

ADAPTIVE DIFFERENTIAL PROTECTION FOR SHUNT REACTOR

PS 1

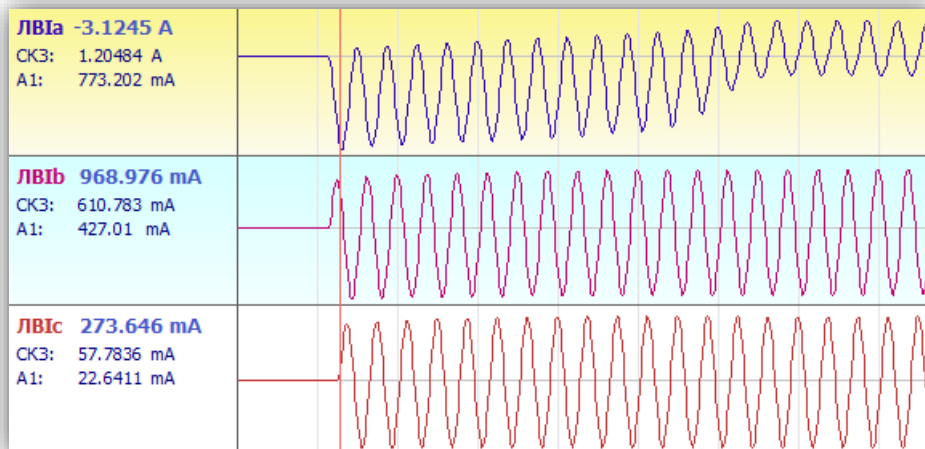
Kholodov Alexander (Russia)

GOALS

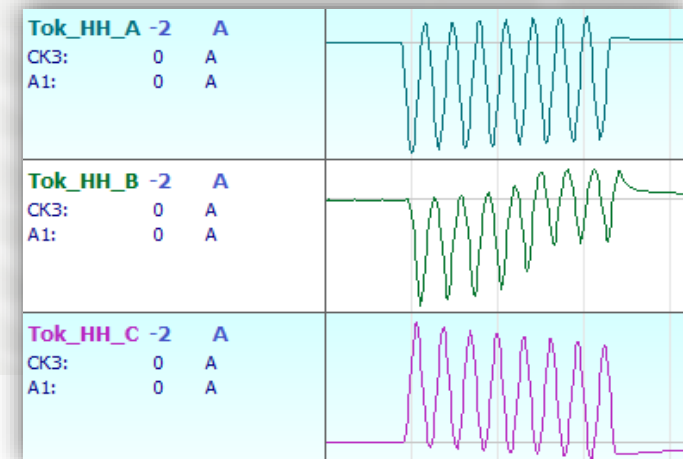
This work includes:

- Analysis of technological disturbances in SS 330 kV and SS 500 kV
- Analysis of technological solutions is to prevent technological disturbances
- Analysis of capability of IEDs
- Development of a new algorithm of shunt reactor differential protection
- Development of IED prototype based on IEC 61850
- Validation of the new algorithm based on real-time models

Oscillogram of TD in SS 330 kV



Oscillogram of TD in SS 500 kV

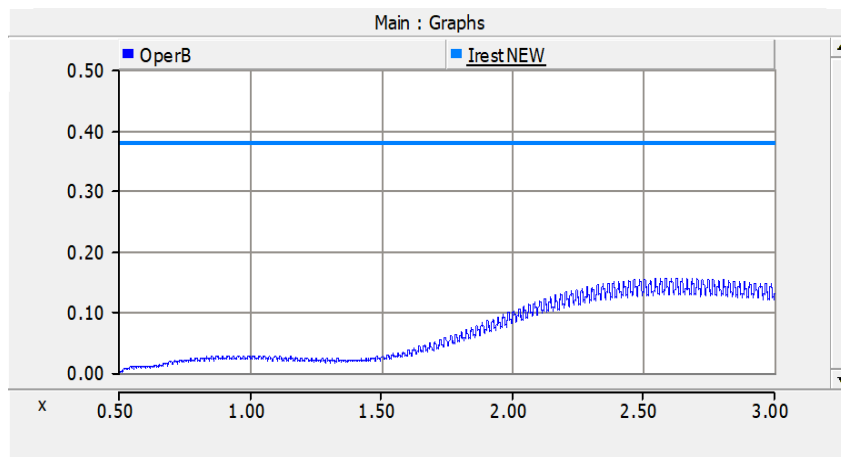


CONDUCTED WORKS

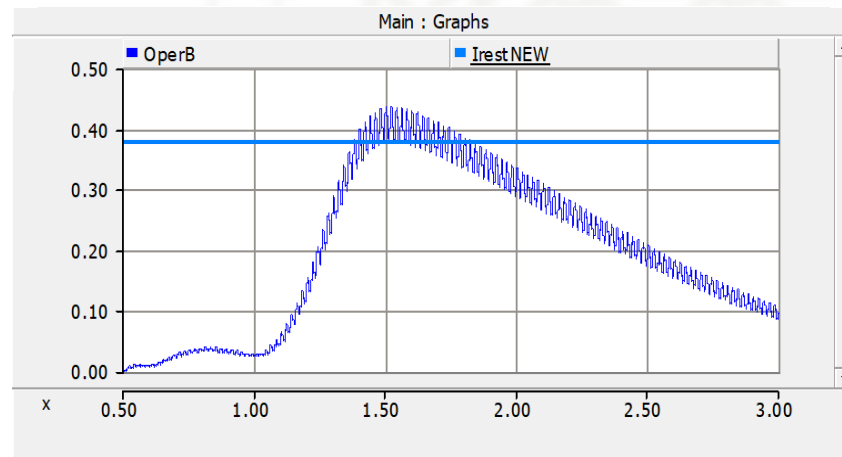
- Creation and verification of real-time models of SS 330 kV, SS 500 kV and SS 750 kV using RTDS.
- Determination of incorrect protection trip reasons
- Conduction of technological disturbances analysis
- Assessment of existing technical solutions and IED capability
- Development of a new adaptive algorithm of shunt reactor differential protection.
- Development of IED prototype based on IEC 61850 which implements the new algorithm
- Real-time model-based testing of developed device

TECHNICAL SOLUTIONS

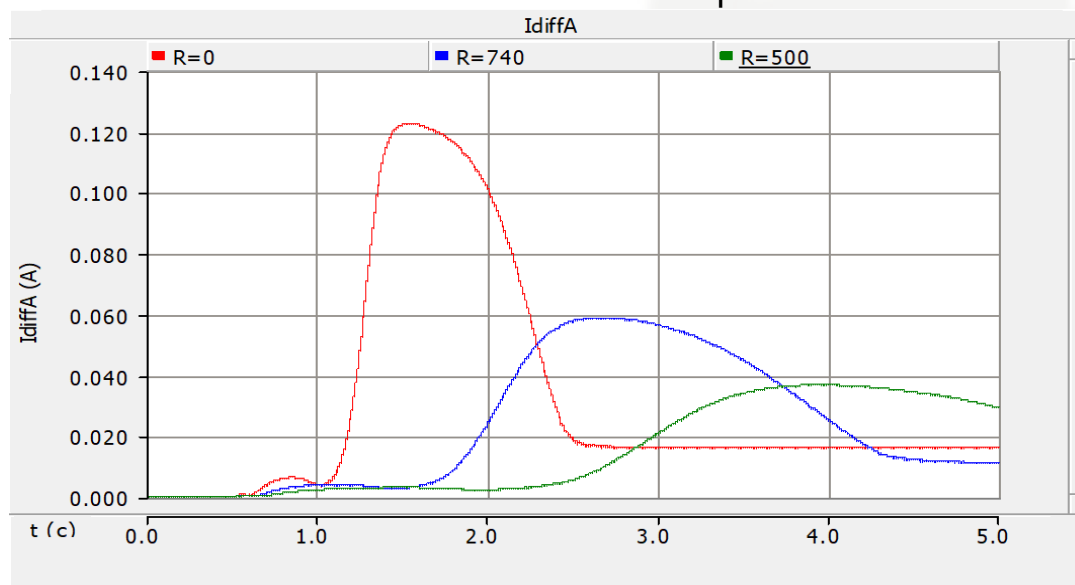
Controlled switching: ± 1 ms accuracy



Controlled switching: ± 2 ms accuracy



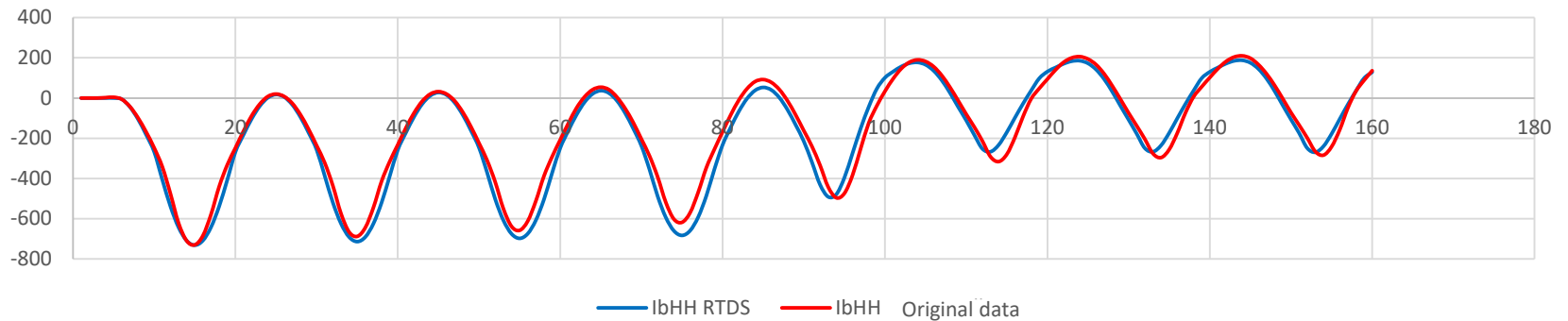
The use of circuit breaker with per-insertion resistors



THE ACCURACY OF THE SIMULATION

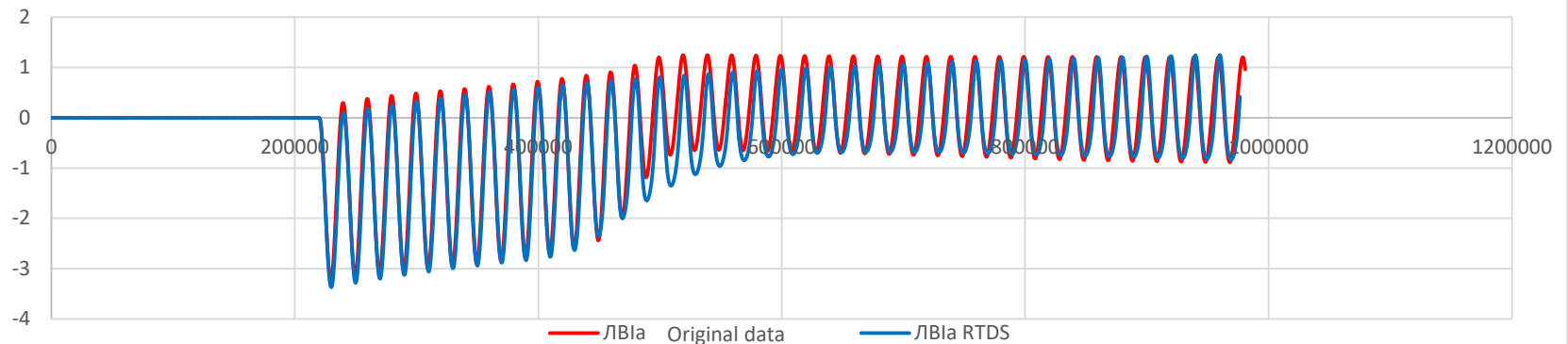
Substation 500 kV

The accuracy of the simulation: 93,27%

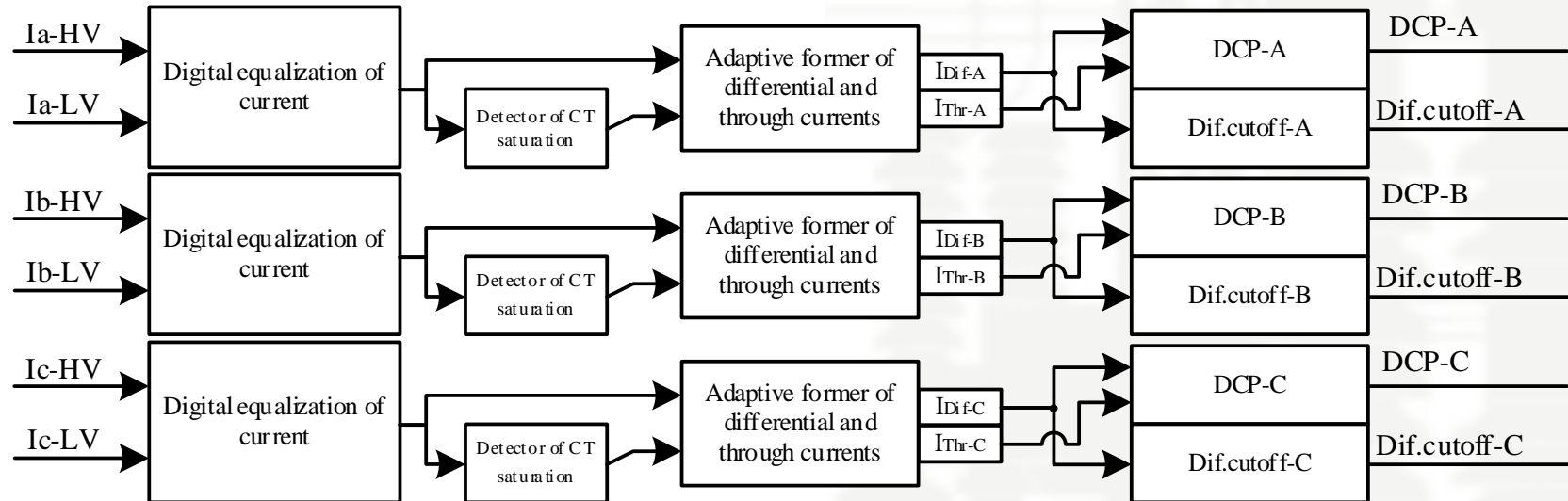


Substation 330 kV

The accuracy of the simulation: 97,89%

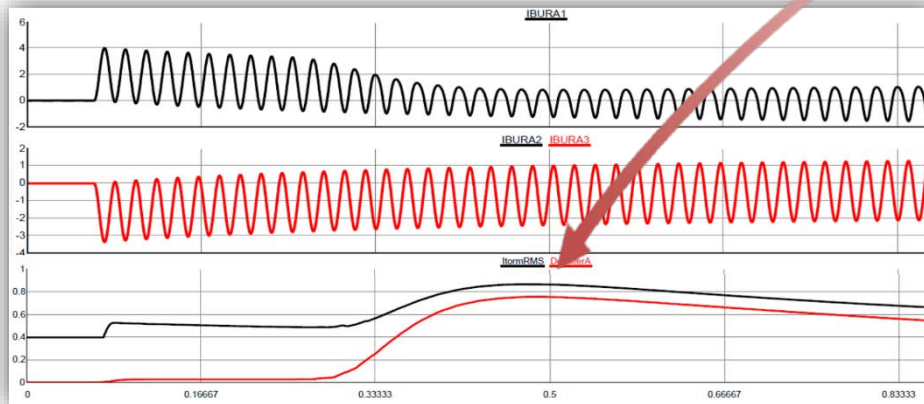


ADAPTIVE ALGORITHM



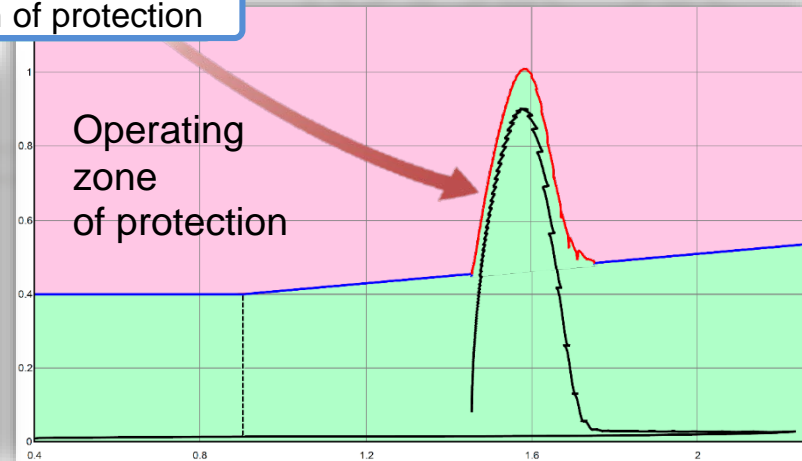
RESULTS

Shunt reactor switching on



Adaptation of protection

Restraint Characteristic



- The adaptive algorithm of reactor differential protection and software have been developed
- The prototype of IED based on IEC 61850 has been developed
- False tripping has been excluded
- Differential protection sensitivity and reliability are increased
- Efficiency of a new adaptive algorithm is verified on real-time models