

## ***ANALYTIC CENTER***

Analytic Center (AC), SP ZAO IVS (NPO RIVS) is a multitasking, creative team that provide research and development works, design engineering, consulting and engineering audit of mining and processing complexes in the field of representative sampling and reliable analytical control.

Main target function of AC is to provide R&D in the field of state-of-the-art automatic sampling and analytical control solutions for research and chemical laboratories and engineering of systems as a part of APCS of the mining and processing operations. There are five specialty sectors within AC including Methodological and Mathematical Studies, Engineering, System Engineering, Software Engineering and Engineering Support. Analytic Center has three laboratories: Research, Testing and Demonstration Laboratory equipped with advanced equipment. In AC there are highly skilled professionals having many years' experience of successful solutions and young specialists in the field of physics, chemistry and mathematics skillful in design, design engineering and software engineering.

### ***ASAK-RIVS automatic system of analytical control***

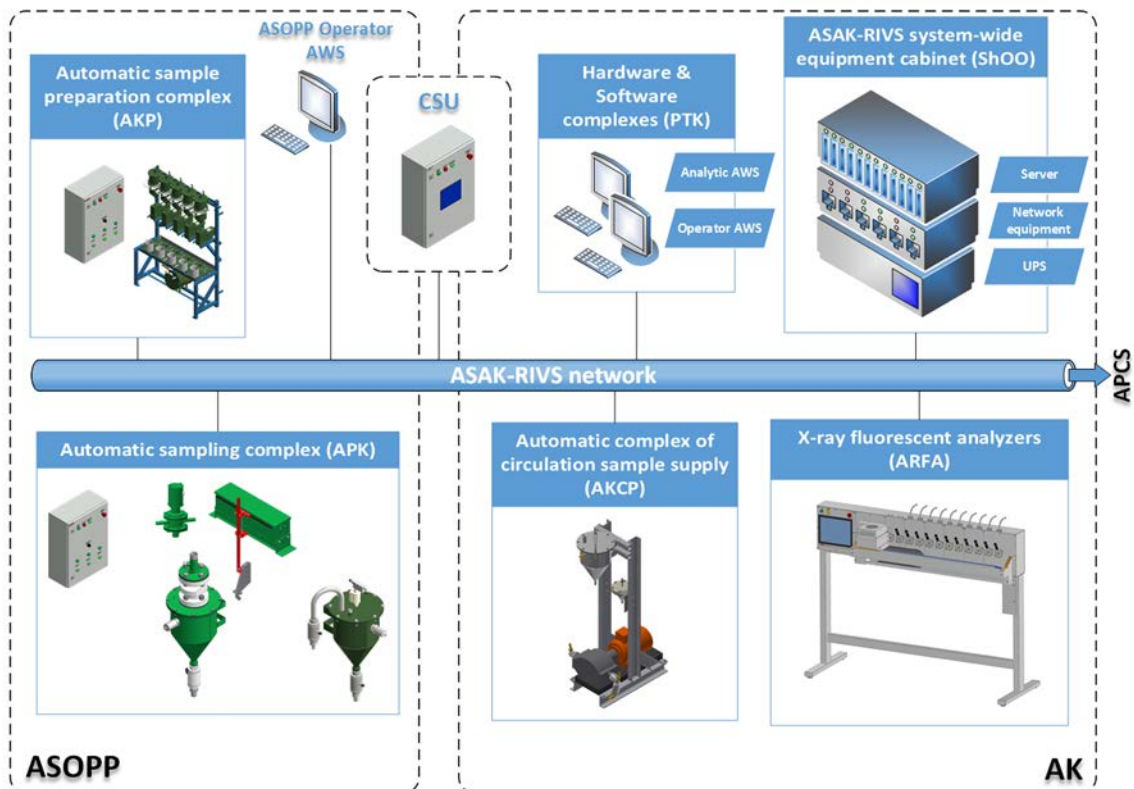
Immediate assay and rapid analytical control are the crucial operations of mining and processing complexes that are necessary to monitor and control technological processes efficiently. For this purpose, closed-proprietary ASAK-RIVS system has been developed in AC as a basis of X-ray spectral express laboratories (RSEL) at mining and processing complexes.

Large-scale ASAK and RSEL provide efficient solutions to the following main challenges at operating mining and processing complexes:

- ore quality control for mining exploration, expeditious reserves estimate and ore mining processes control for the following processing in averaging mode or by technological ore grades;
- mineral processing control aiming at decreasing of metal loss with final tailings, higher quality of commercial concentrates, reduction of energy, chemicals and material consumption by immediate, in particular, automatic process control;
- feasibility study including current circuit inventory and commodity balance based on data on commercial components in ROM ore, middlings, concentrates and tailings;
- commercial concentrate quality control for estimation of its grade and formation of consignment for shipping;
- control of samples to improve mining and ore processing methods.

ASAK-RIVS system, developed by Analytic Center from scratch within the several years, integrates the most advanced solutions in the field of automatic assay and express analytical control and many years of experience of the key developers of the system. ASAK-RIVS has no rivals within the domestic market, being outdated in terms of technology, and has a number of fundamental advantages against the worlds known systems.

## **ASAK RIVS = ASOPP + AK**



### ***ASAK-RIVS structure in general***

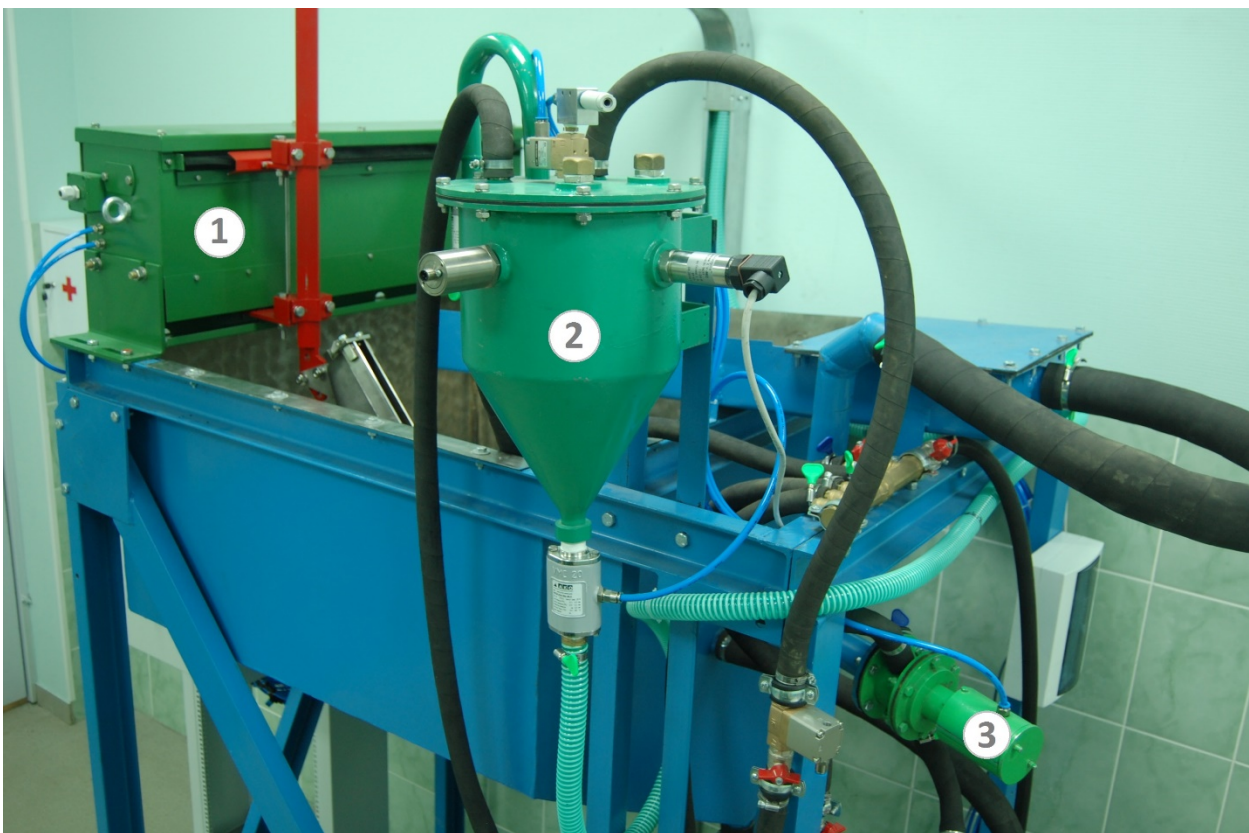
ASAK-RIVS system comprises of two subsystems: automatic system of slurry sampling (ASOPP) and analytical complex (AK). ASOPP task is automated sampling and accumulation of representative slurry samples of process products under control, its pneumatic delivery to RSEL and conditioning before elemental analysis both express slurry and power methods used. AK task is an X-ray fluorescent analysis of samples, measurement processing and reliable data output on element contents in control points of the process to any consumer.

### ***Automatic system of slurry sampling***

ASOPP is a complicated system distributed to all processing stages of the mining and processing complex. It consists of independent automatic units of two types. First type is automatic sampling

complex (APK) that selects one-time samples of controllable products, accumulates integrated (total) sample and delivers it by pneumatic transport system to preparation site for further analysis. Second type is automatic sample preparation complex (AKP) for receipt, deaeration, representational compression and vacuum filtering of slurry samples.

Analytic center has developed assay systems of crossing, vacuum and pressure type. Impact-resistant structure and dust protection provide for reliable function of a system under heavy conditions of mining and processing operations 24 hours a day at minimum control by operating personnel. It has been proved by long-term industrial operation of this simple and reliable equipment.



***Automatic sampling complexes, three types:***

***1 — crossing with pneumatic drive; 2 — vacuum; 3 — pressure with pneumatic drive***

Automatic sampling complexes can give efficient solutions to representative sampling of balance control points that are included in calculations of process and product balance and real-time assay to keep and improve process performance. Original patented engineering solutions used in its design allow increased reliability of the sampling unit and serviceability compared with similar systems.

Sample delivered to laboratory using pneumatic slurry route, passes several preparation stages for further analysis in automatic sample preparation complex (AKP). It can be powder analysis of dry-out sample or slurry sample delivery to automatic express X-ray fluorescence analysis.



*Automatic sample preparation unit*

*1 — receiving unit and sample deaeration unit (SPDP); 2 — sample dynamic divider with pneumatic drive (SPP); vacuum sample filtering unit (UFPV)*

All actuators of ASOPP are pneumatic. Components are produced by leading global manufacturers to provide high performance efficiency under heavy duty. Automatic flushing is envisaged for components that contact with slurry by providing washing after each assay circuit.



## *Analytical complex*

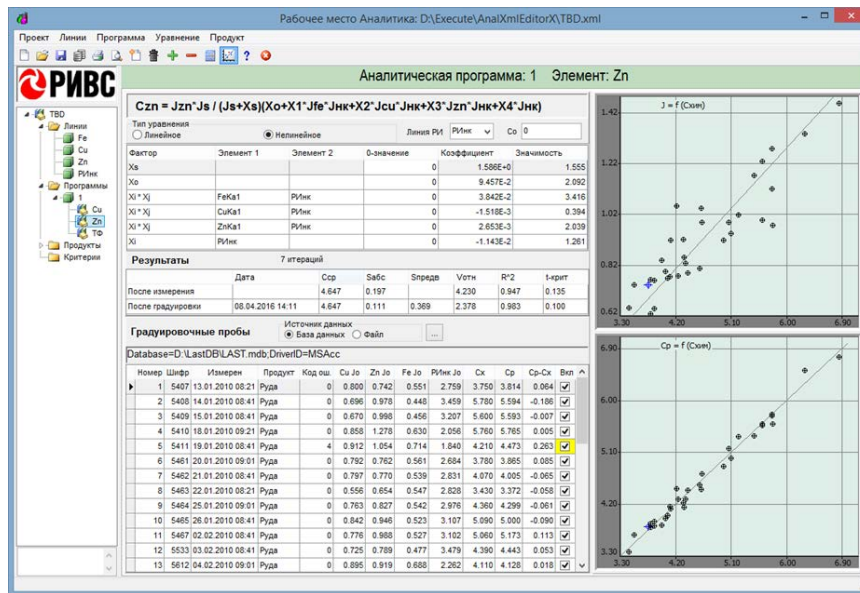
Analytical complex (AK) is a complicated system consisting of unique equipment, advanced hardware and software and closed-proprietary methodological-mathematical support.

The basis of analytical complex is automatic X-ray fluorescent analyzer ARFA-RIVS developed by AC. It is designed for slurry and solution flow analysis. Analytical complex can include one or several flow analyzers and mobile X-ray spectrometer for analysis of powder or pellet research, control and balance samples. Unique ARFA-RIVS spectrometric unit is equipped with original thermal stabilization system. Low power of X-ray tube used together with reliable X-ray protection ensures ARFA-RIVS operation free of strict requirements to radiation control, working space and operating personnel.



## *Analytical complex*

Energy-dispersive X-ray fluorescent analyzer uses innovative semiconductor detector, FastSDD type. This detector along with original methodological-mathematical support provides for achieving analytic parameters brought in line with the best world-known samples of energy and wavelength-dispersive X-ray analyzers. Moreover, parameter improvement “roadmap” is envisaged by Analytic center for slurry and powder analyzer models.



### *Display of Analytic Engineer Automated Workstation*

Some auxiliary subsystems provide for fail-safe and efficient performance of analytical complex. Hardware and software complexes “Service Engineer Automated Workstation”, “Analytic Engineer Automated Workstation” and “Operator Automated Workstation” are designed for proper setting of equipment, rapid analysis method implementation, early diagnostics and real-time control of analytical complex to produce reliable analysis results. ASAK-RIVS server is designed for data storage and archive data access. ASAK-RIVS Central control station controls both Analytical complex and ASOPP equipment. Built-in wireless interface allows monitoring ASAK-RIVS from any spot of the Earth thus providing remote support of the system during guarantee and post-guarantee service.

### *Analytic center excellence*

Analytic center is relatively new department that in a few years developed new branch of activities and delivered solutions to complex fundamental and practical tasks.

Integrated equipment complex has been developed of proprietary ASAK-RIVS consisting of subsystems. The major part of units, networks and systems has been implemented and successfully operates at mining and processing complexes of Russia, Kazakhstan, Armenia and the Philippines.

Original solutions are covered by patent or patent pending. Some computer programs are certified. Each equipment supplied has Quality Certificates.

Personnel of Analytic center make audit of mining and processing complexes on a regular basis and provide recommendations for enhancing quality and efficiency of assaying and analytical control.

Research and development results obtained by Analytic center are published in specialized journals and proceedings, presented at conferences and meetings.

***Focus on automatic process control***

Wide range of sampling, sampling preparation and analytic equipment renders possible to build turnkey proprietary standard RSEL-RIVS for mining and processing complex.

RSEL-RIVS will provide practical solution of optimum automatic process control concept, enabled by effective collaboration between Analytic center and Automated Control Systems Department, NPO RIVS.