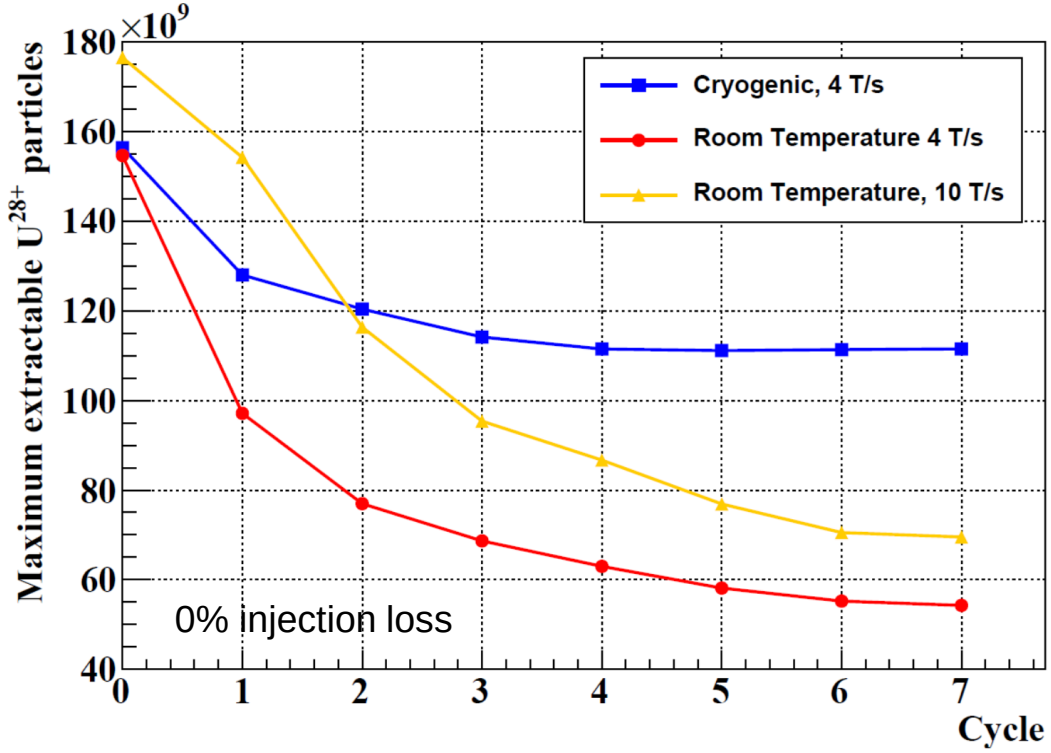
Installation of Kryo-Inserts into SIS18

Lars Bozyk

Motivation: Simulation of SIS18 cycles



Proc. IPAC'17, Copenhagen, Denmark, May 2017, doi:10.18429/JACoW-IPAC2017-TUPVA056

- Simulation with “StrahlSim”:
  - self-consistent pressure profiles evolution
  - energy dependent charge exchange cross section
  - Loss distribution, outgassing
- Maximum extractable intensity per cycle depends on “vacuum history”
  → degrades after few cycles
- cryogenic walls stabilize the vacuum dynamics

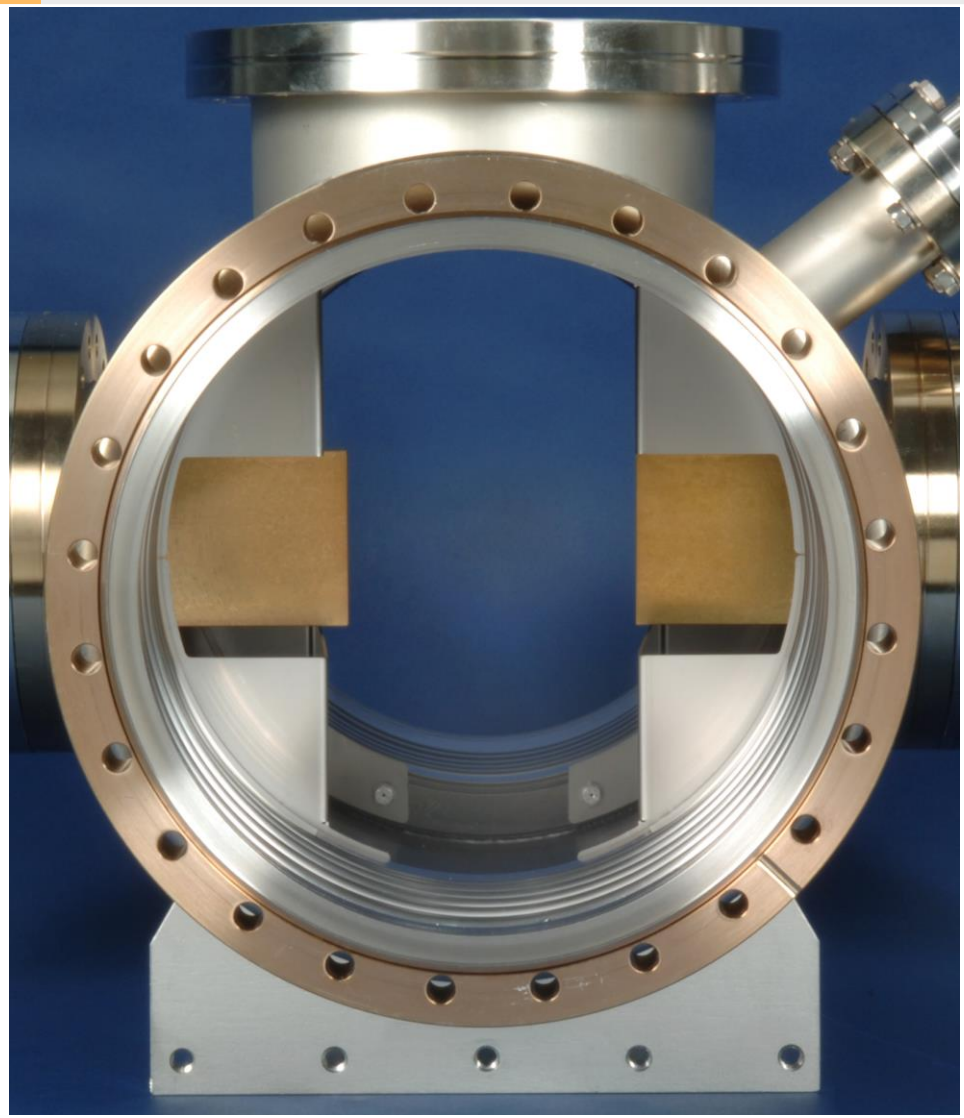
→ **Installation of cryogenic surfaces into room temperature SIS18?!**

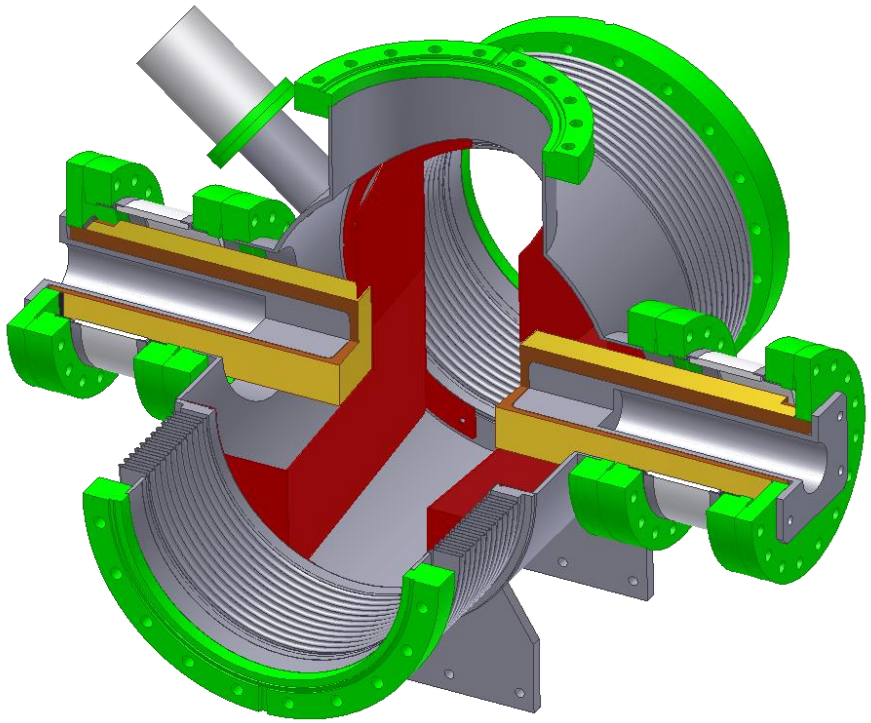
→ see also Poster WED-PO1E-8

Introduction

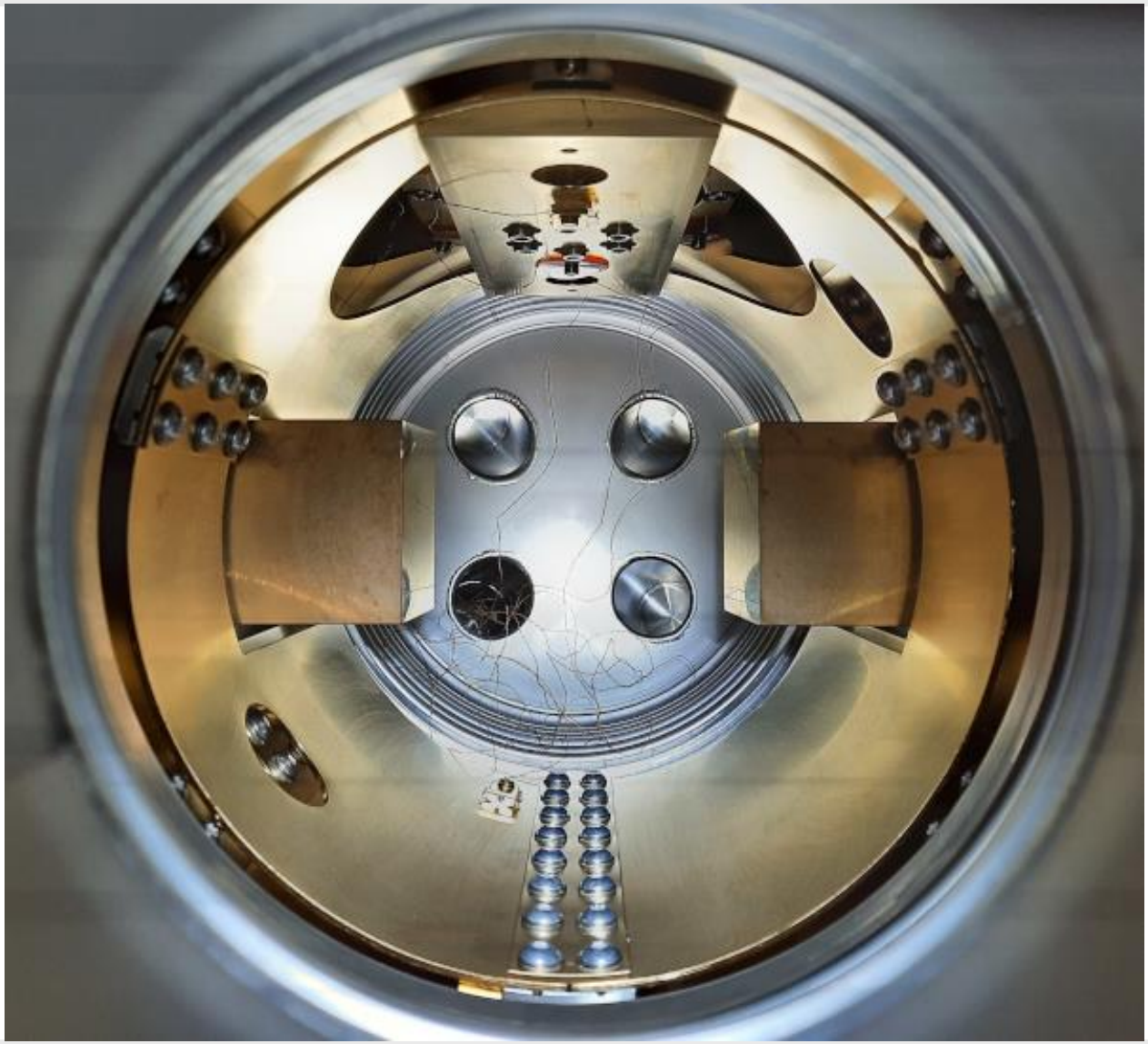
- **Idea**: Cryogenic surfaces around warm SIS18 collimators, to increase pumping speed in heavy ion operation
  - Less residual gas, desorption gas get removed more quickly (high sticking probability of cryogenic surfaces)
  - more heavy ion beam intensity
- Prototype test setup in lab has been tested, results are promising
  - Collimator chamber for S10 rebuilt
  - Cooling with cold head, can be removed for bake-out
- Tests with heavy ion beam required!

Collimators in SIS18





Cryogenic Surfaces around Ioncatcher



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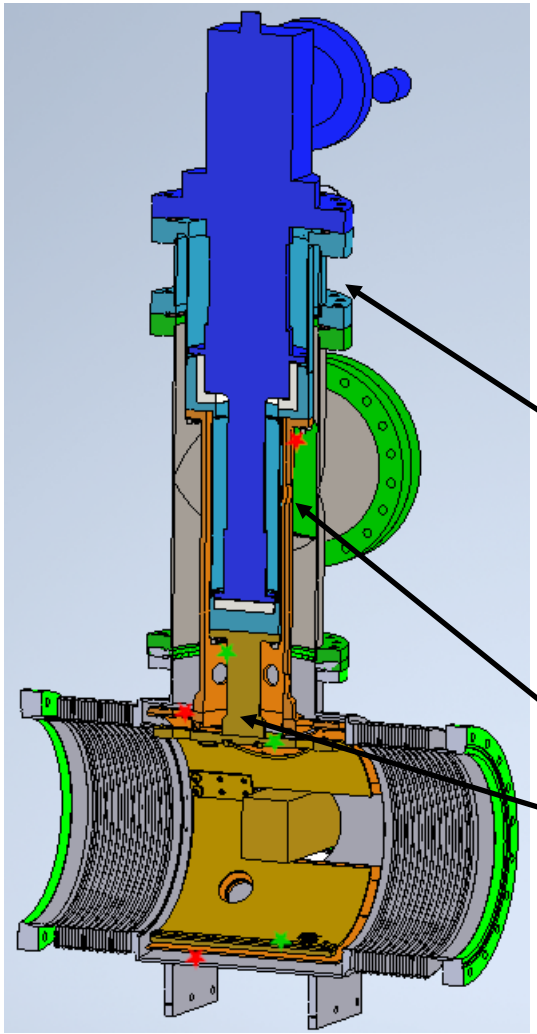
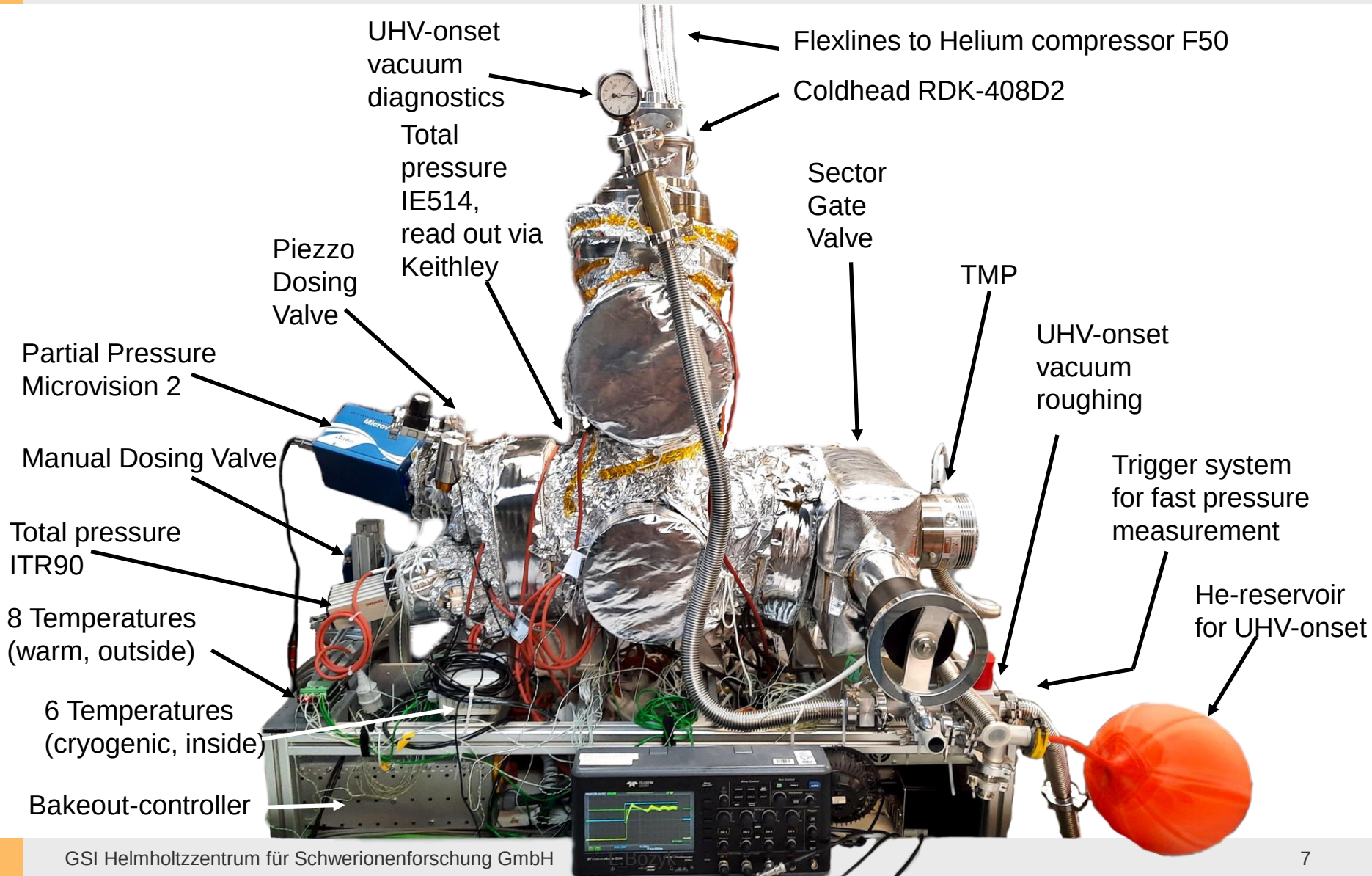


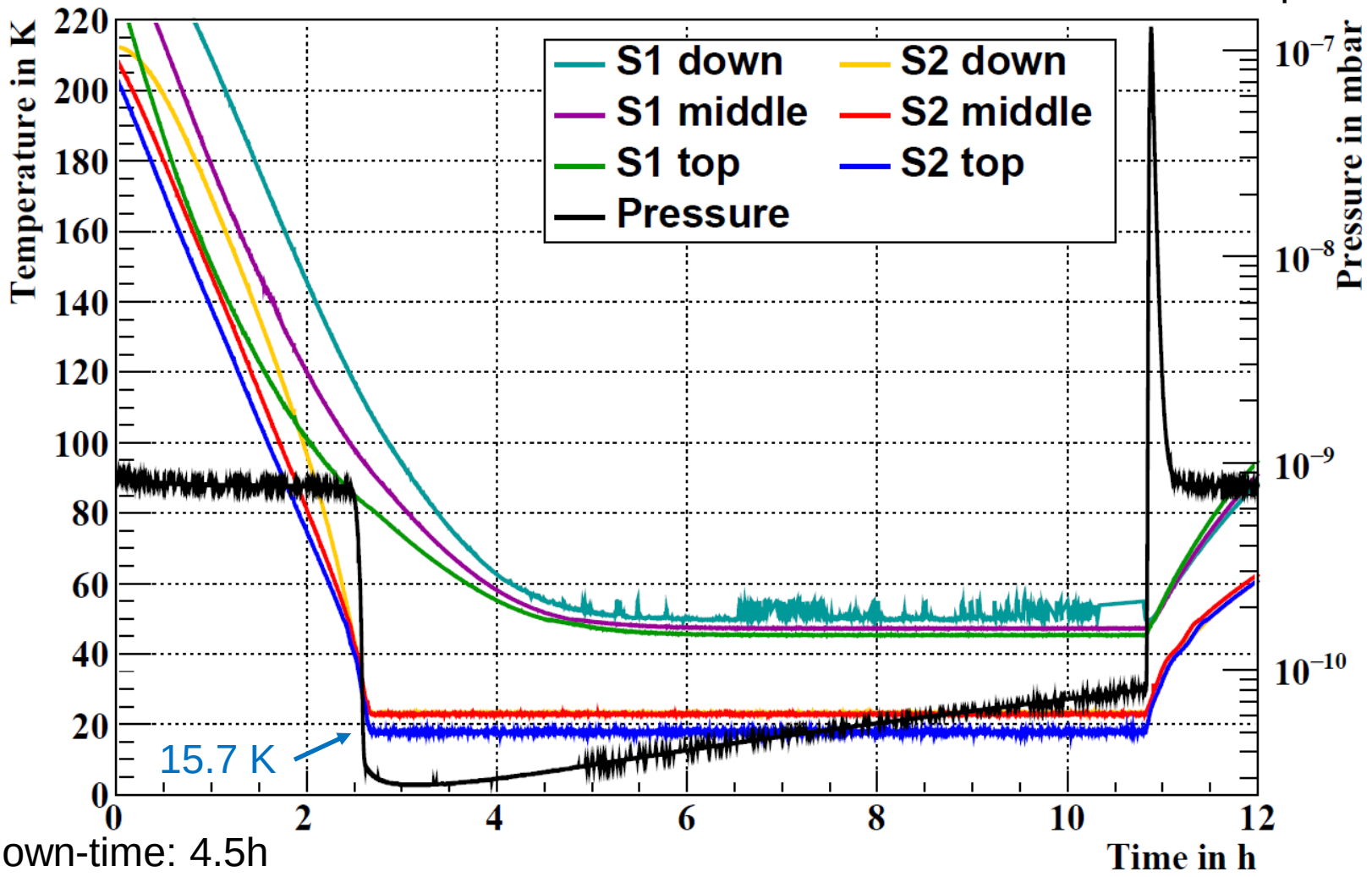
- T < 18 K desirable to pump H_2
- Coldheads can reach 4.2K but can not be baked
- UHV-onset houses coldhead (blue)
  - can be evacuated
  - or filled with gHe
- stage 1: thermal shield
  stage 2: cryo-surfaces
- gold-plated surface to minimize radiation – no super insulation required

Cryogenic Surfaces – Test Setup



Static Measurement Results

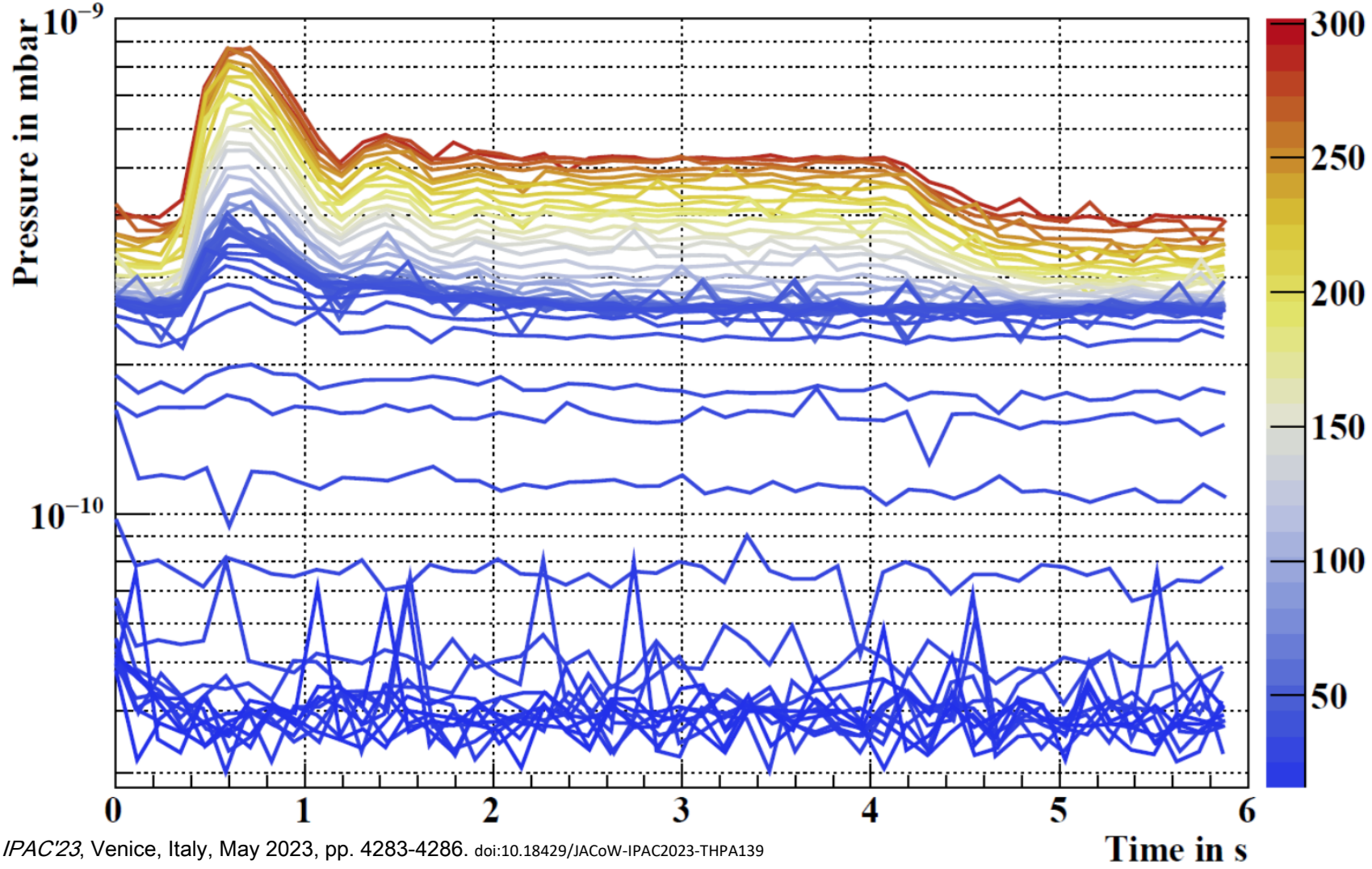
warmup-time: 24.5



cooldown-time: 4.5h

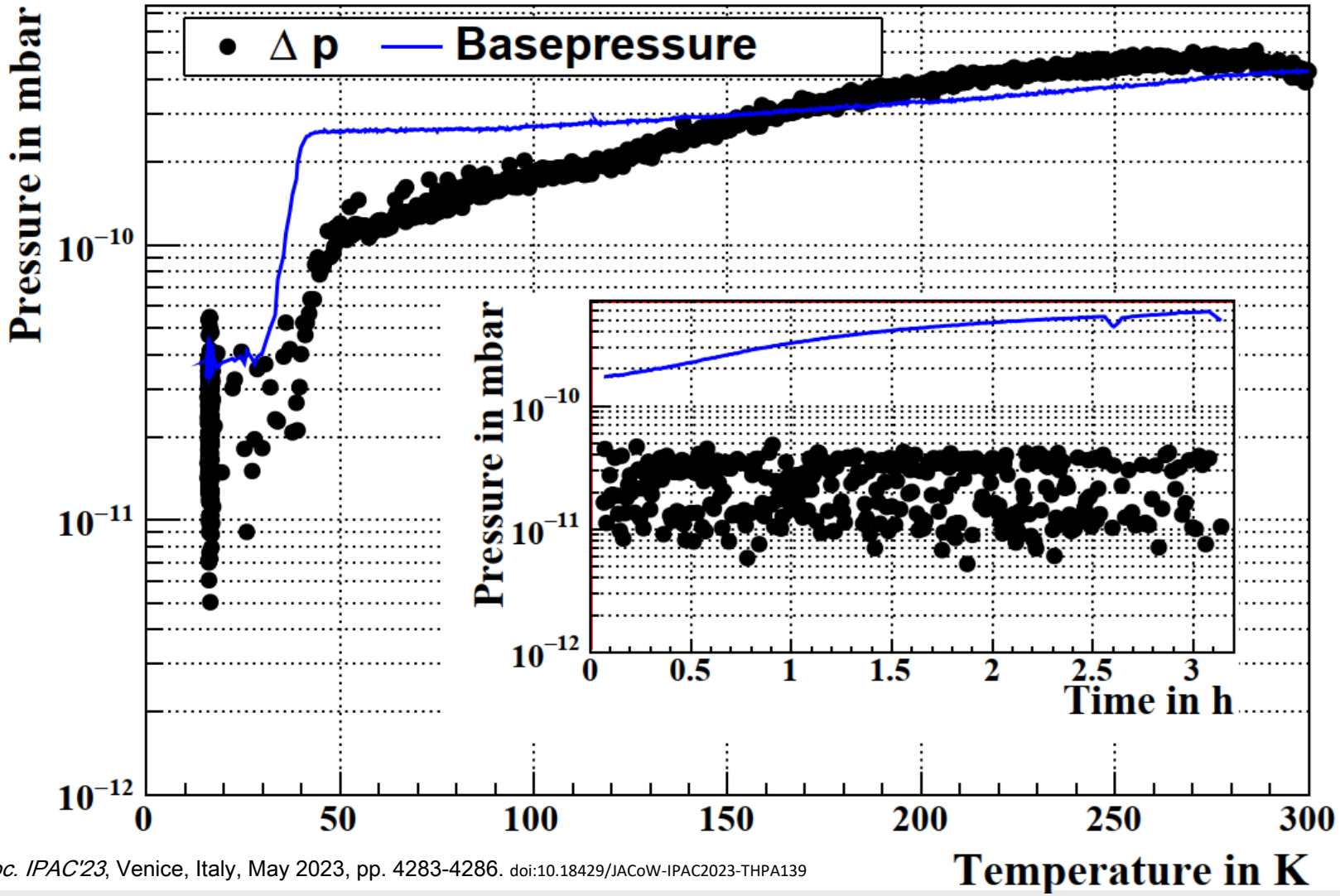
Dynamic Vacuum Measurements with H_2

Piezzo-Dose-Valve pulse evolution for different temperatures in K



in *Proc. IPAC'23*, Venice, Italy, May 2023, pp. 4283-4286. doi:10.18429/JACoW-IPAC2023-THPA139

H_2 Pulse Height Evolution



in *Proc. IPAC'23*, Venice, Italy, May 2023, pp. 4283-4286. doi:10.18429/JACoW-IPAC2023-THPA139

Simulation of SIS18 with Cryogenic inserts

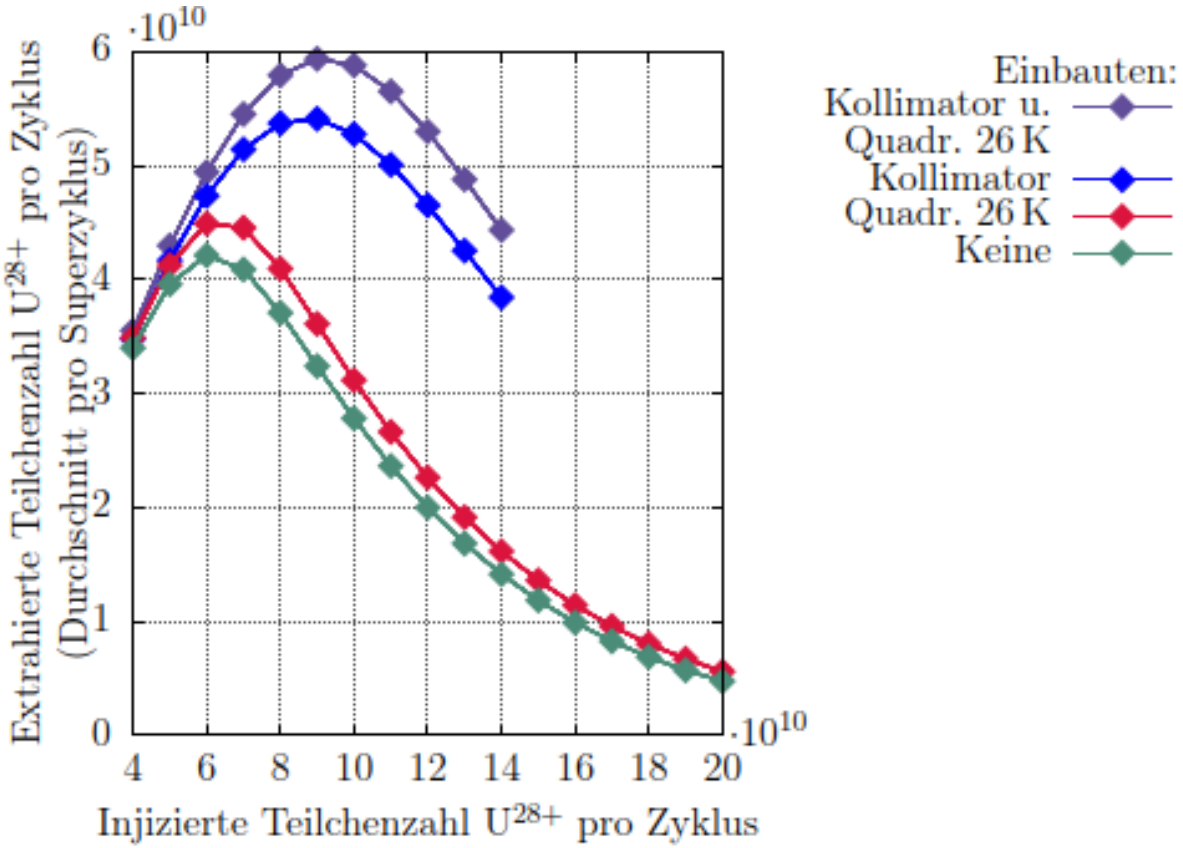
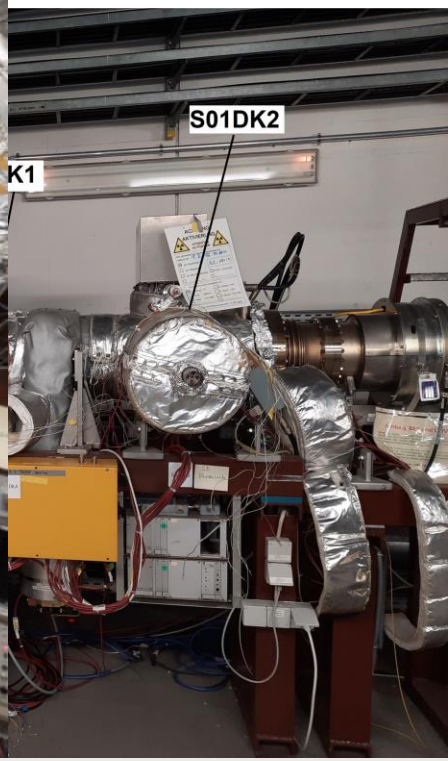


Abbildung 9.6: Ergebnisse der Simulation der extrahierten Teilchenzahlen U^{28+} pro Zyklus gegen die injizierten Teilchen pro Zyklus des SIS18 im Boosterbetrieb mit verschiedenen kryogenen Einbauten.

Dissertation S.Aumüller, 2024, in preparation

Situation in SIS18

- S01DK1 v



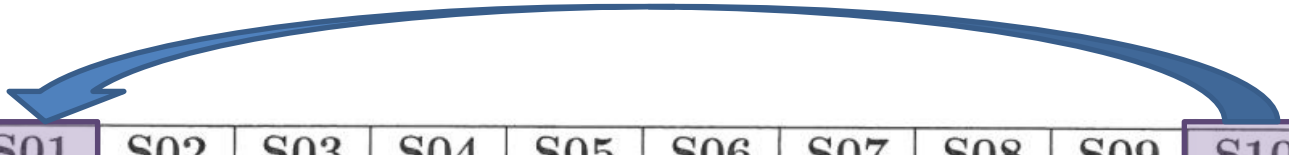
Vorbereitende Maßnahmen

- Vorbereitung im Labor
  - Kollimator-Abstände angepasst ✓
  - UHV-Abnahme ✓
  - Teststand demontieren ✓
    und für Transport vorbereiten

- Infrastruktur im SIS18
  - Kabelpritschen ✓
  - Kühlwasser ✓
  - Wärmetauscher ✓
  - Kabelpritschen ✓
  - Strom ✓
  - Netzwerkanschluss

Kollimatorabstände

- Kryo-Inserts wurde aus verbleibendem Kollimator für S10 gebaut
- Abstände der Kollimatorblöcke müssen angepasst werden

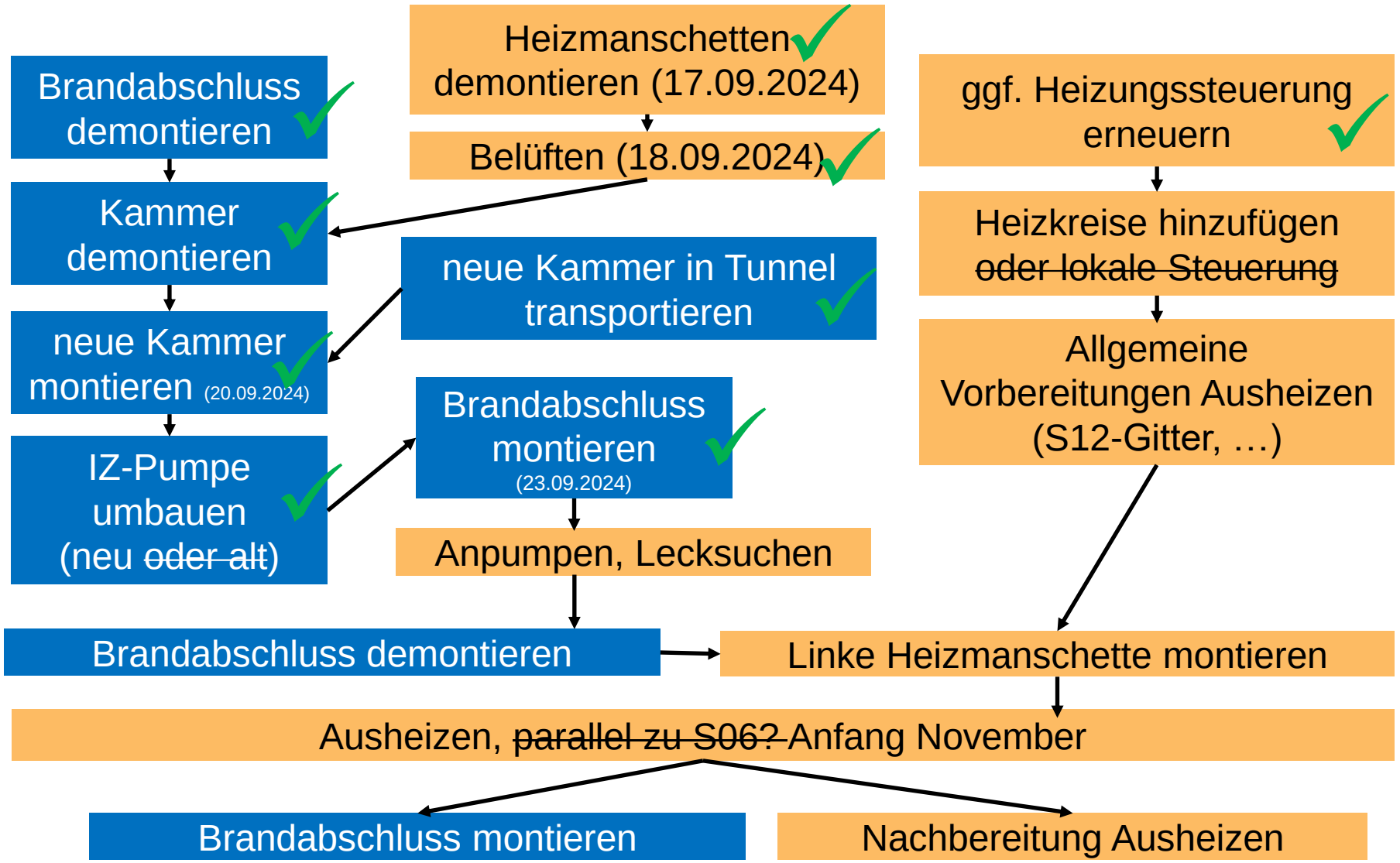


	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12
I	55,5	45,5	55,5	65,5	45,5	–	50,5	45,5	45,5	50,5	45,5	45,5
A	45,5	~~55,5~~	45,5	45,5	~~45,5~~	–	45,5	50,5	55,5	45,5	55,5	55,5

Tabelle 4.1: Abstände der Umladungskollimatoren in den verschiedenen Sektionen des SIS18 von der Strahlachse auf der Innenseite (**I**) und der Außenseite (**A**) in mm [8, 38].

- Fertigung eines neuen Abstandshalters in MeWe beauftragt
- Abstandshalter umgebaut und UHV Abnahme durchgeführt

Arbeiten im SIS18, TRI + VAC



Further Work in SIS18

- Transport further material into the tunnel (TRI)
- Connect compressor, put heat changer into operation (GAT)
- SSI (L.Bozyk, Sh.Ahmed):
  - Install flexlines between compressor and cold head
  - Install cold head after bake-out
  - He-supply UHV-insert
  - Data aquisitioin
  - Connect other devices, etc

- Cool down test run
  (target: mid of November, after bake-out)

Effects on regular Operations

- none.

Effects on regular Operations

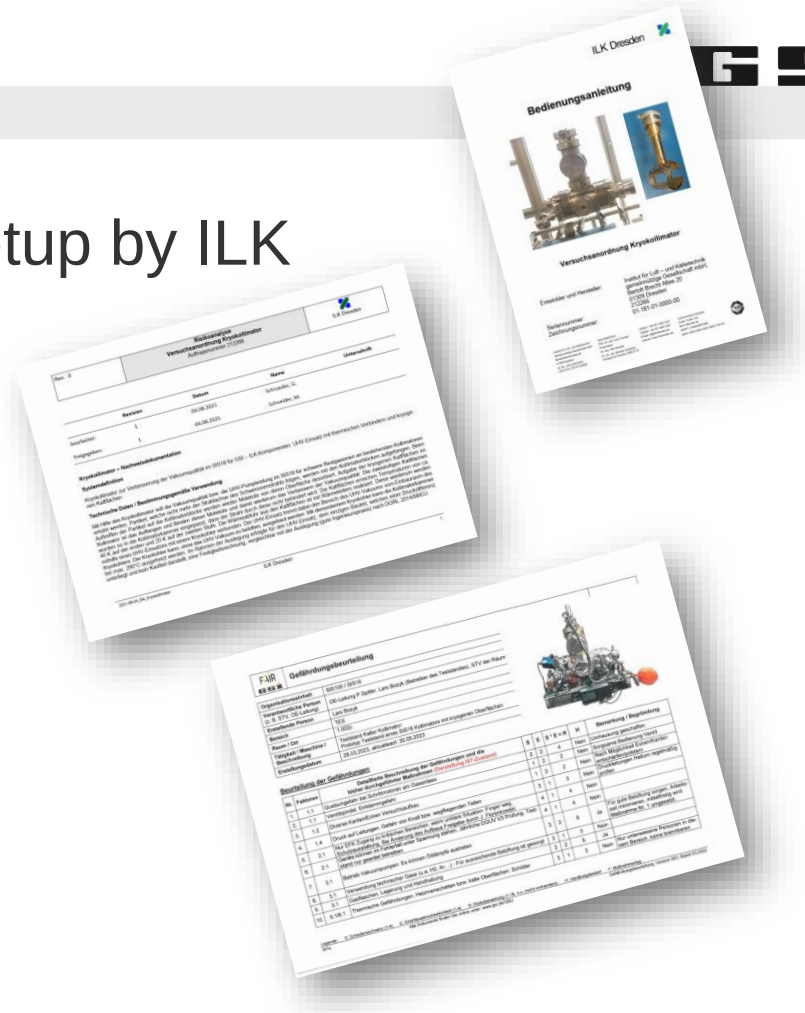
- none.
- Operating parameter (expert operation):
  - On
  - Off

  } On/off does not matter for regular operation
- Status:
  - is On? → no difference for regular operation (better vacuum)
  - Temperature measurement
    → Webdisplay can be set up

- Additional things to be aware of:
  - The cold head must be removed during bake-out
  - The insulation vacuum must be evacuated and filled with helium

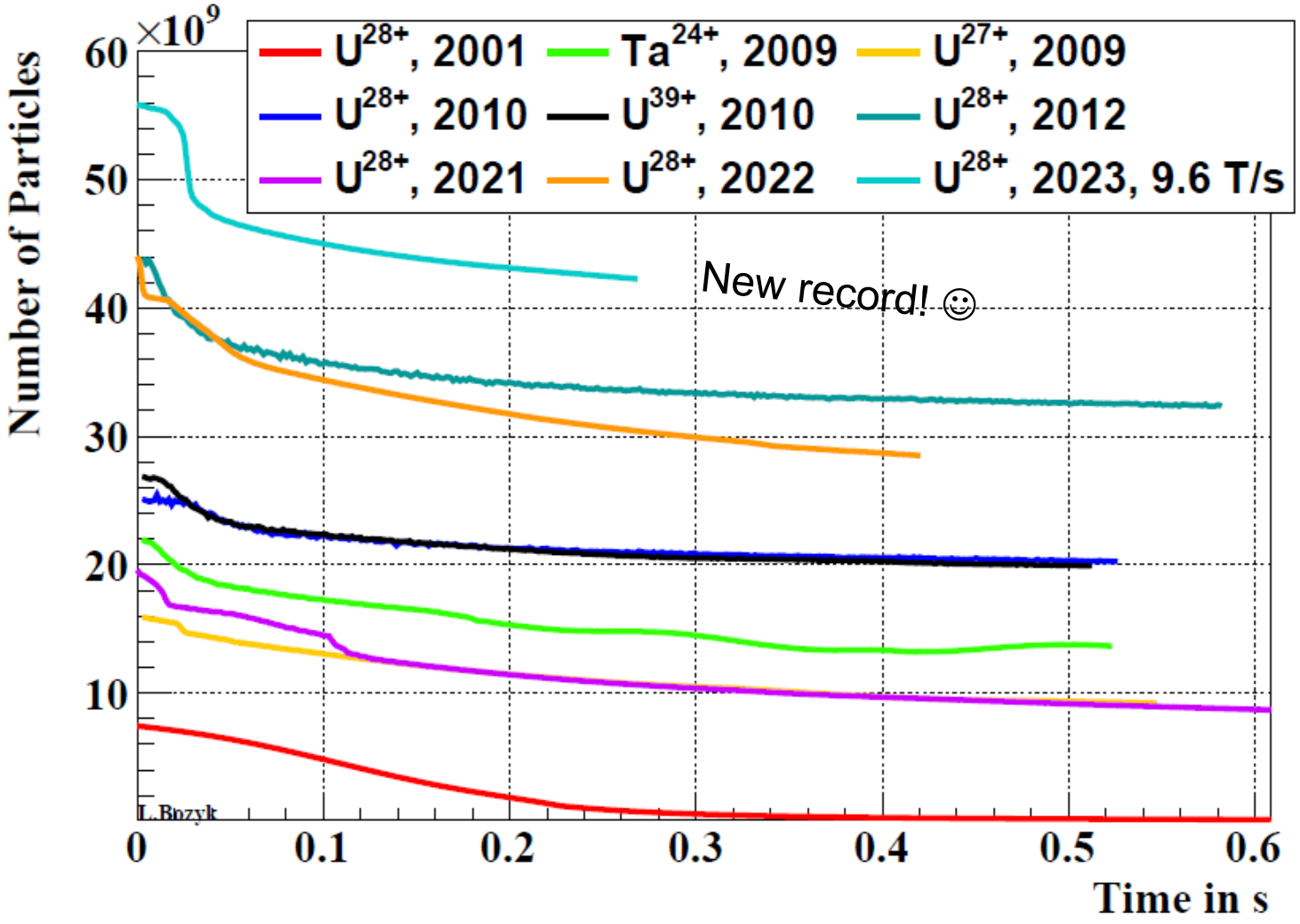
Documentation

- Operating manual test setup by ILK
- Risk Analysis by ILK
- Gefährdungbeurteilung
  by GSI in TES (L.Bozyk)
- Gefährdungsbeurteilung for
  device in SIS-tunnel
  will be created

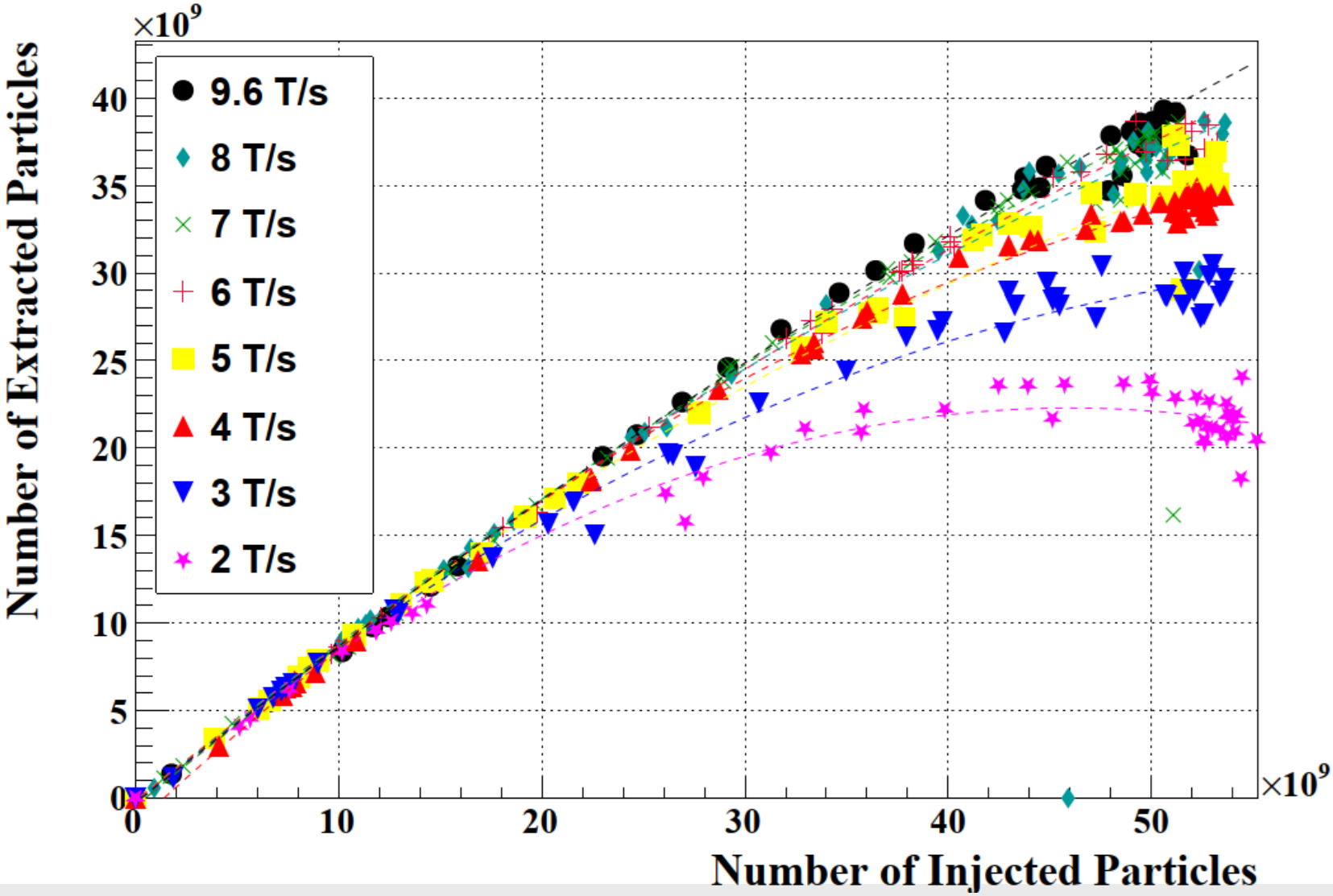


- backup Folien

SIS-Intensities



Dynamic Vacuum measurements



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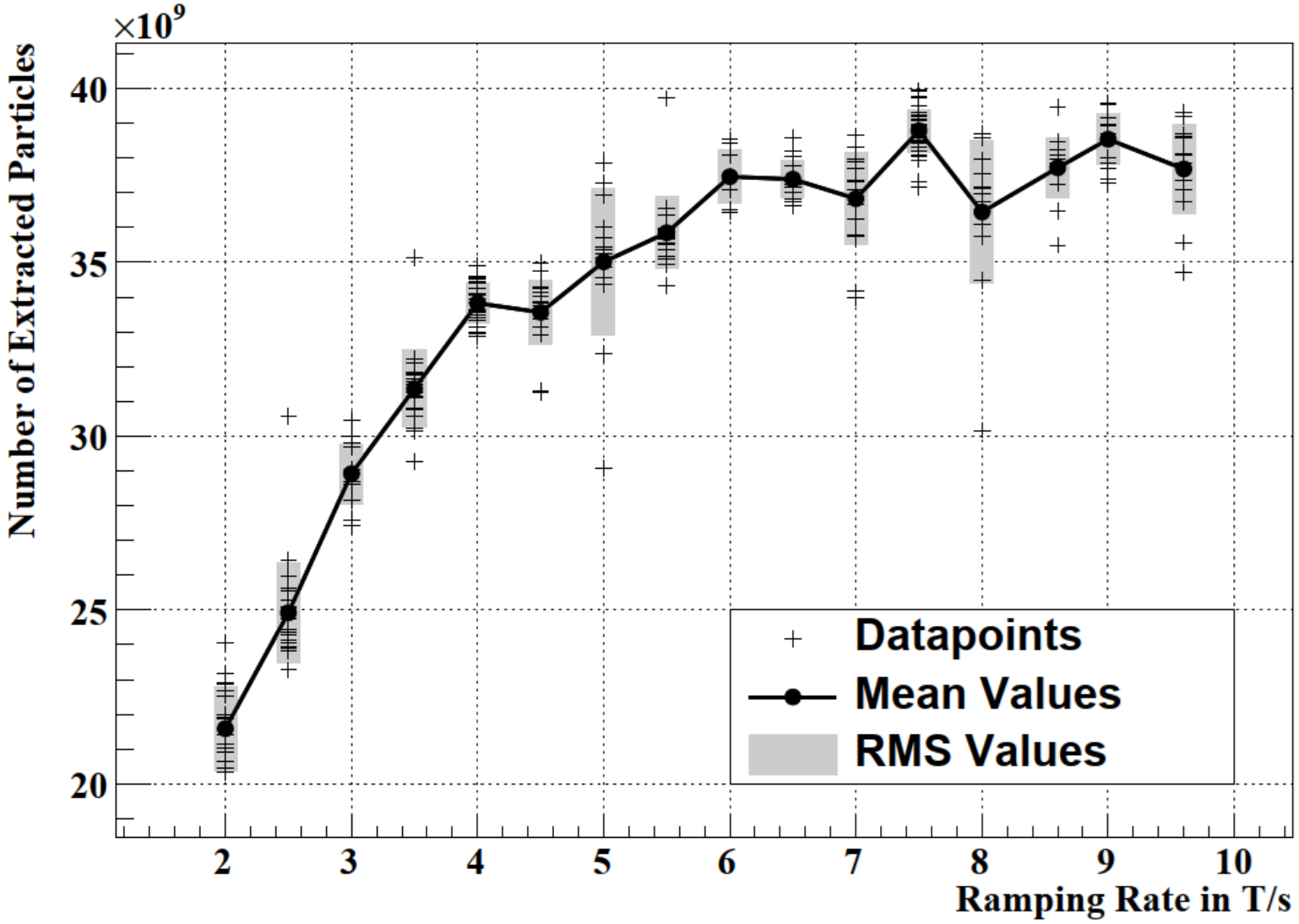
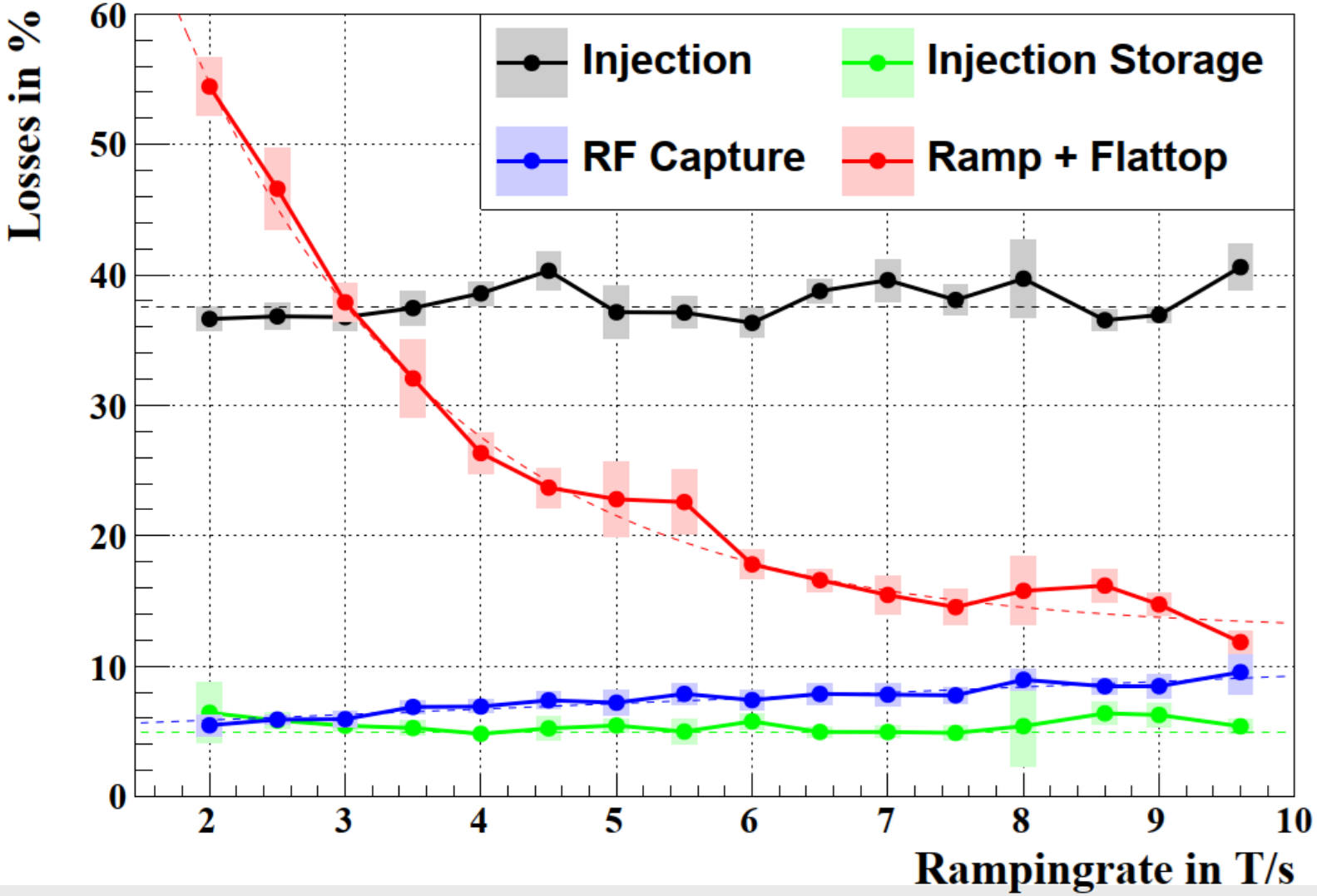


Dynamic Vacuum measurements



Heizmanschetten

- Es werden mehr Heizmanschetten als *bisher* benötigt!

Anzahl	Heizmanschette	Leistung
1	*Kammerkörper*	
2	Balg	
2	*CF200 Flansch*	
2	*Kappe für Kollimator*	
1	CF160 Kreuz, zweiteilig	
1	CF160 Kappe (IZ-Pumpe)	
1	CF160 Flansch-Heizung	
1	CF160 Kappe – UHV-Einsatz oben drauf	
1	CF160 Flansch-Heizung, Cluster-Flansch	
4	CF40-Flansche am Clusterflansch, Heizschlange?	
1	*CF40 Extraktor*	