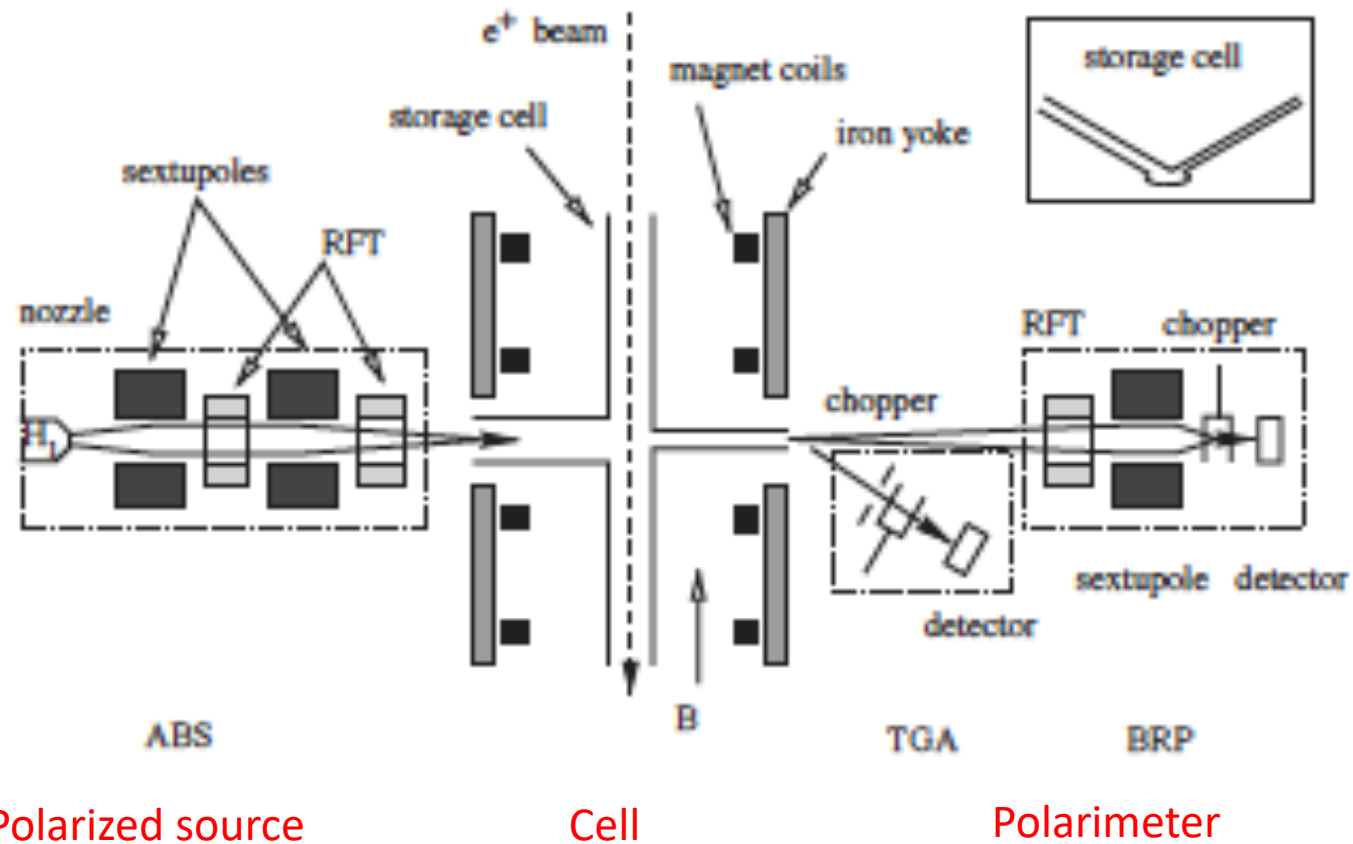
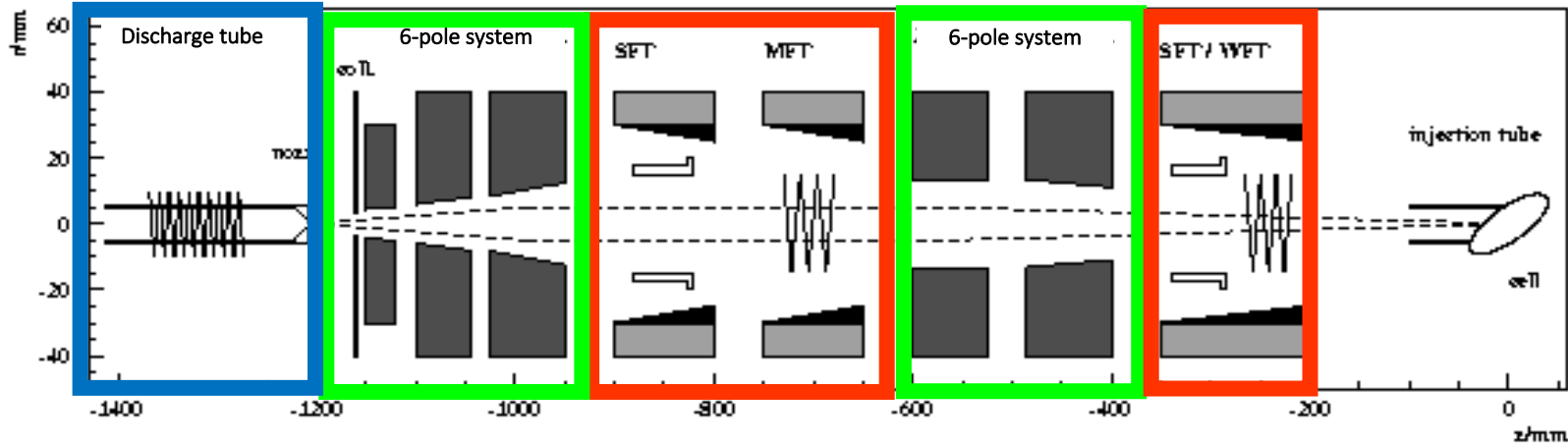


Polarized atomic target and polarimeter



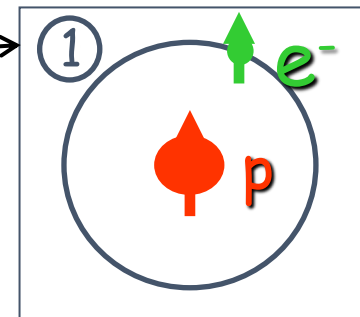
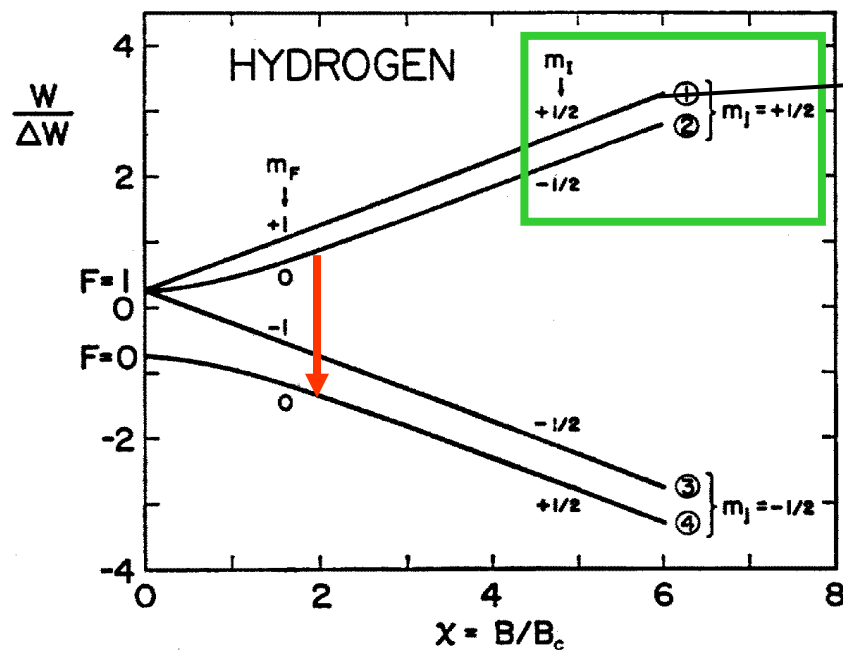
Polarized atomic beam source

Components and working principle



Main components:

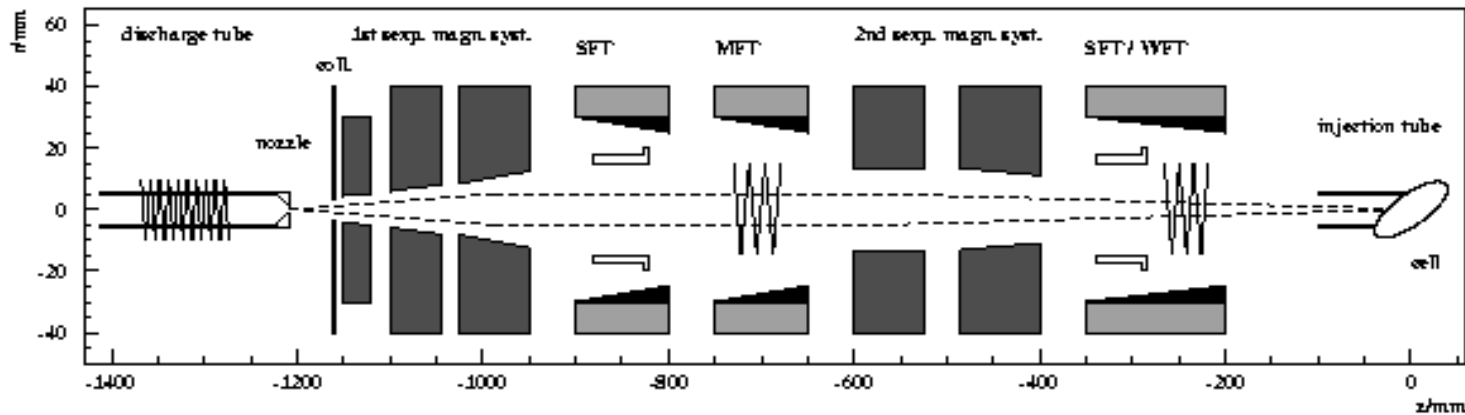
- Dissociator
- 6-poles
- RF-transitions
- Vacuum system



Atoms with $m_j = +\frac{1}{2}$ focused in sextupole magnets.

RF transitions select HFS.

Polarized Atomic Beam Source Design



(HERMES/PAX atomic beam source)

Requirements:

- **MW dissociator**
 - no water cooling;
 - reliable operation;
 - possible design of a shorter dissociator?
 - Test bench for velocity distribution characterization required
- **Space constraints:**
 - Z axis: possible gain compactness at the expense of intensity by removal of transitions after 2nd 6-pole (next slide)
 - Additional space for dissociator insertion and replacement
 - Beam simulations required
 - Radial
 - Services and pumps can be installed in the vertical plane gaining space in the horizontal
- **Vacuum: no UHV (HV sufficient); no baking required**
 - Turbo pumps
 - HERMES had cryopumps requiring maintenance and space
- **Separation valve between ABS and LHC vacuum might be a critical issue**
 - To be discussed with accelerator people

HF-transitions and injected polarization

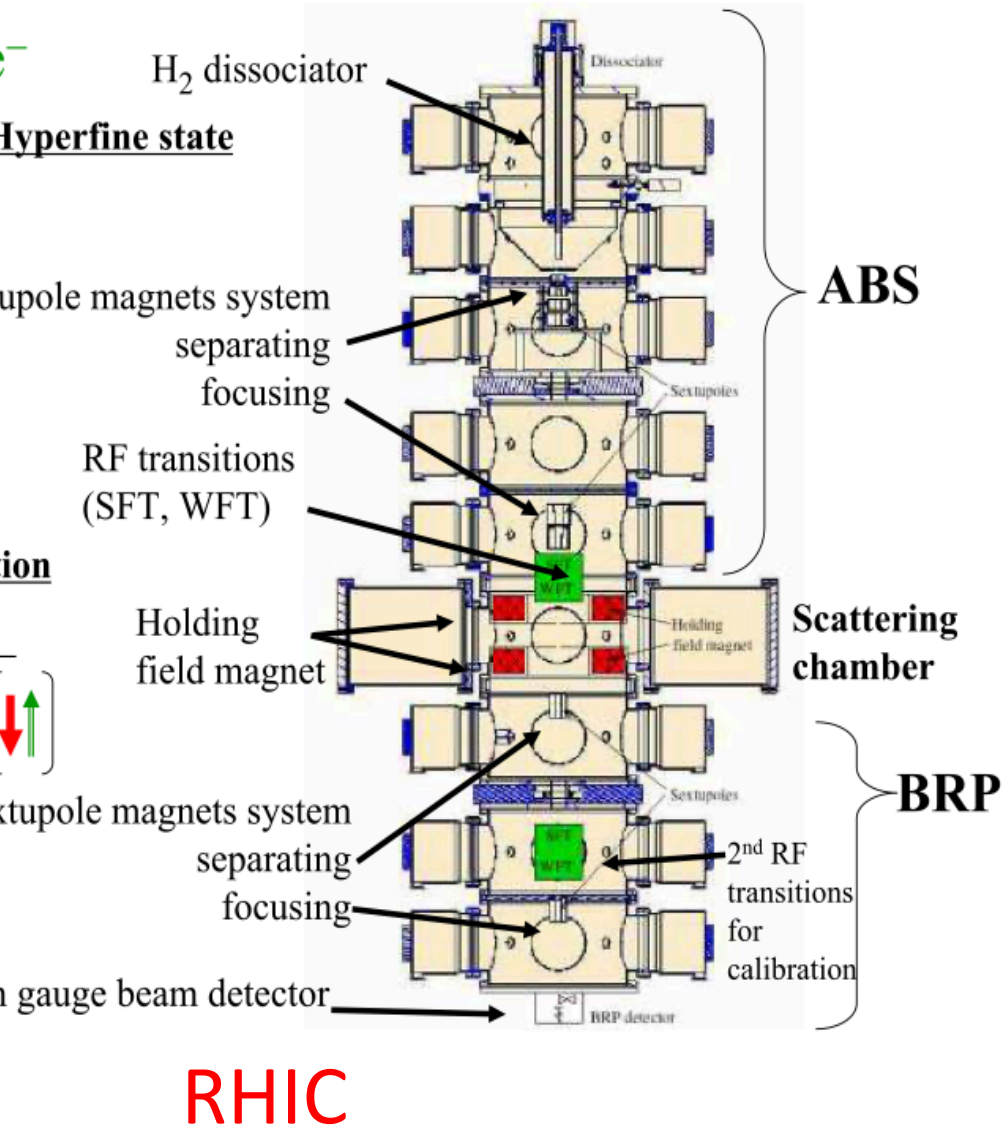
Table 2
Injection modes of the atomic beam source

Gas	HFT (betw. 6-poles)	HFT (after 6-poles)	Inj. states	P_x	P_z	P_{zz}	Use
H	—	—	(1), (2)	+1	0	—	Cal
	—	WFT 1-3	(2), (3)	0	-1	—	Data
	—	SFT 2-4	(1), (4)	0	+1	—	Data
	SFT 2-4 / MFT 2-3	—	(1)	+1	+1	—	Cal
	WFT 1-3/MFT 1-3	—	(2)	+1	-1	—	Cal
	SFT 2-4 / MFT 2-3	WFT 1-3	(3)	-1	-1	—	Cal
	WFT 1-3 / MFT 1-3	SFT 2-4	(4)	-1	+1	—	Cal
	WFT 1-3, SFT 2-4	—	<i>no state</i>	—	—	—	Cal
D	—	—	(1) (2) (3)	+1	0	0	Cal
	SFT 2-5	WFT 1-4	(3) (4)	0	-1	+1	Data
	SFT 3-5	SFT 2-6	(1) (6)	0	+1	+1	Data
	MFT 1-4	SFT 3-5	(2) (5)	0	0	-2	Data
	MFT 1-4	SFT 2-6	(3) (6)	0	0	+1	Data
	MFT 3-4, SFT 2-6	—	(1)	+1	+1	+1	Cal
	WFT 1-4, SFT 2-6	—	(2)	+1	0	-2	Cal
	WFT 1-4, SFT 3-5	—	(3)	+1	-1	+1	Cal
	MFT 3-4, SFT 2-6	WFT 1-4	(4)	-1	-1	+1	Cal
	WFT 1-4, SFT 3-5	SFT 3-5	(5)	+1	0	-2	Cal
WFT 1-4, SFT 2-6	SFT 2-6	(6)	-1	+1	+1	Cal	

- HF transitions after 2nd 6-poles double ABS intensity at the expense of longitudinal length

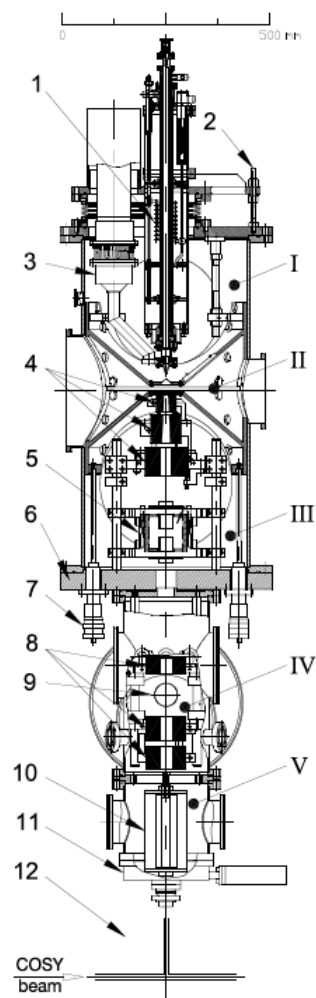
- SFT dual cavity (developed and installed in PAX ABS) can operate both for H and D without requiring hardware access
 - Complicate "remote" tuning -> out of tunnel "engineering model" ABS to reproduce and cure problems

(Other) operational atomic beam sources

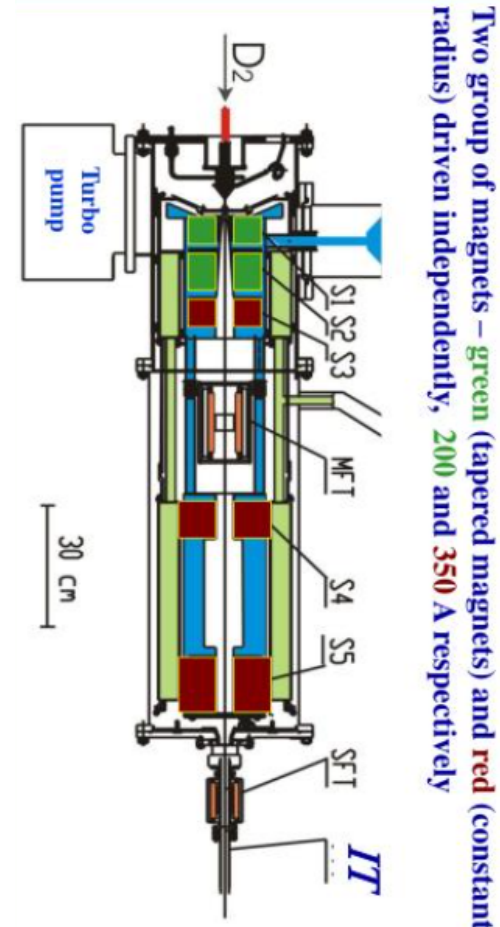


RHIC source

- Designed to optimize intensity (long drift space 1st - 2nd 6-poles)
- Clever use of turbo pumps
- Simplified BRP ok for RF- tuning
- No measurement of atomic fraction



ANKE

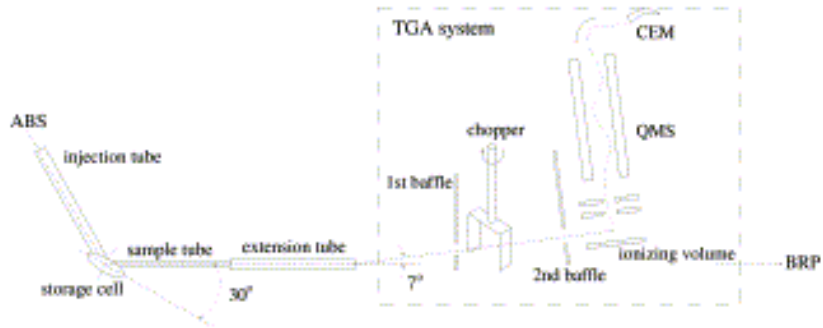


Two group of magnets – green (tapered magnets) and red (constant radius) driven independently, 200 and 350 A respectively

VEPP-3 cryogenic source

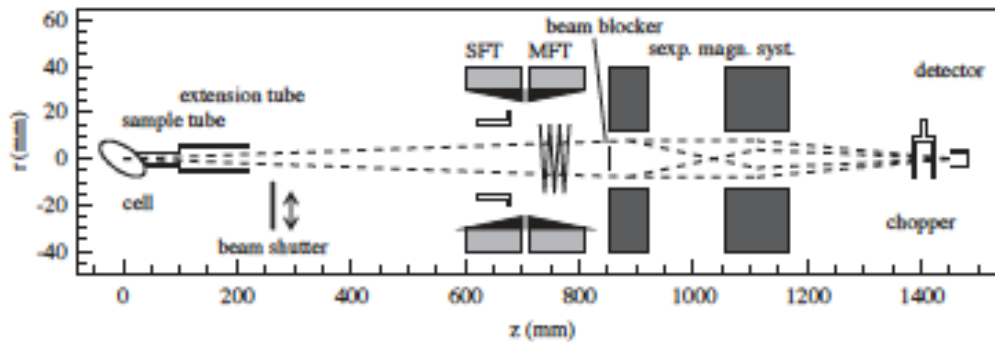
- SC-magnets increase mag poletip fields ($B = 4.8 \text{ T}$, $\phi = 44 \text{ mm}$)
- Requires cryostat and regular surface regeneration
- Requires R&D
- Not suitable for remote operation

Polarimeter



Target Gas Analyzer

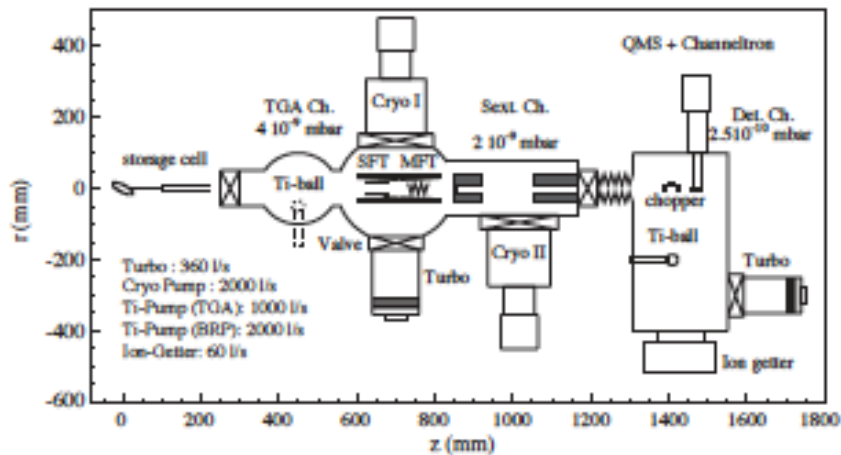
- Measures the atomic vs molecular fraction



Breit-Rabi polarimeter

- Measures the atomic polarization

Vacuum system



Requirements

- Space**
 - More compactness in long. and radial plane?
 - Rearrangement of TGA?
 - Beam simulations required
- Vacuum**
 - UHV necessary
 - Baking required
 - Turbo pumps + NEG
- Separation valve**
 - As for ABS