



Лаборатория Криогенной и Сверхпроводящей Техники

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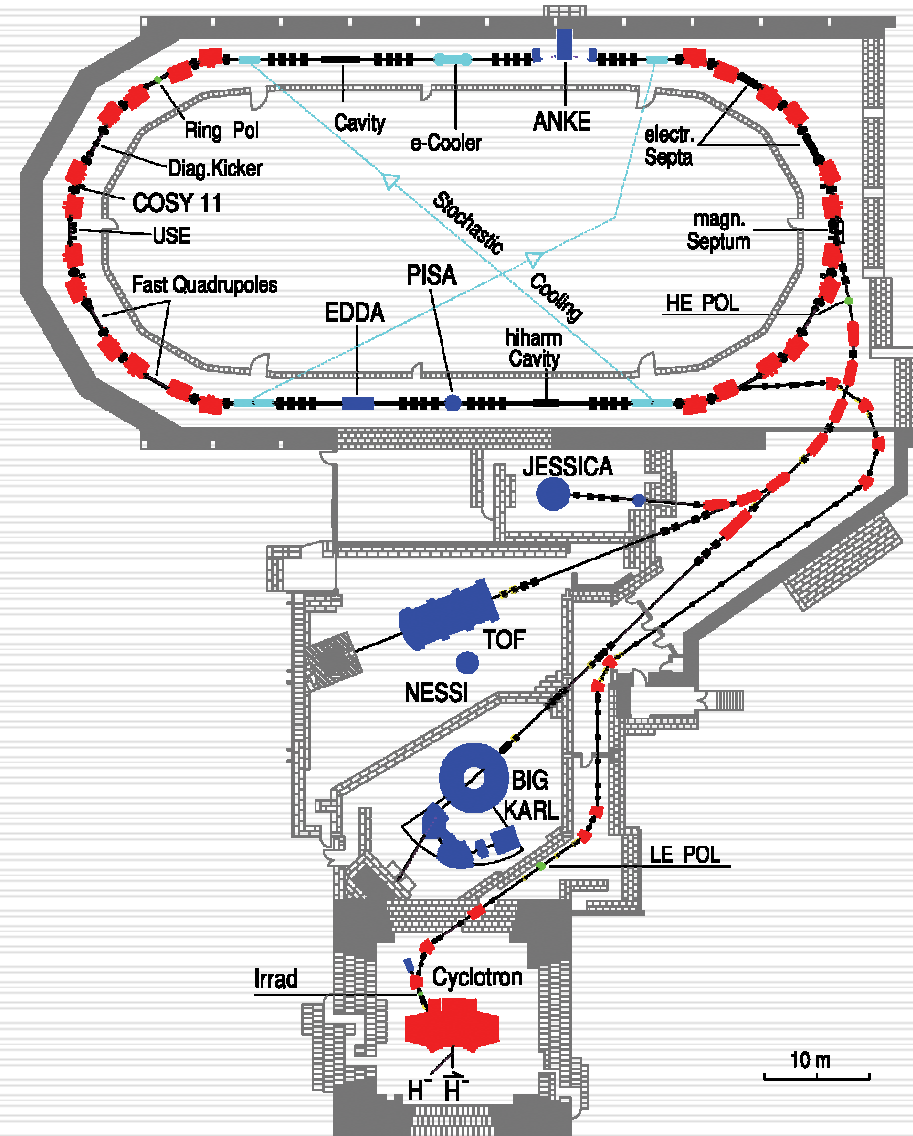
**Laboratory of Cryogenic
and
Superconductive Technique**



COSY - COoler Synchrotron, Jülich, Germany

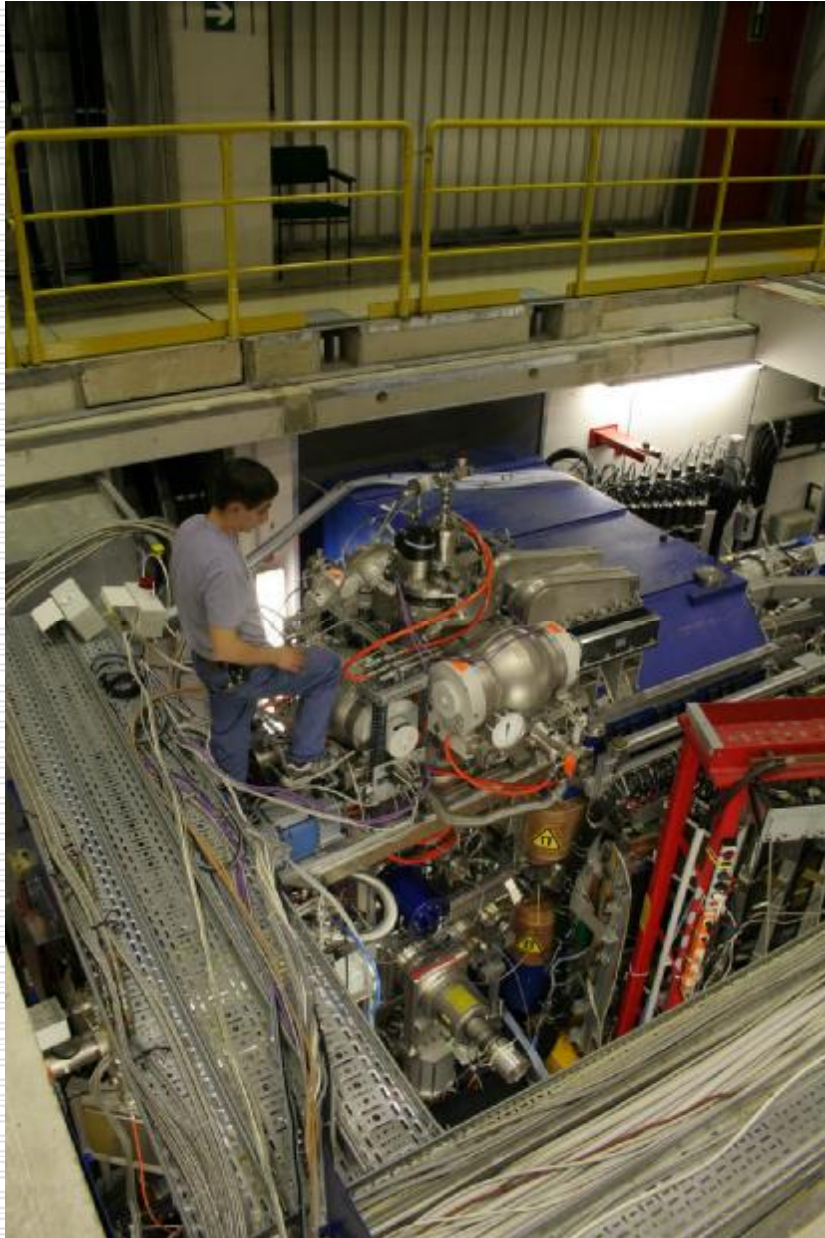
p, \bar{p}, d, \bar{d}
with momenta up to 3.7 GeV/c

- internal experiments –
with the circulating beam
(**ANKE**, COSY-11, EDDA)
- external experiments –
with the extracted beam
(BIG KARL, TOF)





PIT at ANKE



Nozzle cooling system
Temperature range: 50-300 K

Movable baffles
Al casting

1st group of 6-pole magnets
Pole-tip fields are:
#1 1.654 T \varnothing 10/14 mm
#2 1.684 T \varnothing 16/22 mm
#3 1.625 T \varnothing 28 mm

Medium Field Transition unit (MFT)
Frequency: 58.7 MHz (H_z)
Magnetic field: up to \sim 2 kG

Central reference plate
stainless steel (t \sim 50 mm)

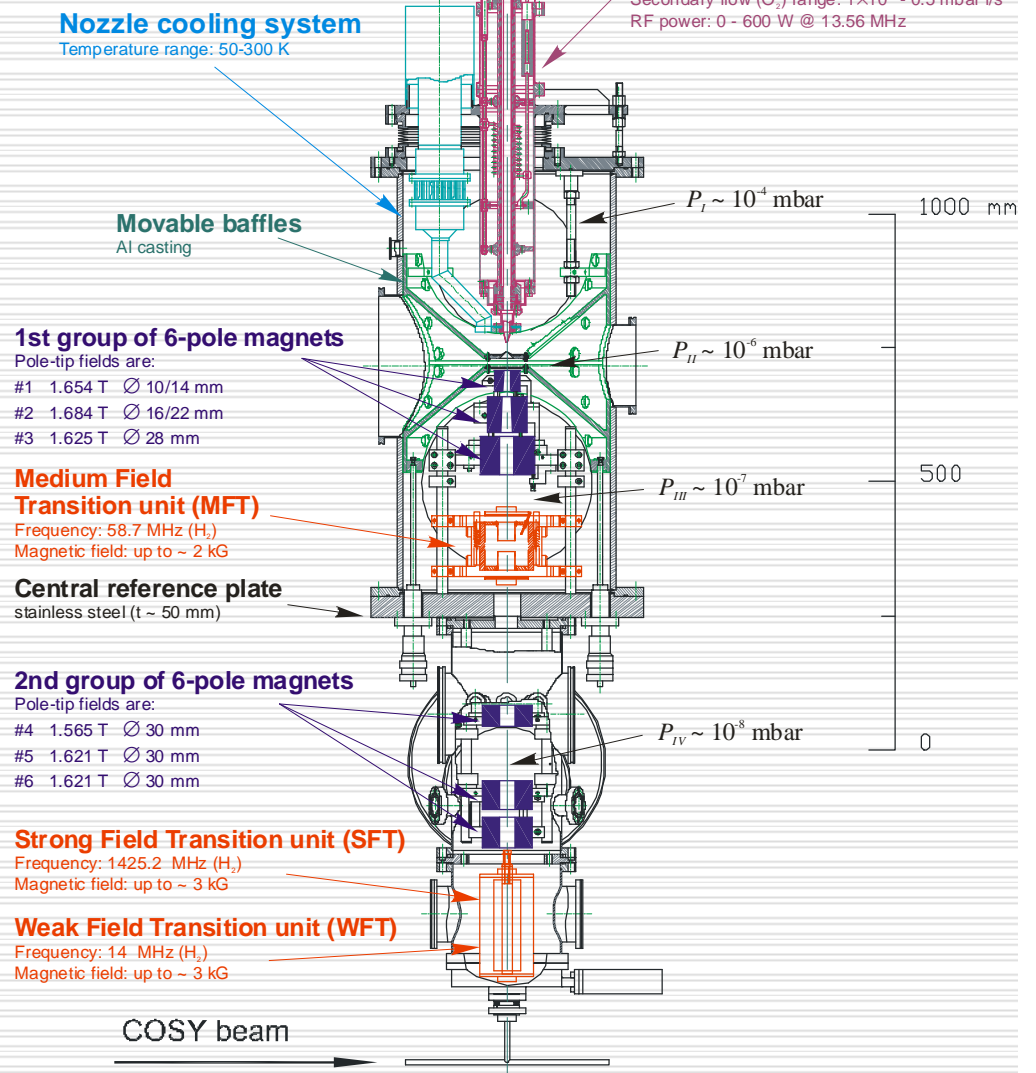
2nd group of 6-pole magnets
Pole-tip fields are:
#4 1.565 T \varnothing 30 mm
#5 1.621 T \varnothing 30 mm
#6 1.621 T \varnothing 30 mm

Strong Field Transition unit (SFT)
Frequency: 1425.2 MHz (H_z)
Magnetic field: up to \sim 3 kG

Weak Field Transition unit (WFT)
Frequency: 14 MHz (H_z)
Magnetic field: up to \sim 3 kG

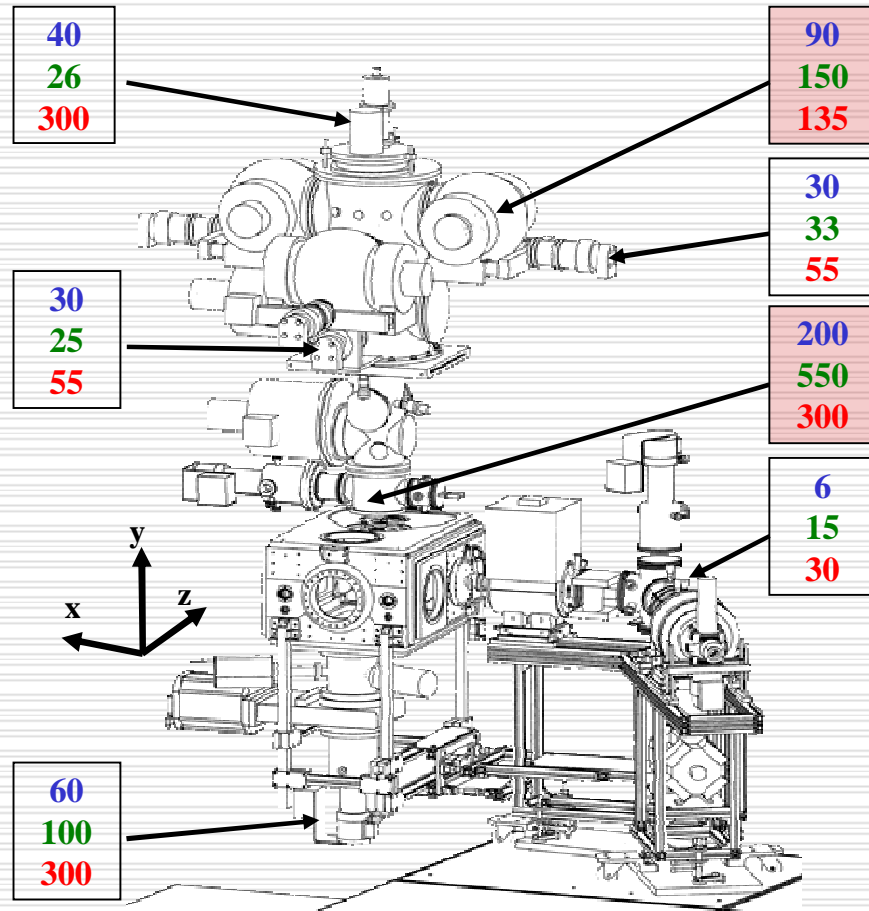
Dissociator

Primary flow (H_2/D_2) range: 1×10^{-3} - 5 mbar l/s
Secondary flow (O_2) range: 1×10^{-3} - 0.5 mbar l/s
RF power: 0 - 600 W @ 13.56 MHz

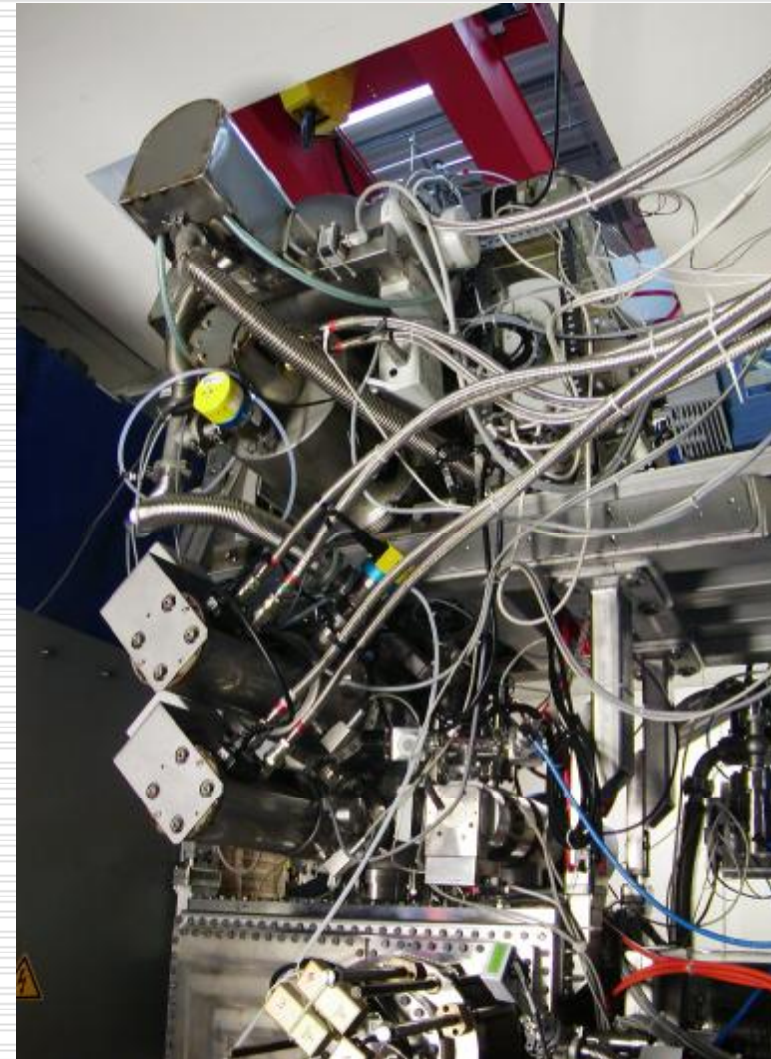




Magnetic stray field of D2



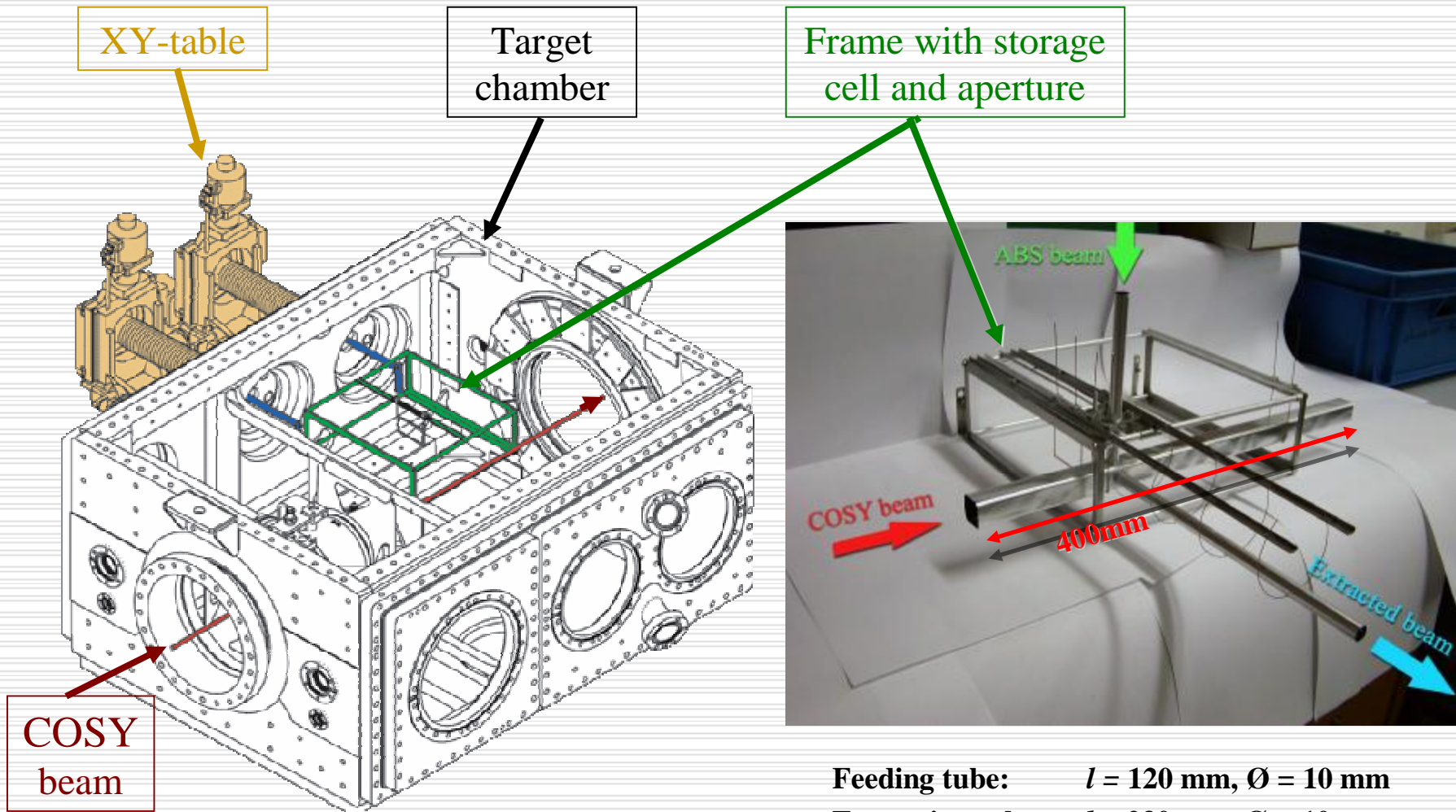
calculated field strength (G)
measured field strength (G)
permissible field strength for the device given by the producer (G)



PIT setup with shielded components at ANKE



Storage cell setup



- Feeding tube: $l = 120 \text{ mm}, \text{Ø} = 10 \text{ mm}$
- Extraction tube: $l = 230 \text{ mm}, \text{Ø} = 10 \text{ mm}$
- Beam tube : $l = 400 \text{ mm}, 20 \times 20 \text{ mm}^2$



Results of the cell tests

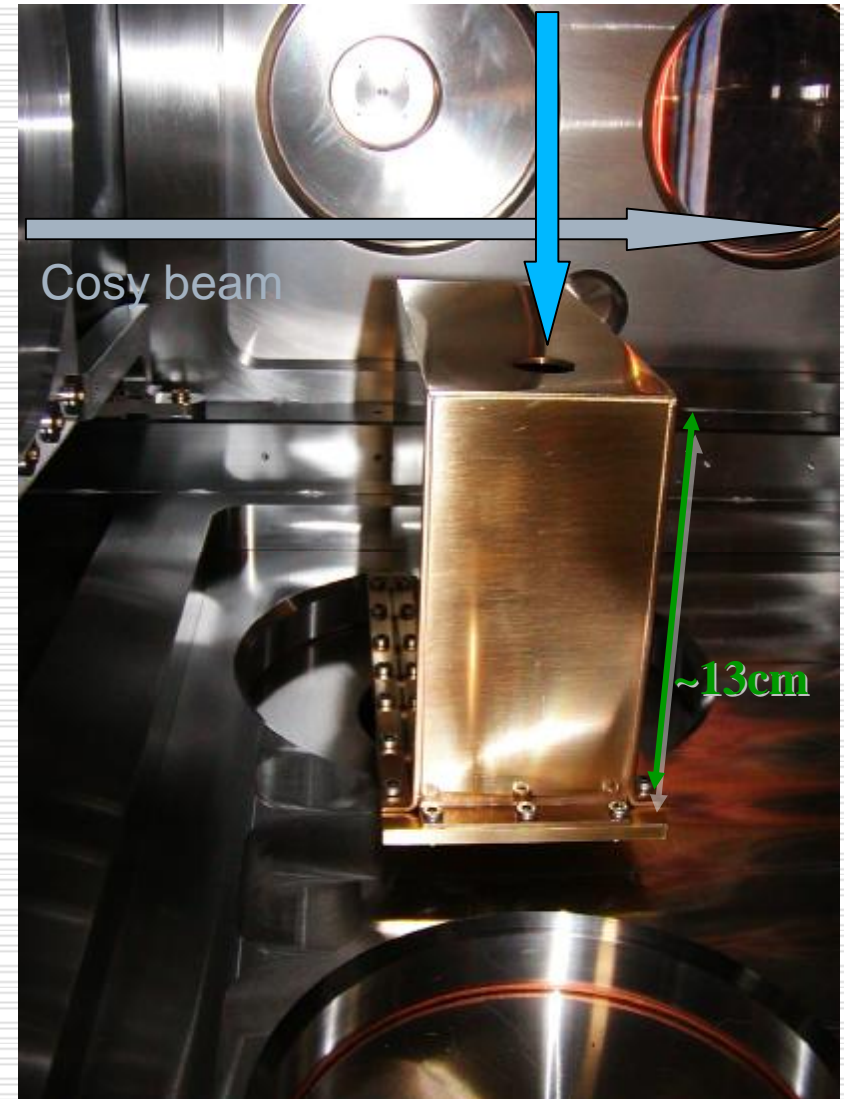
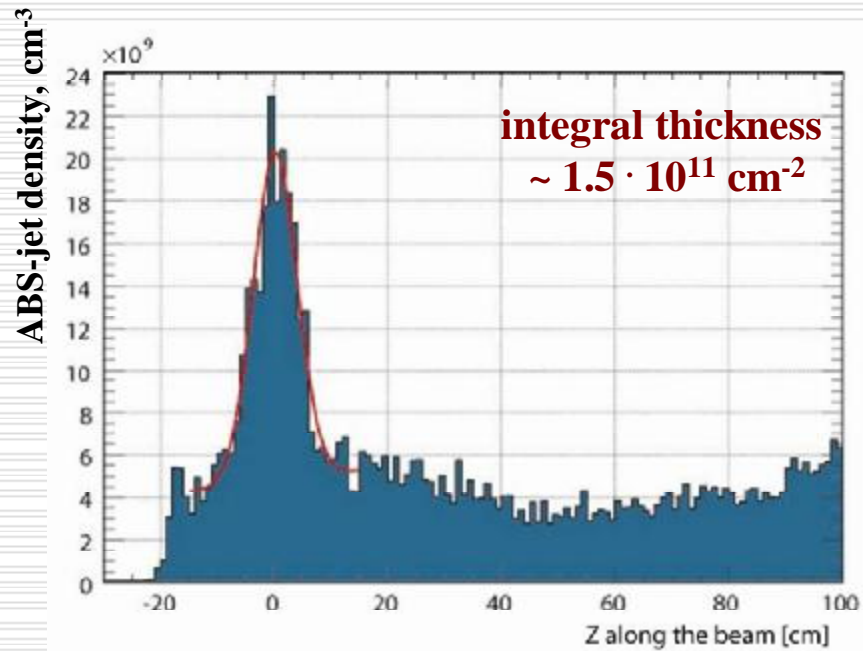
Θ_{ANKE}	injection type	target	number of stored protons * 10^9		
			injection	after cooling	flattop (600 MeV)
0°	single injection	no cell	83	21	14
	single injection	empty cell	7	5	3
	80 stacking + electron cooling	no cell			26
	30 stacking + electron cooling	empty cell			20
9.2°	30 stacking + electron cooling	cell with H gas from ABS		9	6



Use of the ABS jet

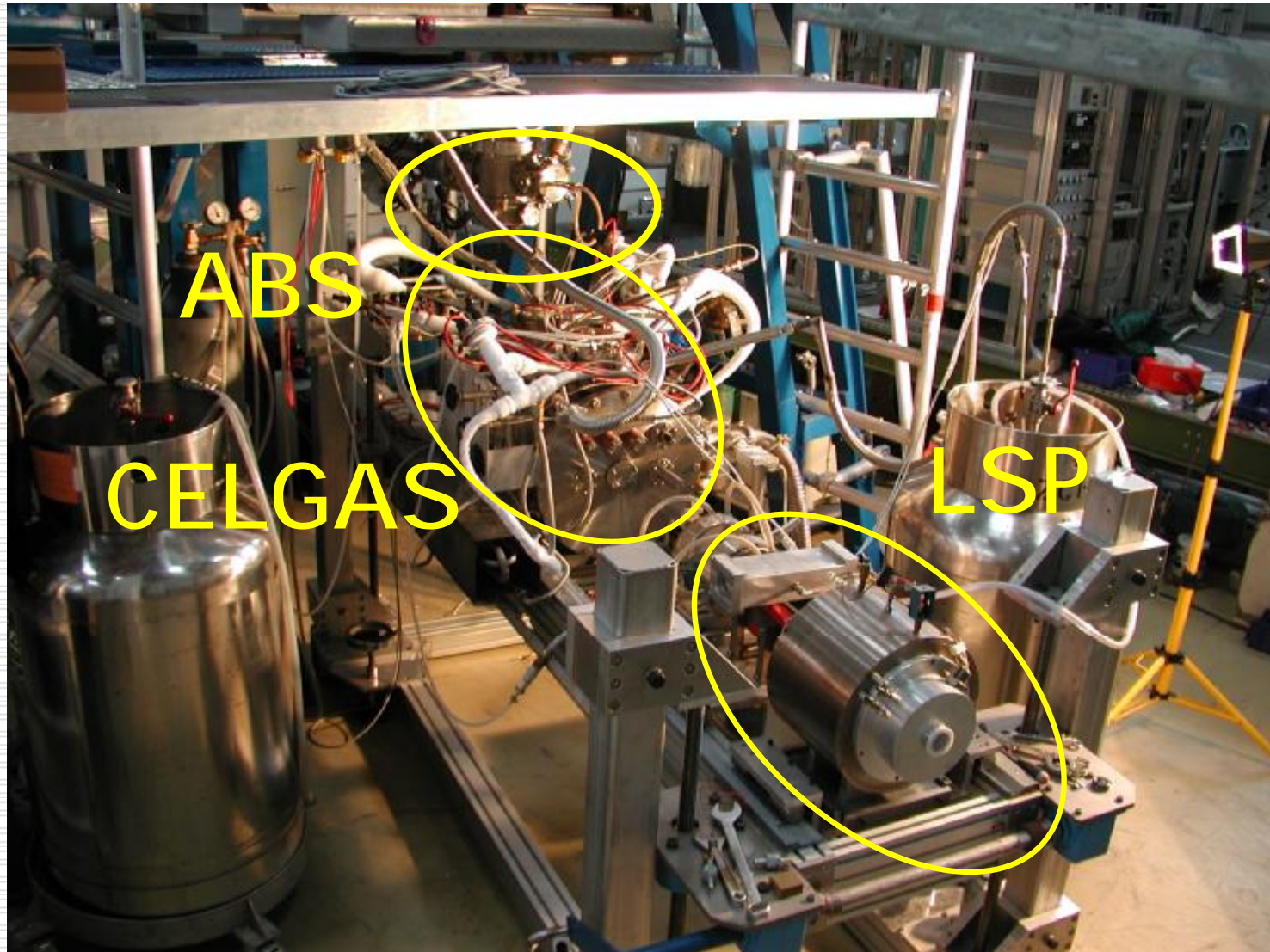
Measured pressures in the target chamber, mbar

	Without ABS jet	With ABS jet
Without catcher	$4.0 \cdot 10^{-9}$	$3.0 \cdot 10^{-7}$
With catcher	$4.0 \cdot 10^{-9}$	$3.7 \cdot 10^{-8}$



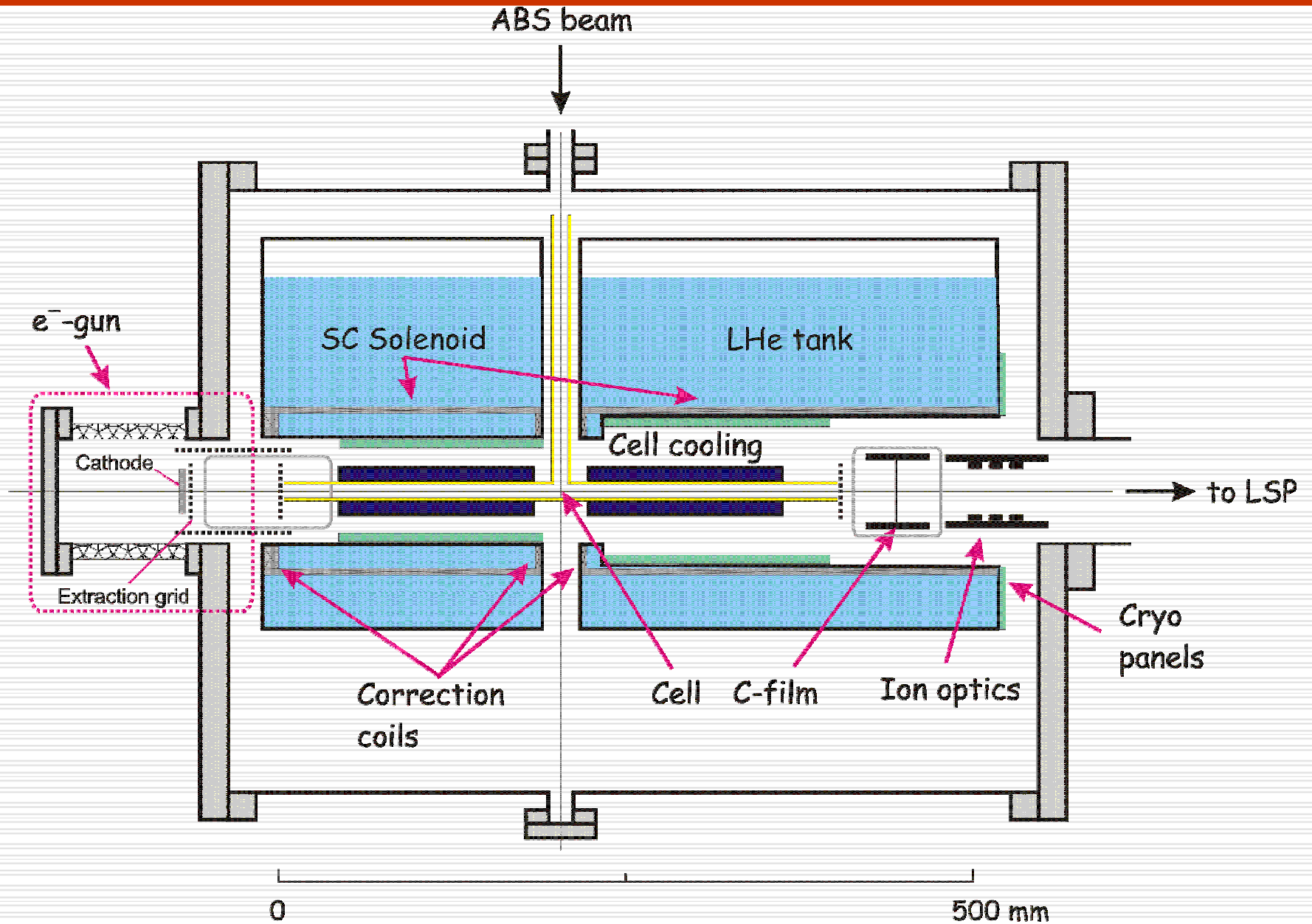


Experimental technique. Polarized molecules.





CelGas project. ISTC 1861





WASA-at-COSY Commissioning - Brief Outline

Beam Development

Tasks: Hydrogen pellet production
Study beam-target interaction
Compensate WASA solenoid

COSY operation with WASA

in parallel: Test DAQ
Low-Level Debugging
Establish WASA-COSY Interfaces

$pp \rightarrow pp\eta$

Tasks: All detector components working,
checked, and tuned
Compare with CELSIUS/WASA
Increase Luminosity

CELSIUS/WASA performance

focuses: $\eta \rightarrow \gamma\gamma$
 $\eta \rightarrow 3\pi^0 \rightarrow 6\gamma$
 $\eta \rightarrow \pi^0\pi^+\pi^-$

$pp \rightarrow pp\eta'$

Tasks: Test high energy detector extensions

(higher) COSY energies

focuses: $\eta' \rightarrow \gamma\gamma$
 $\eta' \rightarrow \eta\pi\pi$
 $\eta' \rightarrow \pi^+\pi^-\gamma$

$dd \rightarrow {}^4\text{He}\pi\pi$

Tasks: Operate deuterium target
Compare with CELSIUS/WASA
 ${}^4\text{He}$ trigger and detection at C/W and high energies

Deuterium Pellet Target

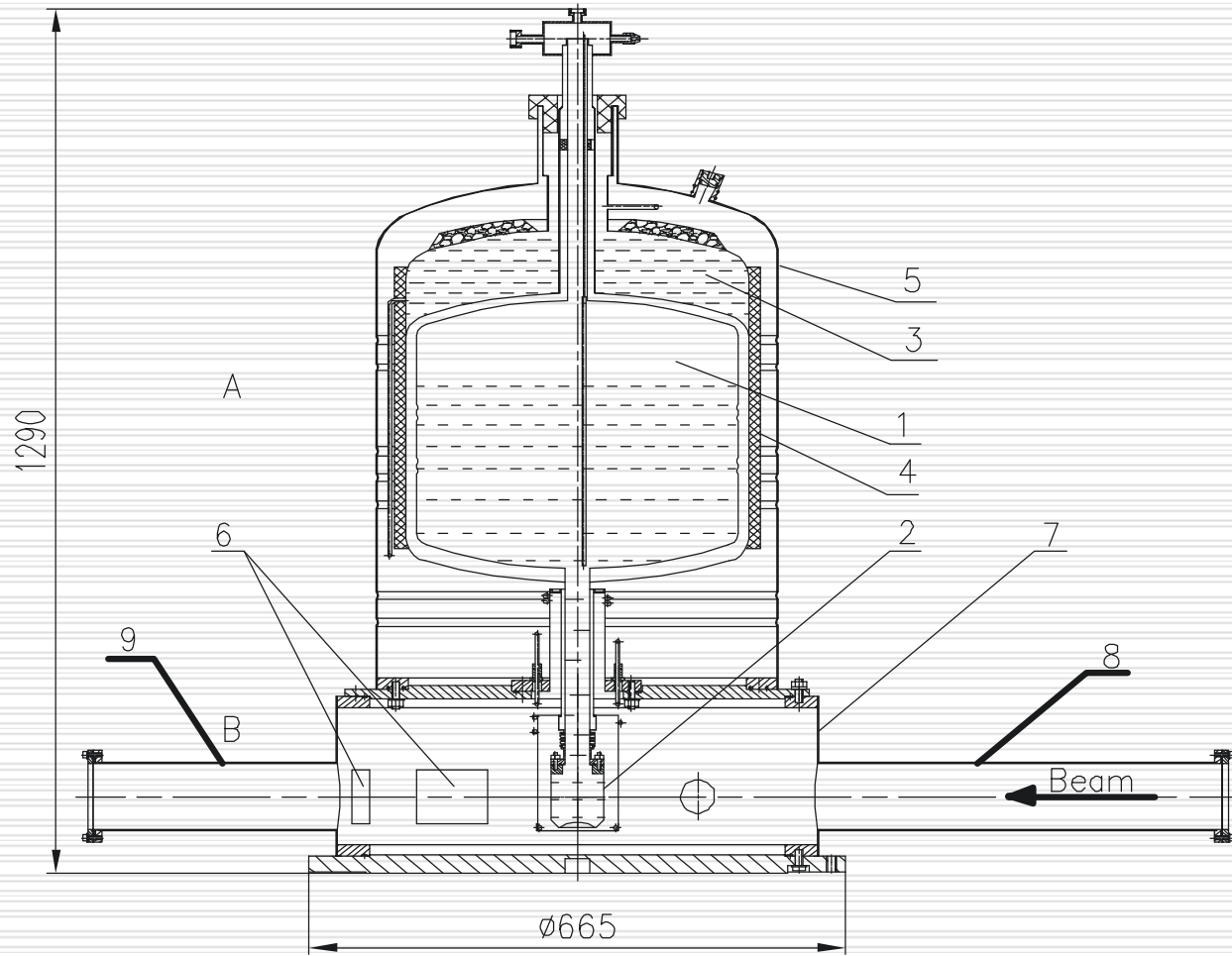


Our responsibility





Л.М. Коченда





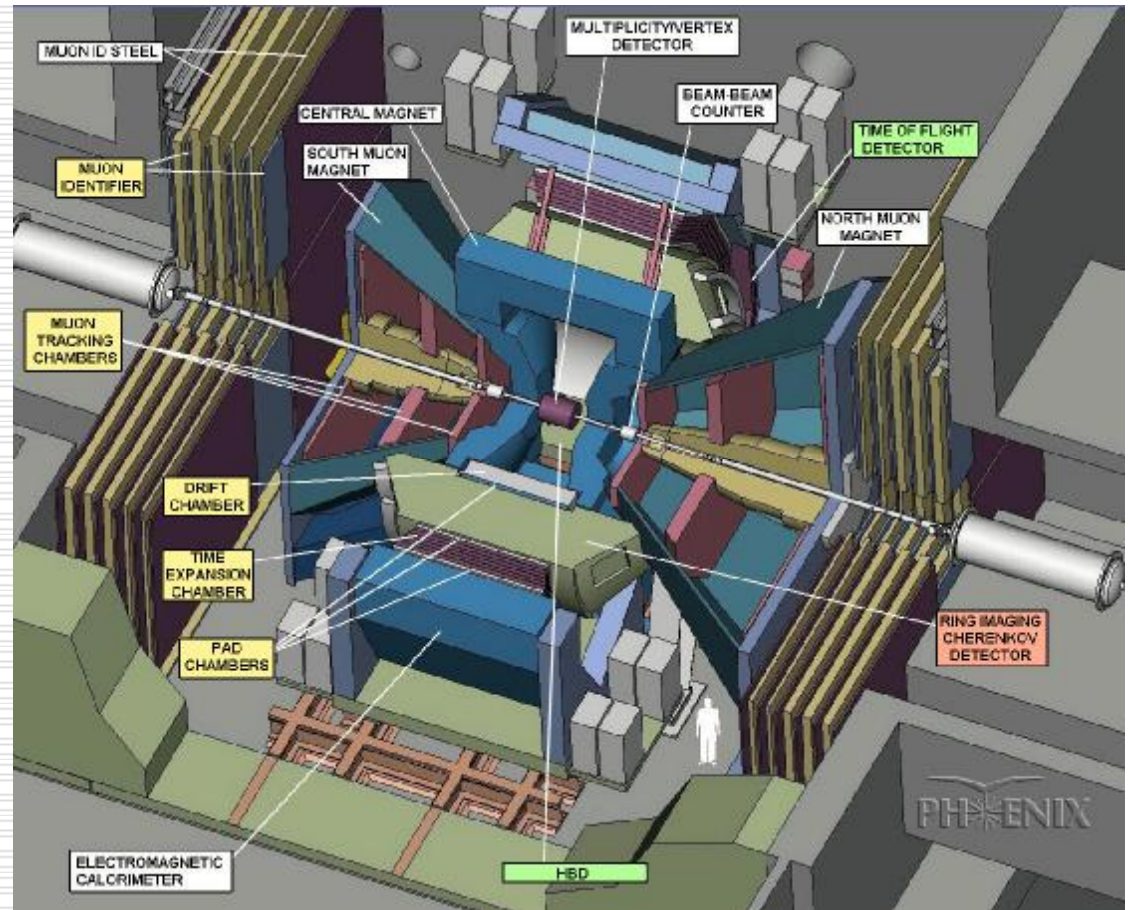
Л.М. Коченда





Gas systems in BNL. Leonid Kochenda

- ∅ В течение 2006 года в БНЛ(США) были проведены следующие работы:
- q Разработана система газообеспечения для нового TOF(time of flight) детектора в эксперименте STAR.
- q Разработаны, смонтированы и отлажены **две системы** газообеспечения детекторов HBD(hadrons blind detector) и TOF в эксперименте PHENIX. Это **5-я и 6-я** системы газообеспечения, сделанные нами в этом эксперименте.



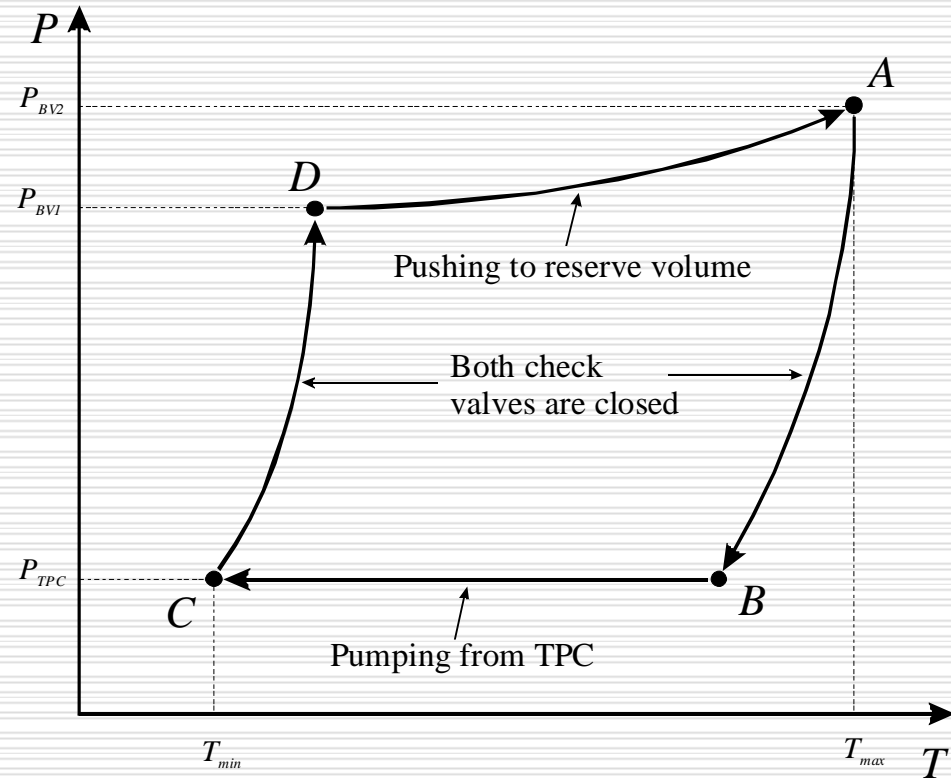
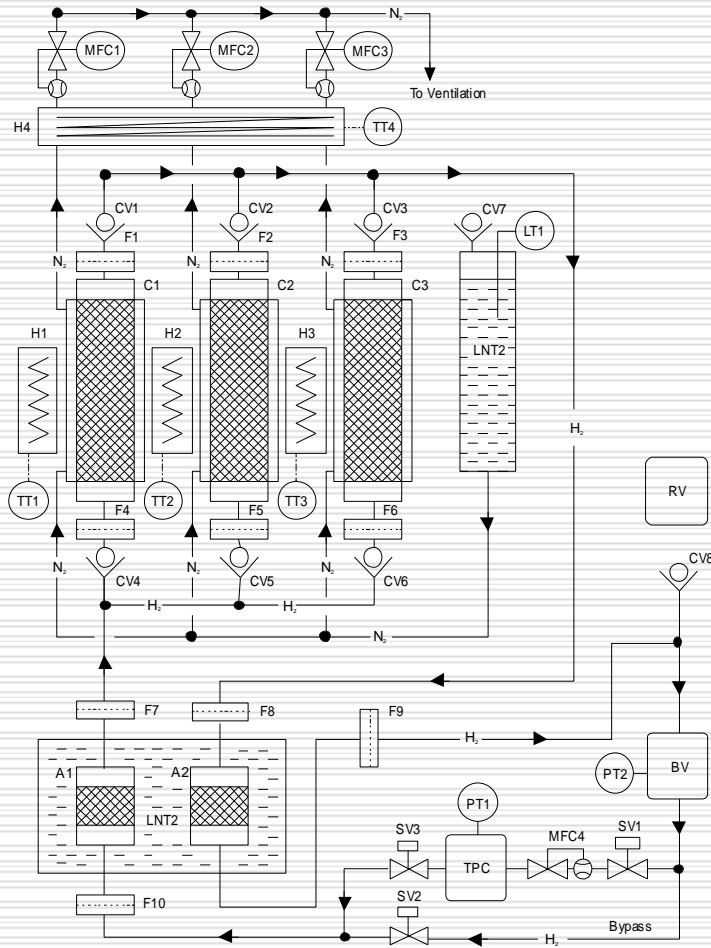


Рециркуляционные газовые системы для различных детекторов. Л. Коченда





Система сверхвысокой очистки водорода (CHUPS) в MuCAP эксперименте, PSI, Switzerland

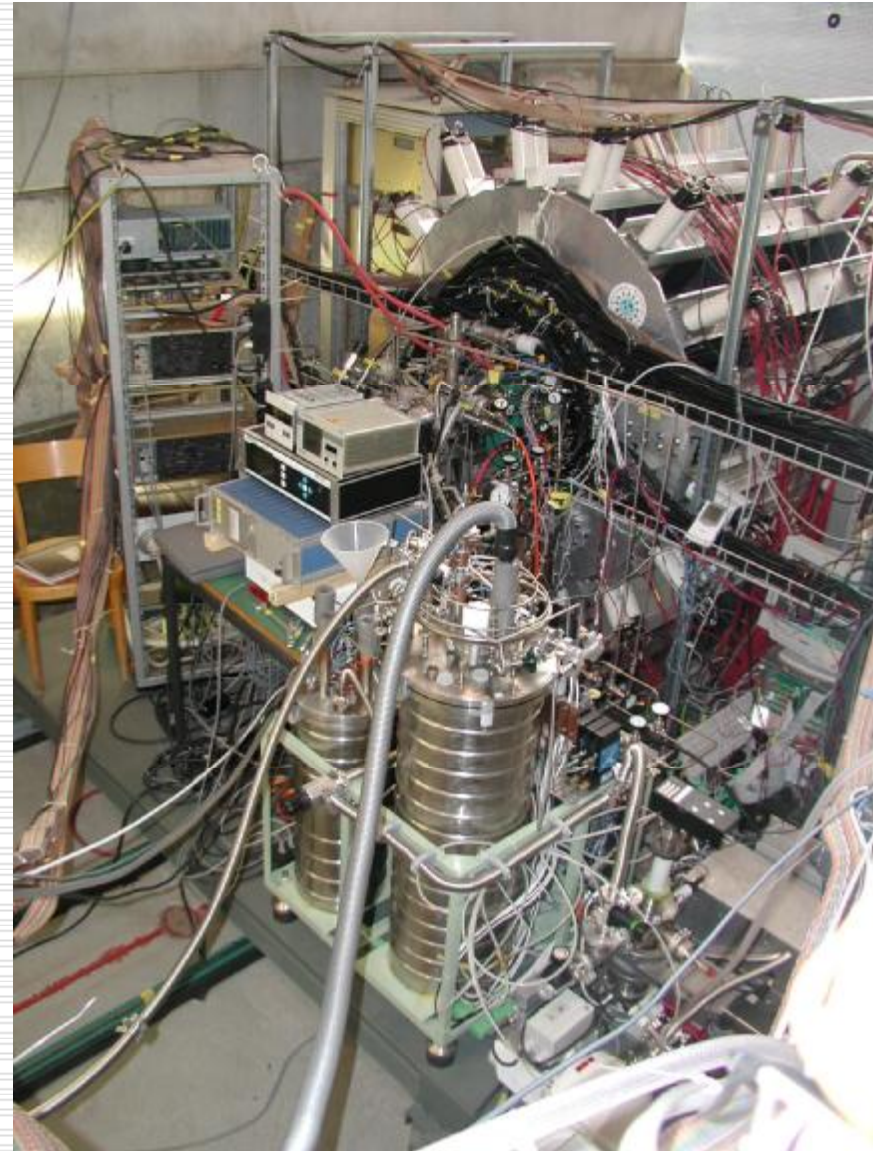




Система сверхвысокой очистки водорода (CHUPS) в MuCAP эксперименте, PSI, Switzerland

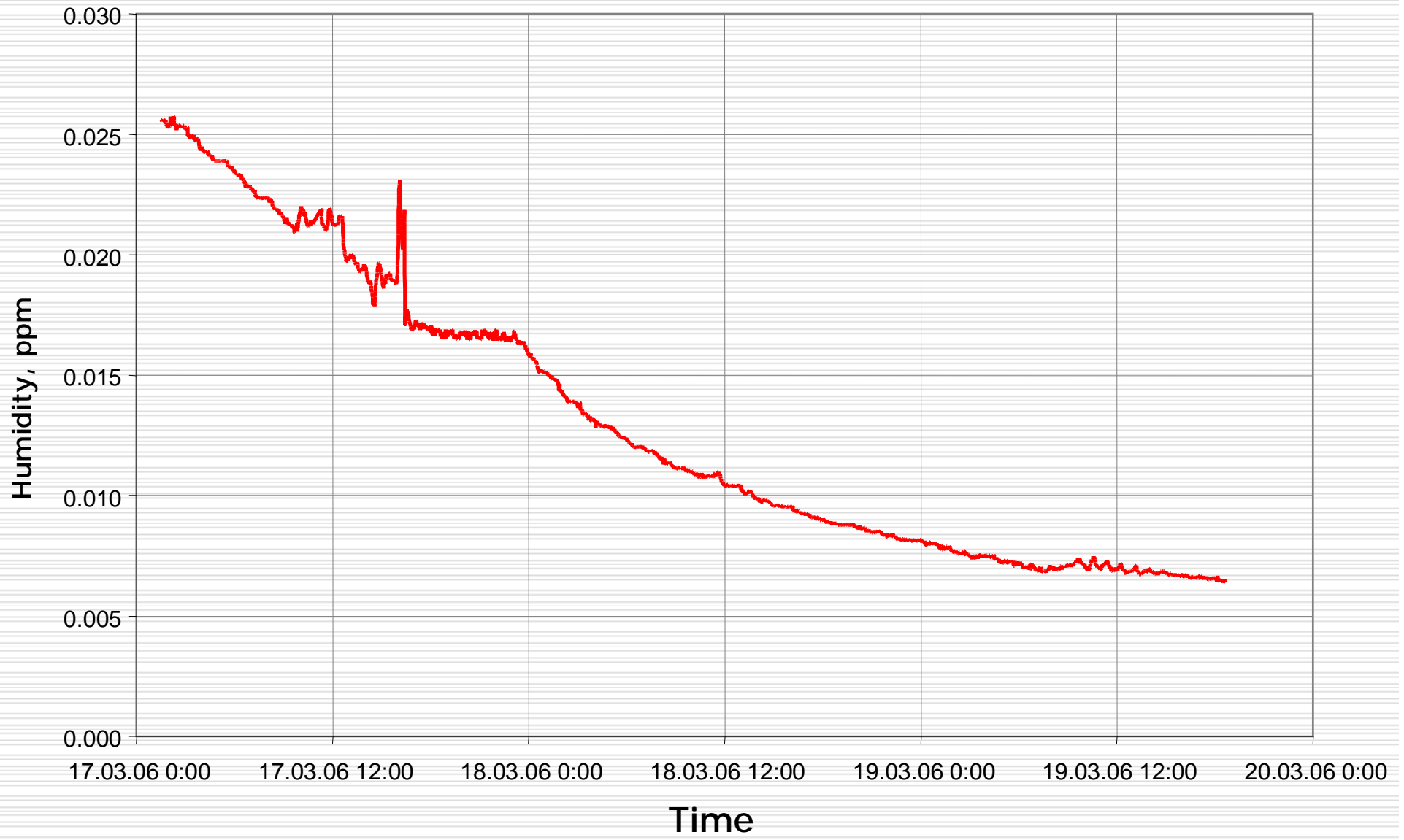
N_2 less than 10 ppb
 O_2 less than 10 ppb
 H_2O about 30 ppb

$D_2 < 0.06$ ppm



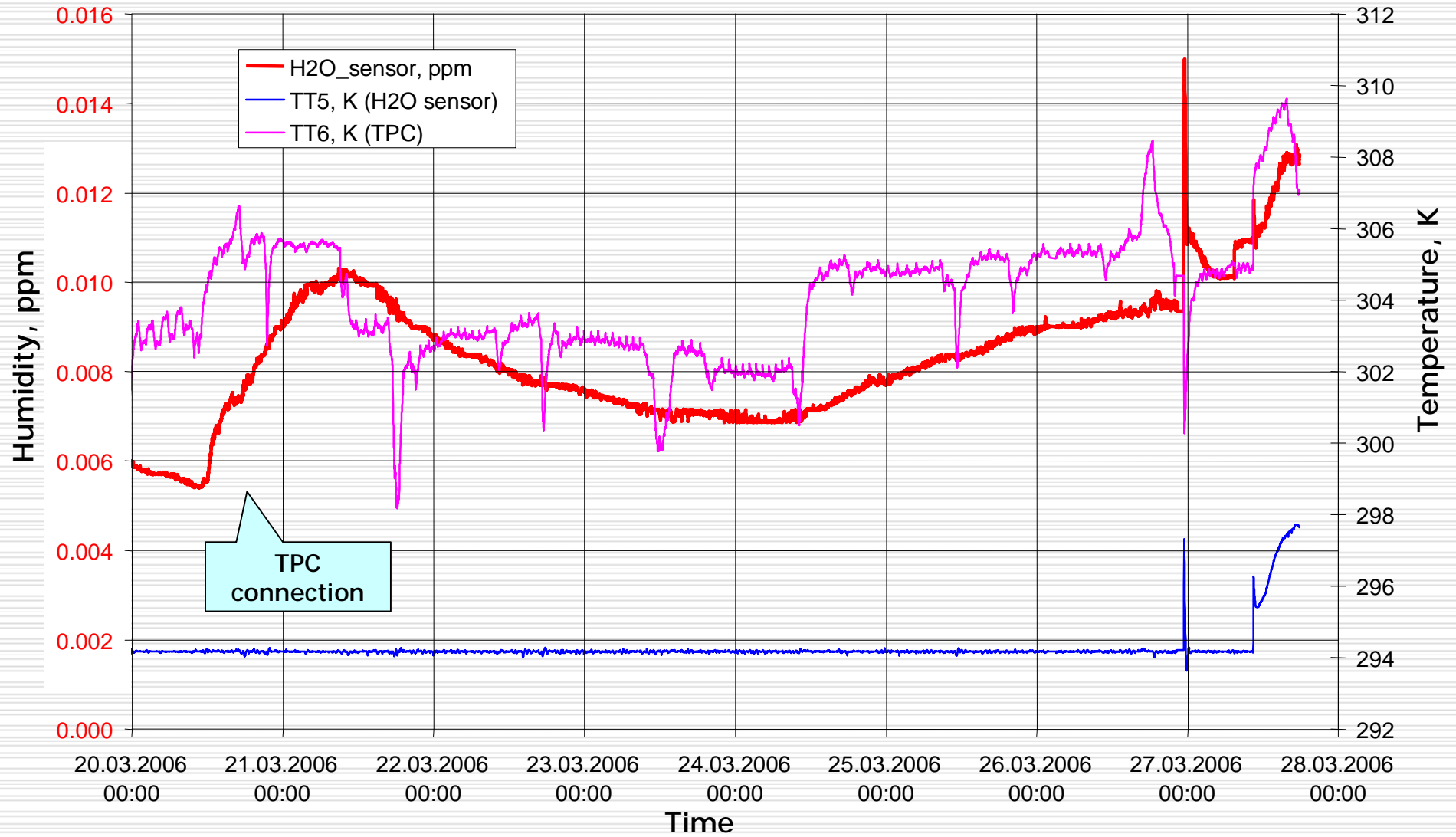


Moisture measurements in CHUPS without TPC



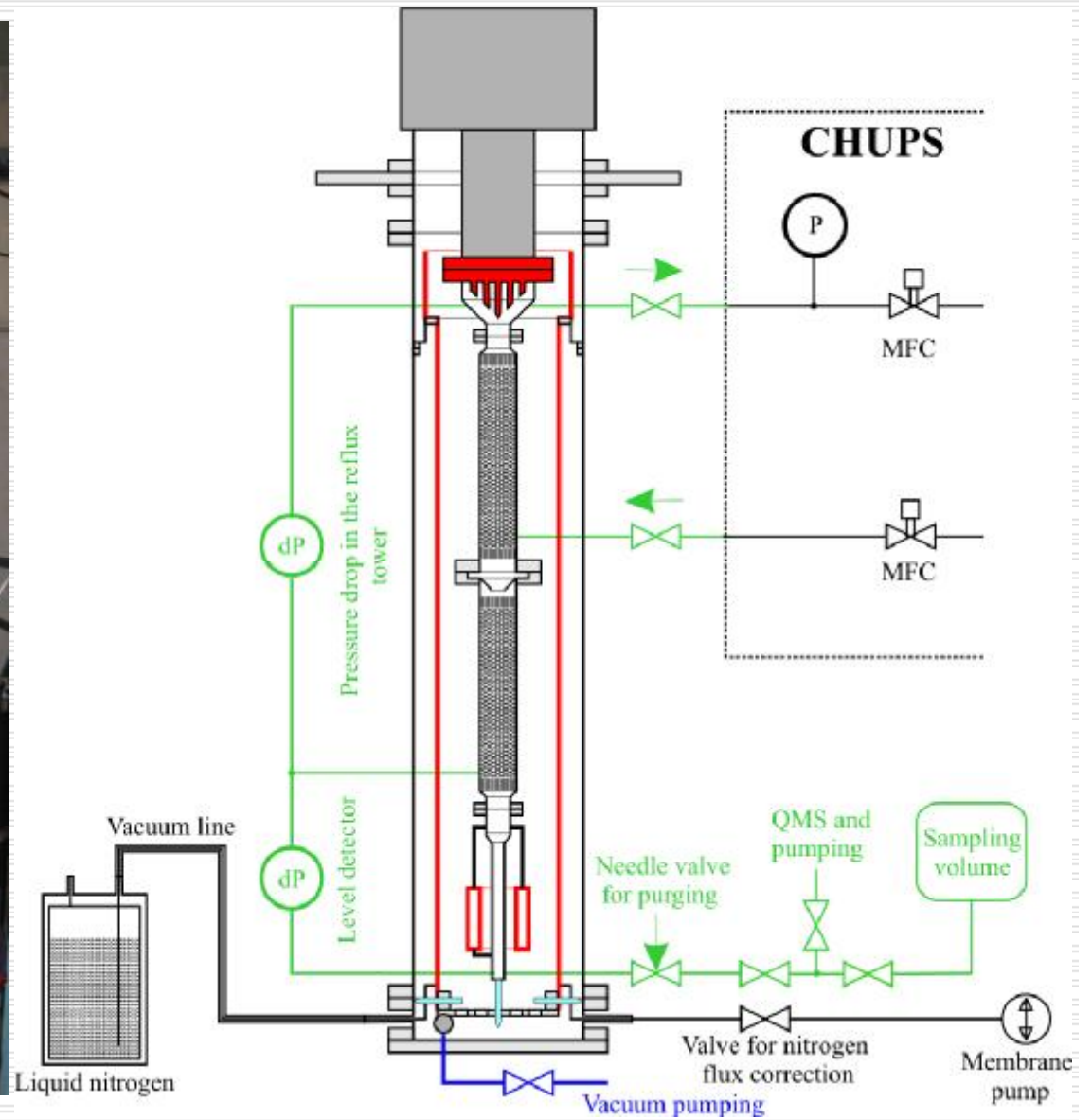


Moisture measurements in CHUPS with TPC



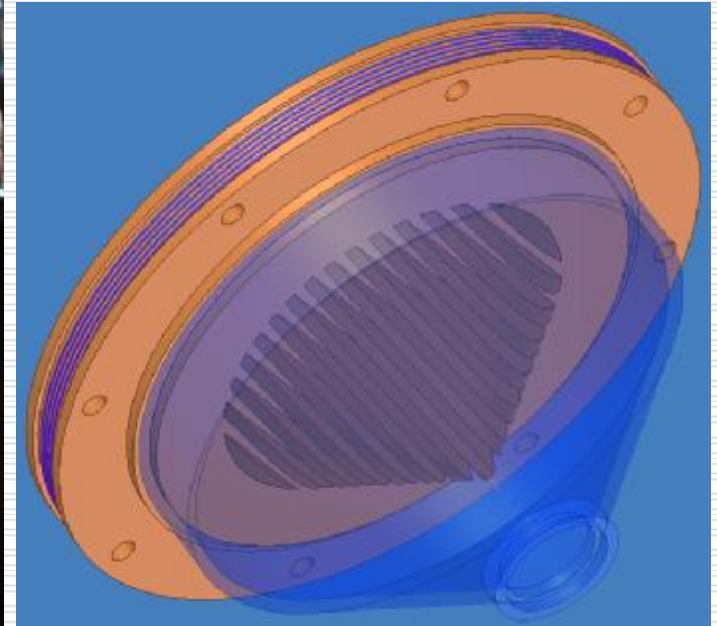
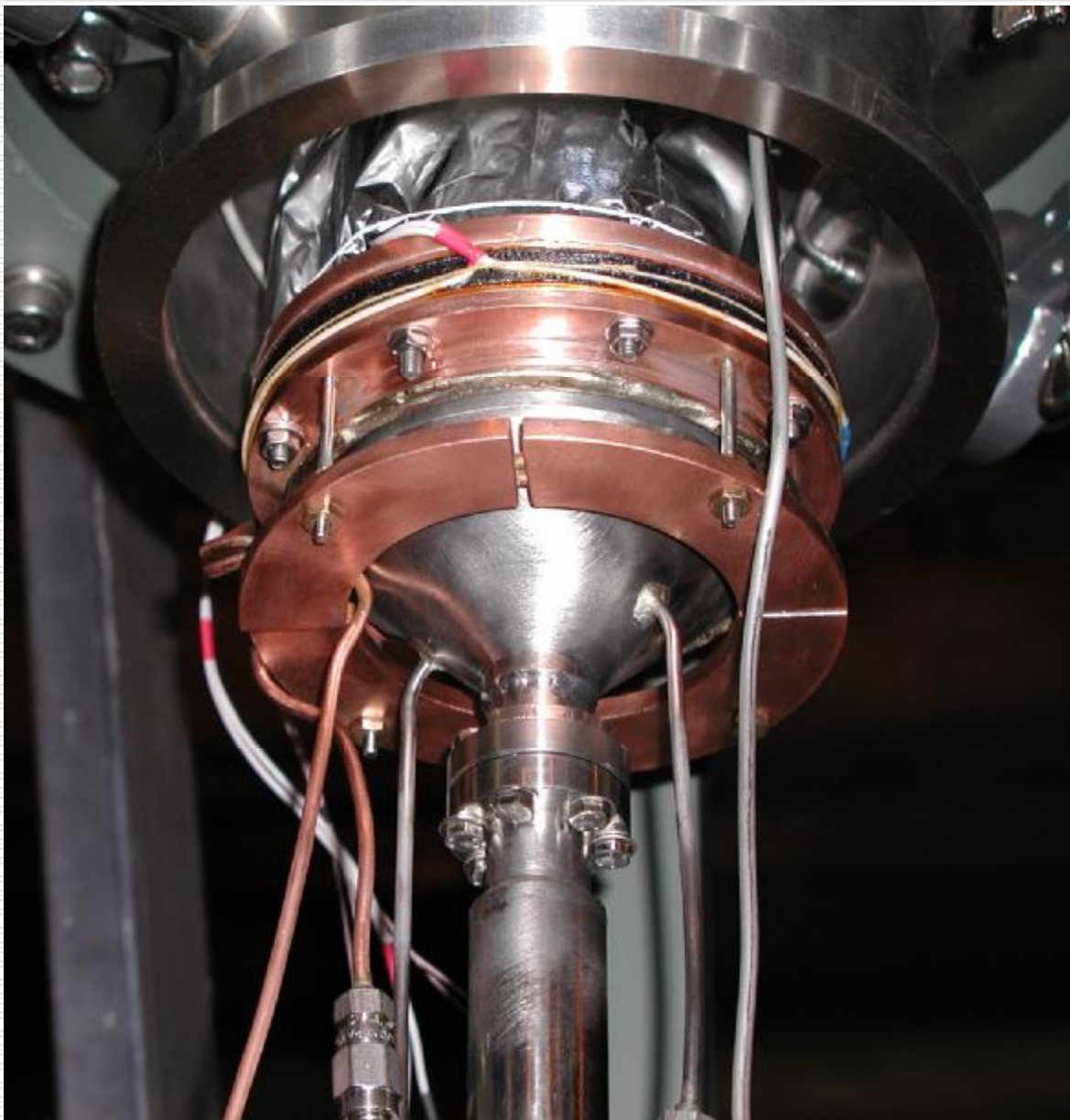


General layout of the cryogenic column



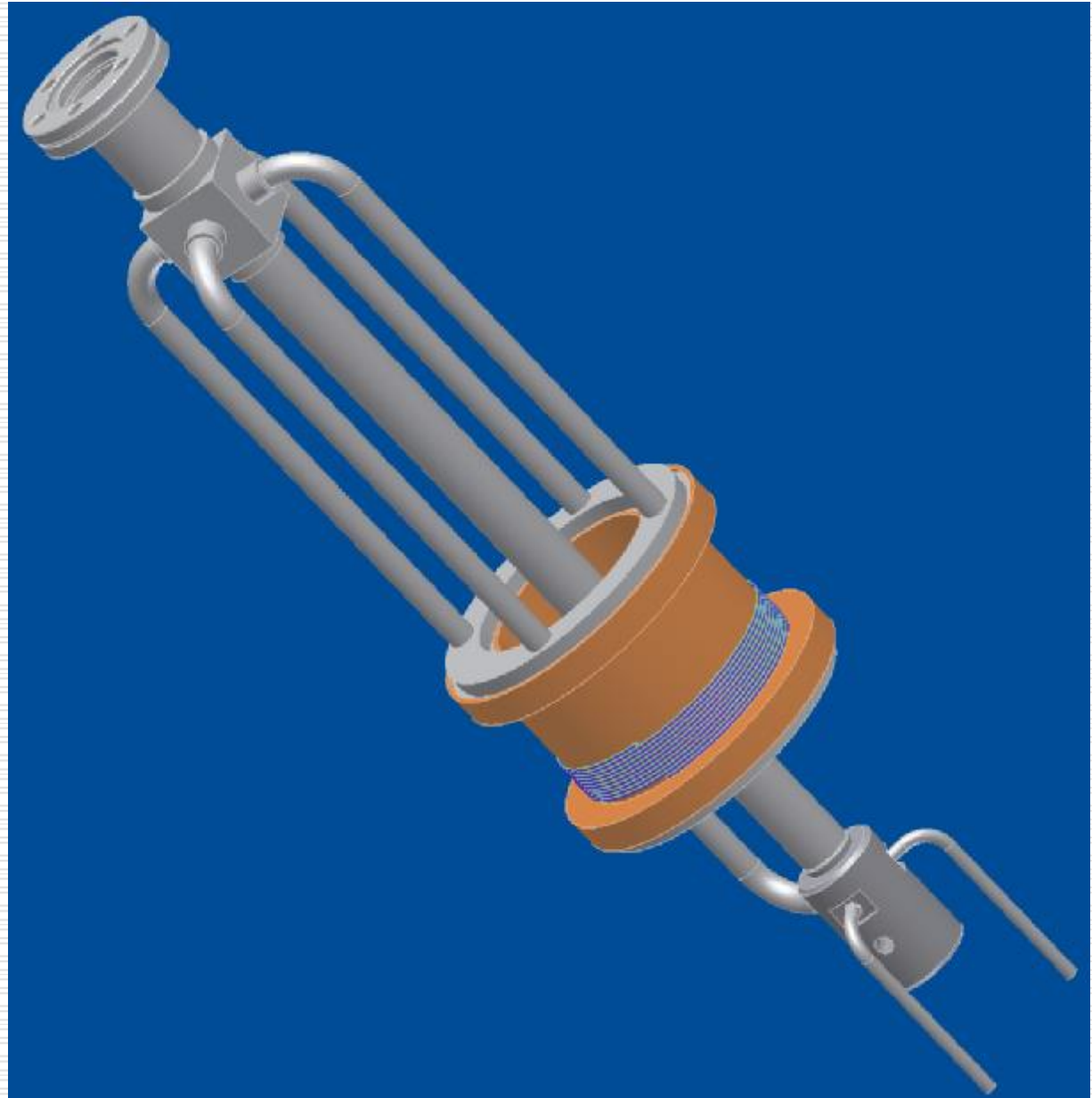


Condenser



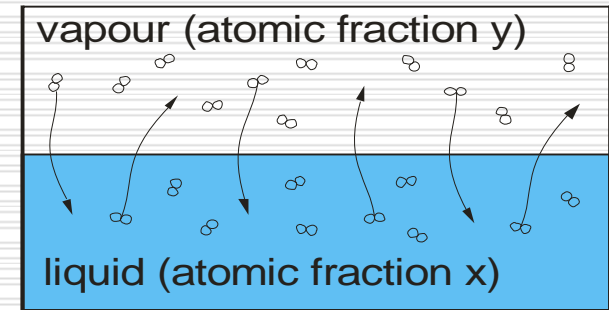
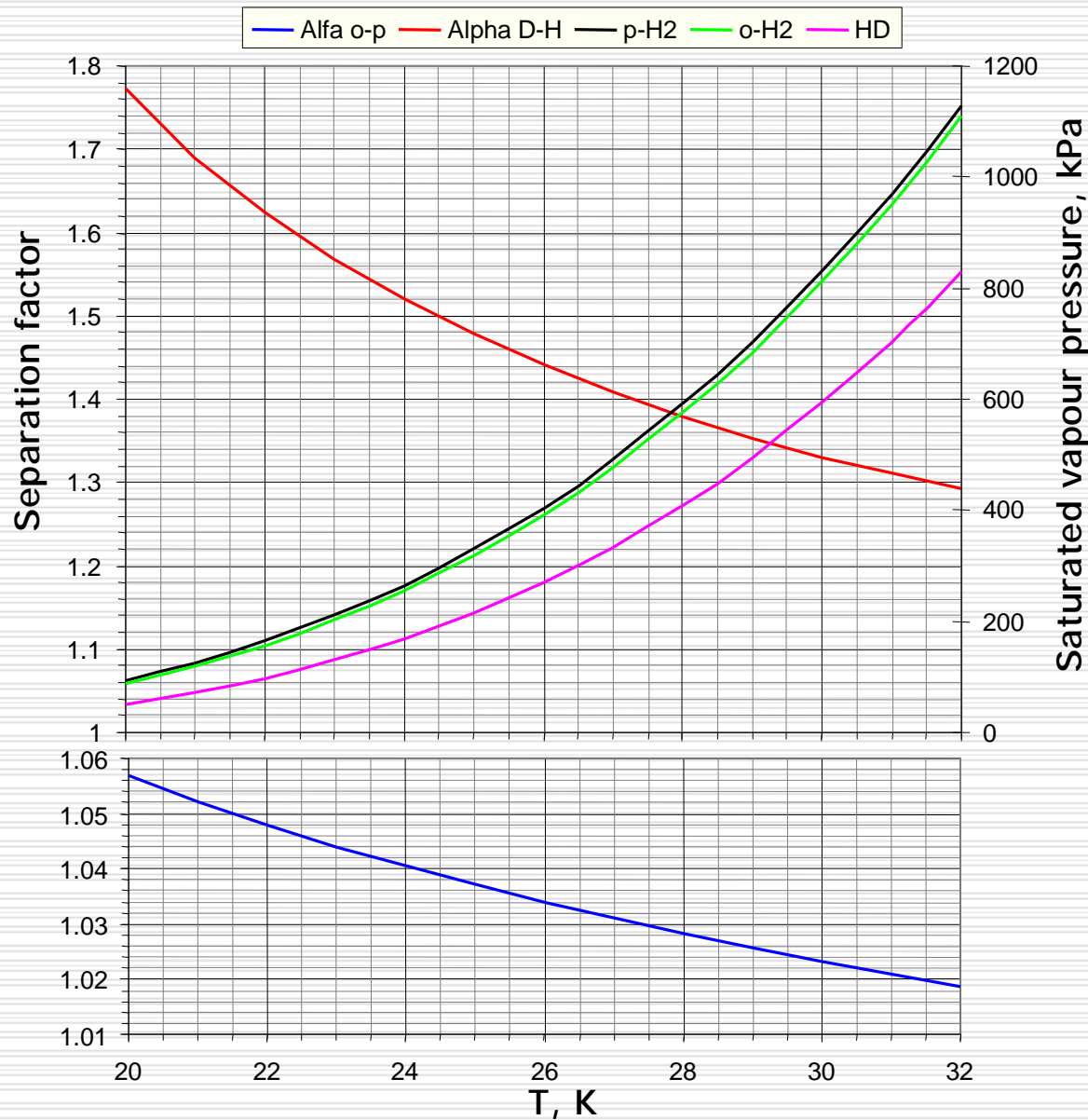


Reboiler





Saturated vapour pressures and separation factors



Temperature = const
 At dynamic equilibrium
 the content of low-boiling
 component is α -times higher
 in liquid.

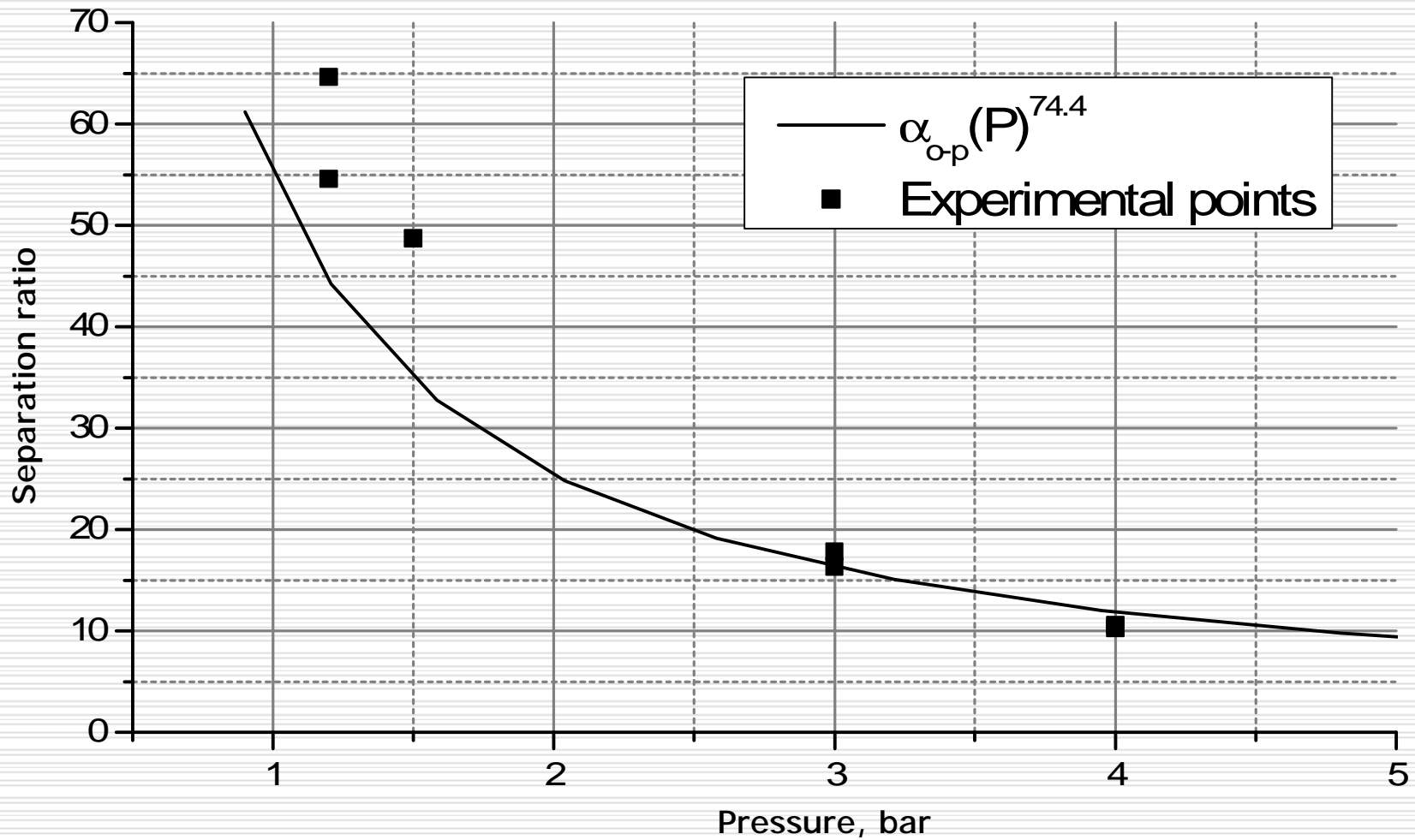
Separation factors:

$$a_{o-p} = \frac{P_{Sat.Para}}{P_{Sat.Ortho}}$$

$$a_{D-H} = \frac{P_{Sat.H_2}}{P_{Sat.HD}}$$



Separation ratio (SR)

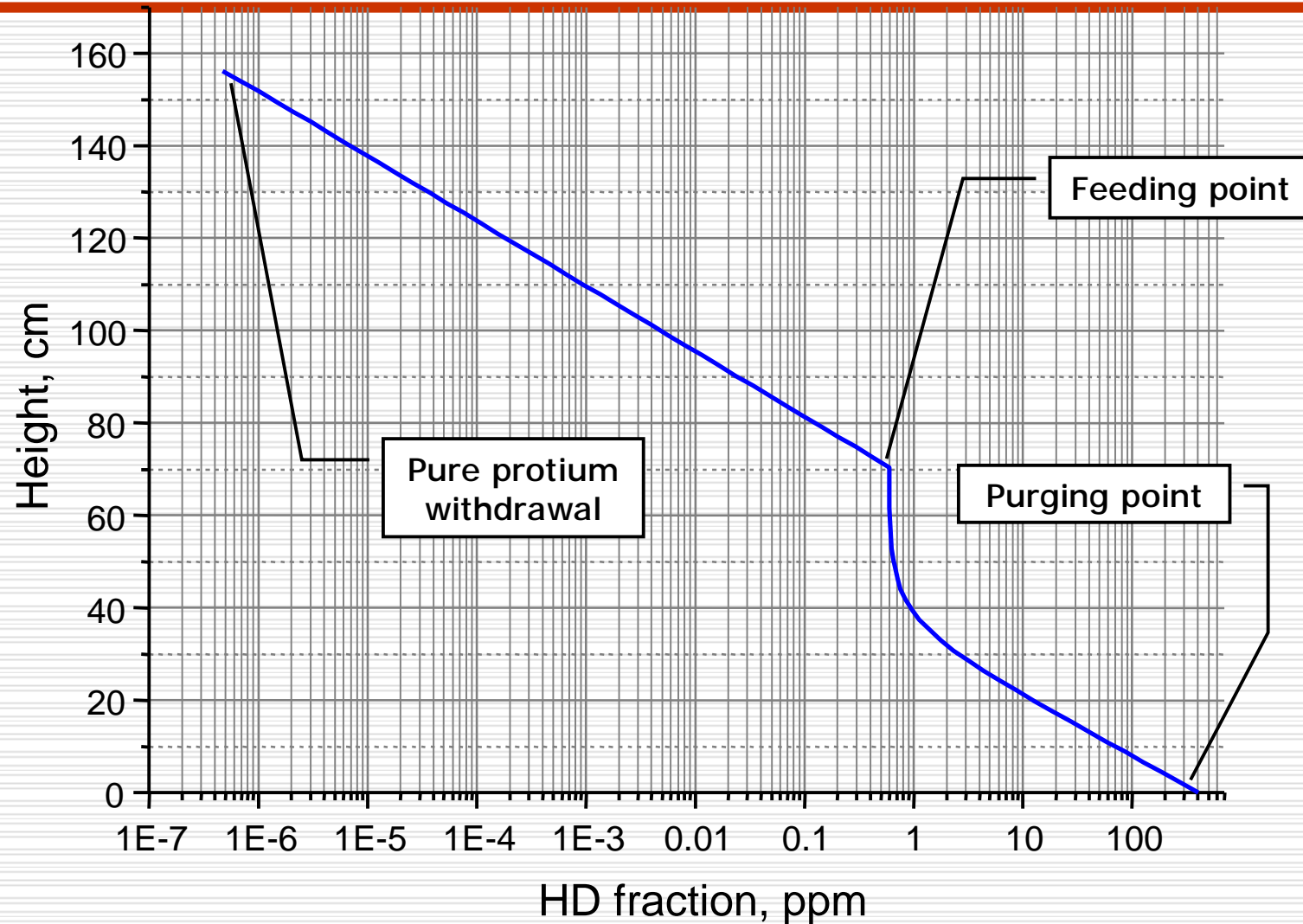


$SR = a^N$ - Fenske equation for total reflux mode
(N – the number of theoretical plates)
HETP=Packing height / N

$$SR = \frac{X_{Bottom} / (1 - X_{Bottom})}{X_{Top} / (1 - X_{Top})}$$



Expected HD concentration profile



Feed flow rate = 1 L/min; Pressure = 1.5 bar; Purging flow rate = 0.015 L/min; HETP = 2.2 cm
Initial HD concentration = 6 ppm (deuterium atomic fraction = 3 ppm)



Изготовление анализ и очистка газов в ПИЯФ, ЛКСТ Б.М.Безымянных

Очистка CO ₂ потребителям (МЗ)									
Потребитель		январь	февраль	март	апрель	май-июнь	июль-октябрь	ноябрь	2006
Подразделение	Руководитель								
Лаб. релятивистской ядерной физики	Самсонов В.М.								0
Группа редких распадов	Гордеев В.А.	0.5	0.5						1
Группа "АТЛАС"	Крившич А.Г.								0
Отдел мюонных камер	Козлов В.С.			4	2	2	2		10
Группа детекторов В-физики	Бочин Б.В.								0
Всего:		0.5	0.5	4	2	2	2	0	11

Изготовление газовых смесей (Ar+CO ₂ +CF ₄)(МЗ)									
Потребитель		январь	февраль	март	апрель	май-июнь	июль-октябрь	ноябрь	2006
Подразделение	Руководитель								
Лаб. релятивистской ядерной физики	Самсонов В.М.								0
Группа редких распадов	Гордеев В.А.	2	2		1				5
Группа "АТЛАС"	Крившич А.Г.							4	4
Отдел мюонных камер	Козлов В.С.	6	6	2	2	8	4		28
Группа детекторов В-физики	Бочин Б.В.		4		2	2			8
	Сумачев В.В.		2						2
Всего:		8	14	2	5	10	4	4	47



Publications

- q Precision Measurement of Singlet Muon Capture Rate on the Proton at PSI. F. Mulhausen, V.A. Andreev, B. Bezymbjannykh, A.A. Fetisov, V.A. Ganzha, P. Kravtsov, A.G. Krivshich, E.M. Maev, O.E. Maev, G.E. Petrov, S. Sadetsky, G.N. Shapkin, G.G. Semenchuk, M. Soroka, V. Trofimov, A. Vasilyev, A.A. Vorobyov, M. Vznuzdaev et al. Nuclear Physics B 15 (2006) 361-364.
- q Experimental Results of Hydrogen Distillation at the Deuterium Removal Unit of the MuCAP Experiment. I. Alekseev, Ev. Arkhipov, S. Bondarenko, O. Fedorchenko, V. Ganzha, P. Kravtsov, V. Trofimov, A. Vasilyev, T. Vasyanina, M.Vznuzdaev. Препринт ПИЯФ № 2702, Gatchina 2006.
- q Molecular polarization with ABS. M. Mikirtychians, N. Chernov, L. Kochenda, P. Kravtsov, V. Trofimov, A. Vasilyev et al. SPIN IN HADRON PHYSICS. International workshop, Tbilisi, September 2006.
- q Polarized Internal Target (PIT) for ANKE. SPIN IN HADRON PHYSICS. R. Engels., K. Grigoryev, P. Kravtsov, M. Mikirtychians, A. Vasilyev et al. International workshop, Tbilisi, September 2006.
- q The polarized internal gas target of ANKE at COSY. R. Engels, K. Grigoryev, P. Kravtsov, M. Mikirtychians, A. Vasilyev et al. International workshop Polarized Sources and Targets November 14-17, 2005, Tokyo, Japan.
- q The Polarized Internal Target at ANKE:First Results. K. Grigoryev, P. Kravtsov, M. Mikirtychians, A. Vasilyev et al. SPIN 2006, 17th International Spin Physics Symposium. Kyoto, Japan.