

**THE DEVELOPMENT OF A DIGITIZED SMART SYSTEM FOR MONITORING PHYSICAL VULNERABILITY AND FREE-FIELD SOIL MOTIONS IN SUPPORT OF COMMUNITY RESILIENCE**

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**GENERAL PRESENTATION**

The digitized intelligent system contributes to the fulfillment of the national strategic objective of reducing the seismic risk of the built stock in Romania, viewed in the wider European and international context of reducing the consequences of natural disasters. Since the destructive earthquakes of Vrancea occur at intervals of decades, the major challenge for the entire field of seismic engineering is to obtain seismic data with a high degree of accuracy, in order to improve the seismic design code. This system will also cover critical areas with surface/crustal earthquakes in Transylvania, Banat, Crişana, Făgăraş and Dobrogea.

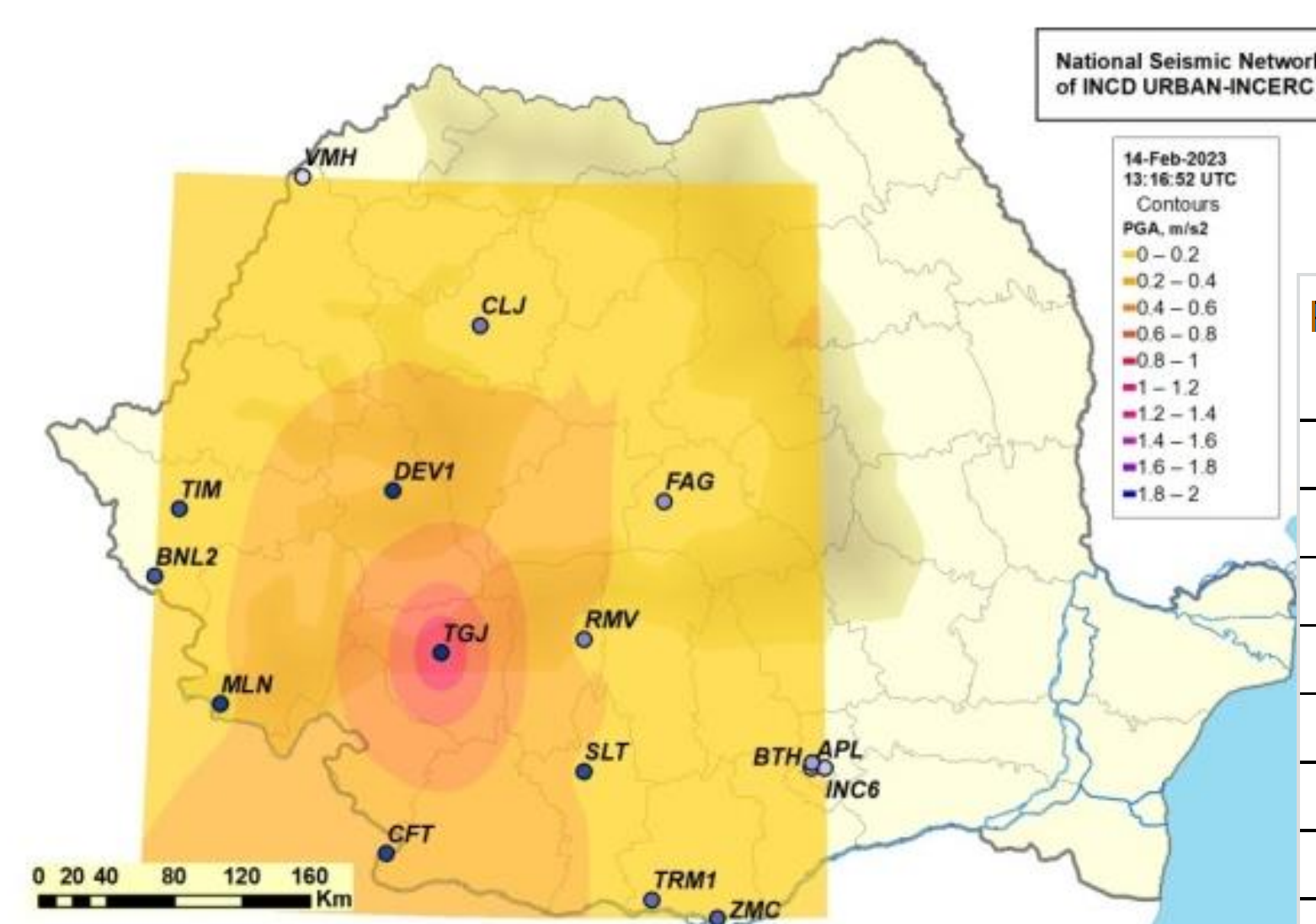
**RESEARCH**

The integrative digital concept of recording, transmission, processing and analysis of data resulting from seismic monitoring of the territory and buildings is supported by:

- the integration of the valuable elements of a special infrastructure, distributed throughout the country, the seismic network of RNMPSPC (URBAN-INCERC) and the existing data and information at its level;
- the use of ultra-modern software and hardware tools;
- creation of scientific and experimental databases with data recorded on seismically monitored buildings;
- the alignment and integration of experimental and research components in the European and international circuit, both at the level of membership of consortia and international organizations (European Plate Observing System, International Seismological Centre).

**RESULTS OF THE SEISMIC MONITORING**

Using broadband sensors/triaxial accelerometers, from internationally experienced firms, some mathematical tools such as transfer functions, fast Fourier transform, frequency domain decomposition, operational modal analysis, etc., the significant parameters obtained from the processing of the obtained instrumental records are relative level displacement/drift, natural vibration frequencies and vibration shapes, as well as other translational and torsional modal parameters.



Peak ground accelerations recorded during the Gorj earthquake of February 14, 2023 (GIS mapping)

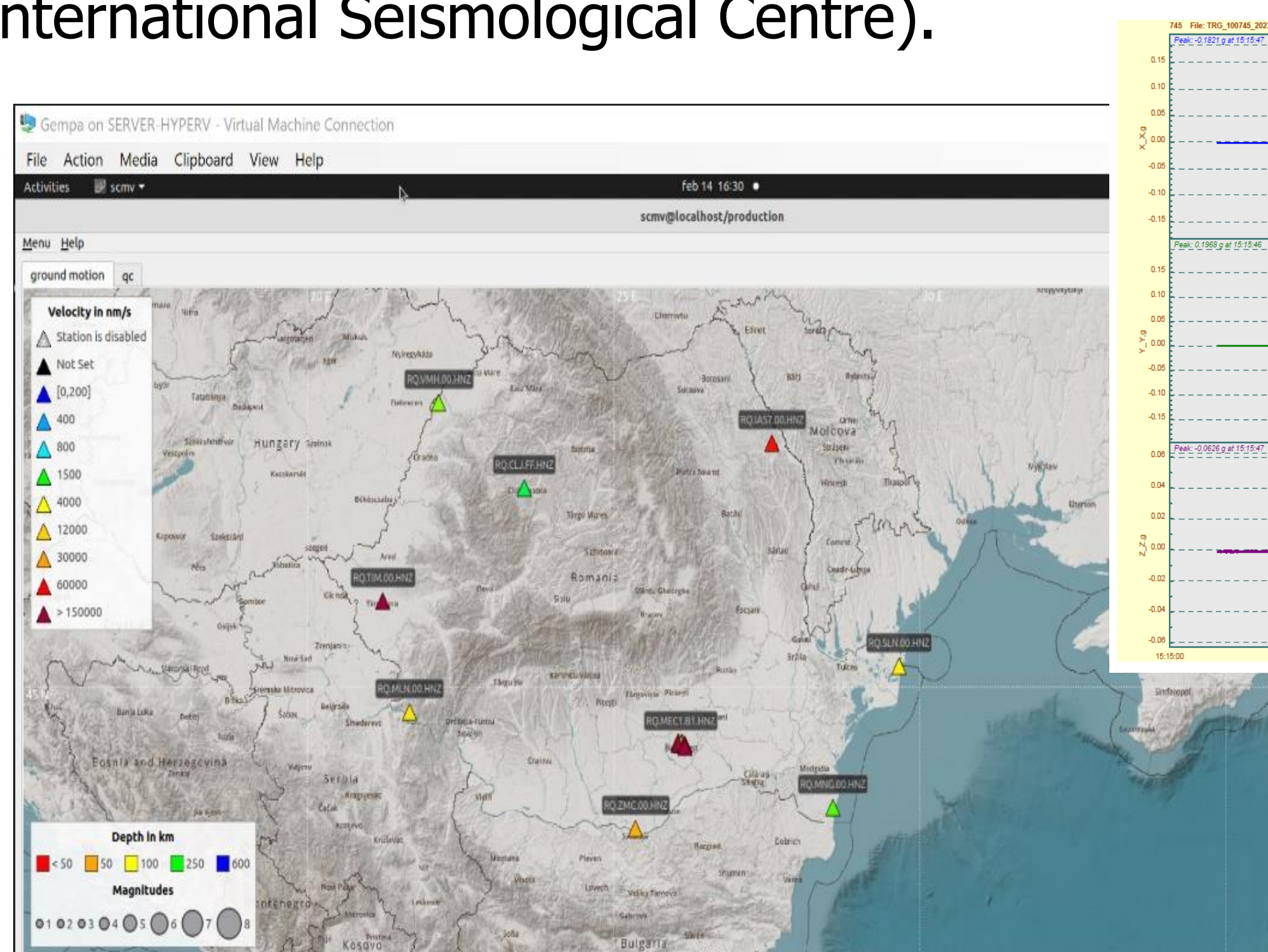
**Crustal earthquakes in northern Oltenia and near Arad, 2023**

Focal depth [km]	Magnitude $M_L$
23.1	5.2
6.3	5.7
12	4.2
12.6	4.2
8.7	4.3
13.2	4
14.7	5
14	4.2

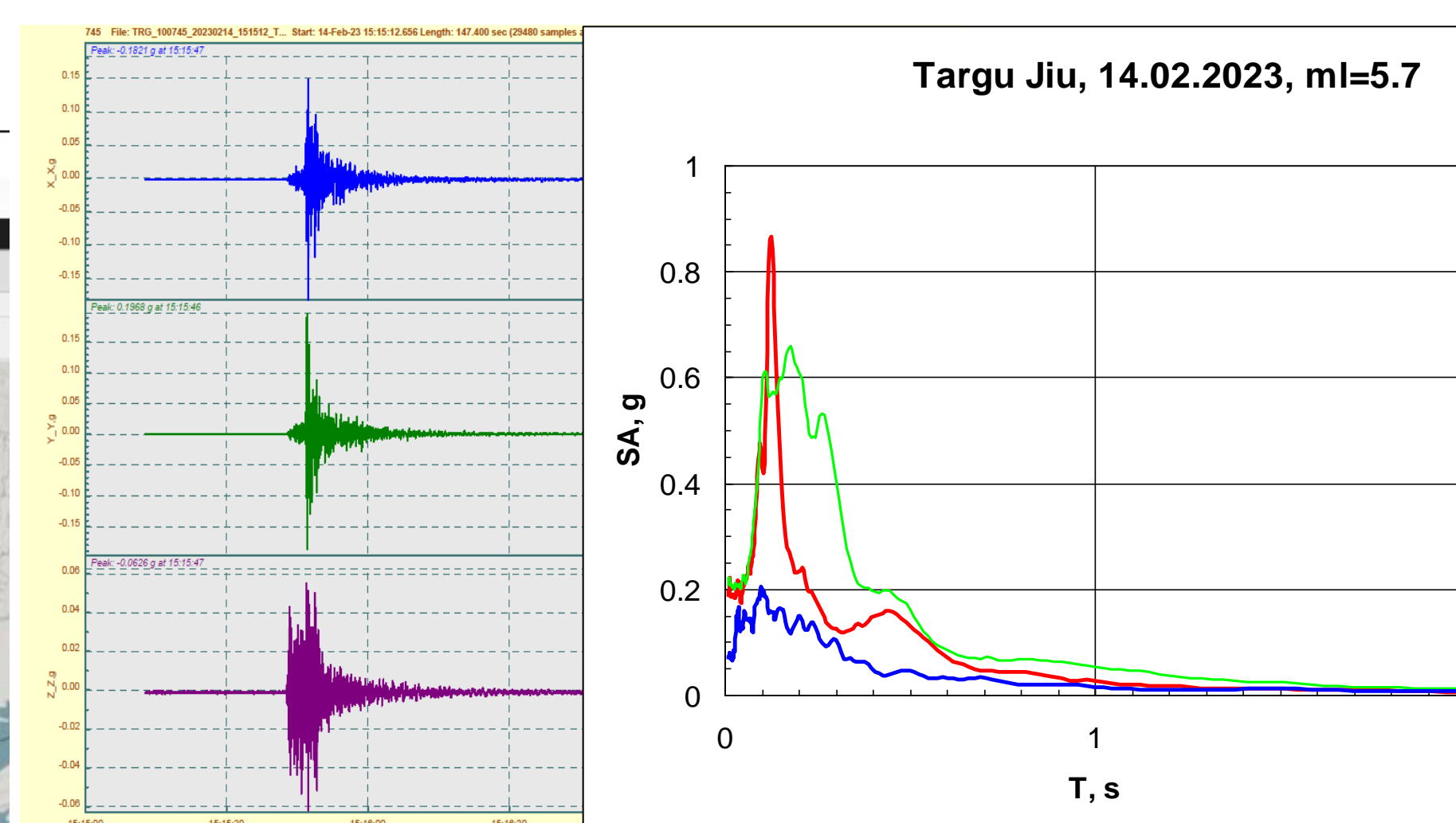
Crustal earthquakes with  $M_L \geq 4$  produced in Oltenia, Gorj (period 13.02-19.06.2023), respectively in the Banat - Arad area (period 22.05-06.06.2023), recorded in the INCD URBAN-INCERC National Monitoring Network

**Subcrustal earthquakes, with the epicenter in Vrancea, 2023**

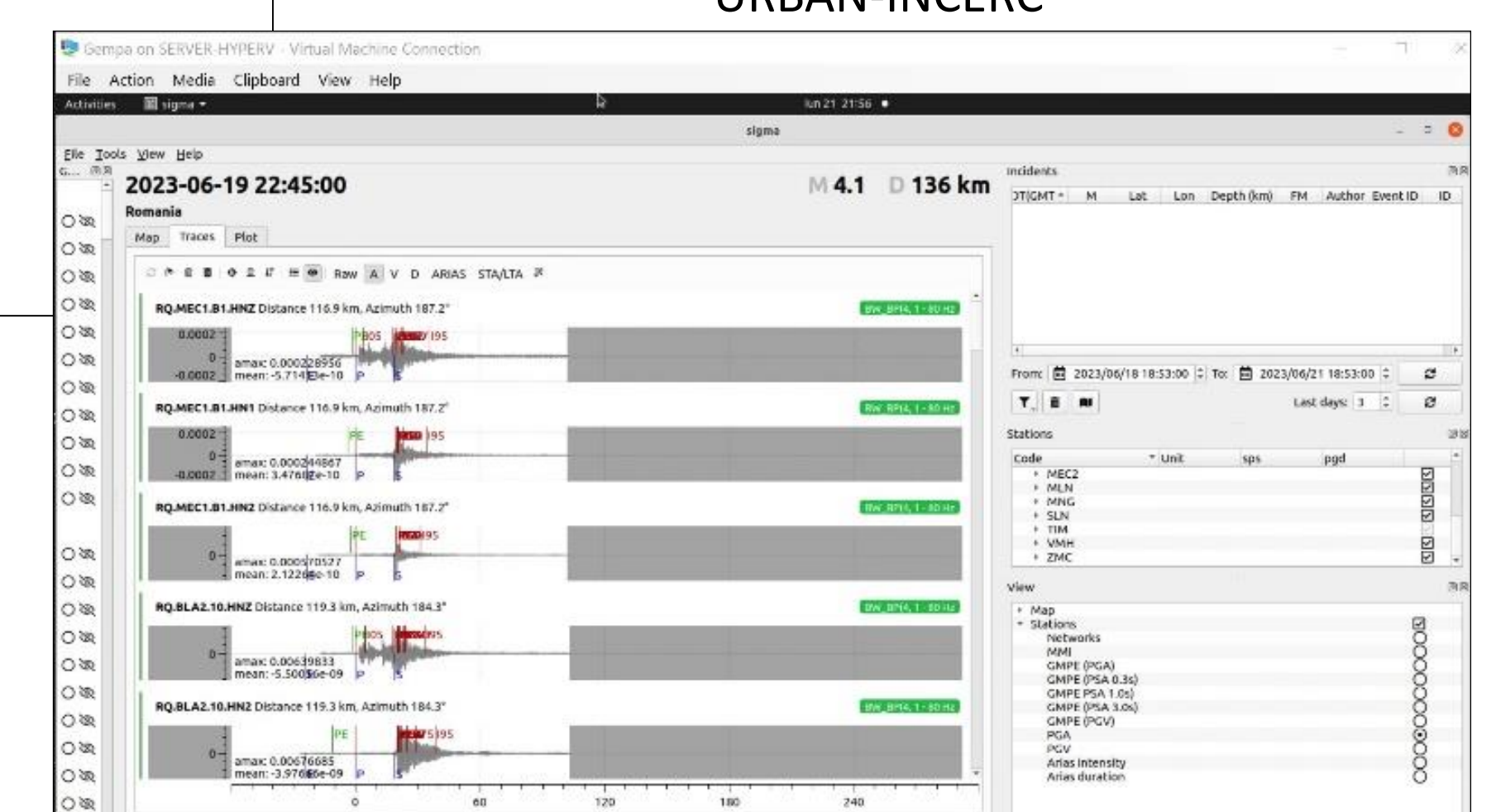
Earthquake in Vrancea, 19.06.2023, recorded on buildings seismically instrumented by INCD URBAN-INCERC



RNMPSPC - INCD URBAN-INCERC stations from the SeisComP system



Spectra of the accelerogram recorded at the Târgu Jiu station from the INCD URBAN INCERC network during the ml=5.7 magnitude earthquake of 14.02.2023



**Earthquakes produced outside the borders of Romania, recorded by the seismic network equipment of INCD URBAN-INCERC:** in southwest Ukraine- $M_L=3.8$ ,  $h=10.9$  km; in Bulgaria- $M_L=5.3$ ,  $h=10$ km; in France- $M_L=4.8$ ,  $h=5$  km; in Serbia- $M_L=4.4$ ,  $h=5$  km; in the Black-Sea, near Crimea- $M_L=5.0$ ,  $h=10$  km etc.

**CONCLUSIONS**

The main research objectives are the development of an integrative digital system of recording, transmission, processing and analysis of data resulting from seismic monitoring of the territory and buildings and the generating a database with free access, established in accordance with the best practice models of similar European infrastructures. In the future, the seismic monitoring system, recently implemented at INCD URBAN-INCERC, could also play an essential role in earthquake early warning (EEW).

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