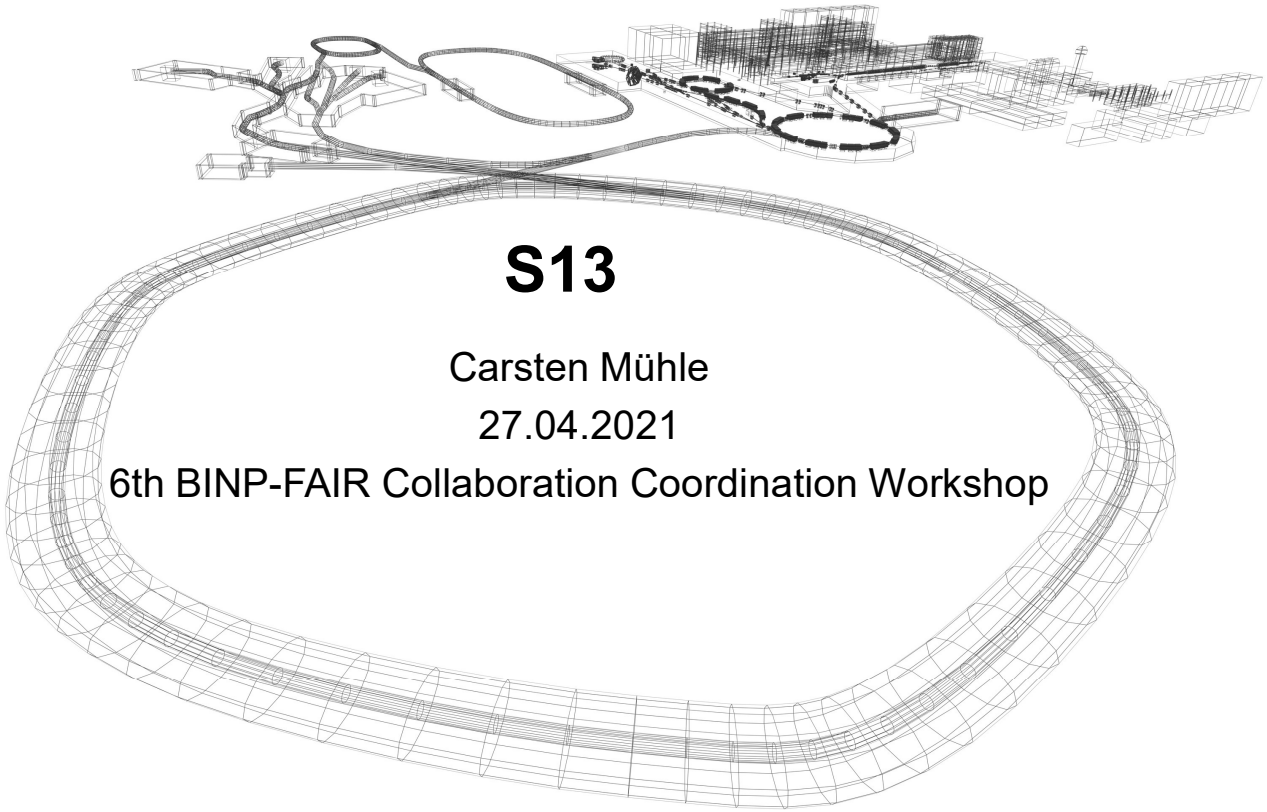


S13

Carsten Mühle

27.04.2021

6th BINP-FAIR Collaboration Coordination Workshop

History

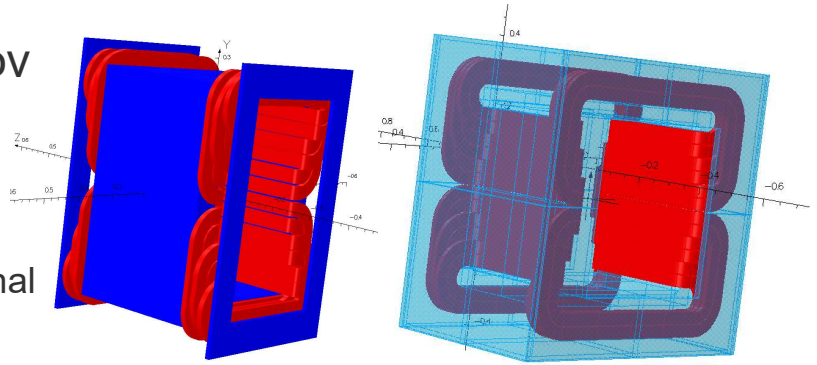
- Huge aperture
- Short length
- Fast ramping
- →High current / low inductance design required

Excerpt from technical parameter list:

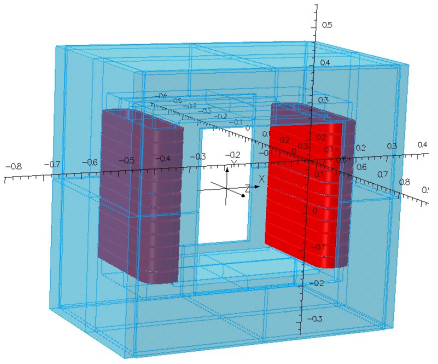
Max. Field	T	±0.05
Min. Field	T	0
Bending angle	mrad	±2 (@13Tm)
Effective path length, L	m	0.5
Useable horizontal aperture	mm	±200
Useable vertical gap	mm	±200
Vertical pole gap height	mm	440
Integrated field error ΔBL/BL		≤±1%
Overall length	m	0.5
Overall width	m	0.56
Overall height	m	0.52
Overall weight	kg	≈280
Current at max. field	A	580.164
Inductance	mH	1.184
Resistance	mOhm	21.854
Max. ramp rate	T/s	0.54
high field flat top	s	∞
low field flat top	s	∞
cycle length	s	∞
average power consumption	kW	7.356

Studies

- Several design studies by Alexander Kalimov
  - Window frame design
    - Saddle coils
    - Mirror plates or full shield
    - + Lower inductance, thinner yoke, full shield optional
    - - Elaborate coil

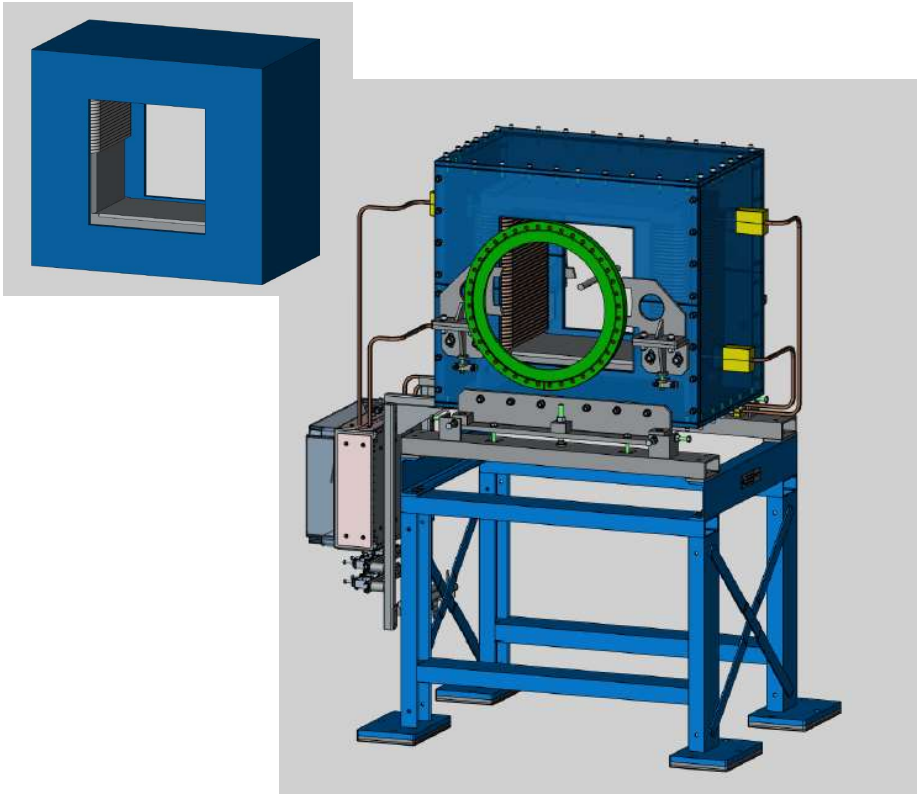


  - Transformer design
    - Race track coils
    - Full shield
    - + Simple coil
    - - Higher inductance, thicker yoke, full shield mandatory



BINP study

- Based on Kalimov‘s transformer design
  - Works in principle
  - Tolerances on spacers between turns critical
  - Alignment bridges at load limit, movement to small
  - Aperture slightly reduced -> enlarged aperture would need higher current

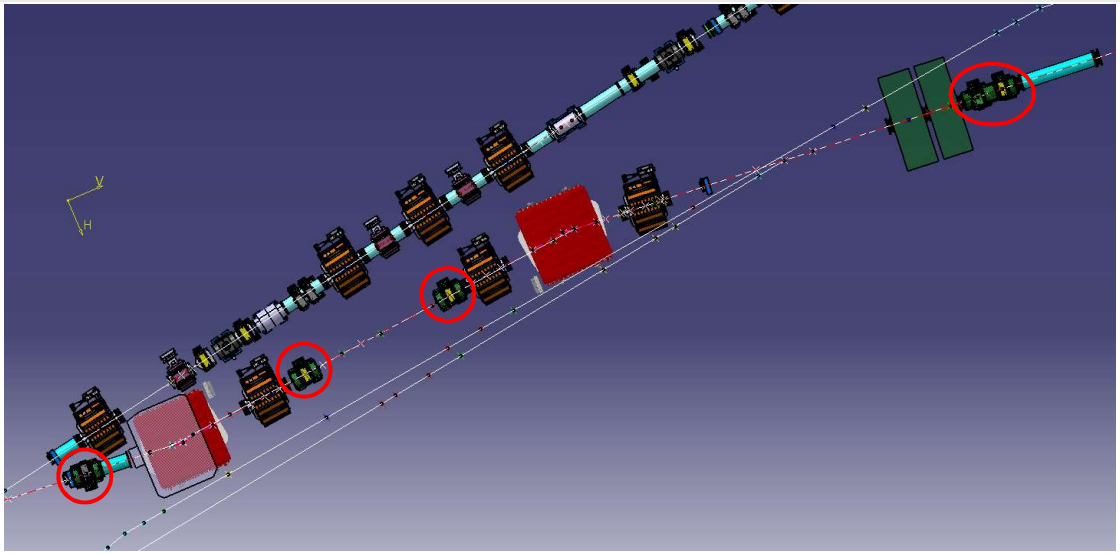


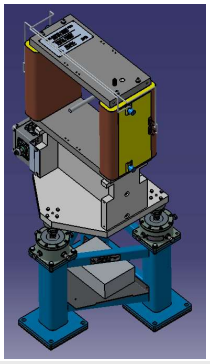
Critical re-check of parameters at GSI

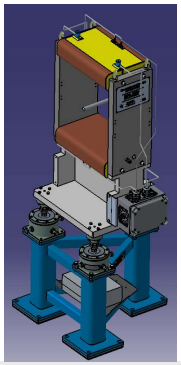
- Fast ramping is not needed in beam lines where S13 is used
  - No ramping → Low current / high inductance design feasible
- Most parameters of CR/pbar-steering magnet fit to S13 requirements
  - Would be a time and cost effective solution.
  - But field integral is only 80% of S13 → Max. steering angle reduced from 2mrad to 1.6mrad.
  - → This drawback can be accepted.

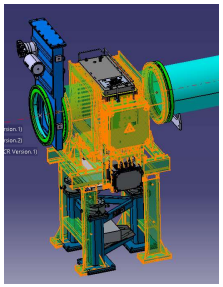
Installation spaces

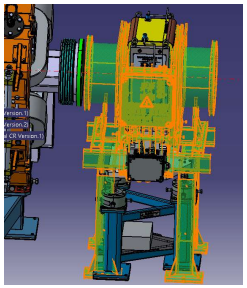
- Checked by Ludwig Heyl
  - → No problem at all 5 positions.

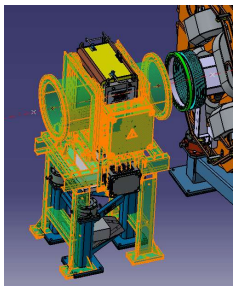


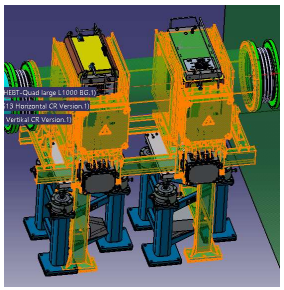












Conclusion

- Replacement of S13 by CR/pbar-steering magnet is a feasible solution.
- It is expected to be time and cost effective.
- Power supply should be changed accordingly.
- Engineering change request must be prepared.