

MAST Error Field Studies

T C Hender, G Cunningham and D F Howell

EURATOM/UKAEA Fusion Association

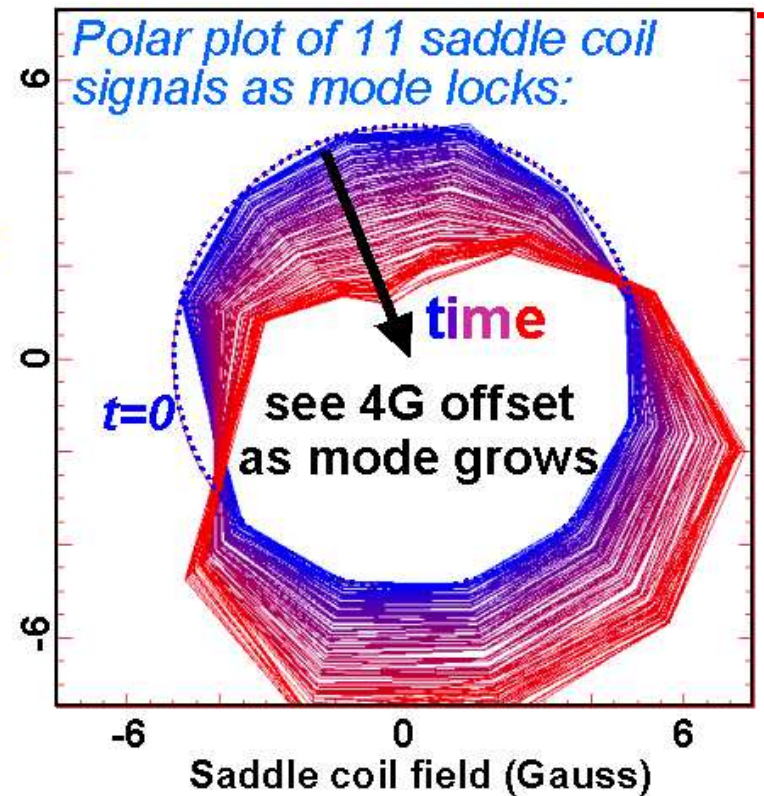
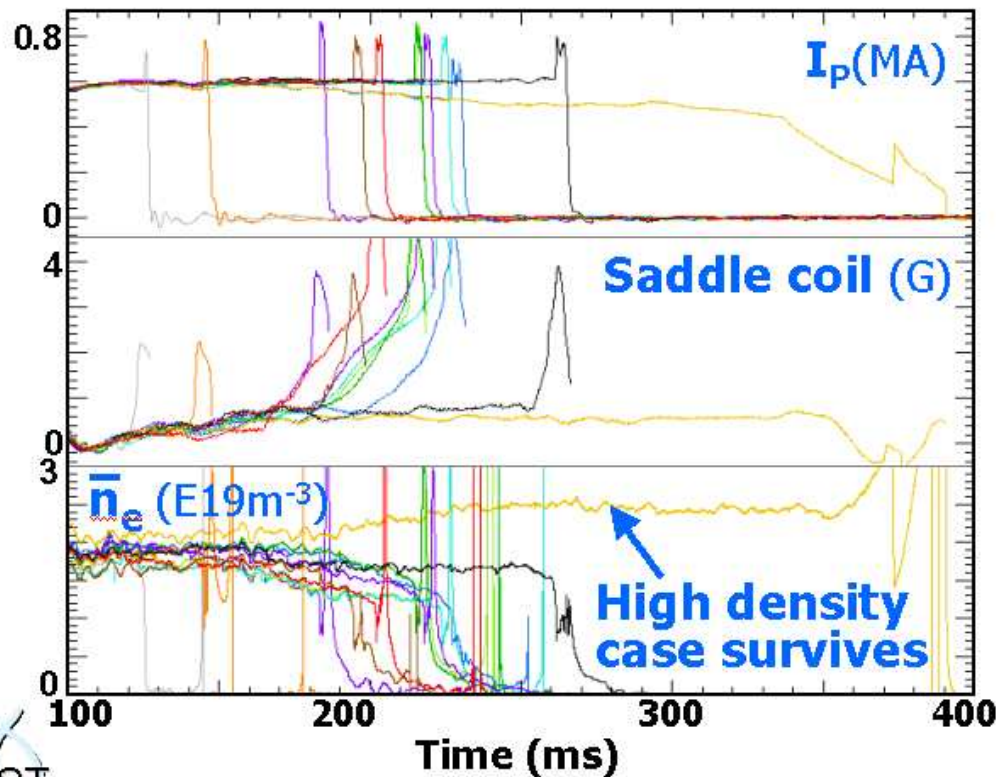


4 new Error Field
Correction Coils
installed on MAST

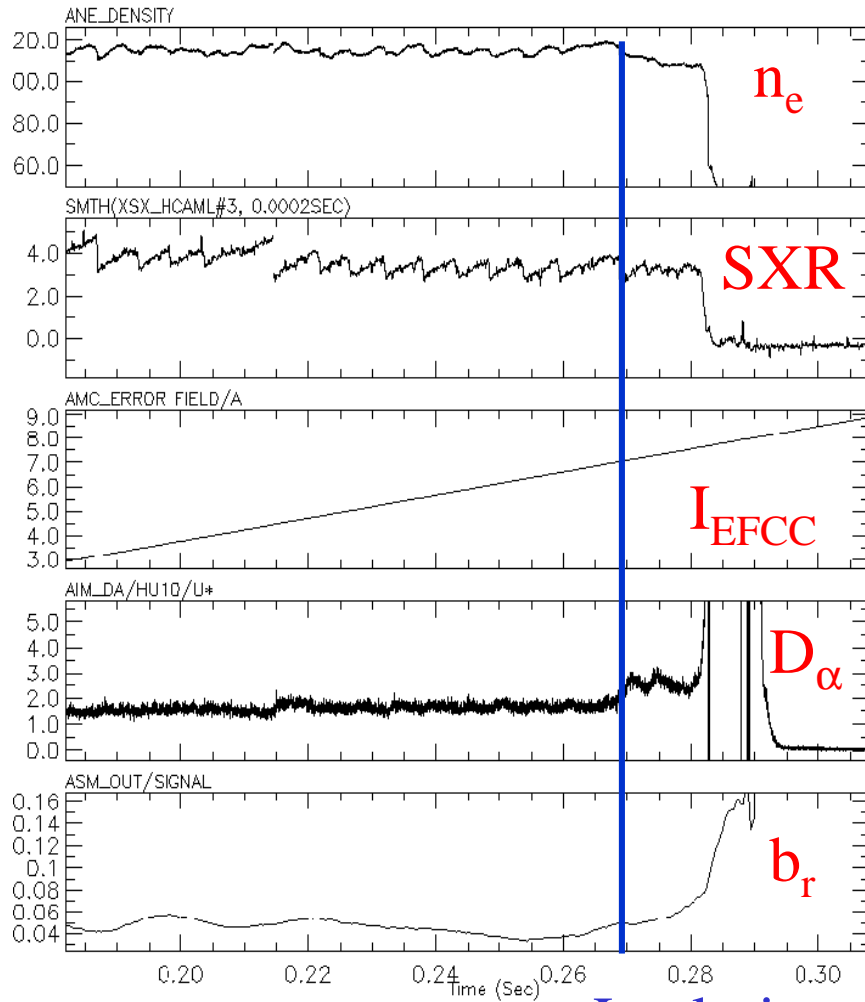
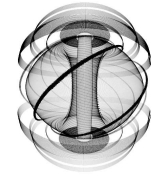
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Error fields playing a role on MAST

- Error field modes specifically a problem at low density
 - Persistent locking in SE direction
 - Low β discharges survive for a while
- Clear threshold in density:



MAST Error Field Experiments

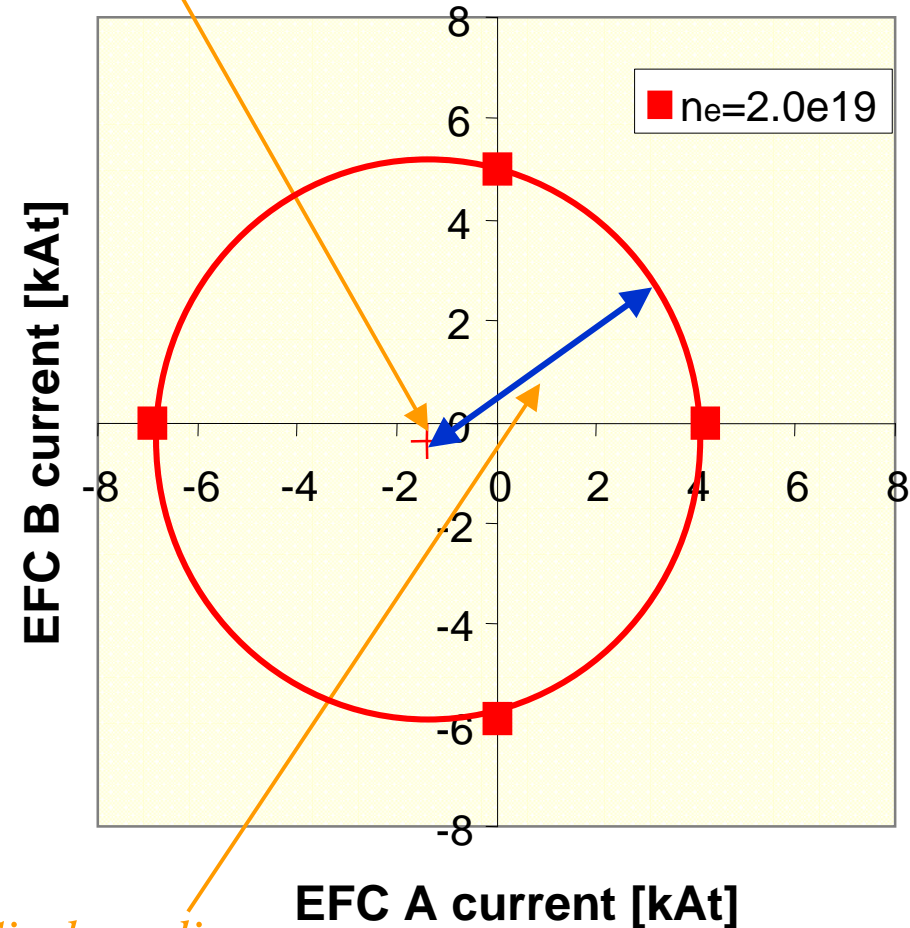


Lock time

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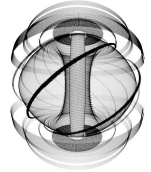
Intrinsic error

Constant $B_t = -0.55T$, $I_p = 600kA$

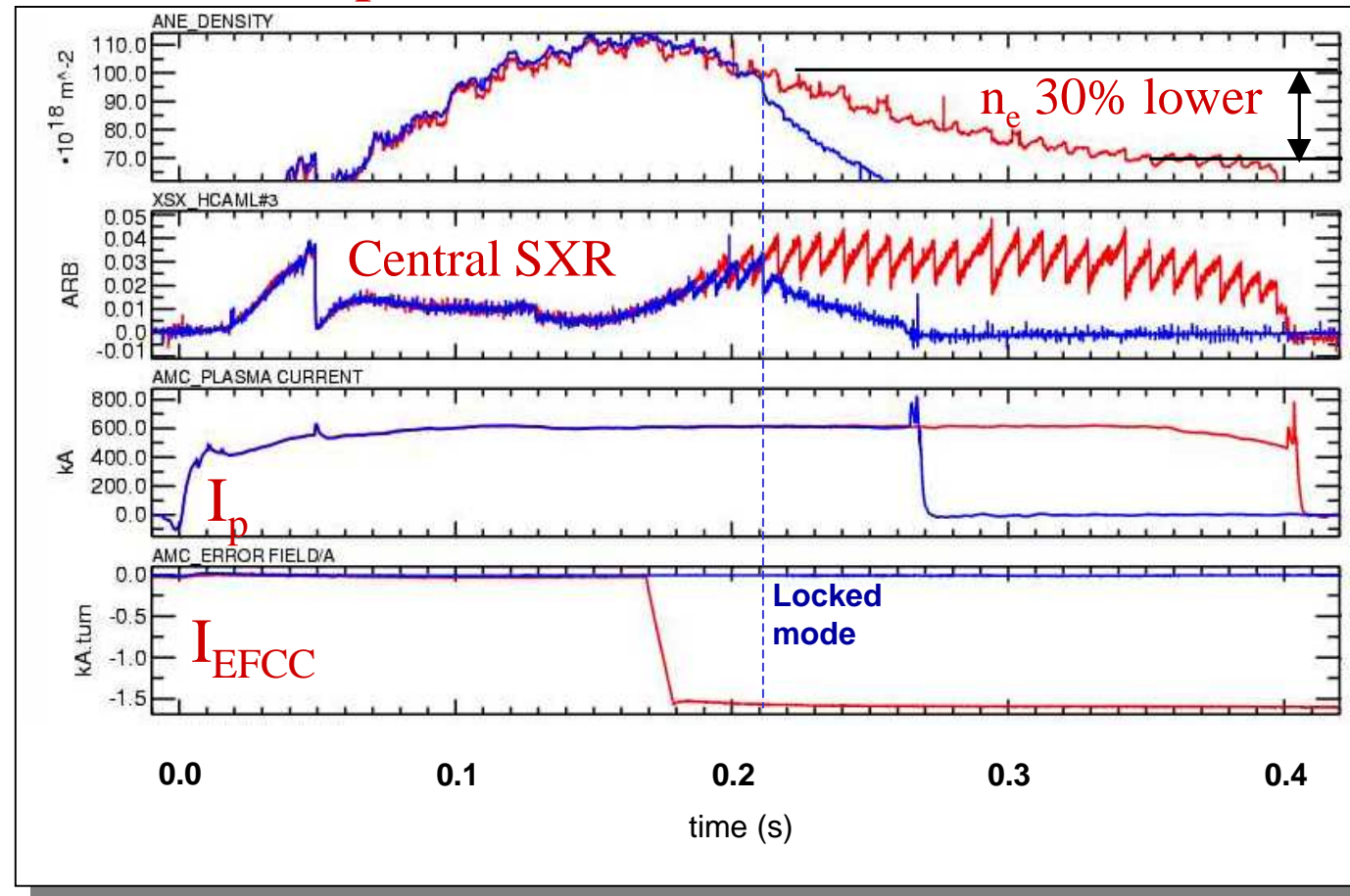


Circle radius = field for locked mode

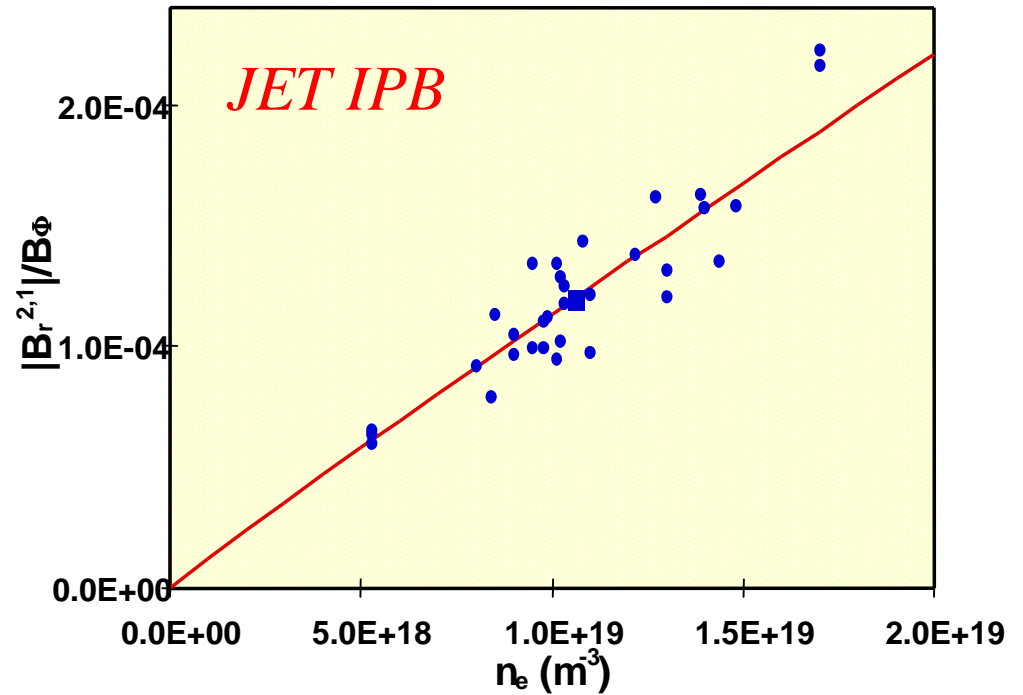
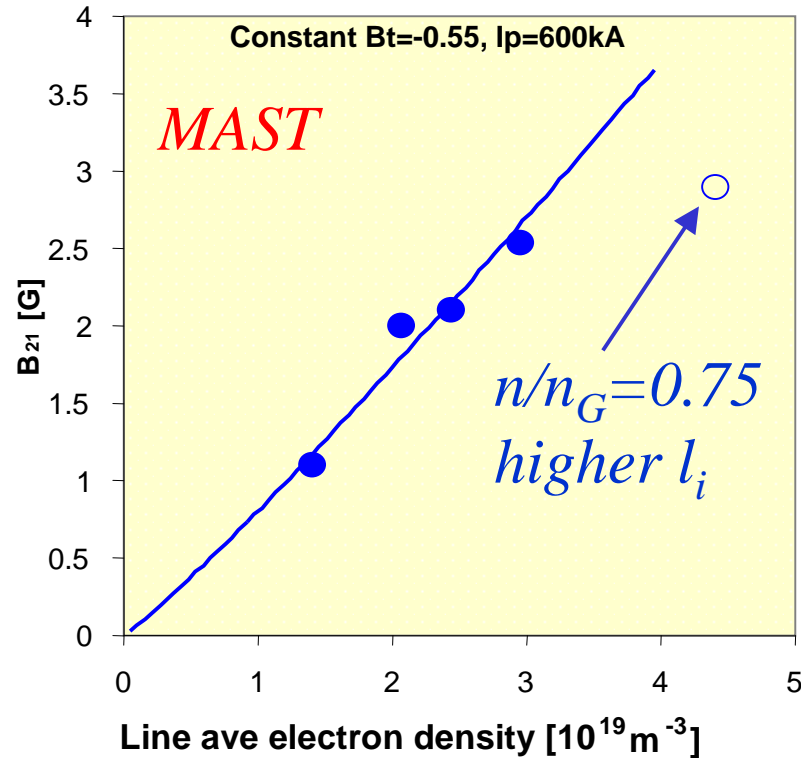
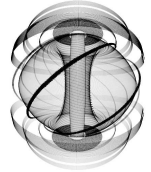
Error Correction Extends Operating Space



No EFCCs, optimal EFCCs



Density Scaling

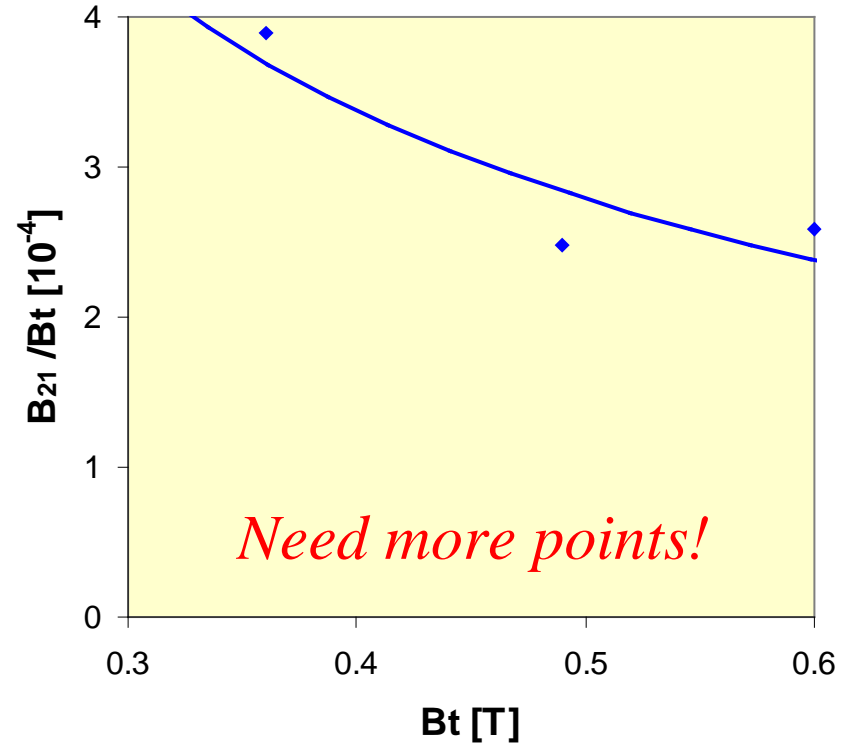
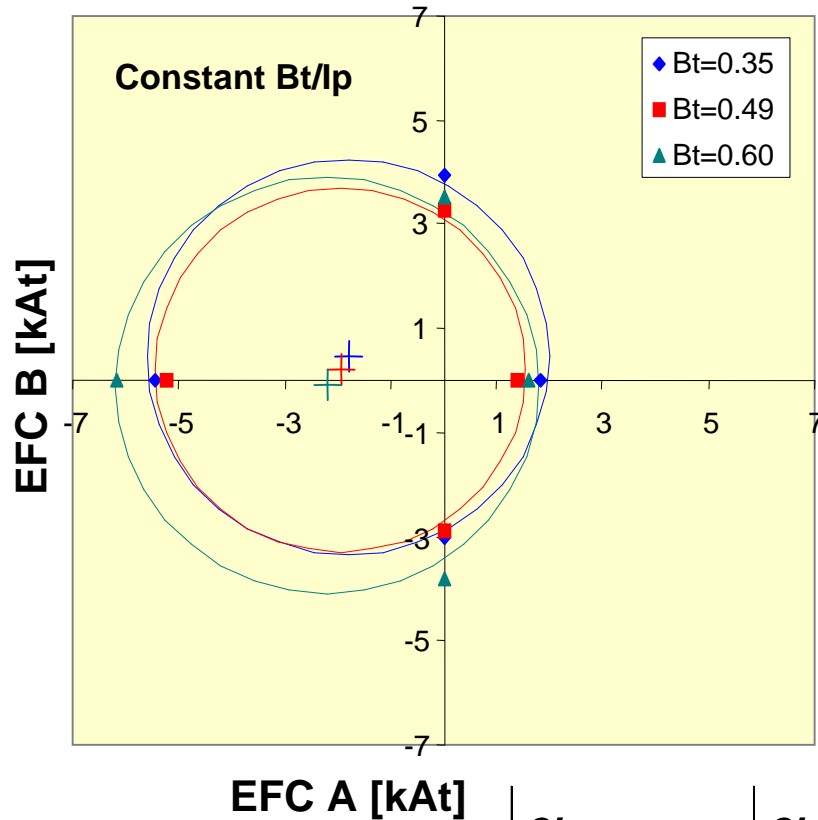
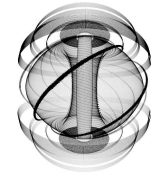


	α_n	α_B	α_q
JET*	0.94	-1.2	~ 2 (EFCC)
DIII-D*	0.99	-0.97	0.83
MAST	1.1		
COMPASS-D*	1.0	-2.9	1.6

$$\frac{b_{pen}}{B_t} \propto n^{\alpha_n} B^{\alpha_B} q^{\alpha_q}$$

*IPB, NF 1999

Toroidal Field Scaling

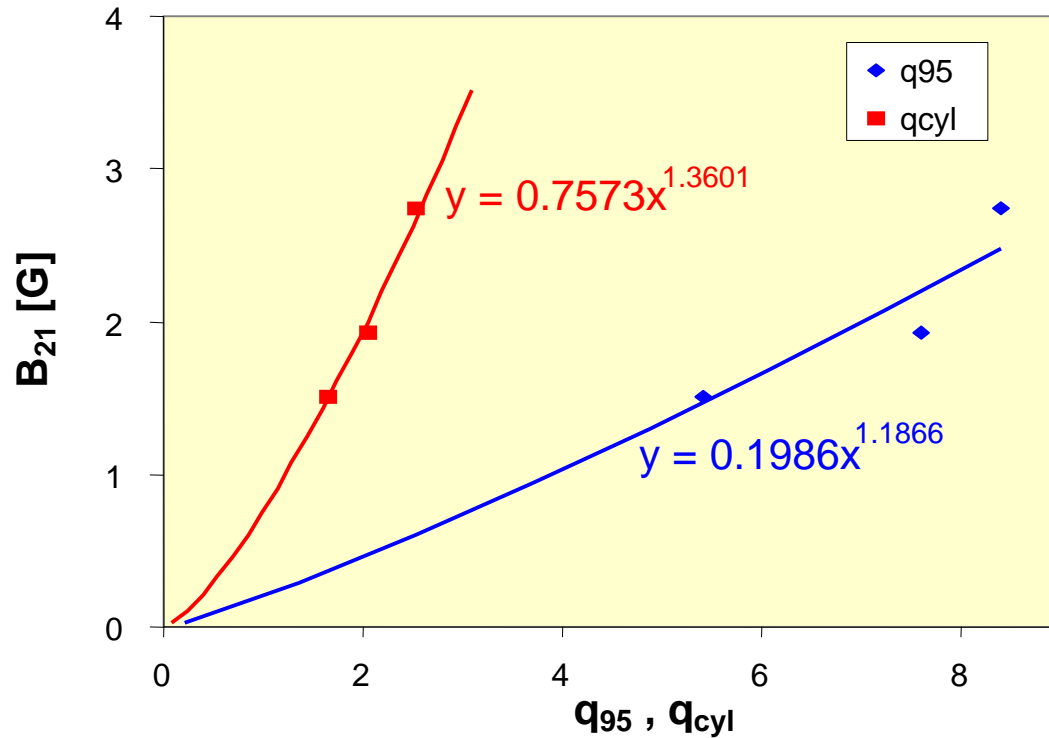
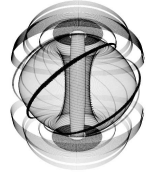


	α_n	α_B	α_q
JET	0.94	-1.2	~ 2 (EFCC)
DIID-D	0.99	-0.97	0.83
MAST	1.1	~ -0.9	
COMPASS-D	1.0	-2.9	1.6

$$\frac{b_{pen}}{B_t} \propto n^{\alpha_n} B^{\alpha_B} q^{\alpha_q}$$

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q-Scaling



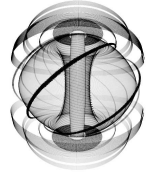
$$q_{cyl} = \frac{aB_t}{RB_\theta} = \frac{2\pi a^2 B_t}{R\mu_0 I_p}$$

	α_n	α_B	α_q
JET	0.94	-1.2	~2 (EFCC)
DIII-D	0.99	-0.97	0.83
MAST	~1.1	~ -0.9	~1.4
COMPASS-D	1.0	-2.9	1.6

$$\frac{b_{pen}}{B_t} \propto n^{\alpha_n} B^{\alpha_B} q^{\alpha_q}$$

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Conclusions



- **Error field limits density operation in MAST**
- **New correction system recently installed, works properly**
- **Measured threshold for locking**
- **Error field correction extends operational space**
- **Scaling seems to be consistent with other experiments**