The Ultra-High Energy Cosmic Ray Spectrum Measured by the Telescope Array's Middle Drum Detector

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for the Telescope Array Experiment
ISVHECRI Highlight Poster
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Telescope Array

- Surface Detector Array
  - 1.2 km spacing
- Fluorescence Detectors
  - Black Rock Mesa
  - Long Ridge
  - Middle Drum
Middle Drum

• 14 telescopes refurbished from HiRes
• Arranged to view
  – 3-31° in elevation
  – ~120° in azimuth
• Sample-and-hold electronics
Goals

- Determine the energy scale between TAMD and HiRes
- Lay the groundwork for the energy scale of Telescope Array
Middle Drum 1-Year On-time

• Middle Drum integrated “mirror-hours”:
• All Weather: 11692 = ~835 hours (~60% of available)
• Good Weather: 10552 = ~754 hours (~90% of collected)
• ~9% duty cycle
Exposure Difference

- High energy aperture ($>10^{19}$ eV) $\approx 1/2$ HiRes-1
- One year of running $\approx 1/5$ of HiRes-1 on-time
- TAMD has $\sim 1/10$ the exposure of HiRes-1
- AGASA exposure $\approx 1/4$ HiRes-1
TAMD Compared to HiRes

Shown at 2009 ICRC
$\Delta R_P / R_P$

- **<18.0**
  - 15%

- **18.0-18.5**
  - 12%

- **18.5-19.0**
  - 8%

- **>19.0**
  - 7%

**Monocular**
ΔΨ

<18.0

14°

18.0-18.5

18.5-19.0

5°

>19.0

4°

8°

Monocular
\[ \Delta E/E \]

- Monocular

**18.0-18.5**

- 10%<
- 15%-
- 20%

**18.5-19.0**

- 15%

**19.0-21.0**

- 15%

Entries, \( \chi^2/\text{ndf} \), Constant, Mean, Sigma values are presented for each energy range.
\( R_p \)

- **<18.0**
- **18.0-18.5**
- **18.5-19.0**
- **>19.0**

Black = Data

Red = MC
\( \theta \)

\(< 18.0 \)

\( 18.0-18.5 \)

\( 18.5-19.0 \)

\( > 19.0 \)

Black = Data

Red = MC