

Spectral distribution of the ANITA white neutron beam facility at TSL at the University of Uppsala

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- **The Svedberg Laboratory / ANITA**
- **Detector, monitors**
- **Experimental setup**
- **Simulation results**
- **First measured spectra**
- **Data evaluation procedure**
- **Summary**

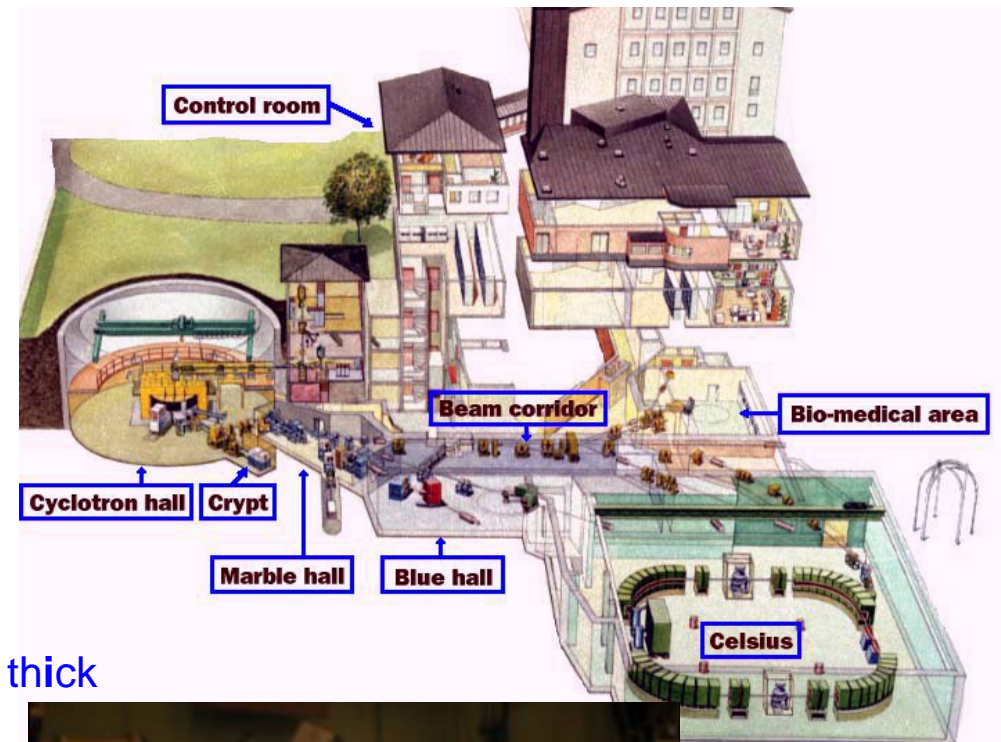
- TSL

- Gustaf Werner Cyclotron

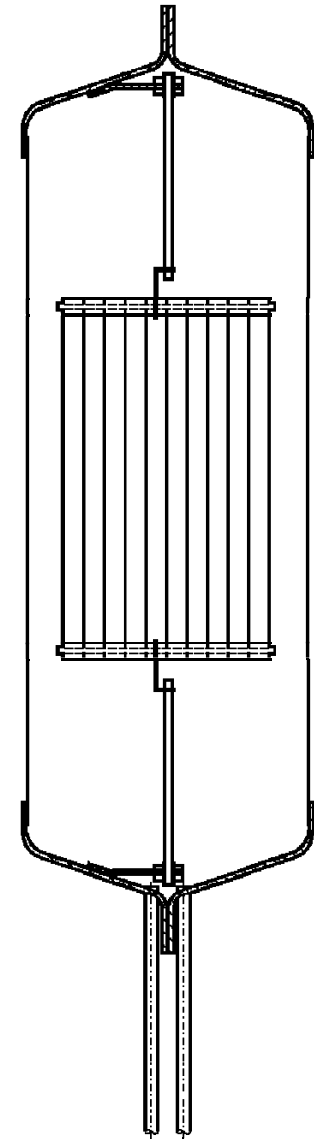
- Isochronous cyclotron for all particles except protons above 100 MeV
- Synchrocyclotron for protons 100-180 MeV
- no pulse selector

- Blue hall

- ANITA: Atmospheric-like Neutrons from thick Target \Rightarrow „white“ neutron spectrum
- 180 MeV protons
- 25 mm W target
- Max. flux density:
 $\varphi \approx 3 \cdot 10^6 \text{ cm}^{-2} \text{ s}^{-1}$ at 2.5 m, 200 nA
- Repetition rate: 22.2 MHz (45 ns)
- Time resolution $\approx 5 - 12 \text{ ns}$ (FWHM)

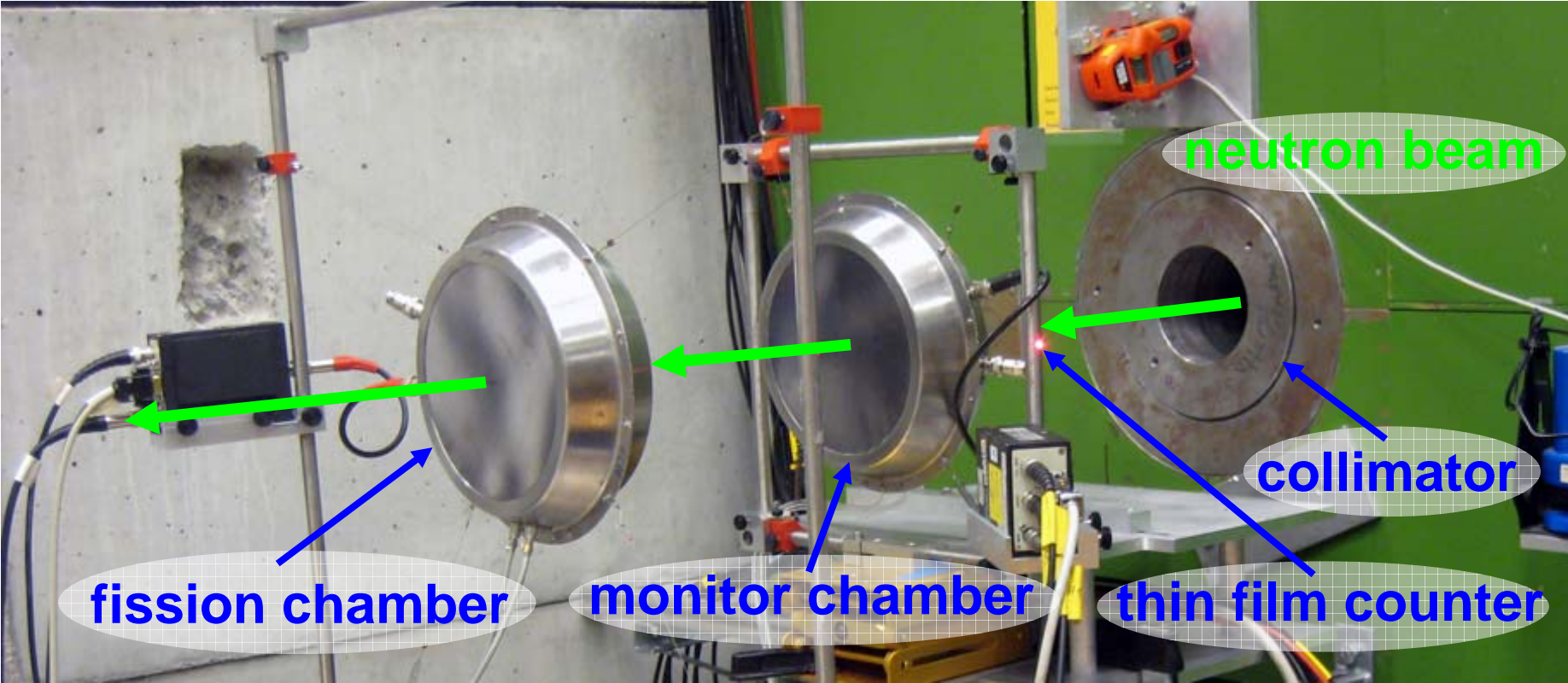


- ^{238}U fission chamber
- Primary detector:
 - 197.8(5) mg of $^{238}\text{U}_2\text{O}_3$
 - ⇒ $436.0 \mu\text{g cm}^{-2}$
 - 10 deposits
 - ⇒ capacity $\sim 145 \text{ pF}$
 - ⇒ time resolution $\sim 4 \text{ ns}$
 - high Z material (Pt/Ta)
 - ⇒ fission fragments (background)
- Monitor detectors:
 - 1) 45.3(5) mg of $^{238}\text{U}_2\text{O}_3$ at 2.5 m distance
 - ⇒ $99.9 \mu\text{g cm}^{-2}$
 - 2) thin film breakthrough counter at 2.4 m distance
 - 3) TSL fission chamber at 15 m distance
 - 4) Proton beam dump charge integrator

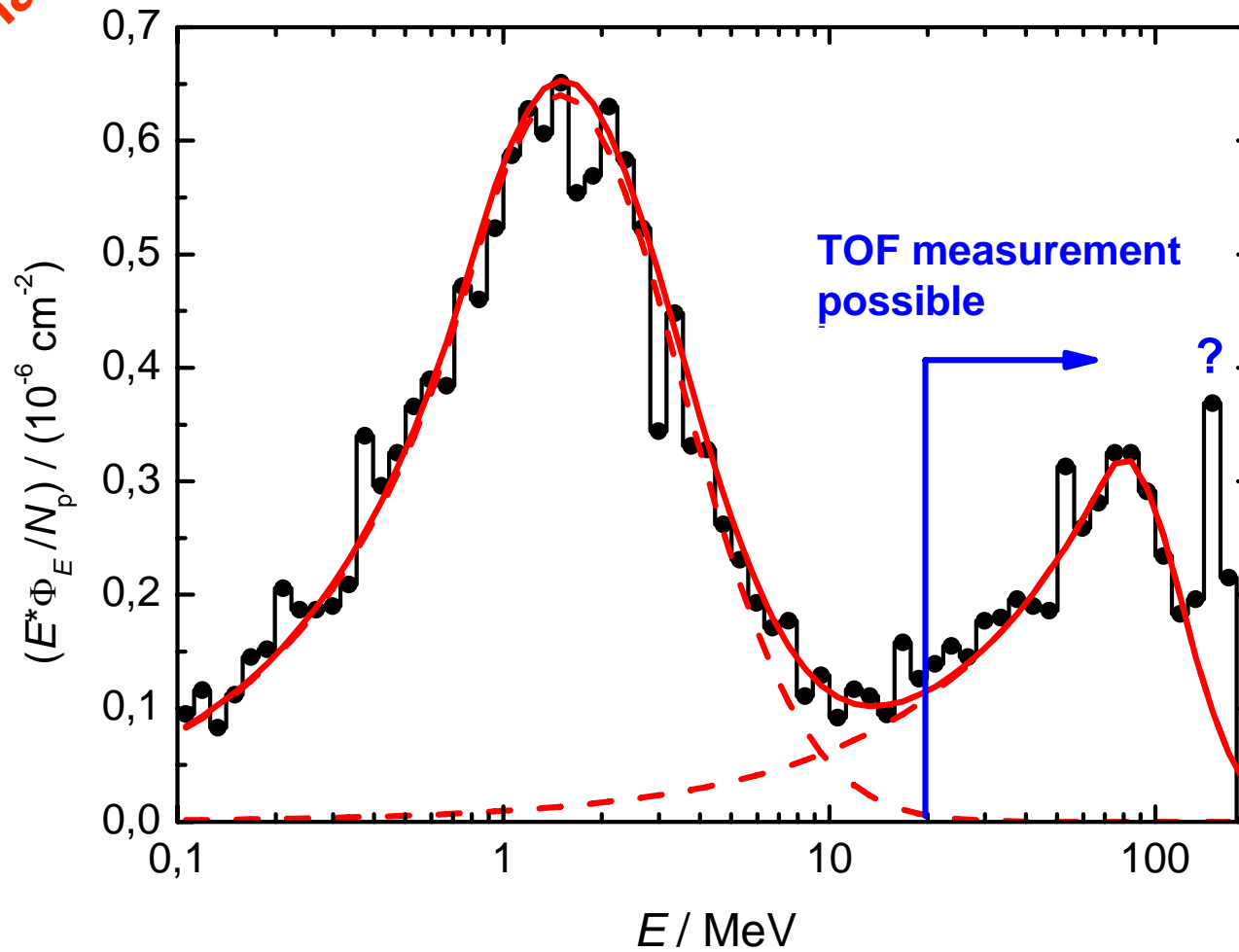


Experimental setup

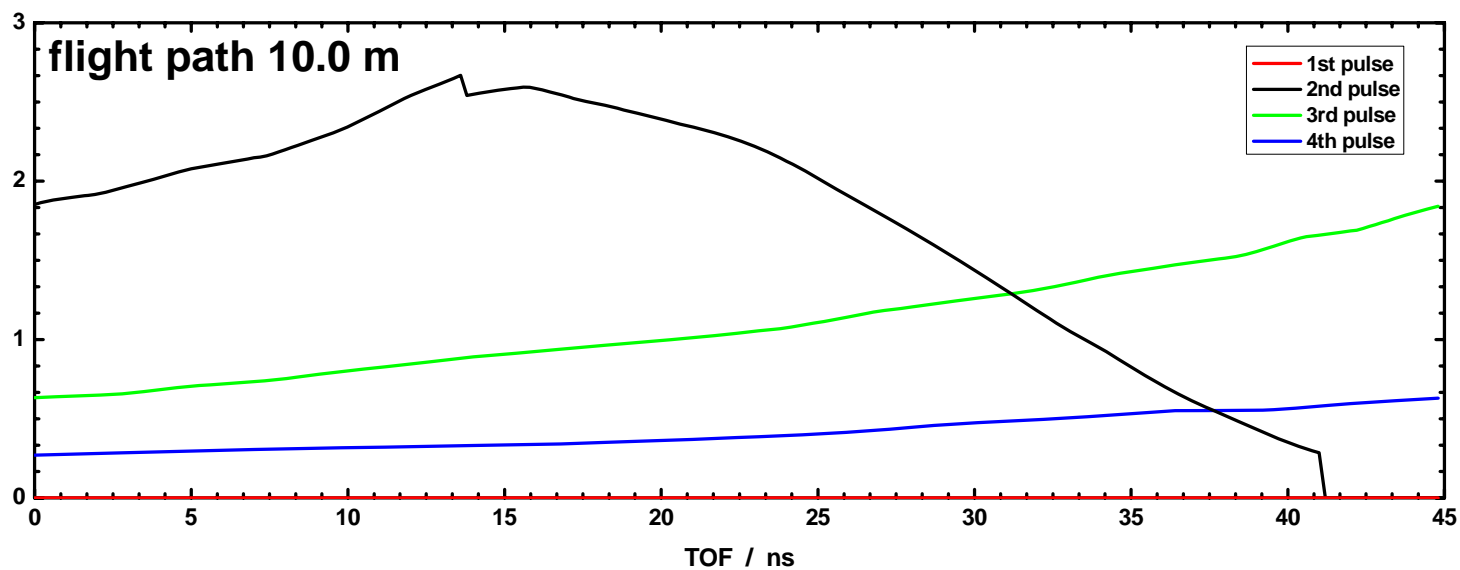
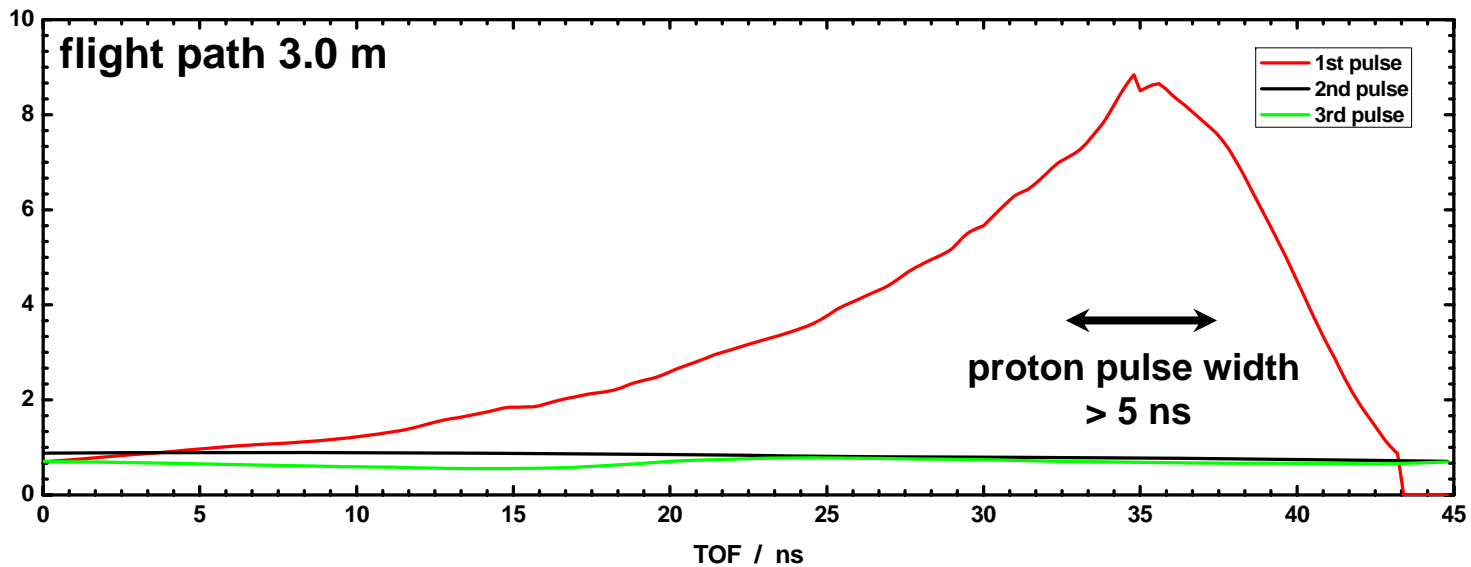
Side view



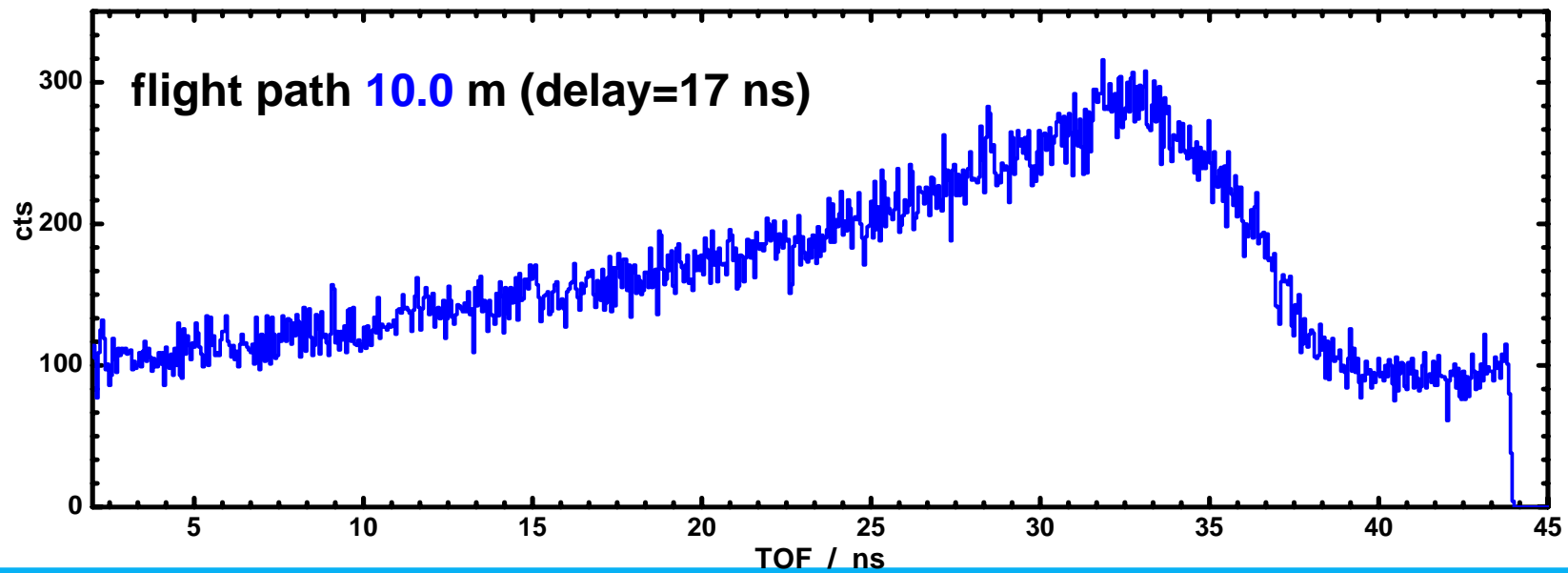
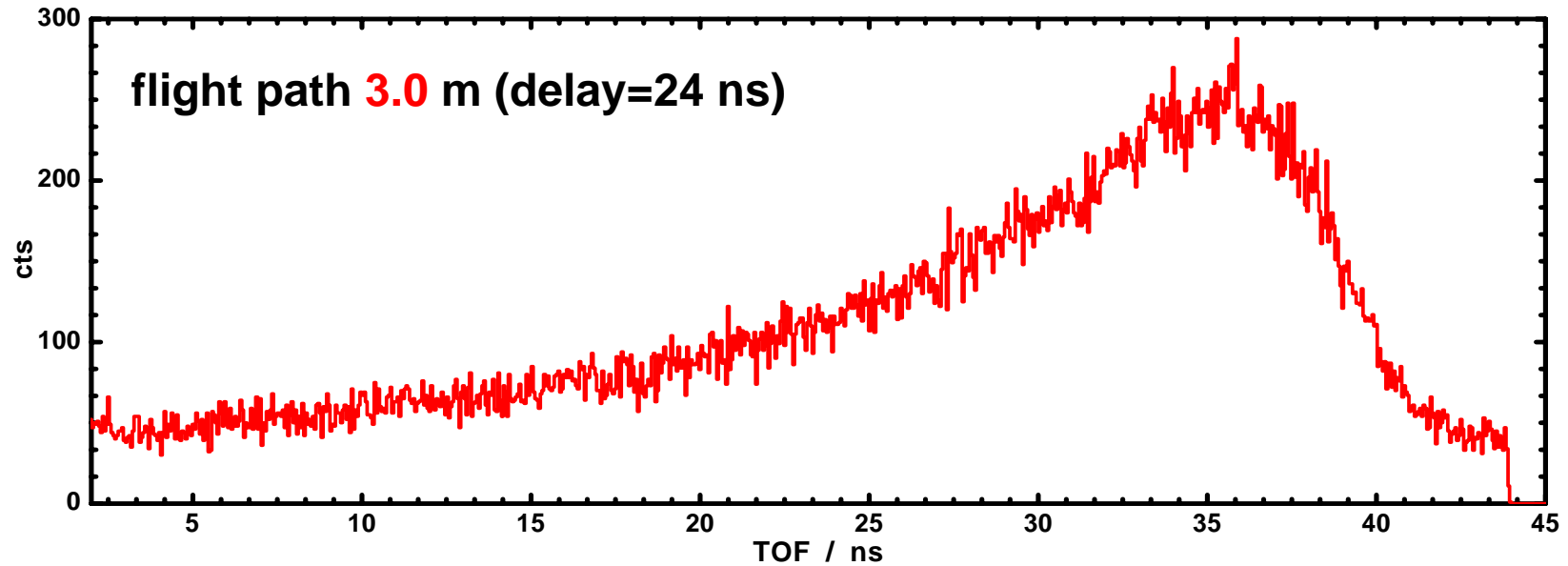
preliminary



Calculated TOF spectra



Experimental Results



- **realistic mc simulation**
 - ⇒ detailed drawings of the target setup required
- **find parameterised model for neutron spectrum**
- **determine parameters that fit simulation**
- **apply Bayesian statistics with MCMC, Gibbs Sampling**
 - ⇒ using e.g. WinBUGS
 - ⇒ adapted parameters with assigned probability distribution
 - ⇒ verification of the simulation, the model and the parameters

- preliminary mc simulation ✓
- parameterised model ✓
- time-of-flight measurement in the ANITA field ✓
- detailed mc simulation
- determination of the probability distributions of the parameters
- below 10 MeV:
 - Bonner sphere spectrometry
 - spectrometry using foil activation (threshold reactions)