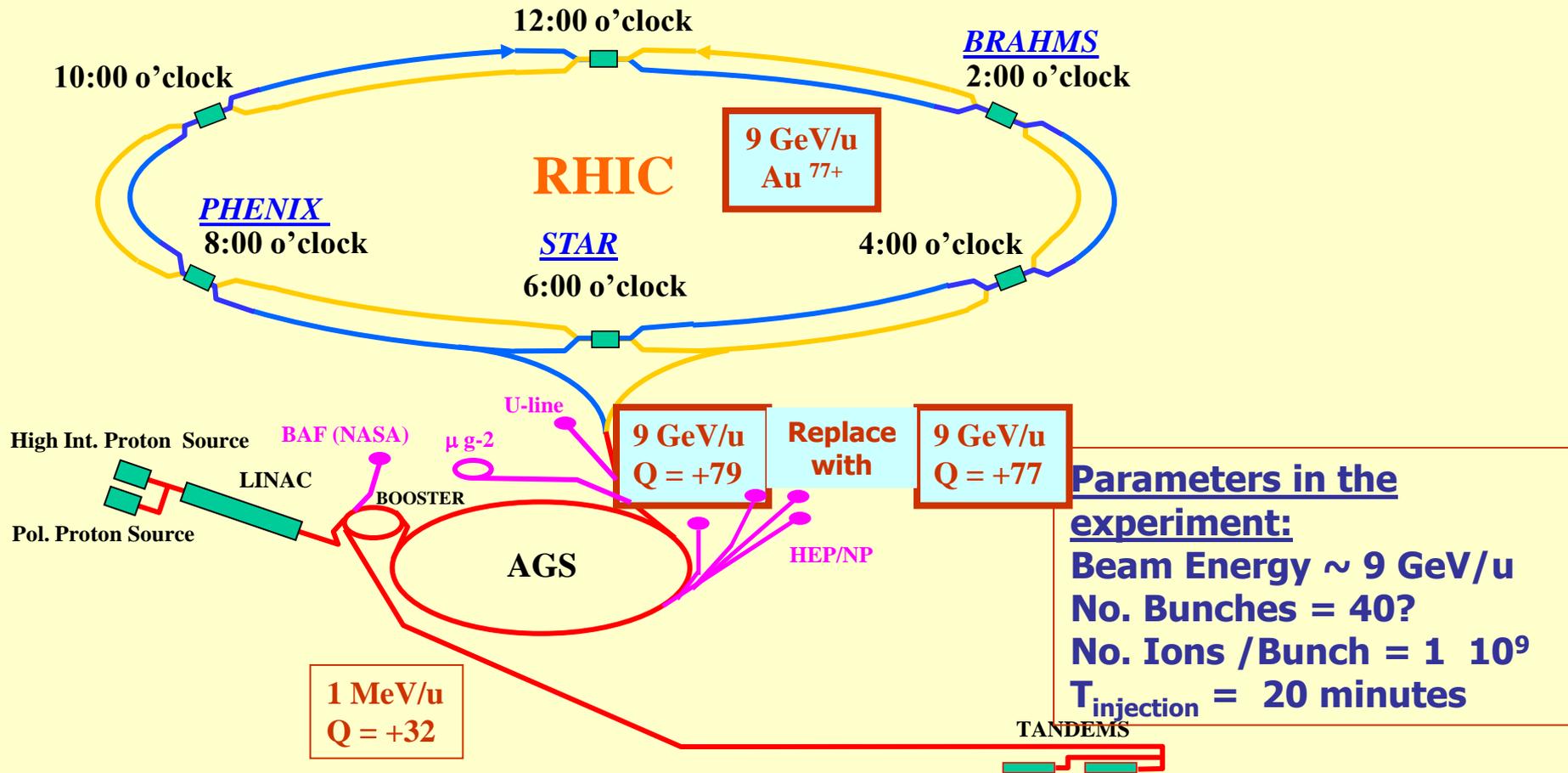


Report from experiment on January 28, 2008: Au⁷⁷⁺ in RHIC

Dejan Trbojevic

- **Participants this evening: Steven Tepikian, William Mackay, Nicholas Tsoupas, John Butler, Dejan Trbojevic.**
- **Details of the vacuum experiment: Titanium sublimation pumps turned on for 10 minutes at 8 and 6 o' clock : TSP → CH₄**
- **Expected photon-decay during beam-gass interaction.**

Introduction: Schematic of the experiment



Introduction:

- **Au⁷⁷⁺ extraction in AGS, stripping @ U-line F2 flag, ATR line tuned for Au⁷⁹⁺ and injection of in RHIC.**

The rest mass of fully stripped gold $m_{\text{Au}} c^2 = 183.4333180 \text{ GeV}$

$$B_{RHIC} \rho_{RHIC} = \frac{A \beta_o \gamma_o}{Z e c} m_{amu} c^2 = \frac{197}{79} \frac{\beta_o \gamma_o}{e c} m_{amu} c^2$$

$$B_{AGS} \rho_{AGS} = \frac{A \beta_o \gamma_o}{Z e c} m_{amu} c^2 = \frac{197}{77} \frac{\beta_o \gamma_o}{e c} m_{amu} c^2$$

$$\frac{\beta_1 \gamma_1}{\beta_o \gamma_o} = \frac{79}{77}$$

$$\frac{B_{AGS_1} \rho_{AGS_1}}{B_{AGS_o} \rho_{AGS_o}} = \frac{\beta_1 \gamma_1}{\beta_o \gamma_o} = \frac{77}{79}$$

- if we fix the $B\rho$ in RHIC and ATR (AGS to RHIC transfer line) only the U – line part and the AGS need adjustments.

Collisions of the Helium like Gold ions Au^{+77} with Al target

Experimental set-up

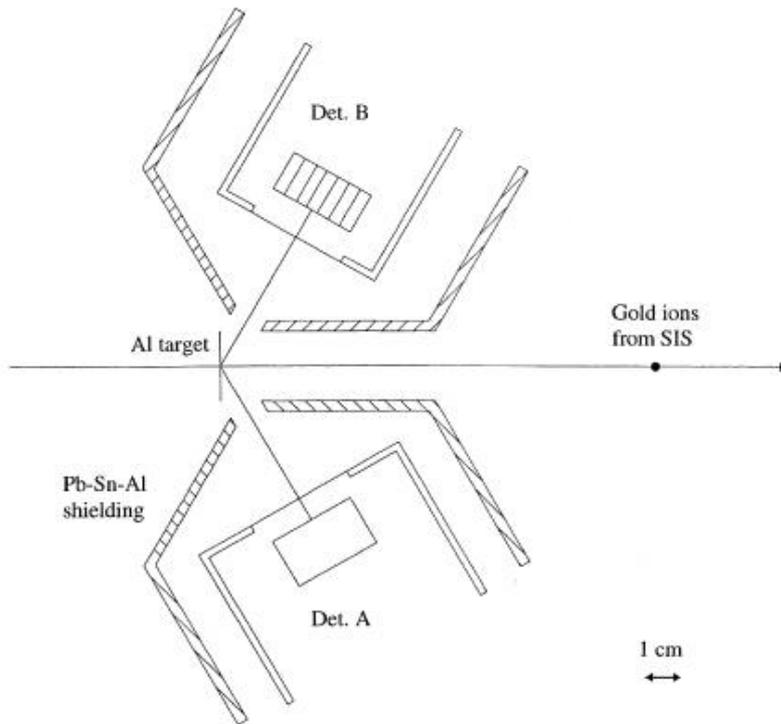


Fig. 2. Experimental setup at the target area.

Two photon decay

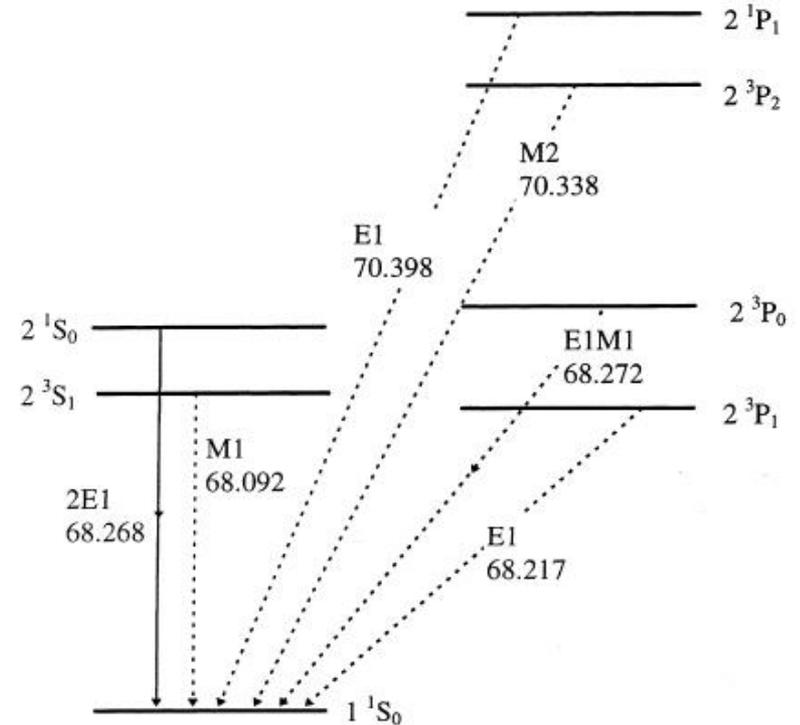


Fig. 1. Level scheme of heliumlike gold including important decay modes. All energies in keV.

Collisions of the Helium like Gold ions Au^{+77} with Al target

Two photon decay

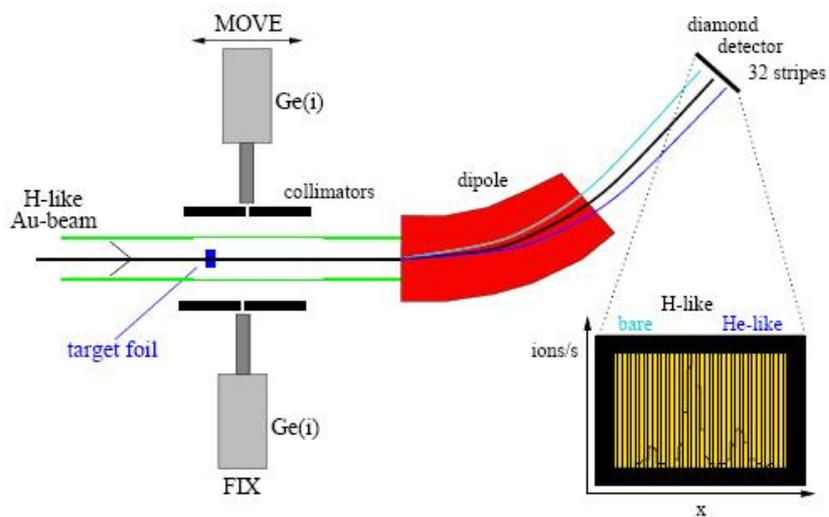


Figure 1: Experimental setup in Cave A.

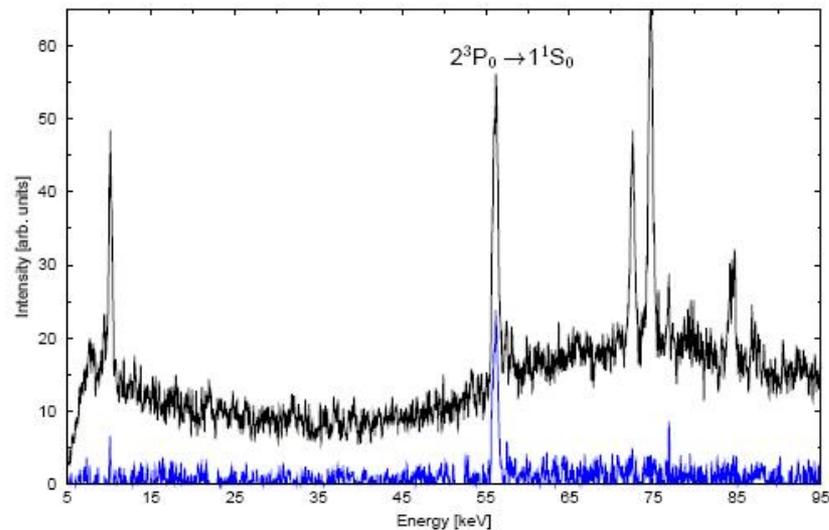


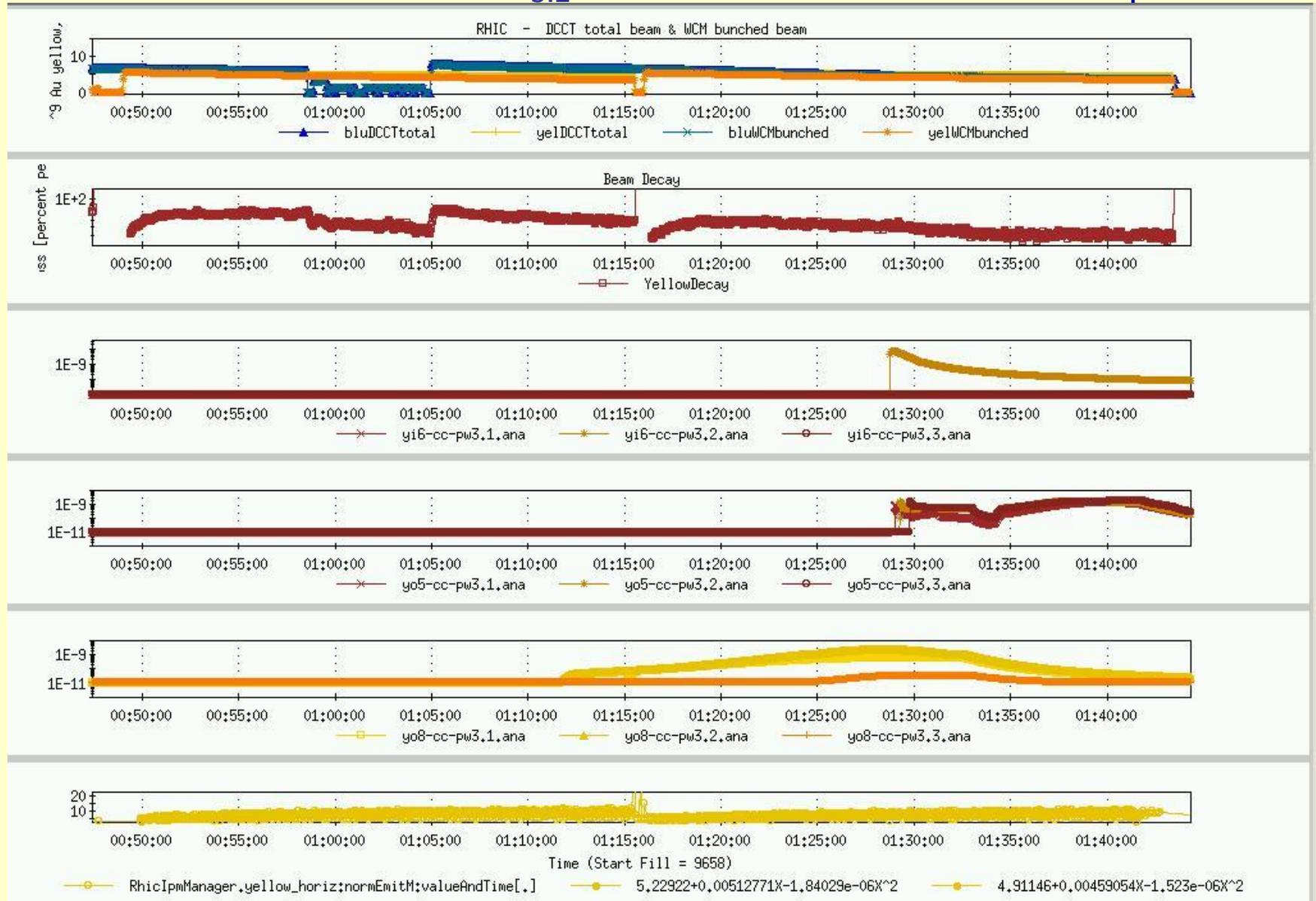
Figure 2: A raw and a coincidence spectrum obtained with the moveable Ge(i) detector.

Collisions of the Helium like Gold ions Au^{+77} with CH_4

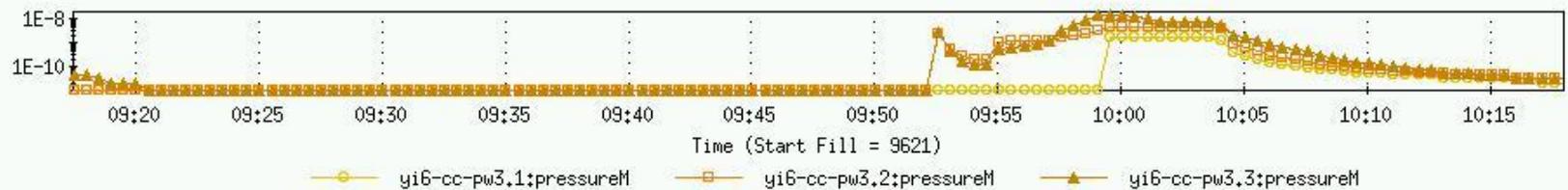
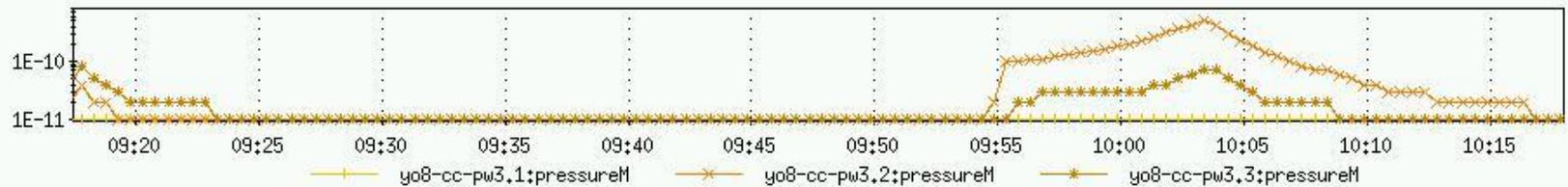
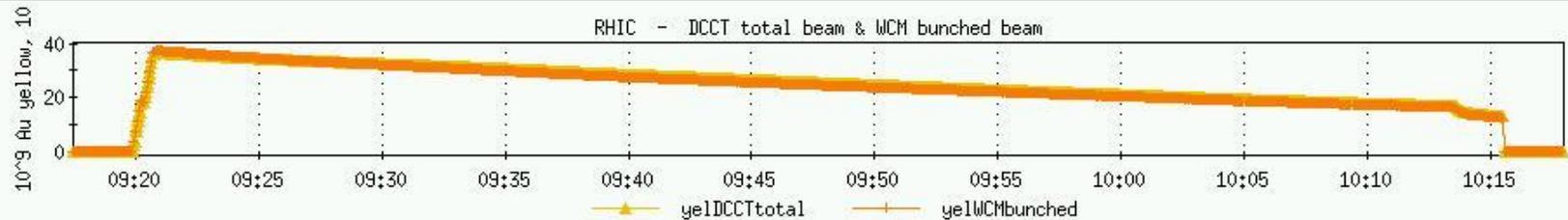
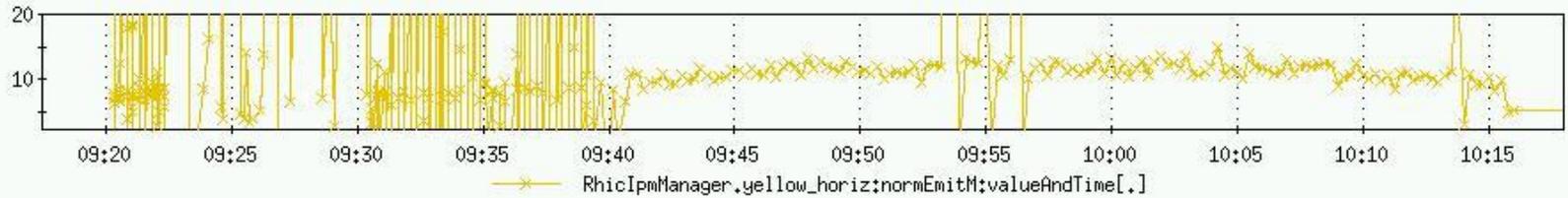
Experimental set-up

3.2

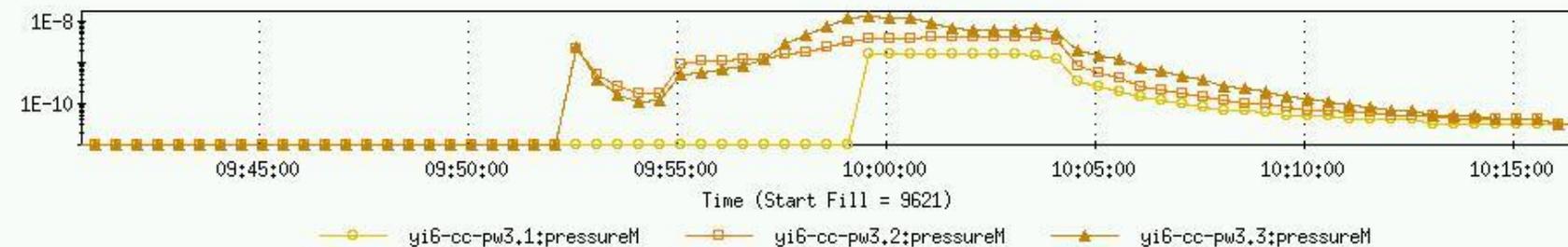
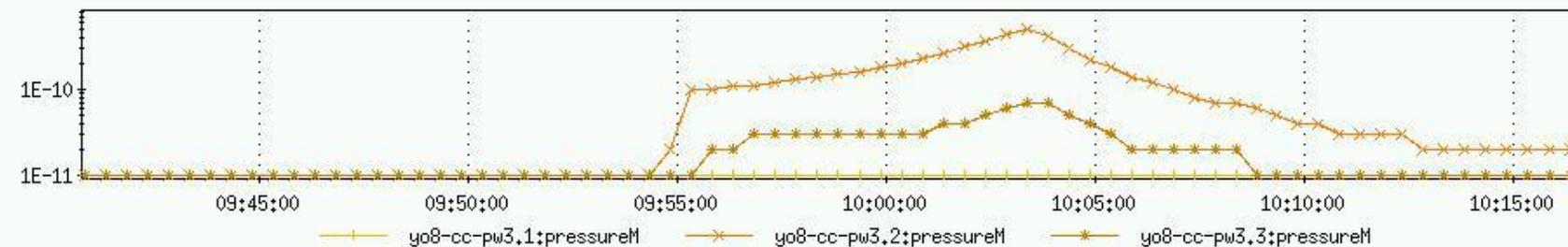
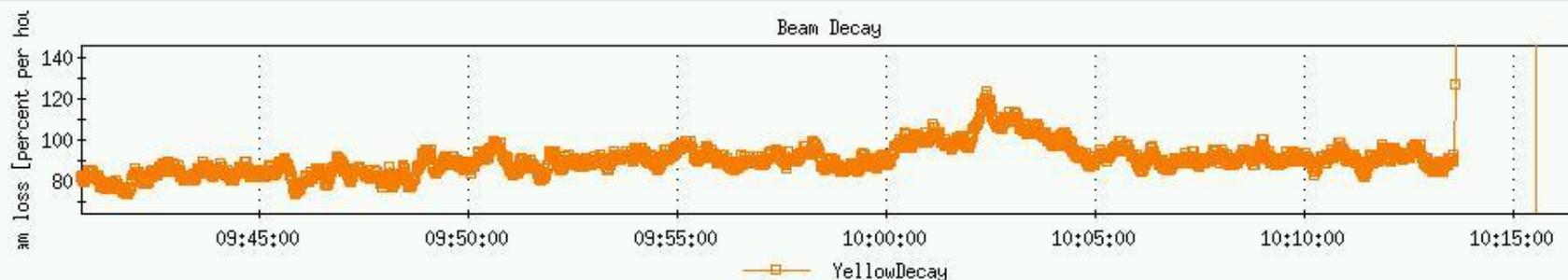
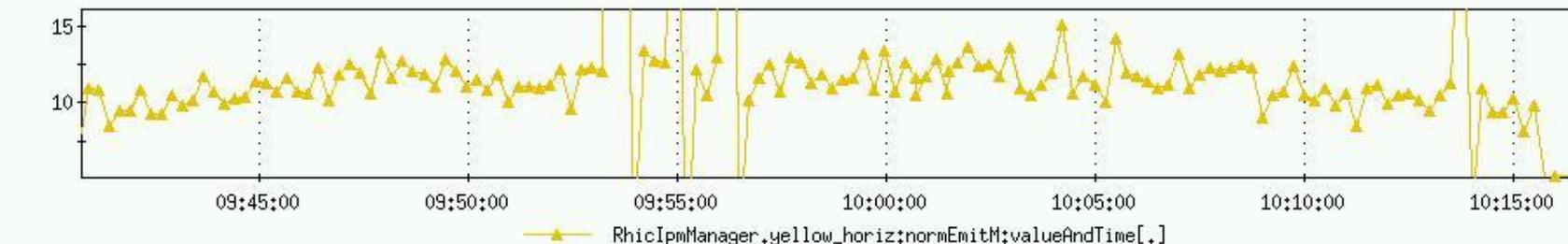
3.3 Two photon decay



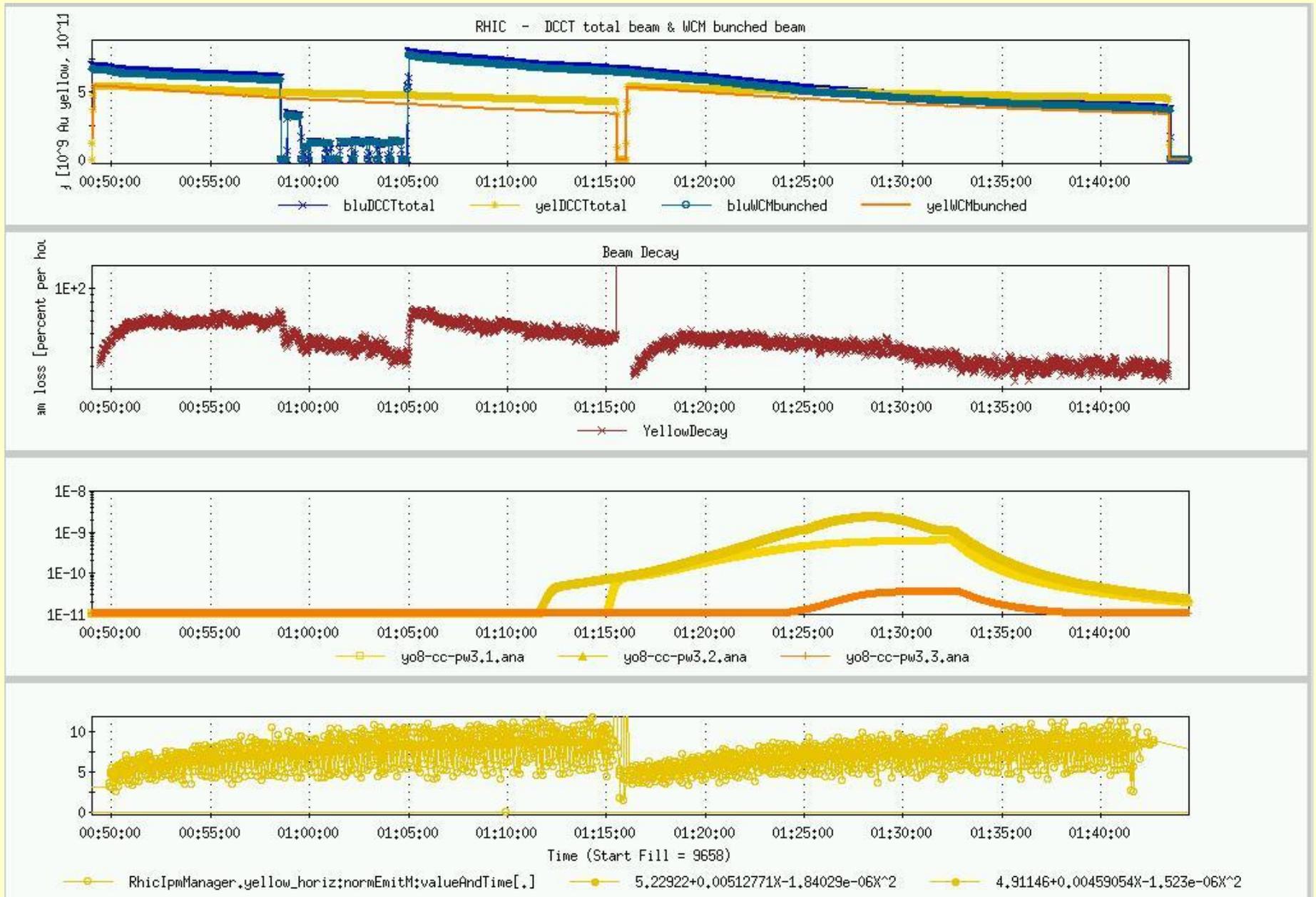
Collisions of the Helium like Gold ions Au^{+77} with CH_4



Collisions of the Helium like Gold ions Au^{+77} with CH_4



Collisions of the Helium like Gold ions Au^{+77} with CH_4

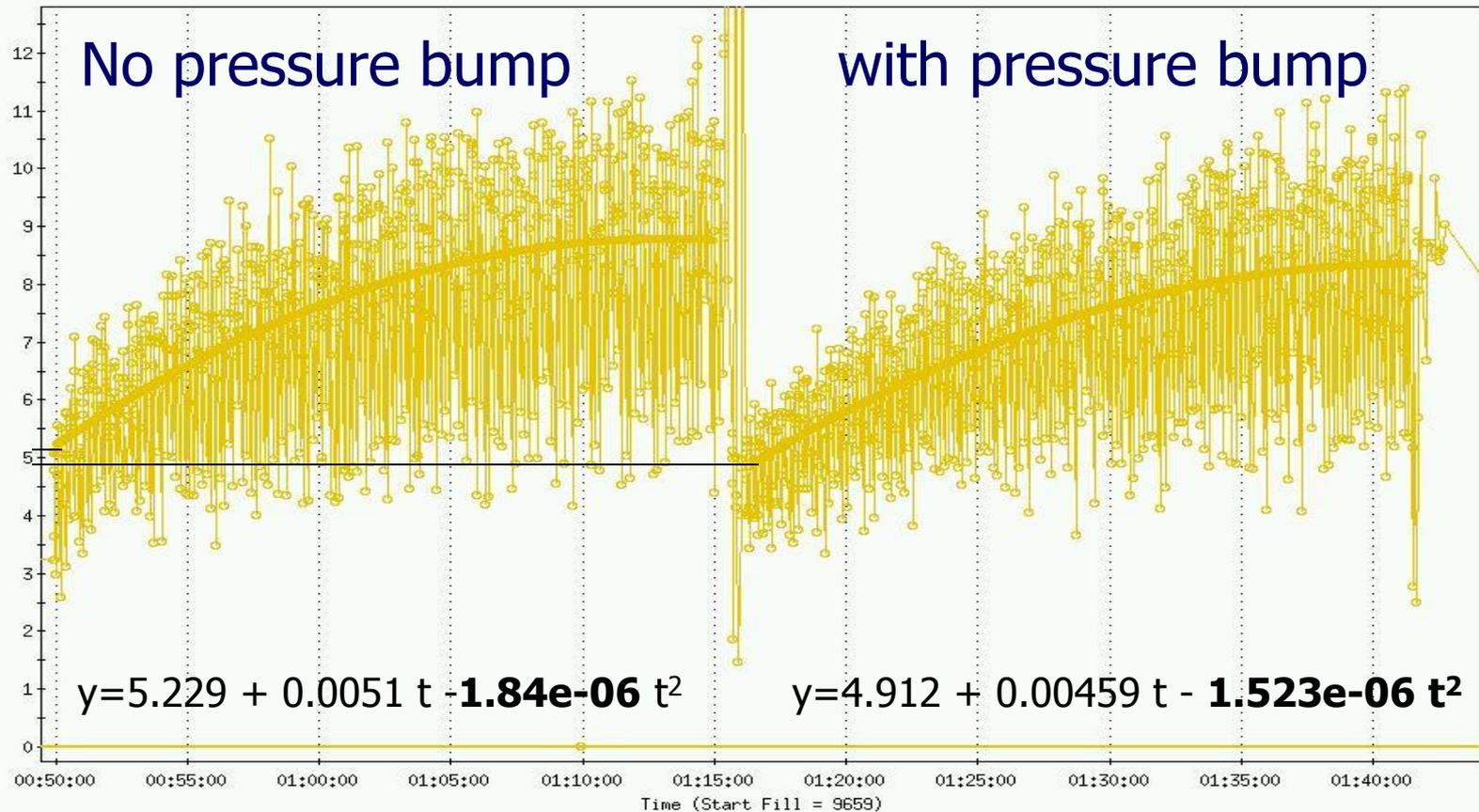


Collisions of the Helium like Gold ions Au^{+77} with CH_4

Details For Fitted Data Sets					
Data Set Name	Fit Name	Fit Type	Coefficients	Chi-Square	Status
RhicIpmManager.	5.22922+0.00512771X-1.84029e-0	Polynomial	-1.84029e-06	1972.69	Success
RhicIpmManager.	4.91146+0.00459054X-1.523e-06X	Polynomial	-1.523e-06	1500.08	Success

Hide

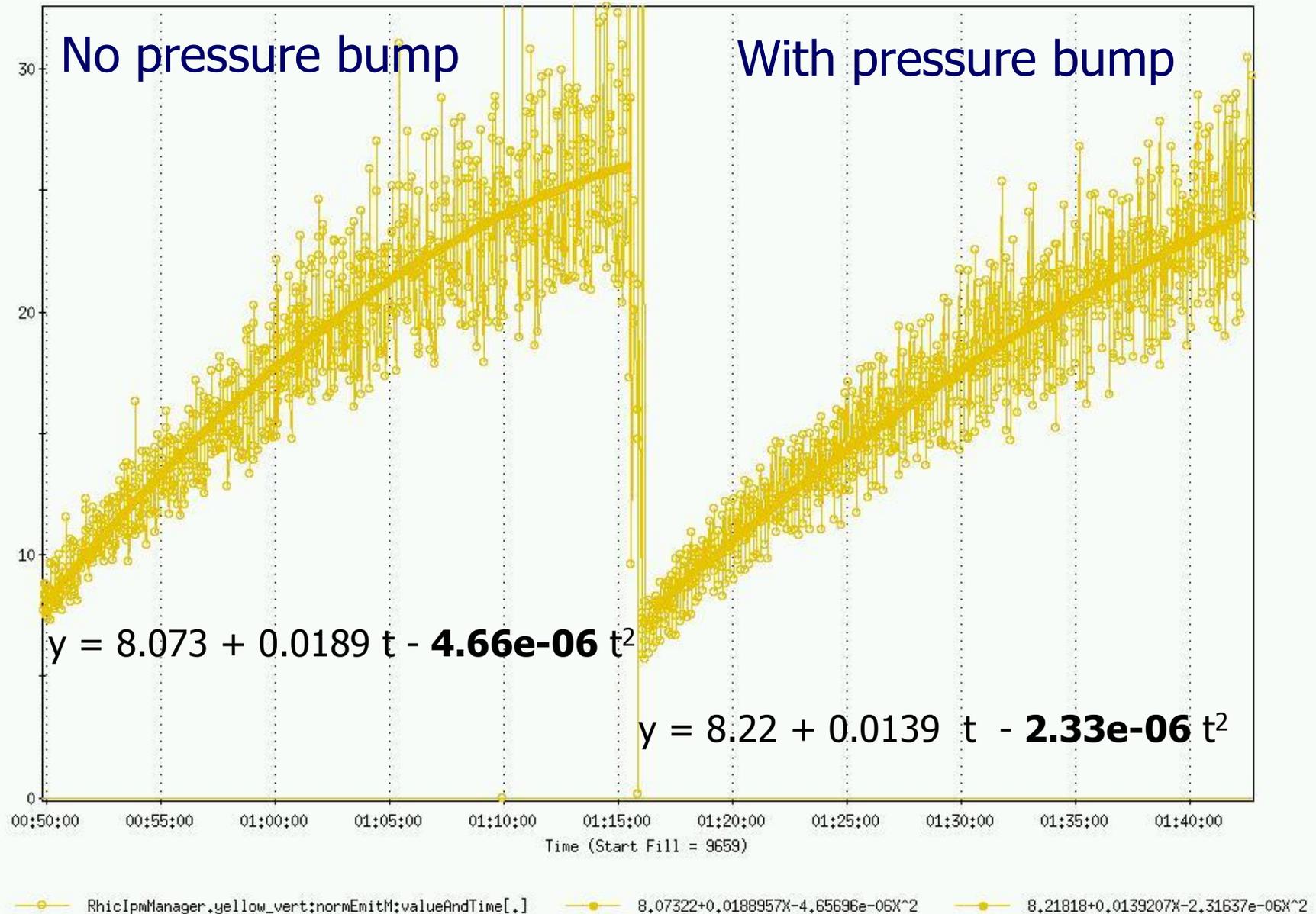
Window Markers Analysis



RhicIpmManager.yellow_horiz:normEmitM:valueAndTime[.] 5.22922+0.00512771X-1.84029e-06X^2 4.91146+0.00459054X-1.523e-06X^2

Collisions of the Helium like Gold ions Au^{+77} with CH_4

Vertical emittance in time



Collisions of the Helium like Gold ions Au⁺⁷⁷ with CH₄

APEX EXPERIMENT On January 28, 2008

Horizontal Emittance growth:

Without the pressure bump:

$$y = 5.23 + 0.00513 t - \mathbf{1.84e-06} t^2$$

x-axis Min=4086.94, Max =5590.4 s

y-axis Min=2.06382, Max =12.632

With the pressure bump:

$$y = 4.91 + 0.00459 t - \mathbf{1.52e-06} t^2$$

x-axis Min=5674.78, Max=7170.57

y-axis Min=1.43991, Max=11.539

Vertical Emittance growth:

No pressure bump: chi square=3635.08

$$y = 8.073 + 0.0189 t - \mathbf{4.66e-06} t^2$$

With Pressure bump: chi square=2498.97

$$y = 8.22 + 0.0139 t - \mathbf{2.33e-06} t^2$$

Summary :

- 1. There is a clear indication of smaller emittance growth with a gas pressure bump induced by TSP in the warm sections of 6 and 8 o'clock.**
- 2. A difference in the beam life time with and without pressure bumps could not be confirmed.**
- 3. A possible electron promotion-excitation followed by the double photon decay is the most plausible Explanation of the "cooling" mechanism a reduction Of the bunch energy from the X-ray emissions.**
- 4. Detail electron promotion diagrams from the collisions of the $\text{Au}^{+77} \rightarrow \text{CH}_4$ will follow.**