Status of Project A01 @ S-DALINAC

M. Hilcker, U. Gayer, N. Pietralla, M. Schilling

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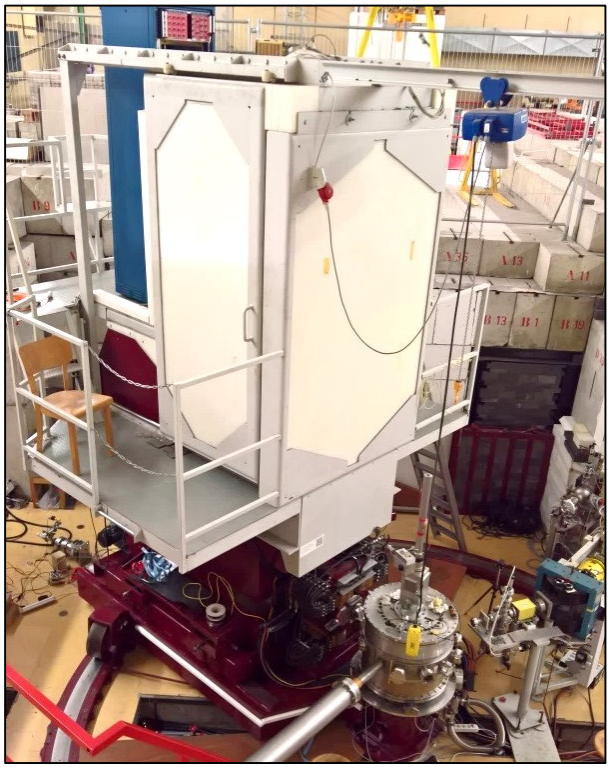

Project Goals

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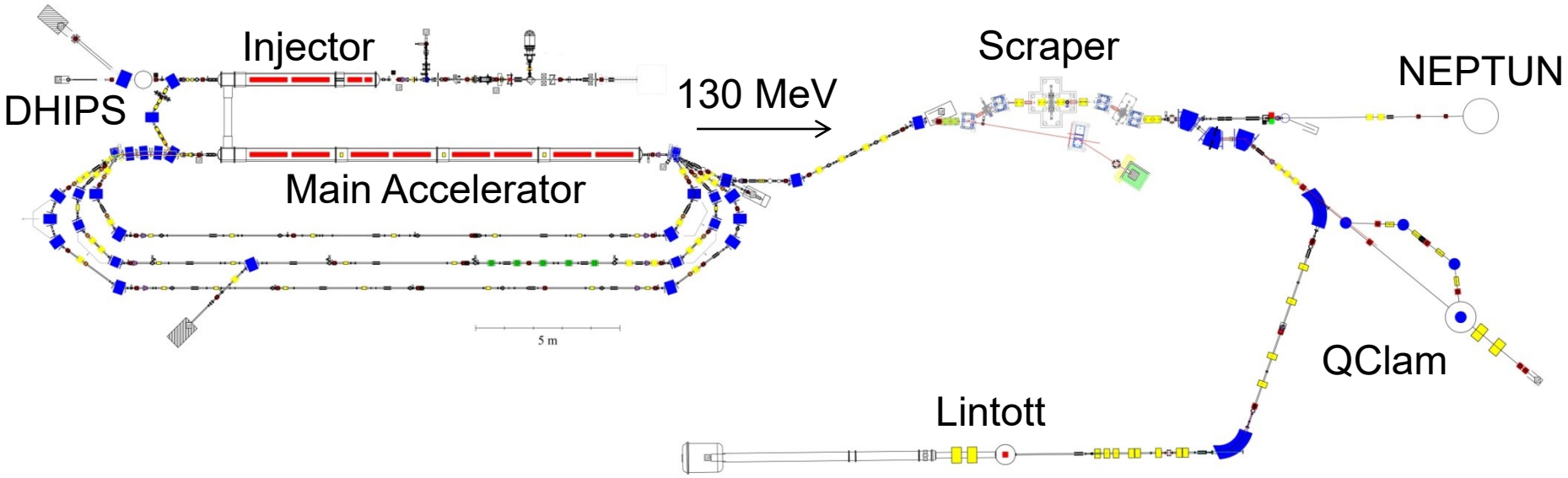
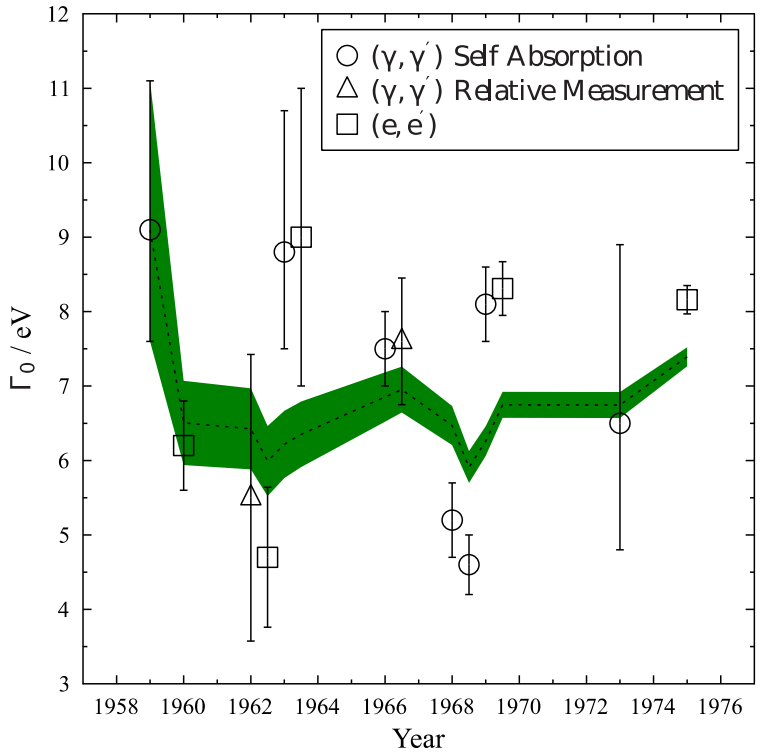
- Precision measurements in few-body systems
- ^{6}Li isovector M1 two-body current contribution
- Charge radius of ^{6}Li
- 0^{+} form factor of ^{4}He at 20.21 MeV

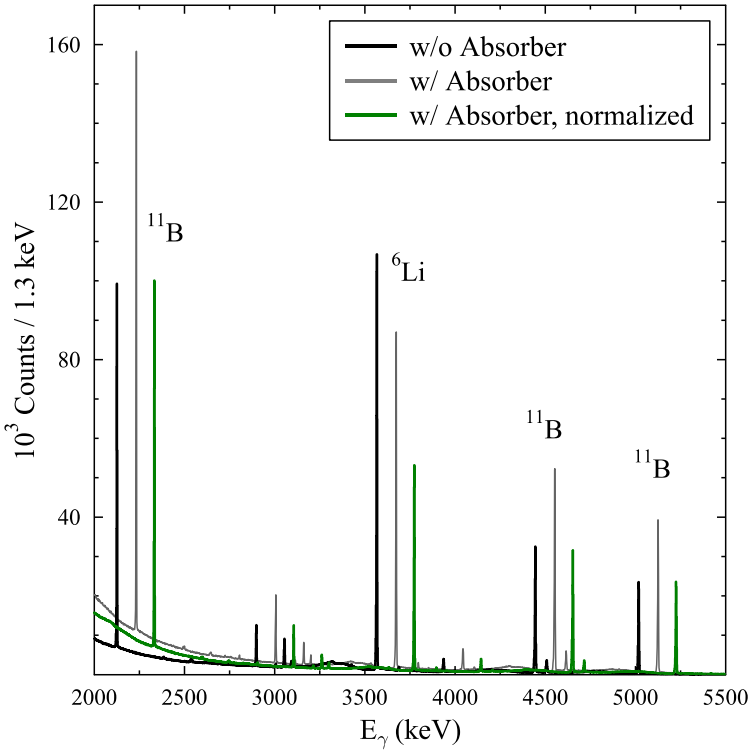
Experimental Setup



M. Arnold, Dissertation, TU Darmstadt (2016)

^{6}Li: Historic and @ DHIPS





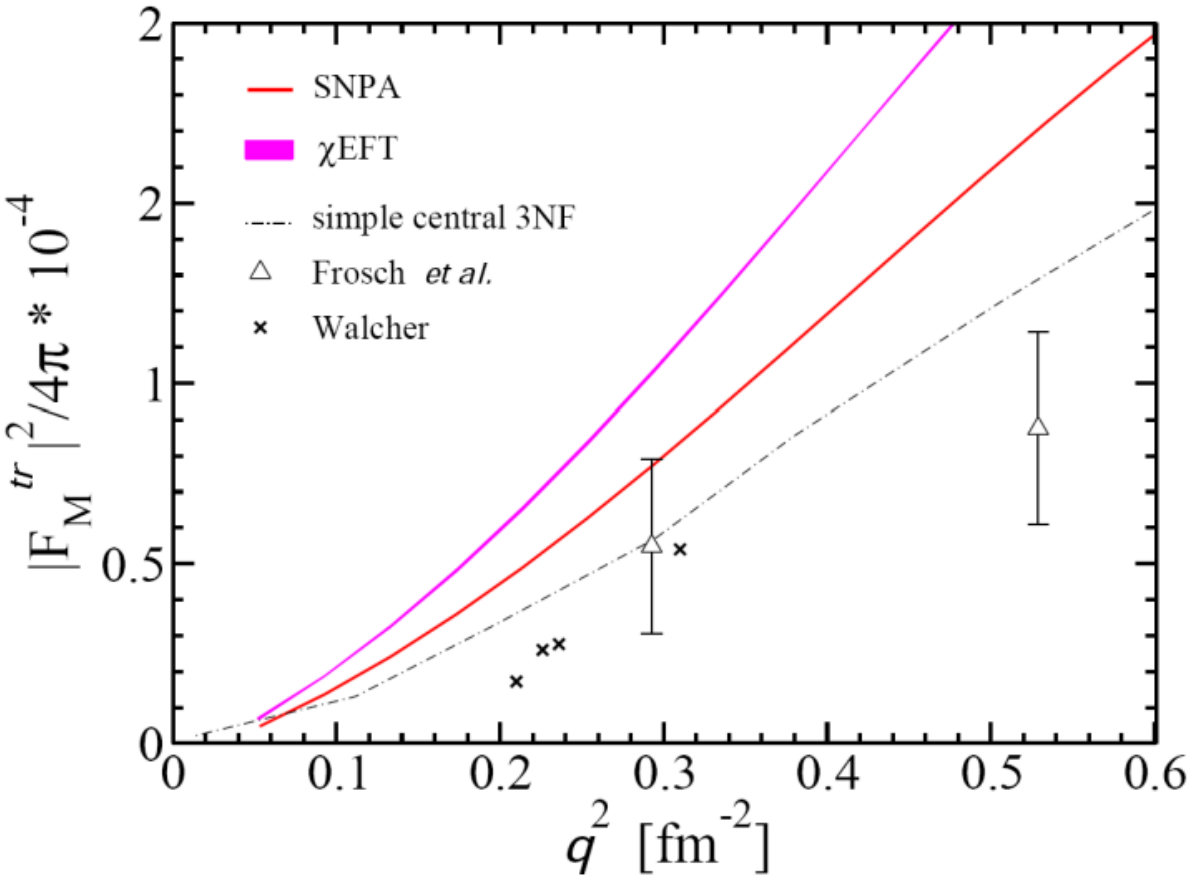
U. Gayer et al., paper in preparation

$\Gamma_0 = 8.16$ eV

$\Delta\Gamma_{stat} = 0.09$ eV $\triangleq 1.10$ %

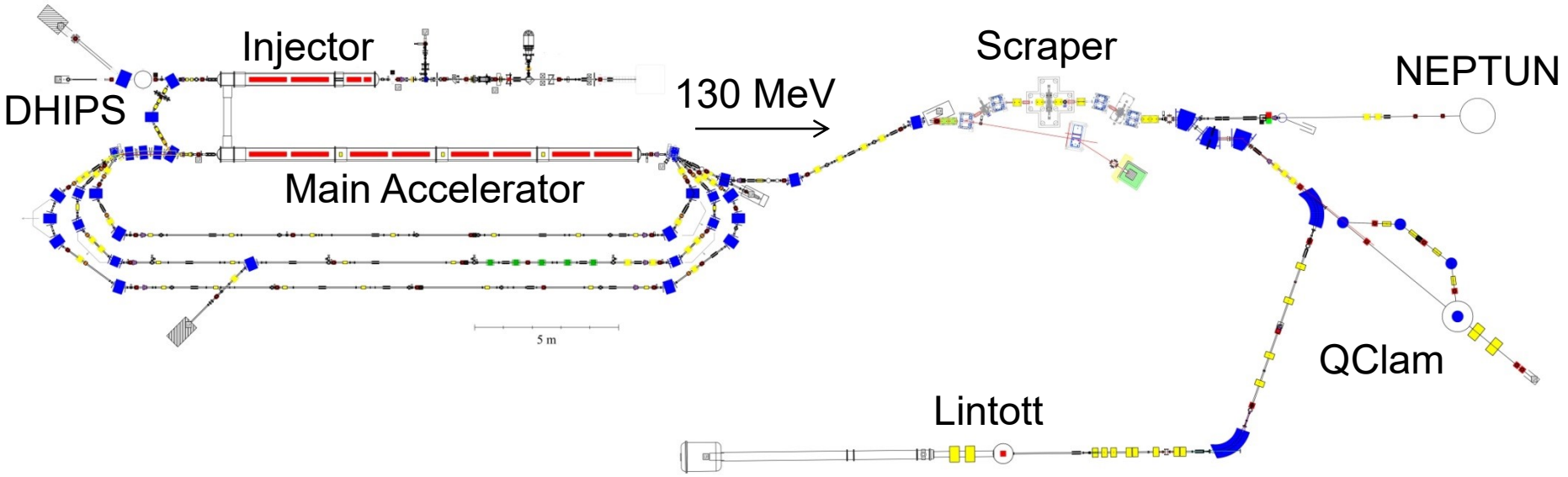
$\Delta\Gamma_{syst} = 0.11$ eV $\triangleq 1.35$ %

ab initio calculation of ^{4}He



S. Bacca et al., Phys. Rev. Lett **110** (2013)

Experimental Setup



M. Arnold, Dissertation, TU Darmstadt (2016)

Requirements on Target Chamber

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- Superfluid liquid helium
- No boiling-bubbles → control of target thickness

- Scattering chamber including cryogenic system for superfluid liquid helium
- Must fit into existing experimental infrastructure
- Pumping unit for cooling below 2 K
- Vacuum system
- Cryogenic monitoring system

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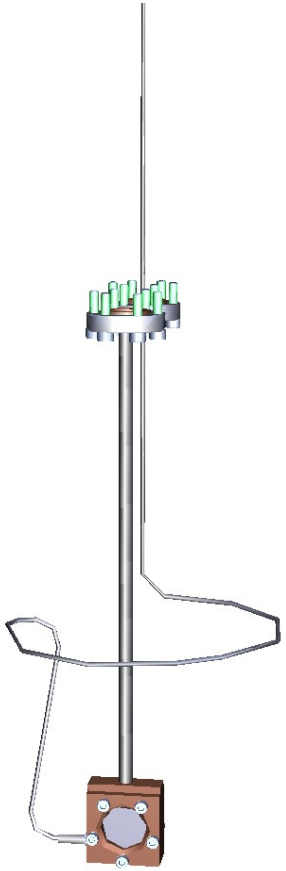
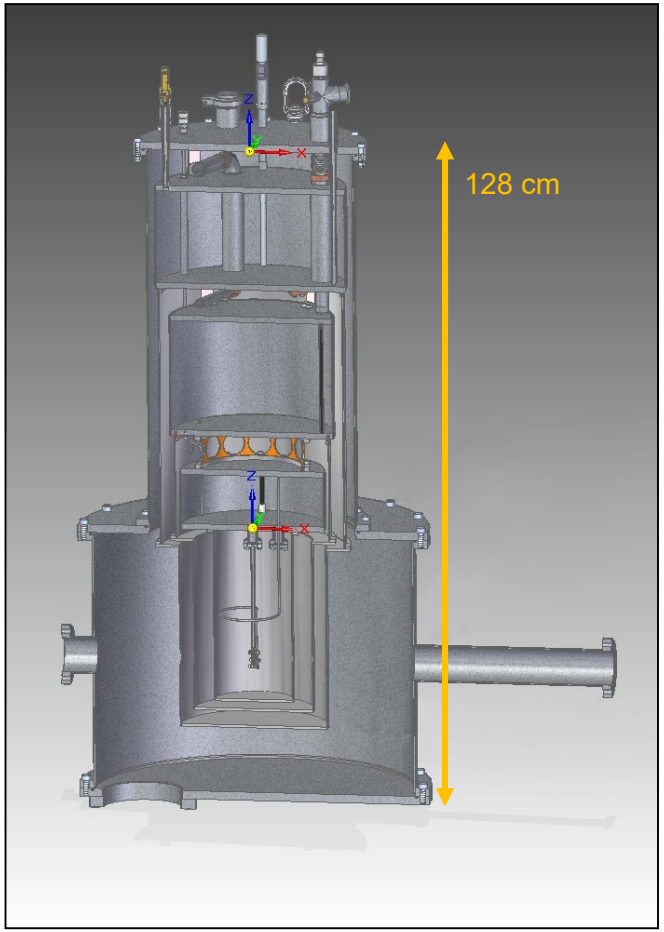
Target Design





CryoVac (2017)

Target test at QClam

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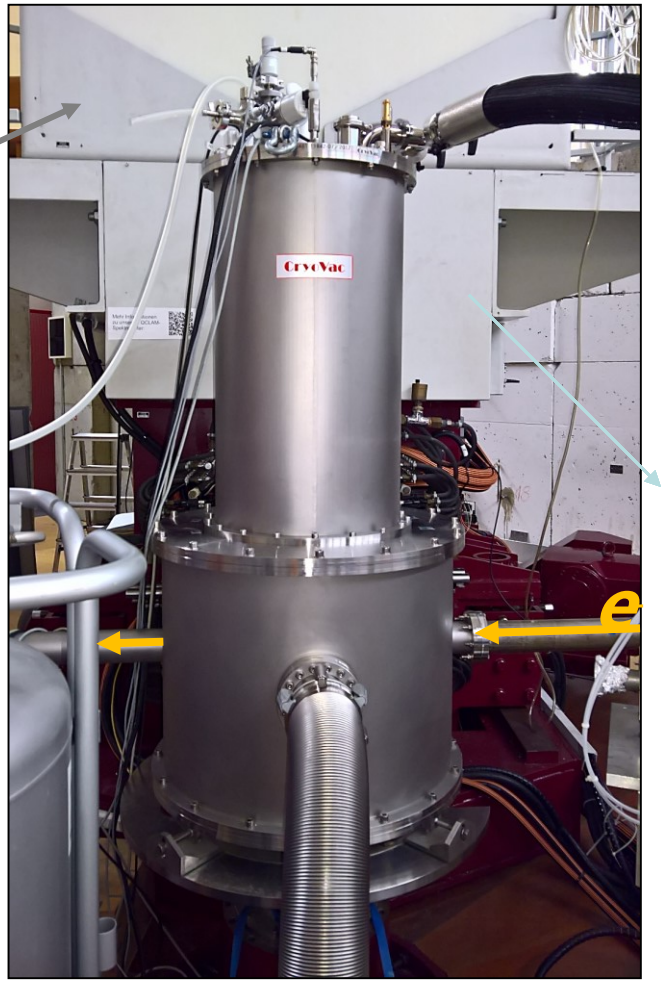
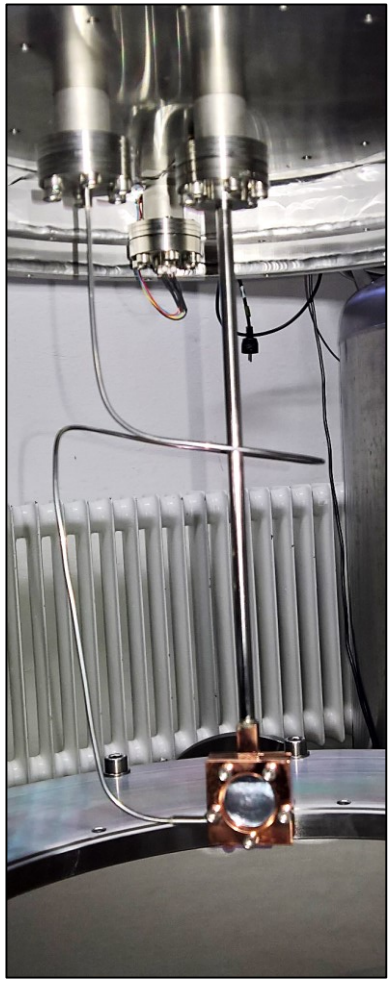
QClam





27.06.2018

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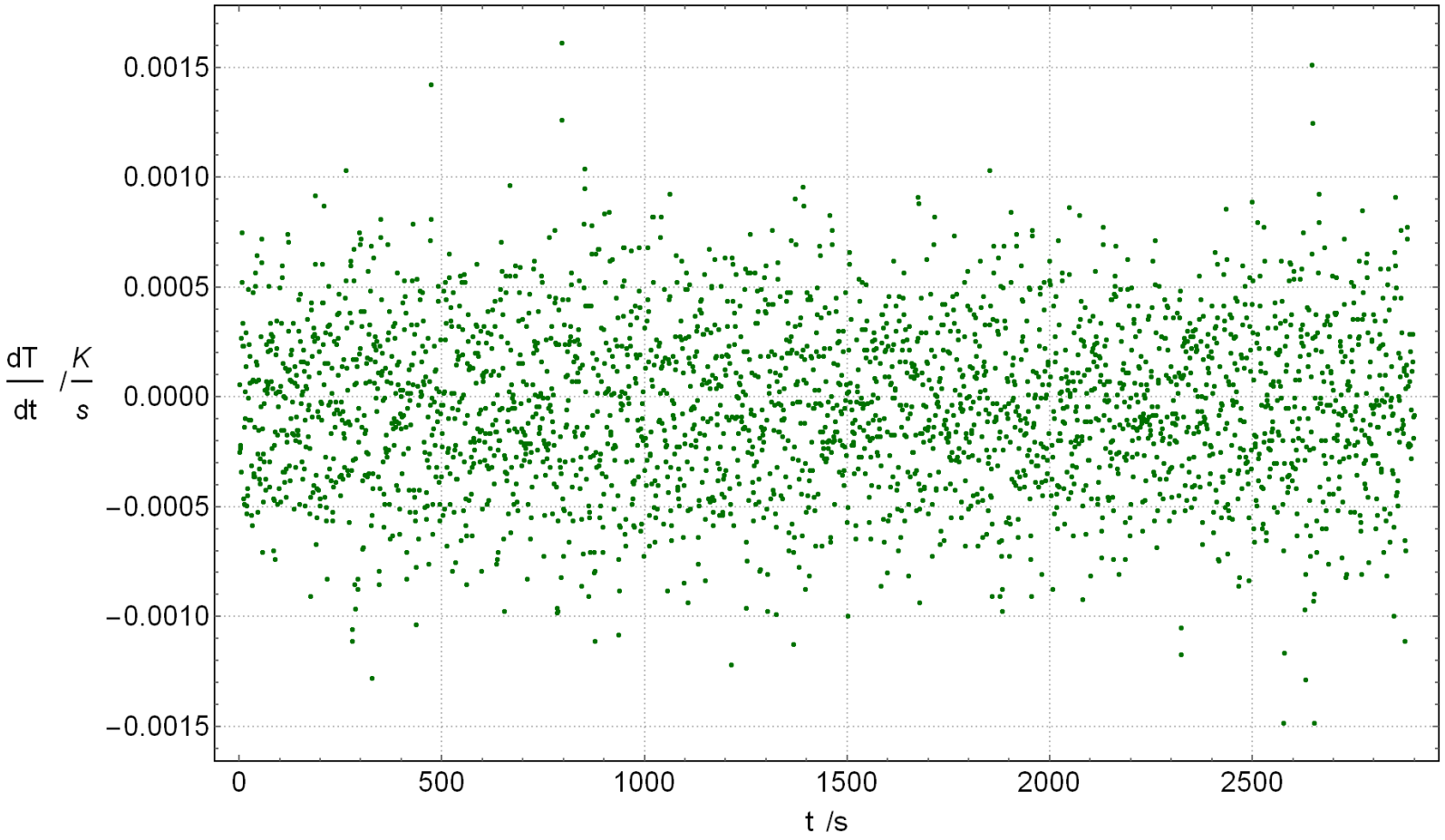
Cryogenic Tests



Planned Beamtime

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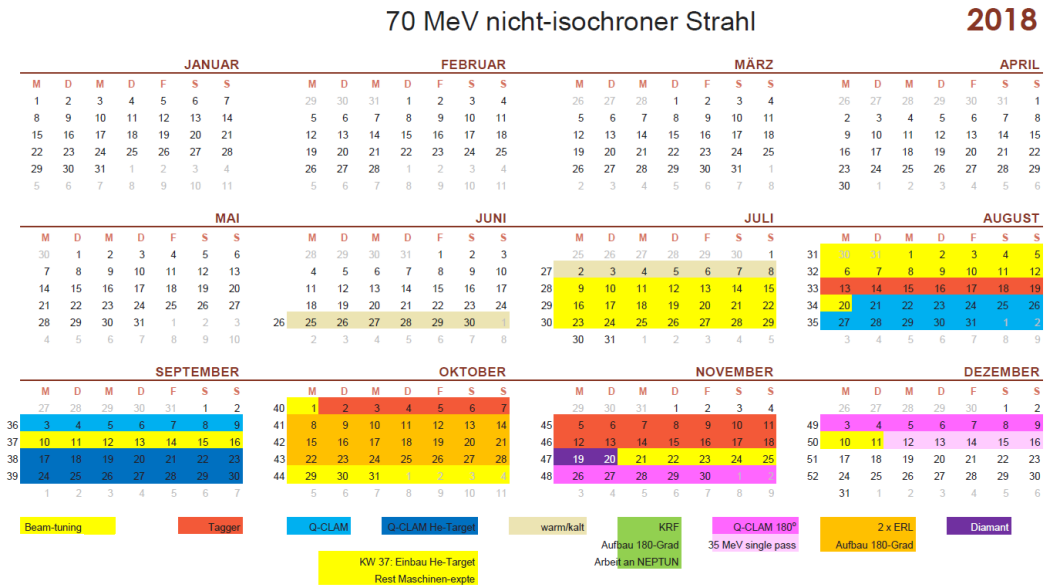
- Beamtime scheduled mid of September
- 2 weeks preparation
- 1 week data taking

- Beam Energy: 70 MeV
- Scattering Angle: 95°
- Momentum transfer: 0.45 fm^{-1}



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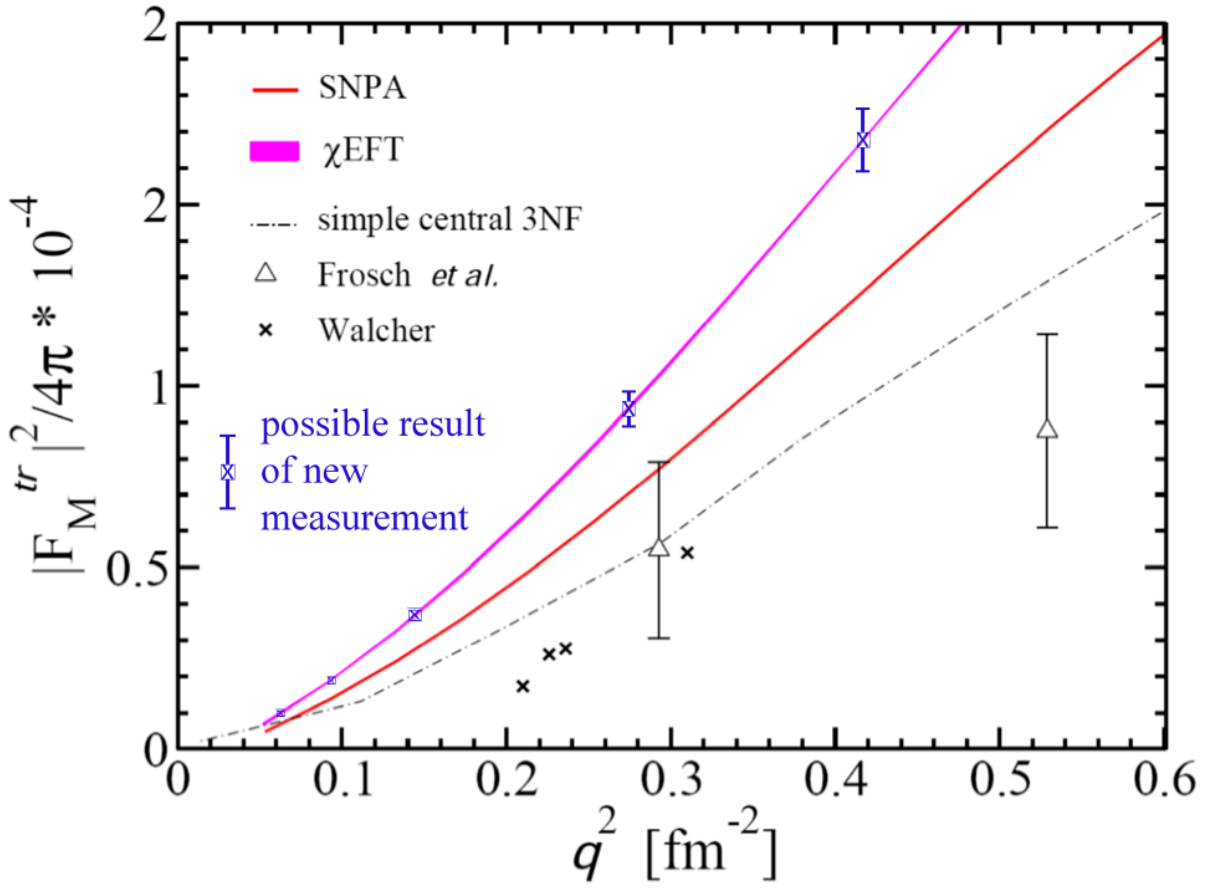
Expected Data



- $N_{elastic}$ = 1,000,000
- Walcher
  $N_{excited}$ = 230
- Bacca
  $N_{excited}$ = 910

S. Bacca et al., Phys. Rev. Lett **110** (2013)

CRC Schedule

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Milestones:

- Design of LHe-target finalized ✓
- Relative Self-Absorption measurement on ^{6}Li at room temperature done ✓
- Construction ✓ and cryo-test of LHe-target finalized (✓ / ✗)
- Analysis of RSA measurement of ^{6}Li completed ✓ and published ✗
- RSA measurement on ^{11}B at room temperature done ✗
- Elastic electron-scattering experiment on ^{6}Li relative to ^{12}C done ✗

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CRC Schedule

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Upcoming milestones (until end of 2019):

- Measurement of inelastic electron scattering off ^{4}He
- Analysis of RSA measurement of ^{11}B at room temperature completed
- NRF experiment of ^{27}Al against ^{6}Li and ^{11}B done
- Analysis of charge radius of ^{6}Li relative to ^{12}C completed
- Analysis of monopole transition radius of 0^{+} of ^{4}He completed
- Analysis of NRF measurement on ^{27}Al completed

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