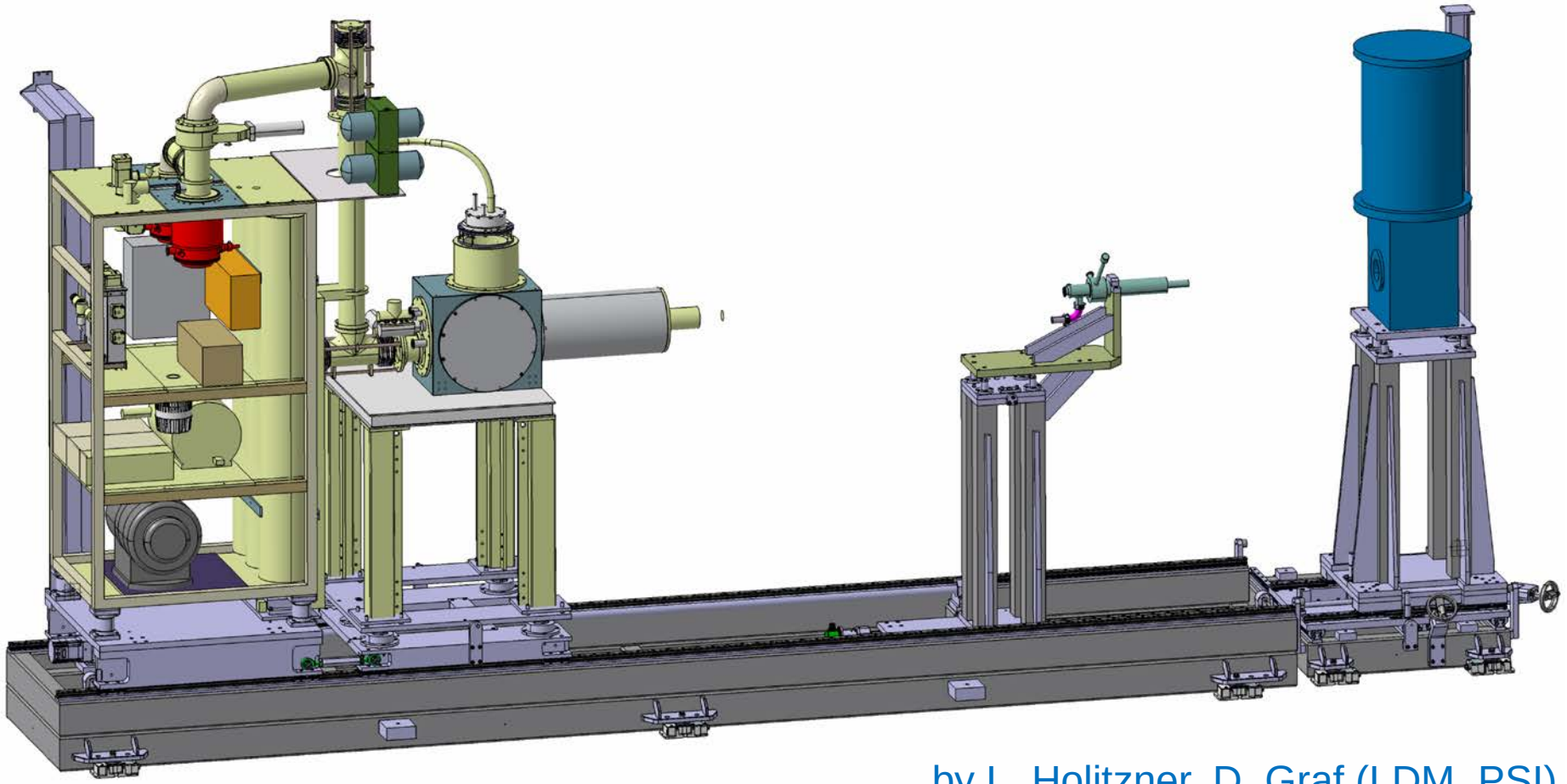
# Combination of Magnet and DR

# Experimental Platform

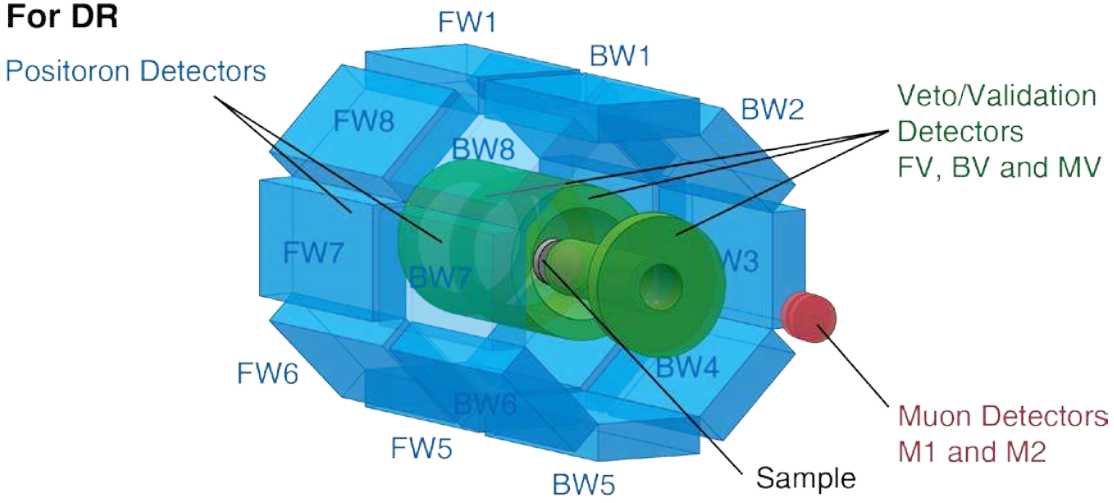
Precision motor drive for cryostat positioning
and automated compensation of thermal shrinkage
(ca. 3 mm from 50-300 K)



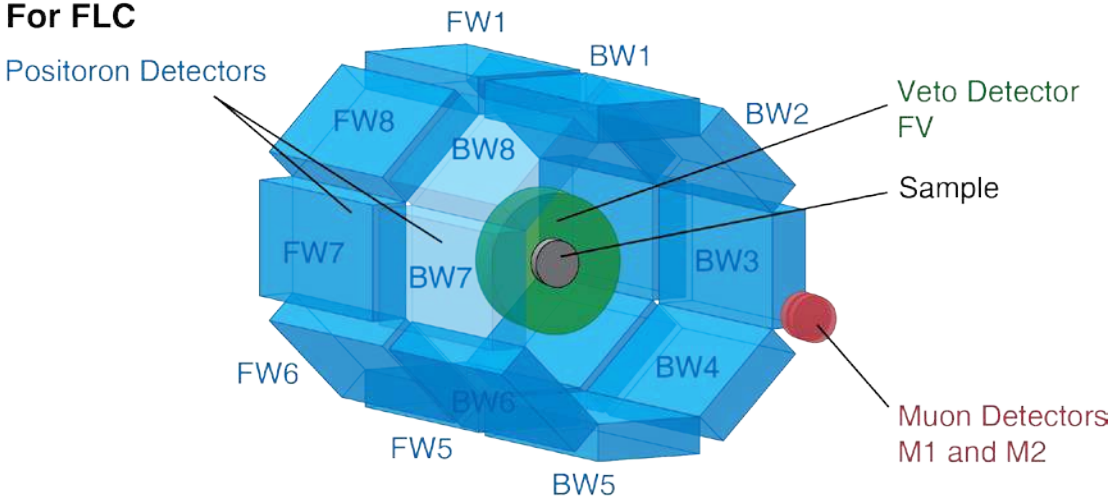
by L. Holitzner, D. Graf (LDM, PSI)

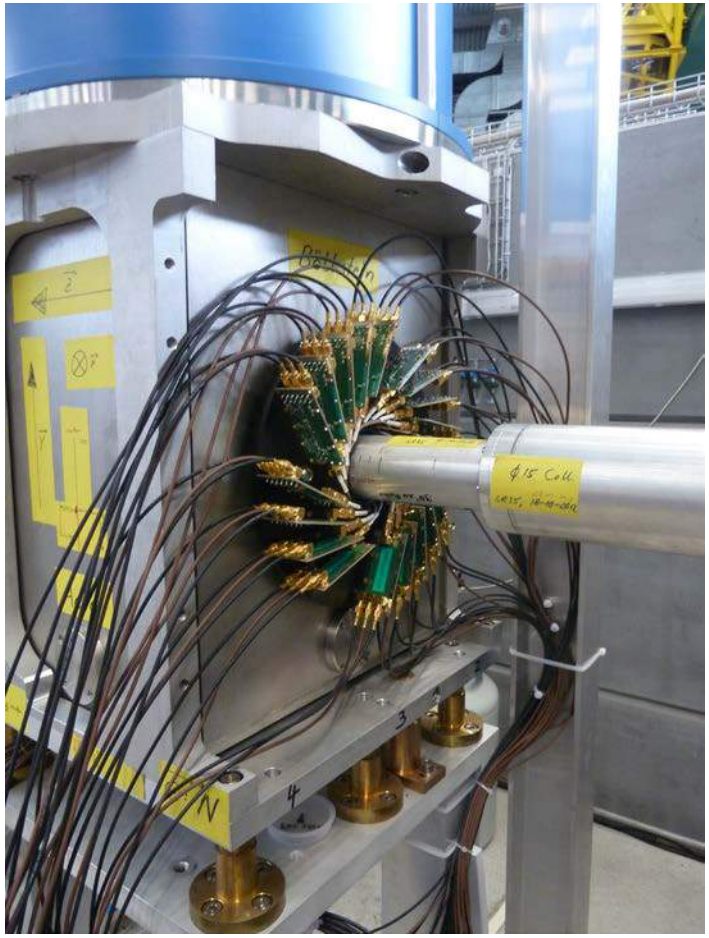
# Detector Arrangement

**For DR**




**For FLC**



# Veto/Validation Detector

Scintillators (Eljen EJ-204)

in sample chamber / on 1K shield

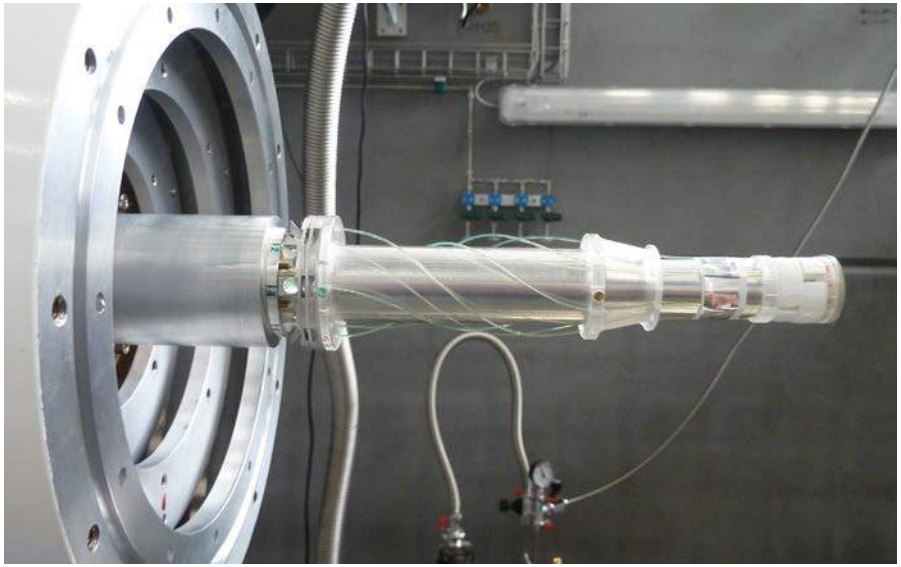
Lens Light Guide

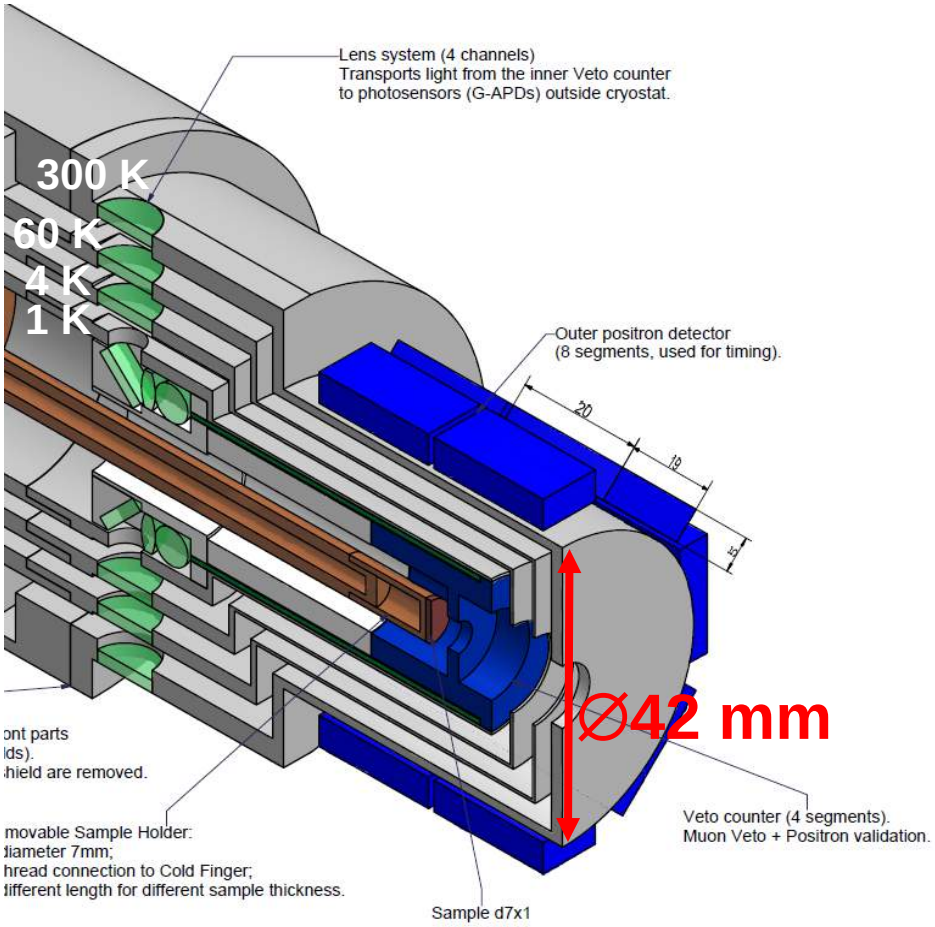
(A. Stoykov *et al*., JINST 6 (2011) P02003)

Wavelength shifting fiber:

Bicron BCF-92, ∅0.8 mm

Lenses / windows: Edmund Optics

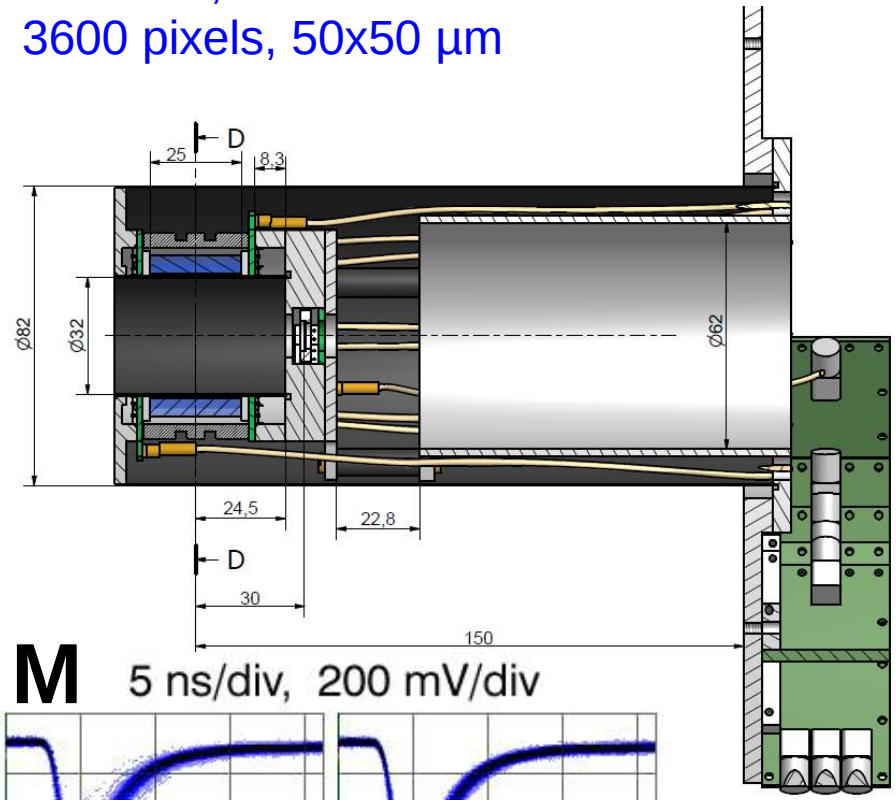


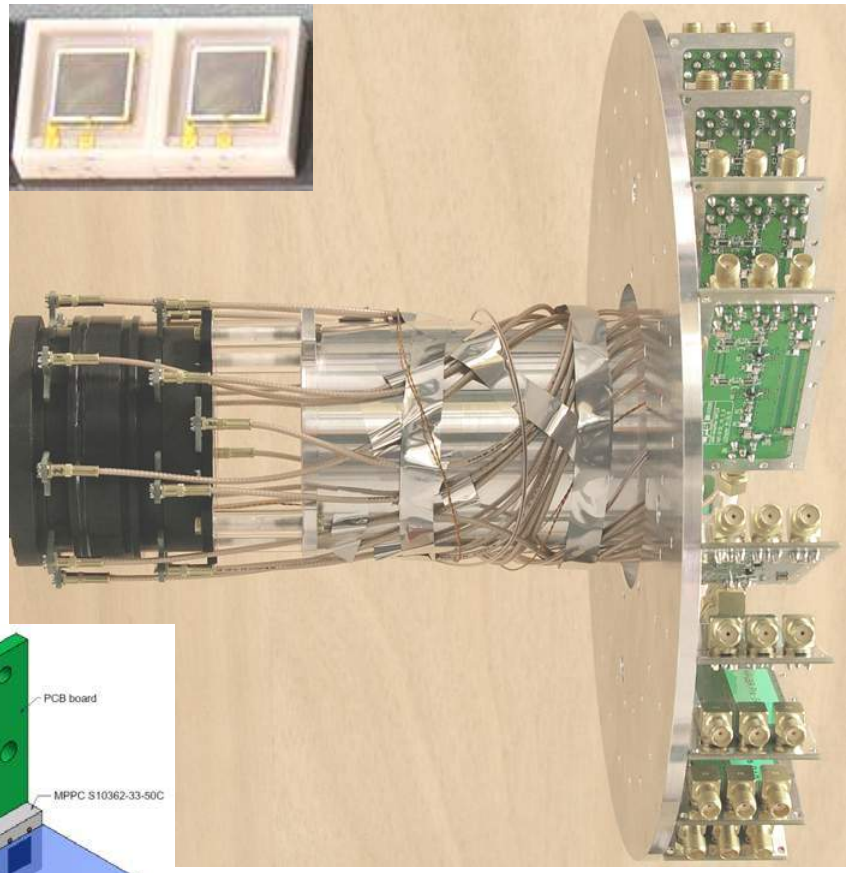


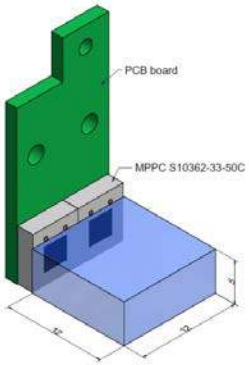

a) rejection of muons missing the sample
b) validation of positrons from muons stopped at the sample
c) ‚routing' in high magnetic fields (small $e^+$ spiraling radii)

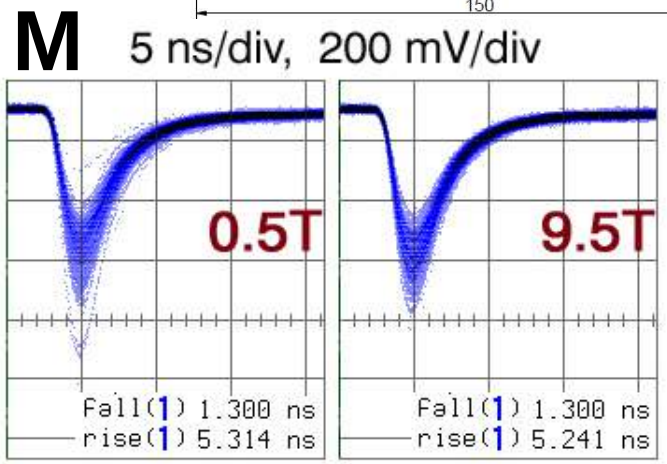
# Timing Detector

Hamamatsu MPPC S10362-33-050C (3x3 mm$^2$)
*PDE* > 30% at 390 nm; *M* ~ 7 x $10^5$;
*U* ~ 70 V; $1/M \times dM/dT$ ~ 6%/K
3600 pixels, 50x50 µm






Scintillator: EJ 232
(‚blue', rise time: 350 ps)

**No change in performance up to 9.5 T !**

# Time Resolution

DC muon source allows us to measure high-frequency muon spin precession in high fields.

HAL-9500

Time resolution: 80 ps

80% signal at 9.5 T

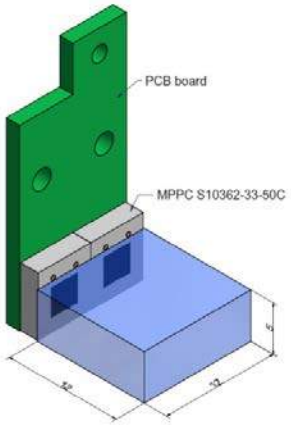
MPPCs + no light guides

HiTime (TRIUMF)

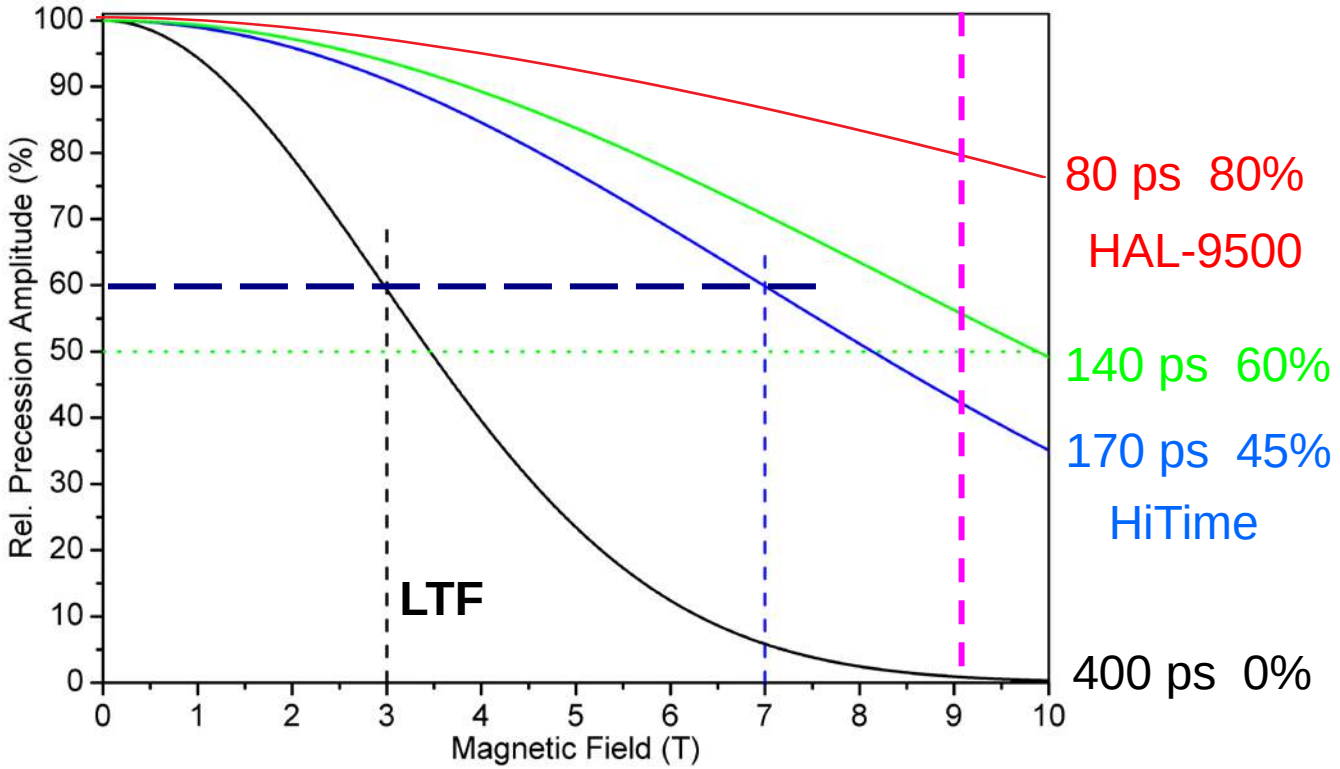
Time resolution: 170 ps

60% signal at 7 T

PMTs + light guides




**Only 20% Reduction!**

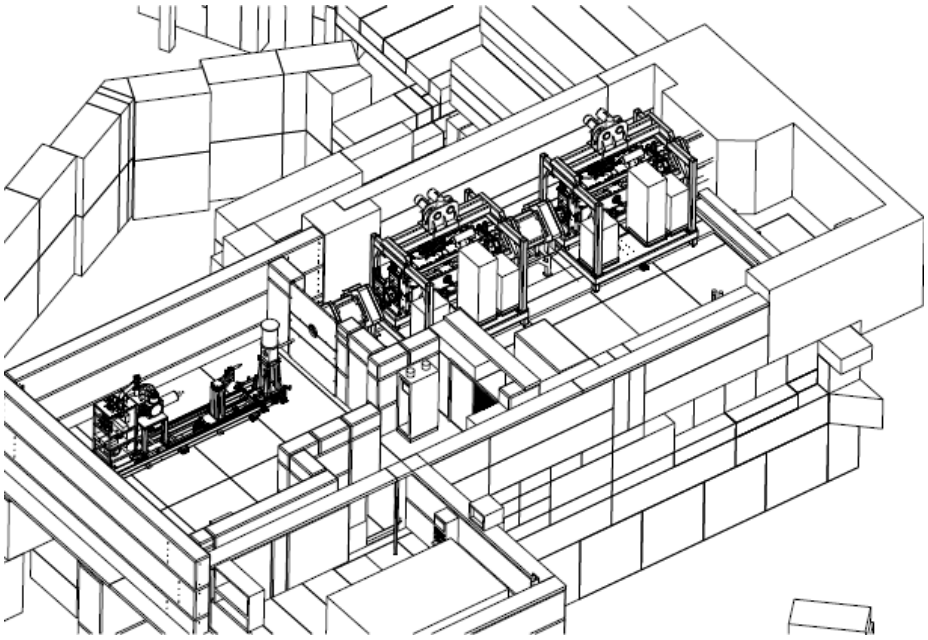


# Beamline

Permanent setup in reconstructed area πE3 with completely new infrastructure (T. Rauber et al.)

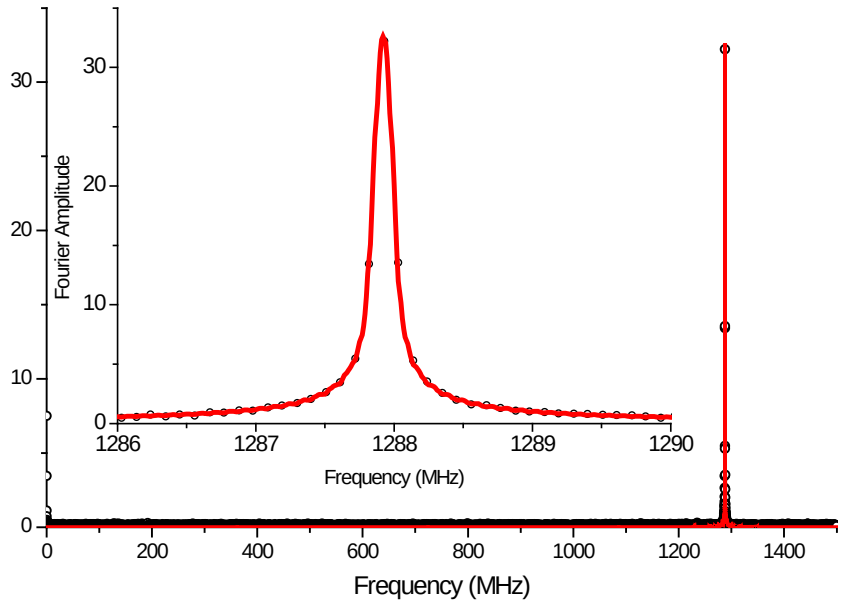
Surface muons 28 MeV/c (stopping power 0.2 g/cm2)

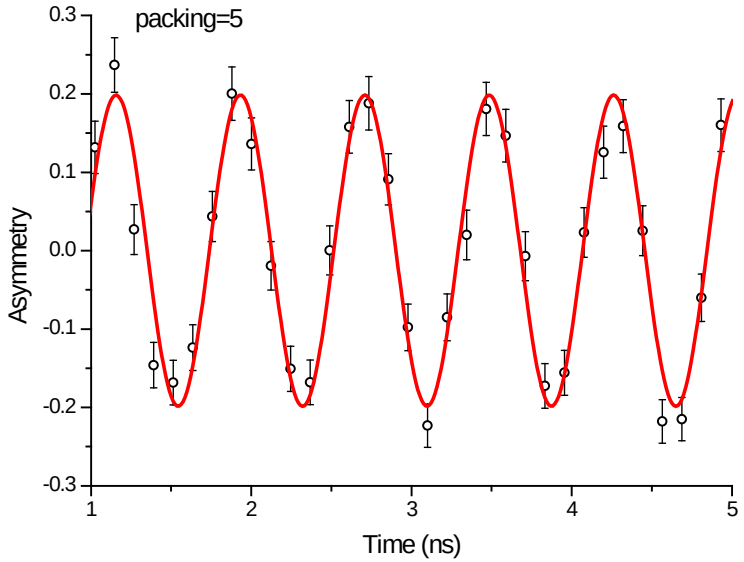
90° spin rotation (2x45° Wien filters)



# First Data at 9.5T on Ag sample (11.05.2011)

(sample 12 × 12 × 1mm³, collimator ∅5mm)




**Fitparameters:**

freq = (1287.9222 ± 0.0002) MHz

asym = (0.1985 ± 0.0004)

sigma = (0.069 ± 0.002) $\mu s^{-1}$

**homogeneity: Δ*B*=0.08 mT (8.4ppm)**

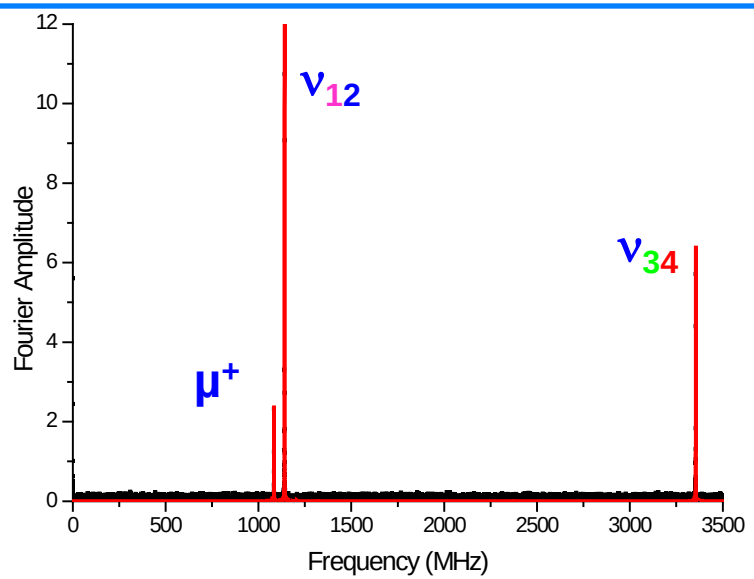
42° spin rotation ($P_\mu$=67%)

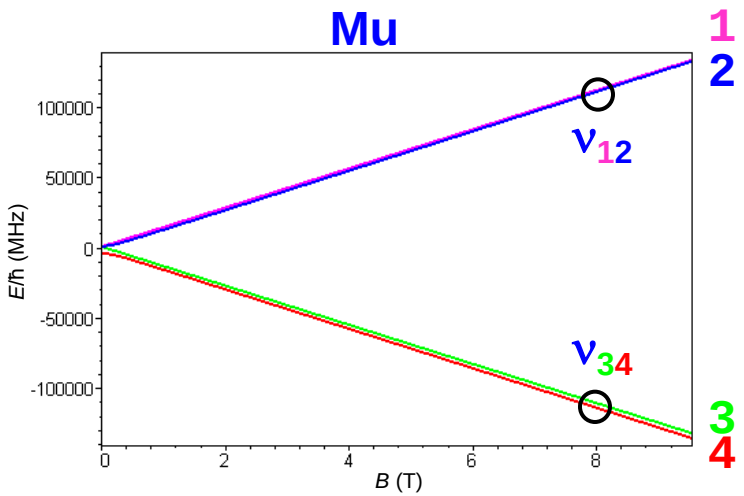
⇒ full asym at 9.5T = 0.3

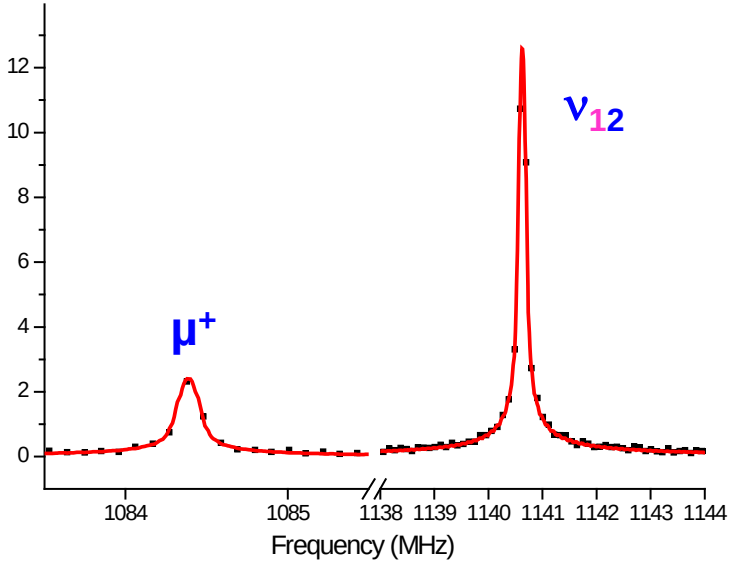
asym at 9.5T with PMT system

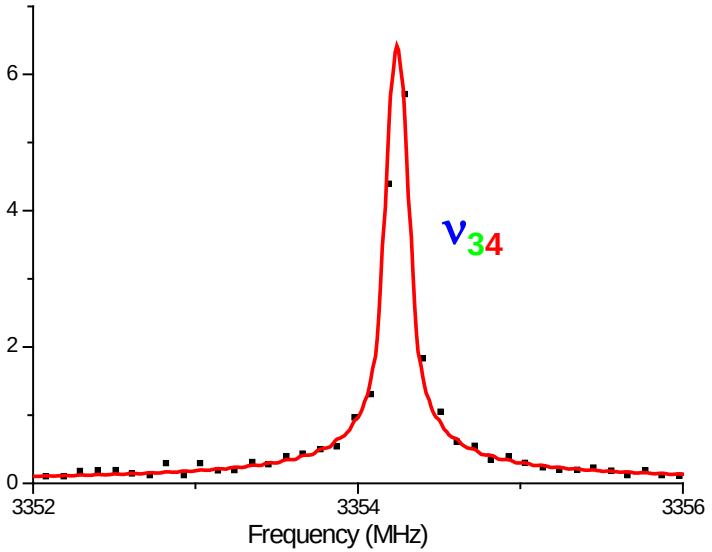
(σ=170ps, TRIUMF) ≈ **60% reduced!**

# Muonium in synthetic quartz crystal @ 8.0T



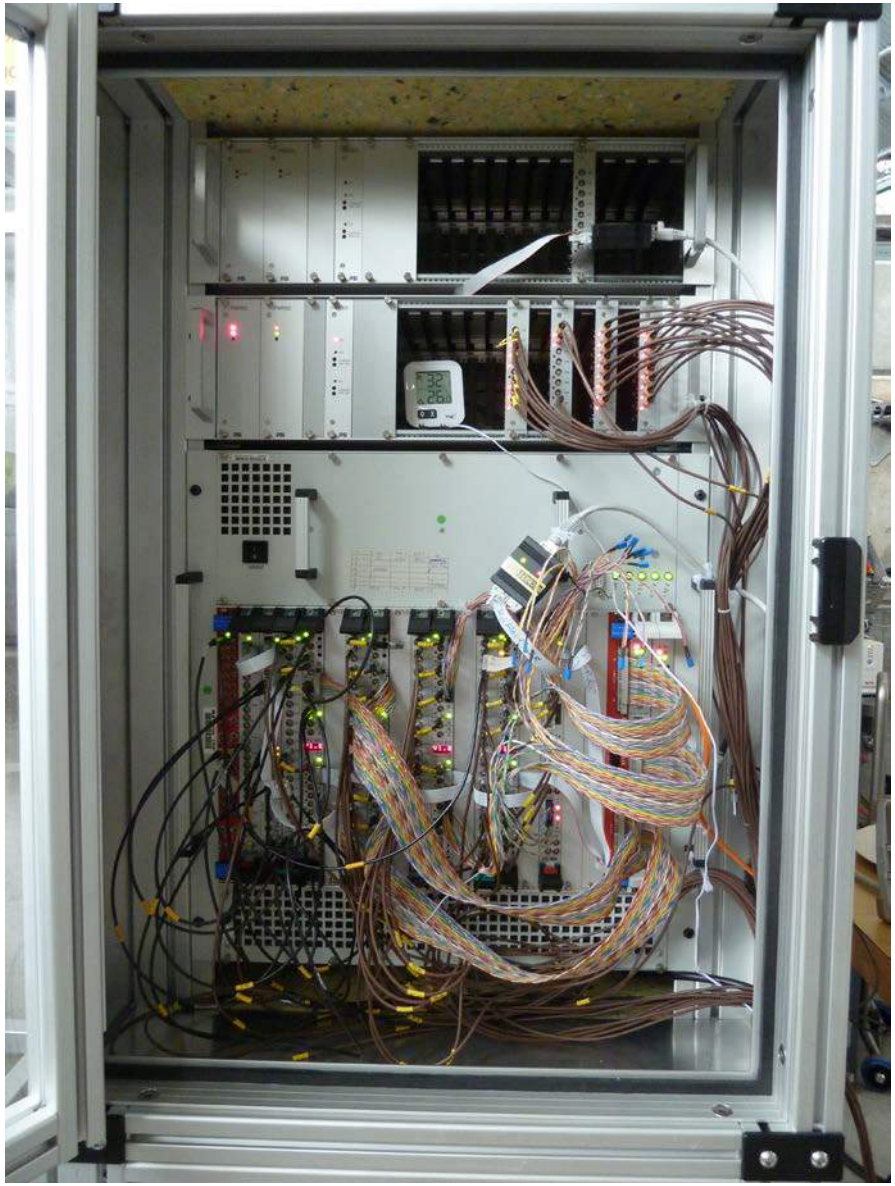




## ⇒ Time resolution from amplitude ratios

# Frontend Electronics



CAEN - TDC V1290A (25 ps)

SIS - Scaler & VME/PCI

PSI electronics
(LTP El. Meas. Sys. group):

HVR800

APD Preamps

VME modules:

CFD950

FC950

LC950

SP950

CD950