Building up a New Geomagnetic Observatory at Polom Station

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Geomagnetic field

- Three axis (vector)
- Magnitude: 48 000 nT (depends on latitude)
- Daily variation:
  - 30 nT (quiet day)
  - 500 nT K9 limit - maximal possible change during storm (depends on latitude)

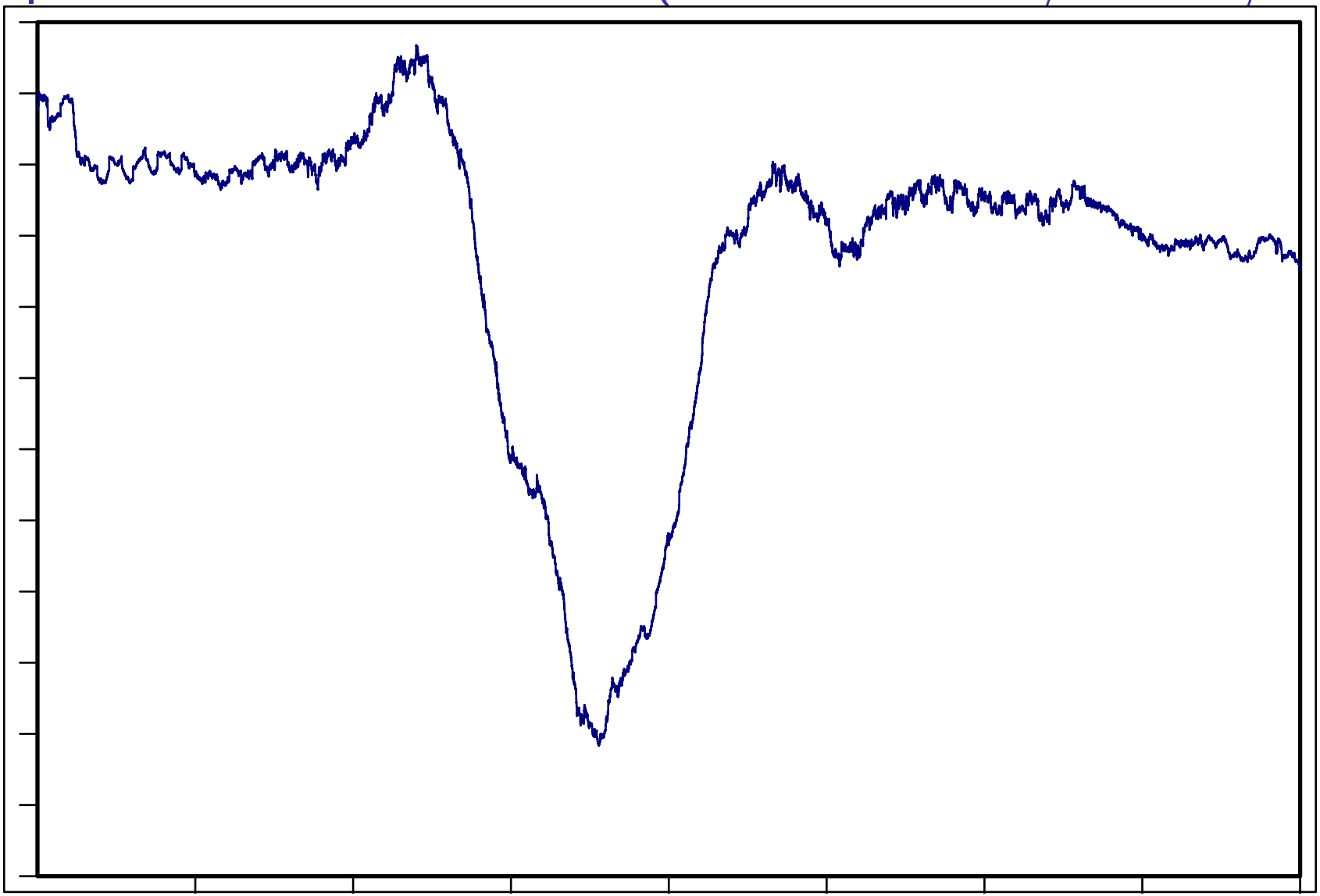
Instruments in needed range

- Scalar (measures magnitude):
  - Proton precession: 100 pT [/sqrt(Hz) @ 1Hz]
  - Overhauser effect: 20 pT - [1 pT]
  - Kalium vapour MASER: 100 fT (need heating, limited lifetime of bulb/[lamp], limited bulb/[lamp] source)
- Triaxial (measures three components):
  - Fluxgate: 50 pT - [1 pT] (better noise = higher thermal dependence)
  - Quartz-gymbal: 10 pT - [1 pT]
  - Kalium vapour MASER @ SERF condition: 1 fT (EMC problems -> only shielded i.e. for paleomagnetism)
  - SQUID: 100 aT (need cryocooling)

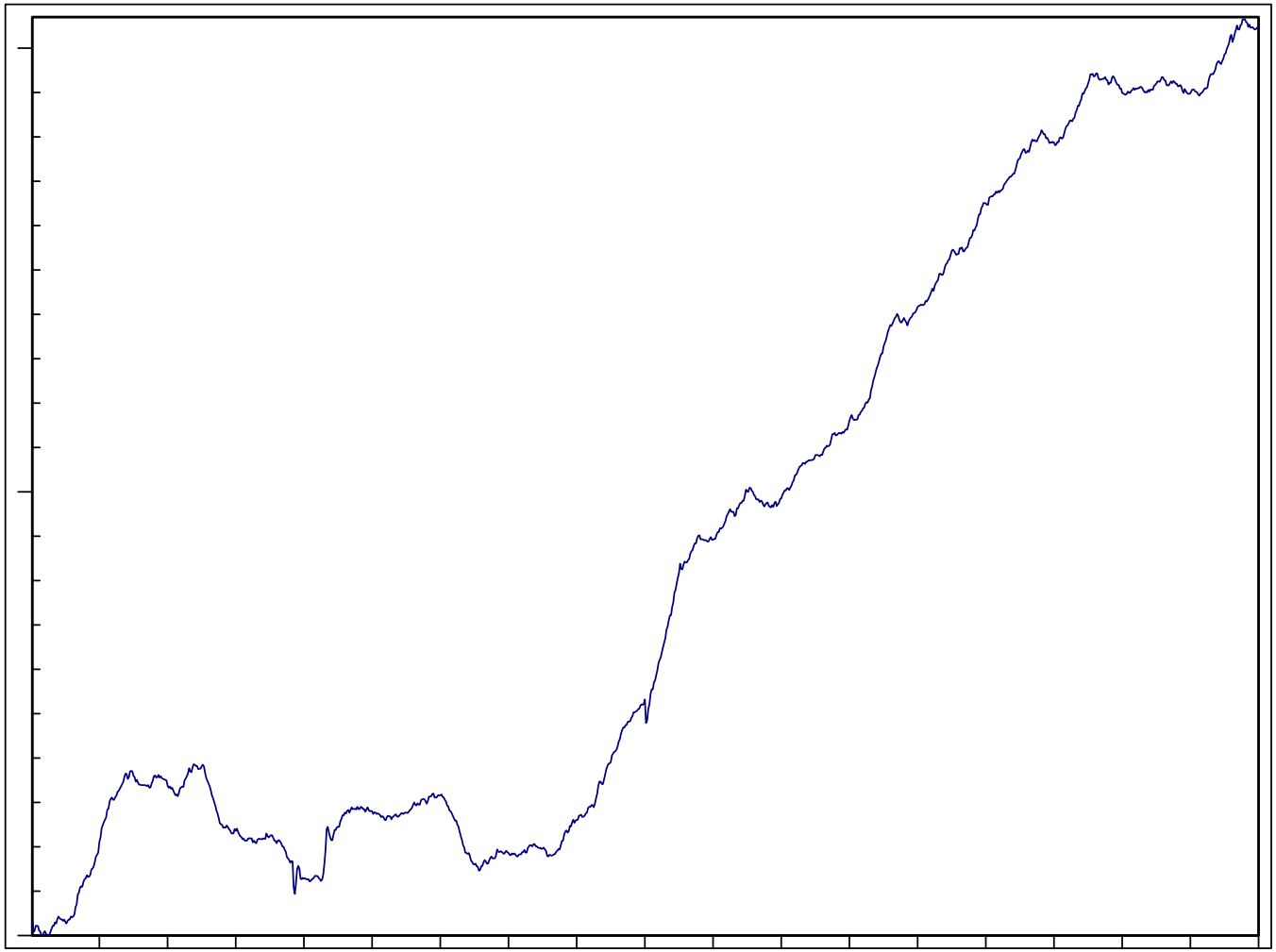
Intermagnet Recommendations Changes

- Old:
  - resolution: 0.1 nT
  - sampling: 60 s
- New:
  - resolution: 1 pT
  - sampling: 1 s (digital resampling preferred)
  - noise: 10 pT/sqrt(Hz) @ 0.1 Hz Problems with fluxgate instrument due to Barkhausen noise -> quartz gymbal instruments resurrection [Russia - using in permafrost]; research in fundamental mode fluxgate [I. Sasada - Japan])
  - timing error: 10 ms RMS (!GPS not reliable!)
- Temperature control leak
- Local disturbances - automobiles

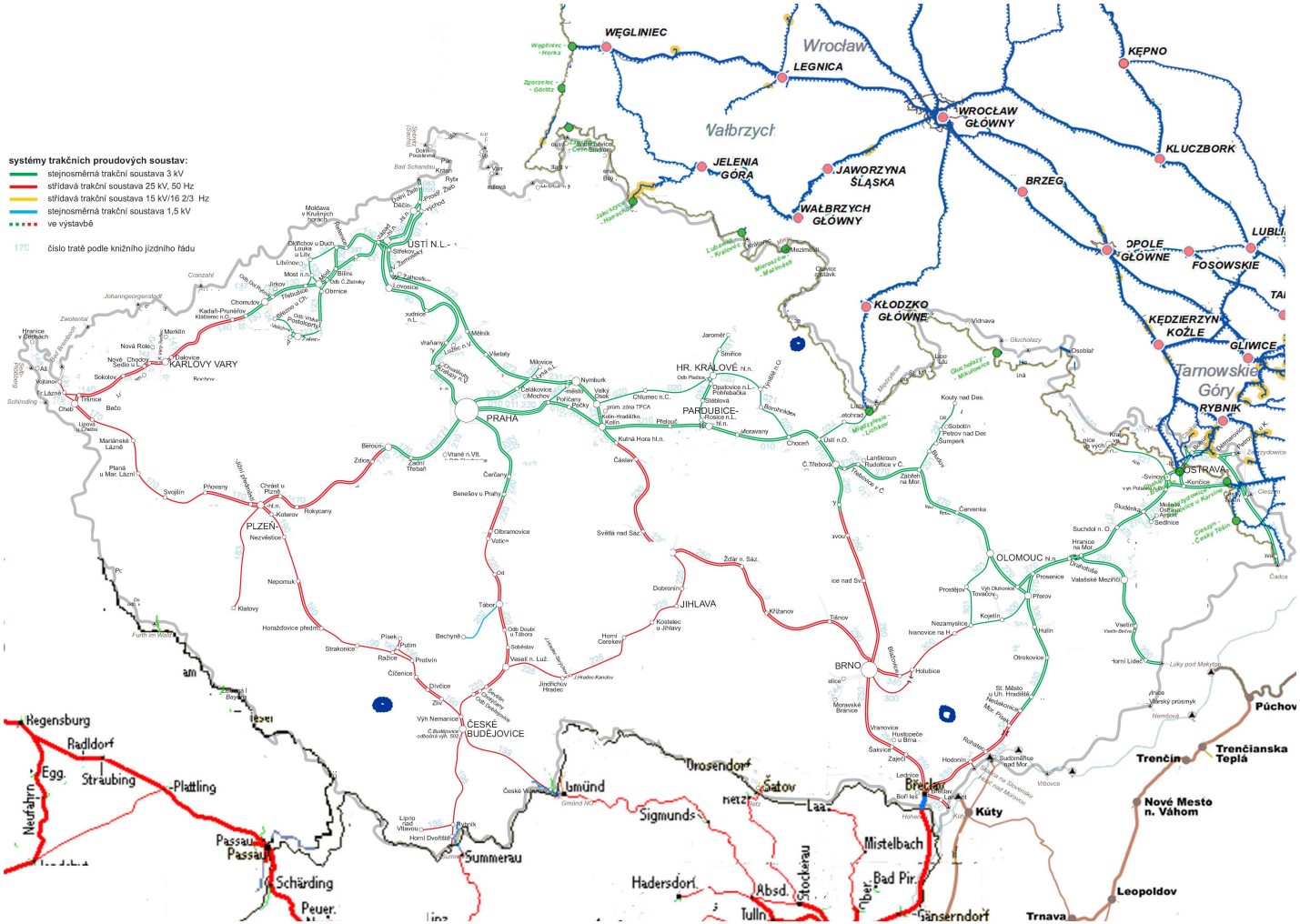
Tempco leak BDV Bobrov Z (6.11.2017 1nT/div, 3h/div)



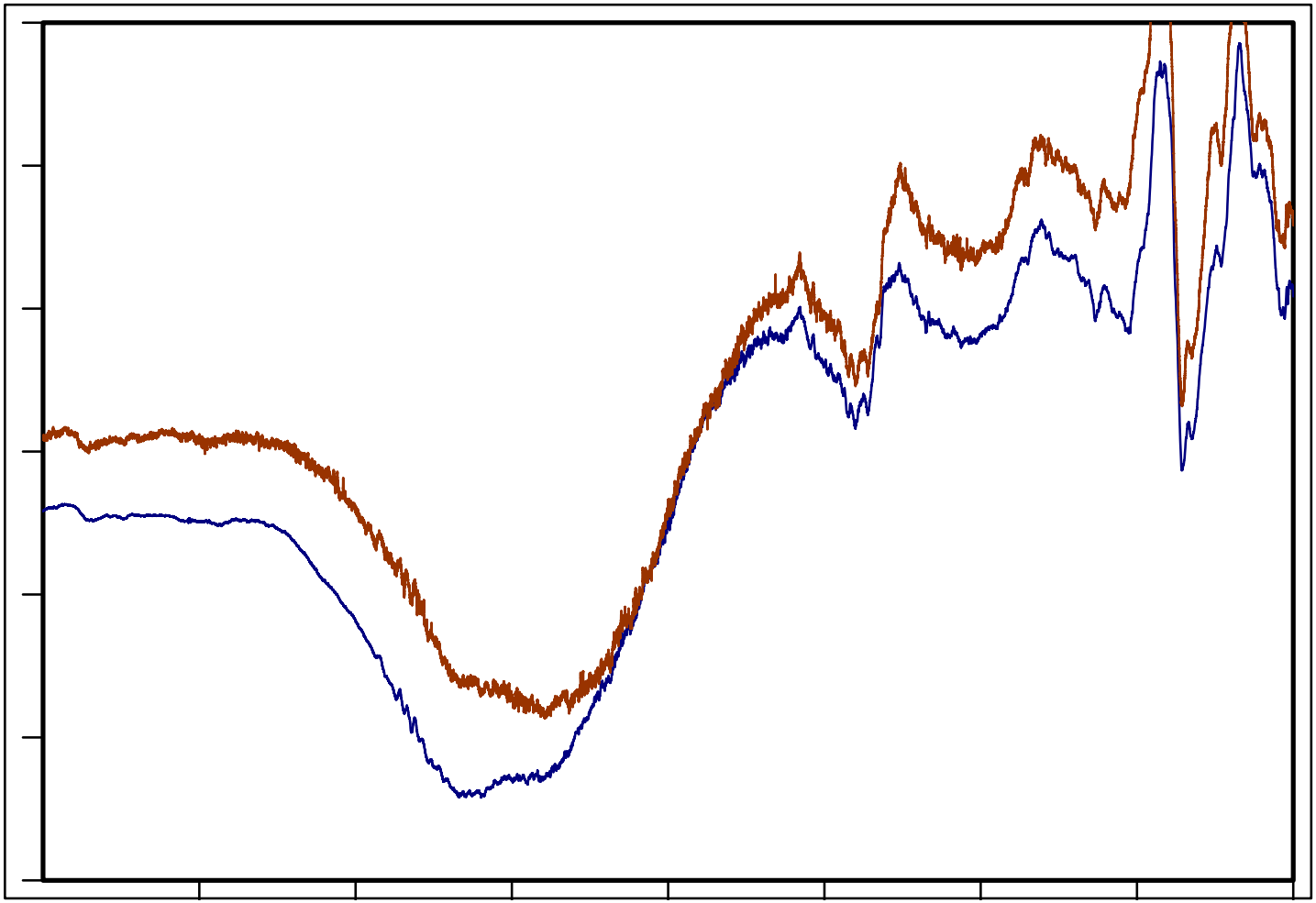
Traffic dtto D (24.5.17/15:22 0.1nT/div, 1min/div)



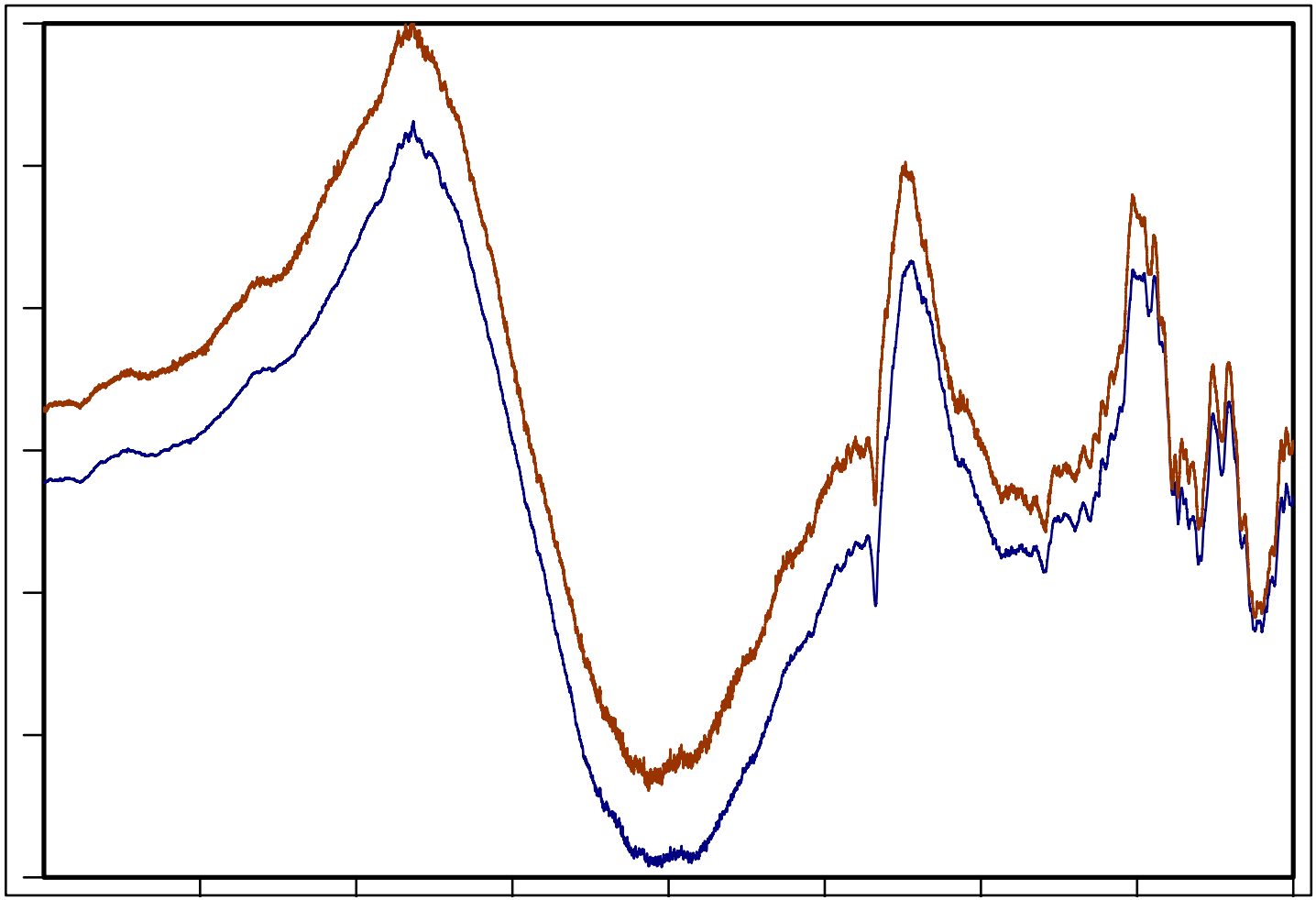
Registering instruments (Budkov, Polom, Kelčany)



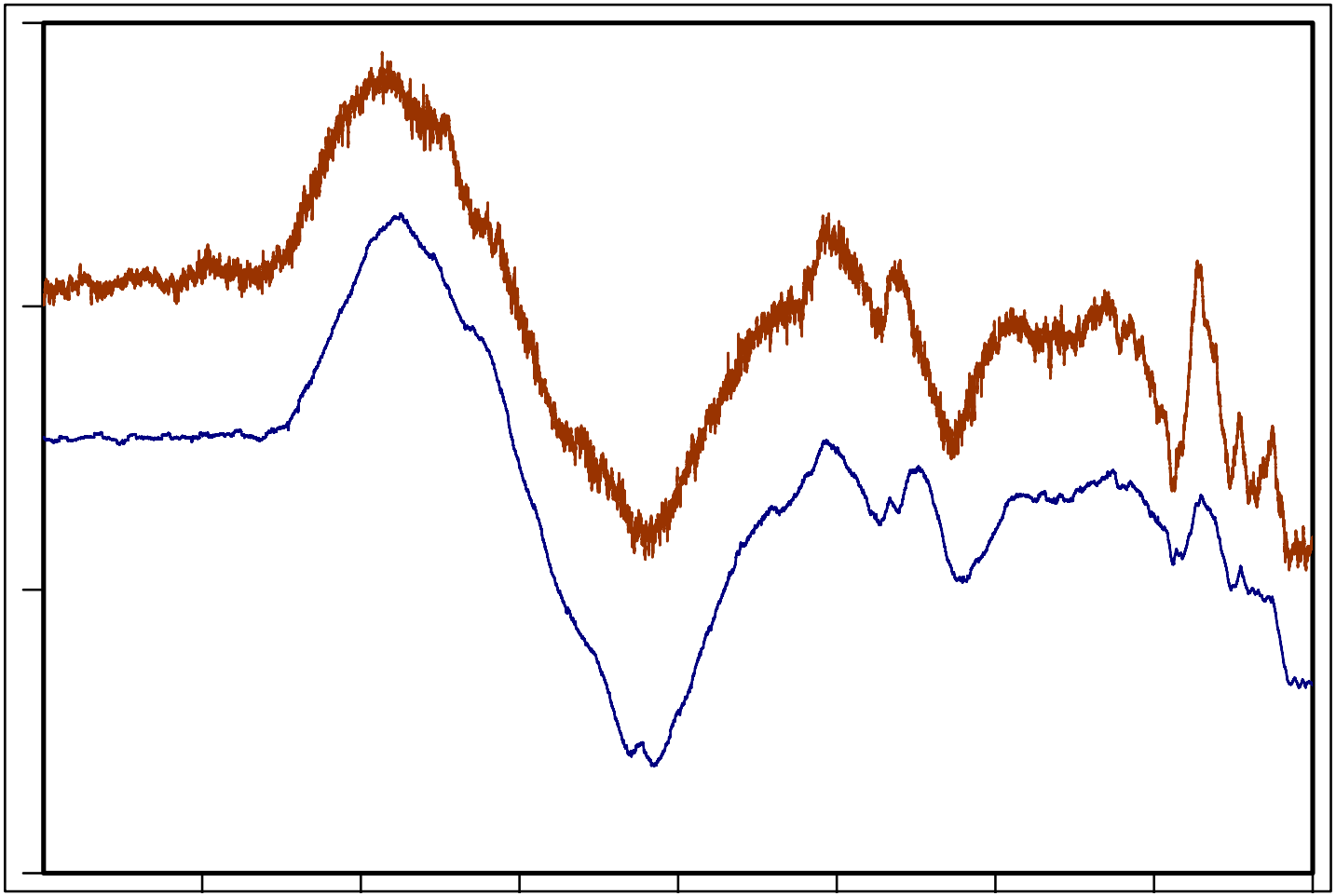
Polom vs BDV Bobrov - H (10nT/div 3h/div)



Polom vs BDV Bobrov - D (10nT/div 3h/div)



Polom vs BDV Bobrov - Z (10nT/div 3h/div)



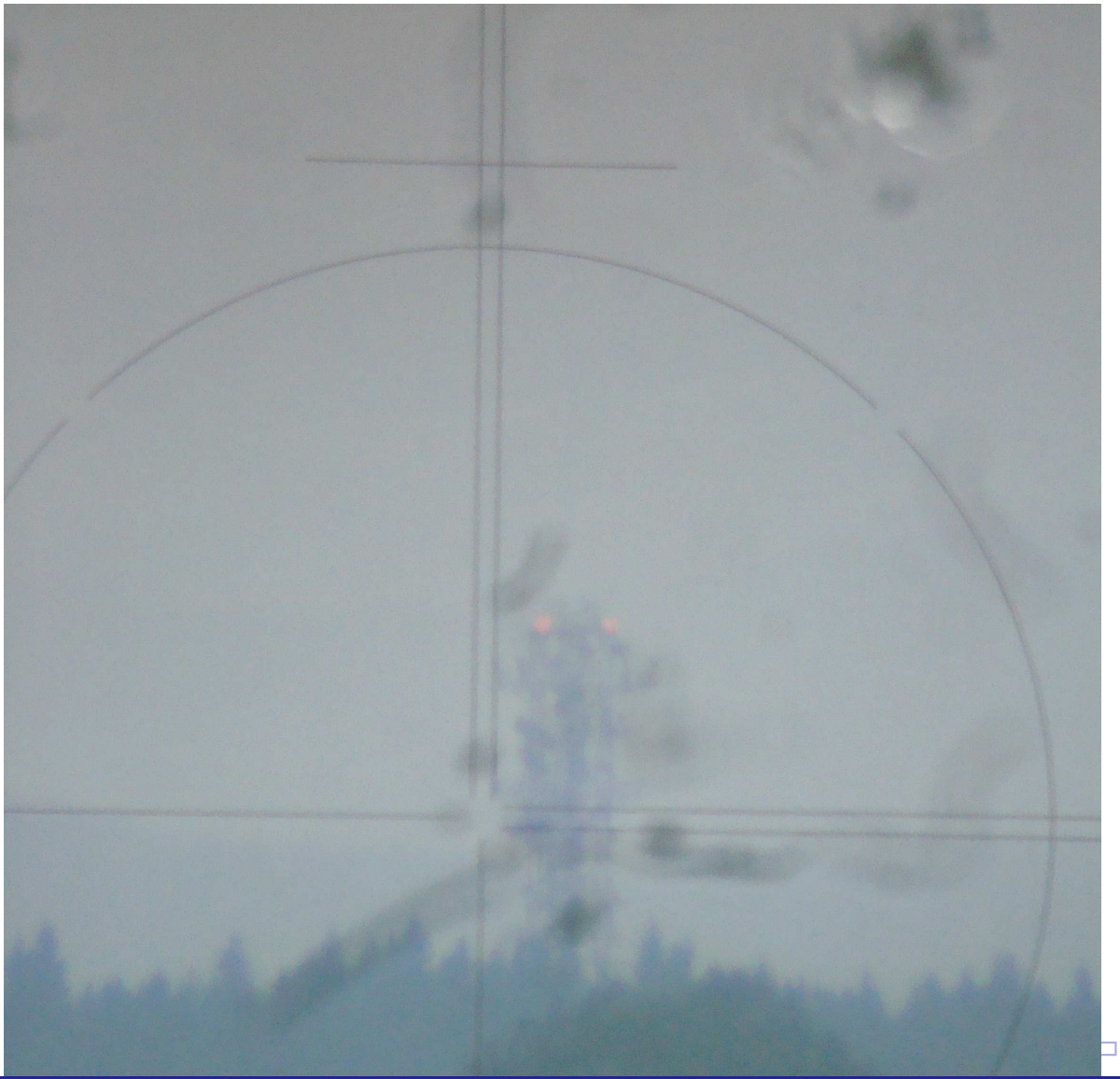
Polom - location

Polom - site

Polom - absolute pillar (T.Bayer - observer)

Polom - direction to MIRE

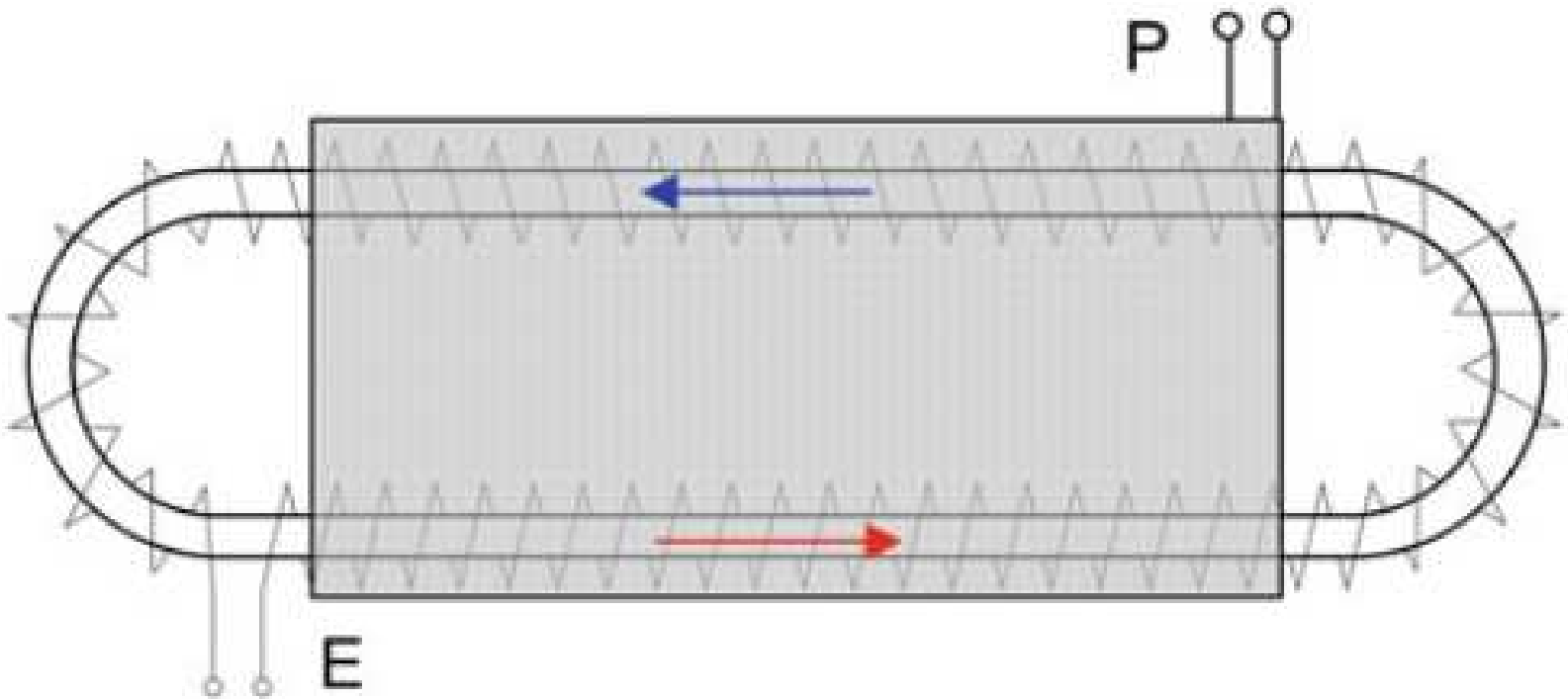
Polom - MIRE detail



Polom - instrument

- Design: P.Ripka - M.Janosek: CTU Prague; Z. Kozacek: CSRC Brunn; TA01010298
- Triaxial racetrack sensor (metglass, as cast)
- Second harmonic regime
- Analogue electronics (closed loop: synchrodetector - integrator) - ferroresonant pumping, separate sense and compensation winding, tuned sense winding
- Noise 4 pT @ partial field regime / 10 pT @ fullfield regime - limited by ADC

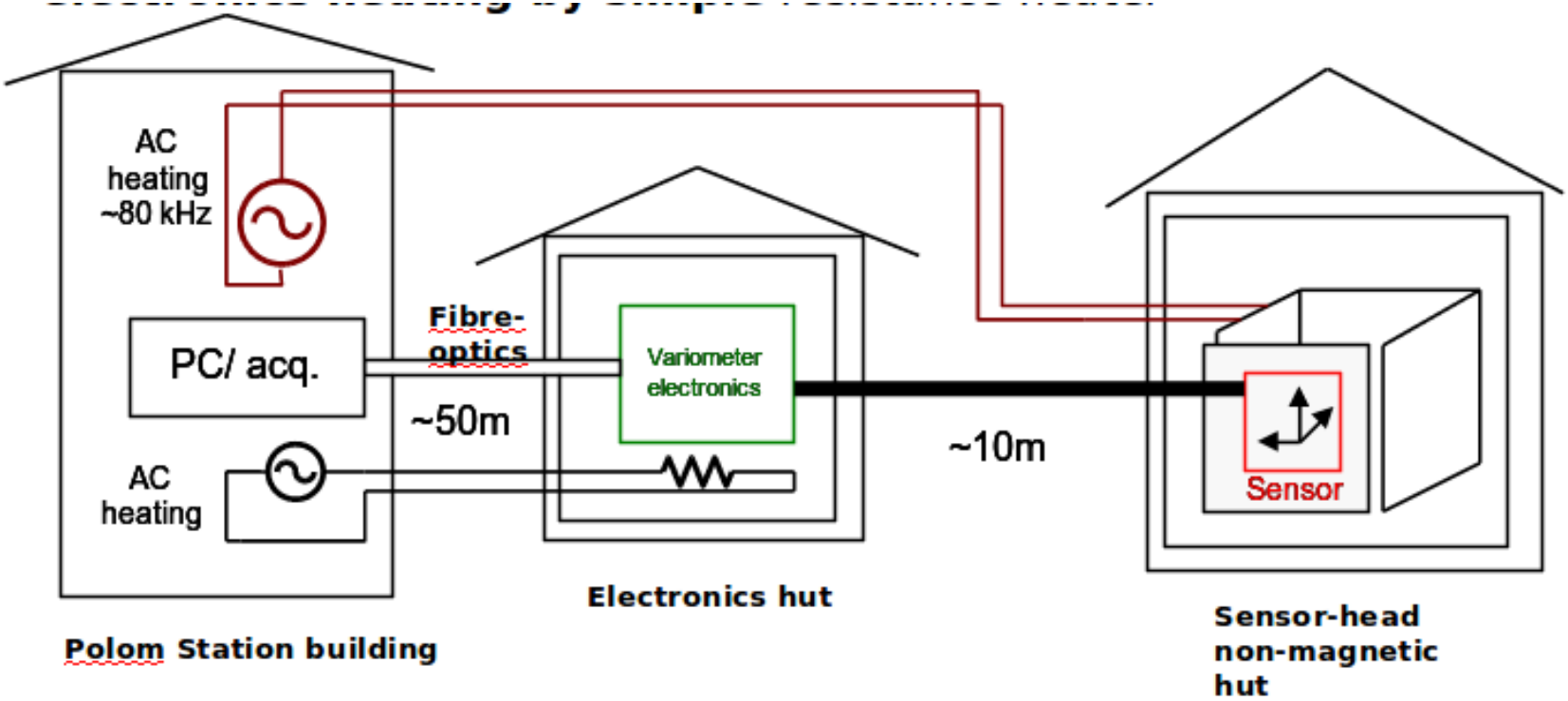
Sensor principial



Sensor head

Electronics

Future: Heating system with limited leak



Thank You