Absolute Accuracy: 3% uncalibrated, 1% with single calibration

**Applications:**
- Study process variation (within-chip, chip-to-chip, run-to-run) of on-chip capacitors
- Measure on-chip calibration capacitors
- Measure interconnect parasitics

**Example:**

Array of 8 on-chip capacitors  
Nominal value: **0.959 pF**  
Measured value (ave. of 32 caps. on 4 chips): **0.963 pF**  
On-chip variation (one s): **0.10%**  
Chip-to-chip variation: **1.50%**
The left side of $C_{\text{unknown}}$ is alternately connected to $V_{\text{ref}}$ and ground at a frequency $f_{ck}$. The charging current $I_{\text{chg}}$ through M1 is measured.

- **Capacitance:** \[ C = \frac{I_{\text{chg}}}{(V_{\text{ref}} + V_\varepsilon) \cdot f_{ck}} \]

- **Error:** \[ \frac{\Delta C}{C} = \frac{V_\varepsilon}{V_{\text{ref}}} \approx \frac{V_{\text{DD}}}{V_{\text{ref}} G_A} ; \quad (G_A = \text{gain of comparator}) \]

- **Insensitive to:**
  - comparator offset voltage
  - parasitic capacitance
  - switch charge injection