



# Tritium Commissioning Time Estimation

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With Doug, Evan

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# Overview

- 2 weeks of beam: Dec 4 ~ Dec 18
  - Tritium commissioning
  - (e,e') SRC at  $1 < x_{bj} < 2$
- 4.3 GeV beam
- (e,e')
- HRS angle: 17 ~ 38 degree
- Momentum:
  - LHRS < 4 GeV, RHRS < 3.1 GeV

# Overview

Beam current:

- Non-tritium mode (Thanks to Meekins, Thia and Rolf!):
  - ~50  $\mu\text{A}$ ?
  - Foil targets only
  - Allow us to finish optics quickly
- Tritium mode:
  - 22.5  $\mu\text{A}$  max

# 0. Survey

Starting settings:

- LHRS: 3.8 GeV, 17 degree
- RHRS: 3 GeV, 17 degree
  
- Target Survey
- HRS angles survey before and after this run period
- Harp survey
- Faraday cup??

# 1. Beamline (non-tritium mode)

- Ion chamber calibration 2hrs
  - First on-target data. Start detector/trigger checkout
- Beam centering: 2hrs
  - Carbon hole target
  - Raster on. Check raster convention.(Dien)
- Raster size check: 1hrs
  - Single foil target

# 1. Beamline

- BPM: 3hrs
  - Take pedestal run in advance
  - Harp scan: center-> 4 corners->back to center (Jason)
- BCM: 2hrs
  - Calibrate UNSER in advance
  - Use single foil, serve as both BCM and boiling data
- ARC Energy Measurement (parasitic)

# Trigger/Detector Checkout

- Use github to track issues?
- Calibration results on git elog, or wiki?

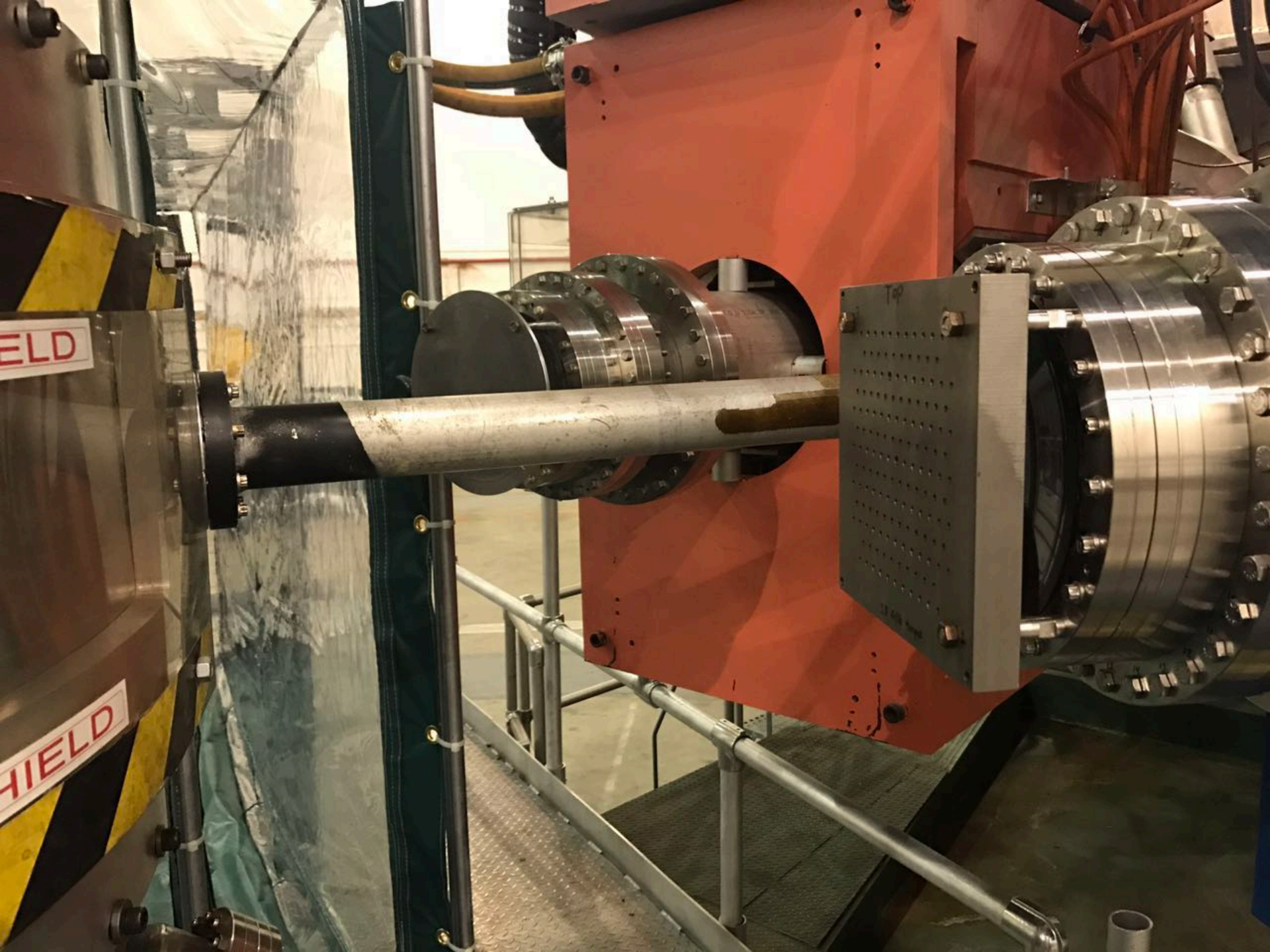
# Optics Issue:

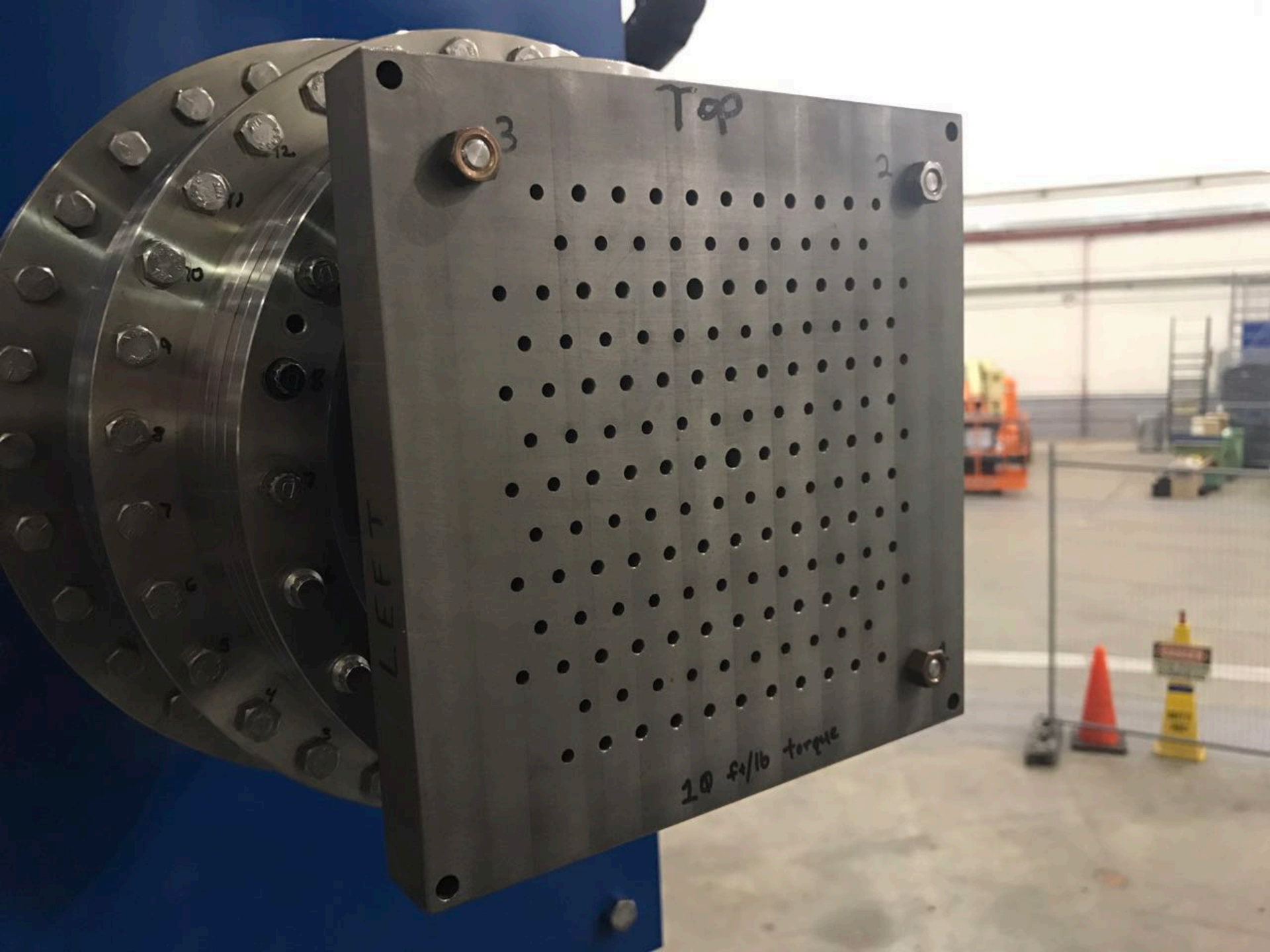
- Q1 saturation:
  - Starts ~ 2 GeV
  - Nonlinear field strength to magnet current relation
    - Field strength reduced by 1% at 3 GeV, ~ 7 % at 3.8 GeV (Javier)
    - raise Q1 current to compensate
  - Field distortion at edge
    - Go noticeable at somewhere between 3.6 GeV and 4 GeV (GMp)
- → **Take sieve runs with saturated Q1!**



IELD

SHIELD





Top

3

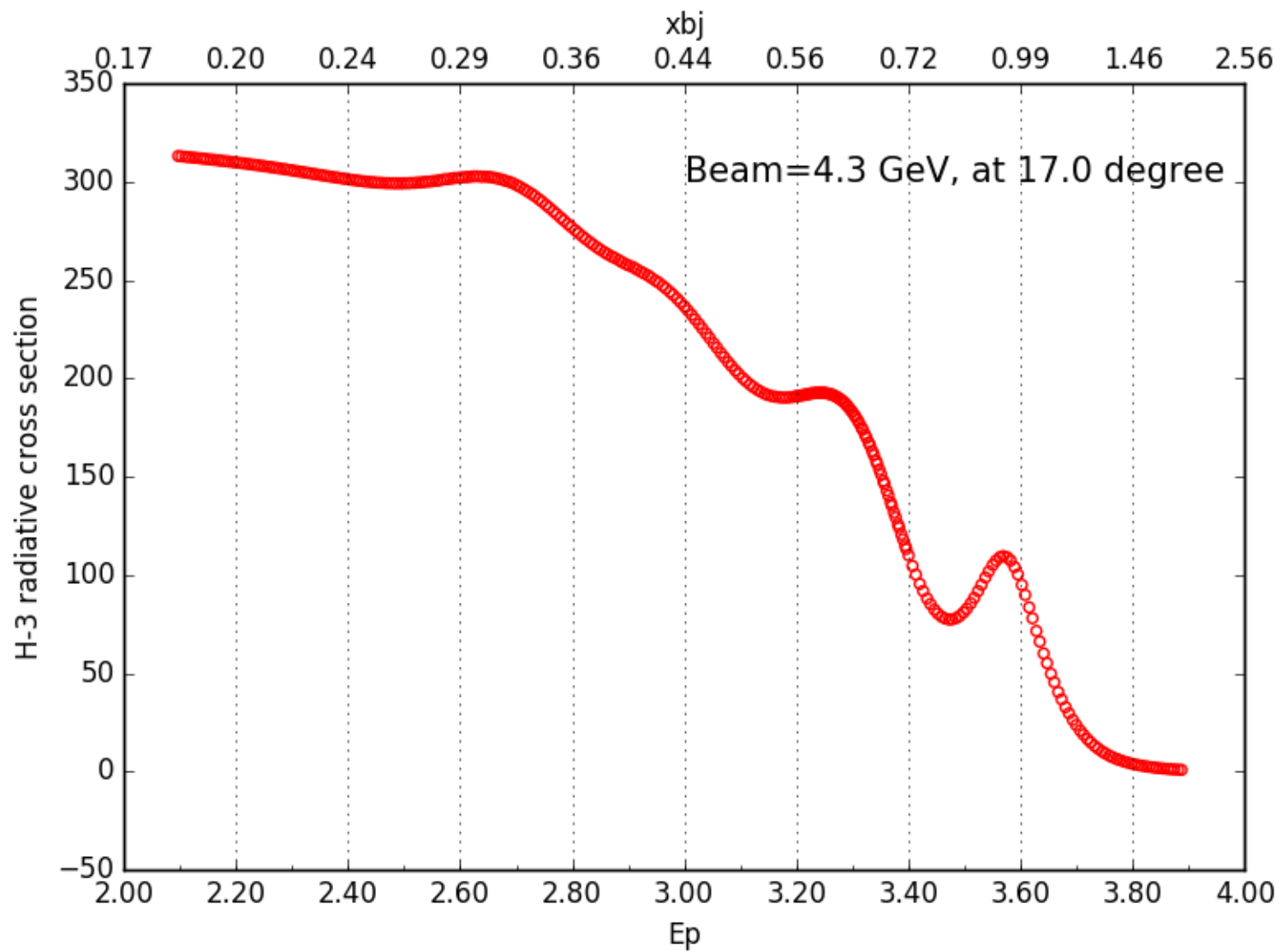
2

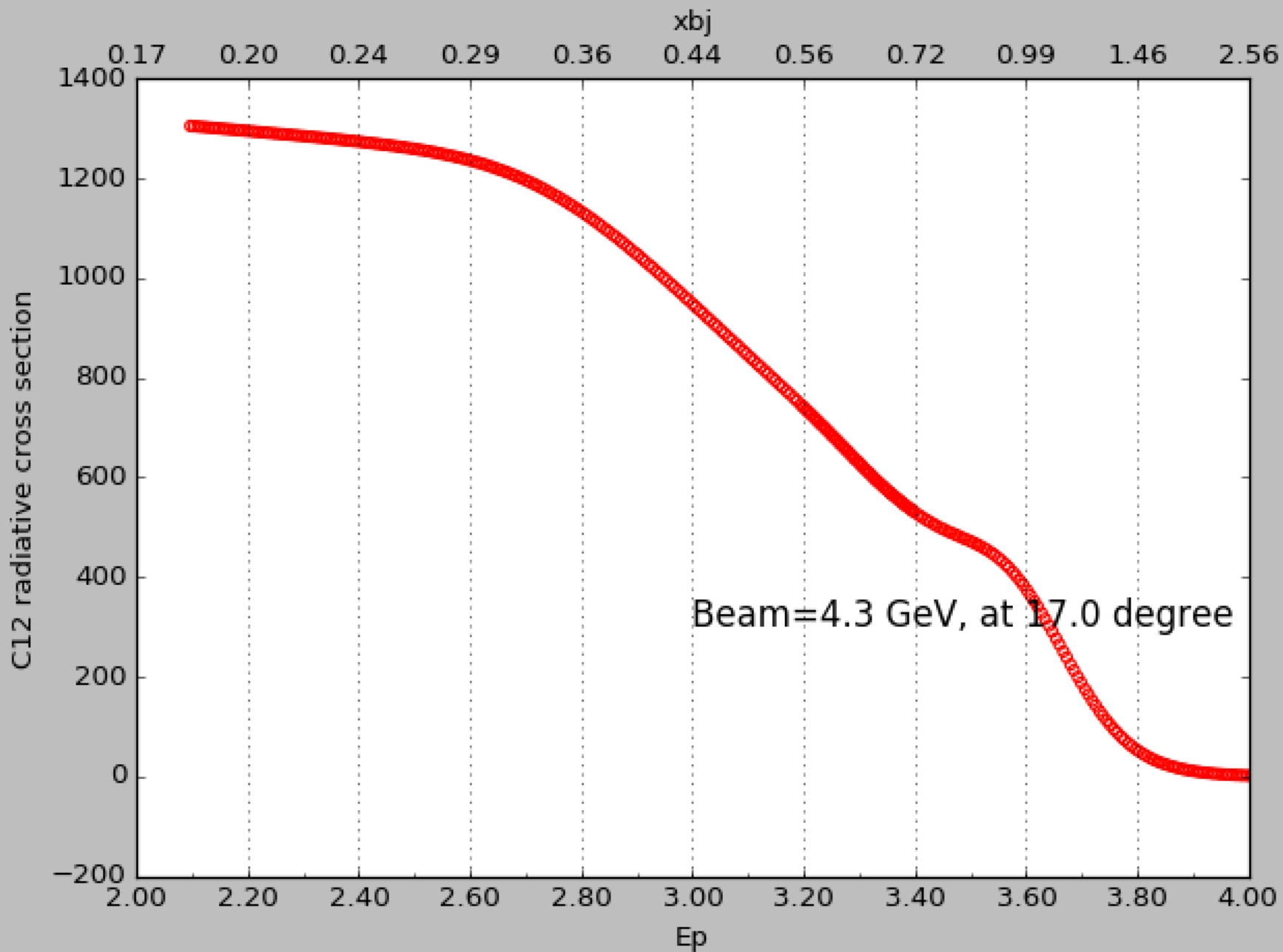
LEFT

20 ft/lb torque

# Optics data

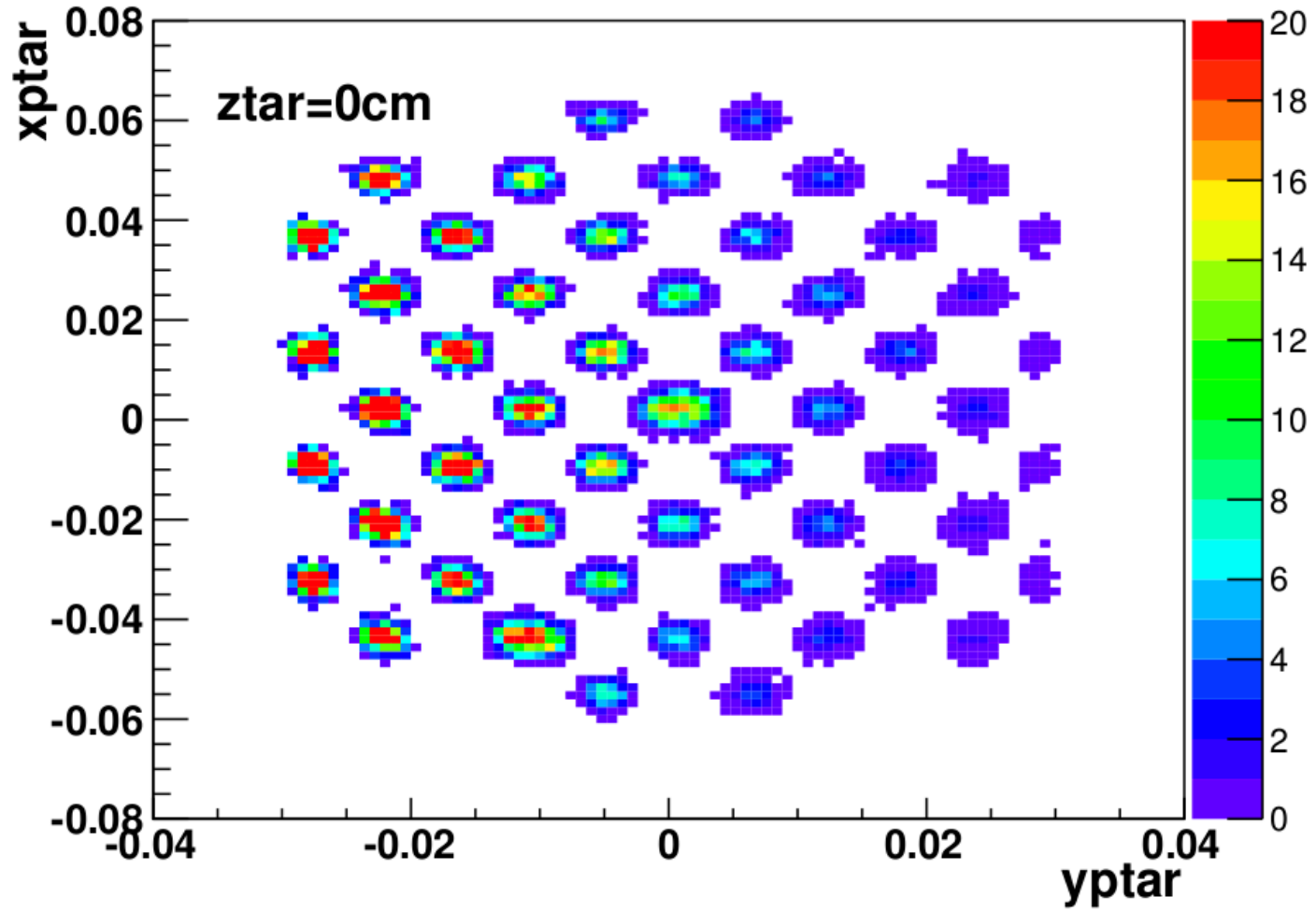
- Available:
  - Gmp optics at 1 GeV with 15 cm multifoil target
- Will take
  - Sieve run ( 100 events per sieve per hole):
    - with 25 cm multifoil (11 foils, truncate??)
    - LHRS at 3.8 GeV ( $x > 1$ ) 5hrs
    - Both arms at 3 GeV (marathon) 1hrs
    - **boiling study 10 hrs**
    - -----**Switch to Tritium mode (<22.5 uA)**-----
  - Hydrogen elastic peak (no sieve)
    - LHRS: 17 degree, 3.57 GeV
    - RHRS: 25 degree 3 GeV 0.5 hrs





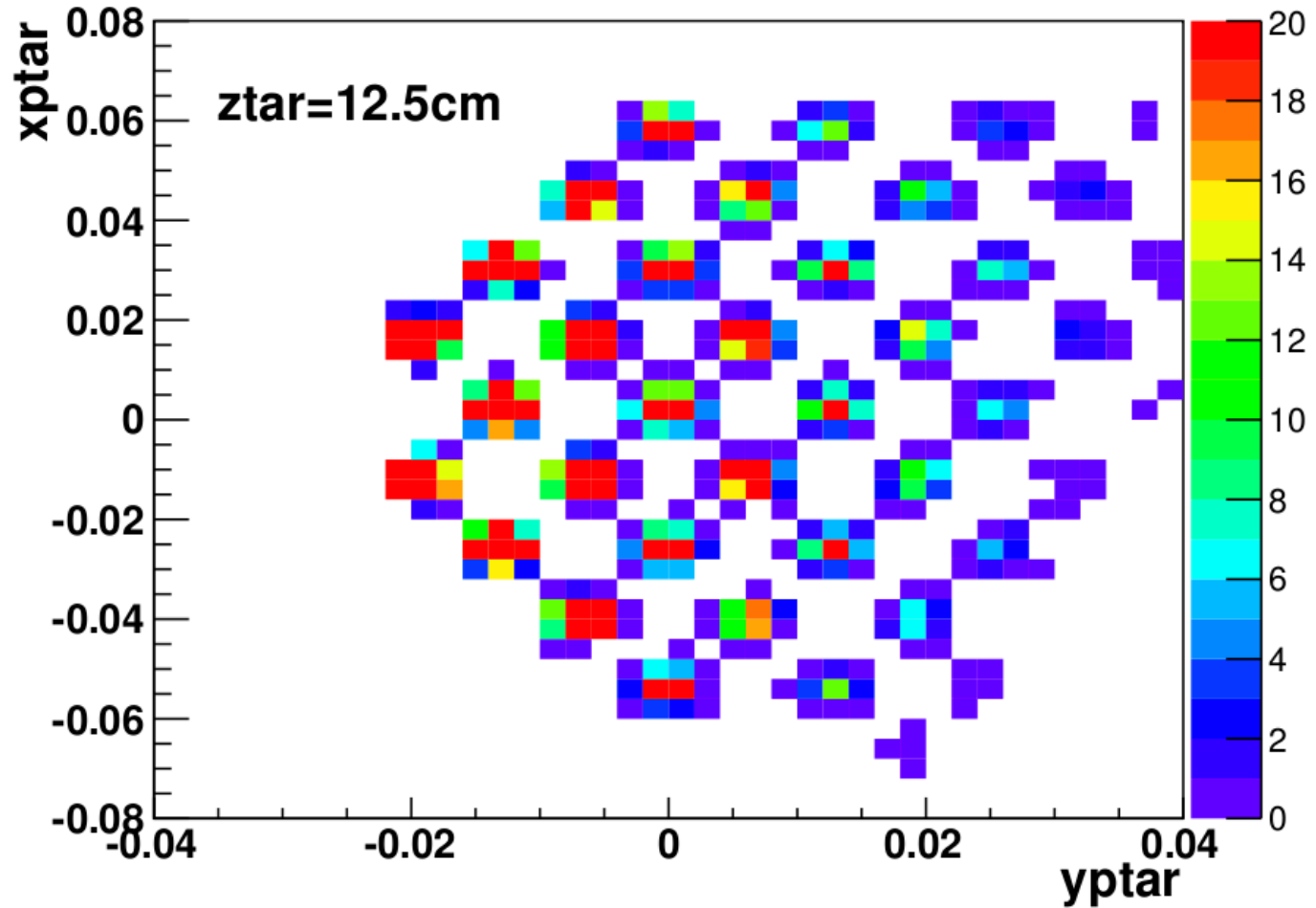
3.82 GeV

counts per hour, no cuts



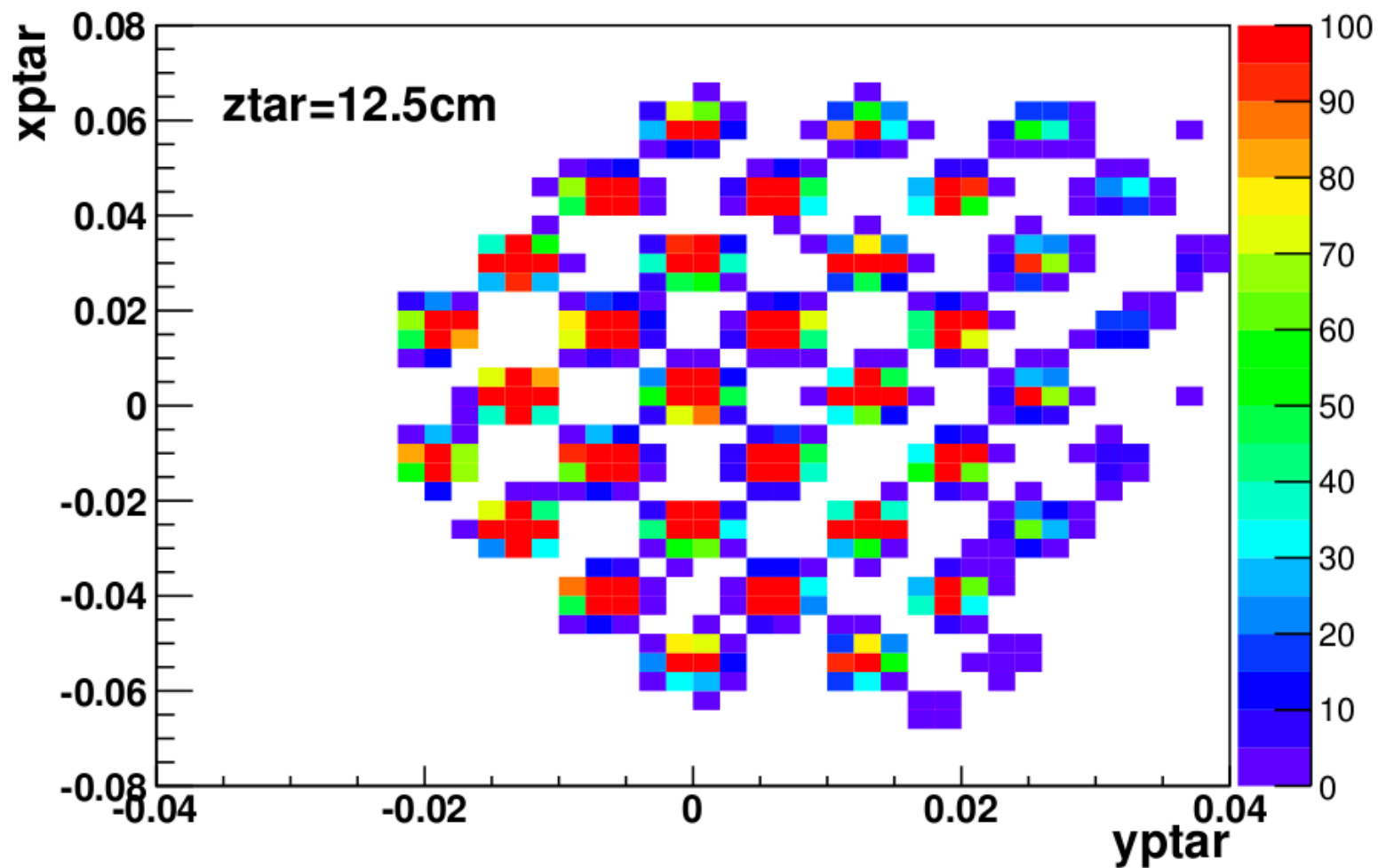
3.82 GeV

counts per hour, no cuts



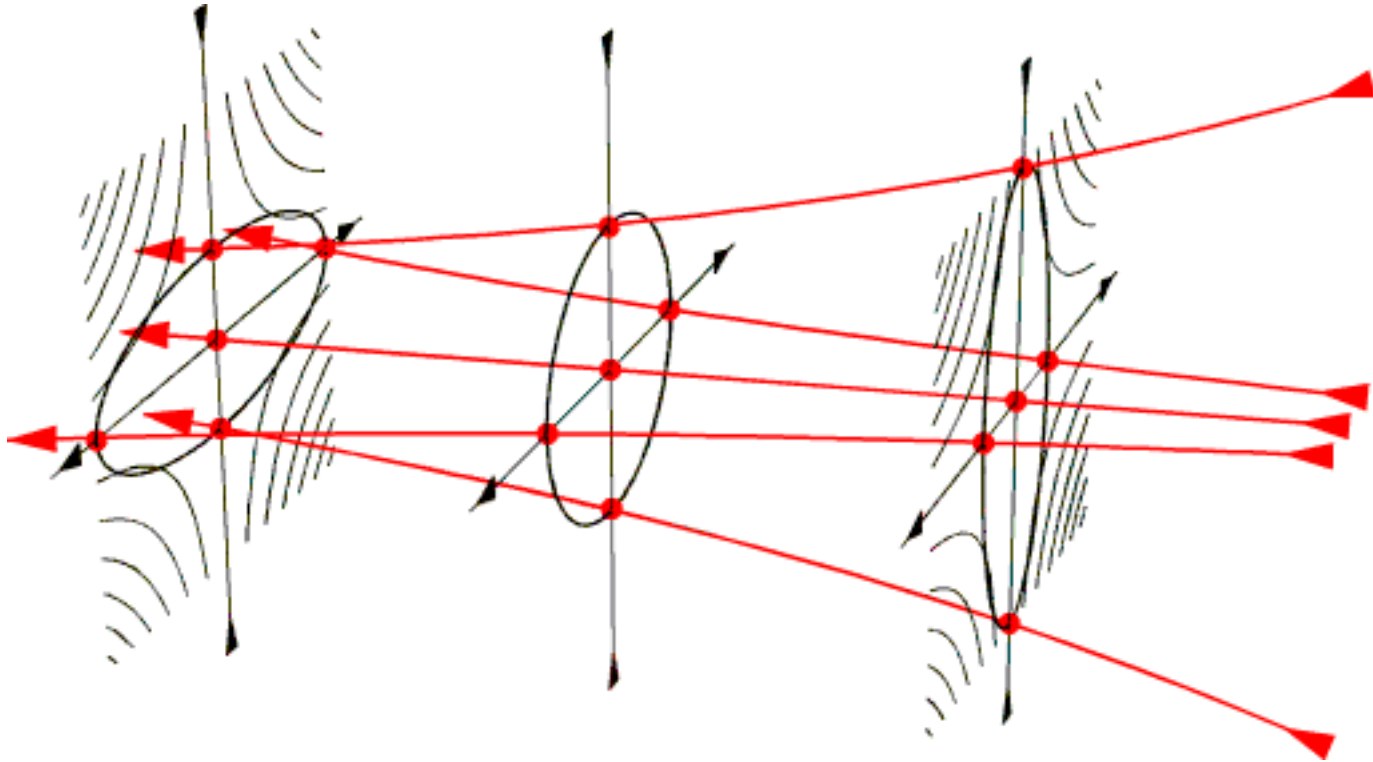
3 GeV

counts per hour, no cuts





<http://socrates.berkeley.edu/~fajans/Quadrupole/body.html>



Optional: Q1 is focusing in vertical direction. Can use a collimator to define out-of-plane angle

# Boiling Study

- Targets: H, D, T,  $^3\text{He}$ , C
- Current: 3, 7, 12, 18, 22.5  $\mu\text{A}$
- Fix target, vary beam current
- 100 k events per target per current setting
- Gas target only take a few seconds to reach equilibrium (Meekins)
- Take empty cell data at 22.5  $\mu\text{A}$  for endcap subtraction

- Total: 26 hours of beam, 25 hours of overhead.
- Goal: Start  $x > 1$  production run by Dec 8th

**Thanks Eric Christy, Dave Meekins, John Arrington, Javier Gomez, J-P Chen for useful discussion.**

**Thanks to all tritium students!**