1. How to use x2ipi with Terrameter LS (ABEM, Sweden)

## 1.1.   Creating protocol files for 4x21 cables set

Terrameter LS is 64-electrode instrument with two 32-pole connector for electrode cables (2x32). However the basic recommended set supplied with the equipment is the set of 4 cables with 21 electrodes each (4x21). Since the last and the first electrode take-outs shall overlap at the cable ends, the equipment allows to measure with 81 electrodes for the system layout (4x21 - 3). It provides increase the depth of ERT investigation up to 25%.

Protocol consists of two types of measurements. The first type - shallow measurements (small electrode spacings). The second type - measurements for deeper parts of the geoelectrical section (large electrode spacings). For example, having cables with 5m spacing between electrode takeouts, LONG32 type (41 electrode with 10m unit electrode spacing) and SHORT32 type (41 electrode with 5m unit electrode spacing) were applied. Two protocols with constant spacing between electrodes each.

x2ipi toolbox provide preparing ABEM protocols for 61-electrode measuring scheme. The example for Schlumberger array. **The first step** is create LONG protocol for long spacing.

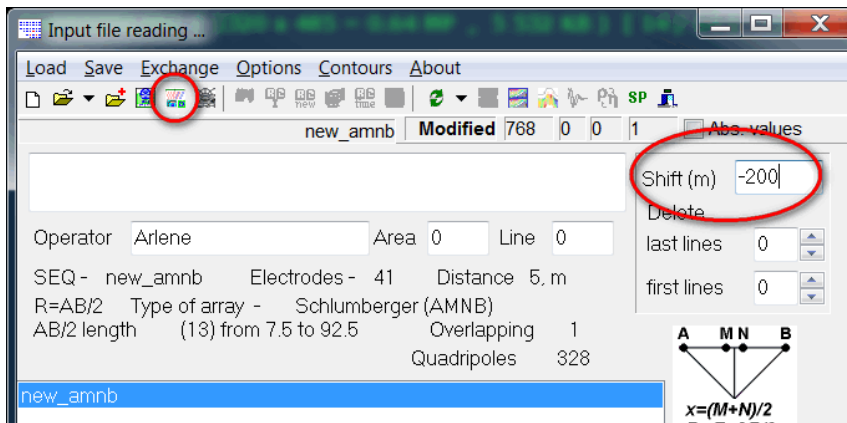1.   [icon] create a new protocol file for 41 electrodes with 5 meter spacing and save it *ElectreII* txt format [icon].
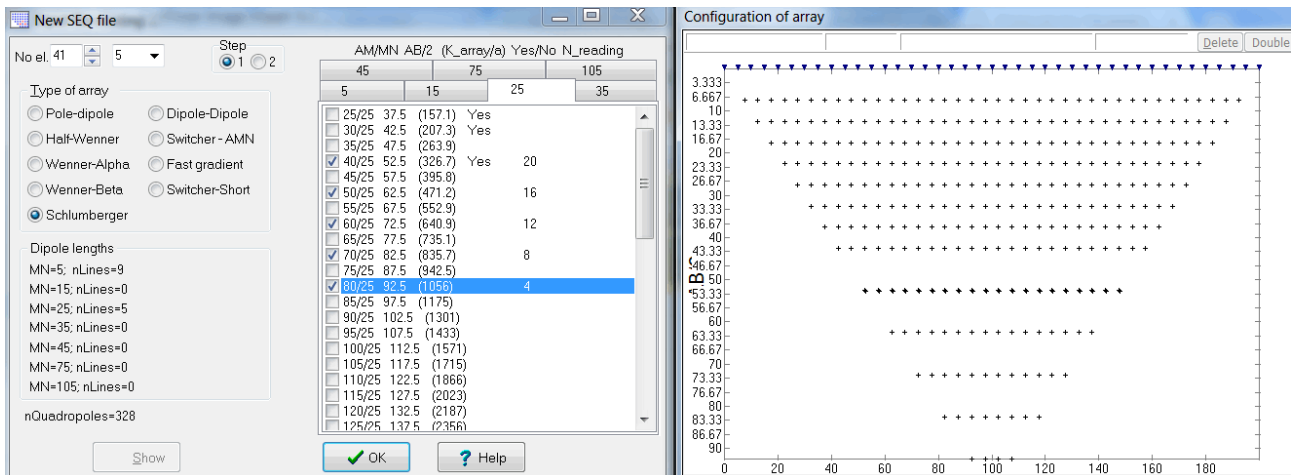

2. **Menu-Save-Seq-Make Long protocol**. It creates TXT protocol file with new numbers of electrodes and 10 meter inter-electrode spacing.
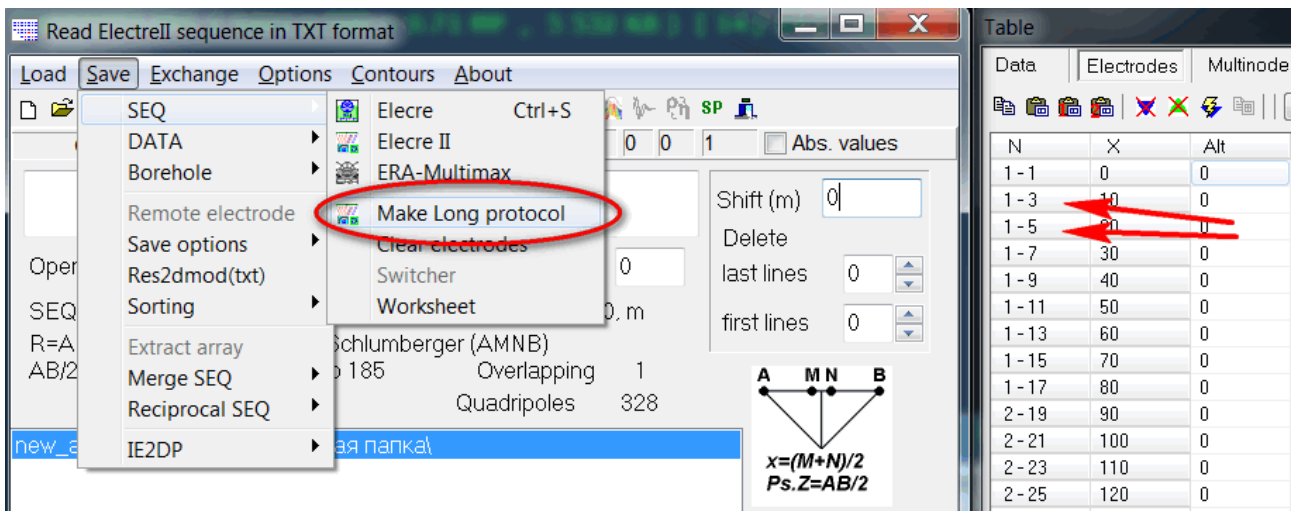
3. Shift X to have 0 coordinate for central electrode. Shift(m) = -200. Save it **Electrell** txt format again.

The second step is create Short protocol for central part of profile.

1. create a new protocol file for 41 electrodes with 5 meter spacing and save it in new file in **Electre II** txt format . We do not need big number of spacing - just 4 lines could be enough.
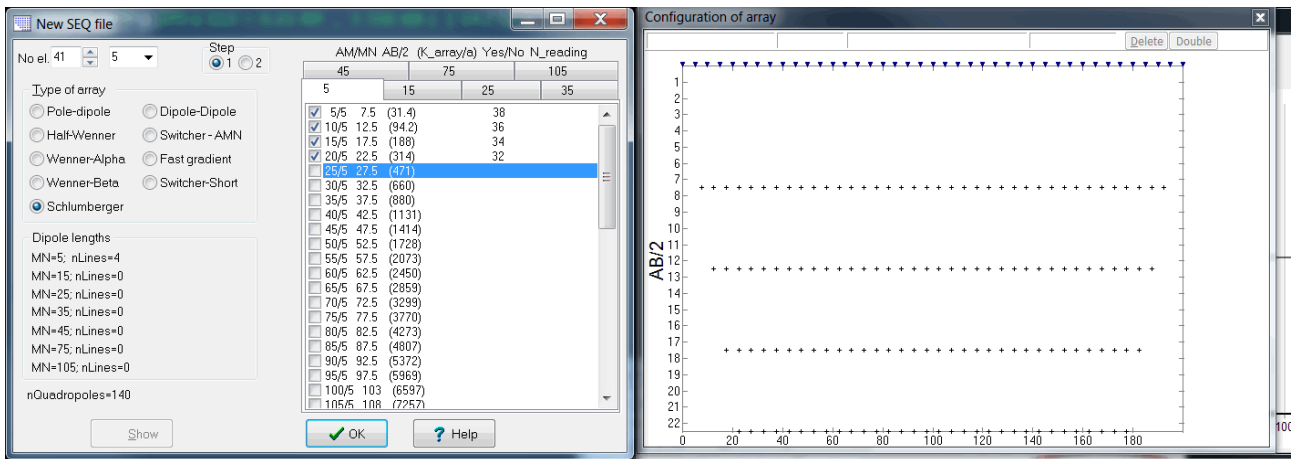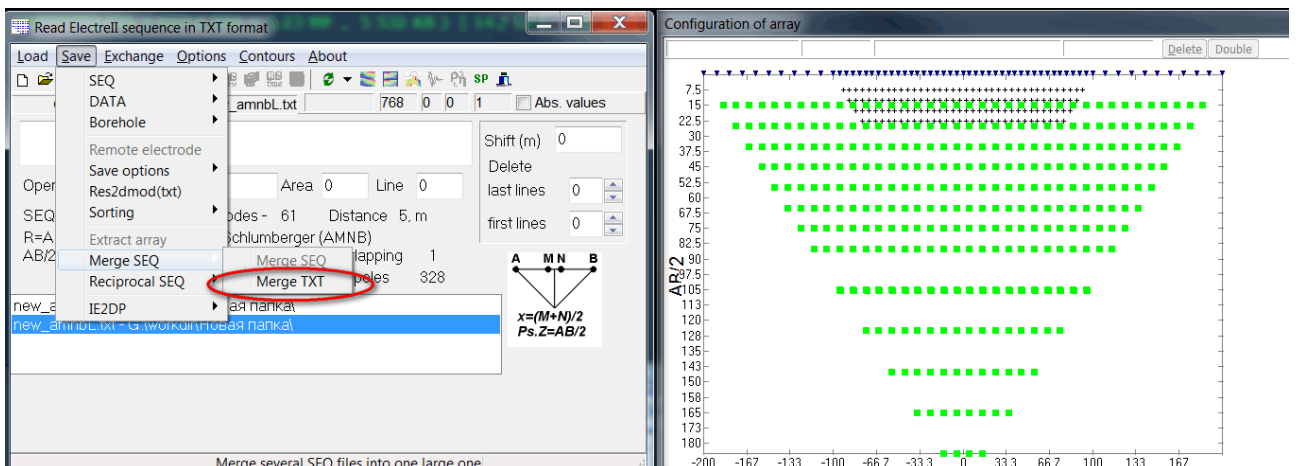

2. Shift X to have 0 coordinate for central electrode. Shift(m) = -100. Save it **Electrell** txt format again.

3. Add file with LONG protocol and save two files in one be **Menu-Save-Merge SEQ-Merge TXT**.
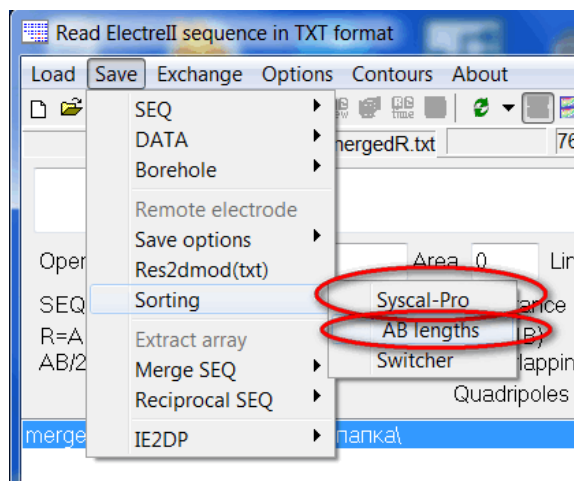
Now we have protocol file for 4x21 cable set. We need to open it and optimize for multichannel receiver. **The third step** is optimization.

1. Make reciprocal Schlumberger array **Menu-Save-Reciprocal SEQ-ElectreII (txt)**. Open result file.
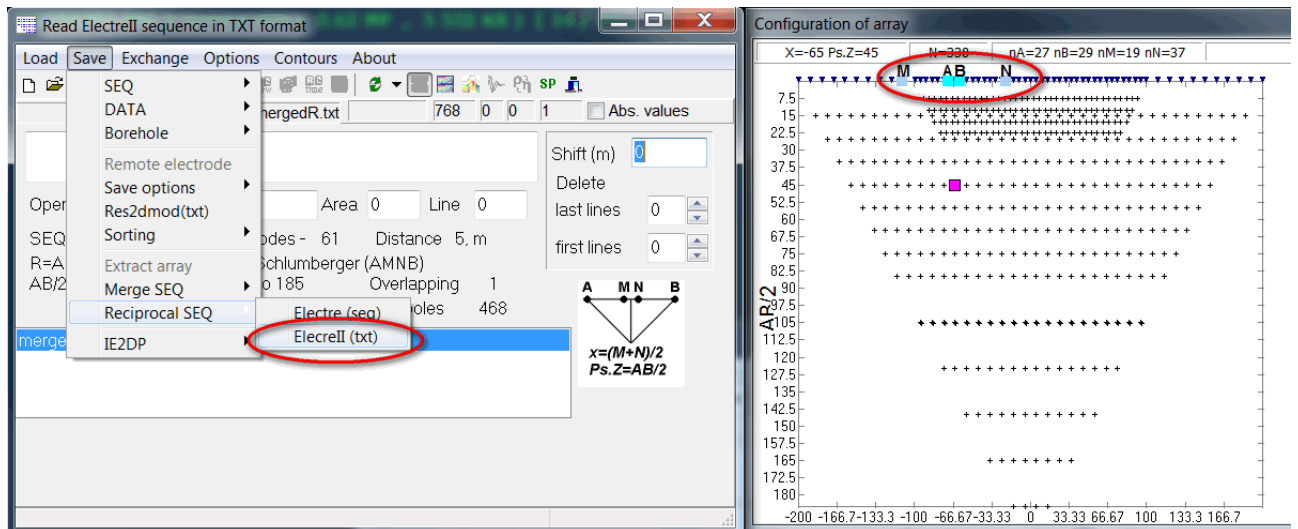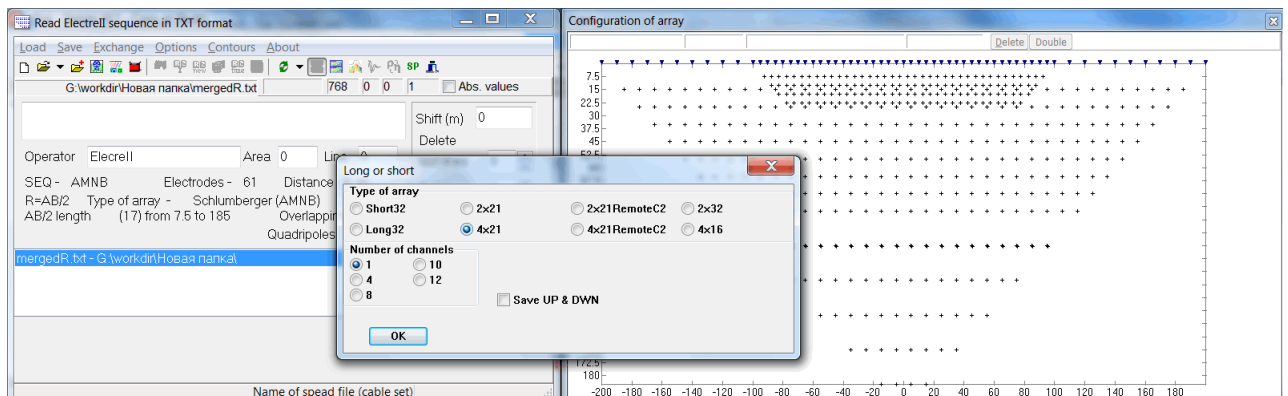

2. Sorting quadripoles. **Menu-Save-Sorting-Syscal-Pro or AB lengths.**

Now we have optimized protocol file for 4x21 cable set. We need to convert it in XML protocol file for Terrameter LS. **The fourth step** is creating XML file.

1. We need to open protocol and Save in ORG format of ABEM.


We do not need change number of channels in Long or short Dialog. It was important for SAS4000 ABEM unit. But we have to indicate correct spread file in ORG file.

- 4x21.adr - 4 electrodes array for 4x21 cable set

- 4x21RemoteC2.adr - pole-dipole array for 4x21 cable set

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- 2x21RemoteC2.adr - pole-dipole array for 2x21 cable set

The correct spread file depends on cable set (2x21, 4x21, 4x16, 2x32 etc) and four or three electrodes array.
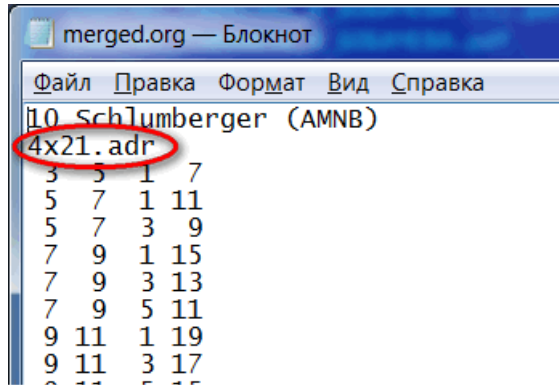

We could also indicate correct spread file in ORG file on the second line of ORG file.

2. Use **Terrameter LS Toolbox** software to convert ORG file in XML file.
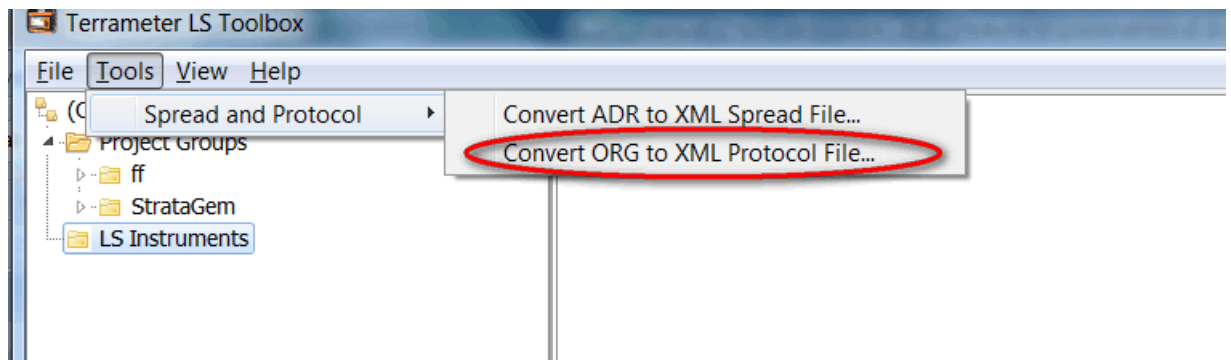
File 4x21.adr does not exist. It results that error messages will be issued, but it does not mean that there is any error in the protocol file. See "6.2 Conversion of ORG to XML Protocol file" in the manual of **Terrameter LS Toolbox**.
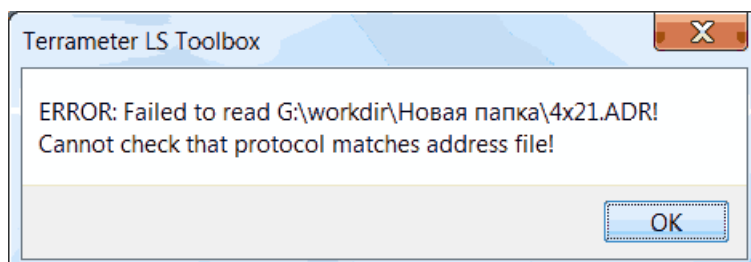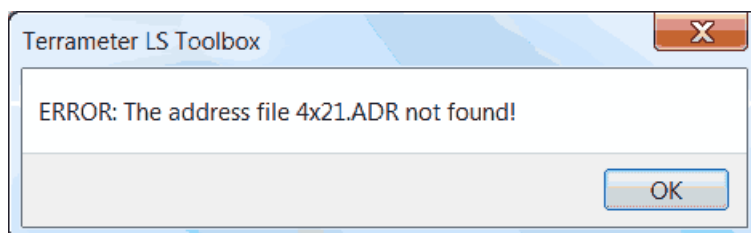
Finally we received protocol XML file with correct spread name, which could be used with **Terrameter LS** and it could be read by **x2ipi** software also.

```xml
<?xml version="1.0" encoding="UTF-8"?>
- <Protocol>
    <Name> merged </Name>
    <Description> A description of the protocol can be written here </Description>
    <Arraycode> 7 </Arraycode>
    <SpreadFile> 4x21.xml </SpreadFile>
  - <Sequence>
    - <Measure>
        <Tx> 3 5 </Tx>
        <Rx> 1 7 </Rx>
      </Measure>
    - <Measure>
        <Tx> 5 7 </Tx>
        <Rx> 1 11 </Rx>
        <Rx> 3 9 </Rx>
      </Measure>
    - <Measure>
        <Tx> 7 9 </Tx>
        <Rx> 1 15 </Rx>
        <Rx> 3 13 </Rx>
        <Rx> 5 11 </Rx>
      </Measure>
```
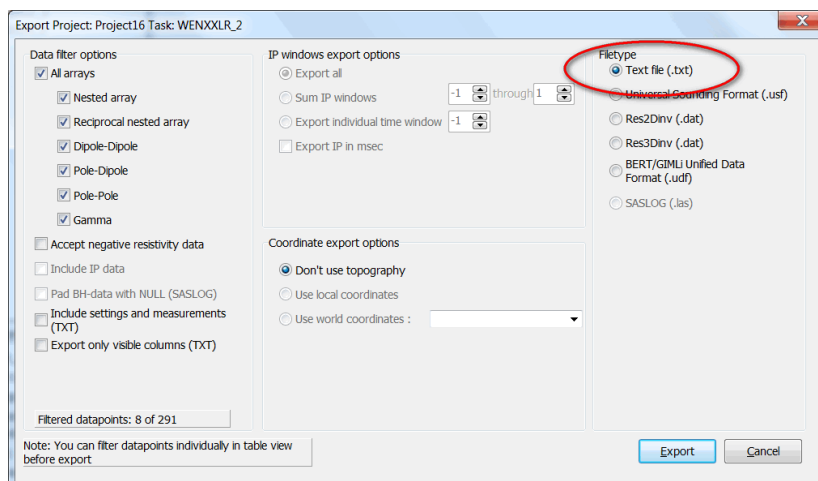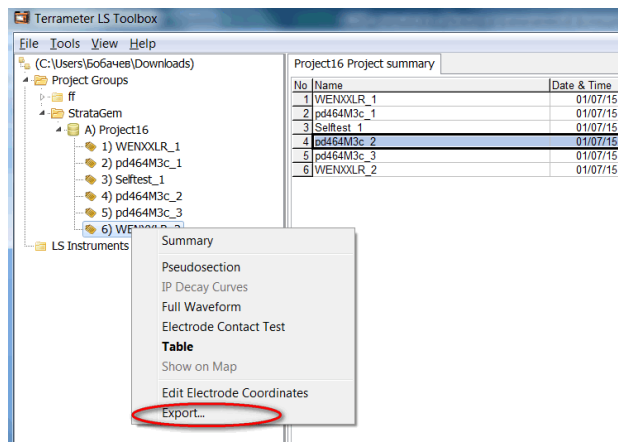
Note! There is not information about inter-electrode spacing in XML or ORG files.

1.2. Read field data of Terrameter LS

Terrameter LS Toolbox software can export field data txt format, which can be read *by x2ipi* software

Use **Data from ABEM (txt)** format to read data from *Terrameter LS Toolbox* software.

Syscal data (*.0*; *.mod)
Syscal sequences (*.seq)
Sens2Dinv (*.ars;*.imp;*.ui)
Res2dInv format (*.dat; *.inv)
ABEM data (AMP format) (*.amp)
ABEM protocol (ORG) (*.org;*.up;*.dwn)
Data from Prosys (Iris Instruments) (*.txt)
SEQ from Electre II (Iris Instruments) (*.txt)
Data from Syscal-Pro (Prosys) (*.txt)
Data in Geosoft IPDATA format (*.dat)
Data from ABEM (txt) (*.txt)