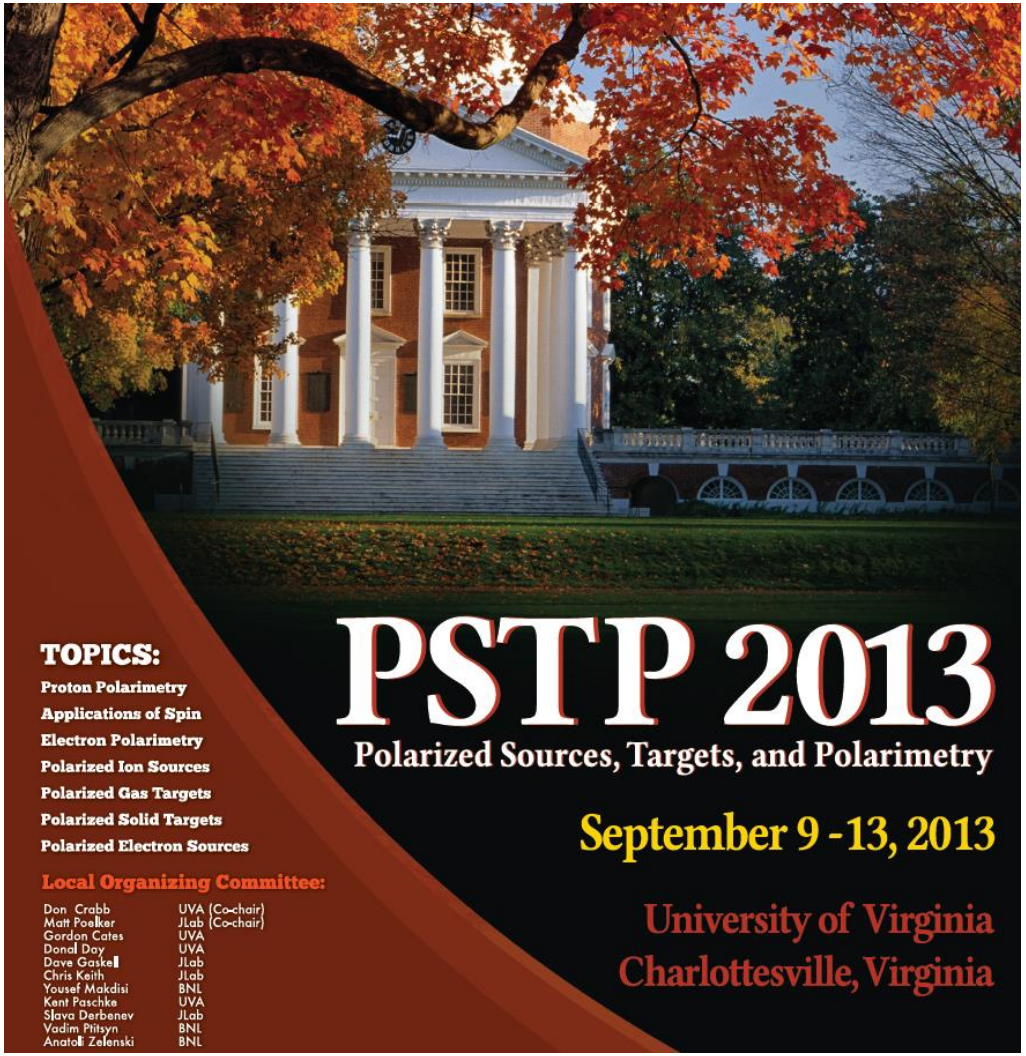


Summary Report PSTP 2013

Matt Poelker for PSTP 2013 Local Organizing Committee

SPIN 2014,
Beijing, China
Oct. 20 – 24, 2014

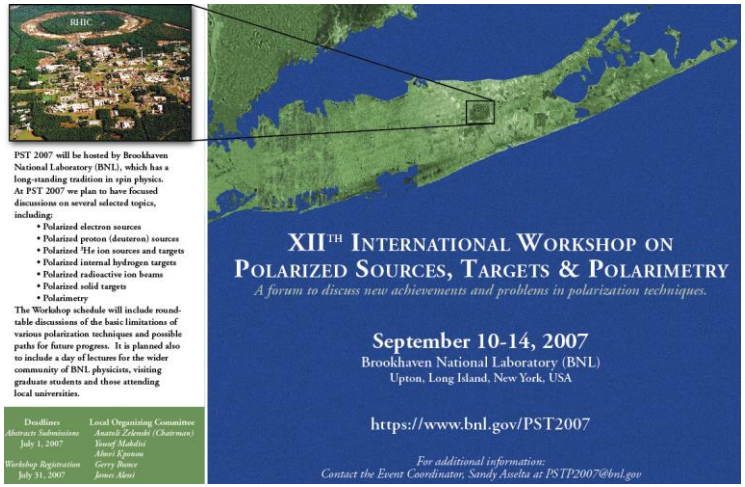
Summary PSTP 2013

68 talks, 73 registered participants

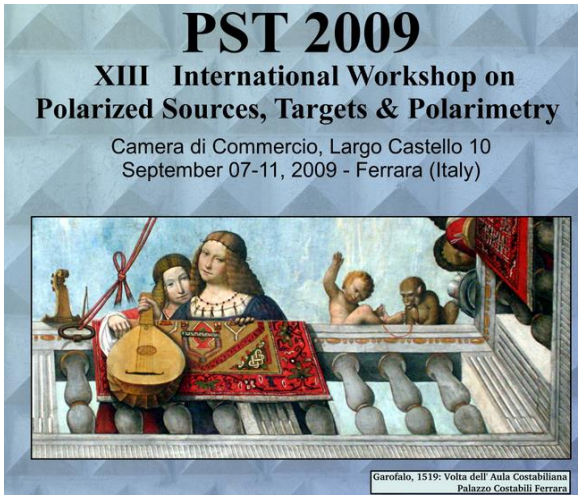
30 talks, 44 registered participants

Another successful workshop!

…the tradition continues



30 talks, 81 registered participants



49 talks, 75 registered participants

Summary PSTP 2013

- Duration 5 days, only plenary sessions
- Financial support for two attendees
- Some visa issues related to Russian and Chinese attendees
- Topics

	#Talks
– Polarized Targets	17
– Polarized Sources	24
– Polarimetry	15
– Facilities	7
– General and New methods	8

Polarized Solid Targets

Polarized Target for Crystal Ball

Tagged CW photon beam $5 \cdot 10^7 \frac{\gamma}{\text{sec}}$ ➡ 4π- detector

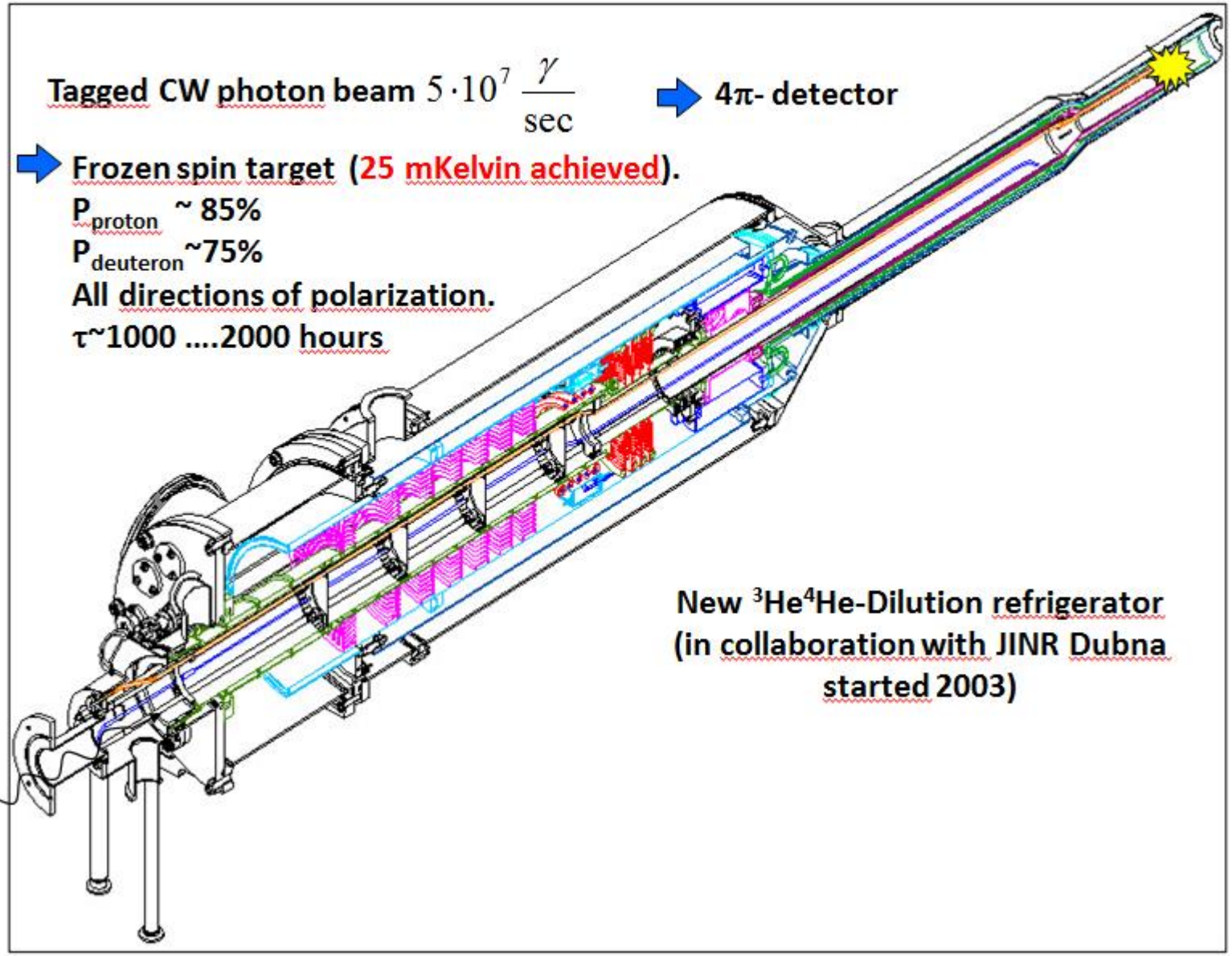
➡ Frozen spin target (25 mKelvin achieved).

P_{proton} ~ 85%

$P_{deuteron}$ ~75%

All directions of polarization.

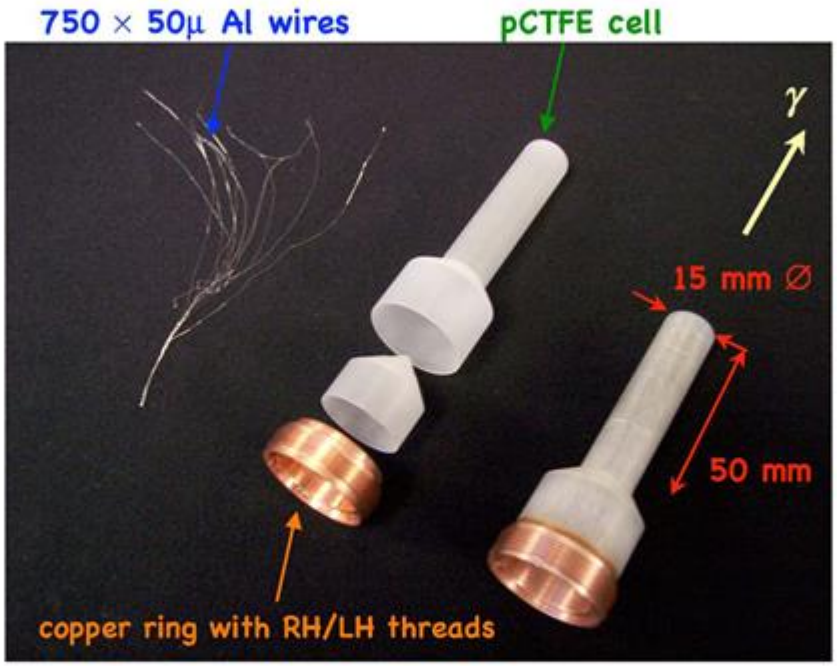
τ~1000 ....2000 hours



New $^3He^4He$-Dilution refrigerator (in collaboration with JINR Dubna started 2003)

Polarized Solid Targets

HDice Target

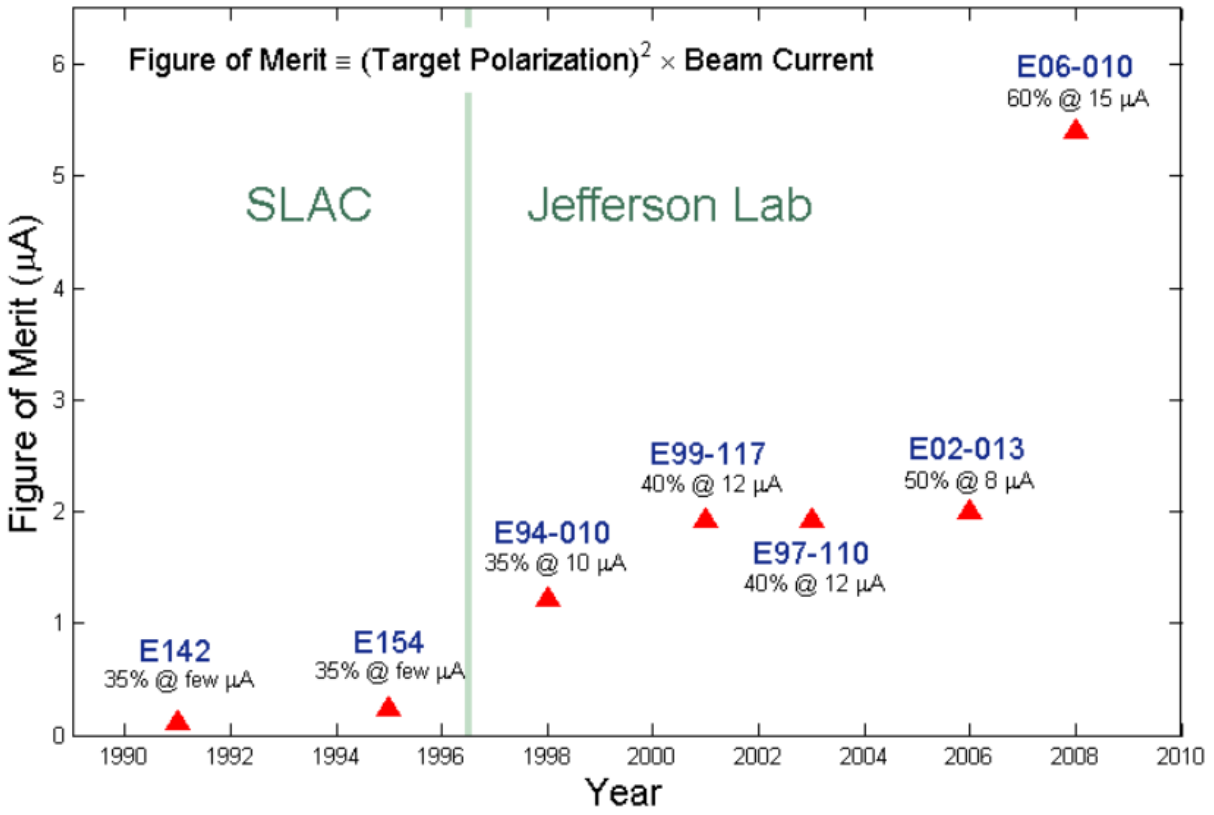


- material in the beam path:

  77% HD + 17 % Al + 6% pCTFE (remove with vertex cuts)

Polarized Gas Targets

Figure-of-Merit History for High Luminosity Polarized ^{3}He Target



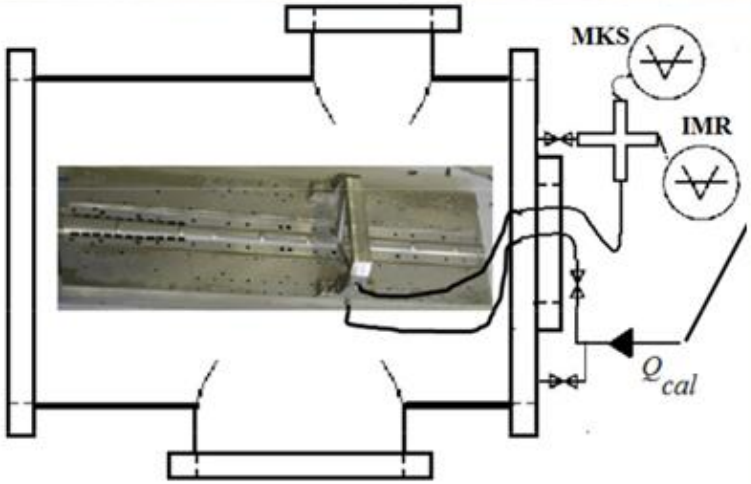
Polarized Gas Targets

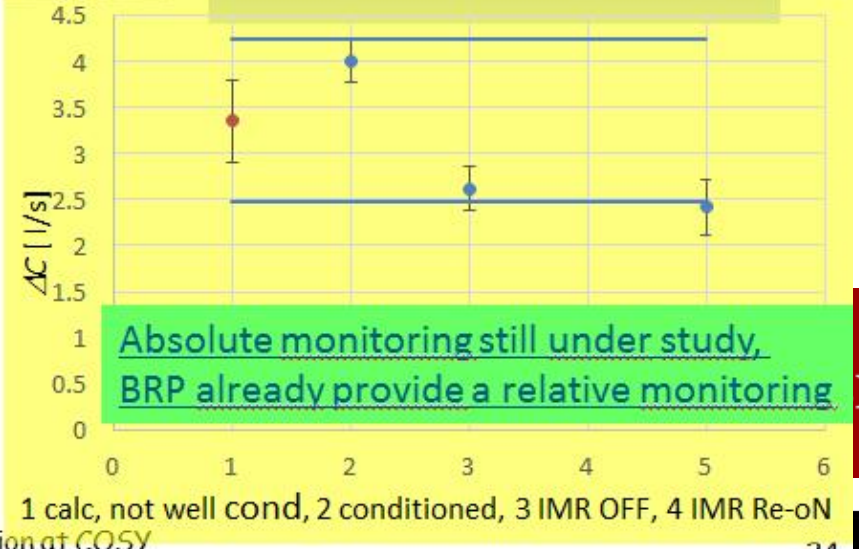
The openable Cell?

High injection at COSY
Constrain for AD

First prototype worked nicely in in the Target commissioning, on COSY target suffers much stresses.

Construction and test *ex situ* by He sniffer : Leaks < 1%.





Absolute monitoring still under study, BRP already provide a relative monitoring

Polarized Ion Sources

Operational Polarized H^- Source at RHIC.

RHIC OPPIS produces reliably 0.5-1.0mA polarized H^- ion current.
Polarization at 200 MeV: P = 80%.
Beam intensity (ion/pulse) routine operation:

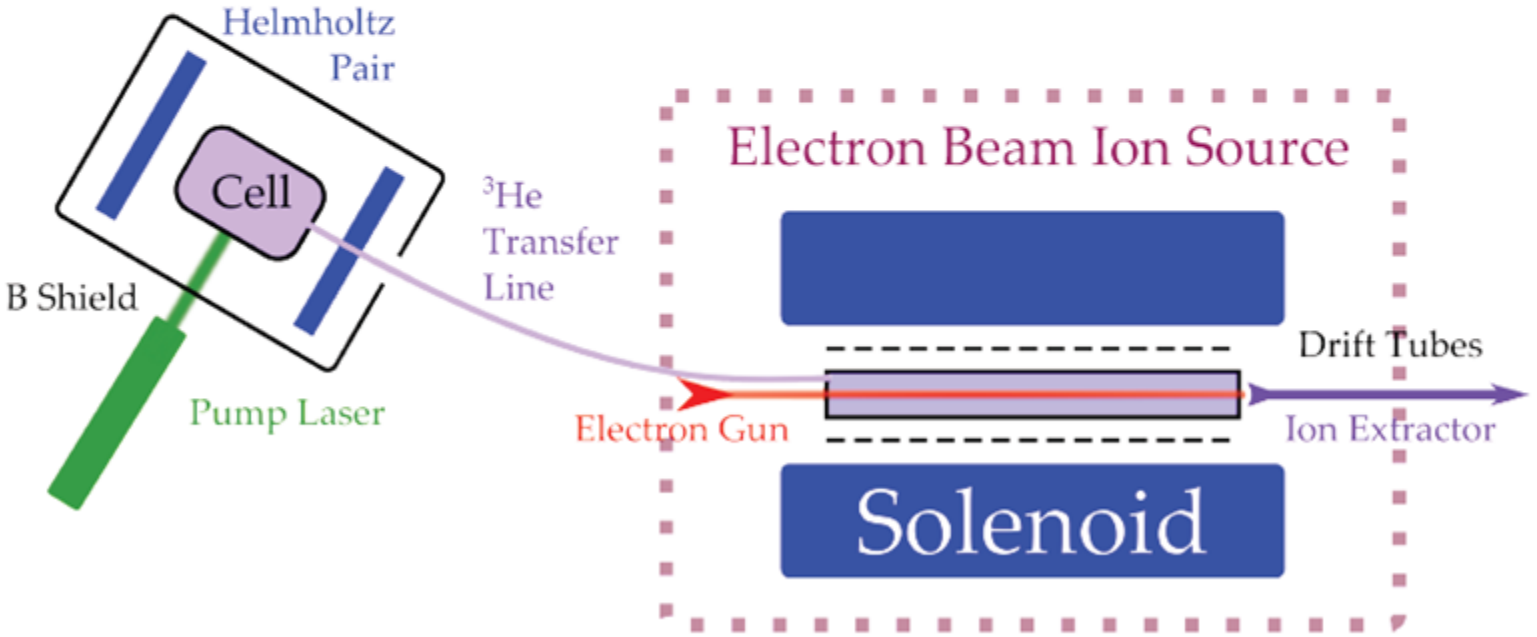
Source	- 10^{12} H^-/pulse
Linac	- $5 \cdot 10^{11}$
AGS	- $1.5\text{-}2.0 \cdot 10^{11}$
RHIC	- $1.5 \cdot 10^{11}$ (protons/bunch).

A 29.2 GHz ECR-type source is used for primary proton beam generation.
The source was originally developed for dc operation.
A ten-fold intensity increase was demonstrated in a pulsed operation by using a very high-brightness Fast Atomic Beam Source instead of the ECR proton source .

Polarized Ion Sources

Source Design Goals

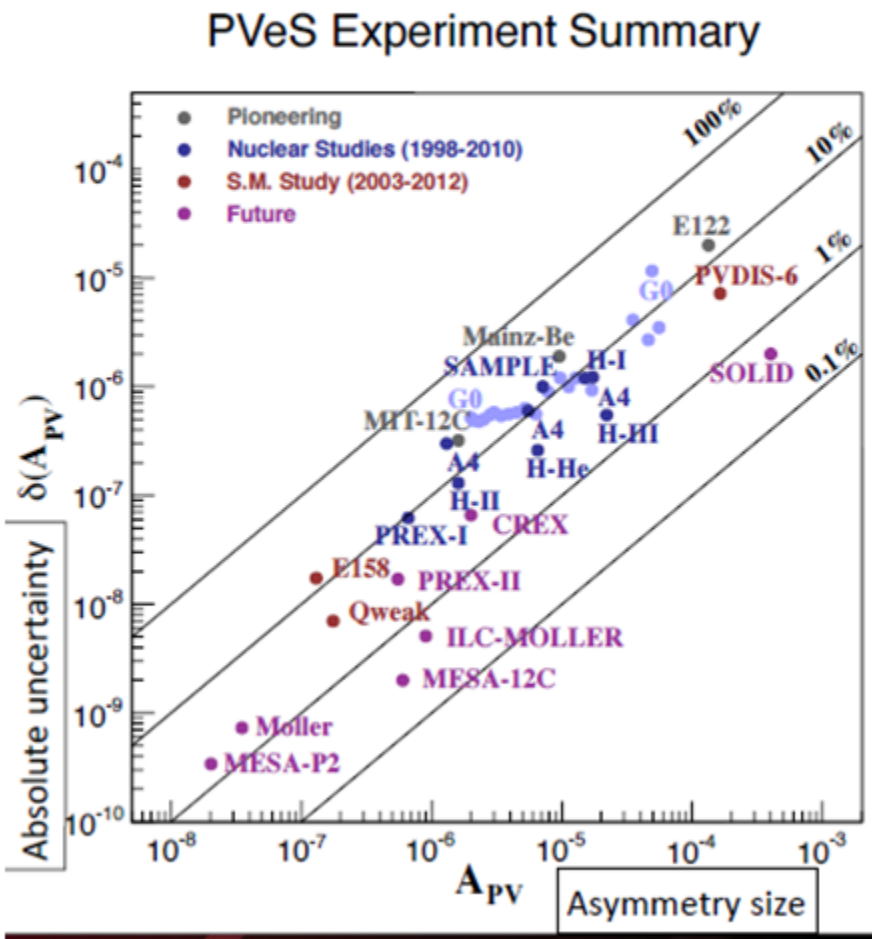
- Polarize to ~70% at 30 G & 1 torr with 10 W laser
- Transfer $\sim 10^{-14}$ ^{3}He/s to EBIS at 5 T & 10^{-7} torr
- Deliver 1.5×10^{11} ^{3}He^{++} ions per 20 μsec pulse



Polarized Electron Sources

PVES Experiments

Mark Dalton - JLab



Experiment	Uncertainty	Reversal
HAPPEX:	δA ~ 1000 ppb	30 Hz
A4:	δA ~ 300 ppb	30 Hz
G0:	δA ~ 300 ppb	30 Hz
HAPPEX-II He:	δA ~ 250 ppb	30 Hz
HAPPEX-II H:	δA ~ 100 ppb	30 Hz
SLAC E158:	δA ~ 15 ppb	30 Hz
PREx II:	δA ~ 15 ppb	240 Hz
Qweak :	δA ~ 5 ppb	960 Hz
MOLLER :	δA ~ 0.5 ppb	1920 Hz
P2:	δA ~ 0.3 ppb	?

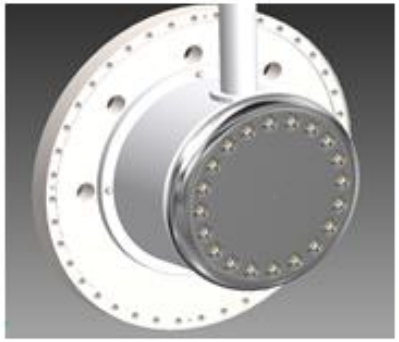
Polarized Electron Sources

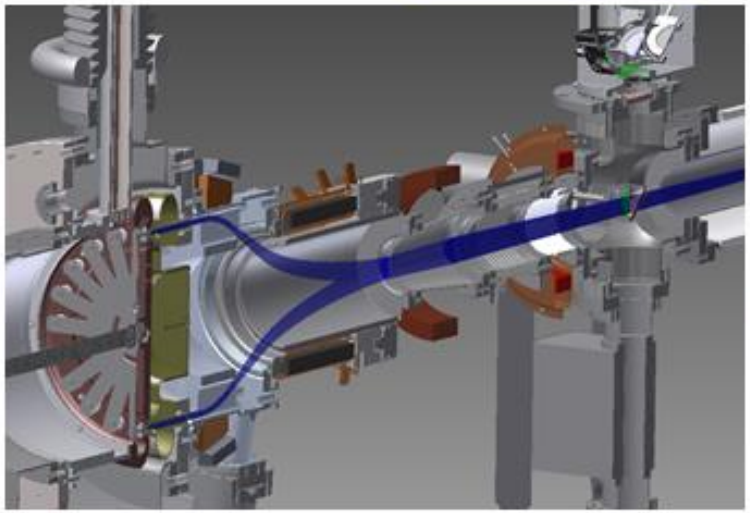
BROOKHAVEN NATIONAL LABORATORY

- How we figure out?

eRHIC requirement:
Weekly cathode exchange, operation lifetime 85 hours(half week)
Average current :50mA
Charge lifetime: 15,300C!!!

State-of-art single cathode charge lifetime: 1000C @ 2.5mA



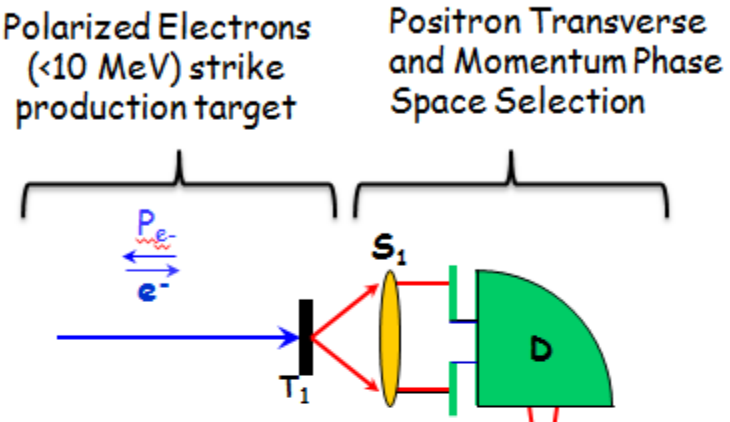


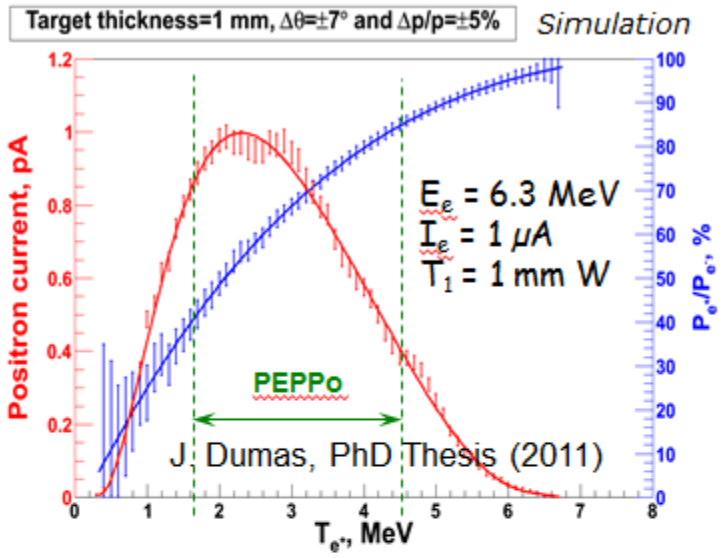
Richard Jordan Gatling 1818-1903

15300C/20=765C<1000C

Polarized Electron Sources

Introducing the PEPPo Concept





- Longitudinal $\vec{e^-}$ (P_{e^-}) produce elliptical γ whose circular (P_γ) component is **proportional** to P_{e^-}.
- γ produces pairs; P_γ transfers to $\vec{e^+}$ into longitudinal (P_{e^+}) and transverse polarization averages to zero.

PEPPo measured the polarization transfer from 8.2 MeV/c longitudinal electrons to longitudinal positrons in the 3.1-6.2 MeV/c momentum range.

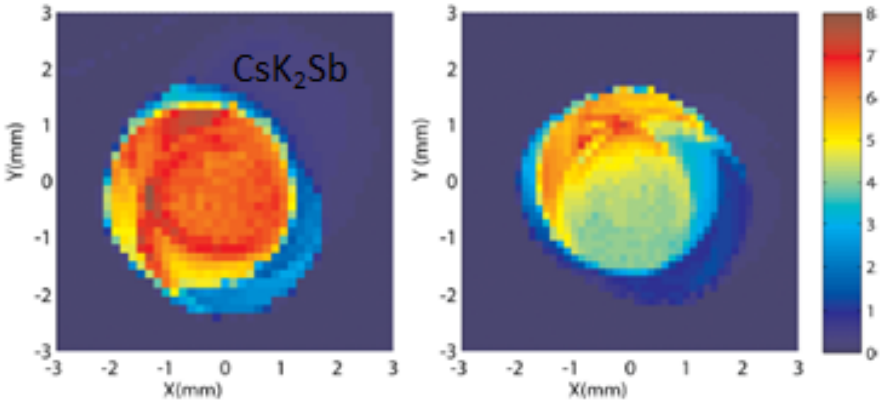
(un)Polarized Electron Sources

Cornell Laboratory for Accelerator-based ScienceS and Education (CLASSE)

World record photoinjector current!

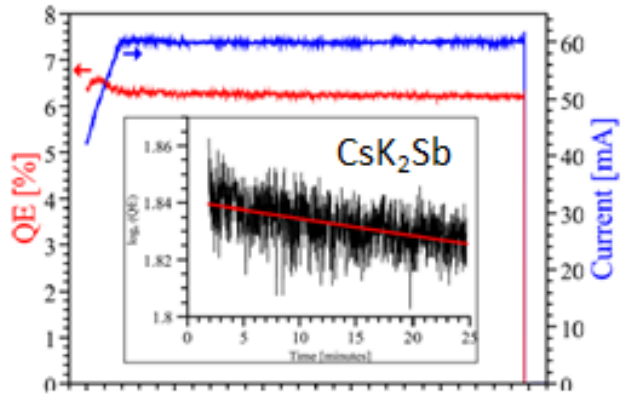
Dunham et. al. APL 102, 034105 (2013)

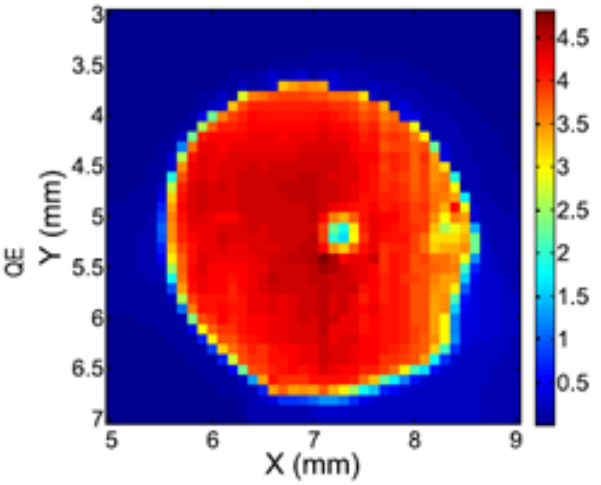
- Using multialkali off center, a robust bulk emitter:



Before use

After use

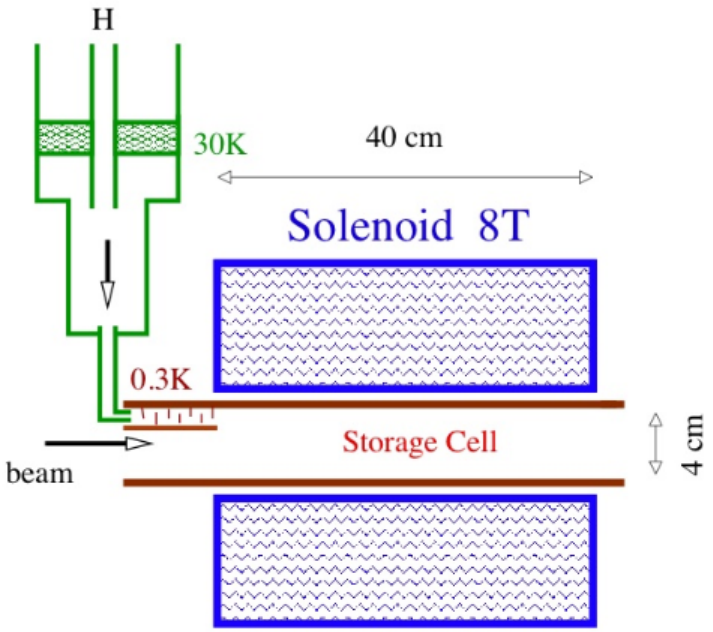




- **60mA run with CsK_2Sb** had ~30 h 1/e lifetime
  - P_{gun}=1.13x10^{-11} torr → 3.0x10^{-11} torr
  - Likely due to beam scraping
- **65mA run with NaKSb** had ~66 h 1/e lifetime

Polarimetry

Atomic Hydrogen For Moller Target



10 cm, $\rho = 3 \times 10^{15}/cm^3$
in B = 7 T at T=300 mK

$$\frac{n_+}{n_-} = e^{-2\mu B / kT} \approx 10^{-14}$$

Brute force polarization

Moller polarimetry from polarized atomic hydrogen gas, stored in an ultra-cold magnetic trap

- 100% electron polarization- opposite polarization quickly ejected
- tiny error on polarization
- thin target (sufficient rates but low dead time)
- Non-invasive, high beam currents - continuous measurement over experiment
- no Levchuk effect

E. Chudakov and V. Luppov, IEEE Transactions on Nuclear Science, v 51, n 4, Aug. 2004, 1533-40

Significant technical challenges

Polarimetry

Summary

- **p-Carbon polarimeters at RHIC performed well in 2011, 2012, and 2013**
- Minimal changes in the setup allowed for year-to-year systematic studies
- p-Carbon polarimeters work well for
  - Measurements of beam polarization profile
  - Statistically significant measurements of polarization losses during a RHIC store
- Ongoing efforts and improvements:
  - Target lifetime with higher beam intensities
  - More control over the amount of material in the beam
  - Absolute detector calibration will benefit in another "absolute" polarimeter
  - Potential to precisely measure pC A_N at very high beam energies

Today and Tomorrow

- Representatives from existing facilities with healthy spin physics programs: CEBAF, RHIC, COSY, ELSA, S-DALINAC, MAMI
- New Facilities will keep innovations coming: EIC including eRHIC and MEIC, NICA, ILC, LHeC, FAIR?

Electronic proceedings!

http://pos.sissa.it/cgi-bin/reader/conf.cgi?confid=182

PROCEEDINGS OF SCIENCE — a service of SISSA

XVth International Workshop on Polarized Sources, Targets, and Polarimetry

The Workshop on Polarized Sources, Targets and Polar
tradition for more than 20 years, moving between the U
Targets and Polarimetry (PTSP 2013) will take place at th
of Virginia and Jefferson Lab, whose scientists have lo
workshop addresses the physics and technological challenges related to polarized gas/solid targets, polarized electron/positron /ion/neutron sources, polarimetry and their applications.

Hardcopies available

(ask Poelker)

Welcome and Introduction

Preface to PSTP 2013 Proceedings
PoS(PSTP2013)072 pdf *D. Crabb and M. Poelker*

Introduction and welcome
PoS(PSTP2013)001 *T. Skalak*

The 12 GeV physics program at Jlab
PoS(PSTP2013)002 *R. McKeown*

...ichel Borghini and Franz Lehar)

...Bochum/Bonn Polarized Target Group
...eicherz

...spin target at MAMI
PoS(PSTP2013)006 pdf *A. Thomas*

Solid Polarized Solid Targets II

Neutron spin filter based on dynamically polarized protons using photo-excited triplet states
PoS(PSTP2013)007 pdf *T. Eichhorn*

Novel Physics with tensor polarized deuteron targets
PoS(PSTP2013)008 pdf *K. Slifer and E. Long*

COMPASS polarized target for Drell-Yan
PoS(PSTP2013)009 pdf *M. Pesek and J. Matousek*

Investigation into polarization uncertainty minimization of solid polarized targets
PoS(PSTP2013)010 pdf *D. Keller*

Applications of Spin

Spintronics
PoS(PSTP2013)011 *S. Wolf*

Polarized fusion: can polarization help to increase the energy output of fusion reactors?
PoS(PSTP2013)012 pdf attachments *R. Engels*

Search for Electric Dipole Moments with Polarized Beams in Storage Rings.
PoS(PSTP2013)013 pdf *P. Lenisa*

Using Polarimetry To Determine The CEBAF Beam Energy