PRISMA+ Cluster of Excellence
Precision Physics, Fundamental Interactions and Structure of Matter

SFB 1044
THE LOW-ENERGY FRONTIER OF THE STANDARD MODEL

MAMI MAINZER MIKROTRON

Welcome
Mainz Perspective

Achim Denig
Institute for Nuclear Physics

TPC Collaboration Meeting

March 09-10, 2020

Goals of this Meeting

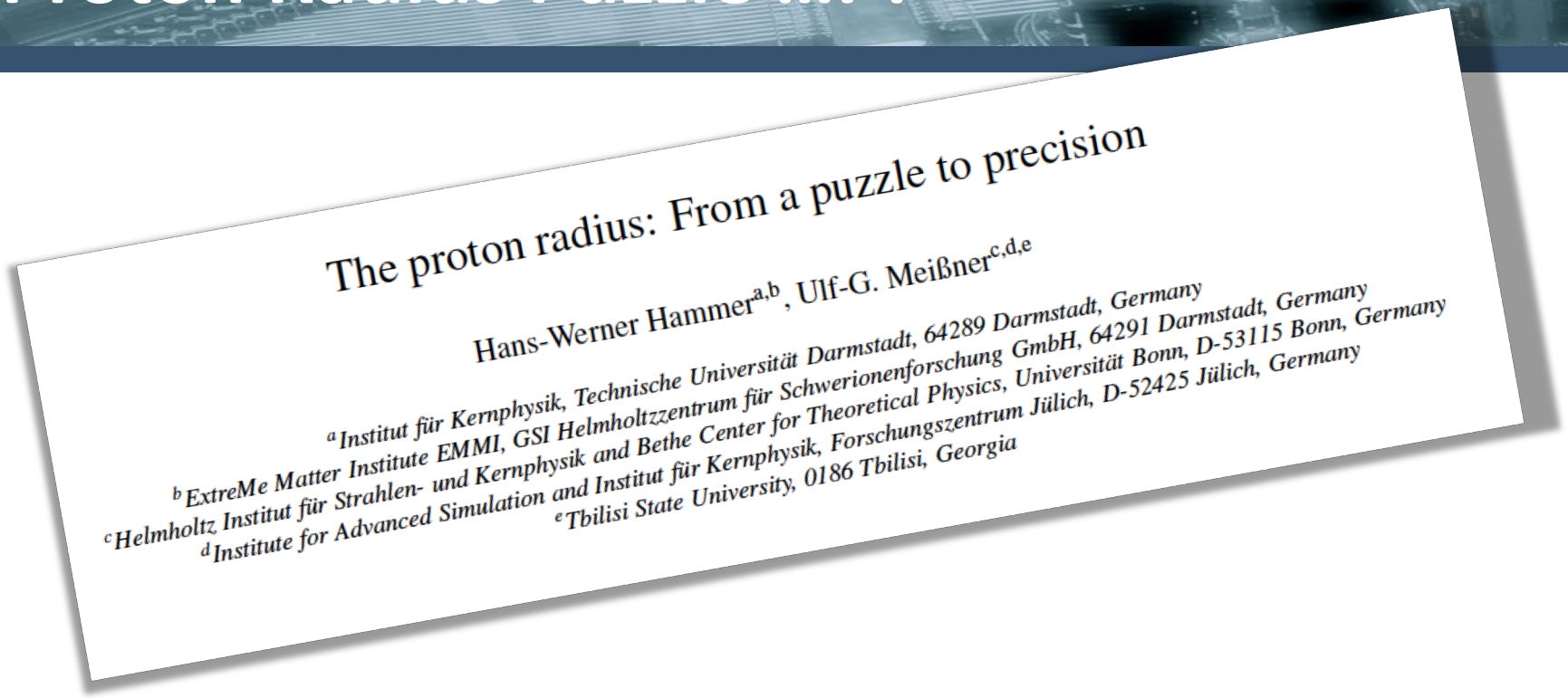
Decision to hold as a video conference: **„ Better safe than sorry ... “**

- Review of the physics case for a proton radius experiment
- Review of the technical aspects of the detector construction
  → share of responsibilities
- Discuss important additional technical aspects as safety system
- Formal aspects towards realization of a collaboration

Foundation of a collaboration !!!

for which the name needs to be decided at this meeting ...

Proton Radius Puzzle …. ?



The proton radius: From a puzzle to precision

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In case that the value from muonic hydrogen is correct:

- Why are old electron scattering experiments wrong ?
- What about the magnetic radius for the proton?
- Why are old (and some of the new) electronic spectroscopy measurements wrong?
- Why there are puzzles for some of the light nuclei, for others not?
- We need to improve the precision even further → electron scattering can help?

Mainz Efforts

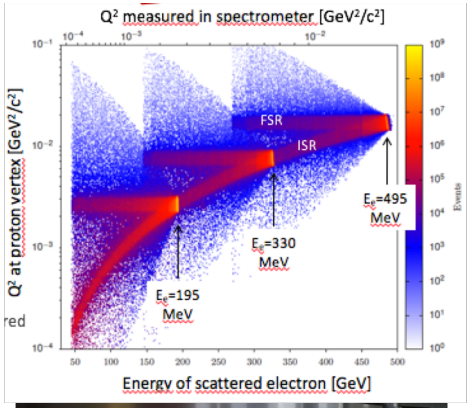
- **Initial State Radiation** programme at A1/MAMI
  → access to low Q^2

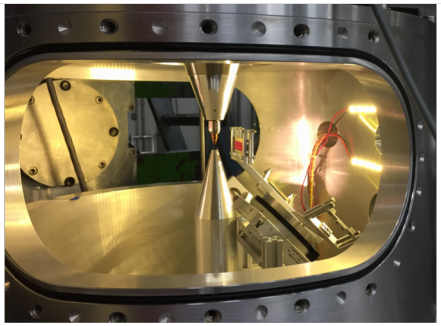
- Repeat Bernauer measurement with **gas jet target** at A1
  → significant reduction of systematic errors

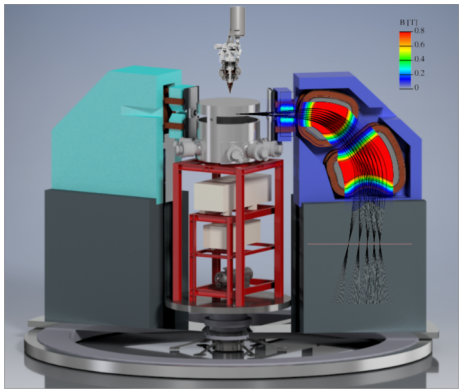
- Form factor programme at A1 of **few body systems (d, ^{4}He)**
  → comparison of radii with muonic spectroscopy
  → essential input to reduce two-photon corrections for muonic spectroscopy

- **TPC measurement at MAMI**

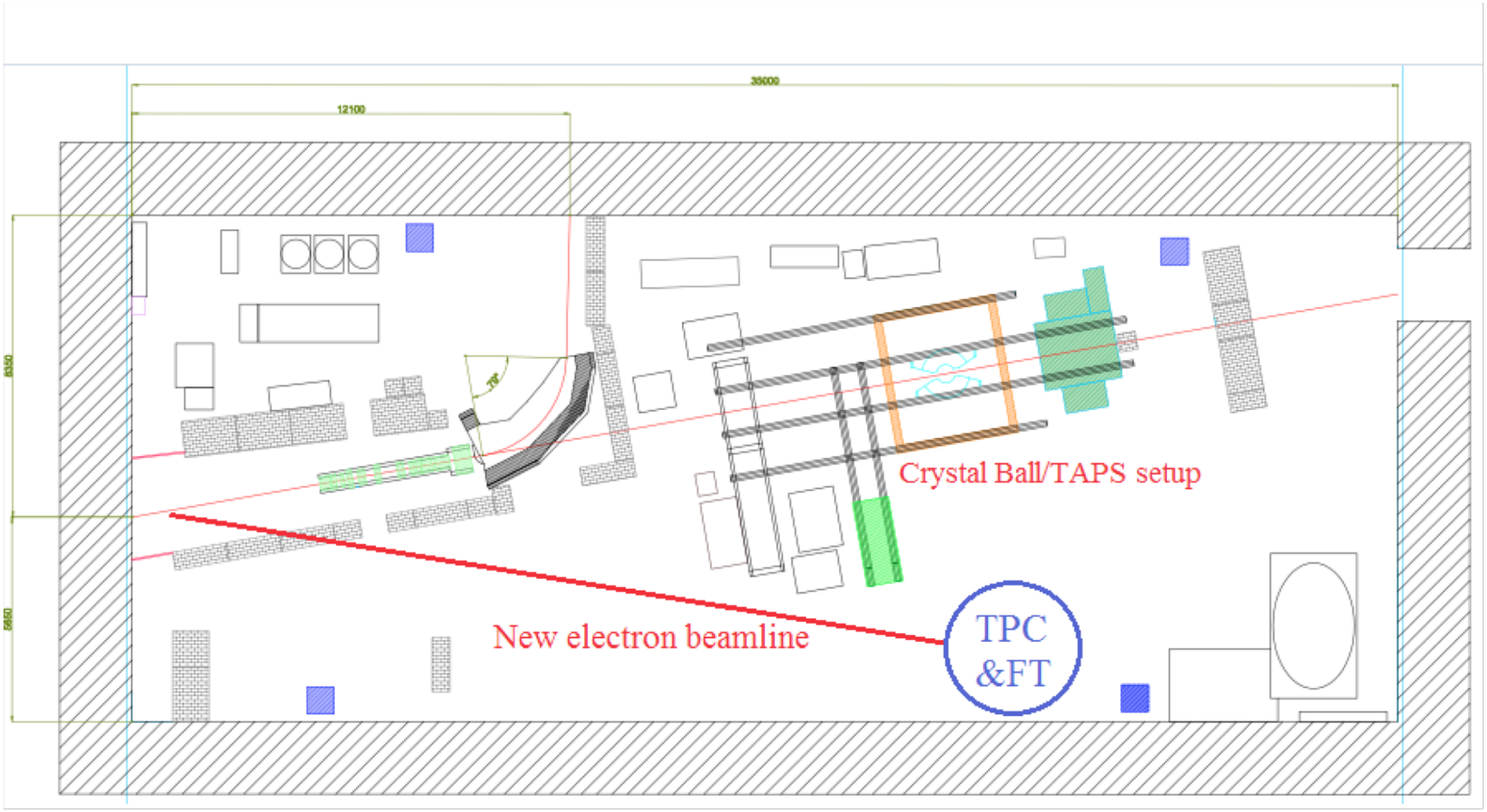
- **Form factor programme at MAGIX at new MESA accelerator**
  → access to low Q^2 due to low beam energy
  → significant reduction of systematic errors (gas jet target)
  → magnetic FF and few body programme







Electron Beam Line in A2 Hall



Separate Photon and Electron Beam Line highly desirable

Towards a TPC Experiment at MAMI …

- Safety concept ready
  → significant risk: external consulting company for proof of safety concept
  → the earlier we receive necessary information, the earlier it will be ready

- Ongoing upgrade of fire protection system at MAMI by local authorities
  → Hydrogen experiments is part of the programme (we do depend on others ...)

- Construction of MESA experimental hall ongoing (in close vicinity to A2 hall)
  → constraints on beam time

- Ongoing experimental programme at Crystal Ball/TAPS
  → existing and upcoming proposals

- Constraints or synergies with CERN measurement of proton radius

Optimal scenario: start of data taking beginning of 2022