**SIS18 Machine Developments in 2019**

Categories:

1. Sorting according to responsibilities and organization (e.g. separation of technical focus from beam dynamics focus)
2. Sorting according to functional systems, processes or devices

***MK/System Design (Machine perspective)***

1. Injection process
2. Extraction process
3. Slow extraction process
4. Fast extraction process
5. Development of FAIR booster operation
6. Operation with maximum ramp rate
7. Operation with low charge state heavy ions
8. Development of beam based-feed back systems
9. Development of machine model (LSA/set-values)
10. Development of Rf cycle and longitudinal manipulations
11. Development of machine optics and orbit

***Beam Dynamics (Beam perspective)***

Development of high current operation

(space charge, beam current, impedance, collective effects, space charge in bucket, space

charge and resonances, benchmarking of codes and understanding etc.)

***RF Systems (Technical Perspective)***

Rf device developments for slow extraction process

Rf device developments for FAIR booster operation

***Beam Instrumentation Developments (Technical Perspective)***

BI device developments for machine optics and orbit

BI devices, developments measurement techniques and methods

26 topics each 2 shift > 52 shift = 2,5 weeks (24 h)

* System Design : 16 topics
* Beam Dynamics: 4 topics
* Rf systems: 5 topics
* Bi systems: 1 topic
* Required Ion species:

1. Light, high intensity ion, e.g. Ar
2. Heavy, “high intensity” ion, e.g. Uranium

* In total about 2 weeks explicitly for SIS18 machine developments in 2019 are needed and can be served
* Prioritization (all high) but according to relevance for user operation (next year) and FAIR operation

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| **Systemdesign** | | | | | | | |
| Priority | Ion Species | Charge State | TK9 Current [emA] | SIS Intensity | Extraction  [F/S] | Topic | Coordinator |
|  |  |  |  |  |  |  |  |
| 1 | arbit. | TK |  | >1E8 | S | Developments of slow extraction process/  Validation of ion optical model | D. Ondreka |
| 2 |  |  |  | >1E8 |  | Influence of Pause on Spill Shape | D. Ondreka |
| 1 | arbit. | TK |  | >1E8 | S | Development of slow extraction process/  Micro spill quality/Commission of new set-up for controlled generation of high frequency modulation of power converters | R. Singh |
| 1 | No beam |  |  | >1E8 | S | Development of slow extraction process/  Determination of long term impact of high frequency modulation on power converter | H. Welker |
| 2 | arbit. | TK |  | >1E8 | S | Development of slow extraction process/  Micro spill quality/ Test of high frequency modulation with alternative magnet PCs | D. Ondreka |
| 1 | arbit. | TK |  | >1E8 | S | Development of slow extraction process/  Micro spill quality/ Initial functional verification with beam. Approval of high current operation with gap short circuit | P. Hülsmann |
| 1 | U28+ |  |  | >1E9 | F | Development of FAIR Booster Operation/  Development of max ramp rate operation  Beam Quality/Beam Loss/Closed Orbit  Alternative transformer configuration and all MA cavities operational | D. Ondreka |
| 1 | U28+ |  |  | >1E9 | F | Development of FAIR Booster Operation/  Development of max ramp rate operation/Radial position and closed orbit  Alternative transformer configuration and all MA cavities operational | D. Ondreka |
| 1 | U28+ |  | 5 emA | >2E10 |  | Development of FAIR Booster Operation/  Ultimate Heavy Intensities/Machine setting for max transmission, Studies of Dynamic Vacuum, Benchmarking of Codes | P. Spiller |
| 1 | arbit. | TK |  | >1E8 | F | Development of beam based feed-back systems/  Test with new system for closed-orbit and radial position control static and dynamic | B. Schlei |
| 2 | arbitr. | TK |  | >1E8 | F | Beam instrumentation developments for machine optics and orbit/  Commissioning of real time closed orbit feed-back | R. Singh |
| 1 | arbit. | TK |  | >1E8 | S | Development of beam based feed-back systems/  Test with new macro spill control | R. Steinhagen |
|  | arbit. | TK |  | >1E8 | F | Development of injection process/  Beam control based on digitized Schottky signal, Commissioning and feed-back. | R. Steinhagen |
| 2 | arbit. | TK |  | >1E8 | F | Development of RF cycle and longitudinal manipulations/  Emittance conservation/adiabaticity of Rf capture, emittance blow-up at different ramp rates | D. Ondreka |
| 1 | arbit. | TK |  | >1E8 | F | Development of injection process/  Beam commissioning of new TK chopper system | Y. El Hayek |
| 2 ? | arbit. | TK |  | >1E8 | F | Development of machine model/  Commissioning of MMTI with LSA and new control system | H. Liebermann |

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| Beam Dynamics | | | | | | | |
|  | Ion Species | Charge State | TK9 Current [emA] | SIS Intensity | Extraction  [F/S] | Topic | Coordinator |
| 2 | Light ion: N, Ne, Ar | TK |  | >5E10 | F | Development of high current operation/  Development of longitudinal beam dynamics/Emittance conservation/Influence of space charge and impedances/ Adiabaticity of Rf capture, Blow-up at different ramp rates | V. Kornilov |
| 2 | Light ion: N, Ne, Ar | TK |  | >5E10 | F | Development of high current operation/  High intensity diagnostics via dispersive coherent mode | A.Oeftiger |
| 2 | Light ion: N, Ne, Ar | TK |  | >5E10 | F | High Current Operation/  Beam loss and beam profiles at long storage times, single and dual harmonic bucket | V. Kornilov |
| 1 | Light ion: N, Ne, Ar | TK |  | >5E10 | F | High Current Operation/  Bunch Merging with high intensity effects | V. Kornilov |

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| RF Systems | | | | | | | |
|  | Ion Species | Charge State | TK9 Current [emA] | SIS Intensity | Extraction  [F/S] | Topic | Coordinator |
| 2 | No beam | TK |  |  |  | Rf Developments for slow extraction process/  Micro spill quality/ Hardware commissioning of new cavity | P. Hülsmann |
| 2 | arbitr. | TK |  | >1E8 | S | Rf Developments for slow extraction process/  Micro spill quality/ Technical commissioning with beam | P. Hülsmann |
| 1 | arbitr. | TK |  | >1E8 | F | Rf Device Developments for FAIR Booster Operation/  Commissioning of new MA cavities/  Development towards higher gap voltages/ Re-commissioning of S07BE3-cavity after repair | H. Klingbeil |
| 1 | arbitr. | TK |  | >1E8 | F | Rf Developments for FAIR Booster Operation/  Development of low level Rf systems/  Cavity synchronisation/phase control loop Rf devices/ Dual harmonic operation | H. Klingbeil |
| 1 | arbitr. | TK |  | >1E8 | F | Rf Developments for FAIR Booster Operation/  Development of low level RF systems/  Development of bunch merging process/hardware with test beam | D. Lens |

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| Beam Instrumentation | | | | | | | |
|  | Ion Species | Charge State | TK9 Current [emA] | SIS Intensity | Extraction  [F/S] | Topic | Coordinator |
| 1 | arbitr. |  | 100emuA | 1emA  (inj) | F | Beam instrumentation device development/Test of a new DAQ for ring FCT, FAIR prototype | H. Braeuning |