

# Chopper for the MePS System

R. Krause-Rehberg, M. Jungmann

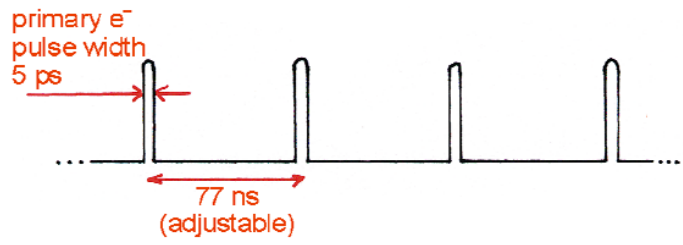
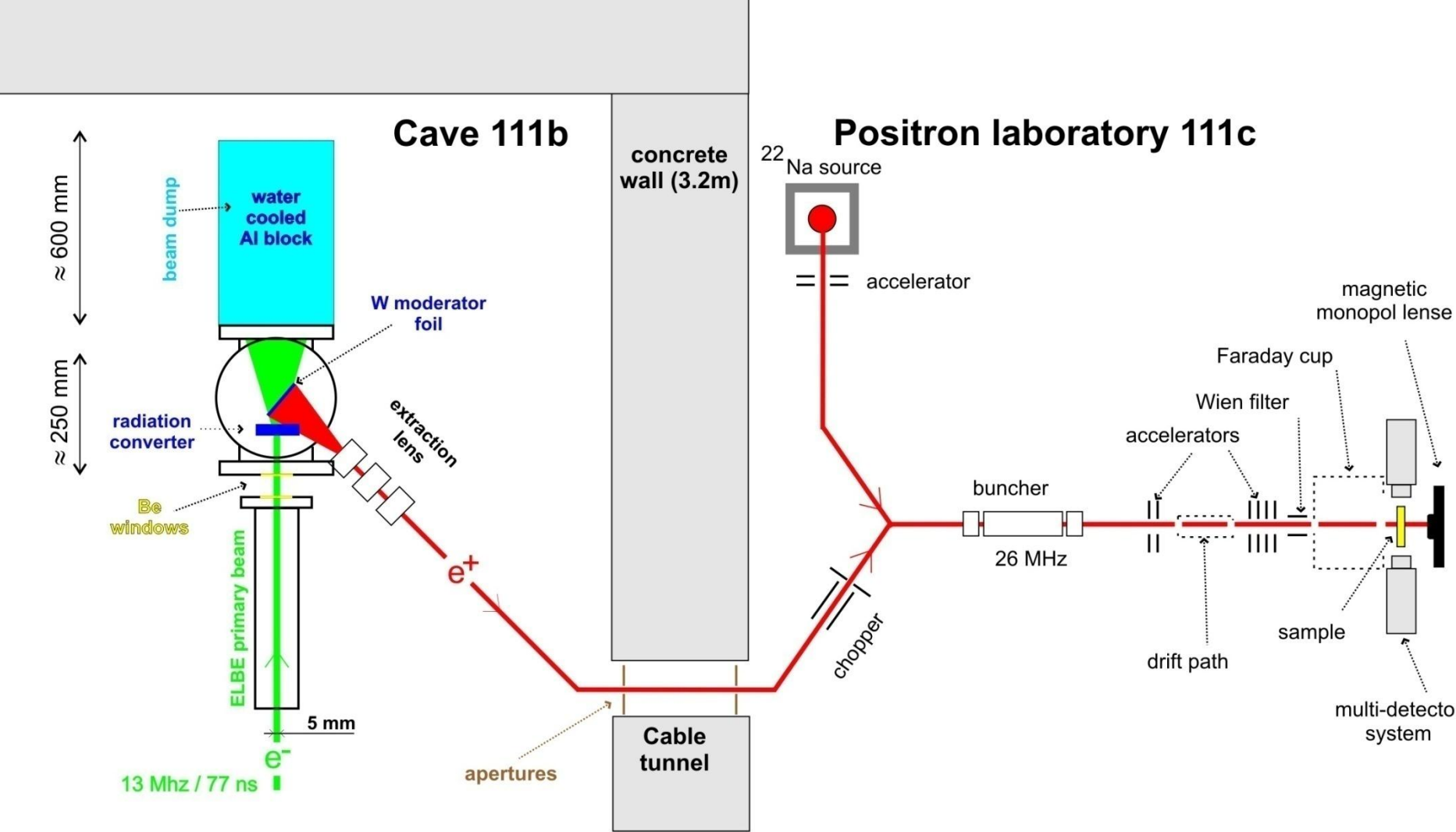
University Halle, Department of Physics, 06099 Halle, Germany

email: reinhard.krause-rehberg@physik.uni-halle.de

- MePS Scheme
- Timing at MePS: Buncher and Chopper

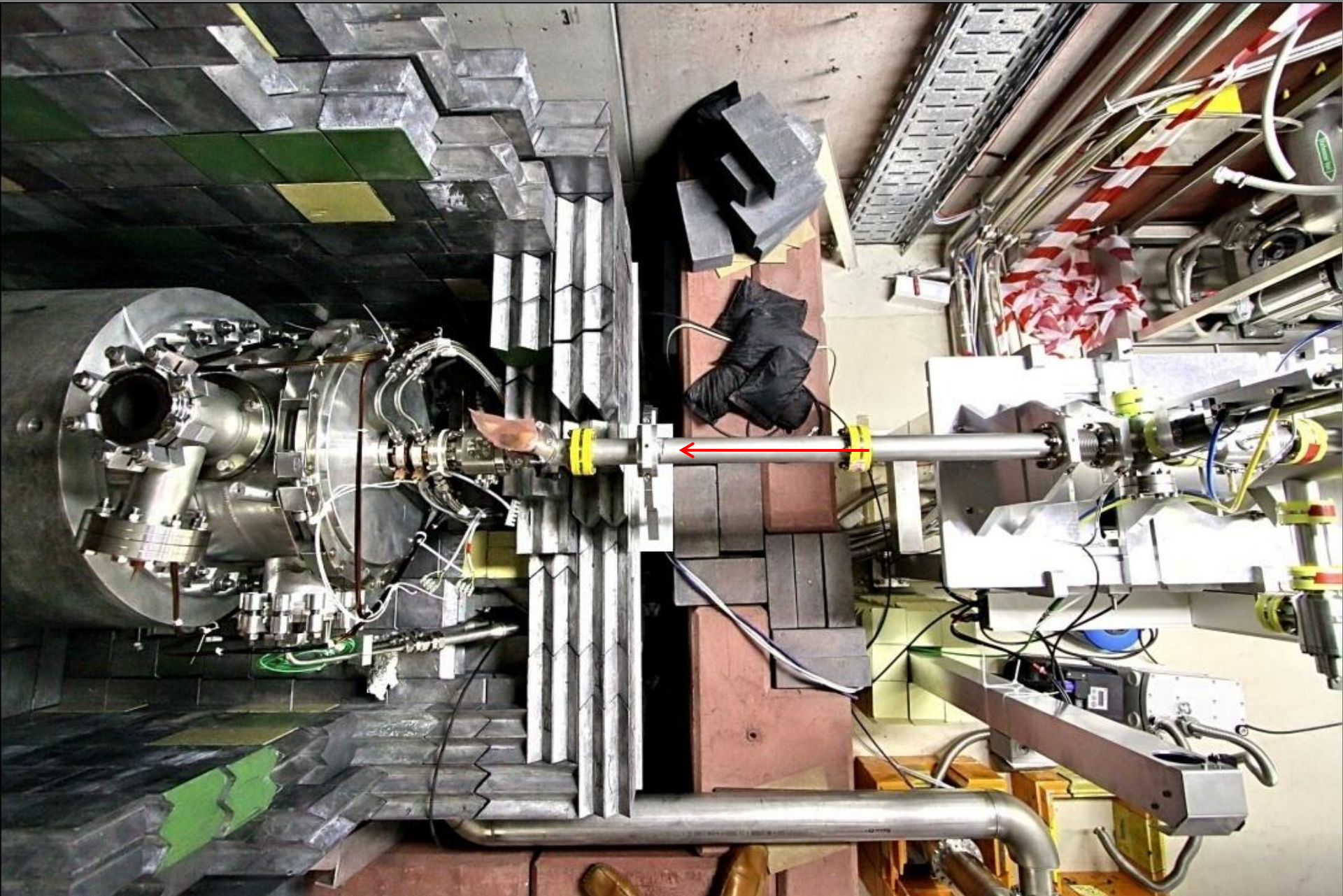
Rosendorf, 12. Jan 2011

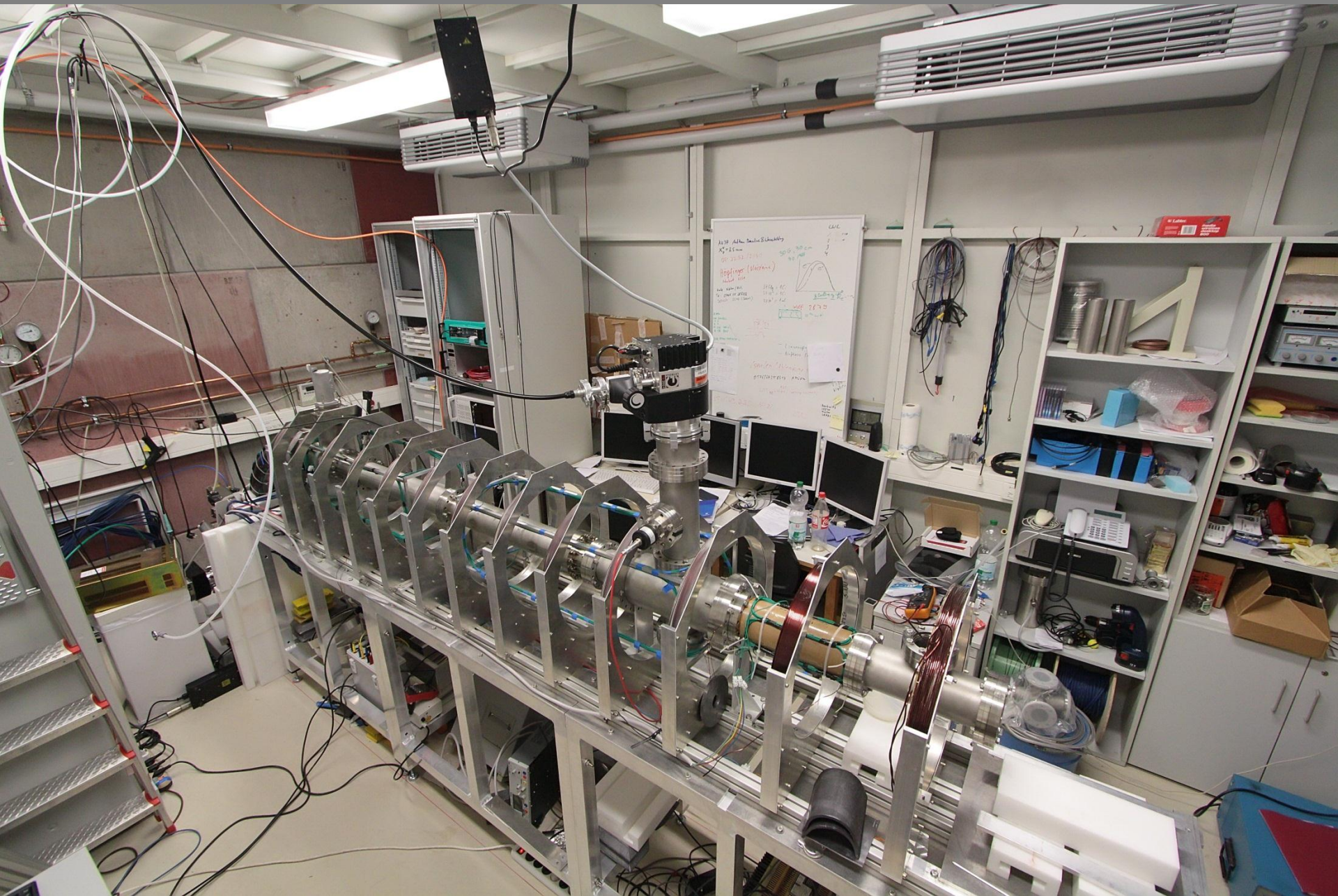




**EPOS scheme**







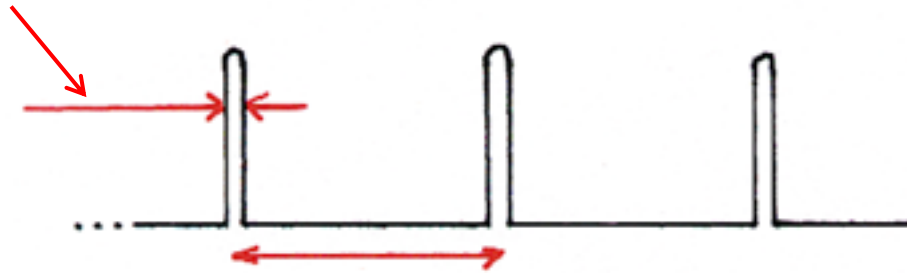
Ag 10. Active Device Stability  
2019.09.12  
S. J. Kim (Munich)  
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# Time structure of ELBE electron source

- electron beam bunched with final time structure in cw-mode
- positron generation by pair production at stack of W foils
- high-energy positrons must be moderated (Pt foil)

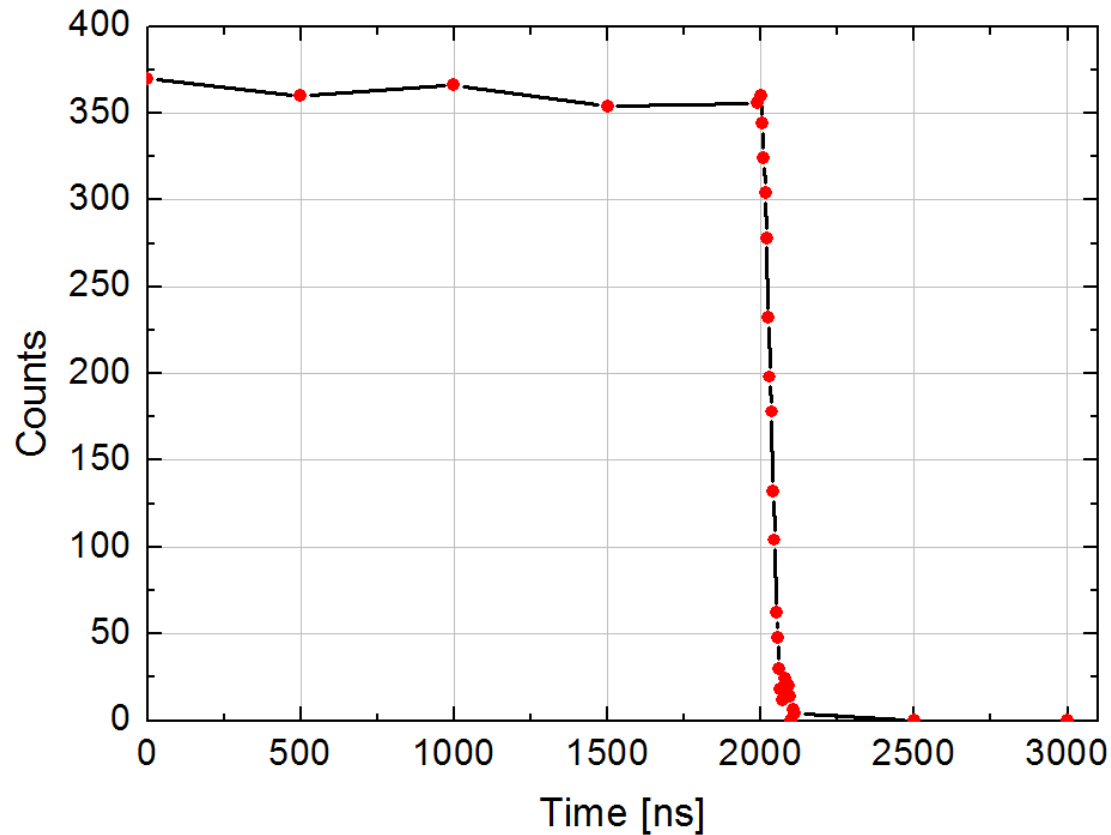
pulse width:  $< 5$  ps



repetition time: 77 ns

- transport energy of positrons 2 keV
- Aim: at sample positron bunch width  $< 50$  ps
- however: energy spread during transport lead to pulse width of  $> 2$  ns
- chopper: cuts time window of  $\Delta t < 2$  ns
- 2-slit buncher compresses pulse

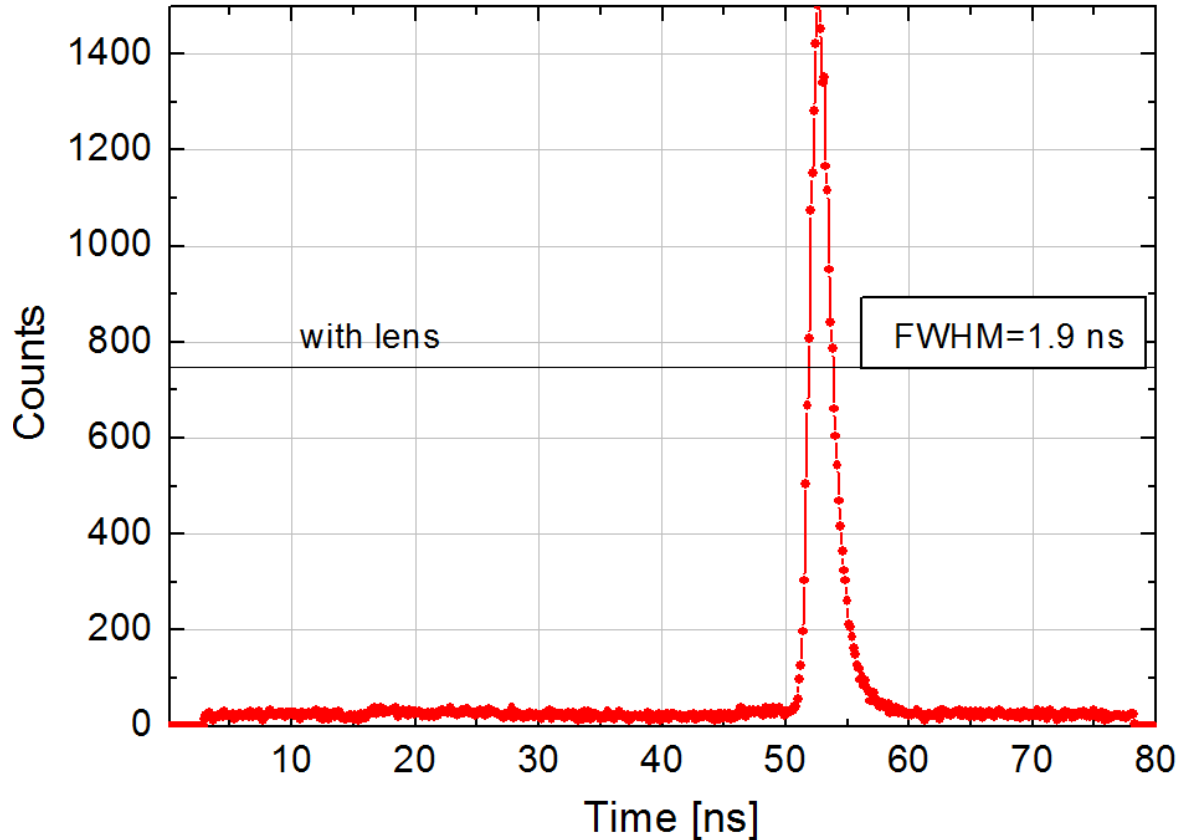
# Energy spectrum measured by a retarding field



- electrostatic lens in action
- 2 apertures of 5mm were mounted in a distance of half a gyration length (63 mm)



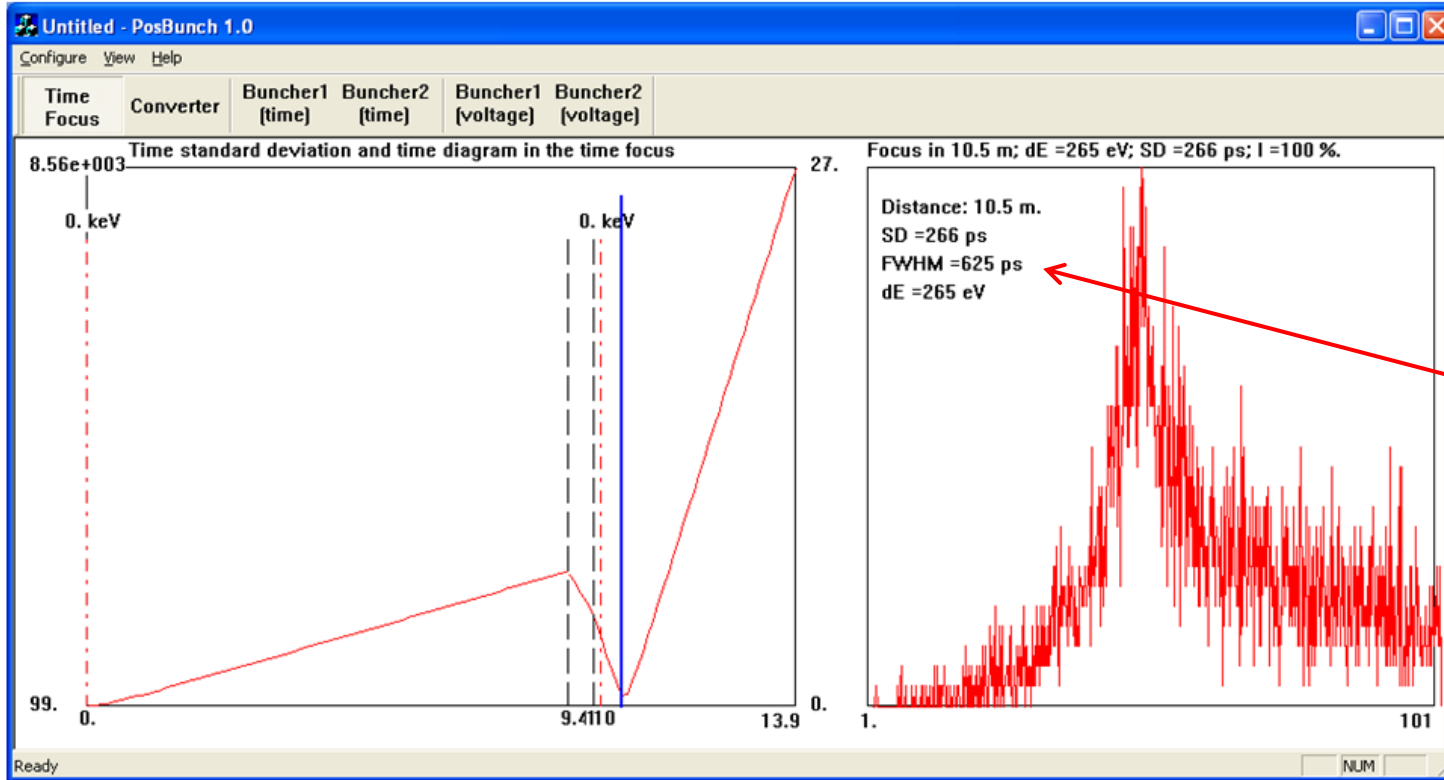
# MePS – measured time structure



- using the double aperture: time structure very useful and according to former simulation
- problem: Chopper signal must be 2 ns / >500V / 13 MHz repetition frequency
- very difficult to do with semiconductor amplifiers



# Monte-Carlo simulations using PosBunch



simulated  
FWHM of  
positron bunch  
625 ps

we measured  
FWHM = 500 ps

Configure

Converter

N 10000 E 2 keV SD(E) 25 eV

Lifetime 100 ps Bulk lifetime 100 ps Kappa 0 1/ns  t<sub>0</sub> 0 ps

Accelerators

Position	Voltage
1: 0 m	0 kV
2: 10.07 m	0 kV
3: 0 m	0 kV

Buncher 1

Amplitude 500 V Frequency 13 x 2 = 26 MHz

Position 9.44 m Width 0.5100766 Phase -58.141521

Buncher 2

Amplitude 110 V Frequency 13 x 2 = 26 MHz

Position 9.1 m Width 0.5100766 Phase -56.047441

Choppers

Position	Width
1: m	ns
2: m	ns

Resolution (FWHM) 0 ps

Distance 14 m Step 0.1 m

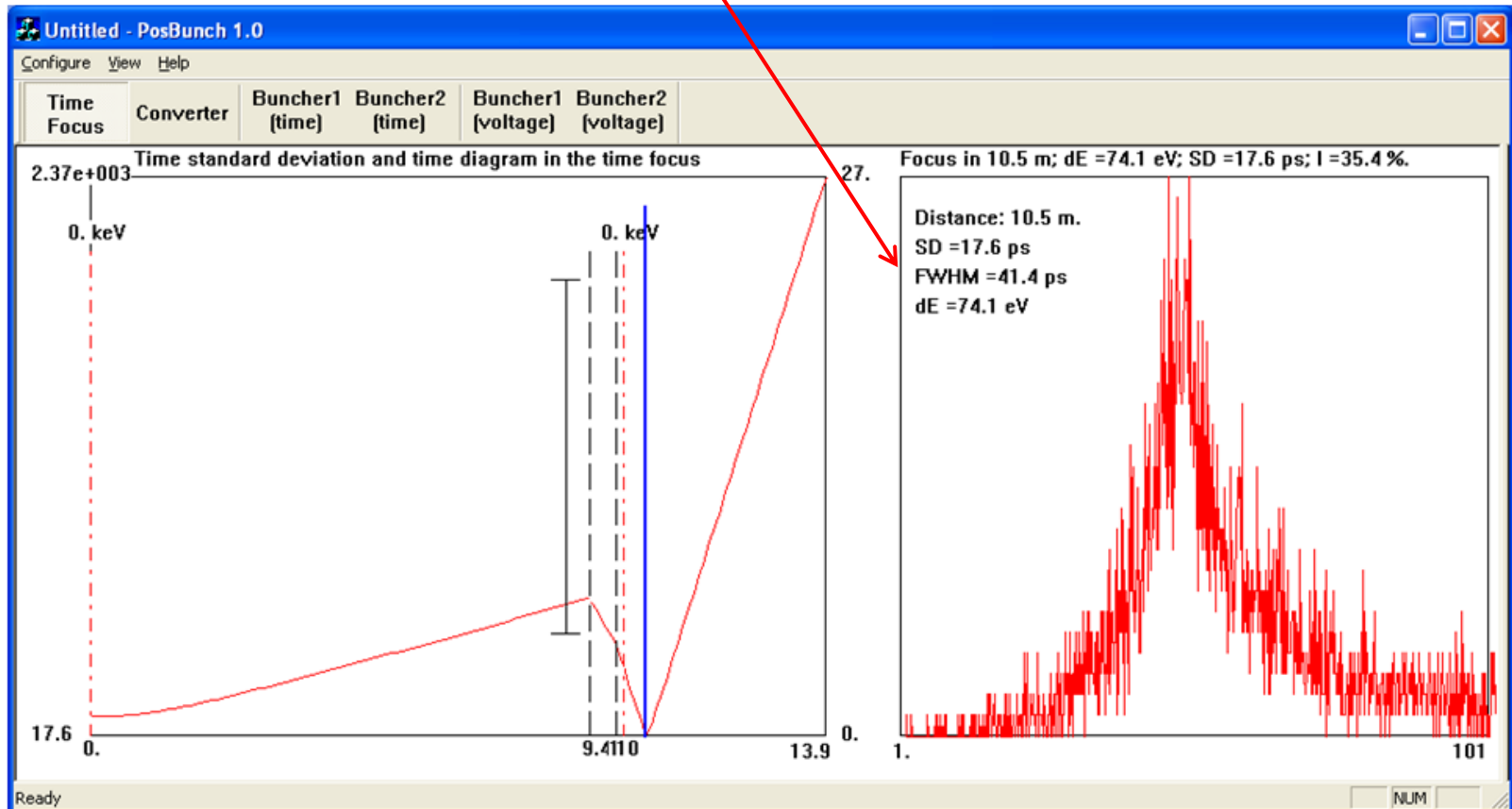
Ready

no chopper

Show Save Parameters Load Parameters  SD(x)  Time Diagramm  Energy  Bunchers



with chopper: FWHM = 41 ps



Intensity 35.4 %

Configure

Converter

N 10000

E 2 keV

SD(E) 25 eV

Lifetime 100 ps

Bulk lifetime 100 ps

Kappa 0 1/ns

t<sub>0</sub> 0 ps

Resolution (FWHM) 0 ps

Distance 14 m Step 0.1 m

Ready

Accelerators

Position	Voltage
1: 0 m	0 kV
2: 10.07 m	0 kV
3: 0 m	0 kV

Buncher 1

Amplitude 500 V Frequency 13 x 2 = 26 MHz

Position 9.44 m Width 0.5100766 Phase -58.141521

Buncher 2

Amplitude 110 V Frequency 13 x 2 = 26 MHz

Position 9.1 m Width 0.5100766 Phase -56.047441

Show

Save Parameters

Load Parameters

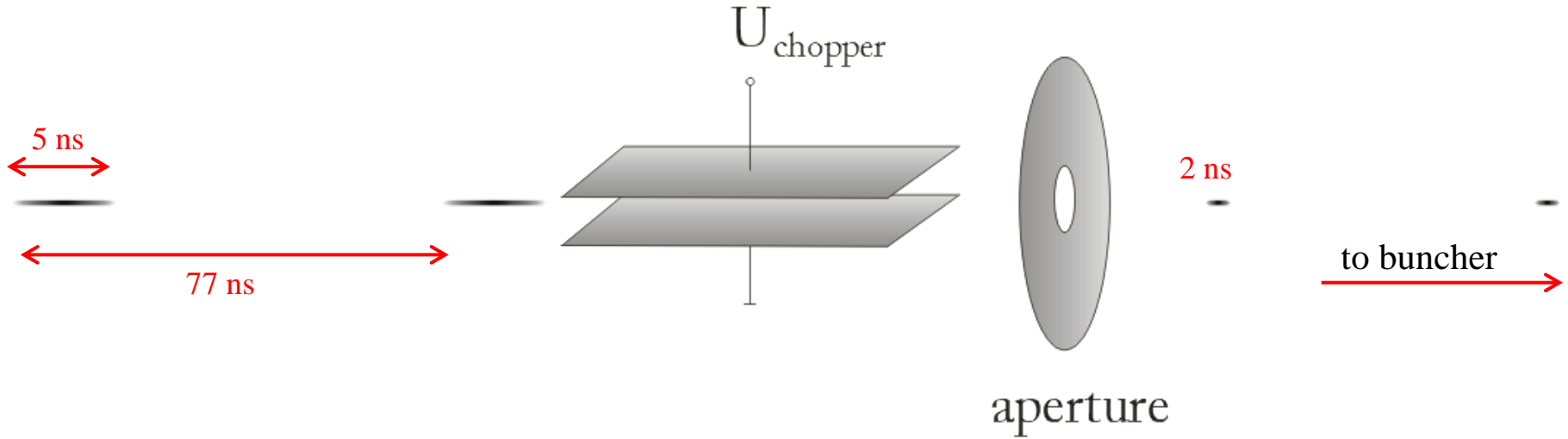
SD(x)

Time Diagramm

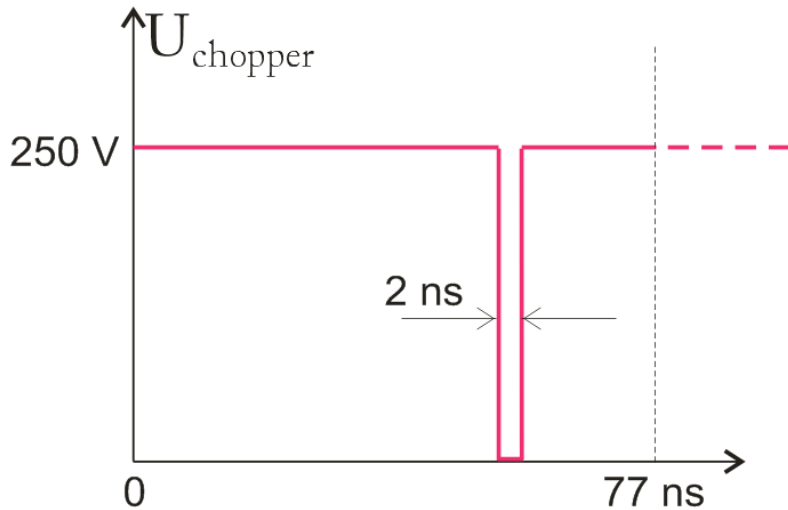
Energy

Bunchers

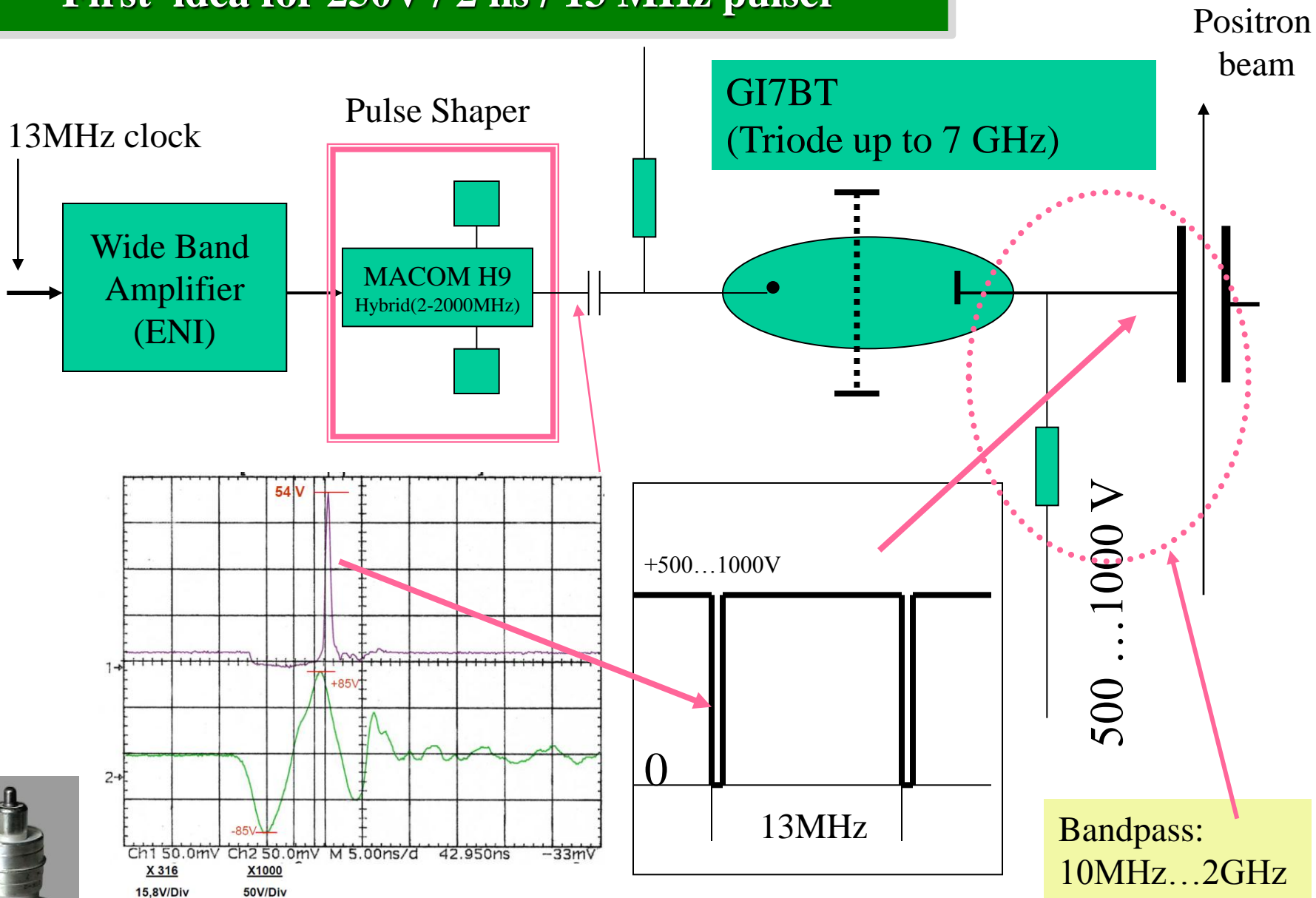
# Chopper



- beam must be deflected all the time – except for 2 ns



# First idea for 250V / 2 ns / 13 MHz pulser



## Conclusions

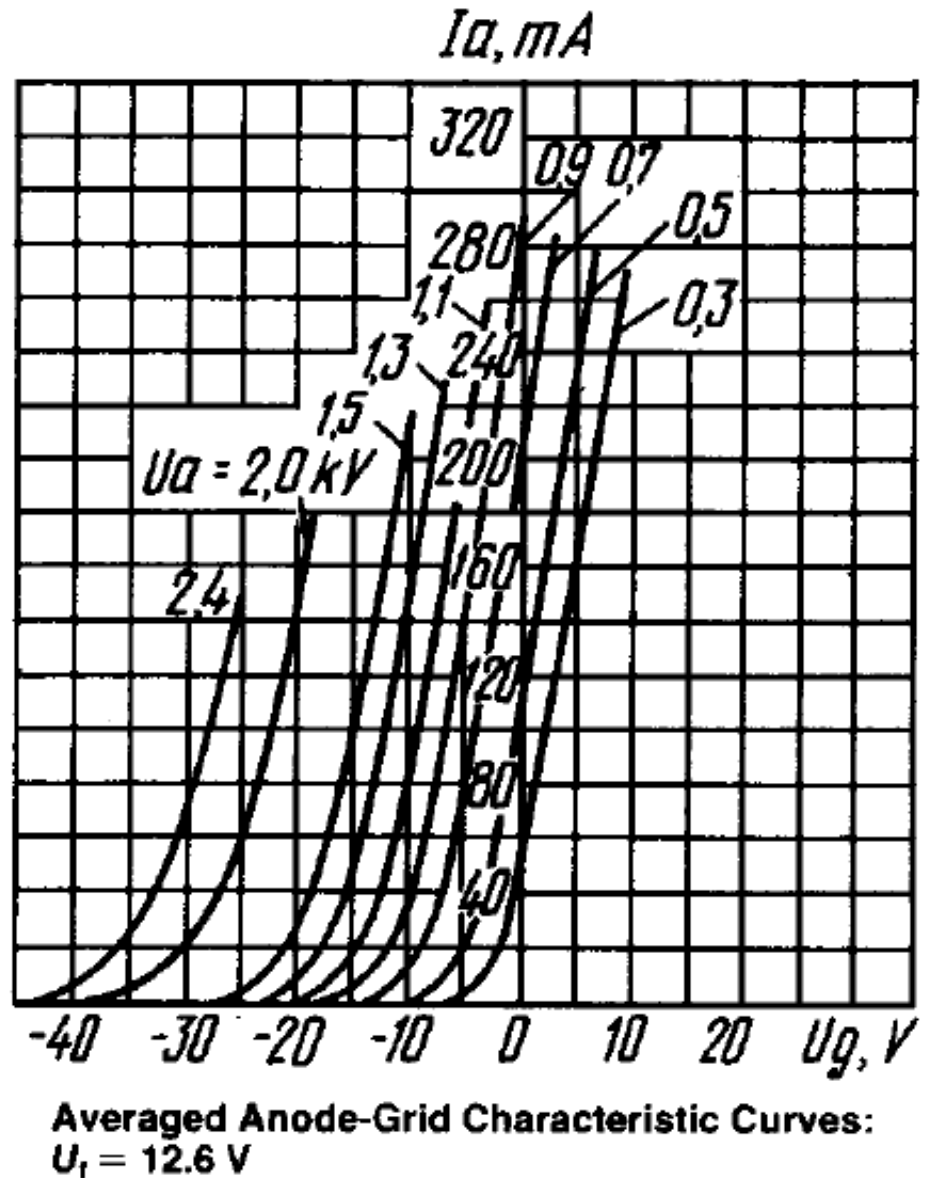
- Chopper pulse generator is most important problem in finalizing MePS
- we need 2 ns / 250 V / 13 MHz pulser

Thank you for your attention!

This presentation can be found as pdf-file on our Website:  
<http://positron.physik.uni-halle.de>

# Idea for 500V / 2 ns / 13 MHz pulse generator

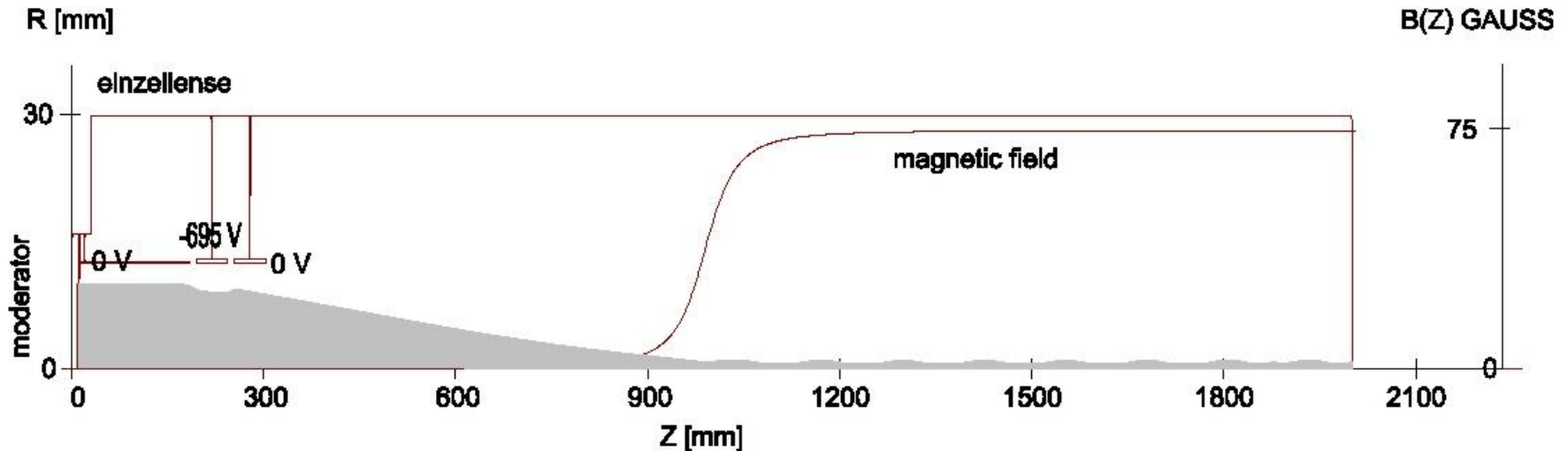
- GI7BT is a Russian military radar pulse tube
- up to 7 GHz / 350 W
- Anode capacity  $\approx 5$  pF
- $I = 7.5$  A (in pulse mode)



# GiPS: Gamma-induced Positron Spectroscopy

electrostatic

magnetic



- positrons which are not well focused get transversal energy
- this is missing in transversal component: broad time structure
- this part must be filtered out
- realized by the three vacuum tube bends and a double aperture

