Status of $X^0 \to L^0 g$ analysis

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- **Reminder:** $X^0 \to L^0 p^0$ **and** $X^0 \to L^0 g$ **selection cuts**
- **Trigger 10 and 11 results.**
- **Asymmetry**
- **Branching ratio systematic error studies**
- **Discussion**

$X^0 \rightarrow L^0 p^0$ selection

- $N_{nclus} > 1$ $N_{track} = 2$

- Fiducial cuts for L^0 and X^0 vertices and L^0 mass cut:
  The X^0 vertex is calculated by the center of gravity method.
  $|M_{L0} - 1.115684| < 0.010$ (GeV), $Z_{vtxL0} > Z_{vtxX0}$
  $95.m < Z_{vtx} < 158.m$, $0.00043 < Y_{vtx}/Z_{vtx}$,
  $0.000376 < X_{vtx}/Z_{vtx} < 0.00124$

- Proton and pion momentum and containment cuts
  $0.065m < |X_P| < 0.235m$ and $|Y_P| < 0.085m$
  $0.215m < |X_{p^-}|$ or $|X_{p^-}| < 0.085m$ and $|Y_{p^-}| > 0.065m$
  $85.GeV < P_P < 600.GeV$ and $5.GeV < P_{p^-} < 150.GeV$
  $E_{p^-}(CSI)/P_{p^-} < 0.9$

- Equivalent Kaon mass $M_K > 0.55GeV$

- $K_1 > 5.0$ GeV, $K_1 + K_2 > 18.0$ GeV. ($K_{ncl} > 1.0GeV$)

- Good separation of clusters on CSI:
  $d(p^-, g_1) > 0.2m$, $d(p^-, g_2) > 0.2m$, $d(g_1, g_2) > 0.2m$

X^0 ® $L^0 g$ selection

- N_{nclus} = 1 or 2 N_{track} =**2** k>5.GeV and d(g p $^-$)>20.cm
- Fiducial cuts for L^0 and X^0 (center of gravity method) vertices and L^0 mass cut

  $|M_{L0}$ -1.115684|<0.005GeV $Z_{vtx L0}>Z_{vtx X0}$

  95.m< Z_{vtx}<158.m, 0.00043<Y_{vtx}/Z_{vtx}, 0.000376<X_{vtx}/Z_{vtx}<0.00124
- Proton and pion momentum and containment cuts (same as $L^0 p^0$).
- $|M_{X0}$ -1.315|<0.04GeV,P_{TX0}<0.07GeV ,P_{TL0}(primary)>0.03GeV,$|DZ_{X0}|$<15.m
- If N_{clus}=2 M_{p0}<0.1GeV, $|Z_{p0}-Z_{X0}|$>10.0m, M_K>0.55GeV
- F_{k1}<0.000025m, F_{k2}>0.00005m

$$F = \frac{(y_k - y_\Lambda)P_x^\Lambda - (x_k - x_\Lambda)P_y^\Lambda}{P_z^\Lambda} + \frac{x_k y_\Lambda - x_\Lambda y_\Lambda}{Z_{CSI}} \qquad P_x^T = P_y^T \Rightarrow F = 0$$

- Equivalent Kaon mass M_K>0.5GeV for Kaon background suppresion
- c^2<2.65

$$c^2 = \left(\frac{k_{miss}}{3.55}\right)^2 + \left(\frac{\Delta z_\Xi}{3.07}\right)^2 + \left(\frac{E_g - 41.94}{18.48}\right)^2$$

$$k_{miss} = \frac{(1.3149\,GeV)^2 - M_\Xi^2}{2(E_\Xi - P_\Xi)}$$

Trigger 10 and 11 results. UPA043-UPA333

	Total Trigger 10	Trigger 10.!11 +Trigger 10.11	Flux
$L^0 p^0 + \underline{L}^0 p^0$	5,990,978	5,124,646+866,332	113,792,082 ± 242245
$L^0 p^0$	5,495,416	4,701,207+794,209	104,379,424 ± 222576
$L^0 g + \underline{L}^0 g$	3,340-(356+39)	2,796+544-(356-39)	137,656 ± 2,851
$L^0 g$	3,022-(327+36)	2,528+494-(327+36)	124,287 ± 2,830

	Total Trigger 11	Trigger 11.!10 +Trigger 10.11	Flux
$L^0 p^0 + \underline{L}^0 p^0$	1,706,899	840,567+866,332	32,002,170 ± 70,395
$L^0 p^0$	1,569,929	775,720+794,209	29,434,158 ± 65,088
$L^0 g + \underline{L}^0 g$	1,040-(100+11)	496+544-(100+11)	42,701 ± 1,590
$L^0 g$	939-(92+10)	445+494-(92+10)	38,467 ± 1,495

Trigger 10 with Hadron-Anti correction:

	Total Trigger 10	Trigger 10.!11 +Trigger 10.11	Flux
$L^0 p^0 + \underline{L}^0 p^0$	11,826,520	10,116,324+1,710,533	224,638,229 ± 473853
$L^0 p^0$	10,892,931	9,318,711+1,574,624	206,906,998 ± 436806
$L^0 g + \underline{L}^0 g$	6,495-(703+77)	5,426+1,069-(703+77)	267,131 ± 4,341
$L^0 g$	5,891-(648+71)	4,919+972-(648+71)	241,750 ± 4,103

Trigger 10 Monte Carlo acceptance studies: ($a_{\underline{L}g}$ = -0.70)

	Generated	Trigger 10 acceptance	Trigger 11 acceptance
$L^0 p^0$	3,999,908	210,589 (5.27 ± 0.011)%	213,343 (5.33 ± 0.011)%
$L^0 g$	999,907	21,392 (2.14 ± 0.014)%	21,757 (2.18 ± 0.015)%

Monte Carlo background study:

	Generated	Background left
$L^0 p^0$	59,080,201	185
$S^0 g$	499,903	51

Branching ratio and Asymmetry

- Trigger 11 $\Lambda^0\gamma + \bar{\Lambda}^0\gamma$: $(1.33 \pm 0.05)\times10^{-3}$
  Trigger 11 $\Lambda^0\gamma$: $(1.31 \pm 0.05)\times10^{-3}$
  Trigger 10 $\Lambda^0\gamma + \bar{\Lambda}^0\gamma$: $(1.21 \pm 0.03)\times10^{-3}$
  Trigger 10 $\Lambda^0\gamma$: $(1.19 \pm 0.03)\times10^{-3}$

- Compare Monte Carlo and data, unpolarized, mutually normalized, cos ϕ distributions and get the χ^2 for various Monte Carlo asymmetries. Phi is the angle between the proton and the cascade in the Lambda rest frame of reference. The $\alpha(\Xi^0 \to \Lambda^0\gamma)$ corresponds to the minimum χ^2. After fitting a parabola at the vicinity of minimum (from both trigger 10 and 11 data) :
  $\alpha(\Xi^0 \to \Lambda^0\gamma) = -0.72 \pm 0.08$.
  The error is the maximum change in the value of asymmetry if we allow the measured minimum χ^2 to change by 1 unit.

Branching ratio systematic errors:

Source	Error
Trigger	0.06 (4%)
Asymmetry	0.02 (1.6%)
χ^0 vertex reconstruction	0.13 (10.0%)

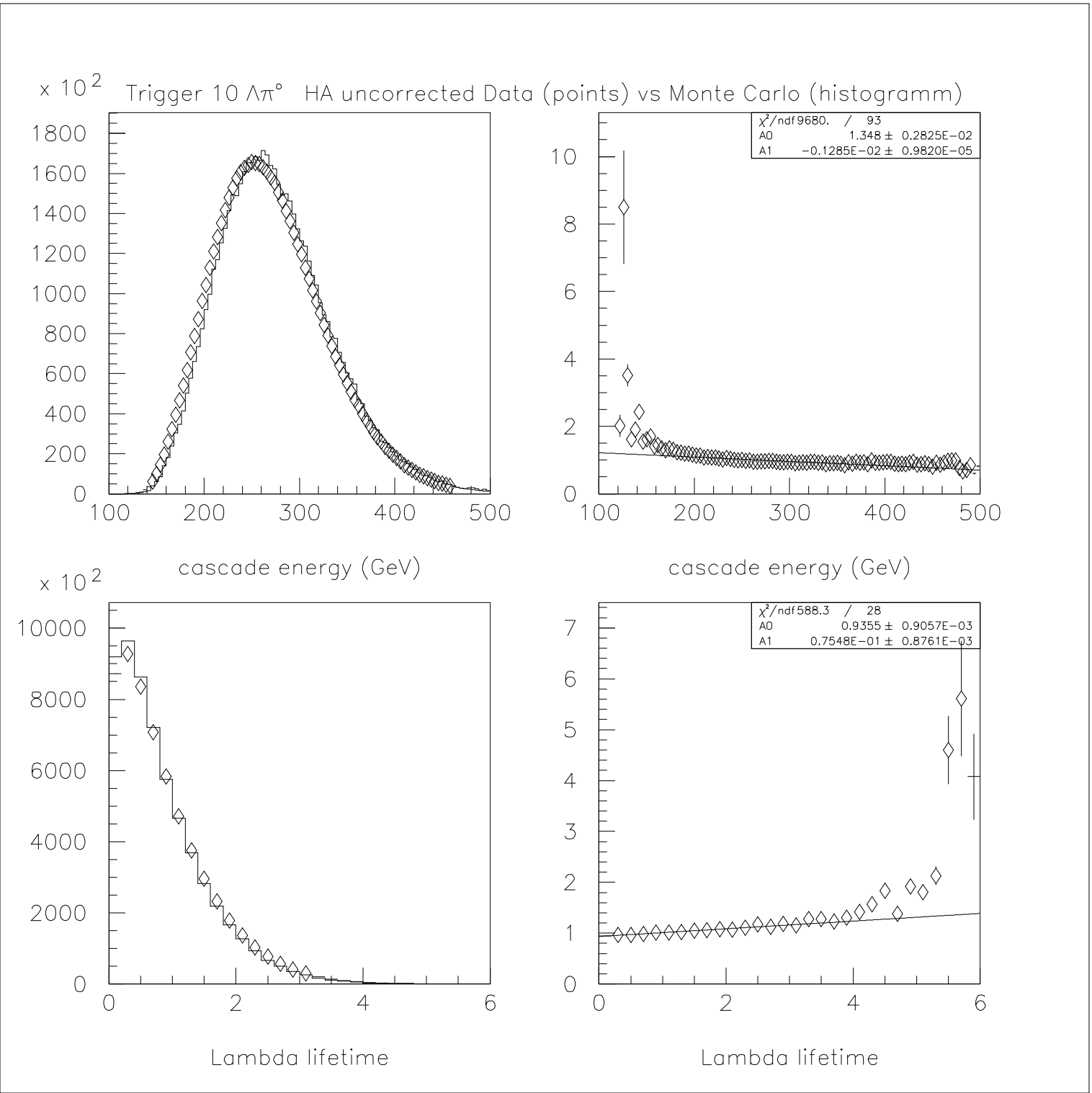
Z_{vtx} (m)	Trig10 Br ($x10^{-3}$)	Trig11 Br ($x10^{-3}$)
100	1.24 ± 0.03	1.34 ± 0.06
105	1.29 ± 0.04	1.37 ± 0.07
110	1.38 ± 0.05	1.49 ± 0.09
115	1.44 ± 0.06	1.58 ± 0.10
120	1.51 ± 0.08	1.66 ± 0.14

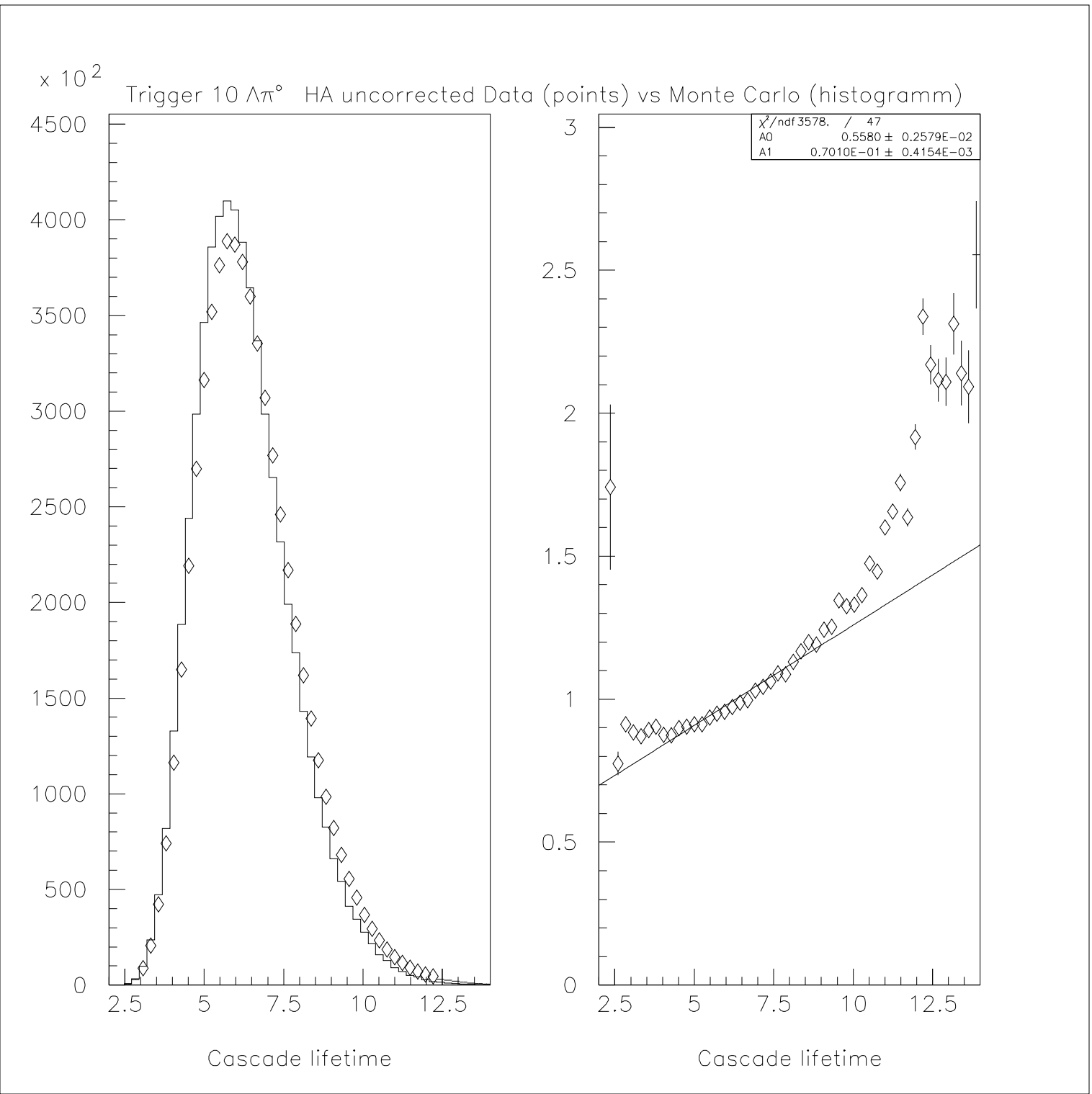
Total	0.15 (12.0%)

Discussion

- The Branching ratio and Asymmetry of the WRHD $X^0 \to L^0 g$ have been measured by using the UPA043-UPA333 raw data tapes for both data sample and normalization $X^0 \to L^0 p^O$. A first version of a KTeV note describing the analysis is posted at **/home/user1/christo/ktevnotes/lg/lg.ps**

- The systematic error study revealed large branching ratio variations with the cascade vertex cut. A discrepancy between data and Monte Carlo has been observed in the cascade lifetime.


Trigger 10 Λπ° HA uncorrected Data (points) vs Monte Carlo (histogramm)
x 10 2
cascade energy (GeV)
χ²/ndf 9680. / 93
A0 1.348 ± 0.2825E−02
A1 −0.1285E−02 ± 0.9820E−05
cascade energy (GeV)
x 10 2
Lambda lifetime
χ²/ndf 588.3 / 28
A0 0.9355 ± 0.9057E−03
A1 0.7548E−01 ± 0.8761E−03
Lambda lifetime


x 10 2
Trigger 10 Λπ° HA uncorrected Data (points) vs Monte Carlo (histogramm)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2.5
5
7.5
10
12.5
Cascade lifetime
χ²/ndf 3578. / 47
A0 0.5580 ± 0.2579E−02
A1 0.7010E−01 ± 0.4154E−03
3
2.5
2
1.5
1
0.5
0
2.5
5
7.5
10
12.5
Cascade lifetime