TOTEM POSITION CONTROL
FIELD LEVEL

Xavier Pons & Sylvain Ravat on behalf of Totem
and PH/DT groups.

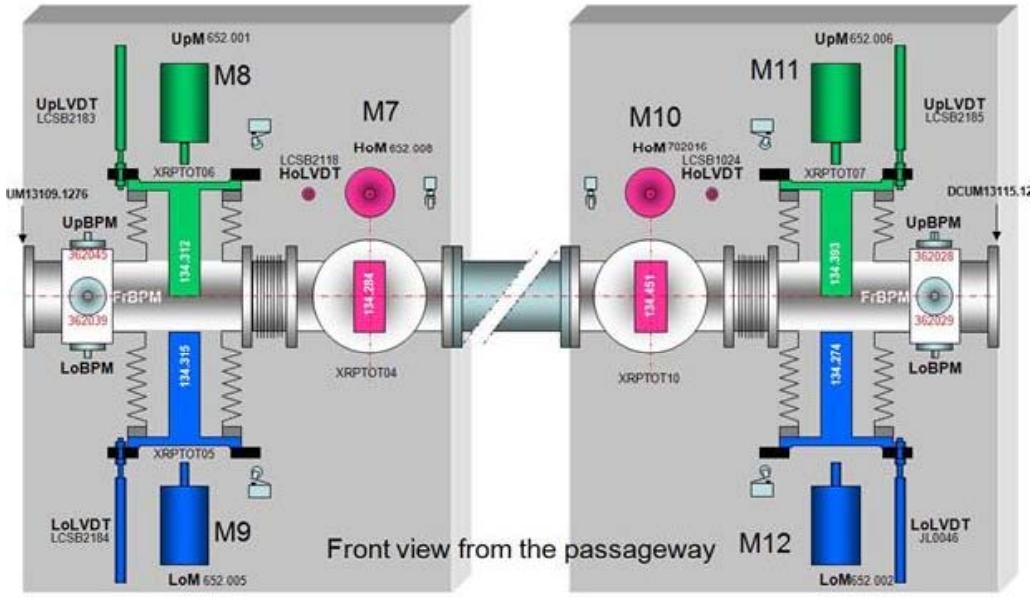
What to move?

A RP detector inside LHC beam pipe

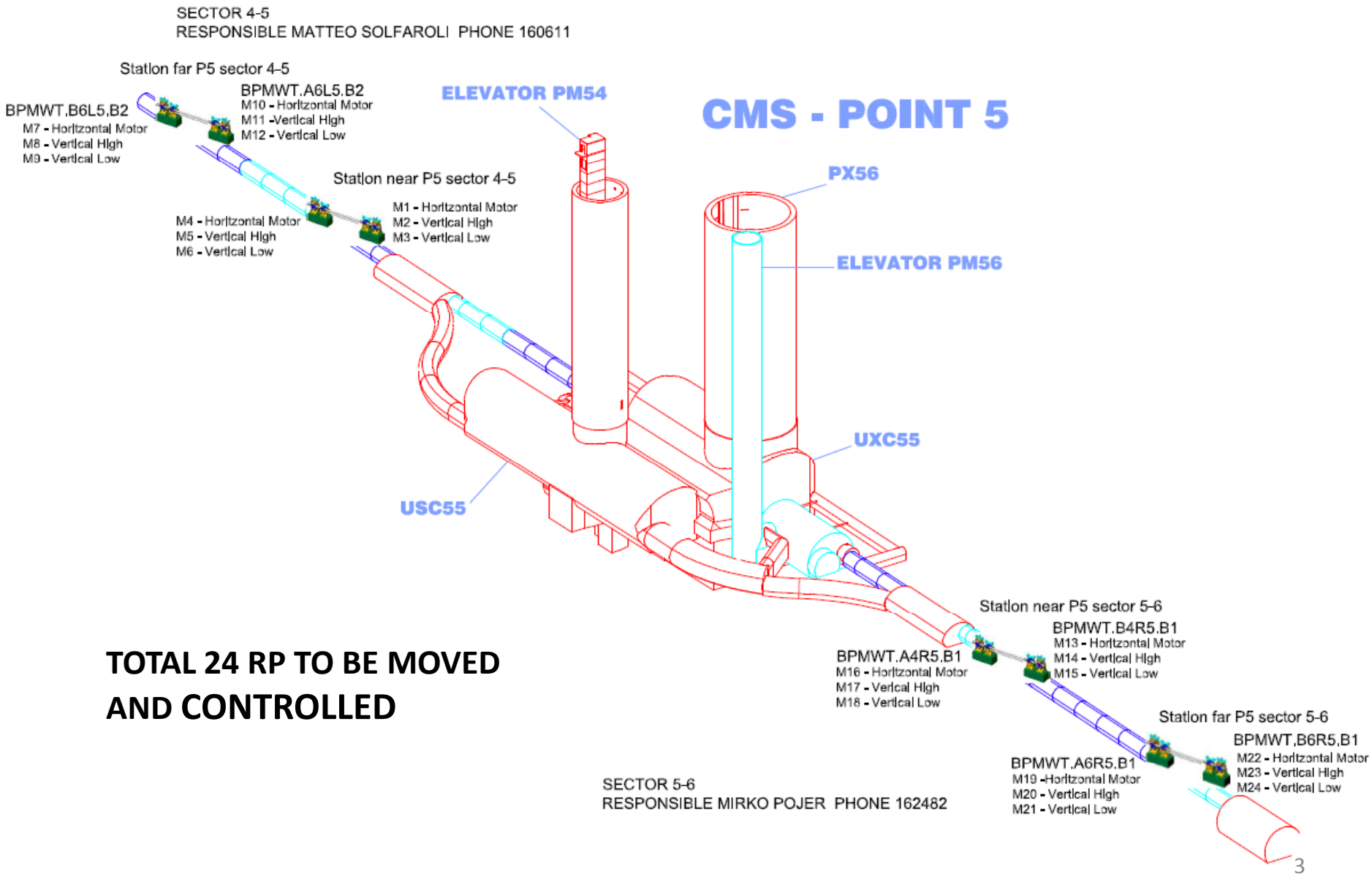
Totem Station (2 substations)
6 RP detectors

Totem sub-station configuration
3 Roman Pots

-Vertical High RP
-Vertical Low RP
-Horizontal RP



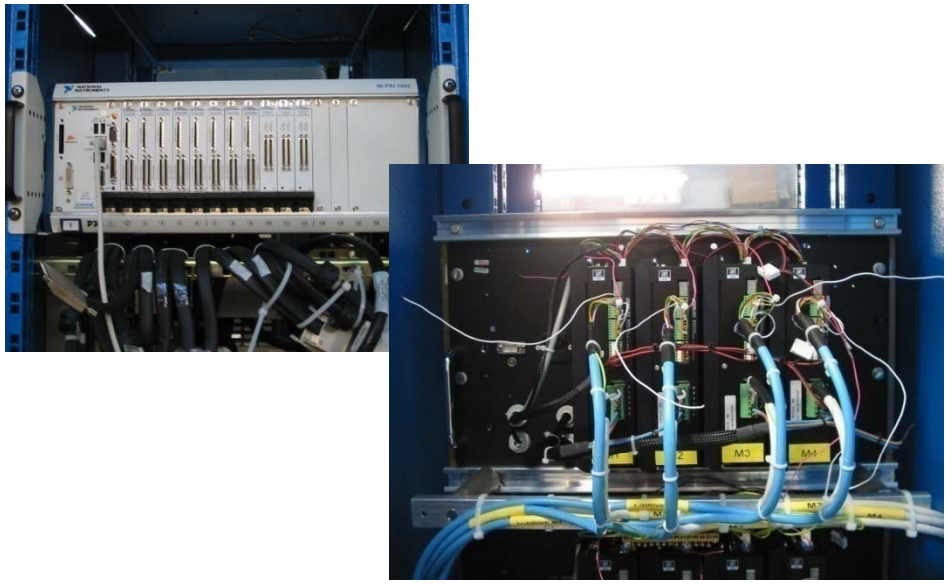
TOTEM P5 INTEGRATION OVERALL

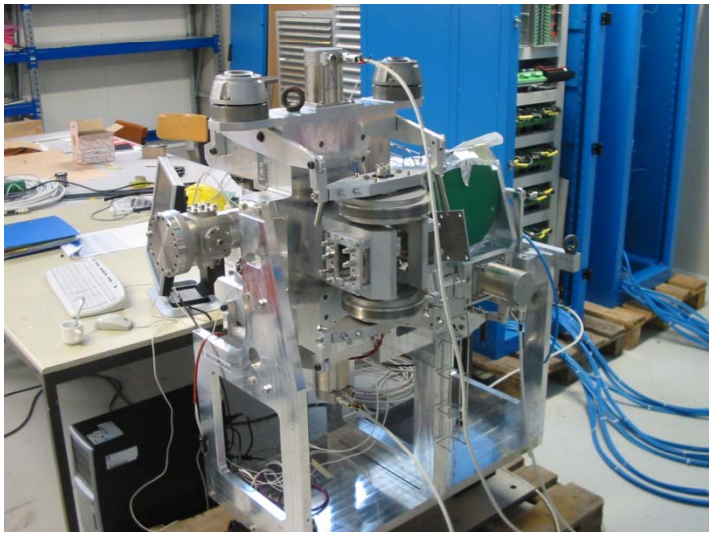


TOTAL 24 RP TO BE MOVED AND CONTROLLED

TOTEM POSITION HARDWARE

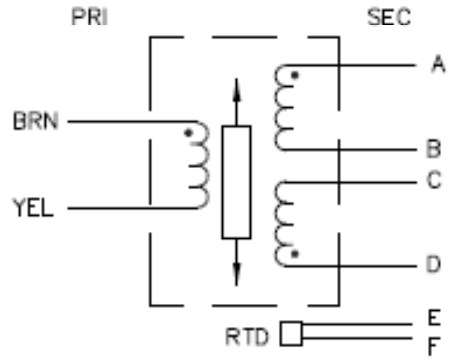
- Same Hardware as collimators
  - Same Motors and motor drives
  - Same LVDT's
  - Same Resolver
  - Same microswitches
  - Same NI PXI FPGA Real Time controller



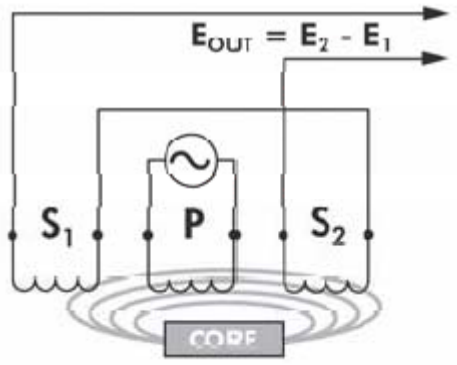


TOTEM POSITION CONTROL KEY DATA

- **400 motor steps = 1 revolution**
- **1 revolution = 2 mm displacement**
- **1 step = 5 µm (minimum resolution)**
- **Nominal speed 50 Hz = 50 steps/second = 0.250 mm/sec**
- **LVDT position acquisition 50 Hz = 50 read position /second.**
- **Each point = mean value of 1024 samples**
- **FPGA processing.**
- **Limit, Home and anti-collision electromechanical microswitches.**
- **Calibration with electrical stoppers**



WIRING SCHEMATIC



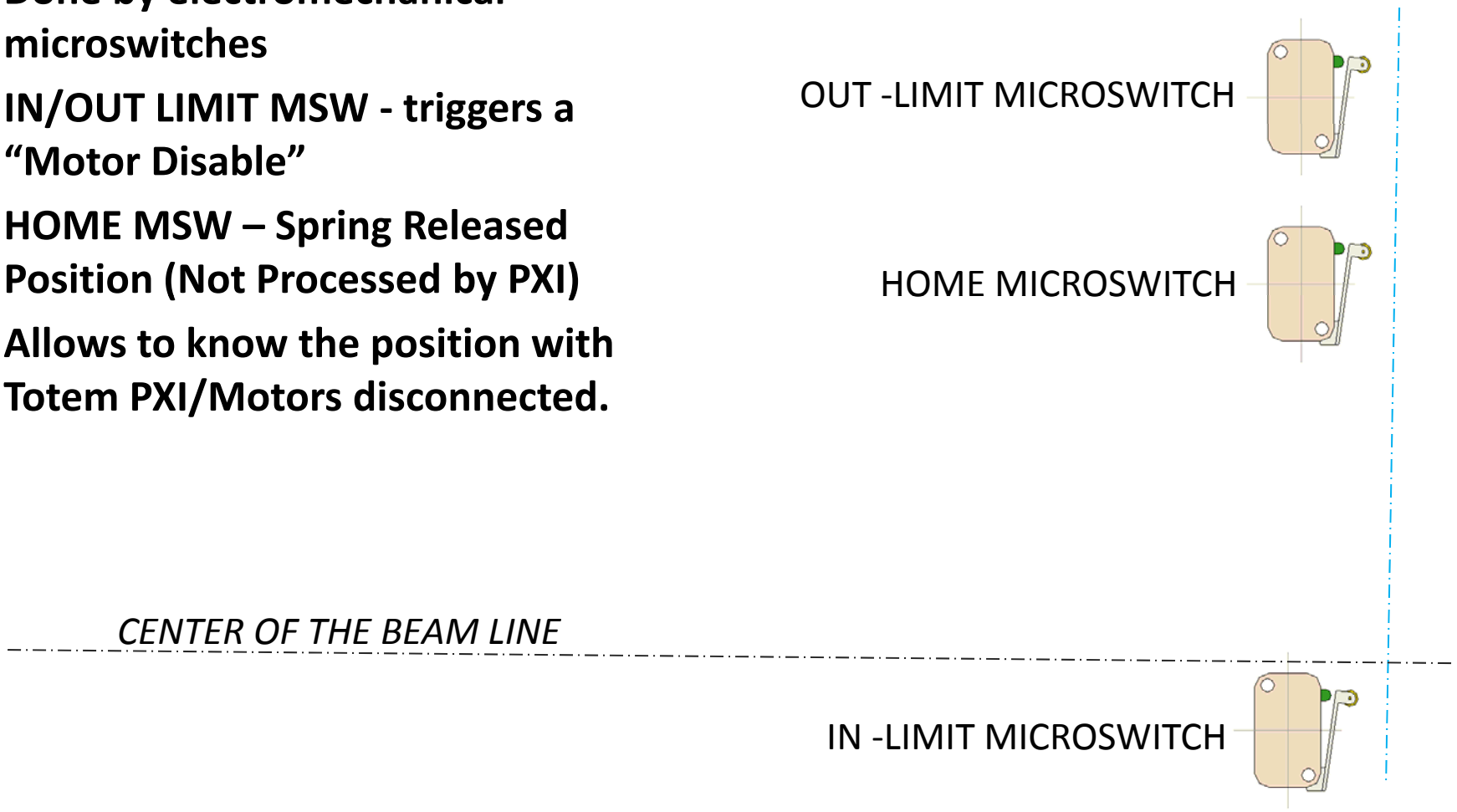
LVDT ratio calculation

$$R_{LVDT} = \frac{E2 - E1}{E2 + E1}$$

TOTEM POSITION SAFETY

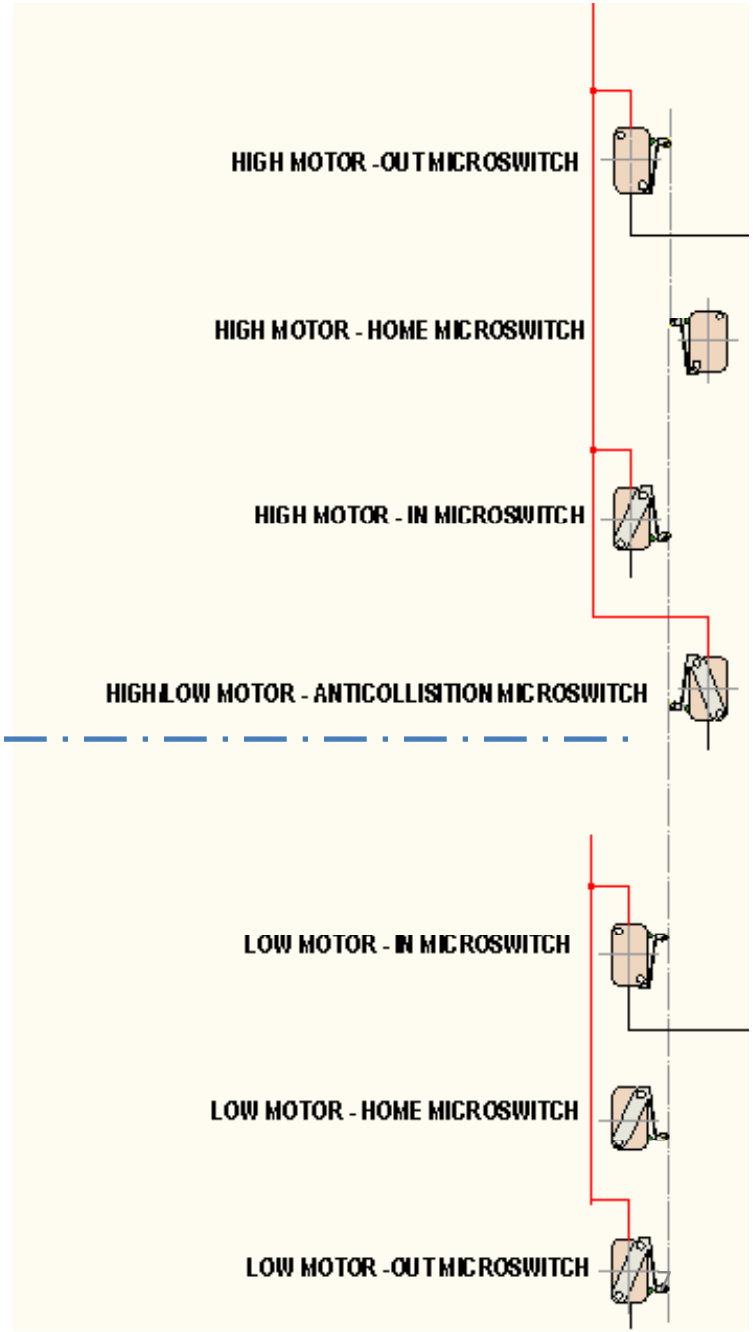
- **Done by electromechanical microswitches**
- **IN/OUT LIMIT MSW - triggers a "Motor Disable"**
- **HOME MSW – Spring Released Position (Not Processed by PXI)**

  Allows to know the position with Totem PXI/Motors disconnected.



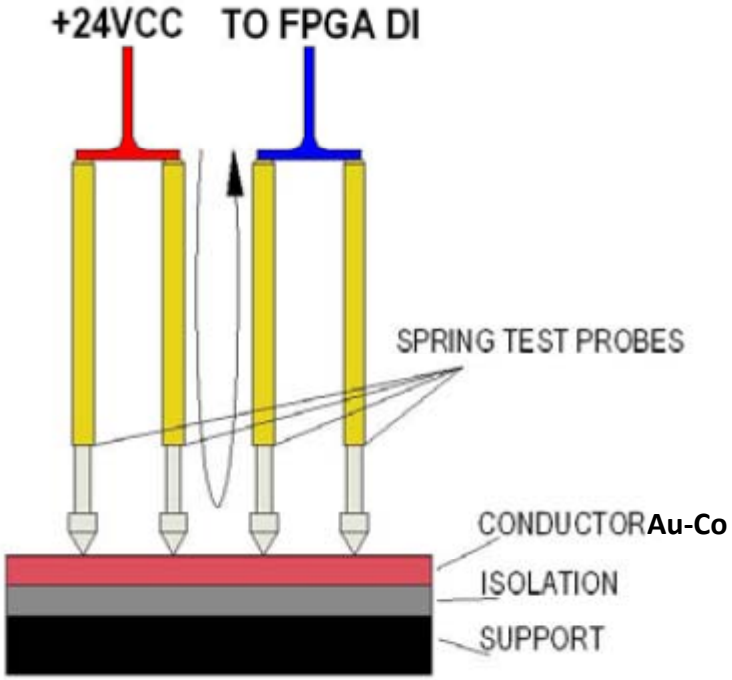
TOTEM POSITION SAFETY – VERTICAL ROMAN POTS

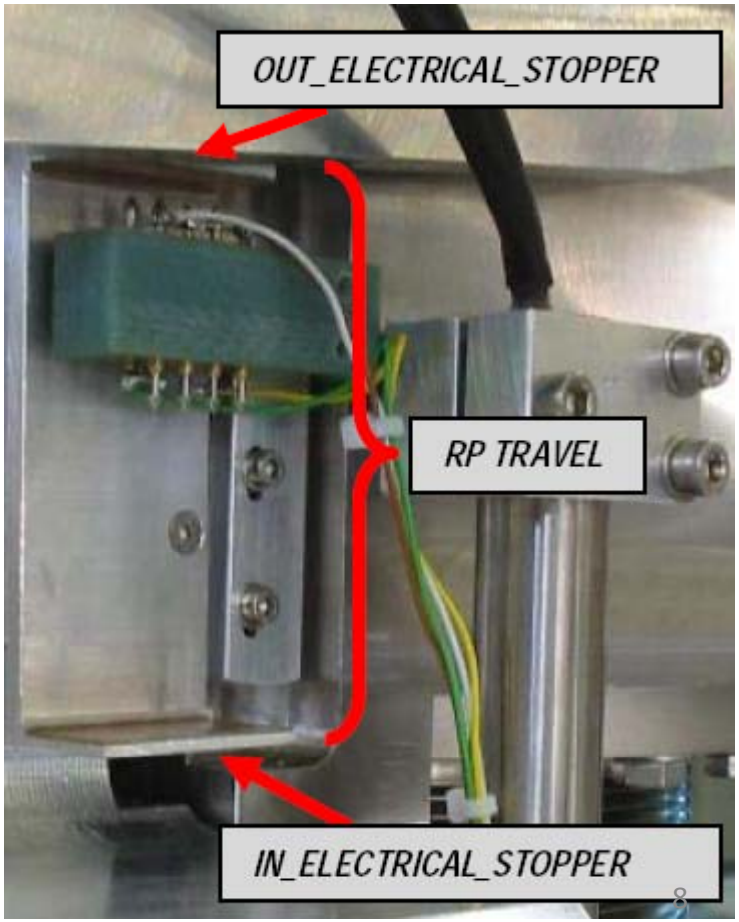
Microswitch to avoid the collision between vertical Roman Pots



TOTEM POSITION CALIBRATION

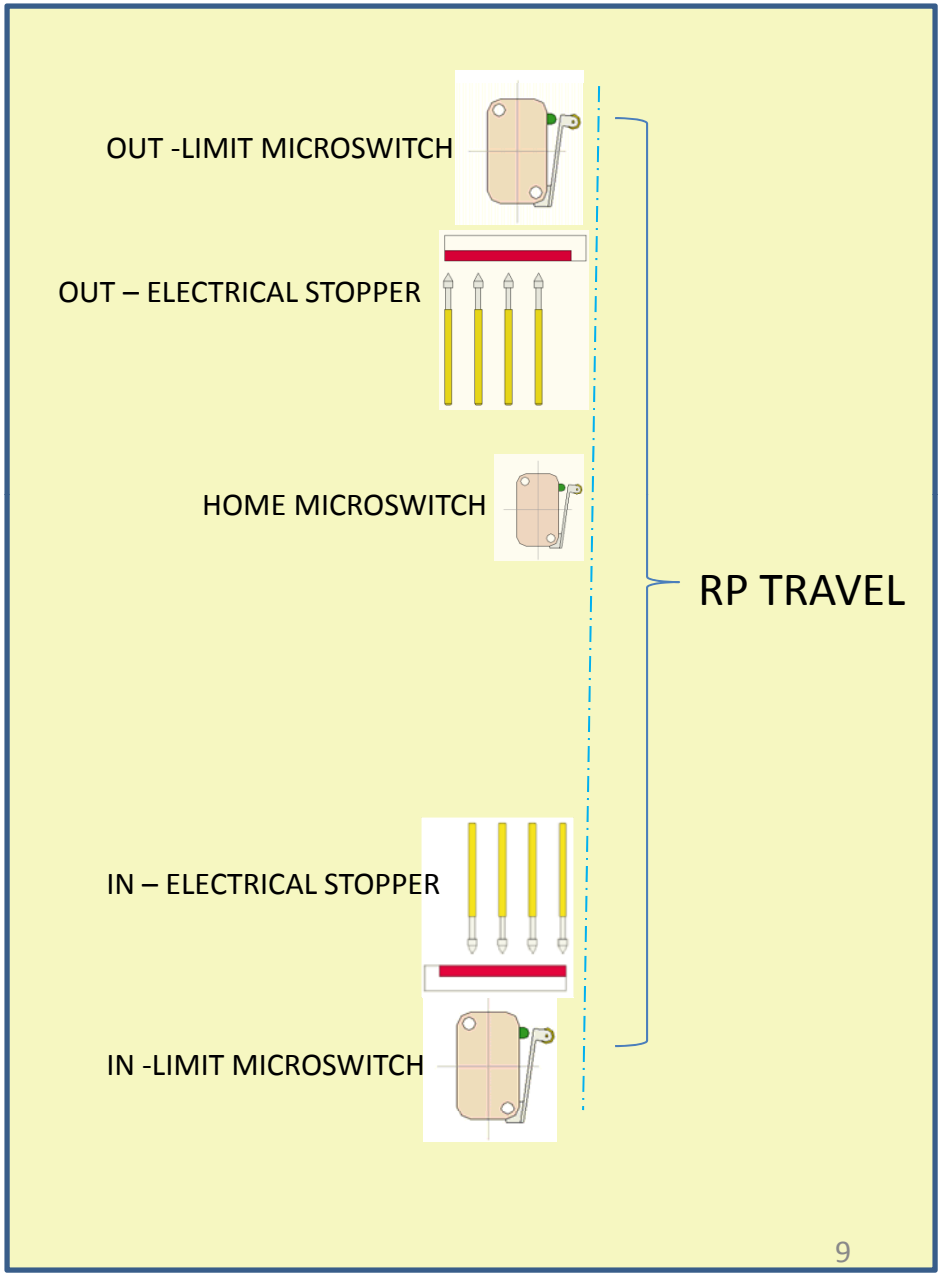
- By electrical stoppers connected to PXI FPGA DI
- Based on spring test probes
- Test on lab shows a repeatability better than 10µm



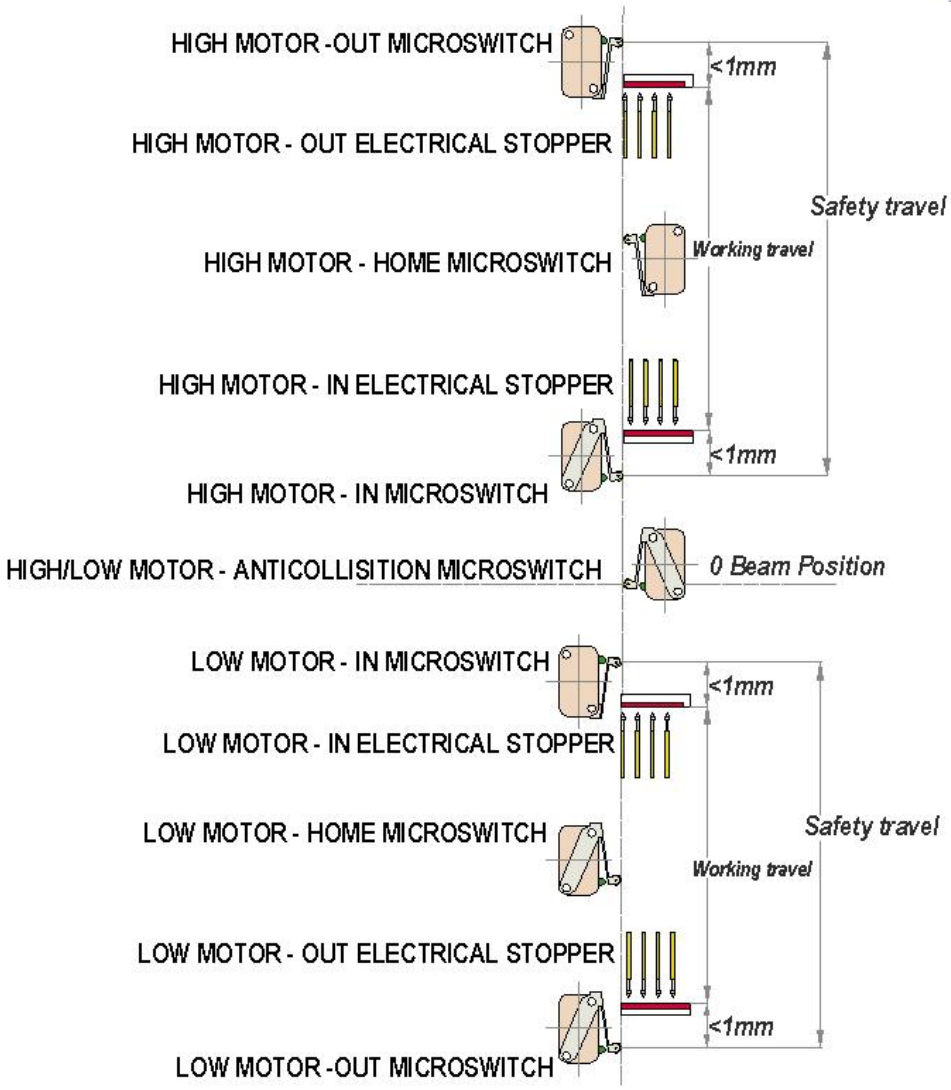


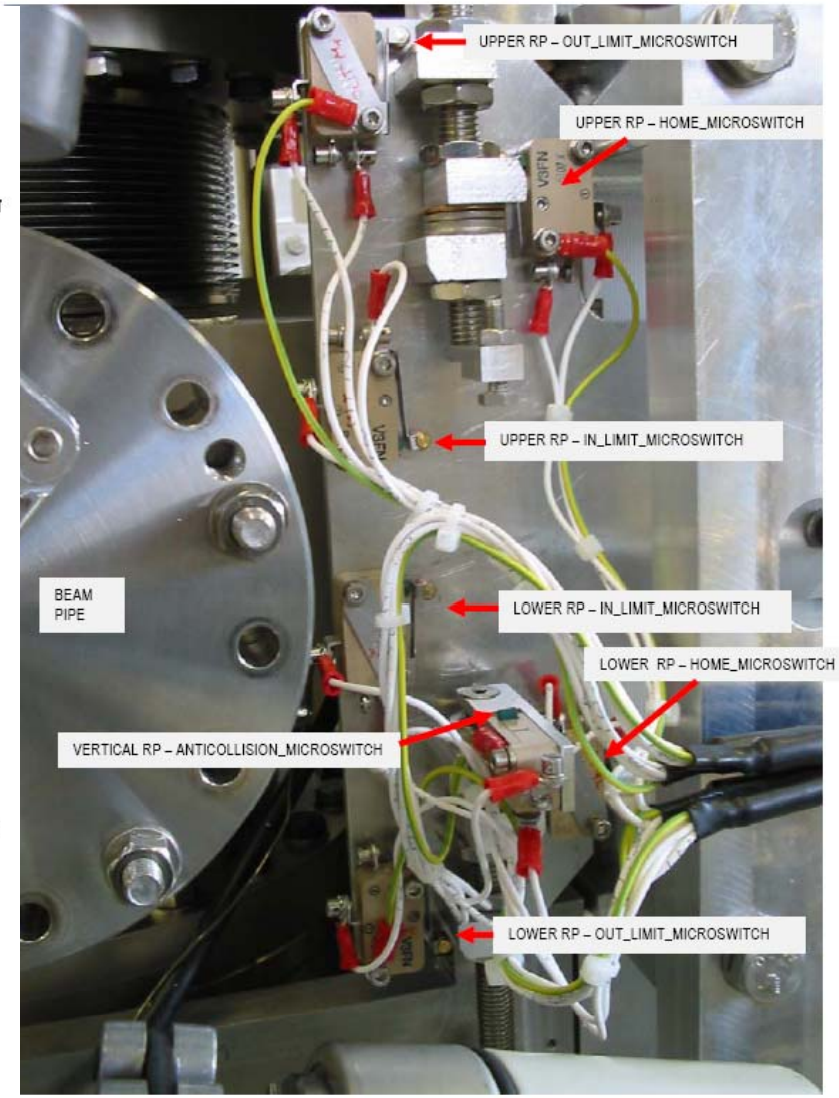
TOTEM POSITION CALIBRATION

- ELECTRICAL STOPPER INSTALLED BEFORE LIMIT MICROSWITCHES
- NO MSW OVERRIDE NEEDED DURING CALIBRATION OPERATION
- ELECTRICAL STOPPER HAVE A FUNCTION OF LIMIT MICROSWITCH TOO
- ELECTROMECHANICAL MICROSWITCHES INSTALLED 1 mm AFTER ELECTRICAL STOPPER



TOTEM – MICROSWITCHES PLATE ASSEMBLY





LVDT RATIO & RP POSITION – M23