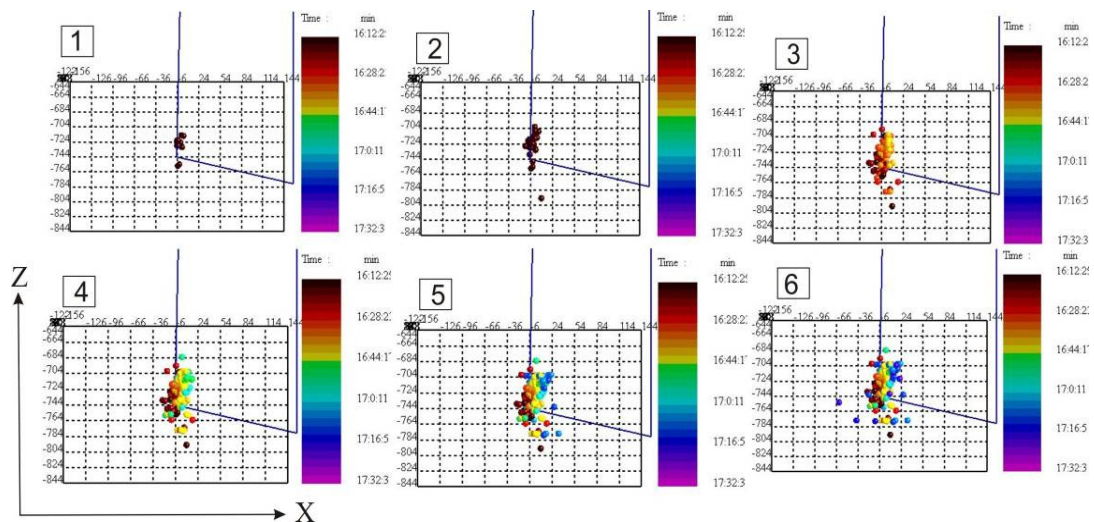




increase the monitoring perspective. When adding three-component microseismic geophones in the well, this may be able to greatly improve source positioning accuracy in the vertical direction.

The S wave in the well, combined with the ground P wave data, and the similarity between the frequency characteristics, the amplitude feature and the phase feature have been used. The frequency of the P-wave (bandwidth 20-50 Hz) on the ground is relatively high compared to its S-wave, and the frequency of the S-wave (bandwidth 30-100 Hz) in the well is relatively low compared to its P-wave. After proper filtering, the energy characteristics of the well S-wave data and the ground P-wave data are similar. According to the normalized feature, the stack energy of the S-wave in the well and the ground P-wave are not deformed. In this way we can locate the position of the microseismic source.

During the twelfth five-year-plan, 11 wells combined with ground MFM have been completed in Shanxi Province. Figure 2. shows the 4-D display of the combined MFM method.



**Figure 2.** Fracture monitoring side view (Z-X). Serial number indicates development at a time scale. Vertical axis Z: refers to the up, up positive; horizontal axis Y: refers to the East, right positive; The color of the ball indicates different time.

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#### References

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