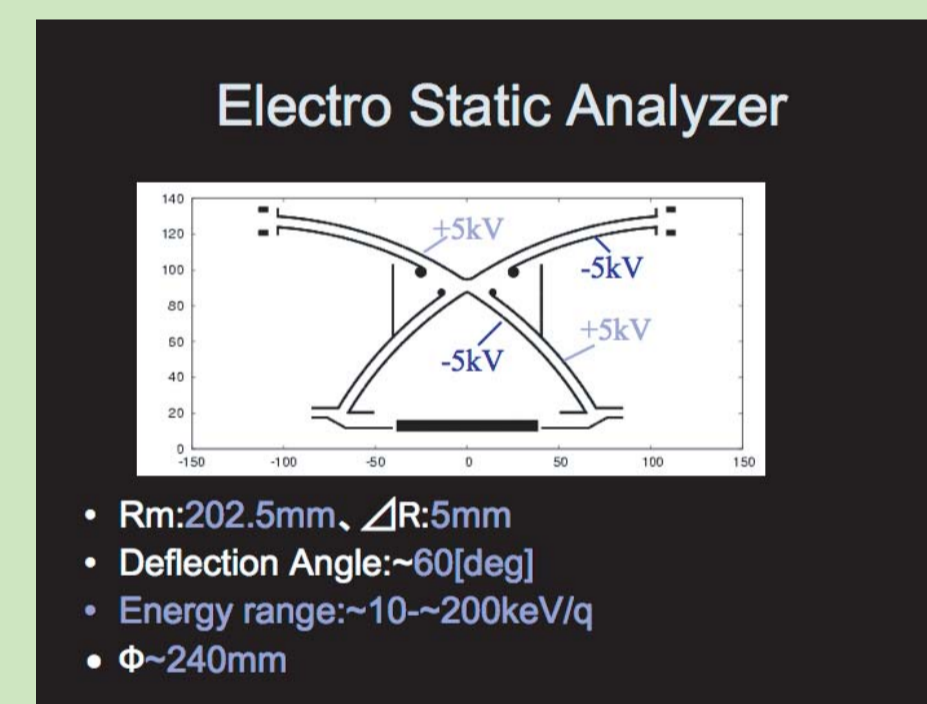
Medium energy range (~10keV - 200keV)



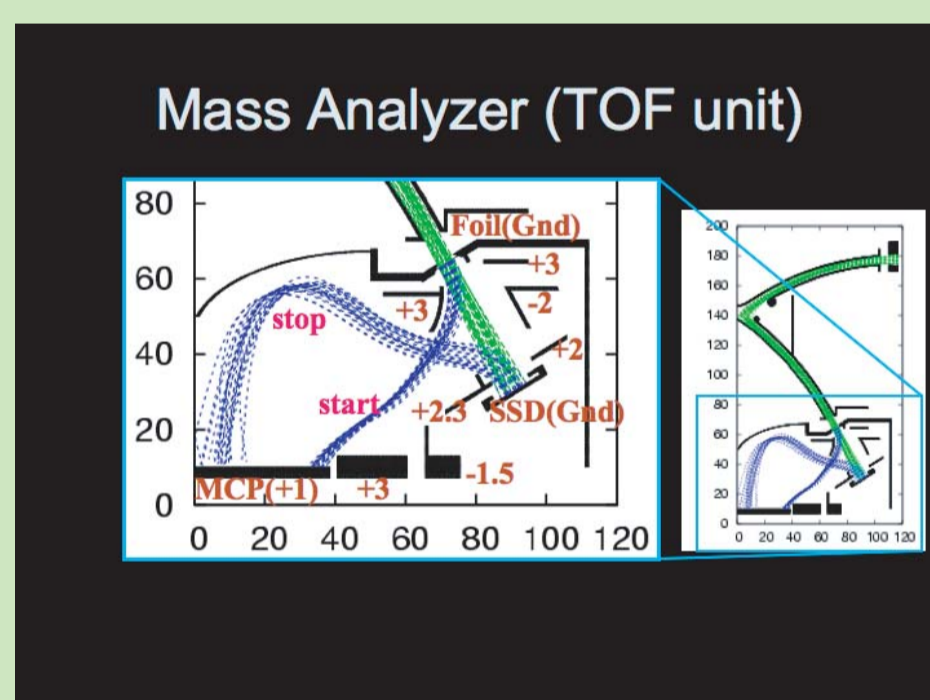
Analyzer principle



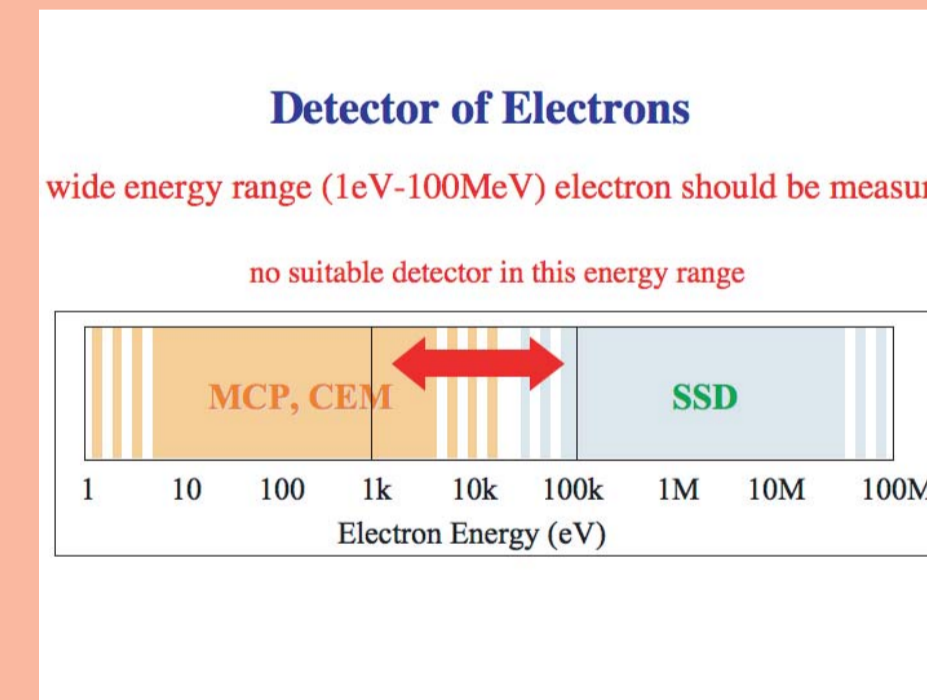
Particle trajectories inside the sensor



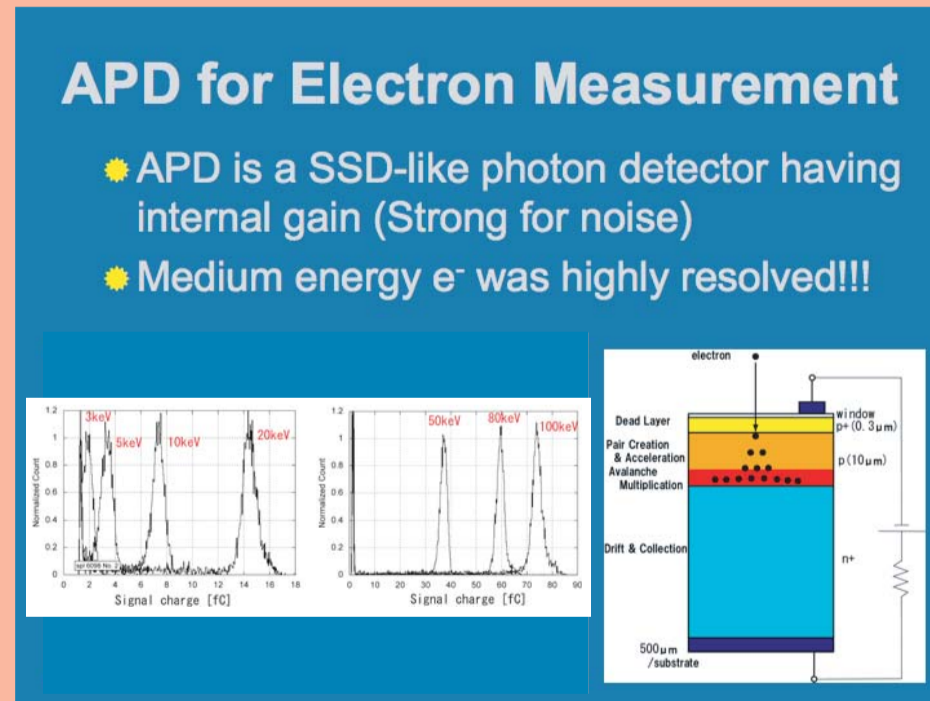
Electrostatic analyzer



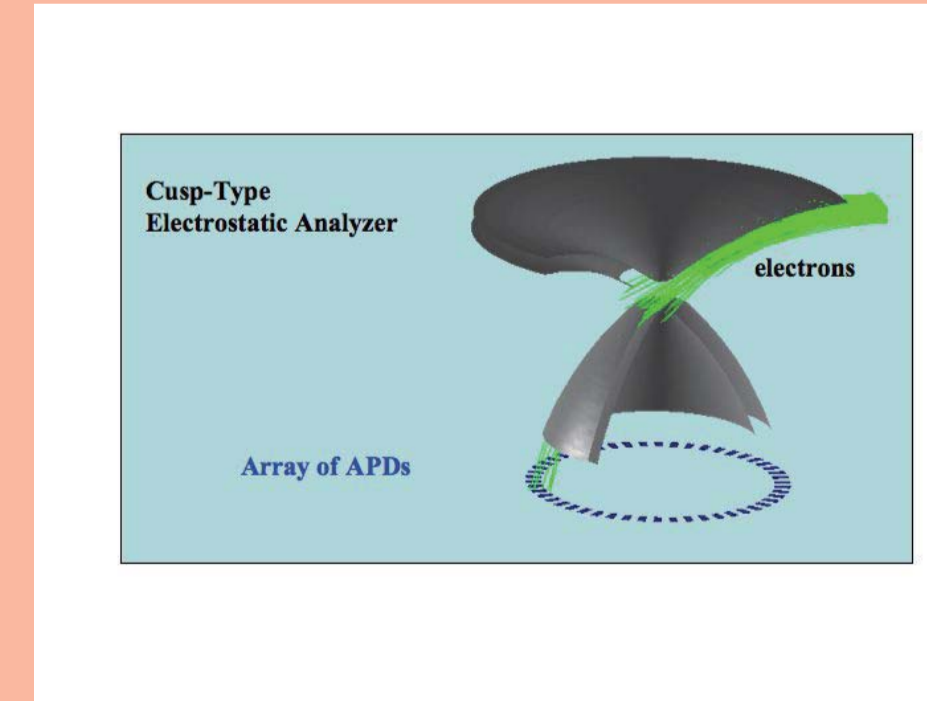
TOF part



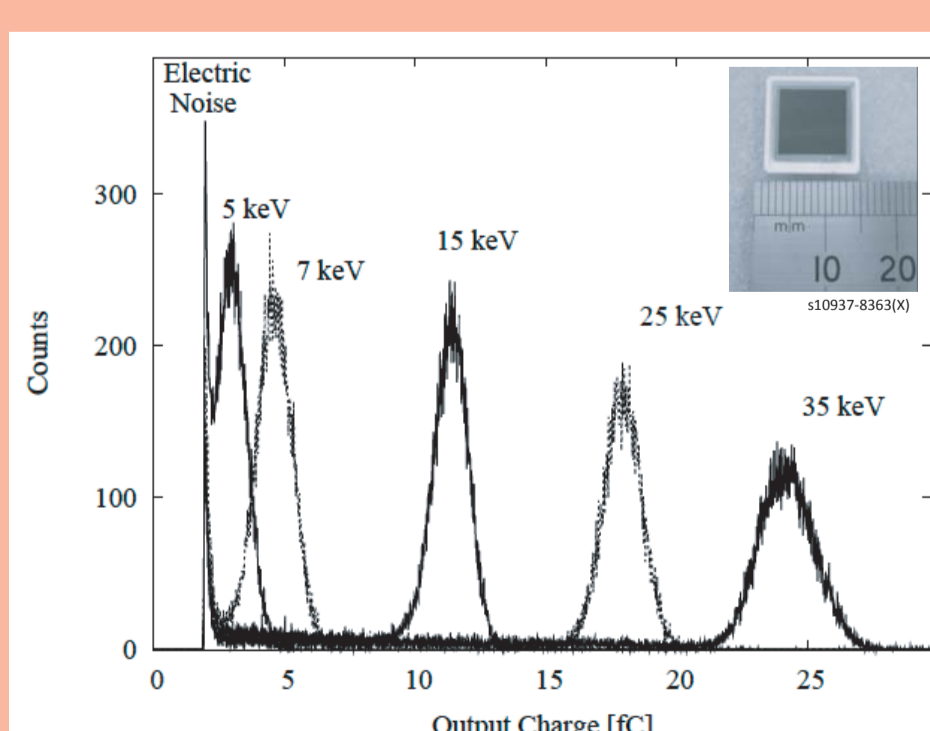
Appropriate detector is necessary



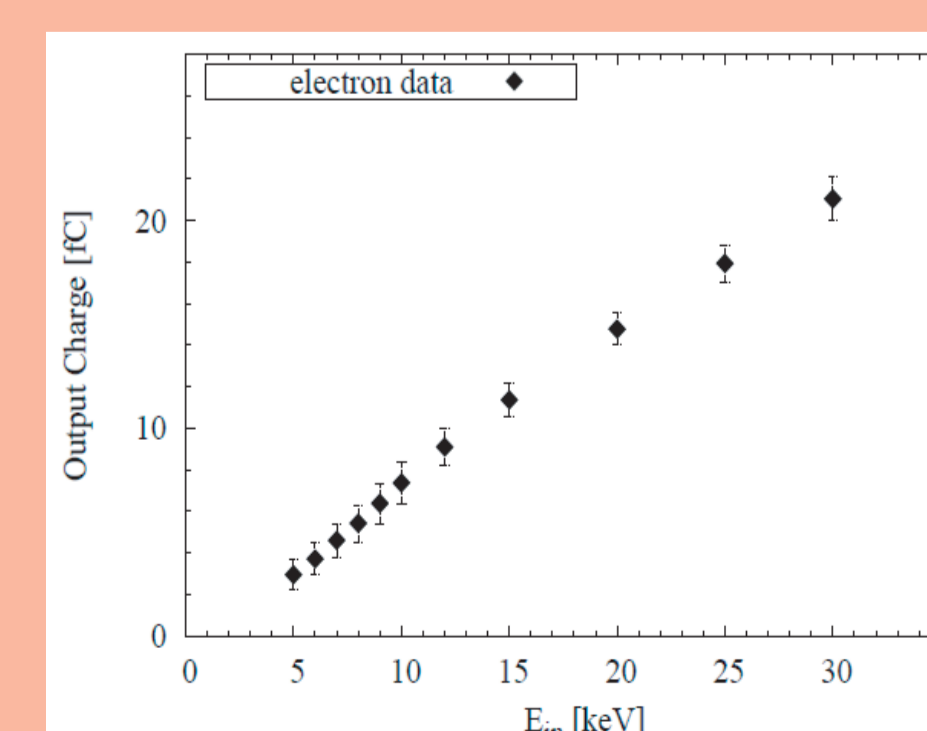
APD for medium-energy electrons



Electrostatic energy analyzer with APD
FOV of 360deg is available



Large area APD (10mm x 10mm)
Depletion layer thickness: 30μm



Large area APD (10mm x 10mm)
Energy resolution

Medium-energy electron sensor