

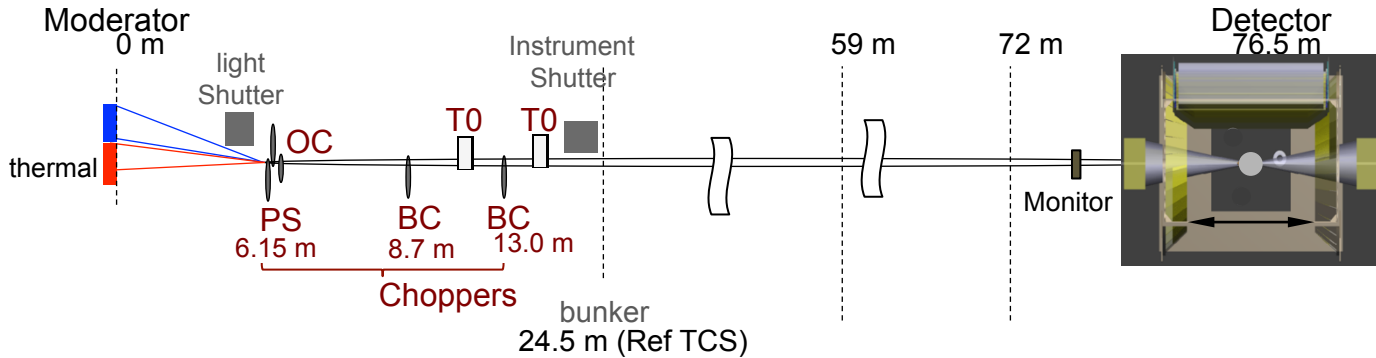
DREAM

Choppers – Activities in Phase 1

Peter Harbott

IKON11, Sep. 2016

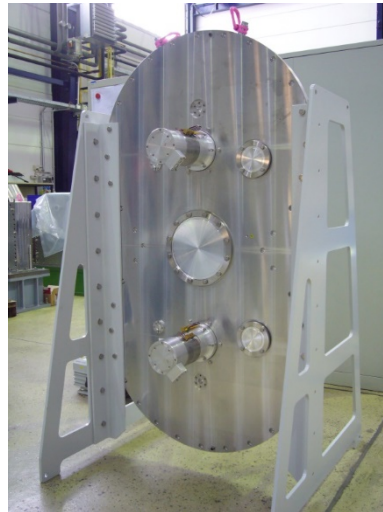
DREAM Layout



DREAM Choppers

Chopper	Type	Ø [mm]	Speed [Hz]	Position [mm]
Puls chopper PS	Double disk	750	210 294 upgrade	6150
14 Hz selection chopper	Disk	337 (adapted to PS)	14	6170
Band chopper 1	Disk	750	126 (9x14)	8700
Band chopper 2	Disk	750	84 (6x14)	13000
T ₀ (PPS) chopper 1	Hammer	Radius 300	28	~10800
T ₀ (PPS) chopper 2	Hammer	Radius 300	28	~15100

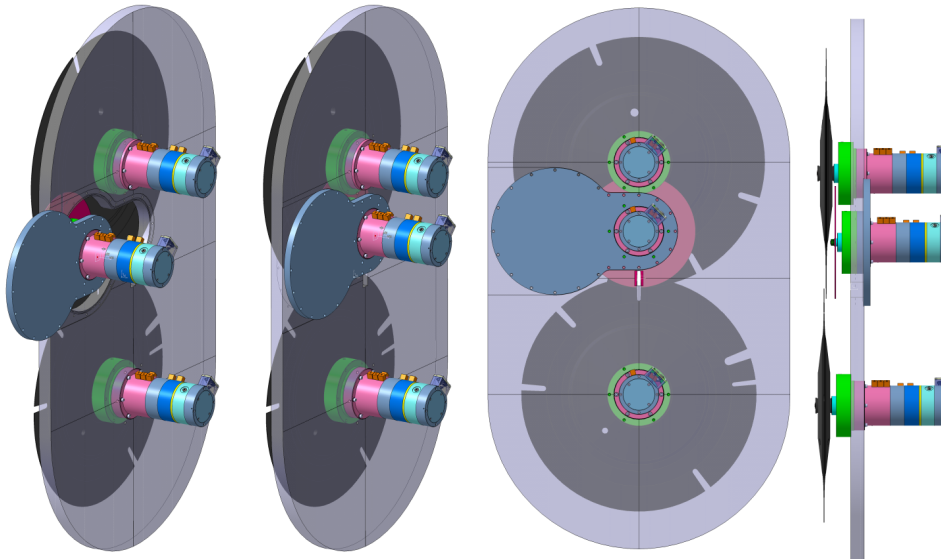
Puls Chopper POWTEX



Double disk, 750 mm Ø
Carbon fiber disc, $^{10}\text{B}_4\text{C}$ coating
220 Hz
Magnetic bearing FZJ-system
Steel housing



Puls chopper DREAM with integrated 14 Hz chopper



Puls chopper:
Double disk, 750 mm Ø
Magnetic bearing

14 Hz selection chopper
Disk 337mm Ø
Magnetic bearing???

Beam size: 25x45 mm
Slit depth: 55 mm

Position at 6.15 m
(challenging, depends
on final Bunker design)

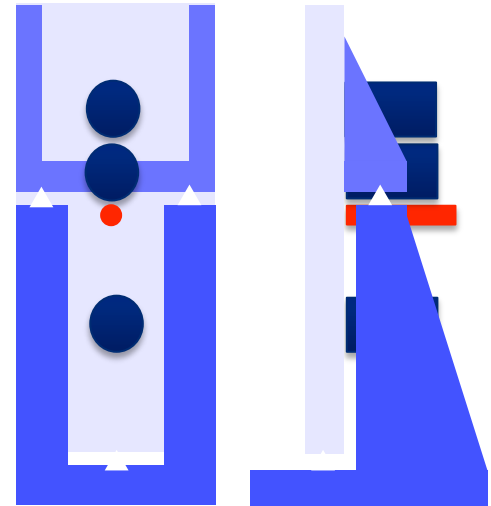
T. Ortmanns; ZEA-1

Endorsed ESS model for pulse chopper

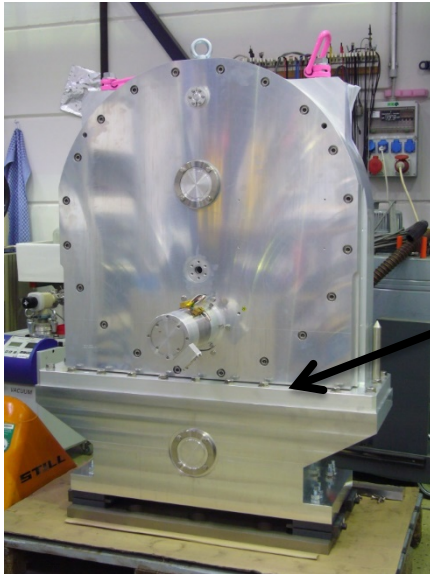
“Over / under” arrangement, standardization ongoing

- Separated vacuum
- Support by two pillars, based on ground plate
- 3-point adjustment
- Vertical extraction, flight tube longer than drives
- Rail guidance, close to monolith slope necessary

Drawing:
Erik Nielsen, ESS NCG,
Modified



Band choppers BC1 and BC2 identical to POWTEX

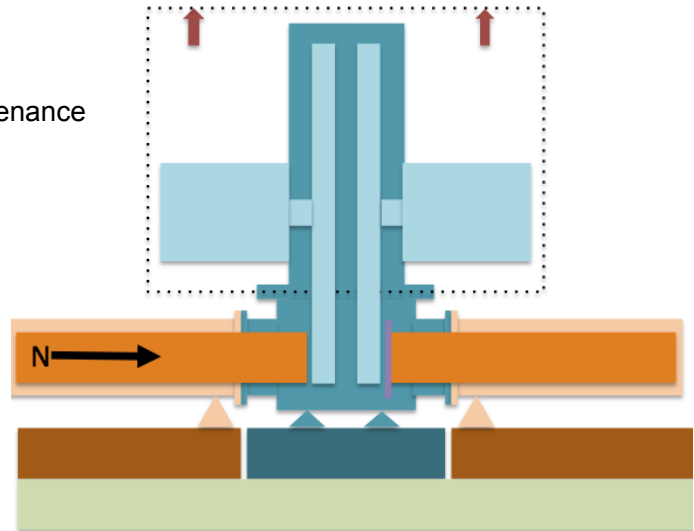


- CF disk, 750 mm Ø
- 9x14 Hz, 6x14 Hz
- Magnet bearing FZJ-system
- Al-housing
- Access to bolts for disassembling the chopper from beamline might be challenging / additional design features simplifying handling might be necessary (depends on final Bunker design)

Endorsed ESS model for band chopper

Horizontal split, independent guide, S3A

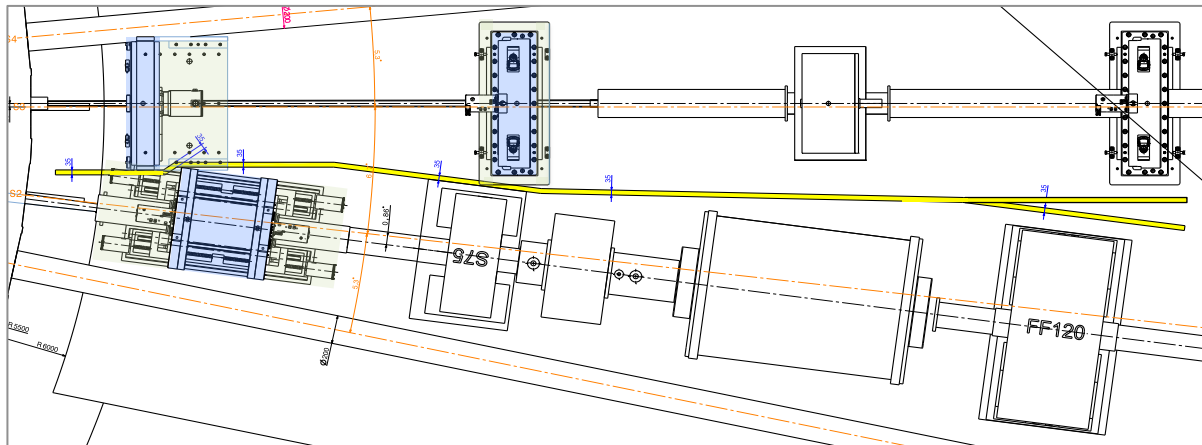
- Common vacuum with guides
- Bottom housing permanently attached to guide system
- Vertical extraction of upper part for maintenance



Drawing:
ESS-0041170
Guideline CHIM_v1.1

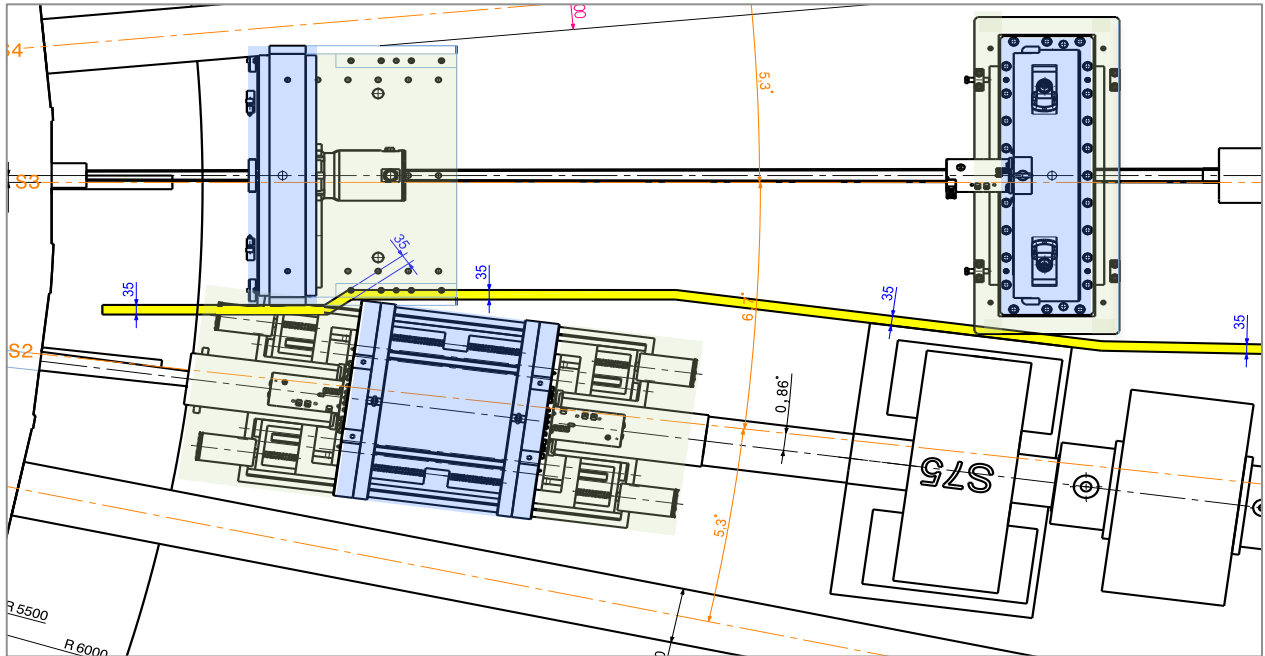
DREAM Disk Choppers

Possible interference with neighboring beamline ODIN



Integration possible, but beamline change favored

DREAM Disk Choppers



DREAM Disk Choppers

Scope

- PSC Tripple Chopper, bauähnlich POWTEX P1 und P2 mit zusätzlichem kleinen Überlapp Chopper.
- 2 x Bandchopper ähnlich POWTEX. Gehäuse evtl. geändert für separates Chopper-vakuum (ähnlich NSE-SNS)
- P-Tripplchopper-Gehäusekonzept ähnlich POWTEX. Handhabung (Bunker) erfordert keinen massiven konstruktiven Mehraufwand.
- Schlitzmuster P chopper ausbalanciert bzw. ohne massive zusätzliche Wuchtgewichte ausbalancierbar.
- Fall back auf 210 HZ möglich falls 300 HZ massive Probleme zeigt. 210Hz Scheiben dann in Aluminium und Gd Beschichtung statt Bor zulässig.
- Kleiner 14 HZ Überlappchopper konventionell gelagert
- Beide Bandchopper-Gehäuse identisch

DREAM Disk Choppers

Scope

Chopper	Beschichtung Schlitzweiten	ϕ [mm]	Position [mm]	Drehzahlen [Hz]	Leiter-Innenhöhe [mm]	Schlitzpositionen
Puls PSC1	^{10}B , 200 mg/ cm ²	750	6100	14, 28, ... 210	40.0 - 55.5	180°, 151.2°, 108°, 338.4°, 211.68°, 197.28° 2.5°, 4.9°
Puls PSC2	^{10}B , 200 mg/ cm ²	750	6110	14, 28, ... 210	40.0 - 55.5	0°, 316.8°, 273.6°, 144°, 83.95°, 69.55° 2.5°, 4.9°
SC-Overlap	^{10}B , 200 mg/ cm ²	337	6140	14	40.0 - 55.5	0° — 26° 29°
Band BC1	^{10}B , 200 mg/ cm ²	750	8700	9x14	40.0 - 55.5	0°, 180° 75.6°, 75.6°
Band BC2	^{10}B , 200 mg/ cm ²	750	13000	6x14/	40.0 - 55.5	0°, 180°

DREAM Disk Choppers

To Do / Challenges (M. Butzek, FZJ chopper group)

- Access / handling boundary conditions not clear due to not final bunker design. Access / handling boundary conditions need to be clear and fixed by 01/2017
- Cooperation between FZJ and Airbus planed to use synergies and combine “best of two worlds”
- 300 Hz Carbon fiber disk in complex housing and support frame challenging. Strongly suggest to build test stand before final design of real chopper
- Communication Chopper controller <-> CHIC not tested yet. Strongly suggest to build test setup of CHIC and perform tests with different chopper controllers.

DREAM Disk Choppers

Quote based on following assumptions / limitations

- Housing concept of triple chopper comparable to POWTEX pulse chopper
- Slit pattern nearly balanced
- Fall back to 210 Hz if 300 Hz turns out difficult
- Both band choppers mainly identical
- Remote access limited to rail extraction system, extended tools
NO robotics

To do before 2017:

- Clarify funding situation
- Boundary conditions like available space, access limitations, radiation levels in bunker must be known and acceptable
- Contact person for bunker concept must be known

DREAM Disk Choppers

Budget estimate:

~ 1350 T€ full cost (incl. Jülich overhead)

Includes:

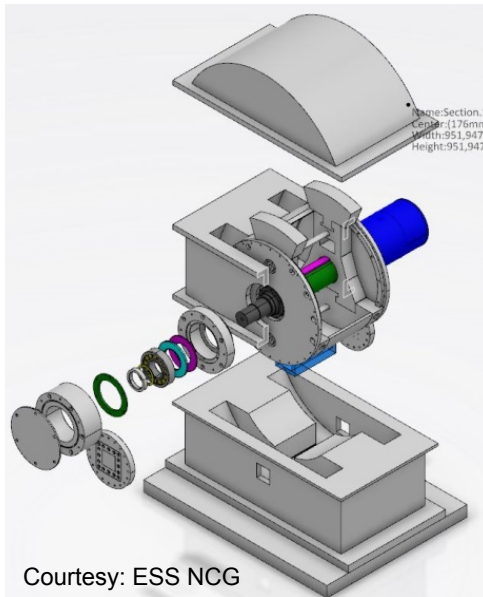
- Design of chopper disk, spindles and crash safe housing (coating B4C supplied by customer)
- All needed electronics up to CHIC (CHIC not included). UPS not included but recommended.
- Manufacture and test run choppers in Jülich chopper lab (CHIC supplied for test by ESS)
- Ship choppers on site (integration in beam line done by customer)
- Cable system and test run choppers on site
- For choppers with horizontal split housing the lower housing will be shipped to site earlier for integration in beam line by customer. Final choppers will be shipped with “dummy” lower housing for test run and protection of disk during shipment.

DREAM Disk Choppers

Timeline

- Start test setup not later than 01/2017
- Build test setup and final decision for 210 or 300 HZ until 04/2018
- Start of test run in Jülich until 08/2019
- Ready for installation on site 06/2020

T₀ (PPS) chopper concept



Courtesy: ESS NCG

Each chopper has a pair of single hammers
 Absorber: 50 mm Tungsten + B₄C

Distance between hammers=300 mm

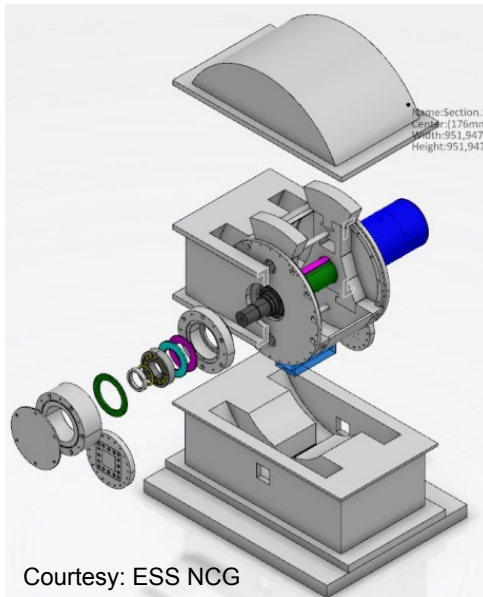
28 Hz

Horizontal split housing

2 T₀-choppers of this type planned
 Positions at ~10,8 and ~ 15,1 m

Simulations pending

T0 (PPS) chopper concept



Courtesy: ESS NCG

Standard platform to be developed by ESS
(In-kind contributions necessary)

Scope of work in review process

Cost estimate for DREAM: 200 k€ per unit
(Manufacturing, procurement, assembly incl.
NO development / testing)

Thank you!